SOIL SURVEY OF

Ocala National Forest Area, Florida

Parts of Marion, Lake, and Putnam Counties

United States Department of Agriculture
Soil Conservation Service and Forest Service
In cooperation with
University of Florida
Institute of Food and Agricultural Sciences
Agricultural Experiment Stations
Soil Science Department

Major fieldwork for this soil survey was done in the period 1963–67. Soil names and descriptions were approved in 1968. Unless otherwise indicated, statements in the publication refer to conditions in the survey area in 1967. This survey was made cooperatively by the Soil Conservation Service, the Forest Service, and the University of Florida Institute of Food and Agricultural Sciences, Agricultural Experiment Stations Soil Science Department. It is part of the technical assistance furnished to the Soil Conservation Districts within the Ocala National Forest Area.

Copies of the soil map in this publication can be made by commercial photographers, or they can be purchased on individual order from the Cartographic Division, Soil Conservation Service, United States Department of Agriculture, Washington, D.C. 20250.

HOW TO USE THIS SOIL SURVEY

THIS SOIL SURVEY contains information that can be applied in managing farms and woodlands; in selecting sites for roads, ponds, buildings, and other structures; and in judging the suitability of tracts of land for farming, industry, and recreation.

Locating Soils

All the soils of the Ocala National Forest Area are shown on the detailed map at the back of this publication. This map consists of many sheets made from aerial photographs. Each sheet is numbered to correspond with a number on the Index to Map Sheets.

On each sheet of the detailed map, soil areas are outlined and are identified by symbols. All areas marked with the same symbol are the same kind of soil. The soil symbol is inside the area if there is enough room; otherwise, it is outside and a pointer shows where the symbol belongs.

Finding and Using Information

The "Guide to Mapping Units" can be used to find information. This guide lists all the soils of the county in alphabetic order by map symbol and gives the capability classification of each. It also shows the page where each soil is described and the page for the woodland group and range site in which the soil has been placed.

Individual colored maps showing the relative suitability or degree of limitation of soils for many specific purposes can be developed by using the soil map and the information in the text. Translucent material can be used as an overlay over the soil map and colored to show soils that have the same limitation or suitability. For example, soils that have a slight limitation for a given use can be colored green, those with a moderate limitation can be colored yellow, and those with a severe limitation can be colored red.

Farmers and those who work with farmers can learn about use and management of the soils from the soil descriptions and from the discussions of the capability units, the woodland groups, and the range management groups.

Foresters and others can refer to the section "Use of the Soils for Woodland," where the soils of the survey area are grouped according to their suitability for trees.

Ranchers and others can find, under "Use of the Soils for Range," groupings of the soils according to their suitability for range, and also the names of many of the plants that grow on each range site.

Game managers, sportsmen, and others can find information about soils and wildlife in the section "Forest-Wildlife Management."

Community planners and others can read about soil properties that affect the choice of sites for dwellings, industrial buildings, and recreation areas in the section "Recreational Developments."

Engineers and builders can find, under "Engineering Uses of the Soils," tables that contain test data, estimates of soil properties, and information about soil features that affect engineering practices.

Scientists and others can read about how the soils formed and how they are classified in the section "Formation, Morphology, and Classification of the Soils."

Newcomers in the Ocala National Forest Area may be especially interested in the section "General Soil Map," where broad patterns of soils are described. They may also be interested in the information about the area given in the section "Additional Facts About the Area."

Cover picture: **Area of prairies where the poorly drained and very poorly drained soils are frequently covered by shallow water. The soils are Myakka and Sellers soils, ponded. The grassy vegetation is dominantly maidencane, which is one of the better, water-tolerant range grasses.**

Contents

SOIL SURVEY OF OCALA NATIONAL FOREST AREA, FLORIDA

PARTS OF MARION, LAKE, AND PUTNAM COUNTIES

BY D. GRAY AYDELOTT AND HENRY C. BULLOCK, FOREST SERVICE, AND ALBERT L. FURMAN, HORACE O. WHITE, AND JAMES W. SPIETH, SOIL CONSERVATION SERVICE

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THE OCALA NATIONAL FOREST AREA: PARTS OF MARION, LAKE, AND PUTNAM COUNTIES (in this survey called the Ocala National Forest Area or the survey area) is in the north-central part of the Florida peninsula (fig. 1). It contains parts of Marion, Lake, and Putnam Counties. It is bordered on the north and west by the Oklawaha River, on the east by the St. Johns River, on the south by the Marion-Lake County line, and on the southeast by Florida State Highway 42. From north to south the survey area is about 38 miles long, and from east to west near the southern boundary, it is about 27 miles wide. There are no large communities within the area but Ocala, the nearest city, is a few miles to the west.

The Ocala National Forest Area covers 452,209 acres, or about 706 square miles, of which 19,570 acres is open water. About 90 percent of the Ocala National Forest Area is forested, but not all of it is national forest or owned by the Federal Government. Approximately 84,563 acres, mostly in the south and southwest, is privately owned.

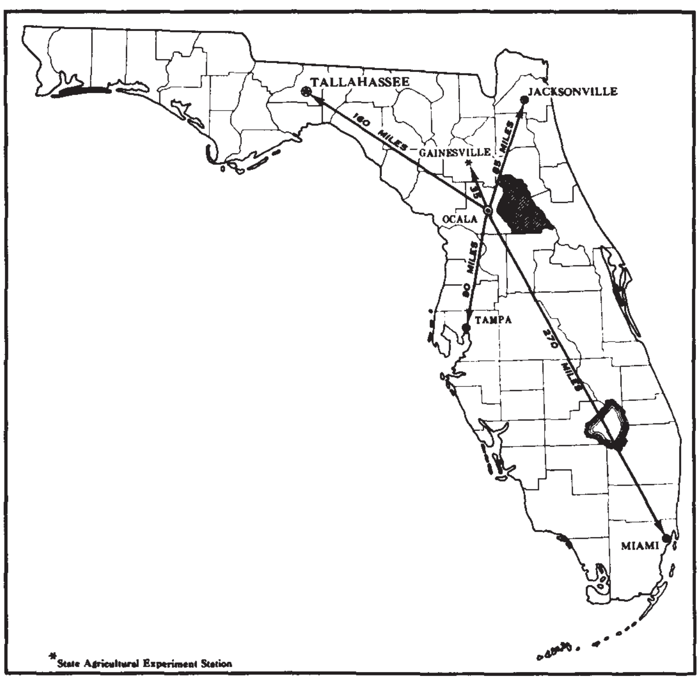

Figure 1.—**Location of the Ocala National Forest Area in Florida.**

Forest products, recreational developments, and wildlife are the main resources. The principal farm crops are citrus and forage, but a few vegetables are grown for home use.

How This Survey Was Made

Soil scientists made this survey to learn what kinds of soil are in the Ocala National Forest Area, where they are located, and how they can be used. The soil scientists went into the survey area knowing they were likely to find many soils they had already seen and perhaps some they had not. They observed the steepness, length, and shape of slopes, the size and speed of streams, the kinds of native plants, the kinds of geologic materials, and many facts about the soils. They dug holes to expose soil profiles. A profile is the sequence of natural layers, or horizons, in a soil: it extends from the surface down into parent material that has not been altered by leaching or by the action of plant roots.

The soil scientists made comparisons among the profiles they studied, and they compared these profiles with those in counties nearby and in places more distant. They classified and named the soils according to nationwide, uniform procedures. The *soil series* and *soil phase* are the categories of soil classification most used in a local survey.

Soils that have profiles almost alike make up a soil series. Except for different texture in the surface layer, the major horizons that all the soils of one series have are similar in thickness, arrangement, and other important characteristics. Each soil series is named for a town or other geographic feature near the place where a soil of that series was first observed and mapped. Astatula and Orlando, for example, are the names of two soil series. All the soils in the United States having the same series name are essentially alike in those characteristics that affect their behavior in the undisturbed landscape. Soils of one series can differ in texture of the surface layer and in slope, stoniness, or some other characteristic that affects their use by man. On the basis of such differences, a soil series is divided into phases. The name of a soil phase indicates a feature that affects management. For example, Astatula sand, dark surface, 0 to 8 percent slopes, is one of several phases within the Astatula series.

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

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

Some mapping units are made up of soils of different series, or of different phases within a series. One such kind of mapping unit shown on the soil map of the Ocala National Forest Area is an undifferentiated group.

An undifferentiated group is made up of two or more soils that could be delineated individually but are shown as one unit because, for the purpose of the soil survey, there is little value in separating them. The pattern and proportion of soils are not uniform. An area shown on the map may be made up of only one of the dominant soils, or of two or more. Sellers and Pamlico soils is an undifferentiated soil group in this survey area.

There are places where the soil material is so variable that it has not been classified by soil series. These places are shown on the soil map and are described in the survey, but they are called land types and given descriptive names. Made land is a land type in this survey area.

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

Soil scientists observe how soils behave when used as a growing place for native and cultivated plants, and as material for structures, foundations for structures, or covering for structures. They relate this behavior to properties of the soils. For example, they observe that filter fields for onsite disposal of sewage fail on a given kind of soil, and they relate this to the slow permeability of the soil or to its high water table. They see that streets, road pavements, and foundations for houses are cracked on a given kind of soil, and they relate this failure to the high shrink-swell potential of the soil material. Thus, they use observation and knowledge of soil properties, together with available research data, to predict limitations or suitability of soils for present and potential uses.

After data have been collected and tested for the key, or benchmark, soils in a survey area, the soil scientists set up trial groups of soils. They test these groups by further study and by consultation with farmers, agronomists, engineers, and others. They then adjust the groups according to the result of their studies and consultation. Thus, the groups that are finally evolved reflect up-to-date knowledge of the soils and their behavior under current methods of use and management.

General Soil Map

The general soil map at the back of this survey shows, in color, the soil associations in the Ocala National Forest Area. A soil association is a landscape that has a distinctive proportional pattern of soils. It normally consists of one or more major soils and at least one minor soil, and it is named for the major soils. The soils in one association may occur in another, but in a different pattern.

A map showing soil associations is useful to people who want a general idea of the soils in an area, who want to compare different parts of an area, or who want to know the location of large tracts that are suitable for a certain kind of land use. Such a map is a useful general guide in managing a watershed, a wooded tract, or a wildlife area, or in planning engineering works, recreational facilities, and community developments. It is not a suitable map for planning the management of a farm or field or for selecting the exact location of a road, building, or similar structure, because the soils in any one association ordinarily differ in slope, depths, stoniness, drainage, and other characteristics that affect their management.

The five soil associations in the Ocala National Forest Area are discussed in the following pages. The terms for texture used in the descriptive heading of the associations apply to all layers, unless otherwise noted. For example, the word "sandy" in association 1 applies to all layers.

1. Astatula-Paola association

Excessively drained, sandy soils that have a light-colored surface layer; on broad upland ridges

This association consists of deep, sandy soils on undulating, dunelike sandhills where there are widely scattered lakes, sinks, and grassy ponds (prairies). The slopes are complex, ranging mostly from 0 to 8 percent, but in some places, especially around the sinks, lakes, and grassy ponds, they are as much as 17 percent. This association is locally called "The Big Scrub." It extends from near Orange Ferry on the north to Pittman on the south.

This association averages about 9 miles in width and makes up about 230,600 acres or 51 percent of the survey area. Astatula soils make up about 73 percent of this association; Paola soils, about 12 percent; and Pomello, Sellers, Immokalee, and Myakka soils, about 12 percent. Lakes and ponds make up the rest of this association.

Areas of Astatula sand are uniform and continuous over large tracts. This soil has a thin, grayish-brown, sandy surface layer underlain by a brownish-yellow, sandy substratum.

Paola sand has a thin, gray sand surface layer. The subsurface layer is white sand, 16 inches thick, that is underlain by yellowish-brown, very pale-brown, and pale-yellow sand extending to a depth of more than 80 inches.

The major soils are excessively drained and droughty.

They have very low natural fertility, very low available water capacity, and very low organic-matter content. Rainwater penetrates so rapidly through the deep, porous sand that there is little runoff and the leaching of plant nutrients is high.

Most of this association is used for sand pines (fig. 2). The association is managed for tree production and for wildlife and recreation. The lakes are used for fishing, boating, and swimming.

This association is not suitable for intensive farming, because the soils are droughty, loose, infertile sands. It fits well, however, into the multiple-use management program of the Ocala National Forest Area.

Most of this association produces very little grass and, therefore, is poorly suited to woodland range. The prairies or grassy ponds within the association, however, are well suited to forage grasses and range.

2. *Astatula, dark surface, association*

Excessively drained, sandy soils that have a dark-colored surface layer; on broad upland ridges

This association consists of deep, sandy soils on undulating sandhills that have large, nearly level ridgetops (fig. 3). Most slopes are 0 to 8 percent, but slopes may be as much as 17 percent near isolated sinks, lakes, and grassy ponds, which are common. The lakes range from less than an acre to more than 100 acres in size.

Figure 2.—Typical stand of sand pines and evergreens in an area of association 1. The soil is an Astatula sand.

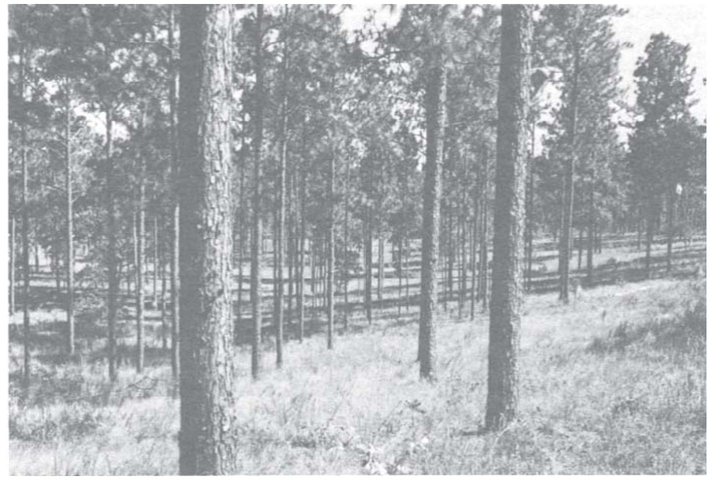

Figure 3.—Stand of longleaf pines in an area of association 2. The soil is Astatula sand, dark surface, 0 to 8 percent slopes.

This association covers about 95,000 acres, or 21 percent of the survey area, mostly in the western half of it. Astatula sand, dark surface, makes up about 56 percent of the association; Astatula sand, moderately deep water table, about 8 percent; and Eustis, Orlando, and Wicksburg soils, about 26 percent. Lakes and ponds make up about 10 percent.

Astatula sand, dark surface, is continuous over much of the association. It has a thin, dark grayish-brown surface layer over yellow sand that extends to a depth of more than 7 feet.

Astatula sand, moderately deep water table, is on the slightly lower, nearly level ridges. It has a sandy, grayish-brown surface layer over brownish-yellow sand that extends to a depth of 40 inches. Below this is light-gray sand. A fluctuating water table ranges from 40 to 70 inches below the surface.

The soils are excessively drained and droughty. They have very low natural fertility, very low available water capacity, and very low organic-matter content. Rainwater penetrates the porous sand rapidly, permitting very little runoff. Few streams have developed.

Most of the association has characteristic parklike stands of longleaf pine and turkey oak. This association is managed for tree production, wildlife, and recreation. A few small areas are cultivated. Recreational facilities have been developed around some of the ponds that are suitable for fishing, swimming, and boating.

This association is not suited to intensive farming, because most of the soils are droughty and infertile. It fits well, however, into the multiple-use program of forest management.

3. *Immokalee-Sellers association*

Poorly drained and very poorly drained, sandy soils; in flatwoods

This association consists of broad, nearly level flatwoods, throughout which many swamps, small lakes, and marshes are scattered. Some low places are isolated, but others are connected by narrow, intermittent drainageways.

This association covers about 67,800 acres or about 15 percent of the survey area. Immokalee sand makes up about 28 percent of the association; Sellers sand, about 17 percent; and Paola, Myakka, St. Johns, Pamlico, Delks, and Pomello soils, about 49 percent. Lakes make up about 6 percent.

The Immokalee soils are nearly level and are on lowlands. They have a black, sandy surface layer about 5 inches thick over leached light-gray sand about 29 inches thick. The leached layer is underlain by weakly cemented, black or dark reddish-brown sand 20 inches thick. Below this is brown sand. These soils have a fluctuating water table that ranges from near the surface in wet seasons to depths of more than 40 inches in dry seasons.

The Sellers soils are in depressions and swamps. They have a black sandy surface layer about 28 inches thick over dark-gray and light brownish-gray sand that extends to a depth of 80 inches or more. Water is near the surface most of the time but is at a depth below 20 inches in dry seasons.

The major soils are poorly drained and very poorly drained. Immokalee soils have low organic-matter content in the surface layer. They have very low available capacity and low natural fertility. Sellers soils have moderate available water capacity and moderately high organic-matter content in the surface layer. They have moderate natural fertility. Surface drainage is slow, mainly through broad, nearly level, channelless drainageways and swamps.

Most of this association is in flatwoods and swamp vegetation. Slash pines are dominant in the flatwoods, and various species of wetland hardwoods grow in the swamps. Because they have a good growth of understory shrubs and grasses, the more open areas of the flatwoods are good range. The soils are suitable for the development of high-quality pastures, and fit well into the multiple-use program of forest management.

4. *Eureka association*

Poorly drained and very poorly drained, sandy soils that have a clayey subsoil; in flatwoods

This association consists of nearly level lowlands interspersed with a few depressed areas, narrow intermittent drainageways, and swamps. It is mainly in the extreme western part of the survey area, near Sharps Ferry.

The Eureka association covers about 13,560 acres, or about 3 percent of the survey area. Eureka loamy fine sand makes up about 40 percent of the association. Minor soils of the Astor, Delks, Iberia, Meggett, and Rains series make up about 60 percent.

The Eureka soils have a black loamy fine sand and surface layer about 4 inches thick over about 7 inches of grayish-brown loamy fine sand. The subsoil is gray sandy clay and clay that, in places, has red, brown, and gray mottles.

Eureka soils are poorly drained and have a very slowly permeable subsoil. They have moderate available water capacity, natural fertility, and organic-matter content. The minor soils are mainly poorly drained and very poorly drained. Most of the association is poorly drained or very poorly drained. Water ponds in the depressions during a wet season.

The association is used mainly for loblolly pine and slash pine in high areas and wetland hardwoods in lower areas. It is excellent for timber and range. It is well suited to the production of food, water, and shelter for wildlife. This association fits well into a forest management plan. A few areas have been converted to improved pasture.

5. *Terra Ceia-Everglades association*

Very poorly drained, organic soils; in swamps and drainageways

This association consists of nearly level or slightly depressed organic soils. It borders lakes, rivers, and smaller drainageways and makes up the larger swamps and marshes.

This association covers about 45,200 acres or about 10 percent of the survey area. Terra Ceia muck makes up about 43 percent of the association; Everglades muck, about 17 percent; and Dorovan, Pamlico, Sellers, and Astor soils, about 25 percent. Lakes and rivers make up about 15 percent.

Terra Ceia muck is in a uniform pattern, especially along the northern reaches of the Oklawaha River and at its junction with the St. Johns River. Large areas also occur along the St. Johns River near Kimball Island. This soil is made up of 52 inches or more of dark reddish-brown to black muck that contains a few fibers.

Everglades muck is along the Oklawaha River near Starks Ferry Bridge, and along the St. Johns River near Kimball Island. It also surrounds Lake Jumper and Lake Lou. It is made up of 52 inches or more of dark reddish-brown, fibrous muck.

The swamp areas of this association are covered with wetland hardwoods, and the marshes are open areas where water-tolerant grasses and sedges grow. A few areas near Starks Ferry have been drained and are used for vegetables.

This association is limited for most uses by excess water. Once land is reclaimed, there is a constant risk of subsidence by oxidation. This association is a natural habitat for many kinds of wildlife.

Descriptions of the Soils

This section describes the soil series and mapping units in the Ocala National Forest Area. Each soil series is described in detail, and then, briefly, each mapping unit in that series. The description of each mapping unit also contains suggestions on how the soil can be managed. Unless it is specifically mentioned otherwise, it is to be assumed that what is stated about the soil series holds true for the mapping units in that series. Thus, to get full information about any one mapping unit, it is necessary to read both the description of the mapping unit and the description of the soil series to which it belongs.

An important part of the description of each soil series is the soil profile, that is, the sequence of layers from the surface downward to rock or other underlying material. Each series contains two descriptions of this profile. The first is brief and in terms familiar to the layman. The second is much more detailed and is for those who need to make thorough and precise studies of soils. The profile described in the series is representative of mapping units in that series. If the profile of a given mapping unit is different from the one described for the series, these differences are stated in describing the mapping unit, or they

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

Soil	Acreage	Percent	Soil	Acreage	Percent
Astatula sand, 0 to 8 percent slopes	164, 689	36. 4	Myakka and Sellers soils, ponded	4, 110	0. 9
Astatula sand, 8 to 17 percent slopes	17, 800	3. 9	Orlando sand	230	(1)
Astatula sand, dark surface, 0 to 8 percent slopes	51, 190	11. 3	Orlando sand, wet variant	390	. 1
Astatula sand, dark surface, 8 to 17 percent slopes	3, 120	. 7	Pamlico muck	230	(1)
Astatula sand, banded substratum, 0 to 8 percent slopes	8, 140	1. 8	Pamlico muck, deep	1, 750	. 4
Astatula sand, moderately deep water table, 0 to 8 percent slopes	7, 770	1. 7	Paola sand, 0 to 8 percent slopes	24, 920	5. 5
Astor sand	4, 820	1. 1	Paola sand, 8 to 17 percent slopes	2, 170	. 5
Basinger sand	1, 790	. 4	Paola sand, moderately deep water table, 0 to 5 percent slopes	10, 010	2. 2
Delks sand	5, 650	1. 2	Pomello sand	10, 730	2. 4
Dorovan muck	3, 450	. 8	Rains loamy fine sand	770	. 2
Duplin loamy sand	350	. 1	St. Johns sand	8, 440	1. 9
Eureka loamy fine sand	5, 710	1. 3	St. Lucie sand	1, 690	. 4
Eureka loamy sand, thick-surface variant	630	. 1	Sellers sand	11, 170	2. 5
Eustis sand	820	. 2	Sellers and Pamlico soils	9, 290	2. 0
Everglades muck	8, 020	1. 8	Terra Ceia muck	19, 780	4. 4
Iberia clay	2, 720	. 6	Wicksburg sand, 0 to 5 percent slopes	2, 680	. 6
Immokalee sand	18, 840	4. 2	Wicksburg sand, 5 to 12 percent slopes	530	. 1
Made land	360	. 1	Submerged marsh	5, 760	1. 2
Meggett loamy sand	1, 770	. 4	Pits and dumps	230	(1)
Myakka sand	10, 070	2. 2	Kitchen middens	50	(1)
			Open water	19, 570	4. 3
			Total	452, 209	100. 0

[1] Less than 0.05 percent.

are differences that are apparent in the name of the mapping unit. Color terms are for moist soil, unless otherwise stated.

As mentioned in the section "How This Survey Was Made," not all mapping units are members of a soil series. Made land, for example, does not belong to a soil series, but nevertheless, is listed in alphabetic order along with the soil series.

Following the name of each mapping unit is a symbol in parentheses. This symbol identifies the mapping unit on the detailed soil map. Listed at the end of each description of a mapping unit is the capability unit, woodland group, and range management group in which the mapping unit has been placed.

The acreage and proportionate extent of each mapping unit are shown in table 1. Many of the terms used in describing soils can be found in the Glossary, and more detailed information about the terminology and methods of soil mapping can be obtained from the Soil Survey Manual (*8*).[1]

Astatula Series

The Astatula series consists of nearly level to moderately steep, excessively drained, sandy soils that are on broad ridges and are adjacent to sinks and small lakes. These soils formed in sandy marine, eolian, or fluvial sediments and are more than 95 percent quartz.

In a representative profile the surface layer is grayish-brown sand about 3 inches thick. Below this, and extending to a depth of 84 inches, is brownish-yellow sand.

Astatula soils have very rapid permeability in the surface layer and rapid to very rapid permeability in underlying layers. Available water capacity is very low in the surface layer and low to very low in underlying layers. These soils are droughty. They have very low organic-matter content and natural fertility.

[1] Italic numbers in parentheses refer to Literature Cited, p. 62.

Representative profile of Astatula sand:

01—2 inches to 0, undecomposed leaves, twigs, and stems underlain by a loosely matted layer of partly decomposed leaves, twigs, and roots, mixed with a small amount of sand.

A1—0 to 3 inches, grayish-brown (2.5Y 5/2) sand; single grained; loose; many large, medium, and fine roots; many clean sand grains; strongly acid; clear, smooth boundary.

C1—3 to 6 inches, brownish-yellow (10YR 6/6) sand; single grained; loose; many large, medium, and fine roots; few faint streaks of gray; many clean sand grains; strongly acid; gradual, wavy boundary.

C2—6 to 84 inches, brownish-yellow (10YR 6/8) sand; single grained; loose; common fine and medium roots; many clean sand grains; strongly acid.

The A horizon ranges from gray or grayish brown to dark grayish brown in color and from 2 to 7 inches in thickness.

The C horizon ranges from pale brown or brownish yellow to yellowish red and extends to a depth of 80 inches or more. In some profiles, the C horizon has mottles of gray or white and is uncoated sand.

Astatula soils are strongly to very strognly acid throughout and have less than 5 percent silt and clay in the layer 10 to 40 inches below the surface. The water table is at a depth of 40 inches to more than 10 feet.

Astatula soils are associated with Paola and St. Lucie soils. Astatula soils have a yellowish C horizon below the A1 horizon instead of the white A2 horizon that is typical of Paola soils. Astatula soils have a yellowish C horizon to a depth of 80 inches or more, whereas St. Lucie soils have a white C horizon.

Astatula sand, 0 to 8 percent slopes (AsB).—This is a nearly level to sloping, excessively drained, sandy soil that is on broad undulating ridges. It has a water table that is always below a depth of 60 inches.

Included with this soil in mapping are small areas, around sinks and depressions, that have slopes greater than 8 percent. Also included are small areas of Astatula sand, moderately deep water table, 0 to 8 percent slopes, and a few scattered areas of Astatula sand, banded substratum, 0 to 8 percent slopes.

Natural vegetation consists of sand pine forests that have scattered sand live oak, myrtle oak, and crookedwood, and an understory of rosemary, scrub palmetto, saw-palmetto, garberia, and lichens. Almost all the areas are in natural vegetation.

Suitability of this soil for cultivated crops is limited to a few special crops, such as watermelon, that grow well in droughty soils. The available water capacity and natural fertility are very low. Very rapid permeability causes plant nutrients to be quickly lost through leaching. Cover crops are needed to control soil blowing and to improve the soil.

This soil is moderately suited to citrus trees, although some areas are subject to freezing in winter. Citrus groves require a cover crop or a cover of weeds and grasses between the trees to control soil blowing. Tillage should be kept to a minimum. Sprinkler irrigation is needed for the survival of young trees. It also makes the soil better suited to the mature trees.

This soil is poorly suited to improved pasture. It produces only fair pastures of bahiagrass and other deep-rooted grasses, even if fertilizer is applied frequently and grazing is carefully controlled. Capability unit VIs–1; woodland group 8; range management group 8.

Astatula sand, 8 to 17 percent slopes (AsD).—This is a strongly sloping to moderately steep, excessively drained, sandy soil that is on choppy, dunelike terrain and on short slopes adjacent to sinks. It is similar to Astatula sand, 0 to 8 percent slopes, but it has stronger slopes. It has a profile similar to that described as representative of the series, but in places the original surface layer has been removed through erosion. The water table is at a depth of 60 inches or more.

Included with this soil in mapping are many small areas of Astatula sand, 0 to 8 percent slopes, that are too small or are mixed with steeper areas in a pattern that is too complex to be mapped separately. Also included are a few small areas of Paola sand.

Natural vegetation is sand pine forests that have scattered sand live oak, myrtle oak, and crookedwood, and an understory of rosemary, scrub palmetto, saw-palmetto, garberia, and lichens. Nearly all areas are in natural vegetation.

Because of poor soil qualities and strong slopes, this soil is not suited to cultivated crops, improved pasture, or citrus trees. It has very low available water capacity and very low natural fertility. Very rapid permeability causes plant nutrients to be quickly lost through leaching. Capability unit VIIs–1; woodland group 8; range management group 8.

Astatula sand, dark surface, 0 to 8 percent slopes (AtB).—This is a nearly level to sloping, excessively drained soil that is on broad, gently undulating ridges. It has a dark-gray or dark grayish-brown, sandy surface layer above yellowish, sandy layers that extend to a depth of 80 inches or more. It is similar to Astatula sand, 0 to 8 percent slopes, except that the surface layer is darker in color. The water table is at a depth of 60 inches or more.

Included with this soil in mapping are some areas that have a very dark gray or black surface layer about 8 inches thick. Also included are small areas of Astatula sand, banded substratum, 0 to 8 percent slopes; Astatula sand, moderately deep water table, 0 to 8 percent slopes; and small areas that have steeper slopes.

Natural vegetation is forests of longleaf pine and turkey oak that have an understory of gopher apple, pawpaw, numerous forbs, and native grasses. Forest is the dominant use.

Because it has poor qualities, this soil is very poorly suited to cultivated crops, but under intensive management it can produce a few special crops, such as watermelon. The available water capacity and natural fertility are very low. Permeability is very rapid, and this results in rapid leaching of plant nutrients. All cultivated crops should be rotated with soil-improving cover crops, and large amounts of fertilizer should be used.

This soil is well suited to citrus trees in a few places where trees are protected from freezing in winter. Growing a cover crop between the trees, applying lime and fertilizer, and irrigating during dry periods are necessary.

If properly managed, this soil is moderately well suited to deep-rooted, improved pasture grasses. Bahiagrass and other deep-rooted grasses are adapted but need fertilizing, liming, and controlled grazing. Hairy indigo, crotalaria, and other deep-rooted legumes can be grown successfully, but careful management is needed to maintain a good cover of vegetation. Capability unit IVs–1; woodland group 7; range management group 7.

Astatula sand, dark surface, 8 to 17 percent slopes (AtD).—This is a strongly sloping to moderately steep, excessively drained soil that is mainly in areas leading to sinks and lakes. It has a dark-gray or dark grayish-brown, sandy surface layer over yellowish, sandy layers that extend to a depth of more than 80 inches. It is similar to Astatula sand, 0 to 8 percent slopes, but this soil has stronger slopes and has a darker colored surface layer. The water table is at a depth of 60 inches or more.

Included with this soil in mapping are a few small areas of Astatula sand, banded substratum, 0 to 8 percent slopes, and Astatula sand, dark surface, 0 to 8 percent slopes. Also included are small areas of poorly drained soils in depressions.

Natural vegetation is forests of longleaf pine and turkey oak that have an understory of gopher apple, pawpaw, and numerous forbs and native grasses. Nearly all areas are in natural vegetation.

This soil is suited mainly to woodland, but it is not suited to cultivated crops, improved pasture, or citrus trees. Its use is limited because of its slope and very poor soil qualities. It has very low available water capacity and very low natural fertility. Permeability is very rapid, and plant nutrients are quickly lost through leaching. Capability unit VIIs–1; woodland group 7; range management group 7.

Astatula sand, banded substratum, 0 to 8 percent slopes (AuB).—This is a nearly level to sloping, excessively drained, sandy soil that has a thin, grayish, sandy surface layer over yellowish or brownish, sandy layers that extend to a depth of more than 80 inches. It has numerous, horizontal, discontinuous layers of loamy sand, 1/8 to 1/4 inch in thickness, between depths of 50 and 80 inches. The combined thickness of these layers is less than 6 inches. The water table is at a depth of more than 60 inches.

Included with this soil in mapping are small areas where the soils have thin loamy sand layers that are more than 6 inches in total thickness, small areas of soils that are sand throughout and do not have loamy bands, and small areas of soils that have slopes of more than 8 percent. Also included are small areas of sandy, less well drained soils.

Natural vegetation is forests of longleaf pine and turkey oak that have an understory of low shrubs and native grasses. Forest is the dominant use, but some acreage is in citrus trees and pasture.

Because it has poor soil qualities, this soil is poorly suited to cultivated crops. Available water capacity and natural fertility are very low. Permeability is very rapid, and this results in rapid leaching of plant nutrients. A few special crops, such as watermelon, are adapted and can be grown if intensive management is used that includes liberal use of fertilizer and sprinkler irrigation. All cultivated crops should be grown in rotation with soil-improving cover crops.

This soil is well suited to citrus trees in a few places where trees are protected from freezing, and some areas are used for citrus trees and pasture. Growing a cover crop between the trees, applying lime and fertilizer, and irrigating during dry periods are necessary.

This soil is moderately well suited to deep-rooted, improved pasture grasses if proper management is used. Bahiagrass and other deep-rooted grasses are adapted, but where these grasses are used, fertilizing, liming, and controlled grazing are needed. Hairy indigo, crotalaria, and other deep-rooted legumes can be grown successfully, but careful management is needed to maintain good vegetative cover. Capability unit IVs–1; woodland group 7; range management group 7.

Astatula sand, moderately deep water table, 0 to 8 percent slopes (AwB).—This is a nearly level to sloping, excessively drained, sandy soil that is mainly on nearly level, low ridges that are intermediate in elevation between areas of flatwoods and the higher ridges. This soil is similar to Astatula sand, 0 to 8 percent slopes, except that the water table is closer to the surface and the soil color below a depth of 40 inches is light gray instead of brownish yellow. The water table is at a depth of 40 to 60 inches for longer than 6 months in most years. In wet seasons it is briefly above a depth of 40 inches, but in dry seasons it is below a depth of 60 inches.

Included with this soil in mapping are small areas of Immokalee sand and a few other areas where there is a loamy layer at a depth of less than 80 inches.

Natural vegetation is forests of longleaf pine and slash pine that have an understory of shrubs and grasses.

The limitations to the use of this soil for cultivated crops are severe, because of poor soil qualities. Available water capacity, natural fertility, and organic-matter content are very low. Water moves very rapidly through the soil, and little is retained in the upper layers. The water table is normally near enough to the surface to supply water to deep-rooted plants, such as improved grasses, watermelons, and citrus trees.

This soil is well suited to citrus trees in places where trees are protected from freezing in winter. Natural drainage is generally adequate for good growth of trees, but the trees may be damaged by a high water table in an unusually wet season. The tree roots extend into the moist area just above the water table and receive adequate amounts of water to sustain them in a dry season. Good management of citrus groves requires growing a cover crop between the trees and applying enough fertilizer and lime.

This soil is well suited to improved pasture. Deep-rooted grasses grow well if they are properly established, fertilized, and limed and if grazing is controlled. Pasture is not adversely affected by dry weather to any great extent. Capability unit IIIs–2; woodland group 4; range management group 4.

Astor Series

The Astor series consists of nearly level, very poorly drained, sandy soils that are in depressions, in low, flat areas, and along poorly defined drainageways. These soils formed in thick beds of marine sediment.

In a representative profile the surface layer is black sand about 8 inches thick. Below this, and extending to a depth of 80 inches, is very dark gray or very dark grayish-brown sand.

Astor soils have rapid permeability in all layers. The available water capacity is moderate to a depth of about 24 inches and, below this, low to a depth of 80 inches. These soils have high organic-matter content in the surface layer, and they have moderate natural fertility.

Representative profile of Astor sand:

01—1 inch to 0, fresh leaves, twigs, stems, and bark.

A11—0 to 8 inches, black (10YR 2/1) sand, very dark brown (10YR 2/2) rubbed; many, medium, distinct, gray (10YR 6/1) mottles; weak, fine, granular structure; friable; many fine, medium, and coarse roots; many sand grains are uncoated; slightly acid; gradual, wavy boundary.

A12—8 to 24 inches, very dark gray (10YR 3/1) sand, very dark grayish brown (10YR 3/2) rubbed; many, medium, faint, grayish-brown mottles; weak, fine, granular structure; friable, nonsticky; common fine, medium, and coarse roots; many uncoated sand grains; moderately alkaline; gradual, wavy boundary.

C1—24 to 32 inches, very dark grayish-brown (10YR 3/2) rubbed, sand; many, medium, faint, very dark gray mottles; single grained; loose; common fine and medium roots; many clean sand grains; moderately alkaline; clear, wavy boundary.

