SOIL SURVEY

(Detailed-Reconnaissance)

Dade County Florida

Series 1947, No. 4

Issued April 1958

UNITED STATES DEPARTMENT OF AGRICULTURE
Soil Conservation Service
In cooperation with the
UNIVERSITY OF FLORIDA AGRICULTURAL EXPERIMENT STATION

How to Use THE SOIL SURVEY REPORT

THIS REPORT IS about the soils of Dade County, Florida. It contains a description of each kind of soil and tells how the soil can be used, how it responds to treatment, what care it needs, and what yields you can expect. Maps accompanying the report show the location and extent of each soil. If you want to know how the soils were formed and how they are classified, some information on these subjects is given in a technical section, Morphology, Genesis, and Classification of Soils.

SOILS OF A FARM

If you want to know about the soils of a farm or other tract, first find the place on the map. The map shows election precinct and section lines, towns and villages, roads, streams, most houses in rural areas, and other landmarks. Remember that an inch on the map equals a mile on the ground. Each soil is marked with a symbol, such as AA, and the extent of each area is shown by a boundary line. Colors on the map help you pick out the areas of different soils.

The map legend sheet has the soil symbols arranged in alphabetical order and the name of each soil. The symbol AA, for example, is used for Arzell fine sand. All areas of this soil, wherever they appear on the map are shown in the same color and marked with this symbol. Soil names are listed in the table of contents, so you can turn easily to the right page in the section, Soil Types and Phases. There the soil is described and some information is given about its use and management. Additional information about some of the important soils is given in the section, Use and Management of Cultivated Soils.

SOILS OF THE COUNTY AS A WHOLE

A general idea of the soils is given in the section, Physiography, Drainage, and Vegetation, and the section, Soil Series and Their Relations. The section on soil series tells about the principal kinds of soils, where they are found, and how they are related. While reading this section, refer to the soil map and notice how the different kinds of soils tend to be arranged in different parts of the county. For example, contrast the soil pattern of the marls in the south with the rocklands extending northeast-southwest. Colors on the map help bring out this contrast.

A newcomer to the county, especially if he considers buying land, will want to know something about physiography; drainage; vegetation; water supply; climate; land use; types of farming; centers of population; size of farms, their principal products, and how they are marketed; kinds and conditions of farm tenure; and farm equipment and machinery. Information about all these will be found in the section, General Character of the Area, and the section, Agriculture.

Series 1947, No. 4 Issued April 1958

SOIL SURVEY (DETAILED-RECONNAISSANCE) OF DADE COUNTY, FLORIDA [1]

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United States Department of Agriculture in cooperation with the University of Florida Agricultural Experiment Station

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[1] This report was written by Ralph G. Leighty, Soil Survey, United States Department of Agriculture and the University of Florida Agricultural Experiment Station, and J. R. Henderson, University of Florida Agricultural Experiment Station.

[2] Soil Survey was transferred to the Soil Conservation Service on November 15, 1952.

A LARGE PART OF Dade County is not developed for farming, even though it is one of the few places in the United States where the climate will permit growing fruits and vegetables in winter. Some of the soils already cultivated support prosperous farms. There is no simple answer to the question why all the rest of Dade County is not under cultivation. It is clear, however, that there are important differences among the soils and that crops and practices that will succeed on one kind of soil may not on another. It is also fairly clear that most soils of Dade County need special treatment to be productive. Many have to be drained before they can be cultivated. But if water levels are lowered too much the peat soils may subside or even burn up from accidental fires. Furthermore, nearly all the soils of Dade County need heavy fertilization. Some of them need copper, zinc, manganese, or other minor elements. Consequently, agriculture develops gradually as trial farms show promise of success on particular kinds of soils. In this respect, the soil map accompanying this report is especially important; for when a crop or management practice proves successful on a certain soil, farmers want to know where other areas of that soil are located in the county.

Much research is needed to learn the most effective way to handle southern Florida soils and to discover new and superior plant varieties or new crops. Most of the crops now produced in Dade County have a high value per acre. They are marketed at a season when there is no competition from cooler sections and, consequently, command high prices. On the other hand, the market for winter-grown fruits and vegetables is very sensitive to increases in supply. Large expansions of production are likely to result in unfavorable prices. Therefore, it is important to choose carefully the soils to be brought into cultivation and to select those on which the costs of development and production are lowest in relation to yields. The soil map is an important means of recognizing such areas.

To provide a basis for determining the best agricultural uses of the soils, this cooperative soil survey was made by the United

States Department of Agriculture and the University of Florida Agricultural Experiment Station. Field work was completed in 1947, and unless otherwise indicated, all statements in this report refer to conditions in the county at that time.

GENERAL CHARACTER OF THE AREA

LOCATION AND EXTENT

Dade County occupies more than half of the southern tip of the Florida peninsula (fig. 1). It is bounded on the east by the Atlantic Ocean, on the south by Florida Bay, on the west by Monroe and Collier Counties, and on the north by Broward County. The county is roughly rectangular. It extends approximately 55 miles from north to south and 47 miles from east to west. The area is 2,109 square miles or 1,349,760 acres. Miami, the county seat, is about 410 miles southeast of Tallahassee, the State capital, and 325 miles south of Jacksonville.

