Formation of the Soils

In this section, the factors of soil formation are discussed and related to the soils in the survey area. In addition, the processes of soil formation are described.

Factors of Soil Formation

Soil is formed by weathering and other processes that act upon the parent material. The characteristics of the soil at any given point depend upon climate, living organisms, parent material, relief, and time. Each factor acts on the soil and modifies the effect of the other four. When climate, living organisms, or any of the other five factors is varied to a significant extent, a different soil may be formed.

Climate and living organisms are the active forces in soil formation. Relief modifies the effects of climate and living organisms, mainly by its influence on temperature and runoff. Because climate, vegetation, parent material, and relief interact over a period of time, the effect of time is also reflected in the soil characteristics. The interaction of the five factors of soil formation is more complex for some soils than for others.

Climate

The climate of Woodruff County is characterized by mild winters, warm or hot summers, and general abundant rainfall. The general warm temperatures and high precipitation probably are similar to the climate under which the soils in the county formed. The average temperature in July is about 81 degrees F and about 39 degrees F in January. The total annual rainfall is about 50 inches and is well distributed throughout the year. For additional information about climate, refer to the section "General Nature of the County."

The warm, moist climate promotes rapid soil formation and encourages rapid chemical reactions. The large amount of water that moves through the soil is instrumental in moving dissolved or suspended material downward in the soil profile. Plant remains decompose rapidly, and the organic acid that forms hastens the removal of carbonates and the formation of clay minerals.

Because the soil is frozen only to a shallow depth and for a relatively short period, soil formation continues almost year round. The climate throughout the county is relatively uniform, but its effect is modified locally by elevation, slope steepness, and slope aspect. Climate alone does not account for differences in the soils of the county.

Living Organisms

Plants and animals, including insects, bacteria, and fungi, are important in the formation of soils. Among the changes they cause are additions of organic matter and nitrogen in the soil, additions or losses in plant nutrients, and changes in soil structure and porosity.

Before Woodruff County was settled, the native vegetation had more influence on soil formation than did animal activity.

Hardwood forests covered most of the bottomland of the county. On the flood plain and natural levees, the trees were mainly oaks, sweetgum, ash, sycamore, hackberry, pecan, and hickory. Amagon, Askew, Bosket, Dubbs, Dundee, and Tuckerman soils formed in these areas. In slackwater areas or swamps, the main trees were baldcypress and water tupelo. Kobel and Yancopin soils formed in these areas. On the loess upland, the forests were mainly mixed stands of hardwoods. Calhoun, Calloway, and Grenada soils formed in these areas.

In the southeast corner of Woodruff County, around Hunter, the native vegetation is believed to have been of a prairie or savannah type. The Hillemann soils formed in this area. These soils, however, do not have the thick, dark colored surface layer commonly associated with soils formed under this type of vegetation.

In most cases, the soil characteristics were influenced more by parent material, climate, and relief than by vegetation.

People are important to the future rate and direction of soil formation. They clear the forests, cultivate the soils, and introduce new kinds of plants. Fertilizers, lime, and chemicals for insect, disease, and weed control are added to the soil. Constructing levees and dams for flood control, improving drainage, and grading

the soil surface also effect the development of soils. Some results of these changes will not be evident for many centuries; nevertheless, the effects of living organisms on soil formation in Woodruff County has been drastically changed by these activities. Thus, man has become the most important organism affecting soil formation.

Parent Material and Geology

The soils of Woodruff County formed in water deposited alluvium and eolian soil material consisting of silty loess and sandy dunes. The alluvium was deposited by the Mississippi River when it flowed in the channels now occupied by the Bayou Deview, Cache, and White Rivers. The alluvium consists of a mixture of minerals washed from many kinds of soils, rocks, and unconsolidated sediments derived from the Mississippi River basins, which extends from Montana to Pennsylvania.