C2—32 to 80 inches, very dark grayish-brown (10YR 3/2) rubbed sand; many, medium, faint, black mottles; single grained; loose; few fine roots; many clean sand grains; moderately alkaline.

The A horizon ranges from black or very dark gray to very dark grayish brown in color and from 24 to 34 inches in thickness. The content of organic matter is 3 to 15 percent in the upper part and 1 to 5 percent in the lower part. Small pockets of gray sand are common in some places.

The C1 horizon ranges from black to very dark grayish brown and from 6 to 18 inches in thickness. In places it is mottled with shades of gray, yellow, or brown. Organic-matter content of the C1 horizon is 1 to 5 percent. The C2 horizon is very dark grayish brown to gray, and there are mottles in shades of gray, yellow, or brown in many places. Vertical streaks of black to gray are common.

Astor soils have a slightly acid to moderately alkaline A horizon and a mildly or moderately alkaline C horizon. The water table is within 10 inches of the surface for more than 6 months in most years. During the wettest seasons it is at or on the surface, but in the driest seasons it recedes to a depth below 20 inches. Many depressed areas are flooded for 3 to 9 months each year.

Astor soils are associated with Immokalee, Myakka, Pomello, and Sellers soils. They are more poorly drained than all of those soils, except the Sellers soils. They have a thick black A1 horizon directly over the C horizon instead of the thin A1 horizon and weakly cemented black B2h horizon that are typical of Immokalee, Myakka, and Pomello soils. Astor soils range from slightly acid to alkaline, whereas Sellers soils are strongly acid to very strongly acid.

Astor sand (Ax).—This is a nearly level, very poorly drained, sandy soil that is in depressions, low nearly level areas, and poorly defined drainageways. It has a dark-colored surface layer 24 to 34 inches thick over sandy layers that extend to a depth of 80 inches or more. Some depressed areas are covered with shallow water for 3 to 9 months each year.

Included with this soil in mapping are a few areas where the surface layer is loamy and other areas where the surface layer is less than 24 inches thick. Also included are spots where there is a dark-colored, weakly cemented layer below a depth of 30 inches, and spots where there is loamy material or marl that contains shells between 40 and 60 inches below the surface. Another inclusion is a small area of Astor sand, southeast of Eureka Bridge, that has mixed gray marl and sand layers within 20 inches of the surface and where large limestone rocks are on the surface. Also included are areas of Sellers sand.

Natural vegetation consists of cabbage palm, water oak, southern red maple, and sweetgum and an understory of waxmyrtle, gallberry, poison-ivy, smilax, and ferns.

The limitations to the use of this soil for cultivated crops are severe because of excessive wetness. Unless drained, the soil is not suited to cultivation. A moderately high organic-matter content and moderate available water capacity in the surface layer make this an excellent soil for truck crops, if the water level is properly controlled and if other factors make the growing of these crops feasible. Natural fertility is moderate, and the response to fertilizer is good. The drainage system must be properly designed, constructed, and maintained.

This soil generally is not suited to citrus trees. Limitations affecting the growth of trees are very poor drainage and the risk of freezing temperatures.

With proper management, this soil produces excellent pasture of improved grasses or grass-clover mixtures. Good management includes water control that removes excess runoff and provides subsurface irrigation. It also includes frequent application of lime and fertilizer and careful control of grazing. Capability unit IIIw-2; woodland group 5; range management group 6.

Basinger Series

The Basinger series consists of nearly level, poorly drained soils that are in sloughs of poorly defined drainageways and depressions in the flatwoods. These soils formed in sandy marine sediments.

In a representative profile the surface layer is dark-gray sand and about 6 inches thick. The next layer is about 21 inches of gray sand that has dark-gray streaks and yellowish root stains. Below this, to a depth of 35 inches, is light-gray sand that has mottles of grayish brown and brown. Between depths of about 35 and 64 inches is a layer of dark-brown sand that has grayish-brown and reddish-brown mottles. Between depths of about 64 and 80 inches is a layer of brown sand.

Basinger soils have very rapid permeability and very low available water capacity. Natural fertility and organic-matter content are low.

Representative profile of Basinger sand:

A1—0 to 6 inches, dark-gray (10YR 4/1) sand; weak, medium, granular structure; very friable; many fine, medium, and coarse roots; few, coarse, faint, brown mottles; strongly acid; clear, wavy boundary.

A21—6 to 27 inches, gray (10YR 5/1) sand; few, fine, distinct, brownish-yellow (10YR 6/6) root stains and common, medium, faint, dark-gray streaks; single grained; loose; common fine and medium roots; medium acid; gradual, wavy boundary.

A22—27 to 35 inches, light-gray (10YR 7/1) sand; common, medium, distinct, grayish-brown (10YR 5/2) and brown (10YR 5/3) mottles; single grained; loose; few fine roots; medium acid; abrupt, wavy boundary.

C&Bh—35 to 64 inches, dark-brown (7.5YR 4/4) sand; common, medium, distinct, grayish-brown (10YR 5/2) and dark reddish-brown (5YR 3/2) mottles; few, medium, dark reddish-brown organic concretions in upper 1 to 2 inches; single grained; loose; few fine roots; many uncoated sand grains; medium acid; gradual, wavy boundary.

C—64 to 80 inches, brown (10YR 5/3) sand; single grained; loose; few fine roots; common, medium, faint, dark reddish-brown (5YR 3/2) mottles; many uncoated sand grains; strongly acid.

The A1 horizon ranges from black to dark gray or grayish brown in color and from 2 to 8 inches in thickness. The A2 horizon ranges from brown to light gray and generally has grayish or brownish mottles. It is 6 to 31 inches thick. Streaks of the A1 horizon extend into the A2 horizon.

The C&Bh horizon is very dark grayish brown, brown, dark brown, or dark yellowish brown and ranges from 6 to 36 inches in thickness. It has few to common light-colored or dark-colored mottles. The C horizon is brown to light gray and extends to a depth of 80 inches or more.

Basinger soils have a medium acid to very strongly acid A horizon and a medium acid to mildly alkaline C&Bh horizon. In most years the water table is within 10 inches of the surface for 2 to 6 months and within 40 inches of the surface for 9 months or more.

Basinger soils are associated with Immokalee, Myakka, Pomello, and Sellers soils. Basinger soils have a C&Bh horizon or imperfectly developed Bh horizon instead of the well-developed Bh horizon that is typical of Immokalee, Myakka, and Pomello soils. They are more poorly drained than Pomello soils. Basinger soils are better drained than Sellers soils, and they lack a thick, dark-colored A horizon, which the Sellers soils have.

Basinger sand (Ba).—This is a nearly level, poorly drained soil that is in flatwoods in sloughs or poorly defined drainageways and depressions. It has an organic-stained layer that begins within 40 inches of the surface. The water table is within 10 inches of the surface for 2 to 6 months in most years. It is at the surface after heavy rains and briefly 40 inches below the surface in unusually dry seasons.

Included with this soil in mapping are some areas of Basinger sand that have a dark-gray surface layer 6 to 10 inches thick. Also included are areas of Basinger sand that lack brownish-stained layers below the surface and a few areas where there is loamy material below the stained layer.

Natural vegetation consists mainly of slash pine, longleaf pine, waxmyrtle, gallberry, saw-palmetto, maidencane, and wiregrass. Most areas are still in natural vegetation, but a few are in improved pasture or citrus trees.

The limitations to the use of this soil for cultivated crops are severe because of wetness and very low available water capacity. Permeability is very rapid, and this results in rapid leaching of plant nutrients. Unless drained, the soil is not suited to cultivated crops, but if drainage and intensive management are used, it is moderately well suited to some vegetable crops. A properly designed, constructed, and maintained water control system that permits reliable control of the water table and provides subsurface irrigation is essential. Other important management practices are a system of crop rotation that improves the soil and frequent applications of fertilizer.

Because of a high water table and a severe hazard of freezing, this soil is poorly suited to citrus trees. A carefully designed, installed, and maintained water control system is needed if this soil is used for citrus trees. This system should consist of ditches or tiles, control structures, and bedding. Because this soil has low fertility and sandy texture, the maintenance of fertility is difficult.

Under intensive management, this soil is well suited to improved pasture of grass or grass and clover. Among good management practices for improved pasture are water control similar to that used for cultivated crops but less intensive, applications of fertilizer as needed, and careful control of grazing. Capability unit IVw-2; woodland group 4; range management group 4.

Delks Series

The Delks series consists of nearly level, somewhat poorly drained soils that are in broad areas in the flatwoods. These soils formed in sandy marine sediment over loamy and clayey marine sediment.

In a representative profile the surface layer is about 4 inches of very dark gray sand over about 21 inches of light-gray sand. Between depths of about 25 and 30 inches is strongly cemented, dark grayish-brown and black sand that has mottles in shades of red, yellow, and brown. The next 8 inches is a layer of strongly cemented sand mottled with dark reddish brown, reddish yellow, dark brown, and yellowish red. Between depths of 46 and 60 inches is gray sandy clay mottled in shades of red, yellow, and light gray.

Permeability is rapid in the surface layer, moderate in the upper part of the cemented layer and moderately slow in the lower part, and slow in the clayey layer. Available water capacity is moderate in the cemented layer, low to very low in the other sandy layers, and high in the clayey layer. These soils have low organic-matter content and low natural fertility.

Representative profile of Delks sand:

O1—2 inches to 0, fresh pine needles, stems, bark, twigs, and about 10 percent live roots.

A1—0 to 4 inches, very dark gray (10YR 3/1) sand; weak, medium, granular structure; friable; many fine, medium, and large roots; many clean sand grains; very strongly acid; clear, smooth boundary.

A2—4 to 25 inches, light-gray (10YR 7/2) sand; common, medium, faint, pale-brown and few, medium, faint, brown mottles; single grained; loose; nonsticky; common fine and medium roots; many clean sand grains; very strongly acid; clear, irregular boundary.

A&Bh—25 to 27 inches, mottled dark grayish-brown (10YR 4/2); grayish-brown (10YR 5/2) and dark-brown (7.5YR 3/2) sand; weak, coarse, subangular blocky structure; firm; weakly cemented; many roots; few black (5YR 2/1) and dark-brown (7.5YR 3/2) weakly cemented concretions consisting of sand coated with organic matter; common, clean sand grains; very strongly acid; clear, irregular boundary.

B21h—27 to 38 inches, black (5YR 2/1) sand; common, medium, distinct, dark-brown (7.5YR 3/2) and yellowish-red (5YR 5/6) mottles, moderate, medium, subangular blocky structure; very firm; strongly cemented, few fine roots; sand grains are coated with organic material, except along old root channels; very strongly acid; clear, wavy boundary.

B22h—38 to 46 inches, mottled dark reddish-brown (5YR 3/3), reddish-yellow (7.5YR 6/6), dark brown (7.5YR 3/2), and yellowish-red (5YR 5/8) sand; moderate, medium, subangular blocky structure; very firm; strongly cemented; few fine roots; few, coarse, clean sand grains; very strongly acid; gradual, wavy boundary.

B'2tg—46 to 60 inches, gray (N 5/0) sandy clay; common, medium, prominent, red (10R 4/8), reddish-yellow (7.5YR 6/8), and light-gray (10YR 7/2) mottles; moderate, medium, subangular blocky structure; firm; few fine roots; clay films continuous on ped faces; few small sand pockets; very strongly acid.

The A1 horizon ranges from 2 to 6 inches in thickness and from dark gray to black in color when rubbed. The A2 horizon ranges from gray to light gray in color and from 16 to 24 inches in thickness. In many places this layer has few to common, brownish or yellowish mottles. In places, streaks of the A1 horizon extend into it. The entire A horizon is less than 30 inches thick. The A&Bh horizon is a thin, discontinuous layer, ½ to 3 inches thick, that has mottles in shades of black, gray, brown, and yellow.

The B2h horizon is black, very dark gray, dark reddish brown, or dark brown, and is 6 to 24 inches thick. This horizon has few to common mottles in shades of red, brown, or yellow. The organic-matter content is 1 to 6 percent. In places the B2h horizon contains root channels up to 1 inch in diameter. These channels are filled with strongly cemented, light brownish-gray or light-gray sand. Between the B2h and B2tg horizons in some profiles, there is a discontinuous layer, ½ inch to 3 inches thick, of light-gray to light-brownish gray, weakly cemented sand, and in some an A'2 horizon of gray sand 2 to 20 inches thick. The B'2tg horizon is dark grayish-brown to dark-brown or gray to light-gray sandy clay loam to sandy clay that has mottles in shades of red, brown, yellow, and gray.

Delks soils are strongly acid or very strongly acid throughout the profile. In most years the water table is within 10 inches of the surface for 1 to 3 months and at a depth between 10 and 40 inches for 6 months or more. During dry seasons it is below a depth of 40 inches.

Delks soils are associated with Immokalee, Myakka, Eureka, Pomello, and St. Lucie soils. They are better drained than Immokalee and Myakka soils and have clayey layers instead of sand beneath the Bh horizon. Delks soils have a Bh horizon that is lacking in Eureka and St. Lucie soils. They are better drained than Eureka soils and are more poorly drained than Pomello or St. Lucie soils.

Delks sand (De).—This is a nearly level, somewhat poorly drained soil in broad areas in the flatwoods, mostly in the western part of the forest area. It has a dark-colored, strongly cemented, sandy layer at a depth of less than 30 inches. The dark color comes from organic matter that coats the sand grains and cements them together. The underlying material is clayey. In most years the water table is within 10 inches of the surface for 1 to 3 months and between depths of 10 and 40 inches for 6 months or more. During dry seasons it may be below a depth of 40 inches.

Included with this soil in mapping are a few small areas where the underlying material is clay instead of sandy clay, and a few other small areas where the underlying layer is sandy rather than clayey. Also included are a few small areas where the soil is slightly acid to medium acid and some areas where there are a few, narrow, choppy, low slopes around depressions.

Natural vegetation is forests of slash pine and longleaf pine that have an understory of gallberry, waxmyrtle, saw-palmetto, and grasses.

The limitations to the use of this soil for cultivated crops are severe because of the periodic wetness and poor soil qualities, which reduce the choice of plants and make the use of intensive management necessary. This soil is low in natural fertility and low to very low in available water capacity in the sandy surface layer. For many plants the cemented layer restricts the root zone to the sandy surface layer.

This soil is well suited to vegetable crops in those areas that are relatively free from frost and where irrigation water is available. Intensive management practices and careful control of the water tables are needed. Drainage-subirrigation systems must be carefully designed, installed, and maintained.

This soil is poorly suited to citrus trees. Poor drainage, susceptibility to freezing, and restriction of the root zone by a cemented subsurface layer adversely affect tree growth. Under the most favorable local climate and soil variations, citrus trees are moderately well suited, but careful control of water and good management are needed. A careful study of the site should be made before the planning for citrus trees is begun.

If excess water is removed by a simple drainage system this soil is well suited to pastures of improved grass. Liberal use of fertilizer is necessary. Clover can be grown with grass but should be irrigated to assure good growth. Capability unit IIIw-1; woodland group 12; range management group 9.

Dorovan Series

The Dorovan series consists of nearly level, very poorly drained, organic soils. The organic material is more than 52 inches thick. These soils are on low flats near rivers and lakes and in large cypress ponds and hardwood swamps. They formed in the highly decomposed remains of hydrophytic, fibrous, nonwoody plants.

In a representative profile Dorovan soils are very dark grayish-brown, highly decomposed muck to a depth of about 64 inches.

Dorovan soils have rapid permeability throughout. The available water capacity, organic-matter content, and nitrogen content are all very high.

Representative profile of Dorovan muck:

Oa—0 to 64 inches, dark-brown (7.5YR 3/2) unrubbed, very dark grayish-brown (10YR 3/2) rubbed, highly decomposed organic matter (muck); massive; nonsticky; about 20 percent fiber unrubbed, but less than 10 percent rubbed; fibers remaining after rubbing are less than 3 millimeters in size; many fine roots in upper few inches; about 10 percent mineral; very strongly acid.

The color of the horizon is somewhat dependent on the kind of decomposed plant tissue, but it ranges from dark brown to black. Mineral material makes up 10 to 30 percent of the soil material and is generally sand. Fiber content is between 10 and 40 percent before rubbing and less than 10 percent after rubbing.

Dorovan soils are strongly acid to very strongly acid. In most years the water table is within 10 inches of the surface for 9 to 12 months. Water frequently accumulates on the surface. In dry seasons, the water table is lower but seldom below a depth of 30 inches.

The annual temperature of the Dorovan soils mapped in this survey area is slightly higher than the defined range for the Dorovan series, but this difference does not alter the usefulness and behavior of the soils.

Dorovan soils are associated with Sellers, Astor, Everglades, Terra Ceia, and Pamlico soils. Dorovan soils are organic soils, whereas Sellers and Astor soils are mineral soils. They are less fibrous and more acid than Everglades soils and are much more acid than Terra Ceia soils. Dorovan soils have an organic layer that is more than 52 inches thick, whereas Pamlico soils have sand within 50 inches of the surface.

Dorovan muck (Do).—This is a nearly level, very poorly drained, organic soil on low flats near rivers and lakes and in large cypress ponds and hardwood swamps. It consists of highly decoposed organic material 52 inches or more thick. In most years the water table is within 10 inches of the surface for 9 to 12 months. Many areas are covered with shallow water most of the time. In dry seasons the water table is 10 to 30 inches below the surface.

Included with this soil in mapping are a few small areas of Pamlico muck and a few areas that are slightly acid instead of strongly acid. Also included are mineral soils around the edges of some areas and, in some places, small islands of mineral soils.

Natural vegetation in wooded areas consists of cypress, loblolly pine, bay, blackgum, and southern red maple and, in open marsh areas, maidencane, sawgrass, buttonbush, and smilax. Most areas are still in native vegetation, but a few are in improved pasture grasses.

The major limitation to the use of this soil for cultivated crops is excess water. If drainage and water control measures are adequate, this soil is excellent for vegetable crops. Drainage can be established through a system of dikes, canals, ditches, and pumps. Control structures are needed to keep the water table at proper depth for crops and to reduce the hazard of subsidence by oxidation of organic matter. Other management practices include the use of cover crops; the frequent application of fertilizer that is high in content of all plant nutrients, except nitrogen; and control of soil reaction.

This soil is not suited to citrus trees.

If properly managed, the soil is well suited to pastures of improved grass or grass and clover mixtures. Management practices include a water control system designed to remove excess surface water and maintain the water table at favorable depths, adequate application of fertilizer and lime where needed, and control of grazing. Capability unit IIIw-5; woodland group 1; range management group 1.

Duplin Series

The Duplin series consists of gently sloping, moderately well drained soils in narrow areas around lakes, ponds, and other depressions. These soils formed in unconsolidated, dominantly clayey sediments.

In a representative profile the surface layer is very dark gray loamy sand about 5 inches thick over 8 inches of brown loamy sand. Below this, to a depth of 32 inches, is sandy clay that is mottled in shades of red, yellow, and brown. At depths between 32 and 50 inches, is mottled gray, yellow, and red sandy clay loam. The underlying material, to a depth of 64 inches, is light-gray sandy loam mottled in shades of gray, red, and brown.

Permeability is rapid in the loamy surface layer, slow in the upper part of the subsoil and moderate in the lower part, and moderately rapid in the underlying material. Available water capacity is moderate in all layers. The organic-matter content is low, and natural fertility is moderate.

Representative profile of Duplin loamy sand:

A1—0 to 5 inches, very dark gray (10YR 3/1) loamy sand; moderate, medium, granular structure; friable; many small, medium, and large roots; very strongly acid; clear, smooth boundary.

A2—5 to 13 inches, brown (10YR 5/3) loamy sand; weak, fine, granular, structure; very friable; few, fine, distinct, very dark gray (10YR 3/1) streaks along old root channels; common fine and medium roots; very strongly acid; abrupt, smooth boundary.

B21t—13 to 29 inches, mottled, brownish-yellow (10YR 6/6), brown (10YR 5/3), and red (10YR 4/8) sandy clay; moderate, medium, subangular blocky structure; firm; common fine and medium roots; very strongly acid; clear, irregular boundary.

B22t—29 to 32 inches, gray (N 5/0) sandy clay; many, medium, prominent mottles of pale brown (10YR 6/3), yellowish brown (10YR 5/6), and red (2.5YR 4/6) and few, medium, faint mottles of dark gray (N 4/0); moderate, medium, subangular blocky structure; firm, few patchy clay films on ped faces; few fine and medium roots; very strongly acid; gradual, wavy boundary.

B3tg—32 to 50 inches, mottled gray (N 5/0), light-gray (N 6/0), yellow (10YR 7/6), and red (2.5YR 4/8) structure; few patchy clay films in pores; few fine and medium roots; very strongly acid; gradual, wavy boundary.

Cg—50 to 64 inches, light-gray (5Y 7/1) sandy loam; many, medium, distinct and prominent mottles of olive gray (5Y 5/2), dark red (10R 3/6), strong brown (7.5YR 5/8), and weak red (10R 5/2); weak, medium, granular structure; firm; very strongly acid.

The A1 horizon ranges from black to gray in color and from 3 to 8 inches in thickness. In places where the color is black or very dark gray, the A1 horizon is less than 6 inches thick. The A2 horizon ranges from dark grayish brown or brown to pale brown, but not all profiles have an A2 horizon. The A horizon ranges from 6 to 20 inches in total thickness.

The B2t horizon is reticulately mottled with shades of yellow, brown, red, and gray. It ranges from 8 to 24 inches in thickness and from sandy clay to clay. The B3tg horizon and Cg horizon are gray or light gray and have few to common mottles in shades of yellow, red, and brown.

Duplin soils are strongly acid or very strongly acid throughout the profile. In most years the water table is 40 to 60 inches below the surface for 6 to 9 months, but in wet seasons it is only 10 to 40 inches below the surface for brief periods.

The annual temperature of the Duplin soils mapped in this survey area is slightly higher than the defined range for the Duplin series, but this difference does not alter the usefulness and behavior of the soils.

Duplin soils are associated with Delks, Eureka, Immokalee, Myakka, Meggett, and Rains soils. They do not have a cemented Bh horizon, which is typical of Delks, Immokalee, and Myakka soils. They are more acid and better drained than Meggett soils. They are better drained than Eureka and Rains soils and have a higher clay content in the subsoil than Rains soils have.

Duplin loamy sand (Du).—This is a moderately well drained soil that is on narrow rims around lakes, ponds, and depressions. It has slopes ranging from 2 to 5 percent. In most years the water table is 40 to 60 inches below the surface for more than 6 months, but in wet seasons it is less than 40 inches from the surface for brief periods.

Included with this soil in mapping are small areas where the surface layer of loamy sand is 20 to 40 inches thick.

Natural vegetation consists of slash pine and longleaf pine and an understory of gallberry, saw-palmetto, and grasses.

If the control of water is adequate, this soil is suited to vegetable crops, but the control of water is difficult because the subsoil has slow permeability. Both drainage and irrigation are necessary. This soil responds well to fertilizer.

This soil is poorly suited to citrus trees because it is wet and in low, cold areas. Careful control of water, protection from cold, and good management are needed in areas planted to citrus trees. A careful study of the site should be made before trees are planted.

If this soil is given proper surface drainage and receives fertilizer in moderate amounts, it is excellent for improved pasture. Bahiagrass and bermudagrass are adapted grasses. Capability unit IIIw-3; woodland group 2; range management group 5.

Eureka Series

The Eureka series consists of nearly level, poorly drained soils in broad, low areas or in small depressions. These soils formed in thick beds of acid, marine sandy clay or clay.

In a representative profile the surface layer is about 4 inches of black loamy fine sand and, below this, about 7 inches of grayish-brown loamy fine sand. The next layer is about 9 inches of gray sandy clay that has red and brownish mottles. Between depths of 20 and 72 inches is gray clay that has mottles in shades of brown, red, and gray.

Permeability is moderately rapid in the surface layer, moderately slow in the upper part of the subsoil, and slow to very slow in the lower part of the subsoil. The subsoil extends to a depth of 72 inches or more. Available water capacity is moderate in the surface layer and moderately high in the clay layer. Natural fertility and organic-matter content are moderate.

Representative profile of Eureka loamy fine sand:

01—1 inch to 0, fresh litter of leaves, twigs, and needles.

A1—0 to 4 inches, black (N 2/0) loamy fine sand; moderate, fine, granular structure; friable; common fine and medium roots; very strongly acid; gradual, wavy boundary.

A2—4 to 11 inches, grayish-brown (10YR 5/2) loamy fine sand; common, medium, faint, gray and pale-brown mottles; moderate, fine granular structure; friable; common fine and medium roots; very strongly acid; abrupt, wavy boundary.

B21tg—11 to 20 inches, gray (N 5/0) sandy clay; common, medium, prominent, strong-brown (7.5YR 5/8) and red (10R 4/6) mottles; moderate, medium, subangular blocky structure parting to weak, fine, angular blocky; firm; common fine and medium roots; discontinuous clay films on ped faces; very strongly acid; gradual, wavy boundary.

B22tg—20 to 57 inches, gray (N 5/0) clay; many, medium, prominent, strong-brown (7.5YR 5/8) and red (10R 4/6) mottles; moderate, medium, subangular blocky structure; firm; patchy clay films on some peds; common fine and medium roots; strongly acid; gradual, wavy boundary.

B23tg—57 to 72 inches, gray (N 5/0) clay; many, medium, prominent mottles of red (10R 4/6) and strong brown (7.5YR 5/8) and many, medium, faint mottles of light brownish gray; moderate, medium, subangular blocky structure; firm; few fine roots; red mottles that decrease with increasing depth; clay films on peds; strongly acid.

The A1 horizon ranges from black to dark gray in color and from 2 to 8 inches in thickness. The A2 horizon ranges from grayish brown to light gray in color, and from 3 to 12 inches in thickness. It has few to many mottles in shades of gray, yellow, and brown.

The Bt horizon ranges from sandy clay loam to clay and from dark gray to light gray. It has few to many mottles in shades of yellow, brown, red, and gray. The Btg horizon extends below a depth of 60 inches. In places the lower part of the Btg horizon has lenses and small pockets of coarser textured material.

Eureka soils are strongly acid or very strongly acid throughout the profile. In most years the water table is within 10 inches of the surface for 2 to 6 months, but it is 10 to 40 inches below the surface the rest of the time. In most years the depressions are covered with shallow water for 2 to 9 months.

Eureka soils are associated with Delks, Iberia, Meggett, Rains, and Sellers soils. Eureka soils are more acid than Iberia and Meggett soils. They have a coarser textured A horizon than Iberia soils. They have a clayey B horizon, whereas the Rains soils have a loamy B horizon and Sellers soils, below the A horizon, have no B horizon but only a sandy C horizon to a depth of 80 inches or more. Eureka soils do not have a dark-colored, strongly cemented Bh horizon, which is typical of Delks soils.

Eureka loamy fine sand (Es).—This is a nearly level, poorly drained soil that is in broad, low areas or in small depressions. It has a clayey subsoil within 20 inches of the surface. In most years the water table is within 10 inches of the surface for 2 to 6 months and the depressions are covered with shallow water for 2 months or longer.

Included with this soil in mapping are small areas where the surface layer is more than 20 inches thick and a few other areas where there is a thin, dark-colored, weakly cemented layer above the clayey subsoil. Also included are a few areas where the soil is alkaline instead of acid and, in several places along the Oklawaha River, a few narrow bands that have slopes of 2 to 8 percent.

Natural vegetation is loblolly pine, slash pine, water oak, live oak, and sweetgum and an understory of gallberry, smilax, waxmyrtle, scattered palmetto, and grasses. Most areas of this soil are in natural vegetation, but a few are in improved pasture and vegetable gardens.

The limitations to the use of this soil for cultivated crops are severe because the soil is excessively wet. Unless drained, the soil is not suited to cultivation. The clayey subsoil has very slow permeability, and water control is difficult. The root zone is restricted and limits the choice of crops. This soil has good texture, moderate organic-matter content, moderate available water capacity in the surface soil, and moderate natural fertility. These are favorable qualities for cultivated crops and pasture if the soil is adequately drained. The choice of cultivated crops is limited to those that are shallow rooted. Shallow ditches and bedding of rows are needed to provide surface drainage. A cropping system that makes full use of cover crops and crop residue should be used.

This soil is not suited to citrus trees. It is well suited to pasture grasses, but simple drainage is needed to remove excess surface water. Legumes, such as white clover, grow well with pasture grasses. Proper management of pasture includes use of adequate fertilizer, control of weeds, and control of grazing. Capability unit IIIw-4; woodland group 3; range management group 3.

Eureka Series, Thick-Surface Variant

The Eureka series, thick-surface variant, consists of nearly level, very poorly drained soils in low areas and in depressions. These soils formed in thick beds of acid, marine sand clay or clay.

In a representative profile the surface layer is about 11 inches of black loamy sand. Below this, the subsurface layer is about 7 inches of grayish-brown sand. Next is gray sandy clay that extends to a depth of about 33 inches and that grades gradually to clay, which extends to a depth of more than 64 inches. The sandy clay and clay are mottled in shades of gray, brown, yellow, or red.

Permeability is moderately rapid in the surface layer and rapid in the sandy subsurface layer, but it decreases with increasing depth from moderately slow to very slow in the subsoil. Available water capacity is moderate in the surface layer, low in the sandy subsurface layer, but moderately high in the subsoil. Natural fertility is moderate.

Representative profile of Eureka loamy sand, thick-surface variant:

A11—0 to 4 inches, black (N 2/0) loamy sand; moderate, medium, granular structure; friable; many fine and medium roots; very strongly acid; gradual, wavy boundary.

A12—4 to 11 inches, black (10YR 2/1) loamy sand; moderate, medium, granular structure; friable; common fine and medium roots; very strongly acid; clear, smooth boundary.

A2—11 to 18 inches, grayish-brown (10YR 5/2) sand; few, faint mottles of gray and few, fine, distinct mottles of brown (7.5YR 4/2); weak, fine, granular structure; very friable; few fine roots; very strongly acid; abrupt, smooth boundary.

B21tg—18 to 33 inches, gray (10YR 5/1) sandy clay; many, coarse, faint, mottles of light gray, containing lenses of sand, and many coarse, prominent mottles of light red (10YR 6/8) and strong brown (7.5YR 5/8); moderate, medium, subangular blocky structure; firm; few patchy clay films on ped faces; few fine roots; very strongly acid; gradual, wavy boundary.

B22tg—33 to 64 inches, gray (10YR 5/1) clay; many, coarse, prominent mottles of red (10R 4/8) and strong-brown (7.5YR 5/8) and many coarse, faint mottles of light gray; moderate, medium, subangular blocky structure; firm; clay films complete on ped faces; very strongly acid.

The A1 horizon is black, very dark gray, or very dark grayish brown in color and ranges from 10 to 20 inches in thickness. The A2 horizon is gray or grayish-brown sand or loamy sand 2 to 12 inches thick. It is faintly to distinctly mottled with shades of gray, yellow, or brown.

The Btg horizon ranges from sandy clay loam to clay and is dark gray to light gray. It has few to many mottles in shades of yellow, brown, red, and gray.

Eureka soils, thick-surface variant, are strongly acid or very strongly acid throughout the profile. In most years the water table is within 10 inches of the surface for 6 to 9 months and between 10 and 40 inches below the surface the rest of the time. Depressions are covered with shallow water for 3 to 9 months of the year.

These soils are similar to Eureka soils, but they have a dark-colored surface layer more than 10 inches thick. Because the acreage is small, no series has been established for these soils, and they are related to the most similar soils as a variant.

Eureka soils, thick-surface variant, are associated with Iberia. Meggett, Eureka, Rains, Sellers, and Delks soils. They are more acid than Iberia and Meggett soils and have a thicker, darker colored A1 horizon, which in Iberia soils is also coarser textured. Eureka soils have a clayey Btg horizon, whereas Rains soils have a loamy one. Eureka soils have a clayey Btg horizon, whereas Sellers soils are sandy to a depth of 80 inches or more. They do not have a Bh horizon, at a depth of less than 30 inches, whereas Delks soils do have.

Eureka loamy sand, thick-surface variant (Er).—This is a nearly level, very poorly drained soil that is in broad, low areas and in depressions. It has a thick, black surface layer and a clayey subsoil that begins within 20 inches of the surface. In most years the water table is within 10 inches of the surface for 6 months or more, and each year the depressions are covered with shallow water for 3 months or more.

Included with this soil in mapping are small areas where the surface layer is less than 10 inches thick. Also included are areas where the subsoil is sandy clay loam, a few areas where the soil is alkaline rather than acid, and small areas where the surface layer is clay or clay loam.

Natural vegetation is mainly maple, bay, and sweetgum and an understory of wetland shrubs, vines, and grasses.

This soil is not suited to cultivated crops, because it is wet. Because the soil is in low areas and has a very slowly permeable subsoil, the establishment of a system that adequately controls water is not feasible in most places. The risk of periodic flooding is also a limitation.

This soil is not suited to citrus trees.

Several kinds of improved pasture grasses and clover can be grown on this soil, but a drainage system that quickly removes excess surface water is essential. Good pasture management also includes use of fertilizer, control of weeds, and control of grazing. Capability unit Vw-1; woodland group 3; range management group 3.

Eustis Series

The Eustis series consists of gently sloping, somewhat excessively drained, sandy soils on broad, high ridges. These soils formed in thick deposits of coarse-textured marine or fluvial sediments.

In a representative profile the surface layer is about 5 inches of very dark grayish-brown sand, and, below this, about 45 inches of brown sand, the upper part of which has black streaks along old root channels in some places. Between depths of about 50 and 84 inches are alternating thin bands of strong-brown loamy sand and very pale brown sand. The bands of loamy sand and sand are thicker in the lower part of this layer.

Eustis soils have very rapid permeability in the sandy surface layer and rapid or moderately rapid permeability in the banded layer. The organic-matter content and natural fertility are low. Available water capacity is very low in the sand layers and low in the bands of sand and loamy sand.

Representative profile of Eustis sand:

O1—1 inch to 0, fresh and partly decomposed leaves, twigs, bark, and stems.

A1—0 to 5 inches, very dark grayish-brown (10YR 3/2) sand; weak, fine, granular structure; very friable; many fine, medium, and coarse roots; strongly acid; gradual, wavy boundary.

A21—5 to 35 inches, brown (10YR 5/3) sand; single grained; loose; common fine and medium roots; common streaks of very dark grayish brown (10YR 3/2) along root channels; strongly acid; gradual, wavy boundary.

A22—35 to 50 inches, brown (10YR 5/3) sand; single grained; loose; common fine roots in upper few inches; common, medium, faint, pale-brown mottles; strongly acid; gradual, wavy boundary.

A2&B21t—50 to 75 inches, bands of strong-brown (7.5YR 5/6) loamy sand, ranging from ½ to 2 inches in thickness, alternate with bands of very pale brown (10YR 7/3) sand, up to 1 inch thick; loamy sand has weak, fine, granular structure, but sand is single grained; common balls of loamy sand up to 1 inch in diameter; sand grains in loamy sand are coated with clay; strongly acid; gradual, wavy boundary.

A2&B22t—75 to 84 inches, bands of very pale brown (10YR 8/3) sand, 2 to 4 inches thick, alternate with bands of strong-brown (7.5YR 5/6) loamy sand as much as 2 inches thick; sand is single grained, and loamy sand has weak, fine, granular structure; sand grains in loamy sand are coated with clay; strongly acid.

The A1 horizon ranges from grayish brown to very dark grayish brown in color and from 5 to 7 inches in thickness. The A2 horizon is brown, light yellowish brown, and pale brown and 9 to 50 inches thick. In places it has splotches or mottles of gray to very pale brown. These splotches are small and do not indicate wetness. In the A2&B2t horizon, bands of yellowish-brown, strong-brown, or yellowish-red loamy sand or coarse sandy loam, ⅛ to 2 inches thick, alternate with bands of gray to very pale brown sand, 1 to 6 inches thick.

Eustis soils are strongly acid or very strongly acid throughout the profile. The water table is below a depth of 60 inches.

The annual temperature of Eustis soils in this survey area is slightly higher than the defined range for the Eustis series, but this difference does not alter the usefulness and behavior of the soils.

Eustis soils are associated with Astatula, Orlando, and Wicksburg soils. Eustis soils have a laminated A2&B2 horizon, which Astatula and Orlando soils do not have. They do not have a well-developed B horizon, whereas Wicksburg soils do. They have a lighter colored A2 horizon, which is lacking in Orlando soils.

