SOIL SURVEY OF

Broward County Area, Florida

United States Department of Agriculture
Soil Conservation Service

In cooperation with

University of Florida
Institute of Food and Agricultural Sciences
Agricultural Experiment Stations
Soil Science Department

This is a publication of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and agencies of the States, usually the Agricultural Experiment Stations. In some surveys, other Federal and local agencies also contribute. The Soil Conservation Service has leadership for the Federal part of the National Cooperative Soil Survey.

Major fieldwork for this soil survey was completed in the period 1970–72. Soil names and descriptions were approved in 1973. Unless otherwise indicated, statements in the publication refer to conditions in the county in 1972. This survey was made cooperatively by the Soil Conservation Service and the University of Florida Institute of Foods and Agricultural Sciences, Agricultural Experiment Stations, Soil Science Department. It is part of the technical assistance furnished to the Palm Beach Broward Soil and Water Conservation District.

Soil maps in this survey may be copied without permission, but any enlargement of these maps could cause misunderstanding of the detail of mapping and result in erroneous interpretations. Enlarged maps do not show small areas of contrasting soils that could have been shown at a larger mapping scale.

HOW TO USE THIS SOIL SURVEY

THIS SOIL SURVEY contains information that can be applied in managing farms, ranches, 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 Broward County 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.

The Broward County Area soil survey map sheets do not join with those of the Dade County detailed reconnaissance soil survey completed about 1952 and published in 1958. The Dade County survey was made under an older classification system and the maps were published at a different scale, not on an aerial photo background. Thus, soil boundary lines of Broward County Area do not join those of Dade County, and soil series names are different.

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.

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 a 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 discussion of the capability units.

Game managers, sportsmen, and others can find information about soils and wildlife in the section "Use of the Soils as Wildlife Habitat."

Community planners and others can read about soil properties that affect the choice of sites for dwellings, industrial buildings, and recreation areas in the sections "Engineering Uses of the Soils" and "Use of the Soils for Recreational Development."

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 Broward County 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 at the beginning and end of the publication.

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SOIL SURVEY OF BROWARD COUNTY AREA, FLORIDA

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UNITED STATES DEPARTMENT OF AGRICULTURE, SOIL CONSERVATION SERVICE, IN COOPERATION WITH UNIVERSITY OF FLORIDA, INSTITUTE OF FOOD AND AGRICULTURAL SCIENCES, AGRICULTURAL EXPERIMENT STATIONS, SOIL SCIENCE DEPARTMENT

BROWARD COUNTY AREA is in Broward County and the southeastern part of Florida (fig. 1). It

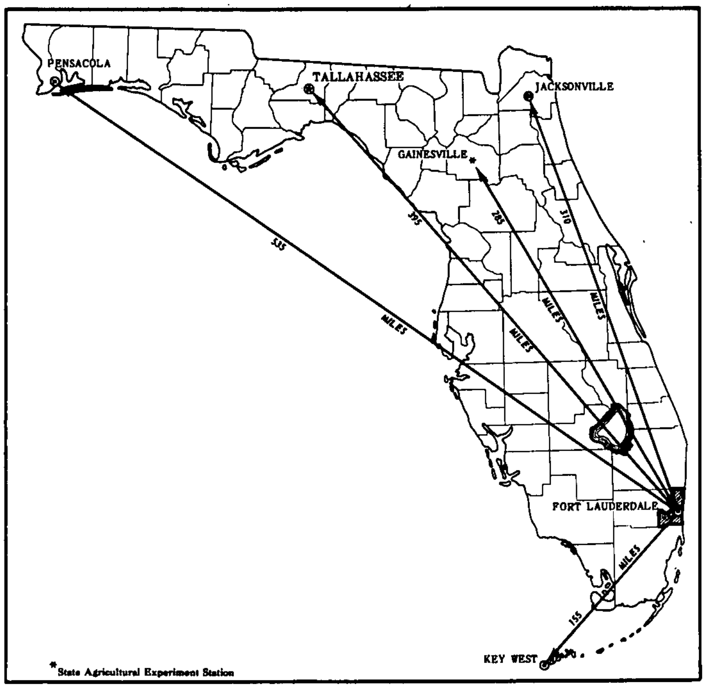

Figure 1.—Location of Broward County Area in Florida.

has a total land area of 189,273 acres or about 296 square miles. Fort Lauderdale is the county seat of Broward County. The survey area is bounded by Dade County on the south, a conservation area on the west, Palm Beach County on the north, and an area defined along Range line 42–43E to Atlantic Boulevard, west on Atlantic Boulevard to Powerline Road, south on Powerline Road to Oakland Park Boulevard, west on Oakland Park Boulevard to Sunshine Parkway, and south on the Sunshine Parkway to the Dade County line.

Most of the survey area is low, nearly level land at an elevation of 2 to 10 feet above sea level. Two sand ridges are in the area. One is a coastal ridge that extends from Palm Beach County and ends south of Pompano. The other is known as Pine Island and is west of Davie and north of Cooper City. This ridge consists of only about 400 acres but is at the highest elevation, 29 feet, in the Area. The average temperature is 75.4° F. Rainfall is abundant, but is unevenly distributed.

The county had a population of 620,000 people in 1970.[1] Almost all of the people live east of the conservation area.

Generally, farm activity has diminished, but some citrus crops, winter truck crops, and cattle are produced.

The Area is very popular with tourists and retired persons because of the warm climate in winter and the various available recreational facilities.

How This Survey Was Made

Soil scientists made this survey to learn what kinds of soil are in the Broward County Area, where they are located, and how they can be used. The soil scientists went into the county knowing they likely would 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 or crops, the kinds of rock, and many facts about the soils. They dug many holes to expose soil profiles. A profile is the sequence of natural layers, or horizons, in a soil; it extends from the surface down into the parent material that has not been changed much by leaching or by 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 the *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 textures in the surface

[1] This figure is taken from statistical data of the U.S. Department of Commerce, Bureau of the Census.

layer, all the soils of one series have major horizons that 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. Hallandale and Sanibel, 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 use of the soils 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, Hallandale fine sand is one of several phases within the Hallandale 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 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 one series. Two such kinds of mapping units are shown on the soil map of the Broward County Area: soil complexes and undifferentiated groups.

A soil complex consists of areas of two or more soils, so intricately mixed or so small in size that they cannot be shown separately on the soil map. Each area of a complex contains some of each of the two or more dominant soils, and the pattern and relative proportions are about the same in all areas. Generally, the name of a soil complex consists of the names of the dominant soils, joined by a hyphen. Immokalee-Urban land complex is an example.

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. Hallandale and Margate soils is an undifferentiated soil group in this survey area.

In most areas surveyed there are places where the soil material is so rocky, so shallow, so severely eroded, or 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 are given descriptive names. Urban 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 for engineering tests. Laboratory data from the same kind of soil in other places are also assembled. Data on yields of crops under defined practices are assembled from farm records and from field or plot experiments on the same kind of soil. Yields under defined management are estimated 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 a high water table. They see that streets, road pavements, and foundations for houses are cracked on a named 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 results 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 Broward County 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 the Area, to people who want to compare different parts of the Area, or to people 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, depth, stoniness, drainage, and other characteristics that affect their management.

Table 1 shows soil ratings and limitations and features affecting selected uses by soil associations for sanitary facilities, community development, source material, and water management. These uses of the soils and the rating system are explained in detail in the section "Engineering Interpretations."

The soil associations in the Broward County Area are discussed in the following paragraphs.

1. Paola-Urban Land-St. Lucie Association

Excessively drained, nearly level mineral soils that are more than 80 inches deep to hard limestone; some areas have been modified for urban use

This association consists of low knolls and ridges that are part of the Coastal Ridge. It is mostly in the northeastern part of the survey area. Very little natural vegetation remains except in the vicinity of Pine Island. What remains is sand pine and scrub oak and an undergrowth of native grasses, cacti, and in places some saw palmetto.

This association makes up about 4 percent of the survey area. About 37 percent of the association is Paola soils and Urban land, about 12 percent is St. Lucie soils, and about 51 percent is minor soils.

Paola soils are excessively drained and nearly level. Typically they have a thin surface layer of gray fine sand, a subsurface layer of white fine sand, and a subsoil of yellow fine sand. These soils are more than 80 inches deep. Most of them have been modified by grading and shaping or generally altered for community or urban development.

Urban land consists of areas that are more than 70 percent covered by houses, streets, driveways, buildings, parking lots, and other structures so that the natural soil is not readily observable.

St. Lucie soils are also excessively drained and nearly level. Typically they have a thin surface layer of gray fine sand that overlies white fine sand to a depth of more than 80 inches.

The minor soils in this association are Immokalee, Pomello, Pompano, and Basinger soils. Most of the Immokalee soils have been modified by grading and shaping or otherwise generally altered.

Much of the area of this association is used for homes, airports, and related urban purposes. Farming has no importance because of extensive urban development; and at any rate, the major soils are generally not suited or are poorly suited to most kinds of farming.

The soils of this association have slight limitations for most nonfarm uses. The major soils have severe limitations for structures designed to retain or hold water.

2. Immokalee-Urban Land-Pompano Association

Poorly drained, nearly level mineral soils that are more than 80 inches deep to hard limestone; some areas have been modified for urban use

This association is made up of broad, low ridges interspersed with sloughs and broad flats. It is in the eastern part of the survey area. The natural vegetation, where it remains, is either slash pine, saw palmetto, and native grasses or pepper, slash pine, guava trees, and native grasses.

This association makes up about 14 percent of the survey area. It is about 50 percent Immokalee soils and Urban land, 20 percent Pompano soils, and 30 percent minor soils.

Immokalee soils are poorly drained and nearly level. They are sandy throughout and typically have a dark-gray surface layer, a light-gray subsurface layer, and a dark-colored, weakly cemented layer that begins at a depth of more than 30 inches. These soils are more than 80 inches deep. They have been disturbed or modified in most places by sandy materials spread on the surface of the soil to an average thickness of about 12 inches.

Urban land consists of areas that are 70 to more than 75 percent covered by houses, shopping centers, parking lots, large buildings, and streets and sidewalks so that the natural soil is not readily observable.

Pompano soils are poorly drained and nearly level. Typically they have a surface layer of gray fine sand mixed with organic matter and grayish or brownish sandy material. The soils are 80 inches or more deep.

The minor soils in this association are Basinger, Sanibel, Plantation, Hallandale, and Margate soils. Some of the minor soils also have been altered or filled.

Much of this association is used for homes, large buildings, shopping centers, and related urban uses. Most of the natural vegetation has been removed. Farming is of no importance because of extensive urban development. Drainage and water control have been established over most of the association and help to reduce the wetness limitation for most nonfarm uses. In undeveloped areas that do not have adequate water control, wetness is a limitation of the soils for most uses, and in some places flooding is a hazard.

3. Hallandale-Margate Association

Poorly drained, nearly level mineral soils that are less than 40 inches deep to hard limestone

This association consists of broad flats and low terraces interspersed with drainageways and ponds or depressions. It is east of the Everglades and west of the Coastal Ridge. The natural vegetation is native grasses, saw palmetto, wax myrtle, and a few slash pine and cypress trees. Cypress trees are common in the drainageways and depressions.

This association makes up about 54 percent of the survey area. About 34 percent of the association is Hallandale soils, about 24 percent is Margate soils, and about 42 percent is minor soils.

Hallandale soils are poorly drained and nearly level. Typically they have a thin surface layer of black fine sand, a subsurface layer of light brownish-gray fine sand, and a subsoil of brown and yellowish-brown fine sand that has slightly more clay than the subsurface layer. Beneath the subsoil is hard limestone. Depth to hard limestone ranges from 7 to 20 inches but is typically 16 inches.

Margate soils are poorly drained and nearly level. Typically they have a surface layer of very dark gray fine sand and a subsurface layer of light brownish-gray fine sand. The subsoil is brown fine sand that is slightly more clayey than the subsurface layer. It has a layer, about 4 inches thick, of brown fine sandy loam mixed with fragments of limestone. Hard limestone is at a depth of about 32 inches. Depth to hard limestone ranges from 20 to 40 inches.

The minor soils in this association are Dania, Lauderhill, and Sanibel soils and areas of Urban land

TABLE 1.—*Degree and kind of soil limitations and*

[Ratings are given for soil associations as a whole, and additional ratings are given for the major component parts. Ratings differ differing from those in the Soil Survey Manual (*5*). Refer to "Explanations of Key Phrases" at the back of

Soil association and component soils	Limitations for sanitary facilities				Limitations for Community Development		
	Septic-tank absorption fields	Sewage lagoons	Sanitary landfill [2]: Trench type	Sanitary landfill [2]: Area type	Shallow excavations	Dwellings without basements	Dwellings with basements
1. Paola-Urban land-St. Lucie (4%).[3]	Slight	Not practical.	Not practical.	Not practical.	Slight	Slight	Slight
Paola-Urban land (37%)[4]	Slight[5]	Not practical.[6]	Not practical.[6]	Not practical.[6]	Slight	Slight	Slight
St. Lucie (12%)	Slight[5]	Severe: seepage.	Severe: seepage; too sandy.	Severe: seepage.	Slight	Slight	Slight
Minor soils (51%).[7] Interpretations not made.							
2. Immokalee-Urban land-Pompano (14%).	Severe	Not practical.	Not practical.	Not practical.	Severe	Severe	Severe
Immokalee (50%)	Severe: wet.	Not practical.	Not practical.	Not practical.	Severe: wetness; cutbanks cave.	Severe: wetness.	Severe: wet.
Pompano (20%)	Severe: wet.	Severe: wetness; seepage.	Severe: wetness; seepage.	Severe: wetness; seepage.	Severe: wetness; cutbanks cave.	Severe: wetness.	Severe: wet.
Minor soils (30%).[7] Interpretations not made.							
3. Hallandale-Margate (54%)	Severe	Severe	Severe	Severe	Severe	Severe	Severe
Hallandale (34%)	Severe: wetness; depth to rock.	Severe: depth to rock; wetness; seepage.	Severe: depth to rock; wetness; seepage; too sandy.	Severe: wetness; seepage.	Severe: depth to rock; wetness; cutbanks cave.	Severe: depth to rock; wetness.	Severe: depth to rock; wetness.
Margate (24%)	Severe: wetness; depth to rock.	Severe: depth to rock; wetness; seepage.	Severe: depth to rock; wetness; seepage.	Severe: wetness; seepage.	Severe: depth to rock; wetness; cutbanks cave.	Severe: wetness.	Severe: depth to rock; wetness.
Minor soils (42%).[7] Interpretations not made.							

features affecting selected uses, by soil associations

in some respects from ratings for the entire association. Soil characteristics in this table are expressed in computer-adapted terms this survey for definitions of "percs rapidly" and other terms that describe soil characteristics]

Limitations for Community Development—continued		Limitations for source material[1]				Water management[1]			
						Limitations for—		Features affecting—	
Small commercial buildings	Local roads and streets	Road fill	Sand	Topsoil	Daily cover for landfill	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Drainage	Irrigation
Slight	Slight	Good	Good	Poor	Poor	Severe	Severe	Not needed.	Droughty; seepage; fast intake.
Slight	Slight	Good	Good	Poor: too sandy.	Poor: too sandy; seepage.	Severe: piping; percs rapidly; unstable fill.	Severe: no water.	Not needed.	Droughty; seepage; fast intake.
Slight	Slight	Good	Good	Poor: too sandy.	Poor: too sandy; seepage.	Severe: piping; percs rapidly; unstable fill.	Severe: no water.	Not needed.	Droughty; seepage; fast intake.
Severe	Severe	Good	Good	Poor	Poor	Severe	Moderate	Cutbanks cave; wetness.	Wetness; seepage; fast intake.
Severe: wetness; corrosive.	Severe: wet.	Good	Good	Poor: too sandy; wetness.	Poor: too sandy; wetness; seepage.	Severe: percs rapidly; piping; unstable fill.	Moderate: deep to water.	Cutbanks cave; wetness.	Wetness; seepage; fast intake.
Severe: wetness; corrosive.	Severe: wet.	Good	Good	Poor: too sandy; wetness.	Poor: too sandy; wetness; seepage.	Severe piping; seepage; unstable fill.	Slight	Cutbanks cave; wetness.	Wetness; seepage.
Severe	Severe	Poor	Poor	Poor	Poor	Severe	Severe	Depth to rock; wetness; cutbanks cave.	Wet; seepage; fast intake.
Severe: depth to rock; wetness; corrosive.	Severe: depth to rock; wetness.	Poor: thin layer; area reclaim.	Poor: thin layer.	Poor: too sandy; wetness; area reclaim.	Poor: too sandy; wetness; seepage; area reclaim.	Severe: thin layer; piping; unstable fill.	Severe: depth to rock.	Depth to rock; wetness; cutbanks cave.	Wet; seepage; fast intake.
Severe: wetness.	Severe: wetness.	Poor: thin layer; wet.	Poor: thin layer.	Poor: too sandy; wetness.	Poor: too sandy; wetness.	Severe: piping; seepage; unstable fill.	Moderate: depth to rock.	Depth to rock; cutbanks cave; wetness.	Wet; seepage; fast intake.

TABLE 1.—*Degree and kind of soil limitations and*

Soil association and component soils	Limitations for sanitary facilities				Limitations for Community Development		
	Septic-tank absorption fields	Sewage lagoons	Sanitary landfill [2] Trench type	Sanitary landfill [2] Area type	Shallow excavations	Dwellings without basements	Dwellings with basements
4. Lauderhill-Dania (28%)	Severe	Severe	Very severe.	Severe	Severe	Very severe.	Very severe.
Lauderhill (63%)	Severe: wetness; depth to rock.	Severe: depth to rock; wetness; excess humus.	Very severe: depth to rock; wetness; seepage; excess humus.	Severe: wetness; seepage.	Severe: depth to rock; wetness; excess humus.	Very severe: wetness; excess humus; low strength.	Very severe: depth to rock; wetness; excess humus; low strength.
Dania (27%)	Severe: wetness; depth to rock.	Severe: depth to rock; wetness; seepage; excess humus.	Very severe: depth to rock; wetness; seepage; excess humus.	Severe: wetness; seepage.	Severe: depth to rock; wetness; excess humus.	Very severe: depth to rock; wetness; excess humus; low strength.	Very severe: depth to rock; wetness; excess humus; low strength.
Minor soils (10%). Interpretations not made.							

[1] Ratings for source material and water management are generally not applicable to the Urban land part of Paola-Urban land-St. Lucie association and Immokalee-Urban land-Pompano association, because Urban land is mostly covered by concrete.

[2] Onsite deep studies of the underlying strata, water tables, and hazards of acquifer pollution and drainage into ground water need to be made for landfills deeper than 5 or 6 feet.

[3] Percentage of Area comprised by the association.

and Hallandale and Margate soils that have been modified by grading, shaping, and covering with fill material.

Much of the area of this association is used for improved pasture (fig. 2) or is in natural vegetation. A few areas are used for truck crops. Urban development is rapidly encroaching into this association so that farming has diminishing importance. Drainage and water control have been established over most of the association. The major soils are unsuited or poorly suited to cultivated crops.

The soils of this association have severe limitations for most nonfarm uses. Because of wetness, water control is necessary for most uses, and commonly fill material needs to be added to the surface of the soil to make areas higher for use as building sites. The hard limestone provides an excellent base for foundations.

4. Lauderhill-Dania Association

Very poorly drained, nearly level organic soils that are less than 40 inches deep to hard limestone

This association is made up of broad flats. It is mostly in the western part of the survey area and the eastern part of the Everglades. The natural vegetation is mainly sawgrass (fig. 3), and where the sawgrass has been burned, melaleuca has become established.

This association makes up about 28 percent of the

Figure 2.—**Typical area of improved grass pasture in the Hallandale-Margate association. The soil is Margate fine sand. Limestone is exposed on the bank of the drainage ditch in the foreground.**

features affecting selected uses, by soil associations—Continued

Limitations for Community Development—continued		Limitations for source material [1]				Water management [1]			
						Limitations for—		Features affecting—	
Small commercial buildings	Local roads and streets	Road fill	Sand	Topsoil	Daily cover for landfill	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Drainage	Irrigation
Very severe.	Very severe.	Poor	Unsuited	Poor	Poor	Severe	Moderate	Depth to rock; wetness; excess humus.	Wetness.
Very severe: wetness; excess humus; low strength.	Very severe: excess humus; low strength; wetness.	Poor: excess humus; low strength; wetness; area reclaim.	Unsuited: excess humus.	Poor: area reclaim; wetness.	Poor: excess humus; area reclaim; wetness.	Severe: excess humus; low strength; seepage.	Moderate: depth to rock.	Depth to rock; wetness; excess humus.	Wetness.
Very severe: depth to rock; wetness; excess humus; low strength.	Very severe: excess humus; low strength; wetness; depth to rock.	Poor: excess humus; low strength; thin layer; wetness; area reclaim.	Unsuited: excess humus.	Poor: area reclaim; wetness.	Poor: excess humus; area reclaim; wetness.	Severe: thin layer; excess humus; low strength.	Severe: depth to rock.	Depth to rock; wetness; excess humus.	Wetness.

[4] Percentage of association comprised by the component soil. Percentages are estimates and are not based on measured acreage.
[5] Excessive permeability may cause pollution of ground water.
[6] Areas are too close to houses and commercial buildings or mostly covered by concrete.
[7] No one of the individual minor soils makes up as large a percentage of the association as the major soil with the lowest percentage.

survey area. It is about 63 percent Lauderhill soils, 27 percent Dania soils, and 10 percent minor soils.

Lauderhill soils are very poorly drained and nearly level. Typically they have a surface layer of black sapric material or muck. Below this is dark reddish-brown sapric material or muck, and hard limestone is at a depth of about 31 inches. Depth to hard limestone varies from 20 to 40 inches.

Dania soils are very poorly drained and nearly level. Typically they have a surface layer of black sapric material or muck. Below this is dark reddish-brown sapric material or muck, a thin layer of brown fine sand, and a thin layer of light-gray sandy marl mixed with limestone fragments. Hard limestone is at a depth of about 18 inches. Depth to hard limestone varies from 14 to 20 inches.

The minor soils in this association are the Plantation and Sanibel soils.

Most of this association is still in its natural vegetation. Several small areas are in improved pasture and some sod farms. With adequate drainage and water control, the soils have good potential for farming. For community developments or other nonfarm uses, wetness and organic material are limitations. The organic material has low strength and is subject to oxidation and subsidence when not saturated with water. For houses or other urban developments, the organic material needs to be removed and replaced by fill (fig. 4).

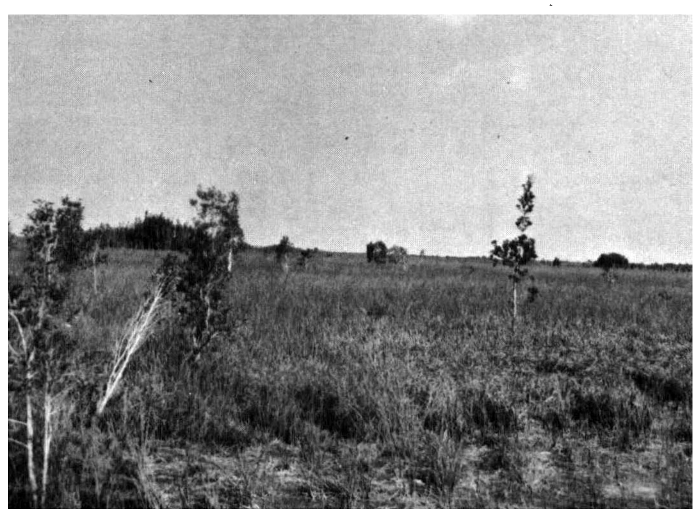

Figure 3.—**Area of sawgrass and scattered malaleuca trees in the Lauderhill-Dania association. The soil is Dania muck.**

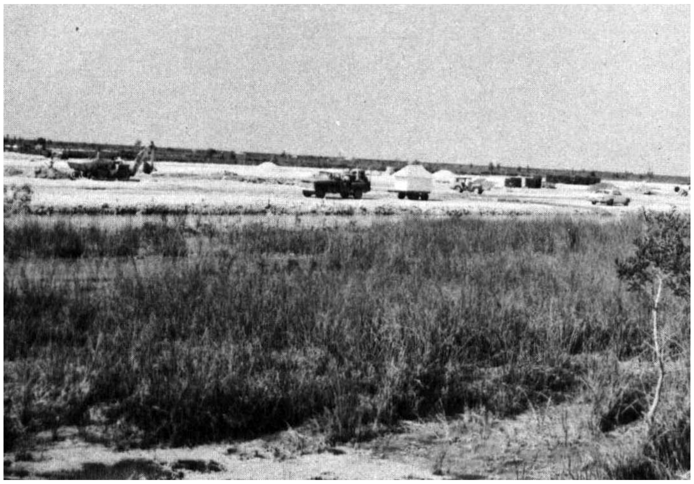

Figure 4.—Trailer park development in an area of the Lauderhill-Dania association. The soils are Lauderhill muck and Dania muck, from which the organic material is removed and replaced by fill. The high water table is a limitation of these soils for septic tanks.

