Series 1961, No. 17

Issued April 1965

SOIL SURVEY

YORK COUNTY SOUTH CAROLINA

UNITED STATES DEPARTMENT OF AGRICULTURE
Soil Conservation Service
In cooperation with
SOUTH CAROLINA AGRICULTURAL EXPERIMENT STATION

HOW TO USE THE SOIL SURVEY REPORT

THIS SOIL SURVEY of York County, South Carolina, will serve several groups of readers. It will help farmers in planning the kind of management that will protect their soils and provide good yields; assist engineers in selecting sites for roads, buildings, ponds, and other structures; aid foresters in managing woodlands; and add to our knowledge of soil science.

Locating soils

Use the index to map sheets at the back of this report to locate areas on the large map. The index is a small map of the county numbered to show where each sheet of the large map is located. When the correct sheet of the large map has been found, it will be seen that boundaries of the soils are outlined, and that there is a symbol for each kind of soil. All areas marked with the same symbol are the same kind of soil, wherever they occur on the map. The symbol is inside the area if there is enough room; otherwise, it is outside the area and a pointer shows where the symbol belongs.

Finding information

This report contains sections that will interest different groups of readers, as well as some sections that may be of interest to all.

Farmers and those who work with farmers can learn about the soils in the section "Descriptions of the Soils" and then turn to the section "Use of Soils for Crops and Pasture." In this way, they first identify the soils on their farm and then learn how these soils can be managed and what yields can be expected The "Guide to Mapping Units, Capability Units, Woodland Suitability Groups, and Wildlife Suitability Groups" at the back of the report will simplify use of the map and report. This guide lists each soil and land type mapped in the county, and the page where each is described. It also lists, for each soil and land type, the capability unit, woodland suitability group, and wildlife suitability group, and the pages where each of these is described.

Foresters and others interested in woodlands can refer to the section "Use of Soils for Woodland." In that section the soils in the county are grouped according to their suitability for trees, and factors affecting the management of woodland are explained.

Engineers will want to refer to the section "Engineering Interpretations of the Soils." Tables in that section show characteristics of the soils that affect engineering.

Scientists and others who are interested will find information about how the soils were formed and how they were classified in the section "Formation, Morphology, and Classification of Soils."

Students, teachers, and other users will find information about soils and their management in various parts of the report, depending on their particular interest.

Newcomers in York County will be especially interested in the section "General Soil Map," where broad patterns of soils are described. They may also be interested in the section "Additional Facts About the County."

* * * * *

Fieldwork for this survey was completed in 1961. Unless otherwise indicated, all statements in the report refer to conditions in the county at that time. The soil survey of York County was made as part of the technical assistance furnished by the Soil Conservation Service to the Catawba Soil Conservation District.

Cover picture.—Typical farm pasture in York County. The trend is from the production of row crops to the production of pasture and livestock.

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Contents

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SOIL SURVEY OF YORK COUNTY, SOUTH CAROLINA

REPORT BY WALLACE J. CAMP, SOIL CONSERVATION SERVICE

FIELDWORK BY W. A. DAVIS, C. M. ELLERBE, V. F. FISHER, L. E. AULL, E. N. MILLER, JR., AND WALLACE J. CAMP, SOIL CONSERVATION SERVICE

UNITED STATES DEPARTMENT OF AGRICULTURE IN COOPERATION WITH THE SOUTH CAROLINA AGRICULTURAL EXPERIMENT STATION

YORK COUNTY is in the northern part of South Carolina along the North Carolina border (fig. 1).

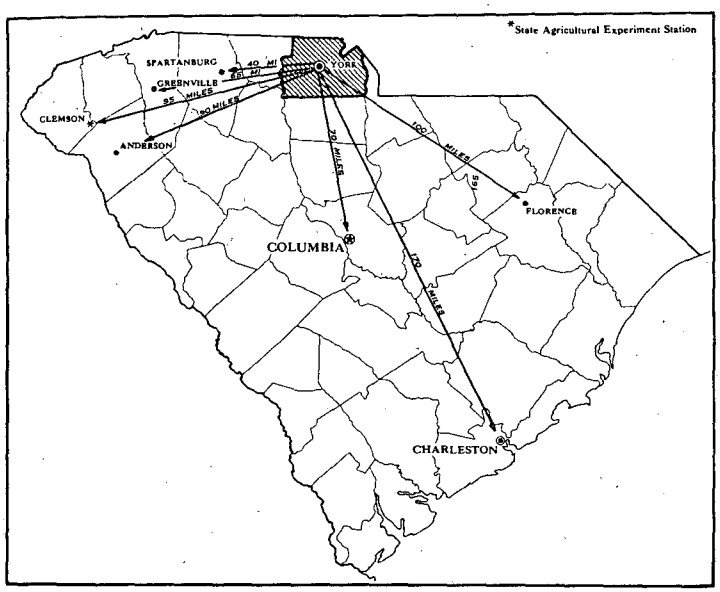

Figure 1.—Location of York County in South Carolina.

The total area of the county is approximately 685 square miles, or 438,400 acres. Of this area, 12 square miles is water, mostly in Lake Wylie on the Catawba River. York, the county seat, is in the west-central part of the county.

The county was first settled about 1751 by Scotch-Irish immigrants who came from Virginia and Pennsylvania (*13*).[1] It was formed in 1785 by dividing the Camden District.

At one time cotton was the principal crop, but now little of it is grown in the county. The raising of beef cattle, dairy cattle, turkeys, and chickens and the production of grain, hay, peaches, and pulpwood are the most important agricultural enterprises at the present time. Some grapes are grown.

Some large textile plants are in York County. There are also many other types of manufacturing. Industry is now an important part of the economy of the county. As a result, the use of land for urban development and other purposes has materially increased in the Rock Hill area.

Kyanite, an aluminum silicate, is mined on Henry Knob in the northwestern part of the county. Paper is manufactured in Catawba.

According to the 1960 census, York County had a population of 78,760, an increase of 10 percent since 1950. Most citizens are native born and own their homes.

The county has many recreational facilities. Rock Hill has 85 acres of public parks and playgrounds. These areas provide facilities for swimming, tennis, skating, picnicking, and other outdoor activity. Lake Wylie provides boating, fishing, and water skiing. The shores of this lake have areas for picnicking, camping, and provide areas for summer homes. The State park near Clover provides swimming, camping, picnicking, and hiking.

The National Military Park was established to preserve the Kings Mountain Battleground as an historical site. Other parks and facilities for swimming and picnicking, as well as two good golf courses, are in the county.

The Catawba Indian Reservation is located in York County. The inhabitants of the reservation are survivors of a once-powerful Indian tribe.

Many ante-bellum homes in York and Rock Hill are open to the public at various times each year.

General Soil Map

After a soil scientist studies the soils in a locality and the way they are arranged, he can make a general map that shows several main patterns of soils, which are called soil associations. Such a map is the colored general soil map in the back of the report. Each soil association, as a rule, contains a few major soils and several minor ones, in a pattern that is characteristic although not strictly uniform.

The soils within any one association are likely to differ in some or in many properties; for example, slope, depth, stoniness, or natural drainage. Thus, the general soil map shows, not the kind of soil at any particular place, but several distinct patterns of soils. Each pattern, furthermore, contains several kinds of soils.

Each soil association is named for the major soil series in it, but, as already noted, soils of other series may also be present. The major soils of one soil association may also be present in another association, but in a different pattern.

[1] Italicized numbers in parentheses refer to Literature Cited, page 106.

The general map is useful to people who want a general idea of the soils, who want to compare different parts of a county, or who want to know the possible location of good-sized areas suitable for a certain kind of farming or other land use.

The nine soil associations in York County are described in the following pages. Detailed information about the soils and land types in each soil association is given in the section "Descriptions of the Soils." Information about the capability groupings is given in the section "Capability Grouping of Soils."

1. Chewacla-Congaree-Wickham association: Nearly level or sloping soils on bottom lands and stream terraces

This is an area of nearly level soils on bottom lands and gently sloping to strongly sloping soils on stream terraces. The bottom lands are narrow, and those along the main streams are crossed by tributaries. The terraces are dominantly gently sloping and are dissected by occasional drainageways; some, however, are strongly sloping. This association makes up 5 percent of the county. It occurs along the Catawba and Broad Rivers and along Bullocks and Turkey Creeks. The major soil series in this association and their relationship to the landscape are shown in figure 2.

About 62 percent of the association consists of Chewacla and Congaree soils, which developed in general alluvium on the bottom land. Of the two soils, the Chewacla has the largest acreage. The Chewacla soils are somewhat poorly drained, have a surface layer of grayish-brown silt loam, and are mainly in elongated, narrow strips adjacent to the uplands. The Congaree soils are well drained, have a surface layer of dark grayish-brown fine sandy loam, and are mainly adjacent to streams. Also in the bottom lands of this association are small areas of the excessively drained Buncombe soils and areas of Mixed alluvial land and of Mixed alluvial land, wet.

The Wickham soils are on the gently sloping to strongly sloping terraces. The Altavista soils occupy the lower slopes, and the red Hiwassee and the excessively drained Molena soils are on the ridge crests and upper slopes.

The soils on terraces have low natural fertility. All soils in the association are acid, and they are all responsive to fertilizer and other management.

The soils produce excellent pasture. About 35 percent of the association is in pasture, and most of it is suited to pasture. Bermudagrass, dallisgrass, tall fescue, white clover, and annual lespedeza are suitable pasture plants.

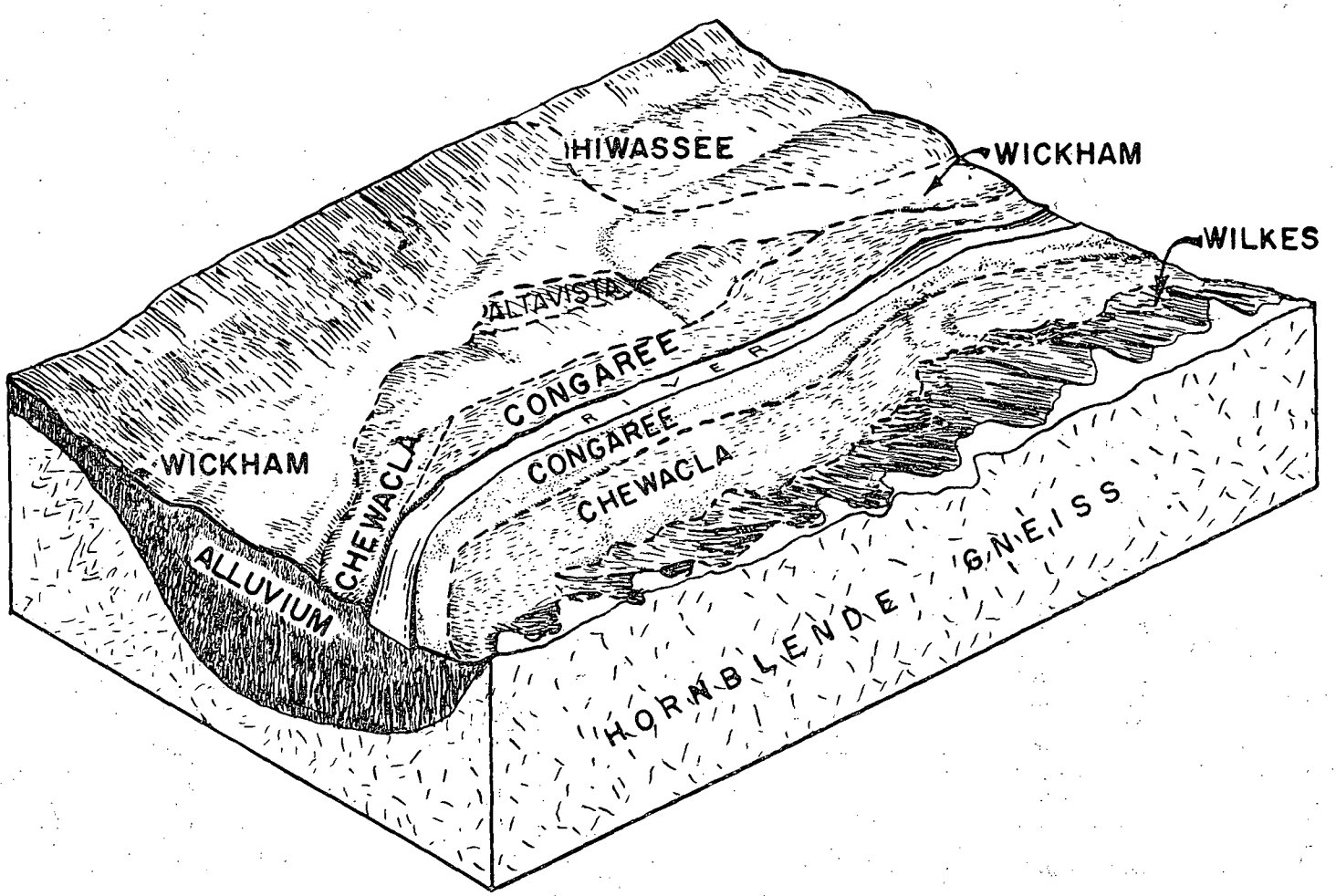

Figure 2.—**Major soils in association 1 and their relation to the landscape.**

Most farms have only a small part of their area in this association. The farmstead is generally in other associations.

Most of the association is also suited to cultivated crops and is responsive to good management. Suitable crops are corn, small grain, soybeans, annual lespedeza, and truck crops.

Canoeing is excellent on the Broad and Catawba Rivers in this association. Hunting is excellent. Trails for hiking and horseback riding can be easily built, especially along streams.

2. Enon-Mecklenburg association: Gently sloping to moderately steep soils with yellowish-brown to reddish-brown, slightly plastic subsoil

This association consists of many broad hills that are dissected by winding drainageways. The steeper slopes are along the large streams. The areas on the tops of the hills are gently sloping and medium in size. Most level areas are in narrow strips on bottom land. The association makes up 2.5 percent of the county.

About 75 percent of the association consists of Mecklenburg and Enon soils. Of the two soils, the Mecklenburg has a slightly larger area. The Mecklenburg soils developed in residuum that weathered from basic rocks. The Enon soils developed from the same material and to a less extent from residuum that weathered from acid rocks or from a mixture of acid and basic rocks. The Mecklenburg soils are mainly in the northeastern part of the association and on the broader slopes. They have a surface layer of dark-brown loam and a subsoil of mottled yellowish-red and reddish-yellow clay. The Enon soils have a surface layer of grayish-brown sandy loam and a subsoil consisting of mottled strong-brown, pale-brown, and red clay.

The Wilkes soils occupy the moderately steep slopes along the Big and Little Dutchman Creeks. Nearly level, Mixed alluvial land types are on the bottom lands. Small areas of the red Cecil and Lloyd soils are on the highest hilltops.

Except for the land types on bottom land, the soils in this association have low natural fertility, but they respond well to fertilizer and management. The Mecklenburg soils are slightly acid; the Enon soils, medium acid.

About 30 percent of the acreage is used for general farming. Subsistence farming is practiced in most places. Cotton, corn, small grain, and annual lespedeza are the main crops.

Much of the association is capable of producing good pasture. Consequently, the area is probably best suited to the raising of livestock, supplemented by the growing of corn and cotton. The moderately steep slopes along streams and the eroded areas are best suited to forest.

Lake Wylie and the Catawba River provide boating, fishing, and water skiing. Hunting, hiking, and picnicking are other recreational opportunities.

3. Tatum-Nason-Manteo association: Gently sloping to steep soils with red to yellowish-brown silty clay subsoil

This association is in two areas, one in the northwestern part and one in the southeastern part of the county. It consists of choppy, irregular hills that are dissected by a dendritic drainage system. Most areas are hilly and have moderately steep to steep slopes along the larger drainageways. Some narrow, gently sloping areas are on the hilltops, and some narrow, level areas are in the bottom land. This association makes up 12 percent of the county. The major soil series and their relationship to the landscape are shown in figure 3.

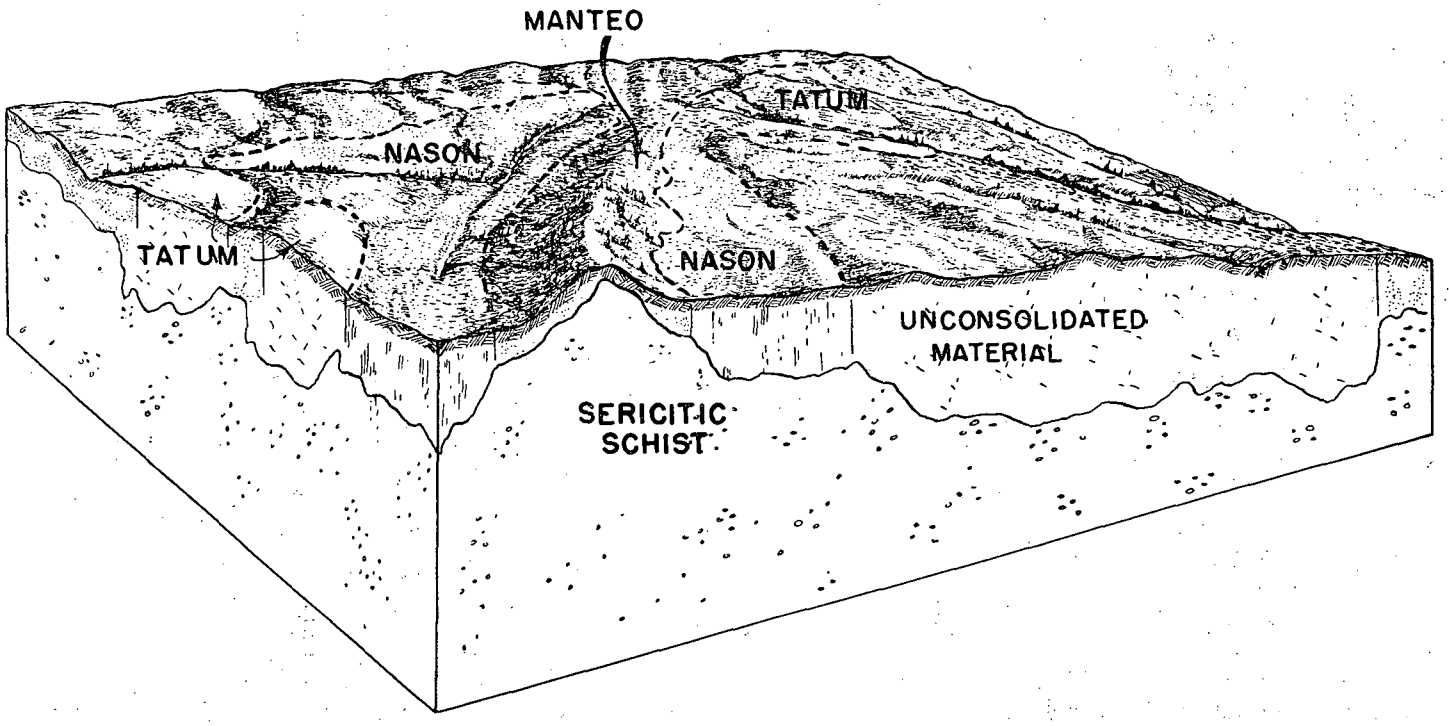

Figure 3.—**Major soils in association 3 and their relation to the landscape.**

About 77 percent of the acreage consists of Tatum soils, which occupy all positions in the landscape. These soils developed in residuum that weathered from sericitic schist. They have a surface layer of yellowish-brown silt loam and a subsoil of red silty clay. Areas of gravelly silt loam are on the narrow ridges.

The Nason soils also occupy all positions in the landscape. They have a surface layer of light olive-brown silt loam and a subsoil of strong-brown silty clay. The Manteo soils occupy strong to steep slopes on the mountains or adjacent to the large streams. They have a surface layer of grayish-brown channery silt loam and a thin or discontinuous B horizon. The Worsham soils, Mixed alluvial land, and Mixed alluvial land, wet, are on the bottom lands.

The soils in this association have low to very low natural fertility and are slightly acid to strongly acid. On about 90 percent of the acreage of these soils, crops would respond well to applications of fertilizer and other good management. On the rest, the response would be low because the soils are too stony or channery to supply enough moisture. Erosion is the chief hazard on the soils of this association.

About 65 percent of this association is in forest, most of which has been cut over. Most of the cultivated acreage is on the ridgetops and the upper part of hills, and it is used mainly for subsistence farms. Cotton, corn, and small grain are the main crops, but peaches are grown on a small acreage.

About 15 percent of this association is in pasture. The most commonly used pasture mixtures are (1) fescue and white clover, and (2) bermudagrass or dallisgrass mixed with white clover and annual lespedeza. Sericea lespedeza is used for pasture and hay except on the Manteo soils. Only fair yields of pasture can be expected without large applications of fertilizer.

The Kings Mountain National Military Park and a State park are in the northwestern part of this association. These parks are for sightseeing and recreational use. Also in this association is a camp for Boy Scouts, and in the southeastern part, the Catawba Indian Reservation.

4. Iredell-Mecklenburg-Davidson association: Nearly level to strongly sloping soils with yellowish-brown to red, firm clay subsoil

This association is in two parts. One occurs in the southeastern part of the county and the other in the northeastern part. This association is an undulating plain 10 to 30 feet lower than the surrounding areas. Narrow, nearly level areas of bottom land are along the streams and drainageways. This association has a weakly developed dendritic drainage system. Except for Fishing and Fork Creeks, the streams have shallow channels. Most of the small streams go dry if droughts are 3 to 6 weeks long. The relief is dominantly nearly level to gently sloping. Sloping and strongly sloping hills, however, are adjacent to the larger streams. This association makes up about 10 percent of the county. The major soil series and their relationship to the landscape are shown in figure 4.

About 60 percent of the acreage consists of Iredell soils. They occur on the nearly level to sloping parts of the association and developed in residuum weathered from basic rocks. Their surface layer is very dark grayish-brown sandy loam to loam, and their subsoil is yellowish-brown plastic clay.

The Mecklenburg soils have a surface layer that is dark-brown loam. Their subsoil is of clay mottled with yellowish-red and strong brown.

The Davidson soils have a surface layer of dusky-red clay loam and a subsoil of dark-red clay. Most of the acreage of the Davidson soils is on hilltops in the northern part of the association. The areas are generally small.

The Elbert soils are along the small drainageways and in upland depressions. The Wilkes soils are on strongly sloping hills along Fishing Creek. The Mecklenburg, Davidson, and Wilkes soils are susceptible to severe erosion. The Iredell soils and Elbert soils have a high available moisture capacity.

The soils in this association have low natural fertility. They are slightly acid or medium acid. They respond well to applications of fertilizer and other good management.

Many of the farms in this association are more than 100 acres in size, and a few are larger than 200 acres. Most farms are operated as full-time general farms. There are a few dairy farms and beef-cattle farms. About 50 percent of the acreage is cultivated. The main crops are cotton, corn, and small grain.

The soils in this association are well suited to pasture. They are best suited to dallisgrass, tall fescue, bermudagrass, white clover, and annual lespedeza, which are responsive to fertilizer and other good management.

Several community centers are in this association. However, other recreational facilities are limited.

5. Enon-Iredell-Wilkes association: Gently sloping to steep soils with brown, slightly plastic and plastic clay subsoil

This association consists of long, narrow, gently sloping ridgetops with sloping sides and of moderately steep to steep slopes along streams. It is dissected by small streams that usually have their source in the area. The bottom lands are very narrow. This association makes up about 1 percent of the county.

About 65 percent of the acreage consists of Enon and Iredell soils. The Enon soils are on slopes below the Iredell soils, which occupy the gently sloping ridgetops. They have a slightly larger acreage than the Iredell soils. The Enon soils developed in residuum that weathered from mixed acidic and basic rocks. They have a surface layer of grayish-brown sandy loam and a clay subsoil mottled with strong brown, pale brown, and red. The Iredell soils developed in residuum that weathered from basic rocks. They have a surface layer of very dark grayish-brown sandy loam and a subsoil of yellowish-brown plastic clay.

The Wilkes soils are on the steep slopes adjacent to the streams. The poorly drained Worsham soils and Mixed alluvial land, wet, are on the narrow bottom lands.

The soils in this association have low to very low natural fertility and are slightly acid or medium acid. Crops on nearly all of these soils respond well to applications of fertilizer and other good management. Crops on the Wilkes soils, however, show poor response because rocks and rock outcrops reduce the supply of moisture.

About 50 percent of the association is in forest. Most

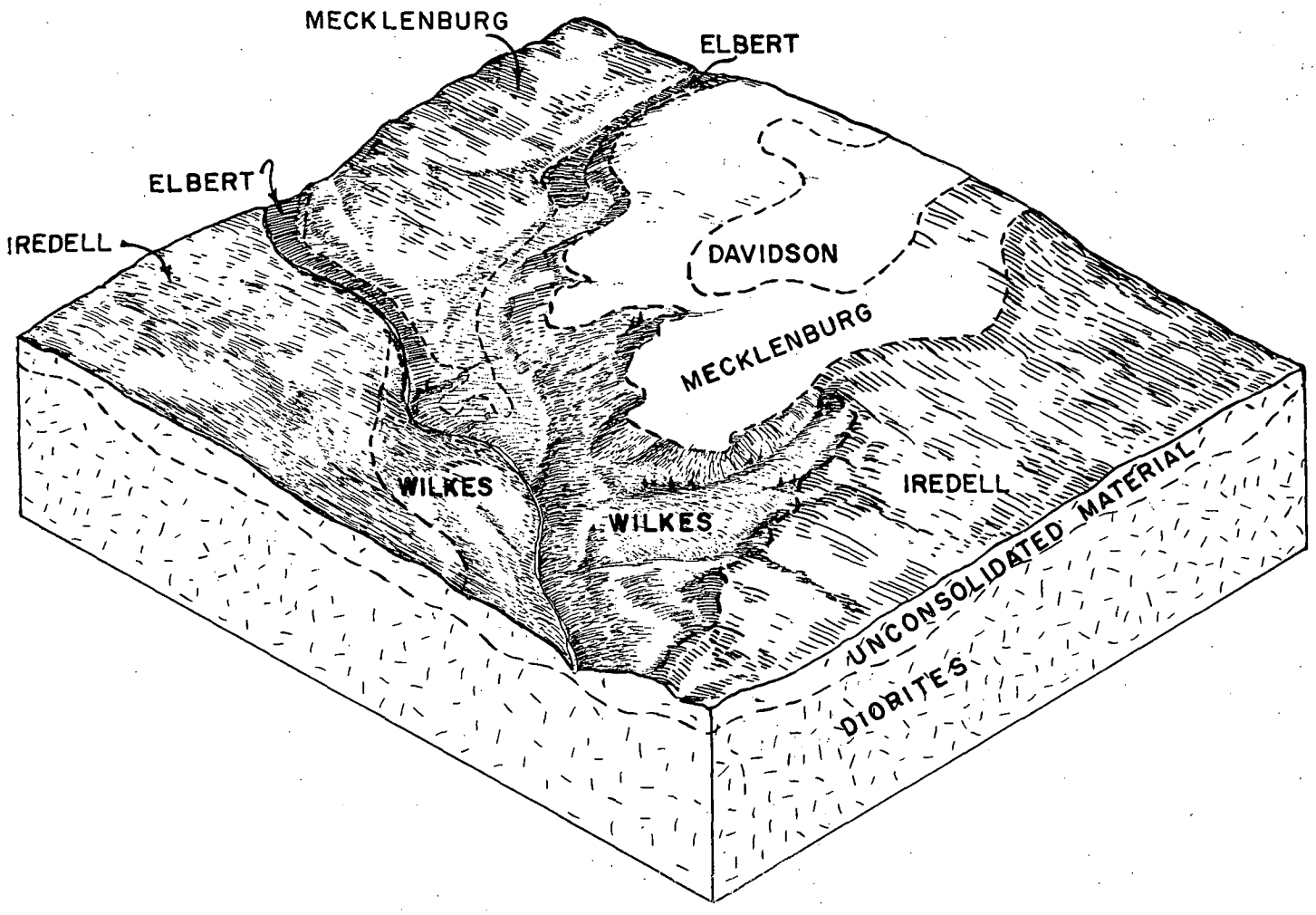

Figure 4.—**Major soils in association 4 and their relation to the landscape.**

of the cleared acreage is in pasture. Except on a few beef-cattle farms, general farming is practiced in this association. Cotton, corn, and small grain are the main crops.

Much of this association is in pasture. The Enon and Iredell soils are well suited to pasture. Mixtures generally used are (1) dallisgrass and white clover, (2) bermudagrass and annual lespedeza, and (3) fescue and white clover. These mixtures respond to fertilizer and produce good yields under good management.

There are no recreational facilities in this associaiton.

6. Cecil-Lloyd-Appling association: Gently sloping to moderately steep soils with red or brown, firm clay subsoil

This association is in two parts. One occurs in the northeastern part and one in the southeastern part of the county. It consists of irregular hills with narrow, medium, and broad tops and of many narrow drainageways. The slopes adjacent to streams are short and moderately steep. Most nearly level areas are in narrow strips on the bottom lands. This association makes up about 20.5 percent of the county.

Cecil and Appling soils make up about 50 percent of this association. The Cecil soils occupy all positions on the landscape; the Appling soils are mainly on the higher ridges. The acreage of the Cecil soils is slightly more than that of the Appling. Cecil soils developed in residuum that weathered from granite and gneiss. They have a surface layer of dark-brown sandy loam and a subsoil of red clay. The Appling soils also developed in residuum that weathered from granite and gneiss. Their surface layer is light brownish-gray sandy loam, and their subsoil is clay loam mottled with red, light red, and brown.

The red Lloyd soils developed in areas where intrusions of basic rock occur. They occupy the gently sloping and sloping areas. Intermixed with these soils are small areas of Vance, Enon, and Helena soils. Small areas of Durham and Colfax soils are intermixed with the Appling and Cecil soils.

Areas of nearly level Local alluvial land occur in depressions and shallow drainageways. The other nearly level areas, which consist of the well-drained Mixed alluvial land, are on narrow bottom lands.

The soils in this association are low in natural fertility, and are slightly acid or medium acid. All the soils respond to fertilizer and other good management.

About 55 percent of the acreage of this association is

forested, but some is cleared on all farms. Many farms range from 100 to 200 acres in size, but a few are larger than 200 acres. Most are operated as full-time general farms. Cotton, corn, and small grain are suitable crops. They are responsive to applications of fertilizer and other good management.

The soils in this association are suited to pasture. The mixture of grasses and legumes generally used are fescue and white clover for winter and spring grazing, and bermudagrass with annual lespedeza or dallisgrass with white clover for summer and fall grazing. Sericea lespedeza is responsive to fertilizer and produces average yields of pasture or hay on the well-drained soils on uplands.

Lake Wylie, adjacent to this association, provides boating, picnicking, fishing, water skiing, and other recreational activities. Many sites are available where smaller lakes could be built and suitable areas for picnics and hiking provided.

7. Lloyd-Cecil-Enon association: Gently sloping to moderately steep soils with red to brown, friable to slightly plastic subsoil

This association consists of uplands dissected by many long, crooked, and narrow drainageways. Most areas are on broad, gently sloping hills. These hills have short sloping to moderately steep sides along the drainageways. The hilltops are undulating in a few small areas. Most of the level areas of this association are in narrow strips on the bottom lands. This association makes up about 20 percent of the county. The major soil series and their relationship to the landscape are shown in figure 5.

About 60 percent of the acreage consists of Lloyd and Cecil soils. These soils occur in all positions on the landscape except the undulating areas on hilltops. The acreage of the Lloyd soils is slightly greater than that of the Cecil soils. The Lloyd soils developed mostly in residuum that weathered mainly from acidic rocks. This material, however, was influenced to some extent by basic rocks. These soils have a surface soil of dark reddish-brown loam or sandy loam and a subsoil of red clay. The Cecil soils developed in residuum that weathered from granite or gneiss. They have a surface layer of dark-brown sandy loam and a subsoil of red clay. The Enon soils developed mainly in residuum that weathered mainly from basic rocks, but to some extent from mixed acidic and basic rocks.

The Helena soils occur in small- to medium-sized areas that are widely scattered throughout the association.

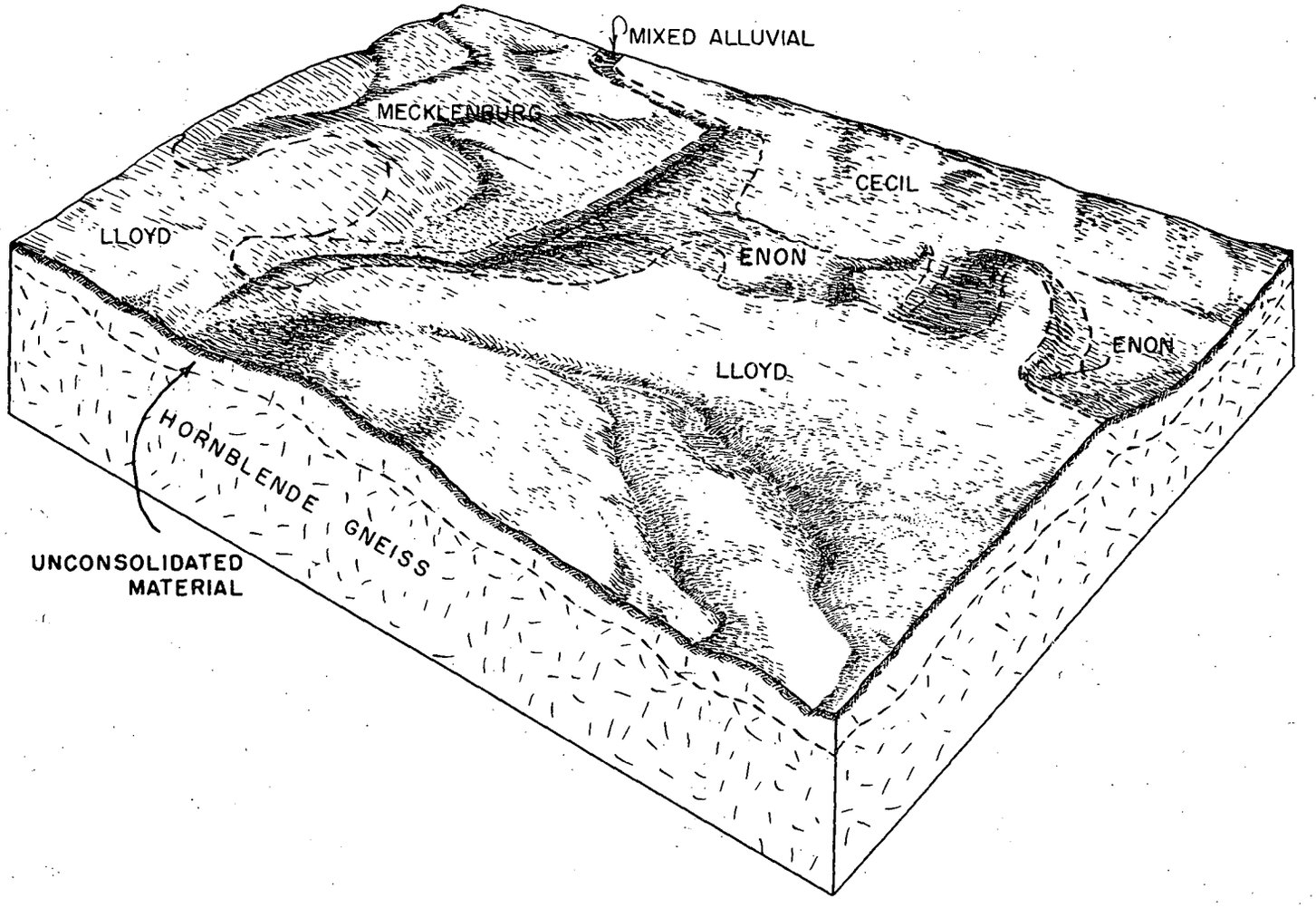

Figure 5.—**Major soils in association 7 and their relation to the landscape.**

They have a surface layer of brown sandy loam and a subsoil of clay mottled with brownish yellow and pale yellow. They developed in residuum that weathered from mixed acidic and basic rocks. The Helena soils occupy the gently sloping to sloping areas between drainageways that are close together and also occur at the head of drainageways.

The Wilkes soils have a surface layer of dark-brown sandy loam and a discontinuous B horizon. They occupy moderately steep slopes adjacent to streams.

Other minor soils in this association are the moderately well drained Mecklenburg and Vance soils and the poorly drained Worsham soils. Mixed alluvial land and Mixed alluvial land, wet, are on the bottom lands. Also, there are a few small areas of Gullied land, friable materials, rolling.

The soils in this association have low to very low natural fertility, and are slightly acid or medium acid. Crops on all the soils respond to applications of fertilizer and to other good management. Erosion is a severe hazard.

About 65 percent of the association is cultivated or pastured. Subsistence farms predominate, and most of these contain more than 100 acres. However, there are a few dairy farms and a few beef-cattle farms. Cotton, corn, small grain, and truck crops are the main crops.

Broad, gently sloping areas of this association are suitable for cultivated crops. Nearly all the acreage is well suited to pasture. If managed well, pastures produce good grazing.

There are several community centers in this association. Many areas could be used for picnicking and hiking.

8. Appling-Cecil-Louisburg association: Gently sloping to moderately steep sandy loam soils with red or brown subsoil

This association consists of uplands that generally have broad gently sloping to sloping ridgetops. It is dissected by many narrow streams and drainageways. The slopes adjacent to the streams are short and strong to moderately steep. Nearly level areas are in narrow strips on the bottom lands. In an area extending in a southwest-northeast direction across the center of the association, granite boulders crop out. These boulders are large enough to interfere with cultivation. This association makes up about 9 percent of the county.

Appling and Cecil soils make up about 62 percent of the association. The Appling soils have a somewhat larger acreage than the Cecil soils. They developed in residuum that weathered from granite and gneiss. They have a surface layer of light brownish-gray sandy loam and a subsoil of clay loam mottled with red, light red, and brown. There is a sizable acreage of Appling coarse sandy loam, thin solum, in this association. This soil developed in material that weathered from coarse-grained granite. The surface layer is light olive-brown, coarse sandy loam and the subsoil is sandy clay mottled with brownish yellow and yellowish red. The Cecil soils are mainly on ridgetops. They developed in residuum that weathered from granite and gneiss. They have a surface layer of dark-brown sandy loam and subsoil of red clay.

The Louisburg soils are weakly developed soils derived from granite. The surface layer is dark grayish brown. The B horizon is generally discontinuous. In places, however, there is a light yellowish-brown sandy clay loam B horizon.

The Worsham soils occur on the poorly drained, narrow drainageways. The moderately well drained Helena soils occupy the gently sloping to strongly sloping areas around the head of streams. Mixed alluvial land is on the bottom lands of the medium- and large-sized streams.

The soils in this association have low natural fertility and are slightly acid or medium acid. Crops on all of these soils respond to applications of fertilizer and to other good management. Those on the Louisburg soils, however, are less responsive, as these soils have a low available moisture capacity. Most of the farms in the area are subsistence farms. Cotton, corn, and small grain are the main crops, but peaches and grapes are grown on some farms.

All gently sloping and sloping areas of these soils are suitable for cultivation, and nearly level areas along the streams are suitable for pasture. Mixtures of bermudagrass and annual lespedeza or of dallisgrass and white clover can be used for pasture in summer and fall. Tall fescue and white clover can be used in winter and spring.

9. Wilkes-Lloyd-Enon association: Gently sloping to steep soils with red to brown, firm subsoil

This association is in the western part of the county. It is an area of irregular hills with narrow and medium ridges. It is dissected by many long, narrow drainageways. The slopes adjacent to the streams are short and moderately steep to steep. Nearly level areas are in narrow strips on the bottom lands. This association makes up about 20 percent of the county.

About 45 percent of the area consists of Wilkes and Lloyd soils. The Wilkes soils are mainly on the stronger slopes adjacent to bottom lands. The Lloyd soils occupy all positions on the landscape. The acreage of the Wilkes soils is slightly greater than that of the Lloyd soils. The Wilkes soils are weakly developed in residuum that weathered from acidic rocks cut by intrusions of dark-colored basic rocks. They have a surface layer of dark-brown sandy loam and a weakly developed, thin or discontinuous B horizon of clay mottled with reddish yellow, brownish yellow, and yellowish red. The Lloyd soils developed in residuum from mixed acidic and basic rocks. Their surface layer is reddish-brown loam to sandy loam, and their subsoil is red clay.

The Enon soils in this association have a grayish-brown loam to sandy loam surface soil and a clay subsoil mottled with strong brown, pale brown, light olive brown, yellowish red, and red. The Enon soils are on the gently sloping to sloping parts in this association.

Minor soils in this association are the Cataula, Helena, Vance, and Mecklenburg. There are also a few small areas of Iredell stony loam. Land types in the association are Gullied land, firm materials; Gullied land, friable materials, rolling; and Gullied land, friable materials, hilly. On nearly level bottom lands are Mixed alluvial land and Mixed alluvial land, wet.

The soils in this association have low to very low natural fertility and are slightly acid to strongly acid. Crops on all the soils respond to applications of fertilizer and to other good management.

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About 80 percent of this association is in forest, but most farms have a small acreage of cleared land. Many of the farms are larger than 200 acres, but most of them are part-time subsistence farms. A few are beef-cattle farms. Cotton, corn, truck crops, and small grain are suitable crops. These crops are responsive to applications of fertilizer and to other good management.

The soils in this association are suited to pasture. Mixtures of grasses and legumes used for winter and spring pasture are fescue and white clover. Either bermudagrass and annual lespedeza or dallisgrass and white clover can be used for summer and fall pasture. Sericea lespedeza is used on well-drained soils on uplands. Kudzu can be used in gullied areas.

A golf course west of York is the only recreation area in this association. Many areas could be developed into beautiful sites for hiking and camping, and other areas could be developed for horseback riding and hunting. Many sites are available for small ponds, and a few for picnic areas.

How Soils Are Mapped and Classified

Soil scientists made this survey to learn what kinds of soils are in York County, where they are located, and how they can be used.

They went into the county knowing they likely would find many soils they had already seen, and perhaps some they had not. As they traveled over the county, they observed steepness, length, and shape of slopes; size and speed of streams; kinds of native plants or crops; kinds of rock; and many facts about the soils. They dug or bored many holes to expose soil profiles. A profile is the sequence of natural layers, or horizons, in a soil; it extends from the surface down into the parent material that has not been changed much by leaching or by roots of plants.

The soil scientists made comparisons among the profiles they studied, and they compared these profiles with those in other counties nearby and in places more distant. They classified and named the soils according to nationwide, uniform procedures. To use this report efficiently, it is necessary to know the kinds of groupings most used in a local soil classification.

Soils that have profiles almost alike make up a soil series. Except for different texture in the surface layer, all the soils of one series have major horizons that are similar in thickness, arrangement, and other important distinguishing characteristics. Each soil series is named for a town or other geographic feature near the place where a soil of that series was first observed and mapped. Cecil and Iredell, for example, are the names of two soil series. All the soils in the United States having the same series name are essentially alike in natural characteristics. Soils of one series can differ in texture of the surface soil and in slope, stoniness, or some other characteristic that affects use of the soils by man.

Many soil series contain soils that differ in the texture of their surface layer. According to this difference in texture, separations called soil types are made. Within a series, all the soils having a surface layer of the same texture belong to one soil type. Iredell loam and Iredell sandy loam are two soil types in the Iredell series. The difference in texture of their surface layer is apparent from their names.

Some soil types vary so much in slope, degree of erosion, number and size of stones, or some other feature affecting their use, that practical suggestions about their management could not be made if they were shown on the soil map as one unit. Such soil types are divided into soil phases. The name of a soil phase indicates a feature that affects management. For example, Iredell loam, 2 to 6 percent slopes, is one of several phases of Iredell loam, a soil type that ranges from nearly level to sloping.

After a guide for classifying and naming the soils had been worked out, the soil scientists drew the boundaries of the individual soils on aerial photographs. These photographs show woodlands, buildings, field borders, trees, and other details that greatly help in drawing soil boundaries accurately. The soil map in the back of this report was prepared from the aerial photographs.

The areas shown on a soil map are called mapping units. On most maps detailed enough to be useful in planning management of farms and fields, a mapping unit is nearly equivalent to a soil type or a phase of a soil type. It is not exactly equivalent, because it is not practical to show on such a map all the small, scattered bits of soil of some other kind that have been seen within an area that is dominantly of a recognized soil type or soil phase.

In preparing some detailed maps, the soil scientists have a problem of delineating areas where different kinds of soils are so intricately mixed, and so small in size, that it is not practical to show them separately on the map. Therefore, they show this mixture of soils as one mapping unit and call it a soil complex. Ordinarily, a soil complex is named for the major kinds of soils in it. Also, on most soil maps, areas are shown that are so shallow or so frequently worked by wind and water that they scarcely can be called soils. These areas are shown on a soil map like other mapping units, but they are given descriptive names, such as Mixed alluvial land; Gullied land, friable materials, rolling; and Gullied land, friable materials, hilly.

While a soil survey is in progress, samples are taken, as needed, for laboratory measurements and for engineering tests. Laboratory data from the same kinds of soils in other places are assembled. Data on yields of crops under defined practices are assembled from farm records and from field or plot experiments on the same kind of soils. Yields under defined management are estimated for all the soils.

But only part of a soil survey is done when the soils have been named, described, and delineated on the map, and the laboratory data and yield data have been assembled. The mass of detailed information then needs to be organized in a way that is readily useful to different groups of readers, among them farmers, foresters, engineers, and biologists. Grouping soils that are similar in suitability for each specified use is a method of organization commonly used in the soil survey reports. Based on the yield and practice tables and other data, the soil scientists set up trial groups, and test them by further study and by consultation with farmers, agronomists, engineers, and others. Then, the scientists adjust the

groups according to the results of their studies and consultations. Thus, the groups that are finally evolved reflect up-to-date knowledge of the soils and their behavior under present methods of use and management.

Descriptions of the Soils

This section describes for nontechnical readers the soil series (groups of soils) and single soils (mapping units) of York County. The acreage and proportionate extent of each mapping unit are given in table 1.

The procedure in this section is first to describe the soil series, and then the mapping units in that series. Thus, to get full information of any one mapping unit, it is necessary to read the description of that unit and also the description of the soil series to which it belongs. As mentioned in the section "How Soils Are Mapped and Classified," a few of the mapping units are not members of soil series. Local alluvial land, Rock outcrop, and other miscellaneous land types do not belong to a soil series but, nevertheless, are listed in alphabetic order along with the soil series.

A soil symbol in parentheses follows each mapping unit and identifies that unit on the detailed soil map. Listed at the end of the description of a mapping unit are the capability unit and the woodland suitability group in which that kind of soil has been placed. The pages on which the capability unit and woodland suitability group are described can be found readily by referring to the "Guide to Mapping Units, Capability Units, Woodland Suitability Groups, and Wildlife Suitability Groups" at the back of this report.

Soil scientists, teachers, foresters, engineers, and others who want more detailed information about soils should turn to the section "Formation, Morphology, and Classification of Soils." Many terms used in the soil descriptions and in other sections of the report are defined in the Glossary.

TABLE 1.—*Approximate acreage and proportionate extent of soils*

Soil	Acres	Percent	Soil	Acres	Percent
Altavista fine sandy loam, 0 to 6 percent slopes	440	0. 1	Cecil sandy loam, 2 to 6 percent slopes, eroded	22, 508	5. 1
Appling coarse sandy loam, thin solum, 2 to 6 percent slopes	1, 951	. 4	Cecil sandy loam, 6 to 10 percent slopes, eroded	6, 308	1. 4
Appling coarse sandy loam, thin solum, 2 to 6 percent slopes, eroded	748	. 2	Cecil sandy loam, 10 to 15 percent slopes, eroded	4, 820	1. 1
Appling coarse sandy loam, thin solum, 6 to 10 percent slopes	1, 763	. 4	Cecil sandy loam, 15 to 30 percent slopes	401	. 1
Appling coarse sandy loam, thin solum, 6 to 10 percent slopes, eroded	1, 013	. 2	Cecil sandy loam, 15 to 25 percent slopes, eroded	5, 293	1. 2
Appling coarse sandy loam, thin solum, 10 to 15 percent slopes	234	. 1	Chewacla silt loam	3, 198	. 7
Appling coarse sandy loam, thin solum, 10 to 15 percent slopes, eroded	428	. 1	Colfax sandy loam, 2 to 6 percent slopes	405	. 1
Appling coarse sandy loam, thin solum, 15 to 25 percent slopes, eroded	249	. 1	Congaree fine sandy loam	1, 812	. 4
Appling sandy loam, 2 to 6 percent slopes	3, 298	. 8	Davidson clay loam, 2 to 6 percent slopes, eroded	628	. 1
Appling sandy loam, 2 to 6 percent slopes, eroded	7, 926	1. 8	Davidson clay loam, 6 to 10 percent slopes, severely eroded	110	(1)
Appling sandy loam, 6 to 10 percent slopes	1, 057	. 2	Durham sandy loam, 2 to 6 percent slopes	2, 131	. 5
Appling sandy loam, 6 to 10 percent slopes, eroded	5, 206	1. 2	Durham sandy loam, 6 to 10 percent slopes	1, 721	. 4
Appling sandy loam, 10 to 15 percent slopes	545	. 1	Elbert loam	2, 609	. 6
Appling sandy loam, 10 to 15 percent slopes, eroded	3, 192	. 7	Enon clay loam, 2 to 6 percent slopes, severely eroded	529	. 1
Appling sandy loam, 15 to 25 percent slopes	683	. 2	Enon clay loam, 6 to 10 percent slopes, severely eroded	1, 071	. 3
Appling sandy loam, 15 to 25 percent slopes, eroded	1, 578	. 3	Enon clay loam, 10 to 15 percent slopes, severely eroded	546	. 1
Buncombe loamy sand, 0 to 4 percent slopes	520	. 1	Enon sandy loam, 2 to 6 percent slopes, eroded	7, 728	1. 8
Cataula clay loam, 2 to 6 percent slopes, severely eroded	379	. 1	Enon sandy loam, 6 to 10 percent slopes, eroded	7, 731	1. 8
Cataula clay loam, 6 to 10 percent slopes, severely eroded	1, 025	. 2	Enon sandy loam, 10 to 15 percent slopes, eroded	3, 697	. 8
Cataula clay loam, 10 to 15 percent slopes, severely eroded	654	. 1	Enon sandy loam, 15 to 25 percent slopes, eroded	2, 868	. 7
Cataula clay loam, 15 to 25 percent slopes, severely eroded	189	(1)	Gullied land, firm materials	1, 782	. 4
Cataula sandy loam, 2 to 6 percent slopes, eroded	611	. 1	Gullied land, friable materials, rolling	1, 995	. 5
Cataula sandy loam, 6 to 10 percent slopes, eroded	432	. 1	Gullied land, friable materials, hilly	2, 108	. 5
Cecil clay loam, 2 to 6 percent slopes, severely eroded	14, 325	3. 3	Helena sandy loam, 2 to 6 percent slopes	1, 381	. 3
Cecil clay loam, 6 to 10 percent slopes, severely eroded	13, 519	3. 1	Helena sandy loam, 2 to 6 percent slopes, eroded	3, 190	. 7
Cecil clay loam, 10 to 15 percent slopes, severely eroded	5, 891	1. 3	Helena sandy loam, 6 to 10 percent slopes	351	. 1
Cecil clay loam, 15 to 25 percent slopes, severely eroded	3, 423	. 8	Helena sandy loam, 6 to 10 percent slopes, eroded	3, 086	. 7
			Helena sandy loam, 10 to 15 percent slopes, eroded	1, 438	. 3
			Hiwassee sandy loam, 2 to 6 percent slopes, eroded	297	. 1
			Hiwassee sandy loam, 6 to 10 percent slopes, eroded	155	(1)
			Hiwassee sandy loam, 10 to 18 percent slopes, eroded	328	. 1
			Iredell loam, 0 to 2 percent slopes	8, 555	1. 9
			Iredell loam, 2 to 6 percent slopes	5, 299	1. 2
			Iredell loam, 2 to 6 percent slopes, eroded	2, 222	. 5

TABLE 1.—*Approximate acreage and proportionate extent of soils*—Continued

Soil	Acres	Percent
Iredell loam, 6 to 10 percent slopes, eroded	1,003	0.2
Iredell loam, thin solum, 0 to 2 percent slopes	1,141	.3
Iredell loam, thin solum, 2 to 6 percent slopes	2,509	.6
Iredell sandy loam, 0 to 2 percent slopes	465	.1
Iredell sandy loam, 2 to 6 percent slopes	4,296	1.0
Iredell sandy loam, 2 to 6 percent slopes, eroded	1,699	.4
Iredell sandy loam, 6 to 10 percent slopes	303	.1
Iredell sandy loam, 6 to 10 percent slopes, eroded	732	.2
Iredell very stony loam, 0 to 6 percent slopes	424	.1
Lloyd clay loam, 2 to 6 percent slopes, severely eroded	19,525	4.4
Lloyd clay loam, 6 to 10 percent slopes, severely eroded	13,934	3.2
Lloyd clay loam, 10 to 15 percent slopes, severely eroded	4,711	1.1
Lloyd clay loam, 15 to 25 percent slopes, severely eroded	4,034	.9
Lloyd clay loam, compact subsoil, 2 to 6 percent slopes, severely eroded	593	.1
Lloyd clay loam, compact subsoil, 6 to 10 percent slopes, severely eroded	918	.2
Lloyd clay loam, compact subsoil, 10 to 20 percent slopes, severely eroded	606	.1
Lloyd loam, 2 to 6 percent slopes	372	.1
Lloyd loam, 2 to 6 percent slopes, eroded	14,259	3.3
Lloyd loam, 6 to 10 percent slopes	199	(1)
Lloyd loam, 6 to 10 percent slopes, eroded	2,894	.7
Lloyd loam, 10 to 15 percent slopes, eroded	1,995	.5
Lloyd sandy loam, 2 to 6 percent slopes, eroded	9,069	2.1
Lloyd sandy loam, 6 to 10 percent slopes, eroded	1,806	.4
Lloyd sandy loam, 10 to 15 percent slopes, eroded	1,277	.3
Lloyd sandy loam, 15 to 25 percent slopes	379	.1
Lloyd sandy loam, 15 to 25 percent slopes, eroded	4,393	1.0
Lloyd sandy loam, compact subsoil, 2 to 6 percent slopes, eroded	319	.1
Local alluvial land	710	.2
Louisburg sandy loam, 2 to 6 percent slopes	717	.2
Louisburg sandy loam, 6 to 10 percent slopes	1,536	.4
Louisburg sandy loam, 10 to 15 percent slopes	1,033	.2
Louisburg sandy loam, 15 to 25 percent slopes	837	.2
Manteo channery silt loam, 10 to 15 percent slopes, eroded	243	.1
Manteo channery silt loam, 15 to 35 percent slopes	1,969	.4
Mecklenburg clay loam, 2 to 6 percent slopes, severely eroded	1,390	.3
Mecklenburg clay loam, 6 to 10 percent slopes, severely eroded	3,822	.9
Mecklenburg clay loam, 10 to 15 percent slopes, severely eroded	1,333	.3
Mecklenburg clay loam, 15 to 25 percent slopes, severely eroded	1,240	.3
Mecklenburg loam, 0 to 2 percent slopes	460	.1
Mecklenburg loam, 2 to 6 percent slopes, eroded	10,179	2.3
Mecklenburg loam, 6 to 10 percent slopes, eroded	3,584	.8
Mecklenburg loam, 10 to 15 percent slopes, eroded	1,223	.3
Mecklenburg loam, 15 to 25 percent slopes, eroded	1,170	.3
Mine pits and dumps	86	(1)
Mixed alluvial land	20,001	4.6
Mixed alluvial land, wet	9,358	2.1
Molena loamy sand, 2 to 8 percent slopes	126	(1)
Nason silt loam, 2 to 6 percent slopes, eroded	2,519	.6
Nason silt loam, 6 to 10 percent slopes, eroded	3,557	.8
Nason silt loam, 10 to 15 percent slopes, eroded	2,075	.5
Nason silt loam, 15 to 25 percent slopes	502	.1
Nason silt loam, 15 to 25 percent slopes, eroded	1,650	.4
Roanoke silt loam	108	(1)
Rock outcrop	126	(1)
Tatum gravelly silt loam, 2 to 6 percent slopes, eroded	1,149	.3
Tatum gravelly silt loam, 6 to 10 percent slopes, eroded	801	.2
Tatum gravelly silt loam, 10 to 15 percent slopes, eroded	394	.1
Tatum gravelly silt loam, 15 to 25 percent slopes, eroded	1,451	.3
Tatum silt loam, 2 to 6 percent slopes	188	(1)
Tatum silt loam, 2 to 6 percent slopes, eroded	9,646	2.2
Tatum silt loam, 6 to 10 percent slopes	227	(1)
Tatum silt loam, 6 to 10 percent slopes, eroded	7,501	1.7
Tatum silt loam, 10 to 15 percent slopes, eroded	5,153	1.1
Tatum silt loam, 15 to 25 percent slopes	2,171	.5
Tatum silt loam, 15 to 25 percent slopes, eroded	5,956	1.4
Tatum silty clay loam, 2 to 6 percent slopes, severely eroded	1,859	.4
Tatum silty clay loam, 6 to 10 percent slopes, severely eroded	2,875	.7
Tatum silty clay loam, 10 to 15 percent slopes, severely eroded	1,037	.2
Tatum silty clay loam, 15 to 25 percent slopes, severely eroded	1,705	.4
Vance clay loam, 2 to 10 percent slopes, severely eroded	257	.1
Vance clay loam, 10 to 25 percent slopes, severely eroded	182	(1)
Vance sandy loam, 2 to 6 percent slopes, eroded	881	.2
Vance sandy loam, 6 to 10 percent slopes, eroded	900	.2
Vance sandy loam, 10 to 15 percent slopes, eroded	586	.1
Vance sandy loam, 15 to 25 percent slopes, eroded	358	.1
Wickham sandy loam, 2 to 6 percent slopes, eroded	985	.2
Wickham sandy loam, 6 to 15 percent slopes, eroded	215	.1
Wilkes complex, 2 to 6 percent slopes	300	(1)
Wilkes complex, 6 to 10 percent slopes	1,188	.3
Wilkes complex, 10 to 15 percent slopes	4,807	1.1
Wilkes complex, 6 to 15 percent slopes, eroded	1,359	.3
Wilkes complex, 15 to 35 percent slopes	33,585	7.7
Wilkes complex, 15 to 35 percent slopes, eroded	3,684	1.0
Worsham sandy loam, 2 to 6 percent slopes	1,815	.4
Worsham sandy loam, 6 to 15 percent slopes	196	(1)
Land	438,400	100.0
Water	7,680	
Total	446,080	

[1] Less than 0.1 percent.

Altavista Series

In the Altavista series are deep, moderately well drained soils on second bottoms of the larger streams in the Piedmont. These soils developed in material that washed from soils that formed in residuum derived from granite, gneiss, schist, and basic rocks. They have a dark grayish-brown to light grayish-brown fine sandy loam surface layer and a light yellowish-brown to strong-brown fine sandy clay loam upper subsoil. Below a depth of 15 to 24 inches, the subsoil is light yellowish-brown clay mottled with yellowish brown, strong brown, and

light gray. At a depth of 30 to 48 inches, there is a layer of fine sandy clay strongly mottled with light brownish gray and brownish yellow. Weathered bedrock is at a depth of 6 to 40 feet or more. Slopes of the Altavista soils range from 0 to 6 percent.

The Altavista soils occur with the Wickham and Hiwassee soils. They have a lighter colored surface layer than those soils. In addition, the Altavista soils have brown to yellow subsoil, whereas the Wickham and Hiwassee soils have a brown to red subsoil.

The Altavista soils have moderately slow permeability, moderately rapid infiltration, and a medium available moisture capacity. They have low natural fertility, contain little organic matter, and are slightly acid to medium acid.

These soils are suited to cultivation and are responsive to management. Tilth is easy to maintain. A small part is cultivated; the rest is forested, idle, or used for nonagricultural purposes.

The original vegetation was oak, gum, elm, maple, and a few pines. The undergrowth consisted of briers and native grasses.

Altavista fine sandy loam, 0 to 6 percent slopes (AaB).—This is a deep, moderately well drained, light-colored fine sandy loam on the second bottoms of the larger streams.

Typical profile:

0 to 12 inches, grayish-brown, very friable fine sandy loam.
12 to 33 inches, light yellowish-brown, friable fine sandy clay mottled with strong brown; subangular blocky structure.
33 to 41 inches, light-gray, firm clay mottled with yellowish brown; coarse, blocky structure.
41 to 76 inches +, light brownish-gray, friable fine sandy clay mottled with brownish yellow.

Gentle slopes, good tilth, and a thick root zone make this soil suitable for most crops grown in the county. Erosion is a hazard in cultivated areas. Crops respond well to fertilizer and lime. Close-growing crops are needed every other year to protect the soil from erosion and to help maintain the supply of organic matter. If managed well, bermudagrass, tall fescue, annual lespedeza, and white clover are suitable for pasture and hay. (Capability unit IIe–2; woodland suitability group 5; wildlife suitability group 1)

Appling Series

In the Appling series are deep, well-drained soils on uplands of the Piedmont. The soils developed in residuum that weathered from granite, gneiss, and schist. They have a light brownish-gray to dark grayish-brown sandy loam surface layer and a yellowish-brown to red clay upper subsoil. Below a depth of 20 to 35 inches, the subsoil is red clay mottled with light yellowish brown or pale yellow. At a depth of 24 to 48 inches, there is a layer of sandy clay loam strongly mottled with red, brown, yellow, and white. Weathered bedrock is at a depth of 3 to 40 feet or more. Slopes of the Appling soils range from about 2 to 25 percent.

The Appling soils occur with the Cecil, Durham, Helena, Enon, and Louisburg soils. They are intermediate in color between the red Cecil soils and the yellow Durham soils. They have a lighter colored surface layer (A horizon) and a more friable subsoil than the Helena and the Enon soils. They have a thicker solum and much more distinct horizons than the Louisburg soils.

Appling soils are well drained throughout. They have moderate permeability and infiltration and a medium available moisture capacity. They have low natural fertility and a low content of organic matter and are medium acid to strongly acid.

Most of the Appling soils are suited to cultivation and are responsive to management. About 50 percent of their area is cultivated; the rest is forested, pastured, idle, or used for nonagricultural purposes.

The original vegetation consisted of oak, hickory, gum, and pine trees and an undergrowth of vines, briers, and native grasses.

Appling sandy loam, 2 to 6 percent slopes (ApB).—This is a deep, well-drained, light-colored soil on uplands.

Typical profile:

0 to 10 inches, light brownish-gray, very friable sandy loam.
10 to 16 inches, yellowish-brown, friable sandy clay loam; subangular blocky structure.
16 to 34 inches, red, friable clay mottled with light red and brown; subangular blocky structure.
34 to 41 inches +, red, firm clay to sandy clay loam mottled with yellowish brown, pale yellow, and strong brown.

Gentle slopes, good tilth, and good available moisture capacity make this soil suitable for all crops grown in the county. Erosion is the chief hazard in cultivated areas. Crops respond well to fertilizer and lime. Close-growing crops are needed every other year to protect the soil from erosion and to help maintain the supply of organic matter. If managed well, bermudagrass, sericea lespedeza, annual lespedeza, and crimson clover are suitable for pasture and hay. (Capability unit IIe–2; woodland suitability group 6; wildlife suitability group 1)

Appling sandy loam, 2 to 6 percent slopes, eroded (ApB2).—This is an important agricultural soil. It occupies ridgetops and short, breaking slopes.

This soil is not so thick as Appling sandy loam, 2 to 6 percent slopes. Its 3- to 5-inch plow layer is a mixture of former surface soil and the subsoil. The texture of this layer ranges from sandy loam to sandy clay loam. Most areas of this soil are in cultivated crops and pasture. Some of the acreage is forested, and some is idle.

Appling sandy loam, 2 to 6 percent slopes, eroded, produces fair yields of the cultivated crops commonly grown in the county. If moderately limed and fertilized, this soil produces average yields of bermudagrass, dallisgrass, crimson clover, sericea lespedeza, and annual lespedeza.

Terraces and grassed waterways that conserve moisture and prevent erosion are needed on this soil. Rotations should include close-growing crops one-half of the time. (Capability unit IIe–2; woodland suitability group 6; wildlife suitability group 1)

Appling sandy loam, 6 to 10 percent slopes (ApC).—This is an important agricultural soil. It has shorter slopes than Appling sandy loam, 2 to 6 percent slopes. Also, the amount and rate of runoff are greater and the hazard of erosion is more severe than on the less sloping soil.

The thickness of the surface layer ranges from 4 to 12 inches. The color of the subsoil ranges from yellowish brown to reddish brown. Mottling occurs at a greater depth than in Appling sandy loam, 2 to 6 percent slopes.

Much of the acreage of this soil is in tilled crops, but some is in pasture and some in trees. A small acreage is idle or used for nonfarm purposes.

This soil is suitable for all crops commonly grown in the county. Rotations should be moderately long and consist of close-growing crops two-thirds of the time. The use of crop residue and green-manure crops help to increase the supply of organic matter. Suitable plants for hay and pasture are bermudagrass, dallisgrass, tall fescue, crimson clover, sericea lespedeza, and annual lespedeza.

Terraces and grassed waterways should be established if the soil is used for crops grown in rotation. (Capability unit IIIe–2; woodland suitability group 6; wildlife suitability group 1)

Appling sandy loam, 6 to 10 percent slopes, eroded (ApC2).—The plow layer is 2 to 6 inches thick and is a mixture of the original surface layer and subsoil. Its color ranges from brown to yellow. The subsoil is mottled at a greater depth than that of Appling sandy loam, 2 to 6 percent slopes. Also, the amount and rate of runoff are greater than on the more gently sloping soil. Shallow gullies are common.

Some areas of this soil are in tilled crops and pasture. Some are forested, and a small acreage is idle or is used for nonfarm purposes.

This soil responds to lime and fertilizer. If management is good, fair yields of crops are obtained. A complete water-disposal system is needed if the soil is used for crops. Also, this soil should be in close-growing crops two-thirds of the time. Bermudagrass, dallisgrass, sericea lespedeza, and annual lespedeza are suitable for hay and pasture. (Capability unit IIIe–2; woodland suitability group 6; wildlife suitability group 1)

Appling sandy loam, 10 to 15 percent slopes (ApD).—The slopes of this soil are shorter than those of Appling sandy loam, 2 to 6 percent slopes. The thickness of the surface soil ranges from 4 to 12 inches. The thickness of the solum ranges from 24 to 40 inches. Runoff is rapid, and the erosion hazard is serious.

Most areas of this soil are forested. A small acreage is cropped and pastured, and a small part is idle or used for nonfarm purposes.

Contour stripcropping and other means of controlling erosion are needed. Terracing, however, is not feasible. Strips should consist of close-growing perennials three-fourths of the time, and rotations should last 4 to 8 years. Grasses and legumes respond to liberal applications of fertilizer and lime.

If this soil is used for row crops, yields less than average can be expected. Under good management, pasture consisting of bermudagrass, sericea lespedeza, annual lespedeza, or kudzu is fairly productive. (Capability unit IVe–1; woodland suitability group 7; wildlife suitability group 2)

Appling sandy loam, 10 to 15 percent slopes, eroded (ApD2).—The surface layer of this soil ranges from 2 to 5 inches in thickness and is generally yellowish brown. The solum, however, ranges from 18 to 30 inches in thickness. Slopes are shorter than those on Appling sandy loam, 2 to 6 percent slopes. This soil is very erodible.

Most areas of this soil are forested. A small acreage is pastured, idle, or used for nonfarm purposes.

The serious erosion hazard restricts the use of this soil for cultivated crops. Terracing is not feasible. If the soil is cultivated, stripcropping on the contour in a rotation that is 4 to 8 years in length is desirable to control erosion. Less than average yields, however, can be expected.

Bermudagrass, sericea lespedeza, and kudzu respond to fertilization, but yields are less than average for the county. (Capability unit IVe–1; woodland suitability group 7; wildlife suitability group 2)

Appling sandy loam, 15 to 25 percent slopes (ApE).—This inextensive soil occurs on the steeper slopes adjacent to streams and below the more gently sloping Appling and other associated soils. The surface layer ranges from 7 to 10 inches in thickness and is generally brown in color. The subsoil is usually light red to yellowish red and from 12 to 30 inches thick. The slopes of this soil are shorter than those of Appling sandy loam, 2 to 6 percent slopes. Also, the amount and rate of runoff are greater and the hazard of erosion is more serious.

Most areas of this soil are forested, but small areas are pastured, and other small areas are idle or used for nonfarm purposes.

This soil is unsuited to row crops. If it is used for pasture, lime, fertilizer, and controlled grazing are needed. Suitable pasture plants are bermudagrass, kudzu, and sericea lespedeza, but only fair yields can be expected. (Capability unit VIe–1; woodland suitability group 7; wildlife suitability group 2)

Appling sandy loam, 15 to 25 percent slopes, eroded (ApE2).—This soil occurs on the steeper slopes adjacent to streams and below the more gently sloping Appling soils. The surface layer ranges from 2 to 7 inches in thickness and is generally light yellowish brown. In most places the subsoil is yellowish red to light red and ranges from 12 to 28 inches in thickness. This soil has shorter and steeper slopes than Appling sandy loam, 2 to 6 percent slopes. Consequently, the amount and rate of runoff is greater and the hazard of erosion is more serious than on the less sloping soil. Shallow gullies are common; deep gullies occur in some places.

Most areas of this soil have been cleared and cultivated but now have reverted to forest. A small acreage, however, is pastured, and a few acres are still cultivated. Also, a small acreage is idle or used for nonfarm purposes.

This soil is unsuited to row crops. If it is used for pasture, liberal amounts of lime and fertilizer should be applied and rotation grazing practiced. Suitable pasture plants are bermudagrass, kudzu, and sericea lespedeza, but only fair yields can be expected. (Capability unit VIe–1; woodland suitability group 7; wildlife suitability group 2)

Appling coarse sandy loam, thin solum, 2 to 6 percent slopes (AcB).—This is a moderately coarse textured soil on uplands. It occurs chiefly with the Louisburg soils and occupies the gently sloping ridges that are narrow or of medium width.

Typical profile:

0 to 11 inches, light olive-brown, very friable coarse sandy loam.
11 to 14 inches, yellowish-brown, friable coarse sandy clay loam; subangular blocky structure.
14 to 19 inches, yellowish-red sandy clay mottled with brownish yellow; firm; blocky structure.
19 to 24 inches +, yellowish-red coarse sand mottled with brownish yellow, olive yellow, and white.

This soil is suited to many cultivated crops, but in places granite boulders on its surface are so large that

machines must go around them. Crops respond to applications of fertilizer and lime. If this soil is used for cultivation, close-growing crops are needed every other year to supply organic matter and to help prevent erosion. This soil is only fairly well suited to pasture. (Capability unit IIe–2; woodland suitability group 10; wildlife suitability group 1)

Appling coarse sandy loam, thin solum, 2 to 6 percent slopes, eroded (AcB2).—The surface layer of this soil is 2 to 4 inches thinner than that of Appling coarse sandy loam, thin solum, 2 to 6 percent slopes, and runoff is greater.

This soil is suited to many crops grown in the county, but close-growing crops are needed every other year to prevent erosion and help supply organic matter. Because it is droughty, this soil is not well suited to pasture. (Capability unit IIe–2; woodland suitability group 10; wildlife suitability group 1)

Appling coarse sandy loam, thin solum, 6 to 10 percent slopes (AcC).—This soil is on the stronger slopes near streams and on sharp hilltops. The amount and rate of runoff are greater than on Appling coarse sandy loam, thin solum, 2 to 6 percent slopes. Large granite boulders crop out.

If this soil is cultivated, close-growing crops are needed 2 years out of 3 to help prevent erosion. Crops respond to fertilizer and lime, but pasture grasses produce only fair yields. (Capability unit IIIe–2; woodland suitability group 10; wildlife suitability group 1)

Appling coarse sandy loam, thin solum, 6 to 10 percent slopes, eroded (AcC2).—This soil is on stronger slopes than Appling coarse sandy loam, thin solum, 2 to 6 percent slopes. The amount and rate of runoff are therefore greater. Shallow gullies are common.

If this soil is cultivated, close-growing crops are needed 2 years out of 3 to help prevent erosion and to supply organic matter. Pasture grasses do not grow well on this soil. Peach trees grow fairly well (fig. 6). (Capability unit IIIe–2; woodland suitability group 10; wildlife suitability group 1)

Appling coarse sandy loam, thin solum, 10 to 15 percent slopes (AcD).—This soil occurs on strong short slopes along medium-sized streams. The solum is 6 to 12 inches thinner than that of Appling coarse sandy loam, thin solum, 2 to 6 percent slopes. Also, the amount and rate of runoff are greater.

Neither cultivated crops nor pasture grow well on this soil. It probably was never cleared, and it is now in a mixture of pines and hardwoods, for which it is best suited. Because the erosion hazard is severe, it is not practical to clear this soil. (Capability unit IVe–1; woodland suitability group 11; wildlife suitability group 2)

Appling coarse sandy loam, thin solum, 10 to 15 percent slopes, eroded (AcD2).—This soil is on strong slopes along drainageways. The surface layer is thinner than that of Appling coarse sandy loam, thin solum, 2 to 6 percent slopes. Also, slopes are shorter, runoff is greater, and erosion is a more serious hazard. A few granite boulders crop out in places. The solum ranges from 10 to 20 inches in thickness.

This soil is not suited to cultivated crops. Pasture plants do not grow well on this droughty soil. (Capability unit IVe–1; woodland suitability group 11; wildlife suitability group 2)

Appling coarse sandy loam, thin solum, 15 to 25 percent slopes, eroded (AcE2).—This soil has a surface layer 2 to 7 inches thick. It occupies the moderately steep slopes adjacent to the medium-sized streams. The slopes are stronger and the amount and rate of runoff are greater than on Appling coarse sandy loam, thin solum, 2 to 6 percent slopes, eroded. Large outcrops of granite are common.

This soil is unsuited to cultivated crops or to pasture. It is best suited to pine trees. (Capability unit VIe–1; woodland suitability group 11; wildlife suitability group 2)

Buncombe Series

In the Buncombe series are deep, droughty soils on bottom lands along the larger streams in the Piedmont. These soils have a very dark grayish-brown to pale-brown loamy sand surface layer. This layer is underlain at a depth of about 11 inches by sand that is mottled, or streaked, with dark brown and yellowish brown. This young soil has not been in place long enough to develop genetically related horizons. Layers of mixed sand and gravel commonly are at a depth below 4 feet. The parent material weathered from granite, gneiss, schist, or basic rocks.

The Buncombe soils occur among the well-drained Congaree soils, the moderately well drained Chewacla soils, and the well-drained and poorly drained, Mixed alluvial land. They differ from these soils, however, in being droughty.

Buncombe soils have slow runoff and excessive internal drainage. Permeability and infiltration are rapid, and the available moisture capacity is low. These soils have low natural fertility and a low organic-matter content and are slightly acid to strongly acid.

The Buncombe soils make up only a small percentage of the county. A little of the acreage is cultivated; the rest is wooded, idle, or pastured.

The original vegetation was oak, elm, beech, gum, and ash trees and an undergrowth of canes, briers, and native grasses.

Buncombe loamy sand, 0 to 4 percent slopes (Bu).—This is a deep, excessively drained soil on the first bottoms of the Broad and Catawba Rivers.

Typical profile:

0 to 11 inches, very dark grayish-brown, very friable loamy sand.
11 to 48 inches +, yellowish-brown loose sand with streaks of dark brown, brown, and yellow.

Because this soil is droughty, its use for cultivated crops is greatly limited. However, its root zone is thick, and tilth is easy to maintain. Less droughty areas of this soil can be used for corn, annual hay, and bermudagrass, but these crops require heavy applications of fertilizer if they are to produce profitable yields. (Capability unit IIIs–2; woodland suitability group 2; wildlife suitability group 5)

Cataula Series

In the Cataula series are moderately deep to deep, moderately well drained soils on uplands of the Piedmont. They developed in residuum that weathered from light-colored gneiss or aplitic granite and are influenced

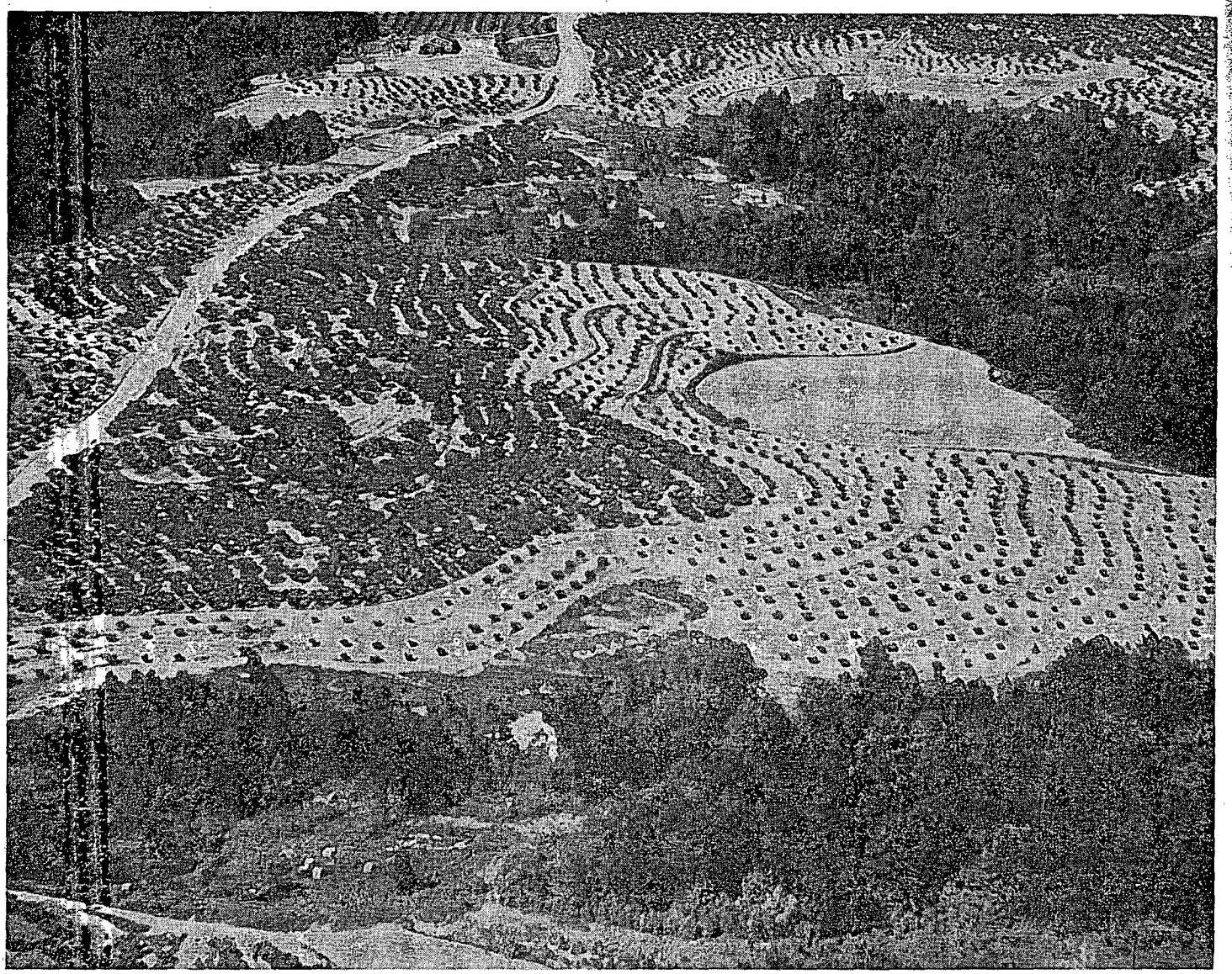

Figure 6.—**Peach trees planted on the contour on Appling coarse sandy loam, thin solum, 6 to 10 percent slopes, eroded. Capability unit IIIe–2.**

locally by slightly basic rocks. These soils have a dark yellowish-brown to light yellowish-brown surface layer and a yellowish-red to light-red clay loam upper subsoil. In places where all the original surface soil has been removed by sheet erosion, the color of the surface layer is light red to red and the texture is clay loam to clay. Below a depth of 8 to 16 inches the subsoil is red clay. At a depth of 18 to 30 inches there is a layer of clay loam, mottled with red, yellowish red, reddish yellow, and strong brown, that contains fine mica. Depth to weathered bedrock ranges from 3 to 30 feet or more. Slopes range from 2 to 25 percent.

The Cataula soils occur with the Cecil, Enon, and Wilkes soils. They have a finer textured subsoil than the Cecil soils. They are redder throughout than the Enon soils. They have a thicker solum than the Wilkes soils and much more distinct horizons.

Cataula soils are moderately well drained. They have moderately slow to slow permeability, moderately slow infiltration, and a low available moisture capacity. They have low fertility and a low content of organic matter and are slightly acid to strongly acid.

Nearly all the acreage of this soil has been cleared and cultivated. Now most of it is forested, but some is cultivated and some pastured. Also, some areas are idle and some are used for nonagricultural purposes.

The original vegetation was oak, elm, gum, cedar, and pine trees and an undergrowth of vines, briers, and native grasses.

Cataula sandy loam, 2 to 6 percent slopes, eroded (CbB2).—This is a moderately deep to deep, moderately well drained soil.

Typical profile:

0 to 8 inches, dark yellowish-brown to light yellowish-brown, very friable sandy loam.

8 to 12 inches, yellowish-red, friable clay loam, subangular blocky structure.
12 to 28 inches, red, firm clay; strong, blocky structure.
28 to 40 inches, red, compact clay mottled with strong brown; very firm; strong blocky structure grading toward platy.
40 to 73 inches +, red, friable clay loam mottled with yellowish red and strong brown.

This soil is fairly well suited to corn, cotton, sorghum, and small grain. Crops respond well to fertilizer and lime. Erosion is the chief hazard in cultivated areas, and close-growing crops are needed every other year to protect the soil and to help maintain the organic-matter content. If well managed, this soil is suited to bermudagrass, tall fescue, dallisgrass, sericea lespedeza, annual lespedeza, and crimson clover for pasture and hay. (Capability unit IIe–3; woodland suitability group 15; wildlife suitability group 4)

Cataula sandy loam, 6 to 10 percent slopes, eroded (CbC2).—The solum of this soil is 2 to 10 inches thinner than that of Cataula sandy loam, 2 to 6 percent slopes, eroded. Also, slopes are stronger and shorter, the amount and rate of runoff are greater, and erosion is a more serious hazard.

This soil is responsive to good management. Cotton, corn, and small grain respond to additions of fertilizer. Close-growing crops are needed 2 years out of 3 if this soil is cultivated. If it is well managed, this soil is suited to bermudagrass, tall fescue, annual lespedeza, and sericea lespedeza for pasture and hay. (Capability unit IIIe–3; woodland suitability group 15; wildlife suitability group 4)

Cataula clay loam, 2 to 6 percent slopes, severely eroded (CaB3).—This soil has lost all its original surface layer through erosion. The present surface layer is yellowish red and is 2 to 4 inches thick. Some shallow gullies have formed. Because the surface layer is fine textured, water infiltrates slowly to very slowly and runoff is rapid. Permeability is slow, and roots penetrate in this soil slowly. The available mositure capacity of this soil is very low.

All areas of this soil have been cleared and used for crops and pasture, but now most areas are forested.

If row crops are grown, they should be rotated with close-growing crops. Large applications of lime and fertilizer help to insure fair yields. Manure, crop residue, and close-growing crops are needed to increase the content of organic matter.

Contour tillage, terraces, grassed waterways, and strips of close-growing crops are needed to protect this erodible soil. (Capability unit IIIe–3; woodland suitability group 17; wildlife suitability group 3)

Cataula clay loam, 6 to 10 percent slopes, severely eroded (CaC3).—The fine-textured surface layer of this soil is yellowish red to red. Slopes are shorter than those of Cataula clay loam, 2 to 6 percent slopes, severely eroded, and the amount and rate of runoff is greater. Internal drainage is slow, and aeration is poor. Some gullies that cannot be crossed by tillage implements are active, but deeper gullies, for the most part, are stabilized by vegetation.

Much of the acreage of this soil has been cropped to cotton, but now most of it is forested. Because the erosion hazard is serious, this soil is not suited to cultivated crops. Well fertilized pastures of bermudagrass, annual lespedeza, and sericea lespedeza give only fair yields. (Capability unit IVe–2; woodland suitability group 17; wildlife suitability group 3)

Cataula clay loam, 10 to 15 percent slopes, severely eroded (CaD3).—This soil has lost all its original surface layer through erosion. Erosion is a serious hazard, and some gullies have formed that cannot be crossed by tillage implements. In most places the surface layer is yellowish red. This soil has shorter and stronger slopes than Cataula clay loam, 2 to 6 percent slopes, severely eroded.

Because erosion is a serious hazard, this soil is not suited to cultivated crops or to pasture. It is best suited to forest. (Capability unit VIe–3; woodland suitability group 17; wildlife suitability group 3)

Cataula clay loam, 15 to 25 percent slopes, severely eroded (CaE3).—This is an inextensive soil. It is on steep slopes at the head of streams and along their sides. The surface layer is yellowish-red to red clay loam or clay. The slopes are shorter and stronger than those on Cataula clay loam, 2 to 6 percent slopes, severely eroded, and the amount and rate of runoff are greater.

All areas of this soil are in trees, for which it is best suited. Pine trees predominate. (Capability unit VIIe–3; woodland suitability group 17; wildlife suitability group 3)

Cecil Series

In the Cecil series are deep, well-drained soils on uplands of the Piedmont. They developed in residuum weathered from metamorphic and igneous rocks, such as granite, gneiss, and schist. Cecil soils have a grayish-brown to dark-brown sandy loam surface layer and a yellowish-red to red clay loam upper subsoil. Below a depth of 12 to 24 inches, the subsoil is red clay. At a depth of 24 to 60 inches there is a sandy clay loam layer mottled with yellowish red, brown, and red. Depth to weathered bedrock ranges from 5 to 50 feet or more. Slopes range from about 2 to 30 percent.

The Cecil soils occur with the Appling, Durham, Lloyd, Enon, and Wilkes soils. Their subsoil is redder than that in the Appling and Durham soils and is lighter red than that in the Lloyd soils. They are redder and more friable throughout than the Enon soils. They have a thicker solum and more distinct horizons than the Wilkes soils.

Where accelerated erosion has removed the original surface soil, the Cecil soils have a yellowish-red surface layer that is clay loam in most places. Areas of Cecil soils that contain quartz gravel are small and few. The areas on Ferguson, Little Nanny, and Barnett Mountains have medium and large cobbles on the surface and are forested.

Cecil soils are well drained throughout. Permeability and infiltration are moderate and the available moisture capacity is medium. These soils have low natural fertility, contain little organic matter, and are slightly acid to medium acid.

These soils are widely distributed throughout the county. About 50 percent of their acreage is cultivated; the rest is forested, pastured, idle, or used for nonfarm purposes. Much of their acreage, if well managed, is suited to cultivation.

The Cecil soils developed under forest. The original vegetation was oak, hickory, gum, and pine trees and an

undergrowth of briers, shrubs, vines, and native grasses.

Cecil sandy loam, 2 to 6 percent slopes, eroded (CdB2).—This is a deep, well-drained, red sandy loam soil on uplands.

Typical profile:

0 to 6 inches, dark-brown, very friable sandy loam.
6 to 14 inches, yellowish-red, friable clay loam; subangular blocky structure.
14 to 43 inches, red, friable to firm clay; subangular blocky structure.
43 to 48 inches +, red sandy clay loam mottled with reddish yellow.

Gentle slopes, good tilth, and good available moisture capacity make this soil suited to all crops grown in the county. Erosion is the chief hazard on cultivated areas. Crops respond well to fertilizer and lime. If this soil is used for row crops, a water-disposal system is needed. Close-growing crops should be planted every other year to protect the soil from erosion and to help maintain the content of organic matter. If managed well, bermudagrass, sericea lespedeza, annual lespedeza, and crimson clover are suitable for pasture and hay. Moderate practices for soil and water conservation are needed (fig. 7). (Capability unit IIe–1; woodland suitability group 6; wildlife suitability group 1)

Cecil sandy loam, 6 to 10 percent slopes, eroded (CdC2).—This soil is on breaks adjacent to Cecil sandy loam, 2 to 6 percent slopes, eroded, and to associated soils. Generally, its slopes are shorter than those of the adjacent Cecil soil. Also, infiltration is slower and the amount of runoff is greater. Consequently, sheet and gully erosion are increased.

Much of the acreage of this soil is forested. Small areas are cropped, pastured, idle, or used for nonfarm purposes.

If this soil is fertilized and limed, yields are average. A moderately long rotation that keeps two-thirds of the acreage in grass or some other close-growing crop is needed to help control erosion and to maintain the content of organic matter.

Bermudagrass, dallisgrass, tall fescue, annual lespedeza, sericea lespedeza, crimson clover, and white clover can be grown for pasture and hay. Yields are average if the soil is fertilized. (Capability unit IIIe–1; woodland suitability group 6; wildlife suitability group 1)

Figure 7.—**Meadow outlet in natural drainageway on Cecil sandy loam, 2 to 6 percent slopes, eroded. Capability unit IIe–1.**

Cecil sandy loam, 10 to 15 percent slopes, eroded (CdD2).—Slopes on this soil are shorter than those of Cecil sandy loam, 2 to 6 percent slopes, eroded, and erosion is a more serious hazard. The thickness of the solum ranges from 20 to 36 inches.

Most areas of this soil have been cropped but have largely reverted to pine or have been planted to pine. A small acreage is in crops or pasture, and a little is idle or used for nonfarm purposes. Because slopes are strong and the erosion hazard is serious, this soil is not suitable for cultivation.

If this soil is used for pasture, use lime and fertilizer and control grazing. (Capability unit IVe–1; woodland suitability group 7; wildlife suitability group 2)

Cecil sandy loam, 15 to 30 percent slopes (CdE).—The slopes on this soil are short. The surface layer is 2 to 8 inches thicker than that of Cecil sandy loam, 2 to 6 percent slopes, eroded, and erosion is a more serious hazard. The thickness of the solum ranges from 14 to 32 inches. This soil is on short, abrupt breaks along small- and medium-sized streams.

Some areas of this soil have been cleared, but most are forested. Only small areas are pastured, idle, or used for nonfarm purposes.

Because its slopes are steep and erosion is a hazard, this soil is not suitable for cultivation. Farm machinery cannot be used on the steep slopes.

If this soil is adequately fertilized, it produces fair yields of kudzu or sericea lespedeza. (Capability unit VIe–1; woodland suitability group 7; wildlife suitability group 2)

Cecil sandy loam, 15 to 25 percent slopes, eroded (CdE2).—This soil occupies breaks adjacent to the more gently sloping Cecil and associated soils. Small gullies have formed in some places. The solum ranges from 12 to 30 inches in thickness. Slopes are shorter than those of Cecil sandy loam, 2 to 6 percent slopes, eroded.

Most areas of this soil are forested. A small acreage is idle or used for nonfarm purposes. Because this soil has steep slopes and is susceptible to further erosion, it is not suitable for cultivation. Its use for pasture is limited. Kudzu and sericea lespedeza are suitable pasture plants and produce fair yields and a good cover if they are adequately limed and fertilized. (Capability unit VIe–1; woodland suitability group 7; wildlife suitability group 2)

Cecil clay loam, 2 to 6 percent slopes, severely eroded (CcB3).—This soil is widely distributed through the county. It is mostly on ridgetops and on gentle slopes near moderately gullied areas. All the original surface layer has been lost through erosion. The present surface layer is predominantly red to yellowish red and is 2 to 4 inches thick. Its texture ranges from clay loam to sandy clay loam. Because this soil is fine textured, infiltration is slow and the amount of runoff is greater than that on Cecil sandy loam, 2 to 6 percent slopes, eroded. Sheet erosion and shallow gullies are common.

All the acreage of this soil has been cultivated, much of it for a while continuously to cotton. Now much of it has reverted to pines.

Because this soil is deficient in organic matter and is low in natural fertility, it is not well suited to crops. If it is cultivated, crop residue should be left on the soil and cover

crops turned under 2 years in 3. Heavy applications of fertilizer and lime are needed for fair yields of cultivated crops, hay, or pasture. (Capability unit IIIe–1; woodland suitability group 8; wildlife suitability group 3)

Cecil clay loam, 6 to 10 percent slopes, severely eroded (CcC3).—The surface layer of this soil ranges from clay loam to sandy clay loam in texture and from reddish brown to red in color. Slopes are shorter than those of Cecil sandy loam, 2 to 6 percent slopes, eroded. Numerous shallow gullies have formed.

Most areas of this soil have been cleared but have reverted to pines. Very small areas are cropped, idle, pastured, or used for nonfarm purposes.

Because slopes are short and the erosion hazard is serious, this soil is not suited to cultivation. If adequately fertilized and limed, it is suited to perennial grasses and legumes. (Capability unit IVe–1; woodland suitability group 8; wildlife suitability group 3)

Cecil clay loam, 10 to 15 percent slopes, severely eroded (CcD3).—The surface layer of this soil ranges from reddish brown to red in color and from sandy clay loam to clay in texture. The depth to parent material ranges from 12 to 24 inches. Runoff is very rapid, and many shallow gullies have formed.

Most areas of this soil are in pines. A small acreage is idle or is used for nonfarm purposes.

This soil is deficient in nutrients, and plant growth is very slow. The erosion hazard makes the soil unsuitable for cultivated crops or pasture. (Capability unit VIe–1; woodland suitability group 8; wildlife suitability group 3)

Cecil clay loam, 15 to 25 percent slopes, severely eroded (CcE3).—This soil is moderately extensive. It is on breaks between small streams and in areas adjacent to the more gently sloping Cecil and associated soils. The present surface layer ranges from sandy clay loam to clay in texture and from reddish brown to red in color. The original surface layer has been removed by erosion. In small areas much subsoil material has also been lost. The thickness of the solum ranges from 10 to 20 inches. Shallow gullies are common.

Nearly all the acreage of this soil is forested, predominantly with pines. Only small areas are idle or used for nonfarm purposes. Because the erosion hazard is serious and slopes are steep, this soil is not suitable for crops and pasture. (Capability unit VIIe–1; woodland suitability group 8; wildlife suitability group 3)

Chewacla Series

The soils in the Chewacla series are deep and somewhat poorly drained. They have a grayish-brown to dark-brown silt loam surface layer and a mottled dark-brown, grayish-brown, yellowish-brown, and gray silty clay loam subsoil. Mottling occurs at a depth of 10 to 22 inches. At a depth of 18 to 36 inches there is a layer of silty clay loam mottled with yellowish brown, dark brown, and gray. Moisture is excessive at a depth of 24 to 60 inches. These soils developed in alluvium that washed from areas of weathered granite, gneiss, schist, and basic rocks. They occupy nearly level areas (0 to 2 percent slopes) on first bottoms along the larger streams in the Piedmont.

The Chewacla soils occur among the Congaree soils. They are more poorly drained than the Congaree soils.

Chewacla soils are somewhat poorly drained throughout. Permeability is moderately slow, infiltration is slow, and the available moisture capacity is high. Depth to the water table ranges from 24 to 60 inches. These soils are subject to frequent flooding. They are high in natural fertility and moderately high in content of organic matter. They are slightly acid to strongly acid.

The Chewacla soils occupy a small acreage in the county. They are in narrow, elongated strips on first bottoms along the larger streams. Much of their acreage is now in trees, but some is in pasture.

The original vegetation consisted of oak, ash, cottonwood, gum, birch, sycamore, and hickory trees and an understory of reeds, briers, and native grasses.

Chewacla silt loam (Ch).—This is a deep, somewhat poorly drained soil.

Typical profile:

0 to 16 inches, grayish-brown, very friable silt loam.
16 to 30 inches, dark-brown friable silt loam mottled with grayish brown; granular structure.
30 to 36 inches +, friable silty clay loam mottled with yellowish brown, dark brown, and gray.

This soil is fairly well suited to such crops as corn, oats, soybeans, and annual lespedeza. Tilth is fairly easy to maintain. Organic matter can be maintained by using green-manure crops or crop residue. Loss of a crop from flooding or waterlogging can be expected every 2 to 4 years. Open ditches are needed to remove surface water quickly.

Because moisture is favorable, this soil is productive of such grasses and legumes as dallisgrass, bermudagrass, tall fescue, white clover, and annual lespedeza. (Capability unit IIIw–2; woodland suitability group 3; wildlife suitability group 7)

Colfax Series

The soils of the Colfax series are deep and somewhat poorly drained. They occur in nearly level and gently sloping areas at the head of small drainageways and on low divides between drainageways. They developed in residuum that weathered from granite, gneiss, and other rocks. They have an olive to grayish-brown sandy loam surface layer and an olive-yellow to yellowish-brown sandy clay loam upper subsoil. Below a depth of 18 to 32 inches, the subsoil is light yellowish-brown clay mottled with brownish yellow and light brownish gray. At a depth of 42 to 60 inches there is a layer of coarse sandy loam distinctly mottled with light gray, brownish yellow, and red. Depth to weathered bedrock ranges from 10 to 60 feet or more. Slopes range from about 0 to 6 percent.

The Colfax soils occur with the Cecil, Appling, and Durham soils. They occupy a lower position than those soils and are not so well drained.

Colfax soils are somewhat poorly drained. Permeability is moderately slow and infiltration is rapid. The available moisture capacity is moderately high to high. These soils have low natural fertility, contain little organic matter, and are medium acid or strongly acid.

Much of the acreage of the Colfax soils is suitable for cultivation if well managed. About 40 percent of the acreage is pastured; the rest is cultivated, forested, idle, or used for nonagricultural purposes.

The original vegetation consisted of oak, gum, alder, and elm trees and an undergrowth of reeds, briers, and native grasses.

Colfax sandy loam, 2 to 6 percent slopes (CoB).—This soil is not extensive. It is somewhat poorly drained.

Typical profile:

0 to 13 inches, olive-gray to pale-yellow, very friable sandy loam.
13 to 23 inches, olive-yellow, friable to firm sandy clay loam; blocky structure.
23 to 34 inches, light yellowish-brown, firm clay mottled with brownish yellow; strong blocky structure.
34 to 55 inches, mottled light brownish-gray, brownish-yellow, and light-gray clay that grades to coarse sandy clay.

All the acreage of this soil has been cropped. As the soil has gentle slopes and is easy to till, it is suitable for cultivation. Open ditches, however, are needed in places on the nearly level areas to remove surface water. Truck crops, corn, and small grain respond to good management. Tall fescue, bermudagrass, dallisgrass, annual lespedeza, and white clover produce moderately good yields. (Capability unit IIIw–3; woodland suitability group 12; wildlife suitability group 7)

Congaree Series

In the Congaree series are deep, well-drained soils on the first bottoms of the larger streams. They are young soils that have not been in place long enough to develop genetically related horizons. The parent material is alluvium that washed from areas of weathered granite, gneiss, schist, and basic rocks.

These soils have a dark grayish-brown to light brownish-gray fine sandy loam surface layer. At a depth of 24 to 48 inches they are underlain by loamy fine sand mottled with dark brown, grayish brown, and yellowish brown. Slopes range from 0 to 2 percent.

The Congaree soils occur among the Chewacla and Buncombe soils, and the well-drained and poorly drained Mixed alluvial land. Congaree soils are better drained than the Chewacla soils and Mixed alluvial land, wet. They are not so excessively drained as the Buncombe soils. They have a more uniform texture in the surface layer than the well-drained Mixed alluvial land.

Congaree soils are well drained throughout, but they are subject to occasional flooding. Infiltration and permeability are moderately rapid. The available moisture capacity is moderately high. These soils have medium natural fertility and a high organic-matter content. They are medium acid.

Under good management, much of the acreage of the Congaree soils is suitable for cultivation, but crop loss from flooding is expected in 1 out of every 5 years. About 20 percent of the acreage is cultivated; the rest is pastured, forested, idle, or used for nonagricultural purposes.

The original vegetation consisted of oak, hickory, elm, beech, gum, ash, and cottonwood trees and an undergrowth of vines, canes, briers, and native grasses.

Congaree fine sandy loam (Cn).—This is a deep, well-drained, soil on first bottoms of the larger streams.

Typical profile:

0 to 7 inches, dark grayish-brown, very friable fine sandy loam.
7 to 33 inches, yellowish-brown, very friable fine sandy loam; weak granular structure.
33 to 44 inches +, loamy fine sand mottled with dark brown, yellowish brown, and grayish brown.

This friable soil permits easy penetration of plant roots and free movement of water and air. Because of good tilth and a good available moisture capacity, this soil is suited to corn, small grain, truck, and other crops. If managed well, dallisgrass, bermudagrass, tall fescue, annual lespedeza, and white clover are suitable for pasture and hay. (Capability unit IIw-2; woodland suitability group 1; wildlife suitability group 6)

Davidson Series

In the Davidson series are deep, well-drained soils on broad ridges in the Piedmont. They developed in residuum that weathered from dark-colored, basic rocks, such as gabbro, diorite, and hornblende schist. They have a dusky-red to dark-red clay loam surface layer and a dusky-red to dark-red clay loam upper subsoil. Below a depth of 12 to 20 inches the subsoil is dark-red to red clay. At a depth of 40 to 72 inches there is a layer of clay loam mottled with red and reddish yellow. The mottling, however, is caused by colors in the parent material and not by slow internal drainage. Depth to weathered bedrock ranges from 7 to 60 feet or more. Slopes range from 2 to 10 percent.

The Davidson soils occur with the Lloyd, Mecklenburg, and Iredell soils. Their surface layer is redder than that in Lloyd, Mecklenburg, and Iredell soils, and their subsoil is darker red.

Davidson soils are well drained throughout. They have moderate permeability, moderately slow infiltration, and a medium available moisture capacity. They have high natural fertility and a moderate amount of organic matter and are slightly acid or medium acid.

About 75 percent of the acreage of these soils is cultivated; the rest is forested, pastured, idle, or used for nonagricultural purposes. Cultivated crops respond to good management on these soils.

The original vegetation was oak, hickory, dogwood, redcedar, holly, and pine trees and an undergrowth of vines, briers, and native grasses.

Davidson clay loam, 2 to 6 percent slopes, eroded (DaB2).—Locally, this soil is called push-dirt.

Typical profile:

0 to 15 inches, dusky-red, friable and sticky clay loam.
15 to 50 inches, dark-red to red firm clay; subangular blocky structure.
50 to 54 inches +, mottled red and reddish-yellow, friable clay loam.

Most areas of this soil are in cultivation. Some areas are pastured, forested, idle, or used for nonfarm purposes.

Because of gentle slopes, high natural fertility, and a good available moisture capacity, this soil is suited to all crops grown in the county.

Erosion is the chief hazard on cultivated areas. Crops respond well to additions of fertilizer. Close-growing crops are needed every other year to protect the soil and help maintain organic matter. If managed well, bermudagrass, dallisgrass, sericea lespedeza, annual lespedeza, crimson clover, and alfalfa are suitable for pasture and hay. (Capability unit IIe–1; woodland suitability group 9; wildlife suitability group 1)

Davidson clay loam, 6 to 10 percent slopes, severely eroded (DaC3).—The slopes on this soil are shorter and

steeper than those of Davidson clay loam, 2 to 6 percent slopes, eroded, and texture of the surface layer is finer. Also, infiltration is slower and sheet erosion more severe.

All the acreage of this soil has been cultivated. Now, most of it is forested. The rest is pastured, idle, or used for nonfarm purposes.

Because of the serious hazard of erosion in cultivated areas, three-fourths of the acreage should be kept in close-growing crops. Bermudagrass, dallisgrass, tall fescue, sericea lespedeza, and annual lespedeza respond well to fertilizer and lime; pasture or hay yields are fair. (Capability unit IVe–1; woodland suitability group 9; wildlife suitability group 3)

Durham Series

The Durham series consists of deep, well-drained to moderately well drained soils in the Piedmont. They developed in residuum that weathered from granite. They have a grayish-brown to dark grayish-brown sandy loam to loamy sand surface layer and a yellow to light yellowish-brown sandy clay loam upper subsoil. Below a depth of 12 to 30 inches, the subsoil is brownish-yellow sandy clay mottled with yellow and reddish yellow. At a depth of 38 to 48 inches there is a layer of sandy clay loam to coarse sandy clay loam mottled with strong brown, reddish yellow, olive yellow, and light gray. Depth to weathered bedrock ranges from 6 to 60 feet or more. Slopes range from about 2 to 10 percent.

The Durham soils occur with the Appling, Colfax, Helena, and Worsham soils. They have a lighter colored and coarser textured subsoil than the Appling soils. They do not have the moderately plastic subsoil that is present in the Helena soils. They are in higher positions and are better drained than the Colfax and Worsham soils.

Durham soils are well drained to moderately well drained throughout. They have moderate to moderately slow permeability and rapid infiltration. Their available moisture capacity is low. They are medium acid to strongly acid, have low natural fertility, and contain little organic matter.

All the acreage of Durham soils is suitable for cultivation. About 60 percent is cultivated; the rest is forested, pastured, idle, or used for nonagricultural purposes.

The original vegetation on these sandy loams consisted of oak, hickory, dogwood, and pine trees and an undergrowth of vines, briers, and native grasses.

Durham sandy loam, 2 to 6 percent slopes (DuB).—This is a deep, moderately well drained to well drained, light-colored soil on uplands.

Typical profile:

0 to 16 inches, grayish-brown to pale-yellow, very friable sandy loam.
16 to 23 inches, yellow, friable sandy clay loam; subangular blocky structure.
23 to 36 inches, brownish-yellow, friable to firm clay loam; blocky structure.
36 to 45 inches, firm clay mottled with yellow, brownish yellow, and reddish yellow; blocky structure.
45 to 47 inches +, sandy clay loam mottled with reddish yellow, yellowish red, and pale olive.

Because of gentle slopes, a thick root zone, and good tilth, this soil is fairly well suited to watermelons, peanuts, sweetpotatoes, and cotton. It is droughty and leaches readily but is suited to deep-rooted grasses and legumes. (Capability unit IIe–2; woodland suitability group 6; wildlife suitability group 1)

Durham sandy loam, 6 to 10 percent slopes (DuC).—Generally, this soil has shorter slopes and a thinner subsoil than Durham sandy loam, 2 to 6 percent slopes. It is suited to the same crops as the less sloping soil, but it needs more careful management because the erosion hazard is greater. All tillage should be on the contour, and a complete water-disposal system ought to be established. Also, rotations should be longer than those on Durham sandy loam, 2 to 6 percent slopes. (Capability unit IIIe–2; woodland suitability group 6; wildlife suitability group 1)

Elbert Series

The soils of the Elbert series are deep and poorly drained and have a plastic subsoil. They developed mainly in colluvium that washed or rolled mainly from areas of Iredell soils. They have a very dark gray to dark grayish-brown loam surface layer and a very dark grayish-brown to dark-brown clay upper subsoil. Below a depth of 18 to 30 inches, the subsoil is dark grayish-brown clay mottled with olive. At a depth of 30 to 42 inches, there is a layer of weathered material mottled with pale olive, olive, dark yellowish brown, and light olive brown. Depth to bedrock ranges from 4 to 10 feet or more. Slopes range from 0 to 2 percent.

The Elbert soils occur mainly with the Iredell soils. Small areas occur with the Mecklenburg soils.

Elbert soils are poorly drained. They have very slow permeability and infiltration but a high available moisture capacity. Their natural fertility and their content of organic matter are low. The soils are slightly acid.

Under good management, much of the acreage of Elbert soils is suitable for cultivated crops. About 50 percent is pastured; the rest is cultivated, forested, idle, or used for nonagricultural purposes

The original vegetation was mostly blackjack and post oak trees and an undergrowth of native grasses.

Elbert loam (Eb).—This is a deep, poorly drained, dark-colored loam in upland depressions.

Typical profile:

0 to 8 inches, very dark gray, friable loam.
8 to 26 inches, very dark grayish-brown, very firm clay; blocky structure.
26 to 37 inches, clay mottled with dark grayish brown and olive; very firm; blocky structure.
37 to 40 inches +, weathered parent material mottled with pale olive, olive, yellowish brown, and light olive brown.

This soil is difficult to keep in good tilth. Because of gentle slopes and a high available moisture capacity, the soil is suited to such crops as corn and grain sorghum. If managed well, tall fescue, dallisgrass, bermudagrass, annual lespedeza, and white clover are suitable for pasture and hay. (Capability unit IVw–2; woodland suitability group 18; wildlife suitability group 7)

Enon Series

The Enon series consists of moderately deep to deep, well drained to moderately well drained soils in the Piedmont. They developed in residuum that weathered from mixed acid and basic rocks. They have a very

dark grayish-brown to brown sandy loam to clay loam surface layer and a strong-brown clay loam upper subsoil. The depth to mottling ranges from 12 to 30 inches. Below a depth of 14 to 30 inches the subsoil is light olive-brown clay mottled with strong brown and yellowish red. At a depth of 20 to 40 inches there is a layer of clay loam mottled with strong brown, yellowish red, and light gray. Depth to weathered bedrock ranges from 3 to 40 feet or more. Slopes range from 2 to 25 percent.

The Enon soils occur with the Cecil, Lloyd, Cataula, Appling, Iredell, and Wilkes soils. They differ from the Cecil, Lloyd, and Appling soils in having a brown surface layer and upper subsoil and mottling below a depth of 14 inches. They differ from the Cataula soils in having a less red upper subsoil. They are better drained and less plastic than the Iredell soils. They are deeper to bedrock than the Wilkes soils, and their horizons are more distinct.

Enon soils are moderately well drained. Infiltration is moderate, permeability is moderately slow, and the available moisture capacity is medium. These soils have low natural fertility and a low content of organic matter. They are slightly acid to strongly acid.

The Enon soils are widely scattered throughout the county. About 25 percent of their acreage is cultivated; the rest is forested, pastured, idle, or used for nonfarm purposes. Cultivated crops respond to good management on much of the acreage.

The original vegetation was oak, hickory, gum, elm, redcedar, and pine trees and an undergrowth of briers, vines, and native grasses.

Enon sandy loam, 2 to 6 percent slopes, eroded (EsB2).—This is a moderately deep to deep, moderately well drained soil in the Piedmont.

Typical profile:

0 to 7 inches, grayish-brown, very friable sandy loam.
7 to 14 inches, strong-brown, friable clay loam; subangular blocky structure.
14 to 34 inches, firm clay mottled with strong brown, pale brown, light olive brown, yellowish red, and red; strong blocky structure.
34 to 72 inches, weathered parent material mottled with strong brown, yellowish red, and light gray.

Because of gentle slopes, good tilth, and good available moisture capacity, this soil is suited to many crops grown in the county. Erosion is the chief hazard in cultivated areas. Close-growing crops are needed every other year to protect the soil from erosion and to help maintain the content of organic matter. Crops respond well to fertilizer and lime. Bermudagrass, dallisgrass, tall fescue, white clover, and annual lespedeza are suitable for pasture and hay. (Capability unit IIe–3; woodland suitability group 15; wildlife suitability group 4)

Enon sandy loam, 6 to 10 percent slopes, eroded (EsC2).—Erosion is the chief hazard on this soil. Because of shorter, stronger slopes, the amount and rate of runoff are greater than on Enon sandy loam, 2 to 6 percent slopes, eroded. In most places the solum is 3 to 6 inches shallower than that of the less sloping soil.

If this soil is used for cultivated crops, management is needed that includes a rotation in which a close-growing crop is grown 2 years in 3. Also a complete water-disposal system should be used. Cotton, corn, small grain, and soybeans are suitable cultivated crops. Plants suitable for pasture and hay are bermudagrass, dallisgrass, tall fescue, annual lespedeza, and white clover. (Capability unit IIIe–3; woodland suitability group 15; wildlife suitability group 4)

Enon sandy loam, 10 to 15 percent slopes, eroded (EsD2).—This soil occurs on strong slopes along the streams. Erosion is a serious hazard. The amount and rate of runoff are greater than on Enon sandy loam, 2 to 6 percent slopes, eroded.

Because of strong slopes and a severe hazard of erosion, this soil cannot be feasibly cultivated. Bermudagrass, dallisgrass, sericea lespedeza, and annual lespedeza provide good cover. Under good management, this soil can be used occasionally for grazing. (Capability unit IVe–2; woodland suitability group 16; wildlife suitability group 4)

Enon sandy loam, 15 to 25 percent slopes, eroded (EsE2).—This soil occurs on moderately steep slopes along and at the head of streams. Erosion is the chief hazard. The solum of this soil is 6 to 10 inches thinner than that of Enon sandy loam, 2 to 6 percent slopes, eroded.

It is not practical to cultivate or to pasture this soil, which is best suited to trees. (Capability unit VIe–3; woodland suitability group 16; wildlife suitability group 2)

Enon clay loam, 2 to 6 percent slopes, severely eroded (EnB3).—The surface layer of this soil is fine textured. Erosion is a serious hazard. The amount and rate of runoff are greater than on Enon sandy loam, 2 to 6 percent slopes, eroded. The original surface layer has been lost through erosion.

Crop yields are only fair. Suitable crops are cotton, small grain, and annual lespedeza. If fertilized well, bermudagrass, dallisgrass, white clover, and annual lespedeza produce fair yields of pasture or hay. (Capability unit IIIe–3; woodland suitability group 17; wildlife suitability group 3)

Enon clay loam, 6 to 10 percent slopes, severely eroded (EnC3).—The surface layer of this soil is finer textured than that of Enon sandy loam, 2 to 6 percent slopes, eroded. Also, slopes are stronger and runoff is greater in volume and more rapid.

It is not feasible to cultivate this soil, as the erosion hazard is severe. If managed well, bermudagrass, annual lespedeza, and sericea lespedeza produce fair grazing. (Capability unit IVe–2; woodland suitability group 17; wildlife suitability group 3)

Enon clay loam, 10 to 15 percent slopes, severely eroded (EnD3).—This soil occupies strongly sloping areas along and at the head of streams. Runoff is rapid, and the erosion hazard is severe. The solum is 12 to 18 inches thinner than that of Enon sandy loam, 2 to 6 percent slopes, eroded.

This soil is not suited to cultivated crops or to pasture. It is best suited to trees. (Capability unit VIe–3; woodland suitability group 17; wildlife suitability group 3)

Gullied Land

Gullied land consists mainly of small areas that are very severely eroded. However, a few areas in the western part of the county are fairly large. The gullies are moderately deep. Small patches or narrow strips of soil occur between the gullies. In these patches the texture of the surface soil ranges from gravelly sandy loam to clay. The thickness of the subsoil varies. Most of this land is on slopes that range from 4 to 25 percent. Most

of the gullies have been stabilized by trees and honeysuckle.

Gullied land, firm materials (Gf).—This land has a firm, light-brown to red subsoil. The exposed parent material, which was derived from basic rocks, is firm to friable. This land is less permeable to roots and water and is more difficult to work than Gullied land, friable materials, rolling. Also, an effective cover is harder to establish. (Capability unit VIIe–2; woodland suitability group not assigned; wildlife suitability group 3)

Gullied land, friable materials, rolling (GuC).—This land has a friable, yellow to red subsoil. Slopes range from 2 to 10 percent. The exposed parent material was derived from granite, gneiss, or schist. It is friable to very friable and is moved easily by runoff. The gullies are stabilized by trees, honeysuckle, and kudzu. (Capability unit VIIe–2; woodland suitability group not assigned; wildlife suitability group 3)

Gullied land, friable materials, hilly (GuD).—This land has slopes of 10 to 30 percent. The yellow to red subsoil is friable, and exposed parent material is moved easily by runoff. Drop inlets, chutes, drops, and other engineering structures are required in most places to stabilize these gullies. (Capability unit VIIe–2; woodland suitability group not assigned; wildlife suitability group 3)

Helena Series

The Helena series consists of deep, moderately well drained soils in the Piedmont. They developed in residuum weathered from mixed acid and basic rocks, such as aplitic granite, gneiss, and quartz diorite. They have a pale-olive to brown sandy loam surface layer and a yellowish-brown to pale-yellow sandy clay loam upper subsoil. Below a depth of 9 to 20 inches, the subsoil is yellowish-brown clay mottled with pale yellow, brownish yellow, and white. At a depth of 37 to 42 inches, there is a layer of sandy clay mottled with pale brown, pink, yellowish red, reddish yellow, and white. Depth to weathered bedrock ranges from 5 to 40 feet or more. Slopes range from 2 to 15 percent.

The Helena soils occur with Cecil, Appling, Durham, Colfax, Worsham, and Wilkes soils. They are more slowly permeable and less well drained than the Cecil, Appling, and Durham soils. Also, they differ from these soils in having a more plastic subsoil. They are in higher positions and are better drained than the Colfax and Worsham soils. They are deeper and more strongly developed than the Wilkes soils.

Helena soils are moderately well drained. They have moderately slow permeability, moderate infiltration, and a medium available moisture capacity. These soils have low natural fertility and a low content of organic matter. They are very slightly acid or medium acid.

These soils are widely scattered throughout the central part of the county. About 30 percent is cultivated; the rest is pastured, forested, idle, or used as nonagricultural land. Cultivated crops respond to good management on much of the acreage of Helena soils.

The original vegetation was oak, gum, elm, pine, and redcedar trees and an undergrowth of vines, briers, and native grasses.

Helena sandy loam, 2 to 6 percent slopes (HaB).—This deep, moderately well drained soil has a firm, medium plastic, blocky subsoil.

Typical profile:

0 to 11 inches, brown to light-brown, very friable sandy loam.
11 to 20 inches, yellowish-brown, friablesandy clay loam; subangular blocky structure.
20 to 39 inches, yellowish-brown, yellow, brownish-yellow, pale yellow, and white firm clay; strong blocky structure.
39 to 74 inches, sandy clay mottled with pale brown, white, pink, yellowish red, and reddish yellow.

Because of gentle slopes, good tilth, and a good available moisture capacity, this soil is suited to such crops as small grain, corn, soybeans, and cotton. Crops respond well to fertilizer and lime.

Erosion is the chief hazard in cultivated areas. A rotation that includes a close-growing crop every other year helps to protect the soil and to maintain organic matter. Bermudagrass, dallisgrass, tall fescue, annual lespedeza, white clover, and sericea lespedeza are suitable for pasture and hay. (Capability unit IIe–3; woodland suitability group 15; wildlife suitability group 4)

Helena sandy loam, 2 to 6 percent slopes, eroded (HaB2).—The surface layer of this soil ranges from 2 to 6 inches in thickness. In some places the plow layer is a mixture of surface soil and subsoil material. This soil is more eroded than Helena sandy loam, 2 to 6 percent slopes.

This soil is susceptible to further erosion. Good management is needed that includes the use of a moderately long rotation and deep-rooted legumes. Close-growing crops should be grown one-half of the time. A complete water-disposal system is needed to control erosion.

Bermudagrass, tall fescue, dallisgrass, annual lespedeza, white clover, and sericea lespedeza respond to fertilizer and line and produce fairly good yields of pasture and hay. (Capability unit IIIe–3; woodland suitability group 15; wildlife suitability group 4)

Helena sandy loam, 6 to 10 percent slopes (HaC).—This soil has a profile similar to that of Helena sandy loam, 2 to 6 percent slopes. Runoff is more rapid, and erosion is a more serious hazard. This soil occupies strong, short slopes along and at the head of small drainageways in the more gently sloping Helena and Durham soils.

All crops grown respond to applications of fertilizer and lime. A rotation is needed that includes close-growing crops two-thirds of the time to control erosion.

Bermudagrass, dallisgrass, tall fescue, annual lespedeza, and sericea lespedeza respond to applications of fertilizer and produce fairly good yields of pasture and hay. (Capability unit IIIe–3; woodland suitability group 15; wildlife suitability group 4)

Helena sandy loam, 6 to 10 percent slopes, eroded (HaC2).—This soil occupies hilltops within areas of Helena sandy loam, 2 to 6 percent slopes. It occupies short, strong slopes above the Colfax soils. The surface soil has been eroded by sheet erosion. It ranges from 2 to 5 inches in thickness and is much thinner than the less sloping Helena soil. In addition, this soil has shorter and stronger slopes and a higher rate and volume of runoff. The hazard of erosion is severe. In a few small areas, all of the surface soil has been lost through erosion.

Small grain, annual lespedeza, soybeans, corn, and cotton produce fair yields if large amounts of fertilizer

are added. However, because further erosion is likely, this soil should be kept under a continuous cover.

If well managed, bermudagrass, dallisgrass, tall fescue, sericea lespedeza, and white clover produce fair yields. (Capability unit IVe–2; woodland suitability group 15; wildlife suitability group 4)

Helena sandy loam, 10 to 15 percent slopes, eroded (HaD2).—The surface layer of this soil ranges from 2 to 4 inches in thickness. It is thinner than that of Helena sandy loam, 2 to 6 percent slopes. Also, its slopes are shorter and stronger, and the amount and rate of runoff are greater.

Most areas of this soil are forested. Crops respond to good management, but only fair yields can be expected.

Because it is susceptible to further erosion, this soil is best suited to trees or to pasture consisting of continuous bermudagrass, dallisgrass, tall fescue, or annual lespedeza. Liberal fertilizing and rotation grazing are needed to keep permanent sod that will protect the soil and hold mositure. (Capability unit VIe–3; woodland suitability group 16; wildlife suitability group 4)

Hiwassee Series

The soils of the Hiwassee series are deep, friable, well drained, and reddish-brown. They are on river terraces and have developed in old alluvium that washed from materials weathered from dark-colored rock. They have a reddish-brown to dark reddish-brown sandy loam surface layer, 2 to 12 inches thick, and a dark-red to dusky-red clay loam upper subsoil. Below a depth of 16 to 30 inches, the subsoil is red to dark-red silty clay to clay. At a depth of 37 to 72 inches, there is a layer of sandy clay loam mottled with red, brownish yellow, strong brown, or reddish yellow. Depth to bedrock ranges from 20 to 80 feet or more. Slopes range from 2 to 18 percent.

The texture of the surface layer ranges from sandy loam to clay loam. In areas where sheet erosion has removed the original surface soil, this layer is clay loam and is usually red. Some areas of the Hiwassee soils have a stony or gravelly lower subsoil. These areas occur in an intricate pattern with the nonstony Hiwassee soils.

The Hiwassee soils are on old, high terraces along the Broad and Catawba Rivers. They occur with the Cecil, Lloyd, Wickham, Molena, and Wilkes soils. They differ from the Cecil and Lloyd soils chiefly in kind of parent material and in the way they have formed. They are darker red throughout than the Wickham soils, have a heavier textured subsoil than the Molena soils, and are better developed than the Wilkes soils.

Hiwassee soils are well drained throughout. Infiltration and permeability are moderate and available moisture capacity is medium. These soils have fairly high natural fertility and a low content of organic matter. They are slightly acid or medium acid.

The largest areas of these soils are south of Fort Mill, in the northeastern part of the county. Smaller areas are in the western part near Broad River. Under good management, much of the Hiwassee acreage is suitable for cultivation. About 30 percent of the acreage is cultivated; the rest is idle, forested, pastured, or used for nonagricultural purposes.

The original vegetation was oak, hickory, dogwood, sourwood, holly, cedar, and pine trees and an undergrowth of shrubs, briers, and native grasses.

Hiwassee sandy loam, 2 to 6 percent slopes, eroded (HwB2).—This is a deep, well-drained, dark-red soil on river terraces.

Typical profile:

0 to 6 inches, reddish-brown, very friable sandy loam.
6 to 20 inches, dark-red, friable clay loam; subangular blocky structure.
20 to 60 inches, dark-red, friable silty clay; subangular blocky structure.
60 to 70 inches, red, firm clay; blocky structure.
70 to 75 inches +, sandy clay loam mottled with red and brownish yellow; contains many pieces of water-rounded gravel and rock fragments 3 to 12 inches across.

Because of good tilth, gentle slopes, and good available moisture capacity, this soil is suited to such crops as corn, cotton, small grain, and soybeans. Erosion is the chief hazard in cultivated areas. Crops respond to applications of fertilizer and lime. Close-growing crops are needed every other year to protect the soil and to help maintain organic matter. Bermudagrass, dallisgrass, tall fescue, annual lespedeza, sericea lespedeza, crimson clover, and white clover are suitable for pasture and hay. (Capability unit IIe–1; woodland suitability group 6; wildlife suitability group 1)

Hiwassee sandy loam, 6 to 10 percent slopes, eroded (HwC2).—This soil has stronger slopes, more and faster runoff, and a greater amount of erosion than Hiwassee sandy loam, 2 to 6 percent slopes, eroded.

This soil is suited to such crops as corn, cotton, soybeans, and small grain. If it is used for crops, a complete water-disposal system should be established, and a rotation that includes a close-growing crop every other year should be used. Bermudagrass, dallisgrass, tall fescue, annual lespedeza, sericea lespedeza, and crimson clover are suitable for pasture and hay. (Capability unit IIIe–1; woodland suitability group 6; wildlife suitability group 1)

Hiwassee sandy loam, 10 to 18 percent slopes, eroded (HwD2).—Because it has strong slopes and rapid runoff, this soil is more susceptible to erosion than Hiwassee sandy loam, 2 to 6 percent slopes, eroded.

It is not feasible to terrace this soil, but it can be strip-cropped on the contour if kept in close-growing crops three-fourths of the time. If fertilized well, pastures consisting of bermudagrass, dallisgrass, tall fescue, sericea lespedeza, and annual lespedeza produce fair yields. (Capability unit IVe–1; woodland suitability group 7; wildlife suitability group 2)

Iredell Series

In the Iredell series are shallow to moderately deep, moderately well drained soils of the Piedmont. They have a heavy plastic clay subsoil. They have developed in residuum that weathered from basic rocks, such as diorite, gabbro, hornblende schist, and hornblende gneiss. These soils have a very dark grayish-brown to light-brown sandy loam to loam surface layer and a dark yellowish-brown to brown plastic clay upper subsoil. Below a depth of 12 to 24 inches, the subsoil is plastic clay mottled with light yellowish brown and light brownish gray. The subsoil is dense and impervious. At a depth of 15 to 32 inches there is a layer of weathered parent

material mottled with grayish brown, light olive brown, green, and black. Depth to bedrock ranges from 18 inches to 4 feet or more. Some areas are very stony. Slopes range from 0 to 10 percent.

Iredell soils occur across the mideastern and southwestern parts of the county with the Mecklenburg, Enon, and Wilkes soils. They have a more plastic and less permeable subsoil than the Mecklenburg and Enon soils and a shallower solum. They have a thicker solum and much more distinct layers than the Wilkes soils.

Iredell soils are moderately well drained. Internal drainage is very slow because of the dense and very slowly permeable subsoil. Infiltration is moderate, and the available moisture capacity is high. These soils are low in natural fertility and in content of organic matter. They are slightly acid or medium acid.

Cultivated crops are suited to the Iredell soils and are responsive to management. About 40 percent of the acreage of these soils is cultivated; the rest is pastured, idle, forested, or used as nonagricultural land.

The original vegetation was oak, hickory, dogwood, redcedar, and holly trees and an undergrowth of native grasses.

Iredell sandy loam, 2 to 6 percent slopes (IsB).—This is a moderately deep to shallow, moderately well drained soil with a plastic clay subsoil.

Typical profile:

0 to 9 inches, very dark grayish-brown, friable sandy loam.
9 to 18 inches, yellowish-brown, very firm plastic clay; blocky structure.
18 to 27 inches, plastic clay mottled with light yellowish brown and light brownish gray; very firm; strong blocky structure.
27 to 30 inches +, weathered parent material mottled with olive brown, yellowish brown, green, and black.

Most areas of this soil are used for pasture and crops. The rest are forested, idle, or used as nonagricultural land.

This soil is suited to cotton, corn, oats, and soybeans. Crops are responsive to lime and fertilizer, especially potash. Rotations should be 2 to 4 years long and include a legume. Because this soil has a heavy plastic subsoil, terraces are hard to construct and maintain. Tall fescue, bermudagrass, dallisgrass, white clover, and annual lespedeza are suitable for pasture and hay (fig. 8). (Capability unit IIe–4; woodland suitability group 18; wildlife suitability group 4)

Iredell sandy loam, 0 to 2 percent slopes (IsA).—Because it is nearly level, this soil is not so erodible as Iredell sandy loam, 2 to 6 percent slopes.

If this soil is cultivated, V-ditches are needed to remove surface water from low places. The soil is suited to such crops as cotton, corn, oats, and soybeans. All crops respond to fertilizer and lime. Tall fescue, dallisgrass, bermudagrass, white clover, and annual lespedeza are suitable for pasture and hay. (Capability unit IIw–3; woodland suitability group 18; wildlife suitability group 7)

Iredell sandy loam, 2 to 6 percent slopes, eroded (IsB2).—The solum of this soil is 4 to 6 inches thinner than that of Iredell sandy loam, 2 to 6 percent slopes. The amount of runoff is greater and erosion is a more serious problem.

This soil is suited to such crops as cotton, corn, oats, and soybeans. Terraces are hard to construct and maintain. A rotation 2 to 4 years long is needed to control erosion and to supply organic matter. Bermudagrass, fescue, dallisgrass, white clover, and annual lespedeza produce good hay and pasture. (Capability unit IIe–4; woodland suitability group 18; wildlife suitability group 4)

Figure 8.—**Tall fescue and white clover pasture on Iredell sandy loam, 2 to 6 percent slopes.**

Iredell sandy loam, 6 to 10 percent slopes (IsC).—This soil has shorter and stronger slopes. The amount and rate of runoff are greater than on Iredell sandy loam, 2 to 6 percent slopes, and erosion is a more serious hazard.

This soil is suitable for cultivation. Because of the tough, plastic clay subsoil, terraces are difficult to construct and maintain. If stripcropping is used to control erosion, two-thirds of the strips should be in close-growing crops. Cotton, corn, small grain, and soybeans respond to fertilizer and lime and produce fair yields. Bermudagrass, dallisgrass, tall fescue, annual lespedeza, and white clover produce good grazing. (Capability unit IIIe–4; woodland suitability group 18; wildlife suitability group 4)

Iredell sandy loam, 6 to 10 percent slopes, eroded (IsC2).—The slopes of this soil are stronger and shorter than those of Iredell sandy loam, 2 to 6 percent slopes, and the surface layer is 5 to 8 inches thinner. The amount and rate of runoff are greater, and erosion is a hazard.

This soil is suited to cotton, corn, oats, and soybeans. A rotation 3 to 6 years long that includes a legume is needed to help supply organic matter and to prevent erosion. Lime and fertilizer, especially potash, are needed for average yields. Fescue, dallisgrass, bermudagrass, white clover, and annual lespedeza produce good pasture. (Capability unit IIIe–4; woodland suitability group 18; wildlife suitability group 4)

Iredell loam, 0 to 2 percent slopes (IdA).—The surface layer of this soil is finer textured than that of Iredell sandy loam, 2 to 6 percent slopes, and infiltration is slower.

Open V-ditches are needed to remove surface water from the low areas. Cultivated crops such as cotton, corn, oats, and soybeans are suited to this soil. Bermudagrass, dallisgrass, fescue, white clover, and annual lespedeza are suitable for pasture and hay. (Capability unit IIw–3; woodland suitability group 18; wildlife suitability group 7)

Iredell loam, 2 to 6 percent slopes (IdB).—This soil has a finer textured surface layer than Iredell sandy loam, 2 to 6 percent slopes, and slower infiltration.

The soil is suited to cultivation. Corn, cotton, oats, and soybeans are suitable crops. Bermudagrass, dallisgrass, fescue, white clover, and annual lespedeza are suitable for pasture and hay. (Capability unit IIe–4; woodland suitability group 18; wildlife suitability group 4)

Iredell loam, 2 to 6 percent slopes, eroded (IdB2).—The surface layer of this soil is 3 to 7 inches thinner than that of Iredell sandy loam, 2 to 6 percent slopes, and infiltration is slower.

This soil is suited to cultivation. Corn, cotton, soybeans, and oats are well suited crops. Dallisgrass, bermudagrass, fescue, white clover, and annual lespedeza are suitable for hay and pasture. (Capability unit IIe–4; woodland suitability group 18; wildlife suitability group 4)

Iredell loam, 6 to 10 percent slopes, eroded (IdC2).—The texture of the surface layer of this soil is finer than that of Iredell sandy loam, 2 to 6 percent slopes. Also, slopes are shorter and stronger, and erosion is more of a hazard.

This soil is suited to corn, cotton, soybeans, oats, bermudagrass, dallisgrass, fescue, white clover, and annual lespedeza. (Capability unit IIIe–4; woodland suitability group 18; wildlife suitability group 4)

Iredell very stony loam, 0 to 6 percent slopes (IvB).—This is a minor soil, and most areas are smaller than 5 acres. It contains stones larger than 10 inches across that interfere with tillage. Diorite boulders are common on this soil. Infiltration is somewhat faster than that of Iredell sandy loam, 2 to 6 percent slopes.

Because it is stony, this soil is not suited to cultivation. If managed well, pastures of bermudagrass, dallisgrass, tall fescue, annual lespedeza, and white clover produce fair yields. (Capability unit VIs–1; woodland suitability group 13; wildlife suitability group 5)

Iredell loam, thin solum, 2 to 6 percent slopes (IrB).—This soil has a shallower solum (15 to 22 inches) than is normal (25 to 32 inches) for the Iredell soils. It has many small, medium, and coarse diorite pebbles in the surface layer, and diorite boulders crop out in places.

Typical profile:

0 to 6 inches, dark grayish-brown, friable loam.
6 to 19 inches, dark yellowish-brown to olive and olive-gray plastic clay; very firm; strong blocky structure.
19 to 29 inches, clay loam mottled with olive and olive gray.

This inextensive soil occurs southeast of Rock Hill. Most of the acreage is idle, subdivided into lots, or wooded. If the soil is cultivated, such crops as cotton, corn, and annual lespedeza are fairly well suited. Bermudagrass, dallisgrass, fescue, annual lespedeza, and white clover are fairly suitable for pasture and hay. (Capability unit IIIe–6; woodland suitability group 19; wildlife suitability group 4)

Iredell loam, thin solum, 0 to 2 percent slopes (IrA).—This soil developed in nearly level areas. The hazard of erosion is less than on Iredell loam, thin solum, 2 to 6 percent slopes.

If this soil is cultivated, V-ditches are needed to remove surface water from low places. Cultivated crops suited to this soil are cotton, corn, and annual lespedeza, but only fair yields can be expected. This soil is better suited to pasture. Dallisgrass, bermudagrass, fescue, white clover, and annual lespedeza are suitable for pasture. (Capability unit IIIw–1; woodland suitability group 19; wildlife suitability group 7)

Lloyd Series

The Lloyd series consists of deep, well-drained, red soils in the Piedmont. These soils developed in residuum that weathered from granite, gneiss, or schist cut by dikes of diorite and similar dark-colored rocks; or they developed from rocks that are intermediate in content of ferromagnesian minerals such as quartz diorite. They have a reddish-brown to brown loam or sandy loam surface layer and a red clay loam upper subsoil. Below a depth of 12 to 24 inches, the subsoil is red clay. Beginning at a depth of 30 to 60 inches there is a layer of clay loam or sandy clay strongly mottled with red and reddish yellow. Depth to weathered bedrock ranges from about 3 feet to 40 feet or more. Slopes range from 2 to 25 percent.

The Lloyd soils occur with Cecil, Davidson, Mecklenburg, and Enon soils. They are not so red throughout as the Davidson soils, and they have a darker red subsoil and a browner surface layer than the Cecil soils. They do not have the brown subsoil of the Mecklenburg and Enon soils, and they are better drained.

The Lloyd soils are well drained throughout and have moderate permeability, infiltration, and available moisture capacity. They have low natural fertility, contain little organic matter, and are slightly acid to medium acid.

Most of the Lloyd soils are suitable for cultivation and are responsive to good management. About 40 percent of the acreage is in cultivation. The rest is forested, pastured, idle, or used for nonagricultural purposes.

The original vegetation was oak, hickory, dogwood, sourwood, redcedar, holly, and pine trees and an undergrowth of briers and native grasses.

Lloyd loam, 2 to 6 percent slopes (LdB).—This is a deep, well-drained, red soil in the Piedmont.

Typical profile:

0 to 8 inches, reddish-brown, friable loam.
8 to 17 inches, red, friable clay loam; subangular blocky structure.
17 to 38 inches, red, firm clay; subangular blocky structure.
38 to 48 inches +, mottled red to dark-red and reddish-yellow, firm clay to clay loam; moderate, fine blocky structure.

Because of gentle slopes, good tilth, and good available moisture capacity, this soil is suited to all crops grown in the county. Erosion is the chief hazard in cultivated areas. Crops respond well to fertilizer and lime. Close-growing crops are needed every other year to protect the soil from erosion and to help maintain the supply of organic matter. Under good management, bermudagrass, tall fescue, sericea lespedeza, annual lespedeza, and crimson clover are suitable for pasture and hay. (Capability unit IIe–1; woodland suitability group 6; wildlife suitability group 1)

Lloyd loam, 2 to 6 percent slopes, eroded (LdB2).—This is an extensive soil. It occupies gentle slopes but has been damaged by sheet erosion. In places the plow layer is a mixture of surface soil and the upper part of the subsoil. The surface soil in many places is red; it is 2 to 4 inches shallower than that of Lloyd loam, 2 to 6 percent slopes.

Because of gentle slopes and good available moisture capacity, this soil is suitable for all crops grown. However, use of a rotation that includes close-growing crops 1 year in 2 and the return of all crop residue helps to prevent erosion and improve the supply of organic matter (fig. 9). Under good management, bermudagrass, fescue, dallisgrass, annual lespedeza, crimson clover, sericea lespedeza, and white clover are suitable for hay and pasture. (Capability unit IIe–1; woodland suitability group 6; wildlife suitability group 1)

Lloyd loam, 6 to 10 percent slopes (LdC).—This soil occupies stronger slopes and has more and faster runoff than Lloyd loam, 2 to 6 percent slopes. Also, erosion is a greater hazard than on the less sloping soil.

This soil is suited to all crops grown in the county. However, management that helps prevent erosion and supply organic matter is needed. Such management should include the use of a complete water-disposal system and of a rotation in which close-growing crops are grown 2 years in 3. Pasture and hay plants respond to fertilizer and lime, and good yields can be expected. (Capability unit IIIe–1; woodland suitability group 6; wildlife suitability goup 1)

Lloyd loam, 6 to 10 percent slopes, eroded (LdC2).—The dark reddish-brown plow layer is a mixture of surface soil and upper subsoil material. The amount and rate of runoff are greater and the hazard of erosion is more severe than on Lloyd loam, 2 to 6 percent slopes. Most crops grown in the county are suitable for this soil and respond to management. Management should include the use of close-growing crops 2 years in 3 and a complete water-disposal system. Legumes and grasses grown for pasture and hay respond to fertilizer and lime. (Capability unit IIIe–1; woodland suitability group 6; wildlife suitability group 1)

Lloyd loam, 10 to 15 percent slopes, eroded (LdD2).—This soil occurs on strong slopes at the head and along the sides of small drainageways. The slopes are shorter and stronger than those of Lloyd loam, 2 to 6 percent slopes, and erosion is more severe. Shallow gullies occur in places.

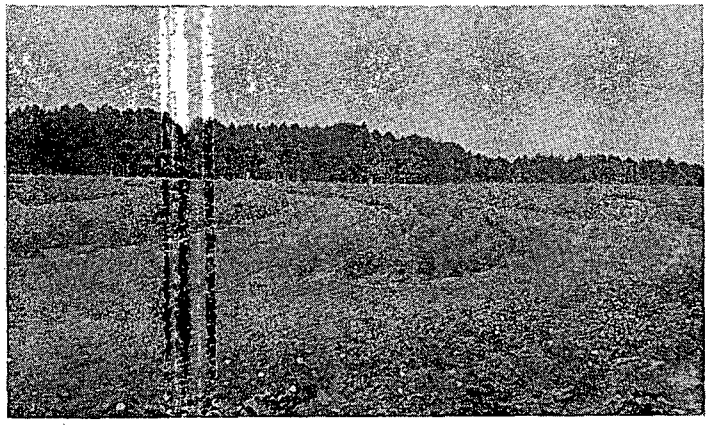

Figure 9.—Cotton planted on contour in strips alternated with grass on Lloyd loam, 2 to 6 percent slopes, eroded. Capability unit IIe–1.

Because of the strong slopes and severe erosion hazard, this soil is not suited to cultivated crops. It is best suited to pine trees. However, well-managed pasture produces fair yields. (Capability unit IVe–1; woodland suitability group 7; wildlife suitability group 2)

Lloyd sandy loam, 2 to 6 percent slopes, eroded (LmB2).—The surface layer of this soil is coarser textured and is 2 to 5 inches thinner than that of Lloyd loam, 2 to 6 percent slopes. In many places the plow layer is a mixture of surface soil and subsoil materials.

Because of gentle slopes and a good available moisture capacity, this soil is suited to all crops commonly grown in the county. The erosion hazard is severe, however, and management that helps to prevent erosion and to maintain organic matter is needed. Such management should include the use of a close-growing crop 1 year in 2. Also a water-disposal system is needed. Pasture and hay plants respond to good management, which includes liberal applications of fertilizer and lime. (Capability unit IIe–1; woodland suitability group 6; wildlife suitability group 1)

Lloyd sandy loam, 6 to 10 percent slopes, eroded (LmC2).—This soil has a coarser textured surface layer than Lloyd loam, 2 to 6 percent slopes. Also, it has shorter and stronger slopes and more and faster runoff. Erosion is a serious hazard.

This soil is suited to all crops grown in the county. Crops respond to fertilizer and lime. A rotation is needed that includes a close-growing crop 2 years in 3 to control erosion and to help maintain organic matter. Also needed to control erosion are a complete water-disposal system and stripcropping. (Capability unit IIIe–1; woodland suitability group 6; wildlife suitability group 1)

Lloyd sandy loam, 10 to 15 percent slopes, eroded (LmD2).—This soil occurs on strong slopes, or breaks, adjacent to areas of more gently sloping Lloyd soils and associated soils. The slopes are shorter than those on the less sloping soil, and the amount and rate of runoff are greater. Erosion is more severe. The surface texture of this soil is coarser than that of Lloyd loam, 2 to 6 percent slopes. The plow layer is a mixture of surface soil and subsoil material.

Because of the severe hazard of erosion, it is not practical to cultivate this soil. If this soil is cultivated, it should be stripcropped on the contour and a close-growing crop should be grown 3 years in 4. Because of the strong slopes, this soil should not be terraced, but all natural draws should be kept in sod. Bermudagrass, dallisgrass, tall fescue, annual lespedeza, and sericea lespedeza respond to fertilizer. Rotation grazing is needed to help keep this soil under good cover. (Capability unit IVe–1; woodland suitability group 7; wildlife suitability group 2)

Lloyd sandy loam, 15 to 25 percent slopes (LmE).—This is a minor soil. It occurs along the larger streams on moderately steep breaks next to other Lloyd soils and associated soils. The texture of the surface layer is not so fine as that of Lloyd loam, 2 to 6 percent slopes. Also,

slopes are shorter and the amount and rate of runoff are greater. The solum is 24 to 36 inches thick.

This soil is closely associated with the shallow Wilkes soils and differs from them in having well-developed horizons.

Most areas of this soil are forested. Small areas are cropped, pastured, or idle.

Because of moderately steep slopes and the severe hazard of erosion, this soil is not suited to row crops, but it can be used for pasture. If limed and fertilized, it produces fair yields of dallisgrass, bermudagrass, tall fescue, annual lespedeza, and sericea lespedeza. Rotation grazing should be practiced to help keep this soil under good cover. (Capability unit VIe–1; woodland suitability group 7; wildlife suitability group 2)

Lloyd sandy loam, 15 to 25 percent slopes, eroded (LmE2).—This soil occurs along the larger streams. It occurs on the moderately steep breaks next to other Lloyd soils and associated soils. The texture of the surface layer is not so fine as that of Lloyd loam, 2 to 6 percent slopes. Also slopes are shorter, and the amount and rate of runoff are greater. The slope range is generally from 15 to 25 percent, but slopes are more than 25 percent on a small acreage. The solum is generally 20 to 30 inches thick. Some shallow gullies have formed.

Most areas of this soil are forested, but some are cropped, pastured, idle, or used for nonfarm purposes.

Because of moderately steep slopes and the severe hazard of erosion, this soil is not suited to row crops but it can be used for pasture. If adequately limed and fertilized, it produces fair yields of bermudagrass, dallisgrass, tall fescue, annual lespedeza, and sericea lespedeza. However, rotation grazing is needed to help keep this soil under good cover. (Capability unit VIe–1; woodland suitability group 7; wildlife suitability group 2)

Lloyd clay loam, 2 to 6 percent slopes, severely eroded (LaB3).—This soil has a red to dark-red surface layer that is finer textured than that of Lloyd loam, 2 to 6 percent slopes. It also has slower infiltration and a larger amount of runoff. Severe sheet erosion has occurred.

This soil is suited to all crops commonly grown in the county. However, large applications of fertilizer and lime are required to produce fair yields. A rotation that includes a close-growing crop 2 years in 3 is needed to supply organic matter and to help prevent erosion. Pasture and hay plants respond to large applications of fertilizer and lime. Rotation grazing is needed to keep this soil under good cover and to help control erosion. (Capability unit IIIe–1; woodland suitability group 8; wildlife suitability group 3)

Lloyd clay loam, 6 to 10 percent slopes, severely eroded (LaC3).—This soil has stronger and shorter slopes than Lloyd loam, 2 to 6 percent slopes. Also, it has a finer textured surface layer. Erosion is a severe hazard.

If this soil is cultivated, a rotation that keeps three-fourths of the soil in a close-growing crop is needed to control erosion. Only fair crop yields can be expected, even with large applications of lime and fertilizer. Pasture plants respond to fertilizer and lime. Rotation grazing is needed to help keep this soil under a good cover. (Capability unit IVe–1; woodland suitability group 8; wildlife suitability group 3)

Lloyd clay loam, 10 to 15 percent slopes, severely eroded (LaD3).—This soil has a finer textured surface layer than Lloyd loam, 2 to 6 percent slopes. Also, it has shorter and stronger slopes, and runoff is more rapid and in larger amounts. Shallow gullies have formed. The solum ranges from 18 to 30 inches in thickness.

Because of strong slopes and a severe erosion hazard, this soil is not suited to cultivated crops. Sericea lespedeza and bermudagrass in pasture respond to fertilizer and lime. Rotation grazing is needed to help keep this soil under good cover. This soil is best suited to pine trees. (Capability unit IVe–1; woodland suitability group 8; wildlife suitability group 3)

Lloyd clay loam, 15 to 25 percent slopes, severely eroded (LaE3).—This soil occupies the moderately steep slopes along the medium-sized drainageways. Erosion is a severe hazard, and frequent shallow gullies are common. The surface layer is red and is finer textured than that of Lloyd loam, 2 to 6 percent slopes. Also, the amount and rate of runoff are greater.

This soil is not suited to cultivated crops or to pasture. It is best suited to pine trees. If used for pasture, it requires large applications of lime and fertilizer to produce bermudagrass and sericea lespedeza. Even so, only fair grazing can be expected. Rotation grazing is needed to keep this soil under good cover. (Capability unit VIe–1; woodland suitability group 8; wildlife suitability group 3)

Lloyd sandy loam, compact subsoil, 2 to 6 percent slopes, eroded (LnB2).—This soil is in the Piedmont and has a red, very firm, compact subsoil. It is on the narrow ridgetops and on slopes adjacent to streams.

Typical profile:

0 to 6 inches, dark-brown, friable sandy loam.
6 to 35 inches, red, very firm, compact clay; strong angular blocky structure with tendency toward platy structure.
35 to 47 inches, red, very firm, compact clay; strong angular blocky structure.

Tilth is difficult to maintain, and only fair yields of crops can be expected. Erosion is the chief hazard in cultivated areas. Crops respond to fertilizer and lime. A complete water-disposal system is needed in cultivated areas. A rotation that includes a close-growing crop every other year is also needed to protect the soil from erosion and to help maintain the supply of organic matter. Cotton, corn, small grain, peaches, and soybeans are suited to the soil. Bermudagrass, dallisgrass, tall fescue, white clover, and annual lespedeza produce fair yields of forage and hay. (Capability unit IIe–3; woodland suitability group 15; wildlife suitability group 4)

Lloyd clay loam, compact subsoil, 2 to 6 percent slopes, severely eroded (LcB3).—This soil has a fine-textured surface layer. Erosion has removed the original surface layer. Infiltration is slower and runoff is faster and in greater quantity than for Lloyd sandy loam, compact subsoil, 2 to 6 percent slopes, eroded.

Tilth is difficult to maintain. When cultivated crops are grown, the rotation should include a close-growing crop 2 years in 3. Close-growing crops also help to maintain the supply of organic matter. Stripcropping and a complete water-disposal system are needed to control erosion in cultivated areas. Fair yields can be obtained from bermudagrass, dallisgrass, tall fescue, annual lespedeza, and sericea lespedeza when used for pasture and hay. (Capability unit IIIe–3; woodland suitability group 17; wildlife suitability group 3)

Lloyd clay loam, compact subsoil, 6 to 10 percent slopes, severely eroded (LcC3).—The original surface layer of this soil has been removed through erosion and shallow

gullies are common. Slopes are shorter and steeper than those of Lloyd sandy loam, compact subsoil, 2 to 6 percent slopes, eroded. Also, runoff is faster and of greater quantity.

When cropped, this soil produces low yields because of erosion. A desirable rotation should include a sod or a close-growing crop 3 years in 4. Pasture and hay crops respond to liberal applications of fertilizer. Rotation grazing should be practiced to help maintain cover. (Capability unit IVe–1; woodland suitability group 17; wildlife suitability group 3)

Lloyd clay loam, compact subsoil, 10 to 20 percent slopes, severely eroded (LcD3).—This soil is subject to severe erosion because of strong slopes and rapid runoff. The surface texture is finer than that of Lloyd sandy loam, compact subsoil, 2 to 6 percent slopes, eroded, and infiltration is slower.

This soil is not suited to cultivation. Bermudagrass and sericea lespedeza produce fair amounts of forage if grazing is rotated and fertilizer and lime are applied liberally. (Capability unit VIe–3; woodland suitability group 17; wildlife suitability group 3)

Local Alluvial Land

This land type consists of deep, well-drained alluvium washed from uplands and deposited in nearly level depressions and along shallow drainageways. It contains a moderate amount of organic matter and plant nutrients and varies greatly in texture. Infiltration is moderately rapid to rapid, and permeability is moderate.

Local alluvial land (Lo).—The texture of the surface layer of this land type is generally sandy loam. The color ranges from dark brown to red. The color and texture, however, vary greatly, depending on drainage and on the kinds of parent soils and the degree to which they were eroded. The thickness of the local alluvium ranges from 12 to 36 inches.

This land type is in small areas throughout the county. Some areas are as large as 2 acres.

Nearly all the acreage of this soil is used for crops. Areas near homes are used for vegetable gardens. Because of good tilth and favorable available moisture capacity, this soil is suitable for intensive use. Under good management, it is very productive of truck crops, corn, small grain, and pasture plants. (Capability unit I–1; woodland suitability group 1; wildlife suitability group 6)

Louisburg Series

In the Louisburg series are shallow to moderately deep, well-drained to somewhat excessively drained soils in the Piedmont. They developed in residuum weathered from coarse-grained granite or coarse-grained gneiss. They have a dark grayish-brown to pale-olive sandy loam surface layer and an olive-yellow to yellowish-red sandy clay loam subsoil. The B horizon is discontinuous, especially in the sloping areas. Light-gray, yellow, light olive-brown, and brownish-yellow weathered material is at a depth of 15 to 36 inches. Depth to bedrock ranges from 20 to 42 inches. Rock outcrops and boulders occur on this soil. Slopes range from 2 to 25 percent or more.

The Louisburg soils occur with the Cecil, Appling, and Durham soils. They lack, however, the thick solum and distinct horizon development of those soils.

Louisburg soils are well drained throughout. They have moderate to moderately high permeability and infiltration and a low available moisture capacity. These soils have a low natural fertility and a low content of organic matter. They are slightly acid to strongly acid.

If well managed, shallow-rooted crops are suited to much of the acreage of the less sloping areas of these soils. Trees are suited to the more sloping areas. A small percentage is cultivated; the rest is forested, pastured, idle, or used for nonagricultural purposes.

The original vegetation was low-grade hardwoods, a few pines, and an undergrowth of vines and native grasses.

Louisburg sandy loam, 2 to 6 percent slopes (LsB).—This is a shallow, excessively drained soil that has a thin, weakly developed and discontinuous B horizon.

Typical profile:

0 to 16 inches, dark grayish-brown to pale-olive, very friable sandy loam.
16 to 20 inches, light yellowish-brown, friable sandy clay loam; weak subangular blocky structure.
20 to 24 inches, mottled light-gray, yellow, brownish-yellow, and light olive-brown, partly weathered, coarse-grained granite.

Shallow-rooted crops are suitable for the less sloping areas of this soil. Erosion is a hazard. Crops respond well to fertilizer and lime. Close-growing crops should be grown 2 years in 3 to protect the soil from erosion and to help maintain the supply of organic matter. If managed well, bermudagrass and annual lespedeza are suitable for pasture and hay. (Capability unit IIIe–5; woodland suitability group 13; wildlife suitability group 5)

Louisburg sandy loam, 6 to 10 percent slopes (LsC).—This soil has stronger slopes and more rapid runoff than Louisburg sandy loam, 2 to 6 percent slopes. The developed subsoil is generally 2 to 4 inches thick, but it is lacking in places. The depth to bedrock ranges from 1 to 5 feet or more.

Most areas of this soil are forested. A small acreage is cropped, pastured, idle, or used for nonfarm purposes.

Because it is shallow, sloping, and susceptible to erosion, this soil should seldom be used for cultivated crops. Even when the soil is used for small grain and grasses, great care should be taken to reduce runoff. (Capability unit IVe–3; woodland suitability group 13; wildlife suitability group 5)

Louisburg sandy loam, 10 to 15 percent slopes (LsD).—This soil is on strong slopes or breaks adjacent to the medium-sized streams. The B horizon is generally discontinuous, but in places it is from 1 to 3 inches thick. Runoff is more rapid than on Louisburg sandy loam, 2 to 6 percent slopes.

Most areas of this soil are forested. They are not suited to cultivated crops or pasture and should be in trees. (Capability unit VIe–2; woodland suitability group 14; wildlife suitability group 5)

Louisburg sandy loam, 15 to 25 percent slopes (LsE).—This soil generally occupies the steep breaks along the larger streams. Large boulders occur on the surface. Mapped with this soil are small areas that have a sandy clay loam subsoil 1 to 2 inches thick.

Practically all of this soil is in trees. Because of the slope and the serious erosion hazard, the soil is best suited

to trees. (Capability unit VIIe–2; woodland suitability group 14; wildlife suitability group 5)

Manteo Series

The soils of the Manteo series are well drained to excessively drained and are shallow. These soils have a grayish-brown to light olive-gray surface layer. They have a yellowish-brown to brown discontinuous B horizon. The surface layer is a channery silt loam, and the B horizon is silty clay or clay. At a depth of 7 to 14 inches, this soil is underlain by partly weathered schist distinctly mottled reddish yellow, yellowish brown, light gray, and white. Depth to bedrock ranges from 6 to 26 inches. These soils developed in residual material from sericitic schist. Slopes range from 10 to 35 percent or more, but the steeper slopes dominate.

The Manteo soils occur with the Tatum and Nason soils. They are shallower, have thinner and less distinct subsoil development, and are more variable throughout than those soils.

Manteo soils are well drained to excessively drained throughout. Infiltration is slow, and runoff is rapid. Permeability is slow where the B horizon has developed and rapid where it has not. The available moisture capacity is low. These soils have low natural fertility and a low content of organic matter. They are medium acid.

The Manteo soils are not extensive in the county. Some of the acreage has been cultivated, but most of it is now in mixed hardwoods and pines.

The original vegetation consisted of mixed oak, gum, and pine trees and an understory of shrubs, vines, and native grasses.

Manteo channery silt loam, 15 to 35 percent slopes (MaE).—This is a shallow, well-drained to excessively drained, medium-textured soil.

Typical profile:

0 to 9 inches, grayish-brown to light olive-brown, friable channery silt loam.
9 to 12 inches, yellowish-brown, firm silty clay; blocky structure.
12 to 19 inches, partly weathered sericitic schist mottled with yellowish brown, reddish yellow, light gray and white.

Because of the shallow root zone, low available moisture capacity, high content of rock fragments, and erosion hazard, this soil is not suited to cultivated crops. It is only fairly well suited to trees. (Capability unit VIIe–2; woodland suitability group 14; wildlife suitability group 5)

Manteo channery silt loam, 10 to 15 percent slopes, eroded (MaD2).—The slopes of this soil are not so steep as those of Manteo channery silt loam, 15 to 35 percent slopes, but they are longer. Runoff is less rapid.

This is an inextensive soil. Most of it is in trees. It occurs mainly in the vicinity of Kings Mountain.

Because of its low available moisture capacity and shallow root zone, this soil is not suited to crops. It is best suited to trees. (Capability unit VIe–2; woodland suitability group 14; wildlife suitability group 5)

Mecklenburg Series

In the Mecklenburg series are deep, moderately well drained to well drained soils in the Piedmont. They developed in residuum weathered from basic rocks, such as hornblende, schist, gabbro, and diorite. They have a dark-brown to brown loam to fine sandy loam surface layer and a yellowish-red to brown clay loam upper subsoil. Below a depth of 17 to 32 inches the subsoil is brown clay mottled with reddish yellow and yellowish brown. At a depth of 20 to 42 inches there is a silty clay loam layer that grades to coarser textured material; this layer is mottled with strong brown, pale brown, and yellowish red. Depth to weathered bedrock ranges from 3 to 20 feet or more. Slopes range from about 2 to 25 percent.

The Mecklenburg soils occur with the Davidson, Lloyd, Cecil, Enon, Iredell, and Wilkes soils. They are browner and have slower internal drainage than the Davidson, Lloyd, and Cecil soils. They are not so sticky as the Enon soils and were derived from rocks that are more basic. They are browner, deeper, and better drained internally than the Iredell soils. They have a thicker solum and more distinct horizons than the Wilkes soils.

Mecklenburg soils are moderately well drained to well drained. Permeability is moderately slow to slow, infiltration is moderate, and available moisture capacity is medium. The natural fertillity is moderate to low, and the content of organic matter is low. The soils are slightly acid or medium acid.

These soils are widely scattered throughout the central part of the county. Under good management, much of the acreage of the Mecklenburg soils is suited to cultivation. Cultivated crops respond to good management. About 20 percent of the acreage is cultivated, and about 20 percent is pastured. The remaining 60 percent is forested, idle, or used for nonagricultural purposes.

The original vegetation consisted of oak, hickory, redcedar, dogwood, and pine trees and an undergrowth of vines, briers, and native grasses.

Mecklenburg loam, 2 to 6 percent slopes, eroded (McB2).—This is a deep, moderately well drained, brown loam in the uplands.

Typical profile:

0 to 5 inches, dark-brown, friable loam.
5 to 27 inches, yellowish-red, friable to firm, sticky clay loam to clay mottled with reddish yellow; moderate subangular blocky structure.
27 to 37 inches, firm sticky clay mottled with brown, reddish yellow, and yellowish brown; coarse subangular blocky structure.
37 to 72 inches, friable silty clay loam mottled with strong brown, pale brown, and yellowish red.

Because of gentle slopes, good tilth, and good available moisture capacity, this soil is suited to all crops grown in the county. Erosion is the chief hazard in cultivated areas. Crops respond well to fertilizer and lime. Close-growing crops are needed every other year to protect the soil from erosion and to help maintain the content of organic matter. If the soil is cultivated, a water-disposal system is needed.

Well-suited crops are cotton, corn, small grain, soybeans, and annual lespedeza. Well-suited pasture and hay plants are bermudagrass, dallisgrass, tall fescue, annual lespedeza, and white clover. Crimson clover and sericea lespedeza grow fairly well. (Capability unit IIe–3; woodland suitability group 15; wildlife suitability group 1)

Mecklenburg loam, 0 to 2 percent slopes (McA).—This soil is on flat hilltops and in depressed areas. Erosion is not a serious hazard. The surface layer is thicker than

that of Mecklenburg loam, 2 to 6 percent slopes, eroded.

Mecklenburg loam, 0 to 2 percent slopes, is in small areas. If near homes, it is used for gardens. It is well suited to cotton, corn, and small grain. Bermudagrass, dallisgrass, tall fescue, white clover, and annual lespedeza are suitable for hay and pasture. (Capability unit IIs–2; woodland suitability group 15; wildlife suitability group 4)

Mecklenburg loam, 6 to 10 percent slopes, eroded (McC2).—This soil is on stronger and shorter slopes than Mecklenburg loam, 2 to 6 percent slopes, eroded. Also, runoff is more rapid and erosion is a more severe hazard. If this soil is cultivated, a complete water-disposal system is needed, and the rotation should include a close-growing crop. Crops suited to this soil are cotton, corn, and small grain. Bermudagrass, dallisgrass, tall fescue, annual lespedeza, and white clover are suitable for hay and pasture. (Capability unit IIIe–3; woodland suitability group 15; wildlife suitability group 1)

Mecklenburg loam, 10 to 15 percent slopes, eroded (McD2).—This soil has shorter and stronger slopes than Mecklenburg loam, 2 to 6 percent slopes, eroded. The amount and rate of runoff are greater, and erosion is a more severe hazard than on the less sloping soil.

If this is soil cultivated, a rotation that includes close-growing crops 3 years in 4 is needed to control erosion. Cotton and corn produce fair yields. Bermudagrass, dallisgrass, tall fescue, and annual lespedeza are suitable for pasture. (Capability unit IVe–2; woodland suitability group 16; wildlife suitability group 2)

Mecklenburg loam, 15 to 25 percent slopes, eroded (McE2).—This soil has short slopes. Runoff is more rapid and the erosion hazard is more severe than on Mecklenburg loam, 2 to 6 percent slopes, eroded. The solum is not so thick as that of the less sloping soil.

If this soil is used for pasture, bermudagrass and annual lespedeza are suitable and respond to large applications of fertilizer. Controlled grazing is needed to keep the soil under good cover. This soil, however, is best suited to trees. (Capability unit VIe–3; woodland suitability group 16; wildlife suitability group 2)

Mecklenburg clay loam, 2 to 6 percent slopes, severely eroded (MbB3).—This soil has a fine-textured surface layer that seals when wet and slows infiltration. The erosion hazard is severe.

If this soil is cultivated, a rotation that includes a close-growing crop 2 years in 3 is needed to supply organic matter and to control erosion. Cotton, corn, and small grain produce only fair yields. Bermudagrass, dallisgrass, annual lespedeza, and white clover produce fair grazing. (Capability unit IIIe–3; woodland suitability group 17; wildlife suitability group 3)

Mecklenburg clay loam, 6 to 10 percent slopes, severely eroded (MbC3).—This soil has a fine-textured surface layer. The erosion hazard is severe. The amount and rate of runoff are greater than on Mecklenburg loam, 2 to 6 percent slopes, eroded. Some shallow gullies have formed.

Because of the hazard of erosion, this soil is not suited to cultivated crops. Bermudagrass, dallisgrass, and annual lespedeza produce fair grazing The soil, however, is best suited to trees. (Capability unit IVe–2; woodland suitability group 17; wildlife suitability group 3)

Mecklenburg clay loam, 10 to 15 percent slopes, severely eroded (MbD3).—This soil has shorter and stronger slopes than Mecklenburg loam, 2 to 6 percent slopes, eroded. The amount and rate of runoff is greater than on the less sloping soil. Erosion is a severe hazard, and shallow gullies have formed.

This soil is best suited to trees. However, under a cover of bermudagrass and annual lespedeza, it can be grazed occasionally. (Capability unit VIe–3; woodland suitability group 17; wildlife suitability group 3)

Mecklenburg clay loam, 15 to 25 percent slopes, severely eroded (MbE3).—This soil has a finer textured surface layer than Mecklenburg loam, 2 to 6 percent slopes, eroded. It occurs on short slopes along streams. Sheet erosion has severely damaged this soil, and shallow gullies are numerous. Runoff is rapid and in large amounts. This soil is best suited to trees. (Capability unit VIIe–3; woodland suitability group 17; wildlife suitability group 3)

Mine Pits and Dumps

This miscellaneous land type consists of areas that have been disturbed by strip mining and by quarrying.

Mine pits and dumps (Md).—This land type is small in total area. It consists of areas that have been mined or quarried. The soil and underlying materials have been removed and have been deposited nearby. Many pits and channels have been left. The spoil banks are irregular in shape, are generally steep, and contain many kinds of mixed material.

The largest area of this land type is on Henry Knob in the northern part of the county. Other small areas are widely scattered but are chiefly in the western part of the county. This land is not suited to cultivated crops or to pasture. It has little or no agricultural value. Some areas could be reclaimed by leveling and planting to trees or by natural reseeding. If trees were established, these areas would furnish cover for wildlife. (Capability unit VIIe–2; woodland suitability group not assigned; wildlife suitability group 5)

Mixed Alluvial Land

This land type consists of deep, poorly drained to well drained alluvium derived from many kinds of rocks. It occurs in long strips along small streams and is frequently flooded. It is widely distributed throughout the county.

Mixed alluvial land (Mn).—This land type occurs on first bottoms of the medium- and small-sized streams. The texture of the surface layer ranges from loamy sand to clay loam, but in a few small areas it is coarse sand or silty clay loam. In some places stones, pebbles, and rock fragments occur in the profile. The color ranges from grayish brown to reddish brown, and in some areas mottles of gray are at a depth of about 2 feet. The water table is within 3 feet of the surface in some places.

This land type contains a moderate amount of organic matter. The natural fertility is moderate. Infiltration and permeability are moderately rapid. The available moisture capacity is medium.

Much of the acreage of this land type has been cleared, and a little is cultivated. A small part is in pasture, but most of the acreage is in hardwoods. A very small acreage is idle or used for nonfarm purposes.

Corn, small grain, and annual lespedeza are the principal crops on cultivated areas. Bermudagrass, tall fescue, dallisgrass, white clover, and annual lespedeza provide

good grazing. (Capability unit IIw–2; woodland suitability group 3; wildlife suitability group 6)

Mixed alluvial land, wet (Mw).—This land type occurs along small streams. It includes areas of gravel, coarse sand, and silt loam. Near the surface the color ranges from light brown to dark brown. The subsurface layer is gray or mottled with gray and brown. Quartz pebbles, cobblestones, and rock fragments are fairly common.

The fertility of this land type is low. Infiltration is moderately rapid and permeability is rapid. Although the water table is high, this land type has a low available moisture capacity.

None of this land type is cultivated. Part of it is used for pasture, but most is in trees that are largely undesirable hardwoods. The undergrowth consists of canes, alders, briers, and native grasses.

White clover, tall fescue, dallisgrass, and annual lespedeza are suitable pasture plants but require rotation grazing. V-ditches with V-ditch drains are needed to remove floodwater. (Capability unit IVw–1; woodland suitability group 4; wildlife suitability group 7)

Molena Series

The soils of the Molena series are deep and well drained to excessively drained. They occur on stream terraces and developed in alluvium that washed from soils derived from granite, gneiss, schist, and basic rocks. They have a very dark brown to pale-brown loamy sand surface layer and a red to reddish-brown sandy loam to loamy sand upper subsoil. A layer of reddish-yellow loamy sand occurs below a depth of 24 to 36 inches. At a depth of 48 to 72 inches there is a layer of reddish-yellow sand. The depth to bedrock is several feet. Slopes range from 2 to 6 percent.

The Molena soils occur with Altavista, Wickham, and Hiwassee soils. They occupy higher positions and are better drained than the Altavista soil. They are sandier and more friable in the lower horizons than the Hiwassee and Wickham soils but are similar in color.

Molena soils are well drained to excessively drained throughout. Permeability and infiltration are rapid, and the available moisture capacity is low. Natural fertility and the content of organic matter are low. The soils are slightly acid or medium acid.

Under good management, much of the acreage of Molena soils is suited to cultivation, and crops are responsive to management. About 75 percent of the acreage of these soils is cultivated; the rest is forested, pastured, idle, or is used for nonagricultural purposes.

The original vegetation consisted of oak, gum, and pine trees and an undergrowth of vines, briers, and native grasses.

Molena loamy sand, 2 to 8 percent slopes (MyB).—This is a deep, well drained to excessively drained loamy sand on stream terraces.

Typical profile:

0 to 24 inches, dark-brown to reddish-brown, very friable loamy sand.
24 to 30 inches, yellowish-red, very friable light sandy loam; weak subangular blocky structure.
30 to 68 inches, reddish-yellow, very friable loose sand.

Because of gentle slopes, good tilth, and a thick root zone, this soil is suited to most crops grown in the county. Erosion by water and wind is a hazard in cultivated areas. Crops respond to fertilizer and lime. Close-growing crops are needed 2 years in 3 to protect the soil from erosion and to help maintain the supply of organic matter. If managed well, bahiagrass, bermudagrass, and sericea lespedeza are suitable for pasture and hay. (Capability unit IIIs–1; woodland suitability group 5; wildlife suitability group 5)

Nason Series

In the Nason series are deep, well-drained soils of the Piedmont. They developed in residuum weathered from fine-grained sericitic schist. They have a grayish-brown to light grayish-brown silt loam surface layer and a strong-brown to reddish-brown upper subsoil. Below a depth of 10 to 20 inches the subsoil is strong-brown silty clay mottled with brownish yellow and yellowish red. At a depth of 20 to 50 inches there is a layer of silty clay loam mottled yellowish brown, yellow, and yellowish red. Depth to weathered bedrock ranges from 3 to 20 feet or more. Slopes range from 2 to 25 percent.

The Nason soils occur with Tatum and Manteo soils. The surface layer is more gray and less brown than that of Tatum soils. The subsoil is more yellow or brown than that of Tatum soils. The Nason soils are deeper and have more distinct horizons than the Manteo soils.

Nason soils are well drained. Permeability is moderate to moderately slow, infiltration is moderately slow, and the availabile moisture capacity is medium. These soils have low natural fertility, contain little organic matter, and are slightly acid to strongly acid.

Under good management, much of the acreage of these soils is suitable for cultivation, and crops are responsive to management. About 70 percent of the acreage is forested; the rest is cultivated, pastured, idle, or used for nonagricultural purposes.

The original vegetation consisted of oak and pine trees and an undergrowth of shrubs, vines, and native grasses.

Nason silt loam, 2 to 6 percent slopes, eroded (NaB2).—This is a deep, well-drained, light-colored silt loam.

Typical profile:

0 to 5 inches, grayish-brown, friable silt loam.
5 to 13 inches, yellow, frable silty clay loam; subangular blocky structure.
13 to 28 inches, strong-brown, firm, sticky silty clay; blocky structure.
28 to 37 inches, firm silty clay mottled with yellowish red and yellow; blocky structure.
37 to 42 inches +, weathered sericitic schist mottled with strong brown, yellowish red, pink, and yellow.

Because of gentle slopes and good available moisture capacity, this soil is fairly well suited to many crops grown in the county. Erosion is the chief hazard in cultivated areas. Close-growing crops are needed every other year to protect the soil from erosion and to help maintain the organic-matter content. Bermudagrass, tall fescue, dallisgrass, sericea lespedeza, and annual lespedeza are suitable for pasture and hay. (Capability unit IIe–2; woodland suitability group 6; wildlife suitability group 1)

Nason silt loam, 6 to 10 percent slopes, eroded (NaC2).—This soil has shorter and stronger slopes than Nason silt loam, 2 to 6 percent slopes, eroded. Also, the amount and rate of runoff are greater and erosion is a more severe hazard than on the less sloping soil.

This soil is suited to many crops grown in the county. If it is cultivated, this soil needs a rotation that includes a close-growing crop 2 years in 3, and a complete water-disposal system to control erosion. If managed well, sericea lespedeza, annual lespedeza, bermudagrass, tall fescue, and dallisgrass produce fair yields of pasture and hay. (Capability unit IIIe–2; woodland suitability group 6; wildlife suitability group 1)

Nason silt loam, 10 to 15 percent slopes, eroded (NaD2).—Slopes of this soil are shorter and stronger than those of Nason silt loam, 2 to 6 percent slopes, eroded, and the amount and rate of runoff are greater. The solum ranges from 20 to 36 inches in thickness.

It is not feasible to cultivate this soil. Under good management, bermudagrass, dallisgrass, tall fescue, sericea lespedeza, and annual lespedeza produce fair yields of pasture. (Capability unit IVe–1; woodland suitability group 7; wildlife suitability group 2)

Nason silt loam, 15 to 25 percent slopes (NaE).—This inextensive soil occupies the moderately steep slopes adjacent to streams. Its slopes are shorter and stronger than those on Nason silt loam, 2 to 6 percent slopes, eroded, and the amount and rate of runoff are greater.

Most of this soil is forested and has never been cleared. Clearing is not feasible because the slopes are moderately steep. Pastures on this soil respond to large applications of fertilizer. Rotation grazing should be practiced to keep the soil under good cover. This soil, however, is best suited to trees. (Capability unit VIe–1; woodland suitability group 7; wildlife suitability group 2)

Nason silt loam, 15 to 25 percent slopes, eroded (NaE2).—This soil occupies strong slopes along the streams. The slopes are stronger and shorter than those on Nason silt loam, 2 to 6 percent slopes, eroded, and the amount and rate of runoff are greater.

This soil is not suited to cultivated crops. It is best suited to trees. Pastures of sericea lespedeza and bermudagrass produce only fair yields. (Capability unit VIe–1; woodland suitability group 7; wildlife suitability group 2)

Roanoke Series

In the Roanoke series are deep, poorly drained soils on the terraces of the larger streams. They developed from sediments that washed from uplands in the Piedmont. They have a dark grayish-brown to light brownish-gray silt loam surface layer and an upper subsoil that is mottled dark brown and olive gray. Below a depth of 10 to 20 inches, the subsoil is gray clay mottled with dark yellowish brown and brownish yellow. At a depth of 30 to 48 inches there is a layer of gray fine sandy clay loam mottled with olive yellow and reddish yellow. Depth to bedrock is variable. Slopes range from 0 to 2 percent.

The Roanoke soils occur with the Altavista and Wickham soils. They are more poorly drained than the Altavista and Wickham soils and have a firmer clay subsoil.

Roanoke soils have slow permeability and infiltration and a medium available moisture capacity. They have low natural fertility, have a low content of organic matter, and are slightly acid or medium acid.

These soils are mainly on terraces of the Catawba River. Under good management, much of the acreage of Roanoke soils is suited to corn, soybeans, truck, and other cultivated crops. A small acreage is cultivated; the rest is pastured, forested, idle, or used for nonagricultural purposes.

The original vegetation consisted of oak, maple, gum, and elm trees and an undergrowth of vines and native grasses.

Roanoke silt loam (Rk).—This is a deep, poorly drained soil on terraces of the larger streams in the Piedmont.

Typical profile:

0 to 7 inches, dark grayish-brown, friable silt loam.
7 to 12 inches, firm, sticky silty clay loam mottled with olive gray and dark brown; blocky structure.
12 to 38 inches, very firm, sticky clay mottled with gray, yellowish brown, brownish yellow, olive, and reddish yellow; strong blocky structure.
38 to 42 inches +, firm to friable, fine sandy clay loam mottled with gray, reddish yellow, and yellowish red.

Because it is poorly drained, this soil has limited suitability for most crops. Corn and soybeans, if adequately fertilized, produce fair yields. Open ditches are needed to drain excess water from cultivated fields. If managed well, dallisgrass, tall fescue, annual lespedeza, and white clover, produce good yields of pasture and hay. V-ditches are needed in pastured areas to remove surface water. Management should include rotation grazing and grazing that is controlled during wet periods. (Capability unit IVw–2; woodland suitability group 3; wildlife suitability group 8)

Rock Outcrop

Areas of this land type consist chiefly of outcrops of granite. They have no agricultural value and little value as wildlife habitats or for recreational areas.

Rock outcrop (Ro).—In York County this land type occurs in areas that range from one-quarter acre to 10 acres in size. It is composed of medium-grained granite.

In some areas the rocks are quarried and crushed for building roads. (Capability unit VIIIs–1; woodland suitability group not assigned; wildlife suitability group 5)

Tatum Series

In the Tatum series are deep, well-drained soils in the Piedmont. They developed in residuum that weathered from sericitic schist. They have a brown to light yellowish-brown silt loam to silty clay loam surface layer and a red silty clay loam upper subsoil. A gravelly silt loam soil type is mapped in places where there is enough gravel to interfere with tillage. The subsoil has a fairly uniform red color and generally a silty clay texture. At a depth of 24 to 56 inches there is a layer of silty clay loam that is distinctly mottled red, reddish yellow, yellowish red, and dark reddish brown. Depth to weathered bedrock ranges from 3 to 30 feet or more. Slopes range from 2 to 25 percent.

The Tatum soils occur with the Nason and Manteo soils. They have a redder subsoil than the Nason soils. They have a thicker solum and much more distinct horizons than the Manteo soils.

Tatum soils have moderate permeability, moderately slow infiltration, and a medium available moisture capacity. They have low natural fertility and low content of organic matter and they are slightly acid or medium acid.

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Under good management, much of the acreage of Tatum soils is suitable for cultivation. Cultivated crops respond to good management. About 20 percent of the soil is cultivated; the rest is forested, pastured, idle, or used for nonfarm purposes.

The original vegetation was oak, hickory, sourwood, and pine trees and an undergrowth of vines, briers, and native grasses.

Tatum silt loam, 2 to 6 percent slopes, eroded (TmB2).—This is a deep, well-drained, friable soil that developed in fine-grained material weathered from sericitic schist.

Typical profile:

0 to 5 inches, yellowish-brown, very friable silt loam.
5 to 14 inches, red, friable silty clay loam; subangular blocky structure.
14 to 48 inches, red, friable silty clay; subangular blocky structure.
48 to 52 inches +, silty clay loam mottled with red, strong brown, yellowish red, and reddish brown.

Because of gentle slopes, good tilth, and a good available moisture capacity, this soil is suited to cultivated crops. If the soil is cultivated, a water-disposal system and a rotation that includes a close-growing crop every other year are needed to control erosion. Large applications of fertilizer and lime are needed to maintain average yields. (Capability unit IIe–1; woodland suitability group 6; wildlife suitability group 1)

Tatum silt loam, 2 to 6 percent slopes (TmB).—This soil has a surface layer that is 3 to 6 inches thicker than that of Tatum silt loam, 2 to 6 percent slopes, eroded. It is suited to cultivated crops, but a complete water-disposal system and a rotation that includes a close-growing crop every other year are needed to control erosion. Large applications of fertilizer and lime are needed to produce average yields. Rotation grazing helps to keep the soil under good cover. Bermudagrass, dallisgrass, tall fescue, annual lespedeza, sericea lespedeza, and crimson clover are suitable for pasture and hay and respond to fertilizer and lime. (Capability unit IIe–1; woodland suitability group 6; wildlife suitability group 1)

Tatum silt loam, 6 to 10 percent slopes (TmC).—This soil has a surface layer that is 3 to 6 inches thicker than that of Tatum silt loam, 2 to 6 percent slopes, eroded. Also, the amount and rate of runoff are greater, and erosion is a more severe hazard than on the less sloping soil.

Close-growing crops are needed 2 out of every 3 years to control erosion. Rotation grazing helps to keep pastured areas under good cover. Pasture plants respond to fertilizer and lime. (Capability unit IIIe–1; woodland suitability group 6; wildlife suitability group 1)

Tatum silt loam, 6 to 10 percent slopes, eroded (TmC2).—This soil has more and faster runoff than Tatum silt loam, 2 to 6 percent slopes, eroded. Erosion is the chief hazard.

Cultivated crops do well in this soil and respond to fertilizer and lime. If the soil is cultivated, a close-growing crop should be grown 2 years in 3 to control erosion. Pasture plants respond to fertilizer and lime and produce fair yields. (Capability unit IIIe–1; woodland suitability group 6; wildlife suitability group 1)

Tatum silt loam, 10 to 15 percent slopes, eroded (TmD2).—This soil occupies the strong slopes along the streams. The solum is 3 to 12 inches thinner than that of Tatum silt loam, 2 to 6 percent slopes, eroded. Also, slopes are shorter and stronger and the amount and rate of runoff are greater. Erosion is therefore a severe hazard.

Because of strong slopes, this soil is not suited to cultivated crops. It is best suited to trees. However, sericea lespedeza and bermudagrass, if managed well, produce fair grazing. (Capability unit IVe–1; woodland suitability group 7; wildlife suitability group 2)

Tatum silt loam, 15 to 25 percent slopes (TmE).—This soil occupies the moderately steep slopes along streams and the moderately steep slopes adjacent to mountains. It has shorter and stronger slopes and more and faster runoff than Tatum silt loam, 2 to 6 percent slopes, eroded. Erosion is the chief hazard on this soil.

This soil is best suited to trees. Sericea lespedeza and bermudagrass, if managed well, produce fair grazing. (Capability unit VIe–1; woodland suitability group 7; wildlife suitability group 2)

Tatum silt loam, 15 to 25 percent slopes, eroded (TmE2).—This soil occupies the moderately steep slopes along streams. The solum is 3 to 12 inches thinner than that of Tatum silt loam, 2 to 6 percent slopes, eroded, and the runoff is greater and more rapid. Erosion is the chief hazard.

This soil is best kept under a continuous cover of trees. However, bermudagrass and sericea lespedeza, if managed well, produce fair grazing. (Capability unit VIe–1; woodland suitability group 7; wildlife suitability group 2)

Tatum silty clay loam, 2 to 6 percent slopes, severely eroded (TtB3).—All the original surface layer of this soil has been removed by sheet erosion, which is the chief hazard. The surface layer is finer textured than that of Tatum silt loam, 2 to 6 percent slopes, eroded, and the amount of runoff is greater.

Crops suited to this soil are cotton, corn, and small grain, but only fair yields can be expected. A complete water-disposal system and a rotation that consists of 1 year of cultivated crops and 2 years of close-growing crops are needed to control erosion. If managed well, bermudagrass, dallisgrass, tall fescue, annual lespedeza, and sericea lespedeza produce fair yields. (Capability unit IIIe–1; woodland suitability group 8; wildlife suitability group 3)

Tatum silty clay loam, 6 to 10 percent slopes, severely eroded (TtC3).—This soil has a finer textured surface layer and more and faster runoff than Tatum silt loam, 2 to 6 percent slopes, eroded. Also, erosion is a more severe hazard than on the less sloping soil.

Because of the erosion hazard, it is not feasible to cultivate this soil. If managed well, bermudagrass, dallisgrass, annual lespedeza, and sericea lespedeza produce fair yields of pasture. (Capability unit IVe–1; woodland suitability group 8; wildlife suitability group 3)

Tatum silty clay loam, 10 to 15 percent slopes, severely eroded (TtD3).—This soil has shorter and stronger slopes and more and faster runoff than Tatum silt loam, 2 to 6 percent slopes, eroded. Erosion is a more severe hazard.

Because of the erosion hazard, it is not feasible to cultivate or to pasture this soil. It is best suited to trees (Capability unit VIe–1; woodland suitability group 8 wildlife suitability group 3)

Tatum silty clay loam, 15 to 25 percent slopes, severely eroded (TtE3).—This soil is on moderately steep slope along streams. It has a finer textured surface layer tha Tatum silt loam, 2 to 6 percent slopes, eroded, and mor and faster runoff.

This soil is best suited to trees. (Capability unit VIIe–1; woodland suitability group 8; wildlife suitability group 3)

Tatum gravelly silt loam, 2 to 6 percent slopes, eroded (TaB2).—This soil is chiefly on sharp ridgetops. The surface layer contains a considerable amount of gravel that is as much as 3 inches across. Infiltration is slightly more rapid than that of Tatum silt loam, 2 to 6 percent slopes, eroded, because raindrops striking the gravel are broken into finer drops.

Enough gravel is in this soil to hinder tillage. If management is good, however, cultivated crops produce fair yields. Annual lespedeza, sericea lespedeza, crimson clover, bermudagrass, dallisgrass, and tall fescue produce good yields of pasture and hay. (Capability unit IIe–1; woodland suitability group 6; wildlife suitability group 1)

Tatum gravelly silt loam, 6 to 10 percent slopes, eroded (TaC2).—The surface layer of this soil contains a considerable amount of gravel that is as much as 3 inches across. Erosion is a more severe hazard on this soil than on Tatum silt loam, 2 to 6 percent slopes, eroded.

Under good management, this soil is suitable for cultivation, but only fair yields are expected. Pasture plants respond to fertilizer and lime and produce fair grazing. (Capability unit IIIe–1; woodland suitability group 6; wildlife suitability group 1)

Tatum gravelly silt loam, 10 to 15 percent slopes, eroded (TaD2).—This soil occupies stronger slopes along the streams than Tatum silt loam, 2 to 6 percent slopes, eroded. Erosion is a more severe hazard.

This soil is not well suited to cultivated crops. Cotton and corn can be grown, but produce only fair yields. Bermudagrass, dallisgrass, annual lespedeza, and sericea lespedeza produce fair yields of pasture. (Capability unit IVe–1; woodland suitability group 7; wildlife suitability group 2)

Tatum gravelly silt loam, 15 to 25 percent slopes, eroded (TaE2).—This soil is on moderately steep slopes. Runoff is more rapid than that on Tatum silt loam, 2 to 6 percent slopes, eroded, and erosion a more severe hazard.

This soil is best suited to trees. However, bermudagrass and sericea lespedeza, if managed well, produce fair grazing. (Capability unit VIe–1; woodland suitability group 7; wildlife suitability group 2)

Vance Series

In the Vance series are deep, moderately well drained soils of the Piedmont. They have a yellowish-brown to light-gray sandy loam surface layer and a strong-brown clay subsoil mottled with brownish yellow and red. At a depth of 24 to 36 inches, the subsoil is clay mottled with light red, yellowish brown, light yellowish brown, and light brownish gray. At a depth of 24 to 46 inches is sandy clay loam that is distinctly mottled or streaked with red, light yellowish brown, and white. Depth to weathered bedrock ranges from 3 to 30 feet or more. These soils developed in residual materials that weathered from acid crystalline rocks (granite and gneiss), which contained a small amount of basic material in most places. They have slopes of 2 to 25 percent.

The Vance series occur among the Cecil, Appling, Helena, and Colfax soils. The Vance soils more closely resemble the Appling but have a finer textured subsoil. They are better drained than Colfax and Helena soils, and their subsoil is less red and firmer than that in the Cecil soils.

Vance soils are moderately well drained. Runoff is moderate to rapid, and internal drainage is moderate to slow. Permeability is moderately slow to slow, infiltration is moderate, and the available moisture capacity is medium. These soils have low natural fertility and a low content of organic matter and are slightly acid to strongly acid.

Most areas of this soil are suitable for cultivation. About 30 percent of the acreage is cultivated; the rest is forested, pastured, idle, or used for nonagricultural purposes.

The original vegetation was oak, hickory, dogwood, sourwood, gum, and shortleaf pine trees and an undergrowth of briers, wild plum bushes, and native grasses.

Vance sandy loam, 2 to 6 percent slopes, eroded (VcB2).—This is a deep, moderately well drained sandy loam.

Typical profile:

0 to 7 inches, yellowish-brown, very friable sandy loam.
7 to 12 inches, strong-brown, friable to firm sandy clay loam; subangular blocky structure.
12 to 32 inches, firm clay mottled with strong brown, red, and brownish yellow; strong blocky structure.
32 to 41 inches, firm to very firm clay mottled with light red, brownish yellow, light yellowish brown, and brownish gray; strong platy structure.
41 to 45 inches +, sandy clay loam mottled with red, light brownish yellow, and white.

Because of gentle slopes, good tilth, and a good available moisture capacity, this soil is suited to most crops grown in the county. As the soil is susceptible to further erosion, a complete water-disposal system that includes grassed waterways and terraces is needed on cultivated areas.

All crops grown on this soil respond to applications of fertilizer and lime. Close-growing crops are needed every other year to protect the soil from erosion. Use of crop residue and green-manure crops helps to maintain organic matter.

Bremudagrass, dallisgrass, sericea lespedeza, annual lespedeza, white clover, and soybeans, if managed well, produce good yields of pasture and hay. (Capability unit IIe–3; woodland suitability group 15; wildlife suitability group 1)

Vance sandy loam, 6 to 10 percent slopes, eroded (VcC2).—This soil occurs on the breaks adjacent to more gently sloping Vance and associated soils. As it occupies strong slopes, erosion is a severe hazard. The amount and rate of runoff are greater than on Vance sandy loam, 2 to 6 percent slopes, eroded.

This soil is suited to general farming. If the soil is used for row crops, a complete water-disposal system is needed to help control erosion. Also, a rotation is needed that consists of close-growing crops two-thirds of the time. (Capability unit IIIe–3; woodland suitability group 15; wildlife suitability group 1)

Vance sandy loam, 10 to 15 percent slopes, eroded (VcD2).—The solum of this soil ranges from 18 to 30 inches in thickness. Runoff is more rapid than that on Vance sandy loam, 2 to 6 percent slopes, eroded. This soil is on breaks adjacent to the streams that flow from areas of other Vance and associated soils. Because of the strong slopes and rapid runoff, the hazard of erosion is serious.

Most areas of this soil are forested. Small areas are cropped, pastured, idle, or used for nonfarm purposes. This soil is best suited to trees but it can be used for pasture if it is fertilized and grazing is rotated. Bermudagrass and annual lespedeza produce fair grazing. (Capability unit IVe–2; woodland suitability group 16; wildlife suitability group 2)

Vance sandy loam, 15 to 25 percent slopes, eroded (VcE2).—This soil occurs on the breaks of the larger streams that flow from the more gently sloping Vance and associated soils. The thickness of the solum ranges from 12 to 24 inches. This soil has more and faster runoff than Vance sandy loam, 2 to 6 percent slopes, eroded. Further erosion is likely.

This soil is not suitable for cultivation. Most of its acreage is in trees, for which it is best suited. It is also suited to bermudagrass and annual lespedeza for pasture, but only fair grazing can be expected. (Capability unit VIe–3; woodland suitability group 16; wildlife suitability group 2)

Vance clay loam, 2 to 10 percent slopes, severely eroded (VaC3).—This is a minor soil. Most of the acreage has slopes that range from 6 to 10 percent. Small areas on narrow ridgetops have slopes that range from 2 to 6 percent.

This soil has shorter slopes and a finer textured surface layer than Vance sandy loam, 2 to 6 percent slopes, eroded. Also it has slower infiltration and more and faster runoff. Erosion is a severe hazard.

Because it is in small areas, this soil is generally cultivated with areas of other Vance soils that are not so severely eroded. Cotton, corn, small grain, and annual lespedeza are suited, but only fair yields can be expected. A rotation that includes close-growing crops 3 years in 4 is needed to control erosion. Also, a complete water-disposal system is needed. If managed well, bermudagrass, tall fescue, dallisgrass, and annual lespedeza produce fair grazing. (Capability unit IVe–2; woodland suitability group 17; wildlife suitability group 3)

Vance clay loam, 10 to 25 percent slopes, severely eroded (VaD3).—This is a minor soil. It occupies breaks along stream that flow from the more gently sloping Vance soil and associated soils. This soil has a finer textured surface layer than Vance sandy loam, 2 to 6 percent slopes, eroded. Also, infiltration is slower, the amount and rate of runoff are greater, and erosion is a more severe hazard than on the less sloping soil.

This soil is not suited to cultivated crops or to pasture. It is best suited to trees. (Capability unit VIIe–3; woodland suitability group 17; wildlife suitability group 3)

Wickham Series

The Wickham series consists of deep, well-drained soils on stream terraces. These soils developed in alluvium washed from residual materials that weathered from granite, gneiss, schist, and basic rocks. They have a surface layer of dark-brown to grayish-brown fine sandy loam, and an upper subsoil of reddish-brown fine sandy clay loam. Below a depth of 24 to 40 inches, the subsoil is red clay mottled with yellowish red. At a depth of 32 to 48 inches there is a sandy clay loam layer distinctly mottled with red, yellowish red, and brownish yellow. The depth to weathered bedrock ranges from 10 to 100 feet or more. Slopes range from 2 to 15 percent.

The Wickham soils occur with the Hiwassee, Molena, and Altavista soils. The subsoil of the Wickham soils is intermediate in color between the dark-red subsoil of the Hiwassee and the yellow to yellowish-brown subsoil of the Altavista soils. Wickham soils have a more clayey subsoil than the Molena soils.

The Wickham soils are well drained throughout. They have moderate permeability and infiltration and medium available moisture capacity. They have low natural fertility and a low content of organic matter, and they are slightly acid or medium acid.

These soils occupy stream terraces along the larger streams in the county. Under good management, much of the acreage of Wickham soils is suitable for cultivation, and cultivated crops are responsive to good management. About 25 percent of the acreage is cultivated; the rest is forested, pastured, idle, or used for nonfarm purposes.

The original vegetation was oak, hickory, elm, gum, and pine trees and an undergrowth of elders, vines, briers, and native grasses.

Wickham sandy loam, 2 to 6 percent slopes, eroded (WcB2).—This is a deep, well-drained, friable soil on stream terraces.

Typical profile:

0 to 7 inches, dark-brown, very friable sandy loam.
7 to 20 inches, reddish-brown, very friable sandy clay loam; weak subangular blocky structure.
20 to 35 inches, yellowish-red, friable clay loam; subangular blocky structure.
35 to 42 inches, clay mottled with red and yellowish red; firm; subangular blocky structure.
42 to 46 inches +, sandy clay loam mottled with red, yellowish red, and brownish yellow.

Because of gentle slopes, good tilth, and a good available moisture capacity, this soil is suited to corn, soybeans, small grain, and annual lespedeza. If management is good and fertilization is adequate, more than average yields can be expected. Erosion is the chief hazard in cultivated areas. A rotation that includes close-growing crops 1 year in 2 helps to prevent erosion and to supply organic matter. Bermudagrass, dallisgrass, tall fescue, sericea lespedeza, and white clover are suitable for hay and pasture. (Capability unit IIe–1; woodland suitability group 5; wildlife suitability group 1)

Wickham sandy loam, 6 to 15 percent slopes, eroded (WcD2).—This is a minor soil. On most of the acreage, slopes range from 6 to 10 percent. All of this soil has been cleared and cultivated. It has shorter and stronger slopes and more and faster runoff than Wickham fine sandy loam 2 to 6 percent slopes, eroded. Erosion is a more severe hazard than on the less sloping soil.

This soil is suited to corn, soybeans, small grain and other cultivated crops. A rotation that includes a close growing crop 2 years in 3 is needed to prevent further damage from erosion and to supply much needed organic matter. Bermudagrass, dallisgrass, tall fescue, sericea lespedeza, annual lespedeza, and white clover produce good yields of pasture and hay. (Capability unit IIIe–1; woodland suitability group 5; wildlife suitability group 1

Wilkes Series

In the Wilkes series are shallow, well-drained soils of the Piedmont. They developed in residuum weathered from acidic rocks that were intruded by dikes of dark-colored basic rock. Their surface layer is dark-brown to grayish-brown sandy loam mottled with reddish yellow and brownish yellow. The yellowish-red clay loam subsoil is weakly developed and in places the B horizon is absent. The subsoil ranges from nonplastic to very plastic and from very friable to firm. At a depth of 10 to 20 inches, these soils are underlain by weathered parent material mottled with strong brown, red, yellow, and green. Depth to bedrock ranges from about 2 to 20 feet. Slopes range from 2 to 35 percent or more.

The Wilkes soils occur along with areas of Lloyd, Mecklenburg, Enon, Helena, and Iredell soils. Wilkes soils are shallower than these associated soils and have less horizon development. In many places small areas of one or more of these other soils form part of the Wilkes complex.

Wilkes soils are well drained in the surface layer and well drained to very poorly drained in the subsoil. They have slow permeability, moderate infiltration, and a very low available moisture capacity. They have very low natural fertility and a low content of organic matter and are very slightly acid to strongly acid.

These soils are widely scattered throughout the county. Most of the acreage now is forested, but a small part is pastured, cultivated, idle or used for nonagricultural purposes.

The original vegetation was oak, cedar, and pine trees and an undergrowth of shrubs, vines, and native grasses.

Wilkes complex, 6 to 15 percent slopes, eroded (WkD2).—The soils of this complex are moderately shallow to shallow and excessively drained. They are underlain by mixed acidic and basic rocks. Small areas of Iredell gravelly loam soils are intricately mixed in this complex. The subsoil of the Iredell soil is plastic and yellowish brown in color.

Typical profile of Wilkes sandy loam:

0 to 7 inches, dark-brown, very friable sandy loam; weak, fine, granular structure.
7 to 12 inches, reddish-yellow friable clay loam mottled with brownish yellow and yellowish red; weak, fine, blocky structure.
12 to 15 inches +, strong-brown weathered rock mottled with reddish brown and yellow; massive (structureless).

The soils of this complex are susceptible to erosion, and crops are seldom grown on them. Cultivated areas required a rotation that includes close-growing grasses or legumes—bermudagrass, annual lespedeza, and sericea lespedeza—3 years in 4. A complete water-disposal system is needed to control erosion. Even then, only fair yields can be expected. (Capability unit VIe–2; woodland suitability group 14; wildlife suitability group 5)

Wilkes complex, 2 to 6 percent slopes (WkB).—Soils in the Wilkes complex, 2 to 6 percent slopes, are on gentle slopes and in most places have a thin, continuous B horizon. Near areas of gravelly Iredell soils, the soils are mixed, and the mapped areas of the complex contain both. Because slopes are gentle, runoff from this complex is not rapid. The color of the surface layer ranges from very dark grayish brown to a brown. In some places the subsoil is yellowish brown and very plastic. Depth to bedrock ranges from 2 to 6 feet.

Nearly all the acreage of this complex of soils has been cultivated, but now most of it has reverted to trees. A small acreage is still cropped, pastured, idle, or used for nonfarm purposes.

Crops on this complex respond to fertilizer and lime. Close-growing crops should be grown two-thirds of the time. Corn, cotton, sorghum, small grain, bermudagrass, dallisgrass, and annual lespedeza are suitable crops. (Capability unit IIIe–5; woodland suitability group 13; wildlife suitability group 5)

Wilkes complex, 6 to 10 percent slopes (WkC).—Soils in this complex are moderately shallow, are moderately well drained to excessively drained, and are underlain by mixed acidic and basic rocks. The surface layer ranges in color from dark grayish brown to brown and in thickness from 8 to 10 inches. The subsoil ranges from reddish yellow to yellowish brown, and in some areas it is plastic. Small areas of Iredell gravelly loam are intricately mixed in this complex.

The soils of this complex have been in forest most of the time. Hardwoods and cedars have been the dominant trees. Corn, cotton, small grain, dallisgrass, bermudagrass, white clover, and annual lespedeza are suitable crops, but only fair yields can be expected. It is not practical to terrace the soils in this complex, but strips of close-growing crops can safely be alternated with cultivated crops if drainageways are kept under plant cover. (Capability unit IVe–3; woodland suitability group 13; wildlife suitability group 5)

Wilkes complex, 10 to 15 percent slopes (WkD).—This complex has more and faster runoff than Wilkes complex, 2 to 6 percent slopes. Small areas of Iredell, Helena, and Enon soils are in this complex. These areas have a thin solum and weakly developed horizons.

Nearly all areas of this complex are forested, but a very small acreage is idle or used for nonfarm purposes. Crops respond to fertilizer and lime. Because of strong slopes, however, the soils are best suited to trees. (Capability unit VIe–2; woodland suitability group 14; wildlife suitability group 5)

Wilkes complex, 15 to 35 percent slopes (WkE).—These soils generally are on steep breaks along the medium-sized streams in the county. The surface layer is 5 to 12 inches thick. In places there is a very weakly developed B horizon that is 2 to 4 inches thick. In many places the surface soil is directly above the parent material. Small areas of weakly developed Iredell, Helena, and Enon soils are in this complex.

Most areas of this complex are in pines and hardwoods. Because slopes are moderately steep, runoff is rapid, and fertility is low, these soils are best suited to trees. (Capability unit VIIe–2; woodland suitability group 14; wildlife suitability group 5)

Wilkes complex, 15 to 35 percent slopes, eroded (WkE2).—This complex occurs on bluffs along rivers and large streams. The steep slopes are shorter than those of the Wilkes complex, 6 to 15 percent slopes, eroded. Generally the surface layer is directly above the parent material. It ranges from 4 to 7 inches in thickness. In a few places there is a thin, weakly developed B horizon. Small areas of weakly developed Helena and Iredell soils are in this complex.

On these soils runoff is very rapid and the erosion hazard is serious. Shallow gullies are common.

All areas of this complex are in trees, for which the soils are fairly well suited. Because of steep slopes, excessive drainage, and poor fertility, these soils are not suited to crops or pasture. (Capability unit VIIe–2; woodland suitability group 14; wildlife suitability group 5)

Worsham Series

The Worsham series consist of deep, poorly drained soils of the Piedmont. They are in narrow strips along small drainageways, at the head of streams, and in depressions on uplands. They developed in residuum that weathered from granite, gneiss, schist, and other metamorphic and igneous rocks.

The surface layer is dark gray to black. In some areas a 3- to 18-inch deposit of recent alluvium is on the surface. At a depth of 10 to 20 inches there is a sandy clay loam upper subsoil mottled with grayish brown and light olive brown. In places where Worsham soils occur with well-drained red soils the upper subsoil has red or brown mottles. At a depth of 28 to 36 inches the subsoil is firm, sticky sandy clay mottled with light gray, yellowish brown, and strong brown. At a depth of 33 to 42 inches is light-gray sandy clay mottled with yellowish brown. Depth to weathered bedrock varies. Slopes range from 2 to 15 percent.

The Worsham soils occur with the Colfax, Helena, Enon, Durham, Appling, and Cecil soils. They occupy a lower position on the landscape and are more poorly drained than the adjacent soils. They also differ from these soils in having a predominantly gray color and a very firm subsoil.

The Worsham soils are poorly drained. Infiltration is moderate. Except in periods of extreme drought, the available moisture capacity is adequate for most crops. These soils have low natural fertility and content of organic matter and are slightly acid or medium acid.

Most of the acreage of these soils is wooded; the rest is pastured, idle, or used for nonfarm purposes.

The original vegetation was hardwoods and an undergrowth of canes, shrubs, briers, and native grasses.

Worsham sandy loam, 2 to 6 percent slopes (WoB).—This is a deep, poorly drained sandy loam soil in small drainageways and in upland depressions.

Typical profile:

0 to 11 inches, black to dark-gray, very friable sandy loam.
11 to 19 inches, friable to firm sandy clay loam mottled with grayish brown and light olive brown; subangular blocky structure.
19 to 38 inches, firm to very firm, sticky clay mottled with light gray, yellowish brown, gray, and strong brown; strong blocky structure.
38 to 40 inches +, hard sandy clay mottled with light gray and yellowish brown.

Poor drainage limits the suitability of this soil to such crops as corn, oats, and a few of the truck crops. The clayey subsoil and poor drainage limit its suitability for cultivation. If this soil is cultivated, open ditches are required to remove excess water. Even then, only fair yields can be expected. If managed well, tall fescue, dallisgrass, bermudagrass, annual lespedeza, and white clover produce good yields of pasture. (Capability unit Vw–1; woodland suitability group 3; wildlife suitability group 8)

Worsham sandy loam, 6 to 15 percent slopes (WoC).—This soil has shorter and stronger slopes and more and faster runoff than Worsham sandy loam, 2 to 6 percent slopes. Its surface layer is 3 to 4 inches thinner than that of the less sloping soil. Erosion is a severe hazard.

This is a minor soil in the county. Most of the acreage is forested. The soil is not suited to cultivated crops. If it is pastured, only fair grazing can be expected. Bermudagrass and annual lespedeza respond to large applications of fertilizer and lime but provide only fair grazing. Rotation grazing is needed to help maintain a ground cover. (Capability unit VIe–1; woodland suitability group 14; wildlife suitability group 2)

Use of Soils for Crops and Pasture

This section consists of six main parts. The first discusses some general practices of soil management. The second explains the land capability classification used by the Soil Conservation Service, and lists and briefly defines the capability units in York County. The third part describes the soils in each capability unit and suggests some principles of use and management. The fourth discusses the suitability of plants for pasture and the grazing systems commonly used. The fifth interprets the relative suitability of soils for crops and lists in a table, for each soil type, a suitability rating for each crop. The sixth part lists in a table, for each principal crop, the estimated yields that can be expected under two levels of management on each soil in the county.

General Practices of Soil Management

The productivity of soils used for cultivated crops or pasture should be maintained by careful management. Soils normally become less productive if they are used continuously for crops and pastures.

Cultivation reduces the supply of organic matter, removes plant nutrients, and increases the hazard of erosion. Cropping systems that provide perennial sod or annual cover crops between periods of clean cultivation help to maintain organic matter and to control erosion.

Fertilization.—Most of the soils of York County are low in natural fertility. The use of fertilizer increases yields and the amount of crop residue. Information on the kinds and amounts of fertilizer that crops need can be obtained from representatives of the Extension Service and other agricultural agencies in the county.

Control of erosion.—The soils on uplands have all been damaged by sheet erosion. Some are severely eroded and have shallow gullies. Runoff must be controlled to prevent loss of soil through erosion. The hazard of erosion is reduced if the rate and amount of runoff are controlled. Terraces, contour cultivation, and wide strips of close growing plants are commonly used to control runoff.

Terraces are used to divert water from fields to natural drainageways. These drainageways should be sodded and kept in close-growing vegetation.

Tillage.—Tillage implements that mix crop residue with the surface layer of the soil are desirable. Tillage

should be done when soil moisture is favorable. Excessive cultivation should be avoided on the gently sloping and sloping soils of York County. Contour tillage helps to protect the soil from erosion.

Capability Grouping of Soils

The capability classification is a grouping that shows, in a general way, how suitable the soils are for most kinds of farming. It is a practical grouping based on limitations of the soils, the risk of damage when they are used, and the way they respond to treatment.

In this system all the kinds of soil are grouped at three levels, the capability class, subclass, and unit. The eight capability classes in the broadest grouping are designated by Roman numerals I through VIII. In class I are the soils that have few limitations, the widest range of use, and the least risk of damage when they are used. The soils in the other classes have progressively greater natural limitations. In class VIII are soils and landforms so rough, shallow, or otherwise limited that they do not produce worthwhile yields of crops, forage, or wood products.

The subclasses indicate major kinds of limitations within the classes. Within most of the classes there can be up to four subclasses. The subclass is indicated by adding a small letter, *e*, *w*, *s*, or *c*, to the class numeral, for example, IIe. The letter *e* shows that the main limitation is risk of erosion unless close-growing plant cover is maintained; *w* means that water in or on the soil will interfere with plant growth or cultivation (in some soils the wetness can be partly corrected by artificial drainage); *s* shows that the soil is limited mainly because it is shallow, droughty, or stony, and *c*, used in only some parts of the country, indicates that the chief limitation is climate that is too cold or too dry. No soils in York County are in subclass *c*.

In class I there are no subclasses, because the soils of this class have few or no limitations. Class V can contain, at the most, only subclasses *w*, *s*, and *c*, because the soils in it are subject to little or no erosion but have other limitations that limit their use largely to pasture, range, woodland, or wildlife.

Within the subclasses are the capability units, groups of soils enough alike to be suited to the same crops and pasture plants, to require similar management, and to have similar productivity and other responses to management. Thus, the capability unit is a convenient grouping for making many statements about management of soils. Capability units are generally identified by numbers assigned locally, for example, IIe–1 or IIIe–2.

Soils are classified in capability classes, subclasses, and units in accordance with the degree and kind of their permanent limitations; but without consideration of major and generally expensive landforming that would change the slope, depth, or other characteristics of the soil; and without consideration of possible but unlikely major reclamation projects.

The eight classes in the capability system, and the subclasses and units in this county, are described in the list that follows.

Class I.—Soils that have few limitations that restrict their use.
- Capability unit I–1: Deep, well-drained soils in upland depressions.

Class II.—Soils that have some limitations that reduce the choice of plants or require moderate conservation practices.
- Subclass IIe: Soils subject to moderate erosion if they are not protected.
  - Capability unit IIe–1: Gently sloping, deep, well-drained soils that have moderate permeability.
  - Capability unit IIe–2: Deep, mostly well-drained soils that have a light-colored surface soil.
  - Capability unit IIe–3: Soils that have a moderately plastic subsoil.
  - Capability unit IIe–4: Soils that have a plastic, heavy clay subsoil.
- Subclass IIw: Soils that have moderate limitations because of excess water.
  - Capability unit IIw–2: Deep, well-drained soils on first bottoms.
  - Capability unit IIw–3: Nearly level soils that have a heavy, plastic clay subsoil that restricts drainage.
- Subclass IIs: Soils that have moderate limitations of tilth and moisture capacity.
  - Capability unit IIs–2: Nearly level loam soils that have a slightly sticky and moderately fine subsoil.

Class III.—Soils that have severe limitations that reduce the choice of plants, or require special conservation practices, or both.
- Subclass IIIe: Soils subject to severe erosion if they are cultivated and not protected.
  - Capability unit IIIe–1: Permeable soils that have a red clay subsoil.
  - Capability unit IIIe–2: Gently sloping to sloping soils that have a gray to brown surface soil.
  - Capability unit IIIe–3: Soils that have a moderately plastic subsoil.
  - Capability unit IIIe–4: Moderately deep soils that have a tough, plastic clay subsoil.
  - Capability unit IIIe–5: Shallow soils that have a discontinuous B horizon.
  - Capability unit IIIe–6: Gently sloping soils that have a shallow, tough, plastic clay subsoil.
- Subclass IIIw: Soils that have severe limitations because of excess water.
  - Capability unit IIIw–1: Imperfectly drained soils that have a tough, plastic clay subsoil.
  - Capability unit IIIw–2: Deep, moderately permeable, somewhat poorly drained soils on first bottoms.
  - Capability unit IIIw–3: Gently sloping, slowly permeable soils on uplands.
- Subclass IIIs: Soils that have severe limitations of moisture capacity, tilth, or fertility.
  - Capability unit IIIs–1: Sandy soils that have a low available moisture capacity.
  - Capability unit IIIs–2: Deep, sandy soils on first bottoms subject to overflow.

Class IV.—Soils that have very severe limitations that restrict the choice of plants, require very careful management, or both.
- Subclass IVe: Soils subject to very severe erosion if they are cultivated and not protected.
  - Capability unit IVe–1: Deep, well-drained, permeable soils.
  - Capability unit IVe–2: Soils that have a firm, moderately plastic clay subsoil.
  - Capability unit IVe–3: Shallow, well-drained soils.
- Subclass IVw: Soils that have very severe limitations for cultivation, because of excess water.
  - Capability unit IVw–1: Soils in elongated, excessively wet areas along small streams.
  - Capability unit IVw–2: Poorly drained soils that have a heavy subsoil.

Class V.—Soils not likely to erode that have limitations, impractical to remove without major reclamation, that limit their use largely to pasture or range, woodland, or wildlife food and cover.
- Subclass Vw: Soils too wet for cultivation; drainage or protection not feasible.
  - Capability unit Vw–1: Soils in narrow, elongated areas along small streams ("crawfish" land).

Class VI.—Soils that have severe limitations that make them generally unsuitable for cultivation and limit their use largely to pasture or range, woodland, or wildlife food and cover.
- Subclass VIe: Soils severely limited, chiefly by risk of erosion if protective cover is not maintained.
  - Capability unit VIe–1: Moderately steep soils that have a friable subsoil.
  - Capability unit VIe–2: Moderately steep, shallow soils.
  - Capability unit VIe–3: Soils that have a moderately plastic clay subsoil.
- Subclass VIs: Soils generally unsuitable for cultivation and limited for other uses by their moisture capacity, stones, or fertility.
  - Capability unit VIs–1: Gently sloping stony land.

Class VII.—Soils that have very severe limitations that make them unsuitable for cultivation without major reclamation, and that restrict their use largely to grazing, woodland, or wildlife.
- Subclass VIIe: Soils very severely limited, chiefly by risk of erosion if protective cover is not maintained.
  - Capability unit VIIe–1: Eroded or severely eroded, strongly sloping to steep soils that have a red clay subsoil and friable parent material.
  - Capability unit VIIe–2: Steep, shallow soils and severely eroded soils.
  - Capability unit VIIe–3: Soils that have a very firm subsoil or very firm parent material.

Class VIII.—Soils and landforms that have limitations that preclude their use, without major reclamation, for commercial production of plants; and restrict their use to recreation, wildlife, water supply, or esthetic purposes.
- Subclass VIIIs: Rock or soil materials that have little potential for production of plants.
  - Capability unit VIIIs–1: Rock outcrop.

Management by Capability Units

In this subsection each capability unit is described, the soils in each are listed, and some suggestions for their use and management are given.

CAPABILITY UNIT I–1

Only Local alluvial land is in this capability unit. It is deep, well drained, and nearly level to gently sloping. It occupies small areas widely distributed in upland depressions throughout the county. It has a loam or sandy loam surface layer and a permeable, very friable subsoil.

This land type is acid, has moderate fertility, and has a moderate capacity for holding available moisture. Tilth is easily maintained. Runoff causes no severe damage. This land type has an area of 710 acres.

This land type is suited to intensive cultivation for corn, soybeans, grain sorghum, small grain, and truck crops. It is also suited to annual lespedeza, tall fescue, dallisgrass, bermudagrass, and white clover harvested for hay and pasture.

Crops on Local alluvial land respond to lime and fertilizer. These materials are needed to obtain good yields from hay and pasture. Row crops need liberal amounts of lime and fertilizer. Crop residue and green-manure crops should be turned under to maintain the supply of organic matter, conserve the soil, and increase the available moisture capacity.

CAPABILITY UNIT IIe–1

This capability unit consists of gently sloping, deep, well-drained soils of moderate permeability. The soils have a yellowish-brown, reddish-brown, or dark-brown, very friable sandy loam to silt loam surface layer 4 to 14 inches thick. They have a friable, firm subsoil that provides a deep root zone.

All soils in this unit are acid, have low fertility, and contain little organic matter. However, they are better supplied with plant nutrients and organic matter than most soils in the county. Leaching is less rapid than in the sandier soils. The capacity for available moisture is moderate. The soils in this unit occupy 59,101 acres. They are—

Cecil sandy loam, 2 to 6 percent slopes, eroded.
Davidson clay loam, 2 to 6 percent slopes, eroded.
Hiwassee sandy loam, 2 to 6 percent slopes, eroded.
Lloyd loam, 2 to 6 percent slopes.
Lloyd loam, 2 to 6 percent slopes, eroded.
Lloyd sandy loam, 2 to 6 percent slopes, eroded.
Tatum gravelly silt loam, 2 to 6 percent slopes, eroded.
Tatum silt loam, 2 to 6 percent slopes.
Tatum silt loam, 2 to 6 percent slopes, eroded.
Wickham sandy loam, 2 to 6 percent slopes, eroded.

These soils are suitable for cultivation and are extensively cropped. They have favorable moisture relations, are easily kept in good tilth, and respond to good management. On these soils cotton, corn, grain sorghum, soybeans, small grain, peaches, vegetables, sericea lespedeza, annual lespedeza, crimson clover, tall fescue, bermudagrass, and dallisgrass grow well. Also, alfalfa grows well on the Davidson, Lloyd, and Cecil soils.

All these soils should be tilled on the contour. They should also have terraces and grassed waterways for the control of runoff. Fields having long slopes should be stripcropped.

CAPABILITY UNIT IIe-2

This capability unit consists of deep soils that are mostly well drained. Their surface layer is very friable sandy loam to silt loam 5 to 16 inches thick. Their subsoil is brown to yellow, friable, and moderately permeable; it provides a deep root zone. Compared to the soils of capability unit IIe–1, these soils have a thicker, lighter colored surface soil, a more slowly permeable subsoil, and a lower capacity for holding available moisture.

All soils in this unit are acid, have low fertility, and contain little organic matter. They have a moderately low available moisture capacity. The soils occupy 19,013 acres. They are—

Altavista fine sandy loam, 0 to 6 percent slopes.
Appling coarse sandy loam, thin solum, 2 to 6 percent slopes.
Appling coarse sandy loam, thin solum, 2 to 6 percent slopes, eroded.
Appling sandy loam, 2 to 6 percent slopes.
Appling sandy loam, 2 to 6 percent slopes, eroded.
Durham sandy loam, 2 to 6 percent slopes.
Nason silt loam, 2 to 6 percent slopes, eroded.

These soils are suitable for cultivation, and cultivated crops respond well to good management. Good management includes use of a rotation that lasts from 2 to 7 years and use of close-growing crops at least half the time. Cotton, corn, soybeans, small grain, sericea lespedeza, and annual lespedeza grow well. Kudzu, tall fescue, bahiagrass, dallisgrass, and bermudagrass produce fair yields of hay and pasture. Crimson clover grows fairly well on the Appling soils.

These soils are easily worked and are easy to keep in good tilth. They should be tilled on the contour and have terraces and grassed waterways to control runoff.

CAPABILITY UNIT IIe-3

This capability unit consists of deep to moderately deep, moderately well drained soils that have a moderately plastic subsoil. The soils have a friable, olive to brown sandy loam to loam surface layer 4 to 16 inches thick. The subsoil is firm to very firm and is mottled with reddish brown and yellow. It provides a deep root zone.

All these soils are acid, contain little organic matter, and have low fertility. They are slowly permeable and have a moderate available moisture capacity. The soils in this unit occupy 21,036 acres. They are—

Cataula sandy loam, 2 to 6 percent slopes, eroded.
Enon sandy loam, 2 to 6 percent slopes, eroded.
Helena sandy loam, 2 to 6 percent slopes.
Lloyd sandy loam, compact subsoil, 2 to 6 percent slopes, eroded.
Mecklenburg loam, 2 to 6 percent slopes, eroded.
Vance sandy loam, 2 to 6 percent slopes, eroded.

These soils are fairly well suited to cultivation. Cultivated crops respond to good management. Chiefly because they have a more plastic clay subsoil and slower permeability, these soils are not so well suited to cultivation as those in capability units IIe–1 and IIe–2.

These soils are good for hay and pasture. Under good management, they are suited to rotations lasting 2 to 4 years in which close-growing crops are grown half the time. They are suited to cotton, corn, small grain, sericea lespedeza, annual lespedeza, white clover, tall fescue, dallisgrass, and bermudagrass. The Mecklenburg soil is moderately well suited to crimson clover.

These soils are fairly easy to work. They should be tilled on the contour and have terraces and grassed waterways for the control of runoff. Long slopes should be stripcropped.

727–672—64——4

CAPABILITY UNIT IIe-4

This capability unit consists of gently sloping, moderately deep soils that have a plastic, heavy clay subsoil. These soils have a friable, dark-brown to olive sandy loam to loam surface layer, 6 to 14 inches thick. The subsoil is very firm and very slowly permeable. The root zone is moderately deep.

These soils are moderately well drained and have a high available moisture capacity. They are moderately fertile, contain a moderate supply of organic matter, but are deficient in potassium. The soils in this unit have an area of 13,516 acres.
They are—

Iredell loam, 2 to 6 percent slopes.
Iredell loam, 2 to 6 percent slopes, eroded.
Iredell sandy loam, 2 to 6 percent slopes.
Iredell sandy loam, 2 to 6 percent slopes, eroded.

Because of the smooth surface and favorable moisture relations, these soils are well suited to all general farm crops and pasture. They are suited to cotton, corn, small grain, tall fescue, vetch, white clover, dallisgrass, bermudagrass, and annual lespedeza. Suitable rotations are 2 or more years of fescue and white clover and 2 years of row crops; or 1 year of a small grain and lespedeza and 1 year of a row crop.

These soils can be kept in good tilth fairly easily. They need contour tillage and grassed waterways. The plastic clay subsoil, however, makes the construction of terraces or ponds difficult.

CAPABILITY UNIT IIw-2

This capability unit consists of nearly level to gently sloping, deep, well-drained soils on first bottoms. These soils are widely distributed throughout the county and are in fairly narrow strips along streams. They are occasionally flooded.

The soils in this unit are acid. They are moderately fertile and contain a moderate supply of organic matter. They are moderately to rapidly permeable and have a high capacity for holding moisture available to plants. The soils in this unit occupy 21,813 acres. They are—

Congaree fine sandy loam.
Mixed alluvial land.

These soils are very productive of vegetables, corn, small grain, and annual lespedeza. They are well suited to tall fescue, white clover, bermudagrass, and bahiagrass.

These soils respond well to good management. Good tilth is easily maintained. Maintaining a moderate supply of organic matter is important if row crops are grown. Grasses and legumes grown for hay and pasture need lime and fertilizer regularly. Flooding is a hazard on these soils.

CAPABILITY UNIT IIw-3

In this capability unit are nearly level, moderately deep soils with a heavy, plastic clay subsoil. Although they were derived from basic rocks, these soils are acid. The surface layer is dark-brown to olive loam to sandy loam. The subsoil is very firm clay that is very slowly permeable. The root zone is moderately deep.

These soils are only moderately well drained, and their available moisture capacity is high. In slightly un-

dulating areas shallow open ditches are required to remove excess water. These soils occupy 9,020 acres. They are—

Iredell loam, 0 to 2 percent slopes.
Iredell sandy loam, 0 to 2 percent slopes.

These soils have a smooth surface and favorable moisture relations; they are therefore suited to all general farm crops and pasture. Cotton, corn, small grain, tall fescue, white clover, dallisgrass, bermudagrass, and annual lespedeza are suitable. Crops respond well to lime and fertilizer. Because of the high available moisture capacity of these soils, crops are not damaged so much in long periods of drought as they are on some other soils.

CAPABILITY UNIT IIs-2

Mecklenburg loam, 0 to 2 percent slopes, is the only soil in capability unit IIs–2. It is a moderately well drained, nearly level soil with a slightly sticky and moderately heavy subsoil. The surface layer is 10 to 14 inches thick. The root zone is deep.

This soil is medium acid or slightly acid. It has moderate to low natural fertility and a low content of organic matter. It has slow permeability and moderate available moisture capacity. Erosion is not a serious hazard. This soil occupies 460 acres in areas of 1 to 5 acres and is on flat hilltops and in depressions.

This soil is less suitable for cultivation than the soils in capability subclass IIe. Open V-ditches are needed to remove excess surface water. Cotton, corn, small grain, tall fescue, white clover, dallisgrass, bermudagrass, and annual lespedeza are suited to this soil. Because of the moderate available moisture capacity of this soil, crops are not damaged during a drought of medium length.

CAPABILITY UNIT IIIe-1

In this capability unit are deep, well-drained, permeable soils that have a red clay subsoil. They are among the best soils in the county for cultivation. These soils have a friable to very friable, yellowish-brown to dark-red surface layer 2 to 12 inches thick. The subsoil is friable and provides a moderately deep to deep root zone.

The soils of this unit are acid. They contain little organic matter and have low natural fertility. They have a moderate available moisture capacity. Soils in this unit occupy 55,815 acres. They are—

Cecil clay loam, 2 to 6 percent slopes, severely eroded.
Cecil sandy loam, 6 to 10 percent slopes, eroded.
Hiwassee sandy loam, 6 to 10 percent slopes, eroded.
Lloyd clay loam, 2 to 6 percent slopes, severely eroded.
Lloyd loam, 6 to 10 percent slopes.
Lloyd loam, 6 to 10 percent slopes, eroded.
Lloyd sandy loam, 6 to 10 percent slopes, eroded.
Tatum gravelly silt loam, 6 to 10 percent slopes, eroded.
Tatum silt loam, 6 to 10 percent slopes.
Tatum silt loam, 6 to 10 percent slopes, eroded.
Tatum silty clay loam, 2 to 6 percent slopes, severely eroded.
Wickham sandy loam, 6 to 15 percent slopes, eroded.

If adequately limed and fertilized, these soils are productive of cotton, corn, small grain, kudzu, crimson clover, white clover, bermudagrass, dallisgrass, tall fescue, sericea lespedeza, and annual lespedeza. The Cecil and Lloyd soils are fairly productive of alfalfa.

These soils are easy to work. Because they are susceptible to erosion, they should be in close-growing crops at least two-thirds of the time. Also, contour tillage, terraces, and grassed waterways are needed. Generally suitable rotations are (1) 4 or more years of tall fescue and white clover or sericea lespedeza and 2 years of row crops; (2) 1 year of a small grain and annual lespedeza, 1 year of volunteer lespedeza or a small grain and lespedeza, and 1 year of a row crop.

CAPABILITY UNIT IIIe-2

This capability unit consists of gently sloping to sloping, deep, well-drained soils that have a gray to brown surface layer and a friable to firm, yellow to brown subsoil. The surface layer is deeper than that of soils in capability unit IIIe–1, and the subsoil is somewhat less permeable. The root zone is deep.

These soils are acid, contain little organic matter, and have low natural fertility. Crops on these soils respond to fertilizer. The soils of this unit have a fairly low available moisture capacity. They are more droughty and leach more readily than the soils in capability unit IIIe–1. These soils are widely distributed and occupy 14,317 acres. They are—

Appling coarse sandy loam, thin solum, 6 to 10 percent slopes.
Appling coarse sandy loam, thin solum, 6 to 10 percent slopes, eroded.
Appling sandy loam, 6 to 10 percent slopes.
Appling sandy loam, 6 to 10 percent slopes, eroded.
Durham sandy loam, 6 to 10 percent slopes.
Nason silt loam, 6 to 10 percent slopes, eroded.

These soils are intensively cropped. If appropriately limed and fertilized, they are suited to cotton, corn, small grain, annual lespedeza, sericea lespedeza, and bermudagrass. The Appling soils are fairly well suited to crimson clover. The soils that are not seriously eroded are suited to bahiagrass.

If these soils are cultivated, close-growing crops should be used two-thirds of the time. Suitable rotations are (1) 4 years of sericea, lespedeza and 2 years of row crops; (2) 1 year of a small grain and annual lespedeza, 1 year of a small grain or volunteer lespedeza, and 1 year of a row crop.

These soils are easy to work. Management is needed that includes contour tillage, terraces, and grassed waterways. In fields where it is feasible, crops should be planted in strips (fig. 10).

CAPABILITY UNIT IIIe-3

In this capability unit are moderately deep to deep, moderately well drained, slightly eroded to moderately eroded soils that have a moderately plastic subsoil. The surface layer is olive to brown, friable, and 4 to 12 inches thick. The subsoil is mottled with red, brown, and yellow.

These soils are acid, contain little organic matter, and have low natural fertility. They have a moderate available moisture capacity. Also, they are less permeable than the soils in capability units IIIe–1 and IIIe–2. These soils are widely distributed and occupy 18,486 acres. They are—

Cataula clay loam, 2 to 6 percent slopes, severely eroded.
Cataula sandy loam, 6 to 10 percent slopes, eroded.
Enon clay loam, 2 to 6 percent slopes, severely eroded.
Enon sandy loam, 6 to 10 percent slopes, eroded.
Helena sandy loam, 2 to 6 percent slopes, eroded.
Helena sandy loam, 6 to 10 percent slopes.
Lloyd clay loam, compact subsoil, 2 to 6 percent slopes, severely eroded.
Mecklenburg clay loam, 2 to 6 percent slopes, severely eroded.
Mecklenburg loam, 6 to 10 percent slopes, eroded.
Vance sandy loam, 6 to 10 percent slopes, eroded.

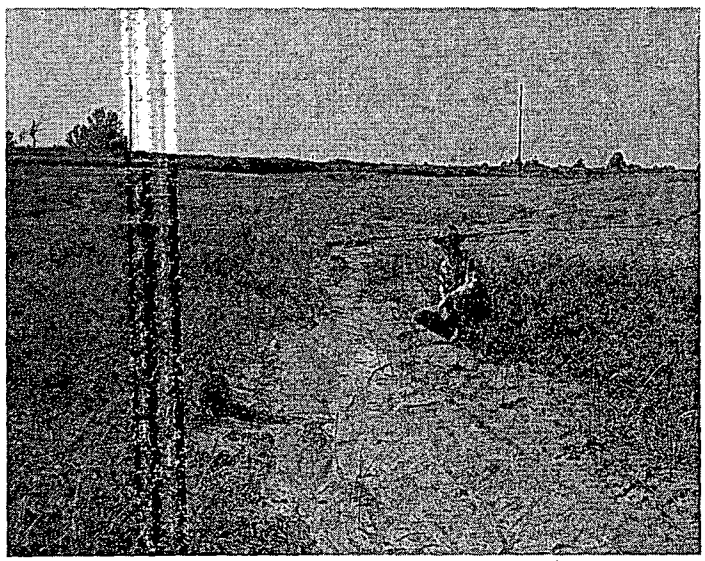

Figure 10.—**Erosion on Appling sandy loam, 6 to 10 percent slopes, eroded, after heavy rain. Capability unit IIIe–2.**

If limed and fertilized, these soils are productive of cotton, corn, small grain, bermudagrass, dallisgrass, white clover, annual lespedeza, and tall fescue.

Close-growing crops should be on these soils at least two-thirds of the time. Suitable rotations are (1) 4 years of fescue and white clover and 2 years of row crops; (2) 1 year of a small grain and annual lespedeza, 1 year of volunteer lespedeza or a small grain and lespedeza, and 1 year of a row crop. Management should include stripcropping, tilling on the contour, terracing, and grassing of waterways.

CAPABILITY UNIT IIIe-4

In this capability unit are moderately deep soils that have a tough, plastic clay subsoil. The surface layer is brown to olive and is friable. The subsoil is plastic heavy clay with very slow permeability. These soils have low natural fertility and a low amount of organic matter. Their capacity for available moisture is high. These soils occupy 2,038 acres. They are—

Iredell loam, 6 to 10 percent slopes, eroded.
Iredell sandy loam, 6 to 10 percent slopes.
Iredell sandy loam, 6 to 10 percent slopes, eroded.

These soils are suited to cotton, corn, and small grain. Bermudagrass, dallisgrass, tall fescue, white clover, and annual lespedeza respond well to fertilizer and produce good yields of pasture and hay.

CAPABILITY UNIT IIIe-5

In this capability unit are shallow, well-drained soils that have a thin or discontinuous B horizon. The surface layer is grayish-brown to dark-brown, very friable sandy loam 4 to 14 inches thick. The subsoil is light yellowish brown to reddish yellow. It is weakly developed and contains much partly disintegrated parent material.

These soils are slowly permeable and have a low capacity for available moisture. They are acid, have low fertility, and contain a small supply of organic matter. These soils occupy 1,017 acres. They are—

Louisburg sandy loam, 2 to 6 percent slopes.
Wilkes complex, 2 to 6 percent slopes.

The soils in this unit are only fairly suitable for crops and pasture. Some of their acreage is cropped, but most is in forest. Cotton, corn, sorghum, small grain, bahiagrass, bermudagrass, crimson clover, annual lespedeza, and sericea lespedeza are suitable crops.

Row crops should not be grown on these soils more than one-third of the time. Suitable rotations are (1) 4 years of dallisgrass or sericea lespedeza and 2 years of row crops; or (2) 1 year of a small grain and annual lespedeza, 1 year of volunteer annual lespedeza, and 1 year of a row crop. Stripcropping should be used where feasible.

These soils need liberal liming and fertilizing, contour tillage, and a complete water-disposal system that includes terraces and grassed waterways.

CAPABILITY UNIT IIIe-6

Iredell loam, thin solum, 2 to 6 percent slopes, is the only soil in this capability unit. It is a gently sloping, shallow, moderately well drained soil with a tough, plastic clay subsoil. The surface layer is dark grayish-brown, friable loam 5 to 10 inches thick. The subsoil is dark yellowish-brown to olive, very firm and tough plastic clay with mottles of dark olive gray.

This soil is very slowly permeable and has a high capacity for available moisture. It is slightly acid or medium acid. It has low natural fertility and a low content of organic matter. This inextensive soil occurs southeast of Rock Hill. It occupies 2,509 acres.

Most of the acreage of this soil is idle, subdivided for suburban development, or forested. Crops, where grown, are responsive to large amounts of fertilizer. Suitable crops are cotton, corn, and annual lespedeza, but only fair yields can be expected. Bermudagrass, dallisgrass, tall fescue, annual lespedeza, and white clover are fairly suitable for pasture and hay.

CAPABILITY UNIT IIIw-1

Iredell loam, thin solum, 0 to 2 percent slopes, is the only soil in this capability unit. It is a shallow, imperfectly drained soil with a tough, plastic clay subsoil. The surface layer is dark grayish-brown to grayish-brown, friable loam 8 to 12 inches thick. The subsoil is yellowish-brown to olive-gray, very firm plastic clay.

This soil is very slowly permeable but has a high capacity for available moisture. It is slightly acid or medium acid, has low fertility, and contains little organic matter. This soil is inextensive; it occupies 1,141 acres.

Most of the acreage of this soil is idle or forested. A small amount is subdivided for suburban development or cropped. Crops on this soil are responsive to large amounts of fertilizer, and fair yields can be expected from cotton, corn, and annual lespedeza. Also, bermudagrass, tall fescue, dallisgrass, annual lespedeza, and white clover produce fair yields of pasture and hay.

CAPABILITY UNIT IIIw-2

Chewacla silt loam is the only soil in this capability unit. It is a deep, moderately permeable, somewhat poorly drained soil on first bottoms. This soil occurs in narrow strips along the larger streams in the county. It is nearly level and is frequently flooded. The surface

layer is silt loam that grades to silty clay loam in the substratum.

This soil is acid, has moderate natural fertility, and contains a moderate supply of organic matter. The capacity for available moisture is high. The total area is 3,198 acres.

If this soil is drained, it can be used to grow corn, soybeans, oats, tall fescue, dallisgrass, bermudagrass, white clover, and annual lespedeza. Because the moisture relations are exceptionally favorable, this soil is very productive of hay and pasture.

This soil can be fairly easily kept in good tilth. It needs lime and fertilizer. It also needs open ditches that remove surface water and diversion ditches that protect it from hillside runoff.

CAPABILITY UNIT IIIw-3

Colfax sandy loam, 2 to 6 percent slopes, is the only soil in this capability unit. It is a gently sloping, slowly permeable, upland soil. It occurs in draws, around heads of draws, and on saddles between them. It covers only 405 acres. The surface layer is olive-gray sandy loam 6 to 18 inches thick. The light yellowish-brown to light brownish-gray subsoil is firm and compact.

This soil is acid, has low natural fertility, and contains little organic matter. It is deep and somewhat poorly drained. This soil has a moderately low available moisture capacity, but because of its position on the landscape, it receives enough water for plants.

If large amounts of lime and fertilizer are added, this soil is fairly productive of corn, grain sorghum, soybeans, oats, and annual lespedeza. Also, it produces fairly good yields of tall fescue, white clover, bermudagrass, and dallisgrass. If it is artificially drained, this soil has a deep root zone.

Management is needed that provides a moderate amount of organic matter, tillage on the contour, and open ditches to remove surplus water. This soil is easy to work and fairly easy to keep in good tilth.

CAPABILITY UNIT IIIs-1

Molena loamy sand, 2 to 8 percent slopes, is the only soil in this capability unit. It has a loamy sand surface layer 18 to 30 inches thick. The root zone is very deep, and tilth is easily maintained.

This soil is acid, has low to very low natural fertility, and contains little organic matter. It has low available moisture capacity. It is droughty and excessively leached. Its area is only 126 acres.

This soil is fairly well suited to sweet potatoes, peanuts, and watermelons. It is fairly well suited to bahiagrass, bermudagrass, and sericea lespedeza. All crops respond to large applications of fertilizer. This soil, however, is less suitable for cultivation than other soils on which erosion is the chief hazard.

CAPABILITY UNIT IIIs-2

Buncombe loamy sand, 0 to 4 percent slopes, is the only soil in this capability unit. It is a deep, sandy soil on first bottoms of large streams and is subject to flooding. It has a deep root zone.

This soil has low fertility and a low amount of organic matter. It is excessively leached and very droughty. Its area is only 520 acres.

This soil is fairly well suited to corn. A crop is lost 1 year in 3, however, because of flooding. Bahiagrass and bermudagrass respond to large applications of fertilizer but produce only fair yields.

CAPABILITY UNIT IVe-1

In this capability unit are deep, well-drained, permeable soils. They occur throughout the county. They have a red, yellow, grayish-brown, or dark-brown surface layer and a friable to firm clay subsoil. In most areas the eroded sloping soils and the severely eroded gently sloping soils have lost most of the original surface soil through erosion. In many places, all the original surface soil and part of the original subsoil have been lost. Shallow gullies are common.

These soils are acid, have low fertility, and contain little organic matter. They have a moderate to low available moisture capacity. These soils occupy 55,590 acres. They are—

Appling coarse sandy loam, thin solum, 10 to 15 percent slopes.
Appling coarse sandy loam, thin solum, 10 to 15 percent slopes, eroded.
Appling sandy loam, 10 to 15 percent slopes.
Appling sandy loam, 10 to 15 percent slopes, eroded.
Cecil clay loam, 6 to 10 percent slopes, severely eroded.
Cecil sandy loam, 10 to 15 percent slopes, eroded.
Davidson clay loam, 6 to 10 percent slopes, severely eroded.
Hiwassee sandy loam, 10 to 18 percent slopes, eroded.
Lloyd clay loam, 6 to 10 percent slopes, severely eroded.
Lloyd clay loam, 10 to 15 percent slopes, severely eroded.
Lloyd clay loam, compact subsoil, 6 to 10 percent slopes, severely eroded.
Lloyd loam, 10 to 15 percent slopes, eroded.
Lloyd sandy loam, 10 to 15 percent slopes, eroded.
Nason silt loam, 10 to 15 percent slopes, eroded.
Tatum gravelly silt loam, 10 to 15 percent slopes, eroded.
Tatum silt loam, 10 to 15 percent slopes, eroded.
Tatum silty clay loam, 6 to 10 percent slopes, severely eroded.

Because they have poor tilth and are extremely susceptible to further erosion, these soils are poorly suited to cultivated crops. They are probably best suited to the production of hay and pasture, but they can be used to a limited extent for corn and small grain. Only fair yields, however, can be expected. If row crops are grown, they should be part of a rotation in which sericea lespedeza, kudzu, and perennial grasses occupy the soils most of the time. Also, row crops should be in strips on the contour and should not occupy more than one-fourth of the field. If appropriately limed and fertilized, these soils are moderately productive of tall fescue, dallisgrass, bermudagrass, and white clover.

All tillage operations should be on the contour. Terracing is not practical, but all natural draws should be kept permanently in close-growing plants.

CAPABILITY UNIT IVe-2

In this capability unit are moderately deep to deep, moderately well drained, slowly permeable soils that have a firm, moderately plastic clay subsoil. These soils are widely distributed. The surface layer is red, brown, and pale yellow. The subsoil ranges from red to grayish brown. The root zone is shallow.

These soils are acid, have low fertility, and contain little organic matter. They have a moderate available moisture capacity. Infiltration of the severely eroded surface layer is slow. These soils occupy 14,510 acres. They are—

Cataula clay loam, 6 to 10 percent slopes, severely eroded.
Enon clay loam, 6 to 10 percent slopes, severely eroded.
Enon sandy loam, 10 to 15 percent slopes, eroded.
Helena sandy loam, 6 to 10 percent slopes, eroded.
Mecklenburg clay loam, 6 to 10 percent slopes, severely eroded.
Mecklenburg loam, 10 to 15 percent slopes, eroded.
Vance clay loam, 2 to 10 percent slopes, severely eroded.
Vance sandy loam, 10 to 15 percent slopes, eroded.

A small part of the acreage of these soils is used for crops and pasture. The rest is in forest. Probably the best use on most farms is for forest, hay, or pasture. Under good management, however, these soils produce fair yields of corn, small grain, tall fescue, bermudagrass, dallisgrass, sericea lespedeza, and annual lespedeza. A suitable rotation consists of 3 years of sericea lespedeza or some other close-growing crop and 1 year of a row crop.

All tillage should be on the contour. It is not feasible to terrace these soils, but some fields can be stripcropped on the contour. The natural draws should be kept in sod or other close-growing plants to control erosion. Pasture should be rotation grazed.

CAPABILITY UNIT IVe-3

In this capability unit are shallow, well-drained soils that are slightly eroded. These soils have a surface layer 4 to 14 inches thick. The subsoil is thin and in places contains fragments of weathered parent material.

These acid soils have very low natural fertility and contain little organic matter. They have a very low available moisture capacity. They are highly susceptible to erosion. These soils occupy 2,895 acres. They are—

Louisburg sandy loam, 6 to 10 percent slopes.
Wilkes complex, 6 to 10 percent slopes.

The soils in this unit are not suitable for cultivation, chiefly because they are shallow. They are hard to till, and runoff is hard to control. Management is needed that includes long rotations, in which close-growing crops are grown three-fourths of the time. Crops respond to lime and fertilizer, but corn, small grain, bermudagrass, dallisgrass, annual lespedeza, and sericea lespedeza produce only fair yields.

All tillage should be on the contour and, if feasible, fields should be stripcropped. Although terracing to control runoff is not feasible, all natural draws should be kept in permanent sod.

CAPABILITY UNIT IVw-1

Only Mixed alluvial land, wet, is in this capability unit. It occurs as elongated, excessively wet areas along small streams and on bottom lands along large streams. It is frequently flooded. The surface layer is sandy loam to silt loam 8 to 24 inches thick. The subsoil varies in texture. This unit contains 9,358 acres.

Cultivation of this land type is restricted. If open ditches for drainage are used, corn grows fairly well. This soil can be used as range pasture in its natural state, but it is greatly improved if drained by V-ditches. Tall fescue, dallisgrass, white clover, and annual lespedeza grow well if the soil is drained, limed, and adequately fertilized.

CAPABILITY UNIT IVw-2

In this capability unit are flat, wet soils that have a clayey heavy subsoil and therefore do not drain readily. They are on stream terraces and in upland depressions and may be flooded occasionally. The surface layer is very dark gray to dark grayish-brown friable loam or silt loam. The subsoil is dark grayish-brown to gray, firm plastic clay. The root zone of these soils is deep.

These soils have low natural fertility and a low content of organic matter and are slightly acid or medium acid. They have slow permeability and a moderate to high available moisture capacity. Tilth is difficult to maintain. These soils occupy 2,717 acres. They are—

Elbert loam.
Roanoke silt loam.

Under good management, much of the acreage of these soils is suited to corn, grain sorghum, soybeans, truck crops, and other cultivated crops. Open ditch drains are needed if crops are grown. Dallisgrass, tall fescue, annual lespedeza, and white clover are suitable for hay and pasture.

CAPABILITY UNIT Vw-1

Only Worsham sandy loam, 2 to 6 percent slopes, is in this capability unit. This gently sloping, poorly drained soil occurs in narrow, elongated areas of "crawfish" land along small streams. It also occurs along intermittent streams, in depressions, and around the head of small streams and draws. Recent deposits of materials that washed from the surrounding soils are on many areas. This capability unit contains 1,815 acres. The surface layer is sandy loam that ranges from 8 to 24 inches in thickness. The subsoil is firm, gray clay that is hard when dry and sticky when wet.

Partly because of its position on the landscape, this soil is excessively wet during the first part of the growing season. It is slowly permeable. The soil is acid and has very low natural fertility.

Because of excessive moisture, this soil is not suitable for cultivation. It is only fairly suitable for pasture, unless it is drained. The most feasible way to drain this soil is with open V-ditches. Tall fescue, dallisgrass, annual lespedeza, and white clover grow fairly well after the soil is drained.

CAPABILITY UNIT VIe-1

This capability unit consists of deep, well-drained, acid, moderately permeable soils that have a friable subsoil. The surface layer ranges from coarse sandy loam to clay loam. The subsoil is friable to firm clay. Most of the original surface soil and, in many places, part of the original subsoil have been removed by erosion. Consequently, much organic matter and plant nutrients have been lost. Shallow gullies are common. Water infiltrates these soils slowly. Their available moisture capacity is moderate to low. These soils occupy 35,864 acres. They are—

Appling coarse sandy loam, thin solum, 15 to 25 percent slopes, eroded.
Appling sandy loam, 15 to 25 percent slopes.
Appling sandy loam, 15 to 25 percent slopes, eroded.
Cecil clay loam, 10 to 15 percent slopes, severely eroded.
Cecil sandy loam, 15 to 30 percent slopes.
Cecil sandy loam, 15 to 25 percent slopes, eroded.
Lloyd clay loam, 15 to 25 percent slopes, severely eroded.
Lloyd sandy loam, 15 to 25 percent slopes.
Lloyd sandy loam, 15 to 25 percent slopes, eroded.
Nason silt loam, 15 to 25 percent slopes.
Nason silt loam, 15 to 25 percent slopes, eroded.
Tatum gravelly silt loam, 15 to 25 percent slopes, eroded.

Tatum silt loam, 15 to 25 percent slopes.
Tatum silt loam, 15 to 25 percent slopes, eroded.
Tatum silty clay loam, 10 to 15 percent slopes, severely eroded.
Worsham sandy loam, 6 to 15 percent slopes.

The less eroded areas of these soils are suited to permanent pasture grasses. However, large applications of fertilizer and careful management are needed. The response to lime and fertilizer is good. These soils are best suited to forest.

CAPABILITY UNIT VIe-2

In this capability unit are moderately steep, shallow, acid soils that are droughty and slowly permeable. The surface layer is channery silt loam or sandy loam 4 to 16 inches thick. The B horizon is thin or discontinuous. In many places it contains fragments of the parent material. These soils are slightly eroded or moderately eroded and are susceptible to further erosion. Shallow gullies are common.

These soils have very low natural fertility and a very small supply of organic matter. They have excessive runoff. Soils in this unit occupy 7,442 acres. They are—

Louisburg sandy loam, 10 to 15 percent slopes.
Manteo channery silt loam, 10 to 15 percent slopes, eroded.
Wilkes complex, 10 to 15 percent slopes.
Wilkes complex, 6 to 15 percent slopes, eroded.

These soils are not suitable for cultivation. If the soils are heavily fertilized and limed, fair yields of tall fescue, bermudagrass, white clover, annual lespedeza, and sericea lespedeza are produced. Controlled grazing helps to keep these soils under good cover.

CAPABILITY UNIT VIe-3

In this capability unit are moderately deep to deep, moderately well drained soils that have a moderately plastic clay subsoil. The surface layer ranges from sandy loam to clay loam; the subsoil is firm, tough, heavy clay mottled with red, brown, and yellow.

These soils are acid, have low natural fertility, and contain little organic matter. The available moisture capacity is moderate, and runoff is very rapid. Permeability is slow. These soils occupy 8,973 acres. They are—

Cataula clay loam, 10 to 15 percent slopes, severely eroded.
Enon clay loam, 10 to 15 percent slopes, severely eroded.
Enon sandy loam, 15 to 25 percent slopes, eroded.
Helena sandy loam, 10 to 15 percent slopes, eroded.
Lloyd clay loam, compact subsoil, 10 to 20 percent slopes, severely eroded.
Mecklenburg clay loam, 10 to 15 percent slopes, severely eroded.
Mecklenburg loam, 15 to 25 percent slopes, eroded.
Vance sandy loam, 15 to 25 percent slopes, eroded.

These soils are not suitable for cultivation. If they are heavily fertilized and limed, they produce fair yields of white clover, bermudagrass, dallisgrass, sericea lespedeza, and annual lespedeza. Tillage in preparation for seeding should be on the contour. Grazing should be controlled so that the soils are under a good cover at all times. Bicolor lespedeza can be grown in the openings of forested areas to produce food for wildlife, but it should be fertilized well.

CAPABILITY UNIT VIs-1

Only Iredell very stony loam, 0 to 6 percent slopes, is in this capability unit. This gently sloping stony soil is inextensive. In most places it is in small areas and is associated with outcrops of diorite. The surface layer is grayish-brown friable loam. The subsoil is yellowish-brown to olive, firm plastic clay. Permeability is slow to very slow, and the available moisture capacity is moderate.

This soil is slightly acid, has low fertility, and contains little organic matter. It covers 424 acres.

Stones in the surface layer hinder tillage, but this soil can be worked for hay crops and improved pasture. Bermudagrass, dallisgrass, tall fescue, white clover, and annual lespedeza respond to large applications of fertilizer and produce fair yields.

CAPABILITY UNIT VIIe-1

This capability unit consists of severely eroded, strongly sloping to steep soils that have friable parent material. These soils are deep, well drained, and moderately permeable. The surface layer is clay loam or silty clay loam, and the subsoil is red to brown friable clay.

These soils are acid, have very low natural fertility, and contain very little organic matter. Much organic matter and much of the supply of plant nutrients have been removed by erosion. Gullies are common on these soils. Their capacity for available moisture is low. Infiltration is slow, and runoff is rapid. Soils in this unit occupy 5,128 acres. They are—

Cecil clay loam, 15 to 25 percent slopes, severely eroded.
Tatum silty clay loam, 15 to 25 percent slopes, severely eroded.

Because they are severely eroded, these soils are not suited to cultivated crops. They are best suited to forest.

CAPABILITY UNIT VIIe-2

This capability unit consists of gullied, eroded, or steep land, pits and mounds, and shallow, well-drained soils. The surface layer is generally gravelly sandy loam to sandy clay loam 2 to 10 inches thick. In a few small, eroded areas it is clay. The B horizon is thin or discontinuous. In many places it is mixed with fragments of weathered parent material.

The soils of this unit are acid, have very low natural fertility, and contain little organic matter. They are slowly permeable and are fairly droughty. The capacity for available moisture is very low. These soils occupy 46,046 acres. They are—

Gullied land, firm materials.
Gullied land, friable materials, rolling.
Gullied land, friable materials, hilly.
Louisburg sandy loam, 15 to 25 percent slopes.
Manteo channery silt loam, 15 to 35 percent slopes.
Mine pits and dumps.
Wilkes complex 15 to 35 percent slopes.
Wilkes complex 15 to 35 percent slopes, eroded.

These soils are not suited to row crops or pasture. Pine trees should be planted in all open areas, and the existing trees should be protected.

CAPABILITY UNIT VIIe-3

In this capability unit are clayey soils that have a very firm subsoil or parent material. These soils are widely distributed in the county and commonly have shallow and deep gullies. The surface layer is light-brown to red clay loam. The subsoil is red to brown, firm to very firm, tough, plastic, heavy clay.

The soils of this unit are acid, have very low fertility, and contain little organic matter. They are slowly per-

meable. Infiltration is slow and the available moisture capacity is moderately low to low. These soils occupy 1,611 acres. They are—

Cataula clay loam, 15 to 25 percent slopes, severely eroded.
Mecklenburg clay loam, 15 to 25 percent slopes, severely eroded.
Vance clay loam, 10 to 25 percent slopes, severely eroded.

Because they are severely eroded, these soils are not suited to crops or pasture. Pine trees should be planted in open areas, and the existing trees should be protected.

CAPABILITY UNIT VIIIs-1

Only Rock outcrop is in this capability unit. It occurs near Clover, in the northern part of the county. For several feet around the outcrops, the soil is very thin. The area of this land type is 126 acres.

This land type is suitable only for wildlife. Cracks and crevices in the rocks provide good shelters. Any plants that grow in these areas should be protected as a cover for wildlife.

Grazing Management [2]

The soils of York County are suited to many native and introduced species of forage plants. Some species grow well during the winter, and others during the summer. Winter perennials are tall fescue and white clover. Summer perennials are bermudagrass, dallisgrass, and sericea lespedeza. The growing season of these plants overlaps in spring and fall.

A mixture of grasses and legumes produces the best pasture. To keep pasture productive, lime and fertilizer should be applied in amounts indicated by soil tests.

Legumes respond well to applications of phosphate. Grasses respond well to frequent, light applications of nitrogen. Nitrogen can be obtained by using commercial fertilizer or by growing legumes. Both grasses and legumes respond to moderate amounts of potash and lime. Lime may be needed only every 3 or 4 years, depending on the results of soil tests. Phosphate and potash are needed on pasture every year. Also, the quality and quantity of forage is improved by rotation grazing.

Weeds and woody plants can be controlled, as needed, by mowing. The material cut in mowing acts as a surface mulch and protects the soil from erosion. On decomposing, the mulch adds some organic material that increases the activity of micro-organisms. Also, it protects the soil from direct rays of the sun and decreases evaporation.

Control of diseases and insects helps maintain desirable pasture plants that produce above-average yields. Herbicides are needed to control undesirable perennial plants.

Annual plantings of small grain, ryegrass, or crimson clover are sometimes used to supplement winter perennials. These plants provide grazing until late in spring. Annual plantings of sudangrass or millet are sometimes used to supplement summer perennials. These supplemental crops should be grown on cropland soils.

Relative Suitability of the Soils for Crops

Suitability ratings of the principal soil types in the county for stated crops are shown in table 2. Soils that are rated number 1 are the most desirable for the stated crop. These soils need the least intensive management, are subject to fewer hazards, and produce the most dependable yields. Soils rated number 2 are limited by excessive moisture, or by a lack of moisture, have a shallow root zone, are low in fertility, or have some other limitation. Soils rated number 3 cannot be expected to produce good yields of the specified crop without intensive management, and such a degree of management is not justified as a rule. Soils rated number 4 are not suited to the stated crop.

Suitability ratings for row crops, truck crops, small grain, and fruits apply only to the soil types or phases that are in capability classes I, II, III, or IV. The miscellaneous land types, Gullied land, friable materials, rolling, and Gullied land, friable materials, hilly, are not rated because they are suitable only for trees and vines.

Estimated Yields

The estimated average acre yields of the principal crops grown under two levels of management for the soils of York County are given in table 3. The yields in columns A are average yields obtained through the management now prevalent in the county. Those in columns B are yields to be expected under improved management.

The yields in columns A are based largely on observations by members of the soil survey party, on information obtained by interviewing farmers and other agricultural workers who have had experience with the soils and crops of the county, and on comparison with crop yields obtained from similar soils in other counties in South Carolina.

The practices used in improved management vary according to the soils. The following practices are considered necessary for obtaining the yields in columns B: (1) Proper choice and rotation of crops; (2) correct use of commercial fertilizer, lime, and manure; (3) correct methods of tillage; (4) return of organic matter to the soils; (5) adequate control of water; (6) maintenance or improvement of workability of the soil; and (7) conservation of soil material, plant nutrients, and soil moisture.

The response of a soil to management can be measured in part by comparing yields in columns B with those in columns A. Better yields can be obtained from nearly all soils in the county through improved management.

Use of Soils for Woodland [3]

Many areas of York County on which hardwoods grew naturally were cleared by early settlers and used for corn and cotton. As yields of these crops declined, or as additional tillable soil was needed, the settlers cleared other forested land, or they abandoned their land and moved to other locations. The most significant effect of this change in land use was the conversion of most of the original hardwood forest to pine forest, as pines readily invaded abandoned fields. In recent years,

[2] By W. A. Mason, Jr., agronomist, Soil Conservation Service.

[3] By George E. Smith, Jr., woodland conservationist, Soil Conservation Service.

TABLE 2.—*Suitability ratings*

[Number 1 means soil is well suited; 2 means suited;

Soil type	Row crops				Truck crops	Small grain			
	Corn	Cotton	Grain sorghum	Soybeans	Sweet potatoes	Barley	Oats	Rye	Wheat
Altavista fine sandy loam	2	4	1	2	2	4	2	3	4
Appling coarse sandy loam	2	2	2	2	1	2	2	1	2
Appling sandy loam	2	1	2	2	1	2	2	1	2
Buncombe loamy sand	4	4	3	3	3	4	3	2	4
Cataula clay loam	3	3	3	3	4	3	3	3	3
Cataula sandy loam	2	2	2	2	3	2	2	2	2
Cecil clay loam	3	3	2	2	4	3	2	2	3
Cecil sandy loam	2	1	1	1	2	1	1	1	1
Chewacla silt loam	2	4	2	2	4	4	3	3	4
Colfax sandy loam	2	4	2	2	4	3	2	2	3
Congaree fine sandy loam	1	4	1	2	3	3	2	2	3
Davidson clay loam	3	3	2	2	4	2	1	2	1
Durham sandy loam	2	2	2	2	1	3	3	1	4
Elbert loam	3	4	3	3	4	3	3	3	3
Enon clay loam	3	4	3	3	4	4	3	3	4
Enon sandy loam	2	3	2	2	3	3	2	2	3
Helena sandy loam	2	2	2	2	2	3	2	2	3
Hiwassee sandy loam	2	2	2	2	2	1	1	1	1
Iredell loam, 0 to 2 percent slopes	2	3	2	2	4	3	2	2	3
Iredell loam, others	2	2	2	2	3	3	2	2	3
Iredell sandy loam, 0 to 2 percent slopes	2	3	2	2	4	3	2	2	3
Iredell sandy loam, others	2	2	2	2	3	3	2	2	3
Iredell very stony loam	3	3	3	4	4	4	3	3	4
Iredell loam, thin solum, 0 to 2 percent slopes	3	3	2	2	4	4	3	3	4
Iredell loam, thin solum, 2 to 6 percent slopes	3	2	2	2	4	4	2	2	4
Lloyd clay loam	3	2	2	2	3	2	2	2	2
Lloyd loam	2	1	1	1	3	1	1	1	1
Lloyd clay loam, compact subsoil	3	3	3	3	3	3	3	3	3
Lloyd sandy loam, compact subsoil	2	2	2	2	3	2	2	2	2
Lloyd sandy loam	2	1	1	1	2	1	1	1	1
Local alluvial land	1	3	1	1	3	2	1	2	2
Louisburg sandy loam	3	3	3	3	2	3	2	2	3
Manteo channery silt loam	4	4	3	4	4	4	3	3	4
Mecklenburg loam	2	2	2	2	3	2	2	2	2
Mecklenburg clay loam	3	3	2	2	4	3	2	2	3
Mixed alluvial land	1	4	1	2	3	3	2	2	3
Mixed alluvial land, wet	3	4	3	3	4	4	3	4	4
Molena loamy sand	3	3	2	2	1	3	2	1	3
Nason silt loam	3	2	2	3	3	3	2	2	3
Roanoke silt loam	3	4	3	3	4	4	3	4	4
Tatum gravelly silt loam	2	2	2	3	4	3	2	2	3
Tatum silt loam	2	2	2	3	3	2	2	2	2
Tatum silty clay loam	3	3	3	4	4	3	3	3	3
Vance clay loam	3	4	3	3	4	4	3	3	4
Vance sandy loam	2	3	2	2	2	3	2	3	3
Wickham sandy loam	2	2	1	1	1	1	1	1	1
Wilkes complex	3	3	3	3	4	3	2	2	3
Worsham sandy loam	3	4	3	4	4	4	4	4	4

[1] Starr, Pearl, German, and Browntop varieties.

of soil types for specified crops

3 means not well suited; and 4 means not suited]

Grasses						Fruits		Wildlife food plants		Legumes			
Common bermudagrass	Coastal bermudagrass	Dallisgrass	Tall fescue	Millet [1]	Ryegrass	Peaches	Grapes	Shrub lespedeza	Browntop millet	Crimson clover	White clover	Annual lespedeza	Sericea lespedeza
2	2	1	2	2	2	4	4	3	2	4	2	1	3
2	2	3	3	2	2	2	2	1	2	3	3	3	1
1	1	3	2	2	2	2	2	1	2	2	3	2	1
3	3	4	4	3	2	4	4	3	3	4	4	3	3
2	4	3	3	3	2	3	3	2	3	3	3	2	2
2	3	2	2	2	2	3	2	2	2	2	2	1	2
2	3	3	2	2	2	2	2	1	2	2	2	2	2
1	1	2	1	1	1	1	1	1	1	1	2	1	1
3	3	1	2	1	2	4	4	3	1	4	1	1	4
1	3	1	2	2	2	4	4	3	2	4	2	2	4
1	1	1	1	1	1	4	4	1	1	2	1	1	3
2	3	2	2	2	2	2	2	2	2	1	2	1	1
3	2	3	3	2	2	3	3	2	2	4	4	3	2
3	4	2	2	3	3	4	4	4	3	4	2	2	4
3	4	2	3	3	2	4	3	2	3	3	3	2	3
2	3	2	2	2	2	3	2	1	2	2	2	2	2
2	2	2	2	1	2	3	2	1	2	2	2	2	2
1	1	2	2	1	1	3	2	1	1	1	2	1	1
3	3	1	1	2	2	4	4	3	2	4	2	1	4
2	3	1	1	2	2	4	3	2	2	2	1	1	3
3	4	1	1	2	2	4	4	3	2	4	2	1	4
2	3	1	1	1	2	4	3	2	1	2	1	1	3
2	4	2	2	2	2	4	4	3	2	4	2	2	4
3	4	2	2	2	2	4	4	4	2	4	2	1	4
2	4	1	1	2	2	4	4	4	2	3	2	1	4
2	3	3	2	2	2	2	2	2	2	2	2	2	2
1	2	2	1	1	1	1	1	1	1	1	2	1	1
2	4	3	3	3	2	3	3	2	3	3	3	2	2
2	3	2	2	2	2	2	2	2	2	2	2	1	2
1	2	2	1	1	1	1	1	1	1	1	2	1	1
1	1	1	1	1	1	4	3	1	1	1	1	1	2
2	2	3	3	2	2	3	2	2	2	2	4	2	2
3	4	4	4	3	3	4	4	3	3	4	4	3	4
1	3	1	1	2	2	3	2	2	2	2	1	1	2
2	3	2	2	2	2	3	2	2	2	2	2	2	2
1	2	1	1	1	1	4	4	2	1	3	1	1	4
3	4	2	2	3	3	4	4	4	3	4	2	2	4
3	2	4	3	2	3	3	3	2	2	4	4	3	2
2	3	3	3	2	2	3	2	2	2	3	3	3	3
3	4	3	3	3	3	4	4	4	3	4	3	2	4
2	3	3	2	2	2	2	2	2	2	2	3	2	2
2	3	3	2	2	2	2	2	2	2	2	2	2	2
3	4	4	3	3	3	3	3	2	3	3	3	3	2
3	4	4	4	3	3	4	4	3	3	4	3	3	3
2	3	3	3	2	2	3	3	2	2	3	3	2	2
1	1	2	1	1	1	3	2	1	1	2	2	1	1
2	3	2	3	2	2	3	3	2	2	3	2	2	2
3	4	3	3	4	3	4	4	3	4	3	2	2	4

TABLE 3.—*Estimated average acre yields of the principal crops under two levels of management*

[Yields in columns A are those obtained under common management practices; those in columns B are to be expected under highest feasible management practices. Absence of data indicates crop is not commonly grown or soil is not suited to it]

Soil	Cotton		Peaches		Corn		Oats		Wheat		Summer pasture [1]		Winter pasture [2]	
	A	B	A	B	A	B	A	B	A	B	A	B	A	B
	Lb.	*Lb.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Cow-acre-days* [3]	*Cow-acre-days* [3]	*Cow-acre-days* [3]	*Cow-acre-days* [3]
Altavista fine sandy loam, 0 to 6 percent slopes					25	50	20	40			125	200	150	210
Appling coarse sandy loam, thin solum, 2 to 6 percent slopes	380	490	265	450	18	40	25	55	18	30	110	165	100	135
Appling coarse sandy loam, thin solum, 2 to 6 percent slopes, eroded	370	475	250	430	16	37	22	50	16	28	100	150	90	120
Appling coarse sandy loam, thin solum, 6 to 10 percent slopes	363	450	225	400	14	35	20	40	14	25	90	135	80	115
Appling coarse sandy loam, thin solum, 6 to 10 percent slopes, eroded	340	430	200	370	10	30	17	35	12	22	80	120	60	100
Appling coarse sandy loam, thin solum, 10 to 15 percent slopes											68	110		
Appling coarse sandy loam, thin solum, 10 to 15 percent slopes, eroded											60	100		
Appling coarse sandy loam, thin solum, 15 to 25 percent slopes, eroded														
Appling sandy loam, 2 to 6 percent slopes	400	750	250	450	20	45	25	55	20	35	140	200	130	190
Appling sandy loam, 2 to 6 percent slopes, eroded	350	600	225	420	18	43	22	50	18	33	135	185	120	180
Appling sandy loam, 6 to 10 percent slopes	340	550	210	400	15	35	20	45	15	30	125	170	110	170
Appling sandy loam, 6 to 10 percent slopes, eroded	325	500	200	380	12	32	17	40	12	25	110	165	100	160
Appling sandy loam, 10 to 15 percent slopes											100	150	90	150
Appling sandy loam, 10 to 15 percent slopes, eroded											90	135	83	145
Appling sandy loam, 15 to 25 percent slopes											75	120		
Appling sandy loam, 15 to 25 percent slopes, eroded														
Buncombe loamy sand, 0 to 4 percent slopes											100	160	75	100
Cataula clay loam, 2 to 6 percent slopes, severely eroded	150	300	100	200	10	20	15	30	10	20	116	167	90	150
Cataula clay loam, 6 to 10 percent slopes, severely eroded											90	135	75	130
Cataula clay loam, 10 to 15 percent slopes, severely eroded											70	100		
Cataula clay loam, 15 to 25 percent slopes, severely eroded														
Cataula sandy loam, 2 to 6 percent slopes, eroded	250	400	150	250	18	35	22	50	18	30	135	195	135	192
Cataula sandy loam, 6 to 10 percent slopes, eroded	200	350	100	200	14	30	20	45	15	25	120	180	120	180
Cecil clay loam, 2 to 6 percent slopes, severely eroded	250	400	275	450	12	30	17	40	14	25	100	170	120	170
Cecil clay loam, 6 to 10 percent slopes, severely eroded	210	360	240	400	10	25	14	30	10	20	90	150	100	140
Cecil clay loam, 10 to 15 percent slopes, severely eroded											75	120		
Cecil clay loam, 15 to 25 percent slopes, severely eroded														
Cecil sandy loam, 2 to 6 percent slopes, eroded	400	750	300	500	25	50	30	65	20	45	163	202	158	220
Cecil sandy loam, 6 to 10 percent slopes, eroded	325	500	250	425	15	35	20	40	15	30	130	190	125	185
Cecil sandy loam, 10 to 15 percent slopes, eroded	200	400	175	350							90	165	90	150
Cecil sandy loam, 15 to 30 percent slopes											75	120		
Cecil sandy loam, 15 to 25 percent slopes, eroded														
Chewacla silt loam					35	60	20	40			125	200	125	200
Colfax sandy loam, 2 to 6 percent slopes					20	45	17	30			130	190	131	205
Congaree fine sandy loam					40	75	30	60			180	250	165	230
Davidson clay loam, 2 to 6 percent slopes, eroded	200	400	225	425	15	35	22	50	20	45	135	195	150	210
Davidson clay loam, 6 to 10 percent slopes, severely eroded	175	365	185	375	12	25	20	40	15	35	120	160	130	195
Durham sandy loam, 2 to 6 percent slopes	350	600	175	300	15	35	12	25			120	150	90	120
Durham sandy loam, 6 to 10 percent slopes	275	475	150	200	12	25	10	20			100	140	75	100
Elbert loam					10	20					120	185	125	190
Enon clay loam, 2 to 6 percent slopes, severely eroded	150	250									100	185	75	150
Enon clay loam, 6 to 10 percent slopes, severely eroded											75	160	65	120
Enon clay loam, 10 to 15 percent slopes, severely eroded														
Enon sandy loam, 2 to 6 percent slopes, eroded	250	400			16	30	22	50	11	20	135	210	120	190
Enon sandy loam, 6 to 10 percent slopes, eroded	200	360			12	20	17	40	9	17	120	200	100	175
Enon sandy loam, 10 to 15 percent slopes, eroded											90	150	75	150
Enon sandy loam, 15 to 25 percent slopes, eroded											75	115		
Gullied land, firm materials														
Gullied land, friable materials, rolling														
Gullied land, friable materials, hilly														
Helena sandy loam, 2 to 6 percent slopes	250	400			20	35	22	50	12	25	130	190	130	190
Helena sandy loam, 2 to 6 percent slopes, eroded	200	365			18	32	18	40	10	22	120	185	120	185
Helena sandy loam, 6 to 10 percent slopes	190	350			15	30	15	35	8	18	110	170	110	170
Helena sandy loam, 6 to 10 percent slopes, eroded	175	325			12	25	12	30	7	16	100	165	100	165
Helena sandy loam, 10 to 15 percent slopes, eroded											75	120	60	120
Hiwassee sandy loam, 2 to 6 percent slopes, eroded	200	400			25	50	30	65	22	40	165	240	165	240
Hiwassee sandy loam, 6 to 10 percent slopes, eroded	150	325			20	40	20	50	18	32	150	205	150	205

See footnotes at end of table.

TABLE 3.—*Estimated average acre yields of the principal crops under two levels of management*—Continued

Soil	Cotton		Peaches		Corn		Oats		Wheat		Summer pasture [1]		Winter pasture [2]	
	A	B	A	B	A	B	A	B	A	B	A	B	A	B
	Lb.	*Lb.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Cow-acre-days* [3]	*Cow-acre-days* [3]	*Cow-acre-days* [3]	*Cow-acre-days* [3]
Hiwassee sandy loam, 10 to 18 percent slopes, eroded											120	180	120	180
Iredell loam, 0 to 2 percent slopes	200	400			30	60	20	45			150	220	150	220
Iredell loam, 2 to 6 percent slopes	350	650			25	50	30	60			150	220	160	240
Iredell loam, 2 to 6 percent slopes, eroded	320	600			20	40	25	50			135	200	135	200
Iredell loam, 6 to 10 percent slopes, eroded	250	550			17	35	18	35			125	190	125	190
Iredell loam, thin solum, 0 to 2 percent slopes	175	350			20	40	18	35			130	190	130	190
Iredell loam, thin solum, 2 to 6 percent slopes	200	400			16	35	20	45			120	180	120	180
Iredell sandy loam, 0 to 2 percent slopes	200	400			30	60	20	45			150	220	150	220
Iredell sandy loam, 2 to 6 percent slopes	350	650			25	50	30	60			155	225	155	225
Iredell sandy loam, 2 to 6 percent slopes, eroded	325	625			18	40	25	50			140	220	160	240
Iredell sandy loam, 6 to 10 percent slopes	300	550			15	35	20	45			130	205	130	205
Iredell sandy loam, 6 to 10 percent slopes, eroded	250	400			12	25	15	32			115	180	115	180
Iredell very stony loam, 0 to 6 percent slopes											90	140	60	120
Lloyd clay loam, 2 to 6 percent slopes, severely eroded	325	550	310	500	12	30	17	40	12	25	120	180	130	200
Lloyd clay loam, 6 to 10 percent slopes, severely eroded	290	510	275	450	8	20	12	30	8	17	100	160	100	160
Lloyd clay loam, 10 to 15 percent slopes, severely eroded											75	120	75	110
Lloyd clay loam, 15 to 25 percent slopes, severely eroded											50	90		
Lloyd clay loam, compact subsoil, 2 to 6 percent slopes, severely eroded	175	275	200	400	15	35	18	40	15	30	130	185	130	185
Lloyd clay loam, compact subsoil, 6 to 10 percent slopes, severely eroded	140	225	100	320			14	25	9	19	90	120	90	150
Lloyd clay loam, compact subsoil, 10 to 20 percent slopes, severely eroded											75	100	65	90
Lloyd loam, 2 to 6 percent slopes	400	750	300	500	25	50	30	65	20	45	165	235	165	235
Lloyd loam, 2 to 6 percent slopes, eroded	375	700	275	475	22	45	25	55	18	42	158	220	158	220
Lloyd loam, 6 to 10 percent slopes	365	680	265	465	20	42	23	50	15	37	140	202	140	202
Lloyd loam 6 to 10 percent slopes, eroded	350	650	250	450	18	38	20	45	12	33	120	185	120	185
Lloyd loam, 10 to 15 percent slopes, eroded											90	150	75	150
Lloyd sandy loam, 2 to 6 percent slopes, eroded	375	700	275	475	22	45	25	55	18	42	158	220	158	220
Lloyd sandy loam, 6 to 10 percent slopes, eroded	350	650	250	450	18	38	20	45	12	33	120	185	120	185
Lloyd sandy loam, 10 to 15 percent slopes, eroded											100	165	100	165
Lloyd sandy loam, 15 to 25 percent slopes											75	140	75	140
Lloyd sandy loam, 15 to 25 percent slopes, eroded														
Lloyd sandy loam, compact subsoil, 2 to 6 percent slopes, eroded	250	400	230	385	18	40	22	45	17	40	150	195	142	192
Local alluvial land	200	400			30	60	30	60	15	30	160	240	160	240
Louisburg sandy loam, 2 to 6 percent slopes	250	400			10	22	22	45			120	185	75	150
Louisburg sandy loam, 6 to 10 percent slopes											100	150	60	120
Louisburg sandy loam, 10 to 15 percent slopes											75	120		
Louisburg sandy loam, 15 to 25 percent slopes														
Manteo channery silt loam, 10 to 15 percent slopes, eroded											75	120		
Manteo channery silt loam, 15 to 35 percent slopes														
Mecklenburg clay loam, 2 to 6 percent slopes, severely eroded	200	400			12	30	20	40	10	20	130	180	130	180
Mecklenburg clay loam, 6 to 10 percent slopes, severely eroded							10	20			100	160	100	160
Mecklenburg clay loam, 10 to 15 percent slopes, severely eroded											75	110		
Mecklenburg clay loam, 15 to 25 percent slopes, severely eroded														
Mecklenburg loam, 0 to 2 percent slopes	250	525	100	250	18	35	20	50	15	32	160	225	160	225
Mecklenburg loam, 2 to 6 percent slopes, eroded	300	600	200	300	20	40	20	50	15	32	180	240	180	240
Mecklenburg loam, 6 to 10 percent slopes, eroded	250	500	175	280	17	35	15	35	12	25	160	220	160	220
Mecklenburg loam, 10 to 15 percent slopes, eroded							10	20			125	193	105	150
Mecklenburg loam, 15 to 25 percent slopes, eroded											90	125		
Mine pits and dumps														
Mixed alluvial land					35	70	30	60			180	240	180	240
Mixed alluvial land, wet					10	30					90	200	75	150
Molena loamy sand, 2 to 8 percent slopes	200	400			15	35	20	40			90	160	75	120
Nason silt loam, 2 to 6 percent slopes, eroded	300	600			15	35	25	55	12	25	110	170	110	170
Nason silt loam, 6 to 10 percent slopes, eroded	240	450			12	27	17	35	8	20	90	150	90	150
Nason silt loam, 10 to 15 percent slopes, eroded							13	28			75	120	75	120
Nason silt loam, 15 to 25 percent slopes											65	100		
Nason silt loam, 15 to 25 percent slopes, eroded											50	90		
Roanoke silt loam					15	35	13	30			75	150	75	150
Rock outcrop														

See footnotes at end of table.

TABLE 3.—*Estimated average acre yields of the principal crops under two levels of management*—Continued

Soil	Cotton		Peaches		Corn		Oats		Wheat		Summer pasture [1]		Winter pasture [2]	
	A	B	A	B	A	B	A	B	A	B	A	B	A	B
	Lb.	*Lb.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Cow-acre-days* [3]	*Cow-acre-days* [3]	*Cow-acre-days* [3]	*Cow-acre-days* [3]
Tatum gravelly silt loam, 2 to 6 percent slopes, eroded	265	415	275	485	15	30	17	40	12	25	130	200	130	200
Tatum gravelly silt loam, 6 to 10 percent slopes, eroded	190	340	150	300	12	25	12	33	8	18	100	160	100	160
Tatum gravelly silt loam, 10 to 15 percent slopes, eroded	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	75	120	75	120
Tatum gravelly silt loam, 15 to 25 percent slopes, eroded	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	60	100	-----	-----
Tatum silt loam, 2 to 6 percent slopes	340	625	250	450	22	45	30	65	20	42	140	200	130	190
Tatum, silt loam, 2 to 6 percent slopes, eroded	325	600	235	425	20	45	25	55	15	35	135	200	130	180
Tatum silt loam, 6 to 10 percent slopes	295	550	220	400	15	35	20	45	12	30	120	180	120	170
Tatum silt loam, 6 to 10 percent slopes, eroded	250	450	150	325	12	30	17	40	10	25	100	150	90	140
Tatum silt loam, 10 to 15 percent slopes, eroded	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	75	120	75	110
Tatum silt loam, 15 to 25 percent slopes	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	60	100	-----	-----
Tatum silt loam, 15 to 25 percent slopes, eroded	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	50	90	-----	-----
Tatum silty clay loam, 2 to 6 percent slopes, severely eroded	265	415	275	485	10	22	17	40	12	25	120	180	120	180
Tatum silty clay loam, 6 to 10 percent slopes, severely eroded	-----	-----	-----	-----	-----	-----	15	33	-----	-----	100	160	100	160
Tatum silty clay loam, 10 to 15 percent slopes, severely eroded	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	50	90	-----	-----
Tatum silty clay loam, 15 to 25 percent slopes, severely eroded	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Vance clay loam, 2 to 10 percent slopes, severely eroded	-----	-----	-----	-----	-----	-----	10	20	-----	-----	90	150	90	150
Vance clay loam, 10 to 25 percent slopes, severely eroded	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Vance sandy loam, 2 to 6 percent slopes, eroded	250	400	-----	-----	15	30	20	45	12	24	135	192	120	190
Vance sandy loam, 6 to 10 percent slopes, eroded	200	335	-----	-----	10	20	15	32	-----	-----	120	170	120	170
Vance sandy loam, 10 to 15 percent slopes, eroded	-----	-----	-----	-----	-----	-----	10	22	-----	-----	90	150	90	150
Vance sandy loam, 15 to 25 percent slopes, eroded	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	75	120	-----	-----
Wickham sandy loam, 2 to 6 percent slopes, eroded	375	650	-----	-----	27	55	30	65	20	45	180	240	180	240
Wickham sandy loam, 6 to 15 percent slopes, eroded	300	525	-----	-----	20	42	25	55	16	33	150	200	150	200
Wilkes complex, 2 to 6 percent slopes	200	400	-----	-----	10	22	22	45	-----	-----	130	190	100	160
Wilkes complex, 6 to 10 percent slopes	-----	-----	-----	-----	-----	-----	15	32	-----	-----	105	168	80	120
Wilkes complex, 10 to 15 percent slopes	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	85	120	-----	-----
Wilkes complex, 6 to 15 percent slopes, eroded	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	60	90	-----	-----
Wilkes complex, 15 to 35 percent slopes	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Wilkes complex, 15 to 35 percent slopes, eroded	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Worsham sandy loam, 2 to 6 percent slopes	-----	-----	-----	-----	15	35	-----	-----	-----	-----	100	160	100	160
Worsham sandy loam, 6 to 15 percent slopes	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	75	120	60	115

[1] Common bermudagrass, dallisgrass, white clover, annual lespedeza.

[2] Fescue and white clover.

[3] Cow-acre-days is a term used to express the number of days 1 acre will support one animal (one cow, one steer, or one horse; five hogs; or seven sheep or goats) without injury to the pasture.

however, fire protection and heavy cutting of pines from pine-hardwood stands have reversed this trend and allowed hardwoods to become dominant again.

The major forest types now in York County are loblolly pine, shortleaf pine, pine-hardwood, oak-hickory, and Virginia pine. These forest types are described in detail in the publication "Forest Cover Types of North America" (*10*).

Many different factors combine to determine the suitability of a soil for trees. For example, the capacity of a soil to supply water to trees is related to such soil properties as structure, texture, and depth of the soil over bedrock or other impervious layers. Like other higher plants, trees need water, air, nutrients, root space, and other favorable site qualities. Different species of trees have different requirements.

Woodland Suitability Grouping of Soils

Management of woodland can be planned more easily if soils are grouped according to those characteristics that affect growth of trees and management of stands. For this reason, the soils of York County have been placed in 19 woodland suitability groups. Each group consists of soils that have about the same suitability for wood crops, require about the same management, and have about the same potential productivity. Listed in table 4, and described in the text, are the 19 woodland suitability groups in the county. Also shown in this table is the site index, to the nearest 10 feet, for three kinds of pine trees in each suitability group; and the hazards and limitations that affect the management of each group. The terms used in this table are explained as follows:

Site index.—This is the potential productivity of a soil for a specified tree. A site index for a given soil is the height, in feet, that a specified kind of tree growing on that soil will reach in 50 years. The site index of a soil is the result mainly of the capacity of the soil to provide moisture and growing space for tree roots. Each site index in table 4 is an average for all the soils

in the suitability group. The site index for any one soil in the group may differ somewhat from the average.

Suitable species.—This indicates which species of trees ought to be favored in the management of existing stands, and which are suitable for planting.

Plant competition.—This refers to the rate of invasion by unwanted trees, shrubs, and vines when openings are made in the canopy. Competition is *slight* if it does not prevent adequate natural regeneration and early growth, or interfere with the normal development of planted seedlings. Competition is *moderate* if it delays the establishment and slows the growth of seedlings, either naturally occurring or planted, but does not prevent the eventual development of a fully stocked, normal stand. Competition is *severe* if it prevents adequate restocking, either natural or artificial, without intensive preparation of the site and without special maintenance practices, including weeding.

Seedling mortality.—This refers to the expected loss of seedlings as a result of unfavorable soil characteristics or topographic features, not as a result of plant competition. Even if healthy seedlings of suitable species are correctly planted or occur naturally in adequate numbers, some will not survive if conditions are unfavorable. Ratings are based on mortality of seedlings among the number normally planted for adequate stocking. *Slight* mortality is the loss of less than 25 percent of the seedlings; *moderate*, between 25 and 50 percent; and *severe*, more than 50 percent.

Equipment limitation.—Some soil characteristics and topographic features restrict or prohibit the use of conventional equipment for planting and harvesting wood crops, for constructing roads, for controlling unwanted vegetation, and for controlling fires. The limitation is *slight* if there is little or no restriction on the type of equipment that can be used or the time of the year that equipment can be used. The limitation is *moderate* if the use of equipment is restricted by one or more unfavorable characteristics, such as slope, stones or other obstructions, seasonal wetness, instability, or risk of injury to roots of trees. The limitation is *severe* if special equipment is needed, or the use of such equipment is severely restricted by one or more unfavorable soil characteristics.

Erosion hazard.—This indicates the potential erosion on the soil under common forest management. The evaluation of erosion hazard is important in selecting species, in site preparation, and in construction of roads, trails, firebreaks, and landings. Each soil unit was rated *slight*, *moderate*, or *severe*, depending on the expected degree of erosion.

Windthrow hazard.—The ratings for windthrow hazard were based on an evaluation of soil characteristics that control tree-root development and thus affect windfirmness. Information was provided by field observations of wind damage to stands of varying densities on different soils. The evaluation is important in estimating for the suitability groups the stand density control needed in thinnings, release cuttings, regeneration, and final harvest cuttings. The ratings are *slight*, *moderate*, or *severe*, depending on the expected hazard of windthrow.

Descriptions of woodland suitability groups

On the following pages the 19 woodland suitability groups of this county are described, and the soils in each group are listed.

Because they are variable and not enough data were available, the following land types were not placed in woodland suitability groups:

(Gf)	Gullied land, firm materials.
(GuC)	Gullied land, friable materials, rolling.
(GuD)	Gullied land, friable materials, hilly.
(Md)	Mine pits and dumps.
(Ro)	Rock outcrop.

WOODLAND SUITABILITY GROUP 1

This group consists of deep, well-drained alluvial soils in upland depressions and on bottom lands along large streams. These soils have a grayish-brown to brown surface layer and a fine sandy loam to sandy loam subsoil. They have moderate to moderately rapid permeability and infiltration. Fertility and the available moisture capacity are moderate to moderately high. The surface layer has a moderate to moderately high content of organic matter. Soils in this group are—

(Cn)	Congaree fine sandy loam.
(Lo)	Local alluvial land.

Sweetgum, yellow-poplar, blackgum, ash, sycamore, cottonwood, black walnut, red maple, red and white oaks, and loblolly pine are the species preferred for these soils. Other species adapted to the soils are hackberry, beech, birch, American elm, winged elm, hickory, post oak, water oak, willow oak, persimmon, mulberry, dogwood, redcedar, and honeylocust.

These soils are suited to sawtimber and pulpwood rotations and to the production of high-quality veneer logs and long poles and piling. Most of the species are primary food plants for wildlife.

The average site index for loblolly pine on soils of this group is 90 to 100; that of shortleaf pine is 70 to 90. The approximate average annual growth per acre (board feet, Schribner rule) of well-stocked, unmanaged stands at 50 years of age is 555 to 700 for loblolly pine and 360 to 650 for shortleaf pine.

Competition between trees and that from grasses, vines, and reeds is severe, particularly for pine and hardwood trees not tolerant of shade. Clearing, disking, furrowing, cutting brush, applying herbicides, prescribed burning, or other intensive treatments are needed to reduce the vegetation and prepare the site and seedbed for pine and selected hardwood trees. The competition to trees from vegetation is not significant if a mixture of naturally occurring hardwoods tolerant of shade is allowed to form the main part of the stand.

Seedling mortality in this group of soils is slight to severe. Reforestation in fields or in areas in which competing vegetation has been controlled is generally satisfactory if adequate seed sources are available, or if proper techniques are used in planting. Planted seedlings generally have a mortality of less than 25 percent. Flooding is generally of short duration on these soils, but regeneration of desired species of trees may be adversely affected by prolonged inundation and by silting.

These soils tend to puddle and pack if worked when wet. Tillage and the use of equipment should be avoided and the trampling of cattle should be prevented during

TABLE 4.—*Site indexes, suitable trees for woodland suitability groups,*

Woodland suitability groups	Site index [1]		
	Loblolly pine	Shortleaf pine	Virginia pine
Group 1. Well-drained alluvial soils	90–100	70–90	
Group 2. Excessively drained soils on flood plains	80–90		
Group 3. Moderately well drained to somewhat poorly drained alluvial soils	90–100		
Group 4. Poorly drained alluvial soils	100		
Group 5. Moderately well drained to excessively drained soils on stream terraces	90	70–80	
Group 6. Deep, well-drained sandy loams and silt loams on uplands; slopes of 10 percent or less.	80–96	60–80	60–70
Group 7. Deep, well-drained soils on uplands; slopes of 10 percent or more	80	60–70	70
Group 8. Severely eroded clay loams	70	60	60
Group 9. Dark-red clay loams on ridgetops	70	60	60
Group 10. Moderately deep, well-drained to excessively drained sandy loams	70	60	
Group 11. Moderately deep to shallow, well-drained to excessively drained soils	70	60	
Group 12. Deep, somewhat poorly drained soils	80	70	
Group 13. Shallow, excessively drained soils; slopes of 15 percent or less	70–80	70–80	70–80
Group 14. Eroded, shallow, excessively drained soils	70–80	70–80	70–80
Group 15. Deep, moderately well drained soils with a plastic subsoil; slopes of 10 percent or less.	70–80	60–70	
Group 16. Moderately deep, moderately well drained soils with a plastic subsoil	60–70	50–60	50–60
Group 17. Severely eroded clay loams	50–80	[2] 40–70	[2] 40–70
Group 18. Moderately deep, moderately well drained to poorly drained soils with a plastic subsoil.	60	50	
Group 19. Shallow, moderately well drained soils	60	[3] 50	

[1] An expression of the quality of soil for trees. The figure is the average height in feet of the dominant stand at the age of 50 years, rounded to the nearest 10 feet. Dashed lines indicate data are not available or the specified tree does not normally occur on soils of the suitability group.

wet periods so that soil structure and tree roots are not damaged. Floods occasionally restrict access to these soils. However, limitation on the use of equipment is generally less than 3 months per year.

Erosion and windthrow are only slight hazards on these soils.

WOODLAND SUITABILITY GROUP 2

The only soil in this group is (Bu) Buncombe loamy sand, 0 to 4 percent slopes. It is a deep, excessively drained soil on the flood plains of large streams. It has a very dark grayish-brown surface layer and stratified sandy subsoil. Infiltration and permeability are rapid. The available moisture capacity is very low. The surface soil has a low content of organic matter. Natural fertility is very low.

Loblolly pine and commercially valuable hardwoods, including ash, sweetgum, cottonwood, sycamore, blackgum, white and red oaks, and red maple are species preferred for this soil.

This soil is suited to sawtimber and pulpwood rotations and to the production of poles and piling of medium length, where pine can be established. The preferred species are important wildlife food plants.

The average site index for loblolly pine on the soil of this group is 80 to 90 (estimated); that for commercial hardwoods was not determined. The approximate average annual growth per acre (board feet, Schribner rule) of well-stocked, unmanaged stands at 50 years of age is 425 to 555 for loblolly pine.

Plant competition is severe for pines and intolerant hardwoods, which are the species preferred on this soil. Clearing, disking, cutting brush, applying herbicides, prescribed burning, and other intensive treatments are generally needed to reduce competing vegetation and prepare sites before reproduction can be established. Where forest develops without the preference of species, the hazard of competing vegetation is slight, and the result is a well-stocked stand of mixed species.

Seedling mortality may be slight to severe. A survival of 75 percent or more of the planted seedlings is normally expected. The mortality may be as much as 50 percent in droughty periods because the soil is shallow and can hold only a small amount of moisture. Natural regeneration results in well-stocked stands if the supply of seed is adequate and plant competition is controlled. The soil is subject to flooding. If it is covered by water for a long time, the loss of seedlings, even for the water-tolerant species, is severe.

Limitation on the use of equipment is slight. Flooding, however, interferes with the use and management of these soils. The deposition and loss of soil in floods is a slight to moderate hazard. Windthrow is only a slight hazard on this soil.

WOODLAND SUITABILITY GROUP 3

This group consists of deep, moderately well drained to somewhat poorly drained alluvial soils on nearly level parts of first and second bottoms. The soils have a

and ratings for major hazards and limitations affecting management

Trees suited to soils	Hazards and limitations				
	Plant competition	Seedling mortality	Equipment limitation	Erosion hazard	Windthrow hazard
Pines, lowland hardwoods	Slight to severe	Slight to severe	Slight to moderate	Slight	Slight.
Pines, lowland hardwoods	Slight to severe	Slight to severe	Slight	Slight to moderate	Slight.
Pines, lowland hardwoods	Slight to severe	Moderate to severe.	Moderate to severe.	Slight	Slight.
Pines, lowland hardwoods	Slight to severe	Slight to severe	Severe	Slight	Slight.
Pines, lowland hardwoods	Slight to severe	Slight	Slight to moderate	Slight to moderate	Slight.
Pines, upland hardwoods	Slight to severe	Slight	Slight to severe	Slight to moderate	Slight.
Pines, upland hardwoods	Slight to severe	Slight to moderate	Slight to severe	Moderate to severe.	Slight to moderate.
Pines	Moderate	Slight to moderate	Moderate to severe.	Severe	Moderate.
Pines	Severe	Moderate	Moderate	Moderate	Moderate.
Pines	Severe	Moderate	Slight	Slight	Slight.
Pines	Moderate to severe.	Slight to moderate	Moderate	Moderate	Moderate.
Pines	Severe	Moderate	Severe	Slight	Moderate.
Pines	Severe	Moderate	Severe	Moderate	Moderate to severe.
Pines, upland hardwoods	Severe	Moderate	Severe	Severe	Moderate to severe.
Pines	Severe	Slight	Moderate	Slight to moderate	Slight.
Pines	Severe	Moderate	Moderate to severe.	Moderate	Moderate.
Pines	Slight to severe	Slight to severe	Severe	Severe	Severe.
Pines	Severe	Moderate to severe.	Moderate	Slight to moderate	Moderate.
Pines	Severe	Moderate	Moderate to severe.	Slight	Severe.

[2] Some of the soils of this unit have a site index below 40 for shortleaf or Virginia pine.

[3] And below.

grayish-brown to dark grayish-brown surface layer and a mottled clay loam to clay subsoil. The Mixed alluvial land in this group consists of stratified material that has little or no development. Infiltration is slow to moderate, and the permeability is moderately slow to moderately rapid. The available moisture capacity is moderately high. There is a moderate amount of organic matter in the surface layer. The natural fertility is low. The soils in this suitability group are—

(Ch) Chewacla silt loam.
(Mn) Mixed alluvial land.
(Rk) Roanoke silt loam.
(WoB) Worsham sandy loam, 2 to 6 percent slopes.

Sweetgum, blackgum, cherrybark oak, Shumard oak, white oak, ash, yellow-poplar, cottonwood, loblolly pine, and red maple are species preferred on these soils. The trees of intermediate priority are willow oak, water oak, post oak, hackberry, American elm, winged elm, hickory, American beech, persimmon, and mulberry. Weed species that grow on these soils are boxelder, blue beech, hophornbeam, and hawthorn.

These soils are suited to sawtimber and pulpwood rotations and to the production of high-quality veneer logs and long poles and piling. Most of the trees mentioned in the previous paragraph are important food plants for wildlife.

The average site index for loblolly pine is 90 to 100; average site indexes for other species have not been determined. Preliminary field studies indicate that the site index of sweetgum may be similar to that of loblolly pine. The approximate average annual growth (board feet, Scribner rule) per acre in well-stocked, unmanaged stands at 50 years of age is 555 to 715 for loblolly pine.

Brush and the less desirable hardwood trees compete severely with pine and the preferred hardwood trees that will not tolerate shade. Clearing, prescribed burning, applying herbicides, disking, or other intensive treatments are necessary to control or eliminate competing vegetation and to prepare a seedbed. Where forest composition develops without selection of species, the hazard of competition is slight, and the result is a well-stocked stand of mixed species.

Seedling mortality differs for each species and is rated as moderate to severe. Flooding is hazardous to the germination of seed and the growth of seedlings of both pines and hardwoods. Prolonged inundation and silting during the growing season are detrimental to the germination of seeds and the growth of seedlings. Water management improves the quality of the site and reduces mortality, but such management generally is not feasible.

Limitation on the use of woodland equipment is moderate to severe. The use of equipment on these soils is restricted by flooding, poor surface drainage, low topographic position, and the lack of permeability in the soils. Adequate drainage is necessary to maintain woodland roads in usable condition. The use of equipment should be avoided and trampling of livestock prevented

when the soils are wet, as these soils tend to puddle and pack easily. In addition, tree roots are susceptible to injury by livestock and equipment when the soils are wet. Water management improves operating conditions in the woodlands, but flooding and debris interfere with the functioning of water-control structures.

The hazards of erosion and windthrow are slight. Many species are suited to the soils in this group. Drought, however, may cause dieback among hardwood trees.

The production potential of the soils in this group is high, but drainage and other intensive site-improvement measures, as well as selection of species that are exactly suited to the site, are needed. Each site needs evaluation to determine the treatment required and the species that are suited to it. The work of Putnam, Furnival, and McKnight (*7*) lists approximately 70 important commercial species of the southern bottom lands and describes important characteristics and site requirements for them.

WOODLAND SUITABILITY GROUP 4

One land type, (Mw) Mixed alluvial land, wet, is the only member of this group. It is poorly drained and occurs on nearly level bottom land along small streams. The water table is moderately deep. The surface layer is light brown to dark brown. It is underlain by stratified material that has mottles of gray and brown. Infiltration is moderately rapid, and permeability is rapid. The available moisture capacity is low. The content of organic matter in the surface layer is low to moderate. Natural fertility is low.

The species preferred on Mixed alluvial land, wet, are loblolly pine, sweetgum, ash, blackgum, tupelo, and red maple. Slightly less desirable are persimmon, hickory, willow oak, water oak, elm, and beech.

These soils are suited to sawtimber and pulpwood rotations and to the production of high-quality veneer logs and long poles and piling, provided drainage is adequate for suited species. Many hardwood trees are important food plants for wildlife.

The average site index for loblolly pine is 100 (estimated); average site indexes for hardwoods have not been determined. The approximate average annual growth per acre (board feet, Scribner rule) of well-stocked, unmanaged stands at 50 years of age is 700 for loblolly pine.

Hardwoods and ground vegetation compete severely with pines. The hazard of plant competition is severe where the regeneration of specific hardwood species is attempted, particularly when intolerant hardwoods are selected. Prescribed burning, applying herbicides, clearing, disking, or other intensive treatments are necessary to reduce the vegetation and to prepare seedbeds. Plant competition is only a slight problem if the growth of any naturally occurring hardwoods is slowed to form the stand.

Seedling mortality ranges from slight to severe, but it differs for the various kinds of trees. Poor drainage and flooding are hazards to the germination of seeds and the growth of seedlings of pines and hardwoods. Prolonged inundation and silting during the growing season cause severe mortality among recently germinated seedlings. Water management improves site quality and reduces mortality, but it frequently is not feasible.

Limitation on the use of woodland equipment is severe on these soils. Poor drainage, a high water table, and flooding severely restrict the use of equipment. Because the surface layer has a fine texture, these soils are boggy and slippery when wet. They puddle and compact easily. Tree roots may be severely damaged through use of equipment or by trampling of livestock.

Grazing large numbers of cattle and the use of equipment should be avoided when these soils are wet. Drainage is needed to maintain woodland roads in usable condition, but it may not be feasible. Windthrow and erosion are only slight hazards.

Many kinds of trees are suited to these soils. The production potential is excellent and justifies intensive treatment, improvement of the site through drainage, and selection of trees to make up the stand. Each site needs evaluation to determine the treatment required and the species suited to it. Putnam, Furnival, and McKnight (*7*) list approximately 70 important commercial species of the southern bottom land and describe important characteristics and site requirements for them.

WOODLAND SUITABILITY GROUP 5

This group consists of deep, moderately well drained to excessively drained, gently sloping to strongly sloping soils on stream terraces. The soils have a dark-brown to grayish-brown surface layer and a light yellowish-brown to yellowish-red sandy loam to sandy clay loam subsoil. Infiltration is moderately rapid, and permeability is moderately slow to rapid. The available moisture capacity is moderate to low. The organic-matter content of the surface soil is low. Natural fertility is low. The soils in this group are—

(AaB)	Altavista fine sandy loam, 0 to 6 percent slopes.
(MyB)	Molena loamy sand, 2 to 8 percent slopes.
(WcB2)	Wickham sandy loam, 2 to 6 percent slopes, eroded.
(WcD2)	Wickham sandy loam, 6 to 15 percent slopes, eroded.

Sweetgum, yellow-poplar, blackgum, ash, sycamore, cottonwood, black walnut, red maple, red oak, white oak, and loblolly pine are the species preferred on these soils. Other species that are suitable are hackberry, beech, birch, American elm, winged elm, hickory, post oak, water oak, willow oak, persimmon, mulberry, dogwood, redcedar, and honeylocust.

The soils of this group are suited to sawtimber and pulpwood rotations and to the production of high-quality veneer logs and poles and piling of medium length. Most of the trees mentioned in the previous paragraph are important food plants for wildlife.

The average site index for loblolly pine is 90; that for shortleaf pine is 70 to 80. The approximate average annual growth per acre (board feet, Scribner rule) of well-stocked, unmanaged stands at 50 years of age is 555 for loblolly pine and 430 for shortleaf pine.

Competition between the trees and from the ground cover of grasses, vines, and reeds is severe, particularly for trees that are intolerant of shade. Clearing, disking, furrowing, cutting brush, applying herbicides, prescribed burning, or other intensive treatments are necessary to reduce competing vegetation or to prepare sites for establishing seedlings of the desired trees. The competition to trees from vegetation is not significant if a mixture of

naturally occurring hardwoods tolerant of shade is allowed to form the main part of the stand.

The reforesting of fields or areas in which competing vegetation has been controlled is generally satisfactory if the amount of seed is adequate and proper techniques are used in planting seed or seedlings. The mortality of planted seedlings is usually less than 25 percent. Periods of flooding are generally short, but some species of seedlings are adversely affected by silting and long periods of flooding.

On slopes of less than 2 percent, the use of equipment is only moderately restricted. During wet periods, cattle should not be allowed to concentrate on these soils and use of equipment should be avoided to prevent damage to the soil structure and to tree roots. This restriction, however, is for less than 3 months during the year. The equipment hazard is slight on slopes of 2 percent or more if surface drainage is good.

Erosion is a slight hazard on slopes of 10 percent or less but is a moderate hazard on slopes of more than 10 percent. Windthrow is only a slight hazard. Sweetgum and other species may be injured by dieback during long periods of dry weather.

WOODLAND SUITABILITY GROUP 6

This group consists of deep, well-drained, gently sloping to sloping soils on uplands and on high stream terraces. These soils have a reddish-brown to grayish-brown surface layer and a red to yellow clay loam to clay subsoil. Infiltration and permeability are moderate to moderately slow. The available moisture capacity is medium. The organic-matter content of the surface soil is generally low. Natural fertility ranges from low to fairly high. The soils in this group are—

(ApB)	Appling sandy loam, 2 to 6 percent slopes.
(ApB2)	Appling sandy loam, 2 to 6 percent slopes, eroded.
(ApC)	Appling sandy loam, 6 to 10 percent slopes.
(ApC2)	Appling sandy loam, 6 to 10 percent slopes, eroded.
(CdB2)	Cecil sandy loam, 2 to 6 percent slopes, eroded.
(CdC2)	Cecil sandy loam, 6 to 10 percent slopes, eroded.
(DuB)	Durham sandy loam, 2 to 6 percent slopes.
(DuC)	Durham sandy loam, 6 to 10 percent slopes.
(HwB2)	Hiwassee sandy loam, 2 to 6 percent slopes, eroded.
(HwC2)	Hiwassee sandy loam, 6 to 10 percent slopes, eroded.
(LdB)	Lloyd loam, 2 to 6 percent slopes.
(LdB2)	Lloyd loam, 2 to 6 percent slopes, eroded.
(LdC)	Lloyd loam, 6 to 10 percent slopes.
(LdC2)	Lloyd loam, 6 to 10 percent slopes, eroded.
(LmB2)	Lloyd sandy loam, 2 to 6 percent slopes, eroded.
(LmC2)	Lloyd sandy loam, 6 to 10 percent slopes, eroded.
(NaB2)	Nason silt loam, 2 to 6 percent slopes, eroded.
(NaC2)	Nason silt loam, 6 to 10 percent slopes, eroded.
(TaB2)	Tatum gravelly silt loam, 2 to 6 percent slopes, eroded.
(TaC2)	Tatum gravelly silt loam, 6 to 10 percent slopes, eroded.
(TmB)	Tatum silt loam, 2 to 6 percent slopes.
(TmB2)	Tatum silt loam, 2 to 6 percent slopes, eroded.
(TmC)	Tatum silt loam, 6 to 10 percent slopes.
(TmC2)	Tatum silt loam, 6 to 10 percent slopes, eroded.

Loblolly pine and shortleaf pine are the conifers preferred on these soils. Hardwoods preferred are white oak, red oak, and yellow-poplar. These soils are suited to sawtimber and pulpwood rotations and to the production of medium to long poles and piling and to high-quality veneer logs. Some hardwood species, particularly hickory, on this site produce excellent food for wildlife.

The site index is 80 to 90 for loblolly pine, 60 to 80 for shortleaf pine, and 60 to 70 for Virginia pine. The index for upland hardwoods was not determined. The approximate average annual growth (board feet, Scribner rule) per acre of well-stocked, unmanaged stands at 50 years of age is 425 to 560 for loblolly pine and 210 to 500 for shortleaf pine.

Competition from undesirable trees and from undergrowth is severe for preferred species. Land clearing, disking, furrowing, cutting brush, prescribed burning, applying herbicides, or other intensive treatments are necessary to control competing plants and to prepare sites for planting or for natural regeneration of desired trees. If there is no preference for certain species, competition is insignificant, and generally a stand of mixed pines and hardwoods will develop.

Mortality of seedlings, because of soil conditions, is generally less than 25 percent. Restocking of abandoned fields or open areas in which plant competition has been controlled or eliminated is satisfactory if adequate amounts of seed are available for natural regeneration or the proper techniques are used in planting.

Boulders or gravel in some soils severely restrict the use of equipment in small local areas; otherwise, the limitation is slight.

On slopes of 6 percent or less, erosion is a slight hazard. On slopes exceeding 6 percent it is a moderate hazard and the construction of roads and firebreaks and other operations that disturb the protective cover of these soils should follow the contour if feasible. Windthrow is no special hazard on these soils.

WOODLAND SUITABILITY GROUP 7

This group consists of deep well-drained, strongly sloping to steep soils on uplands and on high stream terraces. These soils have a grayish-brown to reddish-brown surface layer and a red to yellowish-red clay subsoil. Infiltration and permeability are moderate to moderately slow. The available moisture capacity is medium. The content of organic matter in the surface layer is low. Natural fertility is low to moderately high. The soils in this group are—

(ApD)	Appling sandy loam, 10 to 15 percent slopes.
(ApD2)	Appling sandy loam, 10 to 15 percent slopes, eroded.
(ApE)	Appling sandy loam, 15 to 25 percent slopes.
(ApE2)	Appling sandy loam, 15 to 25 percent slopes, eroded.
(CdD2)	Cecil sandy loam, 10 to 15 percent slopes, eroded.
(CdE)	Cecil sandy loam, 15 to 30 percent slopes.
(CdE2)	Cecil sandy loam, 15 to 25 percent slopes, eroded.
(HwD2)	Hiwassee sandy loam, 10 to 18 percent slopes, eroded.
(LdD2)	Lloyd loam, 10 to 15 percent slopes, eroded.
(LmD2)	Lloyd sandy loam, 10 to 15 percent slopes, eroded.
(LmE)	Lloyd sandy loam, 15 to 25 percent slopes.
(LmE2)	Lloyd sandy loam, 15 to 25 percent slopes, eroded.
(NaD2)	Nason silt loam, 10 to 15 percent slopes, eroded.
(NaE)	Nason silt loam, 15 to 25 percent slopes.
(NaE2)	Nason silt loam, 15 to 25 percent slopes, eroded.
(TaD2)	Tatum gravelly silt loam, 10 to 15 percent slopes, eroded.
(TaE2)	Tatum gravelly silt loam, 15 to 25 percent slopes, eroded.
(TmD2)	Tatum silt loam, 10 to 15 percent slopes, eroded.
(TmE)	Tatum silt loam, 15 to 25 percent slopes.
(TmE2)	Tatum silt loam, 15 to 25 percent slopes, eroded.

Loblolly and shortleaf pine are the species preferred on these soils. However, Virginia pine and upland hardwoods grow well. These soils are suited to sawtimber and pulpwood rotations and to the production

of poles and piling of medium length. Oak and hickory are important food-producing plants for wildlife.

The site index is 80 for loblolly pine, 60 to 70 for shortleaf pine, and 70 for Virginia pine. The approximate average annual growth per acre (board feet, Scribner rule) of well stocked, unmanaged stands at 50 years of age is 425 for loblolly pine and 210 to 360 for shortleaf pine.

Sweetgum, upland oaks, and other vegetation compete severely with preferred pine species. Land clearing, disking, brush cutting, application of herbicides, or other intensive treatments are frequently necessary to eliminate or control competing vegetation or to prepare sites before establishing seedlings. Where species preference is not important, the hazard is considered slight.

Generally, the mortality of planted seedlings is slight (less than 25 percent). On dry, steep, eroded slopes, however, mortality is moderate. It ranges from 25 to 50 percent, and replanting may be necessary in the larger openings. In most places natural reseeding is adequate if sites are prepared well, competing plants are controlled, and enough seeds are available.

Limitation to the use of equipment is variable. It is slight in the less sloping areas and is severe in steeper areas and in areas where boulders occur.

The hazard of erosion is moderate in the less sloping, slightly eroded areas. In steeper and eroded areas the hazard is severe. Construction of roads, firebreaks, and other operations that destroy the protective cover of these soils should follow the contour or, if possible, be avoided.

The windthrow hazard generally is slight. On eroded slopes, however, the hazard is moderate, and some windfall can be expected if trees are released.

WOODLAND SUITABILITY GROUP 8

This group consists of moderately deep to deep soils on gently sloping to moderately steep uplands. These soils have a red clay loam to silty clay loam surface layer and a red clay subsoil. Infiltration is slow and permeability is moderate. The available moisture capacity is low. The organic-matter content of the surface layer is very low. Natural fertility is low. The soils in this group are—

(CcB3)	Cecil clay loam, 2 to 6 percent slopes, severely eroded.
(CcC3)	Cecil clay loam, 6 to 10 percent slopes, severely eroded.
(CcD3)	Cecil clay loam, 10 to 15 percent slopes, severely eroded.
(CcE3)	Cecil clay loam, 15 to 25 percent slopes, severely eroded.
(LaB3)	Lloyd clay loam, 2 to 6 percent slopes, severely eroded.
(LaC3)	Lloyd clay loam, 6 to 10 percent slopes, severely eroded.
(LaD3)	Lloyd clay loam, 10 to 15 percent slopes, severely eroded.
(LaE3)	Lloyd clay loam, 15 to 25 percent slopes, severely eroded.
(TtB3)	Tatum silty clay loam, 2 to 6 percent slopes, severely eroded.
(TtC3)	Tatum silty clay loam, 6 to 10 percent slopes, severely eroded.
(TtD3)	Tatum silty clay loam, 10 to 15 percent slopes, severely eroded.
(TtE3)	Tatum silty clay loam, 15 to 25 percent slopes, severely eroded.

Loblolly pine is the species preferred on these soils (fig. 11). Shortleaf pine and Virginia pine grow well, but littleleaf disease severely damages shortleaf pine. The important commercial hardwoods, however, are not suitable. These soils are suited to sawtimber and pulpwood rotations and to poles and piling of short and medium length.

The average site index is 70 for loblolly pine and 60 for shortleaf pine. The approximate average annual growth per acre (board feet, Scribner rule) of well-stocked, unmanaged stands at 50 years of age is 300 for loblolly pine and 210 for shortleaf pine.

Plant competition is moderate because undesirable hardwoods and other competing plants are not well adapted to these soils. A small amount of preparation is sometimes needed to establish seedlings.

In areas where slopes exceed 10 percent, seedling mortality is moderate. Site preparation, superior planting techniques, and replanting are generally required for adequate stocking. Natural regeneration may not be satisfactory. In areas where slopes are 10 percent or less, mortality is slight. Less than 25 percent loss of planted seedlings is expected, and natural reseeding is generally adequate.

Limitation to use of equipment is moderate on slopes of 10 percent or less. It is severe on slopes greater than 10 percent. Equipment should not be used on these soils when they are wet, as it may cause severe damage to soil structure and to roots of trees.

Because these soils are steep and severely eroded, the hazard of further erosion is severe. If roads and firebreaks are needed, they should be built on the contour. Operations that destroy the protective cover of these soils should be avoided whenever feasible.

Because severe erosion limits the root zone and stability of trees, windthrow is moderate.

WOODLAND SUITABILITY GROUP 9

This group consists of deep, well-drained soils on ridgetops. These soils have a dusky-red surface layer and a dark-red to red clay subsoil. Infiltration is moderately slow, and permeability is moderate. The available moisture capacity is medium. The organic-matter content of

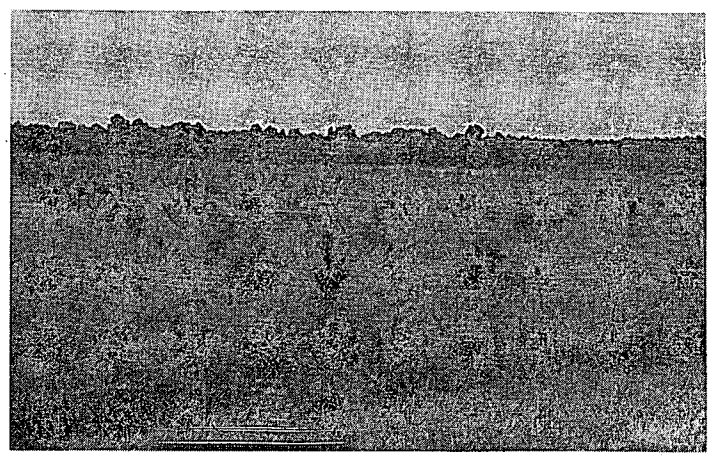

Figure 11.—**A young stand of loblolly pine on Class IV land.**

the surface layer is moderate to low. Natural fertility is moderate to high. The soils in this group are—

(DaB2) Davidson clay loam, 2 to 6 percent slopes, eroded.
(DaC3) Davidson clay loam, 6 to 10 percent slopes, severely eroded.

Loblolly and shortleaf pine are the species preferred on these soils. Oak and hickory are important food trees for wildlife.

These soils are suited to sawtimber and pulpwood rotations and to poles and piling of medium length.

The average site index is 70 for loblolly pine and 60 for shortleaf pine. The approximate average annual growth per acre (board feet, Scribner rule) of well-stocked, unmanaged stands at 50 years of age is 300 for loblolly pine and 210 for shortleaf pine.

Upland hardwoods and ground cover compete severely with the preferred pine species. Clearing land, disking, cutting brush, applying herbicides, or other intensive treatments are necessary to control competing plants and to prepare sites for desired seedlings.

Mortality of planted seedlings of the preferred species is moderate; the rate of survival ranges from 50 to 75 percent. Some replanting is necessary in large openings.

There is a moderate limitation to use of equipment because these soils are eroded. When the soils are wet, the use of equipment should be avoided and the trampling of cattle should be prevented. Otherwise, the soils compact and tree roots are damaged.

The hazard of erosion on these soils is moderate. The windthrow hazard is moderate. Windfall can be expected in periods of normally high wind velocities if trees are released or the density of the stand is reduced.

WOODLAND SUITABILITY GROUP 10

This group consists of moderately deep, well-drained to excessively drained soils on broad hills. These soils have a light olive-brown surface layer and a yellowish-brown to yellowish-red sandy clay subsoil. Infiltration is rapid and permeability is moderate. The available moisture capacity is low. Organic-matter content of the surface layer is low to very low. Natural fertility is low. The soils in this group are—

(AcB) Appling coarse sandy loam, thin solum, 2 to 6 percent slopes.
(AcB2) Appling coarse sandy loam, thin solum, 2 to 6 percent slopes, eroded.
(AcC) Appling coarse sandy loam, thin solum, 6 to 10 percent slopes.
(AcC2) Appling coarse sandy loam, thin solum, 6 to 10 percent slopes, eroded.

On these soils loblolly and shortleaf pines are the species preferred. Persimmon, hickory, gum, and oak are important food-producing trees for wildlife.

These soils are suited to sawtimber and pulpwood rotations and to the production of poles and piling of medium and short lengths.

On these soils the average site index is 70 for loblolly pine and 60 for shortleaf pine. The approximate average annual growth per acre (board feet, Scribner rule) of well-stocked, unmanaged stands at 50 years of age is 300 for loblolly pine and 210 for shortleaf pine.

Competition with preferred species from oak, hickory, sassafras, persimmon, sweetgum, blackgum, and other plants is severe. Clearing land, brush cutting, undercutting roots, prescribed burning, applying herbicides, or other intensive treatments are frequently necessary to control competing plants or to prepare sites for desired seedlings.

Seedling mortality is moderate. The survival of planted seedlings on these soils ranges from 50 to 75 percent. A small amount of seedbed preparation is needed for adequate natural restocking.

The use of equipment is generally not limited on these soils. The hazard of erosion is slight. Trees are subject to only slight windthrow hazard.

WOODLAND SUITABILITY GROUP 11

This group consists of moderately deep to shallow, well-drained to excessively drained soils on strong and moderately steep slopes adjacent to the streams. These soils have a light olive-brown surface layer and a yellowish-red sandy clay subsoil. Infiltration is rapid, and permeability is moderately rapid. The available moisture capacity is very low. The organic-matter content of the surface layer is very low. Natural fertility is low. The soils in this group are—

(AcD) Appling coarse sandy loam, thin solum, 10 to 15 percent slopes.
(AcD2) Appling coarse sandy loam, thin solum, 10 to 15 percent slopes, eroded.
(AcE2) Appling coarse sandy loam, thin solum, 15 to 25 percent slopes, eroded.

On these soils loblolly pine is the species preferred, but shortleaf pine is also suitable.

These soils are suited to sawtimber and pulpwood rotations and to the production of poles and piling of short and medium length. Oak, hickory, maple, sweetgum, and blackgum are important food-producing trees for wildlife.

The average site index is 70 for loblolly pine and 60 for shortleaf pine. The approximate average annual growth per acre (board feet, Scribner rule) of well-stocked, unmanaged stands at 50 years of age is 300 for loblolly pine and 210 for shortleaf pine.

Competition with the preferred species from oak, sweetgum, blackgum, maple, hickory, and other plants is moderate to severe. Disking, furrowing, undercutting roots, cutting brush, or applying herbicides is frequently necessary to control competing plants.

Seedling mortality of 25 to 50 percent can be expected from plantings in open areas where plant competition is controlled. Replanting is generally necessary.

There is a moderate limitation in the use of equipment on these shallow soils. This limitation, however, is generally restricted to less than 3 months in each year.

Where the root zone is shallow because of the slope, the hazard of erosion is moderate. Roads and firebreaks should be built on the contour, if possible, and operations that destroy the protective cover of these soils should be avoided.

In areas where root development in the shallow soil is inadequate to hold exposed trees, the windthrow hazard is moderate.

WOODLAND SUITABILITY GROUP 12

This group includes only (CoB) Colfax sandy loam, 2 to 6 percent slopes. This is a deep and somewhat poorly drained soil in gently sloping depressions on the uplands. It has an olive-gray sandy loam surface layer and a clay subsoil mottled with yellowish brown and brownish

yellow. Infiltration is rapid, and permeability is moderately slow. The available moisture capacity is medium low to low. The organic-matter content of the surface layer is low. Natural fertility is low. This soil has a subsoil that is sticky and plastic when wet and hard when dry.

Loblolly pine is the species preferred, but shortleaf pine is also suitable. This soil is suited to sawtimber and pulpwood rotations and to the production of poles and piling of medium length. Oak is an important food-producing tree for wildlife.

The average site index is 80 for loblolly pine and 70 for shortleaf pine. The approximate average annual growth per acre (board feet, Scribner rule) of well-stocked, unmanaged stands at 50 years of age is 425 for loblolly pine and 360 for shortleaf pine.

Sweetgum, oak, and low-growing shrubs and other plants compete severely with preferred species. Prescribed burning, managing water, clearing land, disking, cutting brush, applying herbicides, and other intensive treatments are frequently necessary to control competing plants and to prepare sites for seedlings.

Mortality of seedlings is determined largely by moisture relations, but is considered moderate. This soil has a limited moisture supply in dry periods, and it heaves and cracks. Normally from 50 to 75 percent of seedlings survive on this soil. If the supply of seed and moisture is sufficient, natural regeneration in open areas is generally adequate.

Equipment limitations are severe. The somewhat poor drainage restricts access to the soil, the use of equipment, and grazing. In most years the restriction is not more than 3 months. Careful management is needed to prevent damage to tree roots by livestock or equipment.

The erosion hazard is slight on this soil. Windthrow is moderate because the growth of roots is restricted.

WOODLAND SUITABILITY GROUP 13

This group consists of shallow, excessively drained soils on gently sloping and sloping ridges and on slopes adjacent to streams. They have a dark-brown to dark grayish-brown surface layer and light yellowish-brown, reddish-yellow, or brownish-yellow sandy clay loam to clay subsoil. Infiltration is moderate to moderately rapid, and permeability ranges from slow to rapid. The available moisture capacity is low. The organic-matter content of the surface layer is low. Natural fertility is very low. The soils in this group are—

(IvB)	Iredell very stony loam, 0 to 6 percent slopes.
(LsB)	Louisburg sandy loam, 2 to 6 percent slopes.
(LsC)	Louisburg sandy loam, 6 to 10 percent slopes.
(WkB)	Wilkes complex, 2 to 6 percent slopes.
(WkC)	Wilkes complex, 6 to 10 percent slopes.

Loblolly pine and short leaf pine are the species preferred, but Virginia pine grows well. Upland oak and hickory are important food plants for wildlife. These soils are adapted to sawtimber and pulpwood rotations and to the production of poles and piling of medium length.

The site index is 70 to 80 for loblolly pine, 70 to 80 for shortleaf pine, and 70 to 80 for Virginia pine. The approximate average annual growth per acre (board feet, Scribner rule) of well-stocked, unmanged stands at 50 years of age is 300 to 425 for loblolly pine and 365 to 500 for shortleaf pine.

Upland hardwoods and ground vegetation compete severely with pine species for the limited moisture supply. Disking, clearing land, cutting brush, undercutting roots, applying herbicides, or other intensive treatments are frequently necessary to control competing plants or to prepare sites for seedlings.

Seedling mortality of planted stock is generally 25 to 50 percent. Replanting is necessary. Seedbed preparation before planting or natural seeding is frequently needed to obtain adequate stands.

The use of equipment is severely limited by the shallowness of these soils. Its use should be kept at the minimum to prevent damage to soils and to roots of trees.

The erosion hazard is moderate. Because of a shallow root zone, root development is restricted, and windthrow is moderate to severe.

WOODLAND SUITABILITY GROUP 14

This group consists of shallow, excessively drained soils on strong to steep slopes adjacent to streams and on the tops and side slopes of mountains. They have a dark-brown to grayish-brown surface layer, and a light yellowish-brown, yellowish-brown, reddish-yellow, and brownish-yellow sandy clay loam to clay subsoil. Infiltration and permeability are rapid. The available moisture capacity is very low. The organic-matter content of the surface layer is very low. Natural fertility is very low. The soils in this group are—

(LsD)	Louisburg sandy loam, 10 to 15 percent slopes.
(LsE)	Louisburg sandy loam, 15 to 25 percent slopes.
(MaD2)	Manteo channery silt loam, 10 to 15 percent slopes, eroded.
(MaE)	Manteo channery silt loam, 15 to 35 percent slopes.
(WkD)	Wilkes complex, 10 to 15 percent slopes.
(WkD2)	Wilkes complex, 6 to 15 percent slopes, eroded.
(WkE)	Wilkes complex, 15 to 35 percent slopes.
(WkE2)	Wilkes complex, 15 to 35 percent slopes, eroded.
(WoC)	Worsham sandy loam, 6 to 15 percent slopes.

On these soils loblolly pine is the species preferred, but shortleaf pine also grows well. However, littleleaf disease may be severe. Upland hardwoods grow well, particularly where seepage occurs.

These soils are suited to sawtimber and pulpwood rotations and to the production of poles and piling of medium length. Beech, black cherry, dogwood, mulberry, oak, hickory, walnut, and pecan are important food-producing plants for wildlife.

On these soils the site index is 70 to 80 for loblolly pine and 70 to 80 for shortleaf pine. The approximate average annual growth per acre (board feet, Scribner rule) of well-stocked, unmanaged stands at 50 years of age is 300 to 425 for loblolly pine and 365 to 550 for shortleaf pine.

Sweetgum, oak, hickory, and other plants compete severely with preferred species or with hardwoods selected for management. Applying herbicides, clearing land, disking, cutting brush, or other intensive treatments are frequently necessary to control competing plants or to prepare sites for seedlings.

Mortality of seedlings is moderate. Normally it ranges from 25 to 50 percent, and replanting is necessary to fill in large openings.

Because of the steep slopes and shallow soils, limitation to use of equipment is severe. Firebreaks and roads

should be built on the contour, if feasible, and operations that destroy protective cover should be avoided.

The erosion hazard is severe. The hazard of windthrow is moderate to severe, depending on the thickness of the root zone. Salvage cuttings can be expected.

WOODLAND SUITABILITY GROUP 15

This group consists of deep, moderately well drained, nearly level to sloping soils. They have a dark-brown to yellowish-brown loam to sandy loam surface layer and a yellowish-brown to red clay subsoil. Infiltration is moderate to moderately slow and permeability is moderately slow to slow. The available moisture capacity is medium. The organic-matter content of the surface layer is low. Natural fertility is also low. The soils in this group are—

(CbB2)	Cataula sandy loam, 2 to 6 percent slopes, eroded.
(CbC2)	Cataula sandy loam, 6 to 10 percent slopes, eroded.
(EsB2)	Enon sandy loam, 2 to 6 percent slopes, eroded.
(EsC2)	Enon sandy loam, 6 to 10 percent slopes, eroded.
(HaB)	Helena sandy loam, 2 to 6 percent slopes.
(HaB2)	Helena sandy loam, 2 to 6 percent slopes, eroded.
(HaC)	Helena sandy loam, 6 to 10 percent slopes.
(HaC2)	Helena sandy loam, 6 to 10 percent slopes, eroded.
(LnB2)	Lloyd sandy loam, compact subsoil, 2 to 6 percent slopes, eroded.
(McA)	Mecklenburg loam, 0 to 2 percent slopes.
(McB2)	Mecklenburg loam, 2 to 6 percent slopes, eroded.
(McC2)	Mecklenburg loam, 6 to 10 percent slopes, eroded.
(VcB2)	Vance sandy loam, 2 to 6 percent slopes, eroded.
(VcC2)	Vance sandy loam, 6 to 10 percent slopes, eroded.

Loblolly pine is the species preferred, but Virginia and shortleaf pines are also suitable. These soils are suited to sawtimber and pulpwood rotations and will produce poles and piling of short and medium length. Oak, hickory, black cherry, and mulberry are important food-producing plants for wildlife.

The site index on these soils is 70 to 80 for loblolly pine and 60 to 70 for shortleaf pine. The approximate average annual growth per acre (board feet, Scribner rule) of well-stocked, unmanaged stands 50 years of age is 300 to 425 for loblolly pine and 210 to 360 for shortleaf pine.

Red oak, white oak, dogwood, persimmon, sweetgum, hickory, and other plants compete severely with pines. Clearing land, disking, cutting brush, undercutting roots, applying herbicides, or other intensive treatments are frequently necessary to control competing plants or to prepare sites for seedlings.

Because seedling mortality is slight, a satisfactory stand is generally obtained from the first planting. If adequate seed is available and competing vegetation is controlled, a well-stocked stand can be obtained by natural regeneration.

The limitation to use of equipment is moderate on those soils that have a plastic subsoil. Operation of equipment on eroded soils should be avoided during wet periods to prevent damage to soil structure and to tree roots.

The erosion hazard is slight to moderate. Operations that disturb plant cover should be avoided. Roads and firebreaks should be constructed on the contour if feasible.

Windthrow is slight to moderate in areas where subsoil limits root growth.

WOODLAND SUITABILITY GROUP 16

This group consists of moderately deep, moderately well drained soils on strong and moderately steep, medium-length slopes adjacent to small streams. These soils have a dark-brown to yellowish-brown surface layer and a yellowish-brown to red clay subsoil. Infiltration is moderate, and permeability is moderately slow. The available moisture capacity is medium to low. The organic-matter content of the surface layer is low. Natural fertility is also low. The soils in this group are—

(EsD2)	Enon sandy loam, 10 to 15 percent slopes, eroded.
(EsE2)	Enon sandy loam, 15 to 25 percent slopes, eroded.
(HaD2)	Helena sandy loam, 10 to 15 percent slopes, eroded.
(McD2)	Mecklenburg loam, 10 to 15 percent slopes, eroded.
(McE2)	Mecklenburg loam, 15 to 25 percent slopes, eroded.
(VcD2)	Vance sandy loam, 10 to 15 percent slopes, eroded.
(VcE2)	Vance sandy loam, 15 to 25 percent slopes, eroded.

Loblolly pine is the species preferred, but shortleaf pine and Virginia pine are suitable. Littleleaf disease, however, attacks shortleaf pine severely. These soils are suited to sawtimber and pulpwood rotations and to the production of poles and piling of short length. Oak and hickory are the primary food-producing plants for wildlife.

The site index is 60 to 70 for loblolly pine; 50 to 60 for shortleaf pine; and 50 to 60 for Virginia pine. The approximate average annual growth per acre (board feet, Scribner rule) of well-stocked, unmanaged stands at 50 years of age is 170 to 300 for loblolly pine and 90 to 210 for shortleaf pine.

Upland oak, hickory, and other associated plants compete severely with preferred pine species. Clearing land, disking, furrowing, cutting brush, applying herbicides, prescribed burning, and other intensive treatments are necessary to control competing plants.

Mortality of seedlings is moderate, or between 25 and 50 percent. Site preparation is needed to obtain natural regeneration; some replanting to fill in large openings may be necessary.

Because of erosion, clayey subsoil, and steep slopes, the use of equipment on these soils is moderately to severely limited. Use of machinery and trampling by livestock damage soil structure and tree roots.

The hazard of windthrow is moderate on these steep, eroded soils. Windfall can be expected in excessively wet periods or during high winds, because these soils do not permit adequate root development.

These soils are eroded, and the hazard of further erosion is moderate. Site preparation, control of competing plants, and other practices should be done with as little disturbance of the present plant cover as possible. Equipment should be used in such a way as to minimize damage from further erosion. Roads, furrows, firebreaks, or other construction should follow the contour.

WOODLAND SUITABILITY GROUP 17

This group consists of moderately deep and moderately well drained soils on gently sloping to moderately steep uplands. They have a brown to red clay loam surface layer and a red to yellowish-brown clay subsoil. Infiltration is slow, and permeability is moderately slow to slow. The available moisture capacity is low. The roganic-matter content of the surface layer is low to

very low. Natural fertility is low. The soils in this group are—

(CaB3) Cataula clay loam, 2 to 6 percent slopes, severely eroded.
(CaC3) Cataula clay loam, 6 to 10 percent slopes, severely eroded.
(CaD3) Cataula clay loam, 10 to 15 percent slopes, severely eroded.
(CaE3) Cataula clay loam, 15 to 25 percent slopes, severely eroded.
(EnB3) Enon clay loam, 2 to 6 percent slopes, severely eroded.
(EnC3) Enon clay loam, 6 to 10 percent slopes, severely eroded.
(EnD3) Enon clay loam, 10 to 15 percent slopes, severely eroded.
(LcB3) Lloyd clay loam, compact subsoil, 2 to 6 percent slopes, severely eroded.
(LcC3) Lloyd clay loam, compact subsoil, 6 to 10 percent slopes, severely eroded.
(LcD3) Lloyd clay loam, compact subsoil, 10 to 20 percent slopes, severely eroded.
(MbB3) Mecklenburg clay loam, 2 to 6 percent slopes, severely eroded.
(MbC3) Mecklenburg clay loam, 6 to 10 percent slopes, severely eroded.
(MbD3) Mecklenburg clay loam, 10 to 15 percent slopes, severely eroded.
(MbE3) Mecklenburg clay loam, 15 to 25 percent slopes, severely eroded.
(VaC3) Vance clay loam, 2 to 10 percent slopes, severely eroded.
(VaD3) Vance clay loam, 10 to 25 percent slopes, severely eroded.

Loblolly pine is a preferred species; however, shortleaf pine and Virginia pine are suitable. Littleleaf disease damages shortleaf pine, and dieback damages loblolly pine severely on some of these soils.

These soils are generally suited to rotations of small sawtimber and pulpwood. They will produce poles and piling of short length. In places where erosion is very severe and the soil is compact, the production of commercial wood products may not be feasible.

The site index is 50 to 80 for loblolly pine; 40 to 70 for shortleaf pine; and 40 to 70 for Virginia pine. Some of the soils of this group have a site index of less than 40.

Competition from undesirable plants is slight on dry, strong slopes and severe on slopes of 2 to 6 percent if the soils have a friable subsoil. Applying herbicides, clearing land, disking, furrowing, and other intensive treatments are frequently necessary to control competing plants or to prepare sites for seedlings. Because of the low potential production of these soils, the cost of their improvement is not justified.

Seedling mortality ranges from slight to very severe. It is slight for soils that are on slopes of 2 to 6 percent and have a friable subsoil and is very severe for soils that are on steep slopes and have a firm subsoil. The soils on steep slopes require very intensive site preparation, superior planting techniques, fertilization, and other special care. The root development and aeration are restricted on soils that have a plastic subsoil, and the mortality of seedlings is severe.

The use of equipment is limited severely on some soils by a plastic subsoil or steep slope. The limitation is for more than 3 months each year.

Erosion is a severe hazard on these soils. Careful management is needed to prevent further damage.

Because of poor root development, the hazard from windthrow is severe on the soils with a heavy plastic subsoil. Windfall from higher than normal wind velocities can be expected in exposed areas. This hazard must be considered in plans for thinning, release cutting, regeneration, and final harvest cutting on these soils.

WOODLAND SUITABILITY GROUP 18

This group consists of moderately deep, moderately well drained to poorly drained soils in nearly level to sloping areas on plains. They have a very dark gray to very dark grayish-brown surface layer and a very dark grayish-brown to yellowish-brown, very firm, plastic clay subsoil. Infiltration is moderate and permeability is very slow. The available moisture capacity is high. The organic-matter content of the surface layer is low. Natural fertility is also low. The soils in this group are—

(Eb) Elbert loam.
(IdA) Iredell loam, 0 to 2 percent slopes.
(IdB) Iredell loam, 2 to 6 percent slopes.
(IdB2) Iredell loam, 2 to 6 percent slopes, eroded.
(IdC2) Iredell loam, 6 to 10 percent slopes, eroded.
(IsA) Iredell sandy loam, 0 to 2 percent slopes.
(IsB) Iredell sandy loam, 2 to 6 percent slopes.
(IsB2) Iredell sandy loam, 2 to 6 percent slopes, eroded.
(IsC) Iredell sandy loam, 6 to 10 percent slopes.
(IsC2) Iredell sandy loam, 6 to 10 percent slopes, eroded.

Loblolly pine is the preferred species. These soils are suited to rotations of small saw timber and pulpwood, but their potential production is low.

The site index is 60 for loblolly pine and 50 for shortleaf pine.

The approximate average annual growth per acre (board feet, Scribner rule) of well-stocked, unmanaged stands at 50 years of age is 170 for loblolly pine and 90 for shortleaf pine.

The natural vegetation, primarily hardwoods and ground cover, competes severely with pine. Prescribed burning, applying herbicides, clearing land, disking, and other intensive treatments are necessary to control competing plants and to prepare a seedbed for planting pine.

Seedling mortality is moderate to severe. Poor drainage and poor aeration are detrimental to recently germinated seedlings.

Use of equipment is moderately limited because of the impervious, fine-textured subsoil, especially if the surface layer is thin. Logging or access roads require drainage. Trampling by cattle or use of equipment when the soils are wet causes compaction and severely damages tree roots.

The windthrow hazard is moderate. Root development is restricted in these soils, and trees are not stable during high winds when the soil is wet.

Erosion is not a hazard, except on eroded areas that have slopes of 6 to 10 percent. Here, the hazard is moderate.

WOODLAND SUITABILITY GROUP 19

This group consists of shallow, moderately well drained soils in nearly level and gently sloping areas at the northern perimeter of the plains. These soils have a dark grayish-brown surface layer and a thin, dark yellowish-brown to olive-gray, very firm, plastic clay subsoil. Infiltration is moderate, and permeability is very slow. The available moisture capacity is moderately high. The organic-matter content of the surface layer is low. The natural fertility of these soils is low. The soils in this group are—

(IrA) Iredell loam, thin solum, 0 to 2 percent slopes.
(IrB) Iredell loam, thin solum, 2 to 6 percent slopes.

Loblolly pine is the preferred species. These soils are suited to pulpwood and sawtimber rotations. They will produce only short length poles and piling. No important commercial hardwoods are adapted to these soils. Oak and hickory occur naturally and are primary food plants for wildlife.

The average site index is 60 for loblolly pine and 50 or less for shortleaf pine. The approximate average annual growth per acre (board feet, Scribner rule) of well-stocked, unmanaged stands at 50 years of age is 170 for loblolly pine and 60 for shortleaf pine.

Upland hardwoods and ground plants compete severely with preferred species. Furrowing, disking, clearing land, cutting brush, undercutting roots, prescribed burning, applying herbicides, and other intensive treatments are frequently necessary to control competing plants or to prepare sites for seedlings.

Seedling mortality is moderate. If plant competition is controlled, restocking of abandoned fields, open areas, or areas opened for regeneration is satisfactory. It is assumed that seeds are adequate and that approved techniques of planting are used. Light seedbed preparation may be beneficial but is not essential. Survival of 50 to 75 percent of planted seedlings may be expected. Some replanting may be needed to fill in large openings, especially if precipitation during the growing season was below normal.

Because the soils are thin, equipment limitation is moderate to severe, particularly during wet periods.

Erosion is not a hazard if these soils are used for woodland. Because of the restricted root zone, the windthrow hazard is severe. Salvage cuttings and other management should be planned to minimize losses.

Woodland Yield

Predictions of average annual board feet from well-stocked pine stands growing on soils of specified site quality (site index) are shown in figure 12.

To obtain these predictions, trees were measured in various woodland sites in the county, and the results were correlated with published yield tables and site indexes (*19*, *8*). Intensive woodland management is needed in many places to attain these potentials.

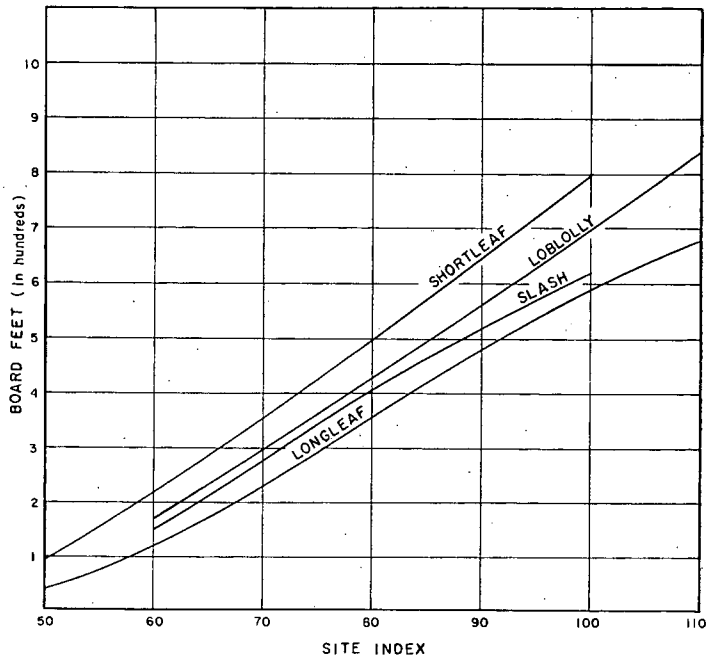

***Figure 12.*—Average annual growth per acre (Scribner, all stems 8 inches or more in diameter) for 50-year-old, well-stocked, unmanaged stands of shortleaf, loblolly, slash, and longleaf pine at site indexes 50 to 110. Adapted from U.S. Dept. Agr. Misc. Pub. No. 50 (*19*)**

Wildlife and Fish [4]

Nearly all the soils of York County support and are suited to one or more kinds of wildlife. Some kinds thrive best in forested areas, others in open farmland, and still others in marsh and water habitats. Necessary foods are insects and other animal foods, seeds and plants, or a combination of these.

Bobwhites, mourning doves, many nongame birds, rabbits, and squirrels, are common throughout the county. Most farms have suitable sites for fishponds. Deer and wild turkeys, once abundant in the county, have been reintroduced. They require an extensive area of well-watered woodland, such as those in the western part of the county. Areas of long, narrow bottom lands along the streams are well distributed throughout the county. Some of these areas are well suited to management for wild ducks.

In table 5, the more significant foods produced by plants are listed and are rated as "choice," "fair," or "unimportant" for each kind of wildlife. The same plants furnish some of the cover needed. Plant cover, however, is generally abundant or excessive in York County or can be readily grown where needed.

In the following paragraphs is a brief summary of the needs of the more important wildlife species in York County:

Bobwhite.—The choice foods of bobwhite are acorns, beechnuts, pecans, blackberries, wild black cherries, dewberries, mulberries, and seeds from browntop millet, corn, cowpeas, flowering dogwood, annual lespedeza, bicolor lespedeza, pine, common ragweed, sweetgum, and tickclover. These birds also eat many kinds of insects. The food must be close to vegetation that furnishes shade and protection from predators and bad weather (fig. 13).

Deer.—Choice foods of deer are acorns and the foliage of bahiagrass, clover, corn, cowpeas, greenbrier, honeysuckle, annual lespedeza, bicolor lespedeza, oats, rescuegrass, ryegrass, and wheat. Cover requirements generally are a woodland of 500 acres or more.

Mourning dove.—Choice foods of mourning doves are the seeds of browntop millet, corn, Japanese millet, pine, common ragweed, and sweetgum. Doves eat no insects, no green leaves, and no fruits. They need water daily.

Ducks.—Choice foods of ducks are acorns and beechnuts, and the seeds of browntop millet, corn, Japanese millet, and smartweed. These foods are more readily available if the feeding area is flooded. However, ducks

[4] By WILLIAM W. NEELY, biologist, Soil Conservation Service.

Figure 13.—**Bicolor lespedeza growing along the edge of woodland provides food and shelter for quail.**

occasionally eat acorns and corn on dry land.

Rabbits.—Choice foods for rabbits are clovers, winter grasses, and other succulent plants, which are usually available. Protective cover, such as a blackberry patch or plum thicket, is essential for rabbits.

Squirrels.—Choice foods of squirrels are acorns, pecans, and beechnuts, and the seeds of blackgum, black cherry, corn, flowering dogwood, and pine. They also eat mulberries. Den trees should be left in woodlots if squirrels are desired.

Wild turkeys.—Wild turkeys eat particularly acorns, beechnuts, pecans, blackberries, wild grapes, hackberries, and mulberries and seeds from bahiagrass, browntop millet, corn, cowpeas, flowering dogwood, oats, pine, rescuegrass, ryegrass, and wheat. They also eat insects and the leaves of clover. These birds survive only in large areas of woodland—generally 2,000 acres or more. They need surface water daily for drinking and often roost in large trees above or near the water.

Nongame birds.—The choice of foods for the many kinds of nongame birds varies greatly. Many kinds eat only insects; some eat both insects and seeds; others eat insects along with acorns, nuts, and fruits. For this reason, the rating of foods for nongame birds in table 5 is general and allows for many exceptions.

Fish.—The main kinds of fish in farm ponds and streams in York County are bass, bluegill, and channel catfish. Bluegill feed mostly on aquatic worms and insects. Bass and channel catfish feed mainly on small fish. The amount of food available to fish is related to the fertility of the water, to the fertility of the soils in the watershed, and somewhat to the fertility of the soils in the bottom of the pond. The soils in York County are generally low in fertility; consequently, most ponds need fertilizer to produce enough microscopic algae and other elements in the food cycle to feed a large population of desirable kinds of fish (fig. 14).

Wildlife Suitability Grouping of Soils

Most kinds of wildlife cannot be related directly to the soils of York County. Instead, a specified kind of wildlife is first related to its choice food. This food, in turn, is related to a group of soils that are capable of producing it.

The soils in York County have been placed in eight soil groups according to their suitability as a habitat for specified kinds of wildlife. The suitability of specified plants to the soils of each group is rated in table 5. Also rated in this table is the suitability of these plants for food for the birds and animals that live in the county or stop there when migrating. Soils in the eight wildlife suitability groups are listed and discussed in the following pages.

WILDLIFE SUITABILITY GROUP 1

In this group are deep, chiefly well-drained soils in uplands and on stream terraces. Slopes range from 2 to 15 percent. The surface layer ranges from sandy loam to clay loam. The subsoil is moderately permeable clay to sandy clay loam. These soils are easily worked, and their available moisture capacity is moderately high. Because of the mild slopes, erosion is only a moderate hazard on most of the acreage.

These soils make up about half of the county, and about half of their acreage is cultivated or pastured. They are suited to many food plants considered choice for several kinds of wildlife. Because of their position and slope, these soils generally are not suitable for flooding for duck fields. Many drains through these areas, however, provide favorable sites for ponds.

The soils are—

Altavista fine sandy loam, 0 to 6 percent slopes.
Appling coarse sandy loam, thin solum, 2 to 6 percent slopes.
Appling coarse sandy loam, thin solum, 2 to 6 percent slopes, eroded.
Appling coarse sandy loam, thin solum, 6 to 10 percent slopes.
Appling coarse sandy loam, thin solum, 6 to 10 percent slopes, eroded.
Appling sandy loam, 2 to 6 percent slopes.
Appling sandy loam, 2 to 6 percent slopes, eroded.
Appling sandy loam, 6 to 10 percent slopes.
Appling sandy loam, 6 to 10 percent slopes, eroded.
Cecil sandy loam, 2 to 6 percent slopes, eroded.
Cecil sandy loam, 6 to 10 percent slopes, eroded.
Davidson clay loam, 2 to 6 percent slopes, eroded.
Durham sandy loam, 2 to 6 percent slopes.
Durham sandy loam, 6 to 10 percent slopes.
Hiwassee sandy loam, 2 to 6 percent slopes, eroded.
Hiwassee sandy loam, 6 to 10 percent slopes, eroded.
Lloyd loam, 2 to 6 percent slopes.
Lloyd loam, 2 to 6 percent slopes, eroded.
Lloyd loam, 6 to 10 percent slopes.
Lloyd loam, 6 to 10 percent slopes, eroded.
Lloyd sandy loam, 2 to 6 percent slopes, eroded.
Lloyd sandy loam, 6 to 10 percent slopes, eroded.
Mecklenburg loam, 2 to 6 percent slopes, eroded.
Mecklenburg loam, 6 to 10 percent slopes, eroded.
Nason silt loam, 2 to 6 percent slopes, eroded.
Nason silt loam, 6 to 10 percent slopes, eroded.
Tatum gravelly silt loam, 2 to 6 percent slopes, eroded.
Tatum gravelly silt loam, 6 to 10 percent slopes, eroded.
Tatum silt loam, 2 to 6 percent slopes.
Tatum silt loam, 2 to 6 percent slopes, eroded.
Tatum silt loam, 6 to 10 percent slopes.
Tatum silt loam, 6 to 10 percent slopes, eroded.
Vance sandy loam, 2 to 6 percent slopes, eroded.
Vance sandy loam, 6 to 10 percent slopes, eroded.
Wickham sandy loam, 2 to 6 percent slopes, eroded.
Wickham sandy loam, 6 to 15 percent slopes, eroded.

WILDLIFE SUITABILITY GROUP 2

In this group are deep, well-drained soils on uplands. Slopes range from 10 to 30 percent. The surface layer ranges from sandy loam to silt loam. The subsoil is moderately permeable clay to clay loam. Because of

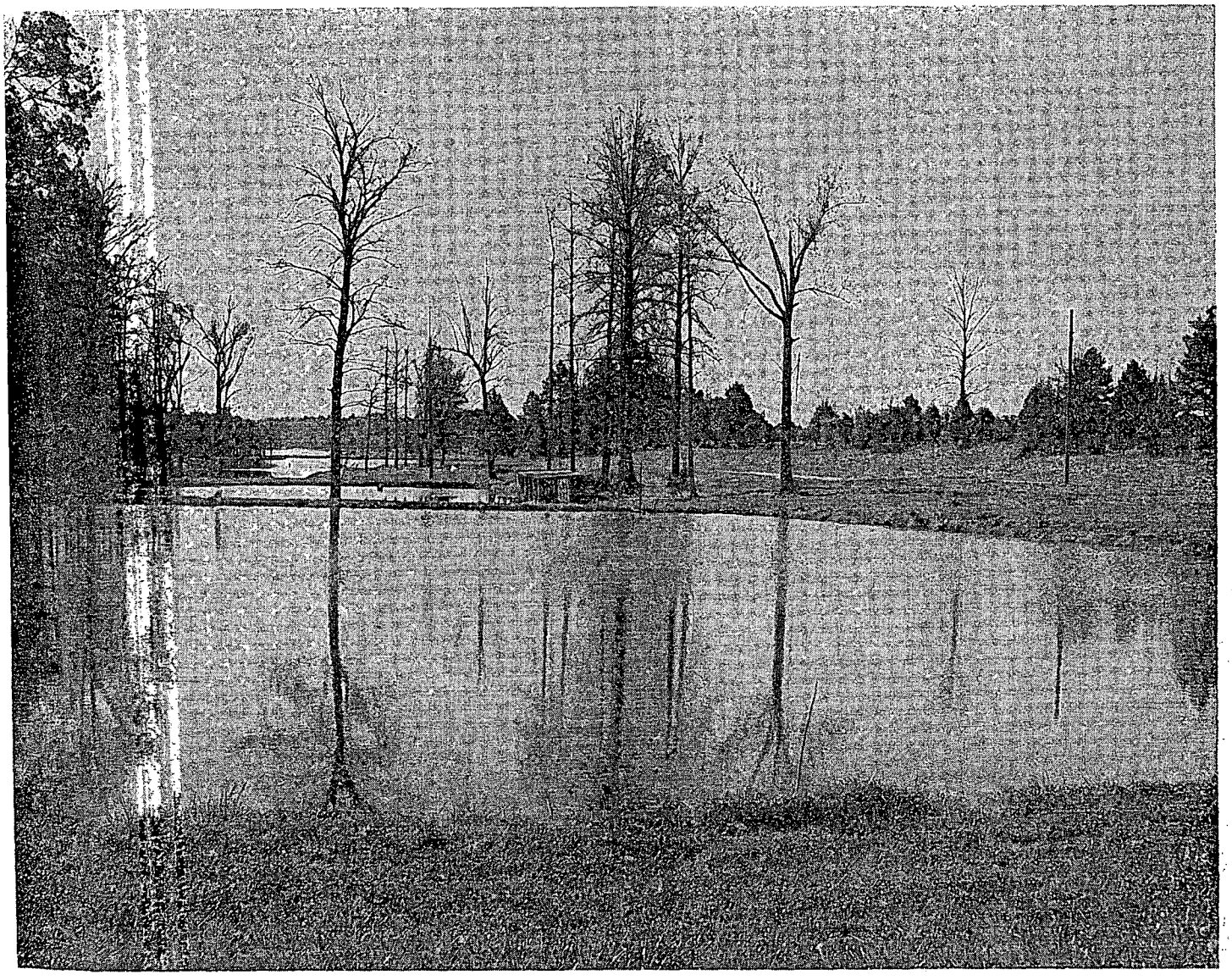

Figure 14.—**Farm ponds stocked with bass and bluegill provide fishing and other recreation.**

steepness, these soils are difficult to work, and the erosion hazard is severe. The available moisture capacity is moderately high.

These soils are fairly extensive and are distributed throughout the county. Nearly all the acreage is wooded. Because their slopes are steep, these soils are marginal for annual lespedeza and are generally unsuited to other annual plants. In addition, they are marginal for perennial grasses, perennial lespedeza, and some woody plants. They are suited to blackgum, wild black cherry, flowering dogwood, hickory, and pine. Many drains through these areas provide favorable sites for ponds.

The soils are—

Appling coarse sandy loam, thin solum, 10 to 15 percent slopes.
Appling coarse sandy loam, thin solum, 10 to 15 percent slopes, eroded.
Appling coarse sandy loam, thin solum, 15 to 25 percent slopes, eroded.
Appling sandy loam, 10 to 15 percent slopes.
Appling sandy loam, 10 to 15 percent slopes, eroded.
Appling sandy loam, 15 to 25 percent slopes.
Appling sandy loam, 15 to 25 percent slopes, eroded.
Cecil sandy loam, 10 to 15 percent slopes, eroded.
Cecil sandy loam, 15 to 30 percent slopes.
Cecil sandy loam, 15 to 25 percent slopes, eroded.
Enon sandy loam, 15 to 25 percent slopes, eroded.
Hiwassee sandy loam, 10 to 18 percent slopes, eroded.
Lloyd loam, 10 to 15 percent slopes, eroded.
Lloyd sandy loam, 10 to 15 percent slopes, eroded.
Lloyd sandy loam, 15 to 25 percent slopes.
Lloyd sandy loam, 15 to 25 percent slopes, eroded.
Mecklenburg loam, 10 to 15 percent slopes, eroded.
Mecklenburg loam, 15 to 25 percent slopes, eroded.
Nason silt loam, 10 to 15 percent slopes, eroded.
Nason silt loam, 15 to 25 percent slopes.
Nason silt loam, 15 to 25 percent slopes, eroded.
Tatum gravelly silt loam, 10 to 15 percent slopes, eroded.
Tatum gravelly silt loam, 15 to 25 percent slopes, eroded.
Tatum silt loam, 10 to 15 percent slopes, eroded.
Tatum silt loam, 15 to 25 percent slopes.
Tatum silt loam, 15 to 25 percent slopes, eroded.
Vance sandy loam, 10 to 15 percent slopes, eroded.
Vance sandy loam, 15 to 25 percent slopes, eroded.
Worsham sandy loam, 6 to 15 percent slopes.

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TABLE 5.—*Rating of plants for wildlife*

[Number 1 indicates choice food that is attractive and nutritious; number 2 indicates food eaten only when choice food is unavailable; suitability

Plant	Part of plant eaten	Suitability of plant as food for—									
		Bobwhite	Deer	Doves	Ducks	Rabbits	Squirrels	Turkeys	Nongame birds that feed on—		
									Fruits[1]	Grain and seeds[2]	Nuts and acorns[3]
Bahiagrass	Foliage		1								
	Seed			2				1		2	
Beech	Nut	1	2		1		1	1			1
Blackberry	Fruit	1					2	1	1		
	Foliage		2								
Blackgum	Fruit	2					1	2	1		2
Browntop millet	Seed	1		1	1			1		1	
Buttonclover	Foliage		1			1		1			
Cherry, black	Fruit	1					1	2	1		2
Clover, crimson	Foliage	2	1			1		1			
Clover, white	Foliage	2	1			1		1			
Corn	Seed	1	1	1	1	1	1	1		1	2
Cowpeas	Seed	1	1	2		2		1			
Dewberry	Fruit	1				2	2	1	1		
Dogwood, flowering	Fruit	1					1	1	1		
Fescue, tall	Foliage		2			2		2			
Grapes, wild	Fruit						2	1	1		
Greenbrier	Foliage		1			1					
Hackberry	Fruit	2					2	1	1		
Hickory	Nuts						1	2			1
Honeysuckle	Foliage		1			2					
Japanese millet	Seed	2		1	1			2		1	
Lespedeza, annual	Foliage		1			2					
	Seed	1						2			
Lespedeza, bicolor	Foliage		1			2					
	Seed	1									
Lespedeza, sericea	Seed										
Mulberry	Fruit	1	2				1	1	1		
Oak	Acorns	1	1		1		1	1			1
Oats	Foliage		1			1		1			
Pecan	Nut	1	2				1	1			1
Pine	Seed	1		1			1	1		1	1
Ragweed, common	Seed	1		1						1	
Rescuegrass	Foliage		1			1		1			

See footnotes at end of table.

food and for wildlife suitability groups

absence of entry indicates that food is unimportant in diet but small amount may be eaten. See text for description of the 8 wildlife groups]

Suitability of plant for wildlife suitability group—							
1	2	3	4	5	6	7	8
Good	Marginal	Poor or not suited.	Good	Marginal	Good	Poor or not suited.	Poor or not suited.
Marginal	Marginal	Poor or not suited.	Good	Poor or not suited.	Good	Marginal	Poor or not suited.
Good	Good	Marginal	Good	Marginal	Good	Good	Poor or not suited.
Good	Good	Poor or not suited.	Marginal	Poor or not suited.	Good	Good	Poor or not suited.
Good	Poor or not suited.	Marginal	Good	Marginal	Good	Good	Poor or not suited.
Good	Poor or not suited.	Poor or not suited.	Poor or not suited.	Poor or not suited.	Good	Marginal	Poor or not suited.
Good	Good	Poor or not suited.	Marginal	Marginal	Good	Marginal	Poor or not suited.
Good	Marginal	Poor or not suited.	Marginal	Marginal	Good	Marginal	Poor or not suited.
Good	Poor or not suited.	Poor or not suited.	Good	Poor or not suited.	Good	Good	Marginal.
Good	Poor or not suited.	Poor or not suited.	Marginal	Poor or not suited.	Good	Marginal	Poor or not suited.
Good	Poor or not suited.	Poor or not suited.	Good	Marginal	Good	Marginal	Poor or not suited.
Good	Marginal	Marginal	Good	Marginal	Marginal	Marginal	Poor or not suited.
Good	Good	Marginal	Good	Good	Marginal	Poor or not suited.	Poor or not suited.
Good	Marginal	Poor or not suited.	Good	Poor or not suited.	Good	Good	Marginal.
Good	Good	Marginal	Good	Marginal	Good	Marginal	Marginal.
Good	Marginal	Marginal	Good	Marginal	Good	Marginal	Marginal.
Good	Marginal	Marginal	Marginal	Marginal	Marginal	Poor or not suited.	Poor or not suited.
Good	Good	Poor or not suited.	Good	Marginal	Good	Poor or not suited.	Poor or not suited.
Good	Marginal	Poor or not suited.	Good	Marginal	Good	Marginal	Poor or not suited.
Good	Poor or not suited.	Poor or not suited.	Good	Poor or not suited.	Good	Good	Good.
Good	Marginal	Marginal	Good	Marginal	Good	Marginal	Poor nor not suited.
Good	Marginal	Marginal	Marginal	Marginal	Good	Poor or not suited.	Poor or not suited.
Good	Marginal	Marginal	Marginal	Marginal	Good	Poor or not suited.	Poor or not suited.
Good	Poor or not suited.	Poor or not suited.	Marginal	Poor or not suited.	Good	Poor or not suited.	Poor or not suited.
Good	Marginal	Marginal	Marginal	Marginal	Good	Good	Marginal.
Good	Poor or not suited.	Poor or not suited.	Good	Poor or not suited.	Good	Poor or not suited.	Poor or not suited.
Good	Good	Poor or not suited.	Good	Marginal	Good	Poor or not suited.	Poor or not suited.
Good	Good	Marginal	Marginal	Marginal	Good	Marginal	Poor or not suited.
Good	Poor or not suited.	Poor or not suited.	Good	Poor or not suited.	Good	Poor or not suited.	Poor or not suited.
Good	Marginal	Poor or not suited.	Good	Marginal	Good	Marginal	Poor or not suited.

TABLE 5.—*Rating of plants for wildlife food*

[Number 1 indicates choice food that is attractive and nutritious; number 2 indicates food eaten only when choice food is unavailable; suitability

Plant	Part of plant eaten	Suitability of plant as food for—									
		Bobwhite	Deer	Doves	Ducks	Rabbits	Squirrels	Turkeys	Nongame birds that feed on—		
									Fruit[1]	Grain and seeds[2]	Nuts and acorns[3]
Ryegrass	Foliage		1			1		1			
Smartweed	Seed	2			1						
Sorghum, grain[4]	Seed	1	1	1	1	1	1	1		1	
Sweetgum	Seed	1		1			2	2		1	
Tickclover (beggarlice)	Seed	1						2			
Wheat	Foliage		1			1		1			

[1] Eaten by bluebirds, catbirds, mockingbirds, and waxwings.
[2] Eaten by blackbirds, cardinals, meadowlarks sparrows, and towhees.
[3] Eaten by chickadees, grackles, bluejays, titmice, and woodpeckers.

WILDLIFE SUITABILITY GROUP 3

This group consists of well-drained, severely eroded soils that are gullied in places. Slopes range from 2 to 25 percent. In most places, these soils have a low to moderate available moisture capacity. Tilth is generally poor, and erosion is a very severe hazard.

These soils occur throughout the county. Nearly all the acreage has been cultivated. Because of poor tilth, severe erosion, and steep slopes, food plants for wildlife are difficult to establish and maintain on these soils, and most of the plants are not highly productive. Even on gentle slopes, these soils are marginal for clover, grass, lespedeza, and tickclover. Some drains through these areas provide sites for ponds, but siltation and muddiness of ponds are problems.

The soils are—

Cataula clay loam, 2 to 6 percent slopes, severly eroded.
Cataula clay loam, 6 to 10 percent slopes, severely eroded.
Cataula clay loam, 10 to 15 percent slopes, severely eroded.
Cataula clay loam, 15 to 25 percent slopes, severely eroded.
Cecil clay loam, 2 to 6 percent slopes, severely eroded.
Cecil clay loam, 6 to 10 percent slopes, severely eroded.
Cecil clay loam, 10 to 15 percent slopes, severely eroded.
Cecil clay loam, 15 to 25 percent slopes, severely eroded.
Davidson clay loam, 6 to 10 percent slopes, severely eroded.
Enon clay loam, 2 to 6 percent slopes, severely eroded.
Enon clay loam, 6 to 10 percent slopes, severely eroded.
Enon clay loam, 10 to 15 percent slopes, severely eroded.
Gullied land, firm materials.
Gullied land, friable materials, rolling.
Gullied land, friable materials, hilly.
Lloyd clay loam, 2 to 6 percent slopes, severely eroded.
Lloyd clay loam, 6 to 10 percent slopes, severely eroded.
Lloyd clay loam, 10 to 15 percent slopes, severely eroded.
Lloyd clay loam, 15 to 25 percent slopes, severely eroded.
Lloyd clay loam, compact subsoil, 2 to 6 percent slopes, severely eroded.
Lloyd clay loam, compact subsoil, 6 to 10 percent slopes, severely eroded.
Lloyd clay loam, compact subsoil, 10 to 20 percent slopes, severely eroded.
Mecklenburg clay loam, 2 to 6 percent slopes, severely eroded.
Mecklenburg clay loam, 6 to 10 percent slopes, severely eroded.
Mecklenburg clay loam, 10 to 15 percent slopes, severely eroded.
Mecklenburg clay loam, 15 to 25 percent slopes, severely eroded.
Tatum silty clay loam, 2 to 6 percent slopes, severely eroded.
Tatum silty clay loam, 6 to 10 percent slopes, severely eroded.
Tatum silty clay loam, 10 to 15 percent slopes, severely eroded.
Tatum silty clay loam, 15 to 25 percent slopes, severely eroded.
Vance clay loam, 2 to 10 percent slopes, severely eroded.
Vance clay loam, 10 to 25 percent slopes, severely eroded.

WILDLIFE SUITABILITY GROUP 4

This group consists mainly of gently sloping soils that are moderately well drained to somewhat poorly drained. They have medium runoff and very slow internal drainage and permeability. They have a very plastic and sticky clay subsoil.

Although these soils are extensive in the county, they occur mostly in localized areas. They are sometimes referred to as blackjack land. Much of the acreage is in crops or pasture. These soils are well suited to many choice plants for wildlife. Probably because they have dependable natural sources of drinking water, these soils usually have more doves than normal.

The soils are—

Cataula sandy loam, 2 to 6 percent slopes, eroded.
Cataula sandy loam, 6 to 10 percent slopes, eroded.
Enon sandy loam, 2 to 6 percent slopes, eroded.
Enon sandy loam, 6 to 10 percent slopes, eroded.
Enon sandy loam, 10 to 15 percent slopes, eroded.
Helena sandy loam, 2 to 6 percent slopes.
Helena sandy loam, 2 to 6 percent slopes, eroded.
Helena sandy loam 6 to 10 percent slopes.
Helena sandy loam, 6 to 10 percent slopes, eroded.
Helena sandy loam, 10 to 15 percent slopes, eroded.

and for wildlife suitability groups—Continued

absence of entry indicates that food is unimportant in diet but small amount may be eaten. See text for description of the 8 wildlife groups]

Suitability of plant for wildlife suitability group—							
1	2	3	4	5	6	7	8
Good	Poor or not suited.	Poor or not suited.	Good	Poor or not suited.	Good	Marginal	Poor or not suited.
Poor or not suited.	Poor or not suited.	Poor or not suited.	Poor or not suited.	Poor or not suited.	Marginal	Good	Good.
Good	Poor or not suited.	Poor or not suited.	Good	Poor or not suited.	Good	Poor or not suited.	Poor or not suited.
Good	Good	Marginal	Marginal	Marginal	Good	Good	Marginal.
Good	Marginal	Marginal	Good	Marginal	Good	Poor or not suited.	Poor or not suited.
Good	Poor or not suited.	Poor or not suited.	Good	Poor or not suited.	Good	Poor or not suited.	Poor or not suited.

[4] Grain sorghum is choice food of most birds and animals that feed on grain. Because it attracts blackbirds, cowbirds, sparrows, and other unwanted birds and rots quickly in humid climate, grain sorghum has limited suitability as wildlife food.

Iredell sandy loam, 2 to 6 percent slopes.
Iredell sandy loam, 2 to 6 percent slopes, eroded.
Iredell sandy loam, 6 to 10 percent slopes.
Iredell sandy loam, 6 to 10 percent slopes, eroded.
Iredell loam, 2 to 6 percent slopes.
Iredell loam, 2 to 6 percent slopes, eroded
Iredell loam, 6 to 10 percent slopes, eroded.
Iredell loam, thin solum, 2 to 6 percent slopes.
Lloyd sandy loam, compact subsoil, 2 to 6 percent slopes, eroded.
Mecklenburg loam, 0 to 2 percent slopes.

WILDLIFE SUITABILITY GROUP 5

This group consists of soils that generally have a shallow root zone, are excessively cobbly or stony, or have a very low available moisture capacity.

Because of these severely limiting factors, the soils in this group are marginal or poorly suited to most food plants for wildlife. Only a few choice plants, such as hickory, oak, pine, and flowering dogwood, are suited. Because they are shallow to bedrock, or are stony, the soils of this group are poorly suited to ponds.

The soils are—

Buncombe loamy sand, 0 to 4 percent slopes.
Iredell very stony loam, 0 to 6 percent slopes.
Louisburg sandy loam, 2 to 6 percent slopes.
Louisburg sandy loam, 6 to 10 percent slopes.
Louisburg sandy loam, 10 to 15 percent slopes.
Louisburg sandy loam, 15 to 25 percent slopes.
Manteo channery silt loam, 10 to 15 percent slopes, eroded.
Manteo channery silt loam, 15 to 35 percent slopes.
Mine pits and dumps.
Molena loamy sand, 2 to 8 percent slopes.
Rock outcrop.
Wilkes complex, 2 to 6 percent slopes.
Wilkes complex, 6 to 10 percent slopes.
Wilkes complex, 10 to 15 percent slopes.
Wilkes complex, 6 to 15 percent slopes, eroded.
Wilkes complex, 15 to 35 percent slopes.
Wilkes complex, 15 to 35 percent slopes, eroded.

WILDLIFE SUITABILITY GROUP 6

This group consists of deep, well drained to moderately well drained soils around the head of drainageways or on first bottoms along creeks and rivers. The areas along first bottoms are infrequently flooded for short periods. These soils are easily worked. They have a high available moisture capacity and produce a wide range of food plants for wildlife.

Small areas of these soils are scattered throughout the county, and many of them are cultivated or pastured. Most wildlife food plants are suited to these soils. These soils provide some of the best sites in the county for duck fields. They also provide some favorable sites for ponds.

The soils are—

Congaree fine sandy loam.
Local alluvial land.
Mixed alluvial land.

WILDLIFE SUITABILITY GROUP 7

This group consists mainly of deep, somewhat poorly drained soils on first bottoms, around the head of drainageways, and on the lower lying, flat areas locally called blackjack land. The soils on first bottoms are frequently flooded. If adequately drained, these soils are easily worked. Their available moisture capacity is high.

Because of poor drainage, a high water table, or flooding, these soils are not well suited as a habitat for quail. They are not suited to such perennial quail foods as bicolor lespedeza and tickclover. Many areas are suitable for flooding and would provide choice food plants for ducks. These include browntop millet, Japanese millet, and smartweed. These soils are also suited to white clover, tall fescue, and other plants suitable as foods for rabbits.

The soils are—

Chewacla silt loam.
Colfax sandy loam, 2 to 6 percent slopes.
Elbert loam.
Iredell sandy loam, 0 to 2 percent slopes.
Iredell loam, 0 to 2 percent slopes.
Iredell loam, thin solum, 0 to 2 percent slopes.
Mixed alluvial land, wet.

WILDLIFE SUITABILITY GROUP 8

In this group are poorly drained soils that are difficult to work. Because of the high water table, these soils have a shallow root zone. Some fields suitable for flooding would produce choice food plants for ducks, such as browntop millet, Japanese millet, and smartweed.

The soils are—

Roanoke silt loam.
Worsham sandy loam, 2 to 6 percent slopes.

Engineering Interpretations of the Soils [5]

Soil properties that interest engineers because they affect construction are permeability, shear strength, compaction characteristics, grain size, plasticity, depth to water table, depth to bedrock, and topography. These properties affect the suitability of soils for use in construction of roads, pipelines, foundations, sewage disposal systems, drainage systems, terraces, and farm ponds.

This report contains information that can be used by engineers to—

1. Make soil and land use studies that will aid in selecting and developing industrial, business, residential, and recreational sites.
2. Make preliminary estimates of the engineering properties of the soil to aid in planning agricultural drainage systems, farm ponds, irrigation systems, and diversion terraces.
3. Make preliminary evaluations of soil and ground conditions that will aid in selecting highway, airport, and pipeline locations and in planning detailed investigations of the selected sites.
4. Determine the suitability of soils for cross-country movements of vehicles and construction equipment.
5. Correlate performance of engineering structures with soil mapping units to develop information that will be useful in designing and maintaining engineering structures.

[5] By HUGH F. LONGSHORE, JR., agricultural engineer, Soil Conservation Service.

TABLE 6.—*Engineering*

Soil name and location	Parent material	Bureau of Public Roads report No.	Depth	Horizon
			Inches	
Altavista fine sandy loam:				
2.2 miles SW. of Pleasant Grove Church and 5 miles SE. of Sharon. (Modal)	Alluvium	S–39179	0–6	Ap
		S–39180	17–33	B2
		S–39181	41–76+	C
Cataula sandy loam:				
0.5 mile SW. of Sharon fire tower and 4 miles SE. of Sharon. (Modal)	Gneiss	S–39182	2–8	A2
		S–39183	12–28	B2
		S–39184	40–73+	C
Enon sandy loam:				
2 miles S. of New Port and 2 miles N. of Adnah Church. (Modal)	Mixed acid and basic rock	S–39185	0–7	Ap
		S–39186	14–29	B2
		S–39258	34–72	C
Helena sandy loam:				
1 mile E. of Philadelphia Church and 7 miles SE. from York. (Modal)	Gneiss and diorite	S–39259	0–7	Ap
		S–39187	20–32	B2
		S–39188	39–74	C
Hiwassee sandy loam:				
2 miles S. of Fort Mill and 150 yards E. of Southern Railroad. (Modal)	Old alluvium	S–39189	0–6	Ap
		S–39190	20–60	B2
		S–39191	70–75+	C
Mecklenburg loam:				
6 miles W. of Rock Hill and 1.5 miles SE. of Oak Ridge Community Center. (Modal)	Diorite, gabbro, or hornblende schist.	S–39260	0–5	Ap
		S–39192	11–27	B2
		S–39193	37–72	C

[1] Tests performed by the Bureau of Public Roads according to standard procedures of the American Association of State Highway Officials (AASHO) (*1*).

[2] Mechanical analyses according to the AASHO Designation T 88. Results by this procedure frequently may differ somewhat from results that would have been attained by the soil survey procedure of the Soil Conservation Service (SCS). In the AASHO procedure, the fine material is analyzed by the hydrometer method and the various grain-size fractions are calculated on the basis of all the material, including that coarser than 2 millimeters in diameter. In the SCS soil survey procedure, the fine material is analyzed by the pipette method and the material coarser than 2 millimeters in

6. Supplement information obtained from other published maps and reports and aerial photographs to make soil maps and reports that can be used readily by engineers.
7. Develop other preliminary estimates for construction purposes pertinent to the particular area.

The information in the soil survey report is somewhat generalized, however, and should be used only in planning more detailed surveys to determine the condition of the soil, in place, at the site of the proposed engineering construction. Because soil samples were taken at a relatively shallow depth, the data may not be adequate for estimating the characteristics of soil materials in deep cuts.

To make the best use of the soil map and the soil survey report, the engineer should know the physical properties of the soil materials and the condition of the soil in place. After testing the soil materials and observing the behavior of each soil when used in engineering structures and foundations, the engineer can develop recommendations for each soil unit designated on the map.

Some of the terms used by soil scientists and farmers may not be familiar to engineers. Others, though familiar, have special meanings in soil science and farming. Most of the terms used in this section and other special terms used in the report are defined in the Glossary at the back of the report. Engineers can find additional information in the sections "How Soils are Mapped and Classified", "Descriptions of the Soils", and "Formation, Morphology, and Classification of Soils".

Most highway engineers classify soil materials according to the system approved by the American Association of State Highway Officials (AASHO) (*1*). In this system, soil materials are classified in seven principal groups. The groups range from A–1, consisting of gravelly soils of high bearing capacity, to A–7, consisting of clay soils having low strength when wet. Within each group, the relative engineering value of the soil materials is indicated by a group index number. These numbers range from 0 for the best materials to 20 for the poorest. The group index number is shown in parentheses following the group symbol.

Some engineers prefer to use the Unified soil classification system (*23*). In this system soil materials are identified as coarse grained (8 classes), fine grained (6 classes), or highly organic.

Most of the information in this section is given in tables. Test data on samples of the principal soil types of six extensive series are given in table 6. Brief descriptions of the soils and of their physical and chemical properties are given in table 7. Engineering classifications (AASHO and Unified) of the soils are given in both tables 6 and 7. The engineering properties of the soils for specific engineering uses are evaluated in table 8.

test data [1]

Mechanical analysis [2]											Liquid limit	Plasticity index	Classification	
Percentage passing sieve—							Percentage smaller than—							
¾ in.	⅜ in.	No. 4 (4.7 mm.)	No. 10 (2.0 mm.)	No. 40 (0.42 mm.)	No. 60 (0.25 mm.)	No. 200 (0.074 mm.)	0.05 mm.	0.02 mm.	0.005 mm.	0.002 mm.			AASHO [3]	Unified [4]
			100	89	80	38	32	21	13	9	[5]	[5]	A–4(1)	SM.
			100	89	82	52	47	36	24	19	29	11	A–6(4)	CL.
			100	84	76	44	39	31	21	18	23	5	A–4(2)	SC.
			100	94	88	69	57	32	16	11	20	3	A–4(7)	ML.
			100	97	95	86	78	62	49	43	53	22	A–7–5(15)	MH.
			100	99	99	90	79	58	43	37	49	18	A–7–5(15)	ML.
100	99	98	97	80	64	34	30	20	12	8	[5]	[5]	A–2–4(0)	SM.
			100	94	89	82	80	77	65	57	80	40	A–7–5(20)	MH.
			100	91	83	65	62	55	41	36	52	22	A–7–5(13)	MH–CH.
			100	80	61	31	28	23	15	11	17	2	A–2–4(0)	SM.
			100	86	74	59	56	53	48	44	64	31	A–7–5(20)	MH–CH.
			100	88	79	67	66	62	48	41	68	28	A–7–5(17)	MH.
	100	99	99	91	79	36	31	23	16	13	[5]	[5]	A–4(0)	SM.
			100	92	85	65	61	58	51	48	48	26	A–7–6(12)	CL.
			100	95	86	71	69	65	54	47	67	27	A–7–5(18)	MH.
			100	87	80	61	56	41	28	23	35	12	A–6(6)	ML–CL.
			100	97	94	84	82	75	61	55	64	30	A–7–5(20)	MH.
			100	99	95	73	66	52	36	30	43	17	A–7–6(11)	ML–CL.

diameter is excluded from calculations of grain-size fractions. The mechanical analyses used in this table are not suitable for use in naming textural classes for soil.

[3] Based on Standard Specifications for Highway Materials and Methods of Sampling and Testing (Pt. 1, Ed. 8): AASHO Designation M 145–49 (*1*).

[4] Based on the Unified Soil Classification System, Waterways Experiment Station, Corps of Engineers, March 1953 (*23*). Soil Conservation Service and Bureau of Public Roads have agreed to consider that all soils having plasticity indexes within 2 points from the A-line are to be given a borderline classification.

[5] Nonplastic.

TABLE 7.—*Brief description of the soils and their estimated*

[Absence of data indicates information

Symbol	Soil [1]	Description of soil	Depth from surface (typical profile)	Classification: USDA texture
			Inches	
AaB	Altavista fine sandy loam, 0 to 6 percent slopes.	6 to 12 inches of well-drained fine sandy loam over 14 to 32 inches of clay loam to clay; derived from general alluvium. Depth to hard rock 6 to 40 feet or more; wet weather water table at 24 inches.	0–6 17–33 41–76+	Fine sandy loam Clay loam to clay Fine sandy clay
AcB	Appling coarse sandy loam, thin solum, 2 to 6 percent slopes.	0 to 11 inches of well-drained coarse sandy loam over 11 to 19 inches well-drained coarse sandy clay loam to sandy clay; derived from granitic gneiss. Depth to hard rock 3 to 40 feet or more.	0–11 11–19 19–24+	Coarse sandy loam Sandy clay loam to sandy clay. Weathered coarse sandy material.
AcB2	Appling coarse sandy loam, thin solum, 2 to 6 percent slopes, eroded.			
AcC	Appling coarse sandy loam, thin solum, 6 to 10 percent slopes.			
AcC2	Appling coarse sandy loam, thin solum, 6 to 10 percent slopes, eroded.			
AcD	Appling coarse sandy loam, thin solum, 10 to 15 percent slopes.			
AcD2	Appling coarse sandy loam, thin solum, 10 to 15 percent slopes, eroded.			
AcE2	Appling coarse sandy loam, thin solum, 15 to 25 percent slopes, eroded.			
ApB	Appling sandy loam, 2 to 6 percent slopes.	0 to 10 inches of well-drained sandy loam over 10 to 34 inches of well-drained sandy clay loam to clay; derived from granite, gneiss, and schist. Depth to hard rock 3 to 40 feet or more.	0–12 12–34 34+	Sandy loam Sandy clay loam to clay. Sandy clay loam
ApB2	Appling sandy loam, 2 to 6 percent slopes, eroded.			
ApC	Appling sandy loam, 6 to 10 percent slopes.			
ApC2	Appling sandy loam, 6 to 10 percent slopes, eroded.			
ApD	Appling sandy loam, 10 to 15 percent slopes.			
ApD2	Appling sandy loam, 10 to 15 percent slopes, eroded.			
ApE	Appling sandy loam, 15 to 25 percent slopes.			
ApE2	Appling sandy loam, 15 to 25 percent slopes, eroded.			
Bu	Buncombe loamy sand, 0 to 4 percent slopes.	0 to 11 inches of excessively drained loamy sand over 11 to 48 inches of excessively drained sand; derived from young alluvium. Depth to hard rock 10 feet or more; subject to seasonal overflow.	0–11 11–48	Loamy sand Sand
CaB3	Cataula clay loam, 2 to 6 percent slopes, severely eroded.	0 to 5 inches of well drained clay loam over 5 to 32 inches of moderately well drained clay; derived from micaceous gneiss. Depth to hard rock 3 to 30 feet or more.	0–5 5–32 32+	Clay loam Clay Clay loam
CaC3	Cataula clay loam, 6 to 10 percent slopes, severely eroded.			
CaD3	Cataula clay loam, 10 to 15 percent slopes, severely eroded.			
CaE3	Cataula clay loam, 15 to 25 percent slopes, severely eroded.			
CbB2	Cataula sandy loam, 2 to 6 percent slopes, eroded.	0 to 8 inches of well drained sandy loam over 8 to 40 inches of moderately well drained clay loam to clay; derived from micaceous gneiss. Depth to hard rock 3 to 30 feet or more.	0–8 8–40 40+	Sandy loam Clay loam to clay Clay loam
CbC2	Cataula sandy loam, 6 to 10 percent slopes, eroded.			
CcB3	Cecil clay loam, 2 to 6 percent slopes, severely eroded.	0 to 6 inches of well-drained clay loam over 6 to 35 inches of well-drained clay; derived from granite, gneiss, and schist. Depth to hard rock 5 to 50 feet or more.	0–6 6–35 35+	Clay loam Clay loam to clay Sandy clay loam
CcC3	Cecil clay loam, 6 to 10 percent slopes, severely eroded.			
CcD3	Cecil clay loam, 10 to 15 percent slopes, severely eroded.			
CcE3	Cecil clay loam, 15 to 25 percent slopes, severely eroded.			

See footnote at end of table.

physical and chemical properties significant to engineering

not available or not applicable]

Classification—Continued		Percentage passing sieve—			Permeability	Available water capacity	Reaction	Dispersion	Shrink-swell potential
Unified	AASHO	No. 4 sieve (4.76 mm.)	No. 10 sieve (2.0 mm.)	No. 200 sieve (0.074 mm.)					
					Inches per hour	*Inches per inch of soil*	*pH*		
SM	A–4		100	30 to 40	0. 8–2. 5	0. 09	6. 2–6. 6	Low	Low.
CL	A–6		100	45 to 60	0. 8–2. 0	. 19		Moderate	Moderate.
SC	A–4		100	40 to 55	0. 2–0. 1	. 11		Low	Low.
SM	A–2	90 to 100	70 to 100	20 to 30	10. 0–20. 0	. 08	4. 5–5. 0	Low	Low.
SC	A–6	100	80 to 100	40 to 50	2. 5–5. 0	. 16	5. 0–5. 5	Moderate	Moderate.
SM	A–2	95 to 100	75 to 100	10 to 50	4. 0–10. 0	. 08	5. 0–5. 5	Low	Low.
SM	A–2	95 to 100	90 to 100	25 to 35	5. 0–10. 0	. 09	5. 9–6. 0	Low	Low.
CL or MH	A–7		100	60 to 70	0. 8–2. 5	. 19	5. 0–5. 5	Moderate	Moderate to high.
ML or CL	A–6 or A–7		100	60 to 70	0. 2–0. 1	. 11	5. 0	Low	Moderate.
ML	A–4		100	70 to 80	5. 0–10. 0	. 06	6. 2–6. 3	Low	Low.
SM	A–2		100	15 to 30	5. 0–10. 0	. 06	6. 4	Low	Low.
ML	A–7		100	65 to 75	1. 0–4. 0	. 12	5. 5–6. 0	Low	Moderate.
MH	A–7		100	70 to 75	0. 5–1. 0	. 13	5. 5–6. 0	Low	Moderate
ML	A–6 or A–7		100	60 to 65	1. 0–2. 5	. 10	5. 0–5. 5	Low	Low.
ML	A–4		100	55 to 60	2. 5–5. 0	. 10	6. 1	Low	Low.
ML or MH	A–6 or A–7		100	70 to 75	0. 5–1. 0	. 13	5. 5–6. 0	Low	Moderate to high.
ML or MH	A–6 or A–7		100	60 to 65	1. 0–2. 5	. 10	5. 0–5. 5	Low	Moderate.
CL	A–6 or A–7		100	60 to 65	3. 0–5. 0	. 11	5. 0–6. 0	Moderate	Moderate.
MH–CH	A–7		100	60 to 70	2. 0–4. 0	. 15	5. 0–6. 0	Moderate	Moderate to high.
CL	A–7		100	60 to 70	2. 5–5. 0	. 08	5. 0–6. 0	Moderate	Moderate.

TABLE 7.—*Brief description of the soils and their estimated*

Symbol	Soil [1]	Description of soil	Depth from surface (typical profile)	Classification: USDA texture
			Inches	
CdB2	Cecil sandy loam, 2 to 6 percent slopes, eroded.	0 to 6 inches of well-drained sandy loam over 6 to 43 inches of well-drained clay loam to clay; derived from granite, gneiss, and schist. Depth to hard rock 5 to 50 feet or more.	0–6	Sandy loam
CdC2	Cecil sandy loam, 6 to 10 percent slopes, eroded.		6–43	Clay loam to clay
CdD2	Cecil sandy loam, 10 to 15 percent slopes, eroded.			
CdE	Cecil sandy loam, 15 to 30 percent slopes.		43+	Sandy clay loam
CdE2	Cecil sandy loam, 15 to 25 percent slopes, eroded.			
Ch	Chewacla silt loam.	0 to 16 inches of moderately well drained silt loam over 16 to 36 inches of somewhat poorly drained silt loam to silty clay loam; derived from young alluvium. Depth to hard rock 10 feet or more; subject to frequent overflow; water table at 20 to 60 inches.	0–16	Silt loam
			16–30	Silt loam
			30–36+	Silty clay loam
CoB	Colfax sandy loam, 2 to 6 percent slopes.	0 to 13 inches of well-drained sandy loam over 13 to 34 inches of somewhat poorly drained sandy clay loam to clay; derived from granite. Depth to hard rock 10 feet or more.	0–13	Sandy loam
			13–34	Sandy clay loam to clay.
Cn	Congaree fine sandy loam.	0 to 7 inches of well-drained fine sandy loam over 7 to 33 inches of well-drained fine sandy loam; derived from young alluvium. Depth to hard rock 10 feet or more; subject to overflow; water table below 30 inches.	0–7	Fine sandy loam
			7–33	Fine sandy loam
			33–44	Loamy fine sand
DaB2	Davidson clay loam, 2 to 6 percent slopes, eroded.	0 to 15 inches of well-drained clay loam over 15 to 50 inches of well-drained clay; derived from dark-colored basic rocks. Depth to hard rock 8 to 60 feet or more.	0–15	Clay loam
DaC3	Davidson clay loam, 6 to 10 percent slopes, severely eroded.		15–50	Clay
			50–54	Clay loam
DuB	Durham sandy loam, 2 to 6 percent slopes.	0 to 16 inches of well drained sandy loam over 16 to 45 inches of moderately well drained sandy clay loam to clay; derived from granite. Depth to hard rock 7 to 60 feet or more.	0–16	Sandy loam
DuC	Durham sandy loam, 6 to 10 percent slopes.		16–45	Sandy clay loam to clay.
Eb	Elbert loam.	0 to 8 inches of moderately well drained loam over 8 to 37 inches of somewhat poorly drained clay; derived from basic rocks. Depth to hard rock 4 to 10 feet or more; wet weather water table at or near the surface.	0–8	Loam
			8–37	Clay
EnB3	Enon clay loam, 2 to 6 percent slopes, severely eroded.	0 to 5 inches of well drained sandy clay loam over 5 to 29 inches of moderately well drained clay; derived from mixed acid and basic rocks. Depth to hard rock 4 to 40 feet or more.	0–5	Sandy clay loam
EnC3	Enon clay loam, 6 to 10 percent slopes, severely eroded.		5–29	Clay
EnD3	Enon clay loam, 10 to 15 percent slopes, severely eroded.		29+	Clay loam

See footnotes at end of table.

physical and chemical properties significant to engineering—Continued

Classification—Continued		Percentage passing sieve—			Permeability	Available water capacity	Reaction	Dispersion	Shrink-swell potential
Unified	AASHO	No. 4 sieve (4.76 mm.)	No. 10 sieve (2.0 mm.)	No. 200 sieve (0.074 mm.)					
					Inches per hour	*Inches per inch of soil*	*pH*		
ML	A-4		100	55 to 60	5. 0–10. 0	0. 10	5. 6	Low	Low.
MH–CH	A-7		100	60 to 70	2. 0–4. 0	. 15	5. 7–5. 8	Moderate	Moderate to high.
CL	A-7		100	60 to 70	2. 5–5. 0	. 08	5. 7	Moderate	Moderate.
ML	A-4		100	90 to 95	2. 5–5. 0	. 21	5. 7–6. 0	Moderate	Low.
ML or CL	A-7		100	90 to 95	0. 8–2. 5	. 21	5. 7–6. 2	Moderate	Moderate.
CL	A-7		100	90 to 95	0. 2–0. 8	. 25	5. 7	Low	Moderate.
ML	A-4		100	55 to 60	4. 0–8. 0	. 06	5. 8–6. 0	Moderate	Low.
CL	A-6		100	50 to 60	0. 8–2. 5	. 06	5. 0–5. 1	Moderate	Moderate.
ML	A-4		100	52 to 58	4. 0–5. 0	. 17	5. 8	Low	Low.
ML	A-4		100	52 to 58	4. 0–5. 0	. 17	5. 4–5. 7	Low	Low.
ML	A-4		100	70 to 80	5. 0–10. 0	. 08	6. 0	Low	Low.
ML	A-7	95 to 100	95 to 100	70 to 80	0. 8–2. 5	. 13	6. 3–6. 5	Moderate	Moderate.
MH	A-7	95 to 100	95 to 100	85 to 100	0. 8–2. 5	. 17	5. 7–6. 5	Moderate	Moderate.
MH	A-7		100	85 to 100	0. 6–2. 0	. 18	5. 7	Moderate	Moderate.
SM	A-2 or A-4		100	30 to 40	2. 5–5. 0	. 08	5. 8–6. 0	High	Low.
MH–CH	A-7		100	55 to 60	0. 8–2. 5	. 24	5. 2–5. 5	Moderate	Moderate to high.
ML	A-4	100	96	60 to 65	1. 5–2. 5	. 25	6. 2–6. 6	Moderate	Moderate.
CH	A-7		100	75 to 80	0. 05–0. 2	. 70	8. 2–8. 5	Low	High.
CL	A-6		100	70 to 80	0. 5–1. 0	. 10	5. 9–6. 2	Low	Moderate.
MH	A-7–5		100	75 to 90	0. 2–0. 8	. 13	5. 7–6. 1	Moderate	High.
MH–CH	A-7–5		100	60 to 80	0. 2–0. 8	. 13	5. 7	Moderate	Moderate.

TABLE 7.—*Brief description of the soils and their estimated*

Symbol	Soil [1]	Description of soil	Depth from surface (typical profile)	Classification: USDA texture
			Inches	
EsB2	Enon sandy loam, 2 to 6 percent slopes, eroded.	0 to 7 inches of well drained sandy loam over 7 to 34 inches of moderately well drained clay loam to clay; derived from mixed acid and basic rocks. Depth to hard rock 4 to 40 feet or more.	0–7	Sandy loam
EsC2	Enon sandy loam, 6 to 10 percent slopes, eroded.		7–34	Clay loam to clay
EsD2	Enon sandy loam, 10 to 15 percent slopes, eroded.		34–72	Clay
EsE2	Enon sandy loam, 15 to 25 percent slopes, eroded.			
HaB	Helena sandy loam, 2 to 6 percent slopes.	0 to 11 inches of well-drained sandy loam over 11 to 39 inches of sandy clay loam to clay; derived from acid and basic rocks. Depth to hard rock 6 to 40 feet or more.	0–11	Sandy loam
HaB2	Helena sandy loam, 2 to 6 percent slopes, eroded.		11–39	Clay loam to clay
HaC	Helena sandy loam, 6 to 10 percent slopes.		39+	Sandy clay to clay
HaC2	Helena sandy loam, 6 to 10 percent slopes, eroded.			
HaD2	Helena sandy loam, 10 to 15 percent slopes, eroded.			
HwB2	Hiwassee sandy loam, 2 to 6 percent slopes, eroded.	0 to 6 inches of well-drained sandy loam over 6 to 70 inches of well-drained clay loam to clay; derived from old alluvium. Depth to hard rock 20 feet or more.	0–6	Sandy loam
HwC2	Hiwassee sandy loam, 6 to 10 percent slopes, eroded.		6–70	Clay loam to clay
HwD2	Hiwassee sandy loam, 10 to 18 percent slopes, eroded.		70+	Clay loam
IsA	Iredell sandy loam, 0 to 2 percent slopes.	0 to 9 inches of well drained sandy loam, loam, and very stony loam over 9 to 27 inches of moderately well drained clay; derived from diorite and gabbro. Depth to hard rock 2 to 4 feet.	0–9	Sandy loam
IsB	Iredell sandy loam, 2 to 6 percent slopes.		9–27	Clay
IsB2	Iredell sandy loam, 2 to 6 percent slopes, eroded.		27+	Clay loam
IsC	Iredell sandy loam, 6 to 10 percent slopes.			
IsC2	Iredell sandy loam, 6 to 10 percent slopes, eroded.			
IdA	Iredell loam, 0 to 2 percent slopes.			
IdB	Iredell loam, 2 to 6 percent slopes.			
IdB2	Iredell loam, 2 to 6 percent slopes, eroded.			
IdC2	Iredell loam, 6 to 10 percent slopes, eroded.			
IrA	Iredell loam, thin solum, 0 to 2 percent slopes.			
IrB	Iredell loam, thin solum, 2 to 6 percent slopes.			
IvB	Iredell very stony loam, 0 to 6 percent slopes.			
LaB3	Lloyd clay loam, 2 to 6 percent slopes, severely eroded.	0 to 9 inches of well-drained clay loam over 9 to 35 inches of well-drained clay; derived from mixed acid and basic rocks. Depth to hard rock 4 to 40 feet or more.	0–9	Clay loam
LaC3	Lloyd clay loam, 6 to 10 percent slopes, severely eroded.		9–35	Clay
LaD3	Lloyd clay loam, 10 to 15 percent slopes, severely eroded.		35+	Clay loam
LaE3	Lloyd clay loam, 15 to 25 percent slopes, severely eroded.			
LcB3	Lloyd clay loam, compact subsoil, 2 to 6 percent slopes, severely eroded.	0 to 5 inches of well drained clay loam over 5 to 40 inches of moderately well drained clay; derived from mixed acid and basic rocks. Depth to hard rock 4 to 40 feet or more.	0–5	Clay loam
LcC3	Lloyd clay loam, compact subsoil, 6 to 10 percent slopes, severely eroded.		5–40	Clay
LcD3	Lloyd clay loam, compact subsoil, 10 to 20 percent slopes, severely eroded.		40+	Clay loam
LdB	Lloyd loam, 2 to 6 percent slopes.	0 to 8 inches of well-drained loam or sandy loam over 8 to 38 inches of well-drained clay loam to clay; derived from mixed acid and basic rocks. Depth to hard rock 4 to 40 feet or more.	0–8	Loam
LdB2	Lloyd loam, 2 to 6 percent slopes, eroded.		8–38	Clay
LdC	Lloyd loam, 6 to 10 percent slopes.		38+	Clay loam
LdC2	Lloyd loam, 6 to 10 percent slopes, eroded.			
LdD2	Lloyd loam, 10 to 15 percent slopes, eroded.			
LmB2	Lloyd sandy loam, 2 to 6 percent slopes, eroded.			
LmC2	Lloyd sandy loam, 6 to 10 percent slopes, eroded.			
LmD2	Lloyd sandy loam, 10 to 15 percent slopes, eroded.			
LmE	Lloyd sandy loam, 15 to 25 percent slopes.			
LmE2	Lloyd sandy loam, 15 to 25 percent slopes, eroded.			
LnB2	Lloyd sandy loam, compact subsoil, 2 to 6 percent slopes, eroded.	0 to 6 inches of well drained sandy loam over 6 to 47 inches of moderately well drained clay; derived from mixed acid and basic rocks. Depth to hard rock 4 to 40 feet or more.	0–6	Sandy loam
			6–47	Clay
			47+	Clay loam

See footnote at end of table.

physical and chemical properties significant to engineering—Continued

Classification—Continued		Percentage passing sieve—			Permeability	Available water capacity	Reaction	Dispersion	Shrink-swell potential
Unified	AASHO	No. 4 sieve (4.76 mm.)	No. 10 sieve (2.0 mm.)	No. 200 sieve (0.074 mm.)					
					Inches per hour	*Inches per inch of soil*	*pH*		
SM	A-2 or A-4	95 to 100	95 to 100	30 to 40	2. 5–5. 0	0. 08	6. 2	Low	Low.
MH	A-7-5		100	75 to 85	0. 2–0. 8	. 13	5. 7–6. 1	Low	Moderate.
MH–CH	A-7-5		100	60 to 85	0. 2–0. 8	. 13	5. 7	Moderate	Moderate.
SM or ML	A-2 or A-4	100	90	30 to 40	2. 5–5. 0	. 08	6. 2–6. 7	Moderate	Low.
MH or CH	A-7	100	97	60 to 70	0. 2–0. 8	. 13	5. 4–6. 5	Low	High.
CL or MH	A-7	100	96	55 to 70	0. 8–2. 5	. 12	5. 2	Low	High.
SM	A-2	100	95	30 to 40	5. 0–10. 0	. 10	5. 8	High	Moderate.
MH–CH	A-7		100	65 to 75	2. 5–5. 0	. 19	5. 7–6. 1	Moderate	Moderate.
MH	A-7-5			60 to 70	2. 0–4. 0	. 17	5. 8	Moderate	Moderate.
ML	A-4	100	97	55 to 65	5. 0–10. 0	. 12	5. 7–6. 0	Moderate	Low.
CH	A-7	100	98	75 to 85	0. 05–0. 2	. 72	6. 7–6. 2	Low	High.
CH	A-7	100	96	70 to 80	0. 10–0. 20	. 40	5. 7–6. 0	Low	Moderate.
MH	A-7-5		100	90 to 100	1. 0–2. 5	. 13	5. 9	Moderate	Moderate.
CH	A-7		100	95 to 100	0. 8–2. 5	. 17	5. 7	Moderate	High.
MH	A-7-5		100	80 to 90	1. 5–2. 0	. 14	5. 7	Moderate	Moderate.
ML	A-4		100	70 to 75	2. 0–4. 0	. 10	5. 8	Low	Low.
MH or CH	A-7		100	75 to 80	0. 2–0. 8	. 11	4. 8–5. 3	Low	High.
ML or MH	A-7-5		100	65 to 75	0. 2–0. 8	. 11	5. 0	Low	Moderate, to high.
ML	A-4		97	70 to 85	2. 5–5. 0	. 12	6. 1	Moderate	Low.
CH	A-7		100	90 to 100	0. 8–2. 5	. 17	5. 6–5. 9	Moderate	High.
ML or MH	A-7-5		100	80 to 90	1. 5–2. 0	. 14	5. 7	Moderate	Moderate, to high.
SM or SC	A-2	100	98	30 to 35	2. 5–5. 0	. 10	5. 8	Low	Low.
MH or CH	A-7		100	75 to 80	0. 2–0. 8	. 11	4. 8–5. 3	Low	High.
MH	A-7-5		100	65 to 75	0. 2–0. 8	. 11	5. 0	Low	Moderate.

TABLE 7.—*Brief description of the soils and their estimated*

Symbol	Soil[1]	Description of soil	Depth from surface (typical profile)	Classification: USDA texture
			Inches	
LsB	Louisburg sandy loam, 2 to 6 percent slopes.	0 to 16 inches of well-drained sandy loam over 16 to 20 inches of well-drained (discontinuous) sandy clay loam; derived from granite or gneiss. Depth to hard rock 20 to 40 inches.	0–16	Sandy loam
LsC	Louisburg sandy loam, 6 to 10 percent slopes.		16–20	Sandy clay loam
LsD	Louisburg sandy loam, 10 to 15 percent slopes.		20–24	Weathered parent material.
LsE	Louisburg sandy loam, 15 to 25 percent slopes.			
MaD2	Manteo channery silt loam, 10 to 15 percent slopes, eroded.	0 to 9 inches of well-drained channery silt loam over a 9- to 12-inch (discontinuous) layer of well-drained silty clay; derived from sericitic schist. Depth to hard rock 6 to 26 inches.	0–9	Channery silt loam
MaE	Manteo channery silt loam, 15 to 35 percent slopes.		9–12	Silty clay
MbB3	Mecklenburg clay loam, 2 to 6 percent slopes, severely eroded.	0 to 5 inches of well drained clay loam over 5 to 32 inches of moderately well drained clay; derived from basic rock. Depth to hard rock 4 to 20 feet or more.	0–5	Clay loam
MbC3	Mecklenburg clay loam, 6 to 10 percent slopes, severely eroded.		5–32	Clay
MbD3	Mecklenburg clay loam, 10 to 15 percent slopes, severely eroded.		32+	Clay loam
MbE3	Mecklenburg clay loam, 15 to 25 percent slopes, severely eroded.			
McA	Mecklenburg loam, 0 to 2 percent slopes.	0 to 5 inches of well drained loam over 5 to 37 inches of moderately well drained clay loam to clay; derived from hornblende gneiss, hornblende schist, gabbro, and diorite. Depth to hard rock 4 to 20 feet or more.	0–5	Loam
McB2	Mecklenburg loam, 2 to 6 percent slopes, eroded.		5–27	Clay
McC2	Mecklenburg loam, 6 to 10 percent slopes, eroded.		27–72	Clay loam
McD2	Mecklenburg loam, 10 to 15 percent slopes, eroded.			
McE2	Mecklenburg loam, 15 to 25 percent slopes, eroded.			
MyB	Molena loamy sand, 2 to 8 percent slopes.	0 to 24 inches of well-drained loamy sand over 24 to 30 inches of well-drained light sandy loam; derived from general alluvium. Depth to hard rock 10 feet or more.	0–24	Loamy sand
			24–30	Light sandy loam
NaB2	Nason silt loam, 2 to 6 percent slopes, eroded.	0 to 5 inches of well drained silt loam over 5 to 37 inches of moderately well drained silty clay loam to silty clay; derived from sericitic schist. Depth to hard rock 4 to 20 feet or more.	0–5	Silt loam
NaC2	Nason silt loam, 6 to 10 percent slopes, eroded.		5–37	Silty clay loam to silty clay.
NaD2	Nason silt loam, 10 to 15 percent slopes, eroded.		37+	Silty clay loam
NaE	Nason silt loam, 15 to 25 percent slopes.			
NaE2	Nason silt loam, 15 to 25 percent slopes, eroded.			
Rk	Roanoke silt loam.	0 to 7 inches of moderately well drained silt loam over 7 to 38 inches of somewhat poorly drained silty clay loam to clay; derived from general alluvium. Depth to hard rock 10 feet or more; perched water table at or near surface in wet periods.	0–7	Silt loam
			7–38	Silty clay loam to clay.
TmB	Tatum silt loam, 2 to 6 percent slopes.	0 to 5 inches of well-drained silt loam and gravelly silt loam over 5 to 48 inches of well-drained silty clay loam to silty clay; derived from sericitic schist. Depth to hard rock 4 to 30 feet or more.	0–5	Silt loam
TmB2	Tatum silt loam, 2 to 6 percent slopes, eroded.		5–48	Silty clay loam to silty clay.
TmC	Tatum silt loam, 6 to 10 percent slopes.			
TmC2	Tatum silt loam, 6 to 10 percent slopes, eroded.			
TmD2	Tatum silt loam, 10 to 15 percent slopes, eroded.			
TmE	Tatum silt loam, 15 to 25 percent slopes.			
TmE2	Tatum silt loam, 15 to 25 percent slopes, eroded.			

See footnote at end of table.

physical and chemical properties significant to engineering—Continued

Classification—Continued		Percentage passing sieve—			Permeability	Available water capacity	Reaction	Dispersion	Shrink-swell potential
Unified	AASHO	No. 4 sieve (4.76 mm.)	No. 10 sieve (2.0 mm.)	No. 200 sieve (0.074 mm.)					
					Inches per hour	*Inches per inch of soil*	*pH*		
SM	A–2	100	95 to 100	20 to 40	2. 5–5. 0	0. 08	6. 5–6. 7	Moderate	Low.
SM	A–2	100	95 to 100	20 to 40	2. 5–5. 0	. 08	6. 8	Moderate	Low.
SM	A–2	95	70 to 90	10 to 30	5. 0–10. 0	. 02	6. 6	Moderate	Low.
ML	A–4	100	95 to 100	55 to 65	5. 0–10. 0	. 12	5. 1–5. 2	Moderate	Low.
ML–CL	A–7	100	95 to 100	55 to 65	2. 5–5. 0	. 21	5. 2	Moderate	Moderate.
ML-CL	A–6		100	65 to 75	0. 5–2. 0	. 19	5. 9	Moderate	Moderate.
MH	A–7–5		100	80 to 90	0. 2–0. 8	. 21	6. 1–6. 3	Moderate	Moderate to high.
ML-CL	A–7–6		100	70 to 80	0. 8–1. 6	. 17	6. 1	Moderate	Moderate.
ML-CL	A–6		100	55 to 65	2. 5–5. 0	. 17	5. 9–6. 1	Moderate	Moderate.
MH	A–7–5		100	80 to 90	0. 2–0. 8	. 21	6. 1–6. 3	Moderate	Moderate to high.
ML-CL	A–7–6		100	70 to 80	0. 8–1. 6	. 17	6. 1	Moderate	Moderate.
SP or SM	A–3	100	100	5 to 10	10. 0–20. 0	. 02	5. 9–6. 3	High	Low.
SP or SM	A–2 or A–3	100	100	5 to 20	5. 0–10. 0	. 04	6. 0	High	Low.
ML	A–4	90 to 100	80 to 90	45 to 55	2. 5–5. 0	. 17	6. 4	Moderate	Low.
MH	A–7		100	75 to 90	0. 2–0. 8	. 21	5. 2–6. 7	Low	Moderate.
ML or CL	A–6	90 to 100	60 to 90	60 to 70	0. 3–0. 6	. 15	5. 5–5. 6	Low	Moderate.
ML	A–4	100	85 to 95	75 to 85	1. 0–2. 0	. 12	6. 3	Low	Low.
ML–CL	A–6	100	90 to 100	65 to 80	0. 05–0. 2	. 12	5. 7–6. 1	Low	Moderate.
ML	A–4	95 to 100	90 to 100	60 to 70	2. 5–5. 0	. 17	6. 4	Low	Low.
CL	A–7	100	90 to 100	70 to 85	1. 0–2. 5	. 21	5. 8–6. 1	Low	Low.

TABLE 7.—*Brief description of the soils and their estimated*

Symbol	Soil [1]	Description of soil	Depth from surface (typical profile)	Classification: USDA texture
			Inches	
TaB2	Tatum gravelly silt loam, 2 to 6 percent slopes, eroded.			
TaC2	Tatum gravelly silt loam, 6 to 10 percent slopes, eroded.			
TaD2	Tatum gravelly silt loam, 10 to 15 percent slopes, eroded.			
TaE2	Tatum gravelly silt loam, 15 to 25 percent slopes, eroded.			
TtB3	Tatum silty clay loam, 2 to 6 percent slopes, severely eroded.	0 to 9 inches of well-drained silty clay loam over 9 to 38 inches of well-drained silty clay; derived from sericitic schist. Depth to hard rock 4 to 30 feet or more.	0–9 9–38 38+	Silty clay loam Silty clay Sandy clay loam
TtC3	Tatum silty clay loam, 6 to 10 percent slopes, severely eroded.			
TtD3	Tatum silty clay loam, 10 to 15 percent slopes, severely eroded.			
TtE3	Tatum silty clay loam, 15 to 25 percent slopes, severely eroded.			
VaC3	Vance clay loam, 2 to 10 percent slopes, severely eroded.	0 to 5 inches of well drained clay loam over 5 to 32 inches of moderately well drained clay; derived from mixed acid and basic rock. Depth to hard rock 4 to 30 feet or more.	0–5 5–32 32+	Clay loam Clay Sandy clay loam
VaD3	Vance clay loam, 10 to 25 percent slopes, severely eroded.			
VcB2	Vance sandy loam, 2 to 6 percent slopes, eroded.	0 to 7 inches of well drained sandy loam over 7 to 41 inches of moderately well drained sandy clay loam to clay; derived from mixed acid and basic rocks. Depth to hard rock 4 to 30 feet or more.	0–7 7–41	Sandy loam Sandy clay loam to clay.
VcC2	Vance sandy loam, 6 to 10 percent slopes, eroded.			
VcD2	Vance sandy loam, 10 to 15 percent slopes, eroded.			
VcE2	Vance sandy loam, 15 to 25 percent slopes, eroded.			
WcB2	Wickham sandy loam, 2 to 6 percent slopes, eroded.	0 to 7 inches of well-drained sandy loam over 7 to 42 inches of well-drained sandy clay loam to clay; derived from general alluvium. Depth to hard rock 10 to 100 feet or more.	0–7 7–42	Sandy loam Sandy clay loam to clay.
WcD2	Wickham sandy loam, 6 to 15 percent slopes, eroded.			
WkB	Wilkes complex, 2 to 6 percent slopes.	0 to 7 inches of well-drained sandy loam over 7 to 12 inches of (discontinuous) well-drained clay; derived from mixed acid and basic rocks. Depth to hard rock 2½ to 20 feet.	0–7 7–12	Sandy loam Clay
WkC	Wilkes complex, 6 to 10 percent slopes.			
WkD	Wilkes complex, 10 to 15 percent slopes.			
WkD2	Wilkes complex, 6 to 15 percent slopes, eroded.			
WkE	Wilkes complex, 15 to 35 percent slopes.			
WkE2	Wilkes complex, 15 to 35 percent slopes, eroded.			
WoB	Worsham sandy loam, 2 to 6 percent slopes.	0 to 11 inches of well-drained sandy loam over 11 to 38 inches of poorly drained sandy clay to clay; derived from granite, gneiss, and schist. Depth to hard rock 6 feet or more; perched water table at or near surface in wet periods.	0–11 11–38	Sandy loam Sandy clay to clay
WoC	Worsham sandy loam, 6 to 15 percent slopes.			

[1] Gullied land, firm materials; Gullied land, friable materials, rolling; Gullied land, friable materials, hilly; Local alluvial land; Mine pits and dumps; Mixed alluvial land; Mixed alluvial land, wet; and Rock outcrop are land types that have variable characteristics, and their properties were not estimated.

physical and chemical properties significant to engineering—Continued

Classification—Continued		Percentage passing sieve—			Permeability	Available water capacity	Reaction	Dispersion	Shrink-swell potential
Unified	AASHO	No. 4 sieve (4.76 mm.)	No. 10 sieve (2.0 mm.)	No. 200 sieve (0.074 mm.)	*Inches per hour*	*Inches per inch of soil*	*pH*		
ML	A-4 or A-6	100	95 to 100	70 to 80	2.0–4.0	0.20	6.1	Low	Low.
CL	A-6 or A-7	100	95 to 100	75 to 85	1.0–2.5	.18	6.4	Low	Moderate to high.
SC	A-6	100	85 to 95	40 to 50	2.5–5.0	.22	5.9	Low	Moderate.
CL	A-7		100	55 to 65	0.2–0.8	.11	5.8–6.1	Low	Low.
MH or CH	A-7		100	80 to 85	0.2–0.8	.13	5.5–5.8	Low	High.
MH	A-7		100	60 to 65	0.2–0.8	.11	5.4–5.7	Low	Moderate to high.
SM	A-2	95 to 100	95 to 100	30 to 40	2.5–5.0	.08	6.0	Low	Low.
ML–CL	A-7		100	80 to 85	0.2–0.8	.13	5.5–5.8	Low	Moderate.
SM	A-2	95 to 100	90 to 100	20 to 30	2.5–5.0	.10	6.0	Moderate	Low.
ML–CL	A-7		100	60 to 70	2.0–4.0	.15	5.9–6.0	Moderate	Moderate.
ML	A-4	95 to 100	90 to 100	50 to 60	5.0–10.0	.10	5.6	Moderate	Low.
CL	A-7		100	80 to 90	0.05–0.2	.17	5.5	Low	Moderate.
ML	A-4		100	50 to 60	5.0–10.0	.12	5.1–5.5	Low	Low.
ML–CL	A-7		100	65 to 70	0.2–0.8	.21	5.1–5.5	Low	Moderate.

TABLE 8.—*Engineering*

[Absence of data indicates practice

Soils and map symbols [2]	Suitability as source of—			Soil features affecting—
	Topsoil	Sand	Road fill	Highway location
Altavista (AaB)	Fair to good	Unsuitable	Poor	High water table; erodible.
Appling (ApB, ApB2, ApC, ApC2, ApD, ApD2, ApE, ApE2).	Fair to good	Fair to good; moderately well graded.	Good	Well drained; good compaction.
Appling (thin solum) (AcB, AcB2, AcC, AcC2, AcD, AcD2, AcE2).	Fair	Fair; moderately well graded.	Good	Well drained; shallow to weathered rock.
Buncombe (Bu)	Poor	Fair; fine textured, inert sand.	Poor	High water table; poor as foundation.
Cataula (CaB3, CaC3, CaD3, CaE3, CbB2, CbC2).	Poor to fair	Unsuitable	Fair	Slightly plastic; poor internal drainage.
Cecil (CcB3 CcC3, CcD3, CcE3, CdB2, CdC2, CdD2, CdE, CdE2).	Good	Fair; poorly graded	Good	Well drained; easily compacted.
Chewacla (Ch)	Fair to good	Unsuitable	Poor	Seasonally high water table; poor as foundation.
Colfax (CoB)	Poor to fair	Fair; poorly graded	Poor	High water table; poor as foundation.
Congaree (Cn)	Good	Unsuitable	Poor	Poor as foundation; high water table; subject to flooding.
Davidson (DaB2, DaC3)	Good	Unsuitable	Fair	Sticky when wet; poor workability; susceptible to cracking.
Durham (DuB, DuC)	Fair to poor	Good; well graded	Good	Well drained; easily compacted.
Elbert (Eb)	Good	Unsuitable	Poor	Poorly drained; plastic
Enon (EnB3, EnC3, EnD3, EsB2, EsC2, EsD2, EsE2).	Fair	Unsuitable	Fair	Plastic; poor internal drainage.
Helena (HaB, HaB2, HaC, HaC2, HaD2)	Fair to good	Unsuitable	Fair	Susceptible to cracking; poor internal drainage.

See footnotes at end of table.

interpretation of soils [1]

is not applicable or not required]

Soil features affecting—Continued						
Farm ponds		Agricultural drainage	Irrigation	Field and diversion terraces	Waterways	Suitability for sewage disposal systems
Reservoir area	Embankment					
Slow seepage	Low to moderate strength and stability; moderately slow permeability.	Shallow surface drainage needed on slopes of 2 percent or less.	Moderately slow infiltration; medium water-holding capacity.	Erodible on slopes.	Erodible on slopes.	Fair.
Moderate seepage.	Moderate to high strength and stability; moderate permeability.	----------	Moderate infiltration; medium water-holding capacity.	Erodible on slopes.	Erodible on slopes.	Suited.
Rapid seepage.	Moderate strength and stability; moderate seepage.	----------	Moderately rapid infiltration; low water-holding capacity.	Erodible on slopes.	Erodible on slopes.	Good.
Rapid seepage.	Moderate strength and stability; rapid permeability.	Excessively drained.	Rapid infiltration; low water-holding capacity.	----------	----------	Not suited; flood hazard.
Slow seepage.	Moderate to high strength and stability; moderately slow permeability.	----------	Moderate infiltration; moderate water-holding capacity.	Highly erodible	Highly erodible.	Fair.
Moderate seepage.	Moderate to high strength and stability; moderate permeability.	----------	Moderate infiltration; medium water-holding capacity.	Erodible on slopes.	Erodible on slopes.	Suited.
Moderate seepage.	Low strength and stability.	Seasonally high water table; moderately slow permeability.	Slow infiltration; medium to high water-holding capacity.	----------	----------	Not suited; flood hazard.
Moderately rapid seepage.	Moderate strength and stability; slow to moderately slow permeability.	Shallow surface drainage needed on slopes of 2 percent or less.	Rapid infiltration; low water-holding capacity.	Erodible on slopes.	Erodible on slopes.	Not suited.
Moderately rapid seepage.	Low strength and stability; moderate to moderately rapid permeability	Subject to occasional flash floods and overflow from streams.	Slow to moderate infiltration; high water-holding capacity.	----------	----------	Not suited; flood hazard.
Moderate seepage.	Moderate strength and stability; moderate permeability.	----------	Slow infiltration; moderately high water-holding capacity.	Erodible	Erodible	Fair.
Moderate seepage.	Moderate strength and stability; moderately slow to moderate permeability.	----------	Rapid infiltration; low water-holding capacity.	Erodible on slopes.	Erodible on slopes; deep-rooted perennials needed.	Fairly well suited; thick surface soil.
Slow to moderate seepage.	Moderate strength and stability; slow permeability.	Shallow surface drainage needed.	Moderate infiltration; moderately high water-holding capacity.	Erodible; terracing difficult.	Erodible; shaping difficult.	Not suited.
Moderate seepage.	Moderate strength and stability; slow to moderately slow permeability.	----------	Moderate infiltration; medium water-holding capacity.	Highly erodible	Highly erodible.	Not suited.
Moderate seepage.	Moderate strength and stability; moderate to moderately slow permeability.	----------	Moderate infiltration; moderately low water-holding capacity.	Erodible	Erodible	Not suited.

TABLE 8.—*Engineering*

Soils and map symbols [2]	Suitability as source of—			Soil features affecting—
	Topsoil	Sand	Road fill	Highway location
Hiwassee (HwB2, HwC2, HwD2)	Good	Unsuitable	Fair	Sticky; poor workability
Iredell (IdA, IdB, IdB2, IdC2, IsA, IsB, IsB2, IsC, IsC2, IvB).	Good	Unsuitable	Poor	Poor; highly plastic; susceptible to cracking when dry.
Iredell (thin solum) (IrA, IrB)	Fair	Unsuitable	Poor	Poor; highly plastic; susceptible to cracking when dry.
Lloyd (LaB3, LaC3, LaD3, LaE3, LdB, LdB2, LdC, LdC2, LdD2, LmB2, LmC2, LmD2, LmE, LmE2).	Good	Unsuitable	Good	Sticky when wet; susceptible to cracking when dry.
Lloyd (compact subsoil) (LcB3, LcC3, LcD3, LnB2).	Fair to good	Unsuitable	Good	Slightly sticky; high clay content.
Local alluvial land (Lo)	Fair to good	Fair; poorly graded	Fair to poor	Highly organic
Louisburg (LsB, LsC, LsD, LsE)	Poor to fair	Fair; poorly graded	Poor	Well drained; shallow to bedrock.
Manteo (MaD2, MaE)	Poor	Unsuitable	Poor	Poor; on high rocky knolls and steep breaks.
Mecklenburg (MbB3, MbC3, MbD3, MbE3, McA, McB2, McC2, McD2, McE2).	Fair to good	Unsuitable	Fair	Plastic; poor workability
Mixed alluvial land (Mn)	Fair to good	Unsuitable	Poor	Shallow; unstable
Mixed alluvial land, wet (Mw)	Fair	Unsuitable	Poor	High water table
Molena (MyB)	Poor	Fair; very fine textured, inert sand.	Fair	Deep loamy sand
Nason (NaB2, NaC2, NaD2, NaE, NaE2)	Poor to fair	Unsuitable	Good	Fine grained; shallow to weathered bedrock.

See footnotes at end of table.

interpretation of soils [1]—Continued

Soil features affecting—Continued						Suitability for sewage disposal systems
Farm ponds		Agricultural drainage	Irrigation	Field and diversion terraces	Waterways	
Reservoir area	Embankment					
Moderate seepage.	Low to moderate strength and stability; moderate permeability.	----------	Moderate infiltration; medium water-holding capacity.	Erodible on slopes.	Erodible on slopes.	Suited.
Slow to moderate seepage.	Moderate strength and stability; slow permeability.	Shallow surface drainage needed in undulating areas.	Moderate infiltration; moderately high water-holding capacity.	Erodible; terracing difficult.	Erodible; shaping difficult.	Not suited.
Moderate seepage.	Moderate strength and stability; slow permeability.	Shallow surface drainage needed in undulating areas.	Moderate infiltration; moderately high water-holding capacity.	Erodible; terracing difficult.	Erodible; shaping difficult.	Not suited.
Moderate seepage.	Moderate strength and stability; moderate permeability.	----------	Low infiltration; moderately high water-holding capacity.	Erodible----------	Erodible------	Suited.
Moderate seepage.	Moderate strength and stability; moderate permeability.	----------	Low infiltration; moderately high water-holding capacity.	Erodible----------	Erodible------	Fair.
Moderate seepage.	Low to moderate strength and stability; moderate to rapid permeability.	----------	Moderately high infiltration; moderately high water-holding capacity.	----------	----------	Not suited.
Moderate to high seepage.	Low to moderate strength and stability; moderate to moderately rapid permeability.	----------	High infiltration; low water-holding capacity.	----------	----------	Not suited; shallow to bedrock.
Moderate to high seepage.	Low to moderate strength and stability; moderately slow to rapid permeability.	----------	Moderately low infiltration; low water-holding capacity.	Erodible; terracing hazardous.	Erodible; shaping hazardous.	Not suited; shallow to bedrock.
Moderate seepage.	Moderate strength and stability; moderately slow to slow permeability.	----------	Low infiltration; moderate water-holding capacity.	Erodible----------	Erodible------	Not suited.
Moderate to rapid seepage.	Low to moderate strength and stability; moderate to rapid permeability.	Interceptor drains may be needed; subject to occasional flash floods and overflow from streams.	Moderate infiltration; moderately high water-holding capacity.	----------	----------	Not suited; flood hazard.
Moderate to rapid seepage.	Low to moderate strength and stability; moderate to rapid permeability.	Seasonal high water table; subject to occasional flash floods and overflow from streams.	----------	----------	----------	Not suited; flood hazard.
Excessive seepage.	Low to moderate strength and stability; rapid permeability.	----------	Rapid infiltration; low water-holding capacity.	----------	----------	Suited.
Moderate seepage.	Moderate strength and stability; moderate to moderately slow permeability.	----------	Moderately low infiltration; moderate water-holding capacity.	Erodible----------	Erodible------	Fairly well suited.

TABLE 8.—*Engineering*

Soils and map symbols [2]	Suitability as source of—			Soil features affecting—
	Topsoil	Sand	Road fill	Highway location
Roanoke (Rk)	Fair	Unsuitable	Poor	High water table; very plastic.
Tatum (TaB2, TaC2, TaD2, TaE2, TmB, TmB2, TmC, TmC2, TmD2, TmE, TmE2, TtB3, TtC3, TtD3, TtE3).	Poor to fair	Unsuitable	Good	Deep, well-drained, easily compacted soils.
Vance (VaC3, VaD3, VcB2, VcC2, VcD2, VcE2)	Fair	Unsuitable	Fair	Slightly plastic, sticky when wet.
Wickham (WcB2, WcD2)	Good	Unsuitable	Good	Well-drained sandy clay; easily compacted.
Wilkes complex (Wilkes component) (WkB, WkC, WkD, WkD2, WkE, WkE2).	Poor to fair	Unsuitable	Poor	Highly erodible; plastic, shallow.
Worsham (WoB, WoC)	Poor	Unsuitable	Poor	Highly plastic; high water table.

[1] W. G. White, Jr., construction engineer, South Carolina State Highway Department assisted in preparing this table.

Engineering Test Data

Samples of the principal soil types of six extensive soil series were tested according to standard procedures. These tests were made to help evaluate the soils for engineering purposes. The laboratory test data are given in table 6. Because samples for these tests were obtained only to a depth of approximately 6 feet, the data may not be adequate for estimating the characteristics of soil materials in very deep cuts.

The engineering soil classifications in table 6 are based on data obtained by mechanical analyses and by tests to determine the liquid limit and the plastic limit. Mechanical analyses were made by the combined sieve and hydrometer methods.

The tests for plastic limit and liquid limit measure the effect of water on the consistence of the soil material. As the moisture of a dry clayey soil increases, the material changes from a semisolid to a plastic state. As the moisture content further increases, the material changes from a plastic to a liquid state. The plastic limit is the moisture content at which the soil material passes from a semisolid to a plastic state (*6*). The liquid limit is the moisture content at which the material passes from a plastic to a liquid state. The plasticity index is the numerical difference between the plastic limit and the liquid. It indicates the range of moisture content within which a soil material is in a plastic condition.

A dual classification, such as ML–CL, is used under the Unified classification system to indicate a borderline soil that possesses characteristics of two groups.

Soil Properties Significant to Engineering

Brief descriptions of the soils in the county and estimates of their physical properties are given in table 7. The soils are described by layers that have properties significant to engineering; hence, the depths shown may not be the same as the depths in the section "Descriptions of the Soils" or "Formation, Morphology, and Classification of Soils." The texture of each layer is listed according to the textural classification of the United States Department of Agriculture (*11*). Also listed for the layers are the estimated percentages of material that will pass a No. 4 sieve, a No. 10 sieve, and a No. 200 sieve.

Permeability is estimated for each layer on the basis of soil structure without compaction. It refers to the rate at which water moves through the soil material and depends largely on the texture and structure of the soil (*16*).

Available water capacity is approximately the amount of capillary water in the soil when the downward flow by gravity has practically stopped. In table 7 it is the water held in the range between field capacity and the wilting point and is expressed in inches of water per inch of soil.

interpretation of soils—Continued [1]

Soil features affecting—Continued						Suitability for sewage disposal systems
Farm ponds		Agricultural drainage	Irrigation	Field and diversion terraces	Waterways	
Reservoir area	Embankment					
Moderately rapid seepage.	Moderate strength and stability; slow to moderately slow permeability.	Shallow surface drainage needed.	Low infiltration; moderately high water-holding capacity.	----------	----------	Not suited.
Moderate seepage.	Moderate strength and stability; moderate permeability.	----------	Moderate infiltration; moderate water-holding capacity.	Erodible----------	Erodible------	Suited.
Moderate seepage.	Moderately high strength and stability; moderate to moderately slow permeability.	----------	Moderate infiltration; moderately low water-holding capacity.	Erodible----------	Erodible------	Not suited.
Moderate seepage.	Moderate strength and stability; moderate permeability.	----------	Moderate infiltration; moderate water-holding capacity.	Erodible----------	Erodible------	Fair.
Moderate to high seepage.	Low to moderate strength and stability; slow to rapid permeability.	----------	Moderate infiltration; moderately low water-holding capacity.	Erodible; terracing hazardous.	Erodible; shaping hazardous.	Not suited; shallow to bedrock.
Slow seepage.	Low strength and stability; moderately slow permeability.	Surface interceptor drainage needed.	Moderate infiltration; moderate water-holding capacity.	----------	----------	Not suited.

[2] Gullied land, firm materials; Gullied land, friable materials, rolling; Gullied land, friable materials, hilly; Mine pits and dumps; and Rock outcrop are land types that have characteristics too variable for interpretation.

Reaction is shown in numerical terms of pH. A pH value less than 7.0 indicates that the soil is acid; values more than pH 7.0 indicate that the soil is alkaline. Extreme acid or alkaline reactions can have an important effect on structures or on soil stabilization treatments.

Dispersion refers to the rate that the soil structure breaks into individual particles and thereby loses stability.

The rating for shrink-swell potential indicates how much a soil changes in volume when it is subjected to changes in moisture content. In general, soils with a high clay content such as CH and A–7, as shown in table 6, have a high shrink-swell potential, and those that contain clean sand and gravel have a low shrink-swell potential.

In table 8 the soils are rated according to their suitability as a source of topsoil, sand, and road fill. Under the heading "Topsoil", the relative suitability of the soil for establishing and supporting vegetation is given. Under the heading "Sand", the terms "poorly graded", and "well graded" are used. Poorly graded sands are either predominantly one grain size or have limited material in one or more size ranges. Well-graded sands are a well balanced blend of different grain sizes. The suitability of a soil material for road fill depends largely upon its texture and natural water content. Plastic soils that have a high natural water content are difficult to work, to dry, and to compact. They are therefore rated *poor*. Highly erodible soils, such as those composed primarily of silt or fine sand, require slopes that are more nearly flat, close moisture control during compaction, and fast stabilization to prevent erosion. These soils are rated *poor* to *fair*.

Soil features affecting farm ponds, agricultural drainage, irrigation, terraces and diversions, and waterways are also given in table 8.

The resistance to seepage is rated for reservoir areas of farm ponds. The amount of seepage that can be tolerated depends on the amount of water flowing into the reservoir. The suitability of a soil as embankment material for farm ponds depends on its permeability, strength, and stability. Well-graded sand and gravel are stable but very permeable. Highly plastic soils have slow permeability and moderate strength and stability, but they are very difficult to work. Soils containing much silt, such as Nason silt loam, have low strength and stability.

Under the heading "Agricultural drainage" are listed the features affecting the removal of surface or subsurface water. The features affecting irrigation include the water-holding capacity of the soil and the infiltration rate.

Terracing plastic soils is difficult. On highly erodible soils, such as the Manteo and Wilkes, it is hazardous and, wherever possible, a cover of growing plants is necessary. Close-growing plants should be established in waterways before terracing.

In table 8, the soils with rapid permeability and a low water table are rated "suited" for sewage disposal systems. Soils with slow permeability or soils with a high water table are rated "not suited".

General Effect of the Soils on Sanitary, Highway, and Conservation Engineering

Most of the information on engineering properties of the soils and their relation to engineering work is given in tables 7 and 8. Some general information, however, on the suitability of the soils for sanitary engineering, road construction, and conservation engineering is given in this subsection, and some of the problems and soil properties that affect these projects are briefly discussed.

SANITARY ENGINEERING

The suitability of a soil for septic tanks and sewage disposal fields depends on the permeability of the soil, the depth to the water table, the hazard of flooding, and the depth to bedrock.

Soils such as the Altavista, Buncombe, Chewacla, Colfax, Congaree, Worsham, and Mixed alluvial land, wet, have a high water table or flood hazard and, therefore, are not suitable for sewage disposal fields. Disposal fields installed in these soils will overflow in a comparatively short time. Because of slow permeability, such soils as the Cataula, Elbert, Iredell, Mecklenburg, and Enon are not suited. The Louisburg, Manteo, and Wilkes soils are shallow to bedrock and, therefore, are not suited.

The Molena soils, on the contrary, are very permeable and are suitable for sewage disposal fields. Other suitable soils include the Appling, Cecil, Davidson, Hiwassee, and Lloyd soils. The rest of the soils in York County are between these extremes in suitability, and investigation is necessary at the site to determine whether or not the soil is satisfactory and, in many cases, what size of field is needed.

HIGHWAY ENGINEERING

As the Worsham and Iredell soils have poor internal drainage, slow permeability, and a plastic subsoil, they are not suitable for surfacing unpaved roads or for subgrade. The Manteo and Louisburg soils are shallow and are not desirable soils for road construction. The Altavista, Buncombe, Chewacla, and Colfax soils, and Mixed alluvial land, wet, have a high water table and provide a poor foundation for roads.

Slopes on cuts and fills should be flat enough to allow for proper stabilization and maintenance. All cuts and fills should be seeded to suitable plants as soon after construction as possible. If parent material is exposed in cuts, a layer of topsoil should be spread over it to insure good plant cover on the slope.

CONSERVATION ENGINEERING

Conservation engineering in York County includes the construction of farm ponds and terraces and the establishment of drainage and irrigation systems.

Farm Ponds.—York County has numerous sites suitable for farm ponds. More than a thousand ponds have been built, and are a major source of water for irrigation and for livestock. Nearly all ponds are stocked with fish. The plains section of the county south of Rock Hill, however, is made up of comparatively flat, very plastic soils. These soils are almost impermeable, are difficult to work, and have a low shear strength. Because of the flat topography, suitable sites for ponds in the plains section are rare.

Problems in constructing a farm pond are (1) selecting a site for maximum impoundment at minimum cost, (2) preventing excessive seepage under or through the dam or along the abutments, (3) providing adequate spillways to carry off stormwater, and (4) stabilizing embankments and emergency spillways with suitable plants.

Terraces.—Terraces can be constructed on soils that have slopes of 2 to 10 percent. The spacing between the terraces depends on the percentage of slope. The gradient of the terrace depends on the soil texture. Terraces on fine-textured, nonerosive soils can have steeper grades than terraces on light, erosive soils. Various grades, however, are used to improve terrace alinement and spacing, since crooked and unevenly spaced terraces make cultivation difficult. All natural draws and depressions should be seeded or sodded to adapted perennial grasses. Shallow depressions may have to be deepened to provide adequate drainage for terraces and rows.

Some soils in the county, for various reasons, are not suitable for terracing. The Wilkes and Louisburg soils, for example, are shallow, and construction of terraces is difficult. Because they are plastic, the Iredell and Elbert soils are not suitable for terracing. It is not feasible to terrace soils on slopes that are less than 2 percent or more than 10 percent.

Drainage.—Most of the soils on the flood plain of the rivers and creeks have a high water table, are subject to frequent overflow, or both. For highest production, most areas of these soils need some type of open drain. Depending on the use of the land, either a trapezoidal ditch or a shallow V-ditch or W-ditch is generally needed. Pastures, for example, can stand more flooding than row crops and would not need a drainage system so elaborate as that normally needed for row crops. Very little tile is used in York County.

The flat areas south of Rock Hill are generally made up of very plastic, shallow, uneven soils. Shallow surface drains are needed in much of this area to remove surface water from the low places. Locating outlets for field ditches, however, is the major problem. In many places the ditches must cross several farms.

Irrigation.—In York County irrigation is limited mostly to peach orchards and truck crops. In recent years a few vineyards have been established and are irrigated. Most irrigation in York County is done with sprinklers. Because most soils have a low rate of infiltration, irrigation systems are generally limited to sprinklers that deliver only one-half inch of water per hour or less.

Land smoothing.—This practice may be desirable on some of the better, deeper soils where peaches and other high-value crops are grown. Land smoothing permits better row arrangement and better row drainage. The Cecil, Tatum, and Lloyd soils are suitable for this practice.

Formation, Morphology, and Classification of Soils

This section consists of three parts. The first part tells how the soils of York County were formed. The second part describes some of the basic processes that affect soils in the area. In the third part the soil series are classified by higher categories, and descriptions of the series, including a representative profile of each, are given.

Factors of Soil Formation

Soil is the product of five principal factors of soil formation: Parent material, climate, living organisms (plants and animals), time, and relief. These factors influence and modify the effectiveness of one another in the process of soil formation. The nature of the soil that develops at any point on the earth depends upon the combined effect of these factors at that point.

The relative importance of each factor differs from place to place. Some soils in this county are sandy because their parent material weathered from granite or gneiss that contained a high content of quartz. Others are silty because their parent material is fine textured. Also, soils differ from place to place because the climate differs.

Differences in natural vegetation cause differences in the soils. Some soils in the county are dark colored because they formed under grass, whereas others are light colored because they formed under forest. Relief also causes many differences in soils. Some soils are shallow because they formed on steep slopes; others are deep because they formed on gentle slopes. Some soils are wet because they formed in low areas where water did not drain away.

Time likewise affects the soils. The soils along the streams are young because sediments are still being deposited or removed.

Although soil formation is complex, it is possible to get some understanding of the processes of soil formation by considering each of the factors separately.

Parent material

Parent material is the disintegrated rock material that has accumulated as a result of weathering. Its formation is the first step in soil development. The parent material is largely responsible for the chemical and mineral composition of the soils. In York County, it was derived from two different sources—residuum from the parent rocks, and recent alluvium deposited by streams.

Residual parent material is formed in place through the weathering of the underlying rock. Soils formed in this material cover about 91 percent of the county. The rocks of York County are chiefly (1) mica gneiss (partly granitized); (2) hornblende gneiss; (3) mica and sericitic schist; (4) granite, massive or weakly foliated; (5) diorite and gabbro; and (6) ultramafic rocks (*2*).

The gneiss and schist rocks are Precambrian (*14*). The mica gneiss contains deeply weathered quartz, feldspar, and mica. The chief minerals in the hornblende gneiss are quartz, feldspar, and hornblende, but in places there are varying amounts of biotite and chlorite. The thick layers of residuum consist of clay mixed with fragments of gneiss, quartz, and mica. Examples of soils formed from this parent material are the Cecil and Lloyd.

The mica and sericitic schists are fine-grained rocks composed chiefly of quartz, muscovite, and sericite (*14*). Weathering has been extensive, and outcrops of fresh rock seldom occur except along streams and on steep slopes. The thick layers of residuum consist of clay mixed with fragments and layers of schist, quartz, and mica. Examples of soils formed from this parent material are the Nason and Tatum.

The granite, diorite, gabbro, and ultramafic rocks are Paleozoic (*2*). The granite is either massive or weakly foliated, and occurs as intrusions into the gneiss and schist. It consists in general, of quartz, orthoclase, plagioclase, biotite, a little muscovite and accessory minerals in varying amounts (*14*). The residuum covering the granite varies in thickness from a few inches to many feet. The soils formed from granite are Appling, Durham, and Louisburg.

The rocks in the diorite and gabbro area range from diorite to gabbro but, in general are intermediate between true diorite and gabbro. These rocks are coarse textured and are distinctly massive and not closely jointed. They are composed chiefly of hornblende, pyroxene, and plagioclase, with varying amounts of quartz and accessory minerals (*14*). In some places flat rock outcrops that are little weathered are exposed, but in most places the rocks are deeply weathered and covered with a thick layer of soil. The Mecklenburg and Iredell soils have formed in parent material from diorite and gabbro.

The ultramafic rocks are intrusive. These rocks are chiefly peridotite and pyroxenite. They are altered to form serpentine. Peridotite contains olivine, and pyroxenite contains pyroxene. The ultramafic rocks have been altered extensively by metamorphism and hydration. These rocks weather slowly; some barren rock is exposed at the surface. Final decay leaves a shallow, stiff, yellow to yellowish-brown clay. Mecklenburg, Enon, and Iredell soils are formed from parent material of ultramafic rocks.

The recent alluvium consists of a mixture of gravel, sand, silt, and clay. Much of this alluvium was derived from rocks of the nearby uplands; however, some was derived from granite and metamorphosed rocks of the Piedmont and mountains farther north. The soils formed in recent alluvium are those on the bottom lands and terraces. Those on the first bottoms are weakly developed and still receive deposition, but those on the old, high terraces and benches have been in place long enough to develop horizons. The recent deposits along smaller streams show little soil development. Along drainageways and in depressions throughout the uplands, however, narrow strips of local alluvium have been modified to some extent by soil-forming processes. Examples of soils formed in recent alluvium are the Congaree and Chewacla. Soils formed on the high stream terraces are the Altavista and Wickham.

Climate

Climate, particularly precipitation and temperature, affects the physical, chemical, and biological relationships in the soil. Water dissolves minerals, aids biological

activity, and transports the dissolved minerals and organic residue through the soil profile. Large amounts of rainfall promote leaching of the soluble bases and the translocation of the less soluble colloidal matter downward in the soil profile. A long frost-free season and relatively high rainfall cause downward movement of fine-textured materials and the loss of plant nutrients.

The amount of water that percolates through the soil is dependent upon rainfall, relative humidity, and the length of the frost-free period. The rate of downward movement, or percolation, is affected by the physiographic position of the soil and its permeability. If percolation is interrupted only by brief periods of shallow freezing, the weathering of parent material is intensified. A relatively high average temperature therefore speeds weathering.

Temperature also influences the number and kinds of organisms. Thus, climate is responsible for certain changes in the soils that are brought about by plants and animals.

Living organisms

The number and kinds of plants and animals that live in and on the soil are determined by the climate and, to a lesser extent, by parent material, relief, and age of the soil.

Bacteria, fungi, and other micro-organisms are indispensable in soil development. They hasten the weathering of rock and the decomposing of organic matter. Larger plants serve to alter the soil microclimate, to furnish organic matter, and to transfer elements from the subsoil to the surface soil.

The fungi, bacteria, and other micro-organisms in the soils of York County are largely confined to the upper few inches of soil. The activity of earthworms and other small invertebrates is chiefly in the A horizon, where they slowly but continuously mix the soil. Bacteria and fungi decompose organic matter and release nutrients for plant use.

Animals play a secondary role in soil formation, but their influence is very great. By eating plants they perform one of the steps in returning plant remains to the soil.

The native vegetation on uplands was chiefly oak, hickory, cedar, shortleaf pine, and loblolly pine. On the well-drained bottom lands it was mainly poplar, sweetgum, ash, and sycamore trees and an abundant growth of canes. Trees on the poorly drained bottom lands were chiefly willow, birch, and beech. A lush growth of native grasses and legumes grew on the plains.

Time

Time is necessary for the development of soils from parent materials. The length of time required for a soil to develop depends largely on the intensity of other soil-forming factors. Less time is required for a soil to form in humid, warm regions with luxuriant vegetation than in cold, dry regions with scanty vegetation. Other things being equal, less time is required for a soil to form if parent material is coarse textured than if it is fine textured.

On the smoother parts of the uplands and on the older stream terraces, the soils have generally developed to maturity. Examples are the Cecil soils on uplands and the Hiwassee soils on stream terraces. On the stronger slopes, geologic erosion has removed soil material almost as rapidly as it has formed. Consequently, the soils are shallow and have little profile development in many places. Examples are the Louisburg, Manteo, and Wilkes soils. On the first bottoms and in other areas of local alluvium, the soils are young because the material has not been in place long enough for horizons to form. Buncombe and Congaree are examples of young soils.

Relief

Relief influences soil formation because of its effect on moisture, temperature, and erosion. This influence, however, is modified by the influence of the other soil-forming factors.

In York County slopes range from 0 to 35 percent. Upland soils on slopes of less than 15 percent have a thick, well-developed profile. On slopes of 15 to 35 percent, geologic erosion removes soil material almost as fast as it forms. As a result, the Wilkes, Manteo, and Louisburg soils have thin, weakly expressed profiles. However, the most extensive soils in York County are gently sloping to strongly sloping and have not been adversely affected by relief.

On the bottoms and on stream terraces, the slopes range from 0 to about 18 percent. Here, the soils are young because the parent material has been in place for a relatively short time.

Basic Processes That Affect Soils in the Area

In most of the soils in York County, morphology is expressed by strongly developed horizons. A few soils, however, have weakly developed horizons. The mature soils are in equilibrium with the soil-forming factors. The B horizon of most of these soils contains much clay, and the structure is strong subangular blocky or strong blocky.

The differentiation of horizons is the result of one or more of these processes: (1) Accumulation of organic matter, (2) leaching of carbonates and salts, (3) translocation of silicate clay minerals, and (4) reduction and transfer of iron. In most of the profiles, two or more of these processes have operated in the development of horizons.

Some organic matter has accumulated in the upper layer of nearly all the soils to form an A1 horizon. Much of the organic matter is in the form of humus. The quantity is very small and, over a large part of the county, the A1 horizon has been obliterated or destroyed by cultivation and accelerated erosion. Soils of the Appling and Cecil series that have never been cultivated have a distinct, thin A1 horizon containing little organic matter. The Congaree and Chewacla soils have a thicker A1 horizon that contains more organic matter than that in Appling and Cecil soils.

Leaching of carbonates and salts has occurred in all soils in the county, but its importance in horizon differentiation has been limited. The effects have been indirect, but leaching has permitted the subsequent translocation of silicate clay minerals in many of the soils. Also, carbonates and salts have been leached completely out of the profile of most of the soils. Nearly all the soils are medium acid to strongly acid. The Davidson

and Iredell soils show less effects of leaching and have a higher pH than the other soils on uplands. Leaching has had little effect on the Congaree and other young soils on the bottom lands.

Translocation of silicate clay has contributed to the development of almost all the soils except those consisting of recent alluvium. It is one of the more important processes in horizon differentiation in the older soils in the county. Many of the soils show strong eluviation in the A horizon and high accumulation of clay in the B horizon. Clay films in root channels and on ped faces are evidence that silicate clays have been moved from the A horizon into the B horizon. The Iredell and Enon soils show evidence of this translocation.

The reduction and transfer of iron has occurred in all the poorly drained and somewhat poorly drained soils. This process is called gleying. In the deeper horizons of Helena sandy loam and other moderately well drained soils, gleying has occurred. Also, in small areas of Worsham sandy loam, and other naturally wet soils, this process has been important in horizon differentiation. Iron has been segregated in some horizons of some soils to form yellowish-red, strong-brown, or yellowish-brown mottles. In other soils it has formed concretions in the lower horizons.

Classification of Soils

Soils are placed in narrow classes for the organization and application of knowledge about their behavior within farms and counties. They are placed in broad classes for study and comparison of continents and other large areas.

The soil classification used in the United States consists of six categories one above the other (*18*). Beginning with the most inclusive, the six categories are the order, suborder, great soil group, family, series, and type.

In the highest category the soils of the country are grouped into three orders; in the lowest thousands of types are recognized. The suborder and family categories have never been fully developed and thus have been little used. Attention has been given largely to the classification of soils into types and series within counties or comparable areas and to the subsequent grouping of series into great soil groups. Soil types are further broken down into phases, which provide finer distinctions significant in use and management.

Classes in the highest category of the classification scheme are the zonal, intrazonal, and azonal orders.

The zonal order consists of soils that have well-developed characteristics that reflect the influence of climate and living organisms (chiefly vegetation). These characteristics are best developed on gently sloping, well-drained uplands. The parent material does not have extreme texture or chemical composition, and it has been in place long enough for biological forces to have had their full influence. Zonal soils have a moderately well developed to a well developed profile that is in equilibrium with the climate as well as with the other soil-forming factors. The great soil groups in the zonal order in York County are in the Red-Yellow Podzolic (*5*) and Reddish-Brown Lateritic great soil groups.

The intrazonal order consists of soils that have more or less well-developed characteristics that reflect the dominating influence of some local factor of relief or parent material over the effects of climate or living organisms. In York County the great soil groups in the intrazonal order are the Planosols and Low-Humic Gley soils.

The azonal order consists of soils that lack well-developed profile characteristics because of their youth, parent material, or relief. In York County the great soil groups in the azonal order are the Lithosols, Regosols, and Alluvial soils.

In table 9 the soil series of York County are classified in soil orders and great soil groups, and some distinguishing characteristics of each series are given. The classification of series into great soil groups is based upon characteristics observable in the field. Further study of the soils may result in future changes in the classification of some series.

In the following pages each great soil group represented in York County is described, as well as the soil series in the great soil group. Also described is a profile representative of each series. Unless otherwise stated, the description is that of a moist soil.

Red-Yellow Podzolic soils

This great soil group consists of well-developed, well-drained, acid soils formed under forest vegetation in a warm-temperate, humid climate. These soils have a thin organic A0 and an organic-mineral A1 horizon. The A1 horizon is underlain by a light-colored, bleached A2 horizon that, in turn, is underlain by a red, yellowish-red, or yellow more clayey B2 horizon. Parent materials are all more or less siliceous. In areas where the parent material is thick, coarse reticulate streaks or mottles of red, yellow, brown, and light gray are characteristic of the deep horizons of Red-Yellow Podzolic soils (*15*).

In York County, Red-Yellow Podzolic soils developed under a mixed forest in a warm-temperate, humid climate. Under these conditions, the leaching of plant nutrients and the decomposition of organic matter are rapid. These soils are slightly acid to strongly acid and are low to very low in calcium, magnesium and other bases. The dominant clay mineral is kaolinite, but large quantities of free iron oxide or iron hydroxide occur and, in places, small amounts of aluminum. Hydrous mica dilutes the clay fraction in some of the soils, but this condition is not considered typical. The subsoil has a moderate to strong, subangular blocky structure. In most places streaks or mottles occur nearer the surface in profiles that have a yellow B horizon than in those that have a red B horizon. In a few soils, the reticulated mottles in the C horizon are lacking.

In cultivated areas the A0 and A1 horizons have been mixed in the plow layer. Also, in many cultivated fields, accelerated erosion has removed all or nearly all of the A horizon and has exposed the red or yellow B horizon.

In the Red-Yellow Podzolic soils of York County the A horizon is low in clay content, is relatively thin, and forms but a small part of the entire profile. The B horizon has a higher clay content and is thicker than the A horizon. In most of these soils, the largest accumulation of clay is in the lower part of the B horizon.

TABLE 9.—*Characteristics and genetic relationships of soil series*

ZONAL

Great soil group and series	Profile description [1]	Position	Drainage	Slope range	Parent material	Degree of profile development [2]
Red-Yellow Podzolic soils:				*Percent*		
Altavista	Deep, friable soils on stream terraces. Grayish-brown fine sandy loam surface layer over light yellowish-brown clay subsoil mottled with strong brown, light olive brown, and light gray.	Moderately low stream terraces.	Moderately good.	0–6	Old alluvium	Moderate.
Appling	Moderately deep to deep, friable soils on uplands. Light brownish-gray sandy loam surface layer over clay subsoil mottled with yellowish red and yellowish brown.	Broad ridges and slopes adjacent to drainageways.	Good	2–25	Residuum from granite, gneiss, and schist.	Strong.
Cataula	Moderately deep to deep, firm soils on uplands. Dark yellowish-brown sandy loam over yellowish-red to red very firm clay subsoil.	High ridges and irregularly dissected side slopes.	Moderately good.	2–25	Residuum from gneiss and schist.	Strong.
Cecil	Deep, friable soils on uplands. Dark-brown sandy loam surface layer over red clay subsoil.	High ridges and regularly dissected side slopes.	Good	2–25	Residuum from granite, gneiss, and schist.	Strong.
Durham	Deep, light colored sandy soils on uplands. Grayish-brown sandy loam over yellow to brownish-yellow sandy clay loam to clay subsoil.	Flat, high ridges.	Good to moderately good.	2–10	Residuum from granite and gneiss.	Strong.
Enon	Grayish-brown sandy loam over mottled strong brown, red, and pale brown firm clay.	Broken ridges and irregular side slopes.	Moderately good.	2–25	Residuum from mixed basic and acidic rocks.	Strong.
Helena	Deep to moderately deep soils on uplands. Brown sandy loam surface layer over clay subsoil mottled brownish yellow, pale yellow, and very pale brown.	Low ridges	Moderately good to somewhat poor.	2–15	Residuum from mixed acidic and basic rocks.	Strong.
Nason	Deep, friable soils on uplands. Light olive-brown to dark grayish-brown silt loam surface layer over pale-yellow, strong-brown, and yellowish-red silty clay subsoil.	Low ridges and slopes adjacent to drainageways.	Good to moderately good.	2–25	Residuum from sericitic schist.	Strong.
Tatum	Deep, friable soils on uplands. Yellowish-brown silt loam over red silty clay subsoil.	High and medium ridges and broken slopes.	Good	2–25	Residuum from sericitic schist.	Strong.
Vance	Deep, to moderately deep soils on uplands. Yellowish-brown sandy loam surface layer over firm clay subsoil mottled strong brown, red, and brownish yellow.	Medium ridges and slopes adjacent to drainageways.	Moderately good.	2–25	Residuum from acidic rock; some basic rock influence.	Strong.
Wickham	Deep, friable soils on stream terraces. Dark-brown sandy loam surface layer over yellowish-red clay loam subsoil.	Slopes on stream terraces.	Good	2–15	Old alluvium on stream terraces.	Moderate.

See footnotes at end of table.

TABLE 9.—*Characteristics and genetic relationships of soil series*—Continued

ZONAL—Continued

Great soil group and series	Profile description [1]	Position	Drainage	Slope range	Parent material	Degree of profile development [2]
Red-Yellow Podzolic soils—Continued						
Red-Yellow Podzolic soils intergrading toward Reddish-Brown Lateritic soils:						
Lloyd (compact subsoil).	Deep, very firm soils on uplands. Dark-brown sandy loam surface soil over very firm red clay subsoil.	High ridges and irregular dissected side slopes.	Moderately good.	2–20	Residuum from acidic rocks with intrusions of basic rocks.	Strong.
Lloyd	Deep, friable soils on uplands. Reddish-brown loam surface layer over red clay subsoil.	High ridges and broken adjacent slopes.	Good	2–15	Residuum from mixed acidic and basic rocks.	Strong.
Red-Yellow Podzolic Soils Intergrading toward Low-Humic Gley soils:						
Colfax	Deep, friable soils on low uplands and around streamheads. Olive-gray sandy loam over clay to sandy clay subsoil mottled light yellowish-brown, brownish yellow, and gray.	Low uplands and flat areas around streamheads.	Somewhat poor	2–6	Residuum from granite.	Moderate.
Reddish-Brown Lateritic soils:						
Davidson	Deep, friable soils on uplands. Dusky-red clay loam surface layer over red clay subsoil.	High ridges	Good	2–10	Residuum from dark-colored basic rock.	Strong.
Hiwassee	Dark colored soils on high stream terraces. Reddish-brown sandy loam over dark-red silty clay to clay subsoil.	High stream terraces.	Good	2–18	Old alluvium washed chiefly from areas over dark-colored rock.	Moderate
Reddish-Brown Lateritic soils intergrading toward Planosols:						
Mecklenburg	Moderately deep to deep soils on uplands. Dark-brown loam surface layer over firm yellowish-red clay subsoil mottled with strong brown.	Low ridges and medium to low side slopes.	Moderately good.	0–25	Residuum from basic rock.	Strong.
INTRAZONAL						
Planosols:						
Elbert	Moderately deep to deep soils in low areas on uplands. Very dark gray loam over dark grayish-brown clay mottled with olive brown.	Flat, low areas	Somewhat poor	0–3	Residuum from basic igneous rock.	Moderate.
Iredell	Moderately deep soils on uplands. Very dark grayish-brown sandy loam surface layer over yellowish-brown heavy plastic clay subsoil.	Low, flat ridges and moderate slopes.	Somewhat poor	0–10	Residuum from basic igneous rock.	Strong.

See footnotes at end of table.

TABLE 9.—*Characteristics and genetic relationships of soil series*—Continued

INTRAZONAL—Continued

Great soil group and series	Profile description [1]	Position	Drainage	Slope range	Parent meterial	Degree of profile development [2]
Low-Humic Gley soils:						
Roanoke	Low wet soils on stream terraces. Dark grayish-brown silt loam surface layer over mottled gray, dark yellowish-brown, and brownish-yellow firm clay.	Low, wet stream terraces.	Poor	0–4	General alluvium.	Moderate.
Worsham	Deep to moderately deep soils in depressions on uplands. Black sandy loam surface layer over gray, light brownish-gray, and yellowish-brown very firm sandy clay subsoil.	Depressions at head of streams and along drainageways.	Poor	2–15	Residuum from granite, gneiss, and schist.	Moderate.
AZONAL						
Lithosols:						
Louisburg	Shallow to moderately deep soils on uplands. Dark grayish-brown sandy loam surface layer and thin, or discontinuous, light yellowish-brown B horizon.	High ridgetops and strong slopes.	Somewhat excessive.	2–25	Residuum from granite.	Weak to none.
Manteo	Shallow, channery soils on uplands. Grayish-brown channery silt loam over thin, or discontinuous, yellowish-brown silty clay B horizon.	Broken ridges and irregular, dissected side slopes.	Good to excessive.	10–35	Residuum from sericitic schist.	Weak to none.
Wilkes	Shallow soils on uplands. Dark-brown sandy loam surface layer over thin, or discontinuous, mottled reddish-yellow, brownish-yellow, and red plastic clay loam B horizon.	Broken ridges and irregular side slopes.	Moderately good to excessive.	2–35	Residuum from mixed basic and acidic rocks.	Weak to none.
Regosols:						
Molena	Droughty soils on stream terraces. Dark-brown loamy sand surface layer over yellowish-red light sandy loam subsoil.	Ridgetops of stream terraces.	Excessive	2–8	Old alluvium	Weak to none.
Alluvial soils:						
Buncombe	Deep sandy soils on bottom lands. Very dark grayish-brown loamy sand over mottled yellowish-brown and dark-brown sand.	High first bottoms.	Excessive	0–4	Recent alluvium	None.
Congaree	Deep, very friable soils on first bottoms. Dark grayish-brown fine sandy loam surface layer over dark-brown loamy fine sand mottled with grayish-brown.	First bottoms	Good	0–2	Young alluvium	None.
Alluvial soils intergrading toward Low-Humic Gley soils:						
Chewacla	Deep, friable soils on bottom lands. Grayish-brown silt loam over yellowish-brown and gray silty clay loam.	First bottoms	Somewhat poor to moderately good.	0–2	Recent alluvium	None.

[1] Descriptions are for soil profiles that have not been materially affected by accelerated erosion.

[2] As measured by the number of important genetic horizons and the degree of contrast between them.

This indicates that the dominant process in the formation of Red-Yellow Podzolic soils is the accumulation of silicate clay minerals in the lower horizon and the loss of these minerals from the upper horizon (*9*). The dominant process by which silicate clay minerals are broken down is apparently hydrolysis.

The Cecil, Tatum, and Wickham soils are the red members of the Red-Yellow Podzolic group. The Appling, Durham, and Nason soils are the yellow members. The B2 horizon in the yellow members is not so fine textured as that in the red members. Cataula, Enon, and Vance soils have a finer textured, tougher B2 horizon than most of the other soils in the Red-Yellow Podzolic group. The Altavista and Helena soils are not in the central concept but are within the range of the Red-Yellow Podzolic group. The Altavista soils have gray mottles in the upper 30 inches, and the Helena soils have a few characteristics of Planosols.

The series in the Red-Yellow Podzolic great soil group are discussed in alphabetical order in the following pages.

ALTAVISTA SERIES.—In the Altavista series are deep, moderately well drained soils on second bottoms along large streams in the Piedmont. They developed in materials that washed from soils derived from granite, gneiss, schist, and basic rocks.

The Altavista soils have a lighter colored surface layer than the Wickham and Hiwassee soils. They have a brown to yellow subsoil, whereas the Wickham and Hiwassee soils have a brown to red subsoil.

Profile of Altavista fine sandy loam in an idle field 2.2 miles southwest of Pleasant Grove Church:

Ap—0 to 6 inches, grayish-brown (2.5Y 5/2) fine sandy loam; weak, fine, granular structure; very friable; many fine roots; few, fine mica flakes; pH 6.2; clear, smooth boundary; 3 to 9 inches thick.

A2—6 to 12 inches, light brownish-gray (2.5Y 6/2) fine sandy loam; very friable; weak, medium and fine, crumb structure; many fine roots; few, fine mica flakes; pH 6.4; clear, smooth boundary; 2 to 10 inches thick.

B1—12 to 17 inches, light yellowish-brown (10YR 6/4) fine sandy clay loam mottled with strong brown (7.5YR 5/8); moderate, medium, subangular blocky structure; friable; few fine roots; few, fine mica flakes; few, fine, faint mottles; pH 6.6; clear, smooth boundary; 3 to 9 inches thick.

B2—17 to 33 inches, light yellowish-brown (2.5Y 6/4) fine sandy clay mottled with yellowish brown (10YR 5/6) and strong brown (7.5YR 5/8); moderate, medium, subangular blocky structure; friable to firm when moist, hard when dry, sticky when wet; many, fine mica flakes; common, medium, distinct mottles; pH 6.5; clear, smooth boundary; 8 to 24 inches thick.

B3—33 to 41 inches, light-gray (2.5Y 7/2) clay mottled with yellowish brown (10YR 5/8); moderate, coarse, blocky structure; firm when moist, hard when dry, sticky when wet; faint, patchy clay films; abundant, fine mica flakes; common, medium, distinct mottles; pH 6.3; clear, wavy boundary; 8 to 14 inches thick.

C—41 to 76 inches +, light brownish-gray (2.5Y 6/2) fine sandy clay mottled with brownish yellow (10YR 6/6); massive (structureless); friable or very friable; abundant, fine mica flakes; few, fine to medium pebbles; common, medium, prominent mottles; pH 6.3; several feet to bedrock.

Range in characteristics.—The principal type in York County is fine sandy loam. The color of the Ap horizon ranges from dark grayish brown to light grayish brown. In wooded areas, however, the A1 horizon is 1 inch to 2 inches thick and is generally very dark gray to black, and the A2 horizon is 3 to 7 inches thick and is generally light brownish gray. The color of the B horizon is light yellowish brown, yellowish brown, or strong brown. The texture of the subsoil ranges from sandy clay loam to clay. The thickness of the solum varies between 22 and 45 inches. Some areas of this soil are underlain by stratified sand, gravel, or sandy clay to a depth of 6 feet, and water-rounded quartz pebbles are on the surface in places.

APPLING SERIES.—In the Appling series are deep, well-drained soils in the Piedmont. They developed in residuum from granite, gneiss, and schist.

The Appling soils are intermediate in color between the red Cecil and yellow Durham soils. They have a lighter colored surface layer and a more friable subsoil than the Helena and Enon soils. They have a thicker solum, and their horizons are much more distinct than those of the Louisburg soils with which they occur.

Profile of Appling sandy loam in a field 0.2 mile northwest of New Home Church.

Ap—0 to 6 inches, light brownish-gray (10YR 6/2) sandy loam; weak, fine, granular structure; very friable; many fine roots; few, small quartz pebbles; pH 5.9; clear, smooth boundary; 2 to 8 inches thick.

A2—6 to 10 inches, light yellowish-brown (2.5Y 6/2) sandy loam; weak, fine, granular structure; very friable; many fine roots; pH 6.0; clear, smooth boundary; 3 to 7 inches thick.

B1—10 to 16 inches, yellowish-brown (10YR 6/6) sandy clay loam; moderate, fine and medium, subangular blocky structure; friable; few fine roots; pH 5.4; clear, smooth boundary; 4 to 10 inches thick.

B2—16 to 34 inches, red (2.5YR 4/8) clay loam mottled with light red (2.5YR 6/6) and brown (7.5YR 5/4); moderate, medium, subangular blocky structure; friable; few, fine mica flakes; patchy clay films on ped faces; few, fine, distinct mottles; pH 5.5; clear, smooth boundary; 10 to 20 inches thick.

B3—34 to 39 inches, red (2.5YR 4/8) clay mottled with light yellowish brown (10YR 6/4) and pale yellow (2.5Y 8/4); weak, coarse, blocky structure that breaks to moderate, medium, blocky structure; firm; few, fine mica flakes; small flakes of weathered gneiss; discontinuous clay films on ped faces; common, medium, distinct mottles; pH 5.5; clear, wavy boundary; 4 to 12 inches thick.

C—39 to 41 inches +, red (2.5YR 4/8) sandy clay loam mottled with strong brown (7.5YR 5/8), pale yellow (2.5Y 8/4), and white (2.5Y 8/2); coarser with increasing depth; massive (structureless); small to medium gneiss fragments; small and medium quartz pebbles; many, fine mica flakes; pH 5.0; several feet to bedrock.

Range in characteristics.—The principal soil types in the Appling series are sandy loam and coarse sandy loam. The color of the Ap horizon ranges from light brownish gray to dark grayish brown, and the texture ranges from sandy loam to coarse sandy loam. The color of the A2 horizon ranges from light yellowish brown to yellowish red, and the texture ranges from sandy loam to coarse sandy loam. The texture of the B horizon ranges from sandy clay loam in the upper part to clay in the lower part. Thickness of the saprolite above bedrock ranges from 2 to 20 feet or more.

CATAULA SERIES.—In the Cataula series are moderately deep to deep, moderately well drained soils in the Piedmont. They developed in residuum weathered from light-colored gneiss, aplite, and granite but in places are influenced by slightly basic rocks.

The Cataula soils have a finer textured B horizon than the Cecil soils and a redder B horizon than the Enon soils. They have a thicker solum and much more distinct horizons than the Wilkes soils.

Profile of Cataula sandy loam in a pine forest 0.5 mile southwest of Sharon fire tower:

Ap—0 to 2 inches, dark yellowish-brown (10YR 4/4) sandy loam; weak, fine, granular structure; very friable; many fine roots; few, coarse sand grains; pH 6.1; abrupt, smooth boundary; 1 to 5 inches thick.

A2—2 to 8 inches, light yellowish-brown (10YR 6/4) sandy loam; weak, fine, granular structure; very friable; many fine roots; coarse sand grains; pH 6.0; clear, smooth boundary; 3 to 10 inches thick.

B1—8 to 12 inches, yellowish-red (5YR 5/8) clay loam; moderate, medium, subangular blocky structure; friable; few fine and medium roots; many, fine mica flakes; pH 5.5; clear, smooth boundary; 1 to 6 inches thick.

B2—12 to 28 inches, red (2.5YR 4/8) clay; strong, coarse, blocky structure that breaks to moderate, fine, blocky structure; firm when moist, hard when dry, sticky when wet; distinct clay films on ped faces; many, fine mica flakes; pH 5.6; clear, smooth boundary; 12 to 18 inches thick.

B3—28 to 40 inches, red (2.5YR 5/8) clay mottled with strong brown (7.5YR 5/8); strong, coarse, blocky structure that breaks to moderate, fine, blocky, or in places, to platy structure; firm to very firm and compact when moist, hard when dry, sticky when wet; some patchy clay films on ped faces; fine and medium, common, distinct mottles; many, fine mica flakes; pH 5.6; clear, wavy boundary; 8 to 18 inches thick.

C—40 to 73 inches +, red (2.5YR 5/8) clay loam mottled with yellowish red (5YR 5/8), reddish yellow (5YR 6/6), and strong brown (7.5YR 5/8); massive (structureless); friable; many, fine mica flakes; weathered micaceous gneiss fragments at about 69 inches; common, fine and medium, distinct mottles; pH 5.5; 3 to 40 feet to bedrock.

Range in characteristics.—The principal soil types in the Cataula series are sandy loam and clay loam. The clay loam occurs where erosion has removed the original surface layer. Cataula soils are dark yellowish brown to light yellowish brown in the surface layer and are yellowish-red to light-red clay loam in the upper part of the subsoil. In places where all of the original surface layer has been removed by erosion, the present surface layer is light red to red. The B horizon is red, firm to very firm clay mottled with strong brown to yellowish brown. The C horizon is variable in color. Depth to bedrock ranges from about 4 feet to 20 feet or more.

CECIL SERIES.—In the Cecil series are deep, well-drained soils in the Piedmont. They developed in residuum weathered from granite, gneiss, schist, and other metamorphic and igneous rocks.

The Cecil soils have a redder B horizon than the Appling and Durham soils. They have a lighter red B horizon than the Lloyd soils. They are redder and more friable than the Enon soils. They have a thicker solum and much more distinct horizons than the Wilkes and Louisburg soils with which they occur.

Profile of Cecil sandy loam in an idle field 0.5 mile north of Shiloh Church:

Ap—0 to 6 inches, dark-brown (10YR 4/3) sandy loam; weak, fine, granular structure; very friable; many fine roots; few, small, brown pebbles; pH 5.6; clear, smooth boundary; 4 to 8 inches thick.

B1—6 to 14 inches, yellowish-red (5YR 5/8) clay loam; weak, fine, subangular blocky structure; friable when moist, slightly sticky when wet; very fine roots; few, fine mica flakes; pH 5.7; clear, smooth boundary; 2 to 10 inches thick.

B2—14 to 35 inches, red (2.5YR 4/8) clay; moderate, medium, subangular blocky structure; friable when moist, sticky when wet, hard when dry; few, fine mica flakes; patchy, discontinuous clay films on ped faces; pH 5.7; clear, smooth boundary; 10 to 24 inches thick.

B3—35 to 43 inches, red (2.5YR 4/8) clay; moderate, coarse, subangular blocky structure that breaks to weak, fine, subangular blocky structure; friable to firm when moist, sticky when wet, hard when dry; many, fine mica flakes; pH 5.8; clear, wavy boundary; 5 to 12 inches thick.

C—43 to 48 inches +, red (2.5YR 4/8) sandy clay loam with few, fine, distinct, reddish-yellow (7.5YR 6/8) mottles; massive (structureless); many, fine mica flakes; weathered shale fragments; grades to coarser texture with increasing depth; pH 5.7; several feet to bedrock.

Range in characteristics.—The principal soil types in the Cecil series are sandy loam and clay loam. In places where accelerated erosion has removed the original surface layer, the texture is clay loam. In uneroded soils the color of the surface layer is grayish brown to dark brown. The B horizon is red in color and friable to firm in consistence. A layer of mottled sandy clay loam is at a depth of 24 to 60 inches. Depth to bedrock ranges from 5 to 50 feet or more.

DURHAM SERIES.—In the Durham series are deep, well drained to moderately well drained soils in the Piedmont. They developed in residuum that weathered from granite.

In the B horizon, the Durham soils are lighter colored and coarser textured than the Appling soils. They do not have a moderately plastic subsoil like that in the Helena soils. They occupy a higher position and are better drained than the Colfax and Worsham soils.

Profile of Durham sandy loam in a forest of oak 0.25 mile south of Neelys Creek Church:

A0—¼ inch to 0, black (2.5Y 2/0) decayed organic matter.

A1—0 to 4 inches, grayish-brown (2.5Y 5/2) sandy loam; weak, fine, granular structure; very friable; many fine roots; few, coarse, quartzite sand grains; pH 5.8; clear, smooth boundary; 2 to 6 inches thick.

A2—4 to 12 inches, light-gray (5Y 7/2) sandy loam; weak, fine, granular structure; very friable; many fine and few medium roots; pH 5.9; clear, smooth boundary; 6 to 12 inches thick.

A3—12 to 16 inches, pale-yellow (5Y 8/3) sandy loam; weak, medium, granular structure; very friable; many fine and medium roots; pH 6.0; clear, smooth boundary; 2 to 6 inches thick.

B1—16 to 23 inches, yellow (2.5Y 7/6) sandy clay loam; moderate, medium, subangular blocky structure; friable; few fine and medium roots; pH 5.5; clear, smooth boundary; 4 to 9 inches thick.

B2—23 to 36 inches, brownish-yellow (10YR 6/6) clay loam; weak, coarse, blocky structure; friable to firm; few fine roots; pH 5.3; clear, smooth boundary; 10 to 14 inches thick.

B3—36 to 45 inches, yellow (2.5Y 7/6) clay; common, fine, distinct mottles of brownish yellow (10YR 6/8) and reddish yellow (5YR 6/8); strong, coarse, blocky structure; firm; small fragments of partly weathered granite; pH 5.4; clear, wavy boundary; 7 to 11 inches thick.

C—45 to 47 inches +, reddish-yellow (7.5YR 6/8) sandy clay loam; common, medium, distinct mottles of yellowish red (5YR 5/8) and pale olive (5Y 6/4); massive (structureless); pH 5.2; bedrock at 6 to 60 feet or more.

Range in characteristics.—The principal soil type in the Durham series is sandy loam. The surface layer ranges in color from grayish brown to dark grayish brown. The upper part of the subsoil ranges in color

from yellow to light yellowish brown; the texture is a sandy clay loam. The lower subsoil is sandy clay mottled with brownish yellow, yellow, and reddish yellow. Depth to weathered bedrock is 6 to 60 feet or more.

ENON SERIES.—In the Enon series are moderately deep to deep, well drained to moderately well drained soils in the Piedmont. They developed in residuum weathered from mixed acidic and basic rocks that include granite and gneiss and intrusions of diorite, gabbro, and other basic rocks.

They are browner in the surface layer and upper part of the subsoil than the Cecil, Lloyd, and Appling soils. They are not so red as the Cataula soils and not so plastic as the Iredell soils. They are deeper to bedrock than soils in the Wilkes complex with which they occur.

Profile of Enon sandy loam in improved pasture 2 miles south of New Port:

Ap—0 to 7 inches, grayish-brown (10YR 5/2) sandy loam; weak, fine, crumb structure; very friable; many fine roots; few, small, brown pebbles; pH 6.2; clear, smooth boundary; 4 to 10 inches thick.

B1—7 to 14 inches, strong-brown (7.5YR 5/8) clay loam; moderate, medium, subangular blocky structure; friable when moist, sticky when wet; many fine roots; pH 6.1; clear, smooth boundary; 4 to 10 inches thick.

B2—14 to 29 inches, strong-brown (7.5YR 5/8) clay mottled with red (2.5YR 4/8) and pale brown (10YR 6/3); moderate, medium, blocky structure; firm when moist, sticky when wet, hard when dry; distinct clay films on ped faces; common, fine, distinct mottles; pH 5.8; clear, smooth boundary; 11 to 20 inches thick.

B3—29 to 34 inches, light olive-brown (2.5Y 5/4) clay mottled with strong brown (7.5YR 5/8) and yellowish red (5YR 5/8); strong, medium, blocky structure; firm when moist, hard when dry, sticky when wet; patchy clay films on ped faces; common, fine and medium, distinct mottles; pH 5.7; clear, wavy boundary; 3 to 14 inches thick.

C—34 to 72 inches, strong-brown (7.5YR 5/6), yellowish-red (5YR 5/8), and light-gray (2.5Y 7/2) clay loam that grades to weathered parent material at a depth of about 49 inches; massive (structureless); friable; contains fragments of weathered acid and basic rock and a few quartz pebbles; pH 5.7; bedrock at 2 to 30 feet.

Range in characteristics.—The principal soil types in the Enon series are sandy loam and clay loam. The surface layer is very dark grayish-brown to brown sandy loam to clay loam, and the upper part of the subsoil is strong-brown clay loam. The lower part of the subsoil is firm clay mottled with strong brown, pale brown, light olive brown, and yellowish red. The depth to weathered bedrock ranges from about 4 feet to 30 feet or more.

HELENA SERIES.—In the Helena series are deep, moderately well drained soils in the Piedmont. They developed in residuum weathered from mixed acidic and basic rocks that included aplite, granite, granite gneiss, or quartz diorite. In places there are intrusions of gabbro or hornblende gneiss.

Helena soils are more slowly permeable, less well drained, and more plastic in the subsoil than the Cecil, Appling, and Durham soils. They are better drained than the Colfax and Worsham soils. They have a thicker solum and a more strongly developed profile than soils in the Wilkes complex.

Profile of Helena sandy loam in a pasture 1 mile east of Philadelphia Church on State Highway No. 334:

Ap—0 to 7 inches, brown (10YR 5/3) sandy loam; weak, fine, granular structure; very friable; many fine roots; pH 6.2; abrupt, smooth boundary; 3 to 10 inches thick.

A2—7 to 11 inches, light yellowish-brown (2.5Y 6/4) sandy loam; weak, fine, granular structure; very friable; many fine roots; pH 6.7; clear, smooth boundary; 2 to 6 inches thick.

B1—11 to 20 inches, yellowish-brown (10YR 5/6) sandy clay loam; moderate, medium, subangular blocky structure; friable when moist, sticky when wet; few fine roots; pH 6.5; clear, smooth boundary; 6 to 15 inches thick.

B2—20 to 32 inches, yellowish-brown (10YR 6/6) clay mottled with pale yellow (2.5Y 7/4); strong, coarse, blocky structure that breaks to weak, fine, blocky structure; firm when moist, plastic and sticky when wet, hard when dry; few fine roots; few, small quartz pebbles; few, fine, faint mottles; patchy clay films on ped faces; pH 5.8; clear, smooth boundary; 8 to 24 inches thick.

B3—32 to 39 inches, brownish-yellow (10YR 6/6) clay mottled with pale yellow (2.5Y 7/4) and white (10YR 8/2); strong, coarse, blocky structure; very firm when moist, plastic and sticky when wet, hard when dry; common, fine and medium, distinct mottles; continuous clay films on ped faces; pH 5.4; clear, wavy boundary; 5 to 12 inches thick.

C—39 to 74 inches, pale-brown (10YR 6/3) sandy clay mottled with white (10YR 8/2), pink (7.5YR 7/4), yellowish red (5YR 4/8), and reddish yellow (5YR 7/8); grades to coarser material with increasing depth; massive (structureless); firm; many, medium, prominent mottles; pH 5.2; bedrock at 3 to 40 feet.

Range in characteristics.—The principal soil type in the Helena series is sandy loam. These soils have a pale-olive to brown sandy loam surface layer. The A horizon ranges from 5 to 16 inches in thickness. The B horizon is light yellowish-brown sandy clay loam to clay with mottles of pale yellow, yellow, brownish yellow, gray, yellowish red, and reddish yellow. The depth to bedrock ranges from 5 feet to 20 feet or more.

NASON SERIES.—In the Nason series are deep, well-drained soils in the Piedmont. They developed in residuum from fine-grained sericitic schist. Their subsoil is more yellow or brown than that of the Tatum soils.

Profile of Nason silt loam in a cultivated field 1 mile north of Catawba:

Ap—0 to 5 inches, grayish-brown (2.5Y 5/4) silt loam; weak, fine, granular structure; friable; many fine roots; few, small quartz pebbles on surface; pH 6.4; abrupt, smooth boundary; 2 to 12 inches thick.

B1—5 to 13 inches, yellow (2.5Y 7/6) silty clay loam; moderate, medium, subangular blocky structure; friable; few fine roots; few, small mica flakes; pH 6.7; clear, smooth boundary; 2 to 6 inches thick.

B2—13 to 28 inches, strong-brown (7.5YR 5/6) silty clay; moderate, medium, blocky structure; firm when moist, sticky when wet, hard when dry; few, fine mica flakes; pH 5.4; clear, smooth boundary; 15 to 25 inches thick.

B3—28 to 37 inches, yellowish-red (5YR 5/8) silty clay mottled with pale yellow (2.5Y 7/4); moderate, fine, blocky structure; firm when moist, sticky when wet, hard when dry; few flakes of weathered sericitic schist; many, fine mica flakes; pH 5.2; clear, wavy boundary; 8 to 20 inches thick.

C—37 to 42 inches +, strong-brown (7.5YR 5/8) silty clay loam mottled with yellowish red (5YR 4/8), pink (2.5YR 7/4), and pale yellow (2.5Y 6/4); massive (structureless); many flakes of weathered sericitic schist; common, medium, distinct mottles; pH 5.2; bedrock at 3 to 30 feet or more.

Range in characteristics.—The principal soil type in the Nason series is silt loam. The surface layer ranges from grayish brown to light grayish brown. The upper part of the subsoil ranges from brown to reddish brown; the lower part is mottled with brownish yellow and yel-

727-672—64——7

lowish red. Depth to weathered bedrock ranges from 3 to 20 feet or more.

TATUM SERIES.—The Tatum series consists of deep, well-drained soils in the Piedmont. They developed in residuum weathered from sericitic schist.

The Tatum soils have a redder subsoil than the Nason soils. They have a thicker solum, and their horizons are much more distinct than those of the Manteo soils.

Profile of Tatum silt loam in an idle field 1 mile west of Catawba Indian School:

Ap—0 to 5 inches, yellowish-brown (10YR 5/4) silt loam; weak, fine, granular structure; very friable; many fine roots; few, small quartz pebbles on the surface; pH 6.4; clear, smooth boundary; 2 to 10 inches thick.

B1—5 to 14 inches, red (2.5YR 4/8) silty clay loam; moderate, medium, subangular blocky structure; friable; many fine roots; few, very small quartz pebbles; pH 6.1; clear, smooth boundary; 4 to 10 inches thick.

B2—14 to 37 inches, red (2.5YR 4/8) silty clay; moderate, coarse, subangular blocky structure; friable; few fine roots; patchy clay films; pH 6.1; clear, smooth boundary; 10 to 25 inches thick.

B3—37 to 48 inches, red (2.5YR 4/8) silty clay; moderate, coarse, subangular blocky structure that crushes to weak, fine, subangular blocky structure; friable; few, fine, mica flakes; pH 5.8; clear, wavy boundary; 5 to 15 inches thick.

C—48 to 52 inches +, red (2.5YR 4/8) silty clay loam; many, medium and fine, distinct mottles of strong brown (7.5YR 6/8), yellowish red (5YR 5/8), and dark reddish brown (5YR 3/4); massive (structureless); many fine and very fine flakes of mica; flakes of disintegrated sericitic schist; pH 5.6; bedrock at 3 to 30 feet or more.

Range in characteristics.—The principal soil types in the Tatum series are silt loam and silty clay loam. The gravelly silt loam is a minor soil type and is mapped only where there is enough gravel to interfere with tillage. The silty clay loam type occurs where accelerated sheet erosion has removed the original surface layer. The color of the surface layer ranges from brown to light yellowish brown. The subsoil is a fairly uniform red. The depth to bedrock ranges from 3 to 30 feet or more.

VANCE SERIES.—The Vance series consists of deep, moderately well drained soils in the Piedmont. They developed in residuum that weathered mainly from granite, gneiss, and other acid crystalline rocks but to a minor extent from basic rock.

The Vance soils have a finer textured subsoil than the Cecil and Appling soils. They are better drained than the Helena and Colfax soils with which they occur.

Profile of Vance sandy loam in unimproved pasture 3 miles southwest of McConnells:

Ap—0 to 7 inches, yellowish-brown (10YR 5/6) sandy loam; weak, fine, granular structure; very friable; many fine roots; few, coarse sand grains and small quartz pebbles; pH 6.0; clear, smooth boundary; 2 to 12 inches thick.

B1—7 to 12 inches, strong-brown (7.5YR 5/6) sandy clay loam; moderate, medium, subangular blocky structure; friable to firm; few fine roots; pH 5.8; clear smooth boundary; 1 to 9 inches thick.

B2—12 to 32 inches, strong-brown (7.5YR 5/6) clay mottled with red (2.5YR 5/8) and brownish yellow (10YR 6/8); strong, coarse, blocky structure; firm when moist, slightly plastic when wet, hard when dry; common, fine and medium, prominent mottles; pH 5.6; gradual, wavy boundary; 14 to 24 inches thick.

B3—32 to 41 inches, light-red (2.5YR 6/8) clay mottled with brownish yellow (10YR 6/8), light yellowish brown (2.5Y 6/4), and light brownish gray (2.5Y 6/2); strong, thick, platy structure that breaks to weak, thin, platy structure; firm to very firm when moist, plastic when wet, hard when dry; common, fine and medium, prominent mottles; pH 5.5; gradual, wavy boundary; 3 to 16 inches thick.

C—41 to 45 inches +, red (2.5YR 4/6) sandy clay loam mottled with light brownish yellow (10YR 6/4) and white (2.5Y 8/2); grades to coarser material with increasing depth; massive (structureless); firm; hard when dry; pH 5.4; bedrock at 3 to 30 feet or more.

Range in characteristics.—The principal soil type in the Vance series is sandy loam. A minor type is clay loam, which occurs where the original surface layer has been removed by accelerated sheet erosion. The color of the surface layer ranges from light gray to yellowish brown. The subsoil is mottled with strong brown, brownish yellow, red, and brownish gray. Depth to weathered bedrock ranges from 3 to 30 feet or more.

WICKHAM SERIES.—The Wickham series consists of deep, well-drained soils on the stream terraces in the Piedmont. They have developed from old alluvium washed from soils that formed from materials weathered from granite, gneiss, schist, and basic rocks.

The subsoil of the Wickham soils is intermediate in color between that of the Hiwassee and Altavista soils. They have a more clayey subsoil than the Molena soils with which they occur.

Profile of Wickham sandy loam in a field 200 yards northeast of Irene Bridge:

Ap—0 to 7 inches, dark-brown (7.5YR 4/4) sandy loam; weak, fine, granular structure; very friable; many fine roots; few, fine mica flakes; pH 6.0; clear, smooth boundary; 3 to 8 inches thick.

B1—7 to 20 inches, reddish-brown (5YR 4/4) sandy clay loam; weak, fine, subangular blocky structure; very friable; few fine roots; few, fine mica flakes; pH 5.9; clear, smooth boundary; 6 to 15 inches thick.

B2—20 to 35 inches, yellowish-red (5YR 4/8) clay loam; moderate, medium, subangular blocky structure; friable when moist, slightly sticky when wet, hard when dry; few, fine mica flakes; pH 5.9; clear, smooth boundary; 12 to 18 inches thick.

B3—35 to 42 inches, red (2.5YR 4/8) clay with few, fine, faint mottles of yellowish red (5YR 5/8); moderate, coarse, subangular blocky structure; friable to firm when moist, slightly sticky when wet, hard when dry; few, fine mica flakes; pH 6.0; clear, wavy boundary; 4 to 10 inches thick.

C—42 to 46 inches +, red (2.5YR 4/8) sandy clay loam with common, medium, distinct mottles of yellowish red (5YR 5/8) and brownish yellow (10YR 6/8); grades to finer textured material with increasing depth; massive (structureless); pH 6.0; bedrock at 6 to 60 feet or more.

Range in characteristics.—The principal soil type in the Wickham series is sandy loam. The color of the surface layer ranges from dark brown to grayish brown. The color of the upper part of the subsoil ranges from brown to reddish brown but that of the lower part is mottled red and yellowish red. Depth to bedrock ranges from 10 to 100 feet or more.

RED-YELLOW PODZOLIC SOILS INTERGRADING TOWARD REDDISH-BROWN LATERITIC SOILS

The Lloyd are Red-Yellow Podzolic soils that have some characteristics of Reddish-Brown Lateritic soils. A dark-brown to reddish-brown surface layer and a darker red subsoil distinguish the Lloyd soils from the representative red soils in the Red-Yellow Podzolic group. The A2 horizon common to the Red-Yellow Podzolic soils is lacking in the Lloyd soils.

The B2 horizon in the Lloyd soils is not so dark red as the B2 horizon of the Davidson and Hiwassee soils, which are in the Reddish-Brown Lateritic group.

The depth to mottling is greater in Lloyd soils than in the normal Red-Yellow Podzolic soils.

LLOYD SERIES.—The Lloyd series consists of moderately deep to deep, well-drained soils in the Piedmont. They developed in residuum from mixed acidic and basic rocks, such as granite, gneiss, and schist. These rocks contained intrusions of diorite and similar dark-colored rock.

The Lloyd soils are not so red as the Davidson soils but are darker red than the Cecil soils. They are better drained than the browner Mecklenburg and Enon soils with which they occur.

Some soils in the Lloyd series have a compact subsoil. These soils have a darker red subsoil than the Cataula and Enon soils. They have a thicker solum than the Wilkes soils with which they occur.

Profile of Lloyd loam in a field of pines and a few gum and oak 0.5 mile east of New Zion Church:

A0—¼ inch to 0, very thin layer of partly decomposed organic matter.
Ap—0 to 8 inches, reddish-brown (5YR 3/4) loam; weak, fine, granular structure; friable; many fine and medium roots; pH 6.1; abrupt, smooth boundary; 4 to 10 inches thick.
B1—8 to 17 inches, red (2.5YR 4/6) clay loam; moderate, medium, subangular blocky structure; friable; many fine roots; few, small pores; pH 5.7; clear, smooth boundary; 6 to 14 inches thick.
B2—17 to 38 inches, red (2.5YR 4/6) clay; moderate, medium, subangular blocky structure; firm; few medium roots; few, fine pores; distinct clay films on ped faces; pH 5.9; clear, smooth boundary; 12 to 24 inches thick.
B3—38 to 44 inches, red (2.5YR 4/6) to dark-red (2.5YR 3/6) clay; moderate, fine, blocky structure; firm; patchy clay films on ped faces; pH 5.6; clear, wavy boundary; 3 to 15 inches thick.
C—44 to 48 inches +, red (2.5YR 4/6) clay loam mottled with reddish-yellow (5YR 6/6); massive (structureless); firm; fragments of dark-colored, weathered rock common; pH 5.5; bedrock at 3 to 40 feet or more.

Profile of Lloyd sandy loam, compact subsoil, in a peach orchard 3 miles southwest of York on county road No. 35:

Ap—0 to 6 inches, dark-brown (7.5YR 4/4) sandy loam; fine crumb structure; friable; few, small quartzite pebbles; few fine roots; pH 5.5; clear, smooth boundary; 2 to 8 inches thick.
B21—6 to 19 inches, red (2.5YR 4/6) clay; strong, medium, blocky structure; very firm and compact when moist, hard when dry, sticky when wet; thin, patchy clay films; many fine roots and pores; pH 5.3; clear, smooth boundary; 10 to 15 inches thick.
B22—19 to 35 inches, weak-red to red (10R 4/4 to 4/6) clay; strong, fine and medium, angular blocky structure; very firm and compact when moist, hard when dry, sticky when wet; continuous clay films; few, fine pores; pH 5.3; gradual, wavy boundary; 10 to 20 inches thick.
B3—35 to 47 inches, red (10R 4/6) clay which ranges to red (2.5YR 4/8) with increasing depth (mottles disappear when moist); strong, coarse, blocky structure; very firm and compact when moist, very hard when dry, sticky when wet; few, coarse sand grains and many, fine mica flakes; pH 5.4.

Range in characteristics.—The principal soil types in the Lloyd series are sandy loam, loam, and clay loam. Lloyd sandy loam, compact subsoil, is a minor phase.

Lloyd clay loam has a red surface layer and occurs where erosion has removed the original surface layer. The lower part of the B horizon may contain mottles of reddish yellow, especially in Lloyd soils that are closely associated with the Mecklenburg and Enon soils. Depth to weathered bedrock ranges from 3 to 40 feet or more.

The color of the surface soil of Lloyd sandy loam, compact subsoil, ranges from dark grayish brown to brown. The color of the B horizon, or subsoil, ranges from weak red to red. The texture of the B horizon is clay. The thickness of the saprolite above the bedrock is generally 5 to 10 feet or more. The consistency of the B horizon is very firm and compact. Where the plow layer has a clay loam texture, the original surface layer has been lost through accelerated sheet erosion. Shallow gullies are common on this soil. Quartz gravel occurs on the surface of a few small areas.

RED-YELLOW PODZOLIC SOILS INTERGRADING TOWARD LOW-HUMIC GLEY SOILS

The Colfax are Red-Yellow Podzolic soils that have some characteristics of Low-Humic Gley soils. These soils have a light-colored, fairly coarse-textured A horizon and a mottled, firm B2 horizon. Their drainage is somewhat poor, and mottling begins at a depth of 18 to 25 inches.

COLFAX SERIES.—The Colfax series consists of deep, somewhat poorly drained soils in the Piedmont that developed in residuum weathered from granite, gneiss, and schist. These soils occur at the head of drainageways and on low ridges between drainageways.

The Colfax soils occupy a lower position and are not so well drained as the Cecil, Appling, and Durham soils with which they occur.

Profile of Colfax sandy loam in an idle field 1 mile southwest of Neelys Creek Church:

Ap—0 to 7 inches, olive-gray (5Y 5/2) sandy loam; weak, fine, granular structure; very friable; many fine roots; few, coarse quartzite sand grains; pH 6.0; clear, smooth boundary; 4 to 8 inches thick.
A2—7 to 13 inches, pale-yellow (5Y 8/4) sandy loam; weak, coarse, granular structure; very friable; few fine roots; pH 5.8; clear, smooth boundary; 4 to 10 inches thick.
B1—13 to 23 inches, olive-yellow (2.5Y 6/6) sandy clay loam; moderate, medium, blocky structure; friable to firm when moist, slightly sticky when wet; pH 5.1; clear, smooth boundary; 8 to 16 inches thick.
B2—23 to 34 inches, light yellowish-brown (2.5Y 6/4) clay; common, fine and medium, distinct brownish-yellow (10YR 6/8) mottles; strong, medium, blocky structure; firm when moist, sticky when wet, and hard when dry; many, fine mica flakes; pH 5.0; clear, smooth boundary; 8 to 16 inches thick.
B3—34 to 50 inches, light brownish-gray (2.5Y 6/2) clay; common, medium, prominent, brownish-yellow (10YR 6/8) mottles; strong, coarse, blocky structure; firm to very firm when moist, sticky when wet, and hard when dry; many, fine mica flakes; pH 5.0; clear, wavy boundary; 12 to 20 inches thick.
C—50 to 55 inches +, light-gray (5Y 7/1) coarse sandy clay; many, fine and medium, distinct mottles of yellowish brown (10YR 5/8), brownish yellow (10YR 6/8), and red (2.5YR 5/8); massive (structureless); many, fine mica flakes; pH 4.6; depth to bedrock varies.

Range in characteristics.—The principal soil type in the Colfax series is sandy loam. The surface layer is olive to grayish-brown sandy loam, and the upper part of the subsoil is yellowish-brown to olive-yellow sandy clay loam. The lower part of the subsoil is compact clay mottled with brownish yellow, yellowish brown, and brownish gray. Thickness of the saprolite above bed-

rock ranges from 3 to 6 feet or more. In places a deposit of soil material 3 to 10 inches thick that washed or rolled from higher lying soils is on the surface.

Reddish-Brown Lateritic soils

This group consists of soils that have a dusky-red to reddish-brown, granular surface layer, a B horizon of dark-red, friable to firm clay, and red or reticulately mottled parent material. The typical soils of this great soil group developed in a humid, tropical climate with wet-dry seasons and tropical forest vegetation (*18*).

The Reddish-Brown Lateritic soils in York County, however, did not develop in a tropical climate. They developed in a climate ranging from warm to temperate. Their subsoil is a little less friable than is typical for this great soil group. The clay in these soils is dominantly kaolinite rather than sesquioxides and is not significantly different from that in the Red-Yellow Podzolic soils. Soils in this group have a dusky-red or reddish-brown granular surface layer and a thick, dark-red to red B horizon that is clay to silty clay in texture. But they do not have the distinct leached A2 horizon that is common in the Red-Yellow Podzolic soils.

In York County the soils in the Reddish-Brown Lateritic great soil group are the Davidson and Hiwassee.

DAVIDSON SERIES.—In the Davidson series are deep, well-drained soils in the Piedmont. They developed in residuum from gabbro, diorite, hornblende schist, and other dark-colored basic rocks. Their surface layer and subsoil are darker red than the Lloyd, Mecklenburg, and Iredell soils with which they occur.

Profile of Davidson clay loam in a cultivated field 4 miles northeast of Smiths Turnout:

Ap—0 to 5 inches, dusky-red (10R 3/3) clay loam; weak, fine, granular structure; friable; sticky when wet, hard when dry; many fine roots; pH 6.5; clear, smooth boundary; 3 to 8 inches thick.

B1—5 to 15 inches, dusky-red (10R 3/4) clay loam; weak, fine, subangular blocky structure; friable when moist, sticky when wet, hard when dry; few fine roots; pH 6.3; clear, smooth boundary; 8 to 12 inches thick.

B2—15 to 37 inches, dark-red (10R 3/6) clay; moderate, medium, subangular blocky structure; firm when moist, very sticky when wet, hard when dry; pH 6.5; clear, smooth boundary; 20 to 36 inches thick.

B3—37 to 50 inches, red (10R 4/6) clay; moderate, fine and medium, subangular blocky structure; firm; very sticky when wet, hard when dry; pH 5.7; clear, wavy boundary; 8 to 14 inches thick.

C—50 to 54 inches +, red (10R 4/6) clay loam mottled with reddish yellow (7.5YR 6/8); massive (structureless); friable; few, fine quartz pebbles; many dark-colored concretions of manganese; few fragments of weathered, dark-colored basic rock; pH 5.7; several feet to bedrock.

Range in characteristics.—The principal soil types in the Davidson series is clay loam. The surface layer ranges from dusky red to dark red. The subsoil ranges from dark red to red and is sticky clay. This soil locally is called push-dirt. Thickness of the solum ranges from 4 to 6 feet, and depth to bedrock ranges from 10 to 50 feet or more.

HIWASSEE SERIES.—The Hiwassee series consists of deep, well-drained soils on the high river terraces in the Piedmont. They developed in old alluvium that washed from material weathered from dark-colored rocks.

The Hiwassee soils are redder than the Wickham soils. They have more clay in their B horizon than the Molena soils. They developed from different parent material than the Cecil and Lloyd soils. Also, they have a well-developed profile that the Wilkes soils do not have.

Profile of Hiwassee sandy loam in an idle field 2 miles south of Fort Mill:

Ap—0 to 6 inches, reddish-brown (5YR 5/4) sandy loam; weak, medium, crumb structure; very friable; many fine roots; few, small and medium, water-rounded pebbles and few, water-rounded rocks 3 to 10 inches in diameter on the surface; pH 5.8; clear, smooth boundary; 4 to 8 inches thick.

B1—6 to 20 inches, dark-red (10R 3/6) clay loam; moderate, medium, subangular blocky structure; friable; sticky when wet; few fine roots; pH 5.8; clear, smooth boundary; 12 to 18 inches thick.

B2—20 to 60 inches, dark-red (10R 3/6) silty clay; moderate, fine, subangular blocky structure; friable; sticky when wet; pH 6.1; clear, smooth boundary; 10 to 50 inches thick.

B3—60 to 70 inches, red (10R 4/6) clay; moderate, fine, blocky structure; firm when moist, sticky when wet, hard when dry; black and brown, water-rounded pebbles; pH 5.7; clear, wavy boundary; 6 to 20 inches thick.

C—70 to 75 inches +, red (2.5YR 5/8) sandy clay loam mottled with brownish yellow (10YR 6/8); friable when moist, sticky when wet, hard when dry; massive (structureless); few, fine, distinct mottles; water-rounded gravel and water-rounded rocks 3 to 12 inches in diameter; pH 5.6; several feet to bedrock.

Range in characteristics.—The principal soil type in the Hiwassee series is sandy loam, but in places there is fine sandy loam, loam, and clay loam. The clay loam soil type occurs where all the original surface layer has been removed by accelerated sheet erosion. The surface layer of Hiwassee soils ranges from reddish black to red, and the subsoil ranges from dark red to red. The texture of the subsoil is clay loam to clay. In places a few water-rounded pebbles are on the surface. Hiwassee soils also have a stony or gravelly B3 horizon in places. Depth to bedrock ranges from 10 to 80 feet or more.

REDDISH-BROWN LATERITIC SOILS INTERGRADING TOWARD PLANOSOLS

The Mecklenburg is a Reddish-Brown Lateritic soil that has some of the characteristics of Planosols. The Mecklenburg soils are better drained than Planosols but have a mottled, plastic clay layer similar to that in the Planosols.

MECKLENBURG SERIES.—In the Mecklenburg series are deep, moderately well drained to well drained soils in the Piedmont. They developed in residuum from hornblende gneiss, schist, gabbro, diorite, and other weathered basic rocks.

They are browner and have slower internal drainage than the Davidson, Lloyd, and Cecil soils, They are not so sticky as Enon soils and show more influence from basic rocks. They have better internal drainage than the Iredell soils. They have a thicker solum and more distinct horizons than the Wilkes soils.

Profile of Mecklenburg loam in an idle field 1.5 miles southeast of old Oak Ridge School:

Ap—0 to 5 inches, dark-brown (7.5YR 4/2) loam; weak, fine, crumb structure; friable; many fine roots; few, dark concretions; pH 5.9; clear, smooth boundary; 3 to 8 inches thick.

B1—5 to 11 inches, yellowish-red (5YR 4/8) clay loam; moderate, medium, subangular blocky structure; friable; few fine roots; few, dark concretions; pH 6.1; clear, smooth boundary; 3 to 9 inches thick.

B2—11 to 27 inches, yellowish-red (5YR 5/6) clay mottled with reddish-yellow (7.5YR 6/8); moderate, medium, subangular blocky structure; firm when moist, sticky when wet; few, dark concretions; distinct clay films on ped faces; few, fine, faint mottles; pH 6.3; clear, smooth boundary; 7 to 18 inches thick.

B3—27 to 37 inches, brown (7.5YR 5/4) clay mottled with reddish yellow (7.5YR 6/8) and yellowish brown (10YR 5/6); medium, coarse, subangular blocky structure that breaks to weak, fine, subangular blocky structure; firm when moist, hard when dry, sticky when wet; clay films on peds faces; common, medium, distinct mottles; pH 6.1; clear, wavy boundary; 5 to 18 inches thick.

C—37 to 72 inches, strong-brown (7.5YR 5/6) silty clay loam mottled with pale brown (10YR 6/3) and yellowish red (5YR 5/8); grades to coarser material with increasing depth; massive (structureless); friable; many dark concretions; common, fine and medium, distinct mottles; weathered, dark, basic rock fragments at about 70 inches; pH 6.1; bedrock at 2 to 35 feet.

Range in characteristics.—The principal soil types in the Mecklenburg series are loam and clay loam. The clay loam occurs where the original surface layer has been removed by accelerated erosion. The A horizon of the Mecklenburg soils ranges from dark brown to brown. The B horizon ranges from yellowish red to brown. Dark-colored concretions are on the surface and occur in pockets in a few places. Depth to bedrock ranges from 3 to 20 feet or more.

Planosols

This group of soils have, because of high clay content or compaction (*18*), one or more horizons abruptly separated from and sharply contrasting to an adjacent horizon. The most widely distributed Planosols have a B horizon that is high in plastic clay. It underlies an A horizon that is much lower in clay, and there is an abrupt boundary between the two horizons. In York County the soils in the Planosol great soil group are in the Elbert and Iredell series.

The Elbert soils have a dark-colored surface layer. Because of their fine-textured, plastic subsoil, the Elbert and Iredell soils have slow drainage.

ELBERT SERIES.—In the Elbert series are deep, poorly drained soils on upland flats, in swales, and at the head of drainageways in the Piedmont. They developed in residuum from gabbro and other dark-colored basic rocks mixed with local alluvium.

The Elbert soils are more poorly drained than the Iredell and Mecklenburg soils with which they occur.

Profile of Elbert loam in a field 1 mile southeast of New Zion Church:

Ap—0 to 8 inches, very dark gray (10YR 3/1) loam; weak, fine, crumb structure; friable when moist, sticky when wet; many fine roots; few, small, dark concretions; pH 6.0; abrupt, smooth boundary; 4 to 10 inches thick.

B2—8 to 26 inches, very dark grayish-brown (10YR 3/2) clay; strong, medium, blocky structure; very firm when moist, hard when dry, and plastic when wet; few, dark concretions; pH 6.6; clear, smooth boundary; 12 to 24 inches thick.

B3—26 to 37 inches, dark grayish-brown (10YR 4/2) clay mottled with olive (5Y 4/4); strong, coarse, blocky structure; very firm when moist, hard when dry, and plastic when wet; common, fine, distinct mottles; pH 8.2; clear, wavy boundary; 8 to 16 inches thick.

C—37 to 40 inches +, pale-olive (5Y 6/4) weathered parent material mottled with olive (5Y 4/4), dark yellowish brown (10YR 4/4), and light olive brown (2.5Y 5/4); massive (structureless); pH 8.5; bedrock at 4 to 10 feet or more.

Range in characteristics.—The principal soil type in the Elbert series is loam. The surface soil is very dark gray to grayish-brown loam, and the upper part of the subsoil is very dark grayish-brown to dark-brown clay. The lower part of the subsoil is dark grayish-brown clay mottled with olive. The quantity of concretions ranges from none to common or more. The thickness of local alluvium ranges from almost 0 to 18 inches or more.

IREDELL SERIES.—In the Iredell series are shallow to moderately deep, moderately well drained to somewhat poorly drained, very slowly permeable soils in the Piedmont. They developed in residuum weathered from diorite, gabbro, hornblende gneiss, and other basic rocks.

They have a more plastic and less permeable subsoil than the Mecklenburg and Enon soils and a thinner solum. They have much more distinct horizons and a thicker solum than the Wilkes soils.

Profile of Iredell sandy loam in an improved pasture 0.5 mile south of Bethesda Church:

Ap—0 to 5 inches, very dark grayish-brown (10YR 3/2) sandy loam; weak, fine, granular structure; friable; many fine roots; many, small, dark concretions; pH 5.7; clear, smooth boundary; 3 to 7 inches thick.

A2—5 to 9 inches, dark grayish-brown (2.5Y 4/4) sandy loam; weak, fine and medium, granular structure; friable; many fine roots; few dark concretions; pH 6.0; abrupt smooth boundary; 3 to 9 inches thick.

B21—9 to 18 inches, yellowish-brown (10YR 5/6) clay; moderate, medium, blocky structure; very firm when moist, plastic and sticky when wet, hard when dry; few fine roots; few, dark concretions; distinct clay films; pH 6.2; clear, smooth boundary; 5 to 13 inches thick.

B22—18 to 27 inches, light yellowish-brown (10YR 6/4) clay mottled with light brownish gray (2.5Y 6/2); strong, coarse, blocky structure; very firm when moist, very sticky and plastic when wet, very hard when dry; distinct, continuous clay films, pH 6.3; clear, wavy boundary; 6 to 12 inches thick.

C—27 to 30 inches +, olive-brown (2.5Y 4/4) weathered parent material mottled with yellowish brown (10YR 5/6), green, and black; massive (structureless); dark rock fragments; many dark concretions; pH 6.5; bedrock at 18 inches to 4 feet or more.

Range in characteristics.—The principal soil types in the Iredell series are loam, sandy loam, and very stony loam. The A horizon ranges from very dark grayish brown to light brown. The B horizon is yellowish brown mottled with light brownish gray and olive gray. The subsoil is firm to very firm, plastic clay. Dark-colored concretions in most places are on the surface and in many places throughout the profile. Depth to bedrock ranges from 18 inches to 4 feet or more.

Low-Humic Gley soils

Low-Humic Gley soils are imperfectly drained to poorly drained. They have a very thin surface horizon that is moderately high in organic matter. This horizon overlies mottled gray and brown, gleylike mineral horizons that have a low degree of textural differentiation (*15*). They are intrazonal soils in which the dominant soil-forming process is gleization.

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The Low-Humic Gley soils in York County are the Roanoke and Worsham. The Worsham soils developed under a pine and hardwood forest. The Roanoke soils developed under hardwoods. Both have characteristics that reflect the influence of nearly level to gently sloping relief, a high water table, and impeded drainage over the effects of climate and vegetation. The surface layer ranges from dark grayish brown to black. The subsoil ranges from mottled yellow, brown, and gray to dominantly gray. The texture ranges from sandy clay loam to clay.

The Worsham soils are at the head of streams and along drainageways in the Piedmont. They formed in residuum derived from granite, gneiss, and schist. The Roanoke soils developed in general alluvium on stream terraces. They are poorly drained. Grayish mottling is very near the surface; at greater depths, gray is the dominant color.

ROANOKE SERIES.—The Roanoke series consists of deep, poorly drained soils on stream terraces in the Piedmont. They developed in medium-textured and fine-textured old alluvium derived from such rocks as mica schist, mica gneiss, hornblende gneiss, and granite.

The Roanoke soils are more poorly drained and have a firmer clay subsoil than the Altavista and Wickham soils with which they occur.

Profile of Roanoke silt loam in a field 3 miles northeast of Catawba:

Ap—0 to 7 inches, dark grayish-brown (2.5Y 4/2) silt loam; weak, fine, crumb structure; friable; many fine roots; few, small mica flakes; pH 6.3; clear, smooth boundary; 4 to 10 inches thick.

B1—7 to 12 inches, olive-gray (5Y 5/2) silty clay loam mottled with dark brown (10YR 4/3); moderate, fine, blocky structure; firm when moist, sticky when wet; few fine roots; few, fine mica flakes; common, fine, distinct mottles; pH 6.1; clear, smooth boundary; 2 to 10 inches thick.

B2g—12 to 30 inches, gray (5Y 5/1) clay mottled with dark yellowish brown (10YR 4/4) and brownish yellow (10YR 6/8); strong, medium and fine, blocky structure; very firm when moist, hard when dry, sticky when wet; few mica flakes; patchy clay films on ped faces; few, fine, distinct mottles; pH 5.8; clear, smooth boundary; 12 to 24 inches thick.

B3g—30 to 38 inches, gray (5Y 6/1) clay mottled with olive (5Y 5/6) and reddish yellow (7.5YR 6/8); strong, coarse, blocky structure that crushes to weak, fine, blocky structure; firm when moist, hard when dry, sticky when wet; few, fine, distinct mottles; pH 5.7; clear, wavy boundary; 6 to 12 inches thick.

C—38 to 42 inches +, gray (5Y 6/1) fine sandy clay loam mottled with reddish yellow (7.5YR 6/8) and yellowish red (5 YR 5/8); grades to finer material with increasing depth; massive (structureless); firm to friable; many, fine mica flakes; common, medium, distinct mottles; pH 5.4; several feet to bedrock.

Range in characteristics.—The principal soil type in the Roanoke series is silt loam. The surface layer ranges from dark grayish brown to dark gray, and the subsoil is mottled dark brown and gray. In most places this soil is underlain by stratified sand and gravel at a depth ranging from 4 to 10 feet or more.

WORSHAM SERIES.—The Worsham series consists of deep, poorly drained soils in small drainageways and in low, upland depressions in the Piedmont. These soils formed in a mixture of colluvium and local alluvium, or in residuum derived from granite, gneiss, or schist.

The Worsham soils occupy a lower position and are more poorly drained than the Colfax, Helena, Enon, Durham, Appling, and Cecil soils with which they occur.

Profile of Worsham sandy loam in an idle field 0.4 mile east of Philadelphia Church:

Ap—0 to 5 inches, black (2.5Y 2/0) sandy loam; weak, fine, granular structure; very friable; many fine roots; few, fine mica flakes; pH 6.4; abrupt, smooth boundary; 2 to 8 inches thick.

A2—5 to 11 inches, dark-gray (10YR 4/1) sandy loam; weak, fine, granular structure; very friable; many fine roots; pH 6.8; clear, smooth boundary; 3 to 10 inches thick.

B1—11 to 19 inches, grayish-brown (10YR 5/2) sandy clay loam; common, fine, distinct mottles of light olive brown (2.5Y 5/4); moderate, medium, subangular blocky structure; friable to firm when moist, hard when dry, sticky when wet; few fine roots; few, fine mica flakes; pH 6.9; clear, smooth boundary; 5 to 12 inches thick.

B2g—19 to 33 inches, light-gray (2.5Y 7/2) sandy clay; common, medium, distinct mottles of yellowish brown (10YR 5/8); strong, coarse, blocky structure; firm when moist, sticky when wet, hard when dry; pH 7.0; clear, smooth boundary; 8 to 16 inches thick.

B3g—33 to 38 inches, gray (10YR 6/1) sandy clay; common, coarse, distinct mottles of strong brown (7.5YR 5/8); strong, coarse, blocky structure; firm to very firm; many, fine mica flakes; pH 7.0; clear, wavy boundary; 3 to 10 inches thick.

Cg—38 to 40 inches +, light-gray (2.5Y 7/0) sandy clay; medium, distinct mottles of yellowish brown (10YR 5/6); massive (structureless); hard when dry, sticky when wet; numerous, fine mica flakes; small shalelike fragments of disintegrated granite; fine to medium quartz pebbles; pH 7.1; grades to coarser material with increasing depth.

Range in characteristics.—The principal soil type in the Worsham series is sandy loam. The surface layer ranges from dark gray to black. In places there may be overwash as much as 18 inches thick. The color range of this material is from yellowish brown to dark grayish brown. The subsoil ranges from gray to brown; the degree of mottling varies. Depth to weathered bedrock is variable.

Lithosols

Lithosols are soils that have very weakly expressed soil horizons; they consist of freshly weathered and imperfectly weathered materials that are shallow over bedrock. These soils have gently sloping to steep relief, on which geologic erosion is relatively rapid. As a result, the soil-forming processes have not acted long enough on these materials to produce well-defined soil properties (*18*).

In York County, the Louisburg, Manteo, and Wilkes soils are in the Lithosol great soil group.

LOUISBURG SERIES.—In the Louisburg series are shallow to moderately deep, well-drained to somewhat excessively drained soils in the Piedmont. They developed in residuum from coarse-grained granite or gneiss under a mixed hardwood and pine forest.

The Louisburg soils lack the thick solum and distinct horizon development of the Cecil, Appling, and Durham soils with which they occur.

Profile of Louisburg sandy loam in a field 0.2 mile southeast of Clover:

Ap—0 to 7 inches, dark grayish-brown (2.5Y 4/2) sandy loam; weak, fine, granular structure; very friable; many fine roots; few, fine mica flakes; few, coarse sand grains; pH 6.5; clear, smooth boundary; 4 to 9 inches thick.

A2—7 to 16 inches, pale-olive (5Y 6/3) sandy loam; weak, medium, granular structure that crushes to weak, fine, granular structure; very friable; few fine roots; few, fine mica flakes; few, coarse sand grains; pH 6.7; clear, wavy boundary; 2 to 12 inches thick.

B2—16 to 20 inches, light yellowish-brown (2.5Y 6/4) sandy clay loam; weak, medium, subangular blocky structure; friable; many, fine mica flakes; few fragments of weathered parent material; pH 6.8; clear, wavy boundary; 0 to 8 inches thick.

C—20 to 24 inches, light-gray (2.5Y 7/2), partly weathered. coarse-grained granite mottled with yellow (2.5Y 7/6), brownish yellow (10YR 6/8), and light olive brown (2.5Y 5/6); massive (structureless); many rock fragments; many, fine mica flakes; many, fine and medium, distinct mottles; pH 6.5; abrupt, wavy boundary; variable thickness.

D—24 inches, hard granite rock.

Range in characteristics.—The principal soil type in the Louisburg series is sandy loam.

The color of the A horizon ranges from dark grayish brown to pale olive. The B horizon is discontinuous, especially in sloping areas. Rock crops out commonly on the steep slopes. Depth to bedrock ranges from 20 to 42 inches or more.

MANTEO SERIES.—In the Manteo series are well-drained to excessively drained, shallow soils in the Piedmont. They have developed in residuum from sericitic schist under a hardwood and pine forest.

Manteo soils are shallower, have a thinner B horizon that has less distinct development, and are more variable throughout than the Tatum and Nason soils with which they occur.

Profile of Manteo channery silt loam in woodland 0.1 mile southwest of museum at Kings Mountain National Military Park:

A1—0 to 4 inches, grayish-brown (10YR 5/2) channery silt loam; weak, medium and fine, granular structure; friable; numerous fine roots; many schist fragments; few, fine mica flakes; pH 5.1; clear, smooth boundary; 1 to 5 inches thick.

A2—4 to 9 inches, light olive-brown (2.5YR 5/4) channery silt loam; weak, medium, granular structure; many fine roots and few medium roots; many small pebbles and fragments of schist; pH 5.2; clear, smooth boundary; 1 to 7 inches thick.

B—9 to 12 inches, yellowish-brown (10YR 5/8) silty clay; strong, medium, blocky structure; firm when moist; few fine and medium roots; many fragments of schist; few mica flakes; pH 5.1; clear, wavy boundary; 1 to 8 inches thick.

C—12 to 19 inches, yellowish-brown (10YR 5/8) partly weathered sericitic schist mottled with reddish yellow (5YR 6/8), light gray (10YR 7/1), and white (10YR 8/1); massive (structureless); friable; many small and medium fragments of schist; many, fine mica flakes; pH 5.1; clear, wavy boundary; 4 to 20 inches thick.

D—19 inches +, schist bedrock.

Range in characteristics.—The principal soil type in the Manteo series is channery silt loam. The surface layer ranges from grayish brown to light olive gray. The B horizon is yellowish brown to brown and is discontinuous. Depth to bedrock ranges from 6 to 26 inches or more.

WILKES SERIES.—The Wilkes series consists of shallow, well-drained soils in the Piedmont. They developed in residuum that weathered from acidic rock intrusions or dykes of dark-colored basic rock under a mixed hardwood and pine forest.

The Wilkes soils are distinguished from the Lloyd, Mecklenburg, Enon, Helena, and Iredell soils by having a shallow or discontinuous B horizon and much less horizon development.

Profile of Wilkes sandy loam in a stand of young pines 6 miles east of York near Fishing Creek:

Ap—0 to 7 inches, dark-brown (10YR 4/3) sandy loam; weak, fine, granular structure; very friable; many fine roots; few, medium and fine quartz pebbles; pH 5.5; abrupt, smooth boundary; 4 to 14 inches thick.

B—7 to 12 inches, reddish-yellow (7.5YR 6/6) clay loam mottled with brownish yellow (10YR 6/8) and yellowish red (5YR 4/8); weak, fine, blocky structure; friable; many fine roots; few, fine mica flakes; few small pebbles; common, fine, distinct mottles; pH 6.5; clear, wavy boundary; 0 to 8 inches thick.

C—12 to 15 inches +, strong-brown weathered rock (7.5YR 5/6) mottled with reddish brown (5YR 4/4) and yellow (10YR 7/6); massive (structureless); common, fine, distinct mottles; pH 6.8; bedrock at 2 to 20 feet or more.

Range in characteristics.—The principal soil type in the Wilkes series is sandy loam, but gravelly sandy loam and loam occur in a few small areas. The surface layer ranges from dark brown to grayish brown. The color of the B horizon is variable—red, brown, yellow, or mottled. The consistence of the subsoil varies from nonplastic to plastic. In some places gravel in considerable amounts or fragments of weathered parent material occur in the solum. The B horizon is discontinuous, especially on the stronger slopes. Depth to bedrock ranges from 2 to 20 feet or more.

Regosols

The Regosol great soil group consists of soils that are developing in deep, unconsolidated deposits or soft rocks and are without definite genetic horizons (*17*). The Molena soils are the only Regosols in York County. They are developing in beds of unconsolidated sand deposited on high stream terraces by the larger streams. They are sandy throughout the profile.

MOLENA SERIES.—The Molena series consists of deep, well-drained to excessively drained soils on the stream terraces in the Piedmont. They developed in old alluvium washed from soils derived from granite, gneiss, and schist.

The Molena soils are sandier and more excessively drained than the Altavista, Wickham, and Hiwassee soils with which they occur.

Profile of Molena loamy sand in a field 2 miles west of Mt. Hopewell Church:

Ap—0 to 7 inches, dark-brown (10YR 4/3) loamy sand; weak, fine, granular structure; very friable; many fine roots; few, fine mica flakes; few, small, water-rounded quartz pebbles on the surface; pH 6.3; clear, smooth boundary; 4 to 9 inches thick.

A2—7 to 24 inches, reddish-brown (5YR 5/4) loamy sand; weak, fine, granular structure; very friable; few fine roots; few, fine mica flakes; pH 6.1; clear, smooth boundary; 10 to 22 inches thick.

B2—24 to 30 inches, yellowish-red (5YR 4/8) light sandy loam; very weak, medium, subangular blocky structure; very friable; few, fine mica flakes; pH 5.9; clear, smooth boundary; 2 to 8 inches thick.

B3—30 to 65 inches, reddish-yellow (5YR 6/8) sand; loose; very friable; many, fine mica flakes; pH 6.0; clear, wavy boundary; 20 to 40 inches thick.

C—65 to 68 inches +, reddish-yellow (7.5YR 7/8) sand; loose; very friable; many, fine mica flakes; few, small and medium, water-rounded pebbles; pH 6.2; several feet to bedrock.

Range in characteristics.—The principal soil type in the Molena series is loamy sand. The surface layer ranges from dark brown to pale brown. The subsoil ranges from red to reddish brown, and its texture is sandy loam. Depth to bedrock ranges from 10 to 40 feet or more.

Alluvial soils

This great soil group consists of soils that are developing in alluvium that has been transported and has been fairly recently deposited. The original soil material has been modified little, or not at all, by soil-forming processes.

Soils of the Buncombe and Congaree series are in this group.

The soils of these series occupy flood plains and may receive or lose material during floods. In areas where the deposits are very recent, the soils have no horizon differentiation. In areas where the deposits are older, the Buncombe soils have slight horizon differentiation and the Congaree slight to moderate differentiation. The native vegetation consisted of hardwoods and a few pines.

The Congaree soils are representative of the Alluvial soils. They are well drained, brownish in color, and moderately coarse textured.

The Buncombe soils are Alluvial soils that have some characteristics of Regosols. They are without definite genetic horizons and are developing in deep, unconsolidated, recent deposits of sandy material. They are excessively drained, brownish in color, and coarse textured.

BUNCOMBE SERIES.—In the Buncombe series are deep, excessively drained soils on the first bottoms of larger streams in the Piedmont. They are developing in materials that washed from soils derived from granite, gneiss, and schist. They are droughty and more excessively drained than the Congaree and Chewacla soils with which they occur.

Profile of Buncombe loamy sand in an idle field about 5 miles west of Mt. Hopewell Church near the Broad River:

Ap—0 to 6 inches, very dark grayish-brown (10YR 3/2) loamy sand; weak, fine, granular structure; very friable; many fine roots; few, small, water-rounded pebbles on surface; fine mica flakes are common; pH 6.2; clear, smooth boundary; 4 to 8 inches thick.

A2—6 to 11 inches, dark-brown (10YR 4/3) loamy sand; weak, fine, granular structure; very friable; few fine roots; many, fine mica flakes; pH 6.3; abrupt, smooth boundary; 2 to 10 inches thick.

C1—11 to 24 inches, yellowish-brown (10YR 5/8) sand with narrow horizontal streaks of dark brown (10YR 4/3); loose; very friable; many fine mica flakes; pH 6.4; gradual, smooth boundary; 9 to 24 inches thick.

C2—24 to 48 inches +, yellowish-brown (10YR 5/8) sand streaked with brown (10YR 5/3) and yellow (10YR 7/8); loose; very friable; few, small, water-rounded quartz pebbles; many fine mica flakes; pH 6.4; several feet to bedrock.

Range in characteristics.—The principal soil type in the Buncombe series is loamy sand. The A horizon ranges from dark grayish brown to pale brown. The C horizon ranges from dark brown to yellowish brown and is usually sand in texture. The underlying strata, beginning at a depth of 24 to 48 inches, is fine sand, coarse sand, or gravel.

CONGAREE SERIES.—The Congaree series consists of deep, well-drained soils on the first bottoms of large streams in the Piedmont. These soils are forming in sediments that washed from soils derived from granite, gneiss, and schist.

The Congaree soils are better drained than the Chewacla soils and not so droughty as the Buncombe soils with which they occur.

Profile of Congaree fine sandy loam in improved pasture 6 miles northeast of Leslie:

Ap—0 to 7 inches, dark grayish-brown (10YR 4/2) fine sandy loam; weak, fine, granular structure; very friable; many fine roots; many small pores or worm holes; pH 5.8; clear, smooth boundary; 4 to 10 inches thick.

A2—7 to 25 inches, yellowish-brown (10YR 5/4) fine sandy loam; weak, fine, granular structure; very friable; many fine roots; many fine pores; many, fine mica flakes; pH 5.4; clear, smooth boundary; 10 to 20 inches thick.

A3—25 to 33 inches, dark yellowish-brown (10YR 4/4) fine sandy loam; weak, coarse, granular structure that crushes to weak, fine, granular structure; very friable; many small pores; many, fine mica flakes; pH 5.7; clear, smooth boundary; 4 to 12 inches thick.

C—33 to 44 inches +, dark-brown (10YR 4/3) loamy fine sand mottled with yellowish brown (10YR 5/6) and grayish brown (10YR 5/2); massive (structureless); loose; many, fine mica flakes; common, fine and medium, faint mottles; pH 6.0; 10 to 80 inches thick.

Range in characteristics.—The principal soil type in the Congaree series is fine sandy loam. The surface layer is dark grayish-brown to light brownish-gray fine sandy loam. Fine sand with mottles of dark brown, grayish brown, and yellowish brown occurs at a depth of 24 to 28 inches. Mica flakes are present throughout the profile. The thickness of the alluvium ranges from 6 to 24 inches or more.

ALLUVIAL SOILS INTEGRADING TOWARD LOW-HUMIC GLEY SOILS

The Chewacla are Alluvial soils that have some characteristics of Low-Humic Gley soils. They are developing in young alluvium on flood plains under a cover of hardwoods. They are faintly mottled below a depth of 12 to 20 inches and distinctly mottled below a depth of 20 to 30 inches. The Chewacla soils are somewhat poorly drained to moderately well drained.

CHEWACLA SERIES.—The soils of the Chewacla series are deep and moderately well drained to somewhat poorly drained. They occupy low first bottoms of the larger streams in the Piedmont and are forming in sediments that washed from soils derived from granite, gneiss, and schist.

The Chewacla soils are more poorly drained than the Congaree and Buncombe soils with which they occur.

Profile of Chewacla silt loam in a pasture 6 miles southeast of Fort Mill on the Catawba River flood plain:

Ap—0 to 7 inches, grayish-brown (10YR 5/2) silt loam; weak, fine, granular structure; very friable; many fine roots; few, very fine mica flakes; very slick when wet; pH 5.7; clear, smooth boundary; 4 to 9 inches thick.

A11—7 to 16 inches, dark-brown (7.5YR 4/4) silt loam; weak, fine, granular structure; very friable; many fine roots; many, fine mica flakes; pH 6.0; clear, smooth boundary; 6 to 12 inches thick.

C1—16 to 30 inches, dark-brown (10YR 4/3) silt loam with grayish-brown (10YR 5/2) mottles; moderate, medium, granular structure; friable; fine flakes of mica; few, small, water-rounded pebbles; medium, fine, distinct mottles; pH 6.2; clear, smooth boundary; 10 to 20 inches thick.

C2—30 to 36 inches +, yellowish-brown (10YR 5/6) silty clay loam, mottled dark brown (7.5YR 4/4) and gray (10YR 5/1); weak, coarse, blocky structure; friable; dark stains of organic matter; many, fine flakes of mica; common, medium, distinct mottles; pH 5.7.

Range in characteristics.—The principal soil type in the Chewacla series is silt loam. The surface layer ranges from dark grayish brown to pale brown, and the subsurface soil ranges from pale brown to dark brown. The average depth to mottling is about 16 to 18 inches, but the range is from 10 to 22 inches. Excessive moisture is at a depth of 24 to 36 inches. Fine mica flakes are common throughout the profile. The texture of the subsurface layers is influenced by stratification.

Additional Facts About the County

This section was prepared for those who desire additional information about the county. It discusses geology, climate, agriculture, and other subjects of general interest.

Schools

At the time of the survey there were 33 elementary schools, 2 junior high schools, and 9 high schools in York County. Pupils are transported to school by bus. There are three colleges in Rock Hill, including Winthrop College for women.

Transportation

Paved or tar-and-gravel Federal and State highways cross York County. Well-maintained roads extend to all parts.

The railroads provide adequate service for shipping. Important cities and towns have a siding for loading and unloading freight.

Electricity

Electric current is available to all communities. Much of the stationary power used on farms is furnished by electric motors. Most rural homes have electric stoves, radios, and television sets. Telephone service is maintained in all the cities, towns, and suburbs and is available to many farm homes along the main roads.

Water Supply

Streams, ponds, and drilled wells are the chief sources of water for livestock. Most of the water used for irrigation is provided by ponds. Dug or drilled wells furnish water for rural homes.

Geology, Physiography, and Drainage

York County is entirely within the Piedmont Plateau. The northwestern edge of the county borders the Kings Mountain Range. The fine-grained rocks at the surface south of Rock Hill are of the Paleozoic era. Those throughout the rest of the county are coarser grained and of Precambrian age. The finer grained rocks are diorite and the coarser grained ones are granite, gneiss, or schist.

The county is a thoroughly dissected plain. The relief ranges from nearly level to steep, but is chiefly gently sloping to moderately steep.

The total area of flood plains and stream terraces is small. Except for moderately steep escarpments adjacent to the flood plains, stream terraces are gently undulating to sloping. The highest point in the county is 1,200 feet. It is on Henry Knob in the northwestern part. The elevation in the central part of the county is 550 to 700 feet. There is a series of hills in the northern part of the county, west of the Catawba River and extending toward the Cherokee County line. The most prominent are Nanny Mountain, Barnett Mountain, Henry Knob, and Joes Mountain, which rise about 200 to 500 feet above the surrounding area. The lowest elevation, 390 feet, is at the intersection of the county line and the Broad River in the extreme southwestern part of the county.

The surface drainage of the county forms a dendritic pattern. All areas of the upland drain into the major streams, which flow into the Broad River or Catawba River. The chief tributaries of these rivers are Fishing, Allison, Crowder, Sugar, Kings, Bullocks, and Turkey Creeks.

Climate of York County [6]

The climate of York County is mild and temperate, and the rainfall is well distributed throughout the year. Temperature and precipitation records and probabilities are shown in table 10. The day-to-day weather is controlled largely by the movement of pressure systems across the Nation, although during the summer there are relatively few complete exchanges of air masses, and tropical maritime air masses persist for extended periods.

Wind and humidity records are not available for the York County area. The records from the nearby station at Charlotte, N.C., indicate that the prevailing winds are generally from the southwest but are northeasterly late in summer and in fall. The average speed is about 7 or 8 miles per hour. The strongest 1-minute wind speed recorded in the Charlotte area was 57 miles per hour in June. The average relative humidity at 1:00 p.m. varies from 58 percent in winter to 47 percent in spring (April and May). The average relative humidity for the year—on the basis of four daily observations at 1 a.m., 7 a.m., 1 p.m., and 7 p.m.—is approximately 69 percent.

The average year in York County has about 75 days in which 0.1 inch or more of rain falls. During the year, the sun is visible about 65 percent of the daylight hours. The range in percentage of visible sunshine is from the low fifties in December and January to the low seventies in May and June. The skies are cloudy or overcast about 35 percent of the time. About 2 percent of the time the clouds are below 500 feet, and 6 percent of the time they are below 1,000 feet. The heaviest annual rainfall in this county in the last 30 years was 63.34 inches at Winthrop College in 1936, and the lightest was 32.59 inches recorded in 1933.

[6] This subsection was prepared by NATHAN KRONBERG, State climatologist, U.S. Weather Bureau.

TABLE 10.—*Temperature and precipitation*

[All data from Winthrop College, Rock Hill, York County, S.C.]

Month	Temperature				Precipitation			
	Average daily maximum	Average daily minimum	2 years in 10 will have at least 4 days with—		Average monthly total	1 year in 10 will have—		Average snowfall
			Maximum temperature equal to or higher than	Minimum temperature equal to or lower than		Less than	More than	
	°F	°F	°F	°F	Inches	Inches	Inches	Inches
January	55	34	72	20	4.2	1.8	7.5	0.7
February	58	35	73	20	3.9	1.5	6.8	.6
March	65	40	79	27	4.4	1.7	7.3	.6
April	74	49	86	35	3.9	1.6	6.4	0
May	83	58	92	47	3.3	1.0	6.0	0
June	90	66	97	56	3.1	1.2	4.7	0
July	91	68	98	61	6.0	2.8	10.0	0
August	89	67	96	60	4.6	1.7	8.3	0
September	84	62	94	50	3.5	.8	6.2	0
October	75	51	86	38	3.0	.8	6.4	0
November	65	41	78	26	2.8	.9	6.5	[1]
December	55	34	70	21	4.0	1.7	6.2	.7
Year	74	50	[2] 101	[3] 12	46.7	37.2	55.3	2.6

[1] Less than 0.05 inch. [2] Average annual highest maximum. [3] Average annual lowest minimum.

Summers are usually long; warm weather generally lasts from May to September. There are relatively few breaks in the heat during midsummer. In a typical summer, about 3 days have a maximum temperature of 100° or more—1 in June, 1 in July, and 1 in August. Occasionally a temperature of 100° is recorded in spring and fall. On the average, 67 days have maximum temperatures of 90° or more. About 1 year in 3, the summers do not have temperature exceeding 100° F. In York County summer is the rainiest season of the year; 30 percent of the annual rainfall occurs during the summer months. The rains are largely local thundershowers. Tropical storms affect York County on an average of once or twice in a decade. They bring strong winds and heavy rains but generally cause only minor damage. These storms, however, are a threat from midsummer to late in fall; they are most likely to occur during September (*4*, *21*).

Because the fall season is a transition between extremes, it has summer weather early in September, then passes through Indian summer into the prewinter cold spells, which begin late in November. On the whole this is the most pleasant season, especially from late in September to early in November, because rainfall is light, the percentage of sunshine is high, and extremes of temperature are rare. September is the month of greatest hurricane frequency. It has had heavy to excessive rains with gusty gale-force winds caused by nearby tropical storms about five times in the last 30 years. Damage and casualties, however, were negligible. The total rainfall in fall is about 20 percent of the annual total (*4*, *21*).

Winters are mild and relatively short, although freezing temperatures occur during about half of the days in winter. There is a good chance that a snow flurry will occur in winter. However, only occasionally are snowfalls significant, and snow cover for an extended period is unusual. In the average winter, about 14 days have temperatures of 20° or below, and 6 days of 15° or less. Only about 3 days with less than 10° have been recorded in the last 30 years. The winter rains are usually steady and make up about 27 percent of the total annual rainfall (*4*, *21*).

Spring is the most changeable season of the year. It varies from frequently cold and windy in March to generally warm and pleasant in May. In this season severe local thunderstorms and tornadoes are most likely to occur. York County has had about five tornadoes in the last 40 years. The spring rainfall is about 24 percent of the annual total (*4*, *21*).

In the order of their importance, significant agricultural products in York County are eggs, milk, cotton, hay, peaches, corn, and small grain. Climatic conditions favor these and other products. The soils accumulate moisture during the winter and spring months. Consequently, in most years they have a full supply of moisture at planting time. Also, there are sufficient dry periods to permit tillage. The freeze-free period, or growing season, lasts from April 1 to November 7, or about 220 days (see table 11). Crops may therefore be planted over a period of several weeks or more, and still have time to mature. Rainfall during the growing season is normally enough for crops, but in some years it is either inadequate or excessive.

Table 10 shows that extreme monthly and annual rainfall deficiencies may occur about 1 year in 10, and extreme excesses about 1 year in 10. For example, July has an average rainfall of 6.0 inches, but it may have less than 2.8 inches or more than 10 inches 1 year in 10 (*3*, *21*).

TABLE 11.—*Probabilities of last freezing temperatures in spring and first in fall.*

[All data from Winthrop College in Rock Hill, South Carolina]

Probability	Dates for given probability and temperature		
	24 °F. or less	28 °F. or less	32 °F. or less
Spring:			
1 year in 10 later than	March 24	April 8	April 22
2 years in 10 later than	March 17	April 1	April 15
5 years in 10 later than	March 3	March 18	April 1
Fall:			
1 year in 10 earlier than	November 13	November 7	October 24
2 years in 10 earlier than	November 18	November 12	October 29
5 years in 10 earlier than	November 30	November 22	November 7

Disastrous droughts occurred in 1925 and 1954. Partial droughts are more frequent and occur once or twice every 10 years. By definition, a drought occurs when there is no water in the soil available for plants. Likewise, a drought day is a day during which no water is available to the plants. Calculation of drought days involves the capacity of the soil to hold available moisture, the amount of precipitation, and the amount of water used or transpired by plants. Even in normal years, there are periods when rainfall does not supply the water needs of most crops. Supplementary irrigation is therefore needed for maximum crop production in all parts of the State in most years. However, during a severe drought, water for irrigation is often very limited or nonexistent.

Estimates of the probability of drought days in York County are shown in table 12. These estimates were obtained by using the Penman method for computing the consumption of soil moisture by both plants and evaporation, or evapotranspiration, and by defining a drought day in terms stated earlier. The total possible amount of stored moisture available to plants varies with soils and with the depth of roots. Therefore, the table shows the estimated number of drought days at five levels of storage capacity for five probability levels. For example, during July on a soil with a 2-inch storage capacity, there is a fifty-fifty chance of accumulating 10 drought days in York County (*22*).

The duration and amount of rainfall for an 8-year period from 1943 to 1950 was recorded by an automatic rain gage at Rock Hill (*20*). Maximum intensity for the period is shown in the following list.

Duration (hours):	*Inches*
1	2.33
2	3.13
3	3.13
6	3.13
12	3.13
24	6.98

TABLE 12.—*Probabilities of drought days on soils of five different moisture-storage capacities (22)*

Month [1]	Probability	Minimum number of drought days if soil has a moisture-storage capacity of [2]—				
		1 inch	2 inches	3 inches	4 inches	5 inches
April	1 in 10	15	0	0	0	0
	2 in 10	12	0	0	0	0
	3 in 10	11	0	0	0	0
	5 in 10	8	0	0	0	0
May	1 in 10	24	23	19	12	6
	2 in 10	21	19	13	5	0
	3 in 10	19	16	8	0	0
	5 in 10	16	11	0	0	0
June	1 in 10	25	25	23	20	16
	2 in 10	23	22	20	17	12
	3 in 10	21	19	17	14	10
	5 in 10	18	15	12	9	5
July	1 in 10	21	20	20	20	19
	2 in 10	19	17	16	15	15
	3 in 10	17	14	13	12	11
	5 in 10	16	10	9	8	6
August	1 in 10	21	18	17	16	15
	2 in 10	18	14	13	12	11
	3 in 10	16	12	10	9	8
	5 in 10	13	8	6	0	0
September	1 in 10	24	23	19	17	15
	2 in 10	21	18	15	12	10
	3 in 10	19	15	11	9	7
	5 in 10	15	10	6	0	0
October	1 in 10	28	26	24	23	22
	2 in 10	24	21	18	16	14
	3 in 10	22	17	14	10	8
	5 in 10	16	11	7	0	0

[1] January, February, March, November, and December are not shown, as crops are rarely damaged by drought in these months.

[2] The depth of water that a soil can hold and make available to plants.

Agriculture [7]

The early settlers of York County cleared sites and built their homes near the streams. They found canes growing on the bottom lands, grasses and wild peas on the plains, and hardwood forests on the hills. The forests consisted of oak, hickory, and chestnut. The bottom lands were cleared first, and corn and wheat were grown on the cleared soils for home use. The settlers raised cattle, swine, and horses. The native grasses and legumes provided an abundance of good forage.

Between 1784 and 1796, severe floods on the bottom lands caused settlers to move their homes to the uplands and clear land for farms. By 1795 the average-sized farm contained approximately 200 acres, and by 1808, 1 acre in 8 was cleared.

Cattle and horses were raised in the first part of the nineteenth century. The animals were driven to markets

[7] By W. A. MASON, JR., agronomist, Soil Conservation Service.

in Charleston, S.C.; in Philadelphia, Pa.; and in New York City. Wheat, corn, and some truck crops were grown for home use.

The lush growth of native grasses and legumes was overgrazed and the forage decreased in quality and quantity. Consequently, the quality of the cattle also decreased. Because of the poor-quality meat, cattle diseases, losses to cattle rustlers, and damage to cattle by ticks, cattle raising in York County declined.

By 1870, wheat, cotton, and corn had become important crops in a more diversified type of agriculture. About 1890, however, wheat and corn became less important, and cotton became the main cash crop.

The acreage of cotton steadily increased in the early part of the twentieth century. Because of intensive cultivation and lack of proper management, soils were eroded and depleted. The use of commercial fertilizer increased the yield of cotton but intensified the hazard of erosion in this one-crop system of agriculture. Cotton growing continued, notwithstanding damage caused by the cotton boll weevil and the depressed prices beginning in the early 1920's. An acreage reduction program, however, was started shortly after 1930.

The establishment of the Fishing Creek soil erosion project in 1934 started a new trend in the care, use, and treatment of agricultural lands in York County. In March 1938 the Catawba Soil Conservation District was formed. It comprised four counties—York, Chester, Lancaster, and Fairfield. In 1950, however, the four counties were placed in four separate districts. The district serving York County was still called the Catawba Soil Conservation District. Through this district, the Soil Conservation Service provides technical assistance in farm planning. The main purpose of the Catawba Soil Conservation District program is to treat each acre of agricultural land according to its capabilities.

Since the beginning of the conservation program in 1938, there has been a decrease in the acreage of row crops. Much of the acreage taken out of row crops has reverted to pine trees or has been planted to them. The acreage planted to grass crops has increased. The soil bank and conservation reserve programs have aided in the conversion of cropland to woodland and to other uses.

In table 13, data from the U.S. Bureau of the Census shows the trend in acreage of principal crops in York County since 1929.

TABLE 13.—*Acreage of principal crops in stated years*

Crops	1929	1939	1949	1954	1959
Cotton	70, 106	35, 373	33, 010	17, 771	10, 439
Corn	38, 716	38, 500	24, 848	14, 978	7, 704
Wheat	2, 919	5, 357	3, 425	3, 614	2, 622
Oats	3, 117	9, 994	11, 754	12, 541	5, 511
Lespedza for hay	----	9, 271	16, 690	7, 683	7, 883
Lespedeza for seed	----	(1)	1, 875	457	1, 204
Pasture (cropland only)	15, 111	37, 492	22, 928	24, 747	28, 486

[1] No data available.

There was a marked decrease in the acreage of cropland from 1954 to 1959 (*12*). This decrease was the result of operators retiring some cropland to trees and placing other cropland in the soil bank. As soil-bank contracts expire, cropland that was planted to sericea lespedeza and grass is likely to be used for pasture. In 1954 the average-sized farm was 100 acres; in 1959 it was 124.2 acres.

The number of farms has decreased and the size of farms has increased as shown in table 14 from the U. S. Bureau of the Census.

TABLE 14.—*Number and size of farms in stated years*

Year	Number	Size
		Acres
1930	(1)	64
1940	(1)	87
1950	3, 574	95
1954	3, 109	100
1960	1, 796	124. 2

[1] No data available.

The number of livestock in York County from 1929 to 1959, inclusive, is shown in table 15.

TABLE 15.—*Number of livestock on farms in stated years*

Livestock	1929	1939	1949	1954	1959
Horses and mules	7, 507	6, 096	4, 787	3, 016	1, 653
Dairy cows	6, 612	6, 041	5, 871	6, 131	3, 570
All cattle and calves	10, 831	9, 647	13, 722	22, 499	18, 697
Turkeys raised	2, 649	27, 674	216, 435	341, 882	96, 545
Chickens	94, 576	102, 098	111, 708	131, 037	114, 859
Broilers	61, 430	87, 087	207, 957	366, 000	147, 700

At present, most farmers in the county are aware of the need for good management. They are rotating crops and are including perennial grasses and legumes in the rotations. They are also returning crop residue to the soil, building complete water-disposal systems, including terraces and grassed water outlets on the gently sloping uplands, and using large amounts of high-analysis fertilizer.

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Glossary

Alluvium. Fine material, such as sand, silt, or clay, that has been deposited on land by streams.

Bedrock. The solid rock that underlies the soil and other unconsolidated material or that is exposed at the surface.

Clay. As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Consistence, soil. The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are—

Loose. Noncoherent; soil will not hold together in a mass.

Friable. When moist, soil crushes easily under gentle to moderate pressure between thumb and forefinger and can be pressed into a lump.

Firm. When moist, soil crushes under moderate pressure between thumb and forefinger but resistance is distinctly noticeable.

Plastic. When wet, soil is readily deformed by moderate pressure but can be pressed into a lump; will form a wire when rolled between thumb and forefinger.

Sticky. When wet, soil adheres to other material; tends to stretch somewhat and pull apart, rather than pull free from other material.

Hard. When dry, soil is moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.

Soft. When dry, soil breaks into powder or individual grains under very slight pressure.

Dendritic. Branched like a tree or shrub; used to describe a river or natural drainage system.

Drainage, surface. Runoff, or surface flow, of water from an area.

Erosion. The wearing away of the land surface by wind, running water, and other geologic agents.

Fertility, soil. The quality of a soil that enables it to provide compounds, in adequate amounts and in the proper balance, for growth of specified plants, when other growth factors such as light, moisture, temperature, and the physical condition (or tilth) of the soil are favorable.

First bottom. The normal flood plain of a stream, subject to frequent or occasional flooding.

Gleyed soil. A soil in which waterlogging and lack of oxygen have caused the material in one or more horizons to be neutral gray in color. The term "gleyed" is applied to soil horizons with yellow and gray mottling caused by intermittent waterlogging.

Horizon, soil. A layer of soil, approximately parallel to the surface, that has distinct characteristics produced by soil-forming processes.

Infiltration. The downward entry of water into the immediate surface of a soil or other material, as contrasted with percolation, which is movement of water through soil layers or material.

Leaching. The removal of soluble materials from soils or other material by percolating water.

Morphology, soil. The makeup of the soil, including the texture, structure, consistence, color, and other physical, chemical, mineralogical, and biological properties of the various horizons that makeup the soil profile.

Mottled. Irregularly marked with spots of different colors that vary in number and size. Mottling in soils usually indicates poor aeration and lack of drainage. Descriptive terms are as follows: abundance—*few, common,* and *many;* size—*fine, medium,* and *coarse;* and contrast—*faint, distinct,* and *prominent.* The size measurements are these: *fine,* less than 5 millimeters (about 0.2 inch) in diameter along the greatest dimension; *medium,* ranging from 5 millimeters to 15 millimeters (about 0.2 to 0.6 inch) in diameter along the greatest dimension; and *coarse,* more than 15 millimeters (about 0.6 inch) in diameter along the greatest dimension.

Natural drainage. Refers to the conditions that existed during the development of the soil, as opposed to altered drainage, which is commonly the result of artificial drainage or irrigation but may be caused by the sudden deepening of channels or the blocking of drainage outlets. Seven different classes of natural drainage are recognized.

Excessively drained soils are commonly very porous and rapidly permeable and have a low water-holding capacity.

Somewhat excessively drained soils are also very permeable and are free from mottling throughout their profile.

Well-drained soils are nearly free from mottling and are commonly of intermediate texture.

Moderately well drained soils commonly have a slowly permeable layer in or immediately beneath the solum. They have uniform color in the A and upper B horizons and have mottling in the lower B and C horizons.

Imperfectly or somewhat poorly drained soils are wet for significant periods but not all the time, and in podzolic soils, commonly

have mottlings below 16 inches in the lower A horizon and in the B and C horizons.

Poorly drained soils are wet for long periods of time and are light gray and generally mottled from the surface downward, though mottling may be absent or nearly so in some soils.

Very poorly drained soils are wet nearly all the time. They have a dark-gray or black surface layer and are gray or light gray, with or without mottling, in the deeper parts of the profile.

Nutrient, plant. An element taken in by the plant, essential to its growth, and used by it in the production of food and tissue. Nitrogen, phosphorus, potassium, calcium, mangesium, sulfur, manganese, copper, boron, zinc, and perhaps other elements obtained from the soil and carbon, hydrogen, and oxygen obtained largely from the air and water, are plant nutrients.

Parent material (soil). The horizon of weathered rock or partly weathered soil material from which soil has formed; horizon C in the soil profile.

Permeability, soil. The quality of a soil horizon that enables water or air to move through it. Terms used to describe permeability are as follows: *very slow, slow, moderately slow, moderate, moderately rapid, rapid,* and *very rapid.*

Phase, soil. A subdivision of a soil type, series, or other unit in the soil classification system made because of differences in the soil that affect its management but do not affect its classification in the natural landscape. A soil type, for example, may be divided into phases because of differences in slope, stoniness, thickness, or some other characteristic that affects management.

Plastic limit (soil engineering). The moisture content at which a soil changes from a semisolid to a plastic state.

Profile, soil. A vertical section of the soil through all its horizons and extending into the parent material. See Horizon, soil.

Reaction, soil. The degree of acidity or alkalinity of a soil expressed in pH values. A soil that tests to pH 7.0 is precisely neutral in reaction because it is neither acid nor alkaline. In words the degrees of acidity or alkalinity are expressed thus:

	pH		*pH*
Extremely acid	Below 4.5	Mildly alkaline	7.4 to 7.8
Very strongly acid	4.5 to 5.0	Moderately alkaline	7.9 to 8.4
Strongly acid	5.1 to 5.5	Strongly alkaline	8.5 to 9.0
Medium acid	5.6 to 6.0	Very strongly alkaline	9.1 and higher
Slightly acid	6.1 to 6.5		
Neutral	6.6 to 7.3		

Relief. The elevations or inequalities of a land surface, considered collectively.

Residuum. Unconsolidated, partly weathered mineral material that accumulated over disintegrating solid rock. This residual material is not soil but is frequently the material in which the soil has formed.

Sand. Individual rock or mineral fragments in soils having diameters ranging from 0.05 to 2.0 millimeters. Most sand grains consist of quartz, but they may be of any mineral composition. The textural class name of any soil that contains 85 percent or more sand and not more than 10 percent clay.

Series, soil. A group of soils developed from a particular type of parent material and having genetic horizons that, except for texture of the surface soil, are similar in differentiating characteristics and in arrangement in the profile.

Silt. Individual mineral particles in a soil that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). Soil of the silt textural class is 80 percent or more silt and less than 12 percent clay.

Soil. A natural, three-dimensional body on the earth's surface that supports plants and that has properties resulting from the integrated effect of climate and living matter acting upon parent material, as conditioned by relief over periods of time.

Solum. The upper part of the soil profile, above the parent material, in which the processes of soil formation are active. The solum in mature soil includes the A and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the underlying parent material. The living roots and other plant and animal life characteristic of the soil are largely confined to the solum.

Stratified. Composed of, or arranged in, strata, or layers, such as stratified alluvium. The term is confined to geologic material. Layers in soils that result from the processes of soil formation are called horizons; those inherited from parent material are called strata.

Structure, soil. The arrangement of primary soil particles into compound particles or clusters that are separated from adjoining aggregates and have properties unlike those of an equal mass of unaggregated primary soil particles. The principal forms of soil structure are—*platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular. Structureless* soils are (1) *single grain* (each grain by itself, as in dune sand) or (2) *massive* (the particles adhering together without any regular cleavage, as in many claypans and hardpans).

Subsoil. Technically, B horizon; roughly, the part of the profile below plow depth.

Substratum. Any layer beneath the solum, or true soil; the C or D horizon.

Surface soil. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, about 5 to 8 inches in thickness. The plowed layer.

Terrace (geological). An old alluvial plain, ordinarily flat or undulating, bordering a river, lake, or the sea. Stream terraces are frequently called *second bottoms,* as contrasted to *flood plains,* and are seldom subject to overflow. Marine terraces were deposited by the sea and are generally wide.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. (See also, clay, sand, and silt.) The basic textural classes, in order of increasing proportions of fine particles are as follows: *sand, loamy sand, sandy loam, loam, silt loam, silt, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay,* and *clay.* The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

Tilth, soil. The condition of the soil in relation to the growth of plants, especially soil structure. Good tilth refers to the friable state and is associated with high noncapillary porosity and stable, granular structure. A soil in poor tilth is nonfriable, hard, nonaggregated, and difficult to till.

Type, soil. A subdivision of the soil series that is made on the basis of differences in the texture of the surface layer.

Upland, (geology). Land consisting of material unworked by water in recent geologic time and lying, in general, at a higher elevation than the alluvial plain or stream terrace. Land above the lowlands along rivers.

GUIDE TO MAPPING UNITS, CAPABILITY UNITS, WOODLAND SUITABILITY GROUPS, AND WILDLIFE SUITABILITY GROUPS

[See table 1, p. 9 , for approximate acreage and proportionate extent of the soils and table 3, p. 48 , for estimated productivity ratings for each unit. See tables 6, 7, and 8, pp. 68 , 70 , and 80 , for information on engineering interpretations of the soils]

Map symbol	Mapping unit	Page	Capability unit		Woodland suitability group		Wildlife suitability group	
			Symbol	Page	Number	Page	Number	Page
AaB	Altavista fine sandy loam, 0 to 6 percent slopes	11	IIe-2	39	5	54	1	62
AcB	Appling coarse sandy loam, thin solum, 2 to 6 percent slopes	12	IIe-2	39	10	57	1	62
AcB2	Appling coarse sandy loam, thin solum, 2 to 6 percent slopes, eroded	13	IIe-2	39	10	57	1	62
AcC	Appling coarse sandy loam, thin solum, 6 to 10 percent slopes	13	IIIe-2	40	10	57	1	62
AcC2	Appling coarse sandy loam, thin solum, 6 to 10 percent slopes, eroded	13	IIIe-2	40	10	57	1	62
AcD	Appling coarse sandy loam, thin solum, 10 to 15 percent slopes	13	IVe-1	42	11	57	2	62
AcD2	Appling coarse sandy loam, thin solum, 10 to 15 percent slopes, eroded	13	IVe-1	42	11	57	2	62
AcE2	Appling coarse sandy loam, thin solum, 15 to 25 percent slopes, eroded	13	VIe-1	43	11	57	2	62
ApB	Appling sandy loam, 2 to 6 percent slopes	11	IIe-2	39	6	55	1	62
ApB2	Appling sandy loam, 2 to 6 percent slopes, eroded	11	IIe-2	39	6	55	1	62
ApC	Appling sandy loam, 6 to 10 percent slopes	11	IIIe-2	40	6	55	1	62
ApC2	Appling sandy loam, 6 to 10 percent slopes, eroded	12	IIIe-2	40	6	55	1	62
ApD	Appling sandy loam, 10 to 15 percent slopes	12	IVe-1	42	7	55	2	62
ApD2	Appling sandy loam, 10 to 15 percent slopes, eroded	12	IVe-1	42	7	55	2	62
ApE	Appling sandy loam, 15 to 25 percent slopes	12	VIe-1	43	7	55	2	62
ApE2	Appling sandy loam, 15 to 25 percent slopes, eroded	12	VIe-1	43	7	55	2	62
Bu	Buncombe loamy sand, 0 to 4 percent slopes	13	IIIs-2	42	2	52	5	67
CaB3	Cataula clay loam, 2 to 6 percent slopes, severely eroded	15	IIIe-3	40	17	59	3	66
CaC3	Cataula clay loam, 6 to 10 percent slopes, severely eroded	15	IVe-2	42	17	59	3	66
CaD3	Cataula clay loam, 10 to 15 percent slopes, severely eroded	15	VIe-3	44	17	59	3	66
CaE3	Cataula clay loam, 15 to 25 percent slopes, severely eroded	15	VIIe-3	44	17	59	3	66
CbB2	Cataula sandy loam, 2 to 6 percent slopes, eroded	14	IIe-3	39	15	59	4	66
CbC2	Cataula sandy loam, 6 to 10 percent slopes, eroded	15	IIIe-3	40	15	59	4	66
CcB3	Cecil clay loam, 2 to 6 percent slopes, severely eroded	16	IIIe-1	40	8	56	3	66
CcC3	Cecil clay loam, 6 to 10 percent slopes, severely eroded	17	IVe-1	42	8	56	3	66
CcD3	Cecil clay loam, 10 to 15 percent slopes, severely eroded	17	VIe-1	43	8	56	3	66
CcE3	Cecil clay loam, 15 to 25 percent slopes, severely eroded	17	VIIe-1	44	8	56	3	66

GUIDE TO MAPPING UNITS, CAPABILITY UNITS, WOODLAND SUITABILITY GROUPS, AND WILDLIFE SUITABILITY GROUPS--CONT'D.

Map symbol	Mapping unit	Page	Capability unit Symbol	Page	Woodland suitability group Number	Page	Wildlife suitability group Number	Page
CdB2	Cecil sandy loam, 2 to 6 percent slopes, eroded	16	IIe-1	44	6	55	1	62
CdC2	Cecil sandy loam, 6 to 10 percent slopes, eroded	16	IIIe-1	40	6	55	1	62
CdD2	Cecil sandy loam, 10 to 15 percent slopes, eroded	16	IVe-1	42	7	55	2	62
CdE	Cecil sandy loam, 15 to 30 percent slopes	16	VIe-1	43	7	55	2	62
CdE2	Cecil sandy loam, 15 to 25 percent slopes, eroded	16	VIe-1	43	7	55	2	62
Ch	Chewacla silt loam	17	IIIw-2	41	3	52	7	67
CoB	Colfax sandy loam, 2 to 6 percent slopes	18	IIIw-3	42	12	57	7	67
Cn	Congaree fine sandy loam	18	IIw-2	39	1	51	6	67
DaB2	Davidson clay loam, 2 to 6 percent slopes, eroded	18	IIe-1	38	9	56	1	62
DaC3	Davidson clay loam, 6 to 10 percent slopes, severely eroded	18	IVe-1	42	9	56	3	66
DuB	Durham sandy loam, 2 to 6 percent slopes	19	IIe-2	39	6	55	1	62
DuC	Durham sandy loam, 6 to 10 percent slopes	19	IIIe-2	40	6	55	1	62
Eb	Elbert loam	19	IVw-2	43	18	60	7	67
EnB3	Enon clay loam, 2 to 6 percent slopes, severely eroded	20	IIIe-3	40	17	59	3	66
EnC3	Enon clay loam, 6 to 10 percent slopes, severely eroded	20	IVe-2	42	17	59	3	66
EnD3	Enon clay loam, 10 to 15 percent slopes, severely eroded	20	VIe-3	44	17	59	3	66
EsB2	Enon sandy loam, 2 to 6 percent slopes, eroded	20	IIe-3	39	15	59	4	66
EsC2	Enon sandy loam, 6 to 10 percent slopes, eroded	20	IIIe-3	40	15	59	4	66
EsD2	Enon sandy loam, 10 to 15 percent slopes, eroded	20	IVe-2	42	16	59	4	66
EsE2	Enon sandy loam, 15 to 25 percent slopes, eroded	20	VIe-3	44	16	59	2	62
Gf	Gullied land, firm materials	21	VIIe-2	44	1/		3	66
GuC	Gullied land, friable materials, rolling	21	VIIe-2	44	1/		3	66
GuD	Gullied land, friable materials, hilly	21	VIIe-2	44	1/		3	66
HaB	Helena sandy loam, 2 to 6 percent slopes	21	IIe-3	39	15	59	4	66
HaB2	Helena sandy loam, 2 to 6 percent slopes, eroded	21	IIIe-3	40	15	59	4	66
HaC	Helena sandy loam, 6 to 10 percent slopes	21	IIIe-3	40	15	59	4	66
HaC2	Helena sandy loam, 6 to 10 percent slopes, eroded	21	IVe-2	42	15	59	4	66
HaD2	Helena sandy loam, 10 to 15 percent slopes, eroded	22	VIe-3	44	16	59	4	66
HwB2	Hiwassee sandy loam, 2 to 6 percent slopes, eroded	22	IIe-1	38	6	55	1	62
HwC2	Hiwassee sandy loam, 6 to 10 percent slopes, eroded	22	IIIe-1	40	6	55	1	62
HwD2	Hiwassee sandy loam, 10 to 18 percent slopes, eroded	22	IVe-1	42	7	55	2	62
IdA	Iredell loam, 0 to 2 percent slopes	23	IIw-3	39	18	60	7	67

GUIDE TO MAPPING UNITS, CAPABILITY UNITS, WOODLAND SUITABILITY GROUPS, AND WILDLIFE SUITABILITY GROUPS--CONT'D.

Map symbol	Mapping unit	Page	Capability unit		Woodland suitability group		Wildlife suitability group	
			Symbol	Page	Number	Page	Number	Page
IdB	Iredell loam, 2 to 6 percent slopes	24	IIe-4	39	18	60	4	66
IdB2	Iredell loam, 2 to 6 percent slopes, eroded	24	IIe-4	39	18	60	4	66
IdC2	Iredell loam, 6 to 10 percent slopes, eroded	24	IIIe-4	41	18	60	4	66
IrA	Iredell loam, thin solum, 0 to 2 percent slopes	24	IIIw-1	41	19	60	7	67
IrB	Iredell loam, thin solum, 2 to 6 percent slopes	24	IIIe-6	41	19	60	4	66
IsA	Iredell sandy loam, 0 to 2 percent slopes	23	IIw-3	39	18	60	7	67
IsB	Iredell sandy loam, 2 to 6 percent slopes	23	IIe-4	39	18	60	4	66
IsB2	Iredell sandy loam, 2 to 6 percent slopes, eroded	23	IIe-4	39	18	60	4	66
IsC	Iredell sandy loam, 6 to 10 percent slopes	23	IIIe-4	41	18	60	4	66
IsC2	Iredell sandy loam, 6 to 10 percent slopes, eroded	23	IIIe-4	41	18	60	4	66
IvB	Iredell very stony loam, 0 to 6 percent slopes	24	VIs-1	44	13	58	5	67
LaB3	Lloyd clay loam, 2 to 6 percent slopes, severely eroded	26	IIIe-1	40	8	56	3	66
LaC3	Lloyd clay loam, 6 to 10 percent slopes, severely eroded	26	IVe-1	42	8	56	3	66
LaD3	Lloyd clay loam, 10 to 15 percent slopes, severely eroded	26	IVe-1	42	8	56	3	66
LaE3	Lloyd clay loam, 15 to 25 percent slopes, severely eroded	26	VIe-1	43	8	56	3	66
LcB3	Lloyd clay loam, compact subsoil, 2 to 6 percent slopes, severely eroded	26	IIIe-3	40	17	57	3	66
LcC3	Lloyd clay loam, compact subsoil, 6 to 10 percent slopes, severely eroded	26	IVe-1	42	17	57	3	66
LcD3	Lloyd clay loam, compact subsoil, 10 to 20 percent slopes, severely eroded	27	VIe-3	44	17	57	3	66
LdB	Lloyd loam, 2 to 6 percent slopes	24	IIe-1	38	6	55	1	62
LdB2	Lloyd loam, 2 to 6 percent slopes, eroded	25	IIe-1	38	6	55	1	62
LdC	Lloyd loam, 6 to 10 percent slopes	25	IIIe-1	40	6	55	1	62
LdC2	Lloyd loam, 6 to 10 percent slopes, eroded	25	IIIe-1	40	6	55	1	62
LdD2	Lloyd loam, 10 to 15 percent slopes, eroded	25	IVe-1	42	7	55	2	62
LmB2	Lloyd sandy loam, 2 to 6 percent slopes, eroded	25	IIe-1	38	6	55	1	62
LmC2	Lloyd sandy loam, 6 to 10 percent slopes, eroded	25	IIIe-1	40	6	55	1	62
LmD2	Lloyd sandy loam, 10 to 15 percent slopes, eroded	25	IVe-1	42	7	55	2	62
LmE	Lloyd sandy loam, 15 to 25 percent slopes	25	VIe-1	43	7	55	2	62
LmE2	Lloyd sandy loam, 15 to 25 percent slopes, eroded	26	VIe-1	43	7	55	2	62
LnB2	Lloyd sandy loam, compact subsoil, 2 to 6 percent slopes, eroded	26	IIe-3	39	15	59	4	66
Lo	Local alluvial land	27	I-1	38	1	51	6	67
LsB	Louisburg sandy loam, 2 to 6 percent slopes	27	IIIe-5	41	13	58	5	67

GUIDE TO MAPPING UNITS, CAPABILITY UNITS, WOODLAND SUITABILITY GROUPS, AND WILDLIFE SUITABILITY GROUPS--CONT'D.

Map symbol	Mapping unit	Page	Capability unit		Woodland suitability group		Wildlife suitability group	
			Symbol	Page	Number	Page	Number	Page
LsC	Louisburg sandy loam, 6 to 10 percent slopes	27	IVe-3	43	13	58	5	67
LsD	Louisburg sandy loam, 10 to 15 percent slopes	27	VIe-2	44	14	58	5	67
LsE	Louisburg sandy loam, 15 to 25 percent slopes	27	VIIe-2	44	14	58	5	67
MaD2	Manteo channery silt loam, 10 to 15 percent slopes, eroded	28	VIe-2	44	14	58	5	67
MaE	Manteo channery silt loam, 15 to 35 percent slopes	28	VIIe-2	44	14	58	5	67
MbB3	Mecklenburg clay loam, 2 to 6 percent slopes, severely eroded	29	IIIe-3	40	17	59	3	66
MbC3	Mecklenburg clay loam, 6 to 10 percent slopes, severely eroded	29	IVe-2	42	17	59	3	66
MbD3	Mecklenburg clay loam, 10 to 15 percent slopes, severely eroded	29	VIe-3	44	17	59	3	66
MbE3	Mecklenburg clay loam, 15 to 25 percent slopes, severely eroded	29	VIIe-3	44	17	59	3	66
McA	Mecklenburg loam, 0 to 2 percent slopes	28	IIs-2	40	15	59	4	66
McB2	Mecklenburg loam, 2 to 6 percent slopes, eroded	28	IIe-3	39	15	59	1	62
McC2	Mecklenburg loam, 6 to 10 percent slopes, eroded	29	IIIe-3	40	15	59	1	62
McD2	Mecklenburg loam, 10 to 15 percent slopes, eroded	29	IVe-2	42	16	59	2	62
McE2	Mecklenburg loam, 15 to 25 percent slopes, eroded	29	VIe-3	44	16	59	2	62
Md	Mine pits and dumps	29	VIIe-2	44	1/		5	67
Mn	Mixed alluvial land	29	IIw-2	39	3	52	6	67
Mw	Mixed alluvial land, wet	30	IVw-1	43	4	54	7	67
MyB	Molena loamy sand, 2 to 8 percent slopes	30	IIIs-1	42	5	54	5	67
NaB2	Nason silt loam, 2 to 6 percent slopes, eroded	30	IIe-2	39	6	55	1	62
NaC2	Nason silt loam, 6 to 10 percent slopes, eroded	30	IIIe-2	40	6	55	1	62
NaD2	Nason silt loam, 10 to 15 percent slopes, eroded	31	IVe-1	42	7	55	2	62
NaE	Nason silt loam, 15 to 25 percent slopes	31	VIe-1	43	7	55	2	62
NaE2	Nason silt loam, 15 to 25 percent slopes, eroded	31	VIe-1	43	7	55	2	62
Rk	Roanoke silt loam	31	IVw-2	43	3	52	8	68
Ro	Rock outcrop	31	VIIIs-1	45	1/		5	67
TaB2	Tatum gravelly silt loam, 2 to 6 percent slopes, eroded	33	IIe-1	38	6	55	1	62
TaC2	Tatum gravelly silt loam, 6 to 10 percent slopes, eroded	33	IIIe-1	40	6	55	1	62
TaD2	Tatum gravelly silt loam, 10 to 15 percent slopes, eroded	33	IVe-1	42	7	55	2	62
TaE2	Tatum gravelly silt loam, 15 to 25 percent slopes, eroded	33	VIe-1	43	7	55	2	62
TmB	Tatum silt loam, 2 to 6 percent slopes	32	IIe-1	38	6	55	1	62
TmB2	Tatum silt loam, 2 to 6 percent slopes, eroded	32	IIe-1	38	6	55	1	62
TmC	Tatum silt loam, 6 to 10 percent slopes	32	IIIe-1	40	6	55	1	62

GUIDE TO MAPPING UNITS, CAPABILITY UNITS, WOODLAND SUITABILITY GROUPS, AND WILDLIFE SUITABILITY GROUPS--CONT'D.

Map symbol	Mapping unit	Page	Capability unit Symbol	Page	Woodland suitability group Number	Page	Wildlife suitability group Number	Page
TmC2	Tatum silt loam, 6 to 10 percent slopes, eroded	32	IIIe-1	40	6	55	1	62
TmD2	Tatum silt loam, 10 to 15 percent slopes, eroded	32	IVe-1	42	7	55	2	62
TmE	Tatum silt loam, 15 to 25 percent slopes	32	VIe-1	43	7	55	2	62
TmE2	Tatum silt loam, 15 to 25 percent slopes, eroded	32	VIe-1	43	7	55	2	62
TtB3	Tatum silty clay loam, 2 to 6 percent slopes, severely eroded	32	IIIe-1	40	8	56	3	66
TtC3	Tatum silty clay loam, 6 to 10 percent slopes, severely eroded	32	IVe-1	42	8	56	3	66
TtD3	Tatum silty clay loam, 10 to 15 percent slopes, severely eroded	32	VIe-1	43	8	56	3	66
TtE3	Tatum silty clay loam, 15 to 25 percent slopes, severely eroded	32	VIIe-1	44	8	56	3	66
VaC3	Vance clay loam, 2 to 10 percent slopes, severely eroded	34	IVe-2	42	17	59	3	66
VaD3	Vance clay loam, 10 to 25 percent slopes, severely eroded	34	VIIe-3	44	17	59	3	66
VcB2	Vance sandy loam, 2 to 6 percent slopes, eroded	34	IIe-3	39	15	59	1	62
VcC2	Vance sandy loam, 6 to 10 percent slopes, eroded	33	IIIe-3	40	15	59	1	62
VcD2	Vance sandy loam, 10 to 15 percent slopes, eroded	33	IVe-2	42	16	59	2	62
VcE2	Vance sandy loam, 15 to 25 percent slopes, eroded	34	VIe-3	44	16	59	2	62
WcB2	Wickham sandy loam, 2 to 6 percent slopes, eroded	34	IIe-1	38	5	54	1	62
WcD2	Wickham sandy loam, 6 to 15 percent slopes, eroded	34	IIIe-1	40	5	54	1	62
WkB	Wilkes complex, 2 to 6 percent slopes	35	IIIe-5	41	13	58	5	67
WkC	Wilkes complex, 6 to 10 percent slopes	35	IVe-3	43	13	58	5	67
WkD	Wilkes complex, 10 to 15 percent slopes	35	VIe-2	43	14	58	5	67
WkD2	Wilkes complex, 6 to 15 percent slopes, eroded	35	VIe-2	43	14	58	5	67
WkE	Wilkes complex, 15 to 35 percent slopes	35	VIIe-2	44	14	58	5	67
WkE2	Wilkes complex, 15 to 35 percent slopes, eroded	35	VIIe-2	44	14	58	5	67
WoB	Worsham sandy loam, 2 to 6 percent slopes	36	Vw-1	43	3	52	8	68
WoC	Worsham sandy loam, 6 to 15 percent slopes	36	VIe-1	43	14	58	2	62

1/ Data insufficient for mapping unit to be assigned woodland suitability group.

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Attachment 73-4

Anderson, James R., E. E. Hardy, J. T. Roach and R. E. Witmer. 1976. A Land Use and Land Cover Classification System for Use with Remote Sensor Data. U. S. Department of the Interior, Geological Survey, Geological Survey Professional Paper 964.

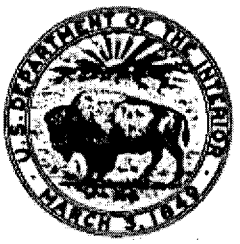
(http://www.ncrs.fs.fed.us/4153/deltawest/landcover/LLCoverPub.html)

A Land Use and Land Cover Classification System for Use with Remote Sen Data

By JAMES R. ANDERSON, ERNEST E. HARDY, JOHN T. ROACH, and RICHARD E. WITMER

GEOLOGICAL SURVEY PROFESSIONAL PAPER 964

A revision of the land use classification system
as presented in U.S. Geological Survey Circular 671



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CONTENTS

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TABLES

A LAND U.S.E AND LAND COVER CLASSIFICATION SYSTEM FOR U.S.E WITH REMO SENSOR DATA

By JAMES R. ANDERSON, ERNEST E. HARDY, JOHN T. ROACH, and RICHARD E. WITMER

ABSTRACT

The framework of a national land use and land cover classification system is presented for use with remote sensor data. The classification system has been developed to meet the needs of Federal and State agencies for an up-to-date overview of land use and land cover throughout the country on a basis that is uniform in categorization at the more generalized first and

second levels and that will be receptive to data from satellite and aircraft remote sensors. The proposed system uses the features of existing widely used classification systems that are amenable to data derived from remote sensing sources. It is intentionally left open-ended so that Federal, regional, State, and local agencies can have flexibility in developing more detailed land use classifications at the third and fourth levels in order to meet their particular needs and at the same time remain compatible with each other and the national system. Revision of the land use classification system as presented in U.S. Geological Survey Circular 671 was undertaken in order to incorporate the results of extensive testing and review of the categorization and definitions.

INTRODUCTION

A modern nation, as a modern business, must have adequate information on many complex interrelated aspects of its activities in order to make decisions. Land use is only one such aspect, but knowledge about land use and land cover has become increasingly important as the Nation plans to overcome the problems of haphazard, uncontrolled development, deteriorating environmental quality, loss of prime agricultural lands, destruction of important wetlands, and loss of fish and wildlife habitat. Land use data are needed in the analysis of environmental processes and problems that must be understood if living conditions and standards are to be improved or maintained at current levels.

One of the prime prerequisites for better use of land is information on existing land use patterns and changes in land use through time. The U.S. Department of Agriculture (1972) reported that during the decade of the 1960's, 730,000 acres

(296,000 hectares) were urbanized each year, transportation land uses expanded by 130,000 acres (53,000 hectares) per year, and recreational area increased by about 1 million acres (409,000 hectares) per year. Knowledge of the present distribution and area of such agricultural, recreational, and urban lands, as well as information on their changing proportions, is needed by legislators, planners, and State and local governmental officials to determine better land use policy, to project transportation and utility demand, to identify future development pressure points and areas, and to implement effective plans for regional development. As Clawson and Stewart (1965) have stated:

In this dynamic situation, accurate, meaningful, current data on land use are essential. If public agencies and private organizations sit to know what is happening, and are to make sound plans for their own future action, then reliable information is critical.

The variety of land use and land cover data needs is exceedingly broad. Current land use and land cover data are needed for equalization of tax assessments in many States. Land use and land cover data also are needed by Federal, State, and local agencies for water resource inventory, flood control, water supply planning, and wastewater treatment. Many Federal agencies need current comprehensive inventories of existing activities on public lands combined with the existing and changing uses of adjacent private lands to improve the management of public lands. Federal agencies also need land use data to assess the environmental impact resulting from the development of energy resources, to manage wildlife resources and minimize man-wildlife ecosystem conflicts, to make national summaries of land use patterns and changes for national policy formulation, and to prepare environmental impact statements and assess future impacts on environmental quality.

NEED FOR STANDARDIZATION

For many years, agencies at the various governmental levels have been collecting data about land, but for the most part they have worked independently and without coordination. Too often this has meant duplication of effort, or it has been found that data collected for a specific purpose were of little or no value for a similar purpose only a short time later.

There are many different sources of information on existing land use and land cover and on changes that are occurring. Local planning agencies make use of detailed information generated during ground surveys involving enumeration and observation. Interpretation of large-scale aerial photographs also has been used widely (Avery, 1968). In some cases, supplementary information is inferred on the basis of utility hookups, building permits, and similar information. Major problems are present in the application and interpretation of the existing data. These include changes in definitions of categories and data collection methods by source agencies, incomplete data coverage, varying data age, and employment of incompatible classification systems. In addition, it is nearly impossible to aggregate the available data because of the differing classification systems used.

The demand for standardized land use and land cover data can only increase as we seek to assess and manage areas of critical concern for environmental control such as flood plains and wetlands, energy resource development and production areas, wildlife habitat, recreational lands, and areas such as major residential and industrial development sites.

As the result of long concern about duplication and coordination among Federal, State, and local governments in the collection and handling of various types of data, the United States has already achieved reasonably effective, though not perfect, standardization in some instances, as evidenced by present programs in soil surveys, topographic mapping, collection of weather information, and inventory of forest resources. Recent developments in data processing and remote sensing technology make the need for similar cooperation in land use inventories even more evident and more pressing. Development and acceptance of a system for classifying land use data obtained primarily by use of remote sensing techniques, but reasonably compatible with existing classification systems, are the urgently needed first steps.

This is not the first time that use of remote sensors has been proposed to provide the primary data from which land use and land cover types and their boundaries are interpreted. During the past 40 years several surveys, studies, and other projects have successfully demonstrated that remote sensor data are useful for land use and land cover inventory and mapping. These surveys have contributed to our confidence that land use and land cover surveys of larger areas are possible by the use of remote sensor data bases.

In the mid 1940's, Francis J. Marschner began mapping major land use associations for the entire United States, using aerial photographs taken during the late 1930's and the early 1940's. Marschner produced a set of State land use maps at the scale of 1:1,000,000 from mosaics of the aerial photographs and then compiled a map of major land uses at 1:5,000,000 (Marschner, 1950).

More recently, the States of New York and Minnesota have used remote sensor data for statewide land use mapping. New York's LUNR (Land Use and Natural Resources) Program (New York State Office of Planning Coordination, 1969) employs computer storage of some 50 categories of land use information derived from hand drafted maps compiled by interpreting 1967—1970 aerial photography. This information can be updated and manipulated to provide numerical summaries and analyses and computer generated maps (Hardy and Shelton, 1970). Aerial photographs taken in the spring of 1968 and 1969 at an altitude of about 40,000 ft (12,400 m) yielded the data incorporated into the nine categories of the Minnesota Land Use Map, a part of the Minnesota Land Management Information System (Orfling and Maki, 1972). Thrower's map (1970) of the Southwestern United States represents the first large area inventory of land use employing satellite imagery. Imagery from several manned and unmanned missions was used in deriving the general land use map published at a scale of 1: 1,000,000.

Remote sensing techniques, including the use of conventional aerial photography, can be used effectively to complement surveys based on ground observation and enumeration, so the potential of a timely and accurate inventory of the current use of the Nation's land resources now exists. At the same time, data processing techniques permit the storage of large quantities of detailed data that can be organized in a variety of ways to meet specific needs.

The patterns of resource use and resource demand are constantly changing. Fortunately, the capability to obtain data about land uses related to resource development is improving because of recent technological improvements in remote sensing equipment, interpretation techniques, and data processing (National Academy of Sciences, 1970).

HISTORICAL DEVELOPMENT OF THE CLASSIFICATION SYSTEM

The needs of Federal agencies for a broad overview of national land use and land cover patterns and trends and environmental values led to the formation of an Interagency Steering Committee on Land Use Information and Classification early in 1971. The work of the committee, composed of representatives from the Geological Survey of the U.S. Department of the Interior, the National Aeronautics and Space Administration (NASA), the Soil Conservation Service of the U.S. Department of Agriculture, the Association of American Geographers, and the International Geographical Union, has been supported by NASA and the Department of the Interior and coordinated by the U.S. Geological Survey (U.S.G.S.).

The objective of the committee was the development of a national classification system that would be receptive to inputs of data from both conventional sources and remote sensors on high altitude aircraft and satellite platforms, and that would at the same time form the framework into which the categories of more detailed land use studies by regional, State, and local agencies could be fitted and aggregated upward from Level IV toward Level I for more generalized smaller scale use at the national level.

Several classification systems designed for or amenable to use with remote sensing techniques served as the basis for discussion at a Conference on Land Use Information and Classification in Washington', DC, June 28—30, 1971. This conference was attended by more than 150 representatives of Federal, State, and local government agencies, universities, institutes, and private concerns. On the basis of these discussions, the Interagency Steering Committee then proposed to

develop and test a land use and land cover classification system that could be used with remote sensing and with minimal reliance on supplemental information at the more generalized first and second levels of categorization. The need for compatibility with the more generalized levels of land use and land cover categorization in classification systems currently in use was clearly recognized, especially those levels of the Standard Land Use Coding Manual published by the U.S. Urban Renewal Administration and the Bureau of Public Roads (1965), the inventory of Major Uses of Land made every 5 years by the Economic Research Service of the U.S. Department of Agriculture (Frey, 1973), and the national inventory of soil and water conservation needs, initiated in 1956 and carried out for the second time in 1966 by several agencies of the U.S. Departments of Agriculture and Interior (U.S. Department of Agriculture, 1971).

Two land use classification systems initially proposed by James R. Anderson for conference use were designed to place major reliance on remote sensing, although supplementary sources of information were assumed to be available for the more elaborate of the two (Anderson, 1971). The classification system for the New York State Land Use and Natural Resources Inventory, developed mainly at the Center for Aerial Photographic Studies at Cornell University, had been designed for use with aerial photography at 1:24,000 scale, and although devised specifically for New York State, it was adaptable for use elsewhere. To take advantage of the New York experience, Ernest E. Hardy and John T. Roach were invited to collaborate in preparing the definitive framework of the proposed classification. Definitions of land use categories used in New York were carefully reviewed and were modified to make them applicable to the country as a whole. The resulting classification was presented in U.S. Geological Survey Circular 671. Because of his past experience with the Commission on Geographic Applications of Remote Sensing of the Association of American Geographers, Richard E. Witmer was invited to participate with the others in this revision of the classification system.

Attention was given mainly to the more generalized first and second levels of categorization. Definitions for each of the categories on these two levels were subjected to selective testing and evaluation by the U.S.G.S., using data obtained primarily from high altitude flights as part of the research in connection with the U.S.G.S. Central Atlantic Regional Ecological Test Site (CARETS) Project (28,800 mi^2 or 74,700 km^2), the Phoenix Pilot Project (31,500 mi^2 or 81,500 km^2), and the land use mapping for the Ozarks Regional Commission (72,000 mi^2 or 186,500km^2).

The work of Pettinger and Poulton (1970) provided valuable insight into the land use mosaic of the Southwestern United States. Some of the categorization for barren-land and rangeland suggested by these researchers has been adopted in this land use and land cover classification system.

DESIGNING A CLASSIFICATION SYSTEM FOR U.S.E WITH REMOTE SENSING TECHNIQUES

There is no one ideal classification of land use and land cover, and it is unlikely that one could ever be developed. There are different perspectives in the classification process, and the process itself tends to be subjective, even when an objective numerical approach is used. There is, in fact, no logical reason to expect that one detailed inventory should be adequate for more than a short time, since land use and land cover patterns change in keeping with demands for natural resources. Each classification is made to suit the needs of the user, and few users will be satisfied with an inventory that does not meet most of their needs. In attempting to develop a classification system for use with remote sensing techniques that will provide a framework to satisfy the needs of the majority of users, certain guidelines of criteria for evaluation must first be established.

To begin with, there is considerable diversity of opinion about what constitutes land use, although present use of land is one of the characteristics that is widely recognized as significant for planning and management purposes. One concept that has much merit is that land use refers to, "man's activities on land which are directly related to the land" (Clawson and Stewart, 1965) . Land cover, on the other hand, describes, "the vegetational and artificial constructions covering the land surface" (Burley, 1961).

The types of land use and land cover categorization developed in the classification system presented in this report can be related to systems for classifying land capability, vulnerability to certain management practices, and potential for any particular activity or land value, either intrinsic or speculative.

Concepts concerning land cover and land use activity are closely related and in many cases have been used interchangeably. The purposes for which lands are being used commonly have associated types of cover, whether they be forest, agricultural, residential, or industrial. Remote sensing image-forming devices do not record activity directly. The remote sensor acquires a response which is based on many characteristics of the land surface, including natural or artificial cover. The interpreter uses patterns, tones, textures, shapes, and site associations to derive information about land use activities from what is basically information about land cover.

Some activities of man, however, cannot be directly related to the type of land cover. Extensive recreational activities covering large tracts of land are not particularly amenable to interpretation from remote sensor data. For example, hunting is a very common and pervasive recreational use of land, but hunting usually occurs on land that would be classified as some type of forest, range, or agricultural land either during ground survey or image interpretation. Consequently, supplemental information is needed to identify lands used for hunting. Supplemental information such as land ownership maps also is necessary to determine the use of lands such as parks, game refuges, or water conservation districts, which may have land uses coincident with administrative boundaries not usually discernible by inventory using remote sensor data. For these reasons, types of land use and land cover identifiable primarily from remote sensor data are used as the basis for organizing this classification system. Agencies requiring more detailed land use information may need to employ more supplemental data.

In almost any classification process, it is rare to find the clearly defined classes that one would like. In determining land cover, it would seem simple to draw the line between land and water until one considers such problems as seasonally wet areas, tidal flats, or marshes with various kinds of plant cover. Decisions that may seem arbitrary must be made at times, but if the descriptions of categories are complete and guidelines are explained, the inventory process can be repeated. The classification system must allow for the inclusion of all parts of the area under study and should also provide a unit of reference for each land use and land cover type.

The problem of inventorying and classifying multiple uses occurring on a single parcel of land will not be easily solved. Multiple uses may occur simultaneously, as in the instance of agricultural land or forest land used for recreational activities such as hunting or camping. Uses may also occur alternately, such as a major reservoir providing flood control during spring runoff and generating power during winter peak demand periods. This same reservoir may have sufficient water depth to be navigable by commercial shipping the year round and may additionally provide summer recreational opportunities. Obviously all of these activities would not be detectable on a single aerial photograph. However, interpreters have occasionally related flood control activities to drawdown easements around reservoirs detectable on imagery acquired during winter low water levels. Similarly, major locks at water-control structures imply barge or ship traffic, and foaming tailraces indicate power generation. Pleasure boat marinas, as well as the wakes of the

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boats themselves, can be detected on high altitude photographs. Although each of these activities is detectable at some time using remote sensing, many other multiple use situations cannot be interpreted with the same degree of success. The example of the reservoir does provide insight into another facet of the problem's solution, however, and that is the possibility and need for acquiring collateral data to aid in the understanding of a multiple use situation.

The vertical arrangement of many uses above and below the actual ground surface provides additional problems for the land use interpreter. Coal and other mineral deposits under croplands or forests, electrical transmission lines crossing pastures, garages underground or on roofs of buildings, and subways beneath urban areas all exemplify situations which must be resolved by individual users and compilers of land use data.

The size of the minimum area which can be depicted as being in any particular land use category depends partially on the scale and resolution of the original remote sensor data or other data source from which the land use is identified and interpreted. It also depends on the scale of data compilation as well as the final scale of the presentation of the land use information. In some cases, land uses cannot be identified with the level of accuracy approaching the size of the smallest unit mappable, while in others, specific land uses can be identified which are too small to be mapped. Farmsteads, for example, are usually not distinguished from other agricultural land uses when mapping at the more generalized levels of the classification. On the other hand, these farmsteads may well be interpretable but too small to be represented at the final format scale. Analogous situations may arise in the use of other categories.

When maps are intended as the format for presenting land use data, it is difficult to represent any unit area smaller than 0.10 inch (2.54mm) on a side. In addition, smaller areas cause legibility problems for the map reader. Users of computer generated graphics are similarly constrained by the minimum size of the computer printout.

CLASSIFICATION CRITERIA

A land use and land cover classification system which can effectively employ orbital and high altitude remote sensor data should meet the following criteria (Anderson, 1971):

1. The minimum level of interpretation accuracy in the identification of land use and land cover categories from remote sensor data should be at least 85 percent.

2. The accuracy of interpretation for the several categories should be about equal.

3. Repeatable or repetitive results should be obtainable from one interpreter to another and from one time of sensing to another.

4. The classification system should be applicable over extensive areas.

5. The categorization should permit vegetation and other types of land cover to be used as surrogates for activity.

6. The classification system should be suitable for use with remote sensor data obtained at different times of the year.

7. Effective use of subcategories that can be obtained from ground surveys or from the use of larger scale or enhanced remote sensor data should be possible.

8. Aggregation of categories must be possible.

9. Comparison with future land use data should be possible.

10. Multiple uses of land should be recognized when possible.

Some of these criteria should apply to land use and land cover classification in general, but some of the criteria apply primarily to land use and land cover data interpreted from remote sensor data.

It is hoped that, at the more generalized first and second levels, an accuracy in interpretation can be attained that will make the land use and land cover data comparable in quality to those obtained in other ways. For land use and land cover data needed for planning and management purposes, the accuracy of interpretation at the generalized first and second levels is satisfactory when the interpreter makes the correct interpretation 85 to 90 percent of the time. For regulation of land use activities or for tax assessment purposes, for example, greater accuracy usually will be required. Greater accuracy generally will be attained only at much higher cost. The accuracy of land use data obtained from remote sensor sources is comparable to that acquired by using enumeration techniques. For example, postenumeration surveys made by the U.S. Bureau Of the Census revealed that 14 percent of all farms (but not necessarily 14 percent of the farmland) were not enumerated during the 1969 Census of Agriculture (Ingram and Prochaska, 1972).

In addition to perfecting new interpretation techniques and procedures for analysis, such as the various types of image enhancement and signature identification, we can assume that the resolution capability of the various remote sensing systems will also improve.

Resolution, or resolving power, of an imaging system refers to its ability to separate two objects some distance apart. In most land use applications, we are most interested in the minimum size of an area which can be recognized as having an interpretable land use or land cover type. Obviously, such a minimum area depends not only on the type and characteristics of the imaging system involved, but pragmatically also on the order of "generation" of the imagery, that is, how far the study image is removed in number of reproduction stages from the original record. The user should refer to the most recent information available in determining the resolution parameters of the system.

The kind and amount of land use and land cover information that may be obtained from different sensors depend on the altitude and the resolution of each sensor. There is little likelihood that any one sensor or system will produce good data at all altitudes. It would be desirable to evaluate each source of remote sensing data and its application solely on the basis of the qualities and characteristics of the source. However, it is common practice to transfer the data to a base map, and no matter what the guidelines are, it is difficult to use a base map without extracting some additional data from such maps. Topographic maps, road maps, and detailed city maps will generally contribute detail beyond the capabilities of the remote sensor data.

The multilevel land use and land cover classification system described in this report has been developed because different sensors will provide data at a range of resolutions dependent upon altitude and scale. In general, the following relations pertain, assuming a 6 inch focal length camera is used in obtaining aircraft imagery.

Classification level	Typical data characteristics
I	LANDSAT (formery ERTS) type of data.
II	High-altitude data at 40,000 ft (12,400 m) or above (less than 1:80,000 scale).
III	Medium-altitude data taken between 10,000 and 40,000 ft (3,100 and 12,400 in)(1:20,000 to 1:80,000 scale).
IV	Low-altitude data taken below 10,000 ft (3,100 m) (more than 1:20,000 scale).

Although land use data obtained at any level of categorization certainly should not be restricted to any particular level of user groups nor to any particular scale of presentation, information at Levels I and II would generally be of interest to users who desire data on a nationwide, interstate, or statewide basis. More detailed land use and land cover data such as those categorized at Levels III and IV usually will be used more frequently by those who need and generate local information at the intrastate, regional, county, or municipal level. It is intended that these latter levels of categorization will be developed by the user groups themselves, so that their specific needs may be satisfied by the categories they introduce into the structure. Being able to aggregate more detailed categories into the categories at Level II being adopted by the U.S.G.S. is desirable if the classification system is to be useful. In general, Level II land use and land cover data interface quite effectively with point and line data available on the standard U.S.G.S. topographic maps.

This general relationship between the categorization level and the data source is not intended to restrict users to particular scales, either in the original data source from which the land use information is compiled or in the final map product or other graphic device. Level I land use information, for example, while efficiently and economically gathered over large areas by a LANDSAT type of satellite or from high-altitude imagery, could also be interpreted from conventional large-scale aircraft imagery or compiled by ground survey. This same information can be displayed at a wide variety of scales ranging from a standard topographic map scale, such as 1:24,000 or even larger, to the much smaller scale of the orbital imagery, such as 1:1,000,000. Similarly, several Level II categories (and, in some instances, Level III categories) have been interpreted from LANDSAT data. Presently, though, Level II categories are obtained more accurately from high-altitude photographs. Much Level III and Level IV land use and land cover data can also be obtained from high-altitude imagery. This level of categorization can also be presented at a wide range of scales. However, as the more detailed levels of categorization are used, more dependence necessarily must be placed on higher resolution remote sensor data and supplemental ground surveys.

The principal remote sensor source for Level II data at the present time is high-altitude, color-infrared photography. Scales smaller than 1:80,000 are characteristic of high-altitude photographs, but scales from 1:24,000 to 1:250,000 generally have been used for the final map products.

The same photography which now is used to construct or update 1:24,000 topographic maps or orthophotoquads at similar scales is a potential data source for inventorying land use and land cover. The orthophoto base, in particular, commonly can enable rapid interpretation of Levels I and II information at relatively low cost. The cost of acquiring more detailed levels of land use and land cover data might prohibit including such data on large-scale maps over extensive areas.

Recent experiments (Stevens and others, 1974) with Levels I and II land use data referenced to 1:24,000 topographic maps have been conducted by researchers of the Maps and Surveys Branch of the Tennessee Valley Authority in conjunction with the Marshall Space Flight Center and Oak Ridge National Laboratories. Quite satisfactory results have been obtained when interpreting land use from high-altitude photography. In areas of considerable terrain relief a stereoplotter was used to avoid scale problems.

The categories proposed at Level II cannot all be interpreted with equal reliability. In parts of the United States, some categories may be extremely difficult to interpret from high-altitude aircraft imagery alone. Conventional aerial photography and sources of information other than remote sensor data may be needed for interpretation of especially complex areas. On the basis of research and testing carried out in the U.S.G.S. Geography Program's Central Atlantic Regional Ecological Test Site (CARETS) Project, the Phoenix Pilot Project, and in land use mapping for the Ozarks Regional Commission (U.S. Geological Survey, 1978), it has been determined that the cost of using such supplementary information can be held to reasonable levels.

At Level III, which is beyond the scope of the present discussion, use of substantial amounts of supplemental information in addition to some remotely sensed information at scales of 1:15,000 to 1:40,000 should be anticipated. Surprisingly detailed inventories may be undertaken, and by using both remotely sensed and supplemental information, most land use and land

cover types, except those of very complex urban areas or of thoroughly heterogeneous mixtures can be adequately located, measured, and coded.

Level IV would call for much more supplemental information and remotely sensed data at a much larger scale.

DEVELOPING THE CLASSIFICATION SYSTEM

In developing the classification system, every effort has been made to provide as much compatibility as possible with other classification systems currently being used by the various Federal agencies involved in land use inventory and mapping. Special attention has been paid to the definitions of land use categories used by other agencies, to the extent that they are useful in categorizing data obtained from remote sensor sources.

The definition of Urban or Built-up Land, for example, includes those uses similarly classified (Wooten and Anderson, 1957) by the U.S. Department of Agriculture, plus the built-up portions of major recreational sites, public installations, and other similar facilities. Agricultural land has been defined to include Cropland and Pasture; Orchards, Groves, Vineyards, Nurseries, and Ornamental Horticultural Areas; and Confined Feeding Operations as the principal components. Certain land uses such as pasture, however, cannot be separated consistently and accurately by using the remote sensor data sources appropriate to the more generalized levels of the classification. The totality of the category thus closely parallels the U.S. Department of Agriculture definition of agricultural land.

The primary definition of Forest Land employed for use with data acquired by remote sensors approximates that used by the U.S. Forest Service (unpublished manual), with the exception of those brush and shrub form types such as chaparral and mesquite, which are classed as forest land by the Forest Service because of their importance in watershed control. Because of their spectral response, these generally are grouped with Rangeland types in classifications of vegetation interpretable from remote sensing imagery.

The principal concept by which certain types of cover are included in the Rangeland category, and which separates rangeland from pasture land, is that rangeland has a natural climax plant cover of native grasses, forbs, and shrubs which is potentially useful as a grazing or forage resource (U.S. Congress, 1936; U.S. Department of Agriculture, 1962, 1971). Although these rangelands usually are not seeded, fertilized, drained, irrigated, or cultivated, if the forage cover is improved, it is managed primarily like native vegetation, and the forage resource is regulated by varying the intensity and seasonality of grazing (Stoddard and Smith, 1955). Since the typical cropland practices mentioned just above are characteristics of some pasture lands, these pasture lands are similar in image signature to cropland types.

The definition of Wetland incorporates the major elements of the original U.S. Department of the Interior definition (Shaw and Fredine, 1956) as well as the combined efforts of the U.S.G.S. working group on wetlands definition.

Table I presents a general summary of land use compiled every 5 years by the Economic Research Service of the U.S. Department of Agriculture and supplemented from other sources. These statistics, which are available only for States, are provided by the various government agencies which compile information on some categories of land use, several of which parallel the U.S.G.S. land use classification system.

TABLE 1.—Major uses of land, United States, 1969[1]

	Acres (millions)	Hectares (millions)	Percent
Cropland	472	191	20.9
Cropland used for crops	333	135	
Cropland harvested	286	116	
Crop failure	6	2	
Cultivated summer fallow	41	17	
Soil improvement crops and idle cropland	51	21	
Cropland used only for			

pasture.....	88	35	
Grassland pasture and range[2].....	604	245	26.7
Forest land	723	293	31.9
Grazed.....	198	80	
Not grazed.....	525	213	
Special uses[3]	178	72	7.9
Urban areas.....	35	14	
Transportation areas.	26	11	
Rural parks.....	49		19
Wildlife refuges.....	32		13
National defense, flood control, and industrial areas.....	26	11	
State-owned institutions and miscellaneous other uses	2	1	
Farmsteads, farm roads, and lanes.....	8	3	
Miscellaneous land[4]...	287	116	12.6

[1]Frey, H. T., 1973. Does not include area by water in streams more than % of a mile in width and lakes, reservoirs, and so forth of more than 40 acres in size.

[2]Includes pasture that is to be included with cropland in the U.S.G.S. classification system.

[3]Except for urban and built-up areas and transportation uses, these special uses will be classified by dominant cover under the U.S.G.S. Classification system.

[4]Tundra, glacier, and icefields, marshes, open swamp, bare rock areas, deserts, beaches, and other miscellaneous, land.

The land use and land cover classification system presented in this report (table 2) includes only the more generalized first and second levels. The system satisfies the three major attributes of the classification process as outlined by Grigg (1965): (1) it gives names to categories by simply using accepted terminology; (2) it enables information to be transmitted; and (3) it allows inductive generalizations to be made. The classification system is capable of further refinement on the basis of more extended and varied use. At the more generalized levels it should meet the principal objective of providing a land use and land cover classification system for use in land use planning and management activities. Attainment of the more fundamental and long-range objective of providing a standardized system of land use and land cover classification for national and regional covered studies will depend on the improvement that should result from widespread use of the system.

TABLE 2.—Land use and land cover classification system for use with remote sensor data

Level I		Level II
1 Urban or Built-up Land	11	Residential.
	12	Commercial and Services.
	13	Industrial.
	14	Transportation, Communications, and Utilities.
	15	Industrial and Commercial Complexes.
	16	Mixed Urban or Built-up Land.
	17	Other Urban or Built-up Land.
2 Agricultural Land	21	Cropland and Pasture.
	22	Orchards, Groves, Vineyards, Nurseries, and Ornamental Horticultural Areas.
	23	Confined Feeding Operations.
	24	Other Agricultural Land.
3 Rangeland	31	Herbaceous Rangeland.

	32	Shrub and Brush Rangeland.
	33	Mixed Rangeland.
4 Forest Land	41	Deciduous Forest Land.
	42	Evergreen Forest Land.
	43	Mixed Forest Land.
5 Water	51	Streams and Canals.
	52	Lakes.
	53	Reservoirs.
	54	Bays and Estuaries.
6 Wetland	61	Forested Wetland.
	62	Nonforested Wetland.
7 Barren Land	71	Dry Salt Flats.
	72	Beaches.
	73	Sandy Areas other than Beaches.
	74	Bare Exposed Rock.
	75	Strip Mines. Quarries, and Gravel Pits.
	76	Transitional Areas.
	77	Mixed Barren Land.
8 Tundra	81	Shrub and Brush Tundra.
	82	Herbaceous Tundra.
	83	Bare Ground Tundra.
	84	Wet Tundra.
	85	Mixed Tundra.
9 Perennial Snow or Ice	91	Perennial Snowfields.
	92	Glaciers.

As further advances in technology are made, it may be necessary to modify the classification system for use with automatic data analysis. The LANDSAT and Skylab missions and the high-altitude aircraft program of the National Aeronautics and Space Administration have offered opportunities for nationwide testing of the feasibility of using this classification system to obtain land use information on a uniform basis.

The approach to land use and land cover classification embodied in the system described herein is "resource oriented," in contrast, for example, with the "people orientation" of the "Standard Land Use Coding Manual," developed by the U.S. Urban Renewal Administration and the Bureau of Public Roads (1965). For the most part the Manual is derived from the "Standard Industrial Classification Code" established and published by the former Bureau of the Budget (U.S. Executive Office of the President, 1957).

The people-oriented system of the "Standard Land Use Coding Manual" assigns seven of the nine generalized first level categories to urban, transportation, recreational, and related uses of land, which account for less than 5 percent of the total area of the United States (tables 1 and 3). Although there is an obvious need for an urban-oriented land use classification system, there is also a need for a resource-oriented classification system whose primary emphasis would be the remaining 95 percent of the United States land area. The U.S.G.S. Classification system described in this report addresses that need, with eight of the nine Level I categories treating land area of the United States that is not in urban or built-up areas. Six of the first level categories in the standard land use code are retained under Urban or Built-up at Level II in the U.S.G.S. system. Even though the standard land use code and the U.S.G.S. Classification differ considerably in their major emphases, a marked degree of compatibility between these two systems exists at the more Eeneralized levels and even at the more detailed levels.

TABLE 3.—Standard land use code—first level categories[1]

1. Residential.
2. Manufacturing (9 second level categories included).
3. Manufacturing (6 second level categories included).
4. Transportation, communications, and utilities.

5. Trade.
6. Services.
7. Cultural, entertainment, and recreation.
8. Resource production and extraction.
9. Undeveloped land and water areas.

[1] Standard land use coding manual, 1965. p. 29.

U.S.ING THE CLASSIFICATION SYSTEM

The use of the same or similar terminology does not automatically guarantee that the land use data collected and coded according to two systems will be entirely compatible. The principal points of departure between other classifications and the U.S.G.S. System originate because of the emphasis placed on remote sensing as the primary data source used in the U.S.G.S. Classification system. Because of this emphasis, activity must be interpreted using land cover as the principal surrogate, in addition to the image interpreter's customary references to pattern, geographic location, and so forth. This process necessarily precludes the possibility of information being generated which identifies ownership-management units such as farms or ranches or relating detached uses, included in a specific ownership complex, to the parent activity. For example, warehouses cannot be related to retail sales when the two occurrences are separated spatially. The actual cover and related uses are mapped in each case, rather than injecting inference into the inventory process.

Inferences used for prediction could cause problems for the land use interpreter where land use is clearly in transition, with neither the former use nor the future use actually being present. In most such cases, it is tempting to speculate on future use, but all that can actually be determined in such wideranging situations is that change is occurring. Large clear-cut areas in the southeastern forests, for example, are not always returned to forests and might assume any of a variety of future uses, such as a residential subdivision, an industrial site, an area of cropland, or a phosphate mine. The "sagebrush subdivision" of the Southwest may have all the potential earmarks of future settlement, such as carefully platted streets, and yet never experience any construction. Such cleared open areas should be identified as "Transitional Areas."

Since Level II will probably be most appropriate for statewide and interstate regional land use and land cover compilation and mapping, and since Level II categories can be created by aggregating similar Level III categories, the Level II categorization may be considered to be the fulcrum of the classification system. The classification system may be entered at the particular level appropriate to the individual user, and the information generated may be added together with data generated by others to form an aggregate category at the next higher level. As an example, if a local planning group had devised a Level III classification of a particular group of land uses and had included sufficient definitional information of their land use categories, their data could be compiled into a larger inventory by a state or regional planning group compiling data by use of the Level II categories. Such data,in turn, could serve as part of the data base for a national inventory.

Seldom is it necessary to inventory land uses at the more detailed levels, even for local planning. Having greater detail does, however, provide flexibility in manipulating the data when several different purposes must be served. The cost of interpreting, coding, and recording land use data at the more detailed levels is necessarily greater than if the data were handled at more generalized levels. This extra cost reflects the increase in cost of remote sensor and collateral data acquired at larger scales, as well as the increase in interpretation costs.

The U.S.G.S. classification system provides flexibility in developing categorization at the more detailed levels. Therefore, it is appropriate to illustrate the additive properties of the system and to provide examples for users wishing to develop more detailed categorization. The several examples given below represent possible categorizations. Users should not consider themselves limited to categories such as these but should develop categories of utmost utility to their particular needs. It should be emphasized that, whatever categories are used at the various classification levels, special attention should be given to providing the potential users of the data with sufficient information so that they may either compile the data into more generalized levels or aggregate more detailed data into the existing classes.

One example of subcategorization of Residential Land as keyed to the standard land use code would be:

Level I	Level II	
1. Urban or Built-up	11. Residential	111. Single-family Units. 112. Multi-family Units. 113. Group Quarters.

114. Residential Hotels.
115. Mobile Home Parks.
116. Transient Lodgings.
117. Other.

This particular breakdown of "Residential" employs criteria of capacity, type, and permanency of residence as the discriminating factors among classes. Criteria applied to other situations could possibly include density of dwellings, tenancy, age of construction, and so forth. Obviously, such a Level III categorization would require use of supplemental information. Users desiring Level IV information could employ a variety of additional criteria in discriminating among land uses,but it can be seen that the element which allows aggregation and transfer between categories is the proper description of what is included in each individual category at whatever level the data are being classified.

The Level II category, Cropland and Pasture, may be simply subdivided at Level III.

Level II	Level III
21. Cropland and Pasture.	211. Cropland. 212. Pasture.

Some users may wish such additional criteria employed at Level III as degree of activity or idleness or degree of improvement, while others may place such items in Levels IV or V. What may be a primary category for one user group may be of secondary importance to another. As stated by Clawson and Stewart (1965), "One man's miscellany is another man's prime concern." No one would consider publishing a map of current land use of any part of the Western United States without having irrigated land as a major category. With the flexibility inherent in this classification system, an accommodation of this type of need can be made easily, provided that irrigated land is mapped or tabulated as a discrete unit which can be aggregated into the more general categories included in the framework of the classification. A possible restructuring which would accommodate the desire to present irrigated land as a major category would be:

Irrigated agricultural land	Nonirrigated agricultural land
Cropland Pasture Orchards, Groves and so forth	Cropland Pasture Orchards, Groves and so forth

DEFINITIONS

An attempt has been made to include sufficient detail in the definitions presented here to provide a general understanding of what is included in each category at Levels I and IL Many of the uses described in detail will not be detectable on small-scale aerial photographs. However, the detail will aid in the interpretation process, and the additional information will be useful to those who have large-scale aerial photographs and other supplemental information available.

1. URBAN OR BUILT-UP LAND

Urban or Built-up Land is comprised of areas of intensive use with much of the land covered by structures. Included in this category are cities, towns, villages, strip developments along highways, transportation, power, and communications facilities, and areas such as those occupied by mills, shopping centers, industrial and commercial complexes, and institutions that may, in some instances, be isolated from urban areas.

As development progresses, land having less intensive or nonconforming use may be located in the midst of Urban or Built-up areas and will generally be included in this category. Agricultural land, forest, wetland, or water areas on the fringe of Urban or Built-up areas will not be included except where they are surrounded and dominated by urban development. The Urban or Built-up category takes precedence over others when the criteria for more than one category are met. For example, residential areas that have sufficient tree cover to meet Forest Land criteria will be placed in the Residential category.

11. RESIDENTIAL

Residential land uses range from high density, represented by the multiple-unit structures of urban cores, to low density, where houses are on lots of more than an acre, on the periphery of urban expansion. Linear residential developments along transportation routes extending outward from urban areas should be included as residential appendages to urban centers, but care must be taken to distinguish them from commercial strips in the same locality. The residential strips generally have a uniform size and spacing of structures, linear driveways, and lawn areas; the commercial strips are more likely to have buildings of different sizes and spacing, large driveways, and parking areas. Residential development along shorelines is also linear and sometimes extends back only one residential parcel from the shoreline to the first road.

Areas of sparse residential land use, such as farmsteads, will be included in categories to which they are related unless an appropriate compilation scale is being used to indicate such uses separately. Rural residential and recreational subdivisions, however, are included in this category, since the land is almost totally committed to residential use, even though it may have forest or range types of cover. In some places, the boundary will be clear where new housing developments abut against intensively used agricultural areas, but the boundary may be vague and difficult to discern when residential development occurs in small isolated units over an area of mixed or less intensive uses. A careful evaluation of density and the overall relation of the area to the total urban complex must be made.

Residential sections which are integral parts of other uses may be difficult to identify. Housing situations such as those existing on military bases, at colleges and universities, living quarters for laborers near a work base, or lodging for employees of agricultural field operations or resorts thus would be placed within the Industrial, Agricultural, or Commercial and Services categories.

12. COMMERCIAL AND SERVICES

Commercial areas are those used predominantly for the sale of products and services. They are often abutted by residential, agricultural, or other contrasting uses which help define them. Components of the Commercial and Services category are urban central business districts; shopping centers, usually in suburban and outlying areas; commercial strip developments along major highways and access routes to cities; junkyards; resorts; and so forth. The main buildings, secondary structures, and areas supporting the basic use are all included—office buildings, warehouses, driveways, sheds, parking lots, landscaped areas, and waste disposal areas.

Commercial areas may include some noncommercial uses too small to be separated out. Central business districts commonly include some institutions, such as churches and schools, and commercial strip developments may include some residential units. When these noncommercial uses exceed one-third of the total commercial area, the Mixed Urban or Built-up category should be used. There is no separate category for recreational land uses at Level II since most recreational activity is pervasive throughout any other land uses. Selected areas are predominantly recreation oriented, and some of the more distinctive occurrences such as drive-in theaters can, be identified on remote sensor imagery. Most recreational activity, however, necessarily will be identified using supplemental information. Recreational facilities that form an integral part of an institution should be included in this category. There is usually a major visible difference in the form of parking facilities, arrangements for traffic flow, and the general association of buildings and facilities. The intensively developed sections of recreational areas would be included in the Commercial and Services category, but extensive parts of golf courses, riding areas, ski areas, and so forth would be included in the Other Urban or Built-up category.

Institutional land uses, such as the various educational, religious, health, correctional, and military facilities are also components of this category. All buildings, grounds, and parking lots that compose the facility are included within the institutional unit, but areas not specifically related to the purpose of the institution should be placed in the appropriate category. Auxiliary land uses, particularly residential, commercial and services, and other supporting land uses on a military base would be included in this category, but agricultural areas not specifically associated with correctional, educational, or religious institutions are placed in the appropriate agricultural category. Small institutional units, as, for example, many churches and some secondary and elementary schools, would be mappable only at large scales and will usually be included within another category, such as Residential.

13. INDU.S.TRIAL

Industrial areas include a wide array of land uses from light manufacturing to heavy manufacturing plants. Identification of

light industries—those focused on design, assembly, finishing, processing, and packaging of products—can often be based on the type of building, parking, and shipping arrangements. Light industrial areas may be, but are not necessarily, directly in contact with urban areas; many are now found at airports or in relatively open country. Heavy industries use raw materials such as iron ore, timber, or coal. Included are steel mills, pulp and lumber mills, electric-power generating stations, oil refineries and tank farms, chemical plants, and brickmaking plants. Stockpiles of raw materials and waste-product disposal areas are usually visible, along with transportation facilities capable of handling heavy materials.

Surface structures associated with mining operations are included in this category. Surface structures and equipment may range from a minimum of a loading device and trucks to extended areas with access roads, processing facilities, stockpiles, storage sheds, and numerous vehicles. Spoil material and slag heaps usually are found within a short trucking distance of the major mine areas and may be the key indicator of underground mining operations. Uniform identification of all these diverse extractive uses is extremely difficult from remote sensor data alone. Areas of future reserves are included in the appropriate present-use category, such as Agricultural Land or Forest Land, regardless of the expected future use.

14. TRANSPORTATION. COMMUNICATIONS, AND UTILITIES

The land uses included in the Transportation, Communications, and Utilities category occur to some degree within all of the other Urban or Builtup categories and actually can be found within many other categories. Unless they can be mapped separately at whatever scale is being employed, they usually are considered an integral part of the land use within which they occur. For that reason, any statistical summary of the area of land uses in this category typically represents only a partial data set. Statistical area summaries of such land uses aggregated from Levels III and IV, though, would include more accurate area estimates.

Major transportation routes and areas greatly influence other land uses, and many land use boundaries are outlined by them. The types and extent of transportation facilities in a locality determine the degree of access and affect both the present and potential use of the area.

Highways and railways are characterized by areas of activity connected in linear patterns. The highways include rights-of-way, areas used for interchanges, and service and terminal facilities. Rail facilities include stations, parking lots, roundhouses, repair and switching yards, and related areas, as well as overland track and spur connections of sufficient width for delineation at mapping scale.

Airports, seaports, and major lakeports are isolated areas of high utilization, usually with no well-defined intervening connections, although some ports are connected by canals. Airport facilities include the runways, intervening land, terminals, service buildings, navigation aids, fuel storage, parking lots, and a limited buffer zone. Terminal facilities generally include the associated freight and warehousing functions. Small airports (except those on rotated farmland), heliports, and land associated with seaplane bases may be identified if mapping scale permits. Port areas include the docks, shipyards, drydocks, locks, and waterway control structures.

Communications and utilities areas such as those involved in processing, treatment, and transportation of water, gas, oil, and electricity and areas used for airwave communications are also included in this category. Pumping stations, electric substations, and areas used for radio, radar, or television antennas are the major types. Small facilities, or those associated with an industrial or commercial land use, are included within the larger category with which they are associated. Long-distance gas, oil, electric, telephone, water, or other transmission facilities rarely constitute the dominant use of the lands with which they are associated.

15. INDU.S.TRIAL AND COMMERCIAL COMPLEXES

The Industrial and Commercial Complexes category includes those industrial and commercial land uses that typically occur together or in close functional proximity. Such areas commonly are labeled with terminology such as "Industrial Park," but since functions such as warehousing, wholesaling, and occasionally retailing may be found in the same structures or nearby, the more inclusive category title has been adopted.

Industrial and Commercial complexes have a definite remote sensor image signature which allows their separation from other Urban or Built-up land uses. Because of their intentional development as discrete units of land use, they may border on a wide variety of other land use types, from Residential Land to Agricultural Land to Forest Land. If the separate functions included in the category are identified at Levels III or IV using supplemental data or with ground survey, the land use researcher has the discretion of aggregating these functions into the appropriate Level II Urban or Built-up categories or retaining the unit as an Industrial and Commercial Complex.

16. MIXED URBAN OR BUILT-UP LAND

The Mixed Urban or Built-up category is used for a mixture of Level II Urban or Built-up uses where individual uses cannot be separated at mapping scale. Where more than one-third intermixture of another use or uses occurs in a specific area, it is classified as Mixed Urban or Built-up Land. Where the intermixed land use or uses total less than one-third of the specific area, the category appropriate to the dominant land use is applied.

This category typically includes developments along transportation routes and in cities, towns, and built-up areas where separate land uses cannot be mapped individually. Residential, Commercial, Industrial, and occasionally other land uses may be included. A mixture of industrial and commercial uses in Industrial and Commercial Complexes as defined in category 15 are not included in this category. Farmsteads intermixed with strip or cluster settlements will be included within the built-up land, but other agricultural land uses should be excluded.

17. OTHER URBAN OR BUILT-UP LAND

Other Urban or Built-up Land typically consists of uses such as golf driving ranges, zoos, urban parks, cemeteries, waste dumps, water control structures and spillways, the extensive parts of such uses as golf courses and ski areas, and undeveloped land within an urban setting. Open land may be in very intensive use but a use that does not require structures, such as urban playgrounds, botanical gardens, or arboreta. The use of descriptions such as "idle land," "vacant land," or "open land" should be avoided in categorizing undeveloped lands within urban areas on the basis of the use of remote sensor data, since information generally is not available to the interpreter to make such a refinement in categorization.

2. AGRICULTURAL LAND

Agricultural Land may be defined broadly as land used primarily for production of food and fiber. On high-altitude imagery, the chief indications of agricultural activity will, be distinctive geometric field and road patterns on the landscape and the traces produced by livestock or mechanized equipment.

However, pasture and other lands where such equipment is used infrequently may not show as well-defined shapes as other areas. These distinctive geometric patterns are also characteristic of Urban or Built-up Lands because of street layout and development by blocks. Distinguishing between Agricultural and Urban or Built-up Lands ordinarily should be possible on the basis of urban-activity indicators and the associated concentration of population. The number of building complexes is smaller and the density of the road and highway network is much lower in Agricultural Land than in Urban or Built-up Land. Some urban land uses, such as parks and large cemeteries, however, may be mistaken for Agricultural Land, especially when they occur on the periphery of the urban areas.

The interface of Agricultural Land with other categories of land use may sometimes be a transition zone in which there is an intermixture of land uses at first and second levels of categorization. Where farming activities are limited by wetness, the exact boundary also may be difficult to locate, and Agricultural Land may grade into Wetland. When the production of agricultural crops is not hindered by wetland conditions, such cropland should be included in the Agricultural category. This latter stipulation also includes those cases in which agricultural crop production depends on wetland conditions, such as the flooding of ricefields or the development of cranberry bogs. When lands produce economic commodities as a function of their wild state such as wild rice, cattails, or certain forest products commonly associated with wetland, however, they should be included in the Wetland category. Similarly, when wetlands, are drained for agricultural purposes, they should be included in the Agricultural Land category. When such drainage enterprises fall into disuse and if wetland vegetation is reestablished, the land reverts to the Wetland category.

The Level II categories of Agricultural Land are: Cropland and Pasture; Orchards, Groves, Vineyards, Nurseries, and Ornamental Horticultural Areas; Confined Feeding Operations; and Other Agricultural Land.

21. CROPLAND AND PASTURE

The several components of Cropland and Pasture now used for agricultural statistics include: cropland harvested, including bush fruits; cultivated summer-fallow and idle cropland; land on which crop failure occurs; cropland in soil-improvement grasses and legumes; cropland used only for pasture in rotation with crops; and pasture on land more or

less permanently used for that purpose. From imagery alone, it generally is not possible to make a distinction between Cropland and Pasture with a high degree of accuracy and uniformity, let alone a distinction among the various components of Cropland (Hardy, Beicher, and Phillips, 1971). Moreover, some of the components listed represent the condition of the land at the end of the growing season and will not apply exactly to imagery taken at other times of the year. They will, however, be a guide to identification of Cropland and Pasture. Brushland in the Eastern States, typically used to some extent for pasturing cattle, is included in the Shrub-Brushland Rangeland category since the grazing activity is usually not discernible on remote sensor imagery appropriate to Levels I and II. This activity possibly might be distinguished on low-altitude imagery. Such grazing activities generally occur on land where crop production or intensive pasturing has ceased, for any of a variety of reasons, and which has grown up in brush. Such brushlands often are used for grazing, somewhat analogous to the extensive use of rangelands in the West.

Certain factors vary throughout the United States, and this variability also must be recognized; field size depends on topography, soil types, sizes of farms, kinds of crops and pastures, capital investment, labor availability, and other conditions. Irrigated land in the Western States is recognized easily in contrast to Rangeland, but in the Eastern States, irrigation by use of overhead sprinklers generally cannot be detected from imagery unless distinctive circular patterns are created. Drainage or water control on land used for cropland and pasture also may create a recognizable pattern that may aid in identification of the land use. In areas of quick-growing crops, a field may appear to be in nonagricultural use unless the temporary nature of the inactivity is recognized.

22. ORCHARDS, GROVES, VINEYARDS, NURSERIES, AND ORNAMENTAL HORTICULTURAL AREAS

Orchards, groves, and vineyards produce the various fruit and nut crops. Nurseries and horticultural areas, which include floricultural and seed-and-sod areas and some greenhouses, are used perennially for those purposes. Tree nurseries which provide seedlings for plantation forestry also are included, here. Many of these areas may be included in another category, generally Cropland and Pasture, when identification is made by use of small-scale imagery alone. Identification may be aided by recognition of the combination of soil qualities, topography, and local climatological factors needed for these operations: water bodies in close proximity which moderate the effects of short duration temperature fluctuations; site selection for air drainage on sloping land; and deep well-drained soils on slopes moderate enough to permit use of machinery. Isolated small orchards, such as the fruit trees on the family farm, usually are not recognizable on high-altitude imagery and are, therefore, not included.

23. CONFINED FEEDING OPERATIONS

Confined Feeding Operations are large, specialized livestock production enterprises, chiefly beef cattle feedlots, dairy operations with confined feeding, and large poultry farms, but also including hog feedlots. These operations have large animal populations restricted to relatively small areas. The result is a concentration of waste material that is an environmental concern. The waste-disposal problems justify a separate category for these relatively small areas. Confined Feeding Operations have a built-up appearance, chiefly composed of buildings, much fencing, access paths, and waste-disposal areas. Some are located near an urban area to take advantage of transportation facilities and proximity to processing plants.

Excluded are shipping corrals and other temporary holding facilities. Such occurrences as thoroughbred horse farms generally do not have the animal population densities which would place them in this category.

24. OTHER AGRICULTURAL LAND

Other land uses typically associated with the first three categories of Agricultural Land are the principal components of the Other Agricultural Land category. They include farmsteads, holding areas for livestock such as corrals, breeding and training facilities on horse farms, farm lanes and roads, ditches and canals, small farm ponds, and similar uses. Such occurrences generally are quite small in area and often uninterpretable by use of high-altitude data. Even when they are interpretable from such data, it may not be feasible to map them at smaller presentation scales, which generally results in their inclusion with adjacent agricultural use areas. This category should also be used for aggregating data for land uses derived at more detailed levels of classification.

3. RANGELAND

Rangeland historically has been defined as land where the potential natural vegetation is predominantly grasses, grasslike plants, forbs, or shrubs and

where natural herbivory was an important influence in its precivilization state. Management techniques which associate soil, water, and forage-vegetation resources are more suitable for rangeland management than are practices generally used in managing pastureland. Some rangelands have been or may be seeded to introduced or domesticated plant species. Most of the rangelands in the United States are in the western range, the area to the west of an irregular north-south line that cuts through the Dakotas, Nebraska, Kansas, Oklahoma, and Texas. Rangelands also are found in certain places historically not included in the western range, such as the Flint Hills, the Southeastern States, and Alaska. The historical connotation of Rangeland is expanded in this classification to include those areas in the Eastern States which commonly are called brushlands.

The Level II categories of Rangeland are: Herbaceous Range, Shrub and Brush Rangeland, and Mixed Rangeland.

31. HERBACEOU.S. RANGELAND

The Herbaceous Rangeland category encompasses lands dominated by naturally occurring grasses and forbs as well as those areas of actual rangeland which have been modified to include grasses and forbs as their principal cover, when the land is managed for rangeland purposes and not managed using practices typical of pastureland. It includes the tall grass (or true prairie), short grass, bunch grass or palouse grass, and desert grass regions. Respectively, these grass regions represent a sequence of declining amounts of available moisture. Most of the tall grass region has been plowed for agriculture and the remaining tall grass range is now in North Dakota, Nebraska, southern Kansas and Oklahoma, and the Texas Coastal Plain. Short grass rangeland occurs in a strip about 300 miles (500 km) wide from the Texas Panhandle northward to the Dakotas where it widens to cover the western half of the Dakotas, the eastern three-fourths of Montana, and the eastern third of Wyoming. Bunch grass and desert grass are found in many locations, representing transitional situations to desert shrub. Typical occurrences of grasslands include such species as the various bluestems (Andropogon), grama grasses (Bouteloua), wheatgrasses (Agropyron), needlegrasses (Stipa), and fescues (Festuca).

This category also includes the palmetto prairie areas of south-central Florida, which consist mainly of dense stands of medium length and tall grasses such as wiregrass (Aristida stricta) and saw palmettos (Seronoa ripens), interspersed occasional palms (Sabal palmetto), and shrubs (Shelford, 1963). Those palmetto prairie areas now in improved pasture would not be included in this category, nor would the herbaceous varieties of tundra vegetation.

32. SHRUB AND BRU.S.H RANGELAND

The typical shrub occurrences are found in those arid and semiarid regions characterized by such xerophytic vegetative types with woody stems as big sagebrush (Artemisia tridentata), shadscale (Atriplex confertifolia), greasewood (Sarcobatus vermiculatus), or creosotebush (Larrea divaricata) and also by the typical desert succulent xerophytes, such as the various forms of Cactus (Kuchler, 1964). When bottom lands and moist flats are characterized by dense stands of typical wetland species such as mesquite (Prosopis), they are considered Wetland. Where highly alkaline soils are present, halophytes such as desert saltbush (Atriplex) may occur. The type, density, and association of these various species are useful as indicators of the local hydrologic and pedologic environments. Also included in this category are chaparral, a dense mixture of broadleaf evergreen schlerophyll shrubs, and the occurrences of mountain mahogany (Cercocarpus ledifolius) and scrub oaks (Quercus).

The eastern brushlands are typically former croplands or pasture lands (cleared from original forest land) which now have grown up in brush in transition back to forest land to the extent that they are no longer identifiable as cropland or pasture from remote sensor imagery. Many of these brushlands are grazed in an extensive manner by livestock and provide wildlife habitat. These areas usually remain as part of the farm enterprise, even though not being used at their former levels of intensity. Eastern brushland areas traditionally have not been included in the rangeland concept because of their original forested state prior to clearing for cropland or pasture and generally have been summarized statistically with pastureland. Because they function now primarily as extensive grazing land, they are included here as part of the Rangeland category. After sufficient forest growth has occurred, they should be classified as either Deciduous, Evergreen, or Mixed Forest Land. Those occurrences of shrubs and brush which are part of the Tundra are not included under Rangeland.

33. MIXED RANGELAND

When more than one-third intermixture of either herbaceous or shrub and brush rangeland species occurs in a specific area, it is classified as Mixed Rangeland. Where the intermixed land use or uses total less than one-third of the specific area, the category appropriate to the dominant type of Rangeland is applied. Mixtures of herbaceous and shrub or brush tundra plants are not considered Rangeland.

4. FOREST LAND

Forest Lands have a tree-crown areal density (crown closure percentage) of 10 percent or more, are stocked with trees capable of producing timber or other wood products, and exert an influence on the climate or water regime. Forest Land generally can be identified rather easily on high-altitude imagery, although the boundary between it and other categories of land may be difficult to delineate precisely.

Lands from which trees have been removed to less than 10 percent crown closure but which have not been developed for other uses also are included. For example, lands on which there are rotation cycles of clearcutting and blockplanting are part of Forest Land. On such lands, when trees reach marketable size, which for pulpwood in the Southeastern United States may occur in 2 to 3 decades, there will be large areas that have little or no visible forest growth. The pattern can sometimes be identified by the presence of cutting operations in the midst of a large expanse of forest. Unless there is evidence of other use, such areas of, little or no forest growth should be included in the Forest Land category. Forest land which is grazed extensively, as in the Southeastern States, would be included in this category because the dominant cover is forest and the dominant activities are forest related. Such activities could form the basis for Levels III or IV categorization. Lands that meet the requirements for Forest Land and also for an Urban or Built-up category should be placed in the latter category. The only exceptions in classifying Forest Land are those areas which would otherwise be classified as Wetland if not for the forest cover. Since the wet condition is of much interest to land managers and planning groups and is so important as an environmental surrogate and control, such lands are classified as Forested Wetland.

Auxiliary concepts associated with Forest Land, such as wilderness reservation, water conservation, or ownership classification, are not detectable using remote sensor data. Such concepts may be used for creating categories at the more detailed levels when supplemental information is available.

At Level II, Forest Land is divided into three categories: Deciduous, Evergreen, and Mixed. To differentiate these three categories effectively, sequential data, or at least data acquired during the period when deciduous trees are bare, generally will be necessary.

41. DECIDUOU.S. FOREST LAND

Deciduous Forest Land includes all forested areas having a predominance of trees that lose their leaves at the end of the frostfree season or at the beginfling of a dry season. In most parts of the United States, these would be the hardwoods such as oak (Quercus), maple (Acer), or hickory (Carya) and the "soft" hardwoods, such as aspen (Populus tremubides) (Shelford, 1963). Tropical hardwoods are included in the Evergreen Forest Land category. Deciduous forest types characteristic of Wetland, such as tupelo (Nyssa) or cottonwood (Populus deltoides), also are not included in this category.

42. EVERGREEN FOREST LAND

Evergreen Forest Land includes all forested areas in which the trees are predominantly those which remain green throughout the year. Both coniferous and broad-leaved evergreens are included in this category. In most areas, the coniferous evergreens predominate, but some of the forests of Hawaii are notable exceptions. The coniferous evergreens are commonly referred to or classified as softwoods. They include such eastern species as the longleaf pine (Pinus palustris), slash pine (Pinus ellioti), shortleaf pine (Pinus echinata), loblolly pine (Pinus taeda), and other southern yellow pines; various spruces (Picea) and balsam fir (Abies balsamea); white pine (Pinus strobus), red pine (Pinus resinosa), and jack pine (Pinus banksiana) ; and hemlock (Tsuga canadensis); and such western species as Douglas-fir (Pseudotsuga menziesii), redwood (Sequoia sempervirens), ponderosa pine (Pinus monticola), Sitka spruce (Picea sitchensis), Engelmaun spruce (Picea engelmanni), western redcedar (Thuja plicata) , and western hemlock (Tsuga heterophylla) (Shelford, 1963). Evergreen species commonly associated with Wetland, such as tamarack (Larix laricina) or black spruce (Picea mariana), are not included in this category (Kuchler, 1964).

43. MIXED FOREST LAND

Mixed Forest Land includes all forested areas where both evergreen and deciduous trees are growing and neither predominates. When more than onethird intermixture of either evergreen or deciduous species occurs in a specific area, it is classified as Mixed Forest Land. Where the intermixed land use or uses total less than one-third of the specified area, the category appropriate to the dominant type of Forest Land is applied, whether Deciduous or Evergreen.

5. WATER

The delineation of water areas depends on the scale of data presentation and the scale and resolution characteristics of the remote sensor data used for interpretation of land use and land cover. (Water as defined by the Bureau of the Census includes all areas within the land mass of the United States that persistently are water covered, provided that, if linear, they are at least ½ mile (200 m) wide and, if extended, cover at least 40 acres (16 hectares).) For many purposes, agencies need information on the size and number of water bodies smaller than Bureau of the Census minimums. These frequently can be obtained from small-scale remote sensor data with considerable accuracy.

51. STREAMS AND CANALS

The Streams and Canals category includes rivers, creeks, canals, and other linear water bodies. Where the water course is interrupted by a control structure, the impounded area will be placed in the Reservoirs category.

The boundary between streams and other bodies of water is the straight line across the mouth of the stream up to I nautical mile (1.85 km). Beyond that limit, the classification of the water body changes to the appropriate category, whether it be Lakes, Reservoirs, or Bays and Estuaries. These latter categories are used only if the water body is considered to be "inland water" and therefore included in the total area of the United States. No category is applied to waters classified as "other than inland water" or offshore marine waters beyond the mouths of rivers (U.S. Bureau of the Census, 1970).

52. LAKES

Lakes are non-flowing, naturally enclosed bodies of water, including regulated natural lakes but excluding reservoirs. Islands that are too small to delineate should be included in the water area. The delineation of a lake should be based on the areal extent of water at the time the remote sensor data are acquired.

53. RESERVOIRS

Reservoirs are artificial impoundments of water used for irrigation, flood control, municipal water supplies, recreation, hydroelectric power generation, and so forth. Dams, levees, other water-control structures, or the excavation itself usually will be evident to aid in the identification, although the water-control structures themselves and spillways are included in the Other Urban or Built-up Land category.

In most cases, reservoirs serve multiple purposes and may include all of the land use functions just mentioned. In certain cases like the Tennessee River, the entire length of the trunk stream is impounded. In such a situation, the stream exists as a stairstep series of impoundments with waterway, flood-control, recreation, and power-generation functions but is still considered a reservoir, since the additional functions are the result of impoundment.

54. BAYS AND ESTUARIES

Bays and Estuaries are inlets or arms of the sea that extend inland. They are included in this system only when they are considered to be inland water and therefore are included within the total area of the United States. Those bay and estuarine water areas classified as "other than inland water" are not included within the total area of the United States. These "other than inland water" areas are adjacent to certain States and fall under their jurisdiction. They occur in primary bodies of water such as the Atlantic Ocean coastal waters, Chesapeake Bay, Delaware Bay, Long Island Sound, Gulf of Mexico, Pacific Ocean coastal waters, Puget Sound, the Straits of Georgia and Juan de Euca, Gulf of Alaska, Bering Sea, Arctic Ocean coastal waters, and the Great Lakes (U.S. Bureau of the Census, 1970). Only those bays and estuaries classified as inland water are included in this category. No category is applied to offshore waters beyond the limits of Bays and Estuaries.

6. WETLAND

Wetlands are those areas where the water table is at, near, or above the land surface for a significant part of most years. The hydrologic regime is such that aquatic or hydrophytic vegetation usually is established, although alluvial and tidal flats may be nonvegetated. Wetlands frequently are associated with topographic lows, even in mountainous regions. Examples of wetlands include marshes, mudflats, and swamps situated on the shallow margins of bays, lakes, ponds, streams, and manmade impoundments such as reservoirs. They include wet meadows or perched bogs in high mountain valleys and seasonally wet or flooded basins, playas, or potholes with no surface-water outflow. Shallow water areas where aquatic vegetation is submerged are classed as open water and are not included in the Wetland category.

Extensive parts of some river flood plains qualify as Wetlands, as do regularly flooded irrigation overflow areas. These do not include agricultural land where seasonal wetness or short-term flooding may provide an important component of the total annual soil moisture necessary for crop production. Areas in which soil wetness or flooding is so short-lived that no typical wetlands vegetation is developed properly belong in other categories.

Cultivated wetlands such as the flooded fields associated with rice production and developed cranberry bogs are classified as Agricultural Land. Uncultivated wetlands from which wild rice, cattails, or wood products, and so forth are harvested, or wetlands grazed by livestock, are retained in the Wetland category.

Remote sensor data provide the primary source of land use and vegetative cover information for the more generalized levels of this classification system. Vegetation types and detectable surface water or soil moisture interpreted from such data provide the most appropriate means of identifying wetlands and wetland boundaries. Inasmuch as vegetation responds to changes in moisture conditions, remote sensor data acquired over a period of time will allow the detection of fluctuations in wetland conditions. Ground surveys of soil types or the duration of flooding may provide supplemental information to be employed at the more detailed levels of classification.

Wetland areas drained for any purpose belong to other land use and land cover categories such as Agricultural Land, Rangeland, Forest Land, or Urban or Built-up Land. When the drainage is discontinued and such use ceases, classification may revert to Wetland. Wetlands managed for wildlife purposes may show short-term changes in land use as different management practices are used but are properly classified Wetland.

Two separate boundaries are important with respect to wetland discrimination: the upper wetland boundary above which practically any category of land use or land cover may exist, and the boundary between wetland and open water beyond which the appropriate Water category should be employed.

Forested Wetland and Nonforested Wetland are the Level II categories of Wetland.

61. FORESTED WETLAND

Forested Wetlands are wetlands dominated by woody vegetation. Forested Wetland includes seasonally flooded bottom land hardwoods, mangrove swamps, shrub swamps, and wooded swamps including those around bogs. Because Forested Wetlands can be detected and mapped by the use of seasonal (winter/summer) imagery, and because delineation of Forested Wetlands is needed for many environmental planning activities, they are separated from other categories of Forest Land.

The following are examples of typical vegetation found in Forested Wetland. Wooded swamps and southern flood plains contain primarily cypress (Taxodium), tupelo (Nyssa), oaks (Quercus), and red maple (Acer rubrum). Mangroves (Avicennia and Rhizophora) are dominant in certain subtropical Forested Wetland areas. Central and northern flood plains are dominated by cottonwoods (Populus), ash (Fraxinus), alder (Alnus), and willow (Salix). Flood plains of the Southwest may be dominated by mesquite (Prosopis), saltcedar (Tamarix), seepwillow (Baccharis), and arrowweed (Pluchea). Northern bogs typically contain tamarack or larch (Lanx), black spruce (Picea mariana), and heath shrubs (Ericaceae). Shrub swamp vegetation includes alder (Alnus), willow (Salix), and buttonbush (Cephalanthus occidentalis)

62. NONFORESTED WETLAND

Nonforested Wetlands are dominated by wetland herbaceous vegetation or are nonvegetated. These wetlands include tidal and nontidal fresh, brackish, and salt marshes and nonvegetated flats and also freshwater meadows, wet prairies, and open bogs.

The following are examples of vegetation associated with Nonforested Wetland. Narrow-leaved emergents such as cordgrass (Spartina) and rush (Juncus) are dominant in coastal salt marshes. Both narrow-leaved emergents such as cattail (Typha), bulrush (Seirpus), sedges (Carex), sawgrass (Cladium) and other grasses (for example, Panicum and Zizaniopsis miliacea), and broad-leaved emergents such as waterlily (Nuphar, Nymphea), pickereiweed (Pontederia), arrow arum (Peltandra), arrowhead (Sagittaria), water hyacinth (Eichhornia crassipes), and alligatorweed (Alternanthera phiboxeroides) are typical of brackish to freshwater locations. Mosses (Sphagnum) and sedges (Carex) grow in wet meadows and bogs.

7. BARREN LAND

Barren Land is land of limited ability to support life and in which less than one-third of the area has vegetation or other cover. In general, it is an area of thin soil, sand, or rocks. Vegetation, if present, is more widely spaced and scrubby than that in the Shrub and Brush category of Rangeland. Unusual conditions, such as a heavy rainfall, occasionally result in growth of a short-lived, more luxuriant plant cover. Wet, nonvegetated barren lands are included in the Nonforested Wetland category.

Land may appear barren because of man's activities. When it may reasonably be inferred from the data source that the land will be returned to its former use, it is not included in the Barren category but classified on the basis of its site and situation. Agricultural land, for example, may be temporarily without vegetative cover because of cropping season or tillage practices. Similarly, industrial land may have waste and tailing dumps, and areas of intensively managed forest land may have clear-cut blocks evident.

When neither the former nor the future use can be discerned and the area is obviously in a state of land use transition, it is considered to be Barren Land, in order to avoid inferential errors.

Level II categories of Barren Land are: Dry Salt Flats, Beaches, Sandy Areas other than Beaches; Bare Exposed Rock; Strip Mines, Quarries, and Gravel Pits; Transitional Areas; and Mixed Barren Land.

71. DRY SALT FLATS

Dry Salt Flats occurring on the flat-floored bottoms of interior desert basins which do not qualify as Wetland are included in this category. On aerial photographs, Dry Salt Flats tend to appear white or light toned because of the high concentrations of salts at the surface as water has been evaporated, resulting in a higher albedo than other adjacent desert features.

72. BEACHES

Beaches are the smooth sloping accumulations of sand and gravel along shorelines. The surface is stable inland, but the shoreward part is subject to erosion by wind and water and to deposition in protected areas.

73. SANDY AREAS OTHER THAN BEACHES

Sandy Areas other than Beaches are composed primarily of dunes—accumulations of sand transported by the wind. Sand accumulations most commonly are found in deserts although they also occur on coastal plains, river flood plains, and deltas and in periglacial environments. When such sand accumulations are encountered in tundra areas, they are not included here but are placed in the Bare Ground Tundra category.

74. BARE EXPOSED ROCK

The Bare Exposed Rock category includes areas of bedrock exposure, desert pavement, scarps, talus, slides, volcanic material, rock glaciers, and other accumulations of rock without vegetative cover, with the exception of such rock exposures occurring in tundra regions.

75. STRIP MINES, QUARRIES, AND GRAVEL PITS

Those extractive mining activities that have significant surface expression are included in this category. Vegetative cover and overburden are removed to expose such deposits as coal, iron ore, limestone, and copper. Quarrying of building and decorative stone and recovery of sand and gravel deposits also result in large open surface pits. Current mining activity is not always distinguishable, and inactive, unreclaimed, and active strip mines, quarries, borrow pits, and gravel pits are included in this category until other cover or use has been established, after which the land would be classified in accordance with the resulting use or cover. Unused pits or quarries that have been flooded, however, are placed in the appropriate Water category.

76. TRANSITIONAL AREAS

The Transitional Areas category is intended for those areas which are in transition from one land use activity to another. They are characterized by the lack of any remote sensor information which would enable the land use interpreter to predict reliably the future use or discern the past use. All that actually can be determined in these situations is that a transition is in

progress, and inference about past or future use should be avoided. This transitional phase occurs when, for example, forest lands are cleared for agriculture, wetlands are drained for development, or when any type of land use ceases as areas become temporarily bare as construction is planned for such future uses as residences, shopping centers, industrial sites, or suburban and rural residential subdivisions. Land being altered by filling, such as occurs in spoil dumps or sanitary landfills, also is indicative of this transitional phase.

77. MIXED BARREN LAND

The Mixed Barren Land category is used when a mixture of Barren Land features occurs and the dominant land use occupies less than two-thirds of the area. Such a situation arises, for example, in a desert region where combinations of salt flats, sandy areas, bare rock, surface extraction, and transitional activities could occur in close proximity and in areal extent too small for each to be included at mapping scale. Where more than one-third intermixture of another use or uses occurs in a specific area, it is classified as Mixed Barren Land. Where the intermixed land use or uses total less than one-third of the specific area, the category appropriate to the dominant type of Barren Land is applied.

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8. TUNDRA

Tundra is the term applied to the treeless regions beyond the limit of the boreal forest and above the altitudinal limit of trees in high mountain ranges. In the United States, tundra occurs primarily in Alaska, in several areas of the western high mountain ranges, and in small isolated locations in the higher mountains of New England and northern New York. The timber line which separates forest and tundra in alpine regions corresponds to an arctic transition zone in which trees increasingly are restricted to the most favorable sites.

The vegetative cover of the tundra is low, dwarfed, and often forms a complete mat. These plant characteristics are in large part the result of adaptation to the physical environment—one of the most extreme on Earth, where temperatures may average above freezing only 1 or 2 months out of the year, where strong desiccating winds may occur, where great variation in solar energy received may exist, and where permafrost is encountered almost everywhere beneath the vegetative cover.

The number of species in the tundra flora is relatively small compared with typical middle and low-latitude flora, and this number of species decreases as the environment becomes increasingly severe with changes of latitude and altitude. The tundra vegetation consists primarily of grasses, sedges, small flowering herbs, low shrubs, lichens, and mosses. The vegetative cover is most luxuriant near the boreal forest, with the ground surface usually being completely covered. As the plant cover becomes sparse, shrubs become fewer and more bare areas occur. Species diversity is lowest near the boundaries of permanent ice and snow areas, where only isolated patches of vegetation occur on the bare ground surface.

The vegetation of the tundra is closely associated with other environmental factors. Minor manmade disturbances, as well as microenvironrnental changes over short distances, can have significant effects. Minor changes in available moisture or wind protection, for example, can result in different plant associations. Similarly, man's activity in the tundra may engender new drainage patterns with resultant changes in plant community or erosion characteristics (Price, 1972).

The boundaries between Tundra, Perennial Snow or Ice, and Water are best determined by using images acquired in late summer. The Forest Land Tundra boundary in the Arctic tends to be transitional over a wide area and characterized by either incursion of forests where site improvement occurs, as along the flood plains or river valleys, or by increasing environmental severity, as on exposed dry uplands. This Forest Land-Tundra boundary is much easier to delineate in alpine areas. The Barren Land-Tundra interface occurs where one or more of the environmental parameters necessary for vegetation growth is deficient and also would be determined best with late summer imagers.

Using the results of various investigations, Level II categories of Tundra based primarily on what is interpretable from remote sensor image signatures are: Shrub and Brush Tundra, Herbaceous Tundra, Bare Ground Tundra, Wet Tundra, and Mixed Tundra.

81. SHRUB AND BRU.S.H TUNDRA

The Shrub and Brush Tundra category consists of the various woody shrubs and brushy thickets found in the tundra environment. These occur in dense-to-open evergreen and deciduous thickets, with the latter dominated by types such as the various birches (Betuki), alders (Alnus), or willows (Salix), as well as many types of berry plants. Low evergreen shrub thickets are characterized by such dominant types as Empetrum and various members of the heath family, such as

Cassiope, Vaccinium, and Ledum (Viereck and Little, 1972).

82. HERBACEOU.S. TUNDRA

Herbaceous Tundra is composed of various sedges, grasses, forbs, lichens, and mosses, all of which lack woody stems. A wide variety of such herbaceous types may be found in close proximity on the tundra. Sites having sufficient moisture usually are covered with a thick mat of mosses together with sedges such as Carex and Eriophorum (cotton grass) in almost continuous and uniform tussocks, as well as other herbaceous forms such as types of bluegrass (Poa), buttercups (Ranunculus), and lichens such as Cladonia and Cetraria. Drier or more exposed sites usually trend toward a sparse mosss-lichen mat.

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83. BARE GROUND TUNDRA

The Bare Ground Tundra category is intended for those tundra occurrences which are less than one-third vegetated. It usually consists of sites visually dominated by considerable areas of exposed bare rock, sand, or gravel interspersed with low herbaceous and shrubby plants. This type of tundra is indicative of the most severe environmental stress and usually occurs poleward of the areas supporting the more luxuriant herbaceous and shrub forms and on higher mountain ridges. The various species of Dryas, such as white mountain-avens, are dominant in Arctic regions, as are the sandworts (Minuartia) and mountainheaths (Phyllodoce). Bare Ground Tundra gradually merges with one or more of the Barren Land categories on its more severe margin.

84. WET TUNDRA

Wet Tundra is usually found in areas having little topographic relief. Standing water is almost always present during months when temperatures average above the freezing level. Numerous shallow lakes are also common (Joint Federal State Land Use Planning Commission for Alaska, 1973). Permafrost is usually close to the surface, and various patterned ground features may be evident. Sedges (Carex) such as cotton grass are characteristically dominant, and a few shrubby plants may occur on adjacent drier sites. Rooted aquatic plants are also common. Wet Tundra is delineated best on imagery acquired in late summer.

85. MIXED TUNDRA

The Mixed Tundra category is used for a mixture of the Level II Tundra occurrences where any particular type occupies less than two-thirds of the area of the mapping unit. Where more than one-third intermixture of another use or uses occurs in a specific area, it is classified as Mixed Tundra. Where the intermixed land cover categories total less than one-third of the specific area, the category appropriate to the dominant type of Tundra is applied.

9. PERENNIAL SNOW OR ICE

Certain lands have a perennial cover of either snow or ice because of a combination of environmental factors which cause these features to survive the summer melting season. In doing so, they persist as relatively permanent features on the landscape and may be used as environmental surrogates. Snow, firn (coarse, compacted granular snow) , or ice accumulation in these areas exceeds ablation, which is the combined loss of snow or ice mass by evaporation and melt-water runoff. Adjacent lands most commonly will be classed as Water, Wetland, Barren Land, or Tundra, with their common boundaries being distinguished most readily on late summer imagery.

The terminology and nomenclature of any subdivision of Perennial Snow or Ice areas are always subject to considerable debate, but a Level II breakdown into categories of Perennial Snowfields and Glaciers seems to be appropriate for use with remote sensor data. Such a subdivision is based on surface form and the presence or absence of features indicating glacial flow. In addition, these forms and flow features may be related to stage of development and certain periglacial or glacial processes.

91. PERENNIAL SNOWFIELDS

Perennial Snowfields are accumulations of snow and firn that did not entirely melt during previous summers. Snowfields can be quite extensive and thus representative of a regional climate, or can be quite isolated and localized, when they are

known by various terms, such as snowbanks.

The regional snowline is controlled by general climatic conditions and closely parallels the regional 32°F (0°C) isotherm for the average temperature of the warmest summer month. The use of the term "line" is somewhat misleading, because the "snowline" represents an irregular transitional boundary, which is determined at any single location by the combination of snowfall and ablation, variables which can change greatly within short distances because of changes in local topography and slope orientation.

Small isolated snowfields occurring in protected locations can develop into incipient or nivation cirques, which become gradually hollowed by the annual patterns of freezing and thawing, aided by downslope movement of rock material. They are circular to semicircular and often develop ridges of mass-wasted materials called protalus ramparts at their downslope margins. As Flint (1957) has pointed out, "Such cirques, of course, are not in themselves indication of glaciation, they indicate merely a frost climate."

Snowfields can normally be distinguished from the following Glacier category by their relative lack of flow features.

92. GLACIERS

Glacial ice originates from the compaction of snow into firn and finally to ice under the weight of several successive annual accumulations. Refrozen melt water usually contributes to the increasing density of the glacial ice mass. With sufficient thickness, weight, and bulk, flow begins, and all glaciers exhibit evidence of present or past motion in the form of moraines, crevasses, and so forth.

Where the snowline of adjacent ice-free areas extends across the glacier, it is known as the firn limit, which represents the dividing line between the glacier's two major zones, the zone of accumulation and the zone of ablation. While glaciers normally are recognized easily, certain glacial boundaries may be subject to misinterpretation, even by the experienced interpreter. Flow features upglacier from the firn limit typically are obscured by fresh snow, forcing the image interpreter to depend on secondary information such as valley shape or seek a more discriminating sensor. Similarly, morainal material may cover the terminus (or snout) of the glacier because of ablation, making boundary determination in that vicinity difficult. This latter problem occasionally is compounded by the presence of considerable vegetation rooted in the insulating blanket of ablation moraine.

Further subdivision of glacial occurrences, mainly on the basis of form and topographic position, would include: small drift glaciers (sometimes called Ural-type or cirque glaciers); valley glaciers (also called mountain or alpine glaciers); piedmont glaciers; and icecaps (or ice sheets).

Other features have somewhat the surface form of true glaciers, such as "rock glaciers." Since these are composed primarily of fragmented rock material together with interstitial ice, they are classified as Bare Exposed Rock.

MAP PRESENTATION

Figures 1 through 4 depict typical maps, which have been produced using the U.S. Geological Survey land use and land cover classification system. The land use and land cover maps have been produced by conventional interpretation techniques and are typical examples of maps produced from high-altitude color-infrared photographs.

In order to provide a systematic and uniform approach to the presentation of land use and land cover information in map format, a scheme of color coding is employed (table 4).

TABLE 4. -- U.S.G.S. Level I Land Use Color Code

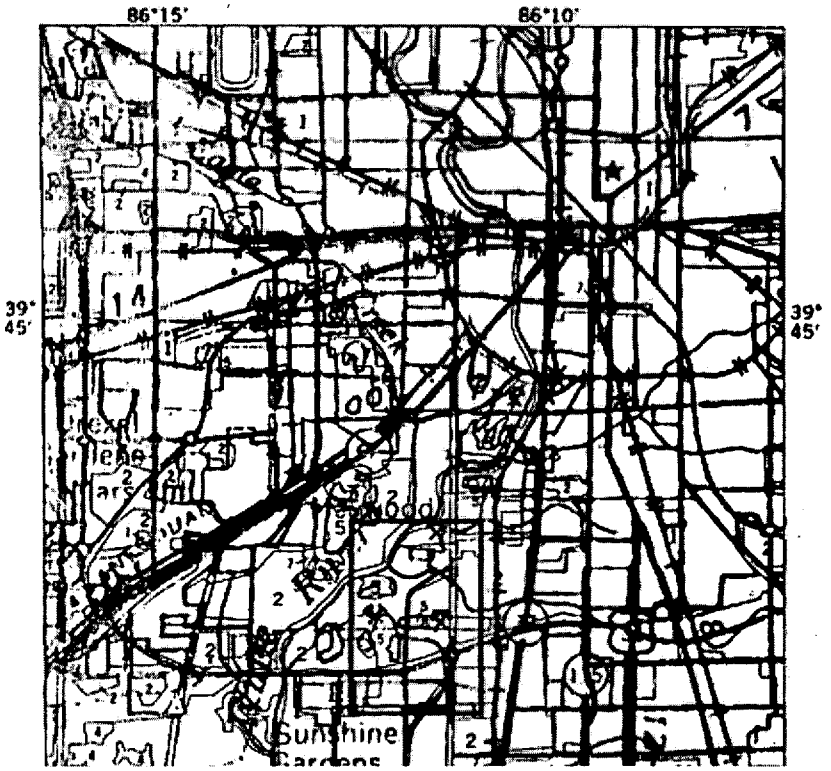
1.	Urban or Built-up Land	Red (Munsell 5R 6/12).
2.	Agricultural Land	Light Brown (Munsell 5YR 7/4).
3.	Rangeland	Light Orange (Munsell 10YR 9/4).
4.	Forest Land	Green (Munsell 10GY 8/5).
5.	Water	Dark Blue (Munsell, 10B 7/7).

6.	Wetland	Light Blue (Munsell 7.5B 8.5/3).
7.	Barren Land	Gray (Munsell N 8/0).
8.	Tundra	Green-Gray (Munsell 10G 8.5/1.5).
9.	Perennial snow or Ice	White (Munsell N 10/0).

In this scheme, Level I land uses are color coded using a modified version of the World Land Use Survey (International Geographical Union, 1952) color scheme. Level II land uses can be presented using the two-digit numeral appropriate to the land use category, such as "21," which would signify Cropland and Pasture. The use of some type of system other than a further stratification by color is necessary at Level II since it would be a considerable problem to select 37 different colors which would be distinguishable a the size of the minimum mapping unit. A numerical system, with the number of digits equaling the level of categorization, forms a flexible classification system that permits continuation to Levels III and IV or beyond. In addition, retaining a discrete color code for each Level I land use or land cover category permits rapid visual integration of the areas characterized by that use or cover type.

Even though a numerical system for the Level II land uses has been illustrated, such a system is not the only method of presenting Level II land use information. What is proposed is the use of the modified International Geographical Union World Land Use Survey color code at Level I. Alternatives to a numerical code at Level II could take the form of graphic symbols such as dots, stipples, cross-hatching, swam or marsh symbols, or any of the great variety of such items available to the cartographer. Such a method, together with the Level I color coding, would allow the reader rapid visual orientation to each discrete Level II land use category but would impede statistical inventory of the area included in each land use and would be difficult to subdivide further into Level III categories.

Another alternative for land use symbolization at Level II is the use of an alphabetical code for each category such as "Ur," representing (Urban or Built-up) Residential Land, or "Ac," for (Agricultural) Cropland and Pasture. Such a system has the merit of suggesting the logical name of each category but also impedes interpretation and enumeration at the more detailed levels because of increased complexity of the alphabetical code. In addition, the increase in length of the alphabetical code used for the more detailed levels will cause placement problems as the minimum size of a mapping unit is approached.



EXPLANATION

1 Urban Or built-up land
2 Agricultural land
4 Forest land
5 Water
7 Barren land

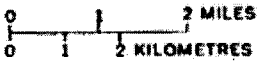
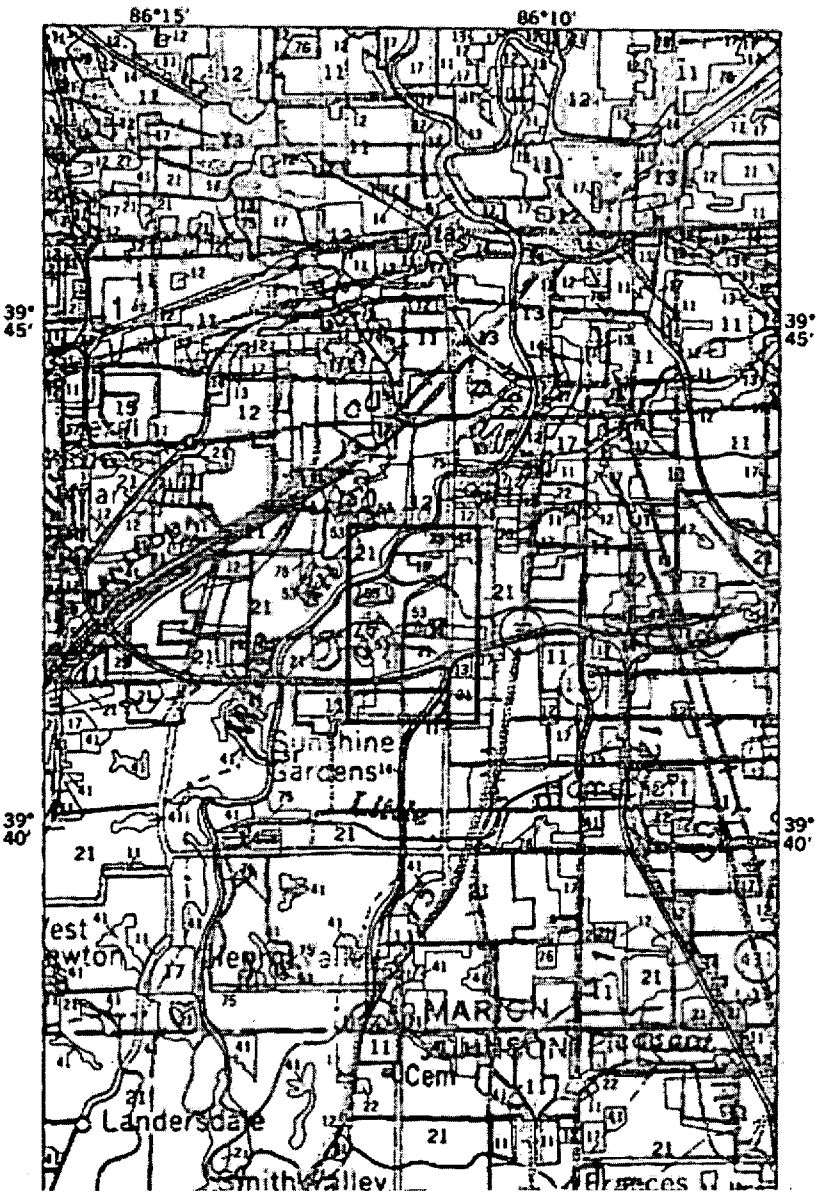


FIGURE 1.—Level I land use and land cover in an enlarged part of the northeast quarter of the Indianapolis, Indiana-Illinois, 1:250,000 quadrangle. Area outlined In center of map corresponds to Maywood area shown in figures 8 and 4.



EXPLANATION
11 Residential
12 Commercial and services
13 Industrial
14 Transportation, communications, and utilities
15 industrial and commercial complexes
16 Mixed urban or built-up land
17 Other urban or built-up land
21 Cropland and pasture
22 Orchards, groves, vineyards, nurseries, and ornamental horticultural areas
23 Confined feeding operations
41 Deciduous forest land
51 Streams and canals
53 Reservoirs
75 Strip mines, quarries, and gravel pits
76 Transitional areas

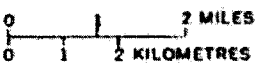


Figure 2.—Level II land use and laud cover in an enlarged part of the northeast quarter of the Indianapolis, Indiana-Illinois, 1:250,000 quadrangle.

Area outlined in center of map corresponds to Maywood area shown in figures 3 and 4.

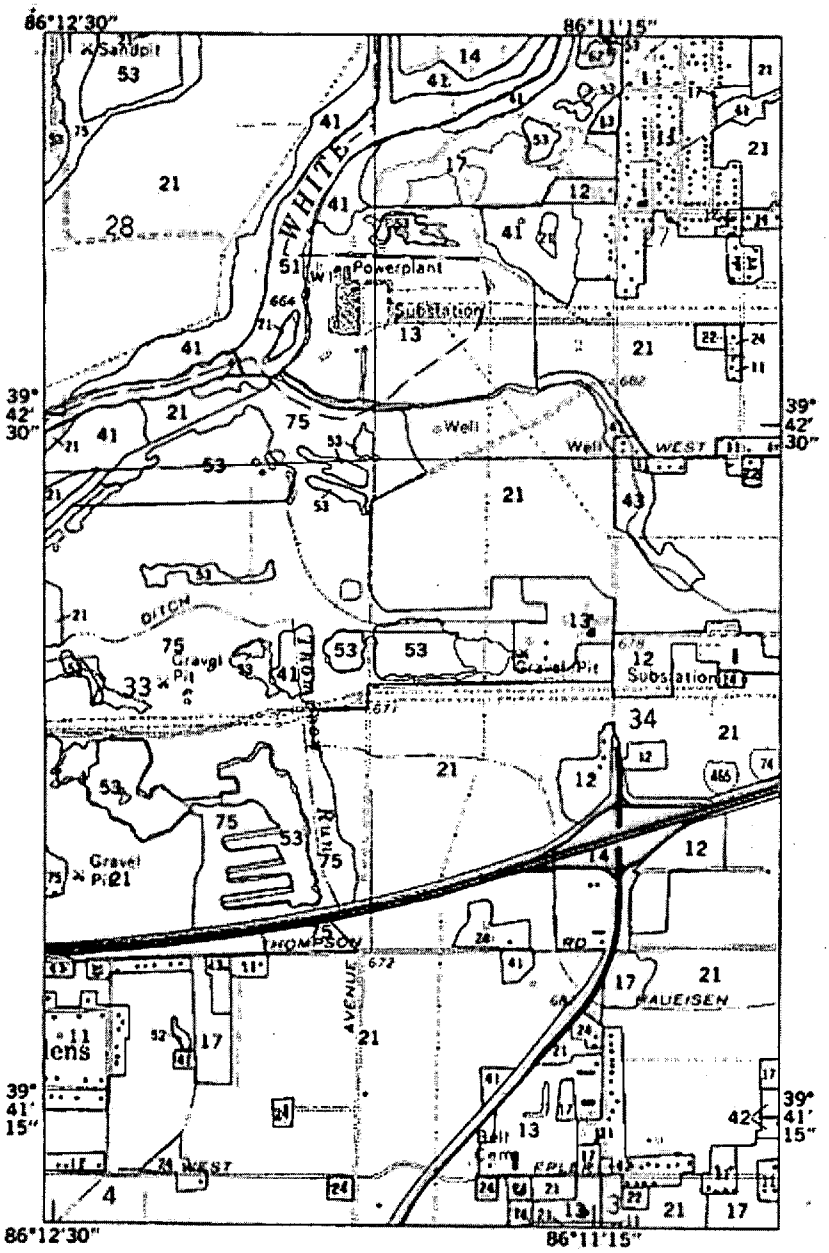


FIGURE 3.—Level II land use and land cover in a part of the Maywood, Indiana, 1:24,000 quadrangle. Level III interpretations for the same area are shown in figure 4.

86°12'30" 86°11'15" EXPLANATION

111 Single family
122 Retail trade
131 Primary processing
132 Fabrication
134 Extraction facilities
141 Highways
144 Airports
145 Communications
147 Utilities
173 Waste dumps
174 Urban undeveloped
211 Cropland
212 Pastureland
224 Nurseries and floriculture
242 Farmsteads
412 10—30 percent crown cover, deciduous
413 30—70 percent crown cover. deciduous
414 >70 percent crown cover, deciduous
424 >70 percent crown cover. evergreen
432 10—30 percent crown cover, mixed
511 Streams
521 Lakes
532 Water-filled quarries
622 Mudflats
753 Sand and gravel pits (active)

FIGURE 4.—Level III land use and land cover in. a part of the Maywood, Indiana, 1:24,000 quadrangle. Level II interpretations for the same area are shown in figure 3.

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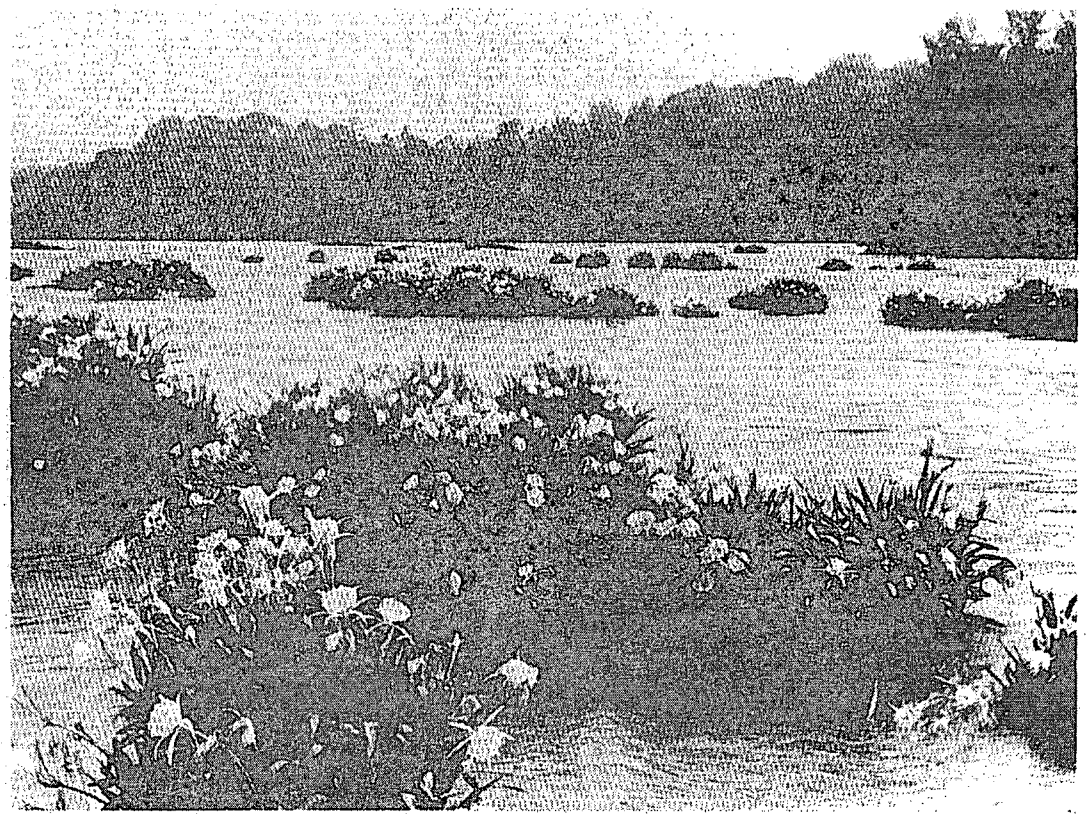
THE NATURAL COMMUNITIES OF SOUTH CAROLINA

Initial Classification and Description

John B. Nelson



A Check For Wildlife

S.C. Wildlife and Marine Resources Dept.
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THE NATURAL COMMUNITIES OF SOUTH CAROLINA

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INTRODUCTION

The maintenance of an accurate inventory of a region's natural resources must involve a system for classifying its natural communities. These communities themselves represent identifiable units which, like individual plant and animal species of concern, contribute to the overall natural diversity characterizing a given region.

This classification has developed from a need to define more accurately the range of natural habitats within South Carolina. From the standpoint of the South Carolina Nongame and Heritage Trust Program, the conceptual range of natural diversity in the state does indeed depend on knowledge of individual community types. Additionally, it is recognized that the various plant and animal species of concern (which make up a significant remainder of our state's natural diversity) are often restricted to single natural communities or to a number of separate, related ones. In some cases, the occurrence of a given natural community allows us to predict, with some confidence, the presence of specialized or endemic resident species. It follows that a reasonable and convenient method of handling the diversity of species within South Carolina is through the concept of these species as residents of a range of natural communities.

Ideally, a nationwide classification system could be developed and then used by all the states. Since adjacent states usually share a number of community types, and yet may each harbor some that are unique, any classification scheme on a national scale would be forced to recognize the variation in a given community from state to state (or region to region) and at the same time to maintain unique communities as distinctive. Obviously, individual states must have fairly well-developed, workable classifications before interstate systems can be solidified. Ecologists from the Heritage Programs of the two Carolinas and Virginia have made initial attempts to standardize their states' community classifications. The development of a Heritage Program in Georgia would contribute to an even more standardized and workable system for this region.

This classification is immediately valuable as an index of South Carolina's natural community diversity. Its incorporation into the Heritage database, followed by an ongoing inventory for exemplary community types, may then take place. During this process, Heritage Trust staff will be able to prioritize South Carolina's natural communities and to formulate strategies for protection projects concerning the most imperiled types. It is hoped that this classification will also prove useful as a reference for other governmental agencies, ecologists, students, local conservation and preservation groups, and amateur naturalists.

This version represents the first approximation of South Carolina's natural community classification, and as such, is intended for use as an open-ended arrangement. Successive versions are expected to present increasingly accurate and detailed modifications of recognized community type and will, of course, treat any new types. Changes may then be expected in the prioritization of various community types for protection in our state. These later versions shall be based, in part, on additional field knowledge moving into the Heritage database. It is also hoped that additional information from its users will fill in some of the gaps present; any comments from such users are greatly appreciated. Succeeding versions can rightfully be thought of as progressively more refined approximations of the system in nature.

Some very basic problems must be considered during the development of any region's natural community classification. Some of these will be described briefly in the following paragraphs.

Natural communities exist in nature as continua, rather than as discrete and faithfully

repetitive units. The classification of such a system must involve some standard of convenience rather than a stringent adherence to scientific principles. Otherwise, the tendency would be for all of nature to be viewed as a myriad of unique communities, often differing from each other only in unrealistically fine detail. In general, a number of physical and biotic parameters of a given site are used together to indicate the type of community occurring there. When these parameters seem to repeat over and over again at different localities, a single community may be designated. The difficulty in recognizing variation among different examples of a single community type comes when trying to decide at what point subtypes of the community can be recognized.

The effects of succession must be considered in designating a classification. Certain good examples of a given community type may only be good examples temporarily. After a certain time, they may become less recognizable as the first community and more and more similar to a second. A clear conception of the variation within a given community type must involve knowledge of the successional relationships it shares with other types.

The manipulation of natural areas in South Carolina has been and will continue to be an important factor in the recognition of community types. An additional dimension can be used to compare various communities: each type will occur in a range from disturbed to pristine, complicating our attempt to recognize natural units.

Certain community types in South Carolina have not been specifically studied in depth. The accumulation of additional data on these communities is part of the goal of Heritage database management. Additional field work and subsequent study will be necessary for the ultimate disposition of some community types.

A stringent hierarchy for arranging communities has not been followed within this version. However, all of the communities described fall into a hydrological scheme as supplied by Cowardin et al. (1979). The great majority of the communities presented here are either terrestrial or palustrine types; a smaller number makes up the estuarine and marine types. One lacustrine community (Interdune Pond) is described. The next version of this classification shall incorporate a modified hierarchical scheme for subdividing communities and will deal with the rest of South Carolina's lacustrine and riverine community types. The difficulties encountered in classifying aquatic communities has often meant that they are treated after the non-aquatic types.

Within the description of each community type presented here, a listing of synonyms is supplied, followed by a brief description of the sites. Dominant species are listed under "Vegetation". These lists describe the most frequently encountered species (canopy, subcanopy, and ground cover, where appropriate) and are not presented as all-inclusive. Potential elements of concern are those plant and animal species which are currently being tracked in the Heritage database or are likely to be added to it in the future. Certain elements of concern appear to have much greater ecological tolerances than do others, and may be present in more than one community. Endemic species, however, are not used to define the natural community within which they reside. A short treatment of the "Dynamics" of each community is presented. Several communities are too poorly understood and/or inventoried to have detailed treatments, at present, concerning dynamics. An idea of the intergradation among related communities (and their geographical nearness to one another) is supplied under a listing of "Associations."

Alphabetical Listing of Communities

Acidic Cliff
Atlantic White Cedar Swamp
Bald Cypress--Tupelo Gum Swamp
Basic Forest
Bay Forest
Beech--Magnolia Hammock
Bottomland Hardwoods
Brackish Marsh
Calcareous cliff
Chestnut Oak Forest
Cove Forest
Depression Meadow
Estuarine Scour Hole
Granitic Dome
Granitic Flatrock
Hemlock Forest
High Elevation Seep
Hillside Herb Bog
Interdune Pond
Intertidal Beach
Intertidal Mud/Sand Flat
Levee
Limestone Sink
Limestone Sinkhole
Marine Deepwater
Maritime Forest
Maritime Grassland
Maritime Shrub Thicket
Marl Forest
Mesic Mixed Hardwood Forest
Middens
Montmorillonite Forest
Non-AIluvial Swamp Forest
Oak--Hickory Forest
Oyster Reef
Piedmont Seepage Forest
Pine Flatwoods
Pine--Oak Heath
Pine Savannah
Pine--Saw Palmetto Flatwoods
Pine--Scrub Oak Sandhill
Pocosin
Pond Cypress Pond
Pond Cypress Savannah
Pond Pine Woodland
Rhododendron Thicket
Salt Flat
Salt Marsh
Salt Shrub Thicket
Seagrass Bed
Seepage Pocosin
Shoal & Stream Bar
Small Stream Forest
Southern Mixed Hardwood Forest
Spray cliff
Spruce Pine--Mixed Hardwood Forest
Streamhead Pocosin
Swale Pocosin
Swamp Tupelo Pond
Talus Slope
Tidal Bald Cypress--Tupelo Gum Swamp
Tidal Freshwater Marsh
Unconsolidated Coastal Bottom
Upland Bog
Upland Depression Swamp Forest
Upland Pine--Wiregrass Woodland
Xeric Sandhill Scrub

ACIDIC CLIFF

Type: Terrestrial

Sites: These are rock faces with variable aspects of size, vegetation and moisture. Rock surface is generally sloped more than either flatrock or dome communities. Larson and Batson (1978) defined cliffs as having a sloping to vertical face with an angle of between 50 and 90 degrees; overhanging cliffs are an additional possibility. The acidic character of these cliffs arises from the weathering of a granitic substrate.

Location: Upper piedmont and mountains.

Vegetation: Acidic cliffs may range from bare rock, on the most open, steepest, driest sites, to those heavily vegetated. Pioneer genera present include many of those found on flatrocks or domes, including *Rhacomitrium*, *Andreaea*, *Cladonia* and *Selaginella*. Although canopy species may be present, and in fact well-represented, a discernable canopy usually is not. In general, woody plants present are the same as those in adjacent forested communities, and are often confined to rock fissures where sufficient soil has built up. These woody species include *Quercus prinus*, *Q. alba*, *Q. velutina*, *Q. rubra*, *Pinus virginiana*, *P. echinata*, *Carya tomentosa*, *C. glabra*, *Juniperus virginiana*, *Chionanthus virginicus*, *Acer rubrum*, *Tsuga canadensis*, *Oxydendrum arboreum*, *Vaccinium arboreum* and *Kalmia latifolia*. Herbaceous flora may be diverse, but is also usually confined to fissures, including *Saxifraga michauxii*, *Festuca octoflora*, *Aster pilosus* and *Carex scabrata*. Rock fissures may also support vegetation mats; *Houstonia longifolia* and *Deschampsia flexuosa* are commonly found on these.

Potential elements of concern: *Fothergilla major. Senecio millefolium. Viguiera porteri.* Green salamander. Peregrine falcon.

Dynamics: These communities are generally unstable, sharing many traits of flatrocks and domes. Their steepness makes colonization of vascular plants, particularly woody ones, quite difficult. Most woody plants are restricted to ledges or fissures that are able to collect detritus.

Associations: Granitic Dome. Granitic Flatrock. Spray Cliff. Upland forest types, such as Chestnut Oak Forest.

Comments: "Cliff", "dome" and "flatrock"---these are gradient situations. For instance, some large granitic flatrocks technically have all three present. Acidic cliffs as a group are probably fairly uniform in terms of potential floristics, but quite variable regarding areal extent, slope and exposure. Conceivably, the sides of single boulders could contain biotic assemblages referable to acidic cliffs. As well, a given cliff may have a significant area of wet seepage zones. Thus, these communities may be associated with Spray Cliffs and/or High Elevation Seepages. Granitic Cliffs probably have less floristic diversity than either domes or flatrocks.

References: Crandell 1977. Larson 1977. Larson & Batson 1978. Oosting & Anderson 1937. Oosting & Hess 1956.

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ATLANTIC WHITE CEDAR SWAMP

Type: Palustrine

Synonyms: Atlantic white cedar forest. Cedar swamp.

Sites: Periodically or permanently wet swampy areas dominated by *Chamaecyparis thyoides*, with a number of other woody species characteristic of Pocosins.

Location: Sandhill drainages, some Carolina Bays, non-alluvial swamps.

Vegetation: *Chamaecyparis thyoides*, *Magnolia virginiana*, *Acer rubrum*, *Pinus serotina*, *Persea borbonia*, *Myrica cerifera*, *M. heterophylla*, *Cyrilla racemiflora*, *Lyonia lucida* and some other shrubs are commonly occurring woody plants. Herbaceous vegetation may include *Drosera capillaris*, *D. rotundifolia*, *Sarracenia flava*, *S. rubra*, *Peltandra virginica*, *Mayaca aubletii*, *Orontium aquaticum*, plus various species of other showy herbs, such as *Rhexia* and *Ludwigia*.

Potential elements of concern: *Rhynchospora alba*. *Syngonanthus flavidulus*. *Vaccinium sempervirens*. *Gaylussacia mosieri*. Pine-barrens tree frog.

Dynamics: Fire is occasional to rare, but very important in maintaining this community. Without fire, these swamps are thought to succeed to Bay Forest (Wells 1942). The dynamics of White Cedar Swamps are not completely understood. It appears that this community may represent a thickly-forested, tall extreme of the variation within the Pocosin "complex".

Associations: Pocosin, Bay Forest, Pond Pine Woodland, Streamhead Pocosin.

Comments: These communities are often thought of (and referred to) as bogs since peat accumulations are usually present. In general, little floristic variation is expected among different sites. White cedars are usually present in even-aged stands. Variation in subcanopy and herbaceous cover is probably due to previous burning or other disturbance. Diverse vertebrate assemblages are often present in this community. Birds, reptiles and amphibians are particularly well-represented.

References: Buell & Cain 1943. Kologiski 1977. Korstian 1924. Pittman 1978. Wells 1942.

BALD CYPRESS-TUPELO GUM SWAMP

Type: Palustrine

Synonyms: Deep freshwater swamp. Cypress-gum swamp. Brownwater/blackwater cypress-gum swamp.

Sites: These are seasonally-flooded forests on floodplains of river systems dominated by

Taxodium distichum and/or *Nyssa aquatica*. They represent the most deeply flooded of all the palustrine natural communities.

Location: Piedmont and coastal plain.

Vegetation: A well-formed canopy is present, consisting of *Taxodium distichum*, *Nyssa aquatica*, *N. biflora*, *Acer rubrum*, *Populus heterophylla*, *Planera aquatica*, *Fraxinus caroliniana*, *F. tomentosa* and other tree species. Shrub and herbaceous layers are less diverse.

Potential elements of concern: *Carex decomposita*. *Ilex amelanchier*. Wading-bird rookeries.

Dynamics: Cypresses have been extensively logged in many sites, and excellent examples of this community, as large tracts, are rare. Floating stumps and logs may have well-developed herbaceous communities on them. Extensive leaf fall occurs in the autumn. Sites include sloughs, guts, backwater places, etc. that are probably not distinctive as community types. Tree bases are very often swollen; cypresses and tupelo gum additionally have "knees". These communities are seriously affected by channelization of associated rivers. Porcher (1981) considers floating log communities to be microhabitats or dry phases of the swamp forest. Some feel that sufficient differences between alluvial (brownwater) and non-alluvial (blackwater) rivers warrant the separation of these forests into distinctive communities...a growing body of evidence supports this idea.

Comments: Larger guts and sloughs in these swamps seldom dry out completely. Smaller guts are sometimes full of cypress knees.

References: Hall & Penfound 1943. Mathies et al. 1983. Mitsch & Ewel 1979. Noble & Murphy 1975. Quarterman & Keener 1962. Stalter 1971. Wells 1942. Wharton 1970. Wharton 1977. Wharton et al. 1977. Wharton et al. 1982.

BASIC FOREST

Type: Terrestrial

Sites: Upland forests on slopes overlying basic or circumneutral soil, often associated with diabase dikes. The canopy is generally dense and made up of a diversity of hardwood species; herbaceous flora is similarly very diverse. This community is especially well-developed on north-facing or sheltered slopes.

Location: Piedmont.

Vegetation: *Quercus alba*, *Q. shumardii*, *Q. velutina*, other oaks, *Carya tomentosa*, *C. glabra*, *Aesculus pavia*, *Liriodendron tulipifera*, *Fagus grandifolia*, *Acer rubrum*, *A. saccharum*, plus other canopy species. The drier variants of this community often have a predominance of *Quercus alba* along with other drier-adapted oak species such as *Q. stellata*. Subcanopy species include *Nyssa sylvatica*, *Cornus florida*. Shrubs include *Euonymus americana*, *Symplocos*

tinctoria, plus various species of *Viburnum*, *Vaccinium* and *Rhododendron*. Herbs include *Luzula* and *Juncus* spp., *Stellaria pubera*, *Podophyllum peltatum*, *Anemone virginiana*, *A. quinquefolia*, *A. lancifolia*, *Trillium cuneatum*, *T. catesbaei*, *T. cernuum*, *Sanguinaria canadensis*, *Hepatica americana*, *Cynoglossum virginianum*, *Uvularia perfoliata*, *Hybanthus concolor* and *Iris cristata*.

Potential elements of concern: *Tradescantia hirsuticaulis. Isotria medeloides. Orchis spectabilis. Quercus durandii. Asarum canadense. Silene ovata. Menispermum canadense. Isopyrum biternatum. Delphinium carolinianum. Aconitum uncinatum. Caulophyllum thalictroides. Rhus michauxii. Euonymus atropurpurea. Panax quinquefolium. Scutellaria nervosa. Stachys clingmanii. Coreopsis latifolia. Solidago auriculata.*

Dynamics: This community is associated with basic soils, especially over parent materials which weather significantly (mafic rock). The availability of water is a significant factor in the overall appearance of this community, as well as a determinant of the variation within it. The drier slopes usually have a sparser canopy layer, and less herbaceous diversity than the optimally moist slope bottoms.

Associations: Various upland forest types.

Comments: This community may be indistinguishable from some other upland forest types, especially Cove Forests. Future investigation may suggest the inseparability of these two community types. In general, the expression of a "basic" flora is achieved when groundwater is plentiful. More mesic sites are thus most likely to have the richest herbaceous layers. Most of these sites are likely to be within the upper half of the Piedmont, in association with the extensive diabase dikes found there.

BAY FOREST

Type: Palustrine

Synonym: Bay swamp (Wharton et al. 1977).

Sites: Heavily forested wet sites (saturated seasonally or intermittently) on the coastal plain, dominated by "bay species".

Location: Drainages of sandhill streams, slopes and depressions. Also scattered through most of the coastal plain.

Vegetation: *Gordonia lasianthus*, *Magnolia virginiana*, and *Persea borbonia* are the three "bays" commonly referred to in literature. A number of other woody species occur, these also commonly found in Atlantic White Cedar Swamps and Pocosins: *Pinus serotina*, *Chamaecyparis thyoides*, *Myrica cerifera*, and *Smilax laurifolia*. Herbs are sparse; Sphagnum moss may be abundant. The canopy is generally quite thick, with very tangled subcanopy layers made up of viny growth and tall shrubbery.

Potential elements of concern: Black bear.

Dynamics: Bay Forests are thought to succeed from Atlantic White Cedar Swamp in absence of fire, to which they may revert after severe burning. Roots are often exposed and twisted on the boggy ground surface, as in White Cedar Swamps and alluvial river swamps (Bald Cypress--Tupelo Gum Swamp). Wharton (1977) suggests that Bay Forests may succeed from Gum Ponds following absence of fire and invasion of additional hardwoods.

Associations: This community may occur in a mosaic situation with Atlantic White Cedar Swamp, Pond Pine Woodland, Pocosin, and/or Streamhead Pocosin, especially in the sandhills. Otherwise, a number of palustrine communities may grade into Bay Forests.

Comments: The Florida Natural Areas Inventory (FNAI) recognizes a number of plant communities that have some connection with SC's Bay Forest type. "Baygall" is a natural community type of north Florida (primarily) found at the bases of sandhill slopes, very often associated with seepage slopes. These spots are essentially constantly wet, never drying out completely, but also never flooded. Water moves into the area from hillside run-off and from adjacent flatland drainage. This consistently wet soil has a lot of peat buildup, much more so than on the adjacent hillside slopes which often dry out and will maintain fire. FNAI also identifies streamhead bay forests of the western panhandle as "Baygalls"--although they differ slightly in soils and hydrology from the central Florida types. The same species are listed for both types.

References: Braun 1950. R. Jones 1981. Kologiski 1977.

BEECH--MAGNOLIA HAMMOCK

Type: Terrestrial

Synonym: Magnolia forest.

Sites: Shady forests dominated by many a number of hardwood species, many of which may have sclerified and/or leathery leaves.

Location: Outer coastal plain: Beaufort, Charleston and Jasper Counties.

Vegetation: *Fagus grandifolia*, *Magnolia grandiflora*, *Liquidambar styraciflua*, *Pinus glabra*, *Quercus laurifolia*, *Ilex opaca*, *Carya glabra* and *C. ovalis* may characterize the canopy. Subcanopy and shrubby species are usually rather diverse, and include *Persea borbonia*, *Callicarpa americana*, *Aralia spinosa*, *Ostrya virginiana*, *Osmanthus americana* and *Carpinus caroliniana*. Ground cover is generally sparse, but may include *Parthenocissus quinquefolia*, *Rhus radicans*, *Vitis rotundifolia*, *Tipularia discolor* and *Goodyera repens*.

Dynamics: This community is not completely understood, especially concerning aspects of

origin and succession. Fire is probably very infrequent, but would be quite significant; many of the species listed above cannot tolerate fire.

Associations: Maritime Forest. Mesic Mixed Hardwood Forest. Oak-Hickory Forest.

Comments: This community is perhaps related to some Florida hammock communities. It is arguably a sub-type or variant of the more widely distributed Mesic Mixed Hardwood Forest. Braun (1950) indicated that these forests may have calcareous soils. She also suggested that a high degree of variability may occur throughout its range, with *Quercus alba*, *Q. nigra*, *Acer floridanum* and *Cercis canadensis* contributing to the canopy/subcanopy layers.

Reference: Braun 1950.

BOTTOMLAND HARDWOODS

Type: Palustrine

Synonyms: Shallow freshwater swamps (Penfound 1952). Blackwater river bottomland hardwoods. Brownwater river bottomland hardwoods.

Sites: Flat, dissected areas on floodplains somewhat elevated above adjoining cypress-gum swamp.

Locations: Piedmont and coastal plain in association with river systems.

Vegetation: This community is characterized by a well-developed canopy of *Liquidambar styraciflua*, *Pinus taeda*, *Celtis laevigata*, *Quercus lyrata*, *Q. nigra*, *Q. phellos*, *Q. laurifolia*, *Q. michauxii*, *Q. falcata* var. *pagodaefolia*, *Fraxinus americana*, *Platanus occidentalis*, *Ilex opaca*, *Ulmus americana* and other species. A subcanopy of young canopy species, plus many tall shrubs (including *Asimina triloba*, *Ligustrum sinense*, *Viburnum dentatum* and *V. prunifolium*) occurs. Viny species are common, especially *Campsis radicans*, *Berchemia scandens*, *Rhus radicans*, *Vitis aestivalis*, *Matelea gonocarpa* and *Cayaponia boykinii*. Herbaceous flora is richest on driest spots: *Leersia lenticularis*, *Commelina virginica*, *C. communis*, *Spiranthes cernua*, *S. vernalis*, *Viola affinis*, *V. lanceolata*, *Boehmeria cylindrica*, *Lobelia cardinalis*, *L. elongata*, *Pilea pumila*, *Scutellaria lateriflora*, *Aster lateriflorus*, *Tovara virginiana*, *Microstegium vimineum*, *Onoclea sensibilis*, *Woodwardia areolata*, *Osmunda regalis*, *O. cinnamomea*, *Uniola latifolia*, *Asclepias perennans*, *Senecio glabellus*, *Thelypteris palustris* and *Asplenium platyneuron* are some possible species.

Potential elements of concern: *Osmunda claytoniana. Dryopteris spinulosa. Fimbristylis vahlii. Eriocaulon ravenelii. Trillium lancifolium. Spiranthes longilabris. Quercus durandii. Aristolochia tomentosa. Silene ovata. Ilex amelanchier. Trepocarpus arethusae. Halesia parviflora. Scutellaria nervosa. Physostegia leptophylla. Bacopa cyclophylla. Dyschoriste humistrata.* Swallow-tailed kite. Black bear.

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Dynamics: Bottomland Hardwoods are extremely diverse in terms of life forms present, and are quite variable from one site to another. Most bottomland hardwoods have been logged to some degree. Some trees may reach immense size, especially loblolly pine, hackberry, sweetgum, laurel oak and swamp-chestnut oak. Windthrown trees (shallow root systems, broad area of root zone coverage) allow canopy openings and thus increased herbaceous diversity. Some herbs colonize the uplifted soil remaining on the roots once the tree is on the ground.

Associations: Levee. Bald Cypress-Tupelo Gum Swamp. Oak-Hickory Forest.

Comments: "Swamp Cane Island" has been thought of as a discrete community within Bottomland Hardwoods, but is probably best considered a microenvironment there. These spots have rich herbaceous vegetation and are sometimes found on the remaining alluvial ridges at some distance away from the river channel, well within the bottomland itself. Braun (1950) identified "ridge bottoms (or cane ridges)" as a recognizable subdivision of the bottomland forest, and added that "These ridges are (or were originally) covered by dense stands of cane." Bottomland Hardwood sites are generally very rich in both diversity and abundance of bird species.

References: Braun 1950. Noble & Murphy 1975. Porcher 1981. Stalter 1971. Wharton 1977. Wharton et al. 1982.

BRACKISH MARSH

Type: Estuarine

Synonyms: Needlerush marsh, Edge-zone marsh (Wharton 1977).

Sites: Edges of estuaries, generally upland from adjacent salt marshes; drained by dendritic or sinuous tidal creeks. These communities are often recognized by a nearly dominant growth of *Juncus roemerianus*.

Location: Outer coastal plain.

Vegetation: Brackish marshes generally have a large abundance of a few species, with grasses and sedges predominant. *Juncus roemerianus* sometimes forms what is close to a natural "monoculture". Other species of this community are *Spartina cynosuroides*, *S. patens*, *Scirpus robustus*, *S. americanus*, *Eleocharis parvula*, *Triglochin striata*, *Distichlis spicata*, *Polypogon monspeliensis*, *Sporobolus virginicus*, *Zizania aquatica*, *Zizaniopsis miliacea*, *Cladium jamaicense*, *Cyperus tetragonus*, *Fimbristylis spadicea*, *Typha angustifolia*, *Sagittaria falcata*, *S. subulata*, *Amaranthus cannabinus*, *Lilaeopsis chinensis*, *Limonium carolinianum*, *Aster tenuifolius* and *Solidago sempervirens*.

Potential elements of concern: *Eleocharis cellulosa. E. fallax. E. rostulata.*

Dynamics: Fires are probably infrequent.

Associations: Salt Marsh, Salt Flat, Salt Shrub, Intertidal Mud/Sand Flats.

Comments: Many invertebrate species are found in Brackish Marshes, including a number of crustaceans (*Uca* spp., other crabs) and annelids. Bird life is generally rather poor, except for marsh hens, clapper rails and a few other species.

References: Cooper & Waits 1973. Jackson 1952. Johnson et al. 1974. Penfound 1952. Stalter 1973. Wells 1928. Zingmark 1978.

CALCAREOUS CLIFF

Type: Terrestrial

Synonyms: Calciphyte forest. Limestone cliff. Marl cliff.

Sites: Slopes or steep walls of marl, sometimes mixed with other mineral soils and/or shell "hash".

Location: Bluffs along rivers of outer coastal plain.

Vegetation: The representation of canopy members depends upon slope and exposure of substrate. Generally, woody plants are at a disadvantage in colonization of this community; canopy species present may in fact be more properly considered part of surrounding forests. Potential woody species include *Tilia heterophylla*, *Tilia caroliniana*, *Quercus muhlenbergii*, *Morus rubra*, *Cercis canadensis*, *Rhamnus caroliniana*, *Acer saccharum*, *Lindera benzoin* and *Ulmus americana*. Ferns are often well-represented on these communities. Other herbs which may occur are *Hybanthus concolor*, *Ponthieva racemosa*, *Elytraria caroliniensis* and *Campanula americana*.

Potential elements of concern: *Asplenium resiliens. A. heteroresiliens. Pellaea atropurpurea. Carex eburnea. Carya myristicaeformis.*

Dynamics: Poorly understood. Some calcareous cliffs may have little vegetation, especially on the steepest parts. Fire is probably never a factor. Certain cliffs may owe at least part of their origin to dredging or widening of rivers and the accompanying accumulation of spoil material.

Associations: Marl Forest. Upland forest types, including Oak-Hickory Forest, Spruce Pine-Mixed Hardwood Forest.

Comments: More field knowledge is definitely needed for this rare community.

Reference: Sloan 1908.

CHESTNUT OAK FOREST

Type: Terrestrial

Sites: Ridges and dry south-facing slopes, dominated by chestnut oak, and with several other xeric-adapted oaks, pines and hickories.

Location: Mountains and piedmont (higher elevations).

Vegetation: *Quercus prinus*, *Q. rubra*, *Q. alba*, *Q. coccinea*, *Q. velutina*, *Q. falcata*, *Pinus echinata*, *P. virginiana*, *Carya glabra*, *C. tomentosa*, *Oxydendrum arboreum*, *Nyssa sylvatica*, *Acer rubrum*, *Sassafras albidum*, *Castanea dentata* (stump sprouts), *Kalmia latifolia*, *Rhododendron minus*, *Pyrularia pubera*. The herbaceous flora of this community is usually very sparse.

Potential elements of concern: *Xerophyllum asphodeloides*. *Anemone caroliniana*. *Arabis laevis* var. *missouriensis*. *Fothergilla major*. Black bear.

Dynamics: *Quercus prinus* and other associated hardwoods are taking over where *Castanea dentata* once dominated. Without disturbance, hardwoods increase in importance relative to pines. In mountainous areas, Chestnut Oak Forest is likely to be found on practically any exposure, whereas in the piedmont, they are best developed on north-facing sites, especially those with an acidic (quartzite-based) substrate.

Associations: Acidic Cliff. Cove Forest downslope. Oak-Hickory Forest.

Comments: This community may be found on monadnocks of the piedmont.

COVE FOREST

Type: Terrestrial

Synonyms: Cove Transition Forest. Montane Cove Forest.

Sites: Mesic ravines, sheltered slopes and rich broad flats next to streams. These are not restricted necessarily to northern exposures.

Location: Mountains and piedmont.

Vegetation: These forests are characterized by dense canopies of great diversity, including *Tilia heterophylla*, *Acer saccharum*, *Liriodendron tulipifera*, *Fagus grandifolia*, *Tsuga canadensis*, *Betula lenta*, and others. The shrub layer is reasonably open to quite dense, with *Rhododendron maximum*, *Hydrangea arborescens*, *Lindera benzoin* and *Cornus florida*. The herbaceous flora is particularly rich and diverse, with spectacular blooming during the spring.

Potential elements of concern: *Trichomanes petersii. Asplenium rhizophyllum. Carex austrocaroliniana. Disporum lanuginosum. Platanthera integrilabia. Isopyrum biternatum. Caulophyllum thalictroides. Shortia galacifolia. Circaea lutetiana. Cladrastis kentuckea.*

Dynamics: This is often recognized as a stable, climax community. Earlier disturbance is indicated by a preponderance of *Tsuga* and *Liriodendron*. Some canopy trees attain immense proportions.

Associations: Basic Forest. Rhododendron Thicket. Hemlock Forest. Chestnut Oak Forest. Spray Cliff.

Comments: The separation of this community from some Basic Forests may be particularly difficult. Differences among these communities may be centered around composition of herbaceous layer rather than canopy species, which are essentially the same. Of the communities within the mountains of South Carolina, this one is probably the most productive regarding songbird diversity and abundance.

References: Bratton 1978. Hardin & Lewis 1980. Whittaker 1956.

DEPRESSION MEADOW

Type: Palustrine

Synonyms: Depression marsh. Freshwater marsh. Bur-reed marsh (Hall & Penfound 1943). Grass/sedge bog. Wet prairie.

Sites: Wetland with widely fluctuating water level, usually every year, dominated by emergent grasses and sedges.

Location: Possibly throughout state, but probably best developed on Coastal Plain.

Vegetation: Shrubby vegetation is generally of minor importance in this community. Possible shrubby species are *Cephalanthus occidentalis*, *Diospyros virginiana* and *Ilex myrtifolia. Acer rubrum* and *Liquidambar styraciflua* may occur abundantly in certain sites. Vegetation is dominated by grasses and sedges, especially *Panicum* spp. (*P. hemitomin*, *P. verrucosum*, *P. dichotomiflorum*, etc.), *Rhynchospora* spp., *Carex* spp., *Fimbristylis* spp., *Eleocharis* spp., *Cyperus* spp., together with other graminoid genera and forbs, including *Leersia* spp., *Hydrochloa caroliniensis*, *Juncus repens*, other *Juncus* species, *Xyris* spp., *Ludwigia decurrens*, *L. sphaerocarpa*, *L. octovalvis*, *L. alternifolia*, *L. suffruticosa*, *L. pilosa*, other *Ludwigia* species, *Rhexia mariana*, *Sabatia bartramii*, *S. difformis*, *S. brevifolia*, *Lachnanthes caroliniana*, *Iris tridentata*, *I. prismatica*, *I. hexagona*, *I. virginica*, *Proserpinaca pectinata* and *Cuphea carthagensis*.

Potential elements of concern: *Amphicarpum muhlenbergianum. Fimbristylis vahlii. Rhynchospora inundata. R. tracyi. Cladium mariscoides. Sagittaria isoetiformis. Echinodorus*

parvulus. Stillingia aquatica. Litsea aestivalis. Polygala nana. Hypericum adpressum. H. nitidum. Ludwigia spathulata. Rhexia aristosa. Oxypolis canbyi. Ptilimnium nodosum. Coreopsis rosea.

Dynamics: These sites may be rounded or irregular in shape. A high degree of vegetational zonation may occur, which is most easily observed in the more rounded meadows. Peat accumulates at center? Fire is probably very important in maintenance. Exclusion of fire probably allows conversion of sites into shrub-dominated communities.

Associations: Pond Cypress Pond. Swamp Tupelo Pond. Pine Savannah. Limestone sink.

Comments: This community is frequently observed in many Carolina bays. Limestone sinks may have essentially the same species present, but dynamics (especially involving hydrology) probably allow consistent separation.

ESTUARINE SCOUR HOLE

Type: Marine

Sites: Holes 15-30 meters deep, and 2-5 times deeper than adjacent tidal channels. These depressions extend below marsh and channel sediments, and cut into Tertiary Cooper marl lime bedrock.

Location: About 25 sites located to date up and down SC coast.

Vegetation: None known; presumably, restricted to algae.

Dynamics: Scouring action occurs during flood (inflow). Sites are swept clear of unconsolidated sediments by receding tide (outflow). Ebb-dominant currents tend to introduce sand from upstream. Cooper marl exposures on bottom are kept bare.

Associations: Unconsolidated Marine Bottom.

Comments: Practically no field knowledge is available. Molluscs (especially pelycypods and bivalves), crustaceans and echinoderms are known to be present.

References: Kjerfve et al. 1979. Zingmark 1978.

GRANITIC DOME

Type: Terrestrial

Sites: Extruded granite/gneiss at the surface of the surrounding soil, with varyingly sloping angle; not flat.

Location: Piedmont and mountains.

Vegetation: This community shares many vegetational elements with Acidic Cliff and Granitic Flatrock sites. Pioneer species present are essentially the same among all three. Woody vegetation tends to be more abundant here than on Acidic Cliffs. Larson & Batson (1978) list *Krigia montana*, *Danthonia spicata*, *Selaginella tortipila*, *Panicum tennesseense* as the dominant herb species on Granitic Domes.

Potential elements of concern: *Juniperus communis*. *Senecio millefolium*. *Solidago bicolor*.

Dynamics: Mosaic communities on these rock faces are perhaps not as well "defined" as on flatrocks, due to the rapid run-off of water. Solution pools and resultant circular mats and vegetation zones are not found. Successional trees (especially *Juniperus virginiana*, *Pinus virginiana*, etc.) on these sites are more likely to topple over due to windthrow than they are on flatrocks. Crevices and ledges provide the only habitats for larger plants, once sufficient soil has built up. Dome communities are reasonably unstable, as are those of flatrocks and cliffs; their demise is often brought about by heavy rain, prolonged drought or strong winds. Granite domes represent sites for "water-slides", which are best considered as palustrine communities (High Elevation Seeps) on the domes themselves. Crandell (1977) identifies *Krigia*, *Danthonia* and *Calamogrostis* as "surface"-occupying plants, and *Chionanthus virginica*, *Quercus prinus* and *Pinus virginiana* as "fissure" plants.

Associations: Acidic Cliff. Granitic Flatrock. Upland forest types, such as Oak-Hickory Forest and Chestnut Oak Forest.

Comments: Granitic Domes receive some threat from nature enthusiasts, but certainly not as much as do Flatrocks.

References: Crandell 1977. Larson 1977. Larson & Batson 1978. Oosting & Anderson 1937.

GRANITIC FLATROCK

Type: Terrestrial

Synonym: Granite outcrop.

Sites: Extrusive or intrusive granite/gneissic material as more or less flat outcrops, but usually with at least some rolling topography. Elevation is essentially the same as the surrounding ground, as opposed to the situation with Domes and Cliffs.

Location: Piedmont.

Vegetation: Canopy species tend to be diverse, but individual plants are often stunted. *Juniperus virginiana*, *Ulmus alata*, *Quercus alba*, *Q. prinus*, *Pinus echinata* and *Gleditsia*

triacanthos are often seen as trees on Flatrocks. In general, canopy species present may be the same as those from immediately surrounding communities, and are not especially indicative of the Flatrock community. The same is true for shrubby and/or understory species. On the other hand, the herbaceous flora of Granitic Flatrocks is highly specialized, and a large number of endemic species occurs on them. Most of these endemics are quite rare, and are especially sensitive to disturbance. Other than the elements of concern, the herbaceous flora of Flatrocks may include *Erythronium americanum*, *Hypericum gentianoides*, various species of *Rubus*, *Andropogon*, *Juncus*, *Fimbristylis*, *Yucca*, *Aster* and *Chrysopsis*. A number of bryophyte genera are known from these Flatrocks. Some of these are considered important bare-rock colonizers, leading the way for the vegetational succession of vascular plants.

Potential elements of concern: *Isoetes melanocarpa. Hemicarpha micrantha. Schoenolirion croceum. Quercus georgiana. Arenaria uniflora. Arabis laevigata* var. *missouriensis. Draba aprica. Oenothera linifolia. Diamorpha smallii. Portulaca umbraticola. Sedum pusillum. Lepuropetalon spathulatum. Phacelia maculata. Amphianthus pusillus. Viguiera porteri. Aster avitus.*

Dynamics: Well-documented accounts of primary succession on bare rock occur in the literature. Fire is not a factor except perhaps within larger herbaceous micro-communities on the rock itself. Soil mats tend to accumulate organic matter and fragmented rock, and thus expand. This process may be interrupted by windthrown trees. Gneiss soils contain high amounts of iron and aluminum. Both of these elements are characteristic solutes of the typically low-pH water associated with granite. Low pH interferes with the functioning of decay organisms, allowing higher amounts of organic matter to build up than might accumulate on limestone soils, for instance (Balter & Loeb 1983).

Associations: Granitic Dome. Acidic Cliff. Upland forest types, such as Oak-Hickory Forest and Chestnut Oak Forest; transitions are usually rather well-demarcated.

Comments: This is a very specialized community, one that is seriously threatened in South Carolina. Quarrying and recreational activities represent the greatest threats from man.

References: Balter & Loeb 1983. Burbanck & Platt 1964. Knox 1974. Oosting & Anderson 1937. Smith 1941.

HEMLOCK FOREST

Type: Terrestrial

Sites: Hemlock-dominated forests on sites slightly less mesic than Cove Forests, usually on steep slopes, high elevation flats, or adjacent to streams.

Location: Mountains.

Vegetation: Predominantly *Tsuga canadensis*, with *Pinus strobus* usually present together with

other Cove Forest canopy, understory and shrub layer species, such as *Betula lutea*, *Rhododendron maximum*, *Kalmia latifolia*, *Euonymus americana*, *Pyrularia pubera*, *Hamamelis virginiana*, *Vaccinium constablei*, and *Leucothoe axillaris*. Herbaceous species are usually few, but may include *Mitchella repens*, *Viola blanda*, *V. rotundifolia*, *Cimicifuga racemosa*, *Medeola virginiana* and *Polystichum acrostichoides*.

Potential elements of concern: *Trillium persistens. Isotria medeoloides. Triphora trianthophora* on flats adjacent to streams. *Buckleya distichophylla. Caulophyllum thalictroides. Viola macloskeyi. Shortia galacifolia.*

Dynamics: This is presumably a stable community.

Associations: Cove Forest. Drier communities upslope, such as Chestnut Oak Forest.

Comments: The association of hemlock and rhododendron may suppress other species. Boundaries between this and other montane communities are often rather distinct. More variation occurs within these communities in NC, where the presence of *Tsuga caroliniana*, in sufficient abundance and in slightly different ecological settings, has led to suggestions on further division of these community types. Some examples of this community tend to have a scattered layer of ericaceous shrubs and a relatively high diversity of herbaceous species; more xeric examples tend to have a thick shrubbery layer with a relatively depauperate herb layer.

HIGH ELEVATION SEEP

Type: Palustrine

Sites: Wet places of variable size on granitic rock of Acidic Cliffs and Domes. Hydrology differs widely from site to site, and seasonally at a given seep.

Location: Piedmont and mountains.

Vegetation: This community usually contains a diverse assemblage of bryophytes, ferns and herbs; woody plants are not particularly well represented nor characteristic. Frequently encountered species are *Saxifraga michauxii*, *Helenium autumnale*, *Calamogrostis cinnoides*, *Oenothera fruticosa*, *Chelone lyonii*, *Rudbeckia laciniata*.

Potential elements of concern: *Carex biltmoreana. C. prasina. Platanthera integrilabia. Trautvetteria caroliniensis. Sarracenia jonesii. Parnassia asarifolia. P. grandifolia. Saxifraga micranthidifolia. Boykinia aconitifolia. Oenothera perennis. Castilleja coccinea.*

Dynamics: The most highly vegetated High Elevation Seeps are characterized by abundant available sunlight. During dry times of the year these communities may have little water actually moving through them, but they are generally saturated at the soil level all the time.

Associations: Acidic Cliff. Granitic Dome. Spray Cliff.

Comments: These communities are very often quite scenic, even if on a very small scale (due to their patchiness). Very often, a number of Seeps will be separated from each other by stretches of bare rock or forested ground, in association with a larger terrestrial community such as a Granitic Dome. Because of the attraction these sites have for botanists and naturalists, they are in danger of being over-collected and otherwise trampled. However, most of these communities are reasonably isolated and fairly inaccessible.

References: Larson & Batson 1978.

HILLSIDE HERB BOG

Type: Palustrine

Synonym: Seepage Herb Bog.

Sites: Seasonally or permanently saturated slopes on sandhills dominated by many herbaceous species, including grasses, insectivorous plants and orchids that are more commonly considered savannah species.

Location: Fall-line sandhills, possibly entire coastal plain.

Vegetation: Canopy species are usually absent from this community, but potential woody plants are *Liriodendron tulipifera*, *Acer rubrum*, *Liquidambar styraciflua*, *Alnus serrulata*, *Clethra alnifolia* and *Rhus vernix*. Grasses and sedges include *Aristida* spp., *Andropogon virginicus*, *A. gerardii*, *Ctenium aromaticum*, *Scleria triglomerata*, *Rhynchospora* spp., *Fimbristylis* spp. Insectivorous plants are *Sarracenia flava*, *S. purpurea*, *S. rubra*, *Utricularia* spp., *Pinguicula caerulea*, *Drosera* spp. Orchids include *Pogonia ophioglossoides*, *Spiranthes* spp., *Habenaria ciliaris*, *Calopogon barbatus* and potentially other species. Additional showy species include *Tofieldia racemosa*, *Lilium catesbaei*, *Amianthium muscaetoxicum*, *Iris virginica*, *I. tridentata*, *Mayaca fluviatilis*, *Polygala* spp., *Rhexia alifanus*, *R. lutea*, *R. mariana* and *Asclepias rubra*. Other common bog genera include *Sphagnum*, *Osmunda* and *Lycopodium*.

Potential elements of concern: *Aristida spiciformis*. *A. affinis*. Pine-barrens tree frog.

Dynamics: These bogs are probably dependent on fire for maintenance. Shrub invasion from adjacent communities occurs without fire. There may be more artificial representatives of this community type than the "natural" type; construction of gas and power line rights-of-way, and their maintenance, has often resulted in the presence of these bogs.

Associations: Xeric communities uphill and laterally. Bay Forest. Atlantic White Cedar Swamp. Streamhead Pocosin, Seepage Pocosin.

Comments: These probably represent mosaic situations within larger sandhill systems. Their relationship to other communities of the Pocosin "complex" is unclear. The dynamics of these bogs are conceivably largely those of wet pine savannahs (especially the non-canopied "wet

meadows"), but differences between them involve hydrology and topography.

INTERDUNE POND

Type: Lacustrine

Synonym: Marsh Pond (Wharton 1977).

Sites: Permanent or semi-permanent bodies of water located in swales between beach dunes and ridges.

Location: Outer coastal plain, barrier islands.

Vegetation: Many rooted, floating, and/or emergent aquatic species may occur, including *Azolla caroliniana*, *Lemna* spp., *Wolfiella floridana*, *Hydrocotyle bonariensis*, *H. ranunculoides*, *Typha* spp., *Cladium jamaicense*, *Potamageton diversifolius*, *P. pulcher*, *Nymphaea odorata* and *Nuphar luteum*. *Mikania scandens* is sometimes very abundant at the edges of these ponds.

Potential elements of concern: *Cyperus distinctus*. *Lilaeopsis carolinensis*. American alligator.

Dynamics: These ponds are quite variable from site to site with respect to seasonality of flooding, tidal effects, connection with lagoons, salinity and depth.

Associations: Salt Shrub. Maritime Grassland.

References: Zingmark 1978.

INTERTIDAL BEACH

Type: Marine

Synonym: Sand strand (Oosting 1954).

Sites: Unconsolidated, regularly inundated sands at shoreline.

Location: Outer coastal plain, barrier islands.

Vegetation: Typically none, although sometimes a few species from the associated dunes may be present.

Potential elements of concern: Green sea turtle. Loggerhead turtle. Least tern. Brown pelican. Osprey. Bald eagle.

Dynamics: This is a specialized community, and is quite harsh in many ways. Unstable sands

constantly shift due to tides. The presence in SC of low-energy coastlines at the ocean edge is a possibility, but little is known concerning this.

Associations: Seaward into Unconsolidated Coastal Bottom. Landward, almost always grades into Maritime Grassland. Very narrow beaches may be directly adjacent to Maritime Forest.

Comments: These sites are sometimes destroyed by erosion, whether natural or human-caused. Ghost forests are present in spots where erosion of the beach and dunes has encroached upon the maritime forest present. Undisturbed, or minimally disturbed Intertidal Beaches are typically very rich in animal life. Large invertebrate assemblages may occur, including many crustaceans, annelids and molluscs. Most of the animals present (living on the beach rather than merely feeding there) are "sand-dwellers". The diggers and burrowers collectively make up the "endopsammon". Some of these invertebrate genera are *Arenicola* (polychaete worm), *Balanoglossus* (acorn worm), *Donax* and *Cardium* (clams), *Haustoria*, *Orchestia* and *Talorchestia* (amphipods), *Ocypoda* (ghost crab), *Callinectes* (blue crab), *Oliva* and *Terebra* (snails), *Clibarius* and *Pagurus* (hermit crabs), and *Busycon* (whelk). Many shore bird species (plovers, sanderlings, sandpipers, turnstones, etc.) feed on the shore line. Mammals include foragers such as mice, voles and raccoons. Deer are known to cool themselves off in the surf.

References: Johnson et al. 1974. Pinson 1973. Reise 1985. Wharton 1977. Zingmark 1978.

INTERTIDAL MUD/SAND FLAT

Type: Marine, Estuarine

Synonyms: Mud, sand bar. Mud, sand flat.

Sites: Unconsolidated mud, sand, sediment and silt either separated from ('bar') or continuous with ('flat') permanently emersed land masses. These sites are regularly or irregularly inundated.

Location: Outer coastal plain, barrier islands.

Vegetation: None, except for ephemeral adventives. There is generally not enough time during exposure to allow for rooting of seeds and/or vegetative fragments.

Dynamics: These are often ephemeral sites, especially if located as barrier island associates. They are commonly just below the water while the tide is in, and are usually subject to at least some wave action. While flooded, these sites are characterized by "mega-ripples" and "sandwaves" (Findlay 1981). "Bars" and "flats" are loosely separated by nontechnical features: bars have a steeper slope down to the water edge than do flats. Also, bars are surrounded on all sides by water, whereas a flat will have a connection with some other land mass at the point of highest flooding (i.e. high tide).

Associations: Grades into Unconsolidated Marine Bottom, and often occurs at edges of Salt Marshes in estuaries.

Comments: Findlay (1981) lists organisms common to sand flats: nematodes, copepods, nauplii, gastrotrichs and polychaete worms. Sand and Mud Flat fauna may be strongly structured vertically, with this segregation relieving competition pressures. Grant (1981) lists these crustaceans on sandflats from Debidue Island: *Acanthohaustorius millsi*, *Pseudohaustorius carolinensis* and *Monoculodes edwardsi* (amphipods), and *Cyathura burbancki* (isopod). Bacteria present constitute a major source of food for resident invertebrates.

References: Findlay 1981. Grant 1981. Reise 1985. Zingmark 1978. Zobell & Feltham 1942.

LEVEE

Type: Terrestrial

Synonyms: Blackwater river natural levee, brownwater river natural levee.

Sites: Natural overflow barriers along river channels.

Location: This community occurs parallel to major river systems; sites are especially well-represented on the coastal plain.

Vegetation: *Platanus occidentalis*, *Betula nigra*, *Quercus laurifolia* and *Salix* spp. are the major tree components of this community. Other canopy members include *Quercus michauxii*, *Liriodendron tulipifera*, *Liquidambar styraciflua*, *Fraxinus caroliniana*, *F. tomentosa*, *F. pennsylvanica*, *Carya aquatica*, *C. ovata*, *Acer rubrum*, *A. negundo*, *A. saccharinum*, *Planera aquatica* and *Carpinus caroliniana*. Commonly seen shrubs are *Asimina triloba*, *Crataegus marshallii*, *C. viridis* and *Lindera benzoin*. Herbaceous cover varies extensively from site to site, but usually includes *Uniola latifolia*, *Arundinaria gigantea*, *Microstegium vimineum*, *Boehmeria cylindrica*, and on larger levees, *Podophyllum peltatum* and *Corydalis flavula*.

Potential elements of concern: *Aristolochia tomentosa*. *Euonymus atropurpurea*.

Dynamics: Availability of light allows greater plant diversity and density. These communities are seasonally or periodically flooded, and sometimes destroyed this way. The soil is generally very fertile, especially along alluvial rivers. Blackwater rivers are not expected to have as well-developed levees due to lower amount of alluvium. Much variation occurs among sites with respect to width, relation to adjacent river channel, and species composition.

Associations: Small Stream Forest. Bottomland Hardwoods. Shoal and Stream Bar. Levees of smaller rivers (narrow floodplains) probably grade into adjacent upland forests.

Comments: Braun (1950) identifies "bottomland forest" on the landward side of the levee, and "stream margin" communities on the channel side. Some of the early "Cane Bottoms" in South Carolina were probably associated with large levees; the extensive areas of Arundinaria once so widespread are now essentially gone, except for isolated patches, mostly on the piedmont,

References: Braun 1950. Wharton 1977. Wharton et al. 1982.

LIMESTONE SINK

Type: Palustrine

Sites: Irregularly shaped or rounded depressions underlain by limestone, which are seasonally saturated, and with standing water during at least three months of the year.

Location: Coastal plain, especially Orangeburg and Berkeley Counties.

Vegetation: Diverse trees, shrubs and herbs, including *Acer rubrum*, *Pinus taeda*, *Lyonia lucida*, *Alnus serrulata*, *Myrica cerifera*, *Baccharis halimifolia*, *Aristida* spp., *Andropogon* spp., *Rhynchospora* spp., *Carex* spp., *Scirpus* spp., *Limnobium spongia*, *Nymphaea odorata*, *Myriophyllum* spp., and *Lindernia dubia*.

Potential elements of concern: *Scirpus erismanae. Amphicarpum muhlenbergianum. Lindera melissaefolium. Litsea aestivalis. Myriophyllum laxum.*

Dynamics: Not completely understood.

Associations: Pine Savannah. Depression Meadow. Upland Pine-Wiregrass Woodland. Pine Flatwoods.

Comments: Limited knowledge is available for this community. Much more field work is necessary, especially concerning the separation of this from Limestone Sinkhole and Depression Meadow.

LIMESTONE SINKHOLE

Type: Terrestrial

Synonyms: Sinkhole.

Sites: Cavities or depressions, extremely variable in exposure and size, associated with partially or completely collapsed limestone-based rock. Outcropped rock is usually present at the ground surface.

Location: Coastal plain, especially Berkeley, Calhoun and Orangeburg Counties.

Vegetation: The amount and diversity of vegetation depends largely on the conditions of the limestone itself. Large sinkholes may provide a great deal of relief, and may be associated with forest systems typical of the surrounding communities. Smaller sinkholes are likely to be drier,

and with less diverse vegetation. Calciphilic shrubs and herbs normally characterize these sites.

Potential elements of concern: *Asplenium resiliens. A. heteroresiliens.*

Dynamics: Much variation occurs in size and depth. Limestone walls may be bare or extensively vegetated. Fire is probably rare or lacking. Some sites are quite deep, reportedly up to 70 feet. Conic or cylindric holes may have clear streams associated, sometimes as disappearing spring runs.

Associations: Oak--Hickory Forest. Mesic Mixed Hardwood Forest.

MARINE DEEPWATER

Type: Marine

Sites: Subtidal zone, constantly inundated. No sea-water dilution ever occurs. Bottom composed of consolidated or unconsolidated sand, mud, sediments, shells, shell fragments and other non-living detritus.

Location: Outer coastal plain, barrier islands.

Vegetation: Benthic macrophytes, if present, at a depth which precludes the development of extensive plant and/or animal colonies.

Associations: Seaward into oceanic benthos. Landward, into Unconsolidated Coastal Bottom.

Comments: It has been suggested that insufficient light reaches the bottom to allow much biological diversity. This may be a simplistic idea, however. Depth/light relationship is probably variable from site to site, and may depend on other oceanic or meteorological phenomena. More research is needed; it is not anticipated that high priority values will be assigned to this community.

References: Zingmark 1978.

MARITIME FOREST

Type: Terrestrial

Synonyms: Maritime live oak forest (Bordeau & Oosting 1959). Salt spray climax (Wells 1939). Mature live oak hammock (Laessle & Monk 1961). Maritime closed dunes (Rayner & Batson 1976). Maritime strand forest, upland maritime strand forest (Wharton 1977).

Sites: Forests behind dunes on mainland and barrier islands, characterized by slow-growing, evergreen, salt-tolerant species.

Location: Outer coastal plain, barrier islands.

Vegetation: Canopy species include *Quercus virginiana, Q. laurifolia, Magnolia grandiflora, Pinus taeda, P. elliottii* and *P. palustris.* Understory plants include *Juniperus silicicola, J. virginiana, Sabal palmetto, Ilex opaca, Persea borbonia, Myrica cerifera, Ilex vomitoria, Lyonia ferruginea, Osmanthus americana* and *Baccharis halimifolia. Rhus radicans, Cnidoscolus stimulosus, Mitchella repens, Houstonia procumbens, Opuntia compressa, Passiflora incarnata, P. lutea, Scleria triglomerata* and *Stipa avenacea* are frequently seen as members of the herbaceous cover, which is often rather depauperate.

Potential elements of concern: *Agrimonia incisa. Sageretia minutiflora. Cynanchum scoparium.*

Dynamics: Prevalence of high wind induces shearing effect on the most exposed shrubs at the seaward edges of this community, causing gradual merger (usually) with the forest proper. Much potential exists for the subdivision of this community based on cover type. Fire is uncommon; there is generally not enough material on the ground to provide very hot fires. Forests with abundant palmettos will burn more frequently. In general, *Sabal palmetto* is quite fire-resistant once it acquires some height. Severe erosion destroys dune systems and adjacent forests, producing 'ghost forests' at the beach line itself. Laessle & Monk (1961) suggest that more mesic species would move in successionally, but are probably eliminated by fire. These mesic species are probably capable of tolerating more salt spray than is commonly thought, but the poor, dry soils of the Maritime Forests contribute to their exclusion. Maritime forests may be destroyed by shifting dunes.

Associations: Maritime Shrub Thicket. Salt Shrub. Dune Grassland.

Comments: A large amount of site-to-site variability occurs within this community, Various ideas have been proposed to separate out smaller community types. A rather convincing argument is that of separating barrier-island maritime forests from those found on the mainland, based largely on the differences in vegetational diversity found between them. Mainland forests have much more species diversity than those on the barrier islands, which must deal with the most severe conditions (very high wind, salt-spray, etc.). Hammock-like islands of vegetation identical to Maritime Forest communities may be situated well away from the influence of the ocean within marsh systems. A number of possible subtypes of this community have been suggested for SC.

References: Boyce 1954. Burk 1962. Doutt 1941. Johnson et al. 1974. Laessle & Monk 1961. Rayner & Batson 1976. Wells 1939.

MARITIME GRASSLAND

Type: Terrestrial

Synonyms: Dune grassland. Interdune swales. Dune meadow.

Sites: Xeric grassland (grasses, herbs and vines) on tops of stable or shifting dunes and ridges that are well-elevated above highest flood mark, plus intermittently xeric/mesic sites behind foredunes and between adjacent (parallel) backdunes farther inland.

Location: Outer coastal plain, barrier islands.

Vegetation: Various tussock-forming and for rhizomatous grasses, especially *Uniola paniculata*, characterize this community. Other grass species include *Panicum amarum*, *Spartina patens*, *Cenchrus tribuloides*, *Andropogon* spp. and *Triplasis purpurea*. Herbs frequently seen on the seaward margins of this community are *Cakile harperi*, *Salsola kali*, *Heterotheca subaxillaris*, *Erigeron canadensis*, *Sesuvium portulacastrum*, *Atriplex arenaria*, *Ipomoea stolonifera*, *Hydrocotyle bonariensis* and *Oenothera humifusa*. A rather diverse group of shrubs and herbs occurs together behind the seaward dunes, including some from the Maritime Shrub Thicket. Possible species here include *Myrica* spp., *Yucca* spp., *Xanthoxylum clava-herculis*, *Iva imbricata*, *Bumelia tenax*, *Lycium carolinianum*, *Euphorbia polygonifolia*, *Croton punctatus*, *Physalis viscosa*, *Dichromena latifolia*, *Fimbristylis* spp., *Eleocharis* spp., *Scirpus* spp., *Cyperus* spp., *Lippia nodiflora*, *Sabatia stellaris*, *Smilax* spp., *Vitis rotundifolia* and *Solidago sempervirens*.

Potential elements of concern: *Muhlenbergia filipes*. *Amaranthus pumilus*. *Paronychia floridana*. *Ipomoea macrorhiza*. *Heterotheca floridana*. Glass lizard. Sea turtles (nesting sites). Brown pelican.

Dynamics: This community is probably not affected by fires, or only rarely. Sand may be strongly leached of salt. The effects of overwashing and erosion are most noticeable following severe storms. Maritime Grassland will conceivably develop in old outwash spots. This community is easily characterized as a harsh environment, with full sun, deep sand, salt spray and high wind affecting the organisms present. Beach erosion may destroy the dunes; overwash activity and "blow-outs" occur.

Associations: Interdune Ponds may be present. Dune Grassland. Maritime Shrub Thicket.

Comments: The presence of a large number of shrub species has been used to differentiate the interdune swales from the leading edges of the dunes, which are dominated by non-woody plants.

References: Celosi and McCormick 1978. Johnson et al. 1974. Oosting 1945. Oosting and Billings 1942. Pinson 1973. Wagner 1964. Zingmark 1978.

MARITIME SHRUB THICKET

Type: Terrestrial

25mm

Synonyms: Wax myrtle thicket (Sharitz 1975). Temperate coastal strand (Florida Natural Areas Inventory Classification). Interdune type, in part (Wharton 1977).

Sites: Shrubby zones in upland areas (tops of stabilized dunes, edges of maritime forests). Trees are absent.

Location: Outer coastal plain, barrier islands.

Vegetation: A variety of salt-tolerant shrubs occurs, especially *Myrica cerifera*, *Ilex vomitoria*, *Iva imbricata*, with perhaps *Sabal minor*, *S. palmetto* (rarely), and *Serenoa repens*. *Quercus geminata* may be present. Vines may include *Vitis rotundifolia*, *Rhus radicans*, *Berchemia scandens*, *Lonicera japonica*, *Smilax* spp., *Parthenocissus quinquefolia* and *Passiflora incarnata*.

Potential elements of concern: *Sageretia minutiflora*. *Cynanchum scoparium*.

Associations: Maritime Forest. Maritime Grassland.

Comments: This community is closely related to Salt Shrub, but differs in: (1) hydrology - maritime shrub is never flooded, (2) location - seaward of maritime forest rather than landward, (3) no wind-pruning in Salt Shrub community. Maritime Shrub Thickets imperceptibly grade into Maritime Forest, especially at tops of dunes where most shearing takes place, producing stunted shrubby growth. Stalter (1984) suggests that "Maritime Shrub" and "Salt Shrub" make up a single community. Eleuterius (1972) refers to a shrub zone "normally on a sharp rise from the marsh to the terrestrial habitat of trees", although this seems referable to the Salt Shrub community.

References: Boyce 1954. Eleuterius 1972. Sharitz 1975. Wharton 1977.

MARL FOREST

Type: Terrestrial

Synonyms: Calciphyte forest.

Sites: Forested areas over buried or exposed marl.

Location: Coastal plain; very rare.

Vegetation: A diverse assemblage of trees, shrubs and herbs is present, many of which are thought to be calciphilic, including *Cercis canadensis*, *Tilia americana*, *Ulmus rubra*, *Quercus shumardii*, *Juniperus virginiana*, *Cornus florida*, *C. asperifolia*, *Thelypteris kunthii*, other ferns, *Elytraria carolinense*, *Peltandra virginica* and *Echinodorus cordifolius*. Herbaceous cover is sometimes sparse on exposed outcrops.

Potential elements of concern: *Asplenium heteroresiliens*. *A. resiliens*. *Carya myristicaeformis*.

Menispermum canadense.

Dynamics: Incompletely known. Fire is probably not common.

Associations: Calcareous Cliff. Spruce Pine--Mixed Hardwood Forest.

Comments: This is apparently a very rare community in South Carolina, and the few remaining known sites are probably in danger of being developed. Bartgis & Long (1984) report on wetland marl areas in West Virginia, but these do not seem to share much in common with the South Carolina forests.

References: Bartgis & Long 1984.

MESIC MIXED HARDWOOD FOREST

Type: Terrestrial

Synonyms: Piedmont cove forest. Beech ravine.

Sites: Forested slopes and ravines.

Location: Piedmont (steep north-facing slopes and ravines associated with acidic rock) and coastal plain (mesic uplands, especially on north-facing river bluffs and ravine slopes).

Vegetation: Canopy and understory is variously composed of many hardwoods including *Fagus grandifolia*, *Liriodendron tulipifera*, *Nyssa sylvatica*, *Oxydendrum arboreum*, *Quercus alba*, *Q. rubra*, *Q. velutina*, *Liquidambar styraciflua*, *Acer rubrum*, *A. saccharum* (piedmont), *Tilia heterophylla* (piedmont), *T. floridana* (coastal plain), *Carpinus caroliniana*, *Cornus florida*, *Ilex opaca*, *Hamamelis virginiana* and *Ostrya virginiana*. Shrubby species are usually numerous, and include *Symplocos tinctoria*, *Styrax grandifolia*, *Kalmia cuneata*, *Calycanthus floridus* and *Rhododendron nudiflorum*. The herbaceous flora is fairly rich, with many spring ephemerals especially in piedmont sites. Potential members of the herbaceous layer include *Goodyera repens*, *Chrysogonum virginianum*, *Hieracium venosum*, *Uvularia perfoliata*, *Spigelia marilandica*, *Mitchella repens*, *Podophyllum peltatum*, *Sanguinaria canadensis* and *Iris cristata*.

Potential elements of concern: *Trichomanes petersii. Triphora trianthophora. Quercus durandii. Actaea pachypoda. Waldsteinia lobata. Panax quinquefolium.*

Dynamics: This is a stable community, apparently burning only very rarely. It may be difficult or impossible to recognize a single dominant in the canopy.

Associations: Oak-Hickory Forest.

Comments: The beech-dominated "cove" forests of the piedmont may owe their presence to soil type rather than exposure. If so, it makes some sense to consider their inclusion within Basic

Forest. Braun (1950) lists the following species from a Pender County (NC) site: *Fagus grandifolia*, *Carya tomentosa*, *Quercus alba*, *Acer floridanum*, *Liriodendron tulipifera*, *Liquidambar styraciflua*, *Quercus velutina*, *Carya pallida*, *Ilex opaca*, *Castanea pumila*, *Asimina parviflora*, *Hamamelis virginiana*, *Ilex glabra*, *Euonymus americana*, *Vaccineum arboreum* and *Callicarpa americana*. Oosting (1942) indicates *Fagus* as part of the "Postclimax" forest. In general, the Mesic Mixed Hardwood Forests seem vegetatively similar to a number of other forest communities. These sites often appear quite rich, at least initially, but usually do not have any rare plant species associated with them.

References: Braun 1950. Nesom & Treiber 1977. Oosting 1942.

MIDDENS

Type: Terrestrial

Synonyms: Indian middens. Kitchen middens. Shell mounds.

Sites: Natural or man-related accumulations of shell material and detritus in marshes and at tips of landmasses within estuaries.

Location: Outer coastal plain.

Vegetation: This community may support a number of shrub and herb species, especially calciphiles. Various members of the Salt Shrub and Maritime Forest communities are likely to be present. These sites frequently have *Quercus virginiana*, *Sabal palmetto*, *Aesculus pavia*, *Prunus caroliniana*, along with *Juniperus virginiana*, *Ilex vomitoria*, *Rhus radicans*, *Callicarpa americana*, *Tilia heterophylla*, *Zanthoxylum clava-herculis*, *Cynanchum palustre* and *Celtis laevigata*.

Potential elements of concern: *Sageretia minutiflora. Lycium carolinianum. Bumelia tenax. Cynanchum scoparium.*

Dynamics: Fire is probably rare. Piles of shells naturally occurring, however small they (the piles and the shells) might be, would arguably have the same flora/fauna and dynamics as the recognizable middens of Indian origin. Some middens of Indian origin are of distinctive shapes, often round or ringshaped. Middens are particularly distinctive when surrounded by Salt Marsh or Salt Shrub.

Associations: Salt Shrub. Maritime Forest.

Reference: Dorroh 1968.

MONTMORILLONITE FOREST

Type: Terrestrial

Sites: Upland slopes or flat areas over basic rock, with clay soil becoming very hard during drought.

Location: Piedmont, probably restricted to York, Chester, Union and Fairfield Counties, and possibly McCormick, Abbeville and Greenwood.

Vegetation: A thin to dense canopy occurs, including *Juniperus virginiana*, *Pinus echinata*, *P. taeda* (infrequent), together with a number of hardwoods, including *Quercus phellos*, *Q. velutina*, *Q. stellata*, *Q. nigra*, *Q. marilandica*, *Ulmus rubra*, *U. americana*, *Cercis canadensis*, *Fraxinus americana*, *Celtis laevigata*, *Acer saccharum*, *Prunus serotina*, *Carya tomentosa*, *C. ovalis* and *C. carolinae-septentrionalis*. Species of *Viburnum* and *Crataegus* may contribute to the understory, together with *Ulmus alata* and *Rhamnus caroliniana*, below which *Ceanothus americanus* may be expected. Typical herbs include *Clematis ochroleuca*, *Blephilia ciliata*, *Opuntia compressa*, *Andropogon* spp., *Danthonia spicata*, *Penstemon* spp. and *Hypericum* spp.

Potential elements of concern: *Camassia scilloides*. *Carya carolinae-septentrionalis*. *Scutellaria parvula*. *Silphium terebinthinaceum*.

Dynamics: Not known. Hydrology presumably varies widely over the year.

Associations: Oak-Hickory Forest.

Comments: This is a rare community in SC, frequently associated with Iredell and Elbert soils. Remaining examples of this community are in danger of agriculturalization. It is likely that future field efforts will uncover differences between hydrologic regimes at given sites that may be sufficient to warrant the splitting out of additional communities.

References: Batson 1952. Peet and Christensen 1980.

NON-ALLUVIAL SWAMP FOREST

Type: Palustrine

Synonyms: Non-riverine swamp forest. Swamp hardwoods.

Sites: Poorly-drained lowlands not associated with river channels.

Location: Coastal plain.

Vegetation: A diverse assemblage of canopy and subcanopy species occurs, including a number of components from more easily defined pocosin and alluvial swamp forest systems, such as *Nyssa sylvatica* var. *biflora*, *N. aquatica*, *Taxodium ascendens*, *T. distichum*, *Pinus serotina*, *P. taeda*, *Liquidambar styraciflua*, *Acer rubrum*, *Gordonia lasianthus*, *Magnolia virginiana*,

Quercus michauxii, *Q. phellos*, *Q. laurifolia*, *Liriodendron tulipifera*, *Populus heterophylla* and *Carpinus caroliniana*. Shrubs include *Lyonia lucida*, *Persea borbonia*, *Cyrilla racemiflora*, *Cephalanthus occidentalis*, *Lindera benzoin* and *Itea virginica*. Herbs include *Osmunda regalis*, *O. cinnamomea*, *Saururus cernuus*, *Tovara virginiana*, *Boehmeria cylindrica* and *Peltandra virginica*. Sphagnum moss is sometimes abundant. Viny species are often abundant, and include *Smilax* spp., *Rhus radicans*, *Vitis* spp., *Decumaria barbara* and *Bignonia capreolata*, combinations of which may form dense bowers.

Potential elements of concern: *Psilotum nudum. Carex prasina. C. projecta. Cliftonia monophylla. Nyssa ogeche. Physostegia leptophylla.* Swallow-tailed Kite. Black bear.

Dynamics: Largely unknown. These apparently share some community dynamics, both physical and biological, with pocosins and alluvial swamps.

Associations: Pocosin. Pond Pine Woodland. Bald Cypress-Tupelo Gum Swamp. Bottomland Hardwoods. Swamp Tupelo Pond.

Comments: More field work is needed on this community type; its variability, community structure and successional features are poorly understood.

OAK--HICKORY FOREST

Type: Terrestrial

Sites: Upland slopes, especially north-facing on the piedmont, dominated by a diverse assemblage of hardwoods (primarily oaks and hickories) in combination with pines.

Location: Essentially throughout the state; on lower elevations within mountains. Within the coastal plain on upland slopes between rivers and tributaries.

Vegetation: Many hardwoods are present, with oaks and hickories the codominants. Typical canopy and subcanopy species are *Quercus alba*, *Q. velutina*, *Q. rubra*, *Q. marilandica*, *Q. stellata*, *Q. coccinea*, *Q. prinus* (piedmont & mountains), *Carya tomentosa*, *C. glabra*, *C. ovata*, *Acer rubrum*, *Cornus florida*, *Liriodendron tulipifera*, *Pinus taeda*, *P. echinata*, *P. virginiana* (mountains), *P. strobus* (mountains), *Nyssa sylvatica*, *Robinia pseudo-acacia* and *Oxydendron arboreum*. A high predominance of pines and sweet-gum generally indicates past disturbance. The understory includes *Oxydendron arboreum* and *Cornus florida*. Shrubby species include *Euonymus americana*, *Calycanthus floridus*, *Viburnum* spp., *Symplocos tinctoria* and *Vaccinium* spp. The herbaceous layer varies considerably from site to site, but may include *Cypripedium acaule*, *Tipularia discolor*, *Chimaphila maculata*, *Goodyera pubescens*, *Desmodium nudiflorum*, *Rhynchosia tomentosa*, *R. reniformis*, *Stylosanthes biflora* and other species.

Potential elements of concern: *Oryzopsis canadensis. Liparis liliifolia. Magnolia pyramidata. Halesia parviflora. Forestiera ligustrina. Frasera carolinensis. Solidago bicolor.*

Dynamics: All of these sites are somewhat transitional. Fire is probably only occasional to rare. Suppression of fire leads to a greater domination by hardwoods. Shade intolerance keeps "poor site" species out of "good sites". Drought intolerance keeps "good site" species out of "poor sites".

Associations: Many upland forest types.

Comments: This is an abundantly distributed community with much variation from site to site. Very good examples are probably rare, due to forestry, but the community itself is probably not particularly endangered. Some problems exist in attempting to separate this community from some adjacent forest types. Also, the wide variation seen within this community has prompted some to further subdivide it into "dry" and "mesic" subtypes. Obviously, the amount of soil moisture present from site to site weighs heavily in this usually subjective determination. The "poorest" Oak-Hickory Forests are usually typified by blackjack and post oaks (Nehmeth 1968).

Reference: Nehmeth 1968.

OYSTER REEF

Type: Estuarine, Marine

Synonyms: Intertidal oyster reef. Mollusk reef. Oyster rock.

Sites: Living and nonliving portions of structure formed by oysters, together with sponges, marine worms, and whatever macrophytic algae may be present. Located on top of (presumably) dead reef base, all of which is formed on a more or less consolidated surface. Many of the reefs of both Carolinas are composed of Trent marl, in which the dominant fossil is *Venus gardeneri* (Williams 1951).

Location: Outer coastal plain, barrier islands.

Vegetation: Algae.

Animal life: Dominant bivalves are *Crassostrea virginica*, *Brachidontes exustus*, *Geukensia demissa*. *Melita nitida* (amphipod). *Balanus eburneus* (barnacle). *Panopeus*, *Eurypanopeus* (predatory crustaceans). *Amphitrite ornata*, *Heteromastus filiformis*, *Nereis succinea*, *Phyllodocea fragilis* (polychaetes). All of these organisms are common to reefs of NC, SC and GA.

Dynamics: Reefs may or may not be exposed at low tide. The reefs themselves are quite diverse, if unaffected by pollution, with various invertebrate assemblages. Some of these invertebrates utilize shell surface and inter-shell crevices as habitats. Reefs in SC are mostly found within Tidal Creeks and bordering Salt Marshes. Farther south (GA), most reefs are strictly subtidal and farther offshore.

Associations: Generally with distinct boundaries, although oysters can occur in small patchy groups on Intertidal Sand and Mud Flats, Seagrass Beds and edges of Salt Marsh.

Comments: Important community economically.

References: Dame 1971. Dame 1979. Lawrence 1971. Williams 1951. Zingmark 1978.

PIEDMONT SEEPAGE FOREST

Type: Palustrine

Sites: Essentially saturated flat areas with closed canopy and distinctive herbaceous flora.

Location: Upper piedmont.

Vegetation: Canopy of *Acer rubrum*, *Nyssa sylvatica* var. *biflora* and other hardwoods. Shrubs include *Viburnum cassinoides*, *Cornus stricta* and *Rhus vernix*. Herb layer includes many grasses and sedges.

Potential elements of concern: *Carex baileyi. Sagittaria fasciculata. Hexastylis naniflora. Cornus racemosa. Helenium brevifolium.*

Dynamics: This community is characterized by a nearly constant seepage of cool ground water. The ground thus tends to be saturated year-round, and so separates this community from temporarily wet spring seeps, which are found essentially throughout the state.

Associations: Forested communities.

Comments: Much more information is needed concerning this rare community.

PINE FLATWOODS

Type: Terrestrial

Synonym: Upland Pine-Wiregrass Woodland, in part.

Sites: Essentially flat or rolling terrain with canopy of pines and well-developed subcanopy of several tall shrub species. The soil is generally sandy and with a high water table.

Location: Coastal Plain.

Vegetation: *Pinus palustris* (most frequently encountered pine), *P. taeda* and *P. elliottii* are all possible. Understory and shrub layers include *Liquidambar styraciflua*, *Quercus marilandica*, *Magnolia virginiana*, *Gordonia lasianthus*, *Ilex glabra*, *I. coriacea*, *Myrica cerifera*, *M. inodora*, *Lyonia* spp., *Gaylussacia dumosa*, *Kalmia hirsuta*, *Vaccinium tenellum*, *Cyrilla racemiflora*,

Viburnum nudum and *Quercus pumila*. Herbaceous layer is dominated by grasses, notably *Andropogon*, *Aristida*, with *Rhexia* spp., *Pycnanthemum flexuousum*, *Chaptalia tomentosa*, *Aster paludosus*, *A. squarrosus*, *A. tortifolius*, *Ctenium aromaticum*, *Helianthus angustifolius*, *H. radula* and *Pteridium aquilinum*, *Pterocaulon pycnostachyum*, *Tephrosia virginica* and *T. spicata*.

Potential elements of concern: *Anthaenantia rufa* (most likely to be found in ecotones between flatwoods and adjacent savannahs). *Eriocaulon ravenelii*. *Polygala nana*. *Pycnanthemum nudum*. *Schwalbea americana*. *Dyschoriste humistrata*. Red-cockaded woodpecker.

Dynamics: Fire frequent, but probably not as frequent as in savannah. Flatwoods are successional from "cropland abandonment" in upper coastal plain (Christensen 1979). If left unburned, would probably succeed to deciduous hardwood-dominated forests.

Associations: Commonly grades into Pine Savannah. "The distinction between flatwoods and savannas is, to a certain extent, artificial" (Christensen 1979).

References: Braun 1950. Christensen 1979. Heyward 1939.

PINE-OAK HEATH

Type: Terrestrial

Synonyms: A number of phases of subtypes are recognized in the old SC system. Pine leads (Cooper 1963).

Sites: Forests on higher ridgetops with open canopy of stunted pines and oaks.

Location: Upper piedmont and mountains.

Vegetation: Mostly pines and oaks, including *Pinus virginiana*, *P. pungens*, *P. rigida*, *P. echinata* (lower elevations). *Quercus prinus*, *Q. coccinea* and *Q. velutina* as possible canopy members. *Castanea dentata* occurs as stumpsprouts. *Kalmia latifolia*, *Rhododendron minus*, *Gaylussacia dumosa*, *G. ursina*, *G. baccata*, *Vaccinium arboreum*, *V. stamineum* and *V. atrococcum* contribute to the subcanopy and shrub layers. Herbaceous flora is sparse.

Potential elements of concern: *Xerophyllum asphodeloides*. *Gaultheria procumbens*. *Fothergilla major*.

Dynamics: This community may succeed to more closed hardwood systems. Southwest or south-southwest exposures are usually necessary for the best development of pines.

Associations: Chestnut Oak Forest. Hemlock Forest. Granitic Dome.

Comments: *Pinus pungens* is found at the highest elevations, with *P. rigida* and *P. virginiana*

below (and in that order). Slightly less xeric slopes, below the ridgetops, are often dominated by dense stands of *Kalmia latifolia* and *Rhododendron minus*. This represents an essentially treeless variant of Pine-Oak Heath which is closely associated with Rhododendron Thicket and Chestnut Oak Forest, and may warrant separation as a distinctive community.

References: Cooper 1963. Racine 1966.

PINE SAVANNAH

Type: Palustrine

Synonyms: Open savannah (in part), wet prairie, grass-sedge bog, herb bog, pitcher-plant bog.

Sites: Flat areas with thin canopy of pines, thin or no understory, and rich herbaceous flora.

Location: Outer coastal plain, rare on inner coastal plain.

Vegetation: Canopy of pines, almost always *Pinus palustris*, but *P. taeda* and *P. serotina* are possible. The understory is essentially absent or very scattered. Herbaceous flora consists of many grasses and sedges (especially *Aristida* spp., *Ctenium aromaticum*, *Anthaenantia rufa*, *Scleria* spp., *Rhynchospora* spp.), insectivorous plants (*Sarracenia flava*, *S. minor*, *Drosera* spp., *Pinguicula caerulea*, *Utricularia* spp.) and orchids (*Cleistes divaricata*, *Calopogon* spp., *Platanthera* spp., *Spiranthes* spp.).

Potential elements of concern: *Sporobolus teretifolius. Calamovilfa brevipilis. Habenaria quinqueseta. Spiranthes longilabris. Platanthera integra. P. lacera. Xyris brevifolia. Syngonanthus flavidulus. Parnassia caroliniana. Asclepias pedicellata.* Flatwoods salamander.

Dynamics: Fire-maintained. Without fire, succeeds to closed canopy systems, starting with pine flatwoods. The ground is saturated for at least part of the year.

Associations: Pine Flatwoods. Bay Forest. Pocosin. Includes "Open Savannah". These open places are floristically the richest spots of the pine savannahs (at least as far as the herbaceous species go); however, their dynamics are essentially the same as those of the canopied regions. Arguments for the separation of open vs. closed savannahs include: Open savannah consistently without canopy, with wettest ground, and with richest herb coverage. Argument against the separation involves the small patchy nature of the open savannah, plus its presence next to the canopied savannah. "Oak Savannah" has been separated in the past as a distinctive community. Again, these are generally patchy, small areas within the Pine Savannahs that appear to have slightly different dynamics, and a correspondingly different canopy (of post oaks). Until more information comes in on these sites, Oak Savannah will be retained as a part of the larger Pine Savannah.

Comments: Blue Ash-Oak Savannah of Kentucky (Bryant et al. 1980) is not the same as the "oak savannah" entity in SC. Our oak savannahs appear on ridges within wetter pine savannahs,

and are dominated by oaks (especially *Q. marilandica, Q. stellata*) and hickories.

References: Braun 1950. Bryant et al. 1980. Christensen 1979. Dyksterhuis 1957. Gaddy 1982. Wells 1942. Wells & Shunk 1928. Wharton 1977.

PINE-SAW PALMETTO FLATWOODS

Type: Terrestrial

Synonym: Saw-palmetto flatwoods.

Sites: Pine flatwoods dominated by *Pinus palustris, P. elliottii* or occasionally *P. serotina*. Low shrub layer dominated by *Serenoa repens*.

Location: Outer coastal plain (Jasper, Beaufort Counties).

Vegetation: A thin to dense canopy of *Pinus palustris, P. elliottii*, and/or *P. serotina* occurs. Subcanopy is usually sparse, but *Ilex coriacea, I. glabra* are present, with perhaps some other flatwoods shrub species. *Serenoa repens* is probably best thought of as a tall ground cover. The herbaceous flora is usually sparse, but with *Smilax pumila, Trilisa paniculata, T. odoratissima*, etc.

Potential elements of concern: *Lyonia ferruginea. L. fruticosa.*

Dynamics: Fire is definitely a factor in the maintenance of this community. Suppression of fire leads to invasion of shrubs, as in the more typical Pine Flatwoods. Probably occasionally flooded, or at least saturated.

Associations: Pine Flatwoods. Pine Savannah. Maritime Forest.

Comments: This community much more common along Atlantic Coast in both Georgia and Florida, where it is more frequent and more variable.

References: Allen 1956. Braun 1950. Waggoner 1973.

PINE-SCRUB OAK SANDHILL

Type: Terrestrial

Synonyms: Xerophytic deciduous forest (Pessin 1933). Clay ridge forest (Wharton 1977). Blackjack oak-milkpea association (Bozeman 1971). Scrub oak barren (Duke 1961).

Sites: Flat or hilly terrain on lower or middle slopes of sandhills, or on sandhills with relatively high amounts of organic matter, or on higher spots with more moisture.

Location: Fall-line, and scattered throughout coastal plain.

Vegetation: A canopy of *Pinus palustris* occurs, with an increasing percentage of scrub oaks, especially *Quercus marilandica*, *Q. incana*, *Q. stellata* and *Q. margaretta*. *Quercus laevis* is of less importance here than in Xeric Sandhill Scrub. Shrubs present include *Vaccinium stamineum* and other species, as well as *Gaylussacia dumosa*. Grasses are present as ground cover; *Andropogon* and *Aristida* usually dominate. Other herbs include *Tephrosia virginiana*, *Liatris* spp., *Epigaea repens* and *Pteridium aquilinum*.

Potential elements of concern: *Nolina georgiana*. *Pyxidanthera barbulata*. *Rhus michauxii*. *Ruellia carolinensis*. *R. ciliosa*. *Chrysopsis pinifolia*. Red-cockaded woodpecker.

Dynamics: Fire is probably not as frequent as in Xeric Sandhill Scrub. *Quercus marilandica* is usually thought to be a less xeric species than *Q. laevis*. Evidence suggests that the distribution of *Q. marilandica* is not so dependent on water as it is on a sufficiently organic component of the otherwise sterile sandy soil.

Associations: Upward to (usually) Xeric Sandhill Scrub. Swale Pocosin, Seepage Pocosin, Streamhead Pocosin.

References: Bozeman 1971. Braun 1950. Christensen 1979. Duke 1961. Pessin 1933. Wharton 1977.

POCOSIN

Type: Palustrine

Synonyms: Low pocosin. High pocosin. Evergreen shrub thicket.

Sites: Flat or depressed sites, intermittently flooded or saturated, and dominated by a number of evergreen shrub species.

Location: Sandhills and coastal plain.

Vegetation: The canopy may vary greatly in composition and height, and almost always includes some of these species: *Pinus serotina*, *P. palustris*, *P. taeda* (the last two as minor components), *Acer rubrum*, *Magnolia virginiana*, *Liquidambar styraciflua* and *Gordonia lasianthus*. A real "canopy" of tall trees may be absent, however; some of the above listed species may be present as tall, much-branched shrubs. A well-developed shrub layer of various ericaceous species, such as *Lyonia lucida*, *Leucothoe racemosa*, *Zenobia pulverulenta*, *Cassandra calyculata*, *Vaccinium corymbosum*, *V. atrococcum*, *Rhododendron viscosum*, as well as *Cyrilla racemiflora*, *Clethra alnifolia*, *Myrica cerifera*, *Ilex glabra*, *I. coriacea*, *Persea borbonia*, *Rhus vernix* and *Sorbus arbutifolia* occurs. Viny species: *Rhus radicans*, *Vitis* spp., *Smilax* spp., especially *S. laurifolia*. Herbaceous flora is usually sparse. At some sites, however,

variously-sized wet depressions or pools may harbor more herbaceous diversity. A number of *Sphagnum* species may be found in Pocosins.

Potential elements of concern: *Syngonanthus flavidulus. Peltandra sagittaefolia. Tofieldia tenuifolia. Narthecium americanum. Lindera subcoriacea. Kalmia cuneata. Lysimachia asperulifolia. Asclepias pedicellata. Ruellia pinetorum.* (All of these species may be thought of as preferring ecotones between pocosins and adjacent communities; they are most likely to be found at pocosin margins.) Black bear.

Dynamics: This is a fire-maintained community. The absence of fire leads to increase in number and diversity of tree species. "Low Pocosin" is found on substrate with very deep peat, while "High Pocosin" is found on shallower peats. Increased depth of peat inhibits root growth and results in short, shrubby vegetation, essentially without an arboreal canopy. Practically all species within this community will sucker-sprout vigorously following fire or other natural disturbance.

Associations: Pine Flatwoods. Upland Pine-Wiregrass Woodland. Bay Forest. Atlantic White Cedar Swamp. Sometimes merges gradually with sandhill communities.

Comments: The vegetation list above includes species that may be found practically anywhere on the coastal plain, and in some widely varying situations.

POND CYPRESS POND

Type: Palustrine

Synonym: Cypress dome (Wharton 1977).

Sites: Elliptical, circular or irregularly-shaped lowland with canopy dominated by *Taxodium ascendens*; generally with some water on the surface throughout the year.

Location: Sandhills and coastal plain.

Vegetation: *Taxodium ascendens*, *Nyssa sylvatica* var. *biflora* are the overwhelming canopy dominants. The latter may be practically absent, however. Shrubs include *Ilex cassine* var. *myrtifolia*, *Cephalanthus occidentalis*, and *Cyrilla racemiflora*. Herbs are very often limited to species that can root on floating logs or stumps, such as *Boehmeria cylindrica*, *Hypericum* spp., *Eupatorium* spp.

Potential elements of concern: *Litsea aestivalis. Sabatia bartramii.*

Dynamics: Fire is probably not an important factor except in periods of severe drought; its absence may eventually lead to domination by swamp tupelo. Floating logs and stumps provide sites for a number of species usually found in drier areas. Various sites are known locally as "domes". Those associated with Carolina Bays are usually without an easily recognizable dome-

like appearance.

Associations: Pocosin. Cypress Savannah. Pine Savannah. Swamp Tupelo Pond.

Comments: This community is important as breeding habitat for many birds, including egrets, ibises, herons and perching birds, as well as for a number of amphibians. Owls are commonly seen in Pond Cypress Ponds. These sites are sometimes utilized by waterfowl as stop-over points during migration.

References: Wharton 1977. Ewel & Mitsch 1978. Mitsch & Ewel 1979.

POND CYPRESS SAVANNAH

Type: Palustrine

Sites: Flat, poorly drained land with canopy of *Taxodium ascendens*. General aspect is as in pine savannah, but seasonally much wetter.

Location: Coastal plain.

Vegetation: *Taxodium ascendens* forms a canopy which is usually rather open. *Nyssa sylvativa* var. *biflora* and *Acer rubrum* may also be present. Few shrub species occur other than *Ilex cassine* var. *myrtifolia*, some woody Hypericums, *Cephalanthus occidentalis* and *Diospyros virginiana*. Herbaceous flora is often quite rich, with many showy species (*Rhexia* spp., *Ludwigia* spp., *Iris* spp. *Bartonia paniculata, Burmannia biflora, Boltonia caroliniana*, etc.) blooming throughout spring, summer and fall.

Elements of concern: *Rhynchospora tracyi. Scleria baldwinii. Spiranthes longilabris. S. laciniata. Croton elliottii. Oxypolis canbyi. Hypericum nitidum. Rhexia aristosa. Lobelia boykinii.*

Dynamics: Some of these sites may have a rather stunted canopy of cypress, resembling the more extensive dwarf cypress habitats of north Florida. Cypresses apparently tolerate a longer hydroperiod than do pines. Ditching and draining efforts, along with absence of fire, has greatly reduced the number of Cypress Savannahs in South Carolina, as well as Pine Savannahs.

Associations: Bay Forests. Pocosins. Pine Savannah. Depression Meadow.

Comments: Rarities in these communities are not the same as those known from Pine Savannahs. Many of the best remaining examples of this community are within Carolina bays.

References: Christensen 1979. Gaddy 1982. Mitsch & Ewel 1979.

POND PINE WOODLAND

Type: Palustrine

Synonym: Pond pine forest.

Sites: Forested peatlands dominated by *Pinus serotina*, with associated pocosin species.

Location: Coastal plain.

Vegetation: A variable canopy is formed by *Pinus serotina*, *Gordonia lasianthus*, *Chamaecyparis thyoides*, *Acer rubrum* and *Magnolia virginiana*. Shrubs species present are the same ones found in Pocosins, but they are usually much taller.

Potential elements of concern: *Peltandra sagittaefolia* (within interior pools). *Kalmia cuneata* (most likely at margins, in ecotonal areas). Black bear.

Dynamics: This is a fire-maintained community, closely related to Pocosin. Dynamics for sites in South Carolina are not completely known; more field work is necessary. Presumably, peat soil is deeper than for pocosin. Severe fires probably result in the formation of semi-permanent pools on the surface. As in the Pocosins, most of these species re-sprout very vigorously following fires. Sites are usually difficult to walk through, which may be one reason that more is not known about them.

Associations: Pocosin. White Cedar Swamp. Bay Forest. Seepage Pocosin.

RHODODENDRON THICKET

Type: Terrestrial

Synonym: Streamside thicket.

Sites: Usually thick, shady, shrub-dominated areas at edges of streams.

Location: Mountains and upper piedmont.

Vegetation: Dominated by *Rhododendron maximum*. Associated shrub species are *Leucothoe axillaris*, *Kalmia latifolia*, *Xanthorrhiza simplicissima*, *Pyrularia pubera*. Herbaceous flora is sparse to non-existent.

Potential elements of concern: *Trillium persistens* (in ecotonal areas with substantial sunlight).

Dynamics: Occasionally to frequently flooded during rainy seasons. Piles of leaf litter and detritus often collect. Dynamics depend to a degree on the size, etc. of the associated stream.

Associations: Shoal & Stream Bar. Chestnut Oak Forest. Hemlock Forest. Cove Forest. Spray cliff.

SALT FLAT

Type: Estuarine

Synonyms: Salt Pan (Eleuterius 1972). Panne (Godfrey & Godfrey 1974). Saltgrass-Glasswort Zone (Duncan 1974).

Sites: Distinct zones of succulent halophytes, salt-loving grasses and other herbs, plus any other adjacent barren ground. Soil is hyper-saline due to evaporation, composed of mud and/or sand.

Location: Outer coastal plain, barrier islands.

Vegetation: This community contains a number of specialized species, including *Distichlis spicata*, *Suaeda linearis*, *Salicornia virginica*, *Limonium carolinianum*, *Chenopodium berlandieri*, *Atriplex patula*, *Aster tenuifolius*, *Spartina* spp. and *Sporobolus virginiana*.

Dynamics: Fire is probably never a factor in community development. Usually one tide per day floods the site.

Associations: Grades into Salt Marsh, Salt Shrub, Maritime Grassland. Barrens may be dissected by intermittent tidal streams.

Comments: These communities are generally associated with drainage systems in salt marshes behind dunes, or on the landward sides of barrier islands.

References: Duncan 1974. Eleuterius 1972. Godfrey & Godfrey 1974. Uphof 1941. Zingmark 1978.

SALT MARSH

Type: Estuarine

Synonyms: Smooth cordgrass marsh. Saltgrass marsh (Wharton 1977).

Sites: Regularly flooded flat areas dominated by salt-tolerant grasses.

Location: Outer coastal plain, barrier islands.

Vegetation: This community is reasonably species-poor. It is often nearly totally dominated by *Spartina* spp., especially *S. alterniflora* (smooth cordgrass). This species is sometimes recognized as tall, medium and short, depending on where it is growing. *Spartina patens* and

Distichlis spicata are common associates.

Dynamics: Salt marshes are regularly flooded. Adams (1963) suggests that tidal elevation influences are the principle factors in controlling distribution of salt-marsh plants. "High marsh" has been used to describe areas regularly flooded at places adjacent to tidal creeks. "Low marsh" is conceived of as drier, and on slightly elevated ground, usually flooded only during the highest spring tides or during storms. Apparently, the spots at the edge of the tidal creek are less saline than those areas slightly farther away. Height of the *Spartina* is at a maximum next to the creeks; plant density decreases farther away from them.

Associations: Grades into Brackish Marsh, Mud Flat, Sand Flat, Salt Shrub, Salt Flat.

Comments: This is probably the most widely-known estuarine community, and has been the subject of a great deal of research involving community productivity.

References: Adams 1963. Cooper & Waites 1973. Duncan 1974. Eleuterius 1972. Godfrey & Godfrey 1974. Johnson et al. 1974a Jackson 1952. Penfound 1952. Wells 1928. Zingmark 1978.

SALT SHRUB THICKET

Type: Estuarine

Sites: Narrow areas between maritime forests and marsh systems, dominated by various shrubs and grasses.

Location: Outer coastal plain, barrier islands.

Vegetation: Shrubby species include *Baccharis angustifolia*, *B. glomeruliflora*, *B. halimifolia*, *Iva frutescens*, *Borrichia frutescens*, *Myrica cerifera*, *Sabal palmetto* and *Juniperus virginiana*. *Cynanchum palustre*, *Juncus roemerianus*, *Andropogon* spp., *Spartina patens* and *Solidago sempervirens* are possible herbs.

Dynamics: Fires are probably occasional to frequent. This community is probably rarely affected by flooding.

Associations: Grades upland into Maritime Forest. Grades into marshes and Salt Flat. Middens.

Comments: *Iva frutescens* and *Borrichia frutescens* may be the most indicative species. More field knowledge is needed. ?

References: Duncan 1974. Eleuterius 1972.

SEAGRASS BED

Type: Marine, Estuarine

Synonyms: Temperate grass flat. Seagrass bed (Phillips 1974). Tropical marine meadow (Odum 1974). Eelgrass bed (Akins & Jeffcoat 1973). Turtlegrass bed (Eleuterius 1973).

Sites: Shallow offshore regions with unconsolidated substrate (mud, sand, silt or combinations).

Location: Outer coastal plain, barrier islands; offshore sites.

Vegetation: Algae and vascular plants, unless currents preclude attachment. Algae attach by means of holdfasts for penetration of substrate with rhizoids; vascular plants have root systems. Vascular species largely made up of these species (the presence of some of these in SC has not been documented, but may be in the future): *Ruppia maritima* (widgeon-grass), *Cymodocea filiformis* (manatee-grass), *Halodule beaudettei* (shoalgrass); *Zostera marina* (eelgrass). Algal genera include *Sargassum*, *Codium*, *Batophora*, *Champia*, *Gracilaria*, *Grateloupia*, *Chondrus* and *Ulva*.

Potential elements of concern: *Cymodocea*, *Halodule*, *Zostera*--if present at all in SC.

Dynamics: Wave action, currents, temperature, salinity, substrate characteristics and light penetration determine the composition of flora and fauna. Possibly exposed at some points, but probably very rarely. As in Florida, probably the only vegetated natural community which is never affected directly by fire. Violent storms may disrupt or rearrange community makeup.

Associations: Seaward, grades into Unconsolidated Coastal Bottom or Deepwater Coastal Bottom. Landward, may grade into a number of estuarine communities.

Comments: Much more field work needed, especially in Jasper, Beaufort and Charleston Counties. Sites are potentially rich in vertebrate and invertebrate assemblages, including annelids, sponges, crustaceans, mollusks, echinoderms and fish.

References: Akins & Jeffcoat 1973. Eleuterius 1973. Harlin et al. 1982. Odum 1974. Phillips 1974. Zingmark 1978.

SEEPAGE POCOSIN

Type: Palustrine

Synonym: Hillside Bog.

Sites: Seasonally or permanently saturated slopes on sandhills with hard clay lens below peaty/sandy soil. Water percolating downhill is forced to the surface where hardpan rises relative to the soil surface.

Location: Fall-line sandhills.

Vegetation: In general, the same species occur in Seepage Pocosins as in Streamhead Pocosins, but with much less diversity. Canopy species include *Pinus palustris*, and perhaps *P. serotina* and *Oxydendrum arboreum. Cyrilla racemiflora*, *Kalmia latifolia* and *Ilex opaca* are well-represented; *Leiophyllum buxifolium* can probably be considered a reasonable indicator of this community in the sandhills.

Potential elements of concern: *Vaccinium sempervirens*. Pine-barrens tree frog.

Dynamics: An abrupt transition may occur from xeric sandhill situations to this community, which may or may not be dominated by *Leiophyllum buxifolium.* Aspects of fire influence are incompletely known. These slopes probably burn less frequently than the drier woodlands surrounding them. Total fire suppression probably effects some sort of hardwood-dominated mesic forest.

Associations: Xeric communities uphill and laterally. Bay Forest. White Cedar Swamp. Streamhead Pocosin.

Comments: These pocosins are sometimes quite dry, and may have outcrops of sandstone present.

References: Hartshorn 1972. Wells 1928. Wells & Shunk 1931.

SHOAL & STREAM BAR

Type: Palustrine

Synonyms: Sand Bar. Point Bar.

Sites: Regularly or seasonally flooded rocky/sandy/alluvial places in streams. Much variation in size and persistence.

Location: Throughout state.

Vegetation: Many shrubs and trees characteristic of floodplains or otherwise wet places. *Alnus serrulata*, *Platanus occidentalis*, *Betula nigra*, *Viburnum dentatum*, *Sambucus canadensis*, *Salix* spp., *Cornus foemina*, *Acer negundo*, *Populus* spp., *Justicia americana*, *Alternanthera philoxeroides*, *Potamogeton* spp., *Podostemum ceratophyllum.*

Potential elements of concern: *Fimbristylis perpusilla. F. vahlii. Hemicarpha micrantha. Hymenocallis coronaria* (piedmont rocky shoals). *Echinodorus parvulus. Cardamine clematitis. Sabatia kennedyana. Coreopsis rosea.*

Dynamics: Temporariness varies within these sites. Trees and shrubs are usually not able to reach large size before sites are destroyed or altered by flooding. Canopy species may be

knocked off rocks or swept off sand, etc. The best shoal development is within the piedmont and fall line, where boulders form part of the substrate. In general, the larger particles are deposited first, that is, at the upstream end of each site.

Associations: Bottomland Hardwoods. Levee.

Comments: More field work is needed for this community. These sites are interesting from the standpoint of successional phenomena occurring on them. Threats to these communities may be natural (normal flooding) or human-effected (stream manipulation, damming, etc.). Coastal plain rivers will have shoals and bars mostly composed of sand (and mud); the dynamics of these sites are somewhat different from those in the upcountry. The inclusion of piedmont and coastal plain sites together may prove to be too broad for easy conceptualization. Subtypes of this community, as based on location in the state, may be desirable.

References: Barnes 1985. McBride & Strahan 1984.

SMALL STREAM FOREST

Type: Palustrine

Sites: Seasonally or intermittently flooded lowlands bordering small streams.

Location: Throughout state.

Vegetation: Essentially the same as Bottomland Hardwoods and/or Bald Cypress Swamp, but in dissected, mosaic situations. Very heterogeneous.

Potential elements of concern: *Lygodium palmatum. Thalictrum subrotundum. Forestiera ligustrina.*

Dynamics: Flooding regime is different than that of main channels. Duration of standing water not as great, although the floods themselves may be very heavy.

Associations: Upstream to Streamhead Pocosin. Downstream to more discrete floodplain communities.

Comments: There are several unresolved problems with this community. One question concerns its size relationships. It may be that some alluvial or non-alluvial rivers of sufficient size could be considered as having the same vegetation in a system that has smaller streams. Also, alluvial rivers probably have different dynamics due to the presence of well-developed levees.

SOUTHERN MIXED HARDWOOD FOREST

Type: Terrestrial

Synonym: Xeric Hammock (Florida Natural Areas Inventory).

Sites: Forested lowlands protected from fire, with fairly deep well-drained loamy sands. These sites apparently occur on relictual sand ridges.

Location: One site is known to date, near the Savannah River within Jasper County.

Vegetation: A well-developed canopy of many hardwoods exists, made up of *Quercus hemisphaerica*, *Q. virginiana*, *Carya* spp., *Ilex opaca* and *Liquidambar styraciflua*. Spruce pine and loblolly pine are also characteristic. One of the most striking aspects of this community is the great diversity of subcanopy and understory species. These include *Ostrya virginiana*, *Osmanthus americana*, *Cornus florida*, *Nyssa biflora*, *Platanus occidentalis*, *Prunus caroliniana*, *P. serotina* and *Carpinus caroliniana*. Shrubs include *Vaccinium arboreum*, *V. elliottii*, *Serenoa repens*, *Halesia diptera*, *Cornus asperifolia*, *Callicarpa americana*, *Sebastiana ligustrina*, *Asimina* spp., *Bumelia tenax*, *Sabal minor*, *Ilex decidua*, *I. ambigua* and *I. vomitoria*.

Potential elements of concern: *Cyperus tetragonus*. *Halesia diptera*. *Rhapidophyllum hystrix*.

Associations: Maritime Forest.

Comments: The occurrence of this community in SC may represent its northern geographical limit. Dynamics are incompletely known, especially concerning the relationship of these sites to those in north Florida.

References: Aulbach-Smith 1984. Monk 1965. Monk 1968.

SPRAY CLIFF

Type: Palustrine

Sites: Vertical or sloping spray and splash zones at the edges and bases of waterfalls. Separated from High Elevation Seepages by constant water flow.

Location: Mountains and upper piedmont.

Vegetation: Usually limited to shrubs, herbs and bryophytes able to withstand the effects of rapidly flowing water, including occasional flooding and high wind. In general, vascular plants are unable to colonize areas within the stream itself, and are essentially restricted to the walls of the waterfall. Soil buildup is confined to holes and crevices, further limiting colonization by plants of large size. Extremely rich bryophyte and fern floras are possible. Larson and Batson (1978) suggest *Selaginella apoda*, *Asplenium trichomanes*, *Thalictrum clavatum*, and less frequently *Parnassia grandifolia*, as "hydric species" occupying these sites.

Potential elements of concern: *Hygrohypnum alpestre. Trichomanes petersii. T. boschianum. Sphaeroconium* sp. *Hymenophyllum tunbridgense. Saxifraga micranthidifolia.*

Dynamics: Spray cliffs are largely affected by the size and rate of the associated stream's flow. The combination of very high humidity and high wind is unusual for natural communities; in this case, however, these factors impart a tropical influence to the bryophyte assemblages. High Elevation Seeps, which are found in the same geographical region, and may, in fact, be associated with Spray Cliffs, have a flora reflecting the differences in water flow rate and humidity.

Associations: Adjacent terrestrial forest types. Rhododendron Thicket. Shoal and Stream Bar. High Elevation Seep.

Comments: Rock type probably has some effect on floristics. Without high velocity water, these communities would probably be considered as some variant of High Elevation Seepage or Acidic Cliff.

References: Larson & Batson 1978. Pittillo 1975.

SPRUCE PINE--MIXED HARDWOOD FOREST

Type: Terrestrial

Synonym: Bluff & Slope Forest (Wharton 1977).

Sites: Thickly canopied forest on dry to mesic, mostly poorly-drained deep sandy soils, generally low in organic content.

Location: Outer coastal plain.

Vegetation: The canopy is composed of various combinations of *Pinus glabra, Magnolia grandiflora, Liquidambar styraciflua, Carya* spp., *Quercus nigra, Q. laurifolia, Q. virginiana* and *Ilex opaca.* Subcanopy and shrubby species include *Carpinus caroliniana, Ostrya virginiana, Ilex vomitoria, Sebastiana ligustrina, Callicarpa americana, Persea palustris, Sabal minor, Cornus asperifolia* and *Myrica cerifera. Oplismenus setarius, Scleria triglomerata, Elephantopus* spp., *Cyperus* spp., *Rhynchospora* spp., and other species may contribute to the herbaceous layer.

Potential elements of concern: *Trillium pusillum.*

Dynamics: *Pinus glabra* is the only shade-tolerant pine on the coastal plain. Fire is probably only occasional to very rare; spruce pine is not fire-adapted.

Associations: Oak-Hickory Forest. Mesic Mixed Hardwood Forest. Beech-Magnolia Hammock. Southern Mixed Hardwood Forest.

References: Dial et al. 1976. Wharton 1977.

STREAMHEAD POCOSIN

Type: Palustrine

Synonym: Steephead.

Sites: Generally thickly vegetated sites at headwaters and along margins of sandhill streams.

Location: Fall line sandhills, riverine sandhills of coastal plain.

Vegetation: Pocosin species, with additional canopy species usually present. Diverse species assemblages usually occur, possibly including any or all of the following: *Liriodendron tulipifera*, *Liquidambar styraciflua*, *Acer rubrum*, *Pinus serotina*, *Nyssa biflora*, *Persea borbonia*, *Rhus vernix*, *Lyonia lucida*, *Sorbus arbutifolia*, *Clethra alnifolia*, *Kalmia latifolia*, *Magnolia virginiana*, *Viburnum* spp., *Ilex glabra*, *I. coriacea*, *Symplocos tinctoria*, *Sambucus canadensis*, *Arundinaria gigantea*, *Vitis* spp., *Smilax laurifolia*, *Sarracenia rubra*, *S. flava*, *Osmunda* spp., *Sphagnum* spp., *Polytrichum* spp. and others.

Potential elements of concern: *Rhynchospora alba. Lysimachia asperulifolia.*

Dynamics: Fire is an important factor in surrounding and adjacent sandhills, but is probably occasional to rare in Streamhead Pocosin. Presumably, fires that do occur limit the dominance of canopy species in these sites.

Associations: Seepage Pocosin. Atlantic White Cedar Swamp. Bay Forest. Uphill and laterally to various sandhill communities.

Comments: In Florida, this community includes "steepheads" which are readily recognizable, present in the western Panhandle. Extensive bluff systems may be present at these sites. The very uppermost part of the streams associated with these systems is constantly eroding into the bluff behind it. Such a situation, which is largely an effect of topography, is probably rarely (if ever) achieved in the SC sandhills. The more common situation in SC is that of gradual change from xeric hilltops to the mesic slopes adjacent to the stream. Some questions may exist concerning the separation of this community from Hillside Seepage Bogs, which occur in the same regions, but may have distinctive dynamics governing them. Our examples of Streamhead Pocosin tend to be patchy and discontinuous, and little specific information occurs for them. Thus, it is reasonably difficult to characterize them all at once. Additional field work is necessary for better understanding of community dynamics. It is likely that various elements of concern present in the associated communities would also be found in Streamhead Pocosin, although perhaps mostly in ecotonal situations. Included in this concept of Streamhead Pocosins are the narrow to broad bands of vegetation bordering sandhill streams, but not directly associated with the xeric areas on top of the ridges.

References: Wells 1928.

SWALE POCOSIN

Type: Palustrine

Sites: Small irregularly-shaped depressions between or paralleling sandhill ridges, with poor drainage, that accumulate and hold water indefinitely. Usually no distinct inlet or outlet.

Location: Fall-line sandhills, and possibly elsewhere on the coastal plain.

Vegetation: A variable and tangled association of shrubs and vines occurs, plus canopy species of more mesic areas. Otherwise, the vegetation is essentially similar to Pocosin. Typical species are *Pinus serotina*, *Liquidambar styraciflua*, *Acer rubrum*, *Nyssa biflora*, *Aronia arbutifolia*, *Alnus serrulata*, *Cyrilla racemiflora*, *Erianthus* spp., *Arundinaria gigantea*, *Sphagnum* spp. and *Smilax laurifolia*. Herbaceous flora is probably always sparse.

Potential elements of concern: *Polygala nana*.

Dynamics: Fire is probably infrequent, unless drought is extensive. Dynamics are probably much like those of adjacent sandhills.

Associations: Xeric Sandhill Scrub. Pine-Scrub Oak Sandhill. Upland Pine-Wiregrass Woodland.

Comments: This community may arguably be too small to consider as separate from some sandhill community types; it remains distinctive, however, if only as microsites within the more xeric sandhills. Some open boggy places in the sandhills may be more or less permanently wet, and without a real canopy. These are more likely to be dominated by grasses and sedges.

SWAMP TUPELO POND

Type: Palustrine

Synonym: Gum Pond (Wharton 1977).

Sites: Rounded or irregularly-shaped depressions on poorly draining lowlands.

Location: Coastal plain, especially within some Carolina bays and on floodplains.

Vegetation: The canopy consists mostly of hardwoods, especially *Nyssa sylvatica* var. *biflora* and *Acer rubrum*. Shrubs include *Ilex cassine* var. *myrtifolia*, *Leucothoe racemosa* and *Lyonia lucida*. Pond cypress may be present in varying proportions, but is not nearly as abundant as the

Nyssa. Aquatic flora may be well-developed, depending on extent of canopy.

Potential elements of concern: *Rhynchospora inundata. R. tracyi. Heteranthera reniformis. Oxypolis canbyi. Rhexia aristosa. Ilex amelanchier.*

Dynamics: Water table probably does not fluctuate as much as in Pond Cypress Pond. Swamp Tupelo Ponds burn less frequently than Pond Cypress Pond (Wharton 1977), from which they may develop if fire is completely suppressed. Ponds with relatively high water level have less shrubbery within.

Associations: Burning at times of low water reduces amount of peat present, presumably favoring formation of Pond Cypress Pond, or at least allows invasion of more cypress. Increasing peat level tends to allow build-up of shrubs and other hardwoods, and so may result in succession to less hydric communities.

Comments: Floating logs and stumps provide spots for additional herbaceous species. Pond cypress, when present, will increase in dominance due to fires; swamp tupelo is readily removed by burning.

References: Wharton 1977.

TALUS SLOPE

Type: Terrestrial

Synonym: Boulder Field.

Sites: Piles of rock at bases of steep slopes.

Location: Mountains.

Vegetation: Very heterogeneous, and perhaps indistinctive. North Carolina system lists *Betula lutea* as an important tree species on these sites.

Potential elements of concern: *Aconitum uncinatum.*

Dynamics: Not completely known. Bare talus slopes (unvegetated) are unknown currently in SC, although present in Virginia and possibly North Carolina. Shifting, unstable talus slopes are probably always undergoing succession. Presumably, the areas adjacent to an old stabilized talus slope will be forested over, so that rock is not visible above the ground. In that case, there is arguably no longer a Talus Slope present.

Associations: Dry to mesic forest situations of the uplands.

Comments: Possibly not present in SC at all; much more field work needed. The chemistry of

the rocks themselves obviously has a great deal to do with whatever flora develops over them.

References: Hupp 1983. Oosting 1942. Pittillo & Smathers 1979.

TIDAL BALD CYPRESS-TUPELO GUM SWAMP

Type: Estuarine

Synonym: Tidewater River Swamp (Wharton 1977).

Sites: Swamp forest at edge of estuaries on rivers, present at the upper limit of tidal influence.

Location: Outer coastal plain.

Vegetation: Canopy members are essentially the same as in more inland swamp forests and bottomland hardwoods, with *Taxodium distichum*, *Nyssa aquatica*, *N. sylvatica* var. *biflora* and *Liquidambar styraciflua* as dominant species. *Sabal palmetto*, *Persea borbonia*, *Viburnum* spp., *Salix* spp., *Planera aquatica* and *Alnus serrulata* may occur in the subcanopy and shrub layers. Typical herbs include *Arisaema triphyllum*, *Osmunda* spp., *Physostegia virginiana*, *Lobelia cardinalis*, *Impatiens capensis*, *Saururus cernuus* and *Hymenocallis crassifolia*.

Elements of concern: *Isoetes riparia*. *Physostegia leptophylla*. *Nyssa ogeche*. American alligator. Swallow-tailed Kite. Wood stork.

Dynamics: An unusual hydrological regime characterizes this community. Very strong currents may take place during ebb flow, but the river may hardly flow at all when the tide is coming in. Depending on specific sites, the subcanopy and shrub layers may be well-represented or depauperate. The ground surface may be very boggy, and covered with many twisted roots. This community may represent an inland limit for estuarine fauna (crabs, etc.).

Associations: Tidal Freshwater Marsh. Brackish Marsh. Bottomland Hardwoods. Oak-Hickory Forest.

References: Odum et al. 1984. Wharton 1977.

TIDAL FRESHWATER MARSH

Type: Estuarine

Sites: Upward limit of salinity in tidal creeks; areas generally flooded regularly, and with an average annual salinity of 0. 5 ppt or below, except during periods of extreme drought (Odum et al. 1984).

Location: Outer coastal plain.

Vegetation: The floristic composition of these sites is quite heterogeneous, and variable from site to site. They are much more diverse than either salt or brackish marshes. Characteristic species are *Phragmites communis*, *Typha latifolia*, *T. angustifolia*, *T. domingensis*, *Zizaniopsis miliacea*, *Zizania aquatica*, *Sium suave*, *Alternanthera philoxeroides*, *Scirpus validus*, *S. robustus*, *S. cyperinus*, *Sagittaria graminea*, *S. latifolia*, *Peltandra virginica*, *Pontederia cordata*, *Iris virginica*, *Fuirena squarrosa*, *Limnobium spongia*, *Nuphar luteum*, *Nymphaea odorata*, *Myriophyllum brasiliense*, *M. heterophyllum*, *Orontium aquaticum*, *Lemna perpusilla*, *Kosteletzkya virginlca*, *Lythrum lanceolatum*, *Impatiens capensis*, *Ludwigia* spp., *Polygonum* spp. and *Saururus cernuus*.

Potential elements of concern: *Isoetes riparia. Zostera dubia. Vallisneria americana. Pilea fontana. Cardamine longii.*

Dynamics: These marshes occasionally exhibit some salinity; the dominant force is flooding with fresh water due to heavy rains (seasonal) or heavy scattered storms. Site boundaries are very indistinct from the aspect of species composition, with imperceptible merging into surrounding community types.

Associations: Downstream to Brackish Marsh. Upstream to Tidal Bald Cypress - Tupelo Gum Swamp.

Comments: Various microcommunity types could be described within the Tidal Freshwater Marsh. However, the general floristic structure of this community is usually so heterogeneous that it is not particularly well-suited to such subdivision (Odum et al. 1984). Zonation within these marshes is often evident, but as a rule does not repeat consistently from site to site.

References: Jervis 1969. Odum et al. 1984. Stalter 1973. Wells 1928. Zingmark 1978.

UNCONSOLIDATED COASTAL BOTTOM

Type: Marine

Sites: Subtidal zone composed of loose sand (plus sediments) or mud, with shells and shell fragments.

Location: Outer coastal plain, barrier islands.

Vegetation: None.

Potential elements of concern: Cetaceans.

Associations: Seaward into Deepwater Coastal Bottom. Landward into Intertidal Sand/Mud Flat, Seagrass Bed.

Comments: This community can be fairly far-removed from any land mass, and yet remain

relatively shallow. Clearly, more knowledge on these sites' community characteristics is needed.

References: Zingmark 1978.

UPLAND BOG

Type: Palustrine

Synonyms: Montane bog, Sphagnum bog.

Sites: Poorly drained wet seepage areas at heads of small streams, which are nearly always saturated. In South Carolina, this community is probably not found below elevations of 2800 feet.

Location: Mountains. One site is currently known in Greenville County.

Vegetation: Upland Bogs are characterized by Sphagnum and many bog species: orchids, sedges, etc., many of which are also found on the Coastal Plain. Zonation of shrubbery may be evident, but a real canopy is usually absent, unless fire has been excluded long enough to allow its development.

Potential elements of concern: *Lygodium palmatum. Juncus gymnocarpus. Carex folliculata. Arethusa bulbosa. Helonias bullata. Platanthera lacera. Trautvetteria carolinensis.* Bog turtle.

Dynamics: Apparently fire-controlled. Without burning, succeeds to wetland dominated by woody vegetation.

Associations: Upland forest communities.

Comments: This community type is more abundant and diverse in North Carolina, Virginia, and more northern states. More field work is needed.

References: Dansereau & Segadas-vianna 1952. Wieder et al. 1981.

UPLAND DEPRESSION SWAMP FOREST

Type: Palustrine

Synonym: Hardwood semi-bog (old SC system).

Sites: Poorly drained upland flats over basic soil, with high diversity of herbaceous flora.

Location: Piedmont, especially York, Chester Counties.

Vegetation: Bottomland canopy species include *Nyssa biflora*, *Quercus phellos*, *Q. lyrata*, *Q. shumardii*, *Juniperus virginiana*, *Liquidambar styraciflua*, *Fraxinus* spp., *Ilex opaca*, *Liriodendron tulipifera*, *Cercis canadensis*, *Ulmus americana* and *Acer negundo*. Shrubs: *Symphoricarpos orbiculatus*, *Lindera benzoin* and *Viburnum* spp. Herbs: *Camassia scilloides*, *Isoetes* spp., *Ranunculus* spp., *Claytonia virginica*, *Zephyranthes atamasco*, *Cardamine bulbosa*, *Ranunculus* spp., etc.

Potential elements of concern: *Isoetes virginica. Camassia scilloides. Melanthium virginicum. Quercus bicolor.*

Dynamics: The hydrology of these sites fluctuates markedly. Soil present is usually of the Elbert series, which is often derived from Iredell types.

Associations: Basic Mesic Forest. Oak-Hickory Forest. Montmorillonite Forest.

References: Batson 1952. Dayton 1966.

UPLAND PINE-WIREGRASS WOODLAND

Type: Terrestrial

Synonym: Longleaf Pine Upland Forest (Wharton 1977).

Sites: Upland sites on rolling sandhills with open to closed canopy of pines, with shrub layer below, and a reasonably diverse herbaceous layer.

Location: Coastal plain.

Vegetation: A rather thin canopy of pines is present, made up of *Pinus palustris* and perhaps some *P. serotina*. A definite subcanopy may occur, mostly of various species associated with less mesic sandhill systems, such as *Quercus marilandica*, *Q. stellata*, *Cornus florida* and *Carya* spp. Shrubs present may include *Ilex glabra*, *Lyonia mariana*, *Gaylussacia dumosa*, *G. frondosa* and *Vaccinium tenellum*. A dense layer of *Aristida* is usually present. Other herbaceous plants may include *Tephrosia virginiana*, *Elephantopus* spp., *Liatris* spp. and *Chrysopsis* spp.

Potential elements of concern: *Elliottia racemosa. Chrysopsis pinifolia.* Gopher tortoise. Red-cockaded woodpecker.

Dynamics: This community is drier than flatwoods; it is never flooded and usually never wet. Organisms within it are generally very adapted to occasional fires. The absence of fire leads to rapid invasion of additional hardwood species and numerous shrubs.

Associations: Sandhill communities. Pine Flatwoods. Streamhead Pocosin.

Comments: This community is conceivably restricted to the interior Coastal Plain, or on

elevated ridges of the outer Coastal Plain. It is probably always present in ecotonal situations on hillsides between drier sandhills and wetter pocosins.

References: Wharton 1977.

XERIC SANDHILL SCRUB

Type: Terrestrial

Synonyms: Xerophytic deciduous forest (Pessin 1933). Turkey-oak barren (Duke 1961). Dwarf oak forest, Pine-turkey oak sandhill (Wharton 1977).

Sites: Flat or hilly areas on driest parts of sandhills. Formed on deep, well-drained sands.

Location: Fall-line sandhills and coastal plain.

Vegetation: The canopy is dominated by *Pinus palustris*. A recognizable subcanopy of *Quercus laevis* and some tall shrubs usually occurs. Shrubs: *Gaylussacia frondosa*, *Vaccinium* spp., *Ceratiola ericoides*. Herbs: *Stipulicida setacea*, *Opuntia compressa*, *Arenaria caroliniana*, *Euphorbia ipecacuanhae*, *Warea cuneifolia*. Important grass genera are *Aristida*, *Andropogon*, *Sporobolus* and *Triplasis*.

Potential elements of concern: *Nolina georgiana. Licania michauxii. Stylisma pickeringii. Chrysoma pauciflosculosa.* A variant of this community in lower Jasper County includes *Polygonella gracilis*, *Dicerandra odoratissima* and *Rudbeckia mollis*. Indigo snake.

Dynamics: This community is very much dependent on fire for maintenance. Wire grass and leaf-litter generally carry fire well; *Pinus palustris* is the best fire-adapted pine in our state. Where fire is excluded, turkey oaks (and some other scrubby oaks) increase in importance.

Associations: Pine-Scrub Oak Sandhill. Swale Pocosin. Seepage Pocosin. Streamhead Pocosin.

Comments: Within this community there sometimes occurs an easily discerned sub-community, Sandstone Outcrop, which may be more correctly considered distinctive. Except for the presence of rock, these sites may share practically all the attributes of other sandhill communities.

References: Braun 1950. Christensen 1979. Duke 1961. Ebinger 1979. Pessin 1933. Wharton 1977. Van Cleave 1933.

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62 mds

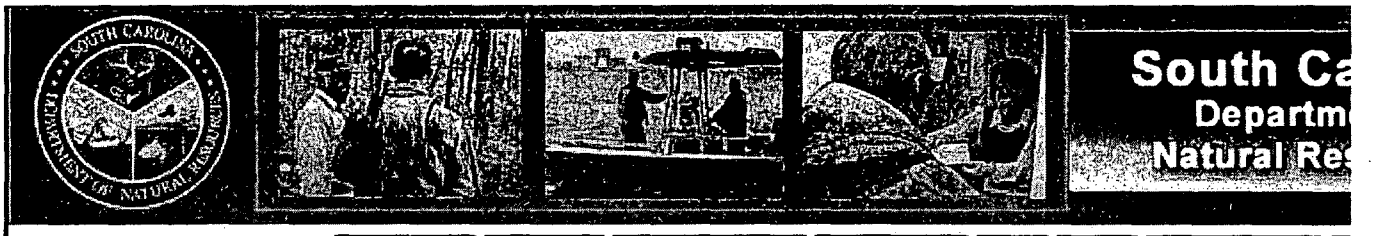
RAI 73

Attachment 73-6

SC Natural Heritage Trust Program. South Carolina Rare, Threatened & Endangered Species Inventory County Lists.

(http://www.dnr.sc.gov:4443/pls/heritage/county_species.select_county_map)

[Best Available Copy Provided]



Regulations

Google Search

South Carolina Rare, Threatened, & Endangered Species Inv
County Selection From List

Please click on a county of interest to view its species data, to list all species found in South Carolina.

Counties A - C	Counties D - L	Counties M
Abbeville	Darlington	Lexington
Aiken	Dillion	Marion
Allendale	Dorchester	Malboro
Anderson	Edgefield	McCormick
Bamberg	Fairfield	Newberry
Barnwell	Florence	Oconee
Beaufort	Georgetown	Orangeburg
Berkeley	Greenville	Pickens
Calhoun	Greenwood	Richland
Charleston	Hampton	Saluda
Cherokee	Horry	Spartanburg
Chester	Jasper	Sumter
Chesterfield	Kershaw	Union
Clarendon	Lancaster	Williamsburg
Colleton	Laurens	York
	Lee	

South Carolina Department of Natural Resources - Phone Numbers
Rembert C. Dennis Building, 1000 Assembly Street, Columbia, SC 29201

South Carolina Rare, Threatened, & Endangered Species Inventory
Species Found In Cherokee County
Data Last Updated January 17th, 2006.

SCIENTIFIC NAME	COMMON NAME	GLOBAL RANK	STATE RANK	LEGAL STATUS
ALLIUM CERNUUM	NODDING ONION	G5	S?	SC
ASTER GEORGIANUS	GEORGIA ASTER	G2G3	S?	SC
CAREX SCABRATA	ROUGH SEDGE	G5	S?	SC
HELIANTHUS LAEVIGATUS	SMOOTH SUNFLOWER	G4	S?	SC
HEXASTYLIS NANIFLORA	DWARF-FLOWERED HEARTLEAF	G2	S2	FT/ST
HYDRANGEA CINEREA	ASHY-HYDRANGEA	G4	S?	SC
MENISPERMUM CANADENSE	CANADA MOONSEED	G5	S?	SC
MONADNOCK		G?	S?	SC
MYOTIS AUSTRORIPARIUS	SOUTHEASTERN MYOTIS	G3G4	S1	SC
XEROPHYLLUM ASPHODELOIDES	EASTERN TURKEYBEARD	G4	S1	SC

For detailed location information about rare & endangered species, please contact Julie Holling.

South Carolina Rare, Threatened, & Endangered Species Inventory
Species Found In Union County
Data Last Updated January 17th, 2006.

SCIENTIFIC NAME	COMMON NAME	GLOBAL RANK	STATE RANK	LEGAL STATUS
AMORPHA SCHWERINII	SCHWERIN INDIGOBUSH	G3	S1	SC
ASTER GEORGIANUS	GEORGIA ASTER	G2G3	S?	SC
CAREX GRACILLIMA	GRACEFUL SEDGE	G5	S?	SC
CAREX PRASINA	DROOPING SEDGE	G4	S?	SC
HACKELIA VIRGINIANA	VIRGINIA STICKSEED	G5	S?	SC
HELIANTHUS LAEVIGATUS	SMOOTH SUNFLOWER	G4	S?	SC
HYMENOCALLIS CORONARIA	SHOALS SPIDER-LILY	G2Q	S2	NC
MINUARTIA UNIFLORA	ONE-FLOWER	G4	S?	SC

	STITCHWORT			
MONOTROPSIS ODORATA	SWEET PINESAP	G3	S1	RC
OPHIOGLOSSUM VULGATUM	ADDER'S-TONGUE	G5	S?	SC
OUTCROP		G?	S?	SC
RHODODENDRON EASTMANII	MAY WHITE	G2	S2	SC
SEDUM PUSILLUM	GRANITE ROCK STONECROP	G3	S2	NC
SILPHIUM TEREBINTHINACEUM	PRAIRIE ROSINWEED	G4G5	S1	SC
SOLIDAGO RIGIDA	PRAIRIE GOLDENROD	G5	S1	SC
VERBENA SIMPLEX	NARROW-LEAVED VERVAIN	G5	S?	SC

For detailed location information about rare & endangered species, please contact Julie Holling .

South Carolina Rare, Threatened, & Endangered Species Inventory
Species Found In York County
Data Last Updated January 17th, 2006.

SCIENTIFIC NAME	COMMON NAME	GLOBAL RANK	STATE RANK	LEGAL STATUS
ACRIS CREPITANS CREPITANS	NORTHERN CRICKET FROG	G5T5	S5	SC
AGALINIS AURICULATA	EARLEAF FOXGLOVE	G3	S1	SC
AGRIMONIA PUBESCENS	SOFT GROOVEBUR	G5	S1	SC
AMPHIANTHUS PUSILLUS	POOL SPRITE	G2	S1	FT/ST
ASTER GEORGIANUS	GEORGIA ASTER	G2G3	S?	SC
ASTER LAEVIS	SMOOTH BLUE ASTER	G5	S?	SC
CAMASSIA SCILLOIDES	WILD HYACINTH	G4G5	S2	RC
COLONIAL WATERBIRD		G?	S?	SC
CYPERUS GRANITOPHILUS	GRANITE-LOVING FLATSEDGE	G3Q	S?	SC
DASISTOMA MACROPHYLLA	MULLEIN FOXGLOVE	G4	S?	SC
ELEOCHARIS PALUSTRIS	SPIKE-RUSH	G5	S?	SC
ELIMIA CATENARIA	GRAVEL ELIMIA	G4	S?	SC
ELYMUS RIPARIUS	WILD-RYE	G5	S?	SC
ETHEOSTOMA COLLIS	CAROLINA DARTER	G3	S?	SC
EUPATORIUM SESSILIFOLIUM VAR VASEYI	THOROUGHWORT	G5T?	S?	SC
HALIAEETUS	BALD EAGLE	G4	S2	FT/SE

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LEUCOCEPHALUS				
HELIANTHUS LAEVIGATUS	SMOOTH SUNFLOWER	G4	S?	SC
HELIANTHUS SCHWEINITZII	SCHWEINITZ'S SUNFLOWER	G2	S1	FE/SE
HYMENOCALLIS CORONARIA	SHOALS SPIDER-LILY	G2Q	S2	NC
ISOETES PIEDMONTANA	PIEDMONT QUILLWORT	G3	S2	SC
JUGLANS CINEREA	BUTTERNUT	G3G4	S?	SC
JUNCUS GEORGIANUS	GEORGIA RUSH	G4	S?	SC
LILIUM CANADENSE	CANADA LILY	G5	S1?	SC
LIPOCARPHA MICRANTHA	DWARF BULRUSH	G4	S2	SC
MELANTHIUM VIRGINICUM	VIRGINIA BUNCHFLOWER	G5	S?	SC
MENISPERMUM CANADENSE	CANADA MOONSEED	G5	S?	SC
MINUARTIA UNIFLORA	ONE-FLOWER STITCHWORT	G4	S?	SC
MONADNOCK		G?	S?	SC
NAJAS FLEXILIS	SLENDER NAIAD	G5	S?	SC
OUTCROP		G?	S?	SC
PANAX QUINQUEFOLIUS	AMERICAN GINSENG	G3G4	S2S3	RC
POA ALSODES	BLUE-GRASS	G4G5	S?	SC
QUERCUS BICOLOR	SWAMP WHITE OAK	G5	S1	SC
QUERCUS OGLETHORPENSIS	OGLETHORPE'S OAK	G3	S3	SC
RANA PALUSTRIS	PICKEREL FROG	G5	S?	SC
RANUNCULUS FASCICULARIS	EARLY BUTTERCUP	G5	S?	SC
RATIBIDA PINNATA	GRAY-HEAD PRAIRIE CONEFLOWER	G5	S?	SC
RHODODENDRON EASTMANII	MAY WHITE	G2	S2	SC
RUDBECKIA HELIOPSIDIS	SUN-FACING CONEFLOWER	G2	S1	NC
SCUTELLARIA PARVULA	SMALL SKULLCAP	G4	S?	SC
SILPHIUM TEREBINTHINACEUM	PRAIRIE ROSINWEED	G4G5	S1	SC
SOLIDAGO PTARMICOIDES	PRAIRIE GOLDENROD	G5	S?	SC
SOLIDAGO RIGIDA	PRAIRIE GOLDENROD	G5	S1	SC
THERMOPSIS MOLLIS	SOFT-HAIRED THERMOPSIS	G4?	S?	SC
TIARELLA CORDIFOLIA VAR CORDIFOLIA	HEART-LEAVED FOAM FLOWER	G5T5	S?	SC
TORREYOCHLOA PALLIDA	PALE MANNA GRASS	G5?	S?	SC
TRILLIUM RUGELII	SOUTHERN NODDING TRILLIUM	G3	S?	SC
VERBENA SIMPLEX	NARROW-LEAVED VERVAIN	G5	S?	SC

VERONICASTRUM VIRGINICUM	CULVER'S-ROOT	G4	S?	SC

For detailed location information about rare & endangered species, please contact Julie Holling
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Attachment 73-7

SC-GAP Project, South Carolina 27-Class Land Cover. SC Cooperative Fish and Wildlife Research Unit, USGS Biological Resources Division, SC Department of Natural Resources. 2001.

(http://www.dnr.sc.gov/GIS/gap/data)

[Best Available Copy Provided]

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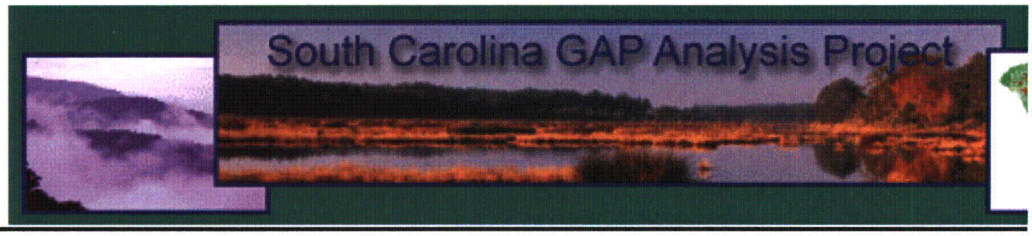

Gap Dynamic Mapping

Gap map layers is in the ESRI GRID format and compressed into a zip file for downloading. Once the downlc unzipped, the grid and related info directories will be installed in a folder or ESRI ArcInfo workspace. The siz uncompressed data file ranges from 1 to 90 MB. To be able to process the data, users must have GIS or ima software supporting ESRI GRID data model. To start downloading, please select the layer of insterest.

Land Cover

Overview

The land cover maps the state?s natural and man-made vegetation types. Available through this website is a 27-class land cover which was created and used for modeling distributions of vertebrate habitats. The accuracy of the map was determined through a combination of aerial photography and ground assessment points that were compared with the land cover. For more information about the accuracy assessment, please refer to the Accuracy Assessment section of GAP final report.

Classification

The satellite imagery used for the classification was Landsat Thematic Mapper (TM). The selected scenes from 1991 through 1993 covering the state were acquiredfrom the Multi-Resolution Land Characteristics Consortium (MRLC). The original 30 x 30 meter pixel resolution was maintained throughout the classification process. The classification of vegetation was performed in two steps, the production of an initial classified image using 27 general classes and the refinement of that classification using soil surveys, National Wetlands Inventory surveys, and elevation data.

Species Habitat

Overview

The habitat maps provide information about the predicted distribution of individual native species according to actual habitat characteristics within their general ranges, and allow calculation of predicted area of distributions and associations to specific habitat characteristics. The predicted distributions are generated for 455 vertebrate species that regularly occur and are relevant to biodiversity studies in South Carolina. Those species include 65 amphibians, 73 reptiles, 249 birds, and 68 mammals.

Habitat Modeling and Mapping

Scientific literature and expert opinion were used to develop a list of vertebrate species and to model their potential spatial distributions. These models combined habitat affinities and land cover data to create distribution maps that highlighted areas whose vegetation was capable of supporting individual vertebrate species. Modeling took place by attributing each species to the counties where it was known

to occur and to the habitat types it used within those counties. Arc/Info scripts were developed to attribute each species to the appropriate counties and habitat. This resulted in a map with 30 x 30 meter pixel resolution attributing each species to a predicted habitat within its documented range. The accuracy of the predicted vertebrate distributions was assessed by comparing a list of species that SC-GAP predicts would be present at a site to a list of species known to occur at a site. The accuracy ranged from 57% to 85% depending on the site.

Land Cover Classes
The vegetation classes include the following types: fresh water, marine water, marsh/emergent wetland, pocosin, swamp, bottomland/floodplain forest, wet soil, wet scrub/shrub thicket, dry scrub/shrub thicket, sandy bare soil, open canopy/recently cleared forest, rock outcrop, aquatic vegetation, closed canopy evergreen forest/woodland, needle-leaved evergreen mixed forest/woodland, pine woodland, dry deciduous forest/woodland, mesic deciduous forest/woodland, dry mixed forest/woodland, mesic mixed forest/woodland, grassland/pasture, cultivated land, urban development, urban residential, wet evergreen, maritime forest, and beach. Detailed descriptions of each land cover class are provided in Appendix 1 of the SC GAP report.

Species Richness

Overview
The species richness map shows species-rich areas or "hotspots." The map identifies where the same numbers of elements co-occur in the same geographic locations. In the case of our data, numbers of animal species are mapped for the same grid cells with a cell size of 90 x 90 meters. These are color-coded or shaded in intensity from the highest numbers of co-occurrence (richness) to the lowest. Richest areas may or may not indicate best conservation opportunities. The 455 vertebrates have been divided into four categories: Amphibian, Bird, Mammal, and Reptile. The richness maps are available for each individual species group and also for all species.

Land Stewardship

Overview
The land stewardship data were created to compare the mapped distribution of elements of biodiversity with their representation in different categories of land ownership and management. Four status categories were used to denote relative level of biodiversity mamagement for each land tract. A status of "1" denoted the hightest level of management, and "4" represented the lowest level of biodiversity management, or unknown status.

Data Sources
The stewardship data were collected from many sources and compiled using survey, database, and GIS techniques. Many of the spatial property files were extracted from field maps, plat, tax maps, and Digital Line Graph (DLG) data. Major data contributors included SCDNR Land Resources Division, U.S. Fish and Wildlife Service's Coastal Ecosystem Program, and U.S. Forest Service.

Stewardship Mapping
Data from various sources and contributors were processed to create the data set of 1:24,000 scale coverages. Each of those polygon coverages was constructed using the Arc/Info GIS and was transferred between agencies. All features were inspected for resolution and positional accuracy. The redundant or antiquated data were eliminated. A single statewide data set was generated by combining remaining

features. Once the data were integrated, additions and modifications to existing properties were evaluated by all state and federal agencies and land management organizations in the state before they were added into the database.

Stewardship Status

Status 1: An area having permanent protection from conversion of natural land cover and a mandated management plan in operation to restore and/or maintain a natural state within which disturbance events (of natural type, frequency, intensity, and legacy) are allowed to proceed without interference or are mimicked through management. This classification may include hunting activities if hunting is not actively managed for.

Status 2: An area having permanent protection from conversion of natural land cover and a mandated management plan in operation to maintain a primarily natural state, but that may receive uses or management practices that degrade the quality of existing natural communities, including suppression of natural disturbance. This status includes lands that may be managed for hunting.

Status 3: An area having permanent protection from conversion of natural land cover for the majority of the area, but subject to extractive uses of either a broad, low-intensity type (e.g., logging) or localized intense type (e.g., mining). It also confers protection to federally listed endangered and threatened species throughout the area.

Status 4: There are no known public or private institutional mandates or legally recognized easements or deed restrictions held by the managing entity to prevent conversion of natural habitat types to anthropogenic