Eustis sand (Eu).—This is a somewhat excessively drained soil that is on broad, gently undulating, high ridges. It has a thick, sandy surface layer and a weakly developed subsoil consisting of alternating thin bands of loamy sand and sand. Slope ranges from 2 to 5 percent. The water table is below a depth of 60 inches.

Included with this soil in mapping are some areas where the soils are less acid than Eustis soils. Also included are small areas of Astatula sand and areas of similar soils that have a uniform subsoil of loamy sand.

Natural vegetation consists of open, parklike stands of longleaf pine and scrub oak and a ground cover of wiregrass. Much of the acreage is in citrus groves.

The limitations to the use of this soil for cultivated crops are severe because of very low available water capacity in the surface layer and rapid leaching of plant nutrients. Natural fertility is low.

Although it is poorly suited to most cultivated crops, Eustis sand is well suited to a few special crops, such as watermelon. All cultivated crops should be grown in rotation with soil-improving cover crops, and liberal use of fertilizer is necessary.

This soil is well suited to citrus trees, but in some places the trees are subject to freezing in winter. If this soil is used for citrus trees, cover crops between the trees, minimum tillage, application of lime and fertilizer, and irrigation during dry periods are necessary.

This soil is moderately well suited to bahiagrass, bermudagrass, and other improved pasture grasses. If carefully managed it is well suited to deep-rooted legumes, such as hairy indigo. Careful control of grazing and frequent use of fertilizer are necessary. Capability unit IIIs–3; woodland group 6; range management group 5.

Everglades Series

The Everglades series consists of nearly level, very poorly drained, organic soils more than 52 inches thick. These soils are in depressions and fresh-water marshes along flood plains of the river. They formed in beds consisting of the remains of hydrophytic, fibrous, nonwoody plants.

In a representative profile the surface layer is dark reddish-brown, fibrous, organic material about 39 inches thick. Between depths of 39 and 100 inches is a mixture of dark reddish-brown and dark-brown, partly decomposed, fibrous, organic materials.

Everglades soils have rapid permeability. Available water capacity is very high in all organic layers. The organic-matter content and nitrogen content are very high.

Representative profile of Everglades muck:

Oe1—0 to 39 inches, dark reddish-brown (5YR 2/2) rubbed and unrubbed, fibrous, partly decomposed organic material (muck); friable; estimated fiber content is about 35 percent unrubbed and 20 percent rubbed; fibers are less than 3 millimeters in length; sodium pyrophosphate extract color is light gray (10YR 7/2); medium acid; gradual, wavy boundary.

Oe2—39 to 100 inches, dark reddish-brown (5YR 3/2) and dark-brown (7.5YR 3/2) unrubbed, dark reddish-brown (5YR 2/2) rubbed, fibrous, partly decomposed organic material; friable; estimated fiber content is 45 percent unrubbed and 25 percent rubbed; fibers are less than 3 millimeters in length; sodium pyrophosphate extract color is light gray (10YR 7/2); medium acid.

The Oe horizon is dark reddish brown, dark brown, very dark gray, or black and ranges from 52 to more than 100 inches in thickness. The organic material is 33 to 66 percent fibrous before rubbing and 10 to 40 percent after rubbing.

Everglades soils are medium acid to moderately alkaline throughout. In most years the water table is within 10 inches of the surface for 9 to 12 months, and the water is frequently above the surface. In dry seasons the water table is lower but seldom at a depth of more than 30 inches.

Everglades soils are associated with Astor, Sellers, Dorovan, Pamlico, and Terra Ceia soils. They are organic soils, whereas Astor and Sellers soils are mineral soils. Everglades soils are more fibrous and less acid than Dorovan and Pamlico soils. They are thicker than Pamlico soils, which have sand within 52 inches of the surface. Everglades soils are more fibrous than Terra Ceia soils.

Everglades muck (Ev).—This is a nearly level, very poorly drained, organic soil that is in depressions and fresh-water swamps along flood plains of the river. The fibrous, partly decomposed organic material is more than 52 inches thick. In most years the water table is within 10 inches of the surface for 9 to 12 months, and shallow water covers some areas much of the time. In dry seasons the water table is 10 to 30 inches below the surface.

Included with this soil in mapping are areas where much of the soil has been drained and now has a less fibrous surface layer. These areas are near the Oklawaha River between Moss Bluff and Starks Ferry. Also included are a few areas where the soil has sandy or clayey mineral layers at a depth of 40 to 50 inches, and a few areas where the soils are strongly acid. Other inclusions are narrow areas of mineral soils around the edges of organic soils, and small islands of mineral soils within some areas of organic soils.

Natural vegetation consists of thick stands of sawgrass in some areas and willow, loblolly pine, bay, buttonbush, and maidencane in others. Some of this soil is used to grow corn for silage. Excess water is the major limitation to the use of this soil for cultivated crops. If adequate drainage and water control measures are used, this soil is excellent for vegetable crops. Drainage can be established through a system of dikes, canals, ditches, and pumps. Control structures are needed to keep the water table at the proper depth for crops and to reduce the hazard of subsidence by oxidation of the organic matter. Other management practices include the use of cover crops; frequent application of fertilizer that is high in content of all plant nutrients, except nitrogen; and control of soil reaction.

This soil is not suited to citrus trees.

Under intensive management, Everglades muck is well suited to pasture of improved grasses and clover mixtures, and some areas are used for improved pasture. Among proper management practices are a water control system designed to remove excess surface water and maintain the water table at a favorable depth; adequate application of fertilizer and lime, where needed; and control of grazing. Capability unit IIIw–5; woodland group 1; range management group 1.

Iberia Series

The Iberia series consists of nearly level, very poorly drained, clayey soils that are in low areas and depressions near the Oklawaha River. These soils formed in thick deposits of clayey marine sediment.

In a representative profile the surface is black clay about 7 inches thick. Below this is about 10 inches of very dark grayish-brown clay. Between depths of about 17 and 38 inches is olive-gray clay that has light olive-brown mottles and light-gray lime nodules. Next, and extending to a depth of about 64 inches, is gray clay that has yellowish-brown and strong-brown mottles.

Iberia soils have very slow permeability and high available water capacity in all layers. Natural fertility and organic-matter content are moderate.

Representative profile of Iberia clay:

O1—2 inches to 0, fresh litter of leaves, twigs, stems, and needles.

A1—0 to 7 inches, black (10YR 2/1) clay; weak, medium and fine, granular structure; friable; many fine, medium, and coarse roots; mildly alkaline; clear, wavy boundary.

B21g—7 to 17 inches, very dark grayish-brown (10YR 3/2) clay; moderate, coarse, subangular blocky structure; very firm, very plastic; pressure faces are prominent on peds; common fine, medium, and coarse roots; few fine, distinct, soft to hard, light-gray (10YR 6/1) lime nodules; mildly alkaline; clear, wavy boundary.

B22g—17 to 38 inches, olive-gray (5Y 5/2) clay; few, fine, prominent, light olive-brown (2.5Y 5/6) mottles; moderate, coarse, subangular blocky structure; very firm, very plastic; pressure faces are prominent and complete on peds; few slickensides that do not intersect; common fine, medium, and coarse roots; common, fine, prominent, soft to hard, light-gray (10YR 6/1) lime nodules; mildly alkaline; clear, wavy boundary.

B3g—38 to 48 inches, gray (N 5/0) clay; common, medium, distinct, yellowish-brown (10YR 5/4) and brown (7.5YR 4/4) mottles; moderate, coarse, subangular blocky structure; very firm, very plastic; pressure faces are distinct and broken on peds and in pores; common fine and medium roots; common light-gray (10YR 6/) lime nodules; mildly alkaline; clear, wavy boundary.

C—48 to 64 inches, gray (N 5/0) clay; reticulate mottles of yellowish brown (10YR 5/6) and strong brown (7.5YR 5/6); massive; very firm, very plastic; common fine and medium roots; many prominent lime nodules; mildly alkaline.

The A1 horizon is black, very dark gray, or very dark grayish brown and ranges from 3 to 8 inches in thickness. The B21g horizon ranges from very dark grayish brown to gray in color and from 7 to 10 inches in thickness. The A1 and B21g horizons range from 10 to 18 inches in combined thickness. The B22g and B3g horizons are dark grayish, brown, dark gray, gray, or olive gray and have mottles in shades of brown and gray. The Bg horizon is sandy clay or clay.

Iberia soils are neutral to moderately alkaline throughout the profile. In most years the water table is within 10 inches of the surface for 6 to 9 months. Each year the depressions are covered with shallow water for 3 to 9 months. During dry seasons the soil may be dry and hard to a depth of 30 inches or more.

The annual temperature of the Iberia soils mapped in this survey area is slightly higher than the defined range for the Iberia series, but this difference does not alter the usefulness or behavior of these soils.

Iberia soils are associated with Astor, Delks, Eureka, Meggett, and Rains soils. Iberia soils are clayey throughout, whereas Astor soils are sandy to a depth of 80 inches or more. They lack a sandy A horizon and a cemented Bh horizon, which Delks soils have. Iberia soils have a thicker, darker colored surface layer than Eureka, Meggett, and Rains soils. They also have a clayey A horizon, whereas Eureka. Meggett, and Rains soils have a loamy A horizon. They are neutral to moderately alkaline, whereas Eureka and Rains soils are acid.

Iberia clay (Ib).—This is a nearly level, very poorly drained soil that is in low areas and depressions near the Oklawaha River. It commonly has a thick, dark-colored surface layer from which tongues extend into the plastic material of the subsoil. In most years the water table is within 10 inches of the surface for 6 months or more, and some areas are covered with shallow water for 3 to 9 months. During dry seasons the water table is 10 to 30 inches below the surface.

Included with this soil in mapping are areas where the surface layer is mucky, and some areas that have a thin, leached layer between the surface layer and the subsoil. Also included are areas where the subsoil is sandy clay loam and other areas where the subsoil is underlain at a depth of about 40 inches by loamy sand or sand. Areas of soil that are slightly acid to medium acid are also included.

Natural vegetation consists of sweetgum, hickory, hornbeam, magnolia, cabbage palm, wild grape, smilax, and poison-ivy.

This soil is generally not suited to cultivated crops or citrus trees. Its use is severely limited by the very slow permeability of the clay, the risk of periodic flooding, and the difficulty of obtaining adequate drainage. The clay surface layer can be tilled safely only within a narrow range of moisture content.

Good pasture can be grown on this soil, but intensive management is necessary. A drainage system properly designed to remove excess surface water is essential. If adequately fertilized, this soil is well suited to grass-clover pastures. Grazing should be controlled and rotated to permit the growth of healthy plants and to prevent the puddling or packing of the surface layer by animals. Capability unit Vw-1; woodland group 3; range management group 3.

Immokalee Series

The Immokalee series consists of nearly level, poorly drained, sandy soils that are mainly on broad, low ridges in flatwoods. Some areas are depressions between high sand ridges or around ponds and in sloughs. These soils formed in beds of marine sand.

In a representative profile the surface layer is black sand about 5 inches thick and, below this, light-gray sand about 29 inches thick. Between depths of about 34 and 54 inches is a layer of black sand that is weakly cemented by organic matter. Below this, and extending to a depth of 72 inches, is brown sand.

Immokalee soils have moderate to moderately rapid permeability in the weakly cemented layers and rapid permeability in all other layers. The available water capacity is moderate in the weakly cemented layers but very low in all other layers. Organic-matter content and natural fertility are low.

Representative profile of Immokalee sand:

A1—0 to 5 inches, sand, black (10YR 2/1) rubbed; weak, fine, granular structure; very friable; many fine, medium, and coarse roots; the color results from the mixture of light-gray sand grains and black organic matter; very strongly acid; clear, smooth boundary.

A2—5 to 34 inches, light-gray (10YR 7/1) sand; few, medium, distinct, grayish-brown (10YR 5/2) mottles; single grained; loose; common fine, medium, and large roots; very strongly acid; clear, wavy boundary.

B2h—34 to 54 inches, black (5YR 2/1) sand; many, coarse, dark reddish-brown (5YR 2/2) and dark-brown (7.5YR 3/2) mottles; common, medium, distinct, dark grayish-brown (10YR 4/2) and gray (N 6/0) streaks along old root channels; moderate, coarse, subangular blocky structure; firm, weakly cemented; few fine and medium roots; sand grains are coated, except in old root channels; very strongly acid; clear, wavy boundary.

C—54 to 72 inches, brown (10YR 5/3) sand; single grained; loose; few fine roots; few, fine, faint dark-brown mottles; sand grains are mostly not coated; very strongly acid.

Where the A1 horizon is black or very dark gray when rubbed, it ranges from 2 to 6 inches in thickness, but where it is dark gray when rubbed, its thickness ranges from 3 to 12 inches. The A2 horizon is gray to light gray and is 20 to 40 inches thick. Few to many streaks from the A1 horizon extend into the A2 horizon. The entire A horizon is 30 to 60 inches thick. The B2h horizon is black to dark reddish brown and is 4 to 24 inches thick. In many places there are dark-brown to black mottles and lighter-colored streaks along old root channels. The Bh horizon ranges from 1 to 6 percent in content of organic matter. In some places there is a brown to dark grayish-brown B3 horizon that is 6 to 12 inches thick and that has common to few, reddish-brown, weakly cemented fragments. The C horizon is brown to white sand that extends to a depth of 80 inches or more. It has common streaks or mottles in brownish colors.

Immokalee soils are strongly acid and very strongly acid in all horizons. In most years the water table is within 10 inches of the surface for 1 to 2 months. It is within 40 inches more than half the time, but in dry seasons it is 40 to 60 inches below the surface. Occasionally, for a few days in wet seasons, water is above the surface of the soils in some places.

Immokalee soils are associated with Sellers, Myakka, Basinger, Pomello, Dekes, and St. Johns soils. Immokalee soils are better drained than Sellers soils, and they have thin A1 and Bh horizons, whereas Sellers soils have a thick, black A1 horizon underlain by a sandy C horizon. They are more poorly drained and have a thicker A1 horizon than Pomello soils. Immokalee soils have a thinner A1 horizon than St. Johns soils. They have a Bh horizon that begins below a depth of 30 inches, whereas St. Johns, Myakka, and Delks soils have a Bh horizon that begins within 30 inches of the surface. Immokalee soils have a well-developed Bh horizon, but this horizon is only rudimentary in Basinger soils.

Immokalee sand (Im).—This is a nearly level, poorly drained soil that has a layer of light-colored, highly leached sand, 30 or more inches thick, over a layer of dark-colored, weakly cemented sand. The dark color results from organic matter that coats and weakly cements the sand grains together. This soil is in broad areas of flatwoods and in low areas between sand ridges, ponds, and sloughs. In most years the water table is within 10 inches of the surface for 1 or 2 months. It is at a depth of less than 40 inches more than half the time, but in dry seasons it is at a depth of more than 40 inches. Occasionally, for a few days in wet seasons, some areas are covered with shallow water.

Included with this soil in mapping are areas of Myakka sand and some areas where the weakly cemented layer is underlain by loamy material instead of sand.

Natural vegetation is slash pine and longleaf pine and an understory of saw-palmetto, gallberry, blueberry, runner oak, deerstongue and grasses. Most areas are still in natural vegetation, but some are used for improved pasture grasses.

The limitations to the use of this soil for cultivated crops are severe because there are periods of excessive wetness and because poor soil qualities reduce the choice of plants and require the use of intensive management. This soil has low natural fertility and very low available water capacity above the weakly cemented layer, which restricts the root zone for many plants.

This soil is moderately well suited to special crops, such as vegetables, in areas where other factors, such as availability of irrigation water and freedom from frost, make these crops feasible. Intensive management practices are necessary, and the water table must be carefully controlled. Drainage-subsurface irrigation systems should be carefully designed, installed, and maintained.

This soil is poorly suited to citrus trees. Poor drainage, susceptibility to freezing, and limited root zone, which is caused by cementation of subsurface layers, adversely affect the growth of trees.

This soil is well suited to pasture of improved grasses, but in wet seasons excess water must be removed by a simple drainage system. Liberal use of fertilizer is necessary. Clover can be grown with grasses but should be irrigated to assure good growth. Capability unit IVw-1; woodland group 11; range management group 9.

Made Land

Made land consists of soil materials that have been reworked and shaped by earth-moving equipment. Many such areas were once low sloughs, marshes, shallow ponds, or swamps that are now filled with soil materials to the level of the surrounding ground or higher. A few areas were originally high ridges that have been graded to below the natural level of the ground. In a few places the original soils have been so reworked that they are no longer recognizable.

Permeability is highly variable and ranges from rapid to slow. The available water capacity is very low to moderately high. Natural fertility and organic-matter content are generally low.

The soil material in Made land is largely material that was dredged from river and lake bottoms, and then deposited on other soils. Much of this material consists of sand and shell fragments, but some is organic material and clayey material. Areas of Made land do not have an orderly sequence of layers but are a mixture of lenses, streaks, and pockets. The soil material varies within short distances. Sandy to clayey material occurs in the same area in many places, but two areas are seldom alike. Transported soil materials that make up Made land generally are 12 to 48 inches thick but, in a few places, are thicker than 60 inches. Each area of Made land should be examined and evaluated before it is used because this land type is so variable. Most excavated areas are on ridges that originally consisted of Astatula, Paola, or St. Lucie soils. The excavations vary in depth, but generally they cut deep into the substratum. Drainage is variable: some areas are well drained; others have a water table that is between 20 and 60 inches from the surface during periods of normal rainfall.

Made land (Ma).—This nearly level to gently sloping land type is in areas of variable soil materials that have been used to fill low sloughs, marshes, shallow ponds, or swamps to or above the level of the surrounding ground. A few areas were once high ridges that have been graded or that have been reworked in places. Most areas of Made land have been leveled and shaped by earth-moving equipment. Drainage is variable. Some areas are well drained, and some have a water table that is within 20 to 60 inches of the surface during periods of normal rainfall.

Areas of Made land are most common near urban centers or along major highways, although some are near lakes or along rivers. Smoothing and shaping have made some areas better suited to use for building sites, roadways, recreational areas, and related uses. Most areas are poorly suited to cultivated crops. Some of the better areas are suited to improved pasture or pine trees. Not placed in a capability unit or woodland group; range management group 10.

Meggett Series

The Meggett series consists of nearly level, poorly drained soils that are in broad areas in the flatwoods. These soils formed in marly and clayey marine sediments.

In a representative profile the surface layer is very dark gray loamy sand about 5 inches thick and, below this, grayish-brown loamy sand about 5 inches thick.

Next is dark-gray clay that extends to about 19 inches below the surface. Between depths of about 19 and 29 inches is gray clay that has mottles in shades of yellow and brown. Next, to a depth of 41 inches, is light olive-gray clay that has yellowish and brownish mottles and many, white, soft nodules of lime. Below this is white marl that extends to a depth of more than 60 inches.

Permeability is moderately rapid in the loamy surface layer and slow to very slow in the clayey subsoil. Available water capacity is moderate in the surface layer and high in the clayey subsoil. Organic-matter content and natural fertility are moderate.

Representative profile of Meggett loamy sand:

A1—0 to 5 inches, very dark gray (10YR 3/1) loamy sand; weak, medium, granular structure; friable; many fine and medium roots; slightly acid; clear, smooth boundary.

A2—5 to 10 inches, grayish-brown (10YR 5/2) loamy sand; weak, fine, granular structure; very friable; common fine and medium roots; slightly acid; abrupt, wavy boundary.

B21tg—10 to 19 inches, dark-gray (10YR 4/1) clay; common, medium, distinct, strong-brown (7.5YR 5/6) mottles, and few, fine, prominent, red (2.5YR 4/8) mottles; moderate, coarse, subangular blockly structure; firm, plastic and sticky; few fine and medium roots; clay films on ped faces; neutral; gradual, wavy boundary.

B22tg—19 to 29 inches, gray (N 5/0) clay; many, coarse, distinct, brownish-yellow (10YR 6/6) and yellowish-brown (10YR 5/8) mottles; moderate, coarse, subangular blocky structure; firm, plastic and sticky; few fine roots; clay films on ped faces; neutral; clear, wavy boundary.

B23tg—29 to 41 inches, light olive-gray (5Y 6/2) clay; many, coarse, prominent, brownish-yellow (10YR 6/6) and yellowish-brown (10YR 5/8) mottles; massive; plastic and sticky; many, medium and coarse, white (N 8/0), soft lime fragments and nodules; moderately alkaline; gradual, wavy boundary.

Cca—41 to 60 inches, white (N 8/0) sandy clay (marl); massive; sticky; many, medium and coarse, light olive-gray (5Y 6/2) mottles; moderately alkaline; calcareous.

The A1 horizon ranges from dark gray to black in color and from 3 to 8 inches in thickness. The A2 horizon ranges from light gray to dark grayish brown and from 2 to 6 inches in thickness. It is lacking in some places. The Bg horizon is dark-gray, gray, or light olive-gray sandy clay or clay and ranges from 20 to 50 inches in thickness. It has few to common, fine to coarse mottles in shades of yellow, brown, and red and, in a few places, a few lenses or pockets of sandy material. In the lower part of this horizon are few to many, light-gray, very pale brown, or white, soft marl concretions or fragments. In some places the marl Cca horizon is lacking, and in these places, the Btg horizon is underlain by stratified sandy clay, clay, and sandy materials.

Meggett soils are slightly acid to moderately alkaline in all horizons. In most years the water table is within 10 inches of the surface for 2 to 6 months. It is 10 to 40 inches below the surface the rest of the time.

The annual temperature of Meggett soils mapped in this survey area is slightly higher than the defined range for the Meggett series, but this difference does not alter the usefulness or behavior of the soils.

Meggett soils are associated with Eureka, Rains, and Iberia soils. They are alkaline, whereas Eureka and Rains soils are acid. They have a B horizon of sandy clay or clay, but Rains soils have a B horizon of sandy clay loam. Meggett soils have a loamy A horizon, whereas Iberia soils have a clayey A horizon.

Meggett loamy sand (Me).—This is a nearly level, poorly drained soil that is in broad areas in the flatwoods. This soil has a clayey subsoil beginning within 20 inches of the surface. There are lime nodules in the subsoil in most areas. In most years the water table is within 10 inches of the surface for 2 to 6 months but is 10 to 40 inches below the surface the rest of the time.

Included with this soil in mapping are areas where the dark-colored surface layer is more than 8 inches thick, a few areas where the subsoil is thin or entirely missing, and some areas where the soils are acid.

Natural vegetation is mainly cabbage palm, sweetgum, magnolia, water oak, southern red maple, and numerous vines and shrubs. Much of the acreage, however, is planted to improved pasture grasses.

The limitations to the use of this soil for cultivated crops are severe because the soil is excessively wet. Unless drained, it is not suitable for cultivation. The clayey subsoil is slowly to very slowly permeable, and water control is difficult. Because the root zone is restricted, the choice of crops is limited. Good surface texture and moderate organic-matter content, available water capacity, and fertility are favorable soil qualities for cultivation and pasture if the soil is adequately drained.

Cultivated crops are limited to those that are shallow-rooted, such as vegetables. The use of shallow ditches and the bedding of rows are needed for surface drainage. A cropping system that includes cover crops should be used, and full use should be made of the crop residue.

This soil is not suited to citrus trees.

Pasture grasses grow well on this soil, but simple drainage is necessary to remove excess surface water. Legumes, such as white clover, do well with pasture grasses. Good management of pasture includes use of adequate fertilizer, control of weeds, and control of grazing. Capability unit IIIw-4; woodland group 3; range management group 3.

Myakka Series

The Myakka series consists of nearly level, poorly drained, sandy soils that are mainly in broad areas in the flatwoods and in low areas between sand ridges, ponds, and sloughs. These soils formed in beds of marine sand.

In a representative profile the surface layer is very dark gray sand about 5 inches thick. Below this is about 15 inches of light-gray sand. At depths between about 20 and 29 inches is dark reddish-brown, brown, and dark-brown sand that is weakly cemented by organic matter that coats the sand grains. The next layer is about 7 inches of yellowish-brown sand. Between depths of 36 and 60 inches is light brownish-gray sand.

Permeability is moderate to moderately rapid in the weakly cemented layers but rapid in all other layers. The available water capacity is moderate in the weakly cemented layers and very low in all other layers. Organic-matter content and natural fertility are low.

Representative profile of Myakka sand:

A1—0 to 5 inches, very dark gray (10YR 3/1) rubbed, sand; weak, fine, granular structure; very friable; mixture of light-gray sand grains and black organic matter; many fine, medium, and large roots; very strongly acid; clear, smooth boundary.

A2—5 to 20 inches, light-gray (10YR 7/1) sand; common, fine, distinct, gray (10YR 5/1) and dark-gray (10YR 4/1) mottles and streaks along root channels; single grained; loose; common fine and medium roots; very strongly acid; clear, wavy boundary.

B2h—20 to 29 inches, dark reddish-brown (5YR 3/2) sand; common, medium, faint, reddish-brown mottles; firm; weakly cemented; few fine roots; few uncoated sand grains; very strongly acid; gradual, wavy boundary.

B3&Bh—29 to 36 inches, yellowish-brown (10YR 5/4) sand; single grained; loose; common, medium, distinct, dark-brown (7.5YR 3/2) mottles; weakly cemented fragments that are well coated with organic matter; few fine roots; very strongly acid; gradual, wavy boundary.

C—36 to 60 inches, light brownish-gray (10YR 6/2) sand; many coarse, faint, pale-olive mottles; single grained, loose; few fine roots; very strongly acid.

The A1 horizon ranges from dark gray to black in color when rubbed and from 4 to 8 inches in thickness. The A2 horizon ranges from gray to light gray in color and from 2 to 22 inches in thickness. Few to many streaks from the A1 horizon extend into the A2 horizon. The combined thickness of the A1 and A2 horizons ranges from 6 to 30 inches.

The B2h horizon ranges from black to dark reddish brown and is 6 to 20 inches thick. In many places there are brown to black mottles and lighter colored streaks along old root channels. The organic-matter content of the Bh horizon is 1 to 6 percent. The B3&Bh horizon ranges from dark grayish brown to yellowish brown in color and from 6 to 12 inches in thickness. It has few to common dark-brown to dark reddish-brown mottles.

The C horizon ranges from yellowish brown or light brownish gray to white. In many places it has few to many mottles or streaks of brownish colors.

Myakka soils are strongly acid or very strongly acid in all horizons. The water table is within 10 inches of the surface for 1 or 2 months of most years and within 30 inches most of the time. In dry seasons it is 30 to 60 inches below the surface. In rainy seasons some areas are briefly covered with shallow water, and in most years the depressions are covered with shallow water for 6 to 12 months.

Myakka soils are associated with Immokalee, Pomello, St. Johns, Basinger, and Sellers soils. Myakka and Immokalee soils are similar, but the B2h horizon begins above a depth of 30 inches in Myakka soils and below a depth of 30 inches in Immokalee soils. Myakka soils are more poorly drained than Pomello soils, have a thicker and darker A1 horizon, and have a Bh horizon nearer the surface. They have a better developed Bh horizon than Basinger soils, which have only a weakly developed stained layer. They are better drained than Sellers soils and have a lighter colored A horizon.

Myakka sand (Mk).—This is a nearly level, poorly drained soil that has a dark-colored, weakly cemented layer within 30 inches of the surface. The dark color results from organic matter that coats and weakly cements the sand grains together. This soil occurs mainly as broad areas in flatwoods and as low areas between sand ridges, ponds, and sloughs. The water table is within 10 inches of the surface for 1 or 2 months of most years and within 30 inches most of the time. In dry seasons it is 30 to 60 inches below the surface. In rainy seasons low areas are briefly covered with shallow water. Depressions are covered with shallow water 6 to 12 months in most years.

Included with this soil in mapping are small areas of Immokalee sand, areas where there is loamy material below the weakly cemented layer in places, and areas where a thin, gray, cemented layer occurs just above the dark-colored, weakly cemented layer.

Natural vegetation is slash pine and longleaf pine and an understory of saw-palmetto, gallberry, blueberry, runner oak, deerstongue, and grasses. Most areas are still in natural vegetation, but some are planted to improved pasture grasses.

This soil is moderately well suited to vegetables if other factors make these specialized crops feasible. Availability of irrigation water and freedom from frost greatly affect the suitability for these crops. Intensive management is necessary, and the water table must be carefully controlled. Drainage-subsurface irrigation systems must be carefully designed, installed, and maintained.

Generally, this soil is poorly suited to citrus trees. Poor drainage, susceptibility to freezing temperatures, and a limited root zone, which is caused by cementation of subsurface layers, adversely affect the growth of trees.

Highly productive pasture of improved grasses can be maintained, but excess water in wet seasons must be removed by a simple drainage system. Liberal use of fertilizer is necessary. Clover can be grown with grasses but must be irrigated to assure good growth. Capability unit IVw–1; woodland group 11; range management group 9.

Myakka and Sellers soils, ponded (Ms).—These soils are in areas locally known as prairies. These prairies are zones of grassy vegetation that grow in the areas between the normal water level and the high water level of ponds and lakes. The width of the prairies is determined by the amount that the water level fluctuates. Some prairies cover hundreds of acres, but others are less than an acre in size. On the prairies the water table fluctuates as much as 6 feet. As much as 2 feet of water stands on Myakka soils for a year or more during wet cycles, but the water on Sellers soils is usually deeper than that on Myakka soils, and it remains for a longer time. During dry cycles the water table is below the soil surface.

One or the other of these soils makes up 75 percent or more of the areas, but the proportion of each soil varies from place to place. The soils occur irregularly.

Myakka soils are poorly drained. They have lighter colored sandy layers over dark-colored, weakly cemented sandy layers that begin within 30 inches of the surface. Sellers soils are very poorly drained. They have a thick, dark-colored sandy surface layer over light-colored sandy layers that extend to a depth of 80 inches.

Included in mapping are areas of other soils, such as those of the Basinger, St. Johns, and Immokalee series. Combined, these inclusions make up about 25 percent of an area.

Natural vegetation is sand cordgrass, maidencane, and St.-Johnswort. Almost all areas are still in native vegetation. During dry cycles of several years duration, pines invade the margins but are killed by flooding in wet cycles.

These soils are not suited to special crops or improved pasture, because of prolonged wetness and flooding. Establishment of an adequate drainage system is difficult, and suitable outlets are not available in most places. These soils are important feeding grounds for many kinds of wading birds and other wildlife. Capability unit VIIw–1; woodland group 1; range management group 2.

Orlando Series

The Orlando series consists of nearly level, well-drained, sandy soils that are on broad ridges. These soils formed in thick beds of sandy marine or fluvial sediment.

In a representative profile the surface layer is very dark gray sand about 27 inches thick. Below this is brown sand that extends to a depth of 80 inches.

Orlando soils have rapid permeability in all layers. The available water capacity is low in the dark-colored surface layer and very low in the underlying layers. Organic-matter content is moderately low, and natural fertility is low.

Representative profile of Orlando sand:

O1—1 inch to 0, undecomposed leaves, twigs, needles, and stems.

A11—0 to 8 inches, very dark gray (N 3/0) sand; weak, medium, granular structure; very friable; many fine, medium, and large roots; strongly acid; gradual, wavy boundary.

A12—8 to 27 inches, very dark gray (10YR 3/1) sand; single grained; loose; common fine, medium, and large roots; strongly acid; clear, wavy boundary.

C—27 to 80 inches, brown (10YR 5/3) sand; single grained; loose; few fine roots; few, medium, distinct, light brownish-gray (10YR 6/2) streaks; strongly acid.

The A horizon is black, very dark gray, or very dark grayish brown and ranges from 10 to 30 inches in thickness. The C horizon is brown, yellowish brown, brownish yellow, light yellowish brown, yellow, pale brown, or very pale brown to a depth of 80 inches or more. In some profiles there are few to common mottles or splotches of uncoated, gray to white sand. The soil is less than 10 percent silt and clay between depths of 10 and 40 inches.

Orlando soils are strongly acid or very strongly acid throughout the profile. The water table is below a depth of 60 inches.

Orlando soils are associated with Astatula, Myakka, and Immokalee soils. Orlando soils have a thick, dark-colored A horizon, which is lacking in Astatula soils. Orlando soils are much better drained than Myakka and Immokalee soils and do not have a Bh horizon.

Orlando sand (Or).—This is a nearly level, well-drained, sandy soil that is on broad ridges. It has a thick, dark-colored surface layer and is sandy to a depth of 80 inches or more. The water table is below a depth of 60 inches.

Included with this soil in mapping are small areas of Orlando sand, wet variant.

Natural vegetation consists of longleaf pine, turkey oak, slash pine, pawpaw, redroot, smilax, and wiregrass. About half the acreage is in citrus trees.

The limitations to the use of this soil for cultivated crops are severe because the soil qualities are poor. Available water capacity and natural fertility are low. Permeability is rapid, and this results in rapid leaching of plant nutrients. This soil is suited to special crops, such as watermelon, if intensive management practices are used. All cultivated crops should be grown in rotation with soil-improving cover crops. Liberal use of fertilizer is necessary.

This soil is well suited to citrus trees in areas that are not subject to damaging frost. Growing a cover crop between the trees, applying lime and fertilizer, and irrigating during dry periods are good management practices.

Orlando sand is moderately well suited to bahiagrass and other deep-rooted, improved pasture grasses if the soil is properly managed. Hairy indigo, crotalaria, and other deep-rooted legumes can be grown successfully, but careful management is needed to maintain good vegetative cover. Capability units IIIs-1; woodland group 6; range management group 5.

Orlando Series, Wet Variant

The Orlando series, wet variant, consists of nearly level, somewhat poorly drained, sandy soils that are in moderately low areas near some of the larger lakes. These soils formed in thick beds of sandy marine or fluvial sediment.

In a representative profile the surface layer is black sand about 30 inches thick. Below this is 6 inches of very dark gray sand. Between depths of 36 and 60 inches is grayish-brown sand. Next, and extending to a depth of 80 inches, is dark grayish-brown sand.

Permeability is rapid in all layers. Available water capacity is moderate in the dark-colored layer and low in the underlying layers. Organic-matter content is moderate. Natural fertility is low.

Representative profile of Orlando sand, wet variant:

A11—0 to 30 inches, black (10YR 2/1) sand; weak, medium granular structure; common clean sand grains; many fine and medium roots; strongly acid; gradual, wavy boundary.

A12—30 to 36 inches, very dark gray (10YR 3/1) sand; single grained; loose; common clean sand grains; many fine and medium roots; strongly acid; clear, wavy boundary.

C1—36 to 60 inches, grayish-brown (10YR 5/2) sand; single grained; loose; many clean sand grains; common, medium, faint mottles of very dark grayish brown (10YR 3/2); few fine roots; strongly acid; gradual, wavy boundary.

C2—60 to 80 inches, dark grayish-brown (10YR 4/2) sand; single grained; loose; common, medium, distinct mottles of very dark gray (10YR 3/1); many clean sand grains; strongly acid.

The A horizon is black, very dark gray, or very dark grayish brown and ranges from 24 to 40 inches in thickness. Organic-matter content ranges from 5 to 8 percent. The C horizon ranges from dark grayish brown to light yellowish brown, and it has few to common mottles of lighter or darker colors.

Orlando soils, wet variant, are strongly acid or very strongly acid throughout the profile. In most years the water table is at a depth of 10 to 40 inches for periods of 2 to 6 months, but in wet seasons it is within 10 inches of the surface. The rest of the time it is at a depth of 40 to 60 inches.

These soils are more poorly drained than has been defined as the range for the Orlando series. Because they occupy only a small acreage, however, no separate series was established.

Orlando soils, wet variant, are associated with Sellers, Myakka, Immokalee, St. Johns, and Basinger soils. They are better drained than any of these soils. They have a thicker, dark-colored A horizon than any of these except Sellers soils. These wet variant Orlando soils have an A horizon underlain by a sandy C horizon, whereas Myakka, Immokalee, and St. Johns soils have a Bh horizon directly beneath the A horizon and Basinger soils have a C&Bh horizon.

Orlando sand, wet variant (Os).—This is a nearly level, somewhat poorly drained, sandy soil that is in moderately low areas near lakes. It has a thick, dark-colored surface layer and is sandy to a depth of 80 inches or more. In most years the water table is at a depth of 10 to 40 inches for 2 to 6 months, but in wet seasons it is within 10 inches of the surface. The rest of the time it is at a depth of 40 to 60 inches.

Included with this soil in mapping are areas where the surface layer is only 10 to 24 inches thick, and a few areas where there is a weakly cemented layer beneath the surface layer.

Natural vegetation consists of slash pine, loblolly pine, bluejack oak, blueberry, smilax, milkpea, and maidencane. Nearly all areas are still in natural vegetation.