The wide range in texture of alluvium in the county results from differences in the site of deposition. When a river overflows and spreads over its flood plain, the coarse sediments are deposited in bands roughly parallel to the channel. Thus, low ridges known as natural levees are formed. On these ridges, Askew, Bosket, and Dubbs soils formed. Finer sediments, high in silt content, are deposited as the floodwaters spread and lose velocity. These sediments contain some sand and clay. Dundee and Amagon soils formed in these sediments of intermediate texture. When the flood recedes and water is left standing as shallow lakes or swamps, the clay and finer silt settle. In these sediments, Jackport and Kobel soils formed.

During much of the Pleistocene Epoch, the Mississippi River flood plain was west of Crowley's Ridge, and the Ohio River flowed on the east side of the ridge. Thousands of years ago, the wide trough carved west of Crowley's Ridge was partially refilled with sediments by the Mississippi River. Finally, the vast complex of alluvial terraces west of Crowley's Ridge was abandoned by the Mississippi River in favor of the Ohio River channel on the east side of the ridge. The broad, abandoned flood plain was subsequently drained by smaller streams that occupied former braided channels of the Mississippi River. The smaller streams were inadequate to maintain the entire area as an active flood plain. Those parts of the plain above overflow were progressively mantled with loess.

The soils on the east side of Woodruff County formed in loess deposits during the Pleistocene Epoch. This mantle of wind-transported material was deposited over older alluvium. The loess mantle is thick enough that the solum of most soils formed entirely in this material. Generally, the loess is about 2 to 12 feet thick. On the level parts of the plain, Calhoun and Henry soils formed. In the nearly level to gently sloping areas, Calloway and Grenada soils formed. Areas where the loess is thin, the Hillemann soils formed.

Adjacent to the White River bottomland in the north and central part of Woodruff County occurs sandy eolian dune deposits. These deposits were formed during periods of low river flow when exposed channels and sand bars provided the source material needed to form dunes. The sand size material was blown out of the streambed and deposited at higher elevations over old alluvium. The Bulltown, Patterson, and Wiville soils formed in this material.

Relief

Relief is the inequalities in elevation of a land surface. The other soil-forming factors are affected by relief through its effect on drainage, runoff, erosion, and percolation of water through the soil. Some of the greatest differences among the soils are due mainly to differences in relief.

In Woodruff County, the alluvial terraces above the flood plains of streams have relief ranging from broad flats and depressions to areas of alternating swales and low ridges. Local differences in elevation range to as much as 20 feet on a few steep escarpments, but are generally 5 to 10 feet in most areas. The slope is generally less than 3 percent. On the broad flats and in depressions on flats and between low ridges, differences in local elevation is small. Surface drainage is slow or very slow. Soils in these areas are poorly drained or somewhat poorly drained and have a seasonal perched water table. Amagon, Dundee, Jackport, and Overcup soils formed in these areas. The well drained Bosket and Dubbs soils are on low ridges at slightly higher elevations.

The loess uplands east of Bayou Deview in Woodruff County has relief ranging from broad flats to gently sloping ridges. Local differences in relief are usually less than 1 foot on flats and range up to 3 to 8 feet on ridges. On the broad flats, surface drainage is slow or very slow. Soils in these areas are poorly drained and have a seasonal high water table. Calhoun and Henry soils formed in these areas. On ridges, the somewhat poorly drained Calloway and the moderately well drained Grenada soils formed.

The flood plain area of Woodruff County consists of the Bayou Deview and Cache and White River bottomland. These areas have relief ranging from broad flats to undulating areas of alternating swales and low ridges. Local differences in relief are usually less than 1 foot on the flats and range up to 3 feet in the areas of

swales and low ridges. On the broad flats, surface drainage is slow or very slow. Soils in these areas are poorly drained and have a seasonal high water table. In the Bayou Deview and Cache River bottomland area, Tuckerman soils formed in these areas; and in the White River bottomland, Kobel soils formed. The somewhat poorly drained Yancopin soils formed in gently undulating areas of the White River bottomland.

The dune areas are in the central and northwest part of Woodruff County, adjacent to the White River bottomland. This area has relief ranging from level to undulating. Local difference in relief are usually less than 3 feet but range up to 8 feet on ridges. On the level to gently sloping areas, the well drained Wiville soils formed. The somewhat excessively drained Bulltown soils formed in undulating areas.