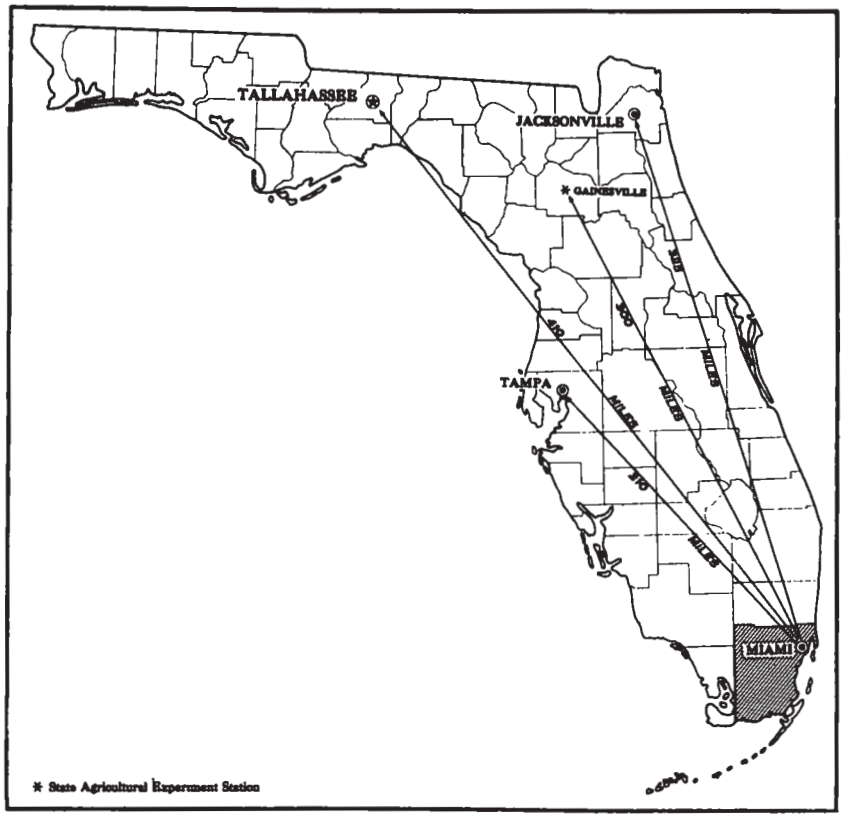

FIGURE 1.—Location of Dade County in Florida.

SETTLEMENT

Ponce de Leon and his men, in 1513, were the first Europeans to visit the area. But the first settlement was not until 1567, when Menendez built a blockhouse near the present site of Miami and left a garrison of 30 soldiers. The place was abandoned the following year because of hostile Indians. Jesuit missions to the Indians were established and abandoned in 1568, and again in 1753.

The United States came into possession of Florida in 1821, and soon afterward the Egan and Lewis families obtained sections of land on the Miami River fronting on Biscayne Bay. In 1827 a man named Fitzpatrick, from Key West, purchased these lands. He erected buildings, imported slaves, and cleared the hammocks. He planted guavas, limes, and other subtropical fruits and grew cotton and sugarcane. The Seminole War in 1837 put a stop to this farming, and many of the fruit trees were destroyed. These lands were deeded by Fitzpatrick to his nephew, William F. English of South Carolina. English built a stone house and slave quarters and again put the lands to extensive agriculture for about 3 years. He died in 1849 and his heirs sold the lands to Dr. J. V. Harris in 1869. In 1890, Mrs. Julia D. Tuttle of Cleveland, Ohio, bought a part of the estate first owned by English. Through her efforts Henry M. Flagler was induced to extend his Florida East Coast Railroad to Miami. After the coming of the railroad, agricultural development was rapid.

ORGANIZATION AND POPULATION

The county was organized in 1836 and was named in honor of Maj. Francis L. Dade, an American Army officer. He helped defend the early settlers at Fort Dallas, the present site of Miami, from hostile Indians during the Seminole War. The present boundaries of the county were fixed in 1915.

The population of Dade County was 495,084 in 1950. Most of the people live in the eastern part of the county. In 1950 the Miami Urbanized Area had a population of 458,647. In 1950 the populations of several of the towns in the rural areas to the south were as follows: Perrine, 2,859; Homestead, 4,573; Florida City, 1,547. The population of Dade County has increased more than threefold since 1930. The rural population was 117,530 in 1950. The rural nonfarm population was 113,052, and the rural farm population was only 4,478. Most of the county, the inland and western parts, is still in natural vegetation and provides a breeding and feeding area for birds and wild animals.

TRANSPORTATION, MARKETS, AND OTHER FACILITIES

Dade County is served by two railroads. The eastern half of the county has a network of paved and graveled roads, but the western half is still undeveloped. Water and air transportation are extensively used. Much of the county's production of vegetables and fruits is shipped by train and truck to northern markets. Numerous industries are located in Miami and the surrounding communities.

School children in the small towns and rural areas are transported by bus to consolidated schools. The county school system includes several high schools in Miami and a large high school near Homestead.

The University of Miami is located at Miami. A branch of the University of Florida Agricultural Experiment Station, located at Homestead, carries on experiments on subtropical fruits and plants. Churches are conveniently located in the eastern part of the county.

Electric and telephone lines reach most of the developed rural areas and serve most of the farm dwellings. The waters and beaches of the county provide recreation throughout the year. Fish and game are varied and abundant. The southwestern part of the county has been turned over to the Department of the Interior for development of Everglades National Park.

PHYSIOGRAPHY, DRAINAGE, AND VEGETATION

Dade County lies within the Floridian section of the Coastal Plain province (*5*).[3] It is part of the Coastal Lowlands (*1*), which in this area is a low, almost level plain containing swamps, marshes, and low ridges.

The entire county is underlain at a shallow depth by limestone or calcareous rocks (*2*). Most of this rock is Miami oolite—a limestone that is crossbedded to massive and almost pure to sandy. The underlying Tamiami formation, a calcareous sandstone or sandy limestone, is exposed in small areas along the western boundary and at the northwestern and northeastern corners. Several keys off the south coast are made up of Key Largo limestone, a coraline deposit. On the mainland, the rock floor forms a narrow ridge near the eastern shore and, to the west of the ridge, a broad shallow trough that is the Everglades basin.

In many places rock is exposed at the surface, especially on the ridge. Elsewhere, the rock is covered by a mantle of sand, marl, or organic material, or combinations of these. Rock surfaces and type of surface material have strongly influenced natural drainage and native vegetation.