This soil is poorly suited to general farm crops. Vegetable crops and other special crops are well suited, however, if water for irrigation is available and if protection from frost is adequate. The level of the water table must be carefully controlled, and for this purpose a combined system for drainage and subsurface irrigation is needed. This system must be carefully designed, installed, and maintained. Such a system provides rapid removal of excess water during severe rains and a means of irrigation in dry seasons. Fertilizer and lime should be applied according to the needs of the crop.

The suitability of this soil for citrus trees is affected by local drainage difficulties and susceptibility to freezing. Areas that are not subject to damaging frost are moderately well suited to citrus trees. In most areas bedding and a well-designed drainage system are needed. The site should be carefully studied before it is used for citrus trees.

If properly managed, this soil is excellent for pasture of improved grasses or grass and clover mixtures. Management practices include a water control system that removes excess surface water and provides subsurface irrigation, application of adequate fertilizer and lime, and careful control of grazing. Capability unit IIw-1; woodland group 5; range management group 5.

Pamlico Series

The Pamlico series consists of nearly level, very poorly drained, organic soils that are in small marshes and swamps. These soils formed in the remains of hydrophytic, fibrous, nonwoody plants.

In a representative profile the surface layer is black, highly decomposed muck to a depth of about 14 inches and, below this, very dark brown muck to a depth of about 24 inches. Below a depth of about 24 inches is dark-brown coarse sand.

Permeability is rapid in the muck and very rapid in the sand. Available water capacity, organic-matter content, and nitrogen content are very high in the muck but very low in the coarse sand.

Representative profile of Pamlico muck:

Oa1—0 to 14 inches, black (5YR 2/1), well-decomposed, organic material (muck); weak, coarse, granular structure; friable; fiber content is less than 33 percent before rubbing and less than 10 percent after rubbing; about 80 percent organic matter; very strongly acid; clear, smooth boundary.

Oa2—14 to 24 inches, very dark brown (10YR 2/2), well-decomposed, organic material (muck); weak, coarse, granular structure; friable; less than 10 percent fiber after rubbing; about 20 percent mineral material; sodium pyrophosphate extract color is brown (10YR 5/3); very strongly acid; abrupt, smooth boundary.

IIAb—24 to 60 inches, dark-brown (10YR 3/3) coarse sand that is gradually paler in color with increasing depth; single grained; loose; very strongly acid.

The Oa horizon is black, very dark brown, or dark reddish brown and ranges from 12 to 50 inches in thickness. The organic-matter content ranges from 30 to 80 percent, and the fiber content ranges from 10 to 40 percent before rubbing but is less than 10 percent after rubbing. The IIAb horizon is brown, dark-brown, or black sand or coarse sand that begins within 50 inches of the surface and extends below a depth of 60 inches.

Pamlico soils are strongly acid to very strongly acid throughout. In most years the water table is within 10 inches of the surface for 9 to 12 months, but in dry seasons it is below a depth of 10 inches. It is seldom below a depth of 30 inches. In wet seasons shallow water covers the surface much of the time.

The annual temperature of the Pamlico soils mapped in this survey area is slightly higher than the defined range for the Pamlico series, but this does not alter the usefulness or behavior of these soils.

Pamlico soils are associated with Sellers, Astor, Dorovan, Terra Ceia, and Everglades soils. Pamlico soils are organic soils, whereas Sellers and Astor soils are mineral soils. They have a thinner Oa horizon than Dorovan and Terra Ceia soils and are more acid than Terra Ceia soils. Pamlico soils are more acid than Everglades soils, and they have an Oa horizon instead of an Oe horizon.

Pamlico muck (Pa).—This is a nearly level, very poorly drained, organic soil that is in small marshes and swamps. It has a surface layer of highly decomposed muck 18 to 36 inches thick. Below this is sandy material that reaches to a depth of more than 50 inches. In most years the water table is within 10 inches of the surface for 9 to 12 months, and the soil is covered with shallow water much of the time. In dry seasons the water table is 10 to 30 inches below the surface.

Included with this soil in mapping are small areas where the organic layer is thinner than 18 inches and other areas where it is thicker than 36 inches. Also included are small areas that are slightly acid or neutral.

Natural vegetation in wooded areas consists of blackgum, southern red maple, loblolly pine, bay, waxmyrtle, smilax, wild grape and buttonbush. Maidencane and ferns grow in open marsh areas. Nearly all areas are still in natural vegetation.

Excess water is the major limitation to the use of this soil for cultivated crops but if the soil is adequately drained and water is controlled, Pamlico muck is excellent for vegetable crops. Drainage is difficult, but it can be established through a system of dikes, canals, ditches, and pumps. Control structures are needed to keep the water table at a proper depth for crops and to reduce the hazard of subsidence by oxidation of organic matter. Other management practices include use of cover crops; frequent application of fertilizer that is high in content of all plant nutrients, except nitrogen; and control of soil reaction.

This soil is not suited to citrus trees.

Under intensive management, high-quality pasture that consists of improved grasses or grass and clover mixtures can be grown. Management includes a system of water control that is designed to remove excess surface water and maintain the water table at a favorable depth; adequate application of fertilizer and lime, where needed; and the control of grazing. Capability unit IIIw-5; woodland group 1; range management group 1.

Pamlico muck, deep (Pd).—This is a nearly level, very poorly drained, organic soil that is in small marshes and swamps. It has a surface layer of highly decomposed muck that is more than 36 inches but less than 50 inches thick. It is underlain by sandy layers within 50 inches of the surface. In most years the water table is within 10 inches of the surface for 9 to 12 months, and the water is frequently above the surface. Although lower in dry seasons, the water table is seldom below a depth of 30 inches.

Included with this soil in mapping are some small areas where the organic layer is thinner than 36 inches or thicker than 50 inches. Also included are a few areas where there is as much as 14 inches of woody peat on the surface.

Natural vegetation in wooded areas consists of blackgum, southern red maple, loblolly pine, bay, waxmyrtle, smilax, wild grape, and buttonbush. Maidencane and ferns grow in open marsh areas. Nearly all areas are still in natural vegetation.

Excess water is the major limitation to the use of this soil for cultivated crops, but if drainage is adequate and water is controlled, this soil is excellent for vegetable crops. Drainage is difficult but can be established through a system of dikes, canals, ditches and pumps. Control structures are needed to keep the water table at a proper depth for crops and to reduce the hazard of subsidence by oxidation of organic matter. Other good management practices include the use of cover crops; frequent application of fertilizer high in content of all plant nutrients, except nitrogen; and control of soil reaction.

This soil is not suited to citrus trees.

Under intensive management, high-quality pasture that consists of improved grasses or grass and clover mixtures can be grown. Proper management includes a water control system that is designed to remove excess surface water and to maintain the water table at a favorable depth, adequate application of fertilizer and lime where needed, and control of grazing. Capability unit IIIw-5; woodland group 1; range management group 1.

Paola Series

The Paola series consists of nearly level to moderately steep, excessively drained, sandy soils that are on high, undulating ridges and short, steeper slopes leading to ponds and lakes. These soils formed in thick deposits of marine sand.

In a representative profile the surface layer is gray sand in the first inch and, below this, white sand to a depth of 17 inches. Between depths of about 17 and 36 inches is yellowish-brown sand that contains common, dark-brown, rounded concretions weakly cemented by organic matter. This is underlain by very pale brown sand to a depth of 72 inches and pale-yellow sand that extends to a depth of 86 inches.

Paola soils have very rapid permeability throughout. Available water capacity is very low. Organic-matter content and natural fertility are very low.

Representative profile of Paola sand:

O1—1 inch to 0, fresh leaves, stems, and twigs, ½ inch thick, over a matted layer of partly decomposed leaves, stems, twigs, roots, and mineral soil (sand).

A1—0 to 1 inch, gray (10YR 5/1) sand; single grained; loose; many roots of various sizes; sand grains mostly clean; strongly acid; abrupt, smooth boundary.

A2—1 to 17 inches, white (10YR 8/1) sand; single grained; loose; many medium and large roots; strongly acid; abrupt, wavy boundary.

B—17 to 36 inches, yellowish-brown (10YR 5/8) sand; single grained; loose; common, medium, distinct, dark-brown (10YR 4/3) spheroidal concretions that are weakly cemented with organic matter; sand grains are coated; many medium roots; strongly acid; gradual, wavy boundary.

C1—36 to 72 inches, very pale brown (10YR 7/4) sand; single grained; loose; few fine and medium roots; many uncoated sand grains; strongly acid; gradual, wavy boundary.

C2—72 to 86 inches, pale-yellow (2.5Y 8/4) sand; single grained; loose; few fine and medium roots; strongly acid.

The A1 horizon is dark-gray to light-gray sand and ranges from 1 to 3 inches in thickness. The A2 horizon ranges from light gray to white in color and from 6 to 40 inches in thickness.

The B horizon is strong brown or yellowish brown to yellow and ranges from 12 to 60 inches in thickness. Few to common tongues of the A horizon extend into the B horizon in some places. The exteriors of these tongues are black to reddish brown. Many profiles have a thin, discontinuous, weakly cemented, dark reddish-brown or very dark grayish-brown layer between the A2 and B horizons.

In many profiles the B horizon has few to common, rounded concretions that are dark brown to dark reddish brown and weakly cemented. The C horizon ranges from pale brown or pale yellow to white, and in places it has mottles of darker or lighter browns or yellows.

Paola soils are strongly acid or very acid throughout the profile. The water table is below a depth of 60 inches.

Paola soils are associated with Astatula, Eustis, Immokalee, Myakka, Pomello, and St. Lucie soils. Paola soils are better drained than Pomello, Myakka, and Immokalee soils and have a yellowish B horizon instead of a dark-colored Bh horizon. They have a light-gray or white A2 horizon that is lacking in Astatula and Eustis soils and a yellowish B horizon that is lacking in St. Lucie soils.

Paola sand, 0 to 8 percent slopes (PlB).—This is a nearly level to sloping, excessively drained, sandy soil on high, broad, gently undulating ridges. The water table is below a depth of 60 inches. This soil has the profile described as representative of the series.

Included with this soil in mapping are a few steeper areas around sinks and small areas of Astatula sand, 0 to 8 percent slopes. Also included are a few areas where the light-colored surface layer is less than 6 inches thick and other areas where it is more than 40 inches thick.

Natural vegetation is dominantly sand pine, but there is generally an understory of crookedwood, scrub live oak, myrtle oak, holly, scrub saw-palmetto, rosemary, and blueberry.

The suitability of this soil for cultivation is limited to a few special crops, such as watermelon, which may be grown if management is intensive. Available water capacity and natural fertility are very low. Permeability is very rapid, and this results in rapid loss of plant nutrients. Cover crops are needed to control soil blowing and to improve the soil.

In areas where the local climate is favorable and the soil has a thin subsurface layer of white sand, this soil is moderately suited to citrus trees. In the groves a cover of weeds and grasses is needed between the trees to control soil blowing. Tillage should be kept to a minimum. Sprinkler irrigation is needed for the survival of young trees and is beneficial to mature trees.

This soil is poorly suited to improved pasture, but fair pastures of bahiagrass and other deep-rooted grasses can be obtained if fertilizer is applied frequently and if grazing is carefully controlled. Capability unit VIs-1; woodland group 8; range management group 8.

Paola sand, 8 to 17 percent slopes (PlD).—This is a strongly sloping to moderately steep, excessively drained, sandy soil that is in choppy, dunelike areas and in areas leading to sinks and ponds. It has a thick surface layer of light-colored sand over a layer of yellowish sand that extends to a depth of 80 inches or more. The water table is below a depth of 6 feet.

Included with this soil in mapping are some areas of

Paola sand, 0 to 8 percent slopes, on narrow ridges and in valleys. Also included are other areas where the light-colored surface layer is thicker than 40 inches.

Natural vegetation is dominantly sand pine, but there is an understory of crookedwood, scrub oak, saw-palmetto, rosemary, blueberry, and grass. Nearly all areas are still in natural vegetation.

This soil is not suited to cultivated crops, citrus trees, or pasture. It has very low available water capacity and natural fertility. Permeability is very rapid, and this results in rapid loss of plant nutrients through leaching. Because this soil is strongly sloping to moderately steep and has poor qualities, it has limited use. Capability unit VIIs-1; woodland group 8; range management group 8.

Paola sand, moderately deep water table, 0 to 5 percent slopes (PmA).—This is a nearly level to gently sloping, excessively drained, sandy soil that is on low ridges intermediate between the flatwoods and the high ridges. The water table in this soil is closer to the surface than the one in Paola sand, 0 to 8 percent slopes. This soil has a surface layer of dark-gray sand to a depth of about 3 inches and white sand to a depth of about 26 inches. Between depths of about 26 and 50 inches is yellow sand that is mottled with other colors and has a few, dark-colored, weakly cemented concretions. Next, to a depth of about 72 inches, is very pale brown sand, and below this is grayish-brown sand that reaches to a depth of 80 inches. In most years the water table is 40 to 60 inches below the surface for 6 to 9 months, but in wet seasons it briefly rises above a depth of 40 inches.

Included with this soil in mapping are small areas of Pomello sand, some small areas where loamy layers are just below a depth of 60 inches, and a few areas where the subsurface layer of white sand is either very thin or missing.

Natural vegetation is mainly sand pine, and there is an understory of scrub live oak, scrub myrtle oak, saw-palmetto, and rosemary.

The limitations for growing cultivated crops are very severe because the soil has poor qualities. Available water capacity, natural fertility, and organic-matter content are all very low. Water moves very rapidly through the soil, and not much is retained for shallow-rooted plants. The moisture supply for the deeper rooted plants is generally favorably affected by the water table in the lower part of the root zone.

Most areas of this soil are poorly suited to citrus trees. Areas where the white subsurface layer is thinnest are moderately well suited to citrus trees if the local climate is favorable and if intensive management practices are used. These practices include irrigation and frequent applications of fertilizer.

If managed intensively this soil is moderately well suited to improved pasture grasses. Bahiagrass and other deep-rooted, drought-resistent grasses grow moderately well if they are heavily fertilized and limed and if grazing is carefully controlled. Capability IVs-2; woodland group 10; range management group 8.

Pomello Series

The Pomello series consists of nearly level and gently sloping, moderately well drained, sandy soils that are on broad, low ridges and narrow, gentle slopes that lead to lower areas. These soils formed in thick beds of marine sand.

In a representative profile the surface layer is gray sand over about 10 inches of dark reddish-brown sand that is weakly cemented with organic matter. Next is about 3 inches of brown sand underlain by yellowish-brown sand that extends to a depth of 70 inches or more.

Permeability is very rapid in most layers, but it is moderately rapid in the dark-colored, weakly cemented layers. The available water capacity is very low in the layers above and below the cemented layer but is moderate in the cemented layer. Organic-matter content and natural fertility are very low.

Representative profile of Pomello sand:

A1—0 to 1 inch, gray (N 6/0) sand; single grained; loose; many fine, medium, and large roots; strongly acid; clear, smooth boundary.

A2—1 to 35 inches, white (10 YR 8/1) sand; single grained; loose; many fine, medium, and large roots in upper 20 inches, few fine and medium roots at a depth below 20 inches; strongly acid; abrupt, irregular boundary.

B2h—35 to 45 inches, dark reddish-brown (5YR 3/3) sand; few, medium, faint, brown mottles; massive in places but parts to weak, medium, subangular blocky structure; firm, weakly cemented; common fine and medium roots; sand grains coated with organic matter; strongly acid; gradual, wavy boundary.

B3—45 to 48 inches, brown (10YR 4/3) sand; single grained; common fine and medium roots; many uncoated sand grains; strongly acid; abrupt, irregular boundary.

C—48 to 70 inches, yellowish-brown (10YR 5/4) sand; single grained; loose; strongly acid.

The A1 horizon ranges from dark gray to light gray in color when rubbed and from 1 to 3 inches in thickness. The A2 horizon ranges from gray to white, and few to many streaks from the A1 horizon extend along old root channels. The A1 and A2 horizons range from 30 to 60 inches in combined thickness.

The B2h horizon is black to dark reddish brown and ranges from 7 to 14 inches in thickness. It has an organic-matter content of 1 to 6 percent. The B3 horizon ranges from brown to dark yellowish brown and, in some places, has common, black to dark reddish-brown, weakly cemented mottles. A B3 horizon does not occur in all profiles.

The C horizon ranges from yellowish brown to light gray and extends to a depth of 70 inches or more.

Pomello soils are strongly acid or very strongly acid throughout. In most years the water table is 30 to 40 inches below the surface for 2 to 6 months and 40 to 60 inches below the surface for 4 to 6 months. In dry seasons it is below a depth of 60 inches, but in high areas in wet seasons, it is seldom above a depth of 40 inches.

Pomello soils are associated with St. Lucie, Paola, Astatula, Immokalee, and Myakka soils. Pomello soils are not so well drained as St. Lucie, Paola, and Astatula soils, and they have a Bh horizon, which the other soils lack. They are better drained and have a thinner A1 horizon than Myakka and Immokalee soils. Pomello soils have a Bh horizon at a greater depth than that of Myakka soils.

Pomello sand (Po).—This is a moderately well drained, sandy soil that is on broad, low ridges and narrow, gentle side slopes leading to lower areas. It has a thick, light-colored surface layer over a weakly cemented, dark-colored layer that begins at a depth of 20 to 30 inches. It is sandy to a depth of 70 inches or more. Slopes are 0 to 5 percent. In most years the water table is 30 to 40 inches below the surface for 2 to 6 months but within 60 inches of the surface the rest of the year. In dry seasons it is below a depth of 60 inches, but in the higher areas it is seldom above a depth of 40 inches.

Included with this soil in mapping are small areas of Myakka sand, small areas where the surface layer is darker than normal for Pomello sand, and some areas that have a loamy rather than a sandy substratum. Also included are small areas of Sellers and St. Johns soils in low depressions, as well as a few, narrow, more strongly sloping areas leading to these depressions.

Natural vegetation consists of sand pine, slash pine, scrub pine, scrub live oak, myrtle oak, saw-palmetto, scrub red bay, crookedwood gerberia, grasses, and pricklypear. Most areas are in natural vegetation, but a few have been cleared and planted to pasture grasses.

This soil is generally not suited to cultivated crops. It is porous, highly leached, and droughty. It has very low available water capacity. Permeability is moderate in the weakly cemented layer but rapid in all the other layers. Organic-matter content and natural fertility are very low.

This soil is poorly suited to citrus trees and to deep-rooted, drought-resistant grasses, even if a large amount of fertilizer is applied. Capability unit VIs-2; woodland group 10; range management group 8.

Rains Series

The Rains series consists of nearly level, poorly drained soils that are in small areas in the flatwoods. These soils formed in loamy marine sediment.

In a representative profile the surface layer is about 7 inches of very dark gray loamy fine sand and, below this, about 9 inches of grayish-brown loamy fine sand. Beneath this is gray sandy clay loam, extending to a depth of 60 inches or more, the upper part of which has brownish mottles and the lower part of which has brownish and reddish mottles.

Permeability is moderately rapid in the surface layer and moderate in the subsoil. Available water capacity is low in the surface layer and moderate in the lower layers. Natural fertility is moderate. Organic-matter content is low.

Representative profile of Rains loamy fine sand:

A1—0 to 7 inches, very dark gray (N 3/0) loamy fine sand; weak, medium, granular structure; friable; common fine and medium roots; very strongly acid; clear, smooth boundary.

A2—7 to 16 inches, grayish-brown (2.5Y 5/2) loamy fine sand; weak, medium, granular structure; friable; common fine and medium roots; very strongly acid; abrupt, smooth boundary.

B21tg—16 to 30 inches, gray (N 6/0) sandy clay loam; firm; patchy clay films on ped surfaces; many, medium, prominent mottles of strong brown (7.5YR 5/8); few fine and medium roots; strongly acid; clear, wavy boundary.

B22tg—30 to 60 inches, gray (N 6/0) sandy clay loam; common, medium, prominent mottles of strong brown (7.5YR 5/8) and dark red (2.5 YR 3/6); moderate, medium, subangular blocky structure; firm; patchy clay films on ped surfaces; few fine and medium roots; strongly acid.

The A1 horizon ranges from dark grayish brown or very dark gray to black in color and from 4 to 9 inches in thickness. The A2 horizon ranges from dark gray or grayish brown to light brownish gray. Few to many streaks from the A1 horizon extend into the A2 horizon. The combined thickness of the A1 and A2 horizons is less than 20 inches.

The B2tg horizon ranges from gray or light gray to light brownish gray. It is dominantly sandy clay loam but ranges to sandy loam or fine sandy loam. In some profiles there are streaks, lenses, or pockets of loamy sand to sandy clay. The B2tg horizon has few to common mottles of brown, strong brown, red, and dark red. In some places there is a big horizon of grayish fine sandy loam, 2 to 6 inches thick, between the A2 and B2tg horizons.

In some places there is a gray to light gray C horizon within 60 inches of the surface. It ranges from sand to clay.

Rains soils are strongly acid and very strongly acid throughout. In most years the water table is within 10 inches of the surface for 2 to 6 months. In wet seasons the surface in some places is briefly covered with shallow water. The rest of the time the water table is 10 to 40 inches below the surface.

The annual temperature of the Rains soils mapped in this survey area is slightly higher than the defined range for the series, but this difference does not alter usefulness and behavior of the soils.

Rains soils are associated with Duplin, Eureka, Iberia, and Meggett soils. Rains soils have less clay in the subsoil than any of those soils. They are wetter and more poorly drained than Eureka soils. Rains soils do not have calcareous fragments in the subsoil, whereas Meggett soils do.

Rains loamy fine sand (Ra).—This is a nearly level, poorly drained soil that has a loamy subsoil within 20 inches of the surface. It is in small areas in the flatwoods. In most years the water table is within 10 inches of the surface for 2 to 6 months, but it is 10 to 40 inches below the surface the rest of the time. In wet seasons shallow water briefly covers the lowest areas.

Included with this soil in mapping are small areas that have a surface layer of loamy fine sand more than 20 inches thick. Also included are small areas where the subsoil is sandy clay or clay instead of sandy clay loam.

Natural vegetation consists of loblolly pine, slash pine, live oak, water oak, waxmyrtle, gallberry, and grasses. Some of the acreage has been planted to improved pasture grasses.

The limitations to the use of this soil for cultivated crops are severe because of excessive wetness. Unless drained, this soil is not suitable for cultivation. Good surface soil texture, moderate available water capacity within the root zone, and moderate fertility are favorable qualities for cultivated crops and pasture if the drainage is adequate.

The choice of cultivated crops is limited to water-tolerant crops or shallow-rooted crops, such as vegetables. Shallow ditches and bedding of rows are needed to give surface drainage. A cropping system that makes full use of cover crops and crop residue should be used.

This soil is not suited to citrus trees.

Pasture grasses grow well on this soil, but simple drainage is necessary to remove the excess surface water. Legumes, such as white clover, grow well with pasture grasses. Good pasture management includes use of adequate fertilizer, control of weeds, and control of grazing. Capability unit IIIw-4; woodland group 3; range management group 3.

St. Johns Series

The St. Johns series consists of nearly level, poorly drained, sandy soils that are in broad areas in the flatwoods. These soils formed in marine sand.

In a representative profile the surface layer is about 11 inches of black sand over about 13 inches of gray sand. Between depths of about 24 and 36 inches is black or dark reddish-brown sand that is weakly cemented by organic matter that coats the sand grains. Below this, and extending to a depth of 60 inches, is dark grayish-brown sand that has very dark brown mottles.

Permeability is moderate in the weakly cemented layers and rapid in other layers. Available water capacity is moderate in the surface layer and the weakly cemented layers but is very low in the other layers. Natural fertility and organic-matter content are moderately low.

Representative profile of St. Johns sand:

A1—0 to 11 inches, black (N 2/0) sand; moderate, medium, granular structure; very friable; many fine, medium, and large roots; very strongly acid; clear, wavy boundary.

A21—11 to 15 inches, gray (10YR 5/1) sand; many, medium, prominent, very dark gray (N 3/0) mottles; single grained; loose; common fine and medium roots; very strongly acid; gradual, wavy boundary.

A22—15 to 24 inches, gray (10YR 6/1) sand; common, medium, faint, dark gray mottles and few, fine, faint, very dark gray mottles; single grained; loose; common fine and medium roots; very strongly acid; abrupt, irregular boundary.

B21h—24 to 30 inches, black (5YR 2/1) sand; moderate, medium, subangular blocky structure; firm; weakly cemented; few fine and medium roots; few uncoated sand grains; very strongly acid; gradual, wavy boundary.

B22h—30 to 36 inches, dark reddish-brown (5YR 3/2) sand; many, medium, faint, black mottles and few, fine, faint, dark-brown mottles; weak, medium, subangular blocky structure; firm; weakly cemented; few fine and medium roots; very strongly acid; few uncoated sand grains; gradual, wavy boundary.

B3—36 to 60 inches, dark grayish-brown (10YR 4/2) sand; common, medium, faint mottles of very dark brown; single grained; loose; many uncoated sand grains; very strongly acid.

The A1 horizon is black or very dark gray when rubbed and ranges from 8 to 20 inches in thickness. The A2 horizon ranges from gray to light gray in color and from 6 to 18 inches in thickness. Few to many streaks or mottles from the A1 horizon extend into the A2 horizon. The total thickness of the A horizon is less than 30 inches.

The B2h horizon ranges from black to dark reddish brown in color and from 4 to 20 inches in thickness. It is weakly cemented with organic matter. The lower part of this horizon has mottles of brown to black in many places. The B3 horizon ranges from brown to dark grayish brown in color and, in most places, has few to common darker colored mottles.

In some places below the B3 horizon, there is a C horizon that ranges from brown to white in color and is mottled.

St. Johns soils are strongly acid or very strongly acid in all horizons. In most years the water table is within 10 inches of the surface for less than 2 months. In periods of average rainfall, the water table is within 10 to 30 inches of the surface, but in dry seasons, it is 30 to 40 inches below the surface.

St. Johns soils are associated with Myakka, Sellers, Pomello, Immokalee, and Basinger soils. St. Johns soils have a thicker, darker-colored A1 horizon than any of those soils, except Sellers soils. They are better drained than Sellers soils, which have a sandy C horizon instead of a Bh horizon beneath the A horizon. They are more poorly drained than Pomello soils. St. Johns soils have a Bh horizon that begins at a depth of less than 30 inches, whereas Pomello and Immokalee soils have a Bh horizon at a depth of more than 30 inches and Basinger soils a C&Bh horizon instead of a Bh horizon.

St. Johns sand (Sa).—This is a nearly level, poorly drained soil that is in broad areas in the flatwoods. It has a thick, black surface layer and a dark, weakly cemented layer within 30 inches of the surface. It is sandy to a depth of 60 inches or more. In most years the water table is within 10 inches of the surface for less than 2 months. In periods of average rainfall the water table is within 30 inches of the surface, and in dry seasons, it is at a depth of 30 to 40 inches.

Included with this soil in mapping are small areas of Myakka sand and some areas that have a weakly cemented layer below a depth of 30 inches. Also included are a few areas where the substratum is loamy instead of sandy.

Natural vegetation is forests of pond pine and slash pine that have an understory of gallberry, saw-palmetto, chokeberry, St.-Johns-wort, smilax, and grasses. A few areas are used for vegetables.

The limitations to the use of this soil for cultivated crops are severe, mainly because of periodic excessive wetness. If drained, the soil is moderately well suited to vegetable crops in areas where other factors make these specialized crops feasible. Availability of irrigation water and freedom from frost hazard in winter greatly affect soil suitability for these crops. Intensive management that includes careful control of the water table is needed. Drainage-subsurface irrigation systems must be carefully designed, installed, and maintained.

Generally, this soil is poorly suited to citrus trees. Poor drainage and susceptibility to freezing temperatures are among the factors that adversely affect the growth of trees. Under the most favorable conditions and where the local climate is suitable, the soil is moderately well suited to citrus trees, but careful control of water and other good management practices are needed. A careful study of the site should be made before planning for citrus is begun.

This soil is well suited to pasture of improved grasses, but a simple drainage system is needed to remove excess water in wet seasons. Liberal use of fertilizer is necessary. Clover can be grown with grasses but should be irrigated to insure good growth. Capability unit IIIw-1; woodland group 11; range management group 6.

St. Lucie Series

The St. Lucie series consists of nearly level and gently sloping, excessively drained, sandy soils that are on high, dunelike ridges. These soils formed in thick beds of marine or eolian sand.

In a representative profile the surface layer is gray sand about 2 inches thick. This layer is underlain by about 6 inches of light-gray sand and, below this, white sand that reaches to a depth of 86 inches or more.

These soils have very rapid permeability throughout. Available water capacity, organic-matter content, and natural fertility are very low.

Representative profile of St. Lucie sand:

A1—0 to 2 inches, gray (N 5/0) sand; single grained; loose; common fine and medium roots; very strongly acid; abrupt, smooth boundary.

C1—2 to 8 inches, light-gray (10YR 7/2) sand; single grained; loose; few, medium, faint, gray mottles from the A1 horizon; uncoated sand grains; very strongly acid; clear, smooth boundary.

C2—8 to 86 inches, white (N 8/0) sand; single grained; loose; few, faint, light-gray streaks; uncoated sand grains; very strongly acid.

The A horizon ranges from 1 to 3 inches in thickness. It is white or light-gray sand mixed with a little organic matter. Rubbing this mixture changes its color to gray or light gray.

The light-gray to white C horizon extends to a depth of 80 inches or more. There is less than 5 percent silt and clay in the upper 10 to 40 inches of this horizon.

St. Lucie soils are strongly acid or very strongly acid in all horizons. The water table is below a depth of 80 inches.

St. Lucie soils are associated with Astatula, Paola, Pomello, Immokalee, and Myakka soils. They are better drained than all of those soils, except Astatula and Paola soils. St. Lucie soils have a white C horizon rather than the yellowish B and C horizons that are typical of Astatula and Paola soils or a B2h horizon like that of Pomello, Immokalee, and Myakka soils.

St. Lucie sand (Sc).—This is an excessively drained soil that is on high, dunelike ridges. Slopes are 0 to 5 percent. This soil is mainly quartz sand, and its silt and clay content is very low. The water table is below a depth of 80 inches.

Included with this soil in mapping are small areas of Paola sand, Pomello sand, and areas that lack a dark-colored cemented layer but where the water table rises to within 40 inches of the surface in wet seasons.

Natural vegetation consists of sand pine and scrub oak and an understory of rosemary, saw-palmetto, cactus, grasses, and lichens. Nearly all areas are still in natural vegetation.

This soil is not suited to cultivated crops, citrus trees, or improved pastures. It has limited use because it has poor soil qualities. It has very low available water capacity and natural fertility. Permeability is very rapid, and this results in the quick loss of plant nutrients through leaching. Capability unit VIIs–1; woodland group 9; range management group 8.

Sellers Series

The Sellers series consists of nearly level, very poorly drained, sandy soils that are in depressions, low areas, and poorly defined drainageways. These soils formed in thick beds of sandy marine sediment.

In a representative profile the surface layer is black sand about 28 inches thick. Underlying this is about 16 inches of dark-gray sand. Below this, and extending to a depth of 84 inches or more, is light brownish-gray sand.

Sellers soils have rapid permeability throughout. The available water capacity is moderate to a depth of about 28 inches, but is low between depths of 28 and about 80 inches. Organic-matter content is moderately high in the surface layer, and natural fertility is moderate.

Representative profile of Sellers sand:

A1—0 to 28 inches, black (10YR 2/1) sand; weak, fine, granular structure; friable; nonsticky; many fine and medium roots; very strongly acid; gradual, wavy boundary.

C1g—28 to 44 inches, dark-gray (10YR 4/1) sand; single grained; nonsticky; common, medium, faint, gray mottles and common, medium, faint streaks of black; common fine roots; strongly acid; clear, wavy boundary.

C2g—44 to 84 inches, light brownish-gray (10YR 6/2) sand; single grained; nonsticky; few fine roots in upper part; many uncoated sand grains; strongly acid.

The A1 horizon is black, very dark gray, or very dark brown and ranges from 24 to 40 inches in thickness. In some profiles the A12 horizon has mixed black and gray colors that, when crushed and rubbed, are very dark gray. Organic-matter content of the A horizon ranges from about 1 to 15 percent.

The Cg horizon ranges from light gray to dark grayish brown in color and extends to a depth of 84 inches or more. It generally has mottles in shades of black, gray, yellow, or brown.

Sellers soils are strongly acid or very strongly acid. In most years the water table is within 10 inches of the surface for 6 to 12 months. During the wettest seasons either the water table is at the surface or water is on the surface, but in the driest seasons the water table is 20 to 40 inches below the surface. Each year some depressions are covered with shallow water for 3 to 9 months.

Sellers soils are associated with Pamlico, Astor, Basinger, Myakka, Immokalee, Pomello, Paola, and St. Lucie soils. Sellers soils are more poorly drained than all of those soils, except the Pamlico and Astor soils. They are acid and mineral soils, whereas Pamlico soils are organic soils, and Astor soils are alkaline. Sellers soils have a thick, black A horizon over a sandy C horizon, which Myakka, Immokalee, and Pomello soils do not have. They do not have a Bh horizon, which is common to Myakka, Immokalee, and Pomello soils. Sellers soils are more poorly drained than Paola and St. Lucie soils.

Sellers sand (Ss).—This is a nearly level, very poorly drained soil that is in depressions, low flat areas, and poorly defined drainageways. It has a thick, black surface layer over sand that extends to a depth of 84 inches or more. In most years the water table is within 10 inches of the surface for 6 to 12 months. During the wettest seasons either the water table is at the surface or water is on the surface. In the driest seasons the water table is 20 to 40 inches below the surface. Each year some depressions are covered with shallow water for 3 to 9 months.

Included with this soil in mapping are areas where the black surface layer is only 10 to 24 inches thick. Also included are areas where the lower part of the surface layer is very dark brown or reddish brown.

Natural vegetation consists mainly of slash pine, pond pine, loblolly pine, bay, St.-Johns-wort, bladderswort, waxmyrtle, gallberry maidencane and rushgrass. Most areas are still in natural vegetation.

The limitations to the use of this soil for cultivated crops are severe because of excessive wetness. The soil is not suited to cultivation unless it is drained. It has some favorable properties, such as moderately high organic-matter content and moderate available water capacity in the surface layer. Natural fertility is moderate, and response to fertilizer is good. This soil is excellent for truck crops if the water level is properly controlled and if other factors make the growing of these crops feasible. The drainage system must be properly designed, constructed, and maintained.

This soil is generally not suited to citrus trees.

If properly managed, this soil is well suited to pasture of improved grasses or grass and clover mixtures. Good management practices include a water control system that drains excess surface water and provides subsurface irrigation, frequent application of lime and fertilizer, and careful control of grazing. Capability class IIIw–2; woodland group 5; range management group 6.

Sellers and Pamlico soils (Sp).—This undifferentiated group consists of very poorly drained Sellers and Pamlico soils that are in low depressions dissected by winding intermittent drainageways. Sellers soils have a surface layer of very thick, black sand over a layer of grayish sand that extends to a depth of 80 inches or more. Pamlico soils have a layer of black muck more than 18 inches but less than 50 inches thick. In most years the water table is within 10 inches of the surface for 6 to 9 months, and each year many areas are covered with shallow water for 3 to 6 months.

The overall composition of this unit is about 40 percent Sellers soils and 30 percent Pamlico soils, but the proportion of each soil varies from place to place. The soils occur in irregular patterns. Soils of one or the other series make up no more than 70 percent of any given area.

Included with this group in mapping are some areas of other soils, such as Everglades and Astor soils, and soils in which the black surface layer is not as thick as normal. Combined, these inclusions make up no more than 30 percent of any area.

Natural vegetation consists mainly of sand cordgrass, maidencane, and rushes. Nearly all areas are still in natural vegetation.

The limitations to the use of these soils for cultivated crops are severe because of excessive wetness. The soils are not suited to cultivation unless they are drained. They have some favorable properties, such as moderately high organic-matter content and moderate available water capacity in the surface layer. Natural fertility is moderate, and the response to fertilizer is good. These are excellent soils for vegetable crops if the water level is properly controlled and if other factors make these crops feasible.

These soils are excellent for pasture of improved grasses or grass and clover mixtures, if they are properly managed. Management practices include a water control system that drains excess surface water and provides subsurface irrigation, frequent applications of lime and fertilizer, and careful control of grazing. Capability unit IIIw-2; woodland group 5; range management group 1.

Terra Ceia Series

The Terra Ceia series consists of nearly level, very poorly drained, organic soils that are mostly in hardwood swamps on the flood plains of the larger rivers and streams. These soils formed in the remains of dominantly nonwoody, fibrous, hydrophytic plants.

In a representative profile dark reddish-brown muck extends to a depth of about 64 inches.

Permeability is rapid, and the available water capacity, organic-matter content, and nitrogen content are very high.

Representative profile of Terra Ceia muck:

Oa—0 to 64 inches, dark reddish-brown (5YR 2/2) unrubbed, black (5YR 2/1) rubbed, well-decomposed organic material (muck); weak, medium, subangular blocky structure; friable; few to many, woody chips up to 4 millimeters in length; estimated 25 percent fiber if unrubbed, 5 percent rubbed; sodium pyrophosphate extract color is pale brown (10YR 6/3); mildly alkaline.

The Oa horizon is black, dark reddish brown, or very dark brown and is more than 52 inches thick over the mineral layers. Content of mineral material ranges from about 5 to 40 percent, and fiber content is 10 to 40 percent before rubbing and less than 10 percent after rubbing. Fibers are generally from nonwoody plants, but in some places fibers from woody plants make up as much as 30 percent of the volume of unrubbed organic material.

Terra Ceia soils are medium acid to moderately alkaline throughout. In most years the water table is within 10 inches of the surface for 9 to 12 months and water is frequently on the surface. In dry seasons the water table is at a depth of 10 to 30 inches.

Terra Ceia soils are associated with Sellers, Astor, Everglades, Dorovan, and Pamlico soils. Terra Ceia soils are organic soils, whereas Sellers and Astor soils are mineral soils. Terra Ceia soils differ from Everglades soils in being less fibrous. They are less acid than Dorovan soils. Terra Ceia soils have a thicker organic layer than Pamlico soils, which have a sandy layer 50 inches below the surface.

Terra Ceia muck (Tc).—This is a nearly level, poorly drained, organic soil that is in hardwood swamps on the flood plains of the larger rivers and streams. The organic material is highly decomposed and is 52 or more inches thick. In most years the water table is within 10 inches of the surface for 9 to 12 months, and each year shallow water covers most areas for more than 6 months. In dry seasons the water table is 10 to 30 inches below the surface.

Included with this soil in mapping are a few small areas of Dorovan muck. Also included are areas of mineral soils that occur as small islands within the mapping unit.

Natural vegetation consists mainly of cypress, ash, cabbage palm, red maple, bay, smilax, and poison-ivy. Most areas are still in natural vegetation, but a few have been cleared and are used for improved pasture or vegetables.

Excess water is the major limitation to the use of this soil for cultivated crops. If adequate drainage is established and water control measures are used, this soil is excellent for vegetable crops. Drainage can be established through a system of dikes, canals, ditches, and pumps. Control structures are needed to keep the water level at a proper depth for crops and to reduce the hazard of subsidence by oxidation of the organic matter. Other management practices include the use of cover crops; frequent application of fertilizer that is high in content of all plant nutrients, except nitrogen; and control of soil reaction.

This soil is not suited to citrus trees.

Under intensive management, this soil produces high-quality pasture of improved grasses or grass and clover mixtures. Good management practices include use of a water control system designed to drain excess surface water and maintain the water table at a proper depth, adequate applications of fertilizer and lime, and control of grazing. Capability unit IIIw-5; woodland group 1; range management group 1.

Wicksburg Series

The Wicksburg series consists of nearly level to strongly sloping, well-drained soils that are on narrow ridges and on slopes surrounding lakes, ponds, and marshes. These soils formed in thick beds of sandy and loamy marine sediment.

In a representative profile the surface layer is about 6 inches of dark-gray sand and, below this, about 29 inches of pale-yellow sand. Next is about 3 inches of brownish-yellow loamy sand over 3 inches of yellowish-brown sandy loam. Between depths of about 41 and 78 inches is sandy clay that is mottled in shades of red, brown, yellow, and gray.

Permeability is very rapid in the surface layer, moderately rapid in the upper part of the subsoil, and slow in the lower part of the subsoil. Available water capacity is very low in the sandy surface layer, moderate in the upper part of the subsoil, and high in the lower part of the subsoil. Organic-matter content and natural fertility are low.

Representative profile of Wicksburg sand:

Ap—0 to 6 inches, dark-gray (10YR 4/1) sand; weak, medium, granular structure; friable; many fine and medium roots; medium acid; clear, wavy boundary.

A2—6 to 35 inches, pale-yellow (2.5Y 7/4) sand; few, fine, distinct, black (10YR 2/1) streaks along root channels; few, fine, faint, yellow and very pale brown mottles; single grained; loose; common fine and medium roots; strongly acid; gradual, wavy boundary.

A&B—35 to 38 inches, brownish-yellow (10YR 6/8) loamy sand; weak, medium, granular structure; friable; common, medium, faint, yellowish-brown lumps of sandy loam; few fine roots; very strongly acid; clear, smooth boundary.

B1t—38 to 41 inches, yellowish-brown (10YR 5/8) sandy loam; common, medium, faint, yellowish-brown mottles; weak, coarse, subangular blocky structure; friable; few, medium, prominent, red (2.5YR 4/8) balls of sandy clay loam; few fine roots; very strongly acid; abrupt, smooth boundary.

B21t—41 to 54 inches, mottled dark-red (10R 3/6), strong-brown (7.5YR 5/8), light-gray (10YR 7/2), and red (2.5YR 4/8) sandy clay; moderate, medium, subangular blocky structure; firm; few patchy clay films on ped faces; few fine roots; very strongly acid; gradual, wavy boundary.

B22t—54 to 78 inches, mottled reddish-yellow (7.5YR 6/8), red (2.5YR 4/8), and light-gray (5YR 6/6) sandy clay; weak, medium, subangular blocky structure; firm; few discontinuous clay films on ped faces; few fine roots; very strongly acid.

The Ap horizon ranges from black to dark gray or brown to dark grayish brown in color and from 7 to 12 inches in thickness. The A2 horizon ranges from brown or yellowish brown to pale yellow in color and from 10 to 30 inches in thickness. It commonly has black or gray streaks extending from the Ap horizon, and few to many, faint, brownish or yellowish mottles. The entire A horizon is 20 to 40 inches thick.

The B1 horizon is yellowish-brown or brownish-yellow sandy loam or sandy clay loam. It is 0 to 5 inches thick but is not present in all profiles. The B2t horizon is sandy clay or clay that generally is highly mottled in shades of yellow, brown, red, and gray, but in some places it is yellowish brown or brownish yellow and has few to many mottles of other colors.

Wicksburg soils are medium acid to very strongly acid in all horizons. The permanent water table is below a depth of 84 inches, but for brief periods after heavy rains, a perched water table is 20 to 40 inches below the surface.

The annual temperature of the Wicksburg soils mapped in this survey area is slightly higher than the defined range for the Wicksburg series, but this does not alter the usefulness and behavior of these soils.

Wicksburg soils are associated with Astatula, Orlando, and Eustis soils. Wicksburg soils have a well-developed, clayey B2t horizon above a depth of 40 inches, whereas Astatula and Orlando soils do not have a B2t horizon but have a sandy C horizon that extends to a depth of 80 inches. Wicksburg soils have a subsoil that has a much higher content of clay than that of Eustis soils, and their subsoil lacks the bands that are typical of Eustis soils.

Wicksburg sand, 0 to 5 percent slopes (WcA).—This is a nearly level to gently sloping, well-drained soil that is on gently undulating, narrow ridges. It has a thick, sandy surface layer over a clayey subsoil. The subsoil begins below a depth of 20 inches but above a depth of 40 inches. The water table is below a depth of 84 inches, but sometimes after heavy rains, a perched water table is above the subsoil for a few hours.

Included with this soil in mapping are many areas of soils where the sandy surface layer is thicker than 40 inches. Some of these included soils have a loamy rather than a clayey subsoil. Also included are a few areas of Wicksburg sand, 5 to 12 percent slopes.

Natural vegetation consists of longleaf pine and slash pine, and an understory of grasses. However, many areas have been cleared and are used for citrus trees and improved pasture.

This soil is poorly suited to cultivated crops. The limitations to use of the soil for such crops are severe because of the very low available water capacity and the rapid leaching of plant nutrients from the thick surface layer. Natural fertility is low. Good management practices include correct use of crop residue and green-manure crops and adequate use of fertilizer and lime. Soil blowing is a concern in the nearly level areas, and both soil blowing and water erosion are hazards on unprotected, gentle slopes. Management practices used to improve soil properties are generally adequate to control erosion.

This soil is well suited to citrus trees, but in some areas the trees are subject to frequent damage by cold. Good management practices include the growing of cover crops between the trees, keeping tillage to a minimum, use of adequate amounts of fertilizer, and, in dry periods, irrigation.

Deep-rooted grasses and legumes that are adapted to this survey area grow well if they are properly established and managed. Less drought resistant plants are not well adapted, because their roots do not penetrate deeply enough to obtain adequate moisture in dry seasons. Capability unit IIIs-4; woodland group 2; range management group 5.

Wicksburg sand, 5 to 12 percent slopes (WcC).—This is a sloping to strongly sloping, well-drained soil that is on the side slopes that lead to lakes, sinks, and depressions. It has a thick, sandy surface layer over a clayey subsoil that begins below a depth of 20 inches but above a depth of 40 inches. Most of the time the water table is below a depth of 84 inches, but sometimes after heavy rains it is above the subsoil for a few hours.

Natural vegetation consists of pine forest and wiregrass. Most areas are still in natural vegetation, but a few have been cleared and used for improved pasture.

This soil is very poorly suited to cultivated crops. The limitations to use of the soil for cultivated crops are very severe because of very low available water capacity, rapid leaching of plant nutrients in the thick surface layer, low natural fertility, and strong slopes. Water erosion is also a hazard, and adequate control measures should be taken to protect the soil at all times. Among good management practices if cultivated crops are grown are the correct use of crop residue and green-manure crops and adequate use of fertilizer and lime.

This soil is suited to citrus trees, but because many areas are subject to frequent damage by cold, the trees must be protected. Good management practices include growing cover crops between the trees, keeping tillage to a minimum, using adequate amounts of fertilizer, and, in dry periods, irrigating.

This soil is well suited to improved pasture. Deep-rooted, drought-resistant grasses and legumes grow well if properly established and managed. Capability unit IVs-3; woodland group 2; range management group 5.

Use and Management of the Soils

The soils of the Ocala National Forest Area are used extensively for woodland, wildlife habitat, and recreation.

To a small extent, they are used for pasture or range, citrus fruits, cultivated crops, and homesites. This section discusses the management of soils for cultivated crops and pasture, explains the capability grouping used by the Soil Conservation Service, and gives the predicted yields of principal crops. It also discusses the management of the soils for woodland, range, and wildlife habitat. It lists, mainly in the form of tables, the soil properties that affect engineering practices and the soil limitations that affect recreational development.

Management for Cultivated Crops and Pasture

Cultivated crops are of minor importance in the Ocala National Forest Area, most of which is woodland. Only a few privately owned farms are in the southern and southwestern parts of the survey area.

Most soils in the Ocala National Forest Area have serious limitations or hazards that have to be overcome before cultivated crops, citrus trees, or improved pasture can be grown successfully. In a good management plan, these limitations or hazards are considered and adequate measures are provided to correct or eliminate them.

A shallow water table, either continuous or seasonal, affects some of the soils. During rainy seasons these soils have excess water in the root zone that is harmful to crops. In dry seasons crops grown on some of these same soils are damaged by a shortage of water. A combined drainage and irrigation system provides a high degree of water control by removing excess water in wet seasons and by supplying water in dry seasons. Soils along the rivers and major streams must be protected from flooding or overflow if they are used for cultivated crops or pasture.

Many of the soils in the survey area are excessively drained, deep, and sandy. During periods of nearly daily rain, there is generally sufficient moisture for a few crops, but supplemental sprinkler irrigation is almost always necessary. These soils have very rapid permeability and very low available water capacity. Plant nutrients are quickly leached.

Most of the soils are nearly level or very rapidly permeable, and there is no rapid runoff during rains. Therefore, erosion is not a serious problem. Erosion along ditchbanks can occur, and these areas need the protection of a vegetative cover. Soil blowing occurs if the excessively drained soils on ridges are left without cover. If cultivated, these soils should be protected by cover crops that require only minimum tillage. Soils that have poor qualities can be improved by growing cover crops and green-manure crops between the trees in citrus groves. Turning under all plant residues left in cultivated fields is beneficial. Response to fertilizer varies, depending on the kind of soil and type of management.

Improved pasture has been established on many farms in the survey area. Most of the farms are in flatwoods on soils that have a clayey subsoil. In the pasture, a system of water control that removes excess surface water, the use of proper fertilizer as well as lime, and other good management practices are needed. Soils adjacent to the rivers and creeks in the survey area must also be protected from flooding if they are used for improved pasture. Irrigation should be used in improved pasture to provide adequate moisture for grasses and clover during dry periods. Bahiagrass and Coastal bermudagrass are the most widely used pasture grasses. White clover, Hubam clover, and clover and grass mixtures are grown for winter grazing in areas where irrigation facilities are available.

Most of the improved pastures in the survey area are used for beef cattle in cow-calf type operations. A good pasture not only supplies forage for livestock but also controls soil blowing and water erosion, improves soil quality by adding organic matter, makes a better environment for micro-organisms, and improves tilth.

The Ocala National Forest Area is in the northern part of the Florida citrus belt. Some citrus crops are grown on the better, well-drained soils in the sourthern part of the survey area, but this is considered risky because of the hazard of frost. Irrigation is needed for the survival and growth of trees. In all groves, cover crops and minimum tillage are needed to control erosion.

Special crops, such as watermelon, are grown on some of the excessively drained, deep, sandy soils in the survey area. Irrigation is necessary to insure an adequate supply of moisture for this crop on sandy soils. Strips of tall plants, such as sorghum, are needed to protect the soil and young plants from wind damage. Vegetables are grown mainly for home use, but the survey area has a potential for production of vegetables, which could be grown on a number of soils.

The management practices suggested for crops and soils can be expected to change as new information is gained from the experience of farm workers. Current information concerning crops, improved plant varieties, and specific management practices can be obtained from the nearest office of the Soil Conservation Service, from the University of Florida Agricultural Experiment Stations, or from the County Agricultural Extension Service.

Capability Grouping

Capability grouping shows, in a general way, the suitability of soils for most field crops. The soils are grouped according to their limitations when used for field crops, the risk of damage when they are so used, and the way they respond to treatment. The grouping does not take into account major and generally expensive landforming that would change slope, depth, or other characteristics of the soils; does not take into consideration possible but unlikely major reclamation projects; and does not apply to rice, cranberries, horticultural crops, or other crops requiring special management.

Those familiar with the capability classification can infer from it much about the behavior of soils when used for other purposes, but this classification is not a substitute for interpretations designed to show suitability and limitations of groups of soils for range, for forest trees, or for engineering.

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

Capability Subclasses are soil groups within one class; they are designated by adding a small letter, *e*, *w*, *s*, or *c*, to the class numeral, for example, IIe. The letter *e* shows that the main limitation is risk of erosion unless close-growing plant cover is maintained; *w* shows that water in or on the soil interferes with plant growth or cultivation (in some soils the wetness can be partly corrected by artificial drainage); *s* shows that the soil is limited mainly because it is shallow, droughty, or stony; and *c*, used in only some parts of the United States, shows that the chief limitation is climate that is too cold or too dry.

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

Capability Units are soil groups within the subclasses. The soils in one capability unit are enough alike to be suited to the same crops and pasture plants, to require similar management, and to have similar productivity and other responses to management. Thus, the capability unit is a convenient grouping for making many statements about soil management. Capability units are generally designed by adding an Arabic numeral to the subclass symbol, for example, IIw-2 or IVs-1. Thus, in one symbol, the Roman numeral designates the capability class, or degree of limitation; the small letter indicates the subclass, or kind of limitation, as defined in the foregoing paragraph; and the Arabic numeral specifically identifies the capability unit within each subclass.

The classes in the capability system and the subclasses in the Ocala National Forest Area are described in the list that follows. The factors that affect the use of soils for cultivated crops and pasture and broad general suggestions for use and management of the soil are given in the description of each mapping unit in the section "Descriptions of the Soils." The capability classification of each soil can be found at the end of each mapping unit description in this section, and it is also given in the "Guide to Mapping Units."

- Class I soils have few limitations that restrict their use. (None in the Ocala National Forest Area.)
- Class II soils have some limitations that reduce the choice of plants or require moderate conservation practices.
  - Subclass IIw soils have slight or moderate limitations because of seasonal wetness.
    - Unit IIw–1. Nearly level, somewhat poorly drained soils that are sandy to a depth of 80 inches.
- Class III soils have severe limitations that reduce the choice of plants, or require special conservation practices, or both.
  - Subclass IIIw soils have severe limitations because of excess water but moderate limitations if the soils are drained; also in this subclass are organic soils that subside when drained.
    - Unit IIIw–1. Nearly level, poorly drained, sandy soils that have a dark-colored surface layer and are underlain by a layer weakly cemented with organic matter at a depth of less than 30 inches; and somewhat poorly drained soils that have clayey layers beneath strongly cemented sandy layers; in flatwoods.
    - Unit IIIw–2. Nearly level, very poorly drained soils that have a very thick, dark-colored surface layer and sand to a depth of 80 inches; on low flats and in depressions.
    - Unit IIIw–3. Nearly level, moderately well drained soils that have a surface layer of loamy sand and a clayey subsoil within 20 inches of the surface; on narrow rims around lakes, ponds, and depressions.
    - Unit IIIw–4. Nearly level, poorly drained soils that have a surface layer of loamy sand and a loamy or clayey subsoil within 20 inches of the surface; in flatwoods and in low depressions.
    - Unit IIIw–5. Nearly level, very poorly drained peats and mucks; on flood plains along the river and in depressions.
  - Subclass IIIs soils have severe limitations because of low available water capacity and low capacity to hold plant nutrients.
    - Unit IIIs–1. Nearly level, well-drained soil has a thick, black surface layer and is sandy to a depth of 80 inches; on droughty ridges.
    - Unit IIIs–2. Nearly level to sloping, excessively drained, droughty sand to a depth of 80 inches that has a favorable water table; on moderately low ridges.
    - Unit IIIs–3. Nearly level to gently sloping, somewhat excessively drained soils that are sand to a depth of 50 inches and sand and loamy sand to a depth of 80 inches; on ridges.
    - Unit IIIs–4. Nearly level and gently sloping, well-drained, droughty soils that have a surface layer of sand 20 to 40 inches thick over a clayey subsoil; on uplands.
- Class IV soils have very severe limitations that restrict the choice of plants, require very careful management, or both.
  - Subclass IVw soils have very severe limitations for cultivation because of excessive wetness.
    - Unit IVw–1. Nearly level, poorly drained soils that have dark-colored, weakly cemented underlying layers and are sandy to a depth of 60 inches; in flatwoods.
    - Unit IVw–2. Nearly level, poorly drained soils that have stained layers above a depth of 40 inches and are sandy to a depth of 80 inches; in sloughs and on low flats.
  - Subclass IVs soils have very severe limitations for cultivation because of very low available water capacity and very low capacity to hold plant nutrients.
    - Unit IVs–1. Nearly level to sloping, excessively drained soils that are sandy to a depth of 80 inches; on high ridges.
    - Unit IVs–2. Nearly level and gently sloping, moderately well drained, droughty soils that are sand to a depth of 80 inches and that have a favorable water table; on moderately high ridges.

Unit IVs–3. Sloping and strongly sloping, well-drained, droughty soils that have a surface layer of sand 20 to 30 inches thick and a clayey subsoil; on upland side slopes.

Class V soils are not likely to erode. They have other limitations, impractical to remove without major reclamation, that limit their use largely to pasture or range, woodland, or wildlife food and cover.

Subclass Vw soils are too wet for cultivation.

Unit Vw–1. Nearly level, very poorly drained soils that have a surface layer of loamy sand or clay and a clayey subsoil to a depth of 60 inches or more; on low flats and in depressions.

Class VI soils have severe limitations that make them generally unsuitable for cultivation and that limit use largely to pasture or range, woodland, or wildlife food and cover.

Subclass VIs soils are generally unsuited to cultivation and limited for other uses by very low available water capacity and very low capacity to hold plant nutrients.

Units VIs–1. Nearly level to sloping, excessively drained, droughty soils that are sandy to a depth of 80 inches or more; on high ridges.

Unit VIs–2. Nearly level, moderately well drained soils that are sandy to a depth of 70 inches or more and have weakly cemented layers below a depth of 30 inches.

Class VII soils have very severe limitations that make them unsuitable for cultivation without major reclamation and that restrict their use largely to grazing, woodland, or wildlife habitat.

Subclass VIIw soils are very severely limited by prolonged flooding.

Unit VIIw–1. Poorly drained and very poorly drained, nearly level soils having sand texture and weakly cemented layers above a depth of 30 inches, or a very thick, dark-colored surface layer; in depressions in flatwoods.

Subclass VIIs soils are very severely limited by very low available water capacity and very low capacity to hold plant nutrients.

Unit VIIs–1. Nearly level to moderately steep, excessively drained soils that are sandy to a depth of 80 inches or more; on broad ridges and side slopes.

Class VIII soils and landforms have, without major reclamation, limitations that preclude their use for commercial production of plants and restrict their use to recreation, wildlife habitat, water supply, or esthetic purposes. (None in the Ocala National Forest Area.)

Predicted Yields

Table 2 lists predicted yields of the principal crops grown in the survey area. The predictions are based on estimates made by farmers, soil scientists, and others who have knowledge of yields in the area and on information taken from research data. The predicted yields are an average per acre that can be expected by good commercial farmers at the level of management that tends to produce the highest economic returns.

The yields are those that can be expected with the generally high level of management used in the survey area. Not included in this table are soils that are used only for range or recreation.

Crops other than those shown in table 2 are grown in the area, but their predicted yields are not included, because their acreage is small or because reliable data on yields are not available.

Use of the Soils for Woodland

Originally, the Ocala National Forest Area (fig. 4) was wooded, and woodland is still the principal use. Trees cover 90 percent of the survey area.

Soils differ greatly in their suitability for trees. The kind of trees that grow on a particular soil and the combinations of species are determined largely by the ability of the soil to maintain favorable moisture and to permit the development of adequate root systems. Some soil characteristics that affect the growth of trees are thickness of the surface layer, texture of the soil material, available water capacity, natural fertility, aeration, and depth to the water table.

The soils of the Ocala National Forest Area have been placed in 12 woodland management groups. These groups and the mapping unit symbols are listed in the first column of table 3. Each group is made up of soils that require similar management practices and that are similar in potential productivity.

***Figure 4.*—Area of the Ocala National Forest, which embraces more than 200,000 acres, the largest stand of sand pine (*Pinus clausa*) in existence. The soils are an Astatula sand and a Paola sand. Sand pine is well suited to the deep, sandy soils.**

TABLE 2.—*Predicted average yields per acre of principal crops*

[Yields are those that can be expected under a high level of management. Absence of yield indicates that the crop is not suited to the soil or is not commonly grown on it]

Soil name	Oranges	Grapefruit	Corn (Field)	Corn (Sweet)	Cabbage	Watermelons (marketable)	Permanent improved pasture: Grass	Permanent improved pasture: Grass-clover
	Boxes	*Boxes*	*Bushels*	*Crates*	*50-pound crate or bag*	*Pounds*	*Animal-unit-months* [1]	*Animal-unit-months* [1]
Astatula sand, 0 to 8 percent slopes	375	575	----	----	----	----	3	----
Astatula sand, 8 to 17 percent slopes	----	----	----	----	----	----	3	----
Astatula sand, dark surface, 0 to 8 percent slopes	425	625	35	----	----	7, 200	6. 5	----
Astatula sand, dark surface, 8 to 17 percent slopes	----	----	----	----	----	----	6. 5	----
Astatula sand, banded substratum, 0 to 8 percent slopes	450	650	35	----	----	7, 200	6. 5	----
Astatula sand, moderately deep water table, 0 to 8 percent slopes	475	675	40	----	----	8, 000	8	----
Astor sand	----	----	----	180	480	----	8	10
Basinger sand	----	----	----	160	400	----	7. 5	9. 5
Delks sand	----	----	----	160	320	10, 000	7	9. 5
Dorovan muck	----	----	100	180	480	----	13	16
Duplin loamy sand	475	675	70	160	460	11, 000	10	----
Eureka loamy fine sand	----	----	----	----	----	----	10	12
Eureka loamy sand, thick-surface variant	----	----	----	----	----	----	10	12
Eustis sand	450	650	35	----	----	8, 000	6. 5	----
Everglades muck	----	----	100	180	480	----	13	16
Iberia clay	----	----	----	----	----	----	10	12
Immokalee sand	----	----	----	160	320	10, 000	7	9. 5
Made land	----	----	----	----	----	----	----	----
Meggett loamy sand	----	----	----	----	----	----	10	12
Myakka sand	----	----	----	160	320	10, 000	8	11
Myakka and Sellers soils, ponded	----	----	----	----	----	----	----	----
Orlando sand	425	625	35	----	----	10, 000	7	----
Orlando sand, wet variant	475	675	35	----	----	10, 000	7	----
Pamlico muck	----	----	100	180	480	----	13	16
Pamlico muck, deep	----	----	100	180	480	----	13	16
Paola sand, 0 to 8 percent slopes	200	350	----	----	----	----	3	----
Paola sand, 8 to 17 percent slopes	----	----	----	----	----	----	3	----
Paola sand, moderately deep water table, 0 to 5 percent slopes	350	450	----	----	----	----	4	----
Pomello sand	----	----	----	----	----	7, 200	4	----
Rains loamy fine sand	----	----	----	----	----	----	10	12
St. Johns sand	----	----	----	180	480	10, 000	9	11
St. Lucie sand	----	----	----	----	----	----	----	----
Sellers sand	----	----	----	180	480	----	8	10
Sellers and Pamlico soils	----	----	----	180	480	----	10	13
Terra Ceia muck	----	----	100	180	480	----	13	16
Wicksburg sand, 0 to 5 percent slopes	400	650	45	----	----	10, 000	8	----
Wicksburg sand, 5 to 12 percent slopes	400	650	40	----	----	10, 000	8	----

[1] Animal-unit-months refers to the number of months during a normal growing season that 1 acre will provide grazing for an animal unit (1 cow, horse, or steer; 5 hogs; or 7 sheep) without injury to the sod.

In the column headed "Tree species" are commercially important trees that are adapted to the soil. These are the trees that woodland managers generally favor in intermediate or improvement cuttings. Also given is the potential productivity of these trees in terms of site index. The site index is the average height of dominant trees, in feet, at age 50.

In the column headed "Productivity class," the potential productivity of five species of pine is indicated. Potential productivity is based on the entire stand (inside bark, stump to tip) at 100 percent stocking and is expressed in cubic feet per acre per year at age 50.

Four timber productivity classes are recognized:

Class I indicates 120 or more cubic feet per acre per year.

Class II indicates 85 to 120 cubic feet per acre per year.

Class III indicates 50 to 85 cubic feet per acre per year.

Class IV indicates 20 to 50 cubic feet per acre per year.

Seedling mortality ratings indicate the losses of planted seedlings to be expected when plant competition is not a limiting factor. Normal rainfall, good planting stock, and proper planting methods are assumed. A rating of slight indicates that expected mortality is less than 25 percent; moderate indicates a loss of 25 to 50 percent; and severe indicates a loss of more than 50 percent.

Plant competition refers to the invasions or encroachment of unwanted species that compete with desired tree

TABLE 3.—*Woodland groups of soils*

Woodland groups and map symbols	Productivity			Limitations and hazards		
	Tree species	Average site index	Productivity class	Seedling mortality	Plant competition	Equipment limitation
Group 1: Do, Ev, Ms, Pa, Pd, Tc.[1]						
Group 2: Du, WcA, WcC.	Slash pine Loblolly pine Longleaf pine	86 91 73	II II III	Slight	Moderate	Slight where slopes are not more than 8 percent. Moderate to severe where slopes are more than 8 percent.
Group 3: Er, Es, Ib, Me, Ra.	Loblolly pine Slash pine Longleaf pine	100 100 79	I II III	Moderate: water control is needed for regeneration and growth.	Moderate	Severe.
Group 4: AwB, Ba.	Slash pine Longleaf pine	84 79	III III	Slight	Slight	Slight.
Group 5: Ax, Os, Sp, Ss.	Slash pine	87	II	Severe: water control is needed for regeneration and growth of pine; excellent hardwood site.	Severe	Severe.
Group 6: Eu, Or.	Longleaf pine Sand pine	86 85	II III [2]	Moderate	Slight	Slight to moderate.
Group 7: AtB, AtD, AuB.	Slash pine Longleaf pine Sand pine	68 68 78	III III III	Moderate	Slight	Moderate where slopes are not more than 8 percent. Moderate to severe where slopes are more than 8 percent.
Group 8: AsB, AsD, PlB, PlD.	Sand pine	65	III	Moderate	Moderate	Moderate where slopes are not more than 8 percent. Severe where slopes are more than 8 percent.
Group 9: Sc.[3]	Sand pine	58	IV	Severe	Moderate	Severe.
Group 10: PmA, Po.	Slash pine Sand pine	80 77	III III	Moderate	Moderate	Moderate.
Group 11: Im, Mk, Sa.	Slash pine Longleaf pine Pond pine	70 63 70	III IV III	Moderate: in the wetter areas, water control is needed for good regeneration and growth.	Moderate	Moderate in Im and Mk. Severe in Sa.
Group 12: De.	Slash pine Longleaf pine	81 70	III III	Moderate	Moderate	Moderate.

[1] The organic soils in this group support hardwoods and scattered slash pine, pond pine, and loblolly pine in some places, but no data on productivity are available. The mineral soils are covered with water periodically and do not support trees.

[2] Productivity for sand pine is based on a site index of 80.

[3] Site index for sand pine is below 60.

species. Slight indicates that plant competition does not materially interfere with initial growth or establishment of a desired stand. Moderate indicates that plant competition does not prevent desirable species from becoming established, but it delays the natural regeneration of trees and slows initial growth. Severe indicates that undesirable brush invades or encroaches, overtops the desirable species, and prevents the establishment of adequate stands of healthy trees.

Equipment limitation reflects soil conditions that restrict the use of equipment normally used in woodland management or harvesting. Slight indicates equipment use is not limited to kind of equipment or time of year. Moderate indicates the limitation is seasonal or that modification in methods or equipment is needed. Severe indicates the need for special equipment or operations.

Fieldwork for this part of the survey was conducted by soil scientists and foresters working cooperatively. Careful attention was given to the stand and to the individual trees before measuring was begun. Trees that were affected abnormally by such influences as fire, insects, diseases, and management were not measured. Only dominant or codominant, apparently healthy trees were measured. On the average, one to six trees per plot were measured to determine age and height. Among the measurements were a ring count at breast height obtained by increment borings, and total height to the nearest foot measured with an Abney level and tape. To obtain the total age, 3 years were added to the ring count for slash pine and loblolly pine, 7 years for longleaf pine, and 4 years for sand pine.

A site index, based on tree height at 50 years of age, was determined for each tree, then averaged for each plot where more than one tree was present. The site indexes recorded represent the average of all the plots for each species. Site index curves used for loblolly and sand pines were from a 1960 publication (*4*) and for longleaf pines and slash pines from a 1929 publication (*7*) of the U.S. Department of Agriculture.

Soils were examined and classified at each location. Sites on transitional soils were avoided. Among other features observed were aspect, slope position, density of the stand, and density of the understory.

Use of the Soils for Range [2]

If forest operations are to be profitable, careful management of available forage and keeping the damage to forest soils to a minimum are required.

Most forage in the Ocala National Forest Area is produced on uplands in soils under an open forest and in areas locally called prairies. Among the principal range plants are pineland three-awn, maidencane, switchgrass, bluestem, carpetgrass, panicgrass, paspalum, lopsided indiangrass, and Curtiss dropseed.

Forage is more nutritious in spring and summer than in other seasons, but not all the current growth should be used by cattle. Enough must be left so that plants can set seed and store food to begin growth the following year. As a general rule, moderate grazing, or grazing only about 40 to 50 percent of the current growth, gives each cow better gains per acre than other grazing intensities.

The soils of the Ocala National Forest Area have been placed in 10 range management groups. These groups are shown in table 4. Each group is made up of soils that require similar management practices and that are similar in potential productivity. Productivity is estimated for both open areas and wooded areas. In open areas crown density is less than 50 percent, and in wooded areas more than 50 percent.

Wooded areas that provide range in this survey area are longleaf-wiregrass sandhills, longleaf wiregrass flatlands, and loblolly-slash pine flatwoods. The other areas are prairies and marshes.

[2] ELDON G. LUCAS, range and wildlife assistant, Forest Service, U.S. Dept. Agr., helped write this section.

Longleaf-wiregrass sandhills consist of excessively drained, sandy soils that support a plant cover that is dominantly longleaf pine and turkey oak. Herbaceous vegetation is seldom dense. Where fire is not frequent, clumps of wiregrass become very large. Among other characteristic range plants are dropseed, bluestem, and panicum.

Longleaf-wiregrass flatwoods consist of poorly drained and moderately well drained, sandy soils that have a fluctuating water table. Longleaf pine is the dominant tree, and shrubby and herbaceous vegetation is dense. Among the characteristic range plants are three-awn, dropseed, indiangrass, and stargrass.

Loblolly-slash pine flatwoods consist of poorly drained and very poorly drained soils. Water stands near the surface during wet seasons but is 3 feet below the surface during prolonged dry seasons. Loblolly pine and slash pine are the dominant trees. Among characteristic plants are three-awn, bluestem, panicum, three-seeded mercury, and rushes.

Prairies and marshes consist of poorly drained and very poorly drained areas that periodically are covered with water (see cover). Very few trees grow in these areas. Among the characteristic range grasses are bluestem, low panicum, cordgrass, and maidencane.

Fieldwork for this part of the survey was conducted on three range allotments according to instructions set forth in Southern Forest Experiment Station Occasional Paper 139, by R. S. Campbell and John T. Cassady (*3*), with two exceptions: (1) Timber types were used in setting up allotments, and (2) a minimum of 20 clipped plots were required for each suitable type. Two clipped plots were required on unsuitable types.

Soils for each plot were examined and classified, but no plot on transitional soil was used. On some soils there were not plots, and for these soils, estimates of production were made on the basis of production on similar soils.

The soils of the Ocala National Forest Area have been placed in 10 range management groups. These groups are listed in the first column of table 4. Each group is made up of soils that require similar management practices and that are similar in potential productivity. Five productivity classes are recognized.

- Class I soils can be expected to produce 4,000 or more pounds, air-dry weight per acre;
- Class II soils 2,000 to 4,000 pounds, air-dry weight per acre;
- Class III soils 1,000 to 2,000 pounds, air-dry weight per acre;
- Class IV soils 500 to 1,000 pounds, air-dry weight per acre; and
- Class V soils 100 to 500 pounds, air-dry weight per acre.

Some of the columns in table 4 are discussed in the following paragraphs.

Surface compactability refers to the risk of compacting soil by excessive grazing, thus causing excess runoff, erosion, reduced plant vigor, and reduced forage production. The two degrees of surface compactability recognized are slight and moderate. Slight means that the site can be

TABLE 4.—*Range management groups of soils*

[The symbol > means more than, and the symbol < means less than]

Range management groups and map symbols	Forage		Factors influencing range use and management			
	Plant cover	Amount	Surface compactability (degree)	Brush encroachment (degree)	Soil stability (degree)	During critical use periods
		Lb. per acre (air dry)				
Group 1: Do, Ev, Pa, Pd, Sp, Tc.	Wooded	<500	Not rated: deciduous trees dominant; herbaceous vegetation sparse.	Not rated: deciduous trees dominant; herbaceous vegetation sparse.	Not rated: deciduous trees dominant; herbaceous vegetation sparse.	Flooding.
Group 2: Ms.	Open	>4, 000	Slight	Slight	Slight	Flooding.
Group 3: Er, Es, Ib, Me, Ra.	Open Wooded	2, 000–4, 000 1, 000–2, 000	Moderate	Moderate	Slight	Excessive wetness.
Group 4: AwB, Ba.	Open Wooded	2, 000–4, 000 1, 000–2, 000	Slight	Moderate	Slight	Excessive wetness.
Group 5: Du, Eu, Or, Os, WcA, WcC.	Open Wooded	2, 000–4, 000 1, 000–2, 000	Slight	Moderate	Slight	Drought.
Group 6: Ax, Sa, Ss.	Open Wooded	>4, 000 500–1, 000	Slight	Severe in most areas. Slight in open areas (prairies).	Slight	Flooding.
Group 7: AtB, AtD, AuB.	Open Wooded	1, 000–2, 000 500–1, 000	Slight	Moderate	Slight where slope is not more than 8 percent.	Drought: moderate where slope is more than 8 percent.
Group 8: AsB, AsD, PlB, PlD, PmA, Po, Sc.[1]	Wooded	>100	Slight	Severe	Slight	Drought.
Group 9: De, Im, Mk.	Open Wooded	1, 000–2, 000 500–1, 000	Slight	Severe	Slight	Wetness.
Group 10: Ma. No ratings given because conditions are extremely variable.						

[1] These soils are not suited to range. They support dense stands of pine and evergreen shrubs, but little grass.

grazed with no significant damage to the soil. Moderate means that a concentration of animals causes moderate compaction, resulting in reduced plant vigor and forage production.

Brush encroachment refers to the degree of plant competition from brush and weeds. The three degrees recognized are slight, moderate, and severe. Slight indicates that brush encroachment does not materially interfere with range plant production. Moderate indicates that brush encroachment reduces forage production to some extent. Severe indicates that brush encroachment drastically reduces forage production.

Soil stability refers to the degree that soil is susceptible to displacement from trampling. The two degrees recognized are slight and moderate. Slight indicates that soil displacement by livestock should not adversely affect range management. Moderate indicates that soil displacement by trampling is evident, particularly where the slope is more than 8 percent and in areas where livestock tend to gather, such as salt blocks and feeders.

Critical use periods are periods during the grazing year when flooding, wetness, and drought restrict use of the range. Flooding means that an area may be flooded with 1 or more feet of water during some part of the grazing season. Wetness means that water may stand at or near the surface during some part of the grazing season. Drought means that plants suffer from lack of moisture and can easily be overgrazed during a prolonged absence of rainfall.

Forest-Wildlife Management [3]

The soil survey provides an ideal meeting ground for coordinating timber and wildlife management. In timber

[3] WILLIAM D. ZEEDYK, forester, Forest Service, U.S. Dept. Agr., helped write this section.

management soil information can be used in deciding what commercially desirable trees can be economically grown. In wildlife management this information can be used in determining the potential of the soil for supporting various kinds and amounts of wildlife. This knowledge leads to a better understanding of both conflicts and opportunities in management.

The objectives of timber and wildlife habitat management are frequently accomplished by adjusting the rate and direction of natural plant succession. The succession of some plants proceeds at a rapid rate and in only a few different stages; that of others proceeds very slowly and in many stages. The rate of change and the composition of the stand in the various stages strongly influence the character and stability of the wildlife habitat. As the availability of foods and cover varies at each different stage, the potential for different wildlife also varies.

The wildlife manager should know what plant communities the soils can support at different times and under various intensities of forest management. Such knowledge helps in—

(a) selecting for emphasis the wildlife species most compatible with timber management objectives,
(b) evaluating the likelihood of success for wildlife management programs incompatible with a soils-based timber program, and
(c) determining the feasibility of modifying timber management practices so that the soils can provide a suitable wildlife habitat.

Kinds of wildlife

The feeding habits of wildlife differ greatly. Some animals eat only insects and small animals; some eat only plants; and others eat a combination of these. The following paragraphs are a summary of foods needed by most of the important animals and fish in the area.

Bear.—Acorns are the most important fall and winter food of the Florida bear. Among choice foods are the fruits of gallberry, cabbage palm, blackgum, and saw-palmetto. Among other foods are armadillo, carpenter ants, acorn weevils, and waterbugs. A mixture of flatwoods, swamp, scrub oak ridges, bay heads, and hammocks, thoroughly interspersed, makes the best habitat for Florida bear.

Bobwhite (quail).—Choice foods for bobwhite are acorns, blackberry, wild black cherry, dewberry, Florida beggarweed, flowering dogwood, lespedeza, pineseed, sweetgum, browntop millet, and tickclover. These birds also eat many insects. The food must be close to vegetation that can protect the wildlife from predators, extreme heat, and adverse weather.

Deer.—Among the choice foods for deer are acorns, basidiomycetes, smilax, saw-palmetto berry, red maple shoots, and tender oak leaves.

Dove, mourning.—Among choice foods for the mourning dove are pineseed, three-seeded mercury seed, partridgepea, common ragweed, and sweetgum seed. Doves do not generally eat insects, green leaves, or fruit. They drink water daily.

Duck.—Choice foods for ducks are acorns, browntip millet, corn, and smartweed seed. Their food generally needs to be flooded.

Squirrel.—Choice food for squirrels are acorns, blackgum seed, pineseed, black cherry, flowering dogwood, magnolia, and cypress seed.

Turkey, wild.—Turkeys survive only in large wooded areas that generally occupy 2,000 acres or more. They need surface water for daily drinking. Choice foods are insects, acorns, bahiagrass seed, blackberry, dewberry, flowering dogwood, gallberry wild grape and pineseed.

Nongame birds.—Nongame birds vary greatly in the foods they choose. Several kinds eat nothing but insects; others eat insects, nuts, and fruits; the predators eat fish, rodents, and other birds.

Fish.—The principal game fish in this area are bluegill, black crappie, redbreast, shellcracker, warmouth, largemouth black bass, jackfish, and channel catfish. The amount of fish produced is related directly to the fertility of the water. This fertility is affected by the soils of the watershed and somewhat by the soils at the bottom of the ponds.

Management by soil associations

Soil information applied to wildlife management aids in determining which game species to emphasize in a particular locality. Wildlife management by soil associations is discussed in the following paragraphs. The soil associations are described in the section "General Soil Map."

1. Astatula-Paola association.—The vegetation in this association, which is locally called "The Big Scrub," is dominated by dense stands of sand pine and evergreen shrubs. The shrubs form a thick understory averaging 6 to 10 feet in height. Mats of lichen are common on the ground. Among the most important plants for wildlife are sand pine, sand live oak, myrtle oak, crookedwood, Chapman oak, turkey oak, scrub palmetto, saw-palmetto, blueberry, milkpea, wildbean, and basidiomycetes.

Clear cutting sand pine at age 40 to 60 in patches and brush chopping the area after harvesting are practices that benefit deer. These practices result in an increased quantity and variety of woody and herbaceous browse plants while retaining cover. In contrast, most browse plants are shaded out in mature stands of sand pine. Controlled burning is not advisable, because these soils have extremely low fertility and because sand pine is not fire tolerant.

Wildlife plantings on the soils of this association often fail because the soils are droughty and infertile. Plantings have less competition and are more successful in areas that have been completely cleared of all evergreen vegetation and the roots removed. Some of these areas are along gaslines.

The isolated lakes and grassy ponds scattered throughout this association provide water within a mile of almost any point. Water-tolerant vegetation abounds in shallow water and grassy ponds, many of which are surrounded by thin borders of Immokalee and Sellers soils. Here slash pine, pond pine, saw-palmetto, waxmyrtle, dwarf huckleberry, and smilax abound. Water-tolerant vegetation can be manipulated on these soils with little difficulty.

2. Astatula, dark surface, association.—The vegetation on this association is dominated by parklike stands of longleaf pine and turkey oak. The proportion of the plant community occupied by longleaf pine or turkey oak depends mainly on the time and the severity of

cuttings and fire: cutting is favorable to turkey oak, and fire is favorable to longleaf pine. Herbaceous vegetation is seldom dense. When fire is infrequent, clumps of perennial wiregrasses become very large and hold back the growth of most other herbaceous members of the plant community.

In preparing for pine plantations, strips of oaks are left throughout the association to promote greater use by game. Where stands of turkey oak become thick, ground cover is shaded out. In these areas thinning of the oaks is needed to increase the production of shrubby vegetation, acorns, and forbs, such as blueberry, aster, milkweed, partridgepea, and elephantopus.

Controlled burning is important for game management. Light periodic burns in selected places, along with occasional rotation of areas to be treated, prevent hot, damaging fires in the wrong season and favor the growth of plants that provide wildlife foods.

Wildlife planting on these soils should be limited to plants that are drought tolerant.

Minor soils of the association have better moisture relationships and the vegetation can be manipulated much easier than on the Astatula soils. In most places small lakes, ponds, and marshes are numerous and watering places are available within a mile.

3. Immokalee-Sellers association.—The vegetation on this association is predominantly a slash pine flatwoods community. There are many small swamps that have the vegetation described for association 5. Some of the major plants in the flatwoods that are significant to wildlife are longleaf pine, slash pine, aster, blueberry, deerstongue, gallberry, runner oak, saw-palmetto, waxmyrtle, wicky, and yellow jasmine.

In the absence of fire, shrubby and herbaceous ground cover becomes very dense. In some of the smaller areas, fetterbush (*Lyonia lucida*) is very dense. Wildfire in these areas burns everything to the ground, but fetterbush sprouts readily from underground stems and eventually crowds out other plants. Controlled burning is needed for better wildlife management. It minimizes hot, out-of-season wildfire and is of value to deer in that it produces sprouting, which increases the palatability of the vegetation. Light burning of small areas each year, along with occasional rotation of burned areas, improves the habitat for quail and turkey.

Clear cutting of pine over large areas and repeated yearly burning of the entire area eventually reduces food and cover and thus reduces the amount of wildlife in the area. In young, dense stands of pine, a selective thinning is needed to open the canopy and permit understory vegetation to develop that can be used for forage.

Wildlife plantings are generally successful. In most places water is available in swamps and lakes within one-half mile.

4. Eureka association.—Stands of loblolly pine and slash pine cover most of this association. Sweetgum, live oak, southern red maple, and cabbage palm are scattered throughout. Harvesting merchantable timber and thinning in young, dense stands are needed to open the canopy and permit a healthy growth of understory plants. American beautyberry, smilax, aster, three-seeded mercury, blueberry, waxmyrtle, and gallberry are among the important plants for wildlife. Hardwoods, such as oak, sweetgum, and southern red maple, provide fruit and woody browse for wildlife. Plants on these soils can be easily manipulated, and special wildlife plantings improve wildlife capacity. In most places water is available within one-half mile.

5. Terra Ceia-Everglades association.—This association includes areas locally called hardwood swamps. It furnishes important cover and a limited amount of food for most wildlife in the survey area. Among the common plants important to wildlife are baldcypress, swamp tupelo, southern red maple, water hickory, swamp chestnut oak, cabbage palm, buttonbush, waxmyrtle, and smilax. Most cypress swamps have dense overstory canopies, and thinning encourages greater production of woody browse vegetation. This association is favorable to turkey, gray squirrel, bear and deer. Many hardwood hammocks border the swamps.

Engineering Uses of the Soils

This section is useful to those who need information about soil used as structural material or as a foundation upon which structures are built. Among those who can benefit from this section are planning commissions, town and city managers, land developers, engineers, contractors, and farmers.

Among properties of soils highly important in engineering are permeability, strength, compaction characteristics, soil drainage, shrink-swell potential, grain size, plasticity, and soil reaction. Also important are depth to the water table, depth to bedrock, and soil slope. These properties, in various degrees and combinations, affect construction and maintenance of roads, airports, pipelines, foundations for small buildings, irrigation systems, ponds and small dams, and systems for disposal of sewage and refuse.

Information in this section of the soil survey can be helpful to those who—

1. Select potential residential, industrial, commercial, and recreational areas.
2. Evaluate alternate routes for roads, highways, pipelines, and underground cables.
3. Seek sources of gravel, sand, or clay.
4. Plan farm drainage systems, irrigation systems, ponds, terraces, and other structures for controlling water and conserving soil.
5. Correlate performance of structures already built with properties of the kinds of soil on which they are built, for the purpose of predicting performance of structures on the same or similar kinds of soil in other places.
6. Predict the trafficability of soils for cross-country movement of vehicles and construction equipment.
7. Develop preliminary estimates pertinent to construction in a particular area.

Most of the information in this section is presented in tables. Table 5 shows several estimated soil properties significant to engineering; table 6 shows interpretations for various engineering uses; table 7 shows results of engineering laboratory tests on soil samples; and table 8 shows degree and kinds of limitation for several land uses.

This information, along with the soil map and other parts of this publication, can be used to make interpretations in addition to those given in tables 7 and 8, and it also can be used to make other useful maps.

This information, however, does not eliminate the need for further investigations at sites selected for engineering work, especially work that involves heavy loads or that requires excavations to depths greater than those shown in the tables, generally depths greater than 6 feet. Also, inspection of sites, especially the small ones, is needed because many delineated areas of a given soil mapping unit may contain small areas of other kinds of soil that have strongly contrasting properties and different suitabilities or limitations for soil engineering.

Some of the terms used in this soil survey have special meaning to soil scientists that is not known to all engineers. The Glossary defines many of these terms commonly used in soil science.

Engineering classification systems

The two systems most commonly used in classifying samples of soils for engineering are the Unified system used by Soil Conservation Service engineers, the Department of Defense, and others, and the AASHO system, adopted by the American Association of State Highway Officials.

In the Unified system (*11*) soils are classified according to particle-size distribution, plasticity, liquid limit, and organic matter. Soils are grouped in 15 classes. There are eight classes of coarse-grained soils, identified as GW, GP, GM, GC, SW, SP, SM, and SC; six classes of fine-grained soils, identified as ML, CL, OL, MH, CH, and OH; and one class of highly organic soils, identified as Pt. A soil on the borderline between two classes is designated by symbols for both classes, for example, SP–SM.

The AASHO system (*1*) is used to classify soil according to properties that affect highway construction and maintenance. In this system a soil is placed in one of seven basic groups, ranging from A–1 through A–7, on the basis of grain-size distribution, liquid limit, and plasticity index. In group A–1 are gravelly soils of high bearing strength, the best soils for subgrade (foundation). At the other extreme, in group A–7, are clay soils that have low strength when wet, the poorest soils for subgrade. Where laboratory data are available to justify a further breakdown, the A–1, A–2 ,and A–7 groups are divided as follows: A–1–a, A–1–b, A–2–4, A–2–5, A–2–6, A–2–7, A–7–5, and A–7–6. As an additional refinement the engineering value of a soil material can be indicated by a group index number. Group indexes range from 0 for the best material to 20 or more for the poorest. The AASHO classification for tested soil with a group index number in parentheses, is shown in table 7. The estimated classification, without a group index number, is given in table 5 for all soils mapped in the survey area.

Soil properties significant to engineering

Several estimated soil properties significant in engineering are given in table 5. These estimates are made for typical soil profiles, by layers sufficiently different to have different significance for soil engineering. The estimates are based on field observations made in the course of mapping, on test data for these and similar soils, and on experience with the same kinds of soil in other countries. Following are explanations of some of the columns in table 5.

Depth to seasonal high water table is the distance from the surface of the soil to the highest level that ground water reaches in the soil in most years.

Flooding is described in terms of the frequency and the duration of flood hazard.

Soil texture is described in table 5 in standard terms used by the Department of Agriculture. These terms take into account the relative percentages of sand, silt, and clay in soil material the particles of which are less than 2 millimeters in diameter. For example, loam is soil material that is 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If the soil contains gravel or other particles coarser than sand, an appropriate modifier is added, such as "gravelly" in "gravelly loamy sand." "Sand," "silt," "clay," and some other terms used in USDA textural classification are defined in the Glossary of this soil survey.

Liquid limit and plasticity index indicate the effect of water on the strengths and consistence of soil material. As a dry, clayey soil absorbs water, it changes from a semisolid to a plastic. If the moisture content is further increased, the clay changes from a plastic to a liquid. The plastic limit is the moisture content at which the soil material changes from a semisolid to a plastic state, and the liquid limit is the moisture content at which the soil material changes from a plastic to a liquid state. The plasticity index is the numerical difference between the liquid limit and the plastic limit. It indicates the range of moisture content within which a soil remains plastic. The liquid limit and plasticity index are estimated in table 5, but are shown on the basis of soil samples in table 7.

Permeability is that quality of a soil that enables it to transmit water or air. It is estimated on the basis of those soil characteristics observed in the field, particularly of structure and texture. The estimates in table 5 do not take into account lateral seepage or transient soil features, such as plowpans and surface crusts.

Available water capacity is the ability of a soil to hold water for use by most plants. It is commonly defined as the difference between the amount of water in the soil at field capacity and the amount at the wilting point of most crop plants.

Reaction is the degree of acidity or alkalinity of a soil, expressed in pH value. The pH value and terms used to describe soil reaction are explained in the Glossary.

Shrink-swell potential is the relative change in volume to be expected of soil material when its moisture content changes: that is, the extent to which the soil shrinks as it dries out, or swells when it gets wet. Shrinkage and swelling are influenced by the amount and kind of clay in the soil, and they cause much damage to building foundations, roads, and other structures. A high shrink-swell potential indicates a hazard to the maintenance of structures built in, on, or with material having this rating.

TABLE 5.—*Estimated engineering*

[An asterisk in the first column indicates that at least one mapping unit in this series is made up of two or more kinds of soil. The soils for referring to other series that appear in the first column of this table.

Soil series and map symbols	Depth to seasonal high water table [1]	Flooding [2]	Depth from surface	Classification		
				USDA texture	Unified	AASHO
			Inches			
Astatula:						
AsB, AsD, AtB, AtD	Deeper than 60 inches continuously.	None.	0–84	Sand	SP, SP–SM	A–3
AuB	Deeper than 60 inches continuously.	None.	0–50	Sand	SP, SP–SM	A–3
			50–80	Sand to loamy sand.	SP–SM, SM	A–3, A–2–4
AwB	40 to 60 inches for 6 months or more of the year.	None.	0–80	Sand	SP, SP–SM	A–3
Astor: Ax	0 to 10 inches for 6 to 12 months.	More often than once every year for 1 to 6 months.	0–24	Sand	SP, SP–SM	A–3, A–2–4
			24–80	Sand	SP, SP–SM	A–3, A–2–4
Basinger: Ba	0 to 10 inches for 2 to 6 months.	More often than once every year for 1 to 6 months.	0–80	Sand	SP–SM	A–3, A–2–4
Delks: De	0 to 10 inches for 1 to 3 months.	Once in 5 to 20 years for 7 days to 1 month.	0–25	Sand	SP, SP–SM	A–3
			25–38	Sand	SM, SP–SM	A–2–4, A–3
			38–46	Sand	SM, SP–SM	A–2–4, A–3
			46–60	Sandy clay	SC	A–2–6, A–6
Dorovan: Do	0 to 10 inches for 9 to 12 months.	More often than once every year for longer than 6 months.	0–64	Muck	Pt	Organic
Duplin: Du	10 to 40 inches for 1 to 2 months.	None.	0–13	Loamy sand	SM	A–2–4
			13–32	Sandy clay	SC	A–6
			32–50	Sandy clay loam.	SC, SM–SC	A–2–4
			50–64	Sandy loam	SM, SM–SC	A–2–4
Eureka: Es	0 to 10 inches for 2 to 6 months.	Once in 1 to 5 years for 7 days to 1 month.	0–11	Loamy fine sand.	SM	A–2–4
			11–20	Sandy clay	SC	A–6
			20–72	Clay	CH, SC	A–7–6
Eureka, thick-surface variant: Er.	0 to 10 inches for 6 to 9 months.	More often than once every year for 3 to 6 months.	0–11	Loamy sand	SM	A–2–4
			11–18	Sand	SP–SM, SM	A–3, A–2–4
			18–33	Sandy clay	SC	A–6
			33–64	Clay	CH	A–7–6
Eustis: Eu	Deeper than 120 inches continuously.	None.	0–50	Sand	SP–SM	A–3, A–2–4
			50–84	Loamy sand	SM	A–2–4
Everglades: Ev	0 to 10 inches for 9 to 12 months.	More often than once every year for longer than 6 months.	0–100	Muck	Pt	Organic
Iberia: Ib	0 to 10 inches for 6 to 9 months.	More often than once every year for 3 to 9 months.	0–64	Clay	CH	A–7–6
Immokalee: Im	0 to 10 inches for 1 to 2 months.	Once in 5 to 20 years for 7 days in 1 month.	0–34	Sand	SP, SP–SM	A–3
			34–54	Sand	SM, SP–SM	A–3, A–2–4
			54–72	Sand	SP, SP–SM	A–3

See footnotes at end of table.

properties of soils

in such mapping units may have different properties and limitations, and for this reason it is necessary to follow carefully the instructions The symbol > means more than; the symbol < means less than]

Percentage passing sieve—[3] No. 4 (4.7 mm.)	No. 10 (2.0 mm.)	No. 40 (0.42 mm.)	No. 200 (0.074 mm.)	Liquid limit	Plasticity index	Permeability	Available water capacity	Reaction	Shrink-swell potential	Corrosivity to— Uncoated steel	Concrete
						Inches per hour	*Inches per inch of soil*	*pH*			
100	100	75–100	2–7	([4])	([4])	>20.0	<0.05	4.5–5.5	Low	Low	Moderate.
100	100	80–100	2–7	([4])	([4])	>20.0	<0.05	4.5–5.5	Low	Low	Moderate.
100	100	80–90	5–15	([4])	([4])	6.3–20.0	0.05–0.10	4.5–5.5	Low	Low	Moderate.
100	100	80–100	2–7	([4])	([4])	>20.0	<0.05	4.5–5.5	Low	Low	High.
100	100	90–100	2–15	([4])	([4])	6.3–20.0	0.10–0.15	6.1–8.4	Low	High	Moderate.
100	100	85–95	2–15	([4])	([4])	6.3–20.0	0.05–0.10	7.4–8.4	Low	High	Low.
100	100	80–95	5–12	([4])	([4])	>20.0	<0.05	4.5–7.8	Low	Low to high.	Low to high.
100	100	75–95	2–8	([4])	([4])	6.3–20.0	<0.05	4.5–5.5	Low	High	High.
100	100	80–95	8–20	([4])	([4])	0.63–2.0	0.10–0.15	4.5–5.5	Low	High	High.
100	100	80–95	8–20	([4])	([4])	0.20–0.63	0.10–0.15	4.5–5.5	Low	High	High.
100	100	85–100	25–50	<40	>11	0.06–0.20	0.15–0.20	4.5–5.5	Low	High	High.
-------	-------	-------	-------	-------	-------	6.3–20.0	>0.25	4.5–5.5	([5])	High	High.
100	100	75–95	15–20	<40	[4]–10	6.3–20.0	0.10–0.15	4.5–5.5	Low	Low	High.
100	100	85–95	36–50	<40	>11	0.06–0.20	0.10–0.15	4.5–5.5	Low	Moderate	High.
100	100	80–90	25–35	<40	[4]–10	0.63–2.0	0.10–0.15	4.5–5.5	Low	High	High.
100	100	60–70	20–30	<40	[4]–10	2.0–6.3	0.10–0.15	4.5–5.5	Low	High	High.
100	100	75–95	15–20	<40	[4]–10	2.0–6.3	0.10–0.15	4.5–5.5	Low	Moderate	High.
100	100	85–95	36–50	<40	>11	0.20–0.63	0.15–0.20	4.5–5.5	Moderate	High	High.
100	100	90–100	45–80	>41	>11	<0.06	0.15–0.20	4.5–5.5	Moderate	High	High.
100	100	75–95	15–20	<40	[4]–10	2.0–6.3	0.10–0.15	4.5–5.5	Low	Moderate	High.
100	100	80–90	5–15	([4])	([4])	6.3–20.0	0.05–0.10	4.5–5.5	Low	Moderate	High.
100	100	85–95	36–50	<40	>11	0.20–0.63	0.15–0.20	4.5–5.5	Moderate	High	High.
100	100	90–100	50–80	>41	>11	<0.06	0.15–0.20	4.5–5.5	Moderate	High	High.
100	100	80–95	5–12	([4])	([4])	>20.0	<0.05	4.5–5.5	Low	Low	High.
100	100	75–95	15–20	>40	[4]–10	2.0–20.0	0.05–0.10	4.5–5.5	Low	Low	High.
-------	-------	-------	-------	-------	-------	6.3–20.0	>0.25	5.6–8.4	([5])	High	Moderate to low.
100	100	90–100	50–80	>41	>11	<0.06	0.15–0.20	6.6–8.4	High	Very high	Low.
100	100	80–95	2–8	([4])	([4])	6.3–20.0	<0.05	4.5–5.5	Low	High	High.
100	100	85–100	8–20	([4])	([4])	0.63–6.3	0.10–0.15	4.5–5.5	Low	High	High.
100	100	80–95	2–8	([4])	([4])	6.3–20.0	<0.05	4.5–5.5	Low	High	High.

TABLE 5.—*Estimated engineering*

Soil series and map symbols	Depth to seasonal high water table [1]	Flooding [2]	Depth from surface	Classification		
				USDA texture	Unified	AASHO
			Inches			
Made land: Ma. Properties too variable to be estimated.						
Meggett: Me	0 to 10 inches for 2 to 6 months.	More often than once every year for 1 to 6 months.	0–10	Loamy sand	SM	A–2–4
			10–41	Clay	CH	A–7–6
			41–60	Sandy clay	SC	A–6
*Myakka: Mk, Ms. For Sellers part of Ms, see Sellers series.	0 to 10 inches for 1 to 2 months.	Once in 5 to 20 years for 7 days to 1 month.	0–20	Sand	SP, SP–SM	A–3
			20–29	Sand	SM, SP–SM	A–3, A–2–4
			29–60	Sand	SP, SP–SM	A–3
Orlando: Or	More than 120 inches continuously.	None.	0–27	Sand	SP–SM	A–3, A–2–4
			27–80	Sand	SP, SP–SM	A–3
Orlando, wet variant: Os.	10 to 40 inches for 2 to 6 months.	None.	0–36	Sand	SP–SM	A–3, A 2–4
			36–80	Sand	SP, SP–SM	A–3
Pamlico:						
Pa	0 to 10 inches for 9 to 12 months.	More often than once every year for longer than 6 months.	0–24	Muck	Pt	Organic
			24–60	Coarse sand	SP	A–3
Pd	0 to 10 inches for 9 to 12 months.	More often than once every year for longer than 6 months.	0–45	Muck	Pt	Organic
			45–60	Coarse sand	SP	A–3
Paola:						
PlB, PlD	More than 120 inches continuously.	None.	0–86	Sand	SP	A–3
PmA	40 to 60 inches for 6 to 9 months.	None.	0–80	Sand	SP	A–3
Pomello: Po	30 to 40 inches for 2 to 6 months.	None.	0–35	Sand	SP, SP–SM	A–3
			35–45	Sand	SM, SP–SM	A–3, A–2–4
			45–70	Sand	SP, SP–SM	A–3
Rains: Ra	0 to 10 inches for 2 to 6 months.	Once in 1 to 5 years for 7 days to 1 month.	0–16	Loamy fine sand.	SM	A–2–4
			16–60	Sandy clay loam.	SC, SM–SC	A–2–4
St. Johns: Sa	0 to 10 inches for 2 to 6 months.	Once in 1 to 5 years for 7 days to 1 month.	0–11	Sand	SP, SP–SM	A–3, A–2–4
			11–24	Sand	SP, SP–SM, SM	A–3, A–2–4
			24–60	Sand	SP, SP–SM	A–3, A–2–4
St. Lucie: Sc	More than 120 inches continuously.	None.	0–86	Sand	SP	A–3
Sellers: Sp, Ss	0 to 10 inches for 6 to 12 months.	More often than once every year for 1 to 6 months.	0–28	Sand	SP, SP–SM	A–3, A–2–4
			28–80	Sand	SP, SP–SM	A–3, A–2–4

See footnotes at end of table.

properties of soils—Continued

Percentage passing sieve— [3]				Liquid limit	Plasticity index	Permeability	Available water capacity	Reaction	Shrink-swell potential	Corrosivity to—	
No. 4 (4.7 mm.)	No. 10 (2.0 mm.)	No. 40 (0.42 mm.)	No. 200 (0.074 mm.)							Uncoated steel	Concrete
						Inches per hour	*Inches per inch of soil*	*pH*			
100	100	75–95	15–20	<40	4–10	2.0–6.3	0.10–0.15	6.1–8.4	Low	High	Low.
100	100	90–100	50–80	>41	>11	<0.20	0.15–0.20	6.1–8.4	High	High	Low.
100	100	85–95	36–50	<40	>11	<0.20	0.15–0.20	6.1–8.4	Moderate	High	Low.
100	100	80–90	2–8	[4]	[4]	6.3–20.0	<0.05	4.5–5.5	Low	High	High.
100	100	85–95	8–20	[4]	[4]	0.63–6.3	0.10–0.15	4.5–5.5	Low	High	High.
100	100	85–95	2–10	[4]	[4]	6.3–20.0	<0.05	4.5–5.5	Low	High	High.
100	100	80–95	5–12	[4]	[4]	6.3–20.0	0.05–0.10	4.5–5.5	Low	Low	Moderate.
100	100	80–95	2–8	[4]	[4]	6.3–20.0	<0.05	4.5–5.5	Low	Low	Moderate.
100	100	80–95	5–12	[4]	[4]	6.3–20.0	0.10–0.15	4.5–5.5	Low	Moderate	Moderate to high.
100	100	80–95	2–8	[4]	[4]	6.3–20.0	0.05–0.10	4.5–5.5	Low	High	High.
-----	-----	-----	-----	-----	-----	6.3–20.0	>0.25	4.5–5.5	[5]	High	High.
100	100	50–70	2–4	[4]	[4]	>20.0	<0.05	4.5–5.5	Low	High	High.
-----	-----	-----	-----	-----	-----	6.3–20.0	>0.25	4.5–5.5	[5]	High	High.
100	100	50–70	2–4	[4]	[4]	>20.0	<0.05	4.5–5.5	Low	High	High.
100	100	75–100	1–4	[4]	[4]	>20.0	<0.05	4.5–5.5	Low	Low	Moderate.
100	100	80–100	1–4	[4]	[4]	>20.0	<0.05	4.5–5.5	Low	Low	Moderate.
100	100	75–95	2–8	[4]	[4]	>20.0	<0.05	4.5–5.5	Low	Low	High.
100	100	85–95	8–20	[4]	[4]	2.0–6.3	0.10–0.15	4.5–5.5	Low	Low	High.
100	100	75–95	2–8	[4]	[4]	>20.0	<0.05	4.5–5.5	Low	Low	High.
100	100	75–95	15–20	<40	4–10	2.0–6.3	0.05–0.10	4.5–5.5	Low	Moderate	Moderate.
100	100	80–90	25–35	<40	4–10	0.63–2.0	0.10–0.15	4.5–5.5	Low	High	High.
100	100	90–100	2–12	[4]	[4]	6.3–20.0	0.10–0.15	4.5–5.5	Low	High	High.
100	100	90–100	2–15	[4]	[4]	6.3–20.0	<0.05	4.5–5.5	Low	High	High.
100	100	85–95	2–12	[4]	[4]	0.63–2.0	0.10–0.15	4.5–5.5	Low	High	High.
100	100	80–100	1–4	[4]	[4]	>20.0	<0.05	4.5–5.5	Low	Low	Moderate.
100	100	90–100	2–15	[4]	[4]	6.3–20.0	0.10–0.15	4.5–5.5	Low	High	High.
100	100	85–95	2–15	[4]	[4]	6.3–20.0	0.05–0.10	4.5–5.5	Low	High	High.

TABLE 5.—*Estimated engineering*

Soil series and map symbols	Depth to seasonal high water table [1]	Flooding [2]	Depth from surface	Classification		
				USDA texture	Unified	AASHO
			Inches			
Terra Ceia: Tc	0 to 10 inches for 9 to 12 months.	More often than once every year for longer than 6 months.	0–64	Muck	Pt	Organic
Wicksburg: WcA, WcC	More than 120 inches continuously.	None.	0–35 35–41 41–78	Sand Sandy loam Sandy clay	SP, SP–SM SM, SM–SC SC	A–3 A–2–4 A–6

[1] Level expected during a normal wet season.
[2] Water standing or flowing above the surface of the soil under natural conditions without artificial drainage.
[3] Fragments of 3 inches or more in diameter were discarded in field sampling.

TABLE 6.—*Engineering*

Soil series and map symbols	Suitability as source of—			
	Road fill	Sand	Topsoil	Beach sand
Astatula:				
AsB, AtB	Good	Good	Poor: sand texture; very low fertility.	Fair
AsD, AtD	Good	Good	Poor: sand texture; thickness; very low fertility; slope.	Fair
AuB	Good	Good	Poor: sand texture; thickness; very low fertility.	Fair
AwB	Good	Good	Poor: sand texture; very low fertility.	Fair
Astor: Ax	Good	Fair: organic-matter content.	Fair: high water table.	Unsuited
Basinger: Ba	Good	Fair: organic-matter content.	Poor: sand texture; thickness; low fertility.	Unsuited
Delks: De	Good above a depth of 46 inches. Fair below: sandy clay subsoil.	Poor: excessive fines	Sand texture; thickness; low fertility.	Unsuited
Dorovan: Do	Poor: organic materials; high water table.	Unsuited: organic materials.	Poor: organic materials; high water table; flooding.	Unsuited

properties of soils—Continued

Percentage passing sieve—[3] No. 4 (4.7 mm.)	No. 10 (2.0 mm.)	No. 40 (0.42 mm.)	No. 200 (0.074 mm.)	Liquid limit	Plasticity index	Permeability	Available water capacity	Reaction	Shrink-swell potential	Corrosivity to— Uncoated steel	Concrete
						Inches per hour	*Inches per inch of soil*	*pH*			
-------	-------	-------	-------	-------	-------	6.3–20.0	>0.25	5.6–8.4	([5])	High	Low to moderate.
100	100	80–100	2–7	([4])	([4])	>20.0	<0.05	4.5–6.0	Low	Low	Moderate.
100	100	60–70	20–30	<40	[4]–10	2.0–6.3	0.10–0.15	4.5–6.0	Low	Low	Moderate.
100	100	85–95	36–50	<40	>11	0.06–0.63	0.15–0.20	4.5–6.0	Low	Moderate	Moderate.

[4] Nonplastic.
[5] High potential subsidence.

interpretations of soils

Soil features affecting— Aquifer-fed excavated ponds	Embankments	Drainage	Irrigation: Sprinkler	Irrigation: Subsurface
Deep to water table; very rapid permeability.	Loose, very rapidly permeable sand; erodible.	Deep to water table	Very low available water capacity.	Very rapid permeability; deep to water table.
Deep to water table; strong slopes; very rapid permeability.	Loose, very rapidly permeable sand; erodible; strong slopes.	Deep to water table	Very low available water capacity.	Very rapid permeability; deep to water table; strong slopes.
Deep to water table; very rapid permeability.	Loose, very rapidly permeable sand at a depth above 50 inches; thin bands of loamy sand at a depth below 50 inches.	Deep to water table	Very low available water capacity.	Very rapid permeability; deep to water table.
Seasonally deep water table; loose sand; very rapid permeability.	Loose, very rapidly permeable sand.	Deep to water table	Very low available water capacity.	Very rapid permeability; seasonally high water table.
Loose sand, unstable side slopes; rapid permeability.	Rapid permeability; moderately high organic-matter content.	Low position; some areas lack drainage outlets.	High water table; flooding.	High water table; flooding.
Loose sand, unstable side slopes; very rapid permeability.	Very rapid permeability; unstable side slopes.	Low position; some areas lack drainage outlets.	High water table; low available water capacity; flooding.	Flooding; seasonally deep to water table.
Periodically deep to water table; loose sand, unstable side slopes.	Rapid permeability above substratum.	High water table; strongly cemented layers; low permeability of subsoil.	Low available water capacity.	Periodically deep to water table.
Organic materials; rapid permeability; flooding.	Organic materials	Low position; inadequate outlets; rapid oxidation.	High water table; flooding; very high available water capacity.	Flooding; organic materials.

TABLE 6.—*Engineering*

Soil series and map symbols	Suitability as source of—			
	Road fill	Sand	Topsoil	Beach sand
Duplin: Du	Fair: sandy clay subsoil.	Poor: sandy clay materials.	Fair: thickness; moderate fertility.	Unsuited.
Eureka: Es	Poor: clay subsoil; moderate shrink-swell potential; high water table.	Poor: clay materials.	Fair: thickness; moderate fertility; high water table.	Unsuited.
Eureka, thick-surface variant: Er.	Poor: clay subsoil; moderate shrink-swell potential; high water table; flooding.	Poor: clayey materials.	Fair: high water table; flooding.	Unsuited.
Eustis: Eu	Good.	Fair: loamy sand below a depth of 50 inches.	Poor: sand texture; low fertility.	Unsuited.
Everglades: Ev	Poor: organic materials.	Unsuited: organic materials.	Poor: organic materials; high water table.	Unsuited.
Iberia: Ib	Poor: high shrink-swell potential; high water table; flooding; clay texture.	Unsuited: clayey materials.	Poor: clay texture; high water table; flooding.	Unsuited.
Immokalee: Im	Good.	Fair: organic matter in weakly cemented layer.	Poor: texture; low fertility.	Unsuited.
Made land: Ma. No interpretations made. Properties too variable. Unsuited as a source of beach sand.				
Meggett: Me	Poor: clay texture; high shrink-swell potential; high water table; flooding.	Poor: clay texture.	Fair: clay texture; flooding.	Unsuited.
Myakka:				
Mk	Fair to good.	Fair: organic matter in weakly cemented layer.	Poor: sand texture; low fertility.	Unsuited.
Ms	Poor: high water table; flooding.	Poor: organic matter in weakly cemented layer.	Poor: sand texture; flooding.	Unsuited.
Orlando: Or	Good.	Good.	Fair: sand texture; low fertility.	Unsuited.
Orlando, wet variant: Os	Good.	Good.	Poor: sand texture; low fertility.	Unsuited.
Pamlico: Pa, Pd	Poor: organic materials.	Unsuited: organic materials.	Poor: organic materials; high water table; flooding.	Unsuited.

interpretations of soils—Continued

Soil features affecting—				
Aquifer-fed excavated ponds	Embankments	Drainage	Irrigation	
			Sprinkler	Subsurface
Deep to water table	Sandy clay loam subsoil	Slow permeability of subsoil.	Moderate available water capacity.	Slow permeability of subsoil; deep to water table.
Very slow permeability	Moderate shrink-swell potential; clayey subsoil.	Very slow permeability of subsoil.	Moderate available water capacity.	Very slow permeability of subsoil.
Very slow permeability; flooding.	Poor stability; clay texture.	Lack of suitable outlets in places; very slow permeability; flooding.	Flooding; moderate available water capacity.	Flooding.
Deep to water table; very rapid permeability.	Loose sand; very rapid permeability.	Deep to water table	Very low available water capacity.	Deep, permeable sand; deep to water table.
Organic materials; rapid permeability; flooding.	Organic materials	Low position; inadequate outlets; flooding; rapid oxidation.	High water table; very high available water capacity; flooding.	Flooding; organic materials.
Clayey texture; very slow permeability; flooding.	Clayey texture; very slow permeability.	Clayey texture; very slow permeability; flooding.	Flooding; slow infiltration rate; very slow permeability.	Flooding; very slow permeability.
Loose sand; unstable slopes; rapid permeability.	Loose sand; rapid permeability; erodible.	Loose sand; high water table.	Very low available water capacity.	Favorably high water table; rapid permeability.
Flooding: very slow permeability.	Clay texture; high shrink-swell potential.	Low position; very slow permeability; lack of outlets in places; flooding.	Flooding; very slow permeability.	Very slow permeability; flooding.
Loose sand; unstable side slopes; rapid permeability.	Loose sand; rapid permeability; erodible.	Loose sand; high water table.	Very low available water capacity.	High water table; rapid permeability.
Unstable side slopes	Loose sand; rapid permeability; erodible.	High water table; flooding; lack of gravity outlets.	Low available water capacity; flooding.	Flooding.
Deep to water table; rapid permeability.	Loose sand; very rapid permeability.	Deep to water table	Low available water capacity.	Deep to water table.
Loose, rapidly permeable sand, unstable side slopes; moderately deep to water table.	Loose sand; rapid permeabillity.	Moderately deep to water table.	Low available water capacity.	Moderately deep to water table; rapid permeability.
Organic materials; rapid permeability; flooding.	Organic materials	Low position; inadequate outlets; rapid oxidation; rapid permeability.	Very high available water capacity; flooding.	Rapid permeability; flooding; high water table.

TABLE 6.—*Engineering*

Soil series and map symbols	Suitability as source of—			
	Road fill	Sand	Topsoil	Beach sand
Paola:				
PlB	Good	Good	Poor: sand texture; very low fertility.	Fair
PlD	Good	Good	Poor: sand texture; very low fertility; slope.	Fair
PmA	Good	Good	Poor: sand texture; very low fertility.	Unsuited
Pomello: Po	Fair to good: moderately high water table.	Good to fair: excessive fines in some places.	Poor: sand texture; low fertility.	Unsuited
Rains: Ra	Poor: high water table	Poor: clayey subsoil	Poor: thickness; high water table.	Unsuited
St. Johns: Sa	Fair: high water table; high organic-matter content in surface layer.	Fair: organic matter in weakly cemented layer.	Fair: thickness; texture	Unsuited
St. Lucie: Sc	Good	Good	Poor: sand texture; very low fertility.	Good
Sellers:				
Ss	Poor: high water table	Poor: moderately high organic-matter content.	Fair: high water table	Unsuited
Sp	Poor: high water table; pockets of organic material.	Poor: pockets of organic material.	Fair: high water table	Unsuited
Terra Ceia: Tc	Poor: organic materials	Unsuited: organic materials.	Poor: organic materials; high water table; flooding.	Unsuited
Wicksburg:				
WcA	Good	Poor: loamy or clayey subsoil.	Poor: sand texture; low fertility.	Unsuited
WcC	Good	Poor: loamy or clayey subsoil; slope.	Poor: sand texture; low fertility; slope.	Unsuited

interpretations of soils—Continued

Soil features affecting—				
Aquifer-fed excavated ponds	Embankments	Drainage	Irrigation	
			Sprinkler	Subsurface
Deep to water table; very rapid permeability.	Loose sand; very rapid permeability; erodible.	Deep to water table	Very low available water capacity.	Very rapid permeability; deep to water table.
Deep to water table; very rapid permeability.	Loose sand; very rapid permeability; erodible; strong slopes.	Deep to water table	Very low available water capacity.	Deep to water table; strong slopes; very rapid permeability.
Seasonally deep to water table; loose sand; very rapid permeability.	Loose sand; very rapid permeability.	Very rapid permeability; moderately deep water table.	Very low available water capacity.	Very rapid permeability; moderately deep water table.
Very rapid permeability; seasonally deep to water table; loose sand, unstable side slopes.	Loose sand; very rapid permeability.	Loose sand; unstable side slopes.	Very low available water capacity.	Seasonally deep to water table; very rapid permeability.
High water table; flooding; moderate permeability.	Moderately permeable subsoil.	Moderately permeable subsoil; flooding.	Moderate available water capacity; flooding.	Moderately permeable subsoil; high water table; flooding.
Loose sand; unstable side slopes; rapid permeability.	Very rapid permeability	Loose sand; high water table; low position; inadequate drainage outlets.	Moderate available water capacity.	Rapid permeability; high water table.
Deep to water table; very rapid permeability.	Loose sand; very rapid permeability.	Deep to water table	Very low available water capacity.	Deep to water table; very rapid permeability.
Loose sand; unstable side slopes; rapid permeability; flooding.	Rapid permeability; high organic-matter content.	Loose sand; unstable side slopes; low position; some areas lack suitable outlets; flooding.	Moderate available water capacity; flooding.	Rapid permeability; flooding.
Loose sand; unstable side slopes; rapid permeability.	Rapid permeability; pockets of organic material.	Low position; lack of suitable outlets.	Moderate available water capacity; flooding.	Rapid permeability; flooding.
Organic materials; rapid permeability; flooding.	Organic materials	Low position; inadequate outlets; rapid oxidation.	Very high available water capacity; flooding.	Rapid permeability; high water table; flooding.
Deep to water table; slow permeability.	Loose sand in upper layers.	Deep to water table	Very low available water capacity.	Deep to water table.
Deep to water table; moderate slope; slow permeability.	Loose sand in upper layers; slope.	Deep to water table	Very low available water capacity; slope.	Deep to water table; slope.

TABLE 7.—*Engineering*

[Tests performed by Florida State Department of Transportation in accordance with

Soil name and location	Parent material	Sample number S65–Fla	Depth	Moisture density[1]	
				Maximum dry density	Optimum moisture
			Inches	*Lb. per cu. ft.*	*Percent*
Astatula sand, 0 to 8 percent slopes: SW¼NW¼ sec. 18, T. 17 S., R. 26 E. (Modal profile)	Unconsolidated sandy sediments.	30–1–4 20–1–5	6–69 69–85	107 105	14 14
Astatula sand, dark surface, 0 to 8 percent slopes: SW¼SW¼ sec. 13, T. 17 S., R. 25 E. (Dark surface horizon).	Unconsolidated sandy sediments.	42–31–2 42–31–4	4–25 47–103	103 102	15 15
NW¼SE¼ sec. 7, T. 15 S., R. 23 E. (Pale-colored C horizon).	Unconsolidated sandy sediments.	33–1–2 33–1–4	6–22 56–98	107 106	14 13
Astatula sand, moderately deep water table, 0 to 8 percent slopes: NW¼NE¼ sec. 16, T. 15 S., R. 24 E. (Water table moderately deep).	Unconsolidated sandy sediments.	32–1–2 32–1–3	4–38 38–67	108 108	14 13
Delks sand: SE¼SE¼ sec. 17, T. 14 S., R. 24 E. (Thin A1 horizon)	Unconsolidated sandy and clayey sediments.	42–27–2 42–27–3 42–27–7	1–36 36–41 55–65	105 114 108	15 11 17
SE¼NE¼ sec. 4, T. 14 S., R. 24 E. (Thin A1 horizon)	Unconsolidated sandy and clayey sediments.	36–1–2 36–1–5	2–25 48–74	101 103	15 20
Eureka loamy fine sand: SE¼NE¼ sec. 18, T. 14 S., R. 24 E. (Modal profile)	Unconsolidated sandy and clayey sediments.	37–1–4	21–57	105	19
Eureka loamy sand, thick-surface variant: SW¼SW¼ sec. 18, T. 14 S., R. 24 E. (Modal profile)	Unconsolidated sandy and clayey sediments.	39–1–2 39–1–4	5–20 24–52	115 95	10 25
Eustis sand: NE¼NE¼ sec. 34, T. 13 S., R. 25 E. (Modal profile)	Unconsolidated sandy and loamy sediments.	41–1–2 41–1–6	4–21 67–97	106 114	14 12
Immokalee sand: NW part of Arredondo Grant (Modal profile)	Unconsolidated sediments.	35–1–2 35–1–3	5–34 34–54	101 99	15 16
Myakka sand: NE¼NE¼ sec. 17, T. 15 S., R. 26 E. (Modal profile)	Unconsolidated sediments.	34–1–2 34–1–3 34–1–6	5–20 20–36 36–65	101 100 107	15 17 14
Paola sand, 0 to 8 percent slopes: SE¼SE¼ sec. 9, T. 17 S., R. 26 E. (Modal profile)	Unconsolidated sandy sediments.	42–28–2 42–28–4	1–17 36–72	100 105	15 14
Paola sand, moderately deep water table, 0 to 5 percent slopes: SE¼SE¼ sec. 16, T. 17 S., R. 26 E. (Water table moderately deep).	Unconsolidated sandy sediments.	25–1–2 25–1–5	2–21 33–45	101 108	16 14
Pomello sand: NE¼NE¼ sec. 28, T. 14 S., R. 24 E. (Modal profile)	Unconsolidated sandy sediments.	42–26–2 42–26–3 42–26–5	1–35 35–45 48–68	101 105 105	15 16 14

[1] Based on the moisture-density relations of soils using 5.5-lb. Rammer and 12-in. Drop, AASHO Designation T 99, Method (*1*).

[2] Mechanical analyses according to AASHO Designation T 88 (*1*). Results by this procedure frequently may differ from results that would have been obtained by the soil survey procedures of the Soil Conservation Service (SCS). In the AASHO procedure, fine material is analyzed by the hydrometer method and various grain-size fractions are calculated on the basis of all material, including that coarser than 2 millimeters in diameter. In the SCS soil survey procedure, fine material is analyzed by the pipette method and material coarser than 2 millimeters in diameter is excluded from calculations of grain-size fractions. The mechanical analyses used in this table are not suitable for use in naming textural classes for soil.

test data

standard procedure of the American Association of State Highway Officials (AASHO)]

Mechanical analysis [2]							Liquid limit	Plasticity index	Classification	
Percentage passing sieve—			Percentage smaller than—							
No. 10 (2.0 mm.)	No. 40 (0.42 mm.)	No. 200 (0.074 mm.)	0.05 mm.	0.02 mm.	0.005 mm.	0.002 mm.			AASHO [3]	Unified [4]
100	76	5	5	5	2	1	(5)	(5)	A-3(0)	SP-SM
100	76	3	3	3	1	1	(5)	(5)	A-3(0)	SP
100	80	3	3	3	1	0	(5)	(5)	A-3(0)	SP
100	82	3	3	3	1	1	(5)	(5)	A-3(0)	SP
100	86	5	5	5	2	1	(5)	(5)	A-3(0)	SP-SM
100	81	3	3	3	2	1	(5)	(5)	A-3(0)	SP
100	87	7	6	5	2	1	(5)	(5)	A-3(0)	SP-SM
100	83	5	5	5	3	2	(5)	(5)	A-3(0)	SP-SM
100	79	6	5	5	1	0	(5)	(5)	A-3(0)	SP-SM
100	84	11	10	9	4	3	(5)	(5)	A-2-4(0)	SP-SM
100	85	29	29	29	25	24	29	12	A-2-6(3)	SC
100	94	5	4	3	2	1	(5)	(5)	A-3(0)	SP-SM
100	96	34	33	32	31	30	29	13	A-2-6(6)	SC
100	94	48	45	41	37	35	49	32	A-7-6(10)	SC
100	84	21	17	10	5	3	(5)	(5)	A-2-4(0)	SM
100	93	56	53	49	45	43	50	29	A-7-6(12)	CL or CH
100	93	9	7	4	1	1	(5)	(5)	A-3(0)	SP-SM
100	91	16	15	13	13	12	(5)	(5)	A-2-4(0)	SM
100	95	2	2	2	0	0	(5)	(5)	A-3(0)	SP
100	92	8	7	6	4	3	(5)	(5)	A-3(0)	SP-SM
100	91	2	2	2	0	0	(5)	(5)	A-3(0)	SP
100	91	9	8	7	5	3	(5)	(5)	A-3(0)	SP-SM
100	91	4	4	3	0	0	(5)	(5)	A-3(0)	SP
100	79	2	2	0	0	0	(5)	(5)	A-3(0)	SP
100	82	3	3	3	1	1	(5)	(5)	A-3(0)	SP
100	84	2	2	2	0	0	(5)	(5)	A-3(0)	SP
100	85	5	5	5	3	3	(5)	(5)	A-3(0)	SP-SM
100	89	4	4	3	0	0	(5)	(5)	A-3(0)	SP
100	87	10	10	10	6	5	(5)	(5)	A-3(0)	SP-SM
100	88	4	3	2	1	1	(5)	(5)	A-3(0)	SP

[3] Based on Standard Specifications for Highway Materials and Methods of Sampling and Testing (Pt. 1, Ed. 8): The Classification of Soils and Soil-Aggregate Mixtures for Highway Construction Purposes, AASHO Designation M 145-49 (*1*).

[4] Based on U.S. Department of Defense MIL-STD-619B (*11*).

[5] Nonplastic.

TABLE 8.—*Degree and kind of limitations*

Soil series and map symbols	Buildings	Landscape plantings	Septic tank absorption fields
Astatula:			
AsB, AtB, AuB	Slight	Moderate: very low available water capacity; very low natural fertility.	Slight [1]
AsD, AtD	Moderate: slope	Moderate: very low available water capacity; very low natural fertility.	Moderate:[1] slope
AwB	Slight	Moderate: very low available water capacity; very low natural fertility.	Moderate:[1] seasonal moderately high water table.
Astor: Ax	Severe: high water table; flooding.	Severe: high water table; flooding.	Severe: high water table; flooding.
Basinger: Ba	Severe: high water table	Severe: high water table	Severe: high water table
Delks: De	Severe: high water table	Moderate: low available water capacity; low natural fertility.	Severe: high water table
Dorovan: Do	Severe: high water table; flooding; low supporting capacity.	Very severe: high water table; flooding.	Severe: high water table; flooding.
Duplin: Du	Slight	Slight	Severe: slow permeability; high water table.
Eureka:			
Es	Moderate: high water table	Moderate: high water table	Severe: high water table; very slow permeability.
Er	Severe: high water table; flooding.	Severe: high water table; flooding.	Severe: high water table; very slow permeability; flooding.
Eustis: Eu	Slight	Moderate: very low available water capacity; low natural fertility.	Slight [1]
Everglades: Ev	Severe: high water table; flooding; low supporting capacity.	Very severe: high water table; flooding.	Severe: high water table; flooding.
Iberia: Ib	Severe: high water table; flooding; high shrink-swell potential.	Severe: high water table; flooding.	Severe: high water table; very slow permeability; flooding.
Immokalee: Im	Moderate: high water table	Moderate: very low available water capacity; low natural fertility.	Severe: high water table
Made land: Ma. No interpretations made. Properties too variable.			
Meggett: Me	Severe: high water table; high shrink-swell potential.	Moderate: high water table	Severe: high water table; slow permeability.
Myakka:			
Mk	Moderate: high water table	Moderate: very low available water capacity; low natural fertility.	Severe: high water table
Ms	Moderate: high water table; flooding.	Severe: high water table; flooding.	Severe: high water table; flooding.
Orlando: Or	Slight	Moderate: low available water capacity; low natural fertility.	Slight [1]
Orlando, wet variant: Os	Moderate: high water table	Moderate: low available water capacity; low natural fertility.	Severe: high water table

See footnote at end of table.

for recreational developments

Local roads	Campsites and picnic areas	Paths and trails	Playgrounds
Slight	Severe: loose sand	Severe: loose sand	Severe: loose sand.
Moderate: slope; loose sand	Severe: loose sand; slope	Severe: loose sand; slope	Severe: loose sand; slope.
Slight	Severe: loose sand	Severe: loose sand	Severe: loose sand.
Severe: high water table; flooding; mucky surface.	Severe: high water table; flooding.	Severe: high water table; flooding.	Severe: high water table; flooding.
Severe: high water table	Severe: high water table	Severe: high water table	Severe: high water table.
Severe: high water table	Severe: high water table	Severe: high water table	Severe: high water table.
Severe: high water table; flooding; low traffic-supporting capacity.	Severe: high water table; flooding.	Severe: high water table; flooding.	Severe: high water table; flooding.
Moderate: clayey subsoil	Slight	Slight	Slight.
Severe: high water table	Severe: high water table	Severe: high water table	Severe: high water table.
Severe: high water table; flooding.	Severe: high water table; flooding.	Severe: high water table; flooding.	Severe: high water table; flooding.
Slight	Moderate: sand texture	Moderate: sand texture	Severe: sand texture.
Severe: high water table; flooding; low traffic-supporting capacity.	Severe: high water table; flooding.	Severe: high water table; flooding.	Severe: high water table; flooding.
Severe: high water table; flooding; high shrink-swell potential.	Severe: high water table; flooding.	Severe: high water table; flooding.	Severe: high water table; flooding.
Severe: high water table	Severe: high water table	Severe: high water table	Severe: high water table.
Severe: high water table; high shrink-swell potential.	Severe: high water table	Severe: high water table	Severe: high water table.
Severe: high water table	Severe: high water table	Severe: high water table	Severe: high water table.
Severe: high water table; flooding.	Severe: high water table; flooding.	Severe: high water table; flooding.	Severe: high water table; flooding.
Slight	Severe: loose sand	Severe: loose sand	Severe: loose sand.
Moderate: high water table	Severe: loose sand; high water table.	Severe: loose sand; high water table.	Severe: loose sand; high water table.

TABLE 8.—*Degree and kind of limitations*

Soil series and map symbols	Buildings	Landscape plantings	Septic tank absorption fields
Pamlico: Pa, Pd	Severe: high water table; flooding; low supporting capacity.	Very severe: high water table; flooding.	Severe: high water table; flooding.
Paola:			
PlB	Slight	Moderate: very low available water capacity; very low natural fertility.	Slight [1]
PlD	Moderate: slope	Moderate: slope	Moderate: [1] slope
PmA	Slight	Moderate: very low available water capacity; very low natural fertility.	Moderate: [1] moderately high water table.
Pomello: Po	Moderate: moderately high water table.	Severe: very low available water capacity; very low natural fertility.	Moderate: [1] moderately high water table.
Rains: Ra	Severe: high water table; flooding.	Moderate: high water table	Severe: high water table; flooding.
St. Johns: Sa	Severe: high water table; flooding.	Moderate: high water table; flooding.	Severe: high water table; flooding.
St. Lucie: Sc	Slight	Severe: very low available water capacity; very low natural fertility.	Slight [1]
Sellers: Sp, Ss	Severe: high water table; flooding; mucky surface.	Severe: high water table; flooding.	Severe: high water table; flooding.
Terra Ceia: Tc	Severe: high water table; flooding; low supporting capacity.	Very severe: high water table; flooding.	Severe: high water table; flooding.
Wicksburg:			
WcA	Slight	Moderate: low available water capacity; low natural fertility.	Slight
WcC	Slight	Moderate: low available water capacity; low natural fertility.	Moderate: slope

[1] Severe in all sloping areas where there is risk of contaminating the ground-water supply.

or recreational developments—Continued

Local roads	Campsites and picnic areas	Paths and trails	Playgrounds
Severe: high water table; flooding; low traffic-supporting capacity.	Severe: high water table; flooding.	Severe: high water table; flooding.	Severe: high water table; flooding.
Slight	Severe: loose sand	Severe: loose sand	Severe: loose sand.
Severe: slope; loose sand	Severe: loose sand; slope	Severe: loose sand	Severe: loose sand; slope.
Slight	Severe: loose sand	Severe: loose sand	Severe: loose sand.
Moderate: moderately high water table.	Severe: loose sand	Severe: loose sand	Severe: loose sand.
Severe: high water table; flooding.	Severe: high water table; flooding.	Severe: high water table; flooding.	Severe: high water table; flooding.
Severe: high water table; flooding.	Severe: high water table; flooding.	Severe: high water table; flooding.	Severe: high water table; flooding.
Slight	Severe: loose sand	Severe: loose sand	Severe: loose sand.
Severe: high water table; flooding; mucky surface.	Severe: high water table; flooding.	Severe: high water table; flooding.	Severe: high water table; flooding.
Severe: high water table; flooding; low traffic-supporting capacity.	Severe: high water table; flooding.	Severe: high water table; flooding.	Severe: high water table; flooding.
Slight	Severe: loose sand	Severe: loose sand	Severe: loose sand.
Slight to moderate: slope	Severe: loose sand; slope	Severe: loose sand; slope	Severe: loose sand; slope.

Corrosivity pertains to potential soil-induced chemical action that dissolves or weakens uncoated steel and concrete. The rate of corrosion of uncoated steel is related to soil properties, such as drainage, texture, total acidity, and electrical conductivity. Corrosivity for concrete is influenced mainly by the content of sodium or magnesium sulfate, but it is also influenced by texture and acidity. Installations of uncoated steel that intersect soil boundaries or soil horizons are more susceptible to corrosion than steel entirely in one kind of soil or one soil horizon. A corrosivity rating of low means that there is a low probability of soil-induced corrosion damage. Since a rating of high indicates a high probability of damage, protective measures should be used to avoid or minimize damage to steel, and more resistant concrete should be used.

Engineering interpretations of soils

The suitability ratings and comments in table 6 are for modal soil profiles and are to be used only as a guide. They are not intended to replace field tests or laboratory analyses in planning for specific uses where exacting determinations are required.

Table 6 rates the soils according to their suitability as sources of road fill, all-purpose sand, topsoil, and beach sand. It also gives features that affect the construction of excavated aquifer-fed farm ponds, embankments, drainage, and irrigation systems. These interpretations are for normal, undisturbed soil profiles and are determined partly by studying the properties of the soil, partly by studying test data, and partly by analyzing the results of actual field experience.

Road fill is soil material used in road embankments. Suitability ratings reflect (1) the predicted performance of soil after it has been placed in an embankment that has been properly compacted and provided with adequate drainage, and (2) the relative ease of excavating the material at borrow areas.

Sand is used in great quantities in many kinds of construction. The ratings in table 6 provide guidance about where to look for probable sources. A soil rated as a good source of sand generally has a layer at least 3 feet thick, the top of which is within 6 feet of the surface. The ratings do not take into account thickness of overburden, depth to the water table, or other factors that affect the excavation of sand, nor do they indicate the quality of the deposit.

Topsoil is used for topdressing an area where vegetation is to be established and maintained. Suitability is affected mainly by ease of working and spreading the soil material, as for example in preparing a seedbed. It is also affected by the natural fertility of the soil or response to fertilizer as well as by the absence of substances toxic to plants. Other characteristics that affect suitability are the texture of the soil material and content of stone fragments. Damage to the area from which topsoil is removed is also considered.

Beach sand is clean, white sand that is suitable for use on the edges of a lake or stream (fig. 5). It is used to improve bathing and swimming facilities where a body of water is developed as a recreation site.

Figure 5.—**Area where white sand brought in for a beach has greatly improved bathing facilities. This is one of many areas where the potential of the site was good, but the use of the original soil for recreation was severely limited by the poor quality of the soil material. The sand was obtained in an area of St. Lucie sand.**

An aquifer-fed excavated pond is a body of water created by excavating a pit or dugout that retains water fed by an aquifer. Excluded are ponds fed by runoff and embankment ponds where the depth of water impounded against the embankment is more than 3 feet. It is assumed that the pond is properly designed, located, and constructed, and that the water is of good quality. Properties affecting the use of soil for aquifer-fed ponds are the existence of a permanent water table, permeability of the aquifer, and properties that interfere with excavation, such as stoniness and rockiness.

For embankments, dikes, and levees, soil material is needed that is resistant to seepage and piping and that has favorable stability, shrink-swell potential, shear strength, and compactibility. The presence of stones or organic material in the soil are among unfavorable factors.

Drainage is affected by permeability, texture, and structure; depth to clay or to other layers that affect the rate of water movement; depth to the water table; slope; stability and ditchbanks; susceptibility to flooding; salinity or alkalinity; and availability of outlets for drainage.

Irrigation of soil is affected by slope; susceptibility to stream overflow, water erosion, or soil blowing; soil texture; depth of root zone; rate of water intake at the surface; permeability of soil layers below the surface layer or of any layers that restrict movement of water; amount of water held available to plants; and depth to water table, which may indicate a need for drainage.

Two kinds of irrigation systems are used in the survey area—sprinkler irrigation and subsurface irrigation. Where sprinkler irrigation is used, the water is pumped through pipes and applied by sprinklers in a way that simulates rain. Soil features that affect suitability of the soil for sprinkler irrigation are rate of infiltration, rate of permeability, available water capacity, slope, and erodibility. If soils have moderate permeability and moderate available water capacity and are not subject to erosion, they are suited to irrigation.

In subsurface irrigation the water table is maintained within controlled limits. This method of irrigation permits adequate capillary movement of water from the water table into the root zone. Open ditches are generally used for this kind of irrigation. The same system can be used to remove excess water after a severe rain. Subsurface irrigation is feasible only where the soils are nearly level and have a water table near the surface. Soil features that affect subsurface irrigation are depth to water table and permeability.

Engineering test data

Table 7 gives engineering test data for some soil series in the Ocala National Forest Area. These tests were made to help evaluate the soils for engineering purposes. The engineering classifications given are based on data obtained by mechanical analyses and by tests that determine the liquid limit and the plastic limit. The mechanical analyses were made by combined sieve and hydrometer methods.

Moisture-density (or compaction) data are important in earthwork. If a soil material is compacted at successively higher moisture content, assuming that the compactive effort remains constant, the density of the compacted material increases until the *optimum moisture content* is reached. After that, density decreases with any increase in moisture content. The highest dry density obtained in the compactive test is termed *maximum dry density*. As a rule, maximum strength of earthwork is obtained if the soil is compacted to the maximum dry density.

Tests to determine liquid limit and plastic index measure the effect of water on the consistence of soil material, as has been explained for table 5.

Recreational developments

Recreation sites should be in areas that have a comfortable environment and a pleasant view. The soils should be well drained, have good trafficability, and be free of flooding. Loose, dry, sandy soils are not suited, because they are easily displaced, have poor trafficability, and do not support a cover of grass under extensive use. Wet soils are often ponded and have poor trafficability. Fine-textured soils become hard and crack when dry and soft and sticky when wet. They have poor trafficability. The best areas for recreational developments are on deep, fertile, friable, well-drained soils, but there are only a few of these soils in the Ocala National Forest Area.

All the recreation areas in the Ocala National Forest Area present some special problems of design and management. Many areas require stabilization or surfacing of roads and trails. The areas around many campsites and picnic tables need to be stabilized (fig. 6). In many places, plantings of grass, shrubs, and trees need to be fertilized and irrigated.

Knowledge of the soils and how they behave is basic to good planning for recreational developments. The soil survey gives basic information, but a more detailed onsite investigation is needed for intensively used recreation areas. The survey does show enough detail to be useful in selecting recreation areas and planning their development and management.

Figure 6.—Campsite in the "Big Scrub." The soil is an Astatula sand, and the dominant vegetation is sand pine. Areas of this deep, loose, sandy soil used for roadways and parking areas should be surfaced with sand-clay materials.

Some important soil characteristics that influence recreational development are texture, slope, permeability, available water capacity, thickness of the soil, depth to rock or slowly permeable material, depth to water table (wetness), flood hazard, bearing capacity, trafficability, and natural productivity.

In table 8 the soils of the Ocala National Forest Area are rated according to limitations that affect their suitability for buildings, landscape plantings, septic tanks, local roads, campsites and picnic areas, paths and trails, and playgrounds. The degrees of limitation are given as slight, moderate, severe, and very severe. For all of these degrees of limitation, it is assumed that a good cover of vegetation can be established and maintained. Slight means that the soil properties are generally favorable and that the limitations are so minor that they can easily be overcome. Moderate means that the limitations can be overcome or modified by planning, design, or special maintenance. Severe means that costly soil reclamation, special design, intensive maintenance, or a combination of these is needed. For some uses, a rating of severe is divided to obtain ratings of severe and very severe. Very severe means that one or more soil properties are so unfavorable for a particular use that overcoming the limitations is most difficult and costly and commonly not practical for the specified use.

Buildings refer to cottages, washrooms, bathhouses, and service buildings that are supported by foundation footings placed in undisturbed soil. The features that affect use of soil for buildings are those that relate to capacity to support load and to resist settlement under that load as well as those that relate to ease of excavation. Soil properties that affect capacity to support load are wetness, susceptibility to flooding, density, plasticity, texture, and shrink-swell potential. Those that affect excavation are wetness, slope, depth to bedrock, and content of stones and rocks.

Landscape plantings are vital to most landscaping efforts. The ability of the soil to support grass, ornamental trees, and shrubs is especially important at campsites and picnic areas, and it affects use of the soil for highway beautification and for most recreational facilities. A wide range of adapted plants is available for landscaping, but local variations in the soils may limit the kinds of plants that can be grown in a specific area. Soil qualities that most affect landscaping are available water capacity, depth to the water table, productivity, effective root depth, and susceptibility to flooding.

Septic tank absorption fields are subsurface systems of tile or perforated pipe that distribute effluent from a septic tank into natural soil. Soil material at a depth between 18 inches and 6 feet is evaluated. Soil properties considered are those that affect both absorption of effluent and construction and operation of the system. Properties that affect absorption are permeability, depth of water table or rock, and susceptibility to flooding. Slope affects difficulty of layout and construction as well as the hazard of soil erosion and the risks of lateral seepage and downslope flow of effluent. Large rocks or boulders increase construction costs.

Local roads have an all-weather surface expected to carry automobile traffic all year. They have a subgrade of underlying soil material; a base consisting of gravel, crushed rock, or soil material stabilized with lime or cement; and a flexible or rigid surface, commonly asphalt or concrete. These roads are graded to shed water, and they have ordinary provisions for drainage. They are built mainly from soil at hand, and most cuts and fills are less than 6 feet deep. They also include access roads in the forest. These roads have a surface treated with sand and clay materials.

Soil properties that most affect design and construction of roads and streets are the load-supporting capacity and stability of the subgrade, as well as the workability and quantity of cut and fill material available. The AASHO and Unified classifications of soil material and the shrink-swell potential indicate load-supporting capacity. Wetness and flooding affect the stability of soil material. Slope, depth to hard rock, content of stones and rocks, and wetness affect ease of excavation and the amount of cut and fill needed to reach an even grade.

Campsites are used intensively for tents, small camp trailers, and the accompanying activities of outdoor living. Little preparation of the site is required, other than shaping and leveling for tenting and parking areas. Campsites are subject to heavy foot traffic and limited vehicular traffic. The best soils have mild slopes, good drainage, a surface that is free of rocks and coarse fragments, freedom from flooding during periods of heavy use, and a surface that is firm after rain but not dusty when dry.

Picnic areas are attractive natural or landscaped tracts used mainly for preparing food and outdoor eating. These areas are subject to heavy foot traffic, but most of the vehicular traffic is confined to access roads. The best soils are firm when wet but not dusty when dry, are free of flooding during the season of use, and do not have slopes or stoniness that greatly increase the cost of leveling the site or of building access roads.

Paths and trails are used for local and cross-country travel by foot or horseback. Design and layout should require little or no cutting and filling. The best soils are at least moderately well drained, are firm when wet but not dusty when dry, are flooded not more than once during the season of use, and have slopes of less than 15 percent. Few or no rocks or stones are on the surface.

Playgrounds are areas used intensively for baseball, football, badminton, and other organized games. Soils that are suitable for this use must be able to withstand intensive foot traffic. The best soils are nearly level, have a surface that is free of coarse fragments and rock outcrops, have good drainage, are free from flooding during periods of use, and have a surface that is firm after rains but not dusty when dry. In areas where grading and leveling are needed, the depth to rock is important.

Formation, Morphology, and Classification of the Soils

This section discusses the factors of soil formation as they affect soils in the Ocala National Forest Area. Morphology of the soils is explained by describing major horizons or soil layers and the processes involved in their development. The classification of the soils is also discussed. Table 9 shows the classification of the soils by higher categories.

TABLE 9.—*Classification of soils by higher categories*

Series	Family	Subgroup	Order
Astatula	Siliceous, hyperthermic, uncoated	Typic Quartzipsamments	Entisols.
Astor	Sandy, siliceous, noncalcareous, hyperthermic	Cumulic Haplaquolls	Mollisols.
Basinger	Siliceous, hyperthermic	Spodic Psammaquents	Entisols.
Delks	Sandy, siliceous, hyperthermic, ortstein	Ultic Haplaquods	Spodosols.
Dorovan [1]	Dysic, hyperthermic	Typic Medisaprists	Histosols.
Duplin [1]	Clayey, kaolinitic, thermic	Aquic Paleudults	Ultisols.
Eureka	Clayey, mixed, hyperthermic	Typic Albaqualfs	Alfisols.
Eureka, thick-surface variant.	Clayey, mixed, hyperthermic	Typic Umbraqualfs	Alfisols.
Eustis [1]	Sandy, siliceous, thermic	Psammentic Paleudults	Ultisols.
Everglades	Euic, hyperthermic	Typic Medihemists	Histosols.
Iberia [1]	Fine, montmorillonitic, noncalcareous, thermic	Vertic Haplaquolls	Mollisols.
Immokalee	Sandy, siliceous, hyperthermic	Arenic Haplaquods	Spodosols.
Meggett [1]	Fine, mixed, thermic	Typic Albaqualfs	Alfisols.
Myakka	Sandy, siliceous, hyperthermic	Aeric Haplaquods	Spodosols.
Orlando	Sandy, siliceous, hyperthermic	Quartzipsammentic Haplumbrepts	Inceptisols.
Orlando, wet variant	Sandy, siliceous, hyperthermic	Cumulic Haplumbrepts	Inceptisols.
Pamlico [1]	Sandy, siliceous, dysic, thermic	Terric Medisaprists	Histosols.
Paola	Siliceous, hyperthermic, uncoated	Spodic Quartzipsamments	Entisols.
Pomello	Sandy, siliceous, hyperthermic	Arenic Haplohumods	Spodosols.
Rains	Fine-loamy, siliceous, thermic	Typic Ochraquults	Ultisols.
St. Johns	Sandy, siliceous, hyperthermic	Typic Haplaquods	Spodosols.
St. Lucie	Siliceous, hyperthermic, uncoated	Typic Quartzipsamments	Entisols.
Sellers	Sandy, siliceous, hyperthermic	Cumulic Humaquepts	Inceptisols.
Terra Ceia	Euic, hyperthermic	Typic Medisaprists	Histosols.
Wicksburg	Clayey, kaolinitic, thermic	Arenic Paleudults	Ultisols.