TABLE 2.—*Approximate acreage and proportionate extent of the soils*

Soil	Acres	Percent
Basinger fine sand	3,080	1.6
Boca fine sand	1,684	.9
Dania muck	15,709	8.4
Hallandale fine sand	35,260	18.6
Hallandale and Margate soils	6,031	3.2
Hallandale-Urban land complex	14,547	7.7
Immokalee fine sand	7,239	3.8
Immokalee-Urban land complex	12,248	6.4
Lauderhill muck	34,594	18.3
Margate fine sand	25,515	13.5
Paola fine sand	747	.4
Paola-Urban land complex	2,156	1.1
Plantation muck	6,404	3.4
Pomello fine sand	961	.5
Pompano fine sand	6,452	3.4
Sanibel muck	3,371	1.8
St. Lucie fine sand	950	.5
Udorthents	3,196	1.7
Udorthents, shaped	6,545	3.4
Urban land	2,584	1.4
Total land area	189,273	100.0

Descriptions of the Soils

This section describes the soil series and mapping units in the Broward County Area. Each soil series is described in detail, and then, briefly, each mapping unit in that series. 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 for the 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 are differences that are apparent in the name of the mapping unit.

As mentioned in the section "How This Survey Was Made," not all mapping units are members of a soil series. Urban 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 in which the mapping unit has been placed. The capability unit for each soil and the page number for each soil mapping unit can be learned by referring to the "Guide to Mapping Units" at the back of this survey.

The acreage and proportionate extent of each mapping unit are shown in table 2. 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 (*5*).[2]

Basinger Series

The Basinger series consists of nearly level, poorly drained soils in broad sloughs and flats. These soils formed in unconsolidated marine sediment. In most years the water table is at a depth of 10 inches or less for 2 to 6 months, and between 10 and 40 inches for 6 months or more. In dry seasons it is below a depth of 40 inches for short periods. Under natural conditions these soils are covered with shallow water 1 to 2 months each year; where there is improved drainage, however, they are not.

In a representative profile the surface layer is very dark grayish-brown fine sand about 6 inches thick. The subsurface layer is about 11 inches of light-gray fine sand. Underlying this, to a depth of 60 inches, is pale-brown fine sand.

Permeability is rapid in all layers of these soils. Available water capacity is very low to a depth of 23 inches. Natural fertility and content of organic matter are low.

Where adequate water control and intensive management practices are in use, Basinger soils are suited to winter truck crops and improved pasture grasses.

Representative profile of Basinger fine sand, about 50 feet west of University Drive and 0.9 mile north of Orange Drive, SE¼SE¼ sec. 21, T. 50 S., R. 41 E.:

A1—0 to 6 inches, very dark grayish-brown (10YR 3/2) fine sand; single grained; loose; few fine roots; strongly acid; clear, smooth boundary.

[2] Italic numbers in parentheses refer to Literature Cited, p. 45.

A21—6 to 13 inches, light gray (10YR 7/1) fine sand; streaks of very dark gray (10YR 3/1) in root channels; single grained; loose; strongly acid; gradual, wavy boundary.

A22—13 to 17 inches, light-gray (10YR 7/2) fine sand; single grained; loose; very strongly acid; gradual, wavy boundary.

A3—17 to 23 inches, brown (10YR 5/3) fine sand; few, medium, distinct, black (10YR 2/1) mottles in root channels; single grained; loose; some uncoated sand grains; sand grains turn white on ignition; very strongly acid; gradual, wavy boundary.

C&Bh—23 to 35 inches, brown (10YR 4/3) fine sand; black (10YR 2/1) streaks in root channels; single grained; loose; some clean and some partly coated sand grains; strongly acid; gradual, wavy boundary.

C—35 to 60 inches, pale-brown (10YR 6/3) fine sand; single grained; loose; many uncoated sand grains; very strongly acid.

Basinger soils range from slightly acid to very strongly acid throughout.

The A1 horizon is black, very dark gray, dark gray, or very dark grayish brown and ranges from 2 to 8 inches in thickness. The A21 horizon is light brownish gray, gray, or light gray and is 5 to 18 inches thick. The A22 horizon is white, light gray, very pale brown, or light brownish gray and is 3 to 6 inches thick. The A3 horizon is brown or dark brown and is 2 to 8 inches thick.

The C&Bh horizon is brown, dark brown, or dark grayish brown and ranges from 6 to 18 inches in thickness. This horizon has a slight increase in clay content over the A2 horizon. The C horizon is brown or pale brown and extends to a depth of 60 inches or more.

Basinger soils are associated with Immokalee, Margate, and Pompano soils. They lack the weakly cemented Bh horizon of Immokalee soils. They differ from Margate soils in not having limestone within a depth of 40 inches. They have a C&Bh horizon that is not present in Pompano soils.

Basinger fine sand (Ba).—This is a nearly level, deep, poorly drained, sandy soil that is in broad sloughs and flats. Included in mapping are small areas of Immokalee fine sand, Pompano fine sand, and Margate fine sand.

Most of the acreage of this soil is in natural vegetation that consists of pepper trees, myrtle, pine, and native grasses. Scattered cypress trees are in lower areas.

This soil is severely limited for cultivated crops by wetness and other adverse properties. To grow any crops and pasture plants on this soil, a water control system is needed that provides subsurface irrigation by controlling the water table. Truck crops, other specialized crops, and improved pasture consisting of a mixture of grass and clover can be grown with adequate water control and intensive management. This soil is severely limited for citrus. Where citrus is grown, very intensive management practices and adequate water control are needed. The soil responds well to applications of fertilizer and lime. Capability unit IVw-1.[3]

Boca Series

The Boca series consists of nearly level, poorly drained soils in low broad wet areas and along grassy, poorly defined drainageways. These soils formed in moderately thick beds of marine sandy loamy sediment over limestone. In most years the water table is at a depth of 10 inches or less for 2 to 6 months, and between 10 and 30 inches for 6 months or more. During dry seasons it remains in cavities of the limestone. Under natural conditions some areas of these soils are covered by shallow water 1 to 2 months each year. Where there is improved drainage, however, they are not.

In a representative profile the surface layer is dark-gray fine sand about 7 inches thick. The subsurface layer is about 6 inches of light-gray fine sand. The subsoil is about 19 inches thick. The upper 12 inches of the subsoil is very pale brown fine sand mottled with brownish yellow and yellowish brown, and the lower 7 inches is grayish-brown sandy clay loam mottled with yellowish brown. Below this is about 2 inches of white to yellowish-brown marl, decomposed rock, sandy clay loam, and sand mixed with limestone fragments. Hard limestone that contains solution holes filled with sandy clay loam is at a depth of 34 inches.

Permeability is rapid in the sandy layers of these soils and moderate in the loamy part of the subsoil. Available water capacity is low in the surface layer, very low between depths of 7 and 25 inches, and medium in the loamy part of the subsoil. Natural fertility and content of organic matter are low.

Where adequate water control and intensive management practices are in use, Boca soils are suited to most winter truck crops and improved pasture grasses.

Representative profile of Boca fine sand, 0.25 mile south of State Road 827 and about 0.7 mile west of U.S. Highway 441, SW¼SW¼NW¼ sec. 36, T. 48 S., R. 41 E.:

Ap—0 to 7 inches, dark-gray (10YR 4/1) fine sand; single grained; loose; many fine and medium roots; medium acid; clear, wavy boundary.

A2—7 to 13 inches, light-gray (10YR 7/1) fine sand; many, medium, distinct, very dark gray (10YR 3/1) mottles; single grained; loose; medium acid; clear, wavy boundary.

B1—13 to 25 inches, very pale brown (10YR 7/3) fine sand; few, fine, distinct, brownish-yellow (10YR 6/6) and common, fine, distinct, yellowish-brown (10YR 5/4) mottles; single grained; loose; neutral; abrupt, smooth boundary. This horizon has a slight increase in clay.

B2tg—25 to 32 inches, grayish-brown (10YR 5/2) sandy clay loam; common, fine and medium, distinct, yellowish-brown (10YR 5/6) mottles; weak, medium, subangular blocky structure; friable; moderately alkaline; abrupt, irregular boundary.

IIC—32 to 34 inches, white (10YR 8/1) to yellowish-brown (10YR 5/8) decomposed rock, marl, sandy clay loam, and sand mixed with limestone fragments; massive in places; friable; moderately alkaline; abrupt, irregular boundary.

IIIR—34 inches, hard limestone. This horizon has two solution holes approximately 15 inches in diameter and extending from 40 to 82 inches below the surface. These holes contain sandy clay loam.

The A1 or Ap horizon is black, very dark gray, dark gray, very dark grayish brown, dark grayish brown, or grayish brown and ranges from 4 to 9 inches in thickness. Where the A1 or Ap horizon is black, very dark gray, or very dark grayish brown, it is less than 6 inches thick. The A2 horizon is grayish brown, dark grayish brown, light gray, or gray and ranges from 14 to 22 inches in thickness. Reaction is strongly acid to neutral.

The B1 horizon, where present, is brown, pale brown, very pale brown, dark-brown, yellowish-brown, or light yellowish-brown fine sand. This horizon has at least a 3 percent increase in clay content from the overlying horizon. The B1 horizon is 0 to 15 inches thick. Reaction ranges from

[3] Placed in capability subclass IVw on the assumption that drainage outlets are available. Without drainage outlets, this soil should be in capability subclass Vw.

strongly acid to neutral. In some places there are mottles in shades of brown, yellow, or gray.

The B2tg horizon is light brownish-gray, grayish-brown, dark grayish-brown, gray, or dark-gray sandy loam or sandy clay loam. It averages from 16 to 23 percent clay. In some places there are mottles in shades of gray, yellow, or brown. Reaction is neutral to moderately alkaline. This horizon is 3 to 7 inches thick.

The IIC horizon is decomposed rock, marl, sandy clay loam, and sand mixed with broken pieces of limerock. The color of this material is white to very dark gray and in places includes shades of yellowish brown. This horizon is 1 to 3 inches thick. Reaction is neutral to moderately alkaline.

Hard limestone is at a depth of 24 to 40 inches, and solution holes extend to a depth of 50 inches or more and are filled with sandy clay loam.

Boca soils are associated with Hallandale, Margate, and Plantation soils. They have a B2t horizon above the rock, whereas Margate and Hallandale soils do not. They do not have the organic surface layer of Plantation soils.

Boca fine sand (Bc).—This is a nearly level, poorly drained, sandy soil underlain by limestone at a depth of 24 to 40 inches. It is in low, broad, wet areas and along grassy, poorly defined drainageways.

Included with this soil in mapping are small areas of Basinger fine sand, Margate fine sand, and Hallandale fine sand.

Most areas of this soil are in natural vegetation that consists of gallberry, saw palmetto, cabbage palmetto, slash pine, and an understory of pineland three-awn. Some areas are used for truck crops, improved pasture, and citrus.

This soil is severely limited for cultivated crops by excessive wetness. To grow any crops and pasture plants on this soil, a water control system is needed that provides subsurface irrigation by controlling the water table. Truck crops and improved pasture consisting of a mixture of grass and clover can be grown with adequate water control and intensive management that includes adequate fertilization and lime if needed. With very intensive management and adequate water control, citrus can be grown on this soil. Capability unit IVw-2.

Dania Series

The Dania series consists of nearly level, very poorly drained soils in broad flats along the eastern part of the Everglades. These soils formed in thin beds of hydrophytic nonwoody plant remains. Under natural conditions they are covered with water most of the year. Where there is improved drainage, water stands on the surface for 2 to 6 months each year. When water is not standing on the surface, the water table is at a depth of less than 10 inches.

In a representative profile the upper 14 inches is sapric material or muck. It is black in the upper 6 inches and dark reddish-brown in the lower 8 inches. Below this is brown fine sand to a depth of 16 inches and light-gray sandy marl that is about 50 percent limestone fragments to a depth of 18 inches. Hard limestone is at a depth of 18 inches.

Permeability is rapid in all layers of these soils. Available water capacity is very high in the organic layers and low in the mineral layers. Content of organic matter is very high, and natural fertility is moderate.

Dania soils are suited to improved pasture grasses but because of excessive wetness are not suited to cultivated crops or citrus.

Representative profile of Dania muck, about 10 miles west of University Drive in Davie, about 1.5 miles east of the intersection of Orange Drive and U.S. Highway 27 on Orange Drive, and 0.3 miles north, NE¼NE¼SE¼ sec. 26, T. 50 S., R. 39 E.:

Oa1—0 to 6 inches, black (N 2/0), rubbed and unrubbed, sapric material; 7 percent fiber, 2 percent rubbed; 65 percent organic material; moderate, medium, granular structure; friable; many medium and fine roots; pale-brown (10YR 6/3) sodium pyrophosphate extract; slightly acid (pH 6.1 in 0.01*M* CaC12); gradual, smooth boundary.

Oa2—6 to 14 inches, dark reddish-brown (5YR 2/2), rubbed and unrubbed, sapric material; about 8 percent fiber; about 64 percent organic material; moderate, medium, granular structure; friable; few coarse and fine roots; light yellowish-brown (10YR 6/4) sodium pyrophosphate extract; slightly acid (pH 6.1 in 0.01*M* CaC12); clear, wavy boundary.

IIC—14 to 16 inches, brown (10YR 5/3) fine sand; single grained; loose; slightly acid; abrupt, irregular boundary.

IIIC—16 to 18 inches, light-gray (10YR 7/1) sandy marl; single grained; loose; about 50 percent limestone fragments; moderately alkaline; abrupt, irregular boundary.

R—18 inches, hard limestone.

The profile ranges from 14 to 20 inches in thickness, and the Oa horizon or the organic material is 12 to 20 inches in thickness. The organic material is more than twice as thick as the mineral material. Fiber content ranges from 5 to 16 percent. Reaction is strongly acid to slightly acid in 0.01*M* calcium chloride.

The Oa1 horizon is black, dark reddish brown, or very dark brown rubbed. Unrubbed colors are black and dark reddish brown. Sodium pyrophosphate extract is pale brown, light yellowish brown, yellowish brown, or brown. This horizon is 4 to 10 inches in total thicknes. The Oa2 horizon is black or dark reddish brown rubbed and unrubbed. Sodium pyrophosphate extract for this horizon is light yellowish brown, yellowish brown, brown, or dark brown. The thickness of the Oa2 horizon is 8 to 10 inches.

The IIC horizon is brown, pale brown, dark gray, dark grayish brown, or very dark gray. This horizon has mottles of any of these colors in some areas. It is fine sand or sand that is mixed with some organic matter and is 1 to 4 inches thick. Reaction is slightly acid to mildly alkaline. The IIIC horizon is white or light gray. It is mixed with about 40 to 60 percent limestone fragments and is 1 to 5 inches thick. Reaction is mildly alkaline to moderately alkaline.

Dania soils are associated with Hallandale, Lauderhill, and Plantation soils. They are organic soils, whereas Hallandale soils are mineral soils. Also they have limestone at a depth of less than 20 inches, whereas Lauderhill and Plantation soils have limestone at a depth of more than 20 inches.

Dania muck (Da).—This is a nearly level, very poorly drained, organic soil underlain by limestone at a depth of 14 to 20 inches. It is in broad flats along the eastern edge of the Everglades.

Included with this soil in mapping are small areas of Lauderhill muck and Plantation muck. Also included are some soils that have solution holes in the limestone extending to a depth of more than 50 inches.

Most of the acreage of this soil is in natural vegetation that consists of sawgrass, lilies, and sedges. In some areas where the sawgrass has been burned, melaleuca has become established. A few areas are used for improved pasture.

This soil is unsuited to cultivated crops or citrus because of the thin layer of organic material above the limestone, wetness, and flooding. Good pasture of im-

.oved grasses or grass and clover can be produced with intensive management. Some water control is needed to keep water from standing on the surface most of the year. Nitrogen fertilizer is not needed, but the soil responds to fertilizer containing potassium and phosphorus. Grazing should be carefully controlled. Capability unit Vw–2.

Hallandale Series

The Hallandale series consists of nearly level, poorly drained sandy soils in broad flats east of the Everglades and west of the Coastal Ridge. These soils formed in sandy marine sediment over limestone. Under natural conditions they are covered with water 1 to 2 months each year. In most years the water table is at a depth of 10 inches or less for 4 to 6 months and between depths of 10 and 20 inches for 6 months or more. During very dry periods water remains briefly in solution holes in the limestone. Near large drainage canals the water table fluctuates with the water level in the canals, and much of the time it is below a depth of 20 inches.

In a representative profile the surface layer is black fine sand about 4 inches thick. The subsurface layer is about 6 inches of light brownish-gray fine sand. The subsoil is brown fine sand about 4 inches thick over 2 inches of yellowish-brown fine sand that contains decomposed limestone fragments. Limestone is at a depth of 16 inches.

Permeability is rapid in all layers of these soils. Available water capacity is low in the surface layer and the layer above the limestone and very low between depths of 4 and 14 inches. Content of organic matter and natural fertility are low.

Hallandale soils are suited to improved pasture, but because of excessive wetness and shallow depth to limestone, they are not suited to cultivated crops or citrus.

Representative profile of Hallandale fine sand about 0.5 mile north of Stirling Road and 0.2 mile east of Hunter Lane and Holatee Trail Junction, NE¼NW¼ SW¼ sec. 34, T. 50 S., R. 40 E.:

A1—0 to 4 inches, black (10YR 2/1) fine sand; weak, fine, granular structure; very friable; many medium and fine roots; strongly acid; clear, smooth boundary.

A2—4 to 10 inches, light brownish-gray (10YR 6/2) fine sand; few, fine, faint, very dark gray mottles and streaks along root channels; single grained; loose; few fine roots; cyclic thickness of 2 to 8 inches; medium acid; gradual, wavy boundary.

B1—10 to 14 inches, brown (10YR 5/3) fine sand; few, faint, very dark grayish-brown mottles; single grained; loose; many uncoated, few well coated, and some thinly coated or partly coated sand grains; cyclic thickness of 1 to 20 inches; medium acid; gradual, wavy boundary.

B2—14 to 16 inches, yellowish-brown (10YR 5/4) fine sand and very pale brown (10YR 8/4) decomposed limestone fragments; common, medium, distinct, grayish-brown (10YR 5/2) and yellowish-brown (10YR 5/6) mottles; single grained; loose; slight increase in clay content; common clean sand grains; discontinuous; cyclic thickness of 0 to 8 inches; neutral; abrupt, irregular boundary.

IIR—16 inches, hard limestone.

Thickness of the solum and depth to limestone are commonly 7 to 20 inches, but solution holes as deep as 50 inches or more are within the profile.

The A1 horizon is black, very dark gray, dark gray, or gray. The A2 horizon is light brownish gray, gray, or grayish brown. The A horizon ranges from 4 to 14 inches in thickness and from strongly acid to slightly acid in reaction.

The B1 horizon is brown, pale brown, dark brown, or grayish brown. Reaction ranges from medium acid to mildly alkaline. In some profiles the B1 horizon is absent, but, where present, it ranges from 1 to 20 inches in thickness. The B2 horizon is yellowish-brown, dark yellowish-brown, or brown fine sand 0 to 8 inches thick. This horizon has an average of about 1 to 3 percent more clay than the B1 horizon. Sandy clay loam or sandy loam is discontinuous where the B2 horizon contacts the limestone. Grayish marly material containing small fragments of weathered rock or carbonatic material is also present at the surface of the limestone. Reaction in the B2 horizon is neutral to moderately alkaline.

The IIR horizon is hard limestone that has many solution holes. These holes range from about 4 inches to 3 feet in diameter and are at intervals of 1 to 6 feet. They are filled with gray (10YR 5/1), light brownish-gray (10YR 6/2), pale-brown (10YR 6/3), or very pale brown (10YR 7/4) fine sand. Solution holes are 50 inches or more in depth.

Hallandale soils are associated with Boca, Dania, Margate, and Plantation soils. They differ from Boca, Margate, and Plantation soils by having limestone at a depth of 20 inches or less. Also, they do not have the loamy B horizon of Boca soils. Hallandale soils do not have the layers of muck or organic matter of Dania and Plantation soils.

Hallandale fine sand (Ha).—This is a nearly level, poorly drained, sandy soil that is underlain by limestone at a depth of 7 to 20 inches. It is in broad flats east of the Everglades and west of the Coastal Ridge. This soil has the profile described as representative for the series.

Included with this soil in mapping are small areas of Margate fine sand, Dania muck, and Plantation muck. In some areas a thin layer, 4 inches thick or less, of organic material is on the surface.

Most of the acreage of this soil is in natural vegetation or improved pasture. The natural vegetation consists of scattered slash pine and saw palmetto, pineland three-awn, paspalum, blue panicum, blue maidencane, and bluestem.

This soil is unsuited to cultivated crops or citrus. Good pasture of improved grasses or grass and clover can be produced under intensive management. Some water control and fertilization with trace elements are needed. Capability unit Vw–1.

Hallandale and Margate soils (Hm).—These are nearly level, poorly drained soils that have been modified by grading, shaping, and covering with 8 to 20 inches of fill material. These alterations were made to provide a base for construction of homes, streets, and industrial buildings. Depth to the water table in these soils is variable and depends on the established drainage in the area.

Hallandale soil covered with fill material makes up about 45 percent of the total acreage, and Margate soil covered with fill makes up about 35 percent. The remaining 20 percent is mostly filled ponds, areas of Pompano soils, and areas of Basinger soils that have been modified by spreading fill on the surface of the original soil.

Included with these soils in mapping are small areas of soils in the Hallandale-Urban land complex.

The fill material on these soils consists of sand, shell fragments, and limestone fragments. About 80 percent of the fill is mixed shell and limestone fragments ranging from sand size to 3 inches in diameter. The average thickness of the fill on these soils is about 12 inches, but some areas that originally were the lower areas in the landscape are covered by as much as 5 feet of fill material.

Planned use of these soils is for urban development only. Not assigned to a capability unit.

Hallandale-Urban land complex (Hb).—This complex consists mainly of Hallandale fine sand and Urban land. Proportions of open land and Urban land, or areas covered by concrete and buildings, vary from one mapped area to another. Depth to the water table depends on the established drainage in the area.

About 20 to 45 percent of the complex is open land, such as lawns and vacant lots, and about 40 to 70 percent is Urban land. The rest is modified areas of Margate, Pompano, and Basinger soils and filled ponds.

The open land consists of nearly level, poorly drained Hallandale soil that has been modified in most places by spreading fill material on the surface of the original soil to an average thickness of about 12 inches. The original soil below the fill material is Hallandale fine sand. About 80 percent of the fill material consists of a mixture of sand, limestone, and shell fragments that range from sand size to about 3 inches in diameter. The remaining 20 percent is sand.

The Urban land consists of areas covered by sidewalks, streets, patios, driveways, buildings, and other constructions related to urban use.

The Margate soils have also been modified by spreading fill material on the surface of the original soil to an average thickness of about 12 inches, and the Pompano and Basinger soils have been modified by spreading fill material on the surface of the original soil.

The determined use of these soils for the foreseeable future is urban related. Not assigned to a capability unit.

Immokalee Series

The Immokalee series consists of nearly level, poorly drained soils on broad low ridges in the eastern part of the survey area. These soils formed in unconsolidated marine sediment. Under natural conditions they have a water table at a depth of 10 inches or less for 1 to 4 months in most years, and at a depth of 10 to 40 inches for most of the rest of the year. In some years these soils are covered with shallow water for a few days.

In a representative profile the surface layer is dark-gray fine sand about 6 inches thick. The subsurface layer is 34 inches of fine sand. The upper 14 inches is light gray, and the lower 20 inches is white. The subsoil extends to a depth of 80 inches. The upper 22 inches is black fine sand that is weakly cemented and coated with organic matter. The next 3 inches is dark reddish-brown fine sand that has black mottles and is weakly cemented and coated with organic matter. The lower 15 inches is dark-brown fine sand.

Permeability is moderate to moderately rapid in the weakly cemented part of the subsoil and rapid in all other layers. Available water capacity is moderate in the subsoil and very low in all other layers. Content of organic matter and natural fertility are low.

Where adequate water control and good management practices are in use, Immokalee soils are suited to winter truck crops and improved pasture grasses.

Representative profile of Immokalee fine sand, 350 feet west of railroad and 1.25 miles south of Hillsborough Boulevard, SE¼NW¼ sec. 11, T. 48 S., R. 42 E.:

A1—0 to 6 inches, dark gray, rubbed (10YR 4/1) fine sand; light-gray (10YR 7/1), unrubbed and dry, sand grains mixed with some organic matter; single grained; loose; common fine and medium roots; strongly acid; clear, smooth boundary.

A21—6 to 20 inches, light-gray (10YR 7/1) fine sand; single grained; loose; few fine and medium roots; strongly acid; clear, smooth boundary.

A22—20 to 40 inches, white (10YR 8/1) fine sand; few, fine, distinct, very dark gray (10YR 3/1) streaks along root channels; single grained; loose; strongly acid; clear, wavy boundary.

B21h—40 to 62 inches, black (10YR 2/1) fine sand; few, medium, faint, dark reddish-brown (5YR 2/2) mottles; weak, medium, granular structure; firm; weakly cemented; most sand grains coated with organic matter; very strongly acid; gradual, smooth boundary.

B22h—62 to 65 inches, dark reddish-brown (5YR 2/2) fine sand; many, medium, faint, black (5YR 2/1) mottles that are weakly cemented; weak, medium, granular structure; friable; most sand grains coated with organic matter; very strongly acid; gradual, smooth boundary.

B3—65 to 80 inches, dark-brown (7.5YR 4/4) fine sand; common, fine, faint, dark reddish-brown (5YR 2/2) weakly cemented Bh bodies; weak, medium, granular structure; friable; strongly acid.

Thickness of the solum is 80 inches or more. Depth to the Bh horizon ranges from 30 to 50 inches. Reaction ranges from very strongly acid to strongly acid throughout.

The A1 or Ap horizon is very dark gray, very dark grayish brown, or dark gray and is 4 to 8 inches thick. The A21 horizon is gray, light brownish gray, light gray, or white and is 4 to 28 inches thick. The A22 horizon is white, gray, or light brownish gray with very dark gray or very dark grayish brown streaks and is 15 to 30 inches thick. An A23 horizon that is light brownish gray, light gray, or white and has very dark grayish-brown or dark-gray streaks is present in places. It is 0 to 15 inches thick. The entire A horizon is 30 to 50 inches thick.

The B21h horizon is black, very dark brown, or dark reddish brown and in places has a few mottles of light brownish gray to light gray. It is 4 to 24 inches thick. The B21h horizon is weakly cemented with organic matter. The B22h horrizon is dark reddish brown or dark brown and in places has a few black mottles that are weakly cemented. Most sand grains are well coated to thinly coated with organic matter. The B22h horizon is 3 to 15 inches thick. The B3 horizon is dark brown or dark yellowish brown and has a few to common dark reddish-brown weakly cemented Bh bodies. The B3 horizon is 4 to 16 inches thick.

In a few places a dark grayish-brown C horizon is present.

Immokalee soils are associated with Basinger, Pomello, and Pompano soils. They have a weakly cemented Bh horizon, whereas Basinger soils have a C&Bh horizon that is not weakly cemented. They are similar to Pomello soils but are poorly drained, whereas Pomello soils are moderately well drained. They have a Bh horizon that Pompano soils do not have.

Immokalee fine sand (Ia).—This is a nearly level, deep, poorly drained, sandy soil that has a layer weakly cemented with organic matter at a depth of 30 inches or more. It is on broad, low ridges in the eastern part of the survey area. This soil has the profile described as representative for the series.

Included with this soil in mapping are small areas of Basinger fine sand, Pompano fine sand, and Margate fine sand. Also included are a few areas of soils that have a thin subsoil that has an accumulation of some

Figure 5.—Typical vegetation of slash pine, saw palmetto, and native grasses in an area of Immokalee fine sand.

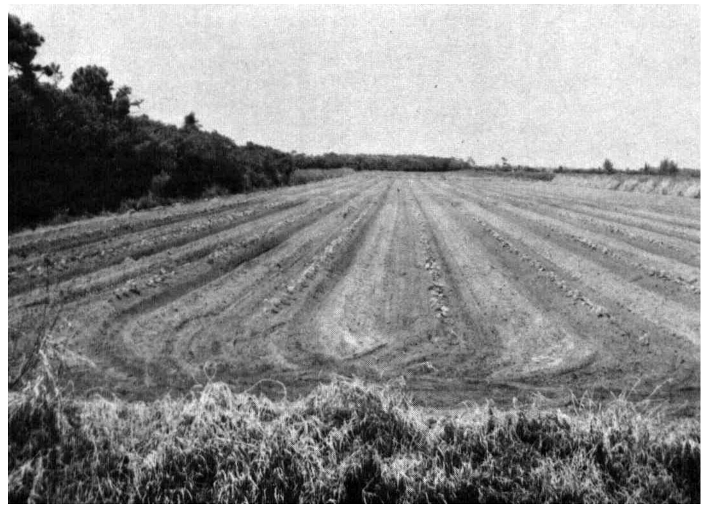

Figure 6.—Eggplant growing in an area of Immokalee fine sand that has been improved for both drainage and irrigation.

organic matter and some areas where the surface layer is gray.

A large part of the acreage of this soil is in natural vegetation that consists of slash pine, saw palmetto, and native grasses (fig. 5).

This soil is limited for cultivated crops and improved pasture by wetness, very low available water capacity in the upper 40 inches, low content of organic matter, and low natural fertility. Where adequate water control and intensive management are in use, this soil is suited to most truck crops (fig. 6) and to improved pasture grasses and clover. A water control system that provides subsurface irrigation by controlling the water table is needed. This soil is poorly suited to citrus. Where adequate water control and intensive management and fertilization are in use, however, some citrus can be grown. The soil responds well to application of complete fertilizer and lime. Capability unit IVw–3.

Immokalee-Urban land complex (Iu).—This complex consists of Immokalee fine sand and Urban land. Proportions of open land and Urban land, or areas covered by concrete and buildings, vary from one mapped area to another. Depth to the water table depends on the established drainage in the area.

About 20 to 45 percent of the complex is open land, such as lawns and vacant lots, and about 40 to 70 percent is Urban land or areas covered by sidewalks, streets, patios, driveways, and buildings where the natural soil cannot be observed.

The open land consists of nearly level, poorly drained Immokalee soils that have been modified in most places by spreading sandy material on the surface of the soil to an average thickness of about 12 inches, but ranging from about 6 to 20 inches. About 10 percent of the Immokalee soils have not been modified. The original soil below the fill material is Immokalee fine sand.

The rest of the land area that is not Immokalee soils or Urban land consists of Basinger, Pompano, Margate, and Hallandale soils, all of which have been modified by spreading fill material on the surface of the original soil.

About 80 percent of the fill material on the Immokalee soils is sand. The rest of the fill material on the Immokalee soils and most of the fill material on the other soils consist almost wholly of a mixture of sand, shell fragments, and limestone fragments. The shell fragments and limestone fragments range from sand size to about 3 inches in diameter and make up 40 percent of the material.

The determined use of these soils for the foreseeable future is urban related. Not assigned to a capability unit.

Lauderhill Series

The Lauderhill series consists of nearly level, very poorly drained soils in broad flats in the Everglades. These soils formed in hydrophytic plant remains mixed with a small amount of mineral material. Under natural conditions these soils are covered with water most of the year. Even where there is improved drainage, water stands on the surface for 6 to 12 months each year.

In a representative profile the upper 9 inches is black sapric material or muck. Below this, to a depth of about 27 inches, is dark reddish-brown sapric material or muck. Between depths of 27 and 31 inches is dark reddish-brown sapric material or muck that is about 77 percent mineral material, of which 15 percent is clay. Hard limestone is at a depth of 31 inches.

Permeability is rapid in these soils. Available water capacity is very high throughout. Content of organic matter is very high, and natural fertility is high. These soils are subject to oxidation, which decreases the amount of their organic material each year.

Where adequate water control is in use, Lauderhill soils are well suited to winter truck crops and improved pasture.

Representative profile of Lauderhill muck, approximately 700 feet west of U.S. Highway 27 and 1.75 miles south of Andytown, SE¼SE¼ sec. 4, T. 50 S., R. 39 E.:

Oa1—0 to 9 inches, black (10YR 2/1), rubbed and unrubbed, sapric material; 4 percent fiber; 67 percent organic material; moderate, medium, subangular blocky structure; friable; few fine and medium roots; brown (10YR 5/3) sodium pyrophosphate extract; neutral (pH 6.6 in 0.01*M* CaC12); clear, wavy boundary.

Oa2—9 to 27 inches, dark reddish-brown (5YR 2/2), rubbed and unrubbed, sapric material; 6 percent fiber; weak, medium, subangular blocky structure; friable; 60 percent organic material; few fine roots; brown (10YR 5/3) sodium pyrophosphate extract; slightly acid (pH 6.5 in 0.01*M* CaC12); gradual, wavy boundary.

Oa3—27 to 31 inches, dark reddish-brown (5YR 2/2), rubbed and unrubbed, sapric material; 20 percent fiber, 5 percent rubbed; 23 percent organic material; about 77 percent mineral material of which 15 percent is clay; moderate, medium, granular structure; friable; few large roots; brown (10YR 5/3) sodium pyrophosphate extract; neutral (pH 6.6 in 0.01*M* CaC12); abrupt, irregular boundary.

IIR—31 inches, hard limestone.

Thickness of the organic material ranges from 20 to 40 inches. Hard limestone rock is below the soil at a depth of 20 to 40 inches. Where the organic material is less than 20 inches thick, a mineral layer up to 6 inches thick is between the organic material and limestone. Reaction ranges from medium acid to neutral in 0.01*M* calcium chloride.

The Oa1 horizon is black or dark reddish brown unrubbed. Rubbed colors are black, very dark brown, dark brown, or dark reddish brown. Sodium pyrophosphate extract for this horizon is pale brown, brown, light yellowish brown, or dark brown. Thickness of this horizon is 6 to 12 inches. The Oa2 horizon is black or dark reddish brown unrubbed. Rubbed colors are black, very dark brown, dark brown, or dark reddish brown. Sodium pyrophosphate extract for this horizon is light yellowish brown, very pale brown, very dark grayish brown, or brown. The thickness of this horizon is 10 to 20 inches. The Oa3 horizon is black, very dark gray, or dark reddish-brown sapric material that is high in content of mineral material. It is 0 to 10 inches thick.

In many places, the Oa3 horizon is absent, and a IIC horizon is in the soil between the organic material and the limestone. Where present, this horizon is black, very dark gray, gray, or dark-gray sand, loamy sand, or sandy loam with or without carbonatic material, or gray or white marl that is mixed with fragments of limestone in some areas. This horizon ranges to about 6 inches in thickness.

Lauderhill soils are associated with Dania, Hallandale, and Margate soils. They have limestone bedrock between depths of 20 and 40 inches, whereas Dania soils have limestone bedrock at a depth of less than 20 inches. They are organic soils, whereas Margate and Hallandale soils are mineral soils.

Lauderhill muck (La).—This is a nearly level, very poorly drained, organic soil underlain by limestone at a depth of 20 to 40 inches. It is in broad flats in the Everglades.

Included with this soil in mapping are small areas of Dania muck and small areas of soils that have organic material 36 to 51 inches thick over limestone. Also included are small areas that have organic material overlying a layer of mineral material more than 6 inches thick.

Most of the acreage of this soil is in natural vegetation that consists of sawgrass. In some places where the sawgrass has been burned, melaleuca has become established. A few acres are in improved pasture.

This soil is severely limited for cultivated crops by excessive wetness. Where it is properly drained, it is well suited to winter truck crops. After drainage and the initial subsidence caused by compaction, subsidence by oxidation is a continual hazard. Thus, structures are needed that hold the water level at the proper depth for crops and permit flooding when the soil is left idle. In addition, fertilizer that is high in all plant nutrients except nitrogen should be applied frequently. Lime is needed in places.

This soil is not suited to citrus; however, high-quality pasture consisting of improved grasses or grass and clover can be produced with intensive management. A drainage system is needed for removing excess surface water and for maintaining the water table at shallow depths. Fertilizer and lime should be applied where needed. Grazing needs to be controlled. Capability unit IIIw-1.[4]

Margate Series

The Margate series consists of nearly level, poorly drained soils on nearly level, low terraces between the Everglades and the Coastal Ridge. These soils formed in sandy marine sediment over limestone. Under natural conditions they are covered with shallow water for 1 to 4 months. Where there is improved drainage, however, they are not. The water table is at a depth of 10 inches for 2 to 6 months in most years and at a depth of 10 to 30 inches most of the rest of the year. In very dry periods water remains briefly in solution holes in the limestone.

In a representative profile the surface layer is very dark gray fine sand about 8 inches thick. The subsurface layer is light brownish-gray fine sand about 8 inches thick. The subsoil extends to a depth of 28 inches. The upper 10 inches of the subsoil is brown fine sand, and the lower 2 inches is brown fine sand mottled with black streaks in root channels. The lower part of the subsoil has about 2.5 percent more clay than the upper part. It is underlain by 4 inches of brown fine sandy loam and decomposed limestone fragments. Hard limestone rock is at a depth of 32 inches.

Permeability is rapid in all layers of these soils. Available water capacity is low in the surface layer and very low in all other layers. Natural fertility and content of organic matter are low.

Where adequate water control and good management practices are in use, these soils are suited to citrus, truck crops, and improved pasture grasses.

Representative profile of Margate fine sand, about 1,980 feet south of Griffin Road and 2,640 feet west of 106th Avenue on Cherry Road, SW¼NW¼ sec. 31, T. 50 S., R. 41 E.:

Ap—0 to 8 inches, very dark gray (10YR 3/1) fine sand; single grained; loose; many fine and medium roots; very strongly acid; clear, smooth boundary.

A2—8 to 16 inches, light brownish-gray (10YR 6/2) fine sand; few streaks of very dark gray (10YR 3/1) in root channels; single grained; loose; few fine roots; cyclic thickness of 2 to 8 inches; medium acid; gradual, wavy boundary.

B1—16 to 26 inches, brown (10YR 5/3) fine sand, brown (10YR 4/3) in root channels; single grained; loose; few medium and fine roots; few clean sand grains, some partly coated; cyclic thickness of 2 to 10 inches; slightly acid; gradual, wavy boundary.

B12—26 to 28 inches, brown (10YR 4/3) fine sand; common, medium, distinct, black (10YR 2/1) mottles; single

[4] Placed in capability subclass IIIw on the assumption that drainage outlets are available and reclamation is feasible. Small areas without drainage outlets should be in capability subclass Vw.

grained; loose; few medium and fine roots; about 2.5 percent increase in clay content from overlying horizon; many partly coated and common clean sand grains; cyclic thickness of 2 to 8 inches; neutral; abrupt, irregular boundary.

C—28 to 32 inches, brown (10YR 5/3) fine sandy loam; weak, fine, subangular blocky structure; friable; about 50 percent very pale brown (10YR 7/4) fragments of limestone; moderately alkaline; gradual, irregular boundary.

IIR—32 inches, hard limestone.

The profile dominantly ranges from 20 to 40 inches thick over hard limestone, but in places pockets range up to 60 inches.

The A1 or Ap horizon is black, very dark gray, or dark gray and is 6 to 10 inches thick. Reaction in this horizon is very strongly acid to medium acid. The A2 horizon is gray, light brownish gray, or grayish brown and is 8 to 16 inches thick. Reaction is strongly acid to slightly acid.

The B1 horizon is brown, grayish brown, or pale brown and is 2 to 10 inches thick. The B2 horizon is dark grayish brown, brown, or grayish brown and is 2 to 8 inches thick. Texture is fine sand with a 1- to 3-percent increase in clay content. Reaction in the B1 and B2 horizons is slightly acid to mildly alkaline.

The C horizon is brown or yellowish-brown loamy fine sand, fine sandy loam, or sandy clay loam mixed with fragments of hard limestone, soft carbonatic material, or both. Reaction is mildly alkaline to moderately alkaline. This horizon is 0 to 5 inches thick.

The IIR horizon is hard limestone that ranges from 20 to 60 inches or more in depth of the solution holes. The holes range from about 6 inches to 3 feet in diameter and occur at intervals of about 2 to 6 feet. They are filled with gray, grayish-brown, light brownish-gray, brown, very pale brown, or pale-brown fine sand.

Margate soils are associated with Dania, Hallandale, and Lauderhill soils. They are mineral soils, whereas Dania and Lauderhill soils are organic. They have limestone at a depth of 20 to 40 inches, whereas Hallandale soils have limestone at a depth of less than 20 inches.

Margate fine sand (Ma).—This is a nearly level, poorly drained, sandy soil that is underlain by limestone at a depth of 20 to 40 inches but has solution holes as deep as 60 inches. It is on nearly level, low terraces between the Everglades and the low, sandy Coastal Ridge.

Included with this soil in mapping are small areas of Basinger fine sand and Plantation muck, and small areas of soils that have up to 8 inches of organic material on the surface. Also included are some areas of soils that are similar to Margate fine sand but have a very dark gray or black surface layer less than 6 inches thick to a dark-gray or gray surface layer 3 to 6 inches thick.

The natural vegetation consists of native grasses, wax myrtle, and a few cypress trees. Most areas of this soil are in improved pastures and some citrus.

This soil is severely limited for cultivated crops by excessive wetness and other poor soil properties. Truck crops and improved pasture grasses can be grown where water control, fertilization with a complete fertilizer and lime, and proper management practices are in use. Under very intensive management and adequate water control, citrus can be grown on this soil (fig. 7). For all crops and pasture, a complete water control system is needed that provides subsurface irrigation by controlling the water table. Capability unit IVw-2.

Paola Series

The Paola series consists of nearly level, excessively drained soils on low knolls and ridges that are part of the Coastal Ridge in the northeastern part of the county. These soils formed in unconsolidated marine sediment. The water table is below a depth of 80 inches throughout the year.

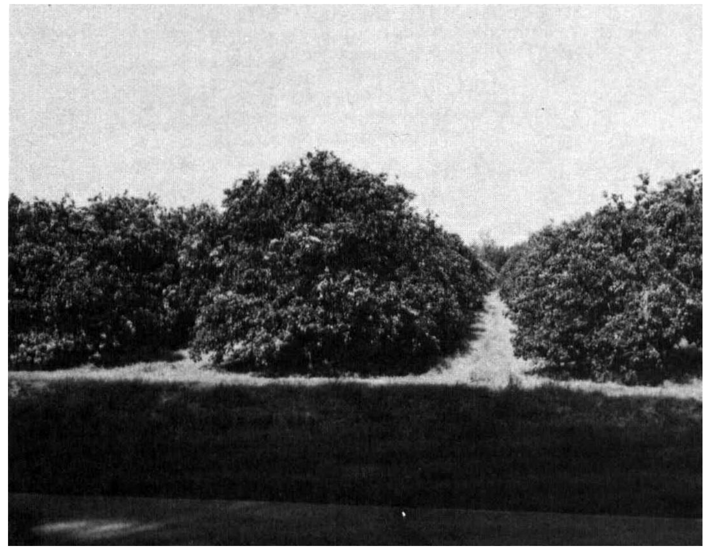

***Figure 7.*—Well-managed citrus grove (grapefruit trees) on Margate fine sand.**

In a representative profile the surface layer is gray fine sand about 4 inches thick. The subsurface layer is white fine sand about 22 inches thick. The subsoil, about 36 inches thick, is yellow fine sand. Light yellowish-brown fine sand is at a depth of 62 to 83 inches.

Permeability is very rapid in all layers of these soils. Available water capacity is very low in all layers. Natural fertility and content of organic matter are low.

These soils are not suited to cultivated crops or citrus. They are poorly suited to improved pasture.

Representative profile of Paola fine sand, 1,200 feet west of the east-west runway of Pompano Beach Airport, NW¼NW¼ sec. 36, T. 48 S., R. 42 E.:

A1—0 to 4 inches, gray (10YR 6/1) fine sand; single grained; loose; few fine and medium roots; very strongly acid; clear, smooth boundary.

A2—4 to 26 inches, white (10YR 8/1) fine sand; few, coarse, distinct, gray (10YR 5/1) and dark-gray (10YR 4/1) mottles in root channels; single grained; loose; few coarse roots; very strongly acid; abrupt, wavy boundary.

B2—26 to 62 inches, yellow (10YR 7/8) fine sand; single grained; loose; few tongues filled with light-colored sand from the A2 horizon throughout; outer edges of the tongues stained with very dark grayish-brown (10YR 3/2) organic material that in places is weakly cemented; outer edges of the tongues are less than 2 inches thick; few coarse roots; very strongly acid; gradual, wavy boundary.

C—62 to 83 inches, light yellowish-brown (10YR 6/4) fine sand; many, coarse, distinct, yellowish-brown (10YR 5/8) mottles; single grained; loose; very strongly acid.

Paola soils are 80 inches or more in thickness. Reaction ranges from very strongly acid to strongly acid throughout. The A1 horizon is 2 to 5 inches thick and is dark gray, gray, or dark grayish brown. The A2 horizon is gray, light gray, or white and is 6 to 40 inches thick. The B horizon is yellow, brownish yellow, yellowish brown, or strong brown and is 12 to 40 inches thick. The tongues filled with A2 material are lacking in some places. The C horizon is light yellowish brown, brown, pale brown, or very pale brown. It is mottled with darker or lighter colors in places.

Paola soils are associated with Pomello and St Lucie soils. They are better drained than Pomello soils, and do not have the Bh horizon of those soils. They have a B horizon that is not present in St. Lucie soils.

Paola fine sand (Pa).—This is a nearly level, deep, excessively drained, sandy soil on low knolls and ridges that make up the Coastal Ridge in the northeastern part of the county. It has the profile described as representative for the series.

Included with this soil in mapping are small areas of Immokalee fine sand, Pomello fine sand, and St. Lucie fine sand.

Most of the acreage of this soil is in natural vegetation that consists of sand pine, scrub live oak and an undergrowth of cacti and native grasses.

This soil is not suited to cultivated crops or citrus because it is droughty and has many other poor soil properties. Plant nutrients are lost rapidly through leaching. Improved pasture of fair quality can be produced under intensive management. Deep-rooted grasses that resist drought should be planted. In addition, large amounts of fertilizer and lime need to be applied frequently. Grazing should be delayed during initial development and controlled carefully thereafter. Capability unit VIs–1.

Paola-Urban land complex (Pb).—This complex consists of about 55 to 75 percent Paola soils which are commonly in lawns, vacant lots, and playgrounds and 20 to 45 percent Urban land that is more than 70 percent covered by houses, streets, driveways, buildings, parking lots, and similar constructions so that the natural soil is not readily observable.

The Paola soils have been modified by grading and shaping or generally altered for community development, and although they can be recognized and are similar to those described as representative for the Paola series, close investigation is difficult, and mapping them separately from Urban land is not feasible. In older communities alteration of the soil has not been great; but more reworking and reshaping has taken place in the newer, more densely developed communities. Excavation of streets below the original land surface and the spreading of this excavated material over adjacent land areas, particularly narrow strips near roads, is a common practice.

Included with this complex in mapping are small areas of St. Lucie fine sand and Pomello fine sand.

The determined use of these soils for the foreseeable future is urban related. Not assigned to a capability unit.

Plantation Series

The Plantation series consists of nearly level, very poorly drained soils in broad flats along the eastern edge of the Everglades. These soils formed in unconsolidated sandy marine sediment. Under natural conditions they are covered with water most of the year. Even where there is improved drainage, there are times when water stands on the surface for a few days. The water table is at a depth of 10 inches or less for 2 to 6 months and 20 inches or less the rest of the year during most years.

In a representative profile a layer of sapric material or muck about 10 inches thick covers the surface. It is black in the upper 4 inches and dark reddish brown in the lower 6 inches. The mineral surface layer is dark-gray fine sand about 6 inches thick. Below this is a layer of light-gray fine sand, about 12 inches thick, that has black mottles; 5 inches of pale-brown fine sand that has mottles of very dark gray and light gray; and 2 inches of pale-brown fine sandy loam that is about 50 percent limestone fragments. Hard limestone rock is 35 inches below the surface of the muck and 25 inches below the top of the mineral surface layer.

Permeability is rapid in all layers of these soils. Available water capacity is very high in the muck layers and very low in the sandy layers. Natural fertility is moderate. Content of organic matter is very high in the muck layers and low in the mineral surface layer.

Where adequate water control and good management practices are in use, Plantation soils are suited to winter truck crops and improved pasture.

Representative profile of Plantation muck, about 520 feet west of Snake Creek Road and 1.1 miles north of Canal number 9, NW¼SE¼NE¼ sec. 26, T. 51 S., R. 40 E.:

Oa1—10 to 6 inches, black (N 2/0), rubbed and unrubbed, sapric material; 6 percent fiber; 50 percent mineral material; weak, fine, subangular blocky structure; friable; few fine and medium roots; pale-brown (10YR 6/3) sodium pyrophosphate extract; strongly acid (pH 5.3 in 0.01*M* CaC12); clear, smooth boundary.

Oa2—6 inches to 0, dark reddish-brown (5YR 2/2), rubbed and unrubbed, sapric material; 10 percent fiber; 37 percent mineral material; weak, medium, subangular blocky structure; friable; few medium roots; light yellowish-brown (10YR 6/4) sodium pyrophosphate extract; strongly acid (pH 5.4 in 0.01*M* CaC12); clear, wavy boundary.

IIA1—0 to 6 inches, dark-gray (10YR 4/1) fine sand; many, coarse, distinct, gray (10YR 6/1) mottles and streaks; single grained; loose; many uncoated sand grains; medium acid; gradual, wavy boundary.

IIA2—6 to 18 inches, light-gray (10YR 7/1) fine sand; common, medium, distinct, black (10YR 2/1) mottles; single grained; loose; many uncoated sand grains; cyclic thickness of 7 to 28 inches; slightly acid; gradual, wavy boundary.

IIC1—18 to 23 inches, pale-brown (10YR 6/3) fine sand; common, medium, distinct, very dark gray (10YR 3/1) and common, coarse, distinct, light-gray (10YR 7/2) mottles; single grained; loose; some partly coated and very thinly coated and common clean sand grains; mildly alkaline; abrupt, irregular boundary.

IIC2—23 to 25 inches, pale-brown (10YR 6/3) fine sandy loam; weak, fine, subangular blocky structure; friable; about 50 percent limestone fragments that are very pale brown (10YR 7/3) and yellow (10YR 8/6); moderately alkaline; abrupt, irregular boundary.

IIIR—25 inches, hard limestone.

Above the limestone the profile ranges from 28 to 56 inches in thickness, but solution pits are more than 60 inches deep. Reaction is strongly acid to slightly acid in the organic material, in 0.01*M* calcium chloride, and slightly acid to moderately alkaline in the mineral material.

The Oa1 horizon is black or dark reddish brown and is 1 to 12 inches thick. The Oa2 horizon is dark reddish brown or very dark brown and is 4 to 12 inches thick.

The IIA1 horizon is dark gray, black, very dark gray, or gray and is 4 to 8 inches thick. The IIA2 horizon is light gray, gray, dark gray, or light brownish gray and is 8 to 20 inches thick.

The IIC1 horizon is brown, yellowish brown, pale brown, or very pale brown and is 5 to 10 inches thick. In many places this horizon has very dark gray, black, or dark-gray mottles or black, very dark brown, or dark reddish-brown weakly cemented fragments. The IIC2 horizon is pale brown, brown, or yellowish brown and is 0 to 4 inches thick. It is fine sand to fine sandy loam, and is about 40 to 60 percent pale-brown or yellow limestone fragments.

The IIIR horizon is hard limestone and has solution pits of varying depth and width.

Plantation soils are associated with Boca, Dania, Hallandale, and Margate soils. They have an organic surface layer that is not present in Boca, Hallandale, and Margate soils. They do not have the loamy B horizon of Boca soils. They are deeper to limestone than Dania and Hallandale soils.

Plantation muck (Pm).—This is a nearly level, very poorly drained soil that has a muck surface layer over sandy mineral material. It is in broad flats along the eastern edge of the Everglades. The organic surface layer is subject to oxidation, which decreases its amount of organic material each year.

Included with this soil in mapping are a few small areas of Dania muck, Lauderhill muck, Margate fine sand, and Hallandale fine sand.

Most areas of this soil are in natural vegetation that consists of sawgrass, paspalum, maidencane, and cutthroat grass. In some areas that have been burned, melaleuca and myrtle have become established. Some areas that have adequate water control are used for improved pasture.

In its natural condition, this soil is very severely limited for cultivated crops and pasture because of excessive wetness and flooding. It is not suited to citrus. The water table is generally controlled by existing ditches. Where adequate water control and proper management are in use, this soil is well suited to winter truck crops and improved pasture grasses or grass and clover. After drainage and the initial subsidence caused by compaction, subsidence by oxidation is a continual hazard. Thus, structures are needed that hold the water level at the proper depth for crops and that permit flooding of the soil when left idle. In addition, fertilizer that is high in all plant nutrients except nitrogen should be applied frequently. Lime is needed in some places. Grazing needs to be controlled on improved pasture. Capability unit IIIw-2.[5]

Pomello Series

The Pomello series consists of nearly level to gently sloping, moderately well drained soils on low ridges east of the Everglades. These soils formed in unconsolidated marine sands. In most years the water table is at a depth of 24 to 40 inches for 2 to 4 months and between depths of 40 and 60 inches most of the rest of the year.

In a representative profile the surface layer is dark-gray fine sand about 5 inches thick. The subsurface layer is 33 inches of fine sand. The upper 3 inches is light gray, and the lower 30 inches is white. The subsoil extends to a depth of 80 inches. The upper 14 inches is black fine sand that is weakly cemented; the next 20 inches is dark reddish-brown fine sand that also is weakly cemented; the lower 8 inches is dark reddish-brown fine sand.

[5] Placed in capability subclass IIIw on the assumption that drainage outlets are available and reclamation is feasible. Small areas without drainage outlets should be in capability subclass Vw.

Permeability is very rapid to a depth of about 38 inches, moderate between depths of 38 and 72 inches, and rapid between depths of 72 and 80 inches. Available water capacity is very low to a depth of 38 inches, moderate between depths of 38 and 72 inches, and low between depths of 72 and 80 inches. Natural fertility and content of organic matter are low.

These soils are not suited to cultivated crops or citrus. They are poorly suited to improved pasture.

Representative profile of Pomello fine sand, 0.9 mile south of State Road 84 and 0.85 mile west of Pine Island Road, SE¼SW¼ sec. 17, T. 50 S., R. 41 E.:

A1—0 to 5 inches, dark-gray (10YR 4/1) fine sand; single grained; loose; many fine and medium and few large roots; very strongly acid; smooth, wavy boundary.

A21—5 to 8 inches, light-gray (10YR 6/1) fine sand; few, fine, faint, dark-gray (10YR 4/1) mottles in root channels; single grained; loose; few fine and medium roots; very strongly acid; clear, smooth boundary.

A22—8 to 38 inches, white (10YR 8/1) fine sand; few, fine, faint, gray (10YR 6/1) streaks in root channels; single grained; loose; few fine and medium roots; very strongly acid; gradual, wavy boundary.

B21h—38 to 52 inches, black (10YR 2/1) fine sand; many light-gray (10YR 7/1) uncoated sand grains; weakly cemented; massive in place, parting to weak, medium, granular structure; friable; few fine and medium roots; very strongly acid; gradual, wavy boundary.

B22h—52 to 72 inches, dark reddish-brown (5YR 3/2) fine sand; common, distinct, black (10YR 2/1) organic coated sand grains; weakly cemented; massive in place, parting to weak, fine, granular structure; friable; very strongly acid; gradual, wavy boundary.

B3—72 to 80 inches, dark reddish-brown (5YR 3/4) fine sand; common, black (10YR 2/1), organic coated sand grains; single grained; loose; very strongly acid.

The solum is 80 inches or more in thickness. Reaction ranges from extremely acid to strongly acid throughout.

The A1 horizon is black, dark gray, or very dark gray and is 3 to 6 inches thick. The A21 and A22 horizons are gray, light gray, or white and have a combined thickness of 8 to 38 inches.

The B2h horizon is black or dark reddish brown. The B21h horizon is 6 to 16 inches thick, and the B22h horizon is 8 to 24 inches thick. The B3 horizon is dark brown or dark reddish brown or dark yellowish brown and extends to a depth of 80 inches or more.

Pomello soils are associated with Immokalee, Margate, Paola, and St. Lucie soils. They are better drained than Immokalee soils. They have a Bh horizon, whereas Paola and St. Lucie soils are excessively drained.

Pomello fine sand (Po).—This is a nearly level to gently sloping, deep, moderately well drained, sandy soil that has a layer weakly cemented with organic matter at a depth of 30 or more inches. It is on low ridges east of the Everglades.

Included with this soil in mapping are small areas of a moderately well drained soil that does not have a subsoil that has an accumulation of organic matter. Also included are small areas of St. Lucie sand.

The natural vegetation consists of pine, palmetto, live oak, and native grasses.

This soil is not suited to cultivated crops or citrus. Even under intensive management, it is too droughty and leaches too rapidly for good growth of such crops. Where intensive management practices are in use, improved deep-rooted pasture grasses of fair quality can be produced. Large amounts of fertilizer should be applied frequently, and lime is also needed. Grazing should be delayed during initial development and controlled carefully thereafter. Capability unit VIs–2.

Pompano Series

The Pompano series consists of nearly level, poorly drained soils in sloughs and broad flats. These soils formed in thick beds of marine sand. Under natural conditions they are covered with shallow water for 1 to 2 months during the year. Under improved drainage they are not. During most years, the water table is at a depth of 10 inches or less for 2 to 6 months and at a depth of 30 inches or less most of the rest of the year.

In a representative profile the surface layer is gray fine sand about 7 inches thick. Below this is gray and light-gray fine sand to a depth of 43 inches. Brown fine sand is at a depth of 43 to 80 inches.

Permeability is rapid in all layers of these soils. Available water capacity is very low in all layers. Natural fertility and content of organic matter are low.

Where adequate water control and good management practices are in use, Pompano soils are suited to winter truck crops and improved pasture grasses.

Representative profile of Pompano fine sand, 1.25 miles east of the Turnpike and 0.5 mile north of Prospect Road, SW¼NE¼ sec. 8, T. 49 S., R. 48 E.:

A1—0 to 7 inches, gray (10YR 5/1), crushed and rubbed, fine sand; organic matter and gray fine sand have a salt-and-pepper appearance; weak, fine, granular structure; very friable; many fine and medium roots; very strongly acid; clear, smooth boundary.

C1—7 to 17 inches, gray (10YR 6/1) fine sand; few, fine, faint, white (10YR 8/1) mottles; single grained; loose; few fine and medium roots; very strongly acid; gradual, smooth boundary.

C2—17 to 35 inches, light-gray (10YR 7/1) fine sand; common, medium, distinct, very dark gray (10YR 3/1) streaks in root channels; single grained; loose; few coarse roots; very strongly acid; gradual, wavy boundary.

C3—35 to 43 inches, light-gray (10YR 7/2) fine sand; many, medium, distinct, very dark grayish-brown (10YR 3/2) mottles in root channels and few, fine, faint, white (10YR 8/1) mottles; single grained; loose; very strongly acid; gradual, wavy boundary.

C4—43 to 80 inches, brown (10YR 5/3) fine sand; many, medium, distinct, very dark grayish-brown (10YR 3/2) mottles in root channels; single grained; loose; very strongly acid.

Pompano soils are more than 80 inches thick. Reaction ranges from very strongly acid to strongly acid throughout.

The A1 or Ap horizon is black, dark gray, very dark gray, or gray and is 2 to 8 inches thick.

The C1 horizon is gray, grayish brown, light brownish gray, or dark grayish brown and is 8 to 20 inches thick. The C2 horizon is light brownish gray, grayish brown, brown, or light gray and is 2 to 20 inches thick The C3 and C4 horizons are light brownish gray, pale brown, brown, grayish brown, or light gray. The C3 horizon is 8 to 20 inches thick, and the C4 horizon is 15 to 40 inches thick or more.

Pompano soils are associated with Basinger, Immokalee, Margate, and Sanibel soils. They do not have the C1 & Bh horizon of Basinger soils or the Bh horizon of Immokalee soils. They are more than 80 inches deep, whereas Margate soils have limestone bedrock at a depth of 20 to 40 inches. They do not have the organic surface layer of Sanibel soils.

Pompano fine sand (Pp).—This is a nearly level, deep, poorly drained, sandy soil in sloughs and broad flats in the eastern part of the Area. Included in mapping are small areas of Immokalee fine sand, Basinger fine sand, and Margate fine sand.

The natural vegetation consists of pepper, slash pine, and guava trees and native grasses. Scattered cypress is in some lower areas.

This soil is severely limited for cultivated crops by wetness and other adverse soil properties. Winter truck crops and improved pasture grasses or a mixture of grass and clover can be grown where adequate water control and fertilization and intensive management are in use. This soil responds well to applications of complete fertilizer, including minor elements, and lime. It is severely limited for citrus. If it is used for citrus, very intensive management practices and adequate water control are needed. Capability unit IVw–1.

Sanibel Series

The Sanibel series consists of nearly level, very poorly drained soils in ponds, drainageways, and low broad flats. These soils formed in thick beds of sand beneath a thin mantle of organic material. Under natural conditions they are covered with shallow water for 2 to 6 months, but where there is improved drainage, they are not. The water table is at depths of less than 10 inches for 6 to 12 months during most years.

In a representative profile a layer of sapric material or muck about 9 inches thick covers the surface. It is black in the upper 2 inches and dark reddish brown in the lower 7 inches. The mineral surface layer is black fine sand mixed with organic material and is about 1 inch thick. The next layer is grayish-brown fine sand about 8 inches thick, and below this is a layer of light-gray fine sand about 51 inches thick or more.

Permeability is rapid in all layers of these soils. Available water capacity is very high in the muck layers and very low in the sandy layers. Content of organic matter is very high in the muck layers and low in the sandy mineral surface layer. Natural fertility is moderate.

Where adequate water control and good management practices are in use, the Sanibel soils are suited to winter truck crops, improved pasture grasses and clover, and citrus.

Representative profile of Sanibel muck, 1.5 miles north of Hollywood Boulevard and 0.1 mile west of WGMA Radio Station on Palm Avenue, SW¼SW¼ sec. 5, T. 51 S., R. 41 E.:

Oa1—9 to 7 inches, black (N 2/0) material; 5 percent fiber; weak, medium, granular structure; friable; many fine and medium roots; about 55 percent mineral material; light yellowish-brown (10YR 6/4) sodium pyrophosphate extract; medium acid (pH 5.8 in 0.01*M* CaC12); clear, smooth boundary.

Oa2—7 inches to 0, dark reddish-brown (5YR 2/2) sapric material; 5 percent fiber; weak, medium, subangular blocky structure; very friable; few fine roots; about 48 percent mineral material; light yellowish-brown (10YR 6/4) sodium pyrophosphate extract; strongly acid (pH 5.5 in 0.01*M* CaC12); gradual, wavy boundary.

IIA—0 to 1 inch, black (10YR 2/1) fine sand mixed with well-decomposed organic material; weak, medium, crumb structure; very friable; few fine roots; medium acid; gradual, wavy boundary.

IIC1—1 to 9 inches, grayish-brown (10YR 5/2) fine sand; few, fine, faint, dark grayish-brown (10YR 4/2) mottles; single grained; loose; few fine roots; medium acid; gradual, wavy boundary.

IIC2—9 to 60 inches, light-gray (10YR 7/1) fine sand; common, medium, distinct, dark-brown (10YR 3/3) mottles in root channels; single grained; loose; medium acid.

Sanibel soils are 60 inches or more in thickness. Reaction ranges from strongly acid to neutral throughout.

The Oa horizon is 8 to 16 inches thick. The Oa1 horizon is black sapric material. The Oa2 horizon is dark reddish-brown or black sapric material. This horizon is absent in some places.

The IIA horizon is grayish brown, dark grayish brown, gray, dark gray, or black. This horizon is 1 to 4 inches thick.

The IIC horizon is gray, light gray, white, light brownish gray, or grayish brown. The IIC1 horizon is 7 to 20 inches thick. The IIC2 horizon extends to a depth of 60 inches or more below the surface of the mineral soil.

Sanibel soils are associated with Basinger, Immokalee, and Pompano soils. They do not have the C1&BH horizon of Basinger soils and the Bh horizon of Immokalee soils. They have an organic surface layer that Basinger, Immokalee, and Pompano soils do not have.

Sanibel muck (Sa).—This is a nearly level, deep, very poorly drained soil that has a muck surface layer over sandy mineral material. It is in ponds, drainageways, and low broad flats in the eastern part of the county.

Included with this soil in mapping are small areas of Dania muck, Lauderhill muck, Plantation muck, and Margate fine sand. Also included are a few small areas of soils that are similar to Sanibel muck but have a dark grayish-brown underlying layer.

The natural vegetation consists of sawgrass. In some areas where the sawgrass has been burned, melaleuca and myrtle have become established. About 75 percent of this soil has adequate water control and is used for citrus production and improved pasture.

In its native state, this soil is not suited to cultivated crops, citrus, or improved pasture grasses because of wetness and flooding. Where adequate water control and good management practices are in use, this soil is suited to winter truck crops, citrus, and improved pasture grasses and clover. After drainage, subsidence caused by oxidation is a continual hazard. Structures are needed that hold the water level at the proper depth for crops and that permit flooding of the soil when left idle. In addition, large amounts of fertilizer that is high in all plant nutrients except nitrogen should be applied frequently. Lime is needed in places. Grazing needs to be controlled in pasture areas. Capability unit IIIw–3.

St. Lucie Series

The St. Lucie series consists of nearly level, excessively drained soils on low knolls and ridges in the eastern part of the county. These soils formed in thick beds of marine sand. The water table is below a depth of 80 inches.

In a representative profile the surface layer is gray fine sand about 4 inches thick. White fine sand is between depths of 4 and 82 inches. Below this, to a depth of 94 inches, is white fine sand mottled with brown.

Permeability is very rapid throughout these soils. Available water capacity is very low in all layers. Natural fertility and content of organic matter are low.

St. Lucie soils are not suited to cultivated crops or citrus and have only limited use for improved pasture.

Representative profile of St. Lucie fine sand, 400 feet south of Cypress Creek Road and 3,320 feet west of NW 12th Avenue, NE¼NE¼SW¼ sec. 9, T. 49 S., R 42 E.:

A1—0 to 4 inches, gray (10YR 5/1) fine sand; single grained; loose; few fine and medium roots; strongly acid; clear, wavy boundary.

C1—4 to 9 inches, white (10YR 8/1) fine sand; common, medium, distinct, gray (10YR 5/1) and dark-gray (10YR 4/1) streaks along root channels; single grained; loose; few coarse roots; strongly acid; gradual, wavy boundary.

C2—9 to 82 inches, white (10YR 8/1) fine sand; single grained; loose; few coarse roots; strongly acid; gradual, wavy boundary.

C3—82 to 94 inches, white (10YR 8/1) fine sand; few, fine, faint, brown (10YR 4/3) and dark yellowish-brown (10YR 4/4) mottles; single grained; loose; strongly acid.

St. Lucie soils are 80 or more inches deep. Reaction ranges from very strongly acid to strongly acid throughout. The A1 horizon is gray or light gray and is 2 to 5 inches thick. The C horizon is white or light gray. This horizon has mottles in shades of gray, yellow, or brown below a depth of 40 inches in some places.

St. Lucie soils are associated with Paola and Pomello soils. They do not have the B horizon of Paola soils or the Bh horizon of Pomello soils. They are excessively drained, whereas Pomello soils are moderately well drained.

St. Lucie fine sand (St).—This is a nearly level, deep, excessively drained, sandy soil on low knolls and ridges in the eastern part of the county. Included in mapping are small areas of Immokalee fine sand, Pomello fine sand, and Paola fine sand.

The natural vegetation consists of sand pine, scrub oak, a few palmetto, and cacti.

This soil has properties that make it unsuited to cultivated crops and citrus and very limited for use as improved pasture. Pasture grasses are hard to maintain and grow poorly because of droughtiness and infertility. Fertilizers leach rapidly. Capability unit VIIs–1.

Udorthents

Udorthents is the name for unconsolidated material or heterogeneous geologic soil material that has been excavated and piled alongside canals and dug ponds, and soils that have been shaped and contoured primarily for golf courses. This soil material is well drained to excessively drained. Alongside canals and dug ponds slopes are 2 to 40 percent, and the water table is generally below a depth of 60 inches throughout the year. In areas of golf courses, the water table is mostly variable and depends on water control, but is generally at a depth of more than 20 inches.

In a representative profile light-gray to white unconsolidated material extends from the surface to a depth of 57 inches. This material is 65 percent broken fragments of consolidated shell and limestone, 30 percent sand, and 5 percent loamy carbonatic material.

Permeability and available water capacity are variable, but permeability is mostly rapid, and available water capacity is generally very low or low. Natural fertility and content of organic matter are low.

Areas of Udorthents alongside canals and dug ponds generally remain idle and serve no useful purpose, but at times material from these areas is hauled away and used as fill. These areas are not suited to cultivated crops, citrus, or improved pasture. Areas that have been shaped and contoured are used primarily for golf courses.

Representative profile of Udorthents, about 0.6 mile west of University Drive and 0.3 mile north of State Highway 84, SE¼SE¼SW¼ sec. 16, T. 50 S., R. 41 E.:

C—0 to 57 inches, mixed light-gray (10YR 7/1) and white (10YR 8/1) unconsolidated material; 65 percent broken shell rock and limerock fragments, 30 percent sand mixed with shell, and 5 percent loamy carbonatic material; few, fine, faint, very dark mottles; massive; friable; moderately alkaline.

Reaction ranges from moderately alkaline to strongly alkaline. The material is mainly gray, white, dark gray, brown, yellow, dark yellowish brown, and pale brown. It is a mixture of shell rock and limerock fragments, sand, shell, loamy sand, and sandy loam or sandy clay loam carbonatic material.

Associated with Udorthents are Urban land and areas of manmade lakes and canals.

Udorthents (Ud).—This soil consists of areas of unconsolidated or heterogeneous geologic material removed in the excavation of ditches, canals, lakes, and ponds. It is commonly piled along banks and has slopes of 2 to 40 percent. This soil has the profile described as representative for Udorthents. Few if any other soils are included in mapping.

Vegetation of weeds and native grasses has become established on some areas of Udorthents. Other areas have little or no vegetation. The soil material is erodible, especially where slopes are steep and where areas are bare or sparsely vegetated.

This soil is unsuited to cultivated crops, citrus, or improved pasture. It is frequently used as a source of roadbuilding material and as a source of fill for new homesites, golf courses, and other purposes. Capability unit VIIIs-1.

Udorthents, shaped (Un).—This soil consists of material that has been shaped and contoured mainly for golf courses. The original soil material has been reshaped or covered with fill or soil and reshaped to make a proper playing surface. Nearly all areas are covered with fill to a depth of 20 inches or more. Some areas consist mostly of limestone rock fragments, while others consist of sand. The fill is commonly obtained from ponds dug on the golf courses. Properties of the fill material are variable, but the identifiable underlying soils have properties representative of their respective series.

About 50 percent of the soils that underlie the fill in this mapping unit can be identified. Of this 50 percent, 66 percent of the soils are in the Hallandale and Margate series, and the remaining 34 percent are in the Pompano, Immokalee, Basinger, Pomello, and Paola series.

Included with Udorthents in mapping are some areas of Urban land that contain the interchanges on Interstate Highway 95 in the northern end of the county. These interchanges are contoured and shaped and, on the average, are 15 to 20 feet above ground level. Also included is a residential area of about 240 acres along Covered Bridge Drive in Coral Springs. This area has been filled and contoured similarly to the areas used as golf courses.

Under proper fertilization, water control, and irrigation, areas of Udorthents support grasses suitable for golf courses.

The main determined use of this soil for the foreseeable future is for golf courses. Not assigned to a capability unit.

Urban Land

Urban land (Ur).—This type consists of areas that are more than 70 percent covered with airports, shopping centers, parking lots, large buildings, streets and sidewalks, and other structures, so that the natural soil is not readily observable. Unoccupied areas of this land type, mostly lawns, parks, vacant lots, and playgrounds, consist of soils in the Hallandale, Margate, Immokalee, and Basinger series that have been altered by fill material spread on the surface to an average thickness of about 12 inches. These unoccupied areas are in tracts too small to be mapped separately. The fill is mostly sandy material, some of which contains limestone and shell fragments. Not assigned to a capability unit.

Use and Management of the Soils

This section explains nonfarm uses of the soils in the Broward County Area. First, the soils are rated and interpretations are given for various engineering uses. Following this, use of the soils for farming is discussed, the system of capability classification used by the Soil Conservation Service is explained, and estimated yields of the principal crops grown in the Area are given. Also covered in this section is suitability of the soils for wildlife habitat and recreational development.

The Broward County Area has urbanized rapidly. Much land that only a few years ago was used for commercial production of citrus, truck and other farm crops, and cattle has been converted to nonfarm uses. If this trend continues, indications are that very little of the Area will remain in farm uses.

Engineering Uses of the Soils [6]

This section is useful to those who need information about soils used as structural material or as foundations 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 characteristics, shrink-swell and consolidation potential, grain-size distribution, 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.

[6] JAMES N. KRIDER, assistant State conservation engineer, Soil Conservation Service, assisted in preparing this section.

2. Evaluate alternate routes for roads, highways, pipelines, and underground cables.
3. Seek sources of gravel, sand, or clay.
4. Plan drainage systems, irrigation systems, ponds, 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 locations.
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 table 3, which shows results of engineering laboratory tests on soil samples; tables 4, 5, and 6, which show several estimated soil properties significant to engineering; and tables 7, 8, 9, and 10, which show interpretations for various engineering 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, 8, 9, and 10, and it also can be used to make other useful maps.

This information, however, does not eliminate need for further investigation at sites selected for engineering works, especially works that involve heavy loads or that require 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 soils 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 are 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 Soil Classification System (*8*), used by the Soil Conservation Service engineers, Department of Defense, and others, and the AASHO Classification System (*1*), adopted by the American Association of State Highway Officials.

In the Unified system 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, HL, OL, MH, CH, and OH; and one class of highly organic soils, identified as Pt. Soils on the borderline between two classes are designated by symbols for both classes; for example, SC–SM.

The AASHO system is used to classify soils according to those properties that affect use in 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 and coarse sandy soils of high bearing strength, or the best soils for subgrade (foundation). At the other extreme, in group A–7, are clay soils that have low strength when wet and that are 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 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 soils, with group index numbers in parentheses, is shown in table 3; the estimated classification, without group index numbers, is given in table 4 for all soils mapped in the survey area.

Engineering test data

Table 3 presents engineering test data for some of the major soil series in the Broward County 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 to determine liquid limits and plastic limits. 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 *maximum dry density* is reached. After that, density decreases with increase in moisture content. The moisture content at the point of maximum dry density is termed the *optimum moisture content.* As a rule, maximum strength of earthwork is obtained if the soil is compacted to the maximum dry density.

Soil properties significant in engineering

Several estimated soil properties significant in engineering are in tables 4, 5, and 6. These estimates are made for typical soil profiles, for the whole soil, and 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 counties. Following are explanations of some of the columns in table 4.

USDA texture is described in table 4 in the standard terms used by the Department of Agriculture. These terms take into account relative percentages of sand, silt, and clay in soil material that is less than 2 millimeters in diameter. "Sandy clay loam," for example, is soil material that contains 20 to 35 percent clay, less than 2 percent silt, and 45 percent or more sand. If the soil contains gravel or other particles coarser than sand, an appropriate modifier is added; for example, "gravelly loamy sand." "Sand," "silt," "clay," and some of the other terms used in USDA textural classification are defined in the Glossary of this soil survey.

TABLE 3.—*Engineering*

[Tests performed by the Florida State Department of Transportation (FDOT) in cooperation with the U.S. Bureau of Public soils tested

Soil name and location	Parent material	FDOT report No.	Depth
			In
Basinger fine sand: About 50 feet west of University Drive and 0.9 mile north of Orange Drive, SE¼SE¼ sec. 21, T. 50 S., R. 41 E. (Modal)	Sandy marine sediment	6–10	6–13 23–35 35–60
Hallandale fine sand: About 0.5 mile north of Stirling Road and 0.2 mile east of Hunter Lane and Holatee Trail Junction, NE¼NW¼SW¼ sec. 34, T. 50 S., R. 40 E. (Modal)	Sandy marine sediment	6–3	4–10
Margate fine sand: About 1,980 feet south of Griffin Road and 2,640 feet west of 106th Avenue on Chenny Road, SW¼NW¼ sec. 31, T. 50 S., R. 41 E. (Modal)	Sandy marine sediment	6–4	8–16
Plantation muck: About 520 feet west of Snake Creek Road and 1.1 miles north of Canal number 9, NW¼SE¼NE¼ sec. 26, T. 51 S., R. 40 E. (Modal)	Sandy marine sediment beneath a thin mantle of organic material.	6–8	18–23
Sanibel muck: About 1.5 miles north of Hollywood Boulevard and 0.1 mile west of WGMA Radio Station on Palm Avenue, SW¼SW¼ sec. 5, T. 51 S., R. 41 E. (Modal)	Sandy marine sediment beneath a thin mantle of organic material.	6–12	9–60

[1] Based on AASHO Designation T99–57 (*1*).
[2] Mechanical analysis according to AASHO Designation T88–57 (*1*). Results by this procedure differ somewhat from results obtained by the soil survey procedure of the Soil Conservation Service (SCS). In the AASHO procedure, the fine material is analyzed by the hydrometer method and the various grain-size fractions are calculated on the basis of all the material, in-

The Unified and AASHO classifications are explained in the section "Engineering Soil Classification Systems." Liquid limit and plasticity index indicate the effect of water on the strength and consistence of soil material. As the moisture content of a fine-grained soil is increased from a dry state, the material changes from a semisolid to a plastic state. If the moisture content is further increased, the material changes from a plastic to a liquid state. The plastic limit is the moisture content at which the soil material changes from a semisolid to a plastic state; and the liquid limit from a plastic to a liquid state. The liquid and plastic limits are expressed as the percentage of water computed on the basis of the dry weight of soil. 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 material is plastic. Liquid limit and plasticity index are estimated in table 4, but in table 3 the data on liquid limit and plasticity index are based on tests of soil samples.

ESTIMATED PHYSICAL AND CHEMICAL CHARACTERISTICS.—Following are explanations of some of the columns in table 5.

Depth to bedrock is distance from the surface of the soil to the upper surface of the rock layer.

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

Available water capacity is the ability of soils 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 values. The pH value and terms used to describe soil reaction are explained in the Glossary.

Corrosivity pertains to potential soil-induced chemical action that dissolves or weakens steel or concrete. Rate of corrosion of steel is related to soil properties such as drainage, texture, total acidity, and electrical conductivity of the soil material. Corrosivity for concrete is influenced mainly by the content of sodium or magnesium sulfate, but also by soil texture and acidity. Installations of steel that intersect soil boundaries or soil horizons are more susceptible to corrosion than installations entirely in one kind of soil or in one soil *test data*

Roads, in accordance with standard procedures of the American Association of State Highway Officials (AASHO) (*1*). All the are nonplastic]

Moisture density [1]		Mechanical analysis [2]					Classification	
		Percentage passing sieve—			Percentage smaller than—			
Maximum dry density	Optimum moisture content	No. 10 (2.0 mm)	No. 40 (0.42 mm)	No. 200 (0.074 mm)	0.05 mm	0.005 mm	AASHO [3]	Unified
Lb/cu ft	*Pct*							
100	16	100	93	2	2	0	A-3(0)	SP
104	14	100	93	3	3	0	A-3(0)	SP
102	15	100	91	2	2	0	A-3(0)	SP
98	15	100	97	3	2	0	A-3(0)	SP
100	14	100	93	2	1	0	A-3(0)	SP
98	16	100	96	1	1	0	A-3(0)	SP
98	13	100	93	1	0	0	A-3(0)	SP

cluding that coarser than 2 millimeters in diameter. In the SCS soil survey procedure, the fine material is analyzed by the pipette method and the material coarser than 2 millimeters is excluded from calculations of grain-size fractions. The mechanical analysis data used in this table are not suitable for naming textural classes for soils.

[3] Based on AASHO Designation M 145-49 (*1*).

horizon. A corrosivity rating of *low* means that there is a low probability of soil-induced corrosion damage. A rating of *high* means that there is a high probability of damage, so that protective measures for steel and more resistant concrete should be used to avoid or minimize damage.

HYDROLOGIC FEATURES.—Following are explanations of some of the columns in table 6.

A seasonal high water table is a zone of saturation at the highest level during the wettest season, and it persists in the soil for more than a few days. Most water tables occur within the soil and are measured from the surface of the soil down to the free-water level. In swamps and marshes, however, the water table is above the surface of the soil much of the time and is measured from the surface of the water down to the soil.

In this survey area two kinds of water tables are recognized: apparent and marsh. An apparent water table is within the soil and is defined as the level at which water stands in a freshly dug, unlined borehole. It is influenced by the hydrostatic pressure of soil water and by pressure at greater depths penetrated by the borehole, water relations across impermeable layers, and other factors. A marsh water table is one defined as having water above the surface of the soil much of the time.

The months when the water table is highest are also given.

Hydrologic groups are those soils with similar runoff potential under similar storm and cover conditions. There are four classes, designated either A, B, C, or D, with class A reflecting the lowest runoff potential. Dual hydrologic groups are given for certain wet soils that can be adequately drained. The first letter applies to the drained condition, the second to the undrained.

Engineering interpretations

The estimated interpretations in tables 7, 8, 9, and 10 are based on the engineering properties of soils shown in tables 4, 5, and 6 and on test data for soils in this survey area and others nearby or adjoining, and on the experience of engineers and soil scientists with the soils of the Broward County Area. In tables 7, 8, 9, and 10, ratings are used to summarize limitation or suitability of the soils for all listed purposes other than for drainage and irrigation. For these particular uses, table 10 lists those soil features not to be overlooked in planning, installation, and maintenance.

Soil limitations are indicated by the ratings slight,

TABLE 4.—*Classification and estimated engineering properties of the soils*

Soil series and map symbols	Depth from surface	USDA texture	Classification		More than 3 inches	Soil material passing sieve—				Liquid limit	Plasticity index
			Unified	AASHO		No. 4 (4.7 mm)	No. 10 (2.0 mm)	No. 40 (0.42 mm)	No. 200 (0.074 mm)		
	In				*Pct*	*Pct*	*Pct*	*Pct*	*Pct*	*Pct*	
Basinger: Ba	0–60	Fine sand	SP, SP-SM	A-3	0	100	100	90–99	2–10	-------	NP[1]
Boca: Bc	0–25	Fine sand	SP, SP-SM	A-3	0	100	100	85–99	2–10	-------	NP
	25–32	Sandy loam and sandy clay loam.	SC	A-2-6, A-6	0	100	95–100	85–99	25–40	20–40	11–20
	32–34	Rock, marl, sandy clay loam, and sand.	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)
Dania: Da	0–14	Muck	Pt	(3)	-------	-------	-------	-------	-------	-------	-------
	14–16	Fine sand and sand	SP, SP-SM	A-3, A-2-4	0	100	95–100	80–95	2–12	-------	NP
	16–18	Sandy marl and limestone fragments.	GM, SM	A-1, A-2-4	0–10	40–60	35–55	30–45	15–25	-------	NP
Hallandale: Ha, Hb,[4] Hm.[4]	0–14	Fine sand	SP, SP-SM	A-3	0	100	100	90–99	2–9	-------	NP
	14–16	Fine sand	SP-SM	A-3	0	100	100	90–99	5–10	-------	NP
Immokalee: Ia, Iu.[4]	0–40	Fine sand	SP, SP-SM	A-3	0	100	100	90–99	2–10	-------	NP
	40–80	Fine sand	SP-SM, SM	A-3, A-2-4	0	100	100	90–99	5–15	-------	NP
Lauderhill: La	0–31	Muck	Pt	(3)	-------	-------	-------	-------	-------	-------	-------
Margate: Ma	0–26	Fine sand	SP, SP-SM	A-3	0	100	100	90–99	2–8	-------	NP
	26–28	Fine sand	SP-SM	A-3	0	100	100	90–99	5–10	-------	NP
	28–32	Loamy fine sand, fine sandy loam, and sandy clay loam.	GM, GM-GC, SM, SM-SC	A-1, A-2-4, A-6	0–10	45–60	35–55	30–45	20–40	[5]<28	NP–7
Paola: Pa, Pb[4]	0–83	Fine sand	SP	A-3	0	100	100	90–99	1–4	-------	NP
Plantation: Pm	10–0	Muck	Pt	(3)	-------	-------	-------	-------	-------	-------	NP
	0–23	Fine sand	SP	A-3	0	100	100	90–99	1–4	-------	NP
	23–25	Fine sand, loamy fine sand, fine sandy loam.	GM, SM, SP, SM	A-1	0–5	60–75	45–60	30–45	8–20	-------	NP
Pomello: Po	0–38	Fine sand	SP, SP-SM	A-3	0	100	100	90–99	2–10	-------	NP
	38–72	Fine sand	SP-SM, SM	A-3 A-2-4	0	100	100	90–99	5–15	-------	NP
	72–80	Fine sand	SP, SP-SM	A-3	0	100	100	90–99	2–10	-------	NP
Pompano: Pp	0–80	Fine sand	SP, SP-SM	A-3	0	100	100	85–99	2–10	-------	NP
Sanibel: Sa	9–0	Muck	Pt	(3)	-------	-------	-------	-------	-------	-------	-------
	0–60	Fine sand	SP	A-3	0	100	100	90–99	1–4	-------	NP
St. Lucie: St	0–94	Fine sand	SP	A-3	0	100	100	90–99	1–4	-------	NP
Udorthents: Ud, Un.[6]											
Urban land: Ur.[6]											

[1] NP = Nonplastic.
[2] Too variable for valid estimates.
[3] Organic.

[4] This mapping unit is made up of more than one kind of soil. The different soils may have different properties, and for this reason, it is necessary to refer to the other series for these soils in the table, as follows: for the Urban land part of Hb, Iu, and Pb, refer to Urban land. For the Margate part of Hm, refer to the Margate series.
[5] The symbol < means less than.
[6] No valid estimates can be made.

TABLE 5.—*Estimated physical and chemical characteristics of the soils*[1]

Soil series and map symbols	Depth to bedrock	Depth from surface	Permeability	Available water capacity	Reaction	Corrosivity	
						Steel[2]	Concrete[3]
	Inches	*Inches*	*Inches per hour*	*Inches per inch of soil*	*pH*		
Basinger: Ba	[4] >72	0–23	6.0–20.0	0.02–0.05	4.5–6.5	High	Moderate.
		23–60	6.0–20.0	0.03–0.07	4.5–6.5	High	Moderate.
Boca: Bc	24–40	0–7	6.0–20.0	0.05–0.10	5.1–7.3	High	Moderate.
		7–25	6.0–20.0	0.02–0.05	5.1–7.3	High	Moderate.
		25–34	0.6–2.0	0.10–0.15	6.6–8.4	High	Low.
Dania: Da	14–20	0–14	6.0–20.0	0.20–0.30	4.5–6.5	Moderate	Moderate.
		14–16	6.0–20.0	0.05–0.10	6.1–7.8	Moderate	Low.
		16–18	6.0–20.0	0.05–0.10	7.4–8.4	Moderate	Low.
Hallandale: Ha, Hb,[5] Hm[5]	7–20	0–4	6.0–20.0	0.05–0.10	5.1–6.5	High	Moderate.
		4–10	6.0–20.0	0.02–0.05	5.1–6.5	High	Moderate.
		10–14	6.0–20.0	0.02–0.05	5.6–7.8	High	Low.
		14–16	6.0–20.0	0.05–0.10	6.6–8.4	High	Low.
Immokalee: Ia, Iu[5]	>80	0–40	6.0–20.0	0.02–0.05	4.5–5.5	High	High.
		40–65	0.6–6.0	0.10–0.15	4.5–5.5	High	High.
		65–80	6.0–20.0	0.10–0.15	4.5–5.5	High	High.
Lauderhill: La	20–40	0–31	6.0–20.0	0.20–0.30	5.6–7.3	Moderate	Moderate.
Margate: Ma	20–40	0–8	6.0–20.0	0.05–0.10	4.5–6.0	High	High.
		8–16	6.0–20.0	0.02–0.05	5.1–6.5	High	Moderate.
		16–28	6.0–20.0	0.02–0.05	6.1–7.8	High	Low.
		28–32	6.0–20.0	0.02–0.05	7.4–8.4	High	Low.
Paola: Pa, Pb[5]	>80	0–83	>20.0	0.02–0.05	4.5–5.5	Low	High.
Plantation: Pm	28–56	10–0	6.0–20.0	0.20–0.30	5.1–6.5	Moderate	Moderate.
		0–25	6.0–20.0	0.02–0.05	6.1–8.4	Moderate	Low.
Pomello: Po	>80	0–38	>20.0	0.02–0.05	4.0–5.5	Low	High.
		38–72	0.6–2.0	0.10–0.15	4.0–5.5	Low	High.
		72–80	6.0–20.0	0.05–0.10	4.0–5.5	Low	High.
Pompano: Pp	>80	0–80	6.0–20.0	0.02–0.05	4.5–5.5	High	High.
Sanibel: Sa	>60	9–0	6.0–20.0	0.20–0.30	5.1–7.3	Moderate	Moderate.
		0–60	6.0–20.0	0.02–0.05	5.1–7.3	Moderate	Moderate.
St. Lucie: St	>80	0–94	>20.0	0.02–0.05	4.5–5.5	Low	High.
Udorthents: Ud, Un. No valid estimates can be made.							
Urban land: Ur. No valid estimates can be made.							

[1] Shrink-swell potential for all the soils in the survey area is low. Shrink-swell potential, however, applies only to the mineral soils or mineral layers in organic soils. Organic soils or organic layers have a high potential subsidence.

[2] Estimates of corrosivity for steel are based on drainage class (wetness) and texture of the soil, estimated total acidity, resistivity of field capacity, and conductivity.

[3] Estimates of corrosivity for concrete are based on soil texture and reaction and estimated sodium and/or magnesium sulfate present in the soil.

[4] The symbol > means more than.

[5] This mapping unit is made up of more than one kind of soil. The different soils may have different characteristics, and for this reason it is necessary to refer to the other series for these soils in the table, as follows: For the Urban land part of Hb, Iu, and Pb, refer to Urban land. For the Margate part of Hm, refer to the Margate series.

moderate, and severe. *Slight* means soil properties generally favorable for the rated use, or in other words, limitations that are minor and easily overcome or modified by special planning and design. *Moderate* means that some soil properties are unfavorable but can be overcome or modified by special planning and design. *Severe* means soil properties are so unfavorable and so difficult to correct or overcome as to require major soil reclamation, special designs, or intensive maintenance. For some uses, the rating of severe is divided to obtain ratings of severe and very severe. *Very severe* means one or more soil properties so unfavorable for a particu-

TABLE 6.—*Hydrologic features of the soils*

[Dashes in a column indicate that appropriate entry cannot be made]

Soil series and map symbols	High water table			Hydrologic soil group
	Depth	Kind	Months	
	Feet			
Basinger: Ba	0–1	Apparent	June-November	A/D
Boca: Bc	0–1	Apparent	June-November	A/D
Dania: Da	0–1.5	Marsh	June-November	A/D
Hallandale:				
Ha	0–1	Apparent	June-November	A/D
Hb, Hm. Too variable for valid estimates.				
Immokalee:				
Ia	0–1	Apparent	July-October	B/D
Iu. Too variable for valid estimates.				
Lauderhill: La	0–1.5	Marsh	June-May	A/D
Margate: Ma	0–1	Apparent	June-November	A/D
Paola: Pa, Pb	[1] >6.5	---	---	A
Plantation: Pm [2]	0–1	Apparent	June-November	A/D
Pomello: Po	2–3.5	Apparent	July-October	C
Pompano: Pp	0–1	Apparent	June-November	A/D
Sanibel: Sa	0–1	Marsh	June-May	A/D
St. Lucie: St	>6.5	---	---	A
Udorthents: Ud, Un. Too variable for valid estimates.				
Urban land: Ur. Too variable for valid estimates.				

[1] The symbol > means more than.
[2] During period of high water table, shallow water may cover the soil at times for a few days.

lar use that overcoming the limitations is most difficult and costly and commonly not practical for the rated use.

Soil suitability is rated by the terms *good, fair,* and *poor,* which have, respectively, meanings approximately parallel to the terms slight, moderate, and severe.

INTERPRETATIONS OF SOILS FOR SANITARY FACILITIES.—Following are explanations of some of the columns in table 7.

Septic tank absorption fields are subsurface systems of tile or perforated pipe that distribute effluent from a septic tank into natural soil. The soil material from a depth of 18 inches to 6 feet is evaluated. The 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 to water table or rock, and susceptibility to flooding. Slope is a soil property that affects difficulty of layout and construction and also the risk of soil erosion, lateral seepage, and downslope flow of effluent. Large rocks or boulders increase construction costs.

Sewage lagoons are excavated ponds constructed to hold sewage within a depth of 5 to 10 feet long enough for bacteria to decompose the solids. A lagoon has a nearly level floor and is protected from flooding by an encircling embankment of compacted soil material. Site properties that affect the construction and function of lagoons are permeability, organic matter, slope, and depth to bedrock. The soil properties that affect the embankment are the engineering properties of the embankment material as interpreted from the Unified Soil Classification System (*8*) and the amounts of stones, if any, that influence the ease of excavation and compaction of the embankment material.

Sanitary landfill is a method of disposing of refuse. The waste is spread in thin layers, compacted, and covered with soil throughout the disposal period. Landfill areas are subject to heavy vehicular traffic. Some

TABLE 7.—*Degree and kind of soil limitations for sanitary facilities*

[Soil characteristics in this table are expressed in computer-adapted terms differing from those in the Soil Survey Manual (*5*). Refer to "Explanation of Key Phrases" at the back of this survey for definition of "percs rapidly" and other terms that describe soil characteristics]

Soil series and map symbols	Septic-tank absorption fields	Sewage lagoons	Sanitary landfill [1]	
			Trench type	Area type
Basinger: Ba	Severe: wetness	Severe: wetness; seepage.	Severe: wetness; too sandy.	Severe: wetness; seepage.
Boca: Bc	Severe: wetness; depth to rock.	Severe: depth to rock; wetness.	Severe: depth to rock; wetness; too sandy.	Severe: wetness.
Dania: Da	Severe: wetness; depth to rock.	Severe: depth to rock; wetness; seepage; excess humus.	Very severe: depth to rock; wetness; seepage; excess humus.	Severe: wetness; seepage.
Hallandale: Ha, Hb,[2] Hm.[3]	Severe: wetness; depth to rock.	Severe: depth to rock; wetness; seepage.	Severe: depth to rock; wetness; seepage; too sandy.	Severe: wetness; seepage.
Immokalee: Ia, Iu [2]	Severe: wetness	Severe: wetness; seepage.	Severe: wetness; seepage.	Severe: wetness; seepage.
Lauderhill: La	Severe: wetness; depth to rock.	Severe: depth to rock; wetness; seepage; excess humus.	Very severe: depth to rock; wetness; seepage; excess humus.	Severe: wetness; seepage.
Margate: Ma	Severe: wetness; depth to rock.	Severe: depth to rock; wetness; seepage.	Severe: depth to rock; wetness; seepage.	Severe: wetness; seepage.
Paola: Pa, Pb [2]	Slight [4]	Severe: seepage	Severe: seepage; too sandy.	Severe: wetness; seepage.
Plantation: Pm	Severe: wetness; depth to rock.	Severe: depth to rock; wetness; seepage.	Severe: depth to rock; wetness; seepage; excess humus.	Severe: wetness; seepage.
Pomello: Po	Severe: wetness	Moderate: wetness; seepage.	Severe: wetness; too sandy.	Moderate: wetness.
Pompano: Pp	Severe: wetness	Severe: wetness; seepage.	Severe: wetness; seepage.	Severe: wetness; seepage.
Sanibel: Sa	Severe: wetness	Severe: wetness; seepage.	Severe: wetness; seepage.	Severe: wetness; seepage.
St. Lucie: St	Slight [4]	Severe: seepage	Severe: seepage; too sandy.	Severe: seepage.
Udorthents: Ud, Un. Too variable for valid estimates.				
Urban land: Ur.[2] Too variable for valid estimates except in Pb.				

[1] Onsite deep studies of the underlying strata, water tables, and hazards of acquifer pollution and drainage into ground water need to be made for landfills deeper than 5 or 6 feet.

[2] Hb, Iu, Pb, and Ur are not suited to sewage lagoons and sanitary landfill because they are too close to houses and commercial buildings or are mostly covered by concrete.

[3] For the Margate part of Hm, refer to the Margate series.

[4] Excessive permeability may cause pollution of ground water.

soil properties that affect suitability for landfill are ease of excavation, hazard of polluting ground water, and trafficability. Ratings apply only to a depth of about 6 feet, and therefore limitating ratings of *slight* or *moderate* may not be valid if excavations are to be much deeper than that. For some soils, reliable predictions can be made to a depth of 10 or 15 feet, but in most instances geologic investigations will be needed below a depth of about 6 feet.

Sanitary landfill (trench) is a dug trench in which refuse is buried daily, or more frequently if necessary. The refuse is covered with a layer of soil material at least 6 inches thick, generally soil excavated in digging the trench. When the trench is full, a final cover of

TABLE 8.—*Degree and kind of soil limitations for community development*

[Soil characteristics in this table are expressed in computer-adapted terms differing from those in the Soil Survey Manual (*5*). Refer to "Explanation of Key Phrases" at the back of this survey for definition of "cutbanks cave" and other terms that describe soil characteristics]

Soil series and map symbols	Shallow excavations	Dwellings— Without basements	Dwellings— With basements	Small commercial buildings	Local roads and streets
Basinger: Ba	Severe: wetness; cutbanks cave.	Severe: wetness	Severe: wetness	Severe: wet; corrosive.	Severe: wetness.
Boca: Bc	Severe: wetness; cutbanks cave; depth to rock.	Severe: wetness	Severe: depth to rock; wetness.	Severe: wet; corrosive.	Severe: wetness.
Dania: Da	Severe: depth to rock; wetness; excess humus.	Very severe: depth to rock; wetness; excess humus; low strength.	Very severe: depth to rock; wetness; excess humus; low strength.	Very severe: depth to rock; wet; excess humus; low strength.	Very severe: excess humus; low strength; wetness; depth to rock.
Hallandale: Ha, Hb,[1] Hm.[1]	Severe: depth to rock; wetness; cutbanks cave.	Severe: depth to rock; wetness.	Severe: depth to rock; wetness.	Severe: depth to rock; wet; corrosive.	Severe: depth to rock; wetness.
Immokalee: Ia, Iu.[1]	Severe: wetness; cutbanks cave.	Severe: wetness	Severe: wetness	Severe: wet; corrosive.	Severe: wetness.
Lauderhill: La	Severe: depth to rock; wetness; excess humus.	Very severe: wetness; excess humus; low strength.	Very severe: depth to rock; wetness; excess humus; low strength.	Very severe: wet; excess humus; low strength.	Very severe: excess humus; low strength; wetness.
Margate: Ma	Severe: depth to rock; wetness; cutbanks cave.	Severe: wetness	Severe: depth to rock; wetness.	Severe: wet	Severe: wetness.
Paola: Pa, Pb[1]	Slight	Slight	Slight	Slight	Slight.
Plantation: Pm	Severe: depth to rock; wetness; cutbanks cave; excess humus.	Severe: wetness; excess humus; low strength.	Severe: wetness; excess humus; low strength.	Severe: wet; excess humus; low strength.	Severe: wetness; excess humus; low strength.
Pomello: Po	Severe: wetness; cutbanks cave.	Moderate: wetness.	Severe: wetness	Moderate: wet	Slight.
Pompano: Pp	Severe: wetness; cutbanks cave.	Severe: wetness	Severe: wetness	Severe: wetness; corrosive.	Severe: wetness.
Sanibel: Sa	Severe: wetness; cutbanks cave.	Severe: wetness; excess humus; low strength.	Severe: wetness; excess humus; low strength.	Severe: wetness; excess humus; low strength.	Severe: wetness; excess humus; low strength.
St. Lucie: St	Slight	Slight	Slight	Slight	Slight.
Udorthents: Ud, Un. Too variable for valid estimates.					
Urban land: Ur. Too variable for valid estimates.					

[1] This mapping unit is made up of more than one kind of soil. The different soils may have different characteristics, and for this reason it is necessary to refer to the other series for these soils in the table, as follows: For the Urban land part of Hb, Iu, and Pb, refer to Urban land. For the Margate part of Hm, refer to the Margate series.

TABLE 9.—*Suitability of the soils as source material*

[Soil characteristics in this table are expressed in computer-adapted terms differing from those in the Soil Survey Manual (*5*). Refer to "Explanation of Key Phrases" at the back of this survey for definition of "percs rapidly" and other terms that describe soil characteristics]

Soil series and map symbols	Road fill	Sand	Topsoil	Daily cover for landfill
Basinger: Ba	Good [1]	Good	Poor: too sandy; wetness.	Poor: too sandy; wetness; seepage.
Boca: Bc	Poor: thin layer; wetness.	Poor: thin layer	Poor: too sandy; wetness.	Poor: too sandy; wetness; seepage.
Dania: Da	Poor: excess humus; low strength; thin layer; wetness; area reclaim.	Unsuited: excess humus.	Poor: area reclaim; wetness.	Poor: excess humus; area reclaim; wetness.
Hallandale: Ha, Hb,[2] Hm.[3]	Poor: thin layer; area reclaim; wetness.	Poor: thin layer	Poor: too sandy; wetness; area reclaim.	Poor: too sandy; wet; seepage; area reclaim.
Immokalee: Ia, Iu [2]	Good [1]	Good	Poor: too sandy; wetness.	Poor: too sandy; wetness; seepage.
Lauderhill: La	Poor: excess humus; low strength; wetness; area reclaim.	Unsuited: excess humus.	Poor: area reclaim; wetness.	Poor: excess humus; area reclaim; wetness.
Margate: Ma	Poor: thin layer; wetness.	Poor: thin layer	Poor: too sandy; wetness.	Poor: too sandy; wetness.
Paola: Pa, Pb [2]	Good	Good	Poor: too sandy	Poor: too sandy; seepage.
Plantation: Pm	Poor: thin layer; excess humus; low strength; wetness.	Poor: thin layer; excess humus.	Fair: thin layer; wetness.	Poor: excess humus; too sandy; seepage; wetness.
Pomello: Po	Good [1]	Good	Poor: too sandy	Poor: too sandy; seepage.
Pompano: Pp	Good [1]	Good	Poor: too sandy; wetness.	Poor: too sandy; seepage; wetness.
Sanibel: Sa	Poor at a depth of 9–0 inches; excess humus; low strength. Good at a depth of 0–60 inches.[1]	Unsuited at a depth of 9–0 inches; excess humus. Good at a depth of 0–60 inches.	Fair: thin layer; wetness.	Poor: excess humus; too sandy; seepage; wetness.
St. Lucie: St	Good	Good	Poor: too sandy	Poor: too sandy; seepage.
Udorthents: Ud, Un [4]	Good	([5])	([5])	([5])
Urban land: Ur.[6]				

[1] Wetness may be a limitation of this soil for this use.
[2] For the Urban land part of Hb, Iu, and Pb, refer to Urban land.
[3] The mapping unit Hm is not suitable for source material because it has been modified for base construction of homes, streets, and industrial buildings.
[4] The mapping unit Un is not suitable for source material. It is used mostly for golf courses.
[5] No valid estimates can be made.
[6] Ur is not suitable for source material because it is mostly covered by concrete.

soil material at least 2 feet thick is placed over the landfill.

In sanitary landfill (area) refuse is placed on the surface of the soil in successive layers. The daily and final cover material generally must be imported. A final cover of soil material at least 2 feet thick is placed over the fill when it is completed.

INTERPRETATIONS OF SOILS FOR COMMUNITY DEVELOPMENT.—Following are explanations of some of the columns in table 8.

Shallow excavations are those that require excavating or trenching to a depth of less than 6 feet, as for example, excavations for pipelines, sewer lines, phone and power transmission lines, basements, open ditches, and cemeteries. Desirable soil properties are good workability, moderate resistance to sloughing, gentle slopes,

TABLE 10.—*Water management*

[Soil characteristics in this table are expressed in computer-adapted terms differing from those in the Soil Survey Manual (*5*). Refer to "Explanation of Key Phrases" at the back of this survey for definition of "percs rapidly" and other terms that describe soil characteristics]

Soil series and map symbols	Limitations for—		Features affecting—	
	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Drainage	Irrigation
Basinger: Ba	Severe: piping; unstable fill; seepage.	Slight	Cutbanks cave; wetness.	Wet; seepage; fast intake.
Boca: Bc	Severe: piping; seepage; unstable fill.	Moderate: deep to water.	Cutbanks cave; depth to rock; wetness.	Wet: fast intake.
Dania: Da	Severe: thin layer; excess humus; low strength.	Severe: depth to rock	Depth to rock; wetness; excess humus.	Wet.
Hallandale: Ha, Hb,[1] Hm.[1]	Severe: thin layer; piping; unstable fill.	Severe: depth to rock	Depth to rock; wetness; cutbanks cave.	Wet; seepage; fast intake.
Immokalee: Ia, Iu[1]	Severe: seepage; piping; unstable fill.	Moderate: deep to water.	Cutbanks cave; wetness.	Wet; seepage; fast intake.
Lauderhill: La	Severe: excess humus; low strength; seepage.	Moderate: depth to rock.	Depth to rock; wetness; excess humus.	Wet.
Margate: Ma	Severe: piping; seepage; unstable fill.	Moderate: depth to rock.	Depth to rock; cutbanks cave; wetness.	Wet; seepage; fast intake.
Paola: Pa, Pb[1]	Severe: piping; seepage; unstable fill.	Severe: no water	Not needed	Droughty; seepage; fast intake.
Plantation: Pm	Severe: piping; seepage; excess humus; unstable fill.	Slight	Depth to rock; wetness; cutbanks cave; excess humus.	Wet; seepage.
Pomello: Po	Severe: piping; seepage; unstable fill.	Moderate: deep to water.	Cutbanks cave; drainage not needed for crops and pasture.	Droughty; seepage; fast intake.
Pompano: Pp	Severe: piping; seepage; unstable fill.	Slight	Cutbanks cave; wetness.	Wet; seepage.
Sanibel: Sa	Severe: piping; seepage; excess humus; unstable fill.	Slight	Cutbanks cave; wetness; excess humus.	Wet; seepage.
St. Lucie: St	Severe: piping; seepage; unstable fill.	Severe: no water	Not needed	Droughty; seepage; fast intake.
Udorthents: Ud, Un. No valid estimates can be made.				
Urban land: Ur.[2]				

[1] This mapping unit is made up of more than one kind of soil. The different soils may have different characteristics and for this reason it is necessary to refer to the other series for these soils in the table, as follows: For the Urban Land part of Hb, Iu, and Pb, refer to Urban land. For the Margate part of Hm, refer to the Margate series.

[2] Urban land is generally not suitable for water management because it is mostly covered by concrete.

absence of rock outcrops or big stones, and freedom from flooding or a high water table.

Dwellings are not more than three stories high and are supported by foundation footings placed in undisturbed soil. The features that affect the rating of a soil for dwellings are those that relate to capacity to support load and resist settlement under load, and 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 and consolidation potential. Those that affect excavation are wetness, slope, depth to bedrock, and content of stones and rocks.

Ratings for small commercial buildings are for the undisturbed soils that are used to support building foundations. Emphasis is on foundations, ease of excavation for underground utilities, and corrosion potential of uncoated steel pipe. The undisturbed soil is rated for footing foundations for buildings less than three stories high. Properties affecting load-supporting capacity and settlement under load are wetness, flooding, texture, plasticity, density, and shrink-swell and consolidation behavior. Properties affecting excavation are wetness, flooding, slope, and depth to bedrock. Properties affecting corrosion of buried uncoated steel pipe are wetness, texture, total acidity, and electrical resistivity.

Local roads and streets 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 have ordinary provisions for drainage. They are built mainly from soil at hand, and most cuts and fills are less than 6 feet deep.

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

INTERPRETATIONS OF SOILS AS SOURCE MATERIAL.—Following are explanations of the columns in table 9.

Road fill is soil material used in embankments for roads. The suitability ratings reflect the predicted performance of soil after it has been placed in an embankment and has been properly compacted and provided with adequate drainage, and 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 9 provide guidance about where to look for probable sources. A soil rated as a good or fair source of sand generally has a layer at least 3 feet thick, the top of which is within a depth of 6 feet. The ratings do not take into account thickness of overburden, location of the water table, or other factors that affect mining of the materials, and do not indicate quality of the deposit.

Soils of the Broward County Area do not contain gravel. Hallandale, Margate, Dania, and Lauderhill soils are underlain by limestone bedrock that is a good source of material to crush for aggregate.

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 preparing a seedbed; natural fertility of the material, or its response of plants when fertilizer is applied; and absence of substances toxic to plants. Texture of the soil material and its content of stone fragments are characteristics that affect suitability, but also considered in the ratings is damage that will result at the area from which topsoil is taken.

Daily cover for landfill generally must be obtained from a source away from the site; for this reason, soils of the Broward County Area are given limitation ratings for use as cover.

Suitability of a soil for use as cover is based on properties that reflect workability; ease of excavating, moving, and spreading over the refuse daily during both wet and dry periods; and slope, permeability, and thickness of the soil material.

INTERPRETATIONS OF SOILS FOR WATER MANAGEMENT.—Following are explanations of the columns in table 10.

Embankments, dikes, and levees require soil material resistant to seepage and piping and of favorable stability, shrink-swell potential, shear strength, and compactability. Presence of stones or organic material in a soil are among factors that are unfavorable.

An aquifer-fed excavated pond is a body of water created by excavating a pit or dugout into a groundwater aquifer. Excluded are ponds fed by runoff and also embankment-type ponds where the depth of water impounded against the embankment exceeds 3 feet. Properties affecting aquifer-fed ponds are the existence of a permanent water table, permeability of the aquifer, and properties that interfere with excavation —stoniness and rockiness.

Drainage is affected by such soil properties as permeability, texture, and structure; depth to claypan, rock, or other layers that influence rate of water movement; depth to the water table; slope; stability in ditchbanks; and salinity or alkalinity. Drainage is also affected by susceptibility to stream overflow and availability of outlets for drainage.

Irrigation of a soil is affected by such features as slope; susceptibility to flooding, water erosion or soil blowing; texture; depth to root zone; rate of water intake at the surface; permeability of layers below the surface layer or other layers that restrict movement of water; amount of water held available to plants; need for drainage; and depth to water table or bedrock.

Use of the Soils for Farming[7]

Most of the soils in the Broward County Area are not suited to farming without some water control. The soils most often used for truck crops, citrus, and pasture are poorly drained soils that have a sandy surface layer and sandy or loamy subsoil that extends to limestone. The soils that have organic surface layers are also used for pasture and some truck crops. They are very poorly drained, and most of them have limestone at a depth of less than 50 inches. If not completely saturated, the organic layers oxidize or subside at the rate of about 1 inch per year.

About 41,000 acres are used for pasture for beef or dairy cattle. Several dairies are in the area. Most of the land used for pasture has water control and improved grasses such as Pangola, Bahia, and St. Augustine. Approximately 6,200 acres are used for truck crops, mostly snap beans, sweet corn, eggplant, squash, and tomatoes. Citrus, mostly oranges, is grown on about 5,600 acres. About 2,800 acres are used for sod and nursery products.

Urban development is expanding rapidly in the Area, and land used for farming is decreasing. It is estimated that the decrease is about 5,000 acres per year.

[7] Figures given in this section are statistical data from the U.S. Department of Commerce, Bureau of the Census.

Capability grouping

Capability grouping shows, in a general way, the suitability of soils for most kinds of field crops. The soils are grouped according to their limitations if used for field crops, the risk of damage if 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 if 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, forest trees, or engineering.

In the capability system, all kinds of soils are grouped at three levels: the class, the subclass, and the unit. The broadest grouping, the capability class, is designated by Roman numerals I to VIII. In class I are the soils that have the fewest limitations, the widest range of use, and the least risk of damage if they are used. The soils in the other classes have progressively greater natural limitations. In class VIII are soils and landforms so rough, shallow, or otherwise limited that they do not produce worthwhile yields of crops, forage, or wood products. The subclass indicates major kinds of limitations within the classes. Within most of the classes there can be up to four subclasses. The subclasses are indicated by adding a small letter, *e, w, s,* or *c,* to the class numeral, for example IIe. The letter *e* shows that the main limitation is risk of erosion unless close-growing plant cover is maintained; *w* means that water in or on the soil 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 only in some parts of the United States, indicates 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 or no limitations. Class V can contain, at the most, only subclasses *w, s,* and *c,* because the soils are subject to little or no erosion but have other limitations that confine their use largely to pasture, range, wildlife, or recreation.

Subclasses are further divided into groups called capability units. These are groups of soils that are so much alike that they are suited to the same crops and pasture plants, require about the same management, and have generally similar productivity and other responses to management. Capability units are generally identified by numbers assigned locally, for example, IIIw-1 or IVw-2.

The eight classes in the capability system and the subclasses and units in the Broward County Area are described in the list that follows. The capability unit in which each soil mapped in the Area has been placed can be learned by referring to that soil in the section "Descriptions of the Soils" or to the "Guide to Mapping Units" at the back of this survey. Information about management is given in the section "Descriptions of the Soils."

CLASS I. Soils that have few limitations that restrict their use (no subclasses). (There are no class I soils in the Broward County Area.)

CLASS II. Soils that have moderate limitations that reduce the choice of plants or require moderate conservation practices. (There are no class II soils in the Broward County Area.)

CLASS III. Soils that have severe limitations that reduce the choice of plants, require special conservation practices, or both.

- SUBCLASS IIIw. Soils that have severe limitations because of excess water.
  - Unit IIIw-1. Nearly level, very poorly drained, organic soils that are underlain by limestone at a depth of 20 to 40 inches.
  - Unit IIIw-2. Nearly level, very poorly drained soils that have a surface layer of muck over sandy mineral soil; underlain by limestone at a depth of 28 to 56 inches.
  - Unit IIIw-3. Nearly level, deep, poorly drained soils that have a surface layer of muck over sandy mineral soil.

CLASS IV. Soils that have very severe limitations that reduce the choice of plants, require very careful management, or both.

- SUBCLASS IVw. Soils that have very severe limitations because of excess water.
  - Unit IVw-1. Nearly level, deep, poorly drained soils that are sandy throughout.
  - Unit IVw-2. Nearly level, poorly drained, sandy soils that are underlain by limestone at a depth of either 20 or 24 to 40 inches.
  - Unit IVw-3. Nearly level, deep, poorly drained, sandy soils that have a layer weakly cemented with organic matter at a depth of 30 or more inches.

CLASS V. Soils that are not likely to erode but have other limitations, impractical to remove, that limit their use largely to pasture, range, woodland, or wildlife.

- SUBCLASS Vw. Soils too wet for cultivation; drainage or protection not feasible.
  - Unit Vw-1. Nearly level, poorly drained, sandy soils that are underlain by limestone at a depth of 7 to 20 inches.
  - Unit Vw-2. Nearly level, very poorly drained, organic soils underlain by limestone at a depth of 14 to 20 inches.

CLASS VI. Soils that have severe limitations that make them generally unsuited to cultivated crops and limit their use largely to pasture, range, woodland, or wildlife.

- SUBCLASS VIs. Soils severely limited because of droughtiness.
  - Unit VIs-1. Nearly level, deep, excessively drained soils that are sandy throughout.
  - Unit VIs-2. Nearly level to gently sloping, deep, moderately well drained, sandy soils that have a layer weakly cemented with organic matter at a depth of 30 or more inches.

CLASS VII. Soils that have very severe limitations that make them generally unsuited to cultivated crops and that restrict their use largely to range, woodland, or wildlife.

SUBCLASS VIIs. Soils very severely limited because of droughtiness.

Unit VIIs–1. Nearly level, deep, excessively drained soils that are sandy throughout.

CLASS VIII. Soils and landforms that have limitations that preclude their use for commercial plants and restrict their use to recreation, wildlife, or water supply or to esthetic purposes.

SUBCLASS VIIIs. Unconsolidated material more than very severely limited because of droughtiness and other poor soil properties.

Unit VIIIs–1. Well-drained to excessively drained unconsolidated material that has slopes of 2 to 40 percent; material has been excavated and piled along the banks of canals and dug ponds.

Estimated yields

Table 11 lists estimated yields of the principal crops and pasture plants grown in the Area. These 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 estimated yields are average yields per acre that can be expected by good commercial farmers at the level of management which tends to produce the highest economic returns.

Crops other than those shown in table 11 are grown in the area, but their estimated yields are not included because their acreage is small or reliable data on yields are not available. Not included in this table are the mapping units Hb, Hm, Iu, Pb, Ud, Un, and Ur, which are not used for crops or pasture. These units include soils that are used only for recreation and urban purposes, or that have been modified for urban development.

The yields given in table 11 can be expected if the following management practices are observed:

1. Rainfall is effectively used and conserved.
2. Surface or subsurface drainage systems, or both, are installed.
3. Crop residue is managed to maintain tilth.
4. Minimum but timely tillage is used.
5. Insect, plant disease, and weed control measures are consistently used.
6. Fertilizer is applied according to soil test and crop needs.
7. Suited crop varieties are used at recommended seeding rates.
8. Irrigation water of suitable quality and quantity is used, where needed.
9. Irrigations are timed to meet the need of the soil and crop.
10. Irrigation systems are properly designed and efficiently used.

Use of the Soils as Wildlife Habitat

Soils directly influence kinds and amounts of vegetation and amounts of water available, and in this way indirectly influence the kinds of wildlife that can live in an area. Soil properties that affect the growth of wildlife habitat are thickness of soil useful for crops, surface texture, available water capacity to a 40–inch depth, wetness, surface stoniness or rockiness, flood hazard, slope, and permeability of the soil to air and water.

In table 12 soils of this survey area are rated for their potential for producing seven elements of wildlife habitat and the potential as habitat for three groups, or kinds, of wildlife. Not considered in the table are the mapping units Hb, Hm, Iu, Pb, Ud, Un, and Ur, which do not have wildlife habitat as a principal use.

TABLE 11.—*Estimated average yields per acre of crops and pasture plants*

[Yields are those to be expected under a high level of management. Absence of a yield figure indicates that the soil is not suited to the crop or data are not available]

Soil name	Vegetable crops			Citrus crops		Permanent improved pasture	
	Tomatoes	Sweet corn	Cabbage	Oranges	Grapefruit	Grass	Grass-clover
	40-pound boxes	*40–60-pound crates*	*50-pound crates*	*Boxes*	*Boxes*	*Animal-unit-months* [1]	*Animal-unit-months* [1]
Basinger fine sand	600	160	350	300	400	7.5	9.5
Boca fine sand	600	160	350	300	400	7.5	9.5
Dania muck	----	----	----	----	----	25	32
Hallandale fine sand	----	----	----	----	----	7.5	9.5
Immokalee fine sand	600	160	350	300	400	7.0	9.0
Lauderhill muck	----	300	550	----	----	35	40
Margate fine sand	600	160	350	300	400	7.5	9.5
Paola fine sand	----	----	----	----	----	4.5	----
Plantation muck	----	180	450	----	----	25	32
Pomello fine sand	----	----	----	----	----	5.6	----
Pompano fine sand	650	160	350	300	400	8	10
Sanibel muck	----	180	450	360	560	25	32
St. Lucie fine sand	----	----	----	----	----	----	----

[1] Animal-unit-months refers to the number of months during a normal growing season that 1 acre will provide grazing for one animal unit without injury to the sod. One animal unit is defined as one cow, horse, or steer; five hogs; or seven sheep.

TABLE 12.—*Potential of the soils for elements of wildlife habitat and kinds of wildlife*

Soil name	Potential for elements of wildlife habitat							Potential as habitat for—		
	Grain and seed crops	Domestic grasses and legumes	Wild herbaceous upland plants	Hardwood trees, shrubs, and vines	Coniferous woody plants	Wetland food and cover plants	Shallow-water areas	Openland wildlife	Woodland wildlife	Wetland wildlife
Basinger fine sand	Poor	Poor	Fair	Poor	Poor	Fair	Good	Poor	Poor	Fair.
Boca fine sand	Poor	Fair	Fair	Poor	Poor	Good	Good	Fair	Poor	Good.
Dania muck	Very poor.	Poor	Poor	Poor	Poor	Good	Fair	Poor	Poor	Fair.
Hallandale fine sand	Poor	Poor	Poor	Poor	Poor	Good	Good	Poor	Poor	Good.
Immokalee fine sand	Poor	Fair	Fair	Poor	Poor	Poor	Poor	Fair	Poor	Poor.
Lauderhill muck	Very poor.	Poor	Poor	Poor	Poor	Good	Good	Poor	Poor	Good.
Margate fine sand	Poor	Fair	Fair	Poor	Poor	Good	Good	Fair	Poor	Good.
Paola fine sand	Very poor.	Poor	Poor	Poor	Poor	Very poor.	Very poor.	Poor	Poor	Very poor.
Plantation muck	Very poor.	Poor	Poor	Poor	Poor	Good	Good	Poor	Poor	Good.
Pomello fine sand	Very poor.	Poor	Poor	Poor	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.
Pompano fine sand	Poor	Fair	Poor	Poor	Poor	Good	Good	Poor	Poor	Good.
Sanibel muck	Very poor.	Poor	Poor	Poor	Poor	Good	Good	Poor	Poor	Good.
St. Lucie fine sand	Poor	Poor	Poor	Poor	Poor	Very poor.	Very poor.	Poor	Poor	Very poor.

In the part on habitat elements, a rating of *good* means the element of wildlife habitat and habitats generally are easily created, improved, and maintained. Few or no limitations affect management in this category, and satisfactory results are expected if the soil is used for the prescribed purpose.

A rating of *fair* means the element of wildlife habitat and habitats can be created, improved, or maintained in most places. Moderate intensity of management and fairly frequent attention may be required for satisfactory results, however.

A rating of *poor* means the element of wildlife and limitations for the designated use are rather severe. Habitats can be created, improved, or maintained in most places, but management is difficult and requires intensive effort.

A rating of very poor means the elements of wildlife habitat are very severe and that unsatisfactory results are to be expected. It is either impossible or impractical to create, improve, or maintain habitats on soils in this category.

Each soil is rated in table 12 according to its potential for producing various kinds of plants and other elements that make up wildlife habitats. The ratings take into account mainly the characteristics of the soils and closely related natural factors of the environment. They do not take into account present use of soils or present distribution of wildlife and human population. For this reason, selection of a site for development as a habitat for wildlife requires inspection at the site.

The significance of each subheading in table 12 in its potential for habitat elements is given in the following paragraphs.

Grain and seed crops are annual grain-producing plants such as corn, sorghum, and millet.

Domestic grasses and legumes are established by planting. They provide food and cover for wildlife. Domestic grasses include bahiagrass, ryegrass, and pangola grass; legumes are primarily limited to white clover and joint vetch.

Wild herbaceous upland plants are native or introduced perennial grasses, forbs, and weeds that provide food and cover for wildlife on uplands. Beggarweed, grassleaf goldaster, sunflowers, pepperweed, and dotten gayfeather are typical examples. On rangeland, typical plants are bluestem, panicums, perennial forbs, and legumes.

Hardwood trees, shrubs, and vines are nonconiferous trees, shrubs, and woody vines that produce wildlife food in the form of fruits, nuts, buds, catkins, or browse. Such plants commonly grow in their natural environment, but they may be planted and developed through wildlife management programs. Typical species in this category are oak, cherry, maple, viburnum, grape, honeysuckle, and greenbrier.

Coniferous woody plants are cone-bearing trees and shrubs that provide cover and commonly furnish food in the form of browse, seeds, or fruitlike cones. They commonly grow in their natural environment, but they may be planted and managed. Typical plants in this category are pines, cedars, and ornamental trees and shrubs.

Wetland food and cover plants are annual and perennial herbaceous plants and grasses that grow wild on moist and wet sites. They furnish food and cover mostly for wetland wildlife. Typical examples of plants are sloughgrass, smartweed, wild millet, spikerush and other rushes, sedges, and torpedograss. Submerged and floating aquatics are not included in this category.

Shallow-water areas are impoundments or excavations for controlling water, generally not more than 5 feet deep, to create habitats that are suitable for waterfowl. Some are designed to be drained, planted, and then flooded; others are permanent impoundments that grow submersed aquatics.