Elevations range from sea level to about 25 feet above sea level. The elevation of the Florida East Coast Railroad at Florida City is 9.8 feet above sea level; at Homestead, 910 feet; at Kendall, 13.0 feet; at Perrine, 13.0 feet (*7*). The elevation at the Flagler station of the Seaboard Airline Railroad in Miami is 11.0 feet above sea level. The elevation at the stone archway on the Tamiami Trail at the Collier-Dade County line is 8.4 feet above sea level.[4]

Because Dade County is so low and flat, it is naturally poorly or very poorly drained. A few low ridges near the east coast are well drained or excessively drained. In the western half of the county, the natural drainage is to the south and southwest through broad shallow sloughs and long narrow areas of cypress swamp. The eastern and southern coasts have numerous embayments, rivers, creeks, and lagoons that extend inland to join the indistinct drainageways of the interior. In the east many canals have been dug to drain the land. Most of these canals have no mechanical structures to control the flow of water, and they have lowered the water level of adjacent lands considerably. As a result, irrigation is often necessary

[3] Italic numbers in parentheses refer to Literature Cited, p. 56.

[4] Elevations obtained from a recent survey made by the Soil Conservation Service, U. S. Department of Agriculture.

on the higher lying pinelands, and occasionally on some of the lower lying lands. In some canals where the gravitational flow of water is very slow, pumps of various sizes are used. The largest pumps have a capacity of 200,000 gallons per minute. Much of the county may be covered by water 2 to 60 inches deep for many days.

The vegetation of Dade County is similar to that in the rest of southern Florida (*3*). It consists of a great variety of plants of distinctly tropical and temperate-zone species. The kinds of plants are locally influenced by variations in soils, water levels, rainfall, and lay of the land.

In Dade County the main physiographic and soil-association areas [5] are: (1) Cypress swamps, (2) mangrove swamps and tidal marshes, (3) marl glades, (4) peat marshes, (5) rocky glades, (6) rocky pinelands, (7) sandy pinelands, and (8) sandy prairies. Description of these areas and their drainage and vegetation is given below; their extent is shown in figure 2. Some miscellaneous land types not shown in figure 2 are Coastal beaches; Made land; and Mines, pits, and dumps.

Cypress swamps.—These swamps are in the west, north of the Tamiami Trail. They border marl glades or peat marshes and extend westward as the Big Cypress Swamp of Collier and Monroe Counties. The surface material is marl or organic deposits. Drainage is poor or very poor. Some of the cypress swamps are long narrow areas that serve as drainageways; others are large bodies with no apparent drainage pattern. The vegetation is mainly cypress trees, but north of the Tamiami Trail there is some sawgrass and waxmyrtle. South of the Trail the open glades have a sparse growth of sawgrass and povertygrass.

Mangrove swamps.—These swamps and marshes occur on the eastern and southern coasts. In the northeast they form a narrow belt just inland from the barrier beaches. To the south they broaden into a belt 8 to 10 miles wide. All these areas are only slightly above sea level and are frequently inundated by salt or brackish water. The surface material is marl or organic deposits. Vegetation in the marshes between the rock rim and the coast is mainly a sparse cover of native sawgrass and needlegrass. In the south, myrtle and bay grow along the drainageways. Vegetation in the eastern tidal swamps is mostly red mangrove; in the southern tidal swamps it is black mangrove. Low shrubs and grasses and some cabbage palmetto, mahogany, and buttonwood trees grow on the brackish marl in the south.

Marl glades.—These glades border the rocky pinelands on the east, south, and southwest and extend across them in many places. Less extensive areas are in the western part of the county. Marl glades lie at lower elevations than the rocky pinelands but at higher elevations than the peat marshes. The surface mantle is marl, 2 to 72 inches thick. This is underlain by oolitic limestone in the east and south, and by either the Miami oolite or the Tamiami formation in the west. Drainage of the marl glades is poor to very poor. Much of the area may be covered with brackish or salt water during very high tides.

The vegetation in the western marl glades is of the hammock-and-glades variety. The hammocks are from 6 to 18 inches higher than

[5] For a similar grouping see Soil Associations of Dade County, Florida (*8*), published in 1954.