[1] These soils are taxadjuncts to their respective series because of soil temperature. Soils of the Dorovan, Duplin, Eustis, Iberia, and Pamlico series are taxadjuncts because they have a mean annual temperature about 2° F. higher than is defined for the series. Soils of the Meggett series are taxadjuncts because they have a mean annual temperature about 1° F. higher than is defined for the series. These differences do not alter the use and behavior of these soils.

Factors of Soil Formation

Soil is produced by the forces of weathering and of soil formation acting on the geologic materials at the surface. The kind of soil that forms depends on the composition of the parent material, the climate under which the soil material accumulated and weathered, the living organisms on and in the soil, the topography, and the length of time the forces of soil development have acted on the soil material.

These factors are interdependent, and each modifies the effect of the others. Any one factor may have more influence than the others on soil development and may account for most of the soil properties. For example, in most areas where soils have formed in almost pure quartz, they have only weakly developed horizons because other factors, except for composition of the parent material, have had little effect. In contrast, where soils have formed in more complex, more easily weathered parent material, they have been modified to a greater extent by the effect of climate, topography, and living organisms in and on the soil. In these areas of more complex parent material, a modification or variation in any one of the five factors results in a different soil.

Parent material

In most places the parent material of the soils in the Ocala National Forest Area is unconsolidated sand that has been transported by wind and redeposited, but in a few places it is clayey sediments. For example, Eureka loamy fine sand formed in the deposits of clayey materials, and Paola sand formed in the thick deposits of sand.

Limestone, which is sedimentary, underlies the entire survey area. It it too deeply buried to be parent material for any of the soils, but the solution of this limestone and the subsequent collapse of overlying marine sand and clay has caused the undulating physiography of the survey area.

On flood plains along the St. Johns River and the Oklawaha River, and in other scattered areas, recent accumulations of organic materials cover the sand and clay. One of the soils that formed in these organic accumulations is Dorovan muck.

Climate

The climate of the Ocala National Forest Area is warm and humid. The present climate is considered similar to that which prevailed during most of the period of soil formation. The summer climate is uniform throughout the survey area, but winters are slightly milder in the southern part than in the northern part. The climate accounts for few differences among the soils. Rainfall averages about 52 inches, and more than half falls in summer.

This climate promotes the rapid decomposition of organic matter and hastens chemical reactions in the soil. Abundant rainfall leaches the soil of most plant nutrients and has produced strongly acid reaction in most of the sandy soils. It also carries the less soluble fine particles downward. Consequently, many of these soils are sandy and are very low in organic-matter content, natural fertility, and available water capacity.

Living organisms

Both plants and animals have an important role in the formation of soils. The kinds and numbers of plants and animals that live in and on the soil are governed largely by climate and to lesser and varying degrees by each of the other soil-forming factors.

The major soil-forming functions of living organisms are furnishing organic matter to soil, altering soil through natural mixing and stirring, and moving plant nutrients from the lower horizons to the upper horizons. Living organisms also promote changes in structure and porosity of the soil.

Micro-organisms, including bacteria and fungi, help to weather and break down minerals and decompose organic matter. They are most numerous in the upper few inches of the soil. Earthworms and some other small animals live in soil material, alter its chemical composition, and mix it with other soil material. The native vegetation also acts on the soil chemically and churns it by root penetration.

Topography

Topography has affected the formation of soils in the Ocala National Forest Area, mainly through its influence on relationships of soil and water. Other factors of soil formation normally associated with topography, such as erosion, temperature, and plant cover, are of less importance.

The three general topographic features in the survey area are the swamps and marshes, along the St. Johns River and the Oklawaha River, that are very wet or flooded much of the time; an area of pine flatwoods forest which is between the river lowlands and the high ridge area and where the water table fluctuates but is generally high; and the high dunelike central ridges that are interspersed with lakes and ponds. This area of central dunelike ridges is the highest and most strongly sloping in the Ocala National Forest Area, and here depth to the water table is greater than in other areas.

In each of these general areas the formation of soils is influenced by the topography and its relationship to depth to the water table. For example, Astatula soils, which are on the high dunelike ridges, are deep to the water table, very low in organic matter, and very highly leached. Myakka soils, which are in the pine flatwoods, are much shallower to a water table, are periodically wet, and have layers that are cemented with organic material. Astor soils, which are on lowlands along the river, have a thick surface layer that is high in organic-matter content, and are shallow to a water table most of the time. This illustrates how soils that formed in the same parent material but in different topographic positions differ in organic-matter content. These differences in content of organic matter were brought about because differences in topographic position result in differences in degree of wetness.

Time

Time is an important factor in the formation of soils. If all other factors of soil formation are equal, the degree of soil development is in direct proportion to time. Geologically, a long time is required for the formation of a soil that has well-defined, genetically related horizons.

Soils formed in material that is resistant to weathering require more time to reach a particular stage of development than do soils formed in easily weathered material. The translocation of fine particles within soils to form distinct horizons varies under different conditions. Most of the soil-forming processes, however, require a relatively long time. The dominant soil material in the Ocala National Forest Area is almost pure quartz sand, which is highly resistant to weathering.

Relatively little geologic time has elapsed for well-defined, genetically related horizons to develop in the parent material laid down in the Ocala National Forest Area. Horizons of sandy loam and sandy clay have formed through the translocation of silt and clay. These horizons have been only slightly altered by weathering. Some distinct genetic horizons, such as a layer of sand cemented with organic materials and a thick black surface layer, have formed in some soils; however, the time required for this development was relatively short.

Processes of Soil Formation

The processes involved in horizon differentiation, or in the formation of soil horizons, are accumulation of organic matter, leaching of calcium carbonates and bases, reduction and transfer of iron, and formation and translocation of silicate clay minerals. In the formation of most soils in the Ocala National Forest Area, more than one of these processes has been active.

Most soils have three main horizons: A, B, and C.

The A horizon is the surface layer. It can be either the horizon of maximum organic-matter content, called the A1 horizon, or the horizon of maximum leaching of soluble or suspended materials, called the A2 horizon.

The B horizon lies immediately below the A horizon and is often called the subsoil. It is the horizon of maximum accumulation of dissolved or suspended materials, such as organic matter, iron, or clay. The B horizon is generally firmer than the horizons immediately above and below, and it may have blocky structure. In many young soils that are sandy, the B horizon has not yet developed.

The C horizon is the substratum. It is very little affected by the soil-forming processes but may have been somewhat modified by weathering.

Some organic matter has accumulated in the surface layer of all soils in the survey area to form an A1 horizon. The content of organic matter varies in different soils and ranges from very low to high as a result of relief and wetness.

Leaching of carbonates and bases has occurred in nearly all the soils. The leaching of bases in soils usually precedes translocation of silicate clay materials. Most of the soils in the survey area are leached to varying degrees. This has contributed to the development of horizons.

The process of chemical reduction and transfer of iron, or gleying, is evident in some soils in the Ocala National Forest Area; however, the high dry soils do not show evidence of this process. Gleying is brought about by the generally wet conditions that exist in many of the soils.

Gray color in the subsoil and grayish mottles in other horizons indicate the reduction and loss of iron in many soils. However, in many sandy soils, gray is the color of the clean sand grains and has no relationship to gleying. Some horizons have reddish-brown mottles and concretions, indicating a segregation of iron.

The translocation of clay, organic matter, or iron oxides has contributed to horizon development in some of the soils in this survey area. The movement of clay, organic matter, or iron is evident in many of the soils. This evidence consists mainly of A2 horizons that are light colored and leached, B2 horizons that have sand grains bridged and coated with clay or organic matter, and a few patchy clay films on ped faces and in root channels. A thin B1 horizon that is intermediate between the A2 and B2t horizons is also present in some soils. Translocation of silicate clays is of minor importance in only a few soils, but all the other processes involved in soil formation have been important in the development of horizons in all the soils.

Effect of Fire on Soil Formation

The effect of fire (fig. 7) on the soils of this survey area is not readily apparent, but the subtle effect of fire causes a great loss in productivity.

Fire acts directly on the soil by releasing mineral nutrients present in the litter. This results in volatilizing nitrogen and returning it to the atmosphere. Other nutrients, such as phosphorus, potassium, and magnesium, become immediately available for plant growth, but if not used, they are quickly leached beyond the depth of most roots. Nutrients taken up by plants after a fire represent only a part of the original total; therefore, the loss of essential elements proceeds in the same manner as the half-life of radioactive elements.

Intense fire often oxidizes humus within the soil, and this changes its physical as well as its chemical properties. Humus can normally hold two or three times its own weight in water. Similarly, its colloidal properties enable it to retain twice as many cations as an equal weight of clay (montmorillonite). Plants then are able to exchange hydrogen ions for elements essential to their growth. In sandy soils, which are naturally droughty and infertile, loss of humus may prevent the return of the original vegetation.

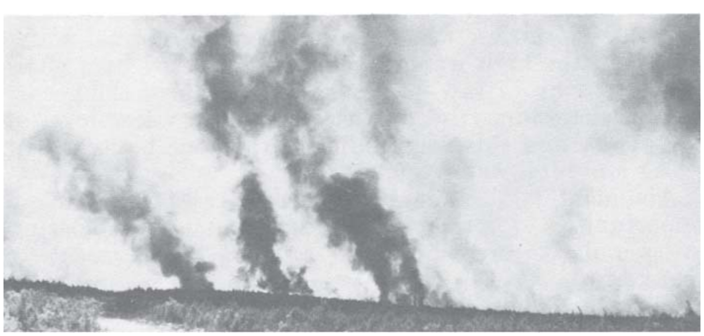

***Figure 7.*—Wildfire in a forest destroys vegetation and wildlife. It also destroys vital humus in the surface layer of deep sandy soils and thus seriously affects soil suitability. The soils are Astatula and Paola soils.**

Classification of the Soils

Soils are classified so that we can more easily remember their significant characteristics. Classification enables us to assemble knowledge about soils, to see their relationships to each other and to the whole environment, and to develop principles that help us understand their behavior and response to manipulation. First through classification, and then through the use of soil maps, we can apply our knowledge of soils to specific fields or to larger tracts of land.

Two systems of classifying soils have been used in the United States in recent years. The older system was adopted in 1938 (*2*) and revised later (*6*). The system currently used by the National Cooperative Soil Survey was developed in the early sixties (*9*) and adopted in 1965 (*5*). It is under continual study.

The current system of classification has six categories. Beginning with the most inclusive, these categories are the order, the suborder, the great group, the subgroup, the family, and the series. The criteria for classification are soil properties that are observable or measurable, but the properties are selected so that soils of similar genesis are grouped together. The placement of some soil series in the current system of classification, particularly in families, may change as more precise information becomes available.

Table 9 shows the classification of each soil series of the Ocala National Forest Area by family, subgroup, and order, according to the current system.

ORDERS.—Ten soil orders are recognized in the current system: Entisols, Vertisols, Inceptisols, Aridisols, Mollisols, Spodosols, Alfisols, Ultisols, Oxisols, and Histosols. The properties used to differentiate soil orders are those that tend to give broad climatic groupings of soils. The two exceptions to this, Entisols and Histosols, occur in many different climates.

Seven of the 10 soil orders occur in the Ocala National Forest Area: Entisols, Inceptisols, Mollisols, Spodosols, Alfisols, Ultisols, and Histosols. Entisols are recent soils in which there has been little, if any, horizon development. Inceptisols are on young land surfaces. Mollisols have a thick, dark-colored surface layer, moderate to strong structure, and a base saturation of more than 50 percent. Spodosols have an iron-enriched and humus-enriched B horizon. Alfisols have a clay-enriched B horizon and a base saturation of more than 35 percent. Ultisols are mineral soils that contain a clay-enriched B horizon that has less than a 35 percent base saturation. The base saturation decreases with increased depth. Histosols have high organic-matter content. They developed from plant remains and some mineral matter, in water.

SUBORDERS.—Each order is divided into suborders mainly on the basis of those soil characteristics that seem to prdouce classes with the greatest genetic similarity. The soil properties used are mainly those that reflect either the presence or absence of waterlogging, or differences in climate or vegetation. The climatic range of the suborders is narrower than that of the orders.

GREAT GROUPS.—Each suborder is divided into great groups on the basis of uniformity in the kinds and sequence of major horizons and soil features. The horizons considered are those in which clay, iron, or humus has accumulated, those that have pans that interfere with the growth of roots, the movement of water, or both, and thick, dark-colored surface horizons. The features considered are the self-mulching properties of clays, soil temperature, chemical composition (mainly calcium, magnesium, sodium, and potassium), and the like.

SUBGROUPS.—Each great group is divided into subgroups, one representing the central (typic) segment of the group, and other groups, called intergrades, that have properties of one great group and also one or more properties of another great group, suborder, or order. Subgroups may also be made in those instances where soil properties intergrade outside the range of any other great group, suborder, or order.

FAMILIES.—Families are established within a subgroup primarily on the basis of properties that affect the growth of plants or the behavior of soils when used for engineering purposes. Among the properties considered are texture, mineralogy, reaction, soil temperature, permeability, thickness of horizons, and consistence.

SERIES.—The series is a group of soils that have major horizons that, except for texture of the surface layer, are similar in important characteristics and in arrangement in the profile.

Additional Facts About the Area

This section discusses physiography, drainage, and water in the Ocala National Forest Area. It also gives important facts about the climate.

Physiography

The Ocala National Forest Area is in two major physiographic regions of Florida. About 72 percent of it is a high ridge that lies in a north-south direction between the Oklawaha River and the St. Johns River. This part is within the Central Highlands physiographic region. The remaining 28 percent is in the Coastal Lowlands, which surrounds the Central Highlands on the west, north, and east. This part ranges from less than half a mile wide in the north to more than 7 miles wide in the southeast. A few other small areas are within the Central Highlands.

Dissolution of limestone and the collapse of overlaying sandy strata have resulted in an undulating surface without a well-defined drainage system. Many lakes and shallow ponds are the result of dissolution of underlying limestone.

The Central Highlands consist of gently undulating, high sandy ridges and many small to large ponds and lakes. Few well-defined streams exist, and this area is drained principally through the porous sand into underground waterways.

The Coastal Lowlands consist of nearly level, poorly drained areas that have not been much dissected by streams. Large and small, poorly defined drainageways, grassy sloughs, and depressions are common.

The elevation of the survey area ranges from less than 10 feet above sea level near Lake George to slightly more than 160 feet near Orange Spring Ferry.

Drainage

The Ocala National Forest Area lies within the watershed of the Oklawaha River and the St. Johns River. These two rivers form all but the southern boundary of the area. The Oklawaha River flows north along the western boundary of the survey area to Orange Springs Ferry and then in an east-southeast direction until it empties into the St. Johns River near Welaka. The St. Johns River extends from the southeast corner of the survey area at Crows Bluff Bridge and flows in a northerly direction along the eastern boundary for a distance of about 35 miles. Lake George, near the center of the east boundary, is part of the St. Johns River.

Alexander Springs Creek, Juniper Creek, Salt Springs Branch, and Blackwater Creek are important streams that originate within the survey area. Most of these streams are spring fed and flow in a northerly and easterly direction.

The ridge area is drained mainly through porous sand into the underlying aquifer, and from there through springs into the Oklawaha River and the St. Johns River. The flatwoods area is drained principally through wide, poorly defined, shallow waterways or through sandy soils.

Water

Lakes.—More than 195 ponds and lakes are in the Ocala National Forest Area. They range from less than one acre to many hundreds of acres in size. They are scattered throughout most of the area, but most are in the west-central part. Most of the numerous, small, shallow, grassy ponds in the flatwoods are isolated and not connected by surface inlets or outlets. Their water supply comes mainly from the seepage and the surface runoff from surrounding flatwoods and sandhill areas. The water level in these ponds fluctuates with the seasons, and some of the ponds dry up during prolonged dry seasons. The water is generally clear but has a brownish color because of dissolved organic matter.

The deepest lakes are mainly in the sand ridge section. They were formed after the underlying limestone had dissolved and the overlaying sandy layers had collapsed. Some are surrounded by extensive, poorly drained, grassy prairies, and others are bordered by forest. The water in these lakes is clear.

Most of the shallow ponds and lakes are surrounded by grassy prairies, which lie between the normal water level and the high water level that is marked by a characteristic ring of saw-palmetto. The width of the grassy zone is determined by fluctuations in the water level of the ponds, and this zone indicates the zone between low water and high water.

Abundant lakes and ponds in the area provide many opportunities for recreation. Swimming and boating are popular, and picnic areas and campsites are along many of the lakes.

Springs.—There are numerous springs in the Ocala National Forest Area. They are of two general types. In one, water that has fallen as rain enters the soil and moves down through permeable formations until it reaches an intersection of land surface where it issues as a spring. In the other type, rainwater enters the soil and moves rapidly into underlying porous bedrock. The water is confined in the aquifer under hydrostatic pressure. Springs issue from this aquifer at a lower elevation where bedrock lies near or is exposed at the land surface. The major springs in the survey area are of this type. Their flow is perennial and relatively uniform, while the water is very clear, even during heavy rainfall.

The major springs in the survey area are Alexander, Juniper, Salt, and Silver Glen. For Alexander Springs the average daily flow is about 78 million gallons and the average temperature is 74° F. For Silver Glen Springs the average daily flow is 72 million gallons and water temperature is 74°. For Salt Springs, the average daily flow is about 52 million gallons and the water temperature is 75°. For Juniper Springs the average daily flow is 8.3 million gallons and the water temperature is 71° (*10*).

Climate [4]

The Ocala National Forest Area has long, warm, relatively humid summers and mild, dry winters. Rainfall averages about 52 inches annually but is quite unevenly distributed. In an average year more than half the rain falls in the period June through September.

The Atlantic Ocean and the Gulf of Mexico, together with numerous inland lakes, have a moderating effect on both summer and winter temperatures. Summer temperatures are fairly uniform from year to year. In winter there is considerable day to day variation in temperature, largely because of the periodic invasions of cold dry air masses from the north. Winter cold spells are short and seldom last for more than 2 or 3 days. Because most of the air masses affecting this survey area in summer have passed over extensive water surfaces, relative humidity is seldom below 50 percent in the period June through September.

Table 10 shows weather data summarized from records from the Federal–State Warning Service at the Palatka and Eustis stations. Table 11 shows probabilities of low temperatures in spring and fall, based on records from the Pierson and Weirsdale stations. Generally, these data are representative of the colder sections of the survey area, and the freeze hazards for the warmer sections are less than those shown in table 11.

During June, July and August, daily maximum temperatures are close to 92° F.; daily minimums during the same period average near 72°. Although afternoon temperatures reach 90° or higher with great regularity during the warmest months, temperatures of 100° or higher seldom occur. Daytime high temperatures in winter average in the low 70's, and daily readings range from the middle 50's on the cooler days to the low and middle 80's on the warmer days. Early morning low temperatures in winter average in the high 40's, and most of the daily readings in winter are between 40° and 60°. Frost or freezing temperatures in the colder sections of the survey area occur at least once every winter and average 8 to 10 times a year. Temperatures in the colder sections drop to 28° two or three times during an average winter, and to 25° or lower in about half the winters. Temperatures as low as 20° are rare. The coldest weather in recent times occurred in December 1962; records from surrounding areas showed temperatures between 15° and 20° on December 13, 1962.

[4] KEITH D. BUTSON, climatologist for Florida, National Weather Service, U.S. Department of Commerce, helped write this section.

TABLE 10.—*Temperature and precipitation data*

Month	Temperature				Precipitation			
	Average daily maximum	Average daily minimum	Average number of days with—		Average total [1]	Largest total at [2]—		Average number of days with 0.10 inch or more [1]
			Maximum of 90° or higher	Minimum of 32° or lower		Palatka	Eustis	
	° F.	° F.			In.	In.	In.	
January	71.3	48.9	0	2	2.20	9.24	6.00	4
February	73.6	49.9	(3)	1	2.83	10.74	8.02	5
March	77.8	53.4	2	(3)	3.71	10.09	10.54	5
April	83.2	59.0	4	0	3.30	9.07	6.62	4
May	89.0	65.2	16	0	3.54	7.07	9.69	6
June	91.9	70.5	23	0	6.27	14.89	16.47	9
July	92.8	72.4	26	0	7.38	15.57	13.73	12
August	92.7	72.5	26	0	6.96	14.30	16.44	10
September	90.0	70.9	18	0	6.92	14.98	13.87	9
October	83.7	63.3	4	0	4.22	11.78	11.85	6
November	76.6	54.3	(3)	1	1.71	7.20	6.32	3
December	71.4	49.4	0	2	2.34	10.61	5.36	4

[1] Average from the Palatka and Eustis stations during the 30-year period 1931 to 1960.
[2] For the period 1931 to 1964.
[3] Average less than one-half day.

TABLE 11.—*Probabilities of low temperatures in spring and fall*

[Based on records from the Federal-State Frost Warning Service stations at Pierson (No. 1428) and Weirsdale (No. 1724-B)]

Probability	Dates for given probability and temperature—	
	28° F. or lower	32° F. or lower
Spring:		
2 years in 10 later than	February 18	March 11
3 years in 10 later than	February 8	March 5
5 years in 10 later than	January 27	February 22
7 years in 10 later than	January 10	February 12
8 years in 10 later than	January 1	February 4
Fall:		
2 years in 10 earlier than	November 25	November 17
3 years in 10 earlier than	December 2	November 23
5 years in 10 earlier than	December 13	December 1
7 years in 10 earlier than	December 30	December 11
8 years in 10 earlier than	(1)	December 24

[1] In some years the first 28° F. freeze of the fall-winter season does not occur until mid-January or later; hence, no date has been indicated.

The dates of the last freezing temperature in spring and the first freezing temperature in fall vary considerably from year to year. The dates recorded for the latest freezing temperatures in spring were 32° on March 31 and 28° on March 10; those recorded for the earliest freezing temperatures in fall were 32° on November 1 and 28° on November 3. Table 11 shows a probability that, in about 3 years in 10, the first temperature of 32° or lower will occur before November 23 and, in about 5 years in 10, the first temperature of 28° or lower will occur before December 13. Other probabilities are that, in spring in about 2 years in 10, a temperature of 32° or lower will occur after March 11 and, in about 3 years in 10, temperatures will drop to 28° or lower after February 8.

Precipitation varies for any one month from year to year. In an average year, nearly 55 percent of the average annual total falls between June and September. On the average, November is the driest month, but the 4-month period of November through February generally has less than 20 percent of the annual total rainfall. Although the fact is not reflected in the averages in table 10, the survey area does receive a slight secondary maximum of rainfall in March and early in April. The period mid-April to late May is often droughty, and within this period are 3 to 4 weeks without appreciable rainfall.

Most summer rainfall comes from afternoon or early evening local thundershowers. During June through September, measurable rainfall can be expected on about half the days. Summer showers are sometimes heavy, and 2 or 3 inches of rain falls in an hour or two. Daylong rains in summer are rare and are almost always associated with a tropical storm. Winter and spring rains are usually associated with large-scale continental weather developments and are of longer duration. Some last for 24 hours or longer. Rains of long duration are usually not so intense as the thundershower-type rains. Occasionally, they do release relatively large amounts of rainfall over large areas. A 24-hour period when the total rainfall is more than 7 inches may be expected about 1 year in 10.

Tropical storms, which occasionally occur between early June and mid-November, cause widespread excessive rainfall and flooding by streams and lakes. Since these storms diminish in intensity quite rapidly as they move inland, the winds are seldom of hurricane force (75 miles per hour or higher). However, the heavy rains associated with these storms cause considerable local flooding.

The Ocala National Forest Area does not have an even distribution of rainfall, and as a result there are extended dry periods when the growth of trees is seriously threatened and there is a serious risk of fire. A dry period is defined as a period of consecutive days when each day has less than 0.20 inch of rainfall. By this definition, according to the records at Eustis, at least one dry period of 50 days or more can be expected about 1 year in 4.

Prevailing winds in the survey area are generally southerly in spring and summer and northerly in fall and winter. Windspeeds during the day usually range between 8 and 15 miles per hour, but nearly always drop below 8 miles per hour at night.

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Glossary

Available water capacity (also termed available moisture capacity). The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil.

Calcareous soil. A soil containing enough calcium carbonate (often with magnesium carbonate) to effervesce (fizz) visibly when treated with cold, dilute hydrochloric acid.

Clay. As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Claypan. A compact, slowly permeable soil horizon that contains more clay than the horizon above and below it. A claypan is commonly hard when dry and plastic or stiff when wet.

Concretions. Grains, pellets, or nodules of various sizes, shapes, and colors consisting of concentrations of compounds, or of soil grains cemented together. The composition of some concretions is unlike that of the surrounding soil. Calcium carbonate and iron oxide are examples of material commonly found in concretions.

Consistence, soil. The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are—

Loose.—Noncoherent when dry or moist; does not hold together in a mass.

Friable.—When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.

Firm.—When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.

Plastic.—When wet, readily deformed by moderate pressure but can be pressed into a lump; will form a "wire" when rolled between thumb and forefinger.

Sticky.—When wet, adheres to other material, and tends to stretch somewhat and pull apart, rather than to pull free from other material.

Hard.—When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.

Soft.—When dry, breaks into powder or individual grains under very slight pressure.

Cemented.—Hard and brittle; little affected by moistening.

Drainage class (natural). Drainage that existed during the development of the soil, as opposed to altered drainage, which is commonly the result of artificial drainage or irrigation but may be caused by the sudden deepening of channels or the blocking of drainage outlets. Seven different classes of natural soil drainage are recognized.

Excessively drained soils are commonly very porous and rapidly permeable and have a low water-holding capacity.

Somewhat excessively drained soils are also very permeable and are free from mottling throughout their profile.

Well-drained soils are nearly free from mottling and are commonly of intermediate texture.

Moderately well drained soils commonly have a slowly permeable layer in or immediately beneath the solum. They have uniform color in the A horizon and upper part of the B horizons and have mottling in the lower part of the B horizon and in the C horizon.

Somewhat poorly drained soils are wet for significant periods but not all the time, and some soils commonly have mottling at a depth below 6 to 16 inches.

Poorly drained soils are wet for long periods; they are light gray and generally mottled from the surface downward, but some have few or no mottles.

Very poorly drained soils are wet nearly all the time. They have a dark-gray or black surface layer and are gray or light gray, with or without mottling, in the deeper parts of the profile.

Fertility, soil. The quality of a soil that enables it to provide compounds, in adequate amounts and in proper balance, for the growth of specified plants, when other growth factors such as light, moisture, temperature, and the physical condition of the soil are favorable.

Ground water (geology). Water that fills all the unblocked pores of underlying material below the water table, which is the upper limit of saturation.

Hardpan. A hardened or cemented soil horizon, or layer. The soil material may be sandy or clayey, and it may be cemented by iron oxide, silica, calcium carbonate, or other substance.

Horizon, soil. A layer of soil, approximately parallel to the surface, that has distinct characteristics produced by soil-forming processes. These are the major horizons:

O horizon.—The layer of organic matter on the surface of a mineral soil. This layer consists of decaying plant residues.

A horizon.—The mineral horizon at the surface or just below an O horizon. This horizon is the one in which living organisms are most active and therefore is marked by the accumulation of humus. The horizon may have lost one or more of soluble salts, clay, and sesquioxides (iron and aluminum oxides).

B horizon.—The mineral horizon below an A horizon. The B horizon is in part a layer of change from the overlying A to the underlying C horizon. The B horizon also has distinctive characteristics caused (1) by accumulation of clay, sesquioxides, humus, or some combination of these; (2) by prismatic or blocky structure; (3) by redder or stronger colors than the A horizon; or (4) by some combination of these. Combined A and B horizons are usually called the solum, or true soil. If a soil lacks a B horizon, the A horizon alone is the solum.

C horizon.—The weathered rock material immediately beneath the solum. In most soils this material is presumed to be like that from which the overlying horizons were formed. If the material is known to be different from that in the solum, a Roman numeral precedes the letter C.

R layer.—Consolidated rock beneath the soil. The rock usually underlies a C horizon but may be immediately beneath an A or B horizon.

Humus. The well-decomposed, more or less stable part of the organic matter in mineral soils.

Mottling, soil. Irregularly marked with spots of different colors that vary in number and size. Mottling in soils usually indicates poor aeration and lack of drainage. Descriptive terms are as follows: Abundance—*few*, *common*, and *many;* size—*fine*, *medium*, and *coarse;* and contrast—*faint*, *distinct*, and *prominent*. The size measurements are these: *fine*, less than 5 millimeters (about 0.2 inch) in diameter along the greatest dimension; *medium*, ranging from 5 millimeters to 15 millimeters (about 0.2 to 0.6 inch) in diameter along the greatest dimension; and *coarse*, more than 15 millimeters (about 0.6 inch) in diameter along the greatest dimension.

Muck. An organic soil consisting of fairly well decomposed organic material that is relatively high in mineral content, finely divided, and dark in color.

Munsell notation. A system for designating color by degrees of the three simple variables—hue, value, and chroma. For example, a notation of 10YR 6/4 is a color with a hue of 10YR, a value of 6, and a chroma of 4.

Organic soil. A general term applied to a soil or to a soil horizon that consists primarily of organic matter, such as peat soils, muck soils, and peaty soil layers. In chemistry, organic refers to the compounds of carbon.

Ortstein. The B horizon in a Podzol or Spodosol that is cemented by accumulated sesquioxides, by organic matter, or by both.

Parent material. Disintegrated and partly weathered rock from which soil has formed.

Peat. Unconsolidated soil material, largely undecomposed organic matter, that has accumulated where there has been excess moisture.

Ped. An individual natural soil aggregate, such as a crumb, a prism, or a block, in contrast to a clod.

Permeability. The quality that enables the soil to transmit water or air. Terms used to describe permeability are as follows: *very slow*, *slow*, *moderately slow*, *moderate*, *moderately rapid*, *rapid*, and *very rapid*.

Profile, soil. A vertical section of the soil through all its horizons and extending into the parent material. See Horizon, soil.

Plowpan. A compacted layer formed in the soil immediately below the plowed layer.

Reaction, soil. The degree of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is precisely neutral in reaction because it is neither acid nor alkaline. An acid, or "sour," soil is one that gives an acid reaction; an alkaline soil is one that is alkaline in reaction. In words, the degrees of acidity or alkalinity are expressed thus:

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

Reticulate mottling. A type of mottling distinguished by a network of differently colored streaks; most frequently occurs in the deeper parts of latosolic soils.

Runoff (hydraulics). The part of the precipitation upon a drainage area that is discharged from the area in stream channels. The water that flows off the land surface without sinking in is called surface runoff; that which enters the ground before reaching surface streams is called ground-water runoff or seepage flow from ground water.

Sand. Individual rock or mineral fragments in a soil that range in diameter from 0.05 to 2.0 millimeters. Most sand grains consist of quartz, but they may be of any mineral composition. The textural class name of any soil that contains 85 percent or more sand and not more than 10 percent clay.

Silt. Individual mineral particles in a soil that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). Soil of the silt textural class is 80 percent or more silt and less than 12 percent clay.

Soil. A natural, three-dimensional body on the earth's surface that supports plants and that has properties resulting from the integrated effect of climate and living matter acting on earthy parent material, as conditioned by relief over periods of time.

Soil separates. Mineral particles, less than 2 millimeters in equivalent diameter and ranging between specified size limits. The names and sizes of separates recognized in the United States are as follows: *Very coarse sand* (2.0 to 1.0 millimeter); *coarse sand* (1.0 to 0.5 millimeter); *medium sand* (0.5 to 0.25 millimeter); *fine sand* (0.25 to 0.10 millimeter); *very fine sand* (0.10 to 0.05 millimeter); *silt* (0.05 to 0.002 millimeter); and *clay* (less than 0.002 millimeter). The separates recognized by the International Society of Soil Science are as follows: I (2.0 to 0.2 millimeter); II (0.2 to 0.02 millimeter); III (0.02 to 0.002 millimeter); IV (less than 0.002 millimeter).

Structure, soil. The arrangement of primary soil particles into compound particles or clusters that are separated from adjoining aggregates and have properties unlike those of an equal mass of unaggregated primary soil particles. The principal forms of soil structure are—*platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular*. *Structureless* soils are either *single grain* (each grain by itself, as in dune sand) or *massive* (the particles adhering together without any regular cleavage, as in many claypans and hardpans).

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are *sand, loamy sand, sandy loam, loam, silt loam, silt, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay*, and *clay*. The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

Variant, soil. A soil having properties sufficiently different from those of other known soils to suggest establishing a new soil series, but a soil of such limited known area that creation of a new series is not believed to be justified.

Water table. The highest part of the soil or underlying rock material that is wholly saturated with water. In some places an upper, or perched, water table may be separated from a lower one by a dry zone.

GUIDE TO MAPPING UNITS

For a full description of a mapping unit, read both the description of the mapping unit and that of the soil series to which the mapping unit belongs. A discussion of the capability classification system begins on page 28, and forest-wildlife management begins on page 34. Other information is given in tables as follows:

Acreage and extent, table 1, page 5.
Predicted yields, table 2, page 31.
Woodland groups, table 3, page 32.
Range groups, table 4, page 34.
Engineering uses of the soils, tables 5, 6, 7, and 8, pages 38 through 53.

Map symbol	Mapping unit	Described on page	Capability unit	Woodland group	Range management group
			Symbol	Number	Number
AsB	Astatula sand, 0 to 8 percent slopes	5	VIs-1	8	8
AsD	Astatula sand, 8 to 17 percent slopes	6	VIIs-1	8	8
AtB	Astatula sand, dark surface, 0 to 8 percent slopes	6	IVs-1	7	7
AtD	Astatula sand, dark surface, 8 to 17 percent slopes	6	VIIs-1	7	7
AuB	Astatula sand, banded substratum, 0 to 8 percent slopes	6	IVs-1	7	7
AwB	Astatula sand, moderately deep water table, 0 to 8 percent slopes	7	IIIs-2	4	4
Ax	Astor sand	8	IIIw-2	5	6
Ba	Basinger sand	8	IVw-2	4	4
De	Delks sand	9	IIIw-1	12	9
Do	Dorovan muck	10	IIIw-5	1	1
Du	Duplin loamy sand	11	IIIw-3	2	5
Er	Eureka loamy sand, thick-surface variant	12	Vw-1	3	3
Es	Eureka loamy fine sand	13	IIIw-4	3	3
Eu	Eustis sand	13	IIIs-3	6	5
Ev	Everglades muck	14	IIIw-5	1	1
Ib	Iberia clay	15	Vw-1	3	3
Im	Immokalee sand	16	IVw-1	11	9
Ma	Made land	16	----	--	10
Me	Meggett loamy sand	17	IIIw-4	3	3
Mk	Myakka sand	18	IVw-1	11	9
Ms	Myakka and Sellers soils, ponded	18	VIIw-1	1	2
Or	Orlando sand	19	IIIs-1	6	5
Os	Orlando sand, wet variant	19	IIw-1	5	5
Pa	Pamlico muck	20	IIIw-5	1	1
Pd	Pamlico muck, deep	20	IIIw-5	1	1
PlB	Paola sand, 0 to 8 percent slopes	21	VIs-1	8	8
PlD	Paola sand, 8 to 17 percent slopes	21	VIIs-1	8	8
PmA	Paola sand, moderately deep water table, 0 to 5 percent slopes	22	IVs-2	10	8
Po	Pomello sand	22	VIs-2	10	8
Ra	Rains loamy fine sand	23	IIIw-4	3	3
Sa	St. Johns sand	24	IIIw-1	11	6
Sc	St. Lucie sand	25	VIIs-1	9	8
Sp	Sellers and Pamlico soils	25	IIIw-2	5	1
Ss	Sellers sand	25	IIIw-2	5	6
Tc	Terra Ceia muck	26	IIIw-5	1	1
WcA	Wicksburg sand, 0 to 5 percent slopes	27	IIIs-4	2	5
WcC	Wicksburg sand, 5 to 12 percent slopes	27	IVs-3	2	5

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