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The Soils of North Carolina

Their Formation, Identification and Use

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TABLE OF CONTENTS

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Introduction

The soils of North Carolina are many and varied. Some are suited to a wide range of crops, others are notably limited in this respect. Properties of soils responsible for recommended soil management differ greatly. A study of the characteristics of soils and of the factors responsible for their formation is basic to the classification of soils. The planning of a sound land use program should be founded upon a study of the classification and relationship of soils to one another, as well as upon the suitability of soils to agriculture, forestry, and other uses.

This publication is designed to present: (1) a background discussion of soil-forming factors in North Carolina; (2) a detailed discussion of the important properties of soils; (3) general information on the State Soil Survey program; (4) specific information on the identification and classification of North Carolina soils; and (5) a discussion of recommended use and management of soils in the State.[1]

The management requirements of a soil result largely from the combination of its physical and chemical properties. These properties usually are influenced by climate, slope, and other external factors. In most publications dealing with soil management the words "proper" or "suitable" or "good" are used to denote the kind of management recommended. In this text the word recommended is used because the proper management practices for many soils are yet to be determined.

* Grateful appreciation is due E. F. Goldston, S. B. McCaleb, and others of the Soils Department staff; and W. H. Allaway, W. S. Ligon, and others of the Soil Survey Division, USDA, for their many valuable suggestions in the preparation of the manuscript.

[1] This is the first of two bulletins on the general subject: "Soils of North Carolina." The second, to be published later, describes the physical characteristics, climate, and land use of the 12 major type-of-farming areas in the State.

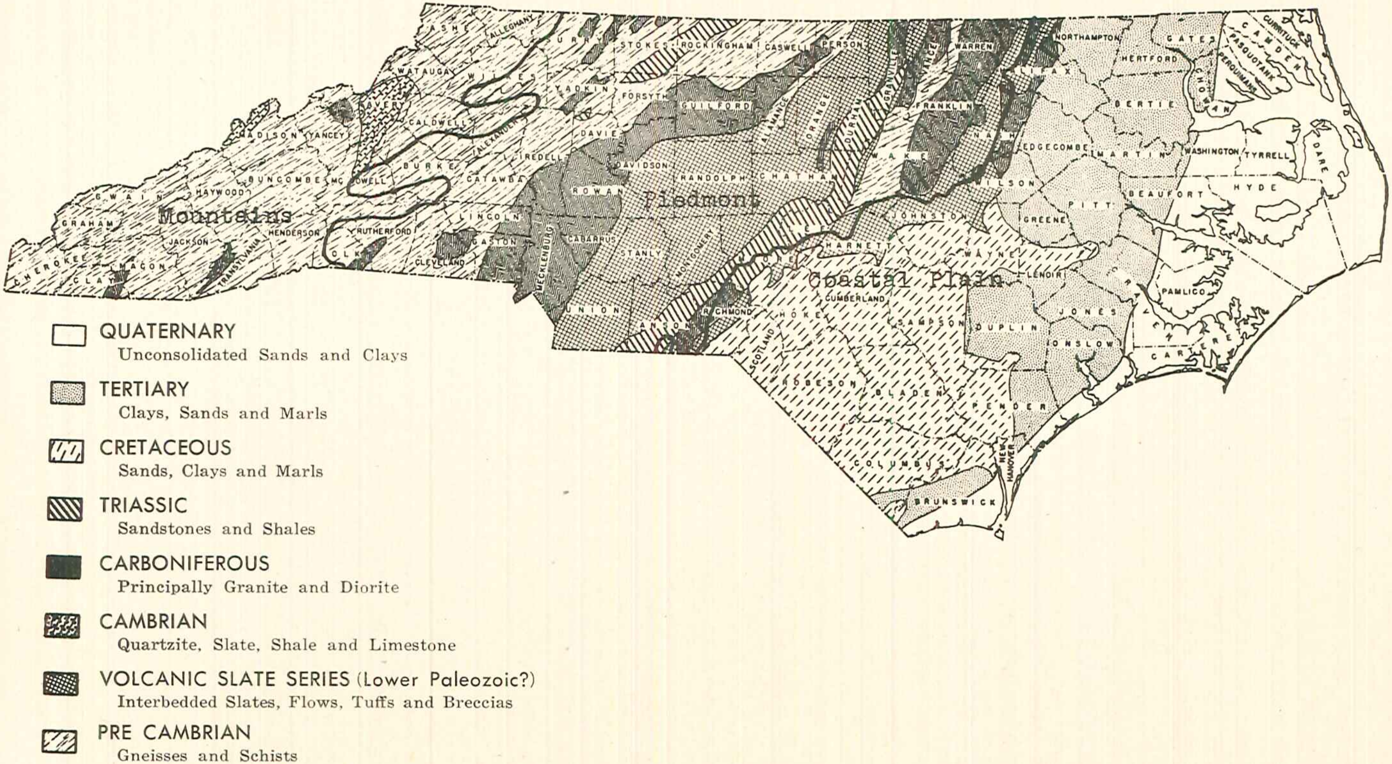

Figure 1. A generalized geologic map of North Carolina. (From N. C. Dept. of Conservation and Development.)

Soil-Forming Factors[2]

For centuries farmers have been learning things about soils through experience. They learned that some soils were better suited to particular crops than other soils, or at least that crop yields were not the same on all soils. According to early records there was some selection of soils for particular crops, but there is no information that reasons were sought for the differences among soils, or that much was done to improve yields on soils except by farrowing or by bringing new areas into crops.

Although early farmers seldom dug deeper than the tillage layer, there was some realization that all soils did not cover the same kind of material. In their migrations these early farmers learned something of the influence of climate on grazing lands or on planted crops. But they learned little of the influence of native vegetation on soils..

For ages, farmers have greatly modified the influence of slope on agriculture, as evidenced by bench terraces on hillsides in many countries, yet there is scant information that they considered the fact that slope also modified soils.

It was not until the 18th century that considerable knowledge was gained about agriculture. This was mainly in the fields of biology, chemistry, and geology. Late in the 19th and early in the present century, as the realization grew that a soil is a complex system, the influence of soil-forming factors became more evident. These factors are *parent material* (rocks), *climate* (temperature and rainfall), *organisms* (mainly vegetation), *relief* (topography or slope), and *time* (age of soil). (Relief is used to designate slope as defined in physical geography: the difference in elevations or the inequalities of a land surface. See glossary of terms, pp. 171-75.)

Thus, soil is the product of certain environmental factors acting upon geologic material. The Soil Survey Manual has this definition: "Soil is the collection of natural bodies occupying portions of the earth's surface that support plants and that have properties due to the integrated effect of climate and living matter, acting upon parent material, as conditioned by relief, over periods of time."

The influence of these factors is interdependent and, in effect, a combined but by no means equal control on soil formation. They appear to be responsible for the 218 soil series recognizable in the State as of 1955.

Because of the interlocking influences of the soil-forming factors, it is difficult to discuss each separately. This is particularly true of *geology*, which treats of the history of the earth as recorded in the rocks, and of *relief* or lay of the land. These two factors will be discussed under one heading, *Physiography*, which deals with the description of the natural features of the earth's surface.

PHYSIOGRAPHY

North Carolina may be divided into two distinct regions upon the basis of geology. The first, or eastern, consists chiefly of unconsolidated rock material, for the most part deposited in the Atlantic Ocean and forming the marine floor until elevated to its present position. The second, or western, is com-

[2] This section in part from the *Soil Survey Manual*, Soil Survey Staff, BPISAE, ARA, U. S. Department of Agriculture Handbook No. 18, 503 pp. illus., August 1951. Also in part from the Yearbook of Agriculture, *Soils and Men*, USDA, 1232 pp. illus., 1938.

posed of consolidated rocks. The eastern region is now known as the Coastal Plain; the western as the Appalachian Highlands with two provinces—the Piedmont Plateau on the east, and the Blue Ridge—or the Mountain area as it is commonly called—on the west (Fig. 1).

The Coastal Plain, Piedmont, and Mountains are separate physiographic regions. The Coastal Plain and Appalachian Highlands differ from each other not only in geologic materials and in age, but also in elevation above sea level, relief, climate, native vegetation and, as a result, in soils. The soils differ within each region because of differences in the materials from which they have been formed or because of differences in relief.

COASTAL PLAIN

The Coastal Plain occupies 44.7 per cent of the land area of the State. It is a relatively smooth plain ranging in elevation from sea level along the coastal portions to generally less than 300 feet where it borders the Piedmont. The Coastal Plain deposits, which are unconsolidated rock, constitute the youngest geologic formations of North Carolina (Fig. 1). These deposits vary in thickness from a thin veneer along the western edge of the region to more than 2,000 feet near the coast. They rest upon consolidated rocks similar to those of the Appalachian Highlands.

The Coastal Plain is composed of a series of seven terraces, each representing a former floor level of the Atlantic Ocean. These terraces have elevations above sea level which range from much less than 25 feet on the inland shore line of the eastern-most terrace to 270 feet or more where the western-most terrace merges with the Piedmont Plateau. (The Sandhill area, on the southwestern border of the Coastal Plain [Fig. 8, Area 5, p. 26] is a distinct and much more elevated section, some 300-650 feet above sea level, and is probably the remnant of a dunesand type of relief similar to that presently at Nags Head.)

Nearly all the materials of the Coastal Plain region were laid down in horizontal or gently sloping beds. Coarser materials predominate on the western edge of each terrace near the old shore line. The finer materials, which are farther to the east and southeast, were deposited in deeper water. In general, the soils of the northern half of the Coastal Plain contain a moderately high portion (more than 55%) of very fine sand, silt, and clay combined, and those of the southern half have a moderately low portion (less than 40%) of very fine sand, silt, and clay combined. The differences in geologic parent materials as influenced by relief are the basis for the classification of soils in the Coastal Plain into units called soil series.[3]

The Coastal Plain is considered by geographers, geologists, and others as having three rather broad units which are distinguished principally by elevation and relief, but also to a considerable degree by soils. These units are the Lower or Tidewater on the east, the Middle, and the Upper Coastal Plain.

TIDEWATER. The common or overall relief of the Tidewater unit, which comprises the two lower marine terraces, is nearly level, with occasional low ridges and gentle slopes, particularly near streams. Very few elevations exceed 25 feet. The land area is intersected by large sounds and by many wide streams which are practically at sea level. Between these streams are numerous broad areas which are poorly drained, and on some of the areas large swamps have developed.

The Quaternary sands and clays, which are unconsolidated and con-

[3] See Soil Classification, page 32.

siderably mixed, occupy the Tidewater unit (Fig. 1). Except for water-transported materials deposited along most streams, and for colluvial (chiefly gravity-roll or creep) materials at the base of a few slopes, these Quaternary deposits are the youngest soil-forming materials in the State. Because of this factor and of the nearly level relief, the soils of the Tidewater are not well developed. Among the more widely spread soil series are the Bladen, Dragston, Coxville, Fallsington, Klej, Rains, Plummer, and Portsmouth.[4] There are many large areas of Muck and Peat.

MIDDLE COASTAL PLAIN. Extending inland the elevation gradually becomes higher across the three marine terraces which comprise the Middle Coastal Plain unit. The highest points are little more than 100 feet above sea level. Streams penetrate most parts of this unit. The overall relief is undulating to gently rolling, and the drainage ranges from somewhat poor to good.

The Tertiary clays, sands, and marls extend practically across the unit from north to south. The older deposits of Cretaceous sands, clays, and marls occupy the southwestern portion where, apparently, the Tertiary materials have been removed by the action of wind and water. Soils with better profile development have formed on these materials than on the younger Quaternary deposits. Among the important or more extensive soils are those of the Craven, Dunbar, Galestown, Goldsboro, Lakeland, Lenoir, Lynchburg, and Norfolk series.

UPPER COASTAL PLAIN. The Upper Coastal Plain unit, comprising the two highest and most inland marine terraces, averages about 130 to 250 feet above sea level. Streams penetrate all parts. The overall relief is undulating to rolling, becoming strongly rolling along streams, and the drainage is generally well established. (In the Sandhills the relief is rolling to hilly.)

Tertiary materials cover the northern half of the Upper Coastal Plain, and the older Cretaceous materials cover the southern half, from which erosion has removed the younger geologic materials which once covered the entire region. Most soils are well developed, except for those of very sandy character, and about three-fourths of the entire unit is occupied by well drained soils. Among the soils having the larger total areas are those of the Caroline, Dunbar, Eustis, Goldsboro, Lakeland, Lynchburg, Norfolk, and Ruston series.

Apparently relief has been an important factor in determining the character of soils throughout the Coastal Plain. In general, the soils occupying undulating or sloping relief (gradients above 3%) are well drained, and have coarse-textured surface soils and medium to fine-textured subsoils which have yellowish, brownish, or reddish colors. These soils under the native woodland cover contain very little organic matter, usually less than 3 per cent in the surface four-inch layer.

The soils on flat or nearly level relief are poorly drained, have medium- to fine-textured surface soils and medium- to very fine-textured subsoils which are grayish to almost black. Such soils contain variable amounts of organic matter, but often it is higher than 8 per cent in the surface four-inch layer.

Soils intermediate in slope between these two groups also are intermediate in drainage and in content of organic matter, but not always intermediate in texture. Consistence and drainage of subsoil materials are used as the basis of classifying Coastal Plain soils.

PIEDMONT

The Piedmont Plateau, which occupies 38.8 per cent of the State, is a much more elevated area than the Coastal Plain, ranging from about 270

[4] See Sec. III, pages 40-97 for a description of soils and soil keys.

feet above sea level along its eastern edge to over 1,200 feet at the foot of the Mountains on the west. The average elevation is between 500 and 900 feet.

The general level of the ridges and hill tops slopes more or less uniformly to the east and southeast and represents the floor of an ancient plain, which apparently was raised to its present plateau position from nearer sea level. As the uplift progressed the various streams crossing the plateau cut deeper and deeper into the valleys and extended their tributaries throughout the region. This resulted in the development of rolling to hilly relief, and the rather thorough to excessive drainage of the region.

There are a number of elevations higher than the general level of the Piedmont, especially in the "Slate Belt" —Orange, Chatham, Randolph, Montgomery, and Stanly Counties (Fig. 1). These hills are remnants of an ancient range of mountains. Other prominent elevations are the Brushy Mountains, mainly in Caldwell, Wilkes, and Alexander Counties; the South Mountains in McDowell, Burke, Rutherford, and Cleveland Counties; Crowders Mountain in Gaston County; Kings Mountain in Cleveland County; Pilot Mountain in Surry County; and the Sauratown Mountains in Stokes County.

MOUNTAINS

The Mountain region occupies only 16.5 per cent of the State. It is bounded on the east by the Blue Ridge and on the west by the Unaka Mountains. These two ranges are connected somewhat with numerous and very irregular north and south cross chains. The elevation above sea level ranges from about 1,300 feet along the eastern slope of the Blue Ridge to 6,684 feet on the summit of Mount Mitchell. The general or average elevation of the typically mountainous portions is about 3,200 to 4,000 feet; that of the valleys or intermountain areas about 2,000 to 2,600 feet. There are many mountains that reach elevations of more than one mile above sea level.

Some of the mountain tops are rounded or dome-shaped, others are sharp irregular peaks. A few of the mountain valleys are broad, with relief features similar to those of the Piedmont; but most valleys are rather narrow with steep slopes.

The character of geologic materials in the Piedmont and Mountain provinces has exerted a greater influence on soil formation than has that of the Coastal Plain materials. But when certain materials in the Mountains are compared to similar materials in the Piedmont the influence of climate on soil formation becomes quite apparent.

These two provinces (Piedmont and Mountain) may be divided into five generalized groups of geologic materials (Fig. 1) commonly called "rock groups". Beginning with the youngest they are (1) beds and lenses of sandstone, shale, and conglomerate of Triassic sediments; (2) granite, diorite, and related rocks of Carboniferous age; (3) quartzite, slate, and shale, (some limestone), of Cambrian age; (4) volcanic slate series, commonly called the "Carolina Slate Belt"; and (5) gneisses and schists of pre-Cambrian age.

Certain soil series are found only in association with particular rock groups. To some extent, therefore, the classification of Piedmont and Mountain soils into series may be based upon the classification of the geologic materials. Soil series developed over Triassic formations have sandy surface soils and highly variable subsoils ranging from sandy clay loams to clays. The important soils are in the Granville, Mayodan, and White Store series.

In the basic crystalline diorite and related rock group are the Clifton, Davidson, Iredell, Lloyd, and Mecklenburg soil series which have loam to clay loam surface soils and clay subsoils. Quartzite and shale have given rise to the Habersham, Fletcher, Matney, and Ramsey soils. The volcanic slates have as associated soils the members of the Alamance, Herndon, Georgeville, and Orange series, all of which are silty in surface and in subsoil.

Among the soil series developed over the mica schists are Piedmont soils with sandy loam surface materials and clay loam to clay subsoils which are known as the Louisa, Surry, Madison, and Grover; and Mountain soils dominantly silty throughout and carrying much fine mica which are known as the Fannin, Watauga, Talladega, and Chandler.

Piedmont soils associated with the acid crystalline gneisses, schists, and granites have sandy loam surface soils and clay loam or clay subsoils, and belong mainly to the Appling, Cecil, and Durham series. Mountain soils associated with these rocks have loam surface soils and clay loam subsoils, and are chiefly in the Ashe, Edneyville, Halewood, Hayesville, Perkinsville, and Porters series.

CLIMATE[5]

The climate of North Carolina ranges from almost sub-tropical, along the Atlantic Ocean in the extreme southeastern corner, to cold-temperate on the highest Mountain ranges, although by far the greater portion of the State, is in the warm temperate belt (Fig. 2). Much of the Mountain region, due to higher altitudes, is included in the cool-temperate belt which occupies about 15 per cent of the State's area. However, the mountains form a partial barrier to cold waves moving southeastward from the interior of the continent and thus considerably modify the winter climate of the Piedmont. Nearness to the Atlantic Ocean and its adjacent sounds has a year-round modifying effect on the climate of the Tidewater region.

The average annual temperature of the State as a unit is 59.2°F., with the average for the greater portion ranging between 56 and 60°F. Within local areas in the Mountain region there are considerable differences in temperature due to sharp changes in elevation. The lowest average annual temperature, 42.9°, is recorded on the summit of Mount Mitchell. However, the lowest average annual reading for an area where general farming operations are conducted is 49.8° at Banner Elk in Avery County, which has an elevation of 3,750 feet. The highest average annual temperature, 64.1°, is at Southport, which is practically at sea level.

The frost-free period, commonly called the growing season, ranges from about 170 to about 220 days. At most weather observer stations in the Mountains, this period is less than 180 days, with Banner Elk the shortest, 148 days, and Asheville the longest, 194 days (Fig. 3). The sections with the longest growing season are on the southeastern coast and on the central and eastern border of South Carolina. Wilmington has 246 days, Charlotte 225 days, and Greensboro 206 days. Elsewhere in the Coastal Plain and Piedmont representative averages are 214 days at Elizabeth City and Greenville, and 200 days at Durham and Salisbury.

North Carolina is rather sunny. The amount of sunshine varies from about 53 per cent of the total possible in the winter to almost 70 per cent in the fall. The average for the year is about 61 per cent. The average number of clear

[5] Data for this section are based upon reports of the Weather Bureau, U. S. Department of Commerce, which has records of more than 25 years length from 67 observer stations.

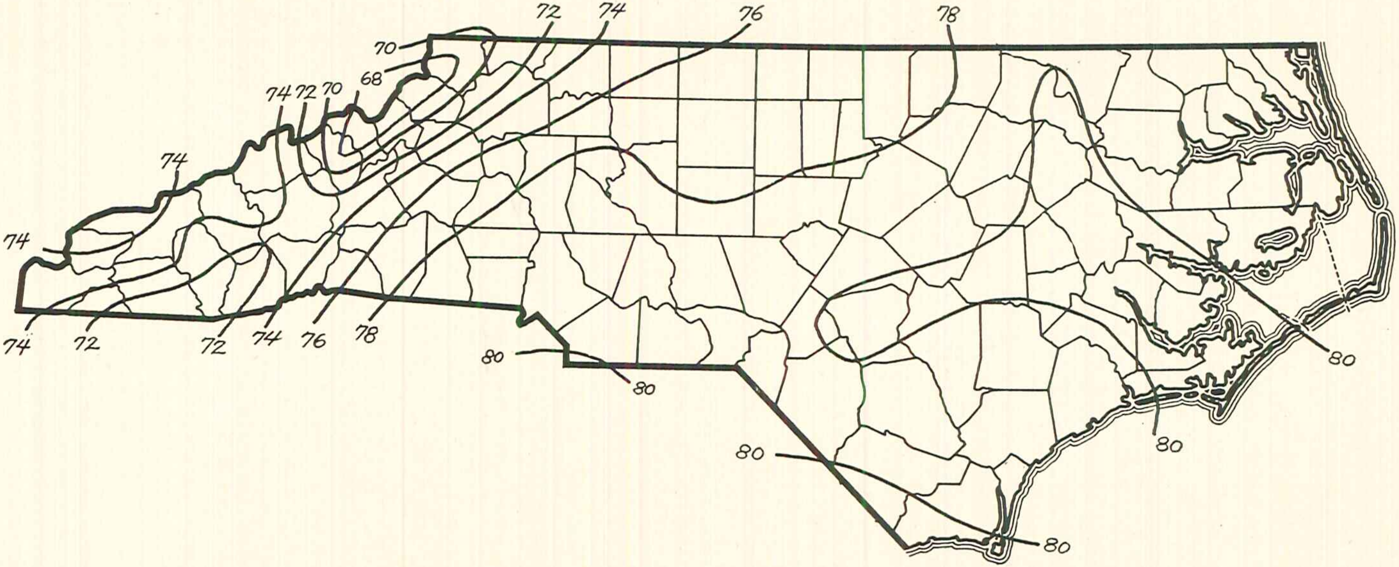

Figure 2 (A). Average July temperature in North Carolina (Degrees F.). (From Weather Bureau, U. S. Department of Commerce.)

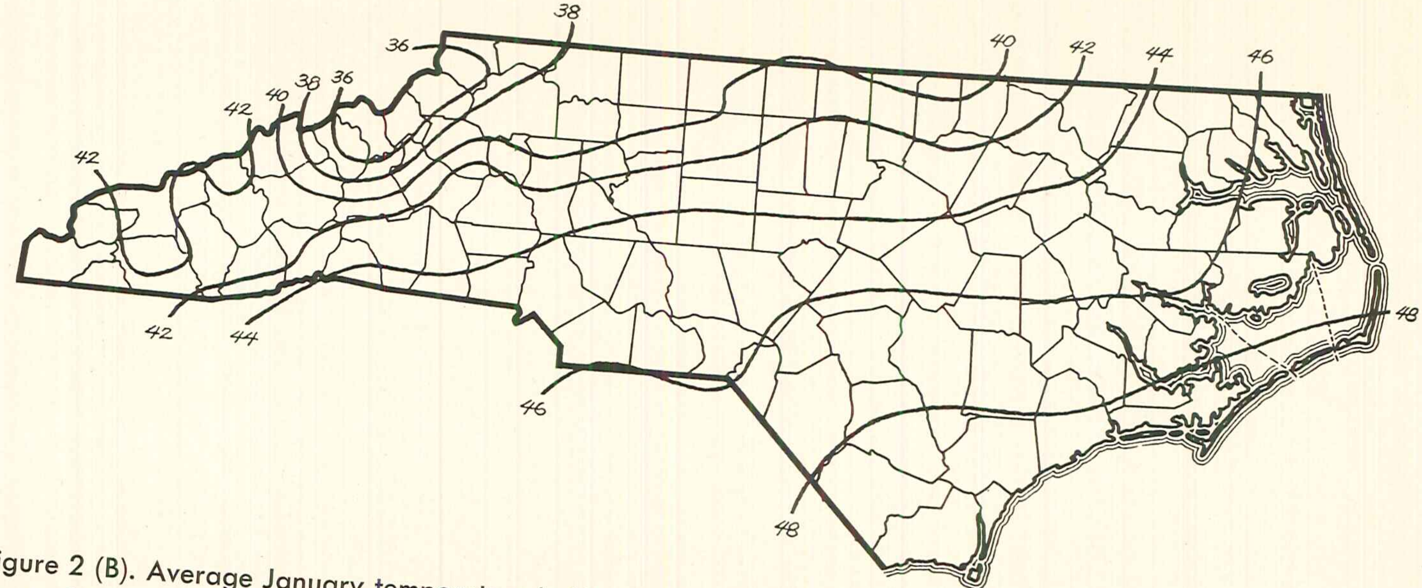

Figure 2 (B). Average January temperature in North Carolina (Degrees F.). (From Weather Bureau, U. S. Department of Commerce).

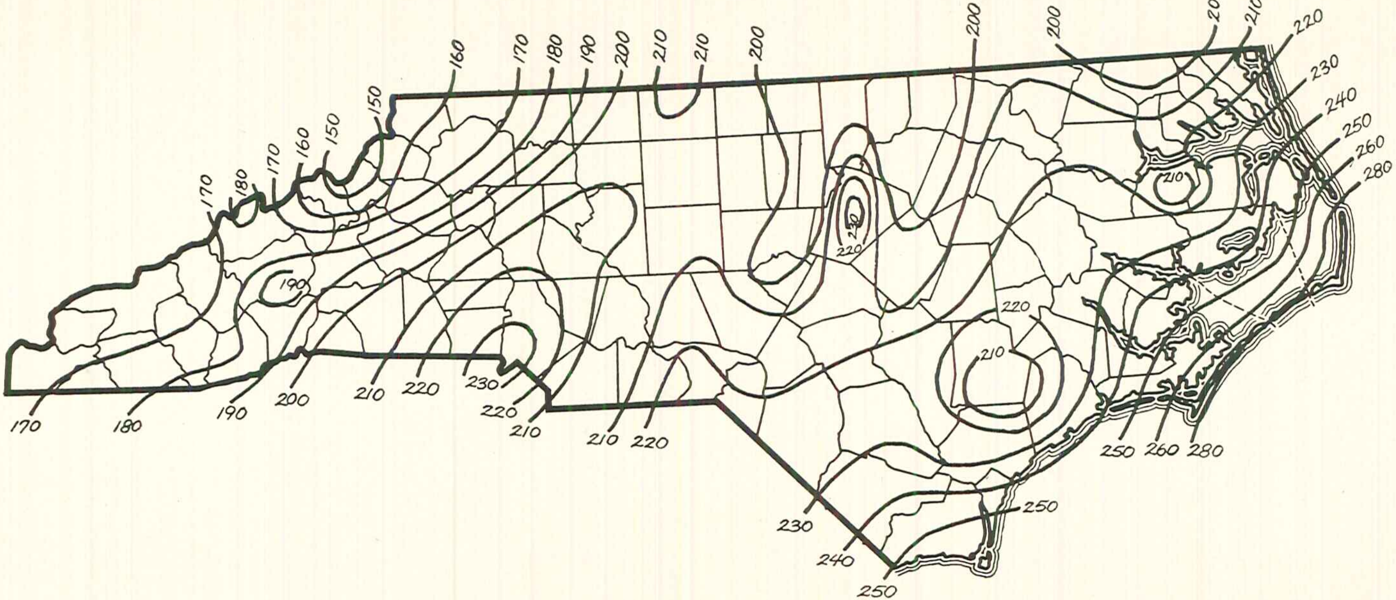

Figure 3. Average length of freeze-free season in North Carolina (Days). (From Weather Bureau, U. S. Department of Commerce.)

days is 165, partly cloudy days, 100, and cloudy days, 100. Average annual relative humidity for the State is about 54 per cent, generally highest in the winter, 56 per cent, and lowest in spring, 48 per cent. Relative humidity averages are somewhat lower in the western parts than in the eastern. (Data are from readings at 1:30 p.m.)

The amount of annual precipitation throughout the State also varies considerably (Fig. 4). Precipitation of .01 inch or more is recorded on an average of 108 days. The average annual amount is 49.65 inches, and the general range is between 44 and 54 inches. The two extreme averages are in the Mountain region, and each probably represents an area of less than 100 square miles. The high, 81.27 inches, is at Rock House, and the low, 37.22 inches, is at Asheville. This high average is greater than for any region of the United States except the Pacific Northwest.

Much of the summer precipitation in North Carolina results from afternoon thunderstorms. Individual storms seldom cover wide areas, and usually last less than two hours. Some storms are very severe, and much of the rainfall is lost as runoff. Figure 5 shows the average warm season precipitation. Winter rains usually are gentle, and often extend over a 24-hour or longer period.

Occasional droughts may damage or destroy crops over areas covering several counties. Hailstorms are of local occurrence, and are quite infrequent (See p. 17).

The average annual snowfall for North Carolina is less than eight inches. Some years there is little or no snow outside the Mountain region, and "big snows" come along only about one year out of four.

The range at Raleigh is from a trace to 26 inches. The average annual snowfall for the Mountains varies from 8.6 inches at Hendersonville to 40 inches at Parker, with a general region-wide average of about 18 inches. Elsewhere in the State the average annual snowfall varies from 11.4 at Reidsville and 6.9 inches at Salisbury in the middle Piedmont, to 5.6 inches at Elizabeth City and 1.7 inches at Wilmington in the eastern Coastal Plain.

Wind movement is not great. The prevailing direction is from the southwest. The State is outside the path of cyclonic storms. Although occasional tornadic storms do occur, they seldom damage areas covering more than 1,000-4,000 acres of cropland. About once in six years a tropical storm coming up the coast from the south will move inland, and the strong winds and heavy rains may damage or destroy as much as 2,000-15,000 acres of cropland, sometimes even much larger areas.

CLIMATE AND SOILS

Climate probably would have made most soils in North Carolina very similar—if uniform geologic or parent materials, equal relief, and like plant and animal life had prevailed, and age or time were comparable. Soil parent materials vary widely in the State (Fig. 1), and so does the age factor since these materials were first exposed to climate. Differences in relief have modified the present climate, often greatly within short distances, as in certain Mountain regions. On the other hand, climate is responsible for the shaping of many land masses. Climate is responsible for variations in plant and animal life to a great extent. The most important direct influence of climate on soils is the alteration of parent material. This works largely through temperature changes, moisture, and vegetation.

In North Carolina because of a warm-temperate climate with moderately high rainfall, most of the soils of the Coastal Plain, Piedmont, and lower

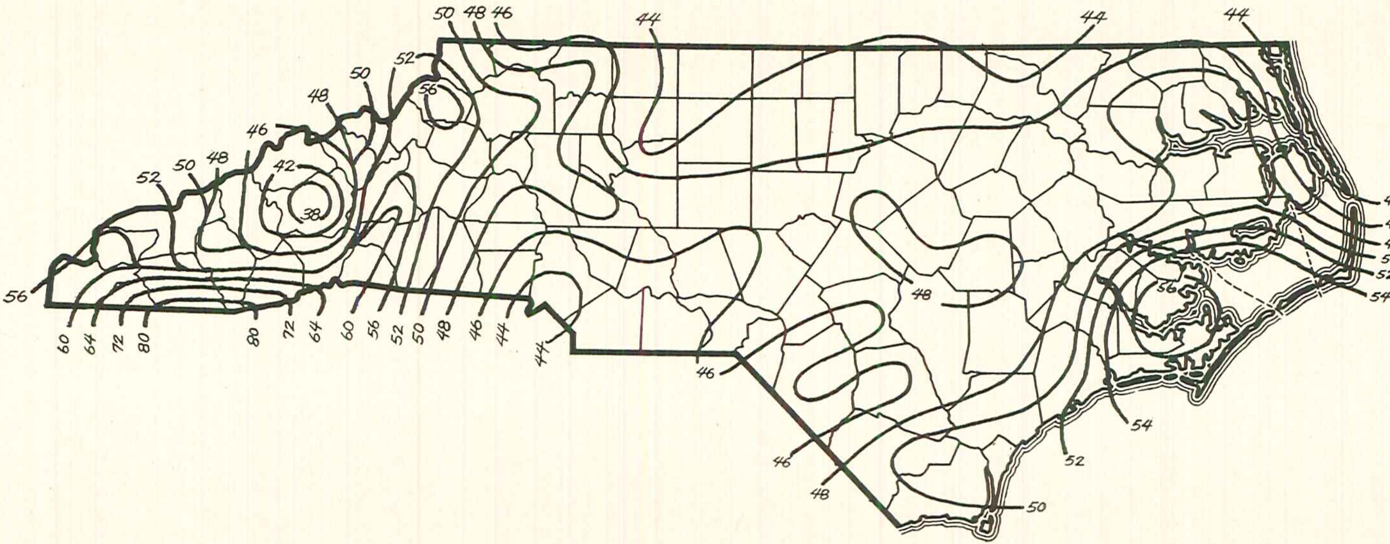

Figure 4. Average annual precipitation in North Carolina (Inches). (From Weather Bureau, U. S. Department of Commerce.)

Mountains are relatively deep and well oxidized. They resemble soils to the south and belong to the Red-Yellow Podzolic Great Soil Group.[6] Because of climatic differences, similar parent materials have given rise to red soils in the Piedmont, to reddish-brown soils in the lower Mountains, and to brown or gray-brown soils in the higher Mountains.

In the higher Mountain region, with its cooler climate, the moderately deep soils have been placed in the Gray-Brown Podzolic Great Soil Group. According to soil classification specialists some of the highest mountain tops have a climate sufficiently cool to result in the formation of Podzol soils, but the steep slopes have precluded this process except in a few small areas. However, even where relief is favorable, the cool summer temperatures have not permitted the development of deep soils.

The abundant rainfall in the State is responsible for the general deep-rooted forest-type vegetation. The rainfall and the warm temperature have resulted in considerable leaching of soils. Oxidation or decomposition has been rapid in most places, and there has been little accumulation of organic matter under the trees. Except for two groups, the soils generally are low in plant food materials and humus. The first exception includes soils in poorly drained locations where partial water cover has retarded oxidation, and where leaching has been slow under the more or less saturated conditions. The second exception includes Mountain area soils on north slopes and other sheltered locations at the lower elevations, and soils on all elevations above 3,500 feet. These soils, under their cooler climate, are less leached and contain more organic matter than similar soils elsewhere.

[6] See Section on Soil Classification, page 37.

CLIMATE AND AGRICULTURE

The climate of North Carolina, with its generally long growing season and moderately abundant rainfall, is very favorable to agriculture (Fig. 2, 3, 4 and 5). The season in the Tidewater section is sufficiently early for the production of potatoes and vegetables for the mid- and late-spring market, and sufficiently long to allow for a second crop (corn, soybeans) on soils which have produced these early crops.

In the Upper Coastal Plain and in most of the Piedmont the frost-free period is sufficiently long for the production of all the field and vegetable crops common to the southeastern United States. The growing period in the Mountain region is considerably modified by the elevation, which not only shortens the length of the season but also lowers the night temperatures. But even there most field crops and vegetables can be produced successfully.

Abnormal late frost sometimes causes damage to spring crops in various parts of the State, but rarely does early frost damage fall crops.

Occasionally there are severe droughts in summer or fall. These may severely damage crops and pastures over areas ranging in size from about six counties to as many as 30 counties. Sometimes, as in 1953 and 1954, nearly all parts of the State may be seriously affected by droughts lasting from 60 to 100 days. The southern Mountain region, including Buncombe and Madison Counties and many of the counties to the southwest of these, probably has more frequent droughts than other sections of the State, or an average of one rather serious drought every five or six years. The central Piedmont, including Iredell County on the west and Randolph County on the east, also has frequent and some-

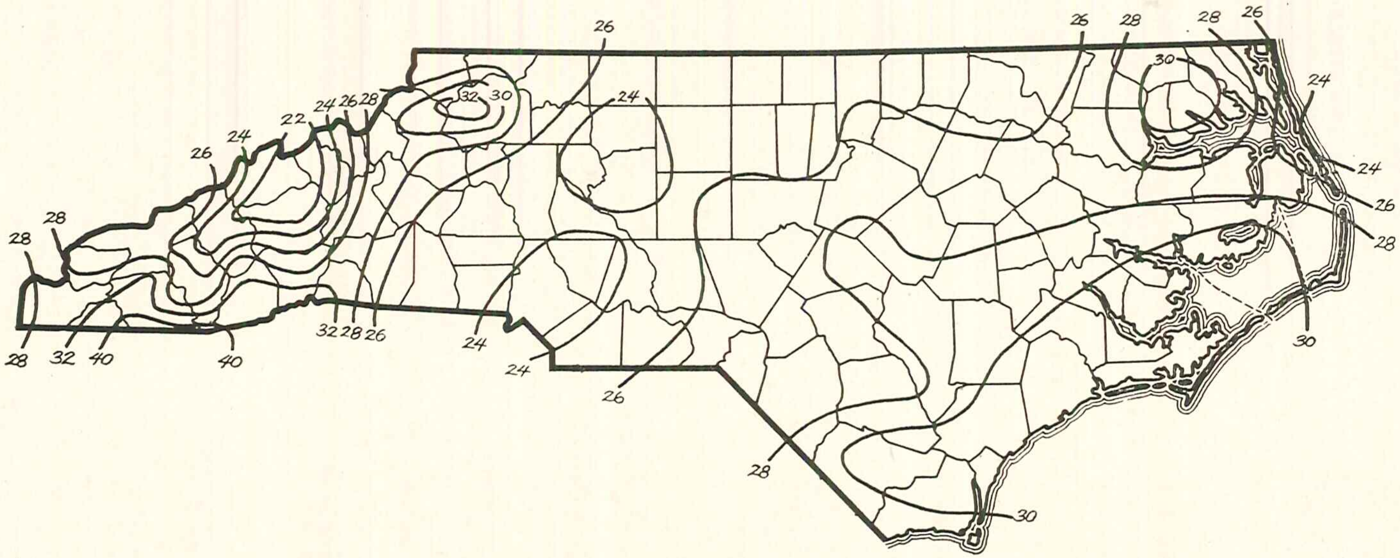

Figure 5. Average warm-season (Apr.-Sept.) precipitation in North Carolina (Inches). (From Weather Bureau, U. S. Department of Commerce.)

what serious droughts, or one in every six or seven years.

Excessive rains in the Mountain and Piedmont regions sometimes may interfere with tillage, or may cause floods which damage crops along the stream bottomlands and on the low stream terraces. Intense rainstorms also may damage crops on upland soils, and may cause considerable loss of soil. In the Tidewater area prolonged rains may be detrimental to crop production, sometimes resulting in late planting, often hampering tillage, and occasionally resulting in loss of a crop.

Hailstorms are of local occurrence, but each year some six to 20 widely separated storms may seriously damage crops on a combined total of 500 to as much as 6,000 acres. All sections apparently are subject to these storms, although the upper Coastal Plain and eastern Piedmont record more than other areas.

Local wind storms sufficiently severe to cause destruction of crops are rare. Soil blowing is a problem only in the middle and upper Coastal Plain areas. During the period from mid-February to early May there may be some loss of soil from large, recently plowed fields, and possible "sand-blast" damage to tobacco, cotton, and other small plants. As previously noted occasional tropical storms may cause some to much crop damage.

Cotton is produced where the average summer temperature is 75°F or higher. About two-thirds of the State, or all of the Coastal Plain and all of the Piedmont except the northwestern portion, has a growing season sufficiently long for cotton.

Climatic conditions throughout the Coastal Plain and Piedmont regions are well suited to the growth of bright leaf tobacco. In the Mountains at elevations below 3,200 feet burley tobacco is grown successfully.

Peanuts are produced chiefly in the north-central Coastal Plain, but temperature and precipitation are favorable for this crop throughout most of the State east of the Mountains.

Early truck crops—particularly white potatoes, lettuce, cabbage, beans, peas, and strawberries—are extensively grown in the Tidewater and Middle Coastal Plain areas because temperature and rainfall are favorable. In most of the Mountain region, due to cool nights and sufficient rainfall, truck crops are produced successfully from mid-summer to fall.

The higher Coastal Plain, particularly the Sandhills, and most of the Piedmont has a favorable climate for commercial peach production. The Mountain region with its cool night temperatures and sufficiently sunny days is famous for the quality of its apples. An outstanding characteristic of parts of western North Carolina is its "thermal belts". Frequent observations and studies by the United States Weather Bureau have shown temperature inversions of 20°F. or more along some mountain-sides. These areas are especially desirable for grape and apple production because of their relative freedom from late frosts.

The climate of most of the State is suitable for the production of small grains. Winter and spring rains are sufficient, and usually there is favorable weather for harvesting.

Hay and forage crops are grown successfully throughout the State. The type of crop varies somewhat with climatic conditions. The Mountain area, with its generally adequate rainfall, low evaporation rate, and cool nights, is well suited to grasses and clovers for the grazing of livestock and the production of hay. The Piedmont and Coastal Plain furnish good grazing in the spring and fall, but supplemental forage for grazing is often needed in mid- and late-summer during periods of low rainfall.

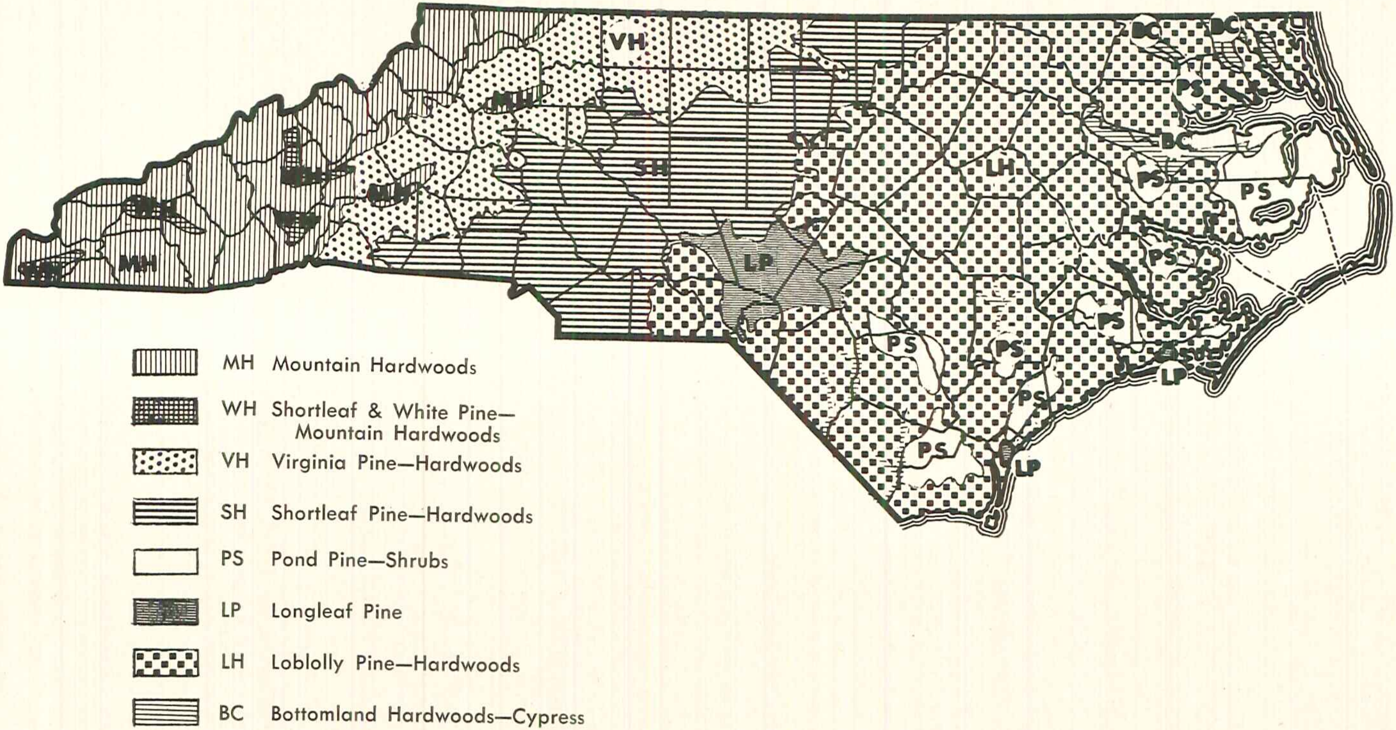

Figure 6. Major Forest Types in North Carolina. (Adapted from map by Forest Service, U. S. Department of Agriculture, Appalachian Forest Experiment Station, 1940.)

While corn is grown on practically every farm in the State, its most successful production is in the Tidewater and Middle Coastal Plain sections, and on bottomland areas in the Piedmont and Mountains. On many upland soil areas west of the Coastal Plain the rainfall frequently is insufficient in midsummer for this crop to make its optimum growth.

VEGETATION[7]

Plants and animals contribute to the make-up of soils. The nature of the changes they bring about depends upon the kinds of life processes peculiar to each. The kinds of plants and animals that exist on and in the soil are determined by the type of climate, soil parent material, relief, and age of the soil, and also by other organisms making up the many factors that contribute to their environment. Climate is the most apparent, but not always the most important, determinant of the kind of higher plants that grow in the soil.

At present about 59 per cent of North Carolina is covered with forest or woodland. The dominant vegetation consists of forest trees with a varying undergrowth of shrubs and smaller plants (Fig. 6). The undergrowth is thickest in the Mountains, because of the normally abundant rainfall and moderately low evaporation, and in the Tidewater region because of the poorly drained lowlands.

According to records left by early settlers this State at one time was almost entirely covered with trees. Apparently, a dominant grass vegetation type never developed to any extent. The principal grass areas are (1) on the narrow tidal marshes of the wet coastal flats where marsh grasses are associated with rushes (Tidal Marsh soil material), and (2) on some small and almost treeless savannas of the Tidewater region where various types of grasses are associated with pitcher plants, chiefly on the soils of three similar and more or less poorly drained series (Plummer, Rains, and Lynchburg). A third group of nearly treeless areas occurs as grassy "balds" on some mountain ridges and tops, usually where the soils are moist and high in organic material (Burton series) and resemble "prairie soils".

COASTAL PLAIN. The original forest growth in the Coastal Plain was chiefly pine. The longleaf pine (*Pinus palustris*) was dominant in the southern portion, especially in the Sandhills. It grew mainly on the coarser-textured and more droughty soils, such as members of the Eustis, Gilead, and Lakeland series. This pine now is associated with turkey oak (*Quercus catesbaei*), and wiregrass (*Aristida stricta*). It would appear that the influence of soil on this vegetation is relatively important.

The loblolly pine (*Pinus taeda*) was dominant in the central and northern portions of the Coastal Plain and grew on a wide variety of soils. It is found on the poorly or somewhat poorly drained soil series (Bladen, Dunbar, Lynchburg, Portsmouth), and also on the well drained soil series (Lakeland, Norfolk, Ruston). But this pine apparently "prefers" the soils having moderate to good drainage with medium- to fine-textured subsoils (members of the Caroline, Craven, Duplin, Goldsboro, Marlboro, Norfolk, and also the Dunbar and Lenoir soil series).

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[7] A popular account of the distribution of the native vegetation in relation to the soils may be found in *The Natural Gardens of North Carolina* by B. W. Wells, formerly Head of the Department of Botany at State College; published by the University of North Carolina Press, Chapel Hill.
Data for this section are partly from "Forest Resources of . . . North Carolina", a series of 5 Forest Survey Releases by the Appalachian Forest Experiment Station, USDA, 1940-41.

Today, pines occupy about 70 per cent of the forested portions of the Coastal Plain, with loblolly the more abundant species. Various hardwoods were interspersed with the pines in the original growth. Oaks, maples, and hickories were the most common species.

In the wetter parts of the region, particularly on Muck and Peat, the high humus sands (i.e. the Rutlege series), and the peaty materials over finer-textured soil materials (Bayboro, Hyde, Portsmouth series), there were many areas forested with cypress *(Taxodium distichum)*, white cedar (*Chamaecyparis thyoides*), and occasional pond pine (*Pinus serotina*). Each species had some switch-cane and various shrubs as undergrowth. Destructive fires followed lumbering operations, and the present vegetation consists mainly of fire-resistant shrubs and pond pine.

Parts of the region only moderately wet (not covered with Peat), and comprised of the Bayboro, Bladen, Coxville, Elkton, Hyde, Portsmouth, and similar soil series, originally were forested with cypress, white cedar, tupelo gum (*Nyssa aquatica*), and various hardwoods. Today, where wooded, these areas have more pines than hardwoods.

PIEDMONT. In the original Piedmont forests oaks and hickories were the principal trees. These were spotted with local stands of shortleaf pine *(Pinus echinata)*. Pines now occupy about 72 per cent of the forested area, with shortleaf the more abundant species. This tree grows principally on the sandy loam soils which have reddish clay subsoils (Cecil, Appling series), and generally in association with deciduous trees. Frequently it occupies areas of soils abandoned because of erosion. The shorter leaf pine *(Pinus virginiana)*, often called "scrub pine", is mainly in the Piedmont and lower Mountains where frequently it occurs as almost pure stands of second- or third-growth trees on the eroded and usually compact reddish clay loam, silty clay, or clay soils (Cecil, Halewood, Hayesville, Lloyd, Georgeville, Mecklenburg series).

MOUNTAINS. In the Mountains various hardwoods—originally chestnut (*Castanea dentata*) abundantly interspersed with oaks—occupied all sections except the highest elevations. Yellow-poplar (*Liriodendron tulipifera*) was common on the moister sites, and there was some white pine (*Pinus strobus*) on the drier sites. Spruce (*Picea rubra*) and balsam fir (*Abies fraseri)* were found on the highest and coolest areas.

Today, hardwoods, chiefly oaks, occupy about 70 per cent of the forested Mountain area, and pines, both shortleaf and white, cover the remainder. The shortleaf is common on the reddish soils (Fannin, Hayesville, Halewood series) of the Mountains at elevations below about 2,700 feet. Shortleaf and white pine, and sometimes Virginia pine, occupy areas of soils abandoned because of erosion. The soils associated with the hardwoods which occupy most of the forested Mountain area above 2,700 feet elevation are chiefly brownish-colored and of loam, clay loam, or light clay texture (Ashe, Clifton, Porters, Ramsey, and Talladega series).

The trees and shrubs common in North Carolina are moderately deep feeders. In the original forests about 60 per cent of the trees were broad-leaved, the remainder conifers. The content of the various plant nutrients in the leaves ranges considerably, but in general the quantities of bases and phosphorus returned to the soil by the leaves of the broad-leaved trees are high compared with those returned by leaves of coniferous trees. In the transfer of material, essential plant nutrients that are returned to the upper part of the soil from the lower subsoil replace, to some extent, those lost through percolating water.

Because of the warmer climate, it appears that this transfer of plant nutrient materials is greater in soils of the Coastal Plain and Piedmont than in soils of the Mountains. Leaching also is a less active process in the Mountain region. This condition tends to offset to some extent the more rapid weathering of soil parent materials and the leaching of the soils in the lower altitudes.

Organic material is added to the soil by the decay of leaves, twigs, roots, and some entire plants. Most of it accumulates on the surface, where it is decomposed by micro-organisms, earthworms, and other forms of life. Some direct chemical reactions occur.

Practically all Mountain province soils contain higher amounts of organic matter than soils of the Piedmont and soils of the better drained Coastal Plain areas. This is because decomposition of organic material proceeds more slowly at the higher, cooler altitudes. On the wet to somewhat poorly drained soils in eastern Carolina organic matter decomposes more slowly than elsewhere. Generally, the wetter the soil the slower the decomposition, and the greater the accumulation of organic material. Oxidation of plant remains proceeds slowly under excess moisture.

AGE

The soils of North Carolina range from very young to old or mature. Soils that have been in place for a long time and have approached equilibrium with their environment are considered mature or old.

In general, soils in the Piedmont are the oldest, and the soils of the Tidewater region in the Coastal Plain are the youngest in the State. Most of the soils in the Mountain region probably are no older than some soils in the Upper Coastal Plain. Soils of the gently to moderately sloping Piedmont, such as the Appling, Cecil, Georgeville, Herndon, and Lloyd series, probably are among the oldest soils in the world. In the Coastal Plain the soils of the Norfolk, Marlboro, and Ruston series are considered mature. Among the mature soils in the Mountains are those of the Clifton, Fannin, Halewood, Hayesville, Perkinsville, and Watauga series.

Recent deposits of alluvium, in place for only a short time, have not been influenced sufficiently by climate and vegetation to develop well-defined layers called horizons. The soils of stream flood plains, usually referred to as first bottoms, are made up of such material. They occur throughout the State. Soils on steep slopes have their materials constantly removed or renewed by geologic erosion, and do not develop deep profiles and well defined horizons. Several such soils in the Mountains (Chandler, Fletcher, Ramsey, and Talladega series) are young.

Some soils on the two lower or easternmost marine terraces are young, not only because the geologic materials are young, but also because of impeded drainage. Among these young soils are those of the Bladen, Elkton, Hyde, Rains, and Portsmouth series.

Major Characteristics of Soils

Soil forming factors are responsible for the series of layers common to soils. The layers are approximately parallel to the earth's surface and are called *soil horizons.* The *soil profile,* as seen in an exposed cut, is a vertical section of the soil from the surface downward to the *parent material,* and includes all horizons.

A distinctive feature of many soils is *color.* Generally somewhat less noticeable features are (1) *texture,* which refers to the proportion of sand, silt, and clay composing the soil; (2) *structure,* which refers to the arrangement of primary soil particles into aggregates; and (3) *consistence,* which refers to the degree of cohesion of the soil and the resistance opposed to forces tending to deform or rupture the aggregates.

An important, but not observable feature of North Carolina soils, is their *reaction,* or degree of acidity and, in an extremely few instances, their degree of alkalinity.

THE SOIL HORIZON

A field examination of soils will reveal that generally they have several more or less clearly defined layers. Usually there are three major layers in a well developed soil. These commonly are called surface soil, subsoil, and underlying material or soil parent material (Fig. 7).

For convenience and uniformity the several soil horizons are named by giving them letter designations. The letter A denotes the surface soil, B the subsoil, and C the parent material. Sometimes D is used to designate a layer of hard rock similar to that from which the C has developed, or to designate layers of sand, silt, or clay that are not soil parent material.

The surface or upper layer consists of leaves, twigs, and other plant remains, generally of the past year. This is termed the A^{00} horizon. The partly decomposed and usually matted plant remains below the A^{00} comprise the A^{0} horizon. Thicknesses of these top horizons are measured upward from the surface of the mineral soil. Fire and sometimes wind and water greatly modify these superficial layers.

The *A horizon* usually consists of a mineral surface layer which contains some organic material, and one of two subsurface layers. It has simple structure forms which are single grain or granular. The topmost mineral soil layer is the A_1. It is usually somewhat darker than the other layers, due to the presence of organic matter. Biological activity normally is greatest in the A_1. The subsurface horizon, or A_2, generally is lighter in color than the layer above or below. It has lost materials—particularly clay minerals, iron, and aluminum—by leaching, and is a layer of eluviation. In many soils there is a layer transitional from the surface soil to the subsoil, but more like the surface. This is the A_3 horizon. For soils plowed or otherwise disturbed the term A_p is used for the surface soil or plow layer.

The *B horizon* may be considered the layer of accumulation, an illuvial horizon. In well drained soils the B usually has a concentration of clay, iron, or aluminum with little or no organic material. In most soils some structure forms are present. Also, the colors are more pronounced than those of the horizons above and below. There are two or three subdivisions, of which the B_1 represents a transition from the

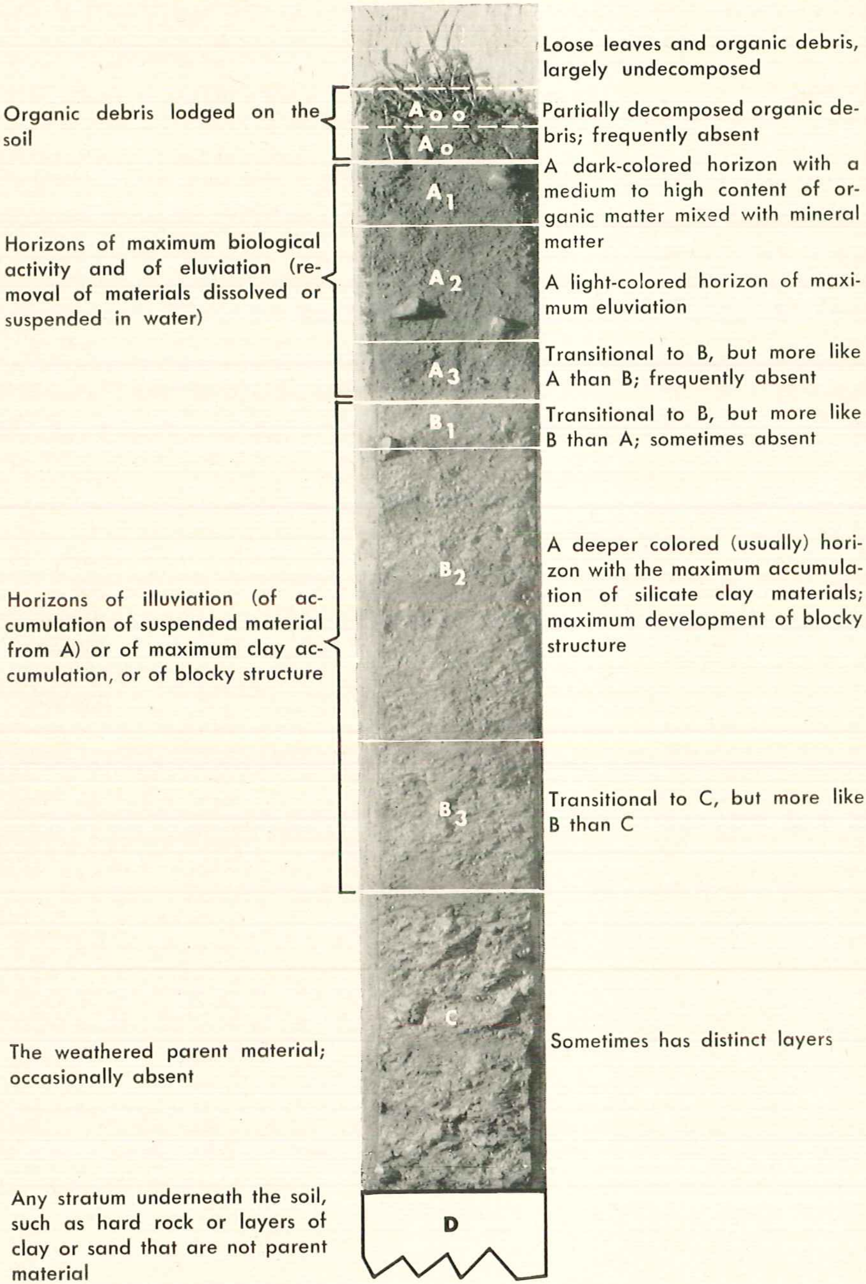


Figure 7. A soil profile containing all of the principal horizons.

A to the B, but is more like B than A. The B_2 is the subhorizon of maximum accumulation of clay minerals and iron, and it shows the strongest development of structure, which is more or less blocky in most North Carolina soils. The layer transitional to the C is the B_3 and is more like B than C.

The *C horizon* is a layer of unconsolidated material supposedly similar in chemical, mineralogical, and physical properties to the material from which some or much of the B and A horizons have developed. Frequently it has an indeterminate lower limit. In North Carolina the C layer under Piedmont and Mountain upland soils is commonly called "rotten rock". In the Coastal Plain the C material somewhat closely resembles the subsoil, but often is different.

The lowest layer or D is not a horizon since it cannot be considered any part of a soil profile, but it may have significance to the overlying soil. Usually it is the "hard rock" of the Piedmont and Mountains. In the Coastal Plain it may be loose sand, gravel, firm clay, or mixtures of two or all of these in varying proportions.

In this publication the term *surface soil* refers to the A horizon, and *subsoil* to the B horizon. Even where the soil has a weakly developed profile, as in Lakeland sand, the layer differing from the surface soil and the deeper-lying material is considered as subsoil. *Parent material* is considered as the C horizon.

SOIL COLOR

Soil color generally is the most noticeable feature of the soil, especially where there is sufficient relief for exposures in road cuts or other observable points. Color is a significant and very useful characteristic for soil identification, or for soil evaluation for agriculture.

Colors in soils are due chiefly to the content of organic matter, to iron compounds, or to quartz. The extreme color range of surface soils in North Carolina is from black (Hyde loam, which is very high in organic matter) to white (St. Lucie sand, which is nearly devoid of organic matter and almost entirely quartz).

All surface soil colors are not due to variations in content of organic matter. However, in the soils of the Coastal Plain region organic matter is one of the most important materials influencing color of surface soils. It exerts some to much influence on the color of the surface soils in the Mountain region, but little on the Piedmont soils.

The range in color of subsoils is from dark gray (again in the Hyde) to white (also in the St. Lucie). Here the dark gray appears to be due to iron in the ferrous form in a more or less permanently saturated horizon, and the white to quartz.

The depth in a soil to which gray or black extend depends upon the nature and distribution of the organic matter and, indirectly, upon the degree of soil drainage, texture, and structure. In the organic soils and soil materials of the Tidewater region color generally is an indication of the stage of decomposition. The relatively coarse-textured Peat is brownish, and the finer-textured Muck is black or very dark gray. Dark gray in the subsoils indicates poor drainage in soils of North Carolina.

Red and reddish-brown soil colors usually are due to the presence of well oxidized iron compounds. Such iron oxides are not very stable where moist much of the time, thus red color indicates good soil drainage and usually a well aerated soil. Climate in the

Mountain region, because of the great variations in altitude, has influenced soil color. Red soils are common in many of the lower valleys, which are warm, but are not found at the higher elevations—more than 3,500 above sea level—where the temperatures are cool. Frequently a south-facing mountain slope will have red soils, but the soil on the north slope will be brown, or gray-brown, yet the underlying rock materials appear to be the same.

Yellow or yellowish soil colors also appear to be due to iron oxides. But a satisfactory explanation cannot be given as to why a soil is yellow. Many soil scientists hold that yellow soils were formed under less well drained conditions than red soils, or in a moister climate, or have been kept wet for a longer period due to a high water table or to restricted drainage because of a slowly permeable layer below the subsoil. In the Piedmont—where yellow soils and red soils occur almost side-by-side, occupy the same slope positions, appear to be of the same age and to have had the same climate—the color differences may be due to differences in weathering of parent materials. At the present time all yellow soils in the State are considered well drained.

Brown soils also owe their color to a considerable amount of iron oxides and, in part, to organic matter. The brown soils are well drained.

Mottlings of various shades of gray, brown, and yellow may be the result of variable drainage conditions, such as a high water table part of the year; or mottling may be inherited from the parent material due to differential weathering.