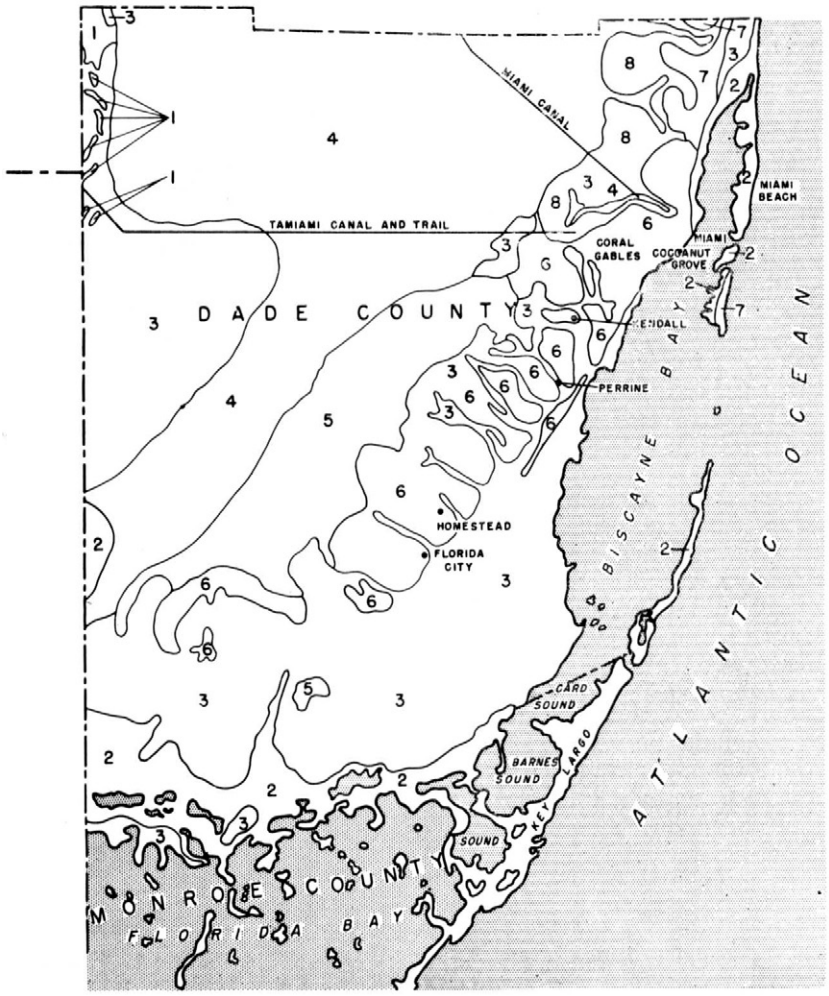

FIGURE 2.—Physiographic and soil-association areas of Dade County, Fla. 1, cypress swamps; 2, mangrove swamps; 3, marl glades: Flamingo, Hialeah, Ochopee, Parkwood, and Perrine soils; 4, peat marshes: Everglades, Gandy, and Loxahatchee soils; 5, rocky glades; 6, rocky pinelands: Rockdale soils; 7, sandy pinelands: Broward, Dade, Palm Beach, St. Lucie soils; 8, sandy prairies: Arzell and Davie soils.

the surrounding glades and support a nearly pure stand of cabbage palmetto, or a mixture of cabbage palmetto, live oak, gumbo-limbo, wild citrus, tamarind, and many vines and ferns. In the areas of marl glades bordering the rocky pinelands, the native vegetation is mainly sawgrass, saltgrass, switchgrass, needlegrass, and reedgrass; various sedges, reeds, and other aquatic plants; and mimosa, buttonwood, and black mangrove.

The soils of the marl glades are of the Flamingo, Hialeah, Ochopee, and Perrine series. The hammocks are mainly Parkwood soil.

Peat marshes.—These marshes occur in a broad area in the western and southern parts of the county. They have developed in the deepest parts of the trough formed by the rock floor. The peat mantle varies from 2 to 60 inches in thickness. Drainage is very poor. The excess surface water moves very slowly through broad shallow sloughs interspersed with slight ridges.

This ridge-slough area contains thousands of small oval-shaped islands interspersed with sloughs and small ponds or lakes. During much of the year, the sloughs are filled with water; aquatic plants grow profusely, especially the bladderworts, coontail moss, spiderlily, bonnets, and a few grasses. Sawgrass usually grows along the slough borders. The islands are mostly of the bay-head type. Their vegetation is mainly whitebay and sweetbay, waxmyrtle, and dahoon holly, with an undergrowth of royalfern, cinnamonfern, and swampfern. The natural cover on the outer marshes is mainly sawgrass.

The soils of the peat marshes are members of the Everglades, Gandy, and Loxahatchee series.

Rocky glades.—These occur in a large area between the higher lying rocky pinelands on the east and south and the lower lying peat marshes on the north and west. The vegetation is mainly sawgrass, switchgrass, beardgrass, sedges, and rushes and some slash pine and cypress in the western areas. A few bay heads have a growth of waxmyrtle and other trees and shrubs. Rockland is the land type mapped on the rocky glades.

Rocky pinelands.—The rocky pinelands form a belt 4 to 10 miles wide that extends from Cocoanut Grove southwest to Florida City. Elevations average 9 feet above sea level but range from 5 to 20 feet. This is the highest large area of land in the county. The rock formation, Miami oolite, is exposed in many places. Drainage is rapid down to the water table. Percolating waters have dissolved the rock and formed numerous holes and small cavities. These solution holes are filled with gray or grayish-brown fine sand, or brown or reddish-brown fine sandy loam or clay loam. The vegetation is mainly slash pine, saw-palmetto, subtropical shrubs, wiregrass, switchgrass, and a scattering of oaks and other hardwood trees. The soils on these lands belong to the Rockdale series.

Sandy pinelands.—These pinelands form a belt 4 to 6 miles wide just inland from the eastern shore. This belt extends south from the Broward-Dade County line to Coral Gables. The rock floor is 3 to 5 feet above sea level. It is covered with a mantle of sand ranging from 6 to 72 inches in thickness. Drainage is rapid, mainly by percolation through the sands and permeable rocks. The native vegetation is mostly slash pine, saw-palmetto, and short grasses. Scattered hammocks have a thick growth of scrub oak, rosemary, and other trees. The soils on the sandy pinelands are of the Broward, Dade, Palm Beach, and St. Lucie series.

Sandy prairies.—The main area is a strip 2 to 6 miles wide, west of the sandy pinelands. This strip extends south and southwest from the Broward-Dade County line for a distance of about 20 miles. The elevations of the rock floor in this area are slightly lower than those of the sandy pinelands. In places the sand mantle over the rock is as much as 5 feet thick. Generally it is much thinner, especially at

the southern end of the area. Originally this land was poorly drained, but extensive drainage operations have lowered the water table. Most of the soil is now well drained to excessively drained. The native vegetation was tall grasses, but since drainage a scattered growth of slash pine has taken hold. The soils on the sandy prairies are of the Arzell and Davie series.

CLIMATE

Data typical of the climate for the whole of Dade County are given in table 1. This information is compiled from records taken at the United States Weather Bureau Station at Homestead.

TABLE 1.—*Normal monthly, seasonal, and annual temperature and precipitation at Homestead, Dade County, Florida*

[Elevation, 11 feet]

Month	Temperature [1]			Precipitation [2]			
	Average	Absolute maximum	Absolute minimum	Average	Driest year (1938)	Wettest year (1947)	Average snowfall
	° *F.*	° *F.*	° *F.*	*Inches*	*Inches*	*Inches*	*Inches*
December	67.3	89	26	1.51	0.71	1.45	0
January	66.5	88	28	2.19	2.69	1.45	0
February	66.6	92	26	1.84	.81	1.95	0
Winter	66.8	92	26	5.54	4.21	4.85	0
March	68.3	93	26	1.90	1.72	1.24	0
April	73.0	95	39	3.66	.07	3.72	[3]
May	76.3	96	49	6.30	3.78	5.95	0
Spring	72.5	96	26	11.86	5.57	10.91	[3]
June	79.4	100	58	8.50	5.65	22.51	0
July	80.4	100	63	6.97	10.07	13.62	0
August	80.9	98	64	8.30	1.63	12.07	0
Summer	80.2	100	58	23.77	17.35	48.20	0
September	80.1	96	61	8.54	6.44	10.37	0
October	76.8	95	42	9.77	4.41	15.96	0
November	71.0	91	30	3.12	2.44	3.78	0
Fall	76.0	96	30	21.43	13.29	30.11	0
Year	73.9	100	26	62.60	40.42	94.07	[3]

[1] Average temperature based on 44-year record, through 1954; highest and lowest temperatures on a 22-year record, 1931–52.