The elevations range from 165 to 195 feet on the flood plains, 195 to 225 feet on alluvial terraces and dune areas, and 200 to 225 feet on Nubbin Ridge and loess uplands.

Time

The time required for soil formation depends largely on other factors of soil formation. Less time generally is required if the climate is warm and humid and the vegetation luxuriant than if climate is cold and vegetation is sparse. If other factors are equal, less time is also required if the parent material is loamy than if it is clayey.

In terms of geological time, most of the soils of Woodruff County are young.

In terms of soil formation, their age varies widely. Older soils usually show a greater contrast between horizons than do younger soils.

All of the soils in Woodruff County have a developed B horizon. Oaklimeter and Yancopin soils have not been in place long enough to form an argillic, or mature B horizon, but have formed a cambic, or less well developed B horizon. The Kobel soils formed in slackwater deposits of clay that shrink and swell. Because of the high clay content and mixing caused by shrinking and swelling, an argillic horizon has not formed. Many soils, such as Bonn, Calhoun, Foley, McCrory, and Tuckerman, have been forming long enough and in stable enough material to have an argillic horizon. Other soils, such as Calloway, Grenada, and Henry, also have a fragipan.

Processes of Soil Formation

The effects of the soil-forming factors are reflected in the soil profile. The soil profile is a succession of layers, or horizons, from the surface to the parent material. These horizons differ in one or more properties, such as color, texture, structure, consistency, porosity, or reaction.

Most soil profiles in this survey area contain 4 to 8 horizons or layers. The master horizons are designated A, E, B, and C. Young soils do not have E and B horizons.

The horizon of maximum accumulation of organic matter is called the A horizon, or the surface layer. An Ap horizon is a plowed surface layer. The horizon of maximum leaching of dissolved or suspended material is called the E horizon, or the subsurface layer.

The B horizon, or subsoil, is below the A or E horizon. It is the horizon of maximum accumulation of suspended material, such as clay and iron. Commonly, the B horizon has blocky structure and is firmer than the horizons immediately above or below it.

The C horizon is below the B horizon. It is affected little by the soil-forming processes, but it can be materially modified by weathering. In some young soils, the C horizon immediately underlies the A horizon and has been slightly modified by living organisms as well as weathering.

In this survey area, several processes have been active in the formation of soil horizons. These processes are the accumulation of organic matter, the leaching of carbonates and bases, the oxidation or reduction and transfer of iron, and the formation and translocation of silicate clay minerals. In most of the soils, more than one of these processes has been active in soil formation.

The accumulation of organic matter in the upper part of the profile (A horizon) has been an important process of soil formation. The soils in Woodruff County range from high to low in organic matter content.

Leaching of carbonates and bases has occurred to some degree in nearly all of the soils in the survey area. Generally, bases are leached downward in soils before silicate clay minerals begin to move. Most of the soils on the uplands in the survey area have been strongly leached. Some soils, such as Kobel and Yancopin, are only slightly leached.

Oxidation of iron is evident in the moderately well drained and well drained soils in the county. Oxidation of iron is indicated by the yellowish brown, brown, and strong brown colors in the B horizon of Grenada, Dubbs, Bosket, Wiville, and Bulltown soils.

The reduction and transfer if iron has occurred to a significant degree in the poorly drained and somewhat poorly drained soils in the lowlands. In the naturally wet soils, this process is called gleying. The gray colors in the horizon below the surface layer indicate the reduction and loss of iron. Some horizons contain

reddish or yellowish accumulations and concretions derived from segregated iron.

Gleying is very pronounced in the Calhoun, Henry, and Tichnor soils.

The translocation of silicate clay minerals has contributed to horizon development in most of the soils in the county. Where the E horizon occurs, it generally has weak subangular blocky structure, has less clay than the lower horizons, and is lighter in color than the rest of the soil. Clay films generally have accumulated in pores and on the surface of peds in the B horizon. The soils were probably leached of carbonates and soluble salts to a great extent before translocation of silicate clay occurred.

Leaching of bases and translocation of silicate clay are among the most important processes in horizon differentiation in the soils of Woodruff County.