Soil color names may be determined by comparison of soils with a color chart developed by the Soil Survey Division, United States Department of Agriculture, and now in general use by agencies concerned with soil classification.[8]

SOIL TEXTURE

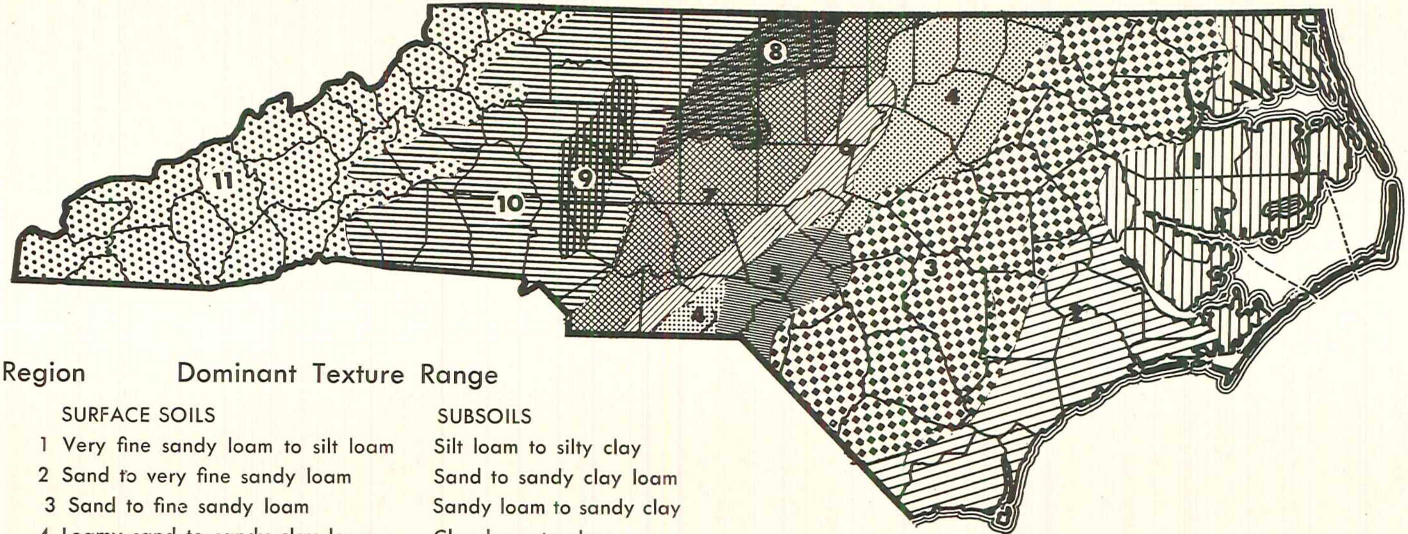
The term *soil texture* refers to the relative proportions of the various size groups of the particles composing a soil. The designation *soil textural class* is given to a specific size group. Practically all soils are made up of three size groups of individual grains—sand, silt, and clay. Sand gives soil a gritty feel, and it may be separated into several grades according to its coarseness or fineness. Clay is composed of extremely fine particles. In North Carolina soils clay tends to make them sticky when wet, and hard and cloddy when dry. Silt is intermediate in size between sand and clay particles. It gives soil a very smooth feel when moist, and is floury when dry.

A crude illustration of the relative sizes of individual sand, silt, and clay particles would compare a medium sand grain to a basketball, a medium silt particle to a golf ball, and a medium clay particle to a dot such as the period at the end of this sentence. The proportions of sand, silt, and clay in soils vary widely, but one size particle usually dominates a soil as *sandy* loam, *clay* loam, or *silt* loam.

Soil texture is of major importance in evaluating soil behavior, in soil classification, and in the management of soil. Texture of the surface soil or A horizon determines the soil type within the soil series, although texture of the subsoil is an important series consideration. The texture of a soil determines its physical character and its chemical properties to a large degree.

Texture exerts a major influence on plant growth and soil management.

[8] Printed by the Munsell Color Company, Inc., 10 East Franklin Street, Baltimore 2, Md.



Region	Dominant Texture Range	
	SURFACE SOILS	SUBSOILS
1	Very fine sandy loam to silt loam	Silt loam to silty clay
2	Sand to very fine sandy loam	Sand to sandy clay loam
3	Sand to fine sandy loam	Sandy loam to sandy clay
4	Loamy sand to sandy clay loam	Clay loam to clay
5	Coarse to medium sand	Sand
6	Sandy loam to silty clay loam	Sandy clay loam to clay
7	Silt loam to silty clay loam	Silty clay loam to silty clay
8	Sandy loam to sandy clay loam	Sandy clay loam to clay
9	Clay loam	Clay
10	Sandy loam to clay loam	Clay loam to clay
11	Sandy loam to loam	Loam to clay loam

Figure 8. Generalized Soil Texture Regions in North Carolina (non-eroded mineral soils).

Soils with coarse texture are rapidly permeable, and have low absorptive properties for water and plant nutrients. Soils with fine texture are slowly permeable and highly absorptive.

The texture of a soil horizon is a relatively permanent feature. But texture of the surface horizon may be modified gradually, as by deeper plowing, or it may be modified very quickly and severely, as by poor management which results in erosion losses.

In North Carolina broad geographic areas may be defined on the basis of soil texture (Fig. 8). Among these areas parent material appears to be the principal factor responsible for the differences in texture. However, for the whole Mountain region, as compared to the entire Piedmont, the cooler climate of the higher elevations, and the younger soils, probably are responsible for some differences in texture. Soil formation in the Mountains has proceeded more slowly, and textural grades are not as distinct as in the Piedmont. These broad soil texture areas are partly responsible for the differences in the types of farming throughout the State.

Soil textural classes may be listed in general terms as follows:

Coarse-textured soils . . .
- Sands
- Loamy sands
- Sandy loam

Medium-textured soils . . .
- Fine sandy loam
- Very fine sandy loam
- Loam
- Silt loam
- Silt

Fine-textured soils . . .
- Clay loam
- Sandy clay loam
- Silty clay loam
- Sandy clay
- Silty clay
- Clay

Specifically, the various soil texture classes, according to the Soil Survey Manual,[9] are listed below in decreasing order of fineness:

1. *Sands:* Soil material containing 85% or more sand, not over 15% silt and clay combined. Subdivisions are Coarse sand, Sand, Fine sand, and Very fine sand.
2. *Loamy sands:* Soil material containing 70 to 85% sand and less than 30% silt and clay combined. Subdivisions are Loamy coarse sand, Loamy sand, Loamy fine sand, and Loamy very fine sand.
3. *Sandy loams:* Soil material containing 50 to 70% sand, less than 50% silt, and less than 20% clay. Subdivisions are Coarse sandy loam, Sandy loam, Fine sandy loam, and Very fine sandy loam.
4. *Loam:* Soil material containing less than 52% sand, between 28 and 50% silt, and between 7 and 27% clay.
5. *Silt loam:* Soil material containing 50% or more silt, 12 to 27% clay; or soil material containing 50 to 80% silt, less than 12% clay, and little sand.
6. *Silt:* Soil material containing 80% or more silt and less than 12% clay.
7. *Sandy clay loams:* Soil material containing 45 to 72% sand, less than 28% silt, and 20 to 35% clay. Subdivisions are Sandy clay loam, Fine sandy clay loam, and Very fine sandy clay loam.
8. *Clay loam:* Soil material containing 27 to 40% clay, 15 to 40% silt, and 20 to 45% sand.
9. *Silty clay loam:* Soil material containing 60 to 73% silt, 27 to 40% clay, and less than 20% sand.
10. *Sandy clays:* Soil material containing 45 to 65% sand and 35 to 55% clay. Divisions are Sandy clay, Fine

[9] In part from *Soil Survey Manual,* pages 210-214.

sandy clay, and Very fine sandy clay.

11. *Silty clay:* Soil material containing 40 to 60% silt and 40 to 60% clay, little or no sand.
12. *Clay:* Soil material containing 40% or more clay, less than 45% sand, and less than 40% silt.

Muck, Mucky Peat, Peat, and Peaty Muck replace textural classes in naming organic soils. Muck is well decomposed plant remains; Peat (woody peat) consists of raw undecomposed plant material in which bits of leaves, twigs, and bark are readily distinguished. Mucky Peat and Peaty Muck designate materials intermediate in decomposition between Peat and Muck. Mineral soils high in organic matter are indicated by adding "mucky" to the textural class name, as *Hyde mucky loam.*

Coarse fragments in soils are recognized as "gravelly" when rounded and less than 3 inches in diameter. They are indicated by adding the word to the textural class name, as Hiwassee gravelly loam. Thin flat fragments are "slaty" or "shaly" as Alamance slaty loam. Fragments 3 to 10 inches in diameter are "cobbly", and their presence in a soil also is indicated by adding the word, as Tusquitee cobbly loam. When more than 10 inches in diameter the term is "stony", as Porters stony loam.

SOIL STRUCTURE

Soil structure refers to the arrangement or grouping of the individual soil grains or particles into aggregates or clusters.[10] Soil structure deals with the size, shape, and durability of natural agregates resulting from variations in the forces of attraction within a soil mass. It is important in the classification of soils. Its influence on soil management and the resultant productivity is very great. Soil drainage or permeability is directly dependent upon the type of soil structure.

According to the *Soil Survey Manual* the four primary types of structure are (1) *blocklike,* with particles arranged around a point and bounded by flat (*angular blocky*) surfaces or by rounded (*subangular blocky*) faces; (2) *spheroidal,* with particles arranged around a point and bounded by curved or irregular surfaces, of which the relatively non-porous aggregates are *granular,* and the very porous ones are *crumb;* (3) *platy,* with particles arranged around a plane, generally horizontal, and usually parallel to the soil surface; and (4) *prismlike,* with particles arranged around a vertical line and bounded by relatively flat vertical surfaces, of which *prismatic* refers to aggregates with flattened upper ends, and *columnar* to those with rounded caps.

All four structure types occur in North Carolina. The blocklike types are the more common in subsoils, the spheroidal in surface soils. A number of soils have weak to moderate platy structure, but very few have prismlike structure. When no structure types are present or observable the term *structureless* is used. If noncoherent, as coarse sand, the term is *single grain;* if coherent, as dense clay, it is *massive.*

[10] Section in part from *Soil Survey Manual,* pages 225-230.

SOIL CONSISTENCE

Soil consistence refers to the relative mutual attraction of the particles in the whole soil mass and to their resistance to deformation or rupture.[11] Consistence deals with the strength and nature of the forces of attraction within a soil mass. Soil consistence is important in the classification of soils. Its influence on soil management is quite notable. Soil drainage is dependent to a considerable degree on soil consistence. A soil which is plastic when wet is difficult to till, and generally slow to drain.

Consistence terms apply to three soil moisture conditions—dry, moist, and wet. Under average or moist field conditions in North Carolina most soil materials tend to break into smaller particles rather than into powder. They are not sticky or plastic when wet, they show some deformation before rupture, and there is an absence of brittleness. Yet the material will cohere again when pressed together. Degrees of consistence are determined by attempting to crush a piece of the soil mass. According to the *Soil Survey Manual* these are:

0. *Loose:* Noncoherent.
1. *Very friable:* Soil material crushes easily under gentle pressure.
2. *Friable:* Soil material crushes easily under moderate pressure.
3. *Firm:* Soil material crushes under moderate pressure, but resistance is distinctly noticeable.
4. *Very firm:* Soil material crushes under strong pressure; barely crushable by thumb and finger.
5. *Extremely firm:* Soil material crushes only under very strong pressure; cannot be crushed by thumb and finger.

The term compact denotes a combination of firm consistence and close packing of soil particles.

SOIL DRAINAGE[12]

Soil drainage refers to the removal of excess water from the soil through runoff and by internal movement or percolation. Evaporation and transpiration are contributing factors to total soil water loss. When drained, a soil is free of saturation or partial saturation with gravitational water. The term "soil drainage" also indicates the frequency and length of the periods the soil pores are partially air filled. The drainage conditions of a soil are due to the existing combination of flow over the soil surface—runoff—and flow through the soil profile—internal drainage.

RUNOFF. Runoff is frequently termed surface flow or external drainage. It refers to the rate water is removed by flow over the surface of the soil. The amount and rapidity of runoff are affected by the texture, structure, and porosity of the surface soil, by the vegetative covering, and by the slope—which generally is the dominant factor.

PERMEABILITY. Soil permeability and internal soil drainage are terms often used interchangeably. Essentially each refers to the movement of water through the soil profile.

Soil permeability refers to the quality or factor of the soil enabling it to transmit water or air. It can be measured quantitatively in terms of "rate of flow of water through a unit cross

[11] Section in part from *Soil Survey Manual*, pages 231-234.
[12] From Committee Report on Soil Drainage Terminology USDA., BPISAE, Oct. 17, 1947, and from material by R. D. Hockensmith, USDA, SCS, 1947-8.

section of saturated soil in unit time, under specified temperature and hydraulic conditions." Percolation rate may be defined as "inches per hour through saturated undisturbed (soil) cores under ½ inch head of water."

Internal soil drainage is "that quality of a soil that permits the downward flow of excess water through it." The rate of movement is affected by the texture, structure, and consistence of both surface soil and subsoil, by the properties of the layers underlying the profile, and by the height of the ground water table. Except height of water table, these are the factors which affect the permeability of a soil.

SOIL DRAINAGE CLASSES. Soil-drainage classes may be set up on the basis of the statements made relative to runoff and soil permeability or internal drainage. The term "natural drainage" is sometimes applied to the soil-drainage classes which are listed below:

0. *Very poorly drained:* Water is removed from the soil so slowly that the water table normally remains at or on the surface from mid-December to late May. Soils of this drainage class usually occupy level or depressed sites and frequently are ponded. They are dark gray or black in the surface layers, and are light gray with or without mottlings in the deeper parts of the profile. These soils are wet enough to prohibit the growth of crops unless artifically drained. Examples of soils are the Hyde and Portsmouth series.
1. *Poorly drained:* Water is removed from the soil so slowly that it remains wet for a large part of the time. The water table is commonly at or near the surface during a portion of the year. Poorly drained conditions are due to a high water table, a very slowly permeable layer within the profile, seepage, or to some combination of these conditions. The soils may be gray to light gray in color from the surface downward, with or without mottlings. Artificial drainage is necessary for the growing of crops. Examples of soils are the Coxville, Rains, and Worsham series.
2. *Somewhat poorly drained:* Water is removed from the soil slowly enough to keep it wet for an appreciable but not large part of the time. Somewhat poorly drained soils commonly have a high water table, a slowly permeable layer within the profile, additions through seepage, or a combination of these conditions. The soils are uniformly gray, brown, or yellow in the upper A horizon with mottlings common in the lower A and in the B and C horizons. Mottling occurs at depths ranging from 6 to 16 inches. Growth of many crops is restricted to a marked degree unless artificial drainage is provided. Among the somewhat poorly drained soil series are the Colfax, Dunbar, and Lynchburg.
3. *Moderately well drained:* Water is removed from the soil somewhat slowly, so that the profile is wet for a small but appreciable part of the time. Moderately well drained soils commonly have a medium high water table, or a slowly permeable layer within or immediately beneath the solum, additions of water through seepage, or a combination of these conditions. The soils have uniform colors in the A and upper B horizons, with mottling in the lower B and C horizons. Except for crops such as bright leaf tobacco drainage is usually adequate. The Craven and Goldsboro series are examples of moderately well drained soils.
4. *Well drained:* Water is removed from the soil readily but not rapidly. Well drained soils commonly are medium in texture, though soils of other textures also may be well drained. The soils are free of gray mottlings. The A horizons may be gray, brown, or red, and the B horizons red, yellow, yellowish-red, or brown. After rain the soils commonly retain optimum amounts of moisture for plant growth. Sometimes the soils are classed as having "good" drainage. The Cecil, Hayesville, and Norfolk series are well drained soils.
5. *Somewhat excessively drained:* Water is removed from the soil rapidly. Many of these soils have low degrees of horizon differentiation, and frequently are sandy and very porous. For the most part, nearly all crops can be grown, but the yields usually are low without irrigation. The Ashe, Lakeland, and Louisburg series are somewhat excessively drained soils.
6. *Excessively drained:* Water is removed from the soil very rapidly. The soils commonly are very sandy, or very gravelly, stony, steep, shallow, or some combination of these conditions. Excessively drained soils usually are yellow, light gray, brown, or reddish in color and free of mottling throughout the profile. Enough precipitation commonly is lost from these soils to make them unsuitable for ordinary crop production. The Kershaw, Ramsey, and Talladega series are excessively drained soils.

SOIL REACTION

Soil reaction—whether the soil is acid or alkaline—has not received much emphasis in the classification of North Carolina soils. Under the native vegetation there are little if any significant differences among the well drained soils. There are slight differences between losse sandy soils as a group and very firm or plastic clay soils also as a group. In addition, there are differences among soils from different parent materials, but these variations are not significant in classification because other and more readily observable characteristics form the basis for classification.

In general, the soils of the Coastal Plain are more acid than those of the Mountains or Piedmont, and Piedmont soils are less acid than Mountain soils.

Among the soils which are not well drained the degree of acidity becomes more intense, in most instances, as drainage becomes poorer. In part, this is tied in with organic matter. Throughout the State the average land operator strives to modify the soil reaction to suit the crop or sequence of crops. Therefore, soil reaction is of primary importance in making soil management recommendations for a number of crops.

The Agricultural Extension Service, Vocational Agriculture teachers, Soil Conservation Service technicians, and other state and federal workers advise farmers to have frequent soil tests made to aid them in adjusting the soil reaction to the crop. Along with the reaction test other tests are made to determine the level of available phosphorus and potassium, the organic matter content, and sometimes for other factors. In North Carolina the Soil Testing Division of the State Department of Agriculture, in cooperation with the Soils and Field Crops Departments of the College, makes the tests free of charge.

For convenience, the degree or intensity of soii acidity or alkalinity is expressed in terms of pH (or the hydrogen ion concentration of the soil solution. Specifically, pH is the logarithm of the reciprocal of H-ion concentration). A pH of 7 is neutral; lower values indicate a greater degree of acidity; higher values, a greater degree of alkalinity. A pH of 4 represents a degree of acidity 10 times as great as that of 5, and so on for each whole number, Thus, pH is a measure of the intensity of soil acidity or soil alkalinity, not the total acidity of the soil.

In general, soils high in clay or in organic matter have greater reserves of acidity than sandy soils or soils low in organic matter. The reserves are highest in peat and muck, lowest in the loose, dry sands.

The terms used to express the ranges in pH are:

	pH
Extremely acid	Below 4.5
Very strongly acid	4.5 - 5.0
Strongly acid	5.1 - 5.5
Medium acid	5.6 - 6.0
Slightly acid	6.1 - 6.5
Neutral	6.6 - 7.3
Mildly alkaline	7.4 - 7.8
Moderately alkaline	7.9 - 8.4
Strongly alkaline	8.5 - 9.0
Very strongly alkaline	9.1 - and higher

The common pH range of well drained soils under native vegetation in the Coastal Plain region is between 4.7 and 5.1; of poorly drained soils it is between 4.1 and 4.8. In the Piedmont the common range is between 5.0 and 5.8; and in the Mountains between 4.8 and 5.4.

Considerable information about the kind and degree of weathering and leaching, and of the soil parent material, may be obtained through studies of the pH values because these reflect the base status of the various soil horizons. Such studies involve rather complex chemical procedures and form a highly specialized field.

The State Soil Survey

Classification and Identification

The aim of the North Carolina Soil Survey is to provide a basis for the application of research findings and farmer experience to every farm. In order to reach this goal we must study, classify, and map soils, and evaluate the soil resources of the State. Essentially, the survey describes the separate soils; sets forth their relationship to each other, to agriculture, and to general land use; and shows their distribution on suitable maps. Since it is concerned with the prediction of yield and quality of products of the soil under various systems of management, it involves field operations and laboratory studies and the interpretation of data obtained.

HISTORY

North Carolina was one of the first six states to begin a systematic classification and mapping of the soils. The original survey, 1900, was a strip 9 miles wide and 105 miles long extending from Raleigh to New Bern. The object of the survey was to show the various soil types across part of eastern North Carolina, covering both Piedmont and Coastal Plain. The Southern and the Atlantic and North Carolina Railway lines, which formed an excellent control base for a map, were the approximate center of this strip. The report sets forth that the State Department of Agriculture "proposes to follow up the survey and locate test farms on the more important soil types revealed by the survey, the object being to study further the fertilizer problems as well as the cultural methods and crops adapted to the different soil types." [13]

Since 1900, by continuous effort, soil surveys have been completed for more than nine-tenths of the total area of the State, nearly all on a county-unit basis. Individual reports covering the soils, agriculture, and other pertinent data of each area in which a survey has been completed have been issued or are in the process of publication. Figure 9 shows the progress of soil classification in the State. In Appendix, Table 1, data are given showing the status of each soil survey.

The Soil Survey gradually has provided the means for fuller coordination and use of the vast store of information gathered by the chemist, plant breeder, agronomist, engineer, and by many others working with soils. The early ideas, which were concerned chiefly with soil as the medium for the growth of plants, have been broadened greatly. A person interested in soil classification may wonder if the knowledge of soils and their management kept pace with the increases in number of recognized and named soils. For example, in North Carolina only eight soil series and nine groups of unclassified soil materials were recognized in the Raleigh to New Bern survey of 1900. Today, more than 50 soil series and four groups of unclassified soil materials would be recognized were a new survey made of the same area. Soil research and management, in general, have kept abreast of advances in soil classification, and have made possible the compilation of data on soil

[13] Soil Survey from Raleigh to New Bern, North Carolina, by William G. Smith, U. S. Department of Agriculture, Division of Soils, 1900.

suitability as shown in Tables 7, 8, 9, pages 100-125.

The systematic grouping or classification of soils into units having related properties is not recent. More than 4,000 years ago the Chinese developed a classification for soils based largely on their color and structure.

Few other known attempts were made by different peoples to classify soils until about 1850 when various Europeans established certain bases of characterizing soils. However, our present system of soil classification, especially at the higher or group levels, has grown out of the work of Russian investigators beginning about 1870. These workers developed a school of soil science which taught that soils were natural and independent bodies, each with a particular form resulting from the combined impact of climate, living matter, relief, and time on parent rock materials. This concept made soil science possible.

Beginning about 1920, C. F. Marbut, in charge of soil survey for the U. S. Department of Agriculture, expanded this new idea of soil science. He laid great emphasis on individual soil profiles as a means of studying and classifying soils (Fig. 7).

About 1930 there was a balancing and broadening of the concept of soil and of soil classification. Then followed a shifting of emphasis from the soil profile. Soil is considered as having more than profile depth from the surface downward; it has breadth, range, and area. These factors, along with genetic qualities, gave a new meaning to soil: that soil is a dynamic portion of the landscape, even landscape itself.

USES OF THE SOIL SURVEY

Some of the ways in which the classification of soils and evaluation of lands by the Soil Survey of North Carolina may be helpful are:

1. To enable the Agricultural Experiment Station to establish basic research on representative soils, and to permit the systematic application of research findings to these soils.
2. To familiarize all those working with soil with the significant differences among soils.
3. To aid county agricultural agents, vocational agriculture teachers, Soil Conservation Service technicians, Farmers Home Administration supervisors, and other agencies in the development and execution of their programs of work with farmers and others.
4. In the selection of test-demonstration farms and demonstration areas.
5. As a basis for the classification of the results of soil management practices.
6. In locating and selecting areas of woodland suitable for clearing and use in crops or pasture.
7. To determine the so-called submarginal lands and their character, location, and extent.
8. To aid land appraisers for federal land banks, insurance companies, and other credit organizations in making land appraisals for the safest possible loans.
9. To aid county and state tax assessors in making the most equitable tax levy.
10. To aid engineers and others in planning engineering works for flood control, irrigation, or drainage.
11. To aid engineers in the location and construction of highways.
12. To aid military and civilian personnel in the location and construction of airports, of army camps, and

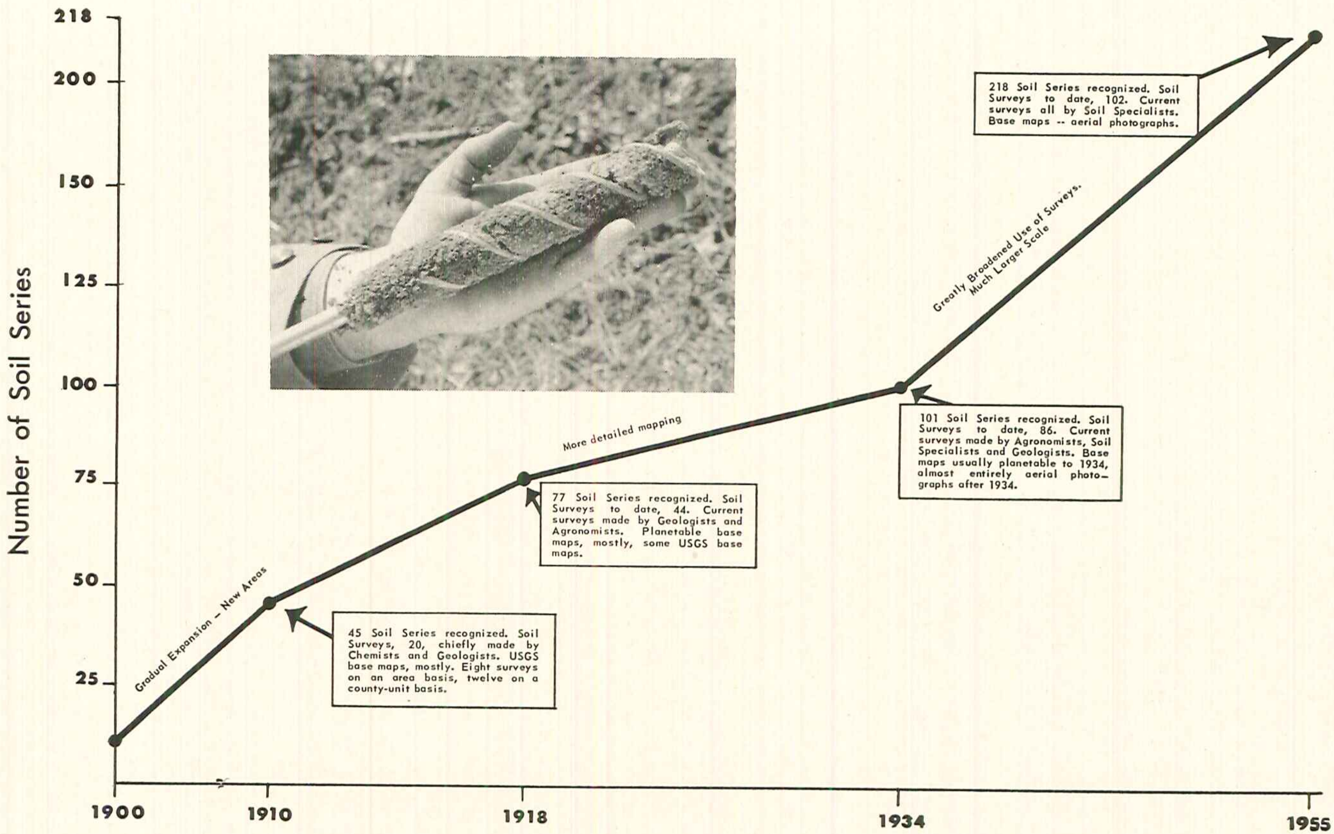


Figure 9. Progress of Soil Classification in North Carolina

of possible routes of troop movements.

13. In assisting real estate operators in determining the suitability of lands for agricultural or other development and, conversely, both as a guide and a safeguard for prospective purchasers of land.
14. As an aid to state and federal agencies in the making of disease and insect surveys, and in the application of the findings.
15. As an aid to teachers of geography and geology.
16. To emphasize, as a means of assisting farmers in their own selection of soils and adapted crops, rotation programs, fertilization, and other forms of soil management.

SOIL SURVEY PROGRAM

The Soil Survey program is divided into four phases: (1) field operations, (2) classification (pp 35-97), (3) research (p. 97), and (4) use, management, and productivity, or the interpretation phase (pp. 97-128).

FIELD OPERATIONS

Field operations deal with the examination, definition, and separation of individual soil units which involve a limited combination of properties. The individual unit is the *soil type* which, throughout the full extent of its occurrence, has relatively uniform texture of the surface soil, has soil horizons similar in differentiating characteristics and arrangement in the profile, and has developed from a particular kind of parent material.

The soil types are shown on a *soil map*. The map is complete as to delineation of streams, bodies of water, mountains, other natural features; roads, railways, power lines, towns, rural houses, churches, schools, and other works of man. Most of the base maps for the early soil surveys were laboriously constructed by planetable and compass or other process. All available maps, as those of the U. S. Geological Survey, Coast and Geodetic Survey, and county surveyors' maps, were used insofar as possible. Practically all of the base maps since about 1936 have been aerial photographs, or were constructed from photographs. The kind of soil survey—as detailed, reconnaissance, detailed-reconnaissance, and individual farm or plot—determines the map scale. Field operations also include the preparation of a soil survey report to accompany the soil map. This is explained on page 97.

SOIL CLASSIFICATION

The soil classification phase develops the fundamental theory of natural soil classification as it applies to North Carolina conditions. Under the natural system, soils are classified on the basis of soil properties. Among these are texture, consistence, structure, and color as well as number, size, and arrangement of horizons; the total thickness of the profile; and sometimes drainage and stoniness.

Soil associations or other groupings are used to show certain relationships among large numbers of soils. The associations discussed on pages 128-170 are groups of geographically associated soils which, in the main, have two or more like profile features, have a common range in relief and drainage, and have similar crop suitability and management problems.

Also included as aids in interpreting and evaluating soil classification are (1) groupings which show soil-drainage relationships, and (2) tables which present soil-erosion relationships. As a means of showing their broad classification relationships on a continental,

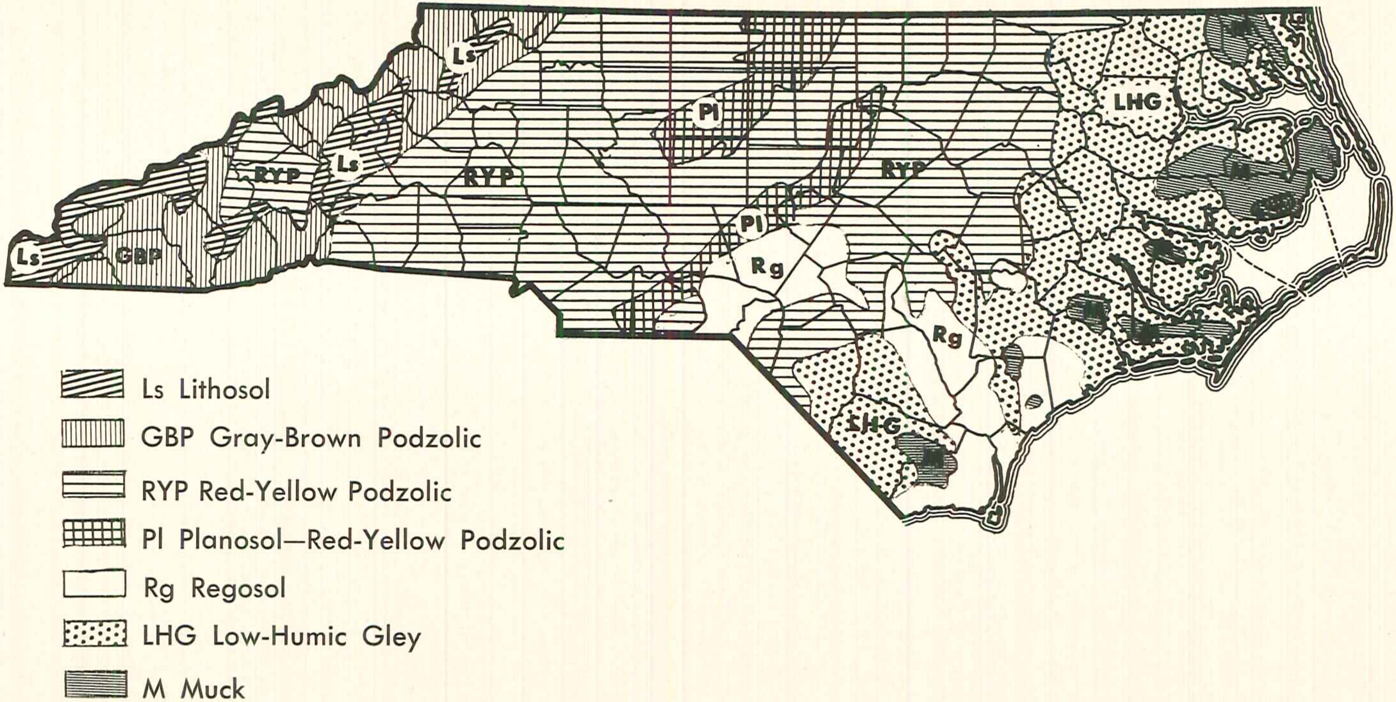


Figure 10. The Great Soil Groups in North Carolina

or even possibly a world-wide basis, soils are placed in *Great Soil Groups* (Fig. 10).

SOIL CLASSIFICATION UNITS

Soil classification, as noted above, is the means of establishing a common ground for an intelligent understanding of soils. It is a systematic grouping or cataloging of soils according to their properties. Soil classification units, termed taxonomic units in some recent publications, usually are soil mapping units. However, classification units may be at various levels of generalization. They may represent considerable broadness, or they may be allowed to approach an almost meaningless detail.

Although the lower unit of soil classification should be essentially alike in all component parts, each unit should be different in at least one readily distinguishable feature from other units. As far as this publication is concerned the various divisions, beginning at the top, are listed in the following paragraphs:

THE GREAT SOIL GROUP. Soils having common internal soil properties—as texture, consistence, structure, a similar drainage range, and similar color, are placed in a great soil group. This is the most workable unit of higher category in soil classification, and is widely used to characterize and classify soils throughout the world. It embraces soils of limited climatic regions, or of limited vegetation regions, or of different relief conditions within one of the regions. Examples are the Red-Yellow Podzolic soils in the well drained parts of the Coastal Plain of North Carolina, and the Humic-Gley soils in the poorly drained parts (pp. 43-65).

THE SOIL FAMILY. The need for a classification unit, known as "soil family" becomes apparent when it is realized that the great soil group is too inclusive to be used for many objectives as, for example, the suitability for a particular crop or the setting up of specific management practices. On the other hand, the number of soil series has become so great that it is very difficult to remember all of them individually. The soil family is considered as filling this classification unit between great soil group and soil series.

By definition, a soil family consists of similar soil series. The series are considered similar if they have (1) relatively the same kind and sequence of horizons, (2) generally the same degree of horizon differentiation, (3) approximately the same size or thickness of solum, (4) a similar range in texture of the B horizon, (5) approximately the same color of the B horizon, and (6) the same range in drainage.

An example of a soil family is the Cecil, which includes these soil series: Cecil, Georgeville, Hayesville, Lockhart, Statesville, Surry, and Wadesboro. Another is the Durham family, consisting of the Alamance, Durham, Edneyville, and Granville series. See pages 43-96 for descriptions of the soil series.

THE SOIL SERIES. The soil series is a group of soils similar in all characteristics except for the texture of the surface soil and, to a very minor degree, for the texture of the subsoil.

Soils within a series have the same character of profile; the same range in color, consistence, and structure, and in sequence of horizons; the same conditions of relief and drainage; and a common origin or kind of parent material. Each soil series has its characteristic range in climate and relief.

In North Carolina there are some differences in native vegetation among the soil series within a region, as the Coastal Plain. But where relief and drainage of the series are equivalent these differences in vegetation are not always apparent.

Soil series seldom are used as units

in soil survey or other soil mapping, but units of a soil series are used.

Soil series are given names taken from the county or area within which they are first defined, or from geographic or other place names near which they are first recognized. North Carolina examples are Alamance, Ashe, Avery, Bertie, Bladen, Buncombe, Craven, Davidson, Durham, Granville, Hyde, Iredell, Johnston, Lenoir, Mecklenburg, Onslow, Pasquotank, and Surry for counties; Balfour, Bayboro, Coxville, Edneyville, Goldston, Hayesville, Helena, Louisburg, Mayodan, and Wadesboro for towns; Cape Fear, Hiwassee, Roanoke, and Toxaway for streams; and Tusquitee for a mountain,

THE SOIL TYPE. The soil type is a unit or subdivision of the soil series based on the texture of the surface soil or A horizon. The name of the soil type is a combination of soil series name and the soil class or texture name, as Alamance silt loam.

In practically all undisturbed soils in North Carolina the texture of the A horizon determines the soil type name within the series. Where cultivated, and also in areas where there has been disturbance without cultivation, the average texture of the plow layer or the approximate upper six inches of the soil is the basis for determining the textural class name. Within a particular soil series there may be other slight differences among various soil types.

Frequently the texture of the A horizon is reflected in the texture of the subsoil or B horizon. Thus, the loamy sand type of a series generally has a slightly coarser-textured B than does the sandy loam type. An extreme example is found in Northampton County, and in some other upper Coastal Plain counties, where the Norfolk series is represented by the broad range of five surface textures from loamy coarse sand to fine sandy loam. The B horizon of the loamy coarse sand is coarser-textured, slightly more friable, and possibly more permeable than the B of the fine sandy loam; but in comparing the B of the sandy loam with that of the fine sandy loam the differences in texture, firmness, and permeability are very slight.

In soil mapping the soil type long has been considered the unit of classification and, therefore, the lowest and most nearly uniform category. In North Carolina the research with crops and fertilizers and related soil studies has been on the basis of soil type by name and definition.

Certain variations within a soil type are called "soil phases". Generally, in most soil classification work, the soil phase is considered as a subdivision of the soil type, but it is not a taxonomic unit. However, "phase" can be considered at any level of generalization. It is used to indicate differences from the representative or modal (ortho) soil properties that have significance in soil management or in general land use. Such variations are in soil slope, degree of accelerated erosion, stoniness, and profile thickness. Sometimes the variations are in underlying materials, or in physiographic position.

Since 1935 the soil phase *appears* to have become the chief unit of mapping. Some consideration has been given to the proposition that the use of the term "soil phase" be discontinued, and that all subdivisions of soil series be considered as soil types. Thus, soil types would be differentiated not only by surface soil texture, but also by any soil characteristics now used to differentiate phases. Since all of the soil surveys (17) in North Carolina since 1935 have emphasized the soil phase in mapping and in the report material, its use cannot be minimized greatly at present. But in this bulletin the soil type is considered as the unit of soil classification, and variations significant in land use are considered as phases.

NOTES ON SOIL PHASES

Each soil has a range in slope. The slope range within one soil series or group of similar or related series, as a soil family, when compared to the range within another series or family may be small or great. In general, the slope range is lowest in the Coastal Plain, highest in the Mountains, intermediate in the Piedmont. Within each of these regions the range varies some among the many soil series or families. Several Coastal Plain soils, as the Bayboro, Hyde, Portsmouth, and Rutlege series, have such a narrow slope range that they come within one slope class. Some Piedmont soil series, as the Appling, Cecil, Georgeville, and Herndon series, cover four slope classes, although one class is somewhat the more common.

Seven slope classes have been recognized in North Carolina. For convenience the classes are designed by letter. The letter A is used for the lowest slope class or for the level to nearly level soils, and G for the highest class or for the very steep soils.

From a broad land use basis the three lowest slope classes, A, B, and C, represent soil slopes suitable for cultivation; the highest classes, F and G, suitable only for trees; the two intermediate classes, D, and E, as suitable for hay crops and pasture.

There is reason to believe that significant gradients or percentages of slope vary not only from Coastal Plain to Piedmont to Mountains, but also by soil groups or families within these regions. However, considerable confusion could result in the use of a variable slope legend. For example, at times during the period of 1933-55 there have been as many as five different gradient ranges in use for one slope class. To avoid any confusion over letter or class groups, there is no reference to such in the soil series descriptions on pages 43-96. Instead, the over-all slope range is given, and also the more common or "typical" range as for instance, Cecil 2-40%, mostly 5-15%.

The standard slope classes currently (1955) in use by the Soil Conservation Service for all of North Carolina are:

Class	*Slope*	*Gradient Range in Per cent*
A	Nearly level	0- 2
B	Gently Sloping	2- 6
C	Sloping	6-10
D	Strongly sloping	10-15
E	Moderately steep	15-25
F	Steep	25-45
G	Very steep	Above 45

Eroded soil phases are used to designate significant differences in the natural soil classification units that have been brought about by accelerated erosion. These phases are an indication of the amount and extent of soil removal, and form part of the factors used in establishing soil or land capability classes. Wind erosion has seriously damaged very few soil areas in the State. These areas and those few which are moderately wind eroded are included in soil mapping with the corresponding water eroded phase. Five eroded soil phases are used to cover most conditions in North Carolina:

(0) *Plus erosion phase*, to indicate areas where soil material has accumulated because of erosion losses from soils on higher-lying positions.

(1) *Slightly eroded phase*, to indicate areas where the soil has been modified to an appreciable extent, but not sufficiently to require much change in the management practices. Less than one-fourth of the original surface soil has been removed from slightly eroded areas.

(2) *Moderately eroded phase*, to indicate areas where erosion has modified the soil to such an extent as to require significant changes in management practices for sustained production. Moderately eroded soils are in a lower use-capability class than slightly eroded soils. Approximately between one-fourth and three -fourths of the original surface soil has been removed from moderately eroded areas.

(3) *Severely eroded phase*, to indicate areas where erosion has so modified the soil that it needs a complete change in treatment. Severely eroded soils are in a lower use-capability class than moderately eroded soils. On severely eroded areas approximately three-fourths or more of the original surface soil has been removed and also up to about one-fourth of the original subsoil.

(4) *Very severely eroded phase*, to indicate areas where erosion has completely modified the soil, especially by gullying. Such soil areas are virtually destroyed as far as any practical agricultural use is concerned. Very severely eroded areas have lost all of the original surface soil and also one-fourth or more of the original subsoil. Appendix Table 2 shows the erosion classes of each county. Figure 11, Appendix, is a map of North Carolina showing erosion classes by approximate delineated areas.

Soils which contain sufficient stony material to interfere with cultivation are indicated as gravelly or stony phases, although the words "gravelly" or "stony" seldom are used with "phase". In North Carolina the general usage has been to insert either word, as it applies, between the soil series name and the type name, as Ruston gravelly sandy loam, Ashe stony loam, or Congaree cobbly loam. Descriptions of the phases are:

(1) *Gravelly phase*, to indicate areas where small stone, somewhat rounded and usually less than 3 inches in diameter, occurs in sufficient quantity to interfere with cultivation. Larger and more or less rounded stone has been indicated as a *cobbly phase* in a few surveys.

(2) *Stony phase*, to indicate areas where angular stone of varying size occurs in sufficient quantity to interfere with cultivation. In some surveys the character of the rock material is indicated as in the following examples: Alamance slate loam or slaty silt loam, Ramsey shale loam or shaly silt loam.

Although the depth or thickness of the soil profile is important in soil identification and classification, it is much more important in soil use and management. Frequently the use-value of a soil is dependent upon its thickness. Usually the term "profile thickness" refers to the combined depth or thickness of both soil and subsoil (A and B horizons generally called the solum; and the C, if present) over strongly contrasting nonconforming rock material (soft or disintegrated) or over hard or solid rock. Each soil series has its characteristic (ortho or representative) depth or thickness of profile. These depths are indicated in the soil keys, pages 43-96.

Many soils in the State, especially in the Coastal Plain, have surface soils or A horizons thinner or thicker than ortho for the soil series. These variations are not due to disturbance or to accelerated erosion. Where they are of significance to soil use and management they are indicated as phases. Each soil series or group of series has its ortho horizon thickness range. For example, the ortho or modal thickness of the A horizon of the Norfolk series appears to be 15 to 18 inches. In field mapping practice if the A is not over 12 inches thick (non-eroded condition) a thin surface phase is indicated, if 20 or more inches then a thick surface phase.

Certain phase names have been used in county soil surveys in North Carolina to indicate conditions varying significantly from normal for the soil series or the soil material. These phases are:

(1) *Burned phase,* to indicate areas of Peat, Muck, Mucky Peat and similar organic materials on which it is apparent that the original surface has been burned to a depth of more than 15 inches. Burned phase is used in current soil surveys.

(2) *Colluvial phase,* to indicate small areas at the base of slopes where material has accumulated due to creep or gravity or movement by water alone. It is in current use for areas not having sufficient total acreage in the survey to be shown as separate soil series.

(3) *High-bottom phase,* to indicate an alluvial soil occupying a position above normal or usual stream overflow. This has been used only in three surveys, none recent.

(4) *Low-terrace phase,* to indicate a stream terrace soil occupying a position below that which is normal for the soil series, hence subject to occasional overflow. Used only in a very few surveys.

(5) *Flat phase,* to indicate areas of a soil type occupying relief more nearly level than normal, and used in a few surveys prior to 1934. Examination of some of these areas shows that, if reclassified, they would be placed in more recently established soil series.

(6) *Low phase,* to indicate areas of a soil type occupying a lower drainage position than normal; used occasionally prior to 1934. Areas, if reclassified, would fit into more recently established soil series.

(7) *Swamp phase,* to indicate more or less continuously wet areas of a soil type normally poorly drained but not wet much of the year; not in current use. Areas, if reclassified, would fit into more recently established soil series.

(8) *Scrub phase,* to indicate areas of Coastal Beach which have some tree and shrub growth, which is not normal for this land type; not in current use. Probably would be indicated as Dunesand if reclassified.

(9) Other phases used prior to 1934 are: *Poorly drained phase, sandy subsoil phase, dark phase, brown substratum phase,* and *mucky phase.*

SOIL KEYS OR IDENTIFICATION GUIDES

A means of identifying soil series in North Carolina by keys is given for each physiographic division on pages 43-96. All presently recognized series are shown. Following the keys are alphabetical lists of the soils and, roughly, their approximate area in acres. Table 3, lists the approximate land area of the Coastal Plain, the Piedmont Plateau, and the Mountain Region.

As previously noted, soils are classified on the basis of their properties into groups or units which consist of great soil groups, soil families, soil series, or soil types depending upon the level of differentiation. The basis of soil classification is not readily recognized by the majority of people who work with the soil, either directly as farmers or indirectly as county agents, teachers of vocational agriculture, and other professional workers. But the farmer or agricultural worker is interested in the performance of soils. He wants to know one or two reasons why some soils have certain capacities or rates of performance that vary from those of other soils under management practices that are relatively the same. When the reasons for differences are noted, then some interest in soil classification, or at least soil identification, usually is expressed.

Various methods may be used to acquaint farmers and others with means of identifying soils. The author has long felt that soil keys or guides—which are based on the more or less readily noticeable soil features, as color or other physical properties of subsoil (sandy, clayey, shallow, deep, etc.) may be used as a means of identifying soils, but should not be considered as a means of classifying soils. Such soil keys or identification guides have been useful to students, professional agricultural workers, land appraisers, tax assessors, real estate agents, military personnel, highway engineers and others, as well as the man on the land. The major soil properties indicated in the Keys will furnish interested persons worthwhile information.

TABLE 3. APPROXIMATE LAND AREA OF THE THREE PHYSIOGRAPHIC DIVISIONS OF NORTH CAROLINA

Coastal Plain	14,036,000 acres	or 44.7 per cent
Piedmont Plateau	12,200,000 acres	or 38.8 per cent
Mountain*	5,186,080 acres	or 16.5 per cent
TOTAL	31,422,080 acres	

DATA ON THE "BORDERLINE" COUNTIES

County	Proportion in Each Division	Acres in Each Division: Piedmont	Acres in Each Division: Mountain
Alexander	(70% Piedmont—30% Mountain)	113,200	50,000
Burke	(66-34)	214,000	109,800
Caldwell	(38-62)	115,900	188,800
Cleveland	(97-3)	289,300	9,000
Iredell	(96-4)	363,200	15,000
McDowell	(35-65)	99,000	183,900
Polk	(82-18)	122,800	27,000
Rutherford	(81-19)	293,000	69,200
Surry	(90-10)	309,300	34,400
Wilkes	(56-44)	274,200	215,400
TOTALS		2,193,900	902,500

County	Proportion in Each Division	Piedmont**	Coastal Plain
Anson	(89% Piedmont—11% Coastal Plain)	303,600	37,500
Halifax	(40-60)	184,800	277,300
Harnett	(17-83)	65.900	321,900
Johnston	(18-82)	91,600	417,200
Lee	(72-28)	120,200	43,000
Montgomery	(92-8)	287,300	25,000
Moore	(45-55)	193,600	236,500
Nash	(54-46)	190,000	163,300
Northampton	(14-86)	48,300	297,300
Richmond	(25-75)	76,300	229,000
Wake	(92-8)	507,900	44,300
Wilson	(4-96)	9,500	229,200
TOTALS		2,079,000	2,321,500

* Not included are the Sauratown Mountains in Stokes County (16,000 acres) and the outlying Brushy Mountains in Yadkin County (3,700 acres). The total acreage figure (5,186,080) for the Mountains is lower than that shown in earlier publications. The several artificial lakes (as Fontana, Chatuge, Hiwassee) have reduced the *land* area.

** About 90% of the Bradley soil series, as formerly mapped, and also about 70% of the Chesterfield soil series are placed with the Piedmont. This alignment differs from all published soil surveys of the Coastal Plain-Piedmont Plateau border counties. The actual acreage of these two soil series probably is about one-sixth of that shown on the county soil survey maps. Large-scale soil maps made since 1934 indicate that a considerable portion of the areas once classed as the Bradley and Chesterfield soil series may be placed with the Appling, Cecil, Durham, Helena, and other soil series. The older surveys, with their one-inch-to-mile scale, could not show the intricate detail present.

Soils of the Coastal Plain Region

The units of the Key to the Coastal Plain Soils of North Carolina are based on this system:

1. Consistence and Texture of the Subsoil (as, Firm sandy clay)
   A. Soil Drainage (as, Somewhat poorly drained)
      (1) Color, consistence, and texture of the surface soil (as, Gray to dark gray friable sandy loam)
         a. Color, consistence, structure, and texture of the subsoil (as, Yellow............mottled with gray firm sandy clay, medium blocky structure)
         b. Thickness of profile (as Deep)
         c. Slope or gradient range (as 0-2%)
         Soil series name (as Dunbar). The letters A and B refer to surface soil and subsoil, as A1 for the upper portion of the surface layer, B1 for the upper portion of the subsoil. (See Figure 7, p 23.)

The various items in this Key are disclosed below:

1. The seven major soil groups based on the consistence and texture of the subsoils under moist field conditions, together with an organic soil group and a group of miscellaneous materials, are:

I. Soils with *Loose Sand Subsoils*
II. Soils with *Sand to Loamy Sand Subsoils*
III. Soils with *Sandy Loam to Friable Sandy Clay Loam Subsoils*
IV. Soils with *Firm Sandy Clay Subsoils*
V. Soils which are friable *Silt Loams or Very Fine Sandy Loams* throughout the profile.
VI. Soils with *Very Firm Sandy Clay, Silty Clay, or Clay Subsoils*
VII. Soils with *Hardpans*
VIII. *Organic Soils*
IX. *Miscellaneous* Soil Materials

(See pp. 24-29 for a discussion of color, consistence, texture, and structure.)

A. Soil drainage terms, as described previously, (p. 29) and the code structure:
   AAA. Excessively drained
   AA. Somewhat excessively drained
   A. Well drained
   B. Moderately well drained
   C. Somewhat poorly drained
   D. Poorly drained
   E. Very poorly drained

B. The following terms are used to express total depth or thickness of profile over material differing from the subsoil:
   Deep—more than 50 inches thick
   Moderately deep—30 to 50 inches
   Shallow—20 to 30 inches
   Very shallow—under 20 inches

C. Slope or gradient percentages refer to rise in feet per 100 feet horizontal distance. Thus, 10% means a slope rise of 10 feet per 100.

In addition, the following general information is supplied:

(1) The Great Soil Group and Low Soil Family to which each soil series

belongs are shown. (A *Low Soil Family* is composed of two or more soil series which are generally similar in texture of the subsoils, drainage, degree of development, degree of weathering, size of profile, and sequence of horizons, and commonly have similar use in agriculture.)

(2) The common occurrence or geographic position of the soil series within the region is indicated by letter symbol:

L—Lower Coastal Plain or Tidewater
M—Middle Coastal Plain
U—Upper Coastal Plain

(3) The names of the states where the soil occurs also are shown by letter symbol. For example:

L: NC-NJ means that the soil is found in the Lower Coastal Plain region from North Carolina to New Jersey.

MU: Va, NC, Ga, Fla, Ala, Miss, La, Ark, East Tex, or simply Va-Tex means that the soil is found in the Middle and Upper Coastal Plain regions of Virginia, North Carolina, South Carolina, Georgia, Florida, Alabama, Mississippi, Louisiana, Arkansas, and East Texas.

(An asterisk (*) following the soil series name indicates a tentative soil series, not established by the Soil Survey Division of the U. S. Department of Agriculture.)

Key to the Soils of the Coastal Plain Region

I. Soils with Loose Sand Subsoils[14] [15]

AAA. Excessively drained soils

1. Light gray loose sand or coarse sand surface soil
   a. Pale yellow to yellow loose sand or coarse sand subsoil, nearly always more than 100 inches deep. Slopes up to 40%, mostly 5-20% ---- *Kershaw*
   Great Soil Group—Regosol, Low Soil Family—Lakeland (Sandhills of NC, SC, Ga; Lake region of Fla; isolated areas in Ala, Ark, Miss, Tex)
2. Light gray to white loose sand surface soil
   a. Yellowish-brown to reddish-yellow loose sand subsoil, becoming lighter in color with depth. Moderately deep soil. Slopes 1-12%, mostly 2-5% ---- *Lakewood*
   Regosol, Lakewood (L: NJ-Ala; only in relatively few and small areas)
3. Almost white to "pepper and salt" gray-white loose sand surface soil (sometimes "snow-white" on surface)
   a. Light gray to almost white loose sand subsoil; moderately deep. Slopes, 1-8%, mostly 2-4% ---- *St. Lucie*
   Regosol, St. Lucie (LM: Fla, Ga, SC, NC)

A. Well drained soil

1. Brownish-gray to pale brown loose sand surface soil
   a. Yellowish-brown to brown loose sand subsoil, mottled with yellow and gray at 24-32 inches; moderately deep. Slopes 0-5%, mostly 1-3% ---- *Wando**
   Regosol, Lakewood (L: NC, SC: only a few small areas)

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[14] The soils in this group have somewhat poorly defined horizons. Hence the letter designations A, B, C, are not used.

[15] See Glossary, Appendix pages 171-175, for definition of terms used in soil key.

II. Soils with Sand to Loamy Sand Subsoils[16]

AA. Somewhat excessively drained soils

1. Brown to dark brown loose sand to loamy sand in upper portion, reddish-brown loose sand or loamy sand in lower portion of the surface soil.
   a. Red to dark reddish-brown loose sand to loamy sand subsoil. Deep soil. Slopes, 0-20%, mostly 1-6% .... *Americus*
   Great Soil Group—Regosol, Low Soil Family—Americus (UM: Mostly in Ga, some in NC-Tex) Formerly called "Red Bay sand"
2. Grayish-brown to dark brown loose sand or loamy sand in upper portion, and reddish-brown to reddish-yellow loose sand or loamy sand in lower portion of the surface soil
   a. Yellowish-brown, reddish-brown, or reddish-yellow loose sand to loamy sand subsoil; deep. Slopes 0-20%, mostly 2-8% .... *Eustis*
   Regosol, Lakeland (UM: NC-Tex) Formerly called "Ruston sand"
3. Grayish-brown to pale yellow loose sand to loamy sand surface soil
   a. Light yellowish-brown or pale yellow in upper portion, and pale yellow and gray in lower portion, loose sand to loamy sand subsoil; deep to very deep. Slopes 0-20%, mostly 2-7% .... *Lakeland*
   Regosol, Lakeland (UM, very little L: Va-Tex) Formerly called "Norfolk sand"
4. Gray to light gray (often gravelly) sand to loamy sand surface soil
   a. Yellowish-gray to red and yellow highly variable, but usually gravelly sand or loamy sand subsoil; shallow to very shallow. Slopes up to 50%, but mostly 6-20% .... *Guin*
   Regosol, Guin (UM: Very little in NC, Tenn, Miss, Ala, Ga)

A. Well drained soils

1. Gray to grayish-brown sand to loose loamy sand surface soil
   a. Light yellow to yellowish-brown in upper portion, and yellowish-brown in lower portion, loose sand to loamy sand subsoil; deep. Slopes mostly 1-4% .... *Evesboro*
   Regosol, Lakeland (L: NC-NJ, but very little in NC)
2. Grayish-brown to brown loose sand to loamy sand surface soil
   a. Light yellowish-brown loose sand to loamy sand subsoil, becoming more yellowish with depth (to about 42 inches); deep. Slopes mostly 1-3% .... *Galestown*
   Regosol, Galestown (L: NC-NJ)
   b. Brown sand to loamy sand subsoil with lighter brown or yellowish-brown color below 28-32 inches; moderately deep. Slopes mostly 1-4% .... *Choptank*
   Regosol, Galestown (L: NC-NJ, but very little in NC)
3. Gray, light gray, or light brownish-gray loose sand to loamy sand surface soil
   a. Light gray loose sand to loamy sand subsoil with a few white and pale yellow mottlings throughout; deep. Slopes mostly 1-3% .... *Blanton*
   Regosol, Lakeland (ML: NC-Fla)

BC. Moderately well drained to somewhat poorly drained soil

1. Gray to light brownish-gray loose sand to loamy sand surface soil
   a. Pale yellow to light yellowish-brown loose sand to loamy sand upper

[16] Although the soils in Group II have horizons more clearly defined than those of soils in Group I, there is some question as to horizon designation in this Key.

subsoil; mottled pale yellow and gray sand lower subsoil; moderately deep. Slopes mostly 1-3% .... *Klej*
Regosol, Braden (ML: NC-NJ)

CD. Somewhat poorly to poorly drained soil
1. Dark brown to brownish-black sand to loose loamy sand surface soil
a. Pale brown to pale yellow sand to loamy sand upper subsoil which is faintly mottled with gray; light gray to pale yellow sand to very friable sandy loam lower subsoil which is mottled with yellow and brown; moderately deep. Slopes 0-2% .... *Scranton*
Great Soil Group—Low-Humic Gley, Scranton (LM: NC-Ala)

D. Poorly drained soil
1. Gray to dark gray loose sand to loamy sand surface soil
a. Light gray to white faintly mottled with yellow very loose sand ("quicksand") subsoil; deep. Slopes 0-5%, mostly under 2% .... *Plummer*
Low-Humic Gley, Plummer (LM: NJ-La)

E. Very poorly drained soils
1. Very dark gray to black sand to loamy sand surface soil, 5-20 inches thick, and containing considerable organic matter
a. Light gray or gray loose sand subsoil; deep. Slopes 0-1% .... *Rutlege*
Humic-Gley, Rutlege (LM: NJ-Tex) Formerly called "Portsmouth sand"
2. Dark brown to black loam (organic loam) surface soil 18-35 inches thick
a. Light gray loose sand subsoil; deep. Slopes 0-1% .... *Elwell**
Humic-Gley, Rutlege (LM: NC)

III. Soils with Sandy Loam to Friable Sandy Clay Loam Subsoils

A. Well drained soils
1. Brown to dark reddish-brown sand or loamy sand A_1, A_3, and dark reddish-brown sand, loamy sand, or very friable sandy loam A_2 or A_3 surface soils
a. Red to dark red sandy loam to friable sandy clay loam (B) subsoil with soft granular or crumb structure; deep. Slopes 1-10%, mostly 2-5% .... *Red Bay*
Great Soil Group—Red-Yellow Podzolic, Red Bay (UM: NC-Ala)
2. Gray-brown to yellowish-brown sand or loamy sand (A_1), and pale yellow to light yellowish-brown sand, loamy sand, or very friable sandy loam (A_2) surface soils
a. Yellowish-red friable sandy loam upper (B_1) subsoil and red sandy loam to friable sandy clay loam (B_2) lower subsoil which has weak medium subangular blocky structure; deep. Slopes 1-20%, mostly 2-6% .... *Orangeburg*
Red-Yellow Podzolic, Ruston (UM: NC-Tex)
b. Reddish-yellow or yellowish-brown friable sandy loam to sandy clay loam (B_1), reddish-yellow to yellowish-red friable sandy clay loam with weak medium subangular blocky structure (B_2), and yellowish-red friable sandy clay loam with subangular blocky structure (B_3) subsoil; deep. Slopes 1-20%, mostly under 7% .... *Ruston*
Red-Yellow Podzolic, Ruston (UM: NC-Tex)
3. Pale brown sand (A_1), brown or yellowish-brown sand, loamy sand, friable sandy loam, or friable loam (A_2) surface soils
a. Yellowish-brown to reddish-brown sandy loam to friable sandy clay loam

with weak subangular blocky structure (B_1), and reddish-brown friable sandy clay loam with weak medium subangular blocky structure (B_2) subsoil; deep. Slopes 1-15%, mostly under 5% .... *Rumford*
Red-Yellow Podzolic, Ruston (ML: Va, little in NC)

b. Brown to yellowish-brown sandy loam to friable sandy clay loam moderately deep (20-32" thick) subsoil (B_2) which is underlain with yellowish-brown to brown sandy material. Subsoil has moderately medium subangular blocky structure, is moderately firm in place, non-sticky when wet. Slopes 1-8%, mostly under 4% .... *Sassafras*
Red-Yellow Podzolic, Ruston (ML: NC-NJ, but little in NC)

4. Gray (A_1) to pale yellow (A_2) sand, loamy sand, or loose sandy loam surface soils
   a. Yellow to brownish-yellow or light yellowish-brown sandy loam to friable sandy clay loam (B_1) with weak medium subangular blocky structure, and light yellowish-brown friable sandy clay loam with moderate to weak subangular blocky structure (B_2) subsoil; deep. Slopes 1-8%, mostly under 4% .... *Norfolk*
   Red-Yellow Podzolic, Norfolk (UM: Very little L: Va-Tex)
   b. Yellowish-brown sandy loam to friable fine sandy clay loam shallow to moderately deep (6-20" thick) subsoil (B_2) which is underlain with yellowish-brown sandy material. Subsoil has weak medium crumb to fine subangular blocky structure, and is more sandy than the Norfolk. Slopes 1-8%, mostly under 5% .... *Kenansville*
   Red-Yellow Podzolic, Norfolk (ML: NC) Formerly called "Norfolk loamy sand"

B. Moderately well drained soils
1. Grayish-brown, gray (A_1) to pale yellow (A_2) sand, loamy sand, or very friable sandy loam surface soils
   a. Yellow to brownish-yellow sandy loam to friable sandy clay loam (B_1) with very weak fine subangular blocky structure; yellow, faintly streaked with pale yellow, friable sandy clay loam (B_{21}) with moderate medium subangular blocky structure; and brownish-yellow mottled with light gray friable sandy clay loam (B_2, beginning at 24-30") with weak subangular blocky structure; deep. Slopes 0-3% .... *Goldsboro*
   Red-Yellow Podzolic, Altavista (UML: NC)
2. Grayish-brown (A_1) to pale brown (A_2) loose loamy sand to very friable fine sandy loam surface soil
   a. Brownish-yellow to yellow sandy loam to friable fine sandy clay loam shallow to moderately deep (10-30") subsoil (B_2) which becomes faintly mottled with gray at 18-30 inches below the soil surface, and is usually underlain with mottled gray and yellowish-brown sandy material. The subsoil has weak medium crumb to fine subangular blocky structure. It contains more sand than the Goldsboro, and has somewhat duller color. Slopes 1-4% .... *Woodstown*
   Red-Yellow Podzolic, Norfolk (L: NC-NJ)

C. Somewhat poorly drained soils
1. Gray to dark gray sand or loamy sand (A_1), and gray loamy sand or very friable sandy loam (A_2) surface soils
   a. Pale yellow loamy sand to fine sandy loam upper (B_2) subsoil which is

lightly mottled with brown and gray and has weak fine crumb to weak subangular blocky structure; mottled with light gray, yellow, and brown sandy loam to fine sandy clay loam lower (B_3) subsoil which has weak fine to medium crumb structure; deep. Slopes mostly under 3% .... *Lynchburg*

Low-Humic Gley, Lynchburg (MLU: NC-Miss)

b. Pale yellow loamy sand to fine sandy loam upper subsoil (B_2) which is lightly mottled with olive brown and gray and has fine subangular blocky structure; and mottled light gray, yellow, and brown sandy loam, fine sandy loam, or sometimes friable sandy clay loam lower subsoil (B_3) which is moderately deep (10-13" thick), has same structure as layer above, and is usually underlain with light gray sandy material. Contains more sand than Lynchburg, and has duller color. Slopes mostly under 3% .... *Dragston*

Low-Humic Gley, Dragston (L: NC-NJ)

2. Gray to very dark gray loamy sand to fine sandy loam surface soils (A)

a. Mottled pale yellow, brownish-yellow, and light gray fine sandy loam subsoil (B_3) which has weak fine crumb structure. It is underlain at 32-38" below the soil surface by loamy fine sand or sand. Slopes mostly under 2% .... *Stono*

Low-Humic Gley, Dragston (L: Little in NC, SC. Ga)

D. Poorly drained soils

1. Gray to dark gray sand or loamy sand (A_1), and gray loamy sand or friable sandy loam (A_2) surface soils

a. Light gray sandy loam to fine sandy clay loam subsoil (B_2 Gley) which is mottled with yellow and sometimes with yellowish-red. It is sticky when wet, but friable when moist or dry. The structure is weak medium crumb to weak subangular blocky; deep. Slopes under 2% .... *Rains*

Low-Humic Gley, Rains (LM: Va-Tex) Formerly called "Plummer sandy loam"

2. Gray to dark gray sand or loamy sand (A_1), and gray sand, loamy sand, or friable sandy loam (A_2) surface soils

a. Light gray sandy loam to friable fine sandy clay loam moderately deep (15-30" thick) subsoil (B_2G) having weak medium crumb structure. It is mottled with yellowish-brown, and usually is underlain with light gray sandy material. Has more sand throughout than Rains, and also duller color. Slopes under 2% .... *Fallsington*

Low-Humic Gley, Fallsington (L: NC-NJ)

E. Very poorly drained soils

1. Very dark gray to black loamy sand, friable sandy loam, or loam surface soils (A)

a. Light gray sandy loam to friable sandy clay loam upper (B_2G) subsoil which is faintly mottled with yellow or yellowish-brown and has weak medium subangular blocky structure; gray sandy loam to friable sandy clay loam lower (CG) subsoil which is often mottled with yellowish-brown, is slightly sticky when wet but friable moist or dry, and has weak medium crumb structure; deep. Slopes under 2% .... *Portsmouth*

Great Soil Group—Humic-Gley, Portsmouth (LMU: NJ-Tex)

b. Gray to light gray sandy loam to friable fine sandy clay loam upper sub-

soil (B_2G) which is mottled with yellowish-brown; gray sandy loam to very friable fine sandy clay loam moderately deep (10-24" thick) lower (CG) subsoil which usually is underlain with gray sandy material. The subsoil has weakly developed fine crumb structure. Soil has more sand throughout than Portsmouth. Slopes under 2% .... *Pocomoke*
Humic-Gley, Portsmouth (LM: NC-NJ)

IV. Soils with Firm Sandy Clay Subsoils

A. Well drained soils

1. Dark reddish-brown loamy sand or sandy loam ($A_{1,3}$) or red friable sandy clay loam surface soils (A_3, B_1 or A_p)[17]
   a. Red sandy clay subsoil (B_2) which is slightly plastic when wet and hard when dry. It has weak medium subangular blocky structure. Deep soil. Slopes up to 18%, mostly 3-7% .... *Greenville*
   Red-Yellow Podzolic, Greenville (UM: Fla-SC, apparently none in NC)
2. Grayish-brown or light yellowish-brown loose sandy loam to friable very fine sandy loam ($A_{1,2}$) or brown to reddish-brown sandy clay loam surface soils (A_2, B_1 or A_p)
   a. Red sandy clay subsoil (A_2, B_1 or A_p) which is slightly plastic when wet and hard when dry. It has weak medium subangular blocky structure. Deep soil. Slopes up to 18%, mostly 3-7% .... *Magnolia*
   Red-Yellow Podzolic, Linker (UM: NC-Fla, but little in NC)
   b. Yellowish-brown (B_1) to reddish-brown (B_2) firm fine sandy clay subsoil which is slightly plastic when wet and hard when dry. It has moderate medium subangular blocky structure. Deep soil. Slopes to 8%, but mostly under 4% .... *Faceville*
   Red-Yellow Podzolic, Ruston (UM: NC-Fla, but little in NC)
3. Gray to brownish-gray loose sandy loam, fine sandy loam, or friable very fine sandy loam ($A_{1,2}$) usually less than 9 inches thick, or sandy clay loam (A_2, B_1 or A_p) surface soils
   a. Yellowish-brown or brownish-yellow fine to very fine sandy clay loam or fine sandy clay subsoil (B_2) which is slightly plastic when wet and hard when dry. It has weak medium subangular blocky structure. Deep soil. Slopes mostly 1-4% .... *Marlboro*
   Red-Yellow Podzolic, Norfolk (UM: Va-Fla, also Ark)
4. Gray to dark grayish-brown loose sandy loam to sandy clay loam surface soils ($A_{1,2}$) with numerous small, rounded, brown to almost black hard iron concretions ("pebbles")
   a. Yellow to brownish-yellow sandy clay loam to sandy clay subsoil (B_2), with numerous "pebbles", which is slightly plastic when wet and hard when dry. It has weak medium subangular blocky structure. Moderately deep soil. Slopes 2-5% .... *Tifton*
   Red-Yellow Podzolic, Tifton (UM: Ga, Ala, SC, Fla, very little in NC)
   b. Yellowish-red, red, or reddish-brown sandy clay loam to fine sandy clay subsoil (B_2), with numerous "pebbles", which is slightly plastic when wet and hard when dry. It has weak medium subangular blocky structure. Moderately deep soil. Slopes 2-5% .... *Carnegie*
   Red-Yellow Podzolic, Tifton (UM: Ga, Ala, SC, Fla, a few spots in NC)

[17] When the surface soil of a soil series in section A, Nos. 1-6, is sandy clay loam probably most of the original surface has been removed by accelerated erosion. Ap refers to the plow layer or the approximate upper six inches of the profile.

5. Grayish-brown to light yellowish-gray sand, loamy sand, or sandy loam, ($A_{1, 2}$) or sandy clay loam (A_2, B_1 or A_p) surface soils
   a. Yellowish-brown to reddish-brown or yellowish-red *hard* sandy clay subsoil (B_2) which is brittle when dry and sticky when wet; often less than 32-36 inches deep. The subsoil breaks into large angular blocks under considerable pressure, and when crushed it crumbles to a fine granular structure. Slopes up to 25%, mostly 4-9% .... *Vaucluse*
   Red-Yellow Podzolic, Hoffman (In Sandhills mostly, NC, SC, Ala, Ga, also Miss)

6. Gray to very light gray sand, loamy sand, sandy loam, ($A_{1, 2}$) or sandy clay loam (A_2, B_1 or A_p) surface soils
   a. Yellow to brownish-yellow *hard* sandy clay subsoil (B_2) which is brittle when dry and sticky when wet; often less than 32-36 inches deep. The subsoil breaks into large angular blocks under considerable pressure, and when crushed it crumbles to a fine granular structure. Slopes up to 18%, mostly 3-8% .... *Gilead*
   Red-Yellow Podzolic, Hoffman (In Sandhills mostly, NC, SC, Ala, Ga, also Miss)
   b. Varicolored (yellow, gray, pink, and white) non-uniform sandy clay, clay loam, or clay subsoil (BC) which is generally hard but brittle when dry and sticky when wet; often much less than 36 inches deep. Slopes up to 40%, but mostly 8-20% .... *Hoffman*
   Red-Yellow Podzolic, Hoffman (In Sandhills mostly, NC, SC, Ga)

B. Moderately well-drained soil
   1. Very dark grayish-brown, brownish-gray, or gray loose sandy loam to friable very fine sandy loam (A_1), grayish-brown (A_2) surface soils usually less than 9 inches thick
      a. Yellowish-brown or brownish-yellow fine to very fine sandy clay loam or friable sandy clay (B_2); brownish-yellow faintly streaked with pale yellow fine sandy clay (B_{22}); and mottled brownish-yellow, light brownish-gray, and yellowish-red fine sandy clay (B_3) subsoil, which has moderate medium subangular blocky structure. It is moderately firm when moist, hard when dry, and slightly plastic when wet. Deep soil. Slopes mostly under 2% .... *Duplin*
      Red-Yellow Podzolic, Altavista (UM: NC)

C. Somewhat poorly drained soil
   1. Gray to dark gray or grayish-brown (A_1), gray (A_2) loose sandy loam to friable very fine sandy loam surface soils
      a. Yellow or pale yellow friable sandy clay loam to very fine sandy clay upper (B_1, 6-20″ thick) subsoil lightly mottled with gray; mottled yellow, gray, (and sometimes red) firm sandy clay loam to very fine sandy clay lower (B_2) subsoil. The B_2 layer has weak medium subangular blocky structure, and is slightly plastic when wet and slightly hard when dry. Deep soil. Slopes mostly under 2% .... *Dunbar*
      Low-Humic Gley, Dunbar (UML: Va-Fla, Ala, Miss)

D. Poorly drained soil
   1. Gray to dark gray friable sandy loam, fine sandy loam, or loam surface soils (A)
      a. Light gray firm fine sandy clay upper (B_1, 7-15″ thick) subsoil mottled

with yellow and brown; light gray firm fine sandy clay lower (B_2) subsoil mottled with yellow and sometimes red. The B_2 layer has weak medium subangular blocky structure, and is slightly plastic when wet and slightly hard when dry. Deep soil. Slopes under 2% .... *Faison**
Low-Humic Gley, Coxville (LM: NC)

E. Very poorly drained soil
1. Very dark gray to black loam surface soil (A) 18-30 inches thick
a. Very dark gray, grayish-brown, or gray smooth silt loam, silty clay loam, silty clay, or fine sandy clay deep subsoil (C Gley). It is slightly plastic when wet; hard when dry, and breaks into small angular blocks. Slopes under 2% .... *Hyde*
Humic-Gley, Bayboro (L: Va-Fla)

V. Soils Which Are Friable to Moderately Firm Silt Loams or Very Fine Sandy Loams Throughout Their Profiles.

B. Moderately well-drained soil
1. Brown very fine sandy loam to silt loam surface soils (A)
a. Yellowish-brown very fine sandy loam to silt loam subsoil (B_2) faintly mottled with light gray at 18-30 inches (B_3). The entire subsoil is friable, slightly sticky when wet, slightly hard when dry, non-plastic; weak fine crumb structure; deep. Slopes under 3% .... *Nixonton*
Red-Yellow Podzolic, Ruston (L: NC)

C. Somewhat poorly drained soil
1. Gray to brownish-gray very fine sandy loam to silt loam surface soils (A)
a. Pale yellow very fine sandy loam to silt loam upper (B_2), 12-20″ thick, subsoil lightly mottled with gray and brown; mottled pale yellow, light gray, and brown very fine sandy loam to silt loam lower (B_3) subsoil. The entire subsoil is friable, slightly sticky when wet, slightly hard when dry, non-plastic; weak fine crumb structure; deep. Slopes under 3% .... *Barclay*
Low-Humic Gley, Dragston (L: NC, Va, Md, Del)

D. Poorly drained soil
1. Grayish-brown to dark grayish-brown very fine sandy loam to silt loam surface soils (A)
a. Light brownish-gray very fine sandy loam to silt loam upper (B_2, 15-20″ thick) subsoil; light brownish-gray mottled with light olive gray very fine sandy loam to silt loam lower (B_3) subsoil. The entire subsoil is friable, slightly plastic when wet and slightly hard when dry, and has weak fine crumb structure; deep. Slopes under 2% .... *Pasquotank*
Low-Humic Gley, Fallsington (L: NC)

E. Very poorly drained soil
1. Very dark gray, very dark brown, or black very fine sandy loam or silt loam surface soils (A)
a. Intermingled very dark gray and light brownish-gray very fine sandy loam or silt loam subsoil (CG). The subsoil is friable, slightly plastic when wet and slightly hard when dry, and has weak fine crumb structure; deep. Slopes under 2% .... *Weeksville*
Humic-Gley, Portsmouth (L: NC)
(Note: The Nixonton, Barclay, Pasquotank, and Weeksville soil series occur only in the northeastern counties.)

VI. Soils with Very Firm Sandy Clay, Silty Clay, or Clay Subsoils

A. Well drained soils, or

Soils having medium to rapid surface runoff, but medium to very slow internal drainage or permeability

1. Light gray, gray, brownish-gray, or brown loamy sand to sandy loam surface soils (A) where not eroded; pale yellow, yellow, brown, or reddish-brown sandy clay loam to sandy clay surface soils where eroded (BC) or (B_1) or (A_p)

   a. Yellowish-brown, reddish-brown, or yellowish-red very firm to hard clay subsoil of variable depth but it is usually shallow and is mainly "parent material". Slopes up to 30%, but mostly under 12% ---------------- *Cuthbert*
   Regosol, Cuthbert (UM: From SC to Texas, but mostly in Gulf region. Little or none in NC)

   b. Highly mottled, mingled, or splotched red, light gray, yellow, and reddish-brown very firm to hard clay subsoil which is usually shallow and is mainly "parent material". Slopes up to 30%, mostly under 12% ---------------- *Susquehanna*
   Regosol, Susquehanna (UM: Chiefly in Ala, Ga, Miss, La, Ark, Tex; some in Va, NC, SC, Fla)

   c. Brown to reddish-brown very fine sandy clay, silty clay, or clay upper (B_2) subsoil; mottled brown, red, yellow, and gray firm but brittle silty clay or clay lower (B_3) subsoil. It is plastic when wet and very hard when dry. The structure is strong medium angular blocky. Deep to moderately deep soil. Slopes mostly 2-7% ---------------- *Shubuta*
   Red-Yellow Podzolic, Shubuta (UM: Gulf States)

   d. Reddish-brown to weak red very firm fine sandy clay to clay subsoil (B_2) which grades below 32-40 inches into gray shaly clay. The subsoil is very plastic when wet, hard when dry. The structure is strong angular blocky. Slopes 1-5% ---------------- *Boswell*
   Red-Yellow Podzolic, Boswell (M: NC-Tex)

   e. Yellowish-brown to brown or light reddish-brown fine sandy clay to silty clay upper (B_2, 8-20" thick) subsoil; yellowish-brown to reddish-brown mottled with yellow and gray very firm but brittle silty clay to clay lower subsoil (B_3). The entire subsoil is plastic to very plastic when wet and very hard when dry. The structure is strong medium angular blocky. Deep to moderately deep soil. Slopes mostly 2-7% ---------------- *Caroline*
   Red-Yellow Podzolic, Shubuta (M: Va, Md, NC)

   f. Dark red clay or very firm sandy clay subsoil (B_2), which is plastic when wet and very hard when dry. The structure is strong medium angular blocky. Deep to moderately deep soil. Slopes mostly 2-7% ---------- *Leroy**
   Red-Yellow Podzolic, Luverne, (UM: Ga, SC, Ala, a few spots in NC)

2. Grayish-brown (A_1) to brown (A_2) silt loam or very fine sandy loam surface soils

   a. Yellowish-brown firm silty clay loam to silty clay moderately deep (B_2, 18-30" thick) subsoil which usually is underlain with yellow to grayish-yellow sandy material. The subsoil has strong medium angular blocky structure. Slopes mostly 2-4% ---------------- *Matapeake*
   Red-Yellow Podzolic, Shubuta (L: Va, Md, NC)

B. Moderately well-drained soils, or

Soils having medium surface runoff, and medium to very slow permeability

1. Gray to pale yellow loamy sand to friable very fine sandy loam (and occasionally silt loam) surface (A_1) soils, pale yellow subsurface (A_2) of somewhat finer texture; brownish-yellow sandy clay loam to silty clay (A_2, B_1, or A_p) where eroded

   a. Yellow to brownish-yellow fine sandy clay loam to clay loam very tough upper (B_2, 9-24" thick) subsoil; mottled yellow, light gray, brown, and occasionally red, clay loam to clay lower (B_3) subsoil, which is very plastic when wet and very hard when dry. The subsoil has strong medium angular blocky structure. Moderately deep to deep soil. Slopes 1-8%, mostly 2-4% ---------- *Craven*
   Red-Yellow Podzolic, Shubuta (UML: NC, Va)

   b. Yellow, motlted with brown, sandy clay to silty clay loam tough upper (B_2, 7-12" thick) subsoil; mottled yellow and gray sandy clay, silty clay, or clay lower (B_3) subsoil, which is very plastic when wet, very hard when dry, and has strong medium angular blocky structure. Moderately deep to deep soil. Slopes 1-7%, mostly 2-5% ---------- *Eulonia*
   Red-Yellow Podzolic, Eulonia (L: SC-Fla, little in NC). Occupies lower-lying positions than the Craven.

2. Gray to olive gray fine sandy loam surface soil (A_1) brown or yellowish-brown subsurface (A_2) of somewhat finer texture; reddish fine sandy clay loam (A_2, B_2, or A_p) where eroded

   a. Red fine sandy clay upper (B_2, 7-12" thick) subsoil lightly mottled with yellow; weak red, slightly mottled with gray and pale yellow, hard and firm very fine sandy clay to clay lower (B_3, C_1) subsoil which is very plastic when wet, very hard when dry and has weak medium angular blocky structure. A moderately deep to somewhat shallow soil. Slopes mostly 1-3% ---------- *Fairhope*
   Great Soil Group: Planosol (Argipan), Fairhope (L: SC-Fla, little in NC)

3. Light brown (A_1) to grayish-brown (A_2) fine to very fine sandy loam or silt loam surface soils

   a. Yellowish-brown to brown loam to firm silty clay loam upper (B_2, 7-15" thick) subsoil; mottled brown, yellow, and gray firm clay loam, silty clay loam, or silty clay lower (B_3) subsoil which is plastic when wet and hard when dry. The structure is moderate medium angular blocky. A moderately deep soil. Slopes mostly 1-3% ---------- *Keyport*
   Red-Yellow Podzolic, Keyport (L: NC-NJ, little in NC)

   b. Yellowish-brown silt loam to silty clay loam upper (B_2, 7-16" thick) subsoil; yellowish-brown slightly mottled with gray firm silty clay loam lower moderately deep (B_3, 12-20" thick) subsoil which usually is underlain with yellowish-gray sandy material. The B_2 and B_3 layers have lenses or pockets of sandy material, but are firm when moist, plastic when wet, and very hard when dry. They have weak medium angular blocky structure. Slopes mostly 1-3% ---------- *Mattapex*
   Red-Yellow Podzolic, Shubuta (L: NC-NJ)

BC. Moderately well to somewhat poorly drained soil

1. Grayish-brown to very dark brown sandy loam to sandy clay loam surface soils (A_1) with lighter brown subsurface (A_2)

a. Dark yellowish-brown fine sandy clay loam to clay loam upper (B_2, 8-18" thick) subsoil; yellowish-brown clay, lightly mottled with yellow and gray, lower (B_3) subsoil which is very plastic when wet and very hard when dry; breaks into angular blocks under much pressure; white firm to very hard marl at 24-40 inches below the soil surface. Slopes 1-3% .... *Invershiel**
Low-Humic Gley, Invershiel (L: NC)

C. Somewhat poorly drained soils, or
Soils having slow surface runoff, and medium to very slow permeability

1. Gray to dark gray (A_1), gray to brownish gray (A_2) sandy loam to silt loam surface soils (sometimes eroded, the A_p or B_1 being yellowish-gray clay loam)

a. Mottled yellow, brown, and light gray very firm sandy clay to silty clay upper (B_2, 8-18" thick) subsoil; mottled gray, brown, and reddish-yellow very firm sandy clay, silty clay, or clay lower (B_3, 10-20" thick) subsoil which is very plastic when wet and very hard when dry. The structure is moderate medium angular blocky. Slopes mostly under 3% .... *Lenoir*
Low-Humic Gley, Lenoir (ML: NC, Va)

b. Pale yellow mottled with brownish-yellow firm sandy clay loam to fine sandy clay upper (B_2, 8-16" thick) subsoil; mottled light gray, brownish-yellow, and yellowish-red very firm sandy clay loam to fine sandy clay (B_3, 8-16" thick) subsoil which is usually underlain with mottled light gray and white sandy material. The B_2 and B_3 layers have lenses or pockets of sandy material, but are very firm when moist, plastic when wet, and very hard when dry. They have weak medium angular blocky structure. Slopes ranges from 1-3% .... *Bertie*
Low-Humic Gley, Bertie (ML: NC)

c. Yellow firm fine sandy clay upper (B_2, 8-15" thick) subsoil faintly mottled with gray; mottled gray and red firm fine sandy clay, silty clay, or clay lower (B_3, C_1) subsoil. The entire subsoil is plastic when wet and very hard when dry, and its structure is strong angular blocky. Slopes generally under 3% .... *Sawyer*
Low-Humic Gley, Lenoir (ML: Some in NC, but mostly in Gulf States, Okla, Ark)

D. Poorly drained soils, or
Soils having very slow surface runoff, and medium to very slow permeability

1. Gray or grayish-brown (A_1), light gray, or whitish (A_2) fine sandy loam to silt loam surface soils

a. Gray mottled with yellowish-brown silty clay to very firm clay upper (B_{21}), 6-14" thick) subsoil; intermingled gray, light gray, and yellowish-brown very firm silty clay or clay lower (BG) subsoil. The entire subsoil is plastic to very plastic when wet and very hard when dry; when moist it breaks into medium angular blocks. Slopes under 2% .... *Elkton*
Low-Humic Gley, Coxville (L: NC-NJ)

b. Gray mottled or streaked with strong yellow firm fine sandy clay to clay upper (B_2, 6-18" thick) subsoil; light gray faintly mottled with yellow clay loam to clay lower (B_3G, 7-15" thick) subsoil usually containing lenses or pockets of sandy material. The clay breaks into medium angular blocks when moist. Slopes mostly under 2% .... *Othello*
Low-Humic Gley, Coxville (L: NC-NJ)

2. Gray to very dark gray (A_1), gray (A_2) fine sandy loam, loam, silt loam, or silty clay loam surface soils
   a. Mottled gray, yellow, pale olive, and pale brown fine sandy clay to clay upper (B_2, 7-20" thick) subsoil; mottled light gray and yellow tough sandy clay to clay lower (B_3G, 10-24" thick) subsoil, often mottled or splotched with bright red. The lower subsoil is very firm when moist, very hard when dry, plastic when wet. In moist condition it will break into medium angular blocks. Slopes under 2% ---------- *Coxville*
   Low-Humic Gley, Coxville (LM: NC-Fla, Ala, Miss)
   b. Gray, streaked with brownish-yellow, fine sandy clay to clay upper (B_2G, 6-18" thick) subsoil; light gray, faintly mottled with yellow, smooth, plastic clay lower (B_3G) subsoil. Somewhat massive structure. Very plastic when wet, very hard when dry, but breaks into medium angular blocks when moist. Deep soil. Slopes usually under 2% ---------- *Bladen*
   Low-Humic Gley, Coxville (L: Va-Tex)
   c. Mottled gray, yellow, and pale brown fine sandy clay upper (B_2, 6-18" thick) subsoil; mottled light gray, yellow, and brown sandy clay to clay loam lower (B_3, 7-20" thick) subsoil; with lenses, thin layers, or small pockets of sandy material throughout the subsoil. The clay breaks into small to medium angular blocks when moist. Sandy material often occurs at depths of 38-42 inches. Slopes mostly under 2% ---------- *Tidewater**
   Low-Humic Gley, Coxville (L: NC)

E. Very poorly drained soils, or
Soils having such slow runoff that the surfaces are ponded part of the year, and with slow to very slow permeability
1. Very dark gray, very dark brown, or black loam surface soil (A) 7-20 inches thick
   a. Gray to dark gray smooth, very plastic clay subsoil (BG) mottled and streaked below 25 inches with brownish-yellow. Massive structure. Deep soil. Slopes mostly under 1% ---------- *Bayboro*
   Humic-Gley, Bayboro (L: Md-Fla)
   b. Very dark gray silty clay to bluish-black very plastic clay (BG) subsoil, white firm to very hard marl at 24-40 inches below the soil surface ---------- *Pender**
   Humic-Gley, Pender (L: NC)
2. Dark gray sandy loam to silt loam surface soils (A). (The soil occurs in limestone sinks, in flats, or depressed areas.)
   a. Gray tough clay subsoil (BG) which is mottled with yellow and brown ---------- *Grady*
   Humic-Gley, Eutaw (L: SC, Ga, Fla, Ala, very little in NC)

VII. Soils with Hardpans

BC. Moderately well to somewhat poorly drained soil
1. Gray or dark gray loamy sand (A_1), yellowish-gray to pale yellow sandy loam or fine sandy loam (A_2) surface soils with a thin hardpan, ½ to 3" thick, or accumulation of iron concretionary material at depths between 4 and 12 inches below the surface. In cultivated areas concretionary material or bits of "iron crust" generally are present on the surface and in the plow layer.
   a. Light yellowish-brown to pale olive sandy loam to friable fine sandy clay loam upper (B_2, 8-18" thick) subsoil; brownish-yellow and gray or olive-

gray friable to moderately firm fine sandy clay loam lower (B_3, 7-20" thick) subsoil. Moderately developed medium subangular blocky structure. Slopes under 3% .... *Onslow*
Great Soil Group: Ground-Water Podzol, Onslow (LM: Va-Fla)

C. Somewhat poorly drained soils
1. Gray or dark gray ("pepper and salt") loose sand surface layer (A_1) with very light gray, yellowish-white, or white loose sand subsurface (A_2)
   a. Dark brown to brownish-black firm to very dense organic hardpan, 2-6 inches thick, usually at depths between 10 and 30 inches below the soil surface, and underlain by brownish-gray, gray, or yellowish-brown loose sand. Slopes under 2% .... *Leon*
   Ground-Water Podzol, Leon (L: NJ to Ala; but mostly in Fla, Ga)
2. Light gray, gray, or dark gray loose sand surface soil (A), light gray to yellowish-white loose sand (subsoil) 30-40 inches thick
   a. Dark brown to brownish-black moderately friable hardpan-like layer, 3-8 inches thick, at depths generally below 30 inches. Slopes under 2% .... *Immokalee*
   Ground-Water Podzol, Immokalee (L: Fla-NC)

CD. Somewhat poorly to poorly drained soil
1. Dark gray to brownish-black sand or loamy sand surface (A) soil
   a. Dark brown to brownish-black friable stain-layer or moderately firm to lightly cemented hardpan, 3-7 inches thick, usually within 12-15 inches of the surface, and underlain by gray, yellowish-gray or brown sand or loamy sand. Slopes under 2% .... *Ona*
   Ground-Water Podzol, Leon (L: Fla-NC)

DE. Poorly to very poorly drained soil
1. Brownish-black or black sand or loamy sand surface (A) soils
   a. Brownish-black or black firm to very dense hardpan, 2-8 inches thick, usually within 12-18 inches of the surface, and underlain by gray or brownish-gray sand or loamy sand. Slopes 0-1% .... *St. Johns*
   Ground-Water Podzol, Leon (L: NJ-Fla, but mostly in Fla, Ga)

   NOTE: Throughout the Middle and Lower Coastal Plain there are occasional areas of moderately well to somewhat poorly drained soils which have "brown stain" layers at depths of 4 to 24 inches below the surface. However, the stain layer seldom is even slightly cemented or hard.

VIII. Organic Soils

(Soils composed predominantly of organic material)

E. Very poorly drained soil
1. Brown or dark brown soft and somewhat spongy or fibrous partially decomposed vegetation in which bits of twigs, bark, and leaves are readily distinguishable; usually contains very little (25% or less) mineral material .... *Peat*
   Peat (L: NJ-Fla-Gulf region)
2. Brownish-black to black soft and smooth to almost slick decomposed vegetation in which plant remains are seldom distinguishable; usually contains little (35% or less) mineral material .... *Muck*
   Muck (L: NJ-Fla-Gulf region)
3. Brown to black partially decomposed vegetation intermediate between Peat and Muck .... *Mucky Peat*
   Muck (L: NJ-Fla-Gulf region)

4. Muck with a noticeable content (up to 50%) of very fine sand, silt, or clay .... *Pamlico Muck*

Muck, Pamlico (L: NC, Va)

NOTE: There are vast areas of Peat and Muck in North Carolina. The depth of the organic material ranges from 20 inches to 8 feet, but is mostly less than 4 feet. The underlying mineral soil materials are highly variable, often ranging from loose sand to clay within short distances, but usually are of sandy character. The surface layers of all of the organic soil areas apparently have been burned severely more than three times, because charcoal and ashes are common on the present surface. The "burns" have removed between 12 and 30 inches of the original surface layer, sometimes probably much more on areas with artificial drainage (See Pl. 7, p. 140).

IX. Miscellaneous Soil Materials

AAA. Well drained to excessively drained soil materials

1. Hills of loose sand (15 to 100 feet or higher) associated with Coastal Beach, usually very near the Atlantic Ocean (or Gulf of Mexico), and subject to constant movement by wind .... *Dunesand* (NJ-Tex)
2. Hills composed of smooth or rounded gravel mixed with sand occuring (1) locally near Lillington along the Cape Fear River in Harnett County, (2) in a few places in southeastern Anson County, and (3) in spots in southwestern Richmond County, North Carolina; locally also in SC, Ga, Ala .... *Gravel Hills*

A. Well drained to excessively drained soil material which is subject to occasional or frequent overflow

1. Sand, gravel, and shells along the beaches adjacent to the Atlantic Ocean (and the Gulf of Mexico) .... *Coastal Beach* (NJ-Tex)

DE. Poorly drained soil materials which are permanently wet or subject to very frequent overflow

1. Tidal flats, often composed largely of silt but sometimes clayey and occasionally sandy, located near or adjacent to the coast and outer land areas of the various coastal sounds, and which are occupied by salt-tolerant grasses and similar vegetation .... *Tidal Marsh* (NJ-Tex)
2. Tidal flats, usually composed of silt but sometimes clayey and occasionally sandy, located near or adjacent to the upland and inner land areas of the various coastal sounds, and which are occupied by fresh water grasses, lilies, and other low-growing vegetation .... *Fresh Water Marsh* (NJ-Tex)
3. Mixed or very non-uniform soil materials deposited along stream courses, usually wet much of the year, and always subject to overflow .... *Swamp* (Pa-Tex) (Also listed under Alluvial soils.)

Soils of the Coastal Plain Stream Terraces

Along many streams there are some areas of soils which occupy terrace or bench-like positions. These stream terraces range in width from a few feet to two or three miles or more, and their soils have formed from materials long ago washed out of higher-lying soils upstream and deposited along the stream floodplain.

As the streams slowly cut deeper channels, the areas of floodplain soil materials gradually became elevated until they now occupy the benchlike position. The relief of the terraces is nearly level to moderately sloping, usually both toward the stream and downstream.

Locally there may be swales, depressions, or hummocky areas. Occasionally there are sharp breaks from the terraces to the first bottomland or the present floodplain, and sometimes rather abrupt rises to a higher-lying terrace or to the upland. On the other hand, some terraces may merge gradually with the lower-lying floodplain soils or grade imperceptibly into the upland.

The Coastal Plain stream terraces are less distinct landscape forms than those of the Piedmont and Mountain regions. This is due largely to: (1) the generally less sloping overall relief of the Coastal Plain (less change in elevation across the landscape); and (2) the older and more definitely established drainage pattern of the Piedmont and the Mountains.

The stream terraces of the Coastal Plain region may be placed in two groups according to their topographic positions with respect to the stream channels: (1) high terraces, or those sufficiently elevated to be above all except the very high floods; and (2) low terraces, or those only a few feet above the bottomlands and which may overflow occasionally.

On the high terraces, which have gently sloping relief with relatively few flat areas, most soils are in the well drained or moderately well drained groups. These better drained soils have subsoil colors which range from reddish-brown to pale yellow.

On the low terraces, the relief is nearly level, and many soils are somewhat poorly drained. The subsoil colors of soils in the poorly drained groups range from pale yellow and gray to very dark gray or almost black.

The code structure is:

I. Consistence of subsoil
  A. Soil drainage
    1. Color, consistence, texture, of surface soil
      a. Color, consistence, texture, of subsoil
         Structure of subsoil
      b. Profile thickness
      c. Slope gradient—overall range, average range
      d. Occurrence—High, Low Terrace
         ---------- *Soil Series Name*
         Great Soil Group, Low Soil Family (States where soil occurs). (Resemblance to upland soils, or other comment)

Key to Soils on the Stream Terraces of the Coastal Plain Region

I. Soils with Loose Sand or Loamy Sand Subsoils

A. Well drained to somewhat excessively drained soils

1. Brown (A_1) to pale brown ($A_{1, 2, 3}$) loose sand or loamy sand surface soils; strong brown, yelowish-brown, or yellowish-red loose sand or loamy sand subsoil ($B_{1, 3}$); moderately deep to deep. Slopes 1-12%, mostly 1-5%. Usually occurs on stream side of high terraces ---------- *Independence*
   Regosol, Lakeland (Va-Tex)
   (Independence resembles the Eustis soil)

2. Ligh yellowish-brown (A_1) to pale yellow ($A_{1, 2, 3}$) loose sand or loamy sand surface soils; light yellowish-brown to brown loose sand or loamy sand subsoil (B_1, B_3). Moderately deep to deep soil. Slopes 1-10%, mostly 1-4%. Usually occurs on stream side of high or low terraces ---------- *Huckabee*
   Regosol, Lakeland (Va-Tex)
   (Huckabee resembles the Lakeland soil)

BC. Moderately well to somewhat poorly drained soil

1. Light brownish-gray to pale brown loose sand or loamy sand surface soils ($A_{1,\,2}$); pale yellow loose sand or loamy sand subsoil ($B_{1,\,3}$) which is mottled with gray. Moderately deep soil. Slopes 0-3%, mostly under 2%. On high and low terraces, often near the upland side .... *Barth*
   Regosol, Braden (NC-La)
   (Barth resembles the Klej soil)

D. Poorly drained soil

1. Gray to light gray or grayish-brown loose sand or loamy sand surface soils ($A_{1,\,2}$); gray to light gray sand or loamy sand upper (B_1) subsoil which is lightly mottled with gray, and mottled gray and brownish-yellow sand or loamy sand lower (B_3) subsoil. Moderately deep soil. Slopes 0-2%. Mainly on low terraces, often next to the upland or low ridges surrounded by soils even more poorly drained .... *Beautancus**
   Low-Humic Gley, Plummer (NC)
   (Beautancus resembles the Plummer soil)

E. Very poorly drained soil

1. Dark gray to almost black sand or loamy sand surface soils (A), apparently containing considerable organic matter; gray to light gray sand or loamy sand subsoil (B_3) which is mottled with brown or yellow. Moderately deep to deep soil. Slopes 0-1%. On high and low terraces, generally adjacent to the upland .... *Calypso**
   Humic-Gley, Rutlege (NC)
   (Calypso resembles the Rutlege soil)

II. Soils with Sandy Loam to Friable Sandy Clay Loam Subsoils

A. Well drained soils

1. Dark grayish-brown (A_1) to brown or strong brown (A_2 or A_p) loose loamy sand to very friable sandy loam surface soils; yellowish-red to red sandy clay loam or friable sandy clay upper (B_2) subsoil which is slightly plastic when wet, slightly hard when dry, and has medium moderate subangular blocky structure. The lower (B_3) subsoil is yellowish-red sandy loam to friable sandy clay loam. Moderately deep to deep soil. Slopes 0-12%, mostly 1-5%. On high terraces, usually near the stream channel or bottomland .... *Cahaba*
   Red-Yellow Podzolic, Ruston (Va-Tex)
   (Cahaba resembles the Ruston soil. The browner soils probably are eroded phases.)
2. Light grayish-brown (A_1) to pale yellow ($A_{1,\,2}$ or A_p) loose loamy sand to friable sandy loam surface soils; yellow to yellowish-brown sandy loam, friable sandy clay loam, or moderately firm sandy clay subsoil (B_2) which is slightly plastic when wet, slightly hard when dry, and has weak medium subangular blocky structure. The lower portion of the subsoil (B_3) is yellow sandy loam to friable sandy clay loam. Moderately deep to deep soil. Slopes 0-10%, mostly 1-4%. On stream side of high or low terraces or inland from Cahaba when that soil is present .... *Kalmia*
   Red-Yellow Podzolic, Norfolk (Va-Tex)
   (Kalmia resembles the Norfolk Soil)

B. Moderately well drained soil

1. Light gray (A_1) to yellowish-gray (A_2) loose loamy sand to very friable sandy loam surface soils; mingled yellowish, pinkish, and reddish-gray friable sandy loam to firm sandy clay loam subsoil (B_2) which is slightly plastic

when wet and hard when dry. The subsoil is highly variable in color, structure, and texture. Moderately deep soil. Slopes 1-7%, mostly 1-3%. Soil is associated with outwash from the Sandhill region on high and low terrace positions .... *Debruce**
Red-Yellow Podzolic, Altavista (NC, SC, Ga, Ala)
(Debruce resembles the Hoffman soil)

C. Somewhat poorly drained soil

1. Light brownish-gray to pale gray friable sandy loam surface soils ($A_{1, 2}$); yellow sandy loam to sandy clay loam subsoil (B_2) which is mottled with gray; it is slightly plastic when wet and slightly hard to hard when dry. Weakly developed subangular blocky structure. Moderately deep soil. Slopes 0-3%, mostly under 2%. On high and low terraces, often near the upland. .... *Stough*
Low-Humic Gley, Lynchburg (NC-La)
(Stough resembles the Lynchburg soil)

D. Poorly drained soil

1. Dark grayish-brown (A_1) to gray or light gray ($A_{1, 2}$) friable sandy loam to very fine sandy loam (sometimes silt loam) surface soils; gray to light gray sandy clay loam upper (B_2) subsoil which is faintly mottled with shades of yellow and brown; mottled gray and brownish-yellow sandy loam or sandy clay loam lower (B_3) subsoil. The subsoil is slightly plastic when wet, slightly hard when dry, and has weakly developed medium subangular blocky structure. Moderately deep soil. Slope 0-1%. On low terraces (occasionally on high), often next to the upland or in flats and depressions .... *Myatt*
Low-Humic Gley, Rains (Va-La)
(Myatt resembles the Rains soil)

E. Very poorly drained soil

1. Very dark gray to black friable loam to sandy loam surface ($A_{1, 2}$) soils containing considerable organic matter; gray to light gray friable loam to fine sandy clay loam subsoil (B_2) which is mottled with shades of brown and yellow, and has weakly developed crumb to subangular blocky structure. Moderately deep to deep soil. Slopes 0-1%. On low and high terraces, generally adjacent to the upland or in flats or depressions .... *Okenee*
Humic-Gley, Portsmouth (Md-La)
(Okenee resembles the Portsmouth soil)

III. Soils with Firm Sandy Clay to Clay Subsoils

B. Moderately well drained soils

1. Light gray ($A_{1, 2}$) or almost white (A_1) friable fine sandy loam to light brownish-gray (A_1) or light gray ($A_{1, 2}$) firm sandy clay loam surface soils; pale brown clay loam or clay upper (B_2) subsoil; light brown to reddish-yellow or red and yellow clay or silty clay lower (B_3) subsoil which is very plastic when wet and very hard when dry. The structure is moderately developed medium angular blocky in the upper (B_2) subsoil, but is massive in the lower (B_3) subsoil. Profile thickness is moderately deep to deep. Slopes 1-8%, but mostly 1-4%. On both high and low terrace positions .... *Flint*
Red-Yellow Podzolic, Shubuta (NC-La)
(Flint resembles the Caroline soil on the upland. The sandy clay loam soils probably are eroded phases.)
2. Dark grayish-brown (A_1) to pale brown (A_2) loose loamy sand or very friable silt loam to sandy loam surface soils; yellowish-brown to yellow sandy clay

loam subsoil (B_2) underlain at 24-32 inches by mottled red, gray, and brown sandy clay (C_1) which is very plastic when wet and very hard when dry. Weakly developed subangular blocky structure. Slopes 0-6%, mostly 1-3%. Usually on stream side of high or low terraces .... *Izagora*
Red-Yellow Podzolic, Eulonia (NC-Ala)

BC. Moderately well to somewhat poorly drained soil

1. Light gray (A_1) or pale yellow ($A_{1,2}$) friable sandy loam to silty clay loam surface soils; pale yellow to light yellowish-brown silty clay loam or silty clay upper (B_2) subsoil which is plastic when wet, hard when dry, and has weak medium angular blocky structure. The lower (B_3) subsoil is mottled light gray, pale yellow, and reddish-brown silty clay or clay which is very plastic when wet and very hard when dry. Moderately deep soil. Slopes 0-5%, mostly 1-3%. On both high and low terraces .... *Wahee*
Planosol (Argipan), White Store (NC, SC, Ga)
(Wahee resembles the Craven soil. The more sloping areas are susceptible to erosion.)

D. Poorly drained soil

1. Dark gray to gray ($A_{1,2}$) friable sandy loam to silt loam surface soils or occasionally moderately firm silty clay loam to firm clay surface (A_2) soils; light brownish-gray clay or silty clay upper (B_2) subsoil which is mottled with brown; and light gray clay or silty clay lower (B_3) subsoil which is mottled with brown, yellow, and red. The subsoil is massive; when wet it is very plastic and when dry, very hard. Moderately deep soil. Slopes 0-3%, mostly under 2%. On side of terrace near upland, both high and low terraces .... *Leaf*
Planosol (Argipan), Leaf (NC-Fla)
(Leaf may resemble the Lenoir or the Coxville soil)

DE. Poorly to very poorly drained soil

1. Grayish-brown (A_1) to gray ($A_{1,2}$) friable loam to moderately firm silty clay loam surface soils; light gray clay loam or silty loam upper (B_2) subsoil which is mottled with brown and yellow; olive gray clay or silty clay lower (B_3G) subsoil which is mottled with brown, yellow, and light gray. The subsoil structure is massive; and it is very plastic when wet and very hard when dry. Moderately deep soil. Slopes 0-1 or 2%. On low terraces mostly .... *Byars*
Humic-Gley, Byars, (NC, SC, Ga)
(Byars resembles the Bladen soil)

Soils of the Coastal Plain Floodplains (Alluvial Soils)

Along practically all streams there are strips of "bottomland", consisting of soil materials washed out of soils upstream and deposited during periods of overflow.

These alluvial soil areas may be only a few inches above normal stream level or they may lie several feet above. The relief is level or nearly so, with only a slight slope toward the stream and also downstream. Locally, there may be swales or other depressions. Occasional low ridges, seldom more than 15 inches above the general level, may be present.

Almost everywhere they occur (unless below large dams) these soils are subject to overflow and to the deposition of "new" soil material.

The soil Key or identification guide for alluvial soils follows the same procedure as that for stream terrace soils (Page 57).

Key to the Soils of the Stream Floodplains or the Alluvial Soils of the Coastal Plain Region

I. Soil with Loose Sand or Loamy Sand Subsoil

AB. Moderately well to well drained soil

1. Brown loose loamy sand or sand surface soils ($A_{1,2}$); brown loose loamy sand or sand subsoils (B_1) becoming very pale brown below 15-24 inches (B_3). Slopes 0-3%, mostly under 2%. Moderately deep soil which occurs in the floodplains of the larger streams .... *Tombigbee*
   Alluvial, Bruno (Va-Tex, but very little in NC)

II. Soils with Friable Sandy Loam to Moderately Firm Sandy Clay Loam Subsoils

AB. Moderately well to well drained soil

1. Grayish-brown very friable (mellow) sandy loam to silt loam surface soils ($A_{1,2}$); brown friable sandy loam or silt loam subsoil (B_1) becoming yellowish-brown at the lower (B_3) depths. Moderately deep over sand, gravel, or other material. Slopes 0-3%, mostly under 2%. Occurs on narrow to broad bottomland, but nearly all areas are subject to overflow .... *Ochlockonee*
   Alluvial, Pope (Md-Tex, very little in NC)

B. Moderately well drained soil

1. Grayish-brown friable sandy loam to silt loam surface soils ($A_{1,2}$); yellowish-brown to pale brown friable fine sandy loam to friable silty clay loam subsoil (B_1) becoming mottled with gray at 16-22 inches (B_2) and dominantly mottled yellow, brown, and gray below 25-30 inches (B_3). Moderately deep soil. Slopes 0-3%, mostly under 2%. Along small to large streams .... *Iuka*
   Alluvial, Philo (NC-Tex, little in NC)

C. Somewhat poorly drained soil

1. Yellowish-brown friable sandy loam to silt loam ($A_{1,2}$) or moderately firm silty clay loam to sandy clay surface soils ($A_{1,2}$); light gray friable sandy loam, friable silty clay loam, or sandy clay loam subsoil which is mottled with shades of brown and yellow (B_1) and becomes decidedly light gray below 24 inches (B_3). Moderately deep soil. Slopes 0-2%, mostly under 1%. Along small to large streams .... *Mantachie*
   Low-Humic Gley, Falaya (Md-Tex, very little in NC)
   (Areas mapped Thompson in Wayne County probably would be classed as Mantachie in current surveys.)

D. Poorly drained soil

1. Light gray friable fine sandy loam ($A_{1,2}$) to moderately firm silty clay loam surface soils ($A_{1,2}$); gray moderately firm fine sandy clay loam to silty clay loam subsoil ($B_{1,2}$) which is faintly mottled with shades of yellow and brown. Moderately deep soil. Slopes 0-1%. On narrow floodplains of small streams or as flat areas in broad floodplains. Subject to frequent overflow and wet much of the year .... *Bibb*
   Low-Humic Gley, Atkins (NC-Tex, little in NC)

E. Very poorly drained soil

1. Very dark gray to black friable loam surface soil (A, often 12-20" thick) which has a high content of organic matter; light gray or gray friable fine sandy loam to moderately firm loam upper (B_2G) subsoil which is mottled lightly with yellow or brown and grades below 25-35 inches into light gray fine sandy loam or loamy sand lower (B_3G) subsoil which is

TABLE 4A. UPLAND SOILS OF THE COASTAL PLAIN REGION

Soil Series	Dominant Surface Texture	Approximate Total Area in Acres*
Americus	Sand	1,000
Barclay	Silt loam	24,000
Bayboro	Loam	165,000
Bertie	Fine sandy loam	80,000
Bladen	Silt loam	350,000
Blanton	Sand	60,000
Boswell	Fine sandy loam	7,000
Carnegie	Sandy loam (loose)	1,000
Caroline (Shubuta)	Fine sandy loam	178,000
Choptank	Sand	1,000
Coxville	Silt loam	200,000
Craven	Fine sandy loam	450,000
Cuthbert	Sandy clay loam	1,000
Dragston	Fine sandy loam	300,000
Dunbar	Fine sandy loam	450,000
Duplin	Fine sandy loam	120,000
Elkton	Silt loam	110,000
Elwell**	Loam	70,000
Eulonia	Fine sandy loam	15,000
Eustis	Sand	300,000
Evesboro	Sand	1,000
Faceville	Fine sandy loam	15,000
Fairhope	Fine sandy loam	12,000
Faison**	Very fine sandy loam	225,000
Fallsington	Fine sandy loam	100,000
Galestown	Fine sand	90,000
Gilead	Sandy loam (loose)	65,000
Goldsboro	Sandy loam (loose)	700,000
Grady	Silt loam	1,000
Guin	Variable	3,000
Hoffman	Sandy loam (loose)	12,000
Hyde	Loam	170,000
Immokalee	Sand	80,000
Invershiel**	Fine sandy loam	8,000
Kenansville	Sandy loam (loose)	300,000
Kershaw	Sand	100,000
Keyport	Fine sandy loam	1,000
Klej	Sand	500,000
Lakeland	Sand	800,000
Lakewood	Sand	20,000
Lenoir	Very fine sandy loam	350,000
Leon	Sand	200,000
Leroy	Sandy clay loam	1,000
Lynchburg	Fine sandy loam	800,000
Magnolia	Fine sandy loam	13,000
Marlboro	Fine sandy loam	200,000

TABLE 4A. (Continued)

Soil Series	Dominant Surface Texture	Approximate Total Area in Acres*
Matapeake	Fine sandy loam	27,000
Mattapex	Very fine sandy loam	25,000
Nixonton	Very fine sandy loam	5,000
Norfolk	Sandy loam (loose)	1,100,000
Ona	Sand	80,000
Onslow	Fine sandy loam	80,000
Orangeburg	Sandy loam (loose)	25,000
Othello	Silt loam	31,000
Pasquotank	Silt loam	25,000
Pender**	Loam	6,000
Plummer	Sand	200,000
Pocomoke	Sandy loam	110,000
Portsmouth	Loam	350,000
Rains	Sandy loam	400,000
Red Bay	Sandy loam (loose)	15,000
Rumford	Sandy loam (loose)	25,000
Ruston	Sandy loam (loose)	300,000
Rutlege	Sand	350,000
St. Johns	Sand	60,000
St. Lucie	Sand	80,000
Sassafras	Sandy loam	6,000
Sawyer	Very fine sandy loam	6,000
Scranton	Sand	20,000
Stono	Loamy sand	2,000
Susquehanna	Sandy clay loam	1,000
Tidewater**	Very fine sandy loam	100,000
Tifton	Sandy loam	1,000
Vaucluse	Sandy loam (loose)	16,000
Wando**	Sand	1,000
Weeksville	Very fine sandy loam	25,000
Woodstown	Fine sandy loam (loose)	180,000
TOTAL, COASTAL PLAIN UPLAND SOILS		11,302,000

* Where the figure 1,000 is given, the approximate area probably is not more than a few hundred acres, perhaps less than 500.

** Tentative soil series, not established by the Soil Survey Division, U. S. Department of Agriculture.

TABLE 4B. ORGANIC SOILS OF THE COASTAL PLAIN REGION

Soil Material	Approximate Total Area in Acres
Muck	600,000
Mucky Peat	700,000
Peat	200,000
TOTAL, COASTAL PLAIN ORGANIC SOILS	1,500,000

TABLE 4C. STREAM TERRACE SOILS OF THE COASTAL PLAIN REGION

Soil Series	Dominant Surface Texture	Approximate Total Area in Acres
Barth	Sand	2,000
Beautancus**	Sand	2,000
Byars	Silt loam	4,000
Cahaba	Sandy loam (loose)	24,000
Calypso**	Sand	3,000
Debruce**	Sandy loam (loose)	1,000
Flint	Fine sandy loam	3,000
Huckabee	Sand	40,000
Independence	Sand	5,000
Izagora	Fine sandy loam	14,000
Kalmia	Sandy loam (loose)	80,000
Leaf	Silt loam	9,000
Myatt	Fine sandy loam	40,000
Okenee	Loam	40,000
Stough	Fine sandy loam	42,000
Wahee	Fine sandy loam	1,000
TOTAL, COASTAL PLAIN TERRACE SOILS		310,000

faintly mottled with yellow or brown. Slopes 0-1%. On some floodplains of small streams, or in depressions or next to the terraces on larger floodplains; usually wet much of the year and subject to very frequent overflow .... *Johnston*

Humic-Gley, Portsmouth (Md-Tex, many small to large areas in NC)

III. Soil with Firm Sandy Clay Loam Subsoil

D. Poorly drained soil

1. Dark grayish-brown to gray friable fine sandy loam ($A_{1,2}$) to moderately firm clay loam surface soils ($A_{1,2}$); pale olive to pale yellow friable fine sandy loam to moderately firm clay loam upper (B_2G) subsoil and mottled light gray, yellow, and red firm fine sandy loam to very firm clay lower (B_3G) subsoil; moderately deep. Slopes 0-2%, mostly under 1%. On small to large stream floodplains associated with fine-textured upland soils .... *Chastain*

   Low-Humic Gley, Chastain (NC-Tex, but little in NC)

IV. Miscellaneous Soil Materials

1. Gray, brownish-gray, dark gray, or black sandy loam, loam, or silt loam non-uniform surface soils (A); mottled brown, gray, and yellow highly variable subsoils (B) ranging from sand to clay and from shallow to deep. Slopes 0-1%, often only a few inches above normal stream level and subject to frequent overflow .... *Mixed Alluvial Land Poorly Drained*

   (Pa-Tex, numerous small areas in NC)
2. Gray to very dark gray or black soil materials of highly variable texture and depth which occupy positions practically at normal stream level, are subject to frequent overflow, and are wet much of the year .... *Swamp*
   (Pa-Tex, numerous small to large areas in NC)

3. Gray, dark gray, brown, or black sand, fine sand, very fine sand, loam, or silt loam loose to friable surface soil containing variable amounts of organic matter but usually sufficient to give the soil a "sticky feel"
   a. Highly variable subsoil, but more commonly very fine sand or loamy very fine sand layered or stratified with organic material; apparently at some time forming a portion of the lake bed .... *Mattamuskeet*
   Low-Humic Gley, Mattamuskeet (only in and adjacent to Lake Mattamuskeet)

(Tables 4A-E give the approximate acreages of soils in the Coastal Plain)

TABLE 4D. ALLUVIAL SOILS OF THE COASTAL PLAIN REGION

Soil Series	Dominant Surface Texture	Approximate Total Area in Acres
Bibb	Fine sandy loam	8,000
Chastain	Very fine sandy loam	1,000
Iuka	Fine sandy loam	8,000
Johnston	Loam	52,000
Mantachie	Fine sandy loam	4,000
Mixed Alluvium, poorly drained	Variable	121,000
Ochlockonee	Fine sandy loam	8,000
Thompson (Not mapped now)	Fine sandy loam	4,000
Tombigbee	Loamy sand	4,000
Swamp, unclassified soil materials along stream courses, wet, and subject to very frequent overflow		400,000
TOTAL, COASTAL PLAIN ALLUVIAL SOILS		610,000

TABLE 4E. MISCELLANEOUS SOIL MATERIALS, COASTAL PLAIN REGION

Soil Material	Dominant Texture	Approximate Total Area in Acres
Coastal Beach and Dunesand	Sand	105,000
Fresh Water Marsh	Silt loam	10,000
Gravel Hills	Very coarse sand	5,000
Tidal Marsh	Silt loam	194,000
TOTAL, COASTAL PLAIN MISCELLANEOUS		314,000

Totals For The Coastal Plain Region

	Acres
Upland Soils	11,302,000
Organic Soils	1,500,000
Stream Terrace Soils	310,000
Alluvial Soils	610,000
Miscellaneous Soil Materials	314,000
GRAND TOTAL	14,036,000

Soils of the Piedmont Plateau

Several bases may be used in setting up keys for identifying soils in the Piedmont. Among these are (1) properties of the subsoil, as texture, consistence, structure, color; (2) parent material or origin of the soil; (3) thickness of the soil profile; and (4) slope and position in the landscape.

One of the most readily observable factors probably is color of subsoil, but to take color as the first step in a key does not show important relationships among soil series (as texture, consistence, structure).

The use of parent material as the first step seems to be reasonable, because soil properties in the Piedmont are closely allied with geologic formations (Fig. 1). For example, certain soils occur only in the "Carolina slate belt," others only in the "Triassic sandstone belt." Because of the influence of parent material some soils have deep or thick profiles, others are shallow or thin; some soils are friable clay loams, others are very firm clays. On the other hand, most Piedmont soils are well drained, and many occur on strongly sloping relief.

The Key outline follows this procedure:

1. Soil Parent Material
   - A. Color of Subsoil
     1. Color, consistence, texture of the surface soil
     2. Color, consistence, texture, structure of the subsoil
   - B. Thickness of profile
     - Deep—over 50 inches thick
     - Moderately deep—30-50 inches
     - Shallow—20-30 inches
     - Very shallow—under 20 inches
   - C. Slope or gradient range

———————————————— *Soil Series Name*

Great Soil Group, Low Soil Family (States where the soil occurs)
(Notes on accelerated erosion)

Key to the Soils of the Piedmont Plateau Region

I. Soils Derived from Acid Crystalline Rocks (Light-colored gneiss, granite, and schist low in mica)

A. Soils with *Red Subsoils* (B Horizons)

1. Gray loamy sand (A_1), brownish-gray loamy sand to sandy loam (A_2), and reddish-brown sandy loam (A_3) wooded or uncultivated surface soils, or reddish-brown friable sandy clay loam to reddish-brown friable clay loam (A_p or B_{1p}) surface soils, occasionally gravelly or stony; light red (B_1), red or reddish-brown (B_2) clay subsoil which is firm when moist, plastic when wet, and hard when dry. The B_2 subsoil has strong medium subangular blocky structure, and often contains small amounts of mica and occasional sand grains. Deep or moderately deep soil. Slope range 2-40%, mostly 5-15% .... *Cecil*

   Great Soil Group: Red-Yellow Podzolic, Low Soil Family: Cecil (Va-Ala) (The gray sandy loam soils usually are not eroded or only slightly eroded, the sandy clay loams apparently are moderately eroded phases, and the clay loams commonly appear to be severely eroded phases. There is considerable variation in color and depth of the Cecil profile.)

2. For the soil resembling Cecil in the "foothills", see page 87 .... *Hayesville*

3. Grayish-brown friable loam (A_1) to yellowish-brown or brown friable clay loam (A_2, $_3$, or A_p, B_{1p}) surface soils; red to reddish-brown smooth clay subsoil (B_2) which is very firm when moist, plastic when wet, and hard when dry. The subsoil has moderate medium subangular blocky structure, and usually contains some finely divided mica. Very deep soil. Slope range 2-24%, mostly 4-12% ---------- *Yadkin*
Red-Yellow Podzolic, Cecil (Va, NC) (The yellowish-brown clay loam soils probably are eroded phases.)
4. Gray (A_1), brownish-gray or yellowish-gray (A_2) friable sandy loam, or reddish-brown friable clay loam (A_p or B_{1p}) surface soils; red, brownish-red, or dark red clay upper subsoil (B_2) which is very firm when moist, very plastic when wet, and very hard when dry. The lower subsoil (B_3) is moderately firm and plastic. The subsoil has moderate medium angular blocky structure, and contains only a little mica and quartz sand grains. Deep or moderately deep soil. Slope range 2-30%, mostly 5-15% ---------- *Cataula*
Red-Yellow Podzolic, Cecil (NC-Ala)
(The reddish-colored clay loam soils appear to be eroded or severely eroded phases. Series is essentially "heavy Cecil".)
5. (From acid crystalline rock containing large feldspar crystals: Porphyritic granite):
Gray (A_1), brownish-gray (A_2) friable sandy loam, or brownish-red friable clay loam (A_p or B_{1p}) surface soils usually containing angular feldspar crystals; red, reddish-brown, or dark red clay subsoil (B_2) which is firm when moist, plastic when wet, and hard when dry. The subsoil has weak medium subangular blocky structure and contains numerous feldspar crystals. Moderately deep to shallow. Slope range 2-35%, mostly 5-12%—— *Lockhart*
Red-Yellow Podzolic, Cecil (NC, SC, Ga)
(The reddish-colored clay loam soils probably are eroded or severely eroded phases.)
6. (Soils with reddish subsoils of clayey Piedmont materials which have an overlay of sandy Coastal Plain materials)
Gray or pale brownish-gray sand, loamy sand (A_1) to pale yellow loose sandy loam (A_2) surface soils; often gravelly and frequently 12-20 inches thick; red, brownish-red, reddish-yellow, or red and yellow clay, clay loam, silty clay, or silty clay loam subsoils (B_2). The subsoils may be Appling, Cecil, Georgeville, Herndon, Wadesboro, or White Store soil materials. Moderately deep to deep soil. Slope range 2-10%, mostly 3-5% ----- *Bradley*
Red-Yellow Podzolic, Cecil (Va-Ga)

B. Soils with *Yellowish-Red* or *Red and Yellow* subsoils
1. Gray, light gray (A_1), grayish-brown or grayish-yellow friable sandy loam (A_2, $_3$), or yellowish sandy clay loam, (A_p, B_{1p}) surface soils, occasionally gravelly or stony; yellowish-red upper (B_1) and reddish-brown, or streaked red and yellow lower (B_2) clay subsoil which is firm when moist, slightly plastic when wet, and hard when dry. The subsoil has moderate to strong medium subangular blocky structure, and often contains small amounts of mica and sand grains. Deep to moderately deep soil. Slopes 2-30%, mostly 3-12% ---------- *Appling*
Red-Yellow Podzolic, Appling (Va-Ala)
(The grayish-yellow sandy clay loam soils probably are eroded phases.)
2. For the soil resembling Appling in the "foothills" see page 88 ----- *Halewood*

3. Gray or light gray (A_1), grayish-yellow or grayish-brown ($A_{2, 3}$) friable sandy loam, or grayish-brown to yellowish-red sandy clay loam (A_p, B_{1p}) surface soils, occasionally gravelly; yellowish-red upper (B_1), and reddish-brown or red lower (B_2) clay subsoil which is streaked and splotched with yellow (and sometimes gray). The subsoil is very firm when moist, plastic when wet, and very hard when dry. It swells on wetting and shrinks and cracks on drying; has strong medium angular blocky structure; and may contain small amounts of mica and occasional sand grains. Moderately deep to deep soil. Slopes 2-24%, mostly 3-12% .... *Vance*
   Red-Yellow Podzolic, Appling (Va-Ala)
   (The sandy clay loam soils probably are eroded phases. Series is essentially "heavy Appling".)