[2] Average precipitation based on a 44-year record, 1911–54; wettest and driest years based on a 44-year record, 1911–54; snowfall based on a 22-year record 1931–52.

[3] Trace.

387498—58——2

Dade County has a subtropical humid climate. Summers are long and warm, and winters are short, mild, and sunny. Temperatures are kept moderate by the sea breezes from the Atlantic Ocean and the Gulf of Mexico. Summer temperatures are also lowered by the almost daily afternoon thunderstorms that frequently last only an hour or two. The pleasant winter temperatures attract many visitors. Cold windy spells in winter are infrequent and last only a day or so. During the winter season frosts destructive of vegetables and some fruits have come in 14 years out of the 24 years of record. In 10 years out of the 24 recorded, no frost occurred. Sometimes several years in succession are without frost.

About three-fourths of the rain falls from May through October, generally as heavy thundershowers. During the rest of the year the rainfall is very light. There is too much rain for crops during some periods and too little in others.

The climate is favorable for winter vegetables, citrus fruits, avocados, papayas, mangoes, guavas, and other subtropical fruits. Native grasses can be grazed all year long, and no shelter is needed for livestock.

From August through November occasional storms of the hurricane type come from the Tropics and cross Dade County. During a hurricane the rain often does more damage to crops than the wind. Adequate warning and improvement in building construction and design help lessen the damage from hurricanes. The damage to fruit trees and vegetables remains great, however.

WATER SUPPLY

The county is well supplied with water. Most of the county is underlain at shallow depths by the Miami oolitic limestone and the Tamiami formation. These are highly permeable rock that transmit water easily. Livestock water is pumped from shallow wells or from numerous ponds and canals. Water for home use is obtained from shallow wells, 20 to 40 feet deep. Pumping is done mainly by electric power. Most of the farm houses are supplied with running water. The water for the towns is obtained from wells 40 to 90 feet deep. Sometimes during the dry seasons, salt water contaminates the wells near the seashore.

During dry periods water is used for irrigating some of the vegetables and fruits. Whenever possible, water for irrigation is pumped from the canals. Otherwise irrigation wells are dug 20 to 40 feet deep and pumps are used. Fruit groves are irrigated mainly by an overhead sprinkling system. Vegetable crops are irrigated by the furrow or by the overhead sprinkling system.

SOILS OF DADE COUNTY

The soils of Dade County are in many respects similar to several of the soils of Broward, Collier, and Palm Beach counties. They were derived from marine deposits made when the sea covered this part of the State, and from recent deposits of organic materials and marl. The soils have developed under the influence of a humid, subtropical climate.

The soils of the county differ greatly from one another in many characteristics, such as color, texture, consistence, depth, reaction, fertility, relief, drainage, stoniness, permeability, and tilth (*10*).

They exhibit many shades of color from nearly white through gray, yellow, and brown to nearly black. Most of the mineral soils have light-colored surface soils. On the hammocks and in some of the depressions, however, partly decayed vegetable matter has accumulated and given the soils a dark color. In most of the soils the lower layers are chiefly light gray, mottled in some areas with numerous shades of gray, yellow, and brown. The organic soils have black or brown peaty layers over light-colored sand, marl, or limestone.

Most of the mineral soils are low in organic matter. Many of them, however, have a thin layer of loose, partly decomposed vegetal matter on the surface. These plant remains are not well incorporated in the soils and usually disappear with cultivation. On the peat marshes the organic material varies from a few inches to about 80 inches in thickness.

The texture ranges from fine sands to silt loams and clay loams. On the low ridge in the eastern part of the county, the surface soils are fine sands, fine sandy loams, and silty clay loams. The texture usually remains the same to the underlying limestone. On the marl glades, the surface soils are mainly silt loams, but some soils in the extreme western part of the county are loamy fine sands. Some of the marls in the southern part of the county are silty clay loams or silty clays. The organic soils are fibrous, nonfibrous, or a combination of both.

In fertility and reaction the soils vary greatly. The reaction of the soil is its degree of acidity or alkalinity expressed mathematically as the pH value. A pH value of 7 indicates precise neutrality; higher values, alkalinity; and lower values, acidity. Indicator solutions are used to determine the reaction. The presence of lime is detected by the use of a dilute solution of hydrochloric acid. The terms referring to reaction that are commonly used in this report are the following (*11*):

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

Some of the soils and the peats have slightly to strongly acid upper layers but have neutral to alkaline lower layers that usually are directly above marl or limestone. The soils on the marl glades are highly alkaline. Most of the soils are very low in natural fertility and need liberal application of fertilizers for normal growth of crops.

The relief is that of a nearly level plain that slopes very gently from north to south and southwestward to the sea. Except for the low ridges near the eastern coast, the soils are naturally poorly drained and the water table is generally near the surface. Water covers most of the peat soils in the Everglades basin during many months of the year. The marl glades in the southeast are artificially drained for crops.

The soils are permeable to roots. Even in areas of rocky outcrops, trees and grasses are growing in cavities or solution holes in the porous rocks where soil materials have accumulated. The tilth of

most soils is favorable for cultivation, but some of the marls puddle and clod when tilled under unfavorable moisture conditions.