Table 12 also rates soils according to their potential as habitat for three kinds of wildlife in the Broward County Area—open-land, woodland, and wetland wildlife. These ratings are related to ratings made for the elements of habitat. For example, soils rated very poor for shallow-water areas are rated very poor for wetland wildlife as well. Kinds of wildlife rated in the table are the following.

Open-land wildlife are birds and mammals that normally live in meadows, pastures, and open areas where grasses, herbs, and shrubby plants grow. Quail, doves, meadowlarks, field sparrows, cottontail rabbits, and foxes are typical examples of openland wildlife.

Woodland wildlife are birds and mammals that normally live in wooded areas of hardwood trees, coniferous trees, and shrubs. Wild turkeys, deer, squirrels, and raccoons are typical examples of woodland wildlife.

Wetland wildlife are birds and mammals that normally live in wet areas, marshes, and swamps. Ducks, shore birds, and herons are typical examples of wetland wildlife.

Use of the Soils for Recreational Development

Knowledge of soils is necessary in planning, developing and maintaining areas used for recreation. In table 13 the soils of the Broward County Area are rated according to limitations that affect their suitability for camp areas, picnic areas, playgrounds, and paths and trails.

The soils in the table are rated as having slight, moderate, or severe limitations for specified uses. For all of these ratings, it is assumed that a good cover of vegetation can be established and maintained. A limitation of *slight* means that soil properties are generally favorable and limitations are so minor that they can be easily overcome. A *moderate* limitation can be overcome or modified by planning, design, or special maintenance. A *severe* limitation means that costly soil reclamation, special design, intense maintenance, or a combination of these, is required.

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

Picnic areas are attractive natural or landscaped tracts used primarily for preparing meals and eating outdoors. These areas are subject to heavy foot traffic. Most of the vehicular traffic, however, 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 cost of leveling sites or of building access roads.

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

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, have slopes of less than 15 percent, and have a few or no rocks or stones on the surface.

Formation, Morphology, and Classification of the Soils

In this section, the factors affecting soil formation and morphology of the soils of the Broward County Area are discussed. The current system of soil classification is also explained and the soils are placed in the higher categories.

Formation of Soils

Soil is formed by weathering and other processes that act on the parent material. The characteristics of the soil, at any given point, are determined by parent material, climate, plants and animals, relief, and time.

Climate and plants and animals are the active forces of soil formation. They act on the parent material that has accumulated through the weathering of rocks and slowly change it into soil. All five factors come into play in the formation of every soil. The relative importance of each differs from place to place; sometimes one is more important and sometimes another. In extreme cases one factor may dominate in the formation of a soil and fix most of its properties. In general, however, it is the combined action of the five factors that determines the present character of each soil.

Parent material

Parent material is the unconsolidated mass from which a soil is formed. It determines the limits of the chemical and mineralogical composition of the soil. All of the soils in the Broward County Area formed in material of Pleistocene or Recent ages. Slightly over 75 percent of the area is covered by the Pamlico Terrace, and the rest by organic material of Recent age (*3*).

The Pamlico Terrace consists mostly of sand and ranges from less than 1 foot to about 8 feet or more in thickness. Near the Executive Airport, the Pamlico Terrace is made up of thick deposits of sand that give rise to the Paola soils.

The Broward County Area is generally underlain by the Miami Oolite formation, a porous limestone formed from small spherules of carbonate of lime. To the north, the oolite merges laterally into the Anastasia formation (a coquinoid limestone, sand, and

TABLE 13.—*Degree and kind of soil limitation for recreational development*

[Soil characteristics in this table are expressed in computer-adapted terms differing from those in the Soil Survey Manual (5). Refer to "Explanation of Key Phrases" at the back of this survey for definition of "depth to rock" and other terms that describe soil characteristics]

Soil series and map symbols	Camp areas	Picnic areas	Playgrounds	Paths and trails
Basinger: Ba	Severe: wetness	Severe: wetness	Severe: wetness; too sandy.	Severe: wetness.
Boca: Bc	Severe: wetness	Severe: wetness	Severe: wetness; too sandy.	Severe: wetness.
Dania: Da	Severe: wetness; excess humus.	Severe: wetness; excess humus.	Severe: wetness; excess humus.	Severe: wetness; excess humus.
Hallandale:				
Ha	Severe: wetness	Severe: wetness	Severe: wetnsss; depth to rock; too sandy.	Severe: wetness.
Hb,[1] Hm [1]	Moderate: wetness	Moderate: wetness	Severe: too sandy; depth to rock.	Moderate: wetness.
Immokalee:				
Ia	Severe: wetness	Severe: wetness	Severe: wetness; too sandy.	Severe: wetness.
Iu [1]	Moderate: wetness	Moderate: wetness	Severe: too sandy	Moderate: wetness.
Lauderhill: La	Severe: wetness; excess humus.	Severe: wetness; excess humus.	Severe: wetness; excess humus.	Severe: wetness; excess humus.
Margate: Ma	Severe: wetness	Severe: wetness	Severe: wetness; too sandy.	Severe: wetness.
Paola: Pa, Pb [1]	Severe: too sandy	Severe: too sandy	Severe: too sandy	Severe: too sandy.
Plantation: Pm	Severe: wetness; excess humus.	Severe: wetness; excess humus.	Severe: wetness; excess humus.	Severe: wetness; excess humus.
Pomello: Po	Severe: too sandy	Severe: too sandy	Severe: too sandy	Severe: too sandy.
Pompano: Pp	Severe: wetness	Severe: wetness	Severe: wetness; too sandy.	Severe: wetness.
Sanibel: Sa	Severe: wetness; excess humus.	Severe: wetness; excess humus.	Severe: wetness; excess humus.	Severe: wetness; excess humus.
St. Lucie: St	Severe: too sandy	Severe: too sandy	Severe: too sandy	Severe: too sandy.
Udorthents: Ud,[2] Un.[3]				
Urban land: Ur.[4]				

[1] This mapping unit is made up of more than one kind of soil. The different soils may have different characteristics, and for this reason it is necessary to refer to the other series for these soils in the table, as follows: For the Urban land part of Hb, Iu, and Pb, refer to Urban land. For the Margate part of Hm, refer to the Margate series.

[2] Ud is too variable for valid interpretations.

[3] Un is not suitable for further recreational development. It is presently used mostly for golf courses.

[4] Ur is not suited to development for these types of recreation.

clay) near the Hillsboro Canal. The northern part of the Everglades in the Broward County Area is underlain by the Fort Thompson formation (a shell hash of alternating marine- and fresh-water mollusks, clay, and sand) that grades into the Miami Oolite in the southern part.

Near the conservation area the Pamlico Terrace is thin over the Miami Oolite limestone. Common in this area are Hallandale soils that are sandy and shallow and extend into the porous limestone in solution holes. In other places, such as the area around Andytown, there is a thin layer of organic material over limestone that gives rise to the Dania soils.

Climate

The Broward County Area has a tropical climate near the coast and a subtropical climate west of the coastal area. The relatively high year-round temperature and large amount of rainfall have hastened soil development. Because the abundant rainfall continuously leaches and translocates soluble minerals, the soils contain only small amounts of organic matter and soluble plant nutrients. Only the soils that were once covered with organic material have fairly high amounts of organic material in the surface layer. Although the climate changes from tropical to humid subtropical, this has caused few differences among the soils.

Plants and animals

Plants have been the principal biological factor in the formation of soils in the Area, but animals, insects, bacteria, and fungi also have been important. Two of the chief functions of plant and animal life are to furnish organic matter and to bring plant nutrients from the lower to the upper horizons. Differences in the amount of organic matter, nitrogen, and plant nutrients in the soils and differences in soil structure and porosity are among those caused by plants and animals.

Relief

Relief has affected the formation of soils in the Area, primarily through its influence on soil-water relationships. Other factors of soil formation normally associated with relief, such as erosion, temperature, and plant cover, are of minor importance.

The Broward County Area is a nearly level plain with an elevation of 2 to 10 feet except for several ridges which are slightly higher. It comprises three general types of areas—flatwoods; wet, grassy flats or Everglades; and coastal ridges. Differences in the soils of these general areas are directly related to differences in relief.

The soils in the flatwoods area have a higher water table and are periodically wet to the surface. These soils, therefore, are not so highly leached as some on the coastal ridges. The soils in the Everglades or wet, grassy flats are covered with water for long periods and have a high content of organic matter on the surface. The soils on the coastal ridges are at higher elevations than those of the flatwoods or Everglades areas, are mostly excessively drained or well drained, and are not influenced by a ground-water table.

Time

Time is an important factor in the formation of soils. Normally, a long time is required for formation of soils that have distinct horizons. The difference in length of time that parent materials have been in place commonly is reflected in the degree of development of the soil.

Some basic minerals from which soils are formed weather fairly rapidly, but other minerals change slowly even though weathering has taken place over a long period. The translocation of fine particles within soils to form the various horizons varies under different conditions. All of the soil forming processes, however, require a relatively long period. Almost pure quartz sand that is highly resistant to weathering is the dominant geologic material in the Broward County Area. Only one soil in the Area contains enough fine-textured material to be classified in a loamy family rather than a sandy family. The organic soils of the Everglades were formed by decayed organic material that built up over the years in shallow water.

In terms of geologic time, the soil material that makes up most of the soils of the Area is young. Not enough time has elapsed since the material was laid down or emerged from the sea for pronounced genetic horizons to develop. Some thin, loamy horizons have formed in place through the process of weathering. An example is the Boca soils. A distinct genetic horizon, such as the spodic horizon, has formed in the Immokalee and Pomello soils; however, the time required for its development is relatively short.

Morphology of Soils

Soil morphology refers to the process involved in the formation of the soil horizon, or horizon differentiation. Differentiation of horizons in the soils of the Broward County Area is the result of accumulation of organic matter, the leaching of carbonates, the reduction and transfer of iron, the accumulation of silicate clay minerals, or of some combination of these processes.

Some organic matter has accumulated in the upper layers of most of the soils to form an A1 horizon. The quantity of organic matter is small in some of the soils but fairly large in others. Leaching of carbonates and salts has occurred in nearly all of the soils. The effects of leaching have been indirect, in that the leaching permitted the subsequent translocation of silicate clay materials in some soils. Most of the soils of the county are leached to varying degrees.

The reduction and transfer of iron has occurred in most of the soils of the survey area but not in the organic soils. In some of the wet soils, iron has been segregated within the deeper horizons to form reddish-brown mottles and concretions.

In the Boca soil, evidence of weathering and clay movement, or alteration is present in the form of a light-colored, leached A2 horizon and a loamy Bt horizon that has sand grains coated and bridged with clay material.

Classification of Soils

Classification consists of an orderly grouping of soils according to a system designed to make it easier to remember soil characteristics and interrelationships. Classification is useful in organizing and applying the results of experience and research. Soils are placed in narrow classes for discussion in detailed soil surveys and for application of knowledge within farms and fields. The many thousands of narrow classes are then grouped into progressively fewer and broader classes in successively higher categories, so that information can be applied to large geographic areas.

Two systems of classifying soils have been used in the United States in recent years. The older system was adopted in 1938 and revised later. The system currently used by the National Cooperative Soil Survey was developed in the early 1960's and adopted in 1965 (*4*, *6*). It is under continual study.[8]

The current system of classification has six categories. Beginning with the most inclusive, these cate-

[8] See the unpublished working document "Selected Chapters from the Unedited Text of the Soil Taxonomy of the National Cooperative Soil Survey." It is ordinarily available in the SCS State Office, and is a good source of information on current soil classification.

TABLE 14.—*Soil series classified according to the current system*[1]

Series	Family	Subgroup	Order
Basinger	Siliceous, hyperthermic	Spodic Psammaquents	Entisols.
Boca	Loamy, siliceous, hyperthermic	Arenic Ochraqualfs	Alfisols.
Dania	Euic, hyperthermic, shallow	Lithic Medisaprists	Histosols.
Hallandale	Siliceous, hyperthermic	Typic Psammaquents	Entisols.
Immokalee	Sandy, siliceous, hyperthermic	Arenic Haplaquods	Spodosols.
Lauderhill	Euic, hyperthermic	Lithic Medisaprists	Histosols.
Margate	Siliceous, hyperthermic	Mollic Psammaquents	Entisols.
Paola	Hyperthermic, uncoated	Spodic Quartzipsamments	Entisols.
Plantation	Siliceous, hyperthermic	Typic Psammaquents	Entisols.
Pomello	Sandy, siliceous, hyperthermic	Arenic Haplohumods	Spodosols.
Pompano	Siliceous, hyperthermic	Typic Psammaquents	Entisols.
Sanibel	Siliceous, hyperthermic	Typic Psammaquents	Entisols.
St. Lucie	Hyperthermic, uncoated	Typic Quartzipsamments	Entisols.

[1] Classification of Udorthents is to the suborder level only, and not into series, family, or subgroup. The order is Entisols.

gories 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 14 shows the classification of each soil series of the Broward County Area by family, subgroup, and order, according to the current system.

Order. Ten soil orders are recognized in the system. They are Alfisols, Aridisols, Entisols, Histosols, Inceptisols, Mollisols, Oxisols, Spodosols, Ultisols, and Vertisols. The properties used to differentiate among soil orders are those that tend to give broad climatic groupings of soils. The exceptions to this are the Entisols, Histosols, and Inceptisols, which occur in many different climates. The soil orders represented in the Broward County Area are Alfisols, Entisols, Histosols, and Spodosols.

Great group. Soil suborders are separated into great groups on the basis of similarity in the kind and sequence of the major horizons and in major soil properties. The horizons used to make separations are those in which clay, iron, or humus have accumulated; those that have pans that interfere with growth of roots, movement of water, or both; and thick, dark-colored surface horizons. The features used are the self-mulching properties of clay, soil temperature, major differences in chemical composition (mainly calcium, magnesium, sodium, and potassium), dark-red and dark-brown colors associated with basic rocks, and the like.

Subgroup. Great groups are subdivided into subgroups, one representing the central (typic) segment of the group and others called intergrades that have properties of the 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.

Family. Soil families are separated within a subgroup primarily on the basis of properties important to the growth of plants or to the behavior of soils if used for engineering. Among the properties considered are texture, mineralogy, reaction, soil temperature, permeability, thickness of horizons, and consistence.

Alfisols are mineral soils that have a clay-enriched B horizon high in base saturation.

Entisols are recent mineral soils that lack a genetic horizon or have only the beginnings of such horizons.

Histosols are organic soils that formed in swamps and marshes where conditions were favorable for the accumulation of decaying plant remains.

Spodosols are mineral soils that have a spodic horizon. The spodic horizon is an iron- and humus-enriched B horizon.

Suborder. Each order is subdivided into suborders primarily on the basis of soil characteristics that seem to produce classes having the greatest genetic similarity. The suborder has a narrower climatic range than the order. The soil properties used to separate suborders are mainly those that reflect either the presence or absence of waterlogging, or soil differences resulting from the climate or vegetation.

Series. The series consists of a group of soils that formed from particular kinds of parent material and that have genetic horizons that, except for texture of the surface layer, are similar in differentiating characteristics and in arrangement in the profile. Among these characteristics are color, structure, reaction, consistence, and mineralogical and chemical composition.

New soil series must be established, and concepts of some established series, especially older ones, that have been used little in recent years, must be revised in the course of the soil survey program across the country. A proposed new series has tentative status until review of the series concept at State, regional, and national levels of responsibility for soil classification results in a judgment that the new series should be established. Most of the soil series described in this publication were established during this survey.

TABLE 15.—*Particle-size distribution analysis of selected soils* [1]

[Analyzed by Soil Characterization Laboratory, Department of Soil Science, University of Florida Agricultural Experiment Stations, Gainesville, Florida]

Soil series and sample number	Horizon	Depth	Particle-size distribution: Very coarse sand (2–1 mm)	Coarse sand (1–0.5 mm)	Medium sand (0.5–0.25 mm)	Fine sand (0.25–0.10 mm)	Very fine sand (0.10–0.05 mm)	Silt (0.05–0.002 mm)	Clay (less than 0.002 mm)
		In	*Pct*	*Pct*	*Pct*	*Pct*	*Pct*	*Pct*	*Pct*
Basinger:									
S6–10–1	A1	0–6	0	3.0	25.3	65.7	3.6	0.8	1.6
S6–10–2	A21	6–13	0.1	2.4	25.7	67.2	3.6	.6	.4
S6–10–3	A22	13–17	0	2.8	27.3	65.3	3.2	.9	.5
S6–10–4	A3	17–23	0	3.0	25.3	65.5	3.4	.2	2.6
S6–10–5	C1&Bh	23–35	0	2.8	27.5	63.2	3.1	0	3.4
S6–10–6	C2	35–60	.1	4.2	36.4	55.8	2.4	.4	.7
Dania:									
S6–6–3	IIC	14–16	.3	5.2	25.6	56.2	3.8	5.4	3.5
Hallandale:									
S6–3–1	A1	0–4	.1	1.0	16.2	71.1	2.4	5.0	4.2
S6–3–2	A2	4–10	0	1.0	15.4	79.0	2.6	.8	1.2
S6–3–3	B1	10–14	0	1.3	16.3	77.3	1.8	.8	2.5
S6–3–4	B2	14–16	0	1.4	17.3	72.5	2.5	1.0	5.3
Margate:									
S6–4–1	Ap	0–8	.1	6.6	35.3	53.4	1.6	1.5	1.5
S6–4–2	A2	8–16	.1	3.2	24.7	67.7	2.9	.5	.9
S6–4–3	B1	16–26	.1	3.3	23.9	68.4	2.7	.1	1.5
S6–4–4	B2	26–28	.1	2.7	22.1	67.8	2.2	.9	4.2
S6–4–5	C	28–32	.2	1.9	16.5	47.6	3.4	24.2	6.2
Plantation:									
S6–8–3	IIA1	0–6	.1	1.7	17.7	76.7	2.2	.4	1.2
S6–8–4	IIA2	6–18	.1	1.7	17.5	77.4	2.3	0	1.0
S6–8–5	IIC1	18–23	.1	2.0	18.4	74.8	2.0	.7	2.0
S6–8–6	IIC2	23–25	0	1.6	15.0	49.2	2.4	25.6	6.2
Pomello:									
S6–15–1	A1	0–5	.1	3.1	24.1	63.9	2.6	5.2	1.0
S6–15–2	A21	5–8	.1	3.9	27.6	65.1	1.9	1.0	.4
S6–15–3	A22	8–38	.1	3.5	25.1	68.5	2.0	.5	.3
S6–15–5	B21h	38–52	.1	2.1	23.8	67.9	1.6	1.7	2.8
S6–15–6	B22h	52–72	0	1.2	19.2	74.2	2.1	1.5	1.8
S6–15–7	B3	72–80	0	2.3	22.0	70.8	2.8	.9	1.2
Sanibel:									
S6–4–4	IIC1	1–9	.1	2.8	24.8	69.4	2.0	.3	.6
S6–4–5	IIC2	9–60	.1	3.6	25.7	68.4	1.8	0	.4

[1] Particle-size distribution analysis was not made on the organic horizons of the Dania, Plantation, and Sanibel series.

Laboratory Data [9]

Particle-size distribution of seven soil series is shown in table 15, and chemical analyses and certain physical properties of eight soil series are shown in table 16. These analyses were conducted and coordinated by the Soil Characterization Laboratory, Soil Science Department, University of Florida Agricultural Experiment Stations, Gainesville, Florida. Detailed descriptions of the soils, including their location, are given in alphabetical order in the section "Descriptions of the Soils."

In addition to the data presented in tables 15 and 16, the results of laboratory analyses for other soils identified in the Broward County Area (profiles sampled in other counties) are on file in the Soil Science Department, University of Florida. Data of this nature are useful in classification, determination of potential productivity, and understanding the genesis of soils.

[9] DR. F. CALHOUN, JR., DR. R. E. CALDWELL, and DR. V. W. CARLISLE, Soil Science Department, University of Florida Agricultural Experiment Stations.

Laboratory Methods

Most of the data were obtained using methods out-

TABLE 16.—*Chemical analyses and certain*

[Analyzed by soil characterization laboratory, Department of Soil Science, University of Florida

Soil series and sample numbers	Horizon	Depth	Soil reaction			Extractable bases				Titratable acidity
			H_2O 1:1	0.01*M* CaCl2 1:2	1*N* KCl 1:1	Ca	Mg	Na	K	
		In	*pH*	*pH*	*pH*	*Meq/100 gms*	*Meq/100 gms*	*Meq/100 gms*	*Meq/100 gms*	*Meq/100 gms*
Basinger:										
S6–10–1	A1	0–6	5.6	5.7	5.3	1.5	0.1	[1] T	0.1	2.3
S6–10–2	A21	6–13	5.7	5.3	5.1	0.4	0.1	0	T	1.9
S6–10–3	A22	13–17	5.9	5.4	5.0	0.3	0.1	T	0.1	1.9
S6–10–4	A3	17–23	5.9	5.3	5.0	0.5	0.1	T	0.1	2.0
S6–10–5	Cl&Bh	23–35	6.0	5.2	5.1	0.9	0.1	T	0.1	2.0
S6–10–6	C2	35–60	5.7	5.1	4.9	0.7	T	T	0.1	2.2
Dania:										
S6–6–1	Oa1	0–6	6.1	6.2	5.7	34.5	1.6	0.2	0.1	6.4
S6–6–2	Oa2	6–14	6.4	6.3	5.9	22.8	1.5	0.2	0.1	4.0
S6–6–3	IIC	14–16	7.1	6.4	6.1	5.0	0.3	0.1	0.1	0.1
Hallandale:										
S6–3–1	A1	0–4	5.8	5.2	5.1	9.3	0.7	0.3	0.1	5.3
S6–3–2	A2	4–10	6.2	5.6	5.7	1.4	0.1	0.1	T	0.7
S6–3–3	B1	10–14	6.3	6.4	6.0	1.2	0.1	0.2	T	0.3
S6–6–4	B2	14–16	7.4	7.4	7.1	12.7	0.3	0.2	0.1	0
S6–3–5	IIR	16+	8.2	7.6	7.9	179	3.1	1.8	3.4	0
Lauderhill:										
S6–14–1	Oa1	7.5	7.5	6.6	6.2	----------	----------	----------	----------	5.2
S6–14–2	Oa2	7.2	7.2	6.5	6.3	----------	----------	----------	----------	2.9
S6–14–3	Oa3	7.2	7.2	6.6	6.4	----------	----------	----------	----------	----------
Margate:										
S6–4–1	Ap	5.7	5.7	4.7	5.0	2.3	0.2	0.2	T	2.9
S6–4–2	A2	6.2	6.2	5.9	6.0	1.1	0.1	0.1	0.1	0.9
S6–4–3	B1	6.4	6.4	6.5	6.4	1.0	0.1	0.2	0.1	0.3
S6–4–4	B2	7.2	7.2	7.0	7.1	15.9	0.1	0.3	0.1	T
Plantation:										
S6–8–1	Oa1	5.9	5.9	5.3	5.2	63.6	3.5	1.1	0.3	4.1
S6–8–2	Oa2	5.8	5.8	5.4	5.4	30.3	1.1	0.6	0.3	2.3
S6–8–3	IIA1	6.3	6.3	5.8	5.9	1.3	0.1	0.2	T	1.9
S6–8–4	IIA2	6.3	6.3	6.2	6.2	0.6	0.1	0.2	T	0.6
S6–8–5	IIC1	7.1	7.1	7.2	7.7	6.3	0.1	0.2	T	0
S6–8–6	IIC2	8.1	8.1	7.3	7.8	192	1.1	2.5	0.3	0
Pomello:										
S6–15–1	A1	4.6	4.6	3.8	3.7	----------	----------	----------	----------	----------
S6–15–2	A21	5.2	5.2	3.9	4.0	----------	----------	----------	----------	----------
S6–15–3	A22	4.9	4.9	4.2	4.2	----------	----------	----------	----------	----------
S6–15–5	B21h	4.6	4.6	3.7	3.5	----------	----------	----------	----------	----------
S6–15–6	B22h	5.2	5.2	4.2	4.0	----------	----------	----------	----------	----------
S6–15–7	B3	5.5	5.5	4.3	4.2	----------	----------	----------	----------	----------
Sanibel:										
S6–12–1	Oa1	9–7	6.4	5.8	5.6	30.2	1.6	0.1	0.1	4.9
S6–12–2	Oa2	7–0	6.2	5.5	5.4	26.5	0.7	0.1	0.2	9.5
S6–12–3	IIA	0–1	6.1	5.7	5.7	3.7	0.1	T	0.1	1.9
S6–12–4	IIC1	1–9	6.4	5.5	5.6	0.8	0.1	T	0.1	0.3
S6–12–5	IIC2	9–60	6.4	5.8	5.7	0.5	T	0	T	0.2

[1] T = Trace.

lined in Soil Survey Investigations Report No. 1 (*7*). Where such methods are mentioned in this section, specific procedures from the Report are given. Soil samples collected from carefully selected sites were air-dried, rolled or crushed, and sieved through a 2-millimeter screen. Particle-size distribution data were obtained by the hydrometer method after dispersion and shaking with sodium hexametaphosphate (*2*). The sand fractions were obtained by dry-sieving through a nest of sieves for at least 15 minutes and expressed on an oven-dry weight basis. The percentage of silt was determined by difference.

Measurements of pH (soil reaction) were made by procedure 8C1 of Soil Survey Investigations Report *physical properties of selected soils*

Agricultural Experiment Stations, Gainesville, Florida. Dashes indicate no determination made]

Cation exchange capacity	Base saturation	Organic matter	Total nitrogen	Resistivity	Corrosion potential	Bulk density	Saturated hydraulic conductivity	Water content at various pressures (bars) 0.10 bar	0.33 bar	15.00 bars	Water retention difference
Meq/100 gms	*Pct*	*Pct*	*Pct*	*Ohms/cm*		*G/cm3*	*Cm/hr*	*Pct*	*Pct*	*Pct*	*In/in*
4.0	43	1.0	---	1.0	0.1	1.55	38.5	11.9	3.7	1.1	0.17
2.4	21	---	---	0.7	0.1	1.54	34.5	2.7	1.6	1.3	0.02
2.4	21	---	---	1.3	0.1	1.57	33.2	2.7	1.4	1.2	0.02
2.7	26	0.1	---	1.3	0.1	1.58	30.3	2.5	1.1	0.5	0.03
3.1	35	0.3	---	0.8	0.1	1.62	32.2	4.8	2.7	0.8	0.06
3.0	27	---	---	2.0	0.2	1.63	43.6	3.9	2.0	0.7	0.05
43.2	85	64.9	---	4.9	0.7	0.20	221	280	235	179	0.11
30.6	80	63.9	---	3.4	0.3	0.13	577	539	436	240	0.24
5.6	98	2.3	---	2.9	0.3	0.62	841	81.5	54.4	6.4	0.46
15.7	66	7.4	0.3	2.0	0.2	1.11	100	27.9	24.0	6.6	0.24
2.3	70	0.5	T	1.0	0.1	1.49	34.8	5.1	3.4	1.8	0.05
1.8	83	---	---	1.0	0.1	1.57	30.9	3.2	2.1	1.5	0.03
13.3	100	---	T	2.2	0.3	1.43	9.2	11.1	9.6	1.4	0.14
187.1	100	---	---	2.2	0.3	---	---	---	---	---	---
---	---	67.2	---	2.9	0.4	---	---	---	---	---	---
---	---	59.2	---	3.2	0.5	---	---	---	---	---	---
---	---	22.9	---	2.9	0.4	---	---	---	---	---	---
5.6	48	1.6	0.1	1.2	0.1	1.38	49.6	10.8	8.1	2.4	0.12
2.4	63	---	---	0.9	0.1	1.60	30.3	2.8	2.0	1.9	0.01
1.7	82	---	---	1.7	0.2	1.62	33.9	3.8	2.1	1.4	0.04
16.4	100	---	T	2.2	0.3	---	---	---	---	---	---
72.6	94	50.0	2.4	4.1	0.6	0.29	479	154	138	64.0	0.21
34.6	93	63.4	1.6	1.9	0.2	0.20	203	355	310	76.8	0.47
3.5	46	---	---	2.1	0.2	1.51	28.9	5.6	3.1	1.5	0.06
1.5	60	---	---	1.8	0.2	1.58	43.1	2.8	1.5	1.4	0.02
6.6	100	---	---	1.7	0.2	1.56	39.4	3.6	2.0	1.0	0.04
196	100	---	---	2.7	0.3	---	---	---	---	---	---
---	---	7.5	---	---	---	---	---	---	---	---	---
---	---	0.4	---	---	---	---	---	---	---	---	---
---	---	0.1	---	---	---	---	---	---	---	---	---
---	---	3.1	---	---	---	---	---	---	---	---	---
---	---	1.6	---	---	---	---	---	---	---	---	---
---	---	0.8	---	---	---	---	---	---	---	---	---
36.9	87	46.0	---	2.8	0.3	0.52	---	132	117	88.1	0.15
37.0	74	51.7	---	3.7	0.5	0.32	---	215	203	119	0.27
5.8	67	1.9	---	3.0	0.4	---	---	---	---	---	---
1.3	77	0.3	---	2.5	0.4	1.63	---	3.5	1.9	1.5	0.03
0.7	71	---	---	1.8	0.2	1.63	---	3.4	2.1	1.8	0.03

No. 1 using a glass electrode. Extractable bases were obtained by leaching a soil sample with ammonium acetate buffered at pH 7.0 as outlined in procedure 5B1. These cations were then determined separately using a Beckman DU flame spectrophotometer. Titratable acidity, which is roughly equivalent to the exchangeable acidity of procedure 6H2a (*7*), was determined by potentiometric titrations with 0.05N barium hydroxide using a Sargent Model D Recording Titrator after immersing 10 grams of soil in 50 milliliters of neutral 1N KCl (*10*). Cation exchange capacity was calculated by summing the exchangeable bases and titratable acidity. Base saturation was derived by dividing the sum of exchangeable bases by the cation exchange capacity and then multiplying by 100.

Organic matter was determined by a modification of the Walkley-Black wet-combustion method as outlined in procedure 6A1a. Total nitrogen was obtained by the semi-micro Kjeldahl method as shown in procedure 6B2a. Resistivity (ohm/em) or an "R" value was obtained using a Model 100 Corrosion Tester. The corrosion potential or a "C" value that was obtained from the manufacturer's tables is directly related to the "R" value. The smaller the "C" value, the less the corrosion and the greater the expectancy of pipe life. Generally, C values range from 1 to 10, and pipe life ranges accordingly from 20 to 2 years.

Bulk density, hydraulic conductivity (saturated), and water retention at 0.10 and 0.33 bar were measured on 3 by 5.4 centimeter cylindrical (undisturbed) soil cores. Water retention at 15-bar suction was determined on disturbed or loose soil samples by procedure 4B2.

Water retention difference was calculated using the formula

$$\text{WRD (in/in)} = \frac{\frac{1}{3} - (\text{or } \frac{1}{10})\text{ bar \%} - 15 - \text{bar \%}}{100}$$

x bulk density, moist. $\frac{1}{10}$ bar was used for sandy soils and $\frac{1}{3}$ bar for organic soils. Water retention difference is considered by many to closely approximate available water capacity.

Additional Facts About the Area

Soil is intimately associated with its environment. The interaction of all factors determines the overall behavior of a soil for a given use. This section discusses briefly the major factors of the environment other than those that affect the use and management of soils. The factors discussed are climate; transportation, markets, and farming; water supply and natural resources; and physiography and drainage.

Climate[10]

The climate of Broward County is characterized by long, warm, humid summers and mild winters. The moderating influence of the waters of the Atlantic on maximum temperatures in summer and minimum temperatures in winter is quite strong along the immediate coast but diminishes noticeably a few miles inland. The moderation of the coastal winter temperatures gives this section of the survey area a tropical climate (temperatures of coldest month higher than 64.4° F), while the rest is designated as humid subtropical.

Rainfall also has a much greater variation in an east-west direction than it has in a north-south direction. Precipitation occurs during all seasons but on the basis of mean monthly totals of precipitation, a rainy season of 5 months from June through October brings nearly 65 percent of the annual rainfall and a relatively dry season of 5 months from November through March produces only about 20 percent of the annual total. Average annual rainfall totals range from 60 inches along the coastal sections to nearly 64 inches a few miles inland, and then diminish to 50 inches along the western border of Broward County.

Most summer rainfall comes from showers and thunderstorms of short duration. They are sometimes heavy, with 2 or 3 inches of rain falling within a period of 1 to 2 hours. Day-long rains in summer are rare. When they occur, they are almost always associated with tropical storms. Winter and spring rains are not generally so intense as summer thundershowers. A 24-hour rainfall of almost 9 inches may be expected to occur sometime during the year in about 1 year in 10 on the average.

Hail falls occasionally in thunderstorms but the hailstones are generally small and seldom cause much damage. Fourteen tornadoes were reported in Broward County during the 12-year period 1959–71.

Temperature and precipitation data for the period 1962–71 are shown in table 17. The data recorded at the Fort Lauderdale Experiment Station are representative of weather conditions in the eastern section of Broward County, but away from the immediate influences of the Atlantic. Table 18 gives a comparison with other weather stations within Broward County. The Experiment Station is located 5 miles southwest of the Fort Lauderdale Post Office, while the Dixie Water Plant is within the city limits, 2 miles southwest of the Post Office. The Bahia Mar observations are taken at the Yacht Club on the ocean, 3 miles east of the Post Office. North New River Canal No. 2 is a weather station that collects rainfall data only. It is located on the northern border of the county, centered midway between its eastern and western boundaries.

Summer temperatures have few day-to-day variations, and temperatures as high as 98° F. are rare. In 45 years of record at the Dixie Water Plant, only one reading of 100° has been recorded. Twenty years of observation show a record high of 98° at the Experiment Station and 96° at Bahia Mar.

Winter minimum temperatures have considerable day-to-day variations due largely to periodic invasions of cold, dry air that has moved southward from Canada. At the Experiment Station, temperatures of 32° or below have been observed on only 11 days during the past 10 years. In 3 of the 10 years, no freezing temperatures have been observed. Data from stations run by the Federal-State Frost Warning Service show that in the 30-year period 1937–67, there were 25 nights on which the temperatures reached 32° or below the coast, and 75 nights inland along the western edge of Broward County. Calculations show that in the same period there were 100 hours with temperatures of 32° or below along the coast, increasing to 300 hours inland. The lowest temperature reported in the Fort Lauderdale area during the last 45 years was 28°. Table 19 gives the record of low temperatures at Davie, a Frost Warning Station located in the interior southeastern section of Broward County. This temperature record can be considered representative of the climate for truck farming in the eastern sections of the survey area.

[10] By JAMES T. BRADLEY, climatologist for Florida, National Weather Service, U.S. Department of Commerce. For convenience in presentation this section includes climate data for all of Broward County.

TABLE 17.—*Temperature and precipitation*

[Based on data recorded at the Fort Lauderdale Experiment Station]

Month	Temperature: Average daily maximum	Temperature: Average daily minimum	Temperature: Two years in 10 will have at least 4 days with— Maximum temperature equal to or higher than—	Temperature: Two years in 10 will have at least 4 days with— Minimum temperature equal to or lower than—	Precipitation: Average monthly total	Precipitation: One year in 10 will have— Less than—	Precipitation: One year in 10 will have— More than—	Precipitation: Average number of days with rainfall of— 0.10 inch or more	Precipitation: Average number of days with rainfall of— 0.50 inch or more	Pan evaporation
	°F	°F	°F	°F	*Inches*	*Inches*	*Inches*			*Inches*
January	75.4	55.0	84	37	2.11	0.66	3.67	5	2	3.71
February	75.7	54.6	85	43	3.14	0.10	5.78	4	2	4.11
March	78.8	58.7	88	44	2.56	0.19	11.67	3	2	5.81
April	83.4	63.4	91	53	1.68	0.03	5.58	2	1	7.08
May	85.9	67.2	91	57	6.73	0.11	15.22	7	3	7.81
June	88.0	70.9	92	66	11.11	5.05	21.28	12	7	6.58
July	90.5	72.9	95	68	6.01	3.20	9.11	11	4	7.36
August	90.8	72.9	94	69	7.04	4.41	9.01	10	5	7.07
September	88.9	72.4	92	69	7.06	3.03	10.68	12	5	5.87
October	85.4	68.3	90	60	9.16	2.96	14.29	10	4	5.42
November	79.5	60.3	84	45	2.10	0.28	3.37	4	1	4.27
December	76.6	55.6	84	40	1.39	0.11	4.30	2	1	3.78

TABLE 18.—*Comparison of weather records in Broward County*

Station	Average annual temperature	Average number of days each year with temperature of 90° F. or more	Average number of days each year with temperature of 32° F. or less	Average annual precipitation	Average number of days each year with rainfall of— 0.10 inch or more	Average number of days each year with rainfall of— 0.50 inch or more
Experiment Station	73.8	82	1	60.1	82	37
Dixie Water Plant	75.4	71	[1] T	60.3	83	39
Bahia Mar	75.5	39	T	61.5	85	39
North New River Canal No. 2				53.9		

[1] T = Trace. Less than 0.5 day.

Tropical storms bring hazardous conditions at irregular intervals; the chance of hurricane-force winds in any given year is estimated 1 in 7.

The prevailing wind direction is southeasterly from March through September and northwesterly to easterly for the other months. Wind velocity generally ranges from 12 to 20 miles per hour during the day and usually drops below 10 miles per hour at night. The average relative humidity ranges from about 87 percent early in the morning to about 60 percent early in the afternoon.

Transportation, Markets, and Farming

The Broward County Area is served by several major highways. U.S. Highway 1 is in the eastern part of the Area, U.S. Highway 441 in the central part, and U.S. Highway 27 in the western part. These highways run north-south. The Florida Sunshine State Parkway also runs north-south through the Area. Numerous roads run east-west, but the most important is State Route 84, which connects Fort Lauderdale with Naples on the west coast. State Route 84 and U.S. Highway 27 are the only roads that go through the Everglades from the survey area.

Rail service is provided by the Florida East Coast Railroad and the Seaboard Coast Line Railroad. Both run north and south.

Transportation by water is available through Port Everglades. This port can accommodate large ships.

TABLE 19.—*Record of low temperatures*

[Period of

Temperature	Percent of seasons at or below various temperatures before—						
	November 20	December 10	December 30	January 19	February 18	March 10	March 30
°F							
36	0	23	57	87	100	100	100
32	0	13	33	57	77	83	83
28	0	0	7	17	33	33	33
26	0	0	7	7	17	17	17
24	0	0	0	0	3	3	3

Four airports are available for use—Fort Lauderdale-Hollywood International Airport, Fort Lauderdale Executive Airport, Pompano Beach Airport, and North Perry Airport. Only Fort Lauderdale International Airport has scheduled commercial airline flights. The other airports are mostly for private planes.

The largest state owned fresh-vegetable market in Florida is the Pompano State Farmers' Market. This market handles vegetables from the survey area and from the southern part of Palm Beach County. Most of the citrus is processed in other counties. More grapefruit is consumed than is produced in the county.

Not much farming was practiced in the Broward County Area before 1910. Drainage was established with the formation of the Napoleon B. Broward Drainage District. After drainage was established, citrus groves were planted between the New River and South New River Canals. Most of the winter vegetable crops were grown in the same area, but planting soon spread primarily to the north as the area was developed (*9*). According to the 1950 Census of Agriculture, approximately 700 farms and 45 dairies were in Broward County in 1950. By 1969, the number had decreased to 291 farms and 8 dairies. Farming in the Area generally is still on the decrease.

This is one of the few places in the United States that has either a tropical or humid subtropical climate. A large percentage of the soils are nearly level, poorly drained, and infertile. Another fairly large group of soils are organic and nearly level, very poorly drained, and relatively fertile. With drainage and proper fertilization, all of these soils produce excellent winter truck crops.

The coastal areas have excellent facilities for fishing and boating.

Water Supply and Natural Resources

The water supply for the cities in the Broward County Area comes primarily from municipal wells. Many private wells are used mostly for watering lawns. Because porous limestone is below most of the soils, water can move laterally for long distances. The water in the canals can be regulated to help recharge the ground water during dry periods.

Although most of the Area receives about 60 inches of rainfall annually, this amount may not be sufficient to provide water needs in the future. The main alternate source could be Lake Okeechobee to the north of the survey area.

Climate is considered one of the most important natural resources of the Area.

Physiography and Drainage

The Broward County Area can be divided into three general parts based on differences in physiography and soils.

The western part is a nearly level, generally treeless sawgrass plain that appears to be flat. The soils are organic and overlie limestone. In many places the soils are shallow. Under natural conditions, water stood on these soils for months and only during extremely dry seasons was the surface exposed. Today, these soils have been drained, and water stands on the surface for only short periods. With drainage, the organic soils are subject to oxidation and subsidence. When exposed to air, organic matter is oxidized or slowly burned up, and this gradual loss of organic matter results in subsidence or a lowering of surface elevation. Also, during dry seasons, wildfires have burned some of the organic surface soil, and decreased the thickness of the organic material.

Very little of the organic soils are presently farmed. A few acres are in improved pasture. In recent years, after some drainage, several types of trees have become established. These trees are melaleuca, Australian pine, and waxmyrtle. One method used for developing the organic soils for urban use removes the organic material and adds fill consisting of rock or sand.

The central part consists of nearly level, grassy areas interspersed with small ponds. The soils here are wet and sandy and are underlain by limestone. Before drainage, water stood on these soils for several months each year. The original vegetation was water-tolerant grasses and a few cypress stands. In the higher areas, pine and palmetto were common. These areas are now farmed, and with drainage produce excellent pasture and truck crops.

This is also an area of rapid urban development. The underlying limestone is mostly porous, and water moves through it laterally for long distances. Water-control ditches can be further apart in these soils than in soils underlain by sand or loamy material. For urban *at Davie in Broward County*

record 1937–67]

Percent of seasons at or below various temperatures after—						
November 20	December 10	December 30	January 19	February 18	March 10	March 30
100	100	100	83	50	13	0
83	80	73	50	17	3	0
37	37	30	20	3	0	0
17	17	10	17	0	0	0
3	3	3	3	0	0	0

development, fill is commonly added to raise the elevation to such a level that water does not cover the soil surface.

The eastern part is made up of low, sandy ridges, a part of which is commonly referred to as flatwoods. The vegetation is mostly pine, palmetto, and native grasses. The flatwoods part is made up of deep, poorly drained, nearly level, sandy soils. These soils have been used mostly for truck crops and pasture, but are rapidly being developed for urban uses. They require drainage, and fill is added to low areas so that the entire acreage can be developed. The other part is made up of deep, excessively drained or well-drained, sandy soils, many of which, are developed for urban uses.

The major drainage systems in the Area flow from west to east and drain into the Atlantic Ocean. These systems are the Hillsboro Canal at the Palm Beach-Broward County line, the Pompano Canal at Margate, the Midriver Canal at Lauderhill, the North New River Canal at Davie, and C–9 at the Dade County line. These canals are under the control of the Central and Southern Florida Flood Central District.

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Glossary

Association, soil. A group of soils geographically associated in a characteristic repeating pattern.

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.

Base saturation. The degree to which material that has base-exchange properties is saturated with exchangeable cations other than hydrogen, expressed as a percentage of the cation-exchange capacity.

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.

Complex, soil. A mapping unit consisting of different kinds of soils that occur in such small individual areas or in such an intricate pattern that they cannot be shown separately on a publishable soil map.

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). Refers to the conditions of frequency and duration of periods of saturation or partial saturation 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 and upper B horizons and mottling in the lower B and the C horizons.

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 and are light gray and generally mottled from the surface downward, although mottling may be absent or nearly so in some soils.

Very poorly drained soils are wet nearly all the time. They have a dark-gray or black surface layer and are gray or light gray, with or without mottling, in the deeper parts of the profile.

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.

Flatwoods. As used in this survey, rather broad areas of land dominated by sandy soils that have a fluctuating water table and characteristic vegetation. Vegetation is typically an open growth of pine and a dense undergrowth of saw palmetto and many kinds of native grasses.

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.

Irrigation. Application of water to soils to assist in production of crops. Methods of irrigation are—

Border.—Water is applied at the upper end of a strip in which the lateral flow of water is controlled by small earth ridges called border dikes, or borders.

Basin.—Water is applied rapidly to relatively level plots surrounded by levees or dikes.

Controlled flooding.—Water is released at intervals from closely spaced field ditches and distributed uniformly over the field.

Corrugation.—Water is applied to small, closely spaced furrows or ditches in fields of close-growing crops, or in orchards, to confine the flow of water to one direction.

Furrow.—Water is applied in small ditches made by cultivation implements used for tree and row crops.

Sprinkler.—Water is sprayed over the soil surface through pipes or nozzles from a pressure system.

Subirrigation.—Water is applied in open ditches or tile lines until the water table is raised enough to wet the soil.

Wild flooding.—Irrigation water, released at high points, flows onto the field without controlled distribution.

Leaching. The removal of soluble materials from soils or other material by percolating water.

Miscellaneous land type. A mapping unit for areas of land that have little or no natural soil; or that are too nearly accessible for orderly examination; or that occur where, for other reasons, it is not feasible to classify the soil.

Morphology, soil. The physical makeup of the soil, including the texture, structure, porosity, consistence, color, and other physical, mineralogical, and biological properties of the various horizons, and their thickness and arrangement in the soil profile.

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.

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.

Parent material. Disintegrated and partly weathered rock from which soil has formed.

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.*

Phase, soil. A subdivision of the soil series or other unit in the soil classification system made because of differences in the soil that affect its management but do not affect its classification in the natural landscape. A soil series, for example, may be divided into phases because of differences in slope, stoniness, thickness, or some other characteristic that affects its management but not its behavior in the natural landscape.

pH value. A numerical means for designing acidity and alkalinity in soils. A pH value of 7.0 indicates precise neutrality; a higher value, alkalinity; and a lower value, acidity.

Profile, soil. A vertical section of the soil through all its horizons and extending into the parent material.

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

Relief. The elevations or inequalities of a land surface, considered collectively.

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.

Series, soil. A group of soils developed from a particular type of parent material and having genetic horizons that, except for texture of the surface layer, are similar in differentiating characteristics and in arrangement in the profile.

Silt. Individual mineral particles in a soil that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). Soil of the silt textural class is 80 percent or more silt and less than 12 percent clay.

Soil. A natural, three-dimensional body on the earth's surface that supports plants and that has properties resulting from the integrated effect of climate and living matter acting 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 grained* (each grain by itself, as in dune sand) or *massive* (the particles adhering together without any regular cleavage, as in many claypans and hardpans).

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Substratum. Technically, the part of the soil below the solum.

Surface soil. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, about 5 to 8 inches in thickness. The plowed layer.

Terrace. An embankment, or ridge, constructed across sloping soils on the contour or at a slight angle to the contour. The terrace intercepts surface runoff so that it may soak into the soil or flow slowly to a prepared outlet without harm. Terraces in fields are generally built so they can be formed. Terraces intended mainly for drainage have a deep channel that is maintained in permanent sod.

Terrace (geological). An old alluvial plain, ordinarily flat or undulating, bordering a river, lake, or the sea. Stream terraces are frequently called second bottoms, as contrasted to flood plains, and are seldom subject to overflow. Marine terraces were deposited by the sea and are generally wide.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. 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."

Topsoil. A presumed fertile soil or soil material, or one that responds to fertilization, ordinarily rich in organic matter, used to topdress roadbanks, lawns, and gardens.

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.

Explanation of Key Phrases

Area reclaim. Borrow areas are difficult to reclaim, and revegetation and erosion control on these areas are extremely difficult.

Corrosive. The soil is relatively soft and decreases excessively in volume when a load is applied.

Cutbanks cave. Walls of cuts are not stable. The soil sloughs easily.

Depth to rock. Bedrock is so near the surface that it affects specified use of soil.

Fast intake. Water infiltrates rapidly into the soil.

Low strength. The soil has inadequate strength to support loads.

Piping. The soil is susceptible to the formation of tunnels or pipelike cavities by moving water.

Seepage. Water moves through the soil so quickly that it affects the specified use.

Thin layer. Suitable soil material is not thick enough for use as borrow material or topsoil.

GUIDE TO MAPPING UNITS

For complete information about a mapping unit, read both the description of the mapping unit and that of the soil series to which the mapping unit belongs. The capability classification system is discussed on pages 32 and 33. Management of the soils for crops and pasture is given in the description of each mapping unit. Other information is given in tables, as follows:

Limitations and uses, by soil association, table 1, p. 4.
Acreage and extent, table 2, p. 8.
Engineering, tables 3 through 10, pp. 22 through 30.
Estimated yields, table 11, p. 33.
Wildlife, table 12, p. 34.
Recreation, table 13, p. 36.

Map symbol	Mapping unit	Described on page	Capability unit Symbol
Ba	Basinger fine sand	9	1/IVw-1
Bc	Boca fine sand	10	IVw-2
Da	Dania muck	10	Vw-2
Ha	Hallandale fine sand	11	Vw-1
Hb	Hallandale-Urban land complex	12	------
Hm	Hallandale and Margate soils	11	------
Ia	Immokalee fine sand	12	IVw-3
Iu	Immokalee-Urban land complex	13	------
La	Lauderhill muck	14	2/IIIw-1
Ma	Margate fine sand	15	IVw-2
Pa	Paola fine sand	16	VIs-1
Pb	Paola-Urban land complex	16	------
Pm	Plantation muck	17	3/IIIw-2
Po	Pomello fine sand	17	VIs-2
Pp	Pompano fine sand	18	IVw-1
Sa	Sanibel muck	19	IIIw-3
St	St. Lucie fine sand	19	VIIs-1
Ud	Udorthents	20	VIIIs-1
Un	Udorthents, shaped	20	------
Ur	Urban land	20	------

1/ Placed in capability subclass IVw on the assumption that drainage outlets are available. Without drainage outlets, this soil should be in capability subclass Vw.

2/ Placed in capability subclass IIIw on the assumption that drainage outlets are available and reclamation is feasible. Small areas without drainage outlets should be in capability subclass Vw.

3/ Placed in capability subclass IIIw on the assumption that drainage outlets are available and reclamation is feasible. Small areas without drainage outlets should be in capability subclass Vw.

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