C. Soils with *Yellow* subsoils

1. Gray (A_1), grayish-brown (A_2), and pale yellow (A_3) very friable sandy loam surface soils; pale yellow, yellow, or brownish-yellow sandy clay, clay loam, or clay upper subsoil (B_2) which is moderately firm to firm when moist, slightly plastic when wet, and slightly hard when dry. The lower subsoil (B_3) at depths of 26-34 inches below the soil surface is streaked yellow, light red, and sometimes gray, sandy clay loam which is friable to moderately firm when moist, slightly sticky when wet, and slightly hard when dry. The subsoil has medium moderate subangular blocky structure, and seldom contains an appreciable amount of mica. Deep to moderately deep soil. Slopes 1-8%, mostly under 5% .... *Durham*
   Red-Yellow Podzolic, Durham (Va-Ga)
2. Gray (A_1) to very light gray (A_2) sand, loamy sand, or loose sandy loam surface layer which is 1 to 3 inches thick; light yellowish-brown to pale yellow sand, loamy sand, or loose sandy loam (A_3, B_1) which is moderately deep to very shallow over partly disintegrated rock. Rock outcrops and boulders are common in places. Slopes 2-35%, mostly 4-12%. Soil is closely associated with the Durham and Appling soil series .... *Louisburg*
   Great Soil Group: Lithosol, Lauderdale (Va-Ala)
3. (Soils with yellowish subsoils of clayey Piedmont materials which have an overlay of sandy Coastal Plain materials)
   Gray or pale brownish-gray sand, loamy sand (A_1) to pale yellow or pale brown loose sandy loam (A_2) surface soils, often gravelly and frequently 12-24 inches thick; yellow, yellow and brown, or brown clay, clay loam, silty clay loam, or silty clay subsoil (B_2). The subsoils may be Alamance, Durham, Granville, Helena, or Herndon soil materials. Moderately deep to deep soil. Slope range 2-10%, mostly 3-5% .... *Chesterfield*
   Red-Yellow Podzolic, Durham (Va-Ga)

D. Soil with *Yellow* and *Gray* subsoil
   (Moderately well to somewhat poorly drained)

1. Dark gray (A_1) to gray (A_2) friable sandy loam to silt loam surface soils, pale yellow sandy clay loam upper subsoil ($B_{1, 2}$) which is firm when moist, plastic when wet, and hard when dry; and mottled light gray, yellow, and sometimes light reddish-brown sandy clay to clay lower subsoil (B_3) which is firm when moist, plastic when wet, and hard to very hard when dry. Moderately deep soil. Slopes 0-4%, mostly under 2%. Occupies nearly level positions as "flats" or low saddles or gentle slopes around spring heads and

drainageways .... *Colfax*
Great Soil Group: Planosol (Argipan) Colbert (Va-Ala)
The Colfax series is an intergrade with the Red-Yellow Podzolic soils, the Low-Humic Gley soils, and the Planosols. It is about midway in drainage and color between the well drained Appling and Cecil series and the poorly drained Worsham series. Frequently it receives seepage water from surrounding soils. (The Colfax series also includes soils formed in similar positions from the Carolina slates, the Triassic sandstones, and mica gneiss.)

E. Soil with much *Gray* in the subsoil

Formed of (1) residual material in place, or (2) of local colluvial-alluvial materials derived from residuum of light-colored gneiss, schist, and granite; occurs as flats or depressed areas in uplands, at the base of slopes, around spring heads, or along streams near the source; and is somewhat poorly to poorly drained, often receiving seepage water from surrounding soils.

1. Gray (A_1) to grayish-brown (A_2) loose sandy loam to friable silt loam surface soils; mottled gray, pale yellow, and yellowish-brown clay loam upper ($B_{1,2}$) subsoil which is firm when moist, plastic when wet, and hard when dry; and light gray to white clay lower (B_3) subsoil which is faintly mottled with yellow, brown, and olive gray and also is plastic when wet and hard when dry. Deep to shallow soil. Slopes 0-9%, mostly 1-3% .... *Worsham*
Planosol (Argipan), Guthrie (Pa-Ala, total acreage is small in each state.)
(The Worsham series also includes soils formed in similar positions from the Carolina slates, the Triassic sandstones, and mica gneiss.)

II. Soils Derived from Basic Crystalline Rocks (mainly diorite, gabbro, diabase, hornblende)

A. Soils with *Red* subsoils (B Horizons)

1. Dark brown (A_1), reddish-brown (A_2 or A_3) friable clay loam, or brownish-red firm clay (A_p, B_{1p}) surface soils; dark red (dusky red or maroon red) clay subsoil (B_2) which is firm when moist, plastic when wet, and hard when dry. The subsoil has moderate fine to coarse subangular blocky structure, and is practically free of mica flakes or sand grains. Deep soil. Slopes 2-40%, mostly 4-12% .... *Davidson*
Red-Yellow Podzolic, Davidson (Va-Ala)
(The more clayey soils probably are eroded phases)
2. (From a mixture of acid and basic rocks, but mostly hornblende gneiss and hornblende schist):
Dark grayish-brown (A_1), reddish-brown ($A_{2,3}$) friable loam, sandy loam, or reddish-brown clay loam surface (A_p, B_{1p}) soils; red to reddish-brown clay loam or clay subsoil (B_2) which is firm when moist, plastic when wet, and hard when dry. The subsoil has weak fine to medium subangular blocky structure, and contains some mica particles and occasional sand grains. Moderately deep or deep soil, but there are many shallow areas. Slopes 2-40%, mostly 3-12% .... *Lloyd*
Red-Yellow Podzolic, Lloyd (Va-Ala)
(The redder loams and all clay loam soils probably are eroded phases. Lloyd soils are about midway between the Davidson and Cecil series in texture, consistence, structure, and color.)

B. Soil with *Yellowish-Red* or *Reddish Brown* subsoil

1. Dark gray or brown friable loam (A_1), dark reddish-brown friable clay loam

(A_2 or A_3), or clay loam (A_p, B_{1p}) surface soils; yellowish-red to red silty clay or clay upper (B_2) subsoil which is firm when moist, plastic when wet, and hard when dry; variable colored lower (B_3) subsoil, but chiefly strong brown silty clay or clay finely mingled with red, yellow, olive, and gray. This layer is very plastic when moist and very hard when dry. The upper subsoil has strong angular blocky structure; the lower subsoil is massive. Moderately deep or deep soil. Slopes 2-20%, mostly 4-12% .... *Mecklenburg*
Red-Yellow Podzolic, Mecklenburg (Va-Ala, little in Ark)
(The more clayey soils probably are eroded phases)

C. Soils with *Yellowish-Brown* or *Olive Brown* subsoils

1. Gray (A_1) grayish-brown to brown (A_2) loose sandy loam or friable loam, to very dark gray ($A_{1,2}$) or yellowish-brown (A_p, B_{3p}) firm clay surface soils; brown, yellowish-brown, olive brown, or pale olive clay subsoil (B_3) which is very firm when moist, very plastic when wet, and very hard when dry. Upon wetting the clay swells, and upon drying it shrinks and cracks into rough angular blocks. Moderately deep soil. Slopes 1-12%, mostly under 5% .... *Iredell*
Planosol (Argipan), Iredell (Va-Ala)
(Excepting a few scattered areas, probably all the sandy clay loam to clay soils are eroded phases.)
2. Grayish-brown (A_1), brown (A_2) or dark brown (A_1, A_2) friable loam to brown or yellowish-brown friable clay loam (A_p) surface soils; brown, yellowish-brown, or olive brown friable loam to firm clay subsoil (B_3). Shallow to moderately deep soil. Slopes 1-20%, mostly 3-8% .... *Zion*
Planosol (Argipan), Orange (Va, little in NC)
(The clay loam soils probably are eroded phases. The soil is less firm and plastic than the Iredell which it closely resembles.)

D. Soil with much *Gray* in the subsoil

Formed (1) of residual material in place, or (2) of local colluvial-alluvial materials derived from residuum of dark-colored rocks, as diorite, gabbro. Occurs as flats or depressed areas in uplands, at the base of slopes, around spring heads, or along streams near the source. It is somewhat poorly to poorly drained.

1. Gray (A_1) friable loam, silt loam, or clay loam surface soils which are mottled with yellowish-brown in the subsurface ($A_{2,3}$). The subsoil is mottled gray, olive, and yellowish-brown clay which is firm when moist, plastic when wet, and hard when dry. Deep to shallow soil. Slopes 0-12%, mostly under 4% .... *Elbert*
Planosol (Argipan), Iredell (Va, SC, Ga, little in NC)

III. Soils Derived from Mixed Acid and Basic Crystalline Rocks

The rock formations are principally granite and gneiss cut by dikes or frequent intrusions of basic rocks as diorite, gabbro, etc. The soils are much less uniform than those of Groups I and II.

A. Soils with *Yellowish-Brown, Yellow* and *Brown,* or *Strong Brown* subsoils

1. Gray (A_1), grayish-brown (A_2), and pale yellow (A_3) loamy sand to very friable sandy loam, or friable sandy clay loam (A_p, B_{1p}) surface soils; streaked or mottled light gray, yellow, brown, and reddish-brown sandy clay (B_2) to clay (B_3) subsoil which is firm when moist, plastic when wet, and hard when dry. The subsoil has strong medium subangular blocky structure. Subsoil

color is very non-uniform. Moderately deep to deep soil. Slopes 1-15%, mostly under 8% .... *Helena*
Planosol (Argipan), Helena (Va-Ala)
(The sandy clay loam soils probably are eroded phases. Soil formerly mapped "smooth phase Wilkes".)

2. Gray (A_1), pale yellow (A_2) loose sandy loam or yellowish-brown sandy clay loam to firm clay loam (A_p, B_{1p}) surface soils; yellowish-brown to brown clay subsoil (B_2) which is firm when moist, very plastic when wet, and hard when dry. Moderately deep soil. Slopes 2-15%, mostly under 7% .... *Enon*
Planosol (Argipan), Helena (Va-Ga)
(The sandy clay loam to clay loam soils probably are eroded phases. Series originally called "basic Helena".

3. Gray (A_1), pale yellow (A_2) loose sandy loam or brownish-yellow sandy clay loam to clay loam (A_p, B_{1p}) surface soils; mottled, streaked, or variegated yellow, brown, and reddish-brown sandy loam, sandy clay loam, or clay thin and extremely variable subsoil (B_3) which is friable to firm when moist, non-sticky to plastic when wet, and loose to hard when dry. Shallow to very shallow soil. Slopes 4-60%, mostly 10-25% .... *Wilkes*
Lithosol, Wilkes (Va-Ala)
(In many places all the surface soil apparently has been removed by accelerated erosion; outcrops of rock are common.

IV. Soils Derived from "Carolina Slates"

The "Carolina Slates" are fine-grained rocks of grayish color. They occur in a belt extending across the State (Fig. 1), and consist of a great series of volcanic and sedimentary formations. Due to changes brought about by pressure and folding of the Earth's crust, some of these formations have slaty structures and are called slates. All are practically free of mica, and are low in quartz. The soils formed from the slates are characteristically silty throughout their profiles.

A. Soils with *Red* subsoils

1. Gray (A_1), grayish-yellow (A_2) thin (2-4") friable silt loam or reddish-yellow to reddish-brown silty clay loam (A_p, B_{1p}) surface soils, occasionally gravelly or slaty, but rarely containing a noticeable amount of sand; reddish-brown to red very smooth silty clay subsoil (B_2) which is firm when moist, "slick" to sticky and slightly plastic when wet, and hard when dry. The subsoil has weak medium subangular blocky structure, and is free of noticeable mica particles and sand grains. Moderately deep or deep soil. Slopes 2-45%, mostly 4-17% .... *Georgeville*
Red-Yellow Podzolic, Cecil (Va-Ga)
(The silty clay loam soils probably are eroded phases)

2. (From dark-colored massive volcanic rocks associated with Carolina Slates): Brown (A_1), reddish-brown (A_2 or A_3) friable silt loam, or reddish-brown to red silty clay loam (A_p, B_{1p}) surface soils; red to dark red smooth silty clay subsoil (B_2) which is firm when moist, plastic when wet, and hard when dry. The subsoil has weak medium subangular blocky structure, and appears to be free of mica particles and sand grains. Moderately deep to deep soil. Slopes 2-30%, mostly 4-12% .... *Tirzah*
Red-Yellow Podzolic, Davidson (NC, SC, Ga)
(The silty clay loam soils probably are eroded phases)

B. Soil with *Yellowish-Brown* or *Reddish-Brown* subsoil

1. Dark brown (A_1), brown (A_2 or A_3) friable silt loam, or yellowish-brown silty

clay loam (A_p, B_{1p}) surface soils; yellowish-brown, reddish-brown, or brownish-red silty clay upper (B_2) subsoil which is firm when moist, plastic when wet, and hard when dry. The lower (B_3) subsoil is streaked yellow, brown, and reddish-yellow silty clay loam. The subsoil generally has strong medium subangular blocky structure, although in some soils the material is nearly massive. There are few or no mica particles and sand grains. Moderately deep soil. Slopes 1-10%, mostly 2-7% .... *Efland*
Red-Yellow Podzolic, Mecklenburg (NC, SC, Ga)
(The silty clay loam soils probably are eroded phases)

C. Soil with *Yellowish-Red* or *Red and Yellow* subsoil

1. Gray (A_1), grayish-brown or grayish-yellow (A_2) friable silt loam or yellowish-brown silty clay loam (A_p, B_{1p}) surface soils, sometimes gravelly or slaty, but rarely containing a noticeable quantity of sand; reddish-yellow (B_1), yellow and red, or reddish-yellow (B_2) very smooth silty clay loam or silty clay subsoil which is firm when moist, "slick" to sticky and slightly plastic when wet, and hard when dry. The subsoil has moderate medium subangular blocky structure, and is practically free of mica particles and sand grains. Moderately deep to deep soil. Slopes 3-50%, but mostly 5-18% .... *Herndon*
Red-Yellow Podzolic, Appling (Va-Ga)
(The silty clay loam soils probably are eroded phases)

D. Soil with *Yellow* subsoil

1. Gray (A_1), pale yellow (A_2) friable and smooth silt loam surface soils, often gravelly or slaty, and occasionally containing a small amount of fine sand; pale yellow (B_1), yellow or brownish- yellow (B_2) silt loam to silty clay loam subsoil which is friable and very smooth when moist, "slick" to sticky when wet, and slightly hard when dry. The subsoil has weak plate-like to fine angular blocky structure. Frequently there are fragments of slate throughout the profile. Moderately deep to shallow soil. Slopes 1-15%, mostly under 5% .... *Alamance*
Red-Yellow Podzolic, Durham (Va-Ga)

E. Soil with *Yellow, Brown,* and *Gray* in the subsoil

1. Gray (A_1), pale yellow (A_2) smooth silt loam surface soils; pale yellow to yellow smooth silty clay loam upper (B_2) subsoil; yellowish-brown, pale yellow and brown, or brown streaked with gray silty clay lower (B_3) subsoil, which is very firm when moist, very plastic when wet, and very hard when dry. The lower subsoil swells on wetting and shrinks on drying, cracking into irregular blocks. Moderately deep to shallow soil. Slopes 1-8%, mostly under 4% .... *Orange*
Planosol (Argipan), Orange (Va-Ga)
(Appears to be very erodible on slopes above 3%)

F. Shallow soil with *Brown, Yellowish-Brown,* or *Reddish-Yellow* subsoil

1. Brownish-gray (A_1), pale yellow (A_2), or brown (A_p, B_{1p}) friable silt loam surface soils, usually containing fragments of slate; brown, yellowish-brown, reddish-yellow, or pale yellow friable silt loam to slightly plastic silty clay thin subsoil (B_3) which contains some to many slate fragments. Shallow to very shallow soil. Slopes 4-40%, mostly 6-15% .... *Goldston*
Lithosol, Louisa (Va-Ga)

G. Soil with yellow and gray in subsoil, see page 68 .... *Colfax*

H. Soil with much *Gray* in the subsoil, see page 69 .... *Worsham*

V. Soils Derived from Sandstones and Shales of the Triassic Formation

A. Soils with *Red* subsoils

1. Gray (A_1), pale yellow (A_2) friable sandy loam or silt loam, or reddish-brown friable to firm clay loam (A_p, B_{1p}) surface soils; red or reddish-brown smooth clay or silty clay subsoil (B_2) which is firm when moist, plastic when wet, and hard when dry. The subsoil has moderate medium subangular blocky structure, and may contain small amounts of sand grains and mica flakes. Moderately deep to deep soil. Slopes 2-24%, mostly 3-10% .... *Wadesboro*
   Red-Yellow Podzolic, Cecil (Va-NC)
   (The clay loam soils probably are eroded phases)
2. Brownish-gray (A_1), brown (A_2) friable fine sandy loam or silt loam, or dark brownish-red friable to firm silty clay loam (A_p, B_{1p}) surface soils; dark red (dusky red or purplish-red) silty clay or clay subsoil (B_2) which is firm when moist, plastic when wet, and hard when dry. The deep subsoil has moderate fine subangular blocky structure, and usually is free of sand grains and mica flakes. Slopes 2-18%, mostly 3-5% .... *Bucks*
   Red-Yellow Podzolic, Bucks (Pa, NJ, Md, Va; very little in NC) (The silty clay loam soils probably are eroded phases)
3. Brownish-gray (A_1), brown (A_2) friable silt loam, or dark brownish-red friable to firm silty clay loam (A_p, B_{1p}) surface soils; dark red (purplish-red) silty clay or clay subsoil (B_2) which is usually shallow or very shallow. Slopes 3-30%, mostly 6-18% .... *Penn*
   Lithosol, Penn (Pa, NJ, Md, Va; little in NC)
   (The silty clay loam soils probably are eroded phases)

B. Soil with *Yellowish-Red* or *Brownish-Red* subsoil

1. Gray, light gray (A_1), grayish-yellow, or grayish-brown (A_2) friable sandy loam, or brownish-yellow sandy clay loam (A_p, B_{1p}) surface soils; brownish-yellow (B_1), yellowish-red, reddish-brown, or streaked yellow and brownish-red (B_2) clay loam or clay subsoil which is firm when moist, plastic when wet, and hard when dry. The subsoil has moderate fine to medium subangular blocky structure, and may contain small amounts of sand and mica flakes. Moderately deep soil. Slopes 2-20%, mostly 3-8% .... *Mayodan*
   Red-Yellow Podzolic, Appling (Va-NC)
   (The sandy clay loam soils probably are eroded phases)

C. Soils with *Red* to *Reddish-Gray* and *Yellow* (often *Varicolored*) subsoils

1. Gray (A_1), brownish-gray or pale yellow (A_2) friable silt loam to sandy loam surface soils, or reddish-brown to reddish-gray firm clay loam to plastic clay (A_p, B_{3p}) surface soils; varicolored subsoil (B_3) which is dominantly reddish-gray or weak red intermingled with shades of gray and sometimes yellow. The subsoil is clay or silty clay which is very firm when moist, very plastic when wet, and very hard when dry. It swells on wetting, and shrinks and cracks on drying into strong medium angular blocky structure particles. The redder-colored subsoils are tougher when moist, more plastic when wet, and harder when dry than those with much yellow and gray. Moderately deep soil. Slopes 2-30%, mostly 3-12% .... *White Store*
   Planosol (Argipan), White Store (NC, Va)
   (The clay loam to clay soils probably are eroded phases, and the soil appears to be very erodible)
2. Light gray (A_1), yellowish-gray or yellowish-brown (A_2) friable sandy loam, or moderately firm reddish-brown sandy clay loam or clay (A_p, B_{3p}) surface

soils varicolored but mostly mottled reddish-gray, reddish-brown, and light gray clay or silty clay thin subsoil (B_3) which is very firm when moist, very plastic when wet, and very hard when dry. Shallow to very shallow soil. Slopes 3-35%, mostly 5-18% .... *Pinkston*
Lithosol, Litz (NC, Va)
(The clay loam or clay soils probably are eroded phases)

3. Gray to light gray (A_1), brownish-gray (A_2), yellowish-brown (A_3) loamy sand to loose sandy loam, or yellowish-brown sandy clay loam (A_p, B_{1p}) surface soils often 12-20 inches thick; light yellowish-brown to yellow friable sandy clay loam upper subsoil (B_1), 4-8 inches thick; yellow or yellowish-brown sandy clay middle subsoil (B_2), 8-18 inches thick, which is friable when moist, slightly plastic when wet, and hard when dry; and highly variegated or mottled reddish-brown, reddish-gray, yellow, and gray clay lower subsoil (B_3) which is very firm when moist, very plastic when wet, and very hard when dry. The B_2 layer has weak medium subangular blocky structure; it swells on wetting and shrinks and cracks on drying. Moderately deep to deep soil. Slopes 2-18%, mostly 3-8% .... *Creedmoor*
Planosol (Fragipan), Conway (Va-NC)
(The sandy clay loam soils probably are eroded phases. The Creedmoor is essentially midway between the White Store and the Granville series.)

D. Soil with *Yellow* or *Brownish-Yellow* subsoil

1. Gray loamy sand (A_1), yellowish-gray (A_2), pale yellow (A_3) very friable sandy loam surface soils; yellow to brownish-yellow sandy clay subsoil (B_2) which is moderately firm when moist, slightly plastic when wet, and hard when dry. The subsoil has weak crumb to weak fine subangular blocky structure, a gritty feel, and sometimes contains small amounts of mica. Moderately deep to deep soil. Slopes 2-12%, mostly under 6% .... *Granville*
Red-Yellow Podzolic, Durham (Va, NC)

E. Soil with *Yellowish-Brown* or *Brown* subsoil

1. Pale brown (A_1), brownish-yellow ($A_{2,3}$) loam surface soil; yellow, yellowish-brown, or brown silty clay loam subsoil (B_2) which is firm when moist, slightly plastic when wet, and slightly hard when dry. Moderately deep soil. Slopes 2-15%, mostly under 8% .... *Lansdale*
Red-Yellow Podzolic, Lansdale (Pa, NJ, Md, Va, very little in NC)

F. Soils with some to much *Gray* in the subsoils

1. Gray (A_1), grayish-brown (A_2) friable silt loam surface soil, which usually contains some shale fragments; gray, mottled with pale yellow and pale brown, silty clay loam to clay subsoil (B_3) which generally has some to much shaly material. The subsoil is firm when moist, plastic when wet, and hard when dry. Moderately deep to shallow soil. Slopes 3-35%, mostly under 12% .... *Lehigh*
Planosol (Fragipan), Lehigh (Pa, NJ, Md, Va, very little in NC)
2. See page 69 for .... *Worsham*
3. See page 68 for .... *Colfax*

VI. Soils Derived from Quartz Mica Schist and Related Rocks

A. Soils with *Red* subsoils

1. Gray (A_1), brownish-gray (A_2) friable fine sandy loam, or reddish-brown friable clay loam (A_p, B_{1p}) surface soils containing considerable mica; reddish-brown to red friable to moderately firm micaceous clay subsoil (B_2) which has a smooth, almost greasy feel. When dry the subsoil is hard, when

wet it is plastic. It has weakly developed medium platy structure. Moderately deep or deep soil. Slopes 4-30%, mostly 6-15% .... *Statesville**
Red-Yellow Podzolic, Cecil (Va, NC, SC)
(The redder loam and all clay loam soils probably are eroded phases, and the soil appears to be very erodible. The series is essentially a "very micaceous Cecil".)

2. Gray (A_1), grayish-brown (A_2) friable sandy loam, or reddish-brown friable clay loam (A_p, B_{2p}) surface soils containing much mica; yellowish-red, brownish-red, or red friable micaceous clay loam subsoil (B_2), which is usually shallow or very shallow. Slopes 3-35%, mostly 7-18% .... *Louisa*
Lithosol, Louisa (Va-Ala)
(The clay loam soils probably are eroded phases, because the soil appears to be very erodible)

3. Grayish-brown loamy sand (A_1), yellowish-brown to light reddish-brown sandy loam (A_2), or reddish-brown friable sandy clay loam (A_p, B_{1p}) surface soils containing flat quartz mica schist fragments and some mica flakes; reddish-brown to brown clay loam to clay firm upper (B_2) subsoil and reddish-brown to light red, often tinged with reddish-gray clay loam or clay lower (B_3) subsoil which is friable to firm when moist and slightly hard when dry. The subsoil has weak medium subangular blocky to very weak platy structure, and contains much mica and flat angular fragments of schist. Moderately deep to somewhat shallow soil. Slopes 2-40%, mostly 6-15% .... *Madison*
Red-Yellow Podzolic, Cecil (Va-Ala)
(The sandy clay loam soils probably are eroded phases)

B. Soil with *Yellowish-Red* or *Light Red* subsoil

1. Gray (A_1), grayish-brown (A_2), grayish-yellow (A_3) friable sandy loam surface soils containing flat quartz mica schist fragments and some mica flakes; reddish-yellow clay loam upper (B_1) subsoil, strong brown clay loam or clay middle (B_2) subsoil, and yellowish-red to light red clay loam or clay lower (B_3) subsoil. The entire subsoil is friable to firm when moist, slightly plastic when wet, and hard when dry. It has very weak platy structure. Throughout the profile the content of mica and flat-angular fragments of schist varies from some to very much. Moderately deep to somewhat shallow soil. Slopes 2-20%, mostly 5-12% .... *Grover*
Red-Yellow Podzolic, Appling (Va-Ga)

C. Soil with *Yellowish-Brown* or *Reddish-Brown* subsoil

1. Brown (A_1), brownish-yellow (A_2) friable loam, or yellowish-brown to reddish-brown clay loam (A_p, B_{1p}) surface soils; yellowish-brown to reddish-brown clay subsoil (B_2) which is moderately firm when moist, slightly plastic when wet, and hard when dry. The subsoil has weak moderate subangular to angular blocky structure. Small mica flakes are present in most locations, and in some places numerous shale and schist fragments are present on the surface and throughout the profile. Moderately deep soil. Slopes 4-50%, mostly 8-20% .... *Surry*
Red-Yellow Podzolic, Cecil (Va, NC)
(The clay loam soils probably are eroded phases. This series is about midway between the Cecil series and the Porters series)

D. Soil with some *Gray* in the subsoil, see page 68 .... *Colfax*
E. Soil with much *Gray* in the subsoil, see page 69 .... *Worsham*

VII. Soils Derived from Light-Colored Metamorphic Rocks

These rocks are fine-grained schists (talcose, sericitic, micaceous); very fine-grained gneisses; and metamorphosed slates and shales.

A. Soil with *Red* subsoil

1. Yellowish-brown (A_1), brownish-yellow (A_2) friable silt loam, or yellowish-red friable silty clay loam (A_p, B_{1p}) surface soils, often gravelly; red smooth clay subsoil (B_2) which is friable to firm when moist, plastic when wet, and hard when dry. The subsoil has moderate medium subangular blocky structure, contains some to large amounts of very fine mica flakes, and is moderately deep to somewhat shallow. Slopes 2-18%, mostly 3-12% .... *Tatum*
   Red-Yellow Podzolic, Cecil (Va, SC, very little in NC)
   (The silty clay loam soils probably are eroded phases)

B. Soils with *Red, Yellow* and *Brown* in the subsoils

1. Grayish-brown (A_1), yellowish-brown (A_2) silt loam, or yellowish-brown to reddish-yellow silty clay loam (A_p, B_{1p}) surface soils which usually contain angular quartz and schist fragments; reddish-yellow silty clay or clay subsoil (B_2) which is mingled with yellowish-brown and red. The subsoil is firm when moist, very smooth and slightly plastic when wet, hard when dry, and has moderate medium subangular blocky structure. There are some to many schist and quartz fragments and much finely divided mica flakes throughout the subsoil. Moderately deep to somewhat shallow soil. Slopes 2-18%, mostly 2-10% .... *Nason*
   Red-Yellow Podzolic, Appling (Va, SC, very little in NC)
   (The silty clay loam soils probably are eroded phases)
2. Yellowish-brown very friable shaly silt loam surface soil (A_1); strong brown friable shaly silt loam thin subsoil (B_3, C_1) mixed with partially weathered brown, yellow, pink, and reddish-yellow platy quartz sericite schist or similar rock fragments. Shallow to very shallow, and rock fragments usually comprise up to half of the profile. Slopes 5-60%, mostly 10-25% ...... *Manteo*
   Lithosol, Louisa (Va, SC, very little in NC)

C. Soil with *Yellow* subsoil

1. Gray (A_1), pale yellow (A_2) friable silt loam surface soils; yellow to brownish-yellow silty clay loam or silty clay subsoil (B_2), which has a greasy or slick feel due to the high content of finely divided mica particles. The subsoil is firm when moist, very smooth to plastic when wet, hard when dry, and has weak fine subangular blocky structure. In many places angular schist rock fragments are common throughout the profile. Moderately deep to shallow soil. Slopes 1-8%, mostly under 5% .... *York*
   Red-Yellow Podzolic, Durham (Va, SC, very little in NC)

VIII. Colluvial Soils, Developed at the Base of Some Slopes

A. Colluvial soils from Cecil, Davidson, Lloyd, and similar soils:

1. Brown, reddish-brown, or red friable loams, silt loams, and clay loams, 20-40 inches deep, with little differentiation in color or texture between surface and lower depths. Slopes 0-5%, mostly under 3% .... *Starr*
   Alluvial, Meadowville, (Only in small bodies of low total area, Va-Ala)

B. Colluvial soils from Appling, Durham, Helena, Wilkes, and similar soils:

1. Gray, grayish-yellow, or yellowish-brown loose to friable sandy loams or loams, 20-40 inches deep, with little differentiation in color or texture between surface and lower depths. Slopes 0-5%, mostly under 3% .... *Seneca*
   Alluvial, Pope (Only in small bodies of low total area, Va-Ala)

Soils of the Piedmont Stream Terraces

The stream terraces of the Piedmont and Mountain regions are much more clearly defined landscape forms than those of the Coastal Plain because of the older and better established drainage pattern. The soils have developed from materials washed out of upland soils in either region.

In many places there are three groups of terraces according to their position: high, intermediate, and low. The high terraces are above stream overflow, having sloping to hilly relief, and generally are occupied by well developed soils.

The low terraces are only a few feet above the bottomlands, are subject to occasional overflow, have nearly level to gently sloping relief, and are occupied by moderately well developed soils.

The intermediate terraces seldom are affected by overflow, have gently to strongly sloping relief and moderately well to well developed soils.

The Soil Key or identification guide follows the same procedure as that outlined for the Coastal Plain terrace soils (page 57).

Key to the Stream Terrace Soils of the Piedmont and Mountain Regions

I. Soil with Loose Sand or Loamy Sand Subsoil

A. Well drained to somewhat excessively drained soil

1. Brown to very pale brown loose sand or loamy sand surface soil (A); reddish-brown to yellowish-red loose sand or loamy sand deep subsoil (B). Slopes 2-20%, mostly 2-8%. On high and intermediate terrace positions ---------- *Molena*

   Great Soil Group: Regosol, Low Soil Family: Americus (NC-Ala)
   (Considerable wind erosion in places. Essentially "sand profile" Wickham)

II. Soils with Friable to Moderately Firm Sandy Loam, Loam, Silt Loam, or Clay Loam Subsoils

A. Well drained soils

1. Grayish-brown (A_1), brown, light brown, or brownish-yellow (A_2) friable sandy loam to loam, or brownish-yellow to yellowish-red clay loam (A_p, B_{1p}) surface soils; yellowish-brown to yellowish-red clay loam to clay subsoil (B_2) which is slightly plastic when wet, hard when dry, and contains some mica flakes. It has strong fine subangular blocky structure. Rounded gravel sometimes is present on surface and commonly underlies the deep subsoil. Slopes 2-30%, mostly 4-15%. On high terrace, some intermediate terrace positions ---------- *Masada*

   Red-Yellow Podzolic, Appling (NC, Va, Ga, Tenn)
   (The brownish-yellow clay loam soils probably are eroded phases. Resembles Appling or Cecil, and is essentially "friable Wickham")

3. Light gray (A_1), pale brown or pale yellow (A_2) very friable fine sandy loam, loam, or silt loam surface soils; yellow to yellowish-brown silt loam, silty clay loam, or fine sandy clay loam subsoil (B_2) which is slightly plastic when wet and slightly hard when dry. The subsoil has moderate fine subangular blocky structure. There are a few mica flakes and occasional gravel present. Deep to moderately deep soil. Slopes 2-12%, mostly 2-6%. On intermediate and low terrace positions ---------- *Tillery**

   Red-Yellow Podzolic, Durham (NC)
   (Essentially "friable Quitsna"*)

4. Light gray (A_1), grayish-yellow (A_2) fine sandy loam surface soil; yellow fine

sandy clay upper (B_2) subsoil which is plastic when wet, hard when dry, and has weak fine subangular blocky structure; and reddish-brown and yellow fine sandy clay lower (B_3) subsoil. Rounded gravel is common in places. Deep soil. Slopes 2-8%, mostly 2-5%. On high and intermediate terrace positions .... *Holston*
Red-Yellow Podzolic, Holston (Va, Ga, Tenn, very little in Madison County, NC)

AB. Moderately well to well drained soil

1. Dark brown (A_1), brown (A_2) loam surface soil; yellowish-brown, brown, or strong brown loam, clay loam, or clay subsoil (B_1 or $_2$) which is slightly plastic when wet, and soft to slightly hard when dry. There are some mica flakes and rounded gravel. The deep subsoil has weakly developed crumb to fine subangular blocky structure. Slopes 1-12%, mostly 1-4%. In development, this soil is about midway between the Congaree of the bottomland and Masada of the terraces. On intermediate and low terrace positions .... *State*
Alluvial, State (NC, SC, Ga, Va, Tenn)

B. Moderately well drained soil

1. Light gray (A_1), pale yellow or pale brown (A_2) friable fine sandy loam, loam, or silt loam surface soils; pale yellow or pale brown silt loam, sandy loam, loam, fine sandy loam, or fine sandy clay loam subsoil (B_2) which is lightly mottled with gray below 24-30 inches (B_3). The subsoil is slightly plastic when wet, soft to slightly hard when dry, and has moderately developed subangular blocky structure. There are a few mica flakes, and occasional gravel. Moderately deep soil. Slopes 1-8%, mostly 1-5%. On low and intermediate terrace positions .... *Harnett**
Red-Yellow Podzolic, Altavista (NC)
(Essentially "friable Altavista")

C. Somewhat poorly drained soil

1. Light brownish-gray (A_1), gray or light gray (A_2) friable sandy loam, loam, or silt loam surface soils; pale brown sandy clay loam, silty clay loam, or sandy clay upper (B_2) subsoil; mottled light gray and pale brown lower (B_3) subsoil which is slightly plastic when wet, hard when dry. Some mica flakes and rounded gravel may be present. The subsoil structure ranges from moderately developed crumb to subangular blocky. Moderately deep soil. Slopes 1-6%, mostly 1-4%. On low and intermediate terrace positions
.... *Augusta*
Low-Humic Gley, Rains (Va-Ala)

D. Poorly drained soil

1. Dark gray (A_1), gray (A_2) friable loam, fine sandy loam, or silt loam surface soils; gray loam or fine sandy loam, upper (B_1) subsoil, and gray silty clay loam or clay loam lower (B_2) subsoil which is heavily mottled with brown, yellow, and olive yellow. The subsoil is slightly plastic when wet, and slightly hard when dry, and has moderately developed crumb to subangular blocky structure. Moderately deep soil. Slopes 0-3%, mostly under 2%. On low and intermediate terraces, frequently adjacent to upland or in depressed positions .... *Grabtown**
Low-Humic Gley, Rains (NC)
(Essentially "friable Roanoke")

E. Very poorly drained soil

1. Very dark gray to black (A) friable loam, silt loam, or silty clay loam surface soils which contain considerable organic matter; gray, light gray, or grayish-brown clay loam, silty clay loam, clay, or silty clay subsoils (B_2). In some places the subsoil is gray mottled with yellow or brown; in other places there is little difference in color and texture from the surface downward for 36 inches or more. The subsoil in most areas is friable to moderately firm, plastic when wet, but only slightly hard when dry. The structure is weakly developed crumb or subangular blocky. Soil profile thickness is deep or moderately deep. Slopes 0-1%. On low and intermediate terraces usually adjacent to upland or in depressed positions .... *Cape Fear*
Humic-Gley, Portsmouth (Va-Ga)
(Resembles the Portsmouth soils)

III. Soils with Firm Clay Loam, Silty Clay, or Clay Subsoils

A. Well drained soils

1. Dark brown (A_1), brown (A_2 or A_3) friable loam, or reddish-brown to red (A_p, B_{2p}) firm clay loam or clay surface soils; red to dark red clay loam, silty clay loam, or clay subsoil (B_2) which is plastic when wet and hard when dry. The subsoil has moderately well developed medium subangular blocky structure, and contains a few mica flakes. Rounded gravel sometimes is present on surface, in soil, and usually underlies the subsoil. Deep to very deep soil. Slope gradient range is 2-35%, but commonly between 5-15%. On high terrace position, very little on intermediate terraces .... *Hiwassee*
Red-Yellow Podzolic, Davidson (NC, SC, Tenn, Ga, Va)
(The clay loam and clay soils probably are eroded phases. Hiwassee resembles the Davidson and Rabun soils.)
2. Grayish-brown (A_1), brown (A_2) very friable sandy loam, or brown friable loam ($A_{1,2}$), or brownish-red moderately firm clay loam or silty clay loam (A_p, B_{2p}) surface soils; brown to reddish-brown firm to very firm clay loam, silty clay, or clay subsoil (B_2) which is plastic when wet, hard to very hard when dry, and has moderate medium subangular blocky structure. Rounded gravel occasionally is present on surface, in the soil, and below the subsoil; mica flakes and some sand grains are noticeable in the subsoil. Deep to very deep soil. Slopes 2-12%, mostly 2-7%. On intermediate terrace positions .... *Wickham*
Red-Yellow Podzolic, Cecil (Md-Ala)
(The clay loam and silty clay loam soils probably are eroded phases. Wickham soils are somewhat similar to Cecil soils, but browner.)
3. Pale brown (A_1), pale yellow (A_2) friable fine sandy loam, loam, or silt loam, or pale yellow moderately firm fine sandy clay loam or silty clay loam (A_p, B_{2p}) surface soils; yellow to yellowish-brown silty clay loam, silty clay, clay loam, or clay subsoil (B_2) which is plastic when wet, hard when dry, and has moderately developed medium subangular blocky structure. Sometimes gravel is present, and mica flakes are usually noticeable. Deep to moderately deep soil. Slopes 1-12%, mostly 2-6%. On intermediate and low terrace positions .... *Quitsna**
Red-Yellow Podzolic, Durham (NC)
(The fine sandy clay loam or silty clay loam soils probably are eroded phases. Essentially "well drained Altavista".)

B. Moderately well drained soil

1. Light gray or brownish-gray (A_1), pale yellow or pale brown (A_2) friable fine sandy loam or loam, or yellowish moderately firm fine sandy clay loam to silty clay loam (A_p, B_{2p}) surface soils; yellow or yellowish-brown clay loam to clay subsoil (B_2) which is lightly mottled with gray below 22-26 inches (B_3). The subsoil is plastic when wet, hard when dry, and has moderately developed medium subangular blocky structure. Usually a few mica flakes are present throughout the profile, and some gravel may be present in places. Moderately deep soil. Slopes 1-8%, mostly 1-5%. On low and intermediate terrace positions .... *Altavista*

   Red-Yellow Podzolic, Altavista (Va-Ala)

   (The fine sandy clay loam and silty clay loam soils probably are eroded phases.)

C. Somewhat poorly drained soil

1. Gray (A_1), light grayish-brown (A_2) friable fine sandy loam, loam, or silt loam surface soils; yellow, yellowish-brown, or brown clay loam upper (B_2) subsoil which is mottled with gray; mottled gray, yellow, and brown massive, dense silty clay or clay lower (B_3) subsoil which is very plastic when wet and very hard when dry. Upon wetting the subsoil swells; upon drying it shrinks and cracks without any regular pattern. Occasionally some rounded gravel is present. Moderately seep soil. Slopes 0-4%, mostly 1-3%. On low and intermediate terrace positions .... *Warne*

   Planosol (Argipan), Iredell (Va-Ala)

   (Subject to serious erosion if clean cultivated on slopes above 2%.)

DE. Poorly to very poorly drained soil

1. Dark gray (A_1), gray (A_2) friable loam, fine sandy loam, silt loam, or firm silty clay loam surface soils; gray clay or silty clay subsoil (B_2) which is heavily mottled with brown, yellow, and olive-yellow, and occasionally with reddish-brown. The subsoil is very plastic when wet, very hard when dry. It is structureless or massive in some localities; in others it shows weakly developed coarse angular blocky structure. Moderately deep soil. Slopes 0-4%, mostly under 2%. On low and intermediate terrace positions, frequently adjacent to the upland or in depressed positions .... *Roanoke*

   Planosol (Fragipan), Leaf (Md-Ala)

Soils of the Piedmont Floodplains (Alluvial Soils)

The strips of "bottomland" in the Piedmont and Mountain regions occupy positions similar to those in the Coastal Plain. The Soil Key or identification guide follows the same procedure as that outlined for the Coastal Plain stream terrace soils (page 57).

Key to the Soils of the Stream Floodplains or the Alluvial Soils of the Piedmont and Mountain Regions.

I. Soil with Sand or Loamy Sand Subsoil

A. Well drained soil

1. Light brownish-gray (A_1), light gray (A_2) sand, or loose loamy sand surface soils; light yellowish-brown to very pale brown sand or loose loamy sand subsoil (B_1) which contains many mica flakes. Moderately deep to deep soil which grades at 30-42 inches into yellowish-brown, pale yellow, or light gray sand, or into layers of sand and rounded gravel. Slopes 1-5%, mostly under 2%, but frequently on somewhat hummocky relief. Soil usually occurs

next to the stream channels and frequently in outside "bends" of the streams .... *Buncombe*

Alluvial, Bruno (Pa-Ala)

II. Soils with Friable to Moderately Firm Loam, Silt Loam, Silty Clay Loam, or Clay Loam Subsoils

AB. Moderately well to well drained soils

1. Brown very friable (mellow) fine sandy loam, silt loam, or loam (A) to brown or reddish-brown moderately firm silty clay loam (A) surface soils; yellowish-brown to light yellowish-brown very friable, silt loam or loam (B) or reddish-brown moderately firm silty clay loam (B) subsoil which contains some to many mica flakes; very slightly plastic to plastic when wet and soft to slightly hard when dry. Sandy loam, sand, or gravel beds usually occur at 30-40 inches below the soil surface, although in extreme cases the subsoil may continue to a depth of 150 inches or more. Slopes 0-3%, mostly under 1%. Gravelly phases often occur. This soil is common throughout many of the Piedmont and Mountain valleys. It is derived from material washed out of soils from acid and basic crystalline rocks, from Carolina slates, and from schist rocks .... *Congaree*

   Alluvial, Pope (Pa-Ala)

2. Brown to reddish-gray friable silt loam or fine sandy loam (A) surface soils; brown, reddish-brown, or reddish-gray friable silt loam (B) to moderately firm silty clay loam (B) subsoil which is slightly plastic when wet and slightly hard when dry. The soil is moderately deep over beds of silt, sand, and sometimes shale fragments. Slopes 0-3%, mostly under 1%. This soil is found only in association with upland soils of the Triassic sandstone formation .... *Bermudian*

   Alluvial, Pope (Pa-NC)

3. Light-gray to brown friable fine sandy loam (A_1) surface soil; brown or yellowish-brown fine sandy loam to friable fine sandy clay (B) moderately deep subsoil. Slopes mostly under 1%. The soil is derived from materials washed out of soils from sandstone and shales .... *Pope*

   Alluvial, Pope (Pa-Okla, a few small areas in Madison County, NC)

BC. Moderately well to somewhat poorly drained soil

1. Dark gray, grayish-brown, or dark brown very friable (mellow) loam or silt loam surface soils (A); yellowish-brown to brown friable silt loam (B_1) or moderately firm silty clay loam (B_2) subsoil which contains some to much mica, is very slightly plastic when wet, soft when dry. Moderately deep to deep soil over layers or beds of sand, silt, or gravel. Slopes 0-3%, mostly under 1%. Associated with soil materials washed out of areas of acid crystalline rock .... *Transylvania*

   Alluvial, Pope (NC Mountains, Ga, Tenn, but only a small total area. Originally called "dark surface Congaree")

C. Somewhat poorly drained soils

1. Pale brown very friable (mellow) sandy loam to silt loam or moderately firm silty clay loam (A) surface soils; pale brown to light brownish-gray very friable sandy loam or silt loam (A_3 or B_1) to moderately firm silty clay loam upper subsoil (B_2) which becomes mottled with gray below 15-24 inches (B_3). Mica flakes are common to abundant throughout the profile. Moderately deep to deep soil over layers or beds of sand, silt, or gravel. Slopes 0-2%, mostly under 1%. This soil is common throughout many Piedmont

TABLE 5A. UPLAND SOILS OF THE PIEDMONT PLATEAU REGION

Soil Series	Dominant Surface Textures	Approximate Total Area in Acres
Alamance	Silt loam	100,000
	Slaty (stony) silt loam (shallow profile)	180,000
Appling	Sandy loam	340,000
	Sandy clay loam (eroded sandy loam)	310,000
	Gravelly or stony sandy loam	90,000
Bradley*	Sandy loam (considerable gravel)	20,000
Bucks	Silt loam	3,000
Cataula	Sandy clay loam	70,000
Cecil	Sandy loam	300,000
	Sandy clay loam (eroded sandy loam)	800,000
	Clay loam (severely eroded sandy loam)	1,180,000
	Gravelly or stony sandy loam	50,000
	Gravelly or stony sandy clay loam (eroded gravelly or stony sandy loam)	90,000
	Gravelly or stony clay loam (severely eroded gravelly or stony sandy loam)	30,000
	(Note: About one-half of the severely eroded Cecil soil areas have shallow profiles.)	
Chesterfield*	Sandy loam	20,000
Colfax**	Sandy loam	120,000
Creedmoor	Sandy loam	100,000
Davidson	Clay loam	130,000
Durham	Sandy loam	40,000
Efland	Silt loam	15,000
Enon	Sandy loam	80,000
Georgeville	Silt loam	400,000
	Silty clay loam (eroded silt loam)	460,000
	Slaty (stony) silt loam (shallow profile)	360,000
Goldston	Slaty (stony) silt loam	280,000
Granville	Sandy loam	50,000
Grover	Gravelly sandy clay loam (Less than one-fifth has slight erosion)	20,000
Gullied Land***		210,000
Halewood****	Loam	100,000

TABLE 5A. (Continued)

Soil Series	Dominant Surface Textures	Approximate Total Area in Acres
Hayesville****	Loam	100,000
	Sandy clay loam (eroded loam)	200,000
	Clay loam (severely eroded loam; about one-half has shallow profile)	250,000
Helena	Sandy loam	330,000
Herndon	Silt loam	200,000
	Silty clay loam	100,000
	Slaty (stony) silt loam (shallow profile)	300,000
Iredell	Loam	250,000
	Sandy loam	120,000
Lansdale	Silt loam	2,000
Lehigh	Silt loam	3,000
Lloyd	Loam and sandy loam	110,000
	Sandy clay loam (eroded sandy loam)	300,000
	Clay loam (severely eroded sandy loam; about one-half has shallow profile)	350,000
Lockhart	Sandy loam	20,000
Louisa	Variable	30,000
Louisburg	Sand	70,000
Madison	Gravelly sandy loam	90,000
	Gravelly sandy clay loam (eroded sandy loam)	170,000
	Stony sandy loam, stony loam	10,000
Manteo	Silt loam	1,000
Mayodan	Sandy loam	80,000
	Sandy clay loam (eroded sandy loam)	60,000
Mecklenburg	Loam, clay loam	260,000
Nason	Silt loam	2,000
Orange	Silt loam (considerable gravel on some areas)	120,000
	Silt loam, shallow phase (considerable gravel on many areas)	120,000
Penn	Silt loam	5,000
	Silty clay loam (eroded silt loam)	10,000
Pinkston	Sandy clay loam (very little sandy loam)	28,000

TABLE 5A. (Continued)

Soil Series	Dominant Surface Textures	Approximate Total Area in Acres
Statesville	Sandy clay loam (very little sandy loam)	40,000
Stony Rough Land*****		60,000
Surry	Loam	100,000
	Gravelly or shaly loam	80,000
Tatum	Silt loam	3,000
Tirzah	Silt loam	15,000
	Silty clay loam (eroded silt loam)	32,000
Vance	Sandy loam	60,000
	Sandy clay loam (eroded sandy loam)	160,000
Wadesboro	Fine sandy loam	30,000
	Fine sandy clay loam (eroded fine sandy loam)	45,000
White Store	Sandy loam	10,000
	Sandy clay loam (eroded sandy loam)	100,000
	Clay loam (severely eroded sandy loam)	90,000
Wilkes	Sandy loam, sandy clay loam	460,000
Yadkin	Loam	30,000
	Clay loam (eroded loam)	20,000
York	Silt loam	1,000
Zion	Sandy loam	10,000
	Stony loam, stony sandy loam	15,000
TOTAL, PIEDMONT UPLAND SOILS		11,000,000

* About 90% of the Bradley soil series, as formerly mapped, and also about 70% of the Chesterfield soil series, are placed with the Piedmont soils (Appling, Cecil, Durham, Helena, others). This alignment differs from all soil surveys of the Coastal Plain-Piedmont Plateau border counties. The actual acreage of these two soil series probably is about one-sixth of that shown on the county soil survey maps. See also footnote **, page 41.

** About three-fourths of the Colfax soil areas are of residual materials, one-fourth of colluvial materials, although nearly one-half of the areas appear to occupy colluvial positions.

*** The term "gullied land" refers to areas of the soil series listed below which are very severely sheet eroded and gullied. Gullies ranging in depth from 3 to 5 or more feet occupy one-third or more of each area. Many spots are eroded to bedrock, although strips between gullies may still retain part of the original surface soil. The soil series represented and their approximate acreages in Gullied Land are:

Appling	5,000	Iredell	10,000	Vance	3,000
Cecil	70,000	Lloyd	25,000	Wadesboro	2,000
Davidson	3,000	Madison	3,000	White Store	30,000
Georgeville	15,000	Mayodan	2,000	Wilkes	25,000
Herndon	5,000	Mecklenburg	3,000		

**** See Soil Key for the Mountain Region. These soils occur in the foothill area, east of the Blue Ridge Mountains.

***** Stony Rough Land includes areas of steep to rugged relief which are so stony that only small tracts have any well developed soils. Among the soil series represented are the Cecil, Georgeville, Halewood, Hayesville, Herndon, Muskingum (see Mountain Region Soil Key), and Surry. Pilot Mountain in Surry County and the Sauratown Mountains in Stokes County are the largest areas of Stony Rough Land.

TABLE 5B. COLLUVIAL SOILS OF THE PIEDMONT PLATEAU REGION

Soil Series	Dominant Surface Texture	Approximate Total Area in Acres
Elbert	Loam	4,000
Seneca	Sandy loam	13,000
Starr	Sandy loam	10,000
Worsham*	Variable	73,000
TOTAL, PIEDMONT COLLUVIAL SOILS		100,000

* About three-fifths of the Worsham soil series areas are residual soils, and two-fifths are colluvial soils. However, more than one-half of the areas occupy positions similar to those of colluvial soils.

TABLE 5C. STREAM TERRACE SOILS OF THE PIEDMONT PLATEAU REGION

Soil Series	Dominant Surface Texture	Approximate Total Area in Acres*
Altavista	Fine sandy loam	25,000
Augusta	Fine sandy loam	20,000
Cape Fear	Loam	8,000
Grabtown	Very fine sandy loam	24,000
Harnett	Very fine sandy loam	21,000
Hiwassee	Clay loam (eroded loam)	2,000
Masada	Fine sandy loam	25,000
Molena	Sand	18,000
Quitsna	Fine sandy loam	12,000
Roanoke	Silt loam	30,000
State	Loam	8,000
Tillery	Fine sandy loam	12,000
Warne	Silt loam	15,000
Wickham	Loam (Many areas of clay loam, sandy clay loam, which are eroded loam or sandy loam)	80,000
TOTAL, PIEDMONT TERRACE SOILS		300,000

* Included are all the terrace soils of Piedmont origin occurring along the Roanoke, Cape Fear, Tar, and Neuse Rivers, and along other streams flowing out of the Piedmont into the upper Coastal Plain province.

and Mountain valleys, except in the Triassic sandstone region .... *Chewacla* Alluvial, Philo (Va-Ala)

2. Brown, reddish-brown, or light brown friable silt loam surface soils (A_1); brown, reddish-brown, or reddish-gray friable silt loam to moderately firm silty clay loam (B_2) subsoil which becomes mottled with shades of gray and yellow at 18-24 inches (B_3). Moderately deep soil over beds of silt and shale. Slopes 0-2%, mostly under 1%. This soil is found only in association with upland soils of the Triassic sandstone formation .... *Rowland* Alluvial, Philo (Pa-NC)

DE. Poorly to very poorly drained soils

1. Olive-gray, gray, or light gray friable fine sandy loam, loam, or silt loam to moderately firm silty clay loam surface soils (A); light brownish-gray or light gray friable loam, silt loam (B), or firm silty clay loam subsoil (B_2G)

TABLE 5D. ALLUVIAL SOILS OF THE PIEDMONT PLATEAU REGION

Soil Series	Dominant Surface Texture	Approximate Total Area in Acres*
Bermudian	Silt loam	2,000
Bowmansville	Silt loam	4,000
Buncombe	Sand	10,000
Chewacla**	Fine sandy loam	300,000
Congaree**	Fine sandy loam	219,000
Rowland	Silt loam	25,000
Wehadkee**	Silt loam	240,000
TOTAL, PIEDMONT ALLUVIAL SOILS		800,000

TOTALS FOR THE PIEDMONT REGION

	Acres
Upland soils	11,000,000
Colluvial soils	100,000
Stream Terrace soils	300,000
Alluvial soils	800,000
GRAND TOTAL, PIEDMONT SOILS	12,200,000

* Included are all alluvial or firstbottom soils of Piedmont origin occurring along the Roanoke, Cape Fear, Tar, and Neuse Rivers, and along other streams flowing out of the Piedmont into the upper Coastal Plain province.

** The many thousands of acres of soils mapped "Alluvial soils, undifferentiated," or "Meadow (Congaree material)" in county soil surveys have been apportioned among the Chewacla, Congaree, and Wehadkee soils in this tabulation. In most county surveys "Meadow" is described as being wet or poorly drained, and all of this "Meadow" acreage is placed with the Wehadkee above. Where "Meadow" is described as well drained to somewhat poorly drained, the acreage is placed with Congaree and Chewacla.

which is heavily mottled with brown and yellow and sometimes blotched with dark red. The subsoil is slightly plastic to very plastic when wet, slightly hard to very hard when dry, and is moderately deep over layers or beds of sand, silt, or gravel. Slopes 0-2%, mostly under 1%. This soil is common throughout many Piedmont and Mountain valleys except in the Triassic sandstone region. It occupies occasional flat areas or depressions in large bottomlands, but the usual occurrence is next to the terrace or the uplands. In addition to being subject to overflow, it receives seepage water and is wet much of the year .... *Wehadkee*
Low-Humic Gley, Atkins (Pa-Ala)

2. Pale brown, brown, or reddish-brown silt loam surface soil (A_1) which is faintly mottled with yellow. The upper portion of the subsoil (B_2) is mottled yellowish-brown or pinkish-brown and gray friable silty clay loam or silty clay. Below 18-24 inches, the subsoil (B_3G) is mottled gray, yellow, and brownish-yellow loam or silty clay loam and is moderately deep over shale or sandstone. Slopes 0-2%, mostly under 1%. This soil is found only in association with upland soils of the Triassic sandstone formation. It is wet much of the year .... *Bowmansville*
Low-Humic Gley, Atkins (Pa-NC)

E. Very poorly drained soil

1. Very dark gray, brownish-gray, brownish-black or black friable, smooth, silt loam or loam surface soil (A) which contains considerable well decomposed

organic matter; brownish-gray, brownish-black, or black moderately friable loam or silt loam to firm clay loam or silty clay loam subsoil (BG) which is plastic when wet and hard when dry. Profile depth is variable, but mostly deep. Occurrence is in (1) low bottomland positions where it is subject to frequent overflow, (2) in depressions in the broader areas of alluvial soils, (3) adjacent to stream terrace soil areas, and (4) occasionally in "high bottom" positions next to upland soils but subject to seepage water. Slopes 0-2%, mostly under 1%. Found only in the Mountains and adjacent upper Piedmont sections .... *Toxaway*
Humic-Gley, Burgin (NC, Ga, Tenn)

III. Miscellaneous Soil Materials

1. Gray, brownish-gray, dark gray, or black sandy loam, loam, or silt loam non-uniform surface soils (A); mottled brown, reddish-brown, yellow, and gray highly variable subsoils (B) ranging from sand to clay and from shallow to deep. Slopes 0-1%, often only a few feet above normal stream level and subject to frequent overflow .... *Mixed Alluvial Land, Poorly Drained* (Pa-Ala)

Soils of the Mountain Region

Soils of the Appalachian Mountain Region may be identified by a Key similar to that used for the soils of the Piedmont Plateau, as explained on page 66. Although the overall relief of the region is rather rugged, three more or less distinct units of relief are present.

The most noticeable is that known as "High Mountain" or simply as "Mountain". Comprising this unit are the numerous irregular mountain chains or ranges. The average elevation of these ranges above sea level is between 3,500 and 4,500 feet, but many mountains are much higher. The highest point, Mount Mitchell, is 6,684 feet, and also the greatest elevation in the eastern United States.

In between the Mountain ranges or Mountain type of relief are many areas of strongly rolling to hilly land which are commonly termed "Intermountain". These Intermountain unit-relief areas have elevations ranging mostly between 2,000 and 3,500 feet.

Scattered throughout the areas of "Mountain" and "Intermountain" land are numerous stream valleys which comprise the third unit of relief. The valleys generally are much less than three miles in width and are quite irregular, but many have a type of relief closely approaching that of the Piedmont Plateau. The largest and most striking of these is the valley of the French Broad River in Henderson County. Most of the "valley" or "plateau" areas have elevations ranging between 1,700 and 2,200 feet.

In the Key the common occurrence of the soils is given as, for example with the Hayesville: valley, plateau-like, low mountain, and intermountain areas.

Key to the Soils of the Mountain Region

I. Soils Derived from Acid Crystalline Rocks (light-colored gneiss, granite, and schist low in mica.)

A. Soils with *Red* or *Brownish-Red* subsoils (B horizons)

1. Gray very friable fine sandy loam or loam (A_1), pale brown or yellowish-brown friable loam to fine sandy clay loam ($A_{2,3}$), or reddish-brown firm clay loam (A_p, B_{1p}) surface soils, often gravelly or stony; brownish-red, to red

clay subsoil (B_2) which is firm when moist, plastic when wet, hard when dry, has moderate medium subangular blocky structure, and often contains small amounts of mica flakes and occasional sand grains. Moderately deep to deep soil. The overall slope gradient range is from about 4% to 60%, but is commonly between 8-35%. Occurrence, valley, plateau-like, low mountain, and intermountain areas .... *Hayesville*
Great Soil Group: Red-Yellow Podzolic, Low Soil Family: Cecil (NC, SC, Va, Ga, Tenn). (The sandy clay loam and clay loam soils probably are eroded phases. There are relatively large areas of Hayesville soils in NC, SC, and Ga in the foothills east and south of the Blue Ridge Mountains. The Hayesville resembles the Cecil series of the Piedmont.)

B. Soils with *Reddish-Brown, Red* and *Yellow,* or *Reddish-Yellow* subsoils

1. Pale-brown to light yellowish-brown loam or sandy loam ($A_{1,2}$) or yellowish-brown ($A_{2,3}$) to yellowish-red silty clay loam or clay loam (A_p, B_{1p}) surface soils which are friable to slightly firm and frequently may be gravelly or stony; reddish-brown to yellowish-red clay loam or clay subsoil (B_2) which is firm when moist, slightly plastic when wet, slightly hard when dry, and has weak medium subangular blocky structure. Moderately deep soil. Slopes 7-60%, mostly 25-40%. Intermountain and to some extent high mountain areas, also plateau and valley .... *Halewood*
Red-Yellow Podzolic, Appling (NC, Ga, Va, Tenn)
(The silty clay loam to clay soils probably are eroded phases. There are some areas of Halewood soils in NC, SC, and Ga in the foothills east and south of the Blue Ridge Mountains. The Halewood resembles the Appling series of the Piedmont.)

C. Soils with *Brown, Yellowish-Brown,* or *Reddish-Brown* subsoils

1. Grayish-brown ($A_{1,2}$) to brown (A_2, B_2 or A_p, B_{2p}) very friable loam or gritty loam surface soil, frequently stony; brown to strong brown loam to gritty clay loam subsoil (B_2) which is friable when moist, slightly plastic when wet, soft to slightly hard when dry, and has very weakly developed fine to medium subangular blocky structure. Moderately deep to shallow soil. Slopes 15-90%, mostly 30-60%. High mountain areas .... *Porters*
Great Soil Group: Gray-Brown Podzolic, Porters (NC, SC, Ga, Va, Tenn) The brown loam soils probably are eroded phases, but the soil is only moderately susceptible to erosion)
2. Brownish-gray (A_1) to pale brown (A_2) friable loam, gritty loam, or brown clay loam (A_p, B_{1p}) surface soils; yellowish-brown, brown, or strong brown to reddish-brown clay loam, sandy clay loam, or gritty clay loam subsoil (B_2) which is friable when moist, slightly plastic when wet, soft to slightly hard when dry, and has weak fine subangular blocky structure. Moderately deep soil. Slopes 4-35%, mostly 5-20%. Intermountain, plateau, and valley areas, seldom in high mountains .... *Balfour*
Red-Yellow Podzolic, Appling (NC)
3. *Colluvial soil:* In colluvial positions, usually down slope from or below Porters soils, but also derived from Ashe, Halewood, Hayesville, and a few other soil series.
Weak brown to dark brown friable loam or gritty loam ($A_{1,2}$) or light brown loam (A_p, B_{1p}) surface soils; yellowish-brown to brown loam or clay loam subsoil (B_2), which is friable when moist, slightly plastic when wet, and soft

to slightly hard when dry. It has soft crumb to fine subangular blocky structure which is moderately developed. Flattish stones frequently occur on the surface and throughout the soil profile. Variable depth soil, but usually moderately deep. Slopes 3-40%, mostly 5-25%. Footslopes in intermountain and mountain areas .... *Tusquitee*
Gray-Brown Podzolic, Porters (NC, Va, Ga, Tenn)
(The light brown loam soils probably are eroded phases, but soil is only moderately susceptible to erosion)

D. Soils with *Yellow, Brownish-Yellow,* or *Yellowish-Brown* subsoils

1. Gray or light gray (A_1), pale yellow (A_2) very friable sandy loam or pale yellow friable sandy clay loam (A_p, B_{1p}) surface soils; yellow or brownish-yellow sandy clay subsoil (B_2), which is friable when moist, slightly plastic when wet, slightly hard when dry, and has weak coarse crumb structure; it contains very little mica. Moderately deep to deep soil. Slopes 2-30%, mostly 5-15%. Intermountain, valley, and plateau areas .... *Edneyville*
Red-Yellow Podzolic, Durham (NC, Ga)
(The sandy clay loam soils probably are eroded phases, although the soil is only moderately susceptible to erosion. Resembles the Durham soil series of the Piedmont.)
2. Dark yellowish-brown very friable loam ($A_{1,2}$) to light yellowish-brown friable loam (A_p, B_{1p}) surface soils, often gritty; yellowish-brown, brownish-yellow, or yellow sandy clay loam, sandy clay, or clay loam upper subsoil (B_2) which is friable to firm when moist, slightly plastic when wet, and slightly hard when dry. The lower subsoil (B_2) becomes lighter in color and more friable with depth. The entire subsoil has moderately developed fine subangular blocky structure. The soil is moderately deep. Slopes 5-35%, mostly 7-15%. Intermountain areas, ridgetops, and lower slopes of high mountains .... *Perkinsville*
Red-Yellow Podzolic, Durham (NC, Va, Tenn)
(The yellowish-brown surface soils probably are eroded phases, although the soil is only moderately susceptible to erosion. Essentially this is the Ashe soil series formed on less sharply sloping relief.)
3. Dark brown (A_1), dark grayish-brown (A_2) or yellowish-brown (A_p, B_{1p}) very friable gritty loam (occasionally sandy loam) surface soils, often stony; brownish-yellow to yellowish-brown sandy clay loam or yellow gritty loam subsoil (B_2) which is friable when moist, slightly plastic when wet, soft to slightly hard when dry, and has weakly developed crumb structure. Moderately deep to shallow soil. Slopes 20-90%, mostly 30-60%. High mountain areas .... *Ashe*
Gray-Brown Podzolic, Ashe (NC, Va, Tenn, Ga)
(The yellowish-brown soils are eroded phases, although the soil is only moderately susceptible to erosion.)
4. Colluvial soil from Ashe and Perkinsville soils,
See I, C .... *Tusquitee*

E. Soil with *Yellow* and *Brown* in the subsoil and some *Gray*

1. Dark gray to almost black friable loam surface soils ($A_{1,2}$) which contain from 20 to 30% organic matter, vary from 6 to 20 inches in thickness, and usually contain some stone; brownish-yellow to dark yellowish-brown gritty loam or clay loam subsoil (B_2) sometimes with streaks of gray at its lower depths. The subsoil is friable when moist, slightly plastic when wet, soft

to slightly hard when dry, and has poorly developed fine to medium crumb structure. Deep to shallow soil. Slopes 5-40%, mostly 8-20%. Occurs on high mountain relief, usually in north coves or on broad ridges, generally above 4,000 feet elevation, and only in small individual areas .... *Burton*
Brown Forest, Burton (NC, Va, Tenn, Ga)

II. Soils Derived From Basic Crystalline Rocks (diorite, hornblende, and similar dark-colored rocks)

A. Soil with *Reddish-Brown* to *Dark Red* subsoil

1. Brown (A_1), reddish-brown (A_2 or A_3) friable silt loam to loam or reddish-brown firm silty clay loam, clay loam, or dark red clay (A_p, B_{1p}) surface soils; reddish-brown to dark red clay or silty clay subsoil (B_2) which is firm when moist, plastic when wet, and hard when dry; has weak medium subangular blocky structure, and seldom contains mica flakes or sand grains. Moderately deep to deep soil. Slopes 5-65%, mostly 10-30%. Intermountain and, to some extent, high mountain areas .... *Rabun*
Red-Yellow Podzolic, Davidson (NC, Ga, Va, Tenn)
(The clay loam and clay soils probably are eroded phases. The Rabun soils resemble the Davidson soils of the Piedmont.)

B. Soil with *Brown, Yellowish-Brown,* or *Yellowish-Red* subsoil

1. Dark brown (A_1), brown (A_2 or A_3) friable loam to silt loam or moderately firm clay loam (A_p, B_{1p}) surface soils; brown, yellowish-brown, or yellowish-red clay loam, silty clay loam, or clay subsoil (B_2) which is moderately firm to firm when moist, plastic when wet, slightly hard when dry, and has moderate medium subangular blocky structure. Moderately deep soil. Slopes 4-80%, mostly 15-45%. Intermountain and mountain areas .... *Clifton*
Red-Yellow Podzolic, Mecklenburg (NC, Tenn, Va, Ga)
(The clay loam soils probably are eroded phases. The Clifton soils resemble the Mecklenburg soils of the Piedmont.)
2. Colluvial soil from Clifton and Rabun soils
Dark brown to reddish-brown friable loam or gritty loam ($A_{1,2}$) or brownish-red loam to clay loam (A_p, B_{1p}) surface soils; reddish-brown to dark red loam or clay loam subsoil (B_2) which is friable when moist, moderately plastic when wet, and slightly hard when dry. It has soft crumb to moderate fine subangular blocky structure. Flattish stones frequently occur on the surface and throughout the soil. Variable depth, but usually moderately deep soil. Slopes 3-40%, mostly 5-20%. Footslopes in intermountain and mountain areas .... *Dyke*
Red-Yellow Podzolic, Davidson (NC, Va)
(The redder soils probably are eroded phases. The soil is rather susceptible to erosion on slopes above 10%.)

C. Soil with *Yellowish-Brown* and *Pale Olive* subsoil

1. Grayish-brown (A_1), olive gray (A_2) loam or yellowish-brown (A_p, B_p) clay loam surface soils; yellowish-brown, or pale olive very firm (moist) to very plastic (wet) clay (B_2) subsoil. Moderately deep soil. Slopes 15-50%, mostly 20-30%. Intermountain areas .... *Iredell*
Planosol (Argipan), Iredell (NC, but very little)
(The clay loam soils probably are eroded phases)

D. Soil with *Yellowish-brown* "mixed" subsoil
(From a mixture of basic and acid crystalline rocks.)

1. Grayish-brown friable gravelly loam surface soil ($A_{1,2}$); yellowish-brown

gravelly fine sandy loam to fine sandy clay subsoil (B_2, or $_3$) which is highly variable in texture, consistence, and thickness. A shallow to very shallow soil. Slopes 15-70%, mostly 30-60%. Intermountain areas .... *Wilkes*
Lithosol, Wilkes (NC, but only a little in Buncombe and Madison Counties)

III. Soils Derived From Very Micaceous Rocks (light-colored schists and gneisses, talcose schists, and similar rocks)

A. Soils with *Red* subsoils

1. Grayish-brown very friable loam, silt loam, or occasionally sandy loam ($A_{1,\,2}$) to brown or reddish-brown moderately firm to firm silty clay loam or clay loam (A_p, B_p) surface soils, sometimes gravelly or stony; reddish-brown to red clay loam or clay subsoil (B_2) which is highly micaceous (greasy feel). The subsoil is moderately firm to firm when moist, slightly plastic when wet, slightly hard when dry, and has moderate medium subangular blocky structure. Slopes 4-40%, mostly 6-25%. The soil is moderately deep, and common to the intermountain and, to some extent, the high mountain areas .... *Fannin*
Red-Yellow Podzolic, Cecil (NC, Ga, SC, Va, Ala, Tenn)
(The silty clay loam to clay loam soils probably are eroded phases, because the soil is very susceptible to accelerated erosion.)
2. Grayish-brown very friable loam, silt loam, or rarely sandy loam ($A_{1,\,2}$) to brown or reddish-brown moderately firm silty clay loam, clay loam, or clay (A_p, B_p) surface soils, frequently slaty or stony; yellowish-brown, reddish-brown, or red friable to firm clay loam or clay thin subsoil (B_2) which is highly micaceous (greasy feel) and usually contains much stony material. Shallow to very shallow soil. Slopes 15-90%, mostly 30-60%. High mountain and rougher intermountain areas, often on choppy to rugged relief, occasionally on smooth relief .... *Talladega*
Lithosol, Louisa (Md, Va, NC, Tenn, SC, Ga, Ala, Ark)
(The silty clay loam to clay soils probably are eroded phases, since the soil is extremely susceptible to accelerated erosion. On some areas "hard rock" is within 10-20 inches of the surface; on other areas the "rotten rock" may extend to several feet, although the actual soil depth is less than 20 inches.)

B. Soils with *Yellow* to *Yellowish-Brown* subsoils

1. Grayish-brown very friable loam ($A_{1,\,2}$) to brownish-yellow friable clay loam (A_p, B_p) surface soils, occasionally with some gravel or stone; yellow, light brown, or brownish-yellow very micaceous clay loam subsoil (B_2) which is friable when moist, plastic when wet, slightly hard to hard when dry, and has weakly developed fine subangular blocky structure. The soil and subsoil have a slick or greasy feel due to the abundance of fine mica flakes, although some quartz sand may be present. Small fragments of mica schist frequently are found in the subsoil which is moderately deep. Slopes 6-35%, mostly 8-24%. Relatively smooth plateau and intermountain areas and broad lower slopes of high mountains .... *Watauga*
Gray-Brown Podzolic, Ashe (NC, Va, Ga)
(The clay loam soils probably are eroded phases since the soil is very susceptible to accelerated erosion.)
2. Dark yellowish-brown (A_1) to grayish-brown (A_2) very friable loam or brownish-yellow friable clay loam (A_p, B_p) surface soils, often stony; yellow, light brown, or brownish-yellow highly micaceous clay loam subsoil (B_2) which is friable when moist, slightly plastic when wet, and slightly hard

to hard when dry. Both soil and subsoil have a slick, greasy feel due to mica. The subsoil frequently is little more than a mixture of clay loam and flat angular schist rock fragments, and is shallow to very shallow. Slopes 20-90%, mostly 40-60%. High mountain areas; considerable on low, choppy intermountain relief .... *Chandler*
Lithosol, Louisa (NC, Va, SC, Tenn, Ga, Ala)
(The clay loam soils probably are eroded phases; the soil is extremely susceptible to accelerated erosion. On some areas "hard rock" is within 10-20 inches of the surface; on many areas the "rotten rock" may extend to several feet, although the actual soil depth is less than 18 inches.)

3. Colluvial soil from Fannin, Talladega, Watauga, Chandler, and often from Hayesville and Halewood soils.
Brown (A_1) to dark yellowish-brown (A_2) friable loam surface soils, sometimes stony; pale yellow, yellow, or brownish-yellow loam to clay loam upper subsoil (B_2) which is friable when moist, slightly plastic when wet, soft to slightly hard when dry, and has weak fine subangular blocky structure. The lower subsoil (B_3) is yellow or yellowish-brown friable clay to clay loam which frequently is mottled with brown and gray. Variable thickness of soil, mostly moderately deep. Slopes 2-30%, chiefly 5-12%. Footslopes or colluvial benches throughout the mountain and intermountain areas in association with soils listed above .... *Tate*
Red-Yellow Podzolic, Appling (NC, Va, Ga, Tenn)

IV. Soils Derived From Shales, Slates, Quartzites (and similar fine-grained rocks, and also from some low-mica schists and gneisses)

A. Soils with *Yellowish-Red* subsoils

1. Grayish-brown or pale yellow very friable stony sandy loam ($A_{1,2}$) to yellowish-red stony sandy clay loam (A_p, B_p) surface soils; yellowish-red sandy clay loam subsoil (B_2) which is friable when moist, slightly plastic when wet, slightly hard when dry, and usually contains some stony material. Moderately deep to somewhat shallow soil. Slopes 5-50%, mostly 10-30%. Intermountain and foothill areas .... *Habersham*
Red-Yellow Podzolic, Linker (NC, only in Cherokee, Clay, and Graham Counties, Ga)
(The sandy clay loam soils probably are eroded phases)

2. Pale yellow or pale brown friable silt loam ($A_{1,2}$) to brownish-yellow moderately firm silty clay loam (A_p, B_p) surface soils, usually gravelly; reddish-brown, yellowish-red, or strong brown silty clay subsoil (B_2) which contains many small gray and black flattish schist fragments and some very fine mica flakes. The subsoil is firm when moist, slightly plastic when wet, slightly hard when dry, and has weak fine subangular blocky structure; it is moderately deep. Slopes 5-40%, mostly 7-30%. Intermountain and plateau-like areas .... *Fletcher*
Red-Yellow Podzolic, Cecil (NC, Ga, Tenn)
(The silty clay loam soils probably are eroded phases.)

3. Colluvial soil from Habersham and Fletcher soils .... *Tate*
See III, B, 3.

B. Soils with *Yellowish-Brown* subsoils

1. Weak brown (A_1), or yellowish-brown friable loam ($A_{1,2}$) to loam or clay loam (A_p, B_p) surface soils; yellowish-brown fine sandy clay loam to clay

loam subsoil (B_2) which is friable when moist, slightly plastic when wet, slightly hard when dry, and has weakly developed fine subangular blocky structure. In same places flat-angular rock fragments are present on the surface and throughout the soil profile, which is moderately deep. Slopes 4-35%, mostly 6-20%. Intermountain, some in high mountain areas .... *Matney*
Gray-Brown Podzolic, Ashe (NC, Va, Tenn, Ga)
(The heavy loam to clay loam soils probably are eroded phases)

2. Weak brown, brown (A_1), or yellowish-brown friable loam (A_2) to friable clay loam (A_p, B_p) surface soils, usually gravelly or stony; yellowish-brown friable fine sandy loam to gritty loam, or firm clay loam subsoil (B_2) which nearly always contains some stony material and is shallow to very shallow. Slopes 15-90%, mostly 30-70%. High mountain, hilly low mountain areas .... *Ramsey*
Lithosol, Ramsey (NC, Tenn, Ga)
(The thin loam and clay loam soils probably are eroded phases)

3. Very dark brown friable stony organic loam surface layer (A_1) over light brownish-gray friable to moderately firm loam, silt loam, or clay loam (A_2) surface soils; brown to dark brown slightly cemented loam or silty clay loam upper subsoil (B_1); light yellowish-brown friable loam to clay loam middle (B_2) subsoil, and lightly streaked gray and yellow clay loam lower (B_3) subsoil; some stone. A moderately deep soil. Slopes 2-30%, mostly 7-15%. High mountain areas .... *Avery*
Ground-Water Podzol, Avery, (NC, only a few small areas in Avery and adjoining counties.)

4. Dark grayish-brown (A_1), to dark yellowish-gray (A_2) friable silt loam, loam, or fine sandy loam surface soils, usually stony; yellow, pale yellow, or light yellowish-brown silt loam, loam, or sandy loam subsoil (B_2) which is friable when moist, plastic when wet, and soft when dry. The subsoil frequently is a mixture of soil material and flattish rock fragments, and is very shallow. Slopes 15-80%, mostly 30-60%. High mountain areas, but commonly on low, choppy, intermountain or hilly areas .... *Muskingum*
Lithosol, Ramsey (O, Ind, Ky, Ala, Ga, Ark, Okla, Tenn, very little in Madison Co., NC)

C. Soils with *Yellow* to *Light Brownish-Gray* subsoils

1. Gray (A_1) to dark grayish-brown (A_2) friable slaty loam surface soil; yellow, pale yellow, or light brownish-gray friable slaty silt loam subsoil (B_2) which is shallow to very shallow. Slopes 16-90%, mostly 20-50%. High mountain areas, sharply sloping lower mountain ridges; also occasionally on low broad ridges .... *Ranger*
Lithosol, Litz (NC, Va, Tenn, Ga)

2. Colluvial soil from Matney, Ramsey, Ranger, Muskingum, and similar soils .... *Tate*
See III, B, 3

V. Soil From Fine-Grained Sandstone

A. Soil with *Red* subsoil

1. Yellowish-brown to purplish-brown silt loam or fine sandy loam surface soils ($A_{1,2}$), which frequently are gravelly or shaly and usually friable; reddish-gray, grayish-red, or pinkish-gray silty clay loam to fine sandy clay loam subsoil (B_2) which is firm when moist, slightly plastic when wet, and slightly

TABLE 6A. UPLAND SOILS OF THE MOUNTAIN REGION

Soil Series	Dominant Surface Textures	Approximate Total Area in Acres
Ashe	Loam	200,000
	Stony Loam	250,000
Avery	Stony Loam	1,000
Balfour	Loam, fine sandy loam	70,000
Burton	Stony loam	10,000
Chandler	Silt loam, loam	60,000
	Stony (slaty) loam	100,000
Clifton	Clay loam (eroded loam), loam	80,000
	Stony loam, stony clay loam	50,000
Edneyville	Sandy loam	7,000
Fannin	Clay loam (eroded loam), loam	50,000
	stony loam, stony clay loam	25,000
Fletcher	Silt loam	16,000
	Slaty (gravelly) silt loam	5,000
Gullied Land*		68,000
Habersham	Loam, clay loam (eroded loam)	15,000
	Stony loam, stony clay loam	40,000
Halewood	Loam	310,000
	Clay loam (eroded loam)	50,000
	Stony loam, stony clay loam	60,000
Hayesville	Loam	100,000
	Clay loam (eroded loam)	160,000
	Stony loam, stony clay loam	10,000
Iredell	Stony loam	1,000
Lehew	Silt loam	1,000
Matney	Loam, silt loam	10,000
	Gravelly (slaty) loam	6,000
Muskingum	Loam, gravelly loam	5,000
	Loam	50,000
Perkinsville	Gravelly (stony) loam	15,000
Porters	Loam	475,000
	Stony loam	600,000
Rabun	Clay loam	10,000
	Stony loam, stony clay loam	7,000
Ramsey	Silt loam, loam	170,000
	Stony (shaly) loam	480,000
Ranger	Slaty silt loam	9,000
Rock Outcrop**		3,000
Stony Rough Land***		970,000
Talladega	Silt loam, silty clay lom (eroded silt loam)	60,000
	Shaly (stony) loam	160,000

TABLE 6A. (Continued)

Soil Series	Dominant Surface Textures	Approximate Total Area in Acres
Watauga	Silt loam	40,000
	Gravelly or slaty loam	10,000
Wilkes	Gravelly loam	3,080
TOTAL, MOUNTAIN UPLAND SOILS		4,822,080

* The term Gullied Land refers to areas of the soil series listed below which are very severely sheet eroded and gullied. Gullies ranging in depth from about 2½ feet to 5 or more feet occupy one-third or more of each area. Many spots are eroded to bedrock, although strips between gullies may still retain part of the original surface soil. The soil series represented and their approximate acreages in Gullied Land are:

Ashe	3,000	Fannin	5,000	Porters	5,000
Chandler	3,000	Halewood	6,000	Ramsey	6,000
Clifton	4,000	Hayesville	20,000	Talladega	12,000

All others 4,000

** Areas of Rock Outcrop sufficiently large to delineate on soil maps (usually more than 2 acres).

*** Soil series materials and the approximate acreages of each are:

Ashe	250,000	Ramsey	250,000
Chandler	20,000	Talladega	50,000
Porters	400,000		

Of the acreage listed as Stony Rough Land probably 15% could be classed as Stony Hilly Land and 1% as Stony Rollling Land (p. 95.)

hard when dry. A moderately deep to somewhat shallow soil. Slopes 6-60%, mostly 8-35%. Intermountain and low mountain area .... *Lehew*
Lithosol, Litz (Pa, W Va, Md, Ga, Tenn, verry little in Madison Co., NC)

VI. Soil From Many Rock Formations and Local Colluvial-Alluvial Materials

A. Soil with *Mottled White, Gray, Yellow* and *Brown* subsoil

1. Gray to grayish-brown loose sandy loam to friable silt loam surface soils ($A_{1, 2, 3}$); mottled gray, pale yellow, and yellowish-brown clay loam thin (6-12") upper ($B_{1, 2}$) subsoil which is firm when moist, plastic when wet, and hard when dry; and light gray to white clay lower (B_3) subsoil which is faintly mottled with yellow, brown, and olive gray. A moderately deep soil. Slopes 1-8%. Mountain, intermountain, and plateau areas chiefly at lower elevations; around spring heads, at base of long gentle slopes, and along some drainageways .... *Worsham*
Planosol (Argipan), Guthrie (NC, Va, Tenn, Ga)

VII. Miscellaneous Soil Materials

A. At base of slopes, along stream overflow areas, or occasionally in old stream channels:

1. Flat-rounded stones mixed with a little soil .... *Stony Colluvium*
(NC, Va, Tenn, Ga)

B. On steep, rugged, broken relief—mostly in high mountain areas:

1. Various soils or soil materials largely covered with stone or boulders or having many outcrops of bedrock .... *Stony Rough Land*
(Porters, Ashe, or other soil materials)
(NC, Va, Tenn, Ga)

C. On moderately steep to rolling relief, mostly in areas of low mountain or intermountain topography:

1. Various soils or soil materials largely covered with stone or boulders or having many outcrops of bedrock .... *Stony Hill Land*
(Porters, Ashe, or other soil materials)
(NC, Va, Tenn, Ga)

TABLE 6B. COLLUVIAL SOILS OF THE MOUNTAIN REGION

Soil Series	Dominant Surface Textures	Approximate Total Area in Acres
Stony Colluvium		10,000
Dyke		20,000
Tate	Loam, silt loam	30,000
	Gravelly and stony loams	10,000
Tusquitee	Loam, silt loam	50,000
	Gravelly and stony loams	60,000
Worsham*	Variable	10,000
TOTAL, MOUNTAIN COLLUVIAL SOILS		190,000

* Approximately one-half of the Worsham soil series areas are formed of residual materials, and one-half of local colluvial-alluvial materials. Probably three-fourths of all the areas occupy positions similar to those of colluvial soils.

TABLE 6C. STREAM TERRACE SOILS OF THE MOUNTAIN REGION

Soil Series	Dominant Surface Texture	Approximate Total Area in Acres
Altavista	Silt loam	6,000
Augusta	Silt loam	7,000
Hiwassee	Clay loam	15,000
Holston	Fine sandy loam	2,000
Masada	Loam	8,000
Roanoke	Silt loam	3,000
State	Loam	10,000
Warne	Silt loam	4,000
TOTAL, MOUNTAIN TERRACE SOILS		55,000

D. Also on rolling relief, as broad ridge tops, some small areas of *Stony Rolling Land*
(Various soil materials)
(NC)

E. Rock. When of sufficient size—usually more than two acres in extent—solid rock outcrops are indicated on soil maps (symbol R) .... *Solid Rock Outcrop*
(NC, Va, Tenn, Ga)

Stream Terrace Soils of the Mountain Region—See Page 77

Alluvial Soils of the Mountain Region—See Page 80

Soils Derived From Limestones

Limestone (rock) materials occur in several parts of the Piedmont and Mountain regions of North Carolina. But, except for a few small areas, all limestone, marble, and similar rocks are covered by a mantle of other geologic materials to a depth of several feet.

In the Piedmont less than 300 acres of soils have been recognized as derived from limestones. These soils are in two locations: (1) South of Kings Mountain along the Cleveland-Gaston County line, where the soils resemble the Decatur and Dewey soils of Alabama and Tennessee; and (2) near Woodlawn in McDowell County, where the resemblance is to the Dewey soils.

The only recognized soil areas derived from limestones in the Mountain region are in Cherokee County: (1) In the vicinity of Marble are several small bodies

TABLE 6D. ALLUVIAL SOILS OF THE MOUNTAIN REGION

Soil Series	Dominant Surface Texture	Approximate Total Area in Acres
Buncombe	Sand	15,000
Chewacla	Silt loam	45,000
Congaree	Fine sandy loam	25,000
Pope	Fine sandy loam	1,000
Toxaway	Loam	13,000
Transylvania	Fine sandy loam	5,000
Wehadkee	Silt loam	15,000
TOTAL, MOUNTAIN ALLUVIAL SOILS		119,000

TOTALS FOR THE MOUNTAIN REGION

	Acres
Upland soils	4,822,080
Colluvial soils	190,000
Stream terrace soils	55,000
Alluvial soils	119,000
GRAND TOTAL, MOUNTAIN REGION	5,186,080

of soils resembling the Decatur soil, but their total area probably is less than 50 acres; and (2) along the boundary between the county and Tennessee are a few areas of Decatur-like soil with an estimated acreage of less than 100.

RESEARCH

The research phase of Soil Survey includes studies (1) to clarify points involved in soil classification; (2) to define the range of variability within mapping units; (3) to show the significance of mapping units upon soil management; and (4) fundamental research in soil genesis.

Among the factors involved in research are those dealing with the relationships of soil parent material, slope, erosion, and drainage to soil development and to soil classification. Other factors deal with the influence of soil on tillage and plant response. This publication does not include any further discussion of research.

USE AND INTERPRETATION

The standard report of the U. S. Department of Agriculture, Soil Survey Division, includes (1) an explanation of how to use the soil map and report; (2) a general description of the area, which is usually a county; (3) descriptions of the individual soil units shown on the map, with supplemental tables and charts to show their characteristics and their relationships; (4) predictions of the yields of the common crops of the area under different specifically defined sets of management practices for all of the soils mapped; and (5) explanations of the management problems of each soil, with particular emphasis on how the characteristics of the soil influence the problems and their solutions.

The report deals specifically with the morphology and genesis of soils and the characterization of their properties. Its greatest use is by technical and research personnel, and probably will continue so.

A somewhat "popular" type of report, published by the North Carolina Agricultural Experiment Station for current and future soil surveys, is being planned. This will be preliminary to the USDA standard report. It will contain a key map to the field sheets of the survey, a mapping code key, and information dealing with the interpretation and use of the survey map. Photographic reproductions of field sheets will be available at the county agricultural agents' office for a nominal fee.

As conditions warrant, some of the older soil survey reports will be revised. The revisions will include information setting forth the relationship of new or present-day mapping units with those on the old soil map. Data will be furnished to show the percentage of inclusions of new mapping units, the means of separating these differences, the interpretive value of the new units as well as the old, and information on current research with soils and crops. With both new and revised reports, examples of farms will be presented showing how to use the information from the soil survey.

The use and interpretation phase of Soil Survey emphasizes the ultimate objective of the program: prediction of the agricultural capabilities of each mapping unit in terms of expected average yields of adapted crops under more than one set of specified management practices.

Steps to attain the objective include (1) the study of the performance and yield of crops from different soils under known management systems; (2) the organization of this information in relation to the system of classifying soils; (3) the development of an educational program to show how soil survey reports and maps may be interpreted and used effectively; and (4) the use of techniques to indicate the nature of soil properties and their influence on soil use and management.

North Carolina Agricultural Experiment Station Bulletin 293, "Agricultural Classification and Evaluation of North Carolina Soils", 1934, contains tables which show productivity ratings for the soils of each type-of-farming area. Fertilizer recommendations are given by soil groups.

Bulletins somewhat similar to 293 have been issued by several states since 1934, and include tables showing soil productivity ratings. In some state bulletins the fertilizer recommendations are given for individual soils or for groups of soils. In North Carolina some of the soil and crop specialists and agencies dealing with soils and their management feel that many of the inherent differences among soils within a region, such as a type-of-farming area, can be equalized by management, more especially with higher rates of fertilization and adequate liming. Such an attitude may not always be sound.

Practically all of the soils of North Carolina were quite acid in their native, undisturbed cover. They were very low in available phosphorus, and low in potassium. Subsequent differences in liming and fertilization practices for various crops have resulted in considerable differences in the fertility level among areas of a particular soil. Hence, it is difficult, and perhaps misleading, to assign any given productivity rating to a soil series or a soil type in this State where moderate to heavy rates of lime and fertilizer have been used for many years.

There is no widespread application of any measure or rating—on a scientific basis—of the kinds of responses among different soils to management. Observation and experience of farmers, and of research and extension workers, indicate variable degrees of responses even among soils relatively alike. True, the more alert farmer can go a long way to modify unfavorable soil properties. He may level off differences among many soils, but even the best farmer may not achieve satisfactory results with some soils.

Soil productivity rating tables are not included in this bulletin. However, tables which indicate the *comparative suitability* of soils for the major crops grown in the three geographic regions are shown in Tables 7, 8, and 9, pages 100-125. For specific fertilizer recommendations it is suggested that the *Handbook for Agricultural Workers,* issued annually by the North Carolina Agricultural Extension Service, be used. This Handbook lists current fertilizer grades and may give recommendations by geographic regions, but not for all soil groups or type-of-farming areas. Farmers may avail themselves of the free services of the Soil Testing Laboratory of the State Department of Agriculture for fertilizer recommendations based on soil tests.

Soil associations, another means of interpreting and using the Soil Survey, are described on pages 126-170.

COMPARATIVE SUITABILITY OF SOILS

Tables 7, 8, and 9 are designed to show the *comparative suitability* of the soils of the Coastal Plain, Piedmont, and Mountain regions for the major crops grown. Therefore, it is assumed that management practices are equal and that soil is the variable. The tables were prepared in 1943, revised in 1950, and further revised and edited in 1955 to bring them up-to-date. Sources of information used in setting up and revising the tables are:

1. Data of the North Carolina Agricultural Experiment Station and the State Department of Agriculture.[18]
2. Soil Survey reports of 76 counties in North Carolina.
3. Information obtained from farmers.
4. Observations of 14 soil survey men, each with 19 or more years' experience in North Carolina.[19]

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[18] (1) The Bulletin of the North Carolina Department of Agriculture: A Preliminary Report on the Mountain Soils, Vol. 32, No. 5, May 1911, Whole No. 151; Report on the Piedmont Soils, Vol. 36, No. 2, February 1915, Whole No. 206; Report on the Coastal Plain Soils, Vol. 39, No. 5, May 1918, Whole No. 244.

(2) Agricultural Classification and Evaluation of North Carolina Soils. N. C. Agr. Exp. Sta. Bul. 293, 1934.

(3) Influence of Crop Rotation and Soil Treatments Upon the Yield of Crops on Porters Loam Soils. N. C. Agr. Exp. Sta. Bul. 315, 1937.

(4) Soil Fertility Studies in the Piedmont.

I. Effects of Limestone and Fertilizers in a 4-year rotation. N. C. Agr. Exp. Sta. Bul. 331, 1942.

II. The Effect of Crop Rotations in Crop Production. N. C. Agr. Exp. Sta. Bul. 341, 1943.

III. The Effect of Different Sources of Nitrogen on Crop Yields. Unpub. Ms., C. B. Williams, W. H. Rankin, J. W. Hendricks.

(5) Agronomy Information Circular 21, 1929—The Quality and Yield of Cotton as Influenced by Fertilizers and Soil Type.

(6) Agronomy Information Circular 62, 1931—Outline of Agronomy Work Being Conducted in North Carolina.

(7) Agronomy Information Circular 67, 1932—Soil Types of North Carolina Found Suited in the Growth of Different Crops.

(8) Agronomy Information Circular 94, 1935—North Carolina Soils Evaluated for Crop Growth

Note: (5), (6), (7), (8) were issued by the Department of Agronomy, N. C. State College

(9) Plant Nutrient Deficiencies of Important Soils of the Piedmont and Mountain Regions of North Carolina: A Summary of Field Data, 1902-1940; Unpub. Ms., C. B. Williams.

(10) Plant Nutrient Deficiencies of Important Soils of the Coastal Plan Region of North Carolina: A Summary of Field Data, 1910-1937; Unpub. Ms., C. B. Williams.

(11) Soil Fertility Studies in the Coastal Plain, 1916-1937; Unpub. Ms., C. B. Williams, H. B. Mann, W. H. Rankin, Charles Dearing.

(12) Soil Fertility Studies in the Mountains

I. 1911-1940, Unpub. Ms., C. B. Williams, W. H. Rankin.

II. 1918-1937, Unpub. Ms., C. B. Williams, W. H. Rankin, S. C. Clapp

III. 1910-1940, Unpub. Ms., C. B. Williams

[19] The following men helped set up the rating tables or offered suggestions for revisions: W. E. Hearn, S. O. Perkins, and R. C. Jurney of the Soil Survey Division, BPISAE, USDA; E. F. Goldston and W. A. Davis of the N. C. Agr. Exp. Sta.; W. W. Stevens, C. L. Hunt, J. B. Watts, H. J. Bragg, W. Haskins, J. B. Newman, R. C. Pleasants, L. O. Rowland, and J. L. Zimmerman of the Soil Conservation Service, USDA. (The Soil Survey Division was transferred to the Soil Conservation Service on Nov. 15, 1952.)

TABLE 7 COMPARATIVE SUITABILITY OF COASTAL PLAIN SOILS FOR THE MAJOR CROPS GROWN*

Soils by Drainage Classes** (More extensive or more common type of each soil series)	Remarks	Corn	Cotton	Tobacco	Soybeans	Peanuts	Sweet Potato	White Potato	Oats	Wheat	*** Hay	Perm. Pas.
1. Well drained to excessively drained soils												
a. With loose sand subsoil Kershaw sand Lakewood sand St. Lucie sand	Very droughty, leach severely, considerable wind erosion.	Very Poor ****	Poor ****	Poor	Very Poor	Poor (Seldom grown)	Poor	Very Poor (Rarely grown)	Very Poor	Very Poor	Very Poor	Poor
2. Well drained to somewhat excessively drained soils												
a. With loose sand or loamy sand subsoils Eustis sand Lakeland sand	These soils are droughty, leach readily, and are subject to considerable wind erosion loss under average management. Under intensive management they would be given a suitability rating of one level higher. These are the principal soils used for peaches in the Sandhills.	Poor	Fair ****	Fair	Poor	Fair	Fair	Poor	Poor	Poor	Poor	Poor
3. Well drained soils												
a. With loose sand to loamy sand subsoils Blanton sand Choptank sand Evesboro sand Galestown sand Huckabee loamy sand (stream terrace) Independence loamy sand (stream terrace)	Droughty, leach readily, considerable wind erosion. None of these soils is extensive.	Poor	Fair	Fair	Fair	Fair	Fair	Poor	Poor	Poor	Poor	Poor
b. With sandy loam to friable sandy clay loam subsoils	Suitability ratings are for soils with normal surface soil thickness, which is about 12-16". Where the surface soil is more than 20" thick, the rating is one level lower. These are good all-round soils, easily tilled, very responsive to management. All are subject to wind erosion losses, and the Orangeburg, Red Bay, and Ruston also are subject to water erosion. The Norfolk is especially well suited to tobacco, peanuts, and sweet potatoes for quality—also for high yields when intensively managed.	****										
Kenansville sandy loam		Good	Good	Good	Fair	Good	Good	Fair	Fair	Fair	Fair	Fair
Norfolk sandy loam		Good	Very Good	Very Good	Good	V. Good	V. Good	Good	Good	Good	Good	Good
Orangeburg sandy loam		Good	V. G.	V. G.	Good	V. Good	V. Good	Good	Good	Good	Good	Good
Red Bay sandy loam		Good	V. G.	Good	Good	V. Good	V. Good	Good	Good	Good	Good	Good
Rumford sandy loam												
Ruston sandy loam		Good	Good	V. G.	Good	V. Good	V. Good	Good	Fair	Good	Good	Good
Sassafras sandy loam												
Cahaba sandy loam (stream terrace)		Good	V. G.	Good	Good	V. Good	V. Good	Good	Good	Good	Good	Good
Kalmia sandy loam (stream terrace)		Fair	Good	Good	Good	Good	Good	Fair	Fair	Fair	Fair	Fair

TABLE 7 (Continued)

Soils	Remarks	Corn	Cotton	Tobacco	Soybeans	Peanuts	Sweet Potato	White Potato	Oats	Wheat	*** Hay	Perm. Pas.
c. With firm sandy clay subsoils	The Faceville, Magnolia, and Marlboro are among the best all-round soils in the Coastal Plain. All 6 soils in this group are subject to wind and water erosion, but seldom are difficult to till. Erosion can be controlled readily by careful management. Marlboro probably is the best cotton soil in the southeastern U. S.											
Faceville fine sandy loam		Good	V. Good	V. Good	Good	V. Good	V. Good	Good	Good	V. Good	V. Good	V. Good
Gilead sandy loam		Fair	Fair	Good	Fair	Poor (Rarely grown)	Good	Fair (Seldom grown)	Fair	Fair	Fair	Fair
Hoffman sandy loam		Fair	Fair	Fair	Fair	Poor (Rarely grown)	Fair	Poor (Rarely grown)	Fair (Sel. gr.)	Poor (Sel. gr.)	Fair (Sel. gr.)	Fair
Magnolia fine sandy loam		Good	V. Good	V. Good	Good	V. Good	V. Good	Good	Good	V. Good	V. Good	V. Good
Marlboro fine sandy loam		Good	V. Good	V. Good	Good	V. Good	V. Good	Good	Good	V. Good	V. Good	V. Good
Vaucluse sandy loam		Fair	Fair	Good	Fair	Good	Good	Fair (Sel. gr.)	Fair (Sel. gr.)	Fair	Fair	Fair
d. With very firm sandy clay, silty clay or clay subsoils	Very susceptible to erosion, also difficult to till when eroded. Ratings are for soils showing slight erosion losses.											
Boswell sandy loam		Fair	Good	Fair	Good	Poor (Rarely grown)	Fair	(Not gr.)	Good	Good	Good	Good
Matapeake fine sandy loam		Good	Fair (Rarely grown)	Fair (Rarely grown)	Good	Good	Good (Sel. gr.)	Good	Good	Good	Good	Good
Caroline sandy loam		Fair	Good	Good	Good	V. Good	Good	Fair (Sel. gr.)	Good	V. Good	Good	Good
4. Moderately well drained soils												
a. With loose sand to loamy sand subsoils	Somewhat droughty and leaches readily, yet can be maintained at satisfactory level of production by careful management. Occasionally becomes saturated during prolonged rains.											
Klej sand		Poor	Fair	Fair	Fair	Fair	Fair	Fair	Fair	Fair (Sel. gr.)	Fair	Fair
b. With sandy loam to friable sandy clay loam subsoils	Good all-round soils. Responsive to intensive management with resultant high yields; easily tilled. Occasional ditching required for tobacco.											
Goldsboro sandy loam Woodstown sandy loam		Good	Good	Good	Good	V. Good	Fair	Good	Fair	Fair	Good	Good
c. With firm sandy clay subsoil	A very good all-round soil, highly responsive to management. Occasional ditching required for tobacco.											
Duplin fine sandy loam		Good	V. Good	Good	Good	V. Good	V. Good	Good	Good	Good	V. Good	Good
d. Soil relatively uniform throughout its profile	One of the better vegetable soils in the Elizabeth City area.											
Nixonton very fine sandy loam		Good	(Not grown)	(Not grown)	Good	Fair (Sel. gr.)	Fair (Sel. gr.)	Good	Good	Good (Sel. gr.)	Good (Sel. gr.)	V. Good (Sel. gr.)

TABLE 7 (Continued)

Soils	Remarks	Corn	Cotton	Tobacco	Soybeans	Peanuts	Sweet Potato	White Potato	Oats	Wheat	*** Hay	Perm. Pas.
e. With very firm sandy clay to clay subsoil												
Craven fine sandy loam	Craven soil on slopes of 3% or more probably is more susceptible to erosion than any other soil in the Coastal Plain.	Fair	Good	Fair	Good	Good	Fair	Fair	Fair	Good	Fair	Good
Mattapex fine sandy loam	Of minor extent.	Good	Good (Sel. gr.)	(Not gr.)	Good	Good	Fair (Sel. gr.)	Good	Good	Good	Good	Good
Keyport fine sandy loam Invershiel fine sandy loam	Of minor extent.	Good	Good	Fair (Sel. gr.)	Good	Good (Sel. gr.)	Fair (Sel. gr.)	Good (Sel. gr.)	Good	Good	V. Good	Good
Flint fine sandy loam (stream terrace)	Of minor extent.	Good	Fair (Rarely grown)	(Rarely grown)	Good	Fair (Rar. gr.)	Poor (Rar. gr.)	Poor (Rar. gr.)	Good	Good (Sel. gr.)	Good	V. Good
Izagora fine sandy loam (stream terrace)	Of minor extent.	Good	Fair (Rarely grown)	(Rarely grown)	Good	(Not grown)	(Not gr.)	Fair (Rar. gr.)	Good	Fair (Sel. gr.)	Good	Good
5. Somewhat poorly drained soils												
a. With loose sand to friable loamy sand subsoils Klej sand Scranton sand	Klej covers two drainage ranges. Both soils require artificial drainage.	Poor	Fair (Sel. gr.)	Poor (Sel. gr.)	Fair	(Not grown)	Fair (Sel. gr.)	Fair	Good	Poor (Sel. gr.)	Fair	Fair
b. With sandy loam to friable sandy clay loam subsoils	Must be drained for all crops except possibly pasture. Responsive to careful management and can be made quite productive. Stough and Stono are minor soils.											
Dragston sandy loam		Good	Good	Fair	Good	Good	Good	Good	V. Good	Good	Good	V. Good
Lynchburg sandy loam		Good	Good	Fair	Good	Good	Good	Good	V. Good	Good	Good	V. Good
Stono sandy loam		Good	Fair (Rar. gr.)	Poor (Rar. gr.)	Good	Poor (Rar. gr.)	Poor (Rar. gr.)	Good	V. Good	(Not gr.)	Good	V. Good
Stough fine sandy loam (stream terrace)		Good	Poor (Rar. gr.)	V. Poor (Rar. gr.)	Good	Poor (Rar. gr.)	(Not gr.)	Poor (Rar. gr.)	V. Good	Fair (Sel. gr.)	Good	V. Good
c. With firm fine sandy clay subsoil Dunbar fine sandy loam	Must be drained for all crops, except possibly pasture. A good all-round soil, very responsive to intensive management.	Good	Good	Fair	V. Good	Good	Fair	Good	V. Good	Good	V. Good	V. Good
d. Soil relatively uniform throughout its profile Barclay silt loam	Only in the Elizabeth City area, but a good all-round soil when drained.	Good	(Not gr.)	(Not gr.)	Good	Good	Fair (Sel. gr.)	Good	V. Good	Good	V. Good	V. Good

TABLE 7 (Continued)

Soils	Remarks	Corn	Cotton	Tobacco	Soybeans	Peanuts	Sweet Potato	White Potato	Oats	Wheat	*** Hay	Perm. Pas.
e. With very fine sandy clay, silty clay, or clay subsoils												
Bladen very fine sandy loam	Must be drained for all crops. Usually difficult to drain because of low position, and difficult to till because of fine texture. Bladen is very responsive to intensive management, other soils moderately responsive. Byars and Leaf are of minor extent.	V. Good	Good	Fair (Sel. gr.)	V. Good	Fair	Fair (Sel. gr.)	V. Good	V. Good	Good (Sel. gr.)	V. Good	V. Good
Coxville very fine sandy loam		Good	Fair	Fair (Sel. gr.)	V. Good	Fair	Fair (Sel. gr.)	Good	V. Good	Good (Sel. gr.)	V. Good	V. Good
Elkton silt loam		Good	(Not gr.)	(Not gr.)	V. Good	Fair	V. Poor (Rar. gr.)	Good	V. Good	Good (Sel. gr.)	Good	V. Good
Othello very fine sandy loam		Good	Fair	Fair (Sel. gr.)	V. Good	Fair	V. Poor (Rar. gr.)	V. Good	V. Good	Good (Sel. gr.)	V. Good	V. Good
Tidewater very fine sandy loam		V. Good	Fair	Fair (Sel. gr.)	V. Good	Fair	Fair (Sel. gr.)	V. Good	V. Good	Good (Sel. gr.)	V. Good	V. Good
Byars silt loam (stream terrace		V. Good	(Not gr.)	(Not gr.)	Fair (Sel. gr.)	(Not gr.)	(Not gr.)	Poor (Sel. gr.)	V. Good	Poor (Rar. gr.)	Good	Good
Leaf very fine sandy loam (stream terrace)		Good	(Not gr.)	(Not gr.)	Fair (Sel. gr.)	(Not gr.)	Poor (Sel. gr.)	Poor (Sel. gr.)	V. Good	(Not gr.)	Good	Good
7. Very poorly drained soils												
a. With loose sand to loamy sand subsoils												
Elwell loam	Must be drained for all crops, but drainage usually difficult because of low position. Moderately responsive to management. Very good for leafy vegetables.	V. Good	Poor (Rar. gr.)	V. Poor (Rar. gr.)	V. Good	(Not gr.)	V. Poor (Rar. gr.)	Good	V. Good	V. Poor (Rar. gr.)	V. Good (Sel. gr.)	V. Good
Rutlege loamy sand		Fair	Poor (Rar. gr.)	V. Poor (Rar. gr.)	Fair	(Not gr.)	(Not gr.)	Fair	Good	V. Poor (Rar. gr.)	Fair (Sel. gr.)	Good
b. With sandy loam to friable sandy clay loam subsoils												
Pocomoke loam	Must be drained for all crops, but often difficult to drain and to till because of low, flat position. Responsive to management, but tend to remain wet following prolonged rains even when ditched or tiled. Very good for most vegetables.	V. Good	Fair (Sel. gr.)	V. Poor (Rar. gr.)	V. Good	Fair (Rar. gr.)	Fair (Sel. gr.)	V. Good	V. Good	Fair (Sel. gr.)	V. Good	V. Good
Portsmouth loam		V. Good	Fair (Sel. gr.)	V. Poor (Rar. gr.)	V. Good	Fair (Rar. gr.)	Fair (Sel. gr.)	V. Good	V. Good	Fair (Sel. gr.)	V. Good	V. Good
Okenee loam (stream terrace)		V. Good	Fair (Sel. gr.)	V. Poor (Rar. gr.)	V. Good	Fair (Rar. gr.)	(Not gr.)	V. Good	V. Good	Fair (Sel. gr.)	V. Good	V. Good

TABLE 7 (Continued)

Soils	Remarks	Corn	Cotton	Tobacco	Soybeans	Peanuts	Sweet Potato	White Potato	Oats	Wheat	*** Hay	Perm. Pas.
e. With very firm sandy clay to clay subsoil	Must be drained for all crops. Difficult to till because of fine texture; very susceptible to erosion when on slopes greater than 1%, yet responsive to intensive management. Eulonia and Sawyer are of minor extent.											
Bertie very fine sandy loam		Good	Good	Fair	Good	Good	Fair	Good	Good	Good	Good	Good
Eulonia very fine sandy loam		Good	Fair	Fair (Sel. gr.)	Good	(Not gr.)	Fair (Sel. gr.)	Good (Sel. gr.)	Good	Good	Good	Good
Lenoir very fine sandy loam		Good	Fair	Fair	Good	Good	Fair	Good	Good	Good	Good	Good
Sawyer very fine sandy loam		Good	Fair	Fair (Sel. gr.)	Good	(Not gr.)	Fair (Sel. gr.)	Good (Sel. gr.)	Good	Good	Good	Good
6. Poorly drained soils												
a. With loose sand to friable loamy sand subsoil	Must be drained for all crops, but difficult to drain because of flow sand character of subsoil. Poor response to management.											
Plummer sand		Poor	Poor (Sel. gr.)	Poor (Sel. gr.)	Poor	Poor (Sel. gr.)	Poor (Sel. gr.)	Poor (Sel. gr.)	Fair	(Not gr.)	Poor	Fair
b. With sandy loam to friable sandy clay loam subsoils	Must be drained for all crops. Moderately responsive to intensive management. Good vegetable soils. Myatt is of minor extent.											
Fallsington sandy loam		Good	Good (Sel. gr.)	Fair (Sel. gr.)	Good	Fair (Sel. gr)	Fair (Sel. gr.)	Good	V. Good	Fair (Sel. gr.)	V. Good	V. Good
Rains sandy loam		Good	Good (Sel. gr.)	Fair (Sel. gr.)	Good	Fair (Sel. gr.)	Fair (Sel. gr.)	Good	V. Good	Fair (Sel. gr.)	V. Good	V. Good
Myatt sandy loam (stream terrace)		Good	Poor (Rar. gr.)	V. Poor (Rar. gr.)	Good	(Not gr.)	(Not gr.)	Good	V. Good	Fair (Rar. gr.)	V. Good	V. Good
c. With fine sandy clay subsoil	Must be drained for all crops. Responsive to intensive management. Good vegetable soil.											
Faison fine sandy loam		Good	Fair (Sel. gr.)	Fair (Sel. gr.)	V. Good	Fair (Sel. gr.)	Fair (Sel. gr.)	Good	V. Good	Fair (Sel. gr.)	V. Good	V. Good
d. Soil relatively uniform throughout its profile	Must be drained for all crops. Occurs only in Elizabeth City area, where it is one of the best vegetable soils.											
Pasquotank silt loam		V. Good	(Not gr.)	(Not gr.)	V. Good	Poor (Rar. gr.)	(Not gr.)	V. Good	V. Good	(Not gr.)	V. Good	V. Good

TABLE 7 (Continued)

Soils	Remarks	Corn	Cotton	Tobacco	Soybeans	Peanuts	Sweet Potato	White Potato	Oats	Wheat	*** Hay	Perm. Pas.
c. With firm silty clay subsoil Hyde loam	Must be drained for all crops, but often difficult to drain and to till because of low, flat position. Responsive to management, but tends to remain wet following prolonged rains even when ditched or tiled. Very good for most vegetables.	V. Good	Good (Sel. gr.)	Fair (Rar. gr.)	V. Good	Fair (Rar. gr.)	Fair (Rar. gr.)	V. Good	V. Good	Good (Sel. gr.)	V. Good	V. Good
d. Soil relatively uniform throughout its profile Weeksville silt loam	Must be drained for all crops, but often difficult to drain and to till because of low, flat position. Responsive to management, but tends to remain wet following prolonged rains even when ditched or tiled. Very good for most vegetables.	V. Good	(Not gr.)	(Not gr.)	V Good	(Not gr.)	(Not gr.)	V. Good	V. Good	(Not gr.)	V. Good	V. Good
e. With very firm silty clay or clay subsoil Bayboro loam	Must be drained for all crops, but often difficult to drain and to till because of low, flat position. Responsive to management, but tends to remain wet following prolonged rains even when ditched or tiled. Very good for most vegetables.	V. Good	Good (Sel. gr.)	(Not gr.)	V Good	(Not gr.)	(Not gr.)	V. Good	V. Good	Good (Sel. gr.)	V. Good	V. Good
Pender clay loam	Very low acreage of Pender	V. Good	Fair (Sel. gr.)	(Not gr.)	V Good	(Not gr.)	(Not gr.)	(Not gr.)	V. Good	(Not gr.)	V. Good	V. Good
Soils with Hardpans												
1. Moderately well to somewhat poorly drained soil with firm sandy clay loam subsoil a. With thin hardpan, 4-12" below surface Onslow fine sandy loam	Hardpan never interferes with cultivation. Some drainage needed for most crops.	Good	Fair	Fair	Good	Good (Sel. gr.)	Good	Good	Good	Good	Good	Good
2. Somewhat poorly drained soils which are mostly sand a. With thick (4-12") dense hardpan at 12-20" below the surface Leon sand	Considered by farmers as one of the best soils for blueberries. Seldom used for other crops.	Poor	Poor	Poor	Poor	(Not gr.)	(Not gr.)	(Not gr.)	Poor	(Not gr.)	V. Poor (Sel. gr.)	Poor

TABLE 7 (Continued)

Soils	Remarks	Corn	Cotton	Tobacco	Soybeans	Peanuts	Sweet Potato	White Potato	Oats	Wheat	*** Hay	Perm. Pas.
b. With moderately thick (3-8") hardpan-like layer 30-40" below the surface Immokalee sand	Droughty, leaches readily	Poor	Poor	Poor	Poor	Poor	Poor	(Not gr.)	V. Poor (Sel. gr.)	(Not gr.)	Poor (Sel. gr.)	Poor
3. Somewhat poorly to poorly drained soil which is mostly sand a. With moderately thick (2-7") soft hardpan-like layer at 10-16" below the surface Ona sand	Must be drained if farmed. Seldom used for any crop other than corn.	Poor	Poor (Rar. gr.)	Poor (Rar. gr.)	Poor (Sel. gr.)	(Not gr.)	(Not gr.)	Poor (Sel. gr.)	Poor	(Not gr.)	Poor	Poor
4. Poorly to very poorly drained soil which is mostly sand a. With moderately thick (2-8") dense hardpan 12-18" below the surface St. Johns sand	Must be drained if farmed. Seldom used for any crop other than blueberries for which it is considered good by farmers.	Poor (Sel. gr.)	Poor (Rar. gr.)	(Not gr.)	Poor (Sel. gr.)	(Not gr.)	(Not gr.)	Poor (Sel. gr.)	Fair	(Not gr.)	Poor	Poor
Miscellaneous Soil Materials												
1. Excessively drained "blow sand" near the Atlantic Ocean Dunesand	Very droughty	Not suited to any agricultural use, so far as presently known.										
2. Well drained to excessively drained sand, gravel, and shells, subject to rare, occasional, or regular overflow Coastal Beach	Very droughty	Has very limited agricultural use in a few small spots here and there.										
3. Poorly drained to very poorly drained soil materials near coastal sounds or broad, sluggish streams, or along smaller inland streams Mixed Alluvial Land Tidal Marsh Fresh Water Marsh Swamp		Poorly suited to any agricultural use, except occasional areas for some grazing, because of (1) difficulty of adequate drainage, (2) frequent overflow, and (3) mixed character of the soil materials.										

TABLE 7 (Continued)

Soils	Remarks	Corn	Cotton	Tobacco	Soybeans	Peanuts	Sweet Potato	White Potato	Oats	Wheat	*** Hay	Perm. Pas.
4. Very poorly drained organic soil materials: upland bogs Muck, Mucky Peat, Peat	A very few acres are producing fair to good yields of pasture plants, corn, oats, soybeans, blueberries, cotton, and vegetables. Apparently the bog soils are of doubtful agricultural value because of the difficulty of maintaining adequate drainage, the possibility of drought if drained, the high probability of fire, and the problems involved in maintaining a satisfactory fertility level. Bog soils are "cold soils", being subject to frosts much later than nearby lighter-colored mineral soils. If a constant water table can be maintained, as in the Everglades projects of Florida, very good yields of many crops are possible with heavy fertilization and liming.											

* In this suitability rating table it is assumed that management practices, climate, and other external features are reasonably constant, and that soil is the variable. Thus, if areas of Lakeland sand and of Norfolk sandy loam, which frequently adjoin, have identical treatment the yields on the Norfolk will be considerably higher than yields on the Lakeland. (Plate 1).

** See p. 30 for a description of the soil drainage classes.

*** Hay includes soybeans cut green, oats cut green, peanut vines, lespedeza, mixed grasses, sometimes alfalfa. By far the greater proportions are soybean or peanut hay. The latter is incidental to the production of peanuts for nuts.

**** A soil indicated as *very good* for a crop is one that produces high yields, excellent or very good quality, and it is not very difficult to till. A soil indicated as *good* for a crop produces medium high yields or yields somewhat lower than a *very good* soil under equal management, the quality of the crop is above average for all soils, and the soil is not difficult to till. A *fair* soil is one which produces yields about average for the crop on all soils, quality is average, and tillage may or may not be difficult. Soils rated as *poor* or *very poor* usually produce low to very low yields because of some adverse factor such as droughtiness or, conversely, difficulty of adequate drainage, or heavy texture.

For corn a *very good* soil will yield above 60 bushels per acre under "average" management; a *good* soil about 40-59 bushels; a *fair* soil about 25-39 bushels; a *poor* soil about 10-24 bushels; a *very poor* soil under 10 bushels. "Average" management for corn means about 300 pounds of 5-10-10 or similar fertilizer before planting and a side dressing of 30 pounds of nitrogen, and a 2 or 3 year rotation which includes a legume with at least part of the legume crop turned under. For cotton "average" management means about 500 pounds of 5-10-10 or equivalent fertilizer per acre, a side-dressing of 15-30 pounds of nitrogen, insect control practices, occasional to frequent change of fields, but seldom a definite rotation of 3 or more years with a turned-under legume. With such management, soils rated *very good* will give yields of 400-500 pounds, *good soils* 300-399 pounds, *fair soils* 200-299 pounds, *poor soils* 100-199 pounds, and *very poor* soils under 100 pounds. Few farmers plant cotton on soils they do not consider as good or very good for this crop.

Tobacco on nearly all farms receives first consideration in choice of soil, as determined by the farmer's experience. The general practice in many counties is to plant tobacco on the same fields each year unless diseases or insects force a change. Practically all tobacco growers fertilize heavily (1000 or more pounds of 4-8-10 or the equivalent). In the comparative suitability ratings the factor of *quality* has received as much consideration as *yield*. Such soils as Hyde loam will produce very high yields but the quality is mediocre because of the heavy, rough, dark leaves.

TABLE 8. COMPARATIVE SUITABILITY OF PIEDMONT SOILS FOR THE MAJOR CROPS GROWN*

Soils	Remarks	Corn	Tobacco	Cotton	Wheat	Oats	Lespedeza	Alfalfa	Permanent Pasture
Soils grouped by **origin** or parent material, **color, consistence, texture** of subsoil and surface soil according to the Key on pp. 66-87. The more extensive type is listed for each series. The prevailing or more common slope range and degree of erosion for areas of the soil under cultivation or in pasture are indicated by letter in parentheses**									
I. Soils from acid crystalline rocks (areas included are most of the central and western Piedmont, some on extreme east, Figs. 1 and 8)									
A. With red firm clay subsoils									
Cecil sandy loam (U, mod)	Considered a good cotton soil by farmers, and a fair all-round soil; very susceptible to erosion.	Fair ***	Good ***	Good	Fair	Fair	Fair	Good	Good
Cecil clay loam (Slo, sev)	Susceptible to further erosion; farmers like this soil for wheat, alfalfa, clover, grass, but not for tobacco.	Fair	Fair	Good	Very Good ***	Fair (Seldom grown)	Good	Very Good	Good
Hayesville clay loam (Slo, sev)	Susceptible to further erosion because usually on steep or strongly rolling relief; about same farmer preference as Cecil clay loam. Most areas should be in sod crops.	Poor ***	Fair	Fair (Seldom grown)	Good	Fair (Seldom grown)	Good	Good	Good
Yadkin clay loam (U, sev)	Similar to Cecil clay loam, probably less susceptible to erosion.	Good	Fair (Seldom grown)	Good	Very Good	Good (Seldom grown)	Very Good	Very Good	Good
Cataula sandy clay loam (U, sev)	Very susceptible to erosion; difficult to till.	Fair	Fair	Good (Seldom grown)	Good	Fair (Seldom grown)	Good	Good	Good
Lockhart sandy clay loam (U. sev)	Very susceptible to erosion, especially gullying. Anson County farmers consider this a very good cotton soil.	Fair	Good	Very Good	Good	Good	Good	Good	Good
B. With yellowish-red firm clay subsoils									
Appling sandy loam (U, mod)	Produces high quality tobacco; farmers consider it a good all-round soil. Used for commercial truck crops in Warren and Davidson Counties.	Fair	Very Good	Good	Good	Good	Good	Good	Good
Halewood loam (Slo, mod)	Usually on sloping to steep relief and therefore poorly suited to row crops. On slopes under 15% this is a good all-round soil.	Fair	Fair (Seldom grown)	Fair (Seldom grown)	Fair	Fair (Seldom grown)	Good	Good (Seldom grown)	Good

TABLE 8 (Continued)

Soils	Remarks	Corn	Tobacco	Cotton	Wheat	Oats	Lespedeza	Alfalfa	Permanent Pasture
Vance sandy clay loam (U, sev)	Very susceptible to erosion.	Fair	Fair	Fair	Good	Fair (Seldom grown)	Good	Fair (Seldom grown)	Good
Bradley sandy loam (U, mod)	Sometimes gravelly, often has deep surface soil, and is somewhat droughty.	Fair	Good	Good	Fair	Fair	Fair	Fair	Fair
C. With yellow firm clay or sandy clay subsoil									
Durham sandy loam (U, sl)	One of the better soils in the Piedmont for high quality bright leaf tobacco with good yields.	Fair	Very Good	Good	Fair	Fair	Fair	Good	Fair
Chesterfield sandy loam (U, sl)	Often has deep sandy loam surface and frequently is droughty.	Fair	Very Good	Good	Fair	Fair	Fair	Good	Fair
D. With yellow sand subsoil									
Louisburg sand (U, sl)	Produces high quality tobacco, but yields frequently are low; droughty, leaches readily. Used for sweet potatoes in Davidson County.	Poor	Good	Fair	Poor	Fair	Fair	Poor	Poor
E. With gray sandy clay to clay subsoil									
Worsham sandy loam (L, sl)	Often wet due to seepage water from higher-lying soils; must be drained, yet very susceptible to accelerated erosion when cultivated on slopes of more than 2%.	Good (Seldom grown)	Very Poor (Rarely grown)	Poor (Rarely grown)	Fair (Seldom grown)	Good	Fair	Very Poor (Not grown)	Very Good
II. Soils from basic crystalline rocks (areas included are mostly in the west-central Piedmont.) A. With red firm clay subsoils									
Davidson clay loam (U, mod)	Probably the best soil in the Piedmont for wheat, alfalfa, lepedeza, clover, fescue, orchard grass, cotton.	Good	Fair (Rarely grown)	Very Good	Very Good	Good	Very Good	Very Good	Very Good
Lloyd clay loam (Slo, sev)	One of the better soils for cotton and wheat. Some shallow profiles throughout range of occurrence. Deeper profiles are very good for alfalfa. Very susceptible to erosion.	Good	Fair (Seldom grown)	Very Good	Very Good	Good	Very Good	Very Good	Very Good

TABLE 8 (Continued)

Soils	Remarks	Corn	Tobacco	Cotton	Wheat	Oats	Lespedeza	Alfalfa	Permanent Pasture
B. With yellowish-red to reddish-brown firm clay subsoil									
Mecklenburg (clay) loam (U, mod)	One of the best wheat, cotton, alfalfa, clover, lespedeza, fescue, and orchard grass soils. Johnson grass frequently is a serious pest. Very susceptible to erosion when on sloping relief and in tilled crops. Often difficult to till because too wet or too dry.	Good	Fair (Seldom grown)	Very Good	Very Good	Very Good	Very Good	Very Good	Very Good
C. With yellowish-brown to olive-brown firm to very firm clay subsoils.									
Iredell loam (L, mod)	Considered one of the better soils for cotton; widely used for oats, grass for hay, pasture. Only fair for good quality tobacco.	Good	Fair (Seldom grown)	Very Good	Good	Very Good	Very Good	Fair	Very Good
Iredell sandy loam (U, mod)	Both Iredell soils are very susceptible to erosion when on sloping relief and in tilled crops. Sometimes difficult to till, frequently remain wet for days after much rain.	Fair	Fair	Very Good	Good	Good	Good	Fair	Good
III. Soils from "mixed" acid and basic crystalline rocks									
A. With yellowish-brown to brown firm clay subsoils.									
Helena sandy loam (U, mod)	Widely used for quality tobacco, although more difficult to handle than the Durham, Granville, and Appling soils. Susceptible to severe erosion losses if sloping areas are tilled.	Fair	Good	Fair (Seldom grown)	Fair	Fair	Fair	Fair	Fair
Enon sandy loam (U, mod)	Rather spotty occurrence. A fair all-round soil.	Fair	Good	Good (Seldom grown)	Fair	Fair	Fair	Fair	Good
Wilkes sandy clay loam (Slo, sev)	Generally considered fair to very good for quality tobacco. Very susceptible to erosion, shallow, and often droughty. Most areas also too steep for cultivation.	Poor	Good	Fair (Seldom grown)	Poor	Poor	Fair	Very Poor	Poor

TABLE 8 (Continued)

Soils	Remarks	Corn	Tobacco	Cotton	Wheat	Oats	Lespedeza	Alfalfa	Permanent Pasture
IV. Soils from "Carolina Slates"									
A. With red firm silty clay subsoils.									
Georgeville silty clay loam (Slo, sev)	Farmers in Randolph, Stanly, and nearby counties consider this a good soil for wheat, lespedeza, alfalfa, cotton. Subject to severe erosion.	Fair	Fair (Rarely grown)	Good	Very Good	Good	Very Good	Very Good	Good
Tirzah silty clay loam (U, mod)	In Chatham County this is considered a very good soil for wheat, alfalfa, lespedeza, clover, fescue, and orchard grass. Moderately susceptible to erosion on slopes under 8%.	Good	Fair (Rarely grown)	Very Good	Very Good	Good	Very Good	Very Good	Very Good
B. With yellowish-brown to reddish-brown firm silty clay subsoil.									
Efland silt loam (U, mod)	A good grain, forage crop, and pasture soil.	Good	Fair (Rarely grown)	Good	Very Good	Good	Very Good	Good	Good
C. With yellowish-red firm silty clay subsoil.									
Herndon silt loam (U, mod)	A good all-round soil.	Fair	Fair	Fair to Good	Good	Fair to Good	Very Good	Good	Good
D. With yellow moderately firm silty clay loam subsoil.									
Alamance silt loam (U, mod)	One of the better soils for lespedeza and oats; good for pasture if sufficient rain.	Fair	Fair to Good	Fair to Good	Fair	Very Good	Very Good	Fair	Good
E. With yellow, gray, and brown very firm silty clay subsoil.									
Orange silt loam (L, sl)	Often gravelly, sometimes shallow, usually difficult to till.	Fair	Poor (Rarely grown)	Good	Good	Very Good	Very Good	Fair	Good
F. Shallow soil with brown to reddish-yellow silty clay loam subsoil.									
Goldston silt loam	Usually gravelly.	Fair	(Seldom grown)	Fair	Fair	Fair	Fair	Very Poor	Poor

TABLE 8 (Continued)

Soils	Remarks	Corn	Tobacco	Cotton	Wheat	Oats	Lespedeza	Alfalfa	Permanent Pasture
G. With gray silty clay to clay subsoil.									
Worsham silt loam (L, sl)	Usually wet because of seepage water; must be drained for crops or pasture, and best use is in pasture.	Good	Very Poor (Rarely grown)	Very Poor (Rarely grown)	Fair (Seldom grown)	Good	Good	Very Poor (Not grown)	Very Good
V. Soils from sandstones and shales of the Triassic formation.									
A. With red firm to very firm clay or silty clay subsoils.									
Wadesboro sandy clay loam (U, sev) Bucks si.l. (U, sev)	Very susceptible to erosion on all slopes above 2%, somewhat difficult to till.	Fair	Fair (Seldom grown)	Good	Good	Fair	Good	Good	Good
Penn silty clay loam (U, sev)	Very susceptible to erosion; shallow; difficult to till; droughty.	Poor	Poor (Seldom grown)	Poor	Poor	Poor	Poor	Poor	Poor
B. With yellowish-red firm clay loam to clay subsoil.									
Mayodan sandy loam (U, mod)	A moderately good all-round soil.	Fair	Good	Good	Fair	Fair	Good	Good	Good
C. With red to reddish-gray and yellow (often varicolored) very firm (tough) clay subsoil.									
White Store clay loam (U, sev)	Most susceptible soil to accelerated soil erosion; very difficult to till, yet responsive to management. Once widely used for tobacco in Durham and Wake Counties, but erosion removed all the sandy surface layer leaving only clay or clay loam.	Poor to Fair	Fair (Seldom grown)	Good	Good	Fair	Fair	Fair	Fair to Good
Creedmoor sandy loam (U, mod)	In Granville and Wake Counties soil is considered very good for tobacco, producing high quality.	Fair	Very Good	Good	Fair	Fair	Fair	Good	Fair
D. With yellow moderately firm sandy clay subsoil.									

TABLE 8 (Continued)

Soils	Remarks	Corn	Tobacco	Cotton	Wheat	Oats	Lespedeza	Alfalfa	Permanent Pasture
Granville sandy loam (U, mod)	One of the best soils in the Piedmont for high quality tobacco.	Fair	Very Good	Good	Fair	Good	Good	Good	Fair
E. With gray firm sandy clay to clay subsoil.									
Worsham sandy loam (L, sl)	Wet, needs drainage for crops and pasture; difficult to till.	Good	Very Poor (Rarely grown)	Fair (Seldom grown)	Fair (Seldom grown)	Good	Good	Very Poor (Not grown)	Very Good
VI. Soils from quartz mica schist and related rocks (areas are mostly in western Piedmont)									
A. With red firm clay subsoils containing much mica.									
Statesville sandy clay loam (Slo, sev)	Very susceptible to erosion, sometimes stony.	Fair	Fair	Good	Fair	Fair	Good	Fair to Good	Fair to Good
Louisa clay loam (Slo, sev)	Very susceptible to erosion, shallow, often very droughty, sometimes stony.	Poor	Poor	Fair	Poor	Poor	Fair	Very Poor (Not grown)	Poor
Madison gravelly sandy clay loam (Slo, sev)	Gravel sometimes interferes with tillage; occasionally shallow, seldom very deep; often on slopes above 15%.	Fair	Fair to Good	Good	Fair	Good	Good	Fair to Good	Fair to Good
B. With yellowish-red firm clay subsoils containing much mica.									
Grover gravelly sandy clay loam (Slo, sev)	Gravel sometimes interferes with tillage; occasionally shallow, seldom very deep.	Fair	Fair to Good	Good	Fair	Fair	Good	Fair to Good	Fair to Good
C. With yellowish-brown to reddish-brown firm clay subsoil with little mica.									
Surry loam (Slo, mod)	Usually gravelly; considered a good soil for quality tobacco in the Mt. Airy-Wilkesboro area. Very good soil for apples, peaches.	Fair	Good	Good (Rarely grown)	Fair to Good	Fair to Good	Good	Fair	Fair to Good

TABLE 8 (Continued)

Soils	Remarks	Corn	Tobacco	Cotton	Wheat	Oats	Lespedeza	Alfalfa	Permanent Pasture
D. With gray firm sandy clay to clay subsoil containing much mica.									
Worsham loam (L, sl)	Wet, needs drainage for crops and pasture; usually only in areas smaller than 5 acres.	Good	Very Poor (Not grown)	Poor (Not grown)	Fair (Seldom grown)	Good	Good	Very Poor (Not grown)	Good
VII. Soils of the stream terraces.									
A. With red sand subsoil.									
Molena sand (U, sl).	Droughty, leaches readily, drifts considerably with February-April winds.	Poor	Fair (Seldom grown)	Poor	Poor	Poor	Poor	Very Poor (Not grown)	Poor
B. With yellowish-red friable to firm sandy loam to clay loam subsoil.									
Masada sandy loam (U, sl)	A good all-round soil, used for peanuts in Halifax and Northampton Counties.	Good	Good (Seldom grown)	Good (Seldom grown)	Good	Good	Good	Very Good (Seldom grown)	Good
C. With yellow friable sandy clay loam to silty clay loam subsoils.									
Tillery sandy loam (U, sl)	A good to very good all-round soil.	Very Good	Good (Seldom grown)	Good	Good	Good	Good	Good (Seldom grown)	Good
D. With brown loam to friable clay subsoil.									
State loam (U, sl)	A very good soil for vegetables.	Very Good	Good (Rarely grown)	Good (Seldom grown)	Good	Very Good	Good	Good (Seldom grown)	Very Good
E. With yellow friable silt loam to silty clay loam subsoil mottled with gray below 24-30 inches.									
Harnett silt loam (L, sl).	A good all-round soil.	Very Good	Fair (Seldom grown)	Good	Good	Very Good	Good (Seldom grown)	Good (Rarely grown)	Very Good

TABLE 8 (Continued)

Soils	Remarks	Corn	Tobacco	Cotton	Wheat	Oats	Lespedeza	Alfalfa	Permanent Pasture
F. With brown, mottled with gray, friable to moderately firm sandy clay loam to clay loam subsoil.									
Augusta sandy loam (L, sl).	Some drainage needed for most crops.	Very Good	Fair (Rarely grown)	Good (Seldom grown)	Good (Seldom grown)	Very Good	Good (Seldom grown)	Fair (Rarely grown)	Very Good
G. With gray, mottled with brown, friable sandy loam to sandy clay loam subsoil.									
Grabtown (silt) loam (L, sl).	Wet, must be drained before any agricultural use.	Verv Good	Very Poor (Rarely grown)	Poor (Rarely grown)	Good (Seldom grown)	Very Good	Good (Seldom grown)	Very Poor (Not grown)	Very Good
H. With dark gray friable loam to clay loam subsoil.									
Cape Fear loam (L, sl).	Wet, must be drained before any agricultural use.	Very Good	Very Poor (Not grown)	Poor (Rarely grown)	Good (Seldom grown)	Very Good	Good (Seldom grown)	Very Poor (Not grown)	Very Good
I. With red to dark red firm clay loam to clay subsoil.									
Hiwassee clay loam (U, mod)	Subject to accelerated erosion, a "strong" soil, but difficult to handle because of high clay content.	Fair	Fair (Rarely grown)	Good	Very Good	Good	Very Good	Very Good	Good
J. With brown to reddish-brown firm clay loam to clay subsoil.									
Wickham sandy (clay) loam (U, mod).	Many areas subject to erosion; a good all-round soil.	Good	Good (Seldom grown)	Very Good	Very Good	Good	Good	Very Good (Seldom grown)	Good
K. With yellow firm silty clay loam to clay subsoil.									
Quitsna fine sandy loam (U, mod).	Some areas subject to erosion; a good all-round soil.	Good	Good (Seldom grown)	Very Good	Very Good	Good	Good	Good (Rarely grown)	Very Good

TABLE 8 (Continued)

Soils	Remarks	Corn	Tobacco	Cotton	Wheat	Oats	Lespedeza	Alfalfa	Permanent Pasture
L. With yellow firm silty clay loam to clay subsoil mottled with gray below 24-30 inches.									
Altavista silt loam (L, sl).	A good all-round soil.	Good to Very Good	Fair (Seldom grown)	Good	Very Good	Good	Good	Fair (Rarely grown)	Very Good
M. With yellow to brown, mottled with gray, very firm clay or silty clay subsoil.									
Warne fine sandy loam (L, sl).	Must have some drainage before any agricultural use. Very difficult to handle because of heavy clay subsoil.	Good	Very Poor (Rarely grown)	Fair (Seldom grown)	Good	Very Good	Good	Very Poor (Not grown)	Very Good
N. With mottled gray, brown, and olive-yellow very firm clay or silty clay subsoil.									
Roanoke silt loam (L, sl).	Must be drained before any agricultural use; very difficult to handle because of silty clay or clay subsoils.	Good	Very Poor (Rarely grown)	Fair (Rarely grown)	Good	Very Good	Fair	Very Poor (Not grown)	Very Good
VIII. Soils of the stream flood-plain.	Practically all soils subject to overflow; and crop damage or loss may occur in about one out of four years.								
A. With yellowish-brown sand subsoil.									
Buncombe sand (L, sl).	Droughty, leaches readily; very easily handled; fair for early vegetables.	Poor	Poor (Not grown)	Poor (Not grown)	Poor (Rarely grown)	Poor (Rarely grown)	Poor (Rarely grown)	Very Poor (Not grown)	Poor
B. With brown friable loam to silty clay loam subsoil.									
Congaree fine sandy loam (L, sl).	Probably the second best soil in the Piedmont for corn; also very good for vegetables, white potatoes, watermelons.	Very Good	Poor (Not grown)	Poor (Not grown)	Very Good	Very Good	Good	Poor (Not grown)	Very Good
Bermudian silt loam (L, sl).	A very good corn and vegetable soil.	Very Good	Very Poor (Not grown)	Poor (Not grown)	Very Good	Very Good	Good	Poor (Not grown)	Very Good

TABLE 8 (Continued)

Soils	Remarks	Corn	Tobacco	Cotton	Wheat	Oats	Lespedeza	Alfalfa	Permanent Pasture
C. With brown, mottled with gray, friable loam to silty clay loam subsoil.									
Chewacla fine sandy loam (L, sl).	Probably the best soil in the Piedmont for corn; also very good for vegetables. Some drainage required for crops.	Very Good	Very Poor (Not grown)	Very Poor (Not grown)	Good	Very Good	Good	Very Poor (Not grown)	Very Good
D. With gray, mottled with brown and yellow, friable loam to very firm clay loam subsoil.									
Wehadkee silt loam (L, sl).	Must be drained before any agricultural use; often difficult to drain because of depressed position or seepage water from higher areas.	Good	Very Poor (Not grown)	Very Poor (Not grown)	Fair	Good	Fair	Very Poor (Not grown)	Good

(See page 118 for footnotes on Table 8)

FOOTNOTES ON TABLE 8

* In this suitability rating table it is assumed that management practices, climate, and other external features are reasonably constant, and that soil is the variable. Thus, if areas of Appling sandy loam and of Louisburg sand, which sometimes adjoin, have identical treatment the yields on the Appling will be considerably higher than yields on the Louisburg because of soil differences (Plate 1A).

** Notes for slope and erosion—On most soils the average area in crops or in pasture has become moderately eroded (between ¼ and ¾ of the original surface soil lost by accelerated erosion), except where the usual slope range is relatively low or there is sufficient amount of stones on the surface to have retarded movement of soil. Slopes above 12 per cent gradient should not be in crops requiring tillage. The following abbreviations are used:

L—**Nearly level** relief or a general slope range between 0 and 2%.
Slo—**Sloping** (rolling) relief or a general slope range between 7 and 15%.
U—**Gently sloping** (undulating) relief or a general slope range between 2 and 7%.
mod—**Moderate** erosion or soils showing loss of approximately ¼ to ¾ of the original surface soil.
sev—**Severe** erosion or soils showing loss of ¾ or more of the original surface soil and also some of the subsoil.
sl—**Slight** erosion or soils showing loss of some of the original surface soil, but not more than approximately one-fourth.

*** A soil indicated as **very good** for a crop is one that produces high yields, excellent or very good quality. It is deep, well developed, and is not so steep or stony that tillage is difficult, nor is the surface texture very fine or very coarse, or the erosion hazard great. It may have some adverse property as very fine or very coarse surface texture, or slightly impeded drainage. A soil indicated as **good** for a crop produces medium to high yields, the quality is equal to or above the average for all soils, but tillage may be difficult because of severe erosion, steepness of slope, or stoniness. Soils rated **fair** are shallow, steep, stony, or of very coarse or very fine texture and offer one or more hazards to cultivation and crop growth. Soils rated **poor** or **very poor** have such adverse factors as to greatly hinder cultivation and adequate plant growth: they may be shallow, stony, steep, or coarse textured. For corn, a **very good** soil will yield above 60 bushels per acre under "average" management; a **good** soil about 25-30 bushels; a **poor** soil about 10-24 bushels; and a **very poor** soil under 10 bushels. "Average management" for corn means less than 300 pounds of 4-10-6, 5-10-5 or similar grade fertilizer before planting and a side dressing of about 20 pounds of nitrogen, and generally a 2 or 3 year rotation. Most farmers will not plant corn on **poor** or **very poor** soils except when they have no other crop land available.

Tobacco on nearly all farms receives first consideration in choice of soil, as determined by the farmer's experience. The average practice is to plant tobacco on the same fields each year unless diseases or insects force a change. Practically all tobacco growers fertilize heavily (1200 or more pounds of 4-8-10 or the equivalent). In the comparative suitability ratings the factor of **quality** has received as much consideration as **yield.** Such soils as Davidson clay loam will produce very high yields but the quality is mediocre because of the heavy, rough, dark leaves and maturity is late. Average yields on Appling, Durham and Granville soils are often above 1500 pounds per acre.

For cotton "average" management means about 500 pounds of 5-10-10 or equivalent fertilizer per acre, a side-dressing of 15-30 pounds of nitrogen, insect control practices, occasional to frequent change of fields, but seldom a definite rotation of 3 or more years with a turned-under legume. With such management, soils rated **very good** will give yields of 400-500 pounds, **good** soils 300-399 pounds, **fair** soils 200-299 pounds, **poor** soils 100-199 pounds, and **very poor** soils under 100 pounds. Few farmers plant cotton on soils they do not consider as good or very good for this crop.

Yields for wheat are: **very good** soils, above 30 bushels per acre; **good** soils, about 20-29 bushels, **fair** soils 15-20 bushels; **poor** soils, 10-15 bushels, and **very poor** soils, under 10 bushel.

For Alfalfa: **very good** soils, above 3 tons per acre; **good** soils, 2-3 tons.

For lespedeza: **very good** soils, above 1 ton per acre; **good** soils, ¾ to 1 ton.

For pasture: **very good** soils will furnish 100 or more cow-acre days grazing; **good** soils, 80-99 days; **fair** soils, 50-79 days; and **poor** soils, under 50 days.

TABLE 9. COMPARATIVE SUITABILITY OF MOUNTAIN SOILS FOR THE MAJOR CROPS GROWN*

Soils grouped by **origin** or parent material, **color**, **consistence**, texture of subsoil and of surface soil according to the Key on pp 87-96 (The more extensive type is listed for each series. The prevailing or more common slope range and degree of erosion for areas of the soil under cultivation or in pasture are indicated by letters in parentheses**)

I. Soils from acid crystalline rocks (granite, gneiss, low-mica schist).	Remarks	Corn	Wheat	White Potatoes	Green Beans	Cabbage	Burley Tobacco	Hay '(Mixed gr. & clover)	Permanent Pasture
A. With red firm clay subsoils.									
Hayesville loam (H, mod).	Very susceptible to erosion, difficult to handle; fair cropland.	Fair ***	Good to Very Good ***	Fair	Good ***	Good	Good	Good	Good
Hayesville clay loam (H, sev).	Repeat the same remarks as above.	Fair	Good to Very Good	(Seldom grown)	(Seldom grown)	(Not grown)	(Not grown)	Fair	Fair
B. With reddish-yellow to red-dish-brown moderately firm to firm clay subsoils.									
Halewood loam (H, mod).	Moderately good general crop soil, very good for pasture and for apples.	Fair	Good	Good	Good	Good	Good	Good	Very Good
C. With brown to reddish-brown friable to moderately firm clay loam to clay subsoils.									
Balfour loam (Slo, mod).	Very good soil for general crops, also apples.	Very Good	Very Good	Very Good	Very Good	Very Good	Very Good	Very Good	Very Good

TABLE 9 (Continued)

Soils	Remarks	Corn	Wheat	White Potatoes	Green Beans	Cabbage	Burley Tobacco	Hay (Mixed gr. & clover)	Permanent Pasture
Porters loam (St, mod).	Mostly too steep for crops, although many areas are in cultivation or in pasture; very good for apples.	Poor	Poor ***	Good	Good	Good	Fair	Fair to Good	Very Good
Porters stony loam (St, sl).	Too steep and stony for crops, although many small areas (1 to 3 acres) are in cultivation; much in pasture.	Poor	(Seldom grown)	Poor	Poor	Poor	(Not grown)	Poor	Fair to Good
Dyke loam (Slo, sl).	Very good for all crops, apples, pasture.	Very Good	Very Good	Very Good	Very Good	Very Good	Very Good	Very Good	Very Good
D. With yellow to brownish-yellow friable to moderately firm sandy clay loam to clay subsoils.									
Ashe loam (St, mod).	Too steep, but many small areas (1 to 3 acres) under cultivation, and numerous small to large areas (3 to 60 acres) in pasture.	Poor	Poor	Good	Good	Good	(Seldom grown)	Fair	Good
Ashe stony loam (St, sl).	Too steep and stony, but many small areas in cultivation, and many small to large areas in pasture.	Poor	(Not grown)	Poor	Poor	Poor	(Not grown)	Poor	Fair to Good
Edneyville sandy loam (Slo, mod).	Very good vegetable and apple soil.	Good	Good	Good	Very Good	Very Good	Very Good	Very Good	Good
Perkinsville loam (Slo, mod).	Very good general crop soil.	Good	Good	Very Good	Very Good	Very Good	Very Good	Very Good	Good
Tusquitee loam (Slo, mod).	Very good for all crops, apples, pasture.	Very Good	Very Good	Very Good	Very Good	Very Good	Very Good	Very Good	Very Good
E. With yellow, brown, and some gray friable loam to clay loam subsoil, often stony. Surface soil dark gray to black loam.									
Burton stony loam (H, mod).	Very little under cultivation because of occurrence at high elevations.	Good	(Not grown)	Good	Good	Good	(Not grown)	Good	Good

TABLE 9 (Continued)

Soils	Remarks	Corn	Wheat	White Potatoes	Green Beans	Cabbage	Burley Tobacco	Hay '(Mixed gr. & clover)	Permanent Pasture
F. With gray, mottled with brown and yellow, moderately firm to firm sandy clay loam to clay subsoil.									
Worsham loam (U, sl).	Must be drained, which is usually difficult because of seepage water from above.	Good	Fair	(Seldom grown)	Good	Good	(Seldom grown)	Good to Very Good	Good to Very Good
II. Soils from basic crystalline rocks (diorite, gabbro, hornblende).									
A. With reddish-brown to dark red moderately firm clay subsoil.									
Rabun clay loam (H, mod).	Moderately good cropland, very good for small grain, hay. Often difficult to till when moist: sticky.	Good	Very Good	(Seldom grown)	Good	Good	(Seldom grown)	Very Good	Very Good
B. With brown, yellowish-brown, or yellowish-red moderately firm to firm clay subsoil.									
Clifton clay loam (H, mod).	Good general cropland, but quite susceptible to accelerated erosion.	Good	Very Good	(Seldom grown)	Good	Good	Good	Very Good	Very Good
Clifton stony (clay) loam H, mod).	Stone interferes with tillage, better use is in pasture.	Poor	Poor	(Seldom grown)	Poor	Poor	(Seldom grown)	Poor	Good
III. Soils from rocks high in mica.									
A. With red firm clay or silty clay subsoil containing much mica (greasy feel).									
Fannin clay loam (Slo, mod).	Moderately good for cropland and pasture, very susceptible to accelerated erosion.	Poor to Fair	Good	Poor	Poor	(Seldom grown)	Fair	Good	Fair to Good
Talladega silty clay loam (St, sev).	Poorly suited to crops or pasture; very susceptible to accelerated erosion, but many areas in crops.	Poor	Poor	(Seldom grown)	Poor	Poor	Poor	Poor	Poor to Fair
Talladega stony silt loam (St, mod).	Very poorly suited to crops or pasture; only fair for trees.	Very Poor ***	(Not grown)	(Not grown)	(Not grown)	(Not grown)	(Not grown)	Very Poor	Very Poor

TABLE 9 (Continued)

Soils	Remarks	Corn	Wheat	White Potatoes	Green Beans	Cabbage	Burley Tobacco	Hay (Mixed gr. & clover)	Permanent Pasture
B. With yellow firm clay or silty clay subsoil containing much mica (greasy feel).									
Watauga (silt) loam (Slo, mod).	Moderately good general cropland and pasture soil.	Good	Good	Fair to Good	Good to Very Good	Good to Very Good	Good	Good	Good to Very Good
Chandler (silt) loam (St, sev).	Poor cropland, but many "patches" under cultivation. Very susceptible to accelerated erosion.	Poor	Poor	Poor	Poor	Poor	(Seldom grown)	Poor	Fair to Poor
Chandler stony loam (St, mod).	Poor to very poor cropland or pasture, and only fair for trees.	Very Poor	(Not grown)	(Not grown)	(Not grown)	(Not grown)	(Not grown)	Very Poor	Very Poor
Tate loam (U, sl).	Very good general crop soil; excellent for vegetables.	Very Good	Very Good	Very Good	Very Good	Very Good	Very Good	Very Good	Very Good
IV. Soils from shales, slates, quartzites, and fine-grained low-mica gneisses and schists.									
A. With yellowish-red moderately firm sandy clay loam, clay loam, or sandy clay subsoils.									
Habersham loam (H, mod).	Occurs only in Cherokee, Clay, and Graham Counties. Moderately good cropland and pasture.	Fair to Good	Good	Fair to Good	(Seldom grown)	(Seldom grown)	(Seldom grown)	Good	Good
Fletcher silt loam (H, sev).	Very susceptible to erosion, somewhat droughty, only fair general cropland.	Poor to Fair	Fair	Poor to Fair	(Seldom grown)	(Seldom grown)	Fair	Fair to Good	Fair to Good
B. With yellowish-brown friable clay loam subsoils.									
Matney (silt) loam (Slo, mod).	Moderately good general cropland, very susceptible to erosion.	Fair to Good	Fair to Good	Good	Good	Good	(Seldom grown)	Good	Good
Ramsey (silt) loam (St, sev).	Too steep, but many small areas (1 to 3 acres) in cultivation and larger areas in pasture (3-25 acres). Shallow, somewhat droughty.	Poor	Poor	Poor	Poor to Fair	Poor to Fair	Poor	Poor	Poor to Fair
Ramsey stony or shaly loam (St, mod).		Very Poor	(Not grown)	(Seldom grown)	(Seldom grown)	(Seldom grown)	(Not grown)	Very Poor	Poor

TABLE 9 (Continued)

Soils	Remarks	Corn	Wheat	White Potatoes	Green Beans	Cabbage	Burley Tobacco	Hay (Mixed gr. & clover)	Permanent Pasture
Muskingum (silt) loam (St, mod).	Occurs only in Madison County. Too steep and too stony, very little in crops or pasture.	Very Poor	Very Poor	(Not grown)	(Not grown)	(Not grown)	Very Poor	Very Poor	Poor
Tate (silt) loam (Slo, mod).	A good to very good general crop and vegetable soil; very good for pasture.	Very Good	Good	Very Good	Very Good	Very Good	Very Good	Very Good	Very Good
C. With light-brown to brownish-gray friable slaty silt loam to silty clay loam subsoil.									
Ranger slaty silt loam (St, mod).	Shallow, droughty, often stony, little in cultivation, or crops.	Fair	Fair	Poor	Fair	Fair	(Not grown)	Fair	Fair
V. Soils of the stream terraces.									
A. With yellowish-red friable to moderately firm loam to clay loam subsoil.									
Masada loam (U, sl).	Very good general crop soil.	Good to Very Good	Very Good	Good to Very Good	Good to Very Good	Good to Very Good	Very Good	Good to Very Good	Good to Very Good
B. With brown loam to friable clay loam subsoil.									
State loam (L, sl).	Probably the best all-round soil in the Mountain area, but of small total acreage.	Very Good	Very Good	Very Good	Very Good	Very Good	Very Good	Very Good	Very Good
C. With red to dark red firm clay loam to clay subsoil.									
Hiwassee (clay) loam (U, mod).	Very good alfalfa, clover, wheat soil, but difficult to handle because of fine-textured surface.	Good	Very Good	Fair	Good to Very Good	Good to Very Good	Good	Very Good	Good
D. With yellow moderately firm clay loam or silty clay loam subsoil, slightly mottled with gray below 24-28 inches.									
Altavista loam (U, sl).	A good all-round soil.	Very Good	Good	Very Good	Very Good	Good	Very Good	Very Good	Very Good

TABLE 9 (Continued)

Soils	Remarks	Corn	Wheat	White Potatoes	Green Beans	Cabbage	Burley Tobacco	Hay (Mixed gr. & clover)	Permanent Pasture
E. With yellow and brown, mottled with gray, very firm silty clay or clay subsoil.									
Warne silt loam (L, sl).	Must be drained for crops; very difficult to handle because of fine-textured subsoil.	Fair to Good	Good	(Seldom grown)	Good	Good	(Seldom grown)	Good	Good
F. With mottled gray, brown, and olive-yellow very firm silty clay or clay subsoil.									
Roanoke silt loam (L, sl).	Must be drained for crops or pasture; very difficult to handle because of fine texture throughout.	Good	(Seldom grown)	(Seldom grown)	Good	Good	(Seldom grown)	Very Good	Good to Very Good
VI. Soils of the stream floodplains.									
A. With yellowish-brown sand subsoil.									
Buncombe sand (L, sl).	Very droughty soil, requires heavy fertilization, easily handled.	Poor	(Seldom grown)	Poor	Poor	Poor	Fair	Fair	Fair
B. With brown friable loam to silty clay loam subsoil.									
Congaree (L)	Very good soil for most crops.	Very Good	Very Good	Very Good	Very Good	Very Good	Very Good	Very Good	Very Good
C. With brown, mottled with gray, friable loam to silty clay loam subsoil.									
Chewacla (L)	Very good soil for most crops. Requires some drainage.	Very Good	Very Good	Very Good	Very Good	Very Good	Very Good	Very Good	Very Good
D. With gray, mottled with brown and yellow, friable loam to firm clay loam subsoil.									
Wehadkee (L)	Wet, difficult to drain.	Fair to Good	Poor	(Seldom grown)	(Seldom grown)	(Seldom grown)	(Not grown)	Fair	Fair to Good
E. With brownish-gray to black moderately firm silt loam to silty clay loam subsoil.									
Toxaway (L)	Must be drained for crops or pasture.	Very Good	(Seldom grown)	(Seldom grown)	Very Good	Very Good	(Seldom grown)	Very Good	Very Good

FOOTNOTES ON TABLE 8

* In this suitability rating table it is assumed that management practices, climate, and other external features are reasonably constant, and that soil is the variable. Thus, if areas of Appling sandy loam and of Louisburg sand, which sometimes adjoin, have identical treatment the yields on the Appling will be considerably higher than yields on the Louisburg because of soil differences (Plate 1A).

** Notes for slope and erosion—On most soils the average area in crops or in pasture has become moderately eroded (between ¼ and ¾ of the original surface soil lost by accelerated erosion), except where the usual slope range is relatively low or there is sufficient amount of stones on the surface to have retarded movement of soil. Slopes above 12 per cent gradient should not be in crops requiring tillage. The following abbreviations are used:

L—**Nearly level** relief or a general slope range between 0 and 2%.
Slo—**Sloping** (rolling) relief or a general slope range between 7 and 15%.
U—**Gently sloping** (undulating) relief or a general slope range between 2 and 7%.
mod—**Moderate** erosion or soils showing loss of approximately ¼ to ¾ of the original surface soil.
sev—**Severe** erosion or soils showing loss of ¾ or more of the original surface soil and also some of the subsoil.
sl—**Slight** erosion or soils showing loss of some of the original surface soil, but not more than approximately one-fourth.

*** A soil indicated as **very good** for a crop is one that produces high yields, excellent or very good quality. It is deep, well developed, and is not so steep or stony that tillage is difficult, nor is the surface texture very fine or very coarse, or the erosion hazard great. It may have some adverse property as very fine or very coarse surface texture, or slightly impeded drainage. A soil indicated as **good** for a crop produces medium to high yields, the quality is equal to or above the average for all soils, but tillage may be difficult because of severe erosion, steepness of slope, or stoniness. Soils rated **fair** are shallow, steep, stony, or of very coarse or very fine texture and offer one or more hazards to cultivation and crop growth. Soils rated **poor** or **very poor** have such adverse factors as to greatly hinder cultivation and adequate plant growth: they may be shallow, stony, steep, or coarse textured. For corn, a **very good** soil will yield above 60 bushels per acre under "average" management; a **good** soil about 25-30 bushels; a **poor** soil about 10-24 bushels; and a **very poor** soil under 10 bushels. "Average management" for corn means less than 300 pounds of 4-10-6, 5-10-5 or similar grade fertilizer before planting and a side dressing of about 20 pounds of nitrogen, and generally a 2 or 3 year rotation. Most farmers will not plant corn on **poor** or **very poor** soils except when they have no other crop land available.

Tobacco on nearly all farms receives first consideration in choice of soil, as determined by the farmer's experience. The average practice is to plant tobacco on the same fields each year unless diseases or insects force a change. Practically all tobacco growers fertilize heavily (1200 or more pounds of 4-8-10 or the equivalent). In the comparative suitability ratings the factor of **quality** has received as much consideration as **yield.** Such soils as Davidson clay loam will produce very high yields but the quality is mediocre because of the heavy, rough, dark leaves and maturity is late. Average yields on Appling, Durham and Granville soils are often above 1500 pounds per acre.

For cotton "average" management means about 500 pounds of 5-10-10 or equivalent fertilizer per acre, a side-dressing of 15-30 pounds of nitrogen, insect control practices, occasional to frequent change of fields, but seldom a definite rotation of 3 or more years with a turned-under legume. With such management, soils rated **very good** will give yields of 400-500 pounds, **good** soils 300-399 pounds, **fair** soils 200-299 pounds, **poor** soils 100-199 pounds, and **very poor** soils under 100 pounds. Few farmers plant cotton on soils they do not consider as good or very good for this crop.

Yields for wheat are: **very good** soils, above 30 bushels per acre; **good** soils, about 20-29 bushels, **fair** soils 15-20 bushels; **poor** soils, 10-15 bushels, and **very poor** soils, under 10 bushel.

For Alfalfa: **very good** soils, above 3 tons per acre; **good** soils, 2-3 tons.

For lespedeza: **very good** soils, above 1 ton per acre; **good** soils, ¾ to 1 ton.

For pasture: **very good** soils will furnish 100 or more cow-acre days grazing; **good** soils, 80-99 days; **fair** soils, 50-79 days; and **poor** soils, under 50 days.

SOIL ASSOCIATIONS

Since 1900 much information has been accumulated on the kind, location, and total acreage of the soils of North Carolina. Soil surveys of various areas—entirely on a county-unit basis after 1909—have covered approximately 97 per cent of the State. In order to assemble these surveys, which total 102, into one usable state-wide soil map having significance in agriculture and other land utilization, several soil associations have been set up. (See Soil Association Map, in color, at back of bulletin.)

In compiling the soil association map, all the county soil surveys since 1912 were carefully field-checked, and the association boundaries were drawn in the field. For soil surveys prior to 1912, and in counties where surveys have not been made, reconnaissance soil association maps were prepared by road traverse into all communities.

Although the 38 soil association units may appear to be mainly geographic associations of relatively similar soils and soil materials, much emphasis in their delineation on the map was placed on their relationship to agriculture. Examples are the Norfolk-Ruston and the Lakeland-Norfolk associations. The Norfolk-Ruston soils are well drained and have proven very good to excellent all-round agricultural soils, but seem to be more especially suited to tobacco, peanuts, sweet potatoes, and cotton. The most apparent reasons for this suitability are their moderately permeable but retentive sandy loam to sandy clay loam subsoils, and their easily tilled loamy sand to sandy loam surface soils which usually are less than 18 inches thick.

The Lakeland-Norfolk soils are somewhat excessively drained and held as only fair to good all-round agricultural soils, not especially suited to any crop, but

Plate 1. Duplin County field of peanuts with two soil types in the same field. The soil in the background where the peanuts are making good growth is Norfolk. The soil in the foreground and to the right where peanuts are making poor growth is Lakeland.

Plate 1A. Peanuts from the same plant row in Nash County. The plants on the left were grown in Louisburg soil. The plants on the right were grown in Appling soil.

considered good to very good for tobacco and peaches. Apparent reasons for this lack of suitability of the LN soils for most crops are their rapidly permeable and somewhat droughty sand to sandy loam subsoils, and their loose and often almost coarse sand to loamy sand surface soils which usually are more than 24 inches thick.

The following considerations served as the bases for establishing the several soil associations: (1) The principal soils in an association normally should occur together—that is, in close geographic proximity; (2) They should have two or more like profile features as, approximately, (a) the same range in thickness over material differing from the subsoils, (b) the same relative degree of consistence in the subsoils, (c) the same range in texture of the surface soils, or (d) the same general kind or type of parent materials; (3) They should have a common range in relief features and in drainage; (4) They should have similar crop suitability; and (5) The soils should be used for the same major crops. However, because of the complex soil patterns over much of North Carolina, it must be noted that in each association are inclusions of one to many soils which are quite different from the principal soils. The more common differences are in slope and drainage, in texture and consistence, and in parent materials.

Some soils occur as major members of two associations. These are the Bladen, Coxville, Georgeville, Granville, Hayesville, Lynchburg, Mecklenburg, Norfolk, Porters, and White Store. The Cecil series is a major member of three associations. The principal reasons for the appearance of a soil series within two associations are its large total acreage, its widespread occurrence, and the fact that it may be associated with certain soils in one place, with other soils in another location. Other reasons are an allowable wide range of slope or relief, and the differences in degree of accelerated erosion. The Cecil illustrates all these factors. It has a large acreage, occurs widely in the Piedmont, has considerable range in slope, and in many areas it has become severely eroded.

For convenience, the descriptions of the soil associations are listed under their respective physiographic divisions—Coastal Plain, Piedmont, and Mountain. These descriptions include general location, approximate total area, relative size of individual tracts, relief or slope, native vegetation, climate, soil parent material, soils, use, and major crops grown. It should be noted that the figures listed for total acreage are estimates. The acreage figures listed on the Soil Association Map are measured data for the areas shown.

In order to reduce the number of units on the map, the letter A is used for alluvial soils throughout the State, and likewise T for terrace soils. However, within each physiographic region the respective Alluvial and Terrace soils are described and their locations given.

Coastal Plain

Symbol Soil Association

A **Alluvial or Bottomland Soils**

Alluvial soils are developed throughout the Coastal Plain chiefly in narrow strips of insufficient size to be indicated on the soil map. There are only three tracts shown within the Coastal Plain region; total area about 30,000 acres. These are along the Roanoke River in Halifax and Northampton Counties and along the Meherrin River in Hertford and Northampton Counties.

The soils are of Piedmont origin on the Roanoke River, chiefly the Congaree, Chewacla, and Wehadkee soil series; and of Coastal Plain origin on the Meherrin River, chiefly the Bibb, Johnston, and Ochlockonee soil series. Because of the constant overflow hazard, only about 20% of the total area of the association is in crops, mainly corn, and about 30% in pasture. The remainder is in woodland.

BM **Bayboro-Muck**

Location: Currituck County to Jones County in 10 tracts ranging in size from about 8,000 to about 30,000 acres, with a total area of approximately 170,000 acres.

Relief: Level, with little or no appreciable slope gradient, resulting in poor to very poor drainage.

Native Vegetation: Cypress, juniper, tupelo gum, bay, reeds. Practically all areas have been burned severely three or more times, and present growth consists of switch cane, fern, gallberry, willow, and red maple. Older "burns" are occupied by yellow-poplar, swamp blackgum, shortleaf pine, loblolly pine, pond pine, and occasional juniper in addition to the undergrowth of cane, gallberry, and bay.

Climate: Averages are: annual precipitation about 52 inches, May-September, 30 inches; annual temperature 61.2°F. January 46.0°F, July 79.0°F; length of growing season, 216 days.

Soil Parent Material: The soils of the association are alike in having dark color and considerable organic matter in their surface layers; "parent materials" differ, and range from silt loam to silty clay with some sandy materials in several locations.

Soils: These soils are in the Bayboro low soil family of the Humic-Gley Great Soil Group (p. 54). They are characterized by gray silt loam, silty clay loam, clay, or sandy loam subsoils and "organic loam" surface soils. Bayboro soils occupy about 20% of the association, and shallow Muck and shallow Peat about 35%.

Other included soils and soil materials and their approximate percentage proportions are Bladen, 10; Hyde, 5; Portsmouth, 10; Pocomoke, 5; and Swamp, 5. Small areas of many other soils comprise the remaining 10%, and some of these occupy very gently sloping relief.

Use: Before any agricultural use can be made of this land artificial drainage is necessary. Adequate drainage is not always possible because of lack of sufficient outfall. Probably one-sixth of the total area of the association is now in open farmland, mostly in crops, with little pasture. Possibly three times this amount has at some time been partly or totally cleared and used for pasture or for crops. The principal crops now are corn and soybeans. Some vegetables, flower bulbs, and flowers are produced. When drained and carefully managed, soils of the association are suitable for many vegetables, flowers and bulbs, Ladino clover and fescue grass pasture, white potatoes, corn, and soybeans.

BE **Bladen-Elkton**

Location: Northern and central Tidewater regions, principally Beaufort, Camden, Chowan, Currituck, Hyde, Pamlico, and Perquimans Counties. Most individual tracts are small, under 50,000 acres, but their total area is approximately 630,000 acres.

Relief: Nearly level, mostly under 2% gradient, with resulting poor or very poor drainage. Many areas remain ponded during late winter and early spring.

Native Vegetation: Oak, gum, maple, cypress, loblolly, shortleaf, and pond pine; characteristic undergrowth is switch cane.

Climate: Averages are: annual precipitation 49 inches, May-September 28 inches; annual temperature 61.0°F, January 45.0°F, July 78.9°; length of growing season, 212 days.

Soil Parent Material: Probably beds of clay with some sand, considerable silt.

Soils: Members of the Coxville low soil family, a division of the Low-humic Gley Great Soil Group. They are characterized by gray very firm (very plastic when wet) fine sandy clay, silty clay, or clay subsoils and gray to dark gray fine sandy loam to silty clay surface soils. Internal water movement is slow to very slow because of the plastic subsoils. Sandy material at depths of 35-40 inches below the surface is common in many areas. Bladen soils comprise about 30% of the association, Elkton soils about 18%. Other soils included and their approximate proportions are: Bayboro 5%, Coxville 8%, Hyde 4%, Muck 5%, Othello 10%. Numerous less extensive soils, including Swamp, make up the remaining 20%.

Use: Possibly 18% of the association area is in crops and 3% in pasture; about 72% is in woodland; and 7% in roads, towns, and similar uses. Artificial drainage is required before crops or pasture plants can be grown. Drainage often is slow except in those areas underlain by sand at 35 or more inches. Care must be exercised not to cut ditches or lay tile in the sand. The soils are considered by farmers as very good for soybeans, oats, corn, leafy vegetables, and pasture. Probably one-half of the acreage in woodland could be drained sufficiently for conversion to pasture or limited crop production, principally corn and soybeans.

C **Coastal Beach-Dunesand**

Location: From the Currituck County-Virginia State boundary to Onslow County the Atlantic Ocean shore line is a narrow strip of unconsolidated sand and gravel beach separated from the mainland by several miles of "sound water", and broken by occasional inlets or bays. From Onslow County southwest the ocean shoreline is much closer to the mainland and actually touches it in a few places. The association C is used to cover this shore line material. The total area is about 115,000 acres.

Relief: Coastal Beach is nearly level or gently sloping toward the ocean. Dunesand lies immediately inland from Coastal Beach. It occupies ridges, knolls, and steep hills interspread with almost flat depressions.

Native Vegetation: The ocean front is usually non-vegetated, and most of the Dunesand has little vegetation. There are numerous thin to thick stands of pin oak, myrtle, cedar, yaupon, and coarse grass inland from the areas affected by high tides or by blowing sands.

Climate: Milder and less sudden temperature changes than any inland areas. Averages for Hatteras are: annual precipitation 58.87 inches, May-September 25.3 inches; annual temperature 62.3°F, January 53.0°, July 83.1°; length of growing season, 285 days (longest in the State).

Soil Parent Materials: Unconsolidated sands and gravel.

Soils: There are very few areas where any true soils have formed because of the constant changes due to the action of water and wind.

Use: Mostly for recreational purposes; very little agricultural value, and little value for woodland.

CB **Coxville-Bladen**

Location: Scattered throughout the Middle and Lower Coastal Plain. Brunswick and Pitt Counties have greater proportions than the other counties which include Beaufort, Bertie, Craven, Gates, Jones, Martin, and Onslow. There are no very large tracts. The total area of CB is approximately 470,000 acres.

Relief: Low-lying, nearly level, with slopes mostly under 2%. Surface runoff is slow and internal water movement also is slow or very slow.

Plate 2. An open V-type drainage ditch on CB soils in Martin County (SCS photo).

Native Vegetation: Loblolly pine, shortleaf pine, blackgum, sweetgum, holly, myrtle, gallberry, bay, and switch cane.

Climate: Averages are: annual precipitation 49.0 inches, May-September 25.5 inches; annual temperature 62.0° F, January 45.0°, July 79.0°; length of growing season, 210 days.

Soil Parent Materials: Apparently beds of silt and clay, with some areas of sandy clay, but a dominance of fine materials.

Soils: Members of the Coxville low family in the Low-Humic Gley Great Soil Group. They are characterized by gray very firm and plastic silty clay or clay subsoils which are commonly streaked or mottled throughout with yellowish-brown and sometimes have red splotches at the lower depths. The surface soils are gray to light gray silt loam or fine sandy loam. Soils of this association differ from the soils of the Bladen-Elkton association in not having sandy material at 35-40 inches, in occupying slightly higher positions, in being somewhat better drained, and in containing less organic matter in the surface layers. The principal soil series included are the Coxville about 20% of the association, Bladen, about 25%; and Lenoir, about 18% (Plate 2). Other soil series and soil materials and their approximate percentage proportions are: Bayboro, 8; Craven, 5; Dunbar, 6; Faison, 6; Hyde, 5; and Swamp, 7.

Use: About 18% of the total association area is in crops, 2% is in pasture, 75% is in woodland, and 5% in towns, roads, and other uses. The principal crops are corn and soybeans. Oats, white potatoes, vegetables, and cotton are grown to a considerable extent on the CB soils in Beaufort, Craven, Jones, and Onslow Counties. Artificial drainage is needed for all crops, and for pasture. The soils drain slowly, but tile and open ditches may be used. A considerable acreage of these soils could be "opened up" for pasture, or for limited production of crops as corn, soybeans, and possibly oats.

CS **Craven-Shubuta (Caroline)**

Location: Throughout the Middle Coastal Plain, but principally in Bertie, Gates, Hertford, and Martin Counties. The total area is about 870,000 acres. Note: Since the map was printed all Shubuta soils in NC have been correlated Caroline.

Relief: Gently sloping to strongly sloping, 2 to 9% gradient, resulting in slow to medium surface runoff.

Native Vegetation: Loblolly and shortleaf pine, white and post oaks, hickory, and gum.

Climate: Averages are: annual precipitation 50.7 inches, May-September 25.8 inches; annual temperature 60.7°F, January 43.3°, July 79.5°; length of growing season, 200 days.

Soil Parent Material: Apparently beds of clay containing some sand and considerable silt.

Soils: The major soils belong to the Shubuta low family of the Red-Yellow Podzolic Great Soil Group. They are characterized by brown, reddish-brown, and yellow firm to very firm fine sandy clay, silty clay, or clay subsoils and loamy sand to clay loam surface soils which range in color from gray to pale yellow to reddish-brown. Soils of the Craven series comprise about 30% of the association area, Caroline 20%, and Lenoir 15%. Numerous other soils are included in the remaining 35%. The more extensive series are the Bladen, Coxville, Dunbar, Duplin, Norfolk, and Ruston.

Use: About 32% of the entire association area is in crops, 1% is idle cropland, and probably less than 2% is in pasture; over 55% in woodland; less than 10% in towns, roads, other uses. Farmers consider the CS soils good for peanut and cotton production, fair for tobacco, corn, soybeans, oats, wheat, and pasture plants. Because of their slowly permeable subsoils the CS soils are very difficult to manage. Where they occupy slopes under 2% gradient, water is slowly removed following rains, but on greater slopes the accelerated erosion problem becomes very acute. Probably one-half of the area now in woodland could be cleared and used—with reasonably good yields—for crops or pasture.

DF Dragston-Fallsington

Location: In the region between Camden and Currituck Counties and the Pamlico River. There are no large tracts, and the total area is approximately 245,000 acres.

Relief: Nearly level, with slope gradients mostly under 2 or 3%. Surface runoff is slow, and internal movement of water is moderate. Lack of drainage is due to a high water table.

Native Vegetation: Loblolly pine, shortleaf pine, blackgum, sweetgum, water oak, willow oak, swamp white oak, occasional pond pine, and an undergrowth of gallberry and other shrubs.

Climate: Averages are: annual precipitation, 49 inches, May-September, 29 inches; annual temperature 61.0°F, January 45.5°, July 79.0°; length of growing season, 215 days.

Soil Parent Material: Probably beds of sandy clay with little silt.

Soils: Members of the Dragston and Fallsington low families, division of the Low-Humic Gley Great Soil Group. They have light-colored friable sandy loam surface soils and pale brown to gray sandy loam to sandy clay loam subsoils. Commonly the soils are underlain at depths of 30-40 inches by whitish or light gray and yellow loose sandy material. Dragston soils occupy about 35% of the association and Fallsington soils about 30%. Included soils and soil materials—some of which are underlain by loose sandy material at 30-40 inches—and their relative proportions by percentage are: Bertie, 3; Elwell, 1; Keyport, 1; Klej, 3; Muck, 2; Pocomoke, 6; Portsmouth 5; Woodstown, 10; and Swamp, 4.

Use: Approximately 30% of the association area is used for cultivated crops, 8% for pasture, 4% is idle cropland, 50% is in woodland, and 8% is in towns, roads, and similar use. The soils are not difficult to drain if sufficient outfall can be provided. The principal crops are corn and soybeans. In the vicinity of Elizabeth City and on the "backbone" of Currituck County, cabbage, white potatoes, snapbeans, cucumbers, sweet corn, and early sweetpotatoes are produced for local and northern markets. Watermelons and peanuts are grown on the better drained areas. The DF soils cannot be cropped successfully or used for pasture unless artificially drained. Because of the loose sandy material frequently encountered at 30-40 inches, all deep ditches tend to cave and undercut. Tile laid in this material partly fill with sand. Probably one-half of the presently wooded acreage could be cleared, drained, and used successfully for crops or pasture.

DL Dunbar-Lynchburg

Location: Throughout the region, but mostly in the Middle Coastal Plain and largely in Bladen, Columbus, Duplin. Greene, Jones, Lenoir, Pitt, and Robeson Counties. Individual tracts are small to large, ranging from about 5,000 to about

300,000 acres. This is the second largest (1,900,000 acres) association in the Coastal Plain.

Relief: Nearly level, with the common slope gradient under 3%. Surface runoff is slow, but internal drainage is moderate. The high water table, because of low position is responsible for the somewhat poor drainage conditions.

Native Vegetation: Various oaks, loblolly pine, occasional gums and other hardwoods, gallberry and other shrubs.

Climate: Averages are: annual precipitation 50 inches, May-September, 28 inches, annual temperature 61.5°F, January 43.6°, July 79.8°; length of growing season, 218 days.

Soil Parent Material: Apparently beds of sandy clay with some silt.

Soils: Considered members of the Low-Humic Gley Great Soil Group. They belong in the Lynchburg low soil family. The DL soils have yellowish sandy loam to sandy clay loam upper subsoils which are faintly streaked or mottled with gray; and mottled yellow and gray friable sandy clay loam to moderately firm sandy clay subsoils which often are streaked or splotched with red at the lower depths. Total profile thickness usually exceeds 40 inches. Along with the Dunbar and Lynchburg soils (each containing about 32% of the total area) the association includes numerous other soils. The more important, with their approximate proportions by percentage are: Coxville, mostly south of the Neuse River, 2; Eulonia and Fairhope, entirely in Brunswick, Columbus, New Hanover, and Pender Counties, 1; Goldsboro, 8; Norfolk, 7; Onslow, 3; Plummer 1; Rains, 5; Ruston, 1; and the miscellaneous materials, Muck 1, and Swamp, 4; several other soils, 3%

Plate 3. Irish potatoes being harvested on DL soils in Duplin County (SCS photo).

Use: The proportion of each individual DL association tract in cropland or pasture varies from about 45% in the lower eastern or Tidewater region to less than 10% in the higher or upper Coastal Plain region. Possibly 30% of the total area of the association is in crops, (Plate 3), 5% in pasture, and 3% in cropland lying idle, 52% is in woodland, and 10% in towns, roads, and similar use. All crops common to the Coastal Plain are grown on the DL soils, but the more important are corn, cotton, tobacco, peanuts, soybeans, oats, white potatoes, snapbeans, cabbage, strawberries, and wheat. Most of the tobacco, peanut, and cotton acreage is in the eastern part of the region. The soils are well suited to pasture. Some artificial drainage is needed for all crops and for pasture. Ditches or tile may be used, and the soils drain readily. Tobacco, peanuts, and other crop rows are individually ridged to secure more complete drainage.

IS **Klej-Leon**

Location: Chiefly in the southeastern part of the State where it is widely developed in Bladen, Brunswick, Duplin, New Hanover, Onslow, and Pender Counties. It is the third largest association in the Coastal Plain, occupying about 1,480,000 acres.

Relief: Nearly level, with most soils occurring on slopes with gradients of less than 2 or 3%. Surface runoff generally is slow.

Native Vegetation: About equally divided between a rather open growth of loblolly pine and shortleaf pine, turkey oak and wire grass, and a medium-dense growth of mixed pine and hardwoods with bay, gallberry, and myrtle undergrowth.

Climate: Averages are: annual precipitation 46.5 inches, May-September 25.5 inches; annual temperature 62.5°F, with January 47.9° and July 79.4°; length of growing season, 225 days.

Soil Parent Material: Apparently beds of sand with very little silt and clay.

Soils: Of the association as outlined on the map are mostly imperfectly or somewhat poorly drained sands, hence the map symbol IS. No two soils appear to be dominant throughout the range of the association. The Klej and the Leon are represented by considerable acreage and occur over a wide range, thus the name Klej-Leon. The soils are dominantly Regosols or Regosol-Low Humic-Gley intergrades, which are characterized by light gray, gray, yellow and gray, or pale yellow loose sand to very friable loamy sand subsoils. The Leon, Ona, Immokalee, and St. Johns are Ground-Water Podzols, (Plate 4) but are almost entirely of sand, and have hardpans at varying depths below the surface. Klej soils comprise about 24% of the total association area, Leon soils about 14%. Other sandy soils and their approximate percentage proportions are Galestown, 10; Immokalee, 3; Lakeland, 4; Lakewood, less than 0.2; Ona, 2; Plummer, 8; Rutlege, 5; St. Johns, 2; and St. Lucie, 4. Also included are members of the following soil series which have sand to loamy sand surface soils and very friable sandy loam to moderately firm sandy clay subsoils: Dragston, 1; Dunbar, 2; Fallsington, 1; Goldsboro, 2; Kenansville, 3; Lynchburg, 9; Rains, 3; and the miscellaneous material, Swamp, 3%.

Use: About 10% of the total area of the association is used for crops and 2% for pasture. Another 3% is cropland lying idle because of low yields. Approximately 77% is in woodland, and the remaining 8% is in roads, towns, and other uses. The major crop is corn, although nearly all other crops are planted to some extent. The more important of these are tobacco, peanuts, soybeans, oats, sweetpotatoes, vegetables, and blueberries. Probably about 30% of the entire association may be considered as fair for crop production, and an aditional 10% could be used for pasture. Generally considered, the IS soils have little to offer for future agricultural expansion. One soil, the Leon, is first choice for blueberry planters, but many "better" soils could be used with greater success.

Plate 4. A cut-away portion of Leon sand, one of the IS soils, in Duplin County.

LC Lenoir-Coxville

Location: North-Central and Central Middle Coastal Plain, mostly in Hertford, Northampton, Bertie, Halifax, Craven, and Jones Counties. Individual tracts range in size from about 5,000 to over 250,000 acres, and their total area is about 640,000 acres.

Relief: Nearly level, with the common slope gradient range under 2% although occasional slopes up to nearly 4% do occur. On the lower slope ranges surface runoff is slow, but on slopes above 2%, the Lenoir and Craven soils are very susceptible to accelerated erosion. Internal movement of water is slow to very slow because of the fine-textured subsoils and, to some extent, because of a high water table part of the year.

Native Vegetation: Dominantly hardwoods in the original forests, with white oak the more common tree. Once-farmed or severely cut-over soils support fair to good stands of loblolly and shortleaf pine with some sweetgum, black gum, oaks, and gallberry and myrtle.

Climate: Averages are: annual precipitation 44.0 inches, May-September 21.9 inches; annual temperature 59.3°F, January 40.2°, July 79.3°; length of growing season, 200 days.

Soil Parent Material: Apparently beds of clay with considerable silt, but little sand or gravel.

Soils: Low-Humic Gley Great Soil Group and members of the Coxville and of the Lenoir low soil families. The LC soils are characterized by mottled gray and yellow subsoils that are very firm (tough) fine sandy clays, silty clays, or clays and by silt loam, silty clay loam, or occasionally fine sandy loam surface soils mostly gray, dark gray, or brownish-gray. Lenoir soils comprise about 35% of the association, Coxville about 20%, and Craven soils nearly 15%. Other soils and their approximate percentage proportions are: Bertie, 7; Bladen, 1; Dunbar, 6; Duplin, 2; Marlboro, 2; Norfolk, 2; Portsmouth, 3; several other soils, 5; and Swamp, 2.

Use: Slightly more than one-third of the total area of the LC association is presently used for agriculture, although probably another one-third has at some time been farmed but later abandoned because of adverse soil or difficult drainage conditions, and is now in loblolly and shortleaf pine. Approximately 32% of the area is in crops, 3% in pasture, 2% in cropland lying idle; 55% is in woodland; and 8% in roads, towns, and similar use. The soils must be drained before they can be used for crops or pasture. Farmers then consider them as good soils for peanuts, soybeans, oats, corn, and pasture; fair to good for cotton and vegetables; but only fair to poor for tobacco. With present-day engineering equipment and better soil management practices most of the LC soil areas once-farmed could be reclaimed.

LN Lakeland-Norfolk

Location: No soil association is more localized in its major occurrence than this group which could be designated the Lakeland-Norfolk-Gilead-Hoffman. It occupies the Sandhill region which covers parts of Cumberland, Harnett, Hoke, Lee, Montgomery, Moore, Richmond, and Scotland Counties. Only 8 scattered tracts, which are in Bladen, Duplin, Lenoir, New Hanover, Sampson, and Wayne Counties, occur outside the Sandhills. The total area is 1,350,000 acres.

Relief: Ranges widely from almost level to strongly rolling and hilly, but usually with slope gradients ranging between 2 and 12%, resulting in medium to rapid surface drainage.

Native Vegetation: Longleaf pine, turkey oak, and wire grass.

Climate: Averages are: annual precipitation 49.9 inches, May-September 25.9 inches; annual temperature 61.7°F, January 44.1°, July 79.0°; length of growing season, 215 days.

Soil Parent Material: Mostly sands with considerable gravel in places and not much silt and clay.

Soils: Are members of the Lakeland and the Hoffman low soil families which are considered Red-Yellow Podzolic intergrades of the Regosols. They are characterized by yellow, yellowish-brown, pale yellow, or gray and pale yellow loose sand or loamy sand subsoils and sand surface soils which are gray to almost white (Plate 5). The major soils of the association are the sands: Lakeland, occupying about 32% of the total area; Eustis, 20%; and Kershaw, 6%. Closely allied with these sands are the Norfolk soils which comprise about 15% of the association, and the "hard sand" subsoil series which are the Gilead, 5%; Hoffman, 1%; and Vaucluse, 1%. Scattered throughout much of the association's extent are the following sandy soils with their approximate percentage proportions: Galestown, 3; Klej, 2; Plummer, 2; Rutlege, 1; and St. Lucie 1. In addition Lynchburg, 7; Portsmouth, 1; and Ruston, 1 occur in places. Swamp occupies about 2% of the association's total area.

Use: About 12% of the entire association area is in crops and not over 1% in pasture; about 76% is in woodland; and 11% in towns, an army post, roads, and similar use. The Sandhill soils were long considered as poorly suited to

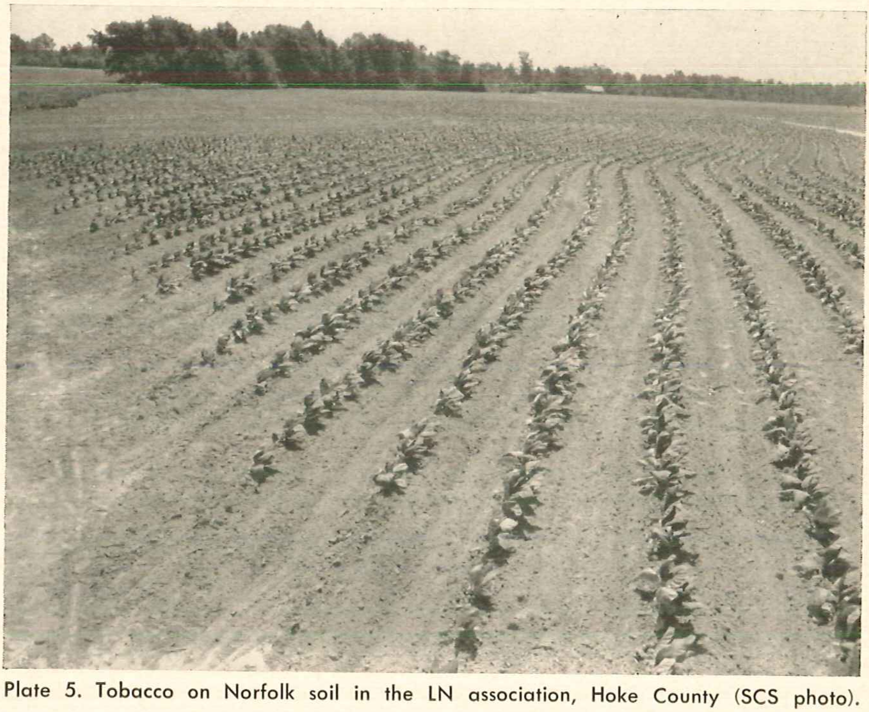

Plate 5. Tobacco on Norfolk soil in the LN association, Hoke County (SCS photo).

agriculture. They are droughty and leach severely. But as the years have passed by, farmers have learned that many of these sandy soils will produce medium to moderately high yields under careful management. Even so, probably less than 18% of the total area of LN soils has at any time been in crops or pasture. The major soils are not considered very good for any crop except peaches, which have been widely grown until recent years (disease and insect damage severe). Many farmers consider the soils good for tobacco with generally excellent quality, but medium-low yields. Cotton is the major cash crop, and with fair to good yields. Crotalaria is widely grown as a soil improvement crop. Corn, soybeans, melons, and early vegetables are locally important crops. Because the soils are very droughty and subject to severe leaching, it is apparent irrigation and heavy fertilization are necessary for relatively high crop yields.

LR **Lynchburg-Rains**

Location: Scattered tracts of Lynchburg-Rains soils are found in 14 counties from Edgecombe and Martin on the north to Columbus on the south. The only tract of large size is in Pender County. The total area of the association is about 800,000 acres.

Relief: Nearly level, with slope gradients mostly under 2%. Surface drainage is slow.

Native Vegetation: Mixed hardwoods--water, white, post and similar oaks; sweetgum, blackgum, and an understory of gallberry and other shrubs with occasionally coarse grasses and some switch cane. Scattered throughout the hardwoods are some to many shortleaf and loblolly pine, but very few longleaf pine. Abandoned cropland is mostly in shortleaf and loblolly pine.

Climate: Averages are: annual precipitation 47 inches, May-September 26 inches; annual temperature 61.5°F, January 47°, July 79°; length of growing season, 215 days.

Soil Parent Material: Sandy clay (probably beds of sand and clay with little silt).

Soils: Members of the Lynchburg and the Rains low soil families in the Low-Humic Gley Great Soil Group. They have yellow and gray to gray and yellow mottled sandy loam to friable sandy clay loam subsoils and gray loamy sand to sandy loam surface soils. The slow drainage is due to the relatively level relief and the high water table. Lynchburg soils occupy about 25% of the total area, Rains soils about 35%. Other included soils and their approximate percentage proportions are: Elwell, 1; Goldsboro, 2; Hyde, 1; Immokalee, 2; Klej, 3; Leon, 1; Muck, 1; Plummer, 8; Portsmouth, 10; Rutlege, 4; St. Johns, 0.3; St. Lucie, 0.7; and wet material along streams which is usually Swamp, 6%.

Soils of this association differ from those of the Dunbar-Lynchburg association in that they have more nearly level relief, are more poorly drained, and contain more coarse materials.

Use: Possibly 15% of the total area of the association is now used for crops, and about 2% may be considered idle cropland. Less than 1% is in pasture. An additional 6 or 8% has been used at some time for agriculture, but abandoned because of drainage difficulties. About 69% is in woodland; and 7% is used for towns, roads, and similar purposes. When drained, limed, and fertilized, farmers consider the LR soils are well suited to most vegetables and truck crops, bulbs, flowers, corn, and soybeans. Pastures do well under careful management. Probably one-half of the present woodland area could be cleared and brought under cultivation if adequate drainage could be secured.

M

Muck-Peat

Location: Throughout the Tidewater Region from Camden and Currituck Counties to Columbus and Brunswick Counties. The largest tract includes most of Dare, Hyde, and Washington Counties, much of Tyrrell, and part of Beaufort County. The total area is 1,400,000 acres.

Relief: Practically level, with no appreciable slope gradient; often areas occupy depressed positions, resulting in very slow surface drainage, and usually ponded conditions.

Native Vegetation: Cypress, juniper, pond pine, gum, switch cane, other water-loving plants. Practically all Muck areas have been burned severely, before or following logging operations; little saw timber is now present, and much of the vegetation consists of certain shrubs which are not severely damaged by fire, and pond pine, with some to much switch cane in places.

Climate: Averages are: annual precipitation 51.7 inches, May-September 27.2 inches; annual temperature 60.7°F, January 41.3°, July 77°; length of growing season 185 days (shortest outside the Mountain Region).

Soil Parent Material: Muck and Peat consist mainly of the residue from partially oxidized plant remains, and are characterized by brown to black fibrous to gelatinous organic materials. Small amounts of mineral soil are present in varying quantity. Muck is underlain at depths of 20 to 60 or more inches by beds of sand, silt, or clay which have widely varying degrees of texture and consistence, but are mostly of sandy properties. Muck and Peat occupy about 75% of the association areas shown on the map. Included soils are Bayboro, Bladen Elwell, Hyde, Pocomoke, Portsmouth, and Rutlege.

Use: Except for the included mineral soils, probably less than 4% of the M association is used for agriculture. There is some production of bulbs and flowers (Plate 6), corn, soybeans, and forage crops for hay, and a few improved pastures.

Plate 6. Many Peat and Muck soils in the Tidewater area are ideal for growing flowers and vegetables. Shown above are gladioli growing on Muck soil in Beaufort County.

An additional 1 to 2% is occupied by drainage canals, canal banks, and roads. Many of the canals were dug to supply soil material for constructing roads. Drainage difficulties, fire hazards, and early and late frost damage have caused the abandonment of most once-farmed tracts (Plate 7). In general, about 90% of the M may be classed as woodland, although vast areas recently burned have no apparent potential timber value.

NR — Norfolk-Ruston

Location: The Upper and Middle Coastal Plain, mostly adjacent to the Piedmont and the Sandhills, in an almost continuous but very irregular band from Virginia to South Carolina; also numerous small tracts scattered in the eastern part of the middle Coastal Plain region. This is the largest soil association in North Carolina, having a total area of approximately 2,601,000 acres.

Relief: Gently to moderately sloping, mainly 2 to 6% gradient, resulting in medium drainage; many areas show accelerated sheet erosion.

Native Vegetation: Mixed hardwoods, mostly oak-hickory, loblolly and shortleaf pine, some longleaf pine in the south.

Climate: Averages are: annual precipitation 46.5 inches, May-September 23.5 inches; annual temperature 60.1°F, January 41.2°, July 80.4°; length of growing season, 210 days.

Soil Parent Material: Sandy clay (probably beds of sand and clay with little silt).

Soils: Belong to the Norfolk and Ruston low soil families of the Red-Yellow Podzolic Great Soil Group. They are characterized by yellow, brown, or light red friable sandy loam to sandy clay loam subsoils and sand to sandy loam sur-

Plate 7. All muck soils will burn. Tile lines, laid about 24-28 inches below the surface in 1930, are now exposed by repeated burning. (Photo taken in July 1954.)

face soils ranging in color from gray to pale yellow. Norfolk soils comprise about 40% of the association area; Ruston soils, 12%, Goldsboro, 10; Marlboro (Plate 8), 6; Lakeland, 4; and Craven, 2%. Other included soils are mainly in the Low-Humic Gley Group. They are the Lynchburg, Rains, Portsmouth, and several others.

Use: Probably 45% of the association area is in crops and less than 5% in pasture; 40% in woodland; and 10% in towns, roads, and similar use. The principal soils are considered by farmers as very good to excellent for tobacco (Plate 9), peanuts, and cotton, and are widely used for these crops. They are fair to good for corn, forage crops, hay, and pasture. This is by far the more desirable soil association for agriculture in the Coastal Plain region. Most of the areas in woodland consist of poorly drained soils included in the association. However, probably one-half of these wooded soils could be cleared, drained, and successfully used for

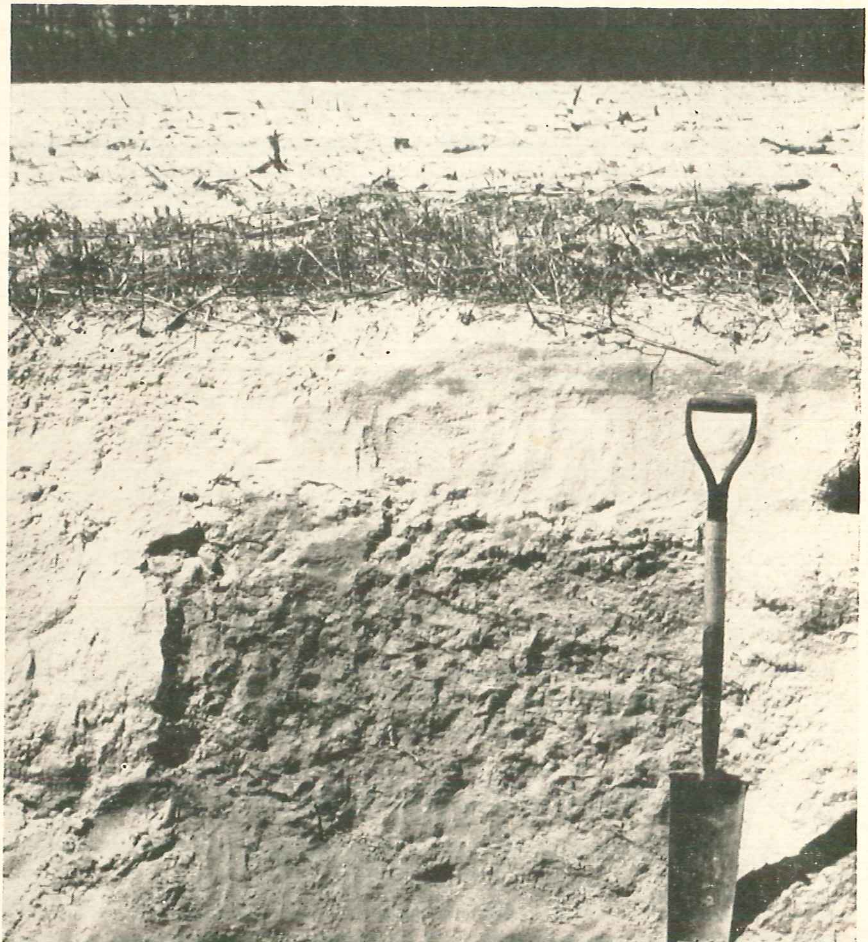

Plate 8. A cut-away profile section showing the Marlboro soil in Duplin County.

Plate 9. Tobacco growing on Norfolk-Ruston soils in Scotland County (SCS photo).

crops and pasture and an additional 5% could be used for pasture only. The major problem of soil management on the NR association is maintenance of soil fertility. This may be brought about by use of rotations and the additions of adequate amounts of commercial fertilizer.

PH Portsmouth-Hyde

Location: Scattered throughout the Tidewater Region in numerous tracts ranging in size from about 5,000 to about 20,000 acres. The total area is approximately 330,000 acres.

Relief: Nearly level to flat or depressed, with slope gradients mostly under 1%, resulting in very slow surface drainage and often ponded conditions in late winter.

Native Vegetation: Cypress, gum, and other water-loving trees; some pine, bay bushes, and switch cane.There are many cut-over and severely burned tracts.

Climate: Averages are: annual precipitation 50.2 inches, May-Septmber 26.5 inches; annual temperature 61.0°F, January 44.5°, July 78.8°; length of growing season, 205 days.

Soil Parent Material: Probably beds of sandy clay with much silt, although in some places it is mainly silt and very fine sand.

Soils: Belong mostly in the Portsmouth low soil family of the Humic-Gley Great Soil Group. These are characterized by gray friable sandy loam to firm silt loam subsoils, and dark gray to nearly black friable loam to sandy loam surface soils. Frequently the surface soils in wooded areas contain 8 to 20% organic matter. The soils are mostly 40 inches or more in thickness over material differing from the subsoils, which usually is sandy. Portsmouth soils (Plate 10) occupy about 40% of the total area of the association, Hyde soils about 20%. Other soils and soil materials and their relative percentage proportions are: Bayboro, 10; Bladen, 3; Fallsington, 2; Pocomoke, 10; and Muck, 8. Various fine sand soils occupy the remaining 7%, and most of these are in the area which once formed the bed of Lake Mattamuskeet. The sands are so "mixed up" with the PH soils that the two associations PH-IS cannot be shown separately on the map.

Use: Approximately 15% is in cropland, 1% idle cropland, and 2% in pasture; 80% in woodland, and 2% in roads, and similar uses. Because of the difficulty in adequately draining such low-lying soils, many tracts may never be suited to cultivated crops, but could be used for pasture. However, these soils are among the

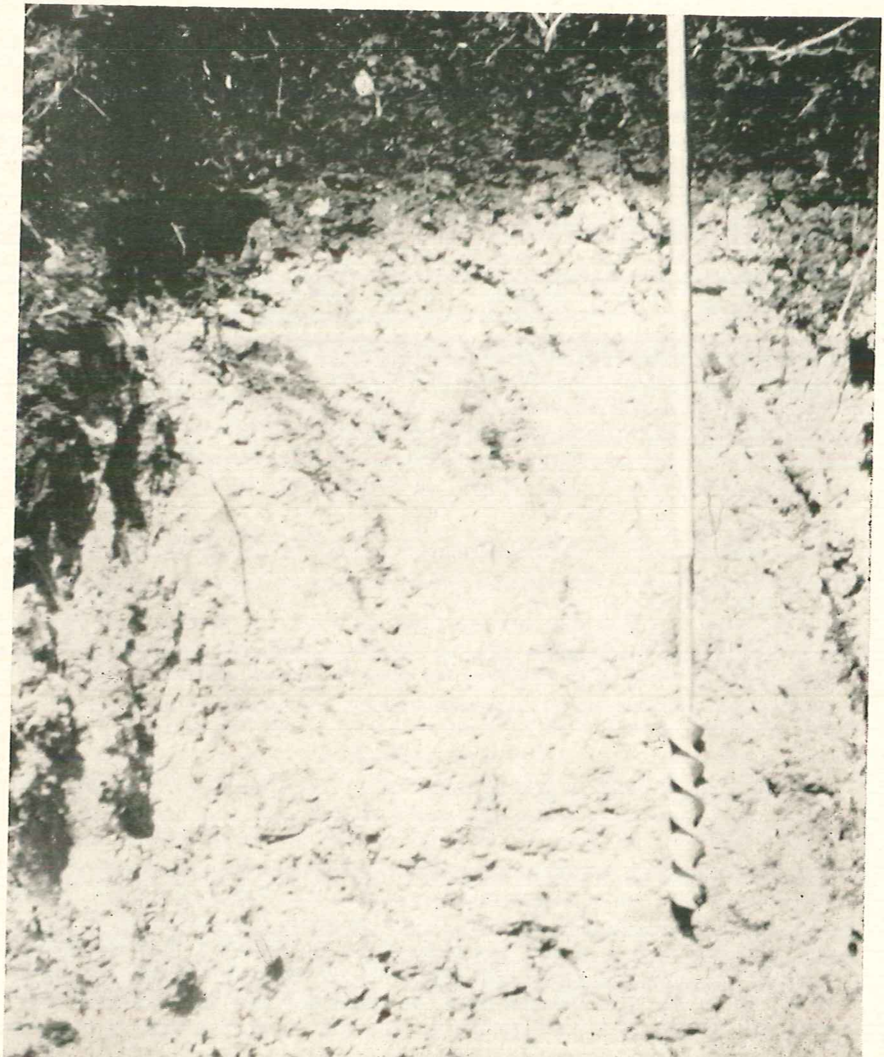

Plate 10. A cut-away section showing the Portsmouth soil in Onslow County.

better corn, soybean, and oats soils in the State. White potatoes, vegetables, and flower bulbs also are grown to some extent.

RP **Rutlege-Plummer**

Location: With one exception, areas of Rutlege-Plummer soils occur south and southwest of the Neuse River. The only moderate-sized bodies are in Bladen, Onslow, and Pender Counties. The total extent of the association is 350,000 acres.

Relief: Practically level, with little appreciable slope gradient, resulting in slow to very slow surface drainage and some ponding in winter and early spring.

Native Vegetation: Mixed hardwoods, some pine. Cut-over tracts support a growth of pond and shortleaf pine with some loblolly pine. A number of areas have a somewhat open or savanna-like appearance with scattered pines and little undergrowth except wire grass and low shrubs. Some of these areas produce "native gardens" of rather brilliant flowers in late spring and early summer.

Climate: Averages are: annual precipitation, 47 inches, May-September 27 inches; annual temperature 62.2°F, January 47.8°, July 79.5°; length of growing season, 210 days.

Soil Parent Materials: Apparently beds of sand which contain only small amounts of silt and clay.

Soils: Belong to the Rutlege low soil family of the Humic-Gley Great Soil Group. They are characterized by gray to light gray loose sand (flow sand) or friable loamy sand subsoils, and gray to almost black sand, loamy sand, or loam surface soils which may contain from 4 to 8% or more of organic matter where not cleared or severely burned. Rutlege soils occupy about 35% of the total area of the association, and Plummer soils about 30%. Included soils and soil materials and their approximate percentage proportions are: Hyde, 2; Portsmouth, 5; Pocomoke, 3; and Rains 15, all having friable sandy loam to sandy clay loam subsoils; the Leon 1, and St. Johns 1, which are hardpan soils; and Muck, 1; Peat, 1; and Swamp, 6%.

Use: Apparently not more than 5% of the association area is in cropland, less than 1% in pasture, and about 4% is idle or abandoned cropland; 85% is classed as woodland; and 5% in roads and similar uses. The RP soils, according to most farmer experience, are only poor to fair for crops or pasture. Drainage is difficult because ditchbanks tend to cave and undercut, and tile lines fill with the loose sand. Near Wilmington and Burgaw some vegetables are produced; also soybeans, corn, and oats, and an occasional area is used for blueberries.

S **Swamp-Tidal Marsh**

Along practically every stream in the Coastal Plain region are strips of low, flat, and often wet, stream-laid soils and soil materials commonly known as Swamp. These strips are subject to very frequent overflow and remain wet much of the year. With each overflow fresh soil material may be added. The resultant soils are very non-uniform. The strips of Swamp vary in width from a few feet on the small streams to as much as seven miles at two points on the Roanoke River.

On a larger scale map, several soil series could be indicated in places along a few of the major streams where rather definite soils have developed, and where overflows are not frequent. These series are the Bibb, Chastain, Iuka, Johnston, and Ochlockonee, but their total area in North Carolina is quite low (73,000 acres). On the smaller streams the strips of Swamp are too narrow to show on the soil association map, and this is also true of many of the larger streams.

Because of their low position, few areas of Swamp can be drained sufficiently for agricultural use. They do support a rather dense growth of cypress, gum, and other water-loving trees and shrubs.

Along many of the Coastal sounds and inlets, and on the sound or inward side of the strips of Coastal Beach, are numerous areas of fine-textured soil materials subject to constant, frequent, or occasional overflow by tides. These areas, known as Tidal Marsh, are largely covered by coarse marsh grass, sedges, rushes, and occasionally by small bushes. The soil material is dark gray oozy loam, silt loam, or fine sandy loam underlain by grayish to almost black soft silty clay or clay. The agricultural value of such areas is quite low except in a few places which furnish scant grazing for cattle.

The combined area of Swamp-Tidal Marsh shown on the soil map is approximately 505,000 acres.

T

Stream Terrace Soils

Along the Meherrin, Tar, Neuse, Little (Cumberland and Hoke Counties), and Lumber Rivers are areas of stream terrace soils of sufficient width to be shown on the soil map. These total about 150,000 acres. Other areas of terrace soils are included with the adjoining upland on the map.

The Coastal Plain terrace soils have considerable range in surface color (light gray to brown to black), and in surface texture and consistence (loose sand to firm clay loam). Subsoil colors range from almost red through yellow and gray to black, and subsoil texture and consistence range from loose sand to very firm clay.

Plate 11. Drainage ditch on wet terrace soils, Lumber River, Robeson County (SCS photo).

Because of their very complicated pattern of occurrence and small individual extent, all the Coastal Plain stream terrace soils are placed in one group on the soil map which is designated T. The more important soils are the Cahaba, Huckabee, Izagora, Kalmia, Myatt, and Okenee. Generally speaking, these terrace soils are subject to infrequent overflow, although some probably never overflow.

Most areas are used for agriculture (Plate 11). The more commonly grown crops are corn and soybeans, although tobacco, cotton, small grain, and many other crops are planted on the better drained soils. Some of the less well drained soils are used for pasture. Where management practices are about the same, crop yields probably are slightly higher on the terrace soils than on the similar soils of the upland.

Piedmont

Symbol — Soil Association

A — Alluvial or Bottomland Soils

Alluvial soils are not extensively developed in the Piedmont. They occur mainly as narrow strips of insufficient size to be indicated on the soil association map, and are included with the adjoining upland soils. Only one area, of about 10,000 acres, is delineated. This is along the Roanoke River in Halifax, Northampton, and Warren Counties, and the soils are mostly the somewhat poorly drained Chewacla, and the poorly drained Wehadkee. They are subject to frequent overflow.

AC — Appling-Cecil

Location: Throughout the eastern half of the Piedmont and in most of the extreme northeast, but only to a very moderate extent in the central portion. The largest tracts are in Davidson, Franklin, Vance, Wake, and Warren Counties. Other counties with moderately large tracts are Anson, Cleveland, Gaston, Halifax, and Nash. The AC is the second largest soil association in the State, covering a total of 2,270,000 acres.

Relief: Undulating to strongly rolling, but mostly with 4 to 12% slope gradient range, resulting in medium to rapid surface runoff. Internal water movement is medium.

Native Vegetation: Oak, hickory, and scattered shortleaf pine; abandoned (previously farmed) tracts are in Virginia and shortleaf pine.

Climate: Averages are: annual precipitation 46 inches, May-September 25 inches; annual temperature 60.0°F, January 41°, July 78°; length of growing season, 200 days.

Soil Parent Material: Acid crystalline rocks, chiefly gneisses and low-mica schists, and some granite.

Soils: Belong in the Appling and Cecil low soil families of the Red-Yellow Podzolic Great Soil Group. They are characterized by red, yellowish-red, red and yellow, or yellow moderately firm to very firm clay loam or clay subsoils and loamy sand, sandy loam, or sandy clay loam surface soils ranging from gray to brownish-red. These are deep soils, generally 35-50 inches thick over partially weathered rock material. Cecil soils comprise about 35% of the total association area, Appling soils 30%. The numerous included soils with their approximate percentage proportions are: Bradley, 1; Cataula, 1; Chesterfield, 1; Colfax, 1; Durham, 2; Helena, 3; Iredell, 3; Lloyd, 2; Lockhart, 1; Louisburg, 3; Vance, 7; Wilkes, 4; and Worsham, 1%. Terrace soils occupy about 1%, and bottomland soils the remaining 4%.

Use: Approximately 32% of the total association area is in cultivated crops and 10% in pasture and permanent hay; 46% in woodland; and 12% in towns, industrial areas, roads, and similar use (Plate 12). There is about as much acreage in corn as in all other row crops combined. The two major cash crops, tobacco and cotton, are second and third in acreage. The soils are well suited to the production of bright-leaf tobacco, and the total acreage in tobacco is far greater than that of any other soil association in the Piedmont. In places there is a considerable acreage in wheat, followed by lespedeza, or in a rotation of wheat, lespedeza, corn, or cotton. A greater portion of the association, probably an additional 15%, could be used for pasture and hay. The Appling-Cecil soils are very susceptible to accelerated erosion, and should be handled under adequate conservation practices. Many thousands of acres of once-farmed land have been abandoned and are now growing up in pine trees. Practically all of the Cecil clay loam in the Cecil-Lloyd association was sandy loam before cultivation and would have been placed in AC, but uncontrolled runoff has removed much or all of the original surface soil.

AO **Alamance-Orange**

Location: In the east-central Piedmont or "slate belt" from Granville and Person Counties to Anson and Union Counties with by far the largest tract in Union County. The total area is approximately 750,000 acres.

Relief: Ranges from nearly level to rolling, but the more common slope gradient range is between 2 and 6%. Surface runoff is medium to slow on the Orange soils and medium on the Alamance. Internal drainage of the Orange is slow to very slow, that of the Alamance medium.

Native Vegetation: Oak, hickory, and other hardwoods, but with the "white oak group" dominant; a few shortleaf and loblolly pine, and red cedar. Cut-over and abandoned farm lands support a growth of Virginia and shortleaf pine.

Climate: Averages are: annual precipitation 48.1 inches, May-September, 22.8

Plate 12. Land use on the AC soil association in Franklin County (SCS photo).

Plate 13. Tobacco growing on Cecil clay loam, the most extensive CL soil, Wake County. This soil has lost all its original sandy loam surface layer, (about 8 inches). The present surface is subsoil material which is poorly suited for growing tobacco.

inches; annual temperature 60.6°F, January 43.1°, July 79.1°; length of growing season, 190 days.

Soil Plant Material: "Carolina Slates", mainly fine-grained volcanic and sedimentary rocks.

Soils: Red-Yellow Podzolic (Durham low soil family) which are characterized by yellow, moderately firm to firm silty clay loam to silty clay subsoils and gray silt loam surface soils, often stony; and Planosols (Orange low soil family) which have gray and yellow to brownish-gray plastic silty clay subsoils and gray silt loam surface soils, frequently stony. The AO soils are only moderately deep, or 24-40 inches thick over partly weathered rock material. Alamance and Orange soils each comprise about 30% of the association. Included soils and their approximate percentage proportions are: Georgeville, 12; Goldston, 10; Herndon, 10; Worsham, 1; Bottomland or alluvial soils, 7%.

Use: Approximately 25% of the association area is in cultivated crops, 7% in pasture and continuous hay, and 2% in idle or abandoned cropland; 56% in woodland; and 10% in towns, industrial areas, roads, and similar use. The principal cash crop in the southern two-thirds of the association is cotton, in the northern third it is tobacco. Throughout the association, lespedeza is the crop most widely grown. The AO soils are somewhat difficult to handle because of their shallow surface layers or their sometimes very firm subsoils. They are much better suited to lespedeza, oats, grass, and cotton than to tobacco, wheat, corn, or deep-rooted legumes. The soils frequently are moderately wet in early spring, yet generally become somewhat droughty during the summer. Accelerated erosion is only a moderately serious problem in soil management.

Plate 14. A first class pasture on Cecil clay loam in Wake County. Putting such land in permanent pasture is an excellent use for this eroded soil (SCS photo).

CL Cecil-Lloyd

Location: Widely developed in the western half of the Piedmont, extending in an almost unbroken but irregular body from Caswell County to Polk County. Other tracts are along the east-central border and in the northeastern portion of the Piedmont. It is the third largest association in the State covering approximately 2,200,000 acres.

Relief: Varies widely from undulating to steep, but mostly ranging between 5 and 8% slope gradient, resulting in medium to generally rapid surface runoff. Internal drainage is medium.

Native Vegetation: Oak, hickory, various other hardwoods, and scattered shortleaf pine. On once cultivated lands there is a fair to very good stand of Virginia and shortleaf pine.

Climate: Averages are: annual precipitation 46.2 inches, May-September 21.2 inches; annual temperature 60.8°F, January 42.2°, July 78.8°; length of growing season, 200 days.

Soil Parent Material: Acid crystalline rocks (gneisses, low-mica schists, some granite) with considerable basic crystalline rock (diorite, gabbro, hornblende), throughout much of the area.

Soils: Red-Yellow Podzolic, which are members of the Cecil and the Lloyd low soil families. They are characterized by red to dark red firm clay subsoils and red moderately firm clay loam to clay surface soils (sometimes sandy clay loam or sandy clay). Cecil soils comprise about 45% of the association and Lloyd soils about 25%. Included Appling soils account for 5%; Hayesville, 10; other upland soils, 5; very severely eroded and gullied land, 5; and bottomland soils, 5%.

Use: About 23% of the association area is in cultivated crops and 12% in continuous hay and pasture; 50% in woodland; and 15% in towns, industrial areas, roads, and like use. Probably almost two-thirds of the area now in woodland was at some time in crops, but abandoned because of severe accelerated erosion. Taking the association as a unit, corn is the principal crop. But in Cleveland, Iredell, Mecklenburg, and Rutherford Counties more cotton than corn is grown. In the northern counties—Caswell, Forsyth, Guilford, Rockingham, and Yadkin—a considerable acreage of these soils is planted to tobacco, not because of present soil suitability, but because of former soil suitability. The Cecil soils in these counties once had sandy loam surface soils and were considered well suited to bright leaf tobacco. Continuous row cropping with little or no conservation practices resulted in the removal of the sandy layer and now the present soils, which are mostly clay loam, are only fair for tobacco (Plate 13). There are quite a number of medium to large dairy farms and a few beef cattle farms scattered throughout the association. The soils are considered by farmers as very good for wheat, alfalfa, clover, lespedeza, and grasses for hay or pasture mixtures (Plate 14); good to very good for cotton; but only fair to good for corn and soybeans. Although these soils are capable of producing high yields, the major management problem is control of erosion. Probably 20% of the portion now in woodland could be cleared and used successfully for pasture.

DM Davidson-Mecklenburg

Location: Mainly in the south-central Piedmont, with the largest tracts in Catawba, Davidson, Davie, Iredell, Lincoln, Polk, Rowan, and Rutherford Counties. The total extent is about 520,000 acres.

Relief: Nearly level to steep, but mostly with slope gradient range between 2 and 15%, resulting in medium to somewhat rapid surface runoff. Internal drainage is medium.

Plate 15. Land use on the DM soil association in Iredell County (SCS photo).

Native Vegetation: Mixed oaks, occasional red cedar, some hickory and other hardwoods; with shortleaf and Virginia pine and red cedar on once-farmed lands.

Climate: Averages are: annual precipitation 48.6 inches, May-September 22.3 inches, annual temperature 60.0°F, January 41.6°, July 78.9°; length of growing season, 200 days.

Soil Parent Material: Dark colored basic crystalline rocks as diorite, gabbro, diabase, some hornblende gneiss and schist, and occasional granodiorite.

Soils: Red-Yellow Podzolic, and members of the Davidson and Mecklenburg low soil families. They are characterized by dark red or brownish-red firm clay subsoils and brownish-red moderately firm clay loam or loam surface soils. There are some inclusions of Planosolic soils (chiefly Iredell) which have yellowish-brown or olive-colored very firm clay subsoils (plastic) and gray to brown loam or clay loam surface soils. Davidson soils occupy about 20% of the association area, Mecklenburg soils 25, and Lloyd 20%. Major inclusions and their approximate proportions by percentage are Cecil clay loam, 12; Iredell, 10; Hiwassee (much of the DM area in Davidson County) 6; and Bottomland soils, chiefly Chewacla and Congaree, 7%.

Use: Approximately 30% of the entire association area is in cultivated crops, including small grain and lespedeza, 20% in continuous hay crops and pasture, 1% in idle cropland; 37% in woodland; and 12% in towns, industrial areas, and similar use (Plate15). Cotton is the principal cash crop, although considerable wheat, much lespedeza seed and hay, clover hay, and some alfalfa hay are grown for sale. There are probably more dairy and beef cattle farms on this association in proportion to its total area than in any other association. Farmers consider the soils to be very good to excellent for legumes, especially alfalfa, also for wheat, cotton, and pasture grasses; but only fair for corn and soybeans. Probably one-half of the portion now in woodland could be cleared and used successfully for pasture.

GT **Georgeville-Tirzah**

Location: Central Piedmont, chiefly in Chatham, Orange, and Randolph Counties, with a total area of about 240,000 acres.

Relief: Undulating to steep, but mostly within 4 to 18% slope gradient range, resulting in medium to rapid surface runoff. Internal drainage is medium.

Native Vegetation: Oak, hickory, with some red cedar; once-farmed lands are mostly in shortleaf and loblolly pine.

Climate: Averages are: annual precipitation 46.6 inches, May-September, 21.8 inches; annual temperature 60.5°F, January 42.5°, July 78.3°; length of growing season, 190 days.

Soil Parent Material: "Carolina Slates", mainly fine-grained volcanic rocks.

Soils: Are in the Red-Yellow Podzolic Great Soil Group, and members of the Cecil low soil family. They are characterized by light red to dark red firm silty clay subsoils and gray-brown to red moderately firm silt loam to silty clay loam surface soils. Georgeville soils occupy about 60% of the association area, Tirzah soils, 15, Herndon, 12, other upland soils, 10, and bottomland soils about 3%.

Use: About 23% of the association area is in cultivated crops including small grain and lespedeza, 10% in continuous hay and pasture, and 3% idle cropland; 53% in woodland; 11% in towns, industrial areas, roads, and like use. The soils are considered by farmers as very good for wheat and lespedeza, which together occupy a much greater acreage than any other crop; good to very good for alfalfa and cotton, which are grown to some extent throughout the association area, but more particularly in the southern portion; fair to good for corn and soybeans; and very good for pasture plants.

GW **Granville-White Store**

Location: Only one area is indicated on the soil map. This includes parts of Durham, Granville, and Wake Counties and covers approximately 180,000 acres.

Relief: Nearly level to strongly rolling, but mostly with slope gradients between 3 and 12%. Surface runoff is medium to rapid. Internal drainage is medium in the Granville, but slow to very slow in the White Store soils which are very susceptible to erosion.

Native Vegetation: Oak, hickory, with a few other hardwoods; abandoned or once-farmed areas are in a poor to fair growth of Virginia and shortleaf pine.

Climate: Averages are: annual precipitation 46.5 inches, May-September, 26.5 inches; annual temperature 60.0°F, January 41.4°, July 78.2°; length of growing season, 200 days.

Soil Parent Material: Two extremes are represented: medium coarse-grained sandstone and shale and fine-grained siltstone.

Soils: These are quite diverse in texture and consistence, and are in two great soils groups: the Red-Yellow Podzolic (Durham low soil family) and the Planosol (White Store low soil family). They are characterized by sandy loam surface soils of varying thickness up to 20 inches. The subsoils range from yellow friable sandy clays (Granville) to reddish firm and plastic clays (White Store). They are moderately deep or 30-40 inches thick over disintegrated rock material. Most of the White Store soils which have some sandy material in the surface layer are included in this association. Soils comprising the association and their approximate percentage proportions are: White Store, 30; Creedmoor, 20; Granville, 10; Mayodan, 5; Wadesboro, 12; numerous other upland soils, 15; bottomland soils, 8%.

Use: About 30% of the association area is in cultivated crops including small grain, and 10% in continuous hay and pasture; 50% in woodland; and 10% in towns, industrial areas, roads, and like use. The Granville and Creedmoor soils are considered by farmers as very good to excellent for tobacco, fair for general crops; the White Store is fair for general crops. However, corn occupies by far the greatest acreage, with tobacco second. The many areas of abandoned land are composed largely of eroded White Store soils which once were used for tobacco. In order to remove rainwater quickly on these soils, which have slowly permeable subsoils, the crop rows were run down-slope, eventually resulting in loss of all the sandy loam top soil and much of the subsoil. However, many areas of these eroded soils could be cleared and used for pasture, or possibly for grass and lespedeza for hay, or for wheat.

HC **Hayesville-Cecil**

Location: Extending almost entirely in one large body from McDowell County northeast to the Virginia line along Rockingham County, the HC association has a total area of approximately 1,040,000 acres.

Relief: Ranges from undulating to very steep, but with most areas having slope gradients somewhere between 8 and 24%. Surface runoff is medium to rapid, internal drainage medium.

Plate 16. Strip crop farming on HC soils in Alexander County (SCS photo).

Native Vegetation: Oak, hickory, scattered white and shortleaf pine; once-farmed lands support a fair to good growth of Virginia, shortleaf, and white pine, with the latter on the higher and cooler elevations.

Climate: Averages are: annual precipitation 50 inches, May-September 24 inches; annual temperature 56.5°F, January 38.3°, July 75.3°; length of growing season, 180 days.

Soil Parent Material: Mainly light-colored acid crystalline rocks, chiefly gneisses and schists but also some granite.

Soils: These are the "Foothill Soils" and belong to the Cecil low soil family of the Red-Yellow Podzolic Great Soil Group. They are characterized by red or yellowish-red moderately firm to firm clay subsoils and gray sandy loam, gray-brown loam, or reddish-brown clay loam surface soils. The soils are not deep, generally ranging from 25-35 inches thick over weathered rock material. Rock outcrops are common, and quite a few of the soils have an appreciable amount of stone. The HC soils are about intermediate in consistence between the moderately firm Hayesville soils of the HH association in the Mountains, and the firm to very firm Cecil soils of the CL association in the Piedmont. Soils of the Hayesville series comprise about 32% of the association area; those of the Cecil series about 37%; and Lloyd soils about 15%. Numerous upland soils including the Appling, Durham, Helena, Madison, and Wilkes series, occupy about 9%; and the bottomland soils, Chewacla, Congaree, and Wehadkee, in about equal proportions, 7%.

Use: Approximately 15% of the total area of the association is in cropland and about 10% in permanent pasture and continuous hay; 62% in woodland; and 13% in roads, industrial areas, and similar use (Plate 16). There is more acreage in corn than in all other crops combined. Considerable wheat is grown, along with lespedeza, clover, and some alfalfa. Cotton is important as a cash crop in the southern portion of the association, tobacco in the northern portion. In general the soils, because of the strongly sloping relief and subsequent difficulty of adequate conservation, are poorly suited to row crops. They are good to very good for grass and legumes as pasture, and for alfalfa and grass as hay crops. The soils, relief, and climate appear to be well suited for apples, peaches, and grapes. Although many thousands of acres in the association have been abandoned because of severe soil erosion, much of this land could be cleared again and used for pasture, as demonstrated by some land owners scattered throughout the region. These "reclaimed lands" could be used to increase greatly the number of dairy and beef farms now within the association.

HG **Herndon-Georgeville**

Location: This is by far the largest and most widely distributed of the three soil associations in the central Piedmont or slate belt. There are tracts on the Virginia line in Granville County and on the South Carolina line in Union County. The largest individual tract covers most of Montgomery, Randolph, and Stanly Counties. The total area of the association is about 1,800,000 acres.

Relief: The range in relief of the HC is much greater than that in the other two slate belt associations, the AO and the GT. The overall extremes are from gently undulating to very steep, but the more common range is between 5 and 20%. Surface runoff is medium to rapid, internal drainage is medium.

Native Vegetation: Oak and hickory, in which white oaks are dominant; occasional shortleaf pine and red cedar. Once-farmed lands are mostly in Virginia and shortleaf pine with fair to good stands.

Climate: Averages are: annual precipitation 45 inches, May-September, 23 inches; annual temperature 60.4°F, January 42.4°, July 78.2°; length of growing season, 190 days.

Soil Parent Material: Carolina Slates, mainly fine-grained volcanic and sedimentary rocks.

Soils: Members of the Appling and the Cecil low soil families of the Red-Yellow Podzolic Great Soil Group. They are characterized by light red to red firm silty clay subsoils, and gray silt loam or reddish-brown silty clay loam surface soils. These soils are moderately deep, ranging from 28 to 40 inches in thickness over partly weathered slate. They are about midway in thickness between the shallow AO and the deep GT soils. They are less stony than the AO, but more stony than the GT. Herndon soils comprise about 30% of the association, Georgeville soils 40%, and Goldston 10%; Alamance, Orange, Worsham, and other upland soils about 13%; and Chewacla, Congaree, and Wehadkee on the bottomlands, about 7%.

Use: Approximately 25% of the association area is in cropland and 7% in permanent pasture and continuous hay. Apparently about one-half of the entire extent of the association has been farmed at some time, but large tracts were abandoned because of steep slopes or severe erosion and, to some extent, because stone interfered with cultivation. About 53% is in woodland; and 15% in towns, roads, industrial areas, and similar use. Corn is by far the most widely grown crop, and occupies the greatest acreage. Except for Union and Stanly Counties, little cotton is grown, and, except for Granville County, hardly any tobacco is grown. Wheat, oats, and lespedeza (for hay and seed) are the major cash crops. There are many dairy farms and a few beef cattle farms. The soils appear well suited to small grain, lespedeza, and other shallow-rooted legumes, and to grasses. With careful management excellent returns may be expected. Most soils are susceptible to accelerated erosion and adequate conservation measures must be followed. Probably one-third of the portion now in woodland could be cleared and successfully used for pasture.

HW Helena-Wilkes

Location: North-central Piedmont, chiefly in one large tract extending across Caswell, Person, Orange, Alamance, Guilford, and Randolph Counties; also a tract covering most of central Granville County; and small tracts in other counties. The total area is approximately 1,040,000 acres.

Relief: Varies from undulating in Guilford County to moderately steep in Caswell County, but mostly within a 5-18% slope gradient range, resulting in medium to rapid surface runoff. Internal drainage is somewhat slow due to the firm subsoil or because of rock material at shallow depths.

Native Vegetation: Oak and hickory intermixed with numerous other hardwoods; once-farmed lands are in fair growth of shortleaf and Virginia pine, and some scattered red cedar.

Climate: Averages are: annual precipitation 43.3 inches, May-September 20.1 inches; annual temperature 58.8°F, January 40.1°, July 77.5°; length of growing season, 190 days.

Soil Parent Material: Is largely acid crystalline rocks, mainly granite and granite-gneiss, cut frequently by basic rock dikes or mixed with basic crystalline rocks.

Soils: Chiefly Planosols (Helena low soil family) and Lithosols (Wilkes low soil family), with many variants, but characterized to a considerable extent by yellow, brown, or yellowish-brown firm sandy clay to clay subsoils, often less than 18 inches thick and seldom more than 35 inches thick, and gray loamy sand to yellowish-gray sandy clay loam surface soils. Helena soils occupy about 24% of the association area, Wilkes soils 32, Iredell 15, Cecil 10; Appling, Durham, Louisburg, and other upland soils 13%; and bottomland soils, about 6%.

Use: About 24% of the association area is in cultivated crops including small grain and lespedeza, 6% in continuous hay and pasture; 55% in woodland; and 15% in towns, industrial areas, roads, and like use. Probably two-thirds of the total area of the HW association at some time has been under cultivation, but many tracts were abandoned because of severe erosion, steep slopes, low yields, and other adverse factors. On an acreage basis corn is the most important crop, tobacco is second, lespedeza third, and wheat fourth. There is much idle cropland, of which part is in a tobacco-weed rotation, and part is "resting" because of low production. There are several dairy farms and a few beef farms, mostly on lands considered too severely eroded for further tobacco production. Farmers consider the soils having considerable sand in the surface six inches as very good for tobacco, and this crop is produced to a greater proportionate extent in this association than in any other association in the Piedmont. However, the soils appear to be only fair for other crops. Control of soil erosion is the major land use problem, but this is closely followed by the need for maintenance of fertility. Except in the White Store-Creedmoor, there is no soil association showing as much loss of soil and subsequent abandonment of farm land as the HW. Although most soils originally had suitable sandy loam surfaces for tobacco culture, they had slowly permeable subsoils. In order to secure quick drainage tobacco rows were run down-slope, resulting in severe erosion. Adequate conservation measures, such as contour tillage, strip cropping, and rotations, are necessary to protect the remaining surface soil.

IM **Iredell-Mecklenburg**

Location: Scattered throughout the west-central Piedmont from Granville County to Gaston County, and occurring mostly in tracts of 5,000-10,000-acre size. The only large tracts are in Cabarrus, Davie, and Rowan Counties. The total extent is about 480,000 acres.

Relief: Ranges from nearly level to strongly rolling, but the more common slope gradients are between 3 and 12%. Surface runoff is medium to rapid, but internal drainage is slow to very slow because of the firm and often plastic clay subsoils.

Native Vegetation: Various hardwoods in which white oak is dominant, red cedar, scattered shortleaf pine. Once-farmed soils support a fairly good growth of shortleaf and Virginia pine, red cedar, and scattered hardwoods.

Climate: Averages are: annual precipitation 49 inches, May-September, 23 inches; annual temperature 60°F, January 41.5°, July 78.7°; length of growing season, 195 days.

Soil Parent Material: Basic crystalline rocks, mostly diorite, diabase, gabbro, and hornblende gneiss, which are low in quartz and mica.

Soils: Planosols and Red-Yellow Podzolics, and members of the Iredell and the Mecklenburg low soil families. They are characterized by brown, olive-brown, or dark reddish-brown firm to very firm clay (moist) subsoils which become very plastic when wet, and by grayish-brown to reddish-brown loam or clay loam surface soils. Profiles of most IM soils are shallow to moderately deep, commonly ranging from 20-30 inches in the Iredell, and from 28-40 inches in the Mecklenburg. Iredell soils constitute about 32% of the total association area, Mecklenburg soils about 25, and Davidson soils 5. The included upland soils, which are: Colfax, Elbert, Enon, Helena, Wilkes, and Zion, occupy about 21%; terrace soils, mostly Altavista and Roanoke, about 3%; bottomland soils, Chewacla, Congaree, and Wehadkee, about 12%; and numerous other upland soils 2%.

Use: About 20% of the association area is in cultivated crops, mostly in rotation with small grain, lespedeza, and other legumes, and 18% in permanent pasture and continuous hay. About 2% is cropland lying idle; 44% in woodland; and 16% in towns, industrial areas, roads, and similar use. Corn occupies the greatest cropland acreage, but is closely followed by lespedeza and small grain. Cotton is a major cash crop, but is seldom grown north of Davie County. Some tobacco is produced in Caswell and Guilford Counties. Wheat, lespedeza for seed and hay, alfalfa and clover hay are minor cash crops throughout the association. Farmer experience indicates that the Mecklenburg soil is well suited to cotton, small grain, clover, alfalfa, and grass; and the Iredell soil to cotton, grass, and shallow rooted legumes. There are many dairy farms and several beef cattle farms throughout the association. Large areas of IM soils have clayey surface textures, are difficult to till, and probably should be used principally for small grain and sod crops. Because of their firm, plastic subsoils and slow permeability, many areas are very susceptible to accelerated soil erosion when cultivated. Experience of farmers and soil conservation workers indicates that fields with slopes greater than 7% gradient should be kept in close growing vegetation most of the time.

MG **Mayodan-Granville**

Location: East-central Piedmont in Anson, Chatham, Durham, Granville, Lee, and Wake Counties; North-central Piedmont, in Davie, Rockingham, Stokes, and Yadkin Counties. Most tracts are relatively small (between 10,000 and 30,-

000 acres), and the total area of the association is about 360,000 acres.

Relief: Undulating to strongly rolling, but mostly within 3 to 14% slope gradient range, resulting in medium to rapid surface runoff. Internal drainage is medium.

Native Vegetation: Mixed hardwoods which are dominantly oak and hickory, with few shortleaf pines; once-farmed lands are in fair to good growth of shortleaf, loblolly, and Virginia pine.

Climate: Averages are: annual precipitation 42.5 inches, May-September, 20.3 inches; annual temperature 59.6°F, January 41.6°, July 78.7°; length of growing season, 200 days.

Soil Parent Material: Mainly the coarser-grained sandstones of the Triassic formation.

Soils: Red-Yellow Podzolic, and members of the Appling and the Durham low soil families, which are characterized by yellow, yellowish-red, or light brownish-red moderately firm sandy clay loam to firm clay subsoils, and gray loamy sand to gray-brown sandy loam or sandy clay loam surface soils. Total profile thickness is medium, ranging from about 26 to 38 inches over rock material which usually is soft or well disintegrated. Mayodan soils occupy about 35% of the association area, Granville soils 10, Creedmoor 20, White Store 10, Wadesboro 5, other upland soils, 13; and the bottomland soils Bermudian, Bowmansville, and Rowland, about 7%. Except for the included Creedmoor and White Store, these are the "sandstone and shale soils" with 4-8 inches of sandy surface material and moderately permeable subsoils.

Use: About 20% of the association area is in cultivated crops including some small grain, and 5% in continuous hay or pasture; 63% in woodland; and 12% in towns, industrial areas, roads, and like use. Although corn occupies the greatest portion of the cultivated land, tobacco is by far the most important crop. Cotton ranks third, but is grown only in the tracts south of Durham County. The soils are considered by farmers as very good for tobacco, and fair for most other crops. With irrigation most soils would be suitable for commercial vegetable crops. Although the soils are not well suited to pasture plants, there are a few dairy farms in the MG areas of Chatham, Durham, and Wake Counties. The soils are moderately susceptible to accelerated erosion, and should be handled under adequate conservation practices which include terraces, contour tillage, strip cropping, and rotations.

MS **Madison-Surry**

Location: In several small (3,000 acre) to very large (150,000 acre) tracts occuring from the Virginia line in Surry County to the South Carolina line in Polk County, with a total area of about 630,000 acres.

Relief: Undulating to very steep, but with the greater portion occupying slope gradients between 6 and 24%, and with subsequent medium to rapid surface runoff. Internal drainage is medium.

Native Vegetation: Oak, hickory, other scattered hardwoods, some white pine; once-cultivated areas are in Virginia and shortleaf pine or in white pine, with the latter at the higher or cooler elevations.

Climate: Probably the most comfortable year-round climate in the State with these averages: annual precipitation 50.6 inches, May-September 24.4 inches; annual temperature 56.8°F, January 38.4°, July 75.4°; length of growing season, 180 days.

Soil Parent Material: Mainly schistose rocks having a high mica content.

Soils: Red-Yellow Podzolic, chiefly in Madison low soil family, which are characterized by yellowish-red, reddish-yellow, or red moderately firm to firm clay subsoils, and gray sandy loam or loam to reddish-brown clay loam surface soils. These are moderately deep soils, the total profile thickness usually ranging between 22 and 34 inches over bed rock. Usually flattish rock fragments and some finely divided mica flakes are present throughout the profile. Madison and Surry soils each occupy about 28% of the association area, Grover soils 5. The Chandler, Talladega, and other included Mountain soils occupy much of the very steep land and comprise about 15% of the association. Other upland soils, mostly the Appling, Hayesville, Lloyd, Statesville, and Louisa account for 16%. Practically all of the highly micaceous Tatum-Nason-York soils are included in two localities (corner of Cleveland and Gaston Counties along the South Carolina line, and adjacent to the southern boundary of Catawba County), but occupy only about 1% of the association. The Chewacla, Congaree, and Wehadkee soils on the bottomlands comprise approximately 7%.

Use: About 15% of the association area is in cultivated crops, including wheat and lespedeza, and 10% in pasture and continuous hay; 57% in woodland; and 18% in towns, industrial areas, roads, and similar use. There is probably as much land in corn as in all other row crops combined. The major cash crops are cotton and tobacco. The geographic line between these two crops is rather sharply defined: Cotton and no tobacco to the south of Alexander County, tobacco and no cotton to the north. Farmers consider the Surry soils as very good for tobacco, apples, and peaches; good for wheat and lespedeza; and fair for corn, soybeans, and pasture plants. The Madison soils are good to very good for cotton, apples, peaches, grapes; fair for other crops, but seldom used for tobacco; and good for pasture plants. The Chandler and Talladega soils are poorly suited to any use including trees. The Hayesville and other soils are good to very good for apples, peaches, wheat, lespedeza, and pasture plants; good for alfalfa and cotton; fair for tobacco, corn, and soybeans. In the vicinity of Valdese a very wide range of crops is produced, including vegetables and small fruits. Many dairy farms are scattered throughout the northern two-thirds of the association area, and there are a few beef cattle farms. Probably one-half of the association area now in woodland could be cleared and used for pasture and hay production. The presence of rock fragments hampers tillage or growth of plants to some extent, but does tend to lessen the erosion hazard.

R — Stony Rough Land

See R under the Mountain area section. Included in the R in the Piedmont are the Sauratown Mountains in Stokes County, Pilot Mountain in Surry County, the mountains along the Yadkin River between Montgomery and Stanly Counties, and the Kings Mountain region.

T — Stream Terrace Soils

There are two areas of Stream Terrace soils in the Piedmont region of sufficient size to be shown on the soil map. One is along the Yadkin River in the corner between Montgomery and Rockingham Counties; the other is along the Cape Fear River in northeastern Lee County. However, Stream Terrace soils formed of Piedmont material extend into the Coastal Plain region in many places, particularly along the Roanoke River into Northampton, Halifax, and Bertie Counties; along the Tar River into Edgecombe County; along the Neuse River into

Wayne County; and along the Cape Fear River into Harnett and Cumberland Counties. The total extent of these terrace soils is about 370,000 acres.

The dominant soil in the T association is Wickham, which is well drained and has light brown loam or sandy loam surface material and brown to reddish-brown firm clay subsoils. Other important soils are the well drained to moderately well drained Altavista, Masada, Harnett, State, and Tillery; the somewhat poorly drained Augusta and Warne; and the poorly drained Grabtown and Roanoke. The important bottomland soils are the well drained Congaree, somewhat poorly drained Chewacla, and the poorly drained Wehadkee. All bottomland soils are subject to complete flooding about once every two or three years. Many of the Terrace soil areas have been covered with flood waters three times since 1920. The Wickham soils occupy slopes having gradient ranges between 2 and 5%; the Roanoke soils generally occupy nearly level to flat areas with slope gradients under 1%. The other soils are mostly nearly level to gently sloping, or with gradients between 1 and 3%. There is an accelerated erosion problem on many areas of the Wickham soils, and to some extent also on a few areas of the Altavista and Warne soils.

Practically all areas of the Stream Terrace soils at some time have been cleared and farmed. At present, approximately two-thirds of the association is in open farm land, mostly planted to corn, cotton, or peanuts, but some areas are in pasture and hay. Very few areas of the included bottomlands are in crops of pasture because of the flood hazard. Soils of the Stream Terraces are highly desirable for the production of cotton, peanuts, corn, soybeans, vegetables, and hay crops. If the flood hazard were removed by large impounding dams or by hydro-electric projects most of the bottomland areas could be used for corn or soybeans, but preferably for large livestock farms whereby the soils could be utilized for pasture and hay because some drainage would be needed for most row crops.

WC **White Store-Creedmoor**

Location: Developed in five small to medium-sized tracts from the southwest corner of Wake County across parts of Chatham, Lee, Moore, Montgomery, Richmond, and Anson Counties to the southeast corner of Union County. The total extent is approximately 310,000 acres.

Relief: Ranges widely or from nearly level to steep, but mostly with slope gradients between 4 and 15%, resulting in medium to rapid surface runoff. Internal drainage is slow to very slow due to the very firm and plastic subsoils.

Native Vegetation: Mixed hardwoods with much white oak; some red cedar, shortleaf and loblolly pine. Once-farmed lands are in a fair to moderately good growth of loblolly, shortleaf, and Virginia pine.

Climate: Averages are: annual precipitation 46.5 inches. May-September, 22 inches; annual temperateure 60.3°F, January 43.0°, July 78.5°; length of growing season, 210 days.

Soil Parent Material: Planosols, and members of the White Store low soil family which are characterized by variable-colored but mostly red, brown, yellow, and gray mottled or streaked very firm (moist) and very plastic (wet) clay subsoils, and gray sandy loam to silt loam or brownish-red clay loam to clay surface soils. White Store soils occupy about 35% of the association area, Creedmoor soils 25, Mayodan 15, Wadesboro 4, Granville 1; other upland soils 5, and severely eroded and gullied land 8%. On the bottomlands, the Bermudian, Bowmansville, and Rowland account for about 7%. The WC association includes most of the Triassic soils which have thin to thick surface layers of medium to fine textured materials and slowly and very slowly permeable subsoils. They are of medium thickness, ranging from about 24-35 inches over rock materials.

Use: Approximately four-fifths of the total area of the association has at some time been under cultivation, but at present only about 20% is in cultivated crops including small grain and lespedeza, 8% in recently abandoned cropland, and 10% in hay crops and pasture; 53% in woodland; and 9% in towns, industrial areas, roads, and similar use. Corn probably occupies as much acreage as all other row crops combined. Cotton is widely grown in the southern portion. Farmers consider the Creedmoor soils as good for tobacco and fair for most other crops. White Store soils are good for cotton and fair for other crops. Soils of the association, because of their very slowly permeable subsoils and sloping relief, appear to be more susceptible to losses through accelerated erosion than any other soils in North Carolina. Under row crop tillage many fields have lost all of their original surface soils and considerable subsoil, resulting in abandonment. Conservation practices, both vegetative and mechanical, are essential for successful management and retention of the remaining portions of these soils.

Mountains

Symbol — Soil Association

A — Alluvial or Bottomland Soils

Alluvial soils occur along all streams in the Mountain region, but only in a few places are these soils of sufficient extent to be indicated on the soil association map as Association A. Chewacla and Congaree are the major soils, each occupying about 35% of the entire extent. These have friable silt loam or loam subsoils and silt loam or fine sandy loam surface materials. They are brown or grayish-brown throughout. Total profile thickness ranges from 26-40 inches over gravel, sand, or other materials. Other soils in the association are the Wehadkee, 15%; Toxaway, 3; and Buncombe, 2, in the first bottoms; and Altavista, Augusta, and Warne, totaling about 7%, on the stream terraces. The remaining 3% is comprised of the colluvial soils Tate and Tusquitee. The total extent of the association is about 50,000 acres. The relief is nearly level to gently sloping, chiefly less than 2% gradient. All the bottomland soils except those which are below large dams are subject to flooding. The terrace soils seldom are flooded. Probably 95% of the total area of A has been cleared, and about two-thirds of this open land is in cultivated crops and one-third is in pasture or hay. There is some idle land because of flood damage or lack of adequate drainage. Soils of the association, when drained, are especially well suited to corn, vegetables, clover, and grass. Response to management is excellent. Yields are high, there is no erosion hazard, but, as noted above, there is a probability of flooding.

CP — Clifton-Porters

Location: Chiefly in Ashe, Macon, Mitchell, Watauga, and Yancey Counties and comprising a total of about 270,000 acres.

Relief: Strongly rolling to very steep, but with most slope gradients ranging between 20 and 40%. Surface runoff is rapid. Internal drainage medium to somewhat rapid.

Native Vegetation: Mixed hardwoods, with some hemlock, spruce, white pine, and, at the higher elevations, occasional balsam fir. Once-farmed soils may be

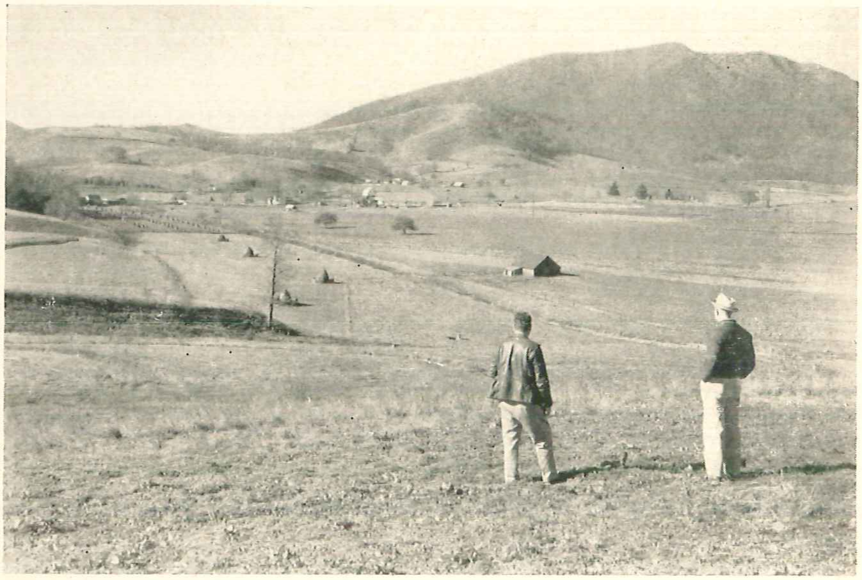

Plate 17. Land use on CP soils in Ashe County. Clifton soils foreground and left center; bottomland soils center and right center; Porters soils background (SCS photo).

in a good growth of white pine, yellow-poplar, or other hardwoods depending upon the exposure, degree of erosion, and similar factors.

Climate: Averages are: annual precipitation 52 inches, May-September, 28 inches; annual temperature 55°F, January 37°, July 73°; length of growing season, 175 days.

Soil Parent Material: Mainly crystalline rocks (gneiss, schist, occasionally granite) which contain some to much basic material.

Soils: Gray-Brown Podzolic and Red-Yellow Podzolic and belonging to the Porters and Lloyd low soil families. These are characterized by brown to dark brownish-red friable to moderately firm clay subsoils and brown to reddish-brown loam or friable clay loam surface soils; often stony; and seldom more than 24 to 36 inches deep over bed rock. The Clifton-Porters soils have thicker profiles than the Porters-Ashe soils; occupy positions on somewhat less steep relief; and generally occur at lower elevations. Clifton soils comprise about 35% of the total association area, Porters soils 25, and Rabun 6. Included tracts of Stony Rough Land occupy about 15%, Ashe soils 10, other upland soils 5; severely eroded and gullied land 1; and the bottomland soils, about 3%.

Use: Approximately 32% of the association area is in pasture and continuous hay crops, 8% in row crops including annual hay, and 1% idle cropland; 50% in woodland; and 9% in towns, industrial areas, roads, and like use (Plate 17). The best agricultural use for the soils appears to be in permanent sod or sod-type crops, with occasional strips in row crops. Although practically all tracts are too steep for row crop management under adequate conservation practices, considerable corn, vegetables, and burley tobacco are grown. Farmers consider the soils good to very good for vegetables, wheat, alfalfa and other legumes, apples, and pasture plants; fair for tobacco and corn.

EB **Edneyville-Balfour**

Location: Henderson and Transylvania Counties, occupying only 64,000 acres, and by far the smallest association in the State.

Relief: Undulating to strongly rolling, but quite similar to a plateau, and on which the more common slope range is between 3 and 10%. Surface runoff is medium, internal drainage medium.

Native Vegetation: Mixed hardwoods, with considerable white and shortleaf pine.

Climate: Averages are: annual precipitation 59.4 inches, May-September, 27.3 inches; annual temperature 55.3°F, January 38.7°, July 72.5°; length of growing season, 180 days.

Soil Parent Material: Acid crystalline rocks, mainly granite and granite-gneiss.

Soils: Red-Yellow Podzolic and Gray-Brown Podzolic, in the Durham and Appling low soil families. These soils are characterized by yellow, brown, or reddish-brown friable to moderately firm clay subsoils, and gray or gray-brown sandy loam to loam surface soils. Total profile depth ranges from 28 to 40 inches or more over rock material. The Edneyville soils comprise about 10% of the association, Balfour soils 45; the Ashe, Fletcher, Halewood, Hayesville, Porters, Tate, Tusquitee, and Worsham soils about 28; Stream Terrace and bottomland soils, 17%.

Use: Approximately 35% of the association is used for cultivated crops and small grain, 10% in apple orchards, and 15% in pasture and continuous hay; 20% in woodland; and 20% in towns, industrial areas, roads, and like use. Corn is the principal crop, but an almost equal proportion is in numerous vegetable crops. The soils are well suited to vegetables, there is only a minor erosion problem, and response to management is excellent. Many of the bottomland tracts need drainage, and all are subject to an occasional overflow.

FW **Fannin-Watauga**

Location: In Alleghany, Ashe, Cherokee, Clay, and Watauga Counties, mostly in very iregular-shaped tracts of less than 10,000 acres individual extent, and of somewhat widely scattered occurrence. The total area is about 110,000 acres.

Relief: Ranges from strongly rolling to steep, with slope gradients more commonly between 12 and 30%, resulting in rapid surface runoff. Internal drainage is medium.

Native Vegetation: Mixed hardwoods—largely various oaks—with scattered shortleaf and white pine; once-farmed areas support a fair to good growth of white and shortleaf pine.

Climate: Has considerable range because the association occurs in the extremes of the northeast and the southwest of the Mountain area. Averages for the northeast are: annual precipitation 49 inches, May-September, 23.7 inches; annual temperature 52.6°F, January 36.1°, July 69.6°; length of growing season, 165 days. Averages for the southwest are: annual precipitation 57.5 inches, May-September, 25 inches; annual temperature 57.3°F, January 41.2°, July 73.8°; length of growing season, 180 days.

Soil Parent Material: Schistose rocks with high mica content, except in Cherokee County where the Habersham soils have formed from siliceous rocks, chiefly graywacke and quartzite.

Soils: Red-Yellow Podzolic and members of the Cecil and Habersham low soil families, which are characterized by yellowish to reddish friable silt loam to

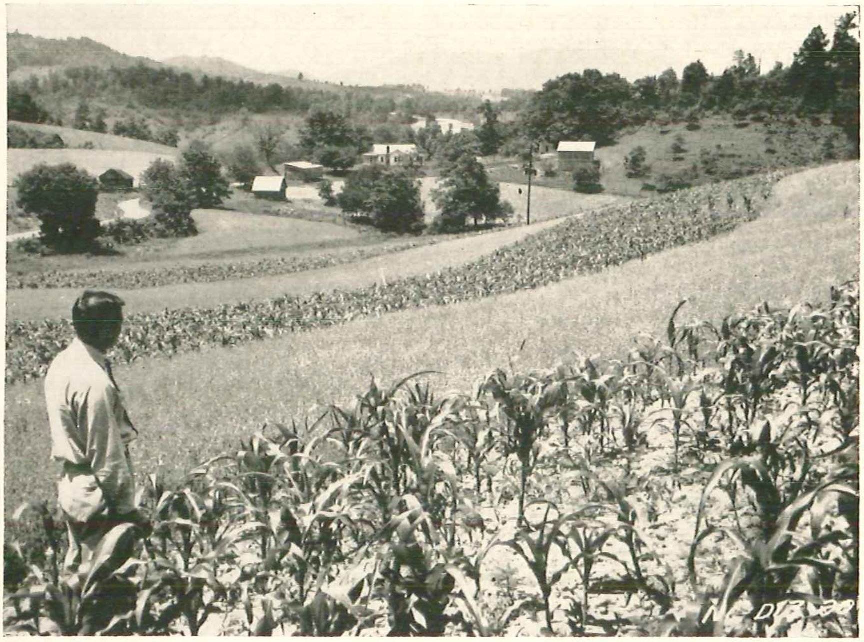

Plate 18. Land use of FW soils in Ashe county. The soils are very erodible, and adequate conservation practices are essential for good farming (SCS photo).

firm silty clay subsoils, and gray to brown loam to silt loam surface soils. These are moderately deep soils, being 25 to 38 inches thick over rock material. The subsoils, except in the Habersham, often contain sufficient mica particles to give the soil a greasy feel. Considerable flat-angular stone may be present in many places. The Fannin soils comprise about 30% of the association, and the Watauga soils about 24. The Habersham soils, occurring only in Cherokee County, account for an additional approximate 24%. Other soils are Ashe, 1%; Chandler, 5; Clifton, 1; Porters, 1; Talladega, 8; Tate 3; and the bottomland Chewacla, Congaree, and Wehadkee about 8%.

Use: Approximately 25% of the association area is used for cultivated crops including small grains and annual hay, 3% idle cropland, 12% in pasture and continuous hay; 50% in woodland; and 10% in towns, industrial areas, roads, and similar use. Most tracts are too steep for use in row crops without much soil loss, but corn is grown throughout the association; also considerable acreage is in vegetable crops and burley tobacco. Farmers consider the association soils as well suited to vegetables but, since all the upland soils are very susceptible to accelerated erosion, adequate conservation practices are essential (Plate 18). Much farm land has been abandoned because of erosion. However, small grain and sod crops can be grown successfully.

HH Halewood-Hayesville

Location: Principally in the south-central mountain region where soils of the association comprise almost the entire central portion of Buncombe, Haywood and Madison Counties; several much smaller tracts are in the other Mountain counties, and also in the foothill portions of Cleveland, Polk, and Rutherford Counties. The total area is about 800,000 acres.

Relief: Rolling to steep, but mostly within the 7 to 25% slope gradient range, resulting in rapid surface runoff. Internal drainage is medium.

Native Vegetation: Numerous oaks, hickory, and other hardwoods, white and shortleaf pine. Once-farmed soils are in a fair to good growth of shortleaf and white pine.

Climate: Averages are: annual precipitation 42.0 inches, May-September, 19.6 inches (lowest in the State); annual temperature 55.7°F, January 38.8°, July 73.0°; length of growing season, 180 days.

Soil Parent Material: Light-colored acid crystalline rocks, chiefly gneisses and schists.

Soils: Red-Yellow Podzolic, members of the Cecil and Appling low soil families, which are characterized by yellowish-red, brownish-red, or red moderately firm to firm clay subsoils and gray, gray-brown, or reddish-brown loam to clay loam surface soils. Total profile depth of most soils is between 28 and 40 inches over rock materials. Although considerable stone occurs in places the quantity usually is not sufficient to interfere with cultivation. Halewood soils occupy about 40% of the association area, and Hayesville soils 30. The included upland soils, which are Ashe, Balfour, Fannin, Fletcher, Porters, Ramsey, Tate, and Tusquitee, account for about 18; severely eroded and gullied land, 3; stream terrace soils, mostly Altavista, Hiwassee, and State, 2; and bottomland soils, Buncombe, Chewacla, Congaree, and Wehadkee, 7%.

Plate 19. Land use on HH soils in Madison County. These soils are extremely erodible on steep slopes. On this farm strips are in row crops once in 4 or 5 years. Outline of strips in previous years can be seen. Background is mostly PA soils (SCS photo).

Plate 20. Porters soil, one of the most extensive mountain soils, in Mitchell County.

Use: About 11% of the association area is used for cultivated crops including small grain and lespedeza, 5% idle cropland, 20% in permanent pasture and continuous hay crops; 49% in woodland; and 15% in towns, industrial areas, roads, and similar use (Plate 19). Corn is grown on about three-fifths of the presently cultivated land, small grain and lespedeza on one-fifth, and burley tobacco and vegetables occupy about one-fifth. Farmers consider the soils as good for wheat, alfalfa, and other legumes, and for pasture plants; fair for tobacco, corn, and vegetables. Because of their firm subsoils, medium permeability, and strongly sloping relief, the HH soils are very susceptible to accelerated erosion. Long periods of continuous planting to corn, tobacco, and other row crops have resulted in much soil loss and the agricultural abandonment of several thousand acres of farm land. There is more eroded land, both moderate and severe, than in any other soil association in the Mountain region. Locally some of the HH soil areas are as severely eroded as any areas in the entire State.

PA **Porters-Ashe**

Location: Throughout the Mountain region; the most widespread, and the most extensive association (1,932,080 acres). The largest individual tracts are in Ashe, Caldwell, Clay, Jackson, Swain, Transylvania, and Watauga Counties. In addition, there are small tracts in Alexander and Yadkin Counties.

Relief: Hilly to steep, or slopes with gradients ranging mostly between 25 and 45%, although slopes above 50% are common in many places. Surface runoff is rapid to very rapid, internal drainage medium.

Native Vegetation: Much oak of many varieties, some hickory, maple, beech, yellow-poplar, white pine, locally some hemlock, occasionally balsam fir at the highest elevations. Once-farmed lands are in white pine or various hardwoods depending upon exposure and elevation.

Climate: Averages are: annual precipitation 54 inches, May-September, 26 inches; annual temperature 54.6°F, January 36.2°, July 70.0°; length of growing season, less than 170 days, depending upon elevation and exposure, north or south.

Soil Parent Material: Mainly acid crystalline rocks, as granite and low-mica gneiss and schist, with some basic crystalline rocks, mostly hornblende gneiss but some diorite.

Soils: Gray-Brown Podzolic, and members of the Porters (Plate 20) and Ashe low soil families. The soils are characterized by brown, yellowish-brown, or reddish-brown friable clay loam to moderately firm clay subsoils that seldom exceed a thickness of 18 to 24 inches, and dark brown, brown, or gray-brown loam and sandy loam surface soils; moderately stony in many places, very stony in a few places. The Porters-Ashe soils have thinner profiles than those of the Clifton-Porters association; occupy positions having somewhat steeper relief; and generally occur at higher elevations. Porters soils, chiefly loam and stony loam, comprise about 40% of the association; Ashe soils, mostly loam, stony loam, and sandy loam, about 20; and Ramsey soils, mostly stony loam, about 10. Other upland soils and land types are: Balfour, Burton, (Plate 21) Clifton, Fannin, Halewood, Hayesville, Matney, Muskingum, Perkinsville, Ramsey, Stony Rough Land, Tate, Tusquitee, and Watauga, and account for 25%. The bottomland soils, Chewacla and Congaree, occupy 5%.

Use: About 24% of the association area is in pasture and continuous hay, 8% in cultivated crops including small grain and rotational legumes; 62% in wood-

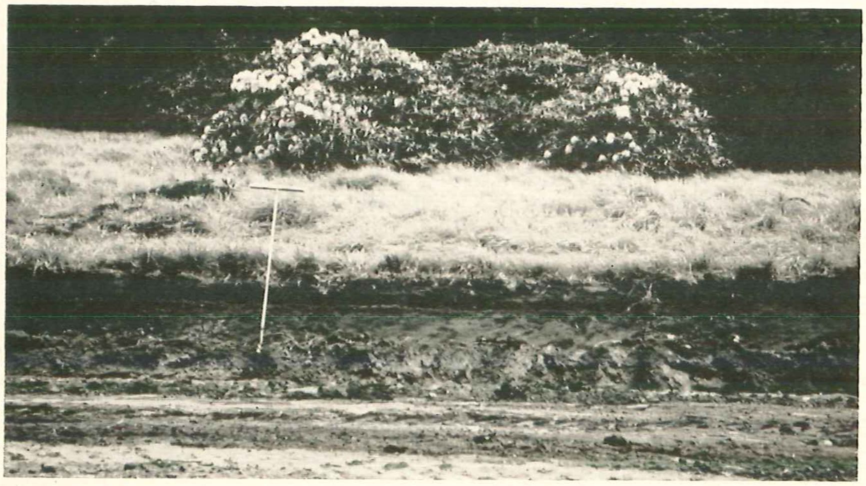

Plate 21. Burton, a limited high mountain soil, on Roan Mountain in Mitchell County.

land including much public-owned forest; and 6% in towns, industrial areas, roads, and similar use. Corn occupies about one-half of the cultivated land. Crops on much of the remaining half are cabbage, potatoes, snapbeans and burley tobacco—all grown as cash crops—and garden vegetables. There are some commercial apple orchards. Except where stony, the soils are well suited to crops and pasture. Because of the steep slopes very few areas should be used for cultivated crops. However, if the need arises, soils on about three-fifths of the woodlands could be cleared and used for pasture, or to some extent for hay, or for orchards. Soils of the association are moderately susceptible to losses brought about by accelerated erosion, but where kept in sod crops the loss is negligible.

R **Stony Rough Land**

Location: This land type is scattered throughout the entire Mountain region in small to large tracts; also in a few small bodies in the Piedmont in Cleveland, Gaston, Montgomery, Stanly, Stokes, and Surry Counties. The total extent of all tracts is about 1,300,000 acres.

Relief: Steep, rugged, broken, and very stony, with slope gradient range mostly from 50% upward. Surface runoff is rapid to very rapid, internal drainage medium to slow.

Native Vegetation: Sparse to fair stands of various hardwoods, but dominantly oak, table mountain pine, pitch pine, hemlock, spruce, some balsam fir at the highest elevations, and often a dense undergrowth of rhododendron and laurel (Kalmia). Frequently the trees are small or misshapen because of shallow soils, inadequate soil moisture, and other adverse conditions.

Climate: Moister and cooler than that of any other association and having these approximate averages: annual precipitation 60 inches. May-September 32 inches; annual temperature 49°F, January 34°, July 66°; length of growing season, less than 165 days.

Soil Parent Material: Any of the rocks of the Mountain region.

Soils: Geological erosion in most places has almost or altogether kept pace with soil formation, and there are not many tracts on which as much as 12 to 24 inches of soil materials—mainly the Ashe, Porters, Talladega, or Ramsey soils—have accumulated. These nearly soil-less (Lithosol) tracts are classed as the land type Stony Rough Land, and approximately 55% of all the R association, as outlined on the map, consists of such stony material. Closely allied with and included in the association, are occasional to numerous tracts of moderately well developed but somewhat steep and stony soils which range in size from 5 acres to over 1,800 acres, but are mostly less than 500 acres. The upland soil series and their approximate proportions of the association by percentage are: Ashe, 4; Burton, 0.1; Chandler, 5; Clifton, 1; Porters, 4; Ramsey, 20; Talladega, 8; and Tusquitee, 2. On the bottomlands, Buncombe, Chewacla, and Congaree account for about 1%.

Use: None of the actual land type, R, is in cultivation and less than 2% in pasture because of steepness or stoniness. Of the included soils a total area amounting to less than 1% of the entire association is in cultivated crops and small grain, about 4% in pasture. The Great Smoky Mountains National Park occupies the largest tract of R. Other publicly-owned lands, as parts of the Pisgah National Forest, also cover considerable portions. Roads and similar open areas comprise about 1%. Probably less than 4% of the total R area could be used for cultivated crops, and rotation legumes and small grains, with any adequate soil and water conservation practices; and an additional 10% could be used for permanent pasture.

Plate 22. Hiwassee soil in Haywood County, probably the oldest and best developed stream terrace soil, from an area not large enough to indicate on an association map.

T **Stream Terrace Soils**

In the Mountains there are numerous narrow strips of Stream Terrace soils bordering the Alluvial or bottomland soils. Only in three places in Cherokee County, and one place each in Buncombe, Macon, and Transylvania Counties are these tracts of Terrace Soils of sufficient individual extent to be shown as the T association on the soil map. Their total area is not over 10,000 acres, but the agricultural value of the soils warrants their delineation as units of an association. The dominant soils are the Hiwassee (Plate 22), which comprises about 35% of the association, and the Masada, 15%. Other included soils are the Altavista, Augusta, Roanoke, State, and Warne. The included bottomland soils are the Chewacla, Congaree, Toxaway, and Wehadkee. In addition, areas of Tate soil, which is colluvial, are included. About two-thirds of the land is in cultivated crops, the remainder in hay and pasture. All soils are highly prized for corn, small grain, and garden vegetables. Corn occupies about 60% of the cultivated land, vegetable crops much of the remainder.

Plate 23. Ramsey soil, a thin stony soil usually on steep relief, in Avery County.

TR **Talladega-Ramsey**

Location: In small to large tracts across the entire Mountain region from Alleghany County to Cherokee County, and having a total area of about 650,000 acres.

Relief: Hilly to rugged and broken, with slope gradient range mostly between 30 and 60%, resulting in rapid to very rapid surface runoff. Internal drainage is medium to slow.

Native Vegetation: Much oak of many varieties, some hickory, maple, beech, white pine, hemlock. Once-farmed areas are in shortleaf pine, sometimes white pine, and occasionally in hardwoods.

Climate: Averages are: annual precipitation 50.0 inches, May-September, 27 inches; annual temperature 54.0°F, January 38.0°, July 72.0°; length of growing season, 170 days.

Soil Parent Material: Mainly schistose rocks high in mica, slates, and shales.

Soils: Lithosols and belong in the Louisa and Ramsey low soil families. They are characterized by brown, yellowish-brown, reddish-brown, or light red firm clay suboils which seldom exceed a thickness of 12 to 20 inches, and dark brown, brown, gray-brown, or reddish-brown loam to clay loam surface soils; usually very stony (Plate 23). Talladega soils, which are very micaceous throughout, occupy about 30% of the association area; Ramsey soils, low in mica but of fine texture, occupy about 35%; and Chandler soils, similar to the Talladega but lighter-colored and probably higher in mica content, about 20. Included upland soils, totaling 8%, are small tracts of Ashe, Fannin, Habersham, Hayesville, Porters, and Ranger; Stony Rough Land, 3%; and rough gullied land, 2%. The bottomlands are not important, being narrow, scattered, occupying only about 2%, and are mostly composed of Chewacla and Congaree soils.

Use: Less than 6% of the association area is used for cultivated crops and about 12% for pasture and continuous hay; about 78% is in woodland; and 4% in villages, roads, and like use. Considerable corn, and some burley tobacco, vegetables, apples, and small grain are grown. Corn probably occupies more acreage than all other row crops combined. However, practically all areas of the association are too steep or too stony or too shallow for cultivated crops or for hay, and most areas also are poorly suited to pasture. The best use appears to be as woodland.

Appendix

Glossary

(Special Terms Used in Soil Classification)

Aggregate—A single mass or cluster of soil consisting of many soil particles held together, such as a clod, crumb, or granule.

Alluvial Soils—A group of soils, developed from transported and relatively recently deposited material (alluvium), characterized by a weak-modification (or none) of the original material by soil-forming processes.

Alluvium—Fine material, such as sand, silt, clay, other sediments deposited on land by streams.

Argipan—A Planosol (clay pan soil) in which the pan is developed within the B horizon.

Azonal Soils—Any group of soils without well-developed profile characteristics, owing to their youth or conditions of parent material or relief that prevent the development of normal soil-profile features.

Bedrock—The solid rock underlying soils.

Bog Soils—A group of soils with a muck or peaty surface soil underlain by muck or peat, developed under wet or marsh types of vegetation.

Category—Any one of the subdivisions of the system of classification in which soils are arranged on the basis of their properties. Beginning with the lowest category, soil type, soils are classified on the basis of progressively fewer characteristics into groups of progressively higher or more inclusive categories, namely, series, family, great soil group.

Clay—The small mineral soil grains, less than 0.002 mm in diameter.

Claypan—A dense and heavy soil horizon underlying the upper part of the soil; hard when dry and plastic or stiff when wet; presumably formed in part by the accumulation of clay brought in from the horizons above by percolating water. Common in many of the Planosols.

Colluvium—Non-uniform deposits of soil material accumulated at the base of slopes through the influence of gravity, including creep and local wash.

Eluviation—The movement of soil material from one place to another within the soil, in solution or in suspension, when there is an excess of rainfall over evaporation. Horizons that have lost material through eluviation are referred to as eluvial and those that have received material as *illuvial.*

Erosion—The wearing away of the land surface by running water, wind, or other geological agents, including such processes as gravitational creep.

Normal—The erosion characteristic of the land surface in its natural environment, undisturbed by human activity, as under the protective cover of the native vegetation. This type of erosion is sometimes referred to as *geologic erosion*. It includes (1) rock erosion, or erosion of rocks, consolidated or unconsolidated, on which there is little or no true soil, as in stream channels, high mountains; and (2) normal soil erosion, or the erosion characteristic of the soil type in its natural environment under the native vegetation, undisturbed by human activity.

Accelerated—Erosion of the soil or rock over and above normal erosion brought about by changes in the natural cover or ground conditions, chiefly due to human activity and those caused by lightning or rodent invasion.

(a) *Sheet*—Removal of a more or less uniform layer of material from the land surface. The effects are less conspicuous than those of other types of erosion that produce large channels. Frequently in sheet erosion, the eroding surface consists of numerous very small rills.

(b) *Gully*—That type of accelerated erosion by water which produces channels. Gullies are not obliterated by normal tillage.

Soil Erosion—Removal of soil material from the solum by wind or running water, including normal soil erosion and accelerated soil erosion. Sometimes used loosely in reference to accelerated erosion only.

Fertility (of soils)—The quality that enables a soil to provide the proper compounds, in the right amounts and in sufficient balance for the growth of specified plants when other factors, such as light, temperature, and the physical condition of the soil, are favorable.

First Bottom—The normal flood plain of a stream, part of which may be flooded only at infrequent intervals. (See Flood plain; Second Bottom.)

Flood Plain—The nearly flat surface subject to overflow along stream courses.

Fragipan—A Planosol (clay pan soil) in which the pan is developed below the B horizon.

Friable—easily crumbled in the fingers; non-plastic.

Genesis, Soil—Mode of origin of the soil, referring particularly to the process responsible for the development of the solum from the unconsolidated parent material.

Gley, Gley Soils—Mineral soils which have mottled or irregular coloration due to alternate dry and wet conditions.

Gray-Brown Podzolic Soils—A group of soils having a comparatively thin organic covering and organic-mineral layers over a grayish-grown leached layer which rests upon an illuvial brown horizon; developed under deciduous forest in a temperate moist climate.

Great Soil Group—A group of soils having common internal soil characteristics; includes one or more families of soils.

Ground-water Laterite Soils—A group of soils with bleached A horizons containing some concretions and more or less thick, cellular hardpans composed largely of iron and aluminum compounds; and with an alternating high and low water table.

Ground-water Podzol Soils—A group of soils, developed from imperfectly drained sandy deposits in humid regions, having a thin organic layer over a light-gray sandy leached layer which rests upon a dark-brown B horizon irregularly cemented with iron or organic compounds, or both.

Half Bog Soils—A group of soils with mucky or peaty surface soils underlain by gray mineral soil; developed largely under swamp-forest types of vegetation.

Hardpan—An indurated (hardened) or cemented soil horizon. The soil may have any texture and is compacted or cemented by iron oxide, organic material, silica, or other substances.

Horizon, Soil—A layer of soil approximately parallel to the land surface with more or less well-defined characteristics that have been produced through the operation of soil-building processes.

Humic-Gley Soils—Very poorly drained soils with dark-colored thick organic-mineral surface horizons (6-24" thick) underlain by mineral horizons dominantly gray.

Humus—The well-decomposed, more or less stable part of the organic matter of the soil.

Illuviation—See Eluviation.

Immature Soil—A young or imperfectly developed soil.

Inherited Characteristic (of soil))—Any characteristic of soil that is due directly to the nature of the parent material as contrasted to those partly or wholly due to the processes of soil formation. Example, the red color of a soil is said to be inherited if it is due entirely to the fact that the parent material is red.

Laterite Soil—The group of soils having very thin organic and organic-mineral layers over reddish leached soil that rests upon highly weather material, relatively rich in hydrous alumina or iron oxide, or both, and poor in silica; usually deep-red in color.

Laterization (Lateritization)—The characteristic process which tends toward the production of Laterites and lateritic soils. Essentially it is the process of the silica removal with consequent increase in the alumina and iron oxide content and decrease in base-exchange capacity of the soil.

Leaching—Removal of materials in solution.

Lithosols (skeletal soils)—A group of soils having no clearly expressed soil morphology and consisting of a freshly and imperfectly weathered mass of rock fragments; largely confined to steeply sloping land. Litho is from the Greek for rock.

Low-Humic Gley Soils—Poorly or somewhat poorly drained soils with thin surface horizons (2-8" thick) moderately high in organic matter underlain by mineral horizons mottled gray and brown or yellow, and rarely gray and red.

Mature Soil—A soil with well-developed characteristics produced by the natural processes of soil formation, and in equilibrium with its environment.

Metamorphic or Metamorphosed Rock—A rock the constitution of which has been altered by natural forces.

Mineral Soil—A general term used in reference to any soil composed chiefly of mineral matter.

Modal—Representative; standard; the central concept, as a modal Cecil sandy loam soil.

Morphology, Soil—The physical constitution of the soil including the texture, structure, porosity, consistence, and color of the various soil horizons, their thickness, and their arrangement in the soil profile.

Mottled (mottling)—Irregularly marked with spots of different colors.

Muck—Fairly well decomposed organic soil material, relatively high in mineral content (40-50%), dark in color, and accumulated under conditions of very poor drainage.

Normal Soil—A soil having a profile in equilibrium with the two principal forces of the environment—native vegetation and climate—usually developed on the gently undulating (but not strickly level) upland, with good drainage, from any parent material, not of extreme texture or chemical composition, that has been in place long enough for biological forces to exert their full effect.

Organic Soil—A general term used in reference to any soil the solid part of which is predominantly organic matter.

Ortho—True, standard, the real thing; used to give a more definite concept than Modal.

Parent Material—The unconsolidated mass from which the soil profile develops.

Parent Rock—The rock from which parent materials of soils are formed.

Peat—Unconsolidated soil material consisting largely of moderately or slightly decomposed organic matter (usually more than 60% of the mass) accumulated under conditions of excessive moisture.

Pedology—The science that deals with soil; soil science.

Phase, Soil—That part of a soil type having variations which are chiefly external, and usually of agricultural significance. Examples, steep phase, eroded phase, stony phase.

Planosol—A group of soils having eluviated surface horizons underlain by B horizons more strongly illuviated, cemented, or compacted than associated normal soils: a 'clay pan' soil.

Plastic—Capable of being molded without rupture; not friable.

Podzol Soils—A group of soils having a very thin organic-mineral layer above a gray leached layer which rests upon an illuvial dark-brown horizon, developed under coniferous or mixed forest, in a temperate to cold moist climate.

Podzolic Soils—Soils that have been formed wholly or partly under the influence of the podzolization process.

Podzolization—The process by which a Podzol is developed: The soils are depleted of bases, acid, have eluvial A horizons (layer of removal) and illuvial B horizons (layer of accumulation).

Productivity (Soil)—The capability of a soil for producing a given plant or sequence of plants under a specified system of management.

Profile, Soil—A vertical section of the soil through all its horizons and extending into the parent material.

Reddish-Brown Latosols—A group of soils with dark reddish-brown granular surface soils, red friable clay B horizons, and red or reticulately mottled parent material.

Red Podzolic Soils—A group of soils having thin organic and organic-mineral layers over a yellowish-brown leached layer which rests upon an illuvial red horizon; developed under a deciduous or mixed forest. Usually combined with yellow as Red-Yellow Podzolic soils.

Regosol—Soils consisting of unconsolidated rock (soft mineral deposits) with few clearly expressed soil characteristics; largely 'dry sand' soils, or soils mostly of slightly weathered clayey material.

Residual or Sedentary Material—Soil material presumably developed from the same kind of rock as that on which it lies. The term "residual" is sometimes incorrectly applied to soils.

Second Bottom—The first terrace level of a stream valley lying above the flood plain, seldom flooded.

Series,Soil—A group of soils having genetic horizons similar as to differentiating characteristics and arrangement in the soil profile, except for the texture of the surface soil, and developed from a particular type of parent material. A series may include two or more soil types differing from one another in the texture of the surface soils.

Soil—The natural medium for the growth of land plants on the surface of the earth. A natural body on the surface of the earth in which plants grow, composed of organic and mineral materials.

Solum—The upper part of the soil profile, above the parent material, in which the processes of soil formation are taking place. In mature soils, this includes the A and B horizons, and the character of the material may be, and usually is, greatly unlike that of the parent material beneath. Living roots and life processes are largely confined to the solum.

Stratified—Composed of, or arranged in, strata or layers, as stratified alluvium. The term is applied to geological materials. Those layers in soils that are produced by the processes of soil formation are called horizons, while those inherited from the parent material are called strata.

Subsoil—Generally, that part of the solum below plow depth.

Surface Soil—That part of the upper soil of arable soils commonly stirred by tillage implements or an equivalent depth (5 to 8 inches) in nonarable soils.

Terrace (geological)—A flat or undulating plain, commonly rather narrow and usually with a steep front, bordering a stream. Some streams are bordered by a series of terraces at different levels indicating the flood plains at successive periods. Although many older terraces have become more or less hilly through dissection by streams, they are still regarded as terraces.

Texture, Soil—The relative proportion of the various size groups of individual soil grains.

Type, Soil—A group of soils having genetic horizons similar as to differentiating characteristics, including texture and arrangement in the soil profile and developed from a particular type of parent material.

Unconsolidated (soil material)—Soil material in a form of loose aggregation.

Weathering—The physical and chemical disintegration and decomposition of rocks and minerals.

Yellow Podzolic Soils—A zonal group of soils having thin organic and organic-mineral layers over a grayish-yellow leached layer which rests on a yellow horizon; developed under a deciduous or mixed forest in a warm-temperate moist climate. Usually combined with Red, as Red-Yellow Podzolic Soils.

Appendix Tables

TABLE 1A. STATUS OF THE NORTH CAROLINA SOIL SURVEY

Coverage (Per Cent)	
Proportion of the State covered	97
Not covered	3
TOTAL	100

Usefulness of the Soil Survey Maps, Based on Total Area of the State (Per Cent)	
With satisfactory maps*	64
With unsatisfactory maps**	28
With obsolete maps***	5
Without surveys	3
TOTAL	100

* A satisfactory soil survey map is one that can be used for at least five of the purposes listed on pages 33-35. For example, the Anson County survey (1916) is satisfactory because it can be used for (3) Aiding professional agricultural workers in their programs of work with farmers, (7) Determining areas of so-called marginal land, (11) Locating tentative routes for roads, (12) Furnishing information for military personnel relative to location of camps, airfields, troop movements, (13) Assisting real estate operators, land seekers, and (15) Assisting teachers of agriculture, geography, or geology. The maps of 63 counties are considered satisfactory.

** An unsatisfactory map can be used only for 2, 3, or 4 of the purposes listed on pages 33-35. There are 24 counties with unsatisfactory maps.

*** An obsolete map is one that has less than two uses. There are 6 such county surveys and 8 area surveys.

TABLE 1B. INFORMATION ON EACH SOIL SURVEY

Area	Published Year	Map Scale: 1 inch equals	Soil Classification Compared to Present Standards	Value for Extension, Other Educational Programs	Value for Research Programs	For Application of Practices within Specific Farms	For Predicting Crop Yields Specific Farms	For Land Classification and assessment	For Soil Behavior for Highway Construction	For Predicting Forest Growth and Yield	Comments
Alamance Co.	1901	1 mile	Poor	Poor	Poor	Poor	Poor	Poor	Fair	Fair	First county soil survey in North Carolina.
Alexander Co.											No complete survey; see Hickory, and Statesville area surveys.
Alleghany Co.	1917	1 mile	Fair	Fair	Fair	Poor	Fair	Fair	Fair	Good	
Anson Co.	1917	1 mile	Good	Good	Fair	Poor	Fair	Fair	Good	Good	
Ashe Co.	1914	1 mile	Fair	Fair	Poor	Poor	Fair	Fair	Fair	Fair	
Asheville Area	1903	1 mile	Poor	Poor	Poor	Poor	Poor	Poor	Poor	Poor	Includes parts of Buncombe, Haywood, and Madison Cos.
Avery Co.	1955	0.379 mile	Excellent	Excellent	Excellent	V. Good	V. Good	Excellent	Excellent	Excellent	
Beaufort Co.	1919	1 mile	Good	Good	Good	Poor	Fair	Fair	Good	Good	
Bertie Co.	1920	1 mile	Fair	Fair	Fair	Poor	Fair	Fair	Good	Good	
Bladen Co.	1915	1 mile	Fair	Fair	Fair	Poor	Fair	Fair	Good	Good	
Brunswick Co.	1937	1 mile	V. Good	Good	Good	Fair	Good	Goor	Good	V. Good	
Buncombe Co.	1923	1 mile	Fair	Fair	Fair	Poor	Fair	Fair	Fair	Fair	
Buncombe Co.	1954	0.379 mile	Excellent	Excellent	Excellent	V. Good	V. Good	V. Good	V. Good	Excellent	
Burke Co.	1928	1 mile	Good	Good	Good	Fair	Good	Good	V. Good	V. Good	
Cabarrus Co.	1911	1 mile	Fair	Fair	Fair	Poor	Fair	Fair	Fair	Fair	
Caldwell Co.	1919	1 mile	Good	Good	Good	Poor	Fair	Fair	Good	Good	
Camden Co.	1926	1 mile	Fair	Fair	Fair	Poor	Fair	Fair	Good	Good	
Carteret Co.	1938	1 mile	Good	Good	Good	Good	Good	Good	V. Good	V. Good	
Caswell Co.	1910	1 mile	Poor	Fair	Fair	Poor	Fair	Fair	Fair	Fair	
Catawba Co.											No complete survey; see Hickory, Statesville area surveys.
Chatham Co.	1937	1 mile	V. Good	Good	Good	Good	Good	Good	V. Good	V. Good	
Cherokee Co.	1924	1 mile	Good	Fair	Fair	Fair	Fair	Good	Good	Good	
Cherokee Co.	1951	0.379 mile	Excellent	V. Good	V. Good	V. Good	V. Good	V.Good	V. Good	Excellent	

TABLE 1B. (Continued)

Area	Published Year	Map Scale: 1 inch equals	Soil Classification Compared to Present Standards	Value for Extension, Other Educational Programs	Value for Research Programs	For Application of Practices within Specific Farms	For Predicting Crop Yields Specific Farms	For Land Classification and assessment	For Soil Behavior for Highway Construction	For Predicting Forest Growth and Yield	Comments
Chowan Co.	1907	1 mile	Poor	Poor	Poor	Poor	Poor	Poor	Fair	Fair	
Clay Co.	1941	0.758 mile	V. Good	Good	Good	Good	Good	Good	V. Good	V. Good	
Cleveland Co.	1918	1 mile	Good	Fair	Good	Fair	Fair	Fair	Good	Good	
Columbus Co.	1917	1 mile	Good	Fair	Good	Poor	Poor	Fair	Good	Good	
Craven Area	1903	1 mile	Poor	Poor	Poor	Poor	Poor	Poor	Fair	Fair	Includes parts of Craven, Jones, Pitt, Beaufort, Lenoir, and Greene Cos.
Craven Co.	1932	1 mile	V. Good	Good	Good	Good	Good	Good	Good	Good	
Cumberland Co.	1925	1 mile	Good	Good	Good	Fair	Fair	Good	Good	Good	
Currituck Co.	1926	1 mile	Fair	Fair	Fair	Poor	Fair	Fair	Good	Good	
Dare Co.											No survey of any kind
Davidson Co.	1917	1 mile	Good	Good	Good	Fair	Fair	Good	Good	Good	
Davie Co.	1930	1 mile	V. Good	Good	Good	Good	Good	Good	V. Good	V. Good	
Duplin Co.	1905	1 mile	Poor	Poor	Poor	Poor	Poor	Poor	Poor	Poor	
Duplin Co.	195-	0.379 mile	Excellent	Excellent	Excellent	Excellent	Excellent	Excellent	Excellent	Excellent	Survey completed in 1954.
Durham Co.	1924	1 mile	Good	Good	Good	Fair	Fair	Fair	Good	V. Good	
Edgecombe Co.	1908	1 mile	Poor	Poor	Poor	Poor	Poor	Poor	Fair	Fair	
Forsyth Co.	1914	1 mile	Good	Good	Good	Fair	Fair	Good	Good	Good	
Franklin Co.	1934	1 mile	V. Good	V. Good	Good	Good	Good	V. Good	V. Good	V. Good	
Gaston Co.	1911	1 mile	Fair	Fair	Fair	Poor	Poor	Fair	Fair	Good	
Gates Co.	1933	1 mile	V. Good	V. Good	Good	Good	Good	Good	V. Good	V. Good	
Graham Co.	1953	0.758 mile	Excellent	Excellent	Excellent	Good	Excellent	Excellent	Excellent	Excellent	
Granville Co.	1912	1 mile	Fair	Fair	Fair	Fair	Fair	Fair	Good	Good	
Greene Co.	1928	1 mile	Good	Good	Good	Good	Good	Good	V. Good	V. Good	
Guilford Co.	1923	1 mile	Good	Good	Good	Good	Fair	Fair	Good	Good	

TABLE 1B. (Continued)

Area	Published Year	Map Scale: 1 inch equals	Soil Classification Compared to Present Standards	Value for Extension, Other Educational Programs	Value for Research Programs	For Application of Practices within Specific Farms	For Predicting Crop Yields Specific Farms	For Land Classification and assessment	For Soil Behavior for Highway Construction	For Predicting Forest Growth and Yield	Comments
Halifax Co.	1918	1 mile	Good	Good	Good	Fair	Fair	Fair	Good	Good	
Harnett Co.	1917	1 mile	Good	Good	Good	Fair	Fair	Fair	Good	Good	
Haywood Co.	1925	1 mile	Good	Good	Good	Good	Good	Good	Good	Good	
Haywood Co.	1954	0.379 mile	Excellent	Excellent	Excellent	Good	V. Good	V. Good	Excellent	Excellent	
Henderson Co.	1908	1 mile	Poor	Poor	Poor	Poor	Poor	Poor	Fair	Fair	
Henderson Co.	1943	0.758 mile	V. Good	V. Good	Good	Good	Good	Good	V. Good	Excellent	
Hertford Co.	1917	1 mile	Good	Good	Good	Fair	Fair	Fair	Good	V. Good	
Hickory Area	1902	1 mile	Poor	Poor	Poor	Poor	Poor	Poor	Poor	Poor	Includes parts of Catawba, Lincoln Burke, Caldwell, Alexander, and Iredell Counties.
Hoke Co.	1921	1 mile	Good	Good	Good	Fair	Fair	Fair	Good	Good	Ft. Bragg occupies nearly half of the county.
Hyde Co.											No complete survey; see Lake Mattamuskeet area survey.
Iredell Co.											No complete survey; see Hickory, Statesville area surveys.
Jackson Co.	1948	0.758 mile	Excellent	V. Good	V. Good	Good	Good	V. Good	Excellent	Excellent	
Johnston Co.	1913	1 mile	Fair	Fair	Fair	Fair	Fair	Fair	Good	Good	
Jones Co.	1938	1 mile	V. Good	Good	Good	Fair	Good	Good	V. Good	V. Good	
Lake Mattamuskeet Area	1910	1 mile	Poor	Poor	Poor	Poor	Poor	Poor	Poor	Poor	About 7/8 of survey area is occupied by the lake. Survey was made of lake bed while same was covered with water.
Lee Co.	1937	1 mile	V. Good	Good	Good	Good	Good	Good	V. Good	V. Good	
Lenoir Co.	1932	1 mile	Good	Good	Good	Fair	Fair	Good	Good	V. Good	
Lincoln Co.	1916	1 mile	Fair	Fair	Fair	Poor	Poor	Fair	Good	Good	
McDowell Co.											No complete survey; see Mt. Mitchell area survey.
Macon Co.	1933	1 mile	Good	Good	Good	Fair	Fair	Good	Good	Good	
Macon Co.	1956	0.379 mile	Excellent	Excellent	Excellent	Excellent	Excellent	Excellent	Excellent	Excellent	
Madison Co.	1942	0.758 mile	V. Good	V. Good	V. Good	V. Good	V. Good	V. Good	V. Good	Excellent	

TABLE 1B. (Continued)

Area	Published Year	Map Scale: 1 inch equals	Soil Classification Compared to Present Standards	Value for Extension, Other Educational Programs	Value for Research Programs	For Application of Practices within Specific Farms	For Predicting Crop Yields Specific Farms	For Land Classification and assessment	For Soil Behavior for Highway Construction	For Predicting Forest Growth and Yield	Comments
Martin Co.	1933	1 mile	Good	Good	Good	Good	Good	Good	Good	V. Good	
Mecklenburg Co.	1912	1 mile	Good	Fair	Fair	Fair	Fair	Fair	Good	Good	
Mitchell Co.	1952	0.379 mile	Excellent	V. Good	V. Good	V. Good	V. Good	V. Good	V. Good	Excellent	
Montgomery Co.	1934	1 mile	V. Good	Good	Good	Good	Good	Good	V. Good	V. Good	
Moore Co.	1922	1 mile	Good	Good	Good	Good	Good	Good	Good	V. Good	
Mt. Mitchell Area	1902	1 mile	Poor	Poor	Poor	Poor	Poor	Poor	Poor	Poor	Includes parts of Yancey, Mitchell, Madison, Buncombe, and McDowell Cos.
Nash Co.	1930	1 mile	V. Good	Good	Good	Good	Good	Good	V. Good	V. Good	
New Hanover Co.	1907	1 mile	Fair	Fair	Fair	Poor	Poor	Poor	Fair	Good	
Northampton Co.	1929	1 mile	Good	Good	Good	Good	Good	Good	Good	V. Good	
Onslow Co.	1923	1 mile	Good	Fair	Fair	Good	Good	Fair	Good	Good	
Orange Co.	1921	1 mile	Good	Fair	Fair	Good	Good	Fair	Good	V. Good	
Pamlico Co.	1937	1 mile	V. Good	Good	Good	Good	Good	Good	V. Good	Excellent	
Pasquotank Co.	1905	1 mile	Poor	Poor	Poor	Poor	Poor	Poor	Poor	Fair	
Pasquotank Co.	195-	0.379 mile	Excellent	Excellent	Excellent	Excellent	Excellent	Excellent	Excellent	Excellent	Re-survey in 1949. Awaiting publication by USDA.
Pender Co.	1914	1 mile	Fair	Fair	Fair	Fair	Fair	Fair	Good	Good	
Perquimans Co.	1905	1 mile	Poor	Poor	Poor	Poor	Poor	Poor	Poor	Fair	
Person Co.	1932	1 mile	Good	Good	Good	Good	Good	Good	V. Good	V. Good	
Pitt Co.	1910	1 mile	Fair	Fair	Poor	Poor	Poor	Poor	Fair	Fair	
Polk Co.	1927	1 mile	Good	Good	Good	Good	Good	Good	V. Good	V. Good	
Raleigh to New Bern Area	1900	1 mile	Poor	Poor	Poor	Poor	Poor	Poor	Poor	Poor	First soil survey in North Carolina. Includes parts of Wake, Johnston, Wayne, Lenoir, Jones, and Craven Counties.
Randolph Co.	1915	1 mile	Fair	Fair	Fair	Fair	Fair	Fair	Good	Good	
Richmond Co.	1912	1 mile	Fair	Fair	Fair	Fair	Fair	Fair	Good	Good	

TABLE 1B. (Continued)

Area	Published Year	Map Scale: 1 inch equals	Soil Classification Compared to Present Standards	Value for Extension, Other Educational Programs	Value for Research Programs	For Application of Practices within Specific Farms	For Predicting Crop Yields Specific Farms	For Land Classification and assessment	For Soil Behavior for Highway Construction	For Predicting Forest Growth and Yield	Comments
Robeson Co.	1908	1 mile	Fair	Poor	Poor	Poor	Poor	Poor	Poor	Fair	
Rockingham Co.	1930	1 mile	Good	Good	Good	Good	Good	Good	V. Good	V. Good	
Rowan Co.	1915	1 mile	Good	Good	Good	Good	Good	Good	Good	V. Good	
Rutherford Co.	1928	1 mile	Good	Good	Good	Good	Good	Good	V. Good	V. Good	
Sampson Co.	1926	1 mile	Good	Good	Good	Good	Good	Good	Good	V. Good	
Scotland Co.	1911	1 mile	Fair	Fair	Fair	Fair	Fair	Poor	Fair	Good	
Stanly Co.	1918	1 mile	Good	Good	Good	Fair	Good	Good	Good	Good	
Statesville Area	1901	1 mile	Poor	Poor	Poor	Poor	Poor	Poor	Poor	Poor	Includes parts of Iredell, Rowan, Davie, Catawba, Lincoln, Alexander, and Mecklenburg Counties. Served as a "training ground" for early soil surveyors, who were kept in uniform.
Stokes Co.	1940	1 mile	V. Good	V. Good	V. Good	Good	V. Good	Good	V. Good	V. Good	
Surry Co.	1937	1 mile	V. Good	V. Good	V. Good	Good	V. Good	Good	V. Good	V. Good	
Swain Co.	1947	0.758 mile	V. Good	V. Good	V. Good	V. Good	V. Good	V. Good	V. Good	Excellent	
Transylvania Co.	1907	1 mile	Fair	Poor	Poor	Poor	Poor	Poor	Fair	Good	
Transylvania Co.	1948	0.758 mile	V. Good	V. Good	V. Good	V. Good	V. Good	V. Good	V. Good	Excellent	
Tyrrell Co.	1924	1 mile	Good	Good	Fair	Fair	Fair	Good	Good	Good	
Union Co.	1916	1 mile	Good	Fair	Good	Fair	Good	Fair	Good	Good	
Vance Co.	1921	1 mile	Good	Good	Good	Good	Good	Good	Good	Good	
Wake Co.	1916	1 mile	Good	Good	Good	Fair	Fair	Good	Good	V. Good	
Warren Co.	1942	1 mile	V. Good	Good	Good	Good	Godd	Good	V. Good	V. Good	
Washington Co.	1937	1 mile	Good	Good	Good	Good	Godd	Good	V. Good	V. Good	
Watauga Co.	1932	1 mile	Good	Good	Good	Good	Godd	Good	V. Good	V. Good	
Watauga Co.	1956	0.379 mile	Excellent	Excellent	Excellent	V. Good	V. Good	Excellent	Excellent	Excellent	

TABLE 1B. (Continued)

Area	Published Year	Map Scale: 1 inch equals	Soil Classification Compared to Present Standards	Value for Extension, Other Educational Programs	Value for Research Programs	For Application of Practices within Specific Farms	For Predicting Crop Yields Specific Farms	For Land Classification and assessment	For Soil Behavior for Highway Construction	For Predicting Forest Growth and Yield	Comments
Wayne Co.	1916	1 mile	Good	Fair	Good	Fair	Fair	Fair	Good	Good	
Wilkes Co.	1921	1 mile	Good	Good	Good	Fair	Fair	Fair	Good	Good	
Wilson Co.	1929	1 mile	Good	Good	Good	Good	Good	Good	V. Good	V. Good	
Yadkin Co.	1928	1 mile	Good	Good	Good	Good	Good	Good	V. Good	V. Good	
Yancey Co.	1952	0.379 mile	Excellent	Excellent	Excellent	V. Good	V. Good	V. Good	Excellent	Excellent	
Greeneville Tennessee-North Carolina Area	1905	1 mile	Poor	Poor	Poor	Poor	Poor	Poor	Poor	Fair	Includes part of Madison County.

TABLE 2. DEGREES OF EROSION FOR EACH NORTH CAROLINA COUNTY ACCORDING TO EROSION CLASSES*

County	Approximate Rating in Order of Severity**	Total Land Area in Acres, 1950***	Degree of Erosion or Erosion Classes: Very Little or None****		Slight or Less Than ¼ of the Original Surface Soil Removed		Moderate or Between ¼ and ¾ of the Original Surface Soil Removed		Severe or More than ¾ of the Original Surface Soil Removed, Often Some Subsoil removed; also Includes Gullied Land	
			Per Cent	Acres	Percent	Acres	Percent	Acres	Percent	Acres
1	2	3	4	5	6	7	8	9	10	11
Alamance	31	277,760	26	72,260	37	102,800	17	47,200	20	55,500
Alexander	26	163,200	20	32,600	36	58,800	24	39,200	20	32,600
Alleghany	40	147,200	24	35,300	36	53,000	32	47,100	8	11,800
Anson	2	341,120	16	54,520	13	44,400	38	129,600	33	112,600
Ashe	29	273,280	14	38,280	41	112,000	36	98,400	9	24,600
Avery	61	158,080	51	80,580	22	34,800	25	39,500	2	3,200
Beaufort	90	531,840	74	393,540	25	133,000	1	5,300	—	—
Bertie	78	443,520	58	257,320	38	168,500	4	17,700	—	—
Bladen	86	562,560	64	360,060	34	191,200	2	11,300	—	—
Brunswick	92	558,720	76	424,620	23	128,500	1	5,600	—	—
Buncombe	35	413,440	38	157,040	17	70,300	27	111,700	18	74,400
Burke	34	323,840	32	103,640	22	71,200	30	97,200	16	51,800
Cabarrus	3	230,400	14	32,200	15	34,600	40	92,200	31	71,400
Caldwell	44	304,640	33	100,440	43	131,000	14	42,700	10	30,500
Camden	91	152,960	75	114,760	24	36,700	1	1,500	—	—
Carteret	95	340,480	81	275,780	18.5	63,000	0.5	1,700	—	—
Caswell	1	278,400	16	44,500	10	27,800	40	111,400	34	94,700
Catawba	12	259,840	20	51,940	20	52,000	33	85,700	27	70,200
Chatham	39	452,480	25	113,080	35	158,400	33	149,300	7	31,700
Cherokee	52	290,560	34	99,360	42	122,500	18	50,800	6	17,900
Chowan	88	115,200	67	77,100	32	36,900	1	1,200	—	—
Clay	50	136,320	34	45,320	41	56,000	19	26,600	6	8,400
Cleveland	4	298,240	17	50,640	13	38,800	40	119,300	30	89,500
Columbus	81	600,960	59	354,560	39	234,400	2	12,000	—	—
Craven	84	464,000	62	287,700	36	167,000	2	9,300	—	—
Cumberland	74	423,040	63	266,540	24.5	103,600	12	50,800	0.5	2,100
Currituck	87	174,720	66	115,220	33	57,700	1	1,800	—	—
Dare	100	248,320	98	243,320	2	5,000	—	—	—	—
Davidson	18	350,720	27	94,720	19	66,600	30	105,200	24	84,200
Davie	9	168,960	17	28,760	20	33,800	35	59,100	28	47,300
Duplin	82	526,080	60	315,580	37	194,700	3	15,800	—	—
Durham	25	191,360	18	34,460	43	82,300	16	30,600	23	44,000
Edgecombe	65	327,040	45	147,140	42	137,400	12.5	40,900	0.5	1,600
Forsyth	17	271,360	17	46,060	19	51,600	34	92,300	30	81,400
Franklin	21	316,160	25	78,960	22	69,600	32	101,200	21	66,400
Gaston	8	229,120	20	45,820	16	36,700	34	77,900	30	68,700
Gates	76	219,520	57	125,120	37	81,200	6	13,200	—	—
Graham	68	184,960	55	99,960	40	75,500	4	7,600	1	1,900
Granville	30	347,520	18	62,520	24	83,400	37	128,600	21	73,000
Greene	63	172,160	38	65,460	50	86,000	11.5	19,800	0.5	900
Guilford	20	416,640	24	99,940	23	95,800	31	129,200	22	91,700
Halifax	55	462,080	33	152,480	47	217,200	15	69,300	5	23,100

TABLE 2. (Continued)

County	Approximate Rating in Order of Severity**	Total Land Area in Acres, 1950***	Degree of Erosion or Erosion Classes: Very Little or None****		Slight or Less Than 1/4 of the Original Surface Soil Removed		Moderate or Between 1/4 and 3/4 of the Original Surface Soil Removed		Severe or More than 3/4 of the Original Surface Soil Removed, Often Some Subsoil removed; also Includes Gullied Land	
			Per Cent	Acres	Percent	Acres	Percent	Acres	Percent	Acres
1	2	3	4	5	6	7	8	9	10	11
Harnett	56	387,840	40	155,140	35	135,700	20	77,600	5	19,400
Haywood	47	347,520	36	125,120	39	135,500	17	59,100	8	27,800
Henderson	57	244,480	42	102,680	40	97,800	13	31,800	5	12,200
Hertford	65	227,840	45	102,640	45	102,500	9.5	21,600	0.5	1,100
Hoke	72	264,960	63	166,960	22	58,300	14	37,100	1	2,600
Hyde	99	405,760	92	373,360	7.9	32,000	0.1	400	—	—
Iredell	6	378,240	20	75,640	16	60,500	34	128,600	30	113,500
Jackson	53	317,440	38	119,440	39	124,500	16	51,100	7	22,400
Johnston	51	508,800	35	178,200	39	198,400	21	106,800	5	25,400
Jones	85	298,880	63	188,280	35	104,600	2	6,000	—	—
Lee	37	163,200	28	45,700	30	49,000	32	52,200	10	16,300
Lenoir	75	250,240	55	137,640	40	100,100	5	12,500	—	—
Lincoln	13	197,120	24	47,320	19	37,500	30	59,100	27	53,200
McDowell	46	282,880	37	104,580	37	104,700	16	45,300	10	28,300
Macon	49	330,880	40	134,480	32	103,200	20	66,600	8	26,600
Madison	43	291,840	40	116,640	25	73,000	26	75,900	9	26,300
Martin	79	307,840	59	181,640	37	113,900	4	12,300	—	—
Mecklenburg	7	346,880	20	69,480	18	62,400	31	107,500	31	107,500
Mitchell	54	140,800	37	52,200	40	56,300	17	23,900	6	8,400
Montgomery	42	312,320	35	109,420	28	87,400	32	99,900	5	15,600
Moore	48	430,080	44	189,280	20	86,000	30	129,000	6	25,800
Nash	41	353,280	30	105,980	29	102,500	35	123,600	6	21,200
New Hanover	89	124,160	69	85,760	30	37,200	1	1,200	—	—
Northampton	62	345,600	36	124,400	52	179,700	11	38,000	1	3,500
Onslow	80	483,840	60	290,340	37	179,000	3	14,500	—	—
Orange	36	254,720	35	89,220	20	50,900	30	76,400	15	38,200
Pamlico	96	218,240	85	185,540	14.8	32,300	0.2	400	—	—
Pasquotank	94	146,560	79	115,860	20.5	30,000	0.5	700	—	—
Pender	83	548,480	61	334,380	36	197,600	3	16,500	—	—
Perquimans	93	167,040	77	128,640	22.5	37,600	0.5	800	—	—
Person	24	256,000	30	76,800	16	41,000	32	81,900	22	56,300
Pitt	77	419,840	58	243,540	36	151,100	6	25,200	—	—
Polk	27	149,760	35	52,460	12	18,000	30	44,900	23	34,400
Randolph	38	512,640	35	179,440	22	112,800	34	174,300	9	46,100
Richmond	60	305,280	43	131,280	38	116,000	17	51,900	2	6,100
Robeson	73	604,160	50	302,060	47	284,000	3	18,100	—	—
Rockingham	11	366,080	28	102,480	11	40,300	33	120,800	28	102,500
Rowan	10	330,880	21	69,580	15	49,600	36	119,100	28	92,600
Rutherford	22	362,240	32	115,940	11	39,800	35	126,800	22	79,700
Sampson	70	616,320	55	338,920	35	215,700	9.6	59,200	0.4	2,500
Scotland	69	202,880	62	125,880	22	44,600	15	30,400	1	2,000
Stanly	32	.255,360	23	58,760	34	86,800	30	76,600	13	33,200

TABLE 2. (Continued)

County	Approximate Rating in Order of Severity**	Total Land Area in Acres, 1950***	Degree of Erosion or Erosion Classes: Very Little or None****		Slight or Less Than ¼ of the Original Surface Soil Removed		Moderate or Between ¼ and ¾ of the Original Surface Soil Removed		Severe or More than ¾ of the Original Surface Soil Removed, Often Some Subsoil removed; also Includes Gullied Land	
			Per Cent	Acres	Percent	Acres	Percent	Acres	Percent	Acres
1	2	3	4	5	6	7	8	9	10	11
Stokes	17	293,760	26	76,360	17	50,000	33	96,900	24	70,500
Surry	23	343,680	29	99,680	20	68,700	30	103,100	21	72,200
Swain	67	339,200	47	159,700	44	149,000	8	27,000	1	3,500
Transylvania	64	242,560	46	111,560	39	94,600	12	29,100	3	7,300
Tyrrell	97	255,360	87	222,160	12.6	32,200	0.4	1,000	—	—
Union	33	411,520	24	98,820	34	139,900	30	123,400	12	49,400
Vance	19	172,160	20	34,460	30	51,600	30	51,600	20	34,500
Wake	14	554,240	19	105,340	23	127,500	37	205,000	21	116,400
Warren	16	284,800	25	71,300	21	59,800	28	79,700	26	74,000
Washington	98	215,040	90	193,440	9.8	21,100	0.2	500	—	—
Watauga	45	204,800	36	73,800	32	65,500	27	55,300	5	10,200
Wayne	71	355,200	55	195,300	36	127,900	9	32,000	—	—
Wilkes	28	489,600	32	156,700	20	97,900	26	127,300	22	107,700
Wilson	58	283,720	40	95,420	40	95,500	18	43,000	2	4,800
Yadkin	15	214,400	25	53,500	18	38,600	33	70,800	24	51,500
Yancey	59	199,040	50	99,440	26	51,800	20	39,800	4	8,000
State Totals		31,422,080	43.2	13,559,280	28.8	9,047,100	18.4	5,787,900	9.6	3,027,800

* Data are for degrees of accelerated erosion: soil losses resulting from clearing of woodland and subsequent cultivation or other use. All figures in columns 4-11 are approximate, and were revised in September, 1954.

** Each county is considered as an absolute unit—regardless of size—in calculating its relative rating in the State. Thus, although there is almost twice as much eroded land in Buncombe County as in Davie County, the percentage (83) of eroded land within small Davie is much greater than the percentage (62) within large Buncombe. Therefore, Davie County places 9th and Buncombe 35th among the 100 counties. Data for this table are based on soil conservation surveys in (1) soil conservation districts which include all counties; (2) upon State-USDA soil surveys in 15 of the Mountain area counties, 2 counties in the Piedmont, and 2 counties in the Coastal Plain area; and (3) upon reconnaissance erosion surveys covering the State. Note: Wind erosion on areas of cropland is not serious, except in a few portions of the Middle and Upper Coastal Plain (see text, p. 39), and is included in the data in the Table. Beach erosion and wind movement of dunesand affect narrow strips along or near the Atlantic Ocean front of eight counties, but such is not considered as accelerated or man-caused erosion.

*** Land area figures of the counties are from the United States Census of Agriculture for 1950.

**** Included are areas of bottomland along streams and other areas of "plus erosion" where soil materials have accumulated.

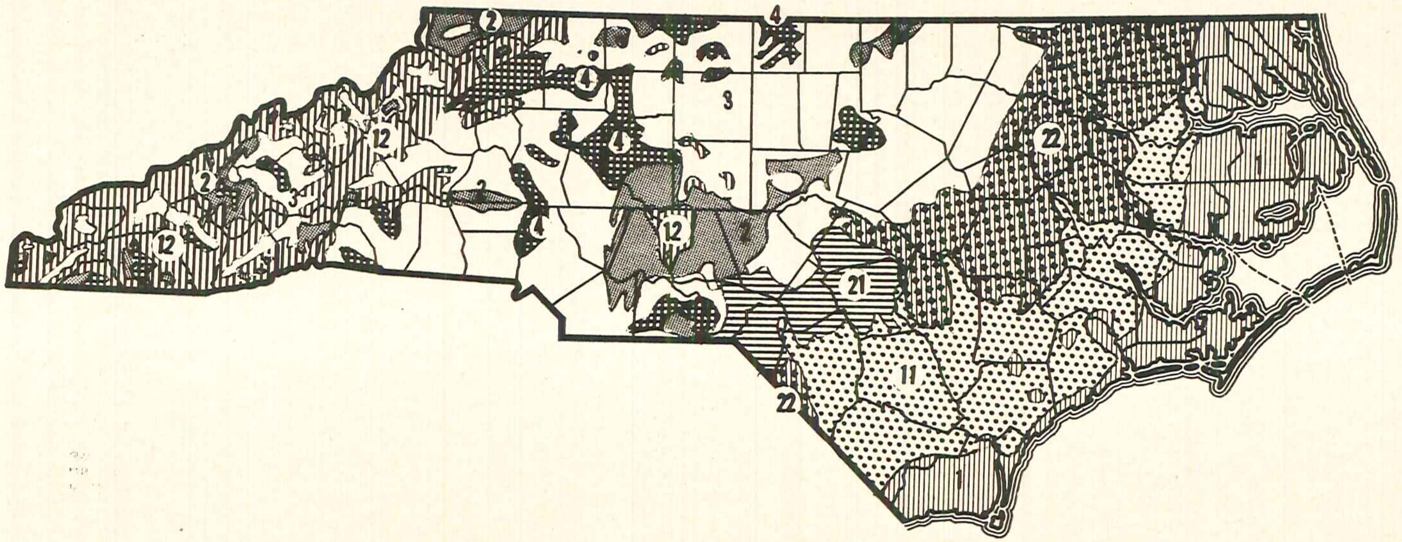

Figure 11. Accelerated Soil Erosion in North Carolina

Guide to Figure 11—Accelerated Soil Erosion

Slight erosion—less than one-fourth of the original surface soil has been removed.

Moderate erosion—between one-fourth and three-fourths of the original surface soil has been removed.

Severe erosion—more than three-fourths of the original surface soil has been removed, also up to about one-fourth of the subsoil.

Very severe erosion—All of the original surface soil has been removed, also one-fourth or more of the subsoil.

Map Symbol	Degree of Accelerated Erosion
1	Very slight or scarcely noticeable erosion by water or wind, except on the strips of Coastal Beach and Dunesand where both types are severe.
11	Slight erosion by water on about 25% of the entire area, slight erosion by wind on an additional 20%.
12	Very slight or scarcely noticeable erosion by water on about 50% of each area, slight erosion on 30, moderate erosion on 15, and severe erosion on about 5%. Little or no wind erosion is apparent in any area.
2	Very slight or scarcely noticeable erosion by water on about 35% of each area, slight erosion on 45, moderate erosion on 15, and severe erosion on about 5%. Little or no wind erosion is apparent in any area.
21	Very slight or scarcely noticeable erosion by water on about 40% of each area, slight erosion on 20, moderate erosion on 10, and much less than 1% severe erosion on the entire area. In addition, about 30% shows slight to moderate erosion by wind.
22	Very slight or scarcely noticeable erosion by water on about 45% of each area, slight erosion on about 34, moderate erosion on 10, and severe erosion on 1%. In addition, about 10% shows slight to moderate erosion by wind.
3	Very slight or noticeable erosion on about 34% of each area, slight erosion on 20, moderate on 30, severe on 10, very severe on 5, and an additional 1% is gullied land. Wind erosion is not noticeable.
4	Very slight or noticeable erosion by water on about 30% of each area, slight erosion on 12, moderate on 30, severe on 20, very severe on 5, and an additional 3% is gullied land. Wind erosion is not noticeable.

Agricultural Experiment Station

North Carolina State College

Raleigh, N. C.,

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