SOIL SERIES AND THEIR RELATIONS

The soils of Dade County are placed in 15 series and 6 miscellaneous land types. The characteristics of each soil series are given in table 2. The mapping units are grouped in this table as (1) sands, (2) rocky lands, (3) marls, and (4) peats. Another grouping, miscellaneous land types, is not shown in the table. These land types are Cypress swamp; Mangrove swamp; Coastal beach; Made land; Mines, pits, and dumps; and Rockland. They do not have enough soil material to be classed as true soils.

Rocky lands are mostly outcrops of porous limestone containing numerous cavities filled with or covered by a thin layer of soil.

Marls vary in texture according to the particle size of their main constituent, calcium carbonate, and the amount of clay or other material that has been mixed with it. The Perrine marl is chiefly calcium carbonate. The Ochopee fine sandy marl, shallow phase, is a mixture of calcium carbonate and quartz sand. The Hialeah mucky marl has alternate layers of organic material and siltlike calcium carbonate. Flamingo marl has the textural properties of a silty clay or clay.

Peats vary considerably according to the kind of organic materials or plants from which they were formed, the thickness of the peat mantle, and the character of the underlying materials. They have formed mainly from (1) sawgrass; (2) lilies, bonnets, and other water-tolerant plants and (3) leaves and stems of woody plants. The peats in Dade County range from 6 to 96 inches in thickness. Three depth phases are recognized: the regular, with 60 to 96 inches of peat; the shallow phase, with 36 to 60 inches; and the very shallow phase, with less than 36 inches. In each of these, the peat mantle may lie directly on the limestone or may be separated from it by a layer of sand or marl.

SOIL TYPES AND PHASES

On the following pages, the soils and miscellaneous land types are described in detail and their agriculture is discussed. In table 3 their acreage and proportionate extent are given. Their location and distribution are shown on the accompanying soil maps. The discussions of the soil types, soil phases, and miscellaneous land types are arranged in alphabetic order on the following pages.

Arzell fine sand (Aa).—This soil occurs on nearly flat outer edges of the sandy prairies. It has developed from comparatively thin deposits of marine fine sand that lie over limestone. It is very low in organic-matter content and available plant nutrients. Much of it lies in the northeast near the sandy pinelands in the area of the Little River and near Opalocka. This soil is closely associated with Dade fine sand and Davie fine sand. It is poorly drained, whereas the Dade fine sand is well drained to excessively drained. Its light-gray, thin surface soil contrasts with the gray surface soil of Davie fine sand.

The present wild vegetation consists of three-awngrass, poverty-grass, switchgrass, broomgrass, carpetgrass, and wiregrass.

TABLE 3.—*Acreage and proportionate extent of soils mapped in Dade County, Fla.*

Soil	Acres	Percent
Arzell fine sand	3,949	0.3
Broward fine sand	279	(1)
Coastal beach	1,323	.1
Cypress swamp (unclassified soils)	5,728	.4
Dade fine sand	20,278	1.5
Davie fine sand	23,176	1.7
Davie fine sand, shallow phase	558	(1)
Davie mucky fine sand	21,312	1.6
Davie mucky fine sand, shallow phase	766	.1
Everglades peat	43,403	3.2
Everglades peat, over shallow marl	981	.1
Everglades peat, shallow phase	54,854	4.1
Everglades peat, shallow phase over deep sand	764	.1
Everglades peat, shallow phase over shallow marl	23,931	1.8
Everglades peat, shallow phase over shallow sand	7,759	.6
Flamingo marl	2,136	.2
Gandy peat	6,889	.5
Gandy peat, shallow phase	4,803	.4
Hialeah mucky marl	10,681	.8
Loxahatchee peat	92,594	6.9
Loxahatchee peat, deep phase	46,609	3.4
Loxahatchee peat, over shallow marl	23,091	1.7
Loxahatchee peat, shallow phase	37,165	2.8
Loxahatchee peat, shallow phase over shallow marl	76,545	5.7
Loxahatchee peat, shallow phase over shallow sand	27,197	2.0
Made land	9,228	.7
Mangrove swamp (unclassified soils)	78,059	5.8
Mines, pits, and dumps	947	.1
Ochopee fine sandy marl, shallow phase	94,680	7.0
Palm Beach fine sand	999	.1
Parkwood fine sand	264	(1)
Perrine marl	41,460	3.1
Perrine marl, peat substratum phase	58,255	4.3
Perrine marl, shallow phase	67,191	5.0
Perrine marl, shallow, peat substratum phase	16,031	1.2
Perrine marl, tidal phase	43,756	3.2
Perrine marl, very shallow phase	79,080	5.8
Rockdale fine sand, level phase—Limestone complex	69,068	5.1
Rockdale fine sand, undulating phase—Limestone complex	1,989	.1
Rockdale fine sandy loam, level phase—Limestone complex	93,348	6.9
Rockdale fine sandy loam, undulating phase—Limestone complex	371	(1)
Rockland	120,253	8.8
St. Lucie fine sand	2,810	.2
Water	35,200	2.6
Total	1,349,760	100.0

[1] Less than 0.1 percent.

Profile description:

0 to 3 inches, light-gray or light brownish-gray loose fine sand, containing a small quantity of coarsely divided organic matter; medium to slightly acid.

3 to 12 inches, light-gray loose fine sand; medium to slightly acid.

12 to 60 inches +, white loose fine sand with a few streaks of pale yellow; slightly acid to neutral.

The depth to the underlying limestone ranges from 36 to 72 inches.

In some of the lower areas of this soil, the surface soil has a thin covering of muck. In higher lying areas the surface soil may be nearly white.

Use and management.—If water control, organic-matter maintenance, and fertilizer requirements are given special attention, many kinds of vegetables and grasses can be grown on Arzell fine sand. With good water control, areas of this soil in adjoining counties produce snap beans, peppers, eggplant, lima beans, cucumbers, and tomatoes. In Dade County, however, most of the soil has already been overdrained.

At the time of survey about half of the soil was in pasture and only a few acres was in crops. Suitable pasture plants for this soil are Pangolagrass, bermudagrass, Coastal bermudagrass, Pensacola Bahiagrass, carpetgrass, and Paragrass. The Pangolagrass, Coastal bermudagrass, and Paragrass may be established by sodding or by spreading green vegetative materials at the rate of 500 pounds per acre and then covering them by disking. Seed Bahiagrasses, carpetgrass, and bermudagrass at the rate of 10 to 15 pounds per acre. Apply from 300 to 600 pounds per acre of a 8–8–8 [6] or a similar fertilizer shortly after seeding or sodding. Control grazing on new pastures until the grasses are well established. Mowing once or twice a year will help to control weeds and to establish a good sod. Established pastures are maintained by an application of 32 to 48 pounds of nitrogen, which is supplied alternatively by 8–8–8 or a nitrogen material, applied at intervals of 60 to 120 days during the growing season.

Broward fine sand (Ba).—This soil occurs in the northeastern part of the county on nearly level, low-lying tracts of sandy pinelands. Most of it is about 2 miles west of North Miami Beach. It has developed from a thin mantle of fine sands that was deposited over limestone when the ocean was at a higher level. Generally the soil is imperfectly drained, but in places artificial drainage is required for crops. This soil is similar to Dade fine sand. Broward fine sand differs from Dade fine sand chiefly in being less well drained and darker colored.

The vegetation consists of second-growth slash pine, saw-palmetto, a scattering of cabbage palmetto, and a few species of grasses.

Profile description:

0 to 6 inches, dark-gray to light brownish-gray loose fine sand containing a small to medium amount of organic matter that gives it a salt-and-pepper appearance; slightly acid to neutral.
6 to 26 inches, light-gray to pale-yellow loose fine sand; slightly acid to neutral.
26 inches +, limestone.

The surface soil varies from dark gray to light brownish gray in color and from 3 to 6 inches in thickness. The second layer ranges from light gray or white to pale yellow or light yellowish brown, or these colors may occur as mottles. The depth to limestone bedrock varies from 18 to 36 inches. In some places a 1- to 2-inch layer of mottled yellow and gray fine sandy clay loam overlies the limestone.

Mapped with this soil type is an area of about 20 acres having a

[6] Percentages, respectively, of nitrogen, phosphorus, and potassium.

6- to 10-inch dark grayish-brown surface layer of fine sand that is underlain by white loose fine sand. At depths of 36 to 40 inches this included soil has about 12 inches of light brownish-gray or grayish-brown fine sand, which overlies the limestone.

Use and management.—About half of this soil is in pasture. The rest is in wild vegetation or is used as building sites for homes.

In some of the counties to the north, this soil is used extensively for vegetables, mainly snap beans, peppers, eggplant, and lima beans. These crops are fertilized with 1,200 to 2,000 pounds per acre of 4–7–5 or a similar fertilizer mixture. The total amount of mixed fertilizer is applied in two to four applications and is supplemented with a side dressing of nitrate of potash or nitrate of soda.

Areas of Broward fine sand used for crops should have a complete system of water control that will remove excess water in the rainy season and supply water for irrigation during the dry season. Maintaining a large supply of organic matter will help the soil hold water and plant nutrients. All of the crop residues and weeds should be disked into the soil. Pasture grasses may be established on this soil according to the methods described for Arzell fine sand.

Coastal beach (Ca).—This land type consists of narrow strips along the ocean shores of several islands on the east coast. These beaches are wind-and-wave deposits of sand and shell fragments. Most of them are devoid of vegetation or have a few coconut trees and a sparse growth of beach morning-glory, seagrape, sea-oats, and other salt-tolerant plants. The plants near the shore are affected by the steady winds and by salt in the soil and air. The Miami and Key Biscayne beaches are used for recreational purposes. Some of the area is used as building sites for resort hotels and the homes of winter residents.

Cypress swamp (unclassified soils) (Cb).—Rather large areas of this land type occur mainly as cypress stands and mixed swamps in the western part of the county. The areas are covered with water during the greater part of the year. Within short distances the soils vary in character of the materials, color, texture, consistence, and thickness of the various layers. In places, the soils consist of sands, marls, or peats or a mixture of these materials. In these swamps it was not practical to separate the intermingled soils into soil types and phases. Although this land has some commercially valuable timber, it is probably better suited as a wildlife refuge and for water storage.

Dade fine sand (Da).—Most of this soil occurs on the sandy pinelands. It extends from the northeastern county line south to Miami. It has developed from a thin mantle of marine sands deposited over limestone. The soil is well drained to excessively drained. It is associated with Broward, Arzell, and St. Lucie fine sands. Dade fine sand differs from the Broward in having better drainage and a lighter colored surface soil, from the Arzell in having better drainage, and from the St. Lucie in being shallower to limestone bedrock.

The vegetation consists of second-growth slash pine, saw-palmetto, low cycads or coonties, and tall and short grasses. A few hammocks covered with live oak, cabbage palmetto, gumbo-limbo, and other hardwood trees are scattered throughout the areas of this soil.

Profile description:

0 to 4 inches, light-gray loose fine sand; a small quantity of partly decayed organic matter gives this layer a salt-and-pepper appearance; medium to strongly acid.
4 to 22 inches, white to pale-yellow, loose, incoherent fine sand; medium to strongly acid.
22 to 34 inches, light brownish-gray to yellowish-brown loose fine sand; neutral to mildly alkaline.
34 inches +, limestone.

The layers vary in thickness within short distances. The surface layer ranges from 2 to 6 inches in thickness, the second layer from 8 to 30 inches, and the third layer from 0 to 3 inches. Limestone occurs at depths of 12 to 48 inches. In the northeastern part of the county, the limestone lies at greater depths than it does near Miami.

Use and management.—Dade fine sand is naturally infertile. It is coarse textured and retains moisture poorly. About 90 percent of it is in pasture. When the soil is used for crops, it requires frequent and liberal applications of fertilizer and organic matter, as well as irrigation water.

Generally this soil is not suitable for crops. However, about 80 acres is used for pineapples. The method of caring for the pineapples is given in the section, Use and Management of Cultivated Soils.

The native vegetation provides poor grazing for cattle. The carrying capacity of the pastured areas may be increased greatly by removing the growth of shrubs and planting improved grasses. Coastal bermudagrass, Pangolagrass and Pensacola Bahiagrass appear well suited to this droughty soil. Fertilization practices are similar to those given for Arzell fine sand.

Because of nearness to populated areas and freedom from excess moisture, areas of this soil are highly desirable for building sites. Areas not required for buildings could be managed to increase the quality and quantity of grasses for grazing and to improve the stand of trees suitable for lumber.

Davie fine sand (Db).—This soil occurs in fairly large areas in the sandy prairies that lie between Arzell fine sand and Everglades peat in the areas northwest, west, and southwest of Miami. It was originally covered with a thin layer of peat or muck. Most of the organic material in the surface soil has been destroyed by excessive drainage, natural oxidation and shrinkage, and fires. The sand is now at the surface.

Davie fine sand differs from the Arzell soi chiefly in having a darker and thicker surface soil. It differs from Everglades peat chiefly in having a sandier surface layer. Davie fine sand has poor to very poor natural drainage, but large areas are now overdrained. Pasture grasses and crops lack moisture during dry seasons.

The native vegetation was mainly sawgrass, but following drainage of adjacent areas, myrtle, groundsel, primrose-willow, and wild grasses have spread over most of the acreage not cultivated.

Profile description:

0 to 6 inches, dark-gray nearly loose fine sand; moderate amount of partly decayed organic matter gives layer a salt-and-pepper appearance; slightly acid to neutral.
6 to 40 inches, light-gray loose fine sand; slightly acid to neutral.
40 inches +, limestone.

The surface soil varies from dark gray to light brownish gray in color and from 6 to 10 inches in thickness. The lower layer ranges from light gray to pale yellow. In many places a yellowish-brown layer with black stains of organic matter lies directly on the limestone. The depth to the limestone ranges from 24 to 48 inches.

Use and management.—Approximately 1,200 acres are used for crops and about 10,000 acres are in pasture. The management and yields of vegetable crops on this soil are similar to those described for the Perrine marls in the section, Use and Management of Cultivated Soils. Under a good water-control system and under a high level of management, including liberal applications of good fertilizers, this soil could be very productive for vegetables, sugarcane, and pasture grasses.

Davie fine sand, shallow phase (Dc).—This soil differs from Davie fine sand chiefly in having limestone at depths of 8 to 24 inches. About 300 acres are used for pasture grasses; the remaining acreage has a cover of myrtle, groundsel, primrose-willow, and grasses. The soil is shallow to the underlying limestone, so water control is more difficult than on Davie fine sand. This soil is most profitably used for pasture grasses.

Davie mucky fine sand (Dd).—This soil occurs northwest and west of Miami on the edges of the sandy prairies that border the Everglades peats. The shallow peat layer of this soil has not yet been completely destroyed by fire or by slow oxidation following drainage. The soil is poorly to very poorly drained. It is closely associated with the Davie fine sand and differs from that soil mainly in having a thin layer of peat or mucky material over the sandy layers. The vegetation is similar to that described for Davie fine sand.

Profile description:

0 to 6 inches, black muck or finely divided fibrous peat.
6 to 10 inches, gray, nearly loose fine sand; slightly acid to neutral.
10 to 30 inches, light-gray loose fine sand; slightly acid but becomes neutral to alkaline with depth.
30 inches +, limestone.

The depth to the limestone ranges from 24 to 48 inches.

Use and management.—Most areas of this soil are in sections that have not been overdrained by the present system of canals. About 3,000 acres are used for crops, and about 6,500 acres are planted in improved grasses. The cultural practices and yields of vegetable crops on this soil are similar to those described for the Perrine marls in the section, Use and Management of Cultivated Soils. Treatments for pasture grasses are similar to those described for the grasses on Arzell fine sand. Under a good water-control system and a high level of management that includes liberal applications of good fertilizers, fair to good yields may be expected from winter vegetables and other crops.

Davie mucky fine sand, shallow phase (De).—This soil is similar to Davie mucky fine sand but differs from it chiefly in having limestone at shallower depths (8 to 24 inches). Only a few acres are used for crops, and less than 200 acres for pasture. Because it is difficult to control water, this soil probably is best suited to pasture grasses.

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Everglades peat (Ea).—This soil has developed in the eastern part of the Everglades basin, northwest and west of Miami, from the remains of sawgrass, lily, sedge, and myrtle. It is closely associated with the Loxahatchee peats but differs from them chiefly in having a black or very dark brown nonfibrous peat surface layer. Everglades peat is very poorly drained and may be covered with water during many months of the year.

Profile description:

0 to 12 inches, black, finely divided, nonfibrous peat made up of fairly well decomposed plants; mineral content ranges from 6 to 15 percent; slightly acid to neutral; gradual transition to layer below.
12 to 40 inches, grayish-brown fibrous peat containing stems and leaves of sawgrass, lily, and sedge; slightly acid to neutral.
40 inches +, limestone.

The surface layer varies from black to very dark brown in color and from 6 to 18 inches in thickness. The second layer ranges from brown to reddish brown. The limestone underlies the peat layers at depths ranging from 36 to 60 inches. Near the canals, where the water table has been lowered by artificial drainage, considerable oxidation of the organic material has taken place. As a result of this increased oxidation, the remaining peat has a higher mineral content, is less fibrous, and is more nearly black.

Use and management.—Less than 300 acres of this soil have been used for vegetable crops, and about 1,300 acres have been used for pasture. The cultural practices and yields of vegetable crops are similar to those described for the Perrine marls in the section, Use and Management of Cultivated Soils. Pasture management is similar to that on Arzell fine sand. However, less nitrogen and more potassium should be applied to crops on Everglades peat.

Owing to the moderate depth of the organic layer and to the high permeability of the underlying rocks to water, this soil is apparently not well suited to installation of water control for agriculture. If reclaimed, the water table should be kept near the surface to prevent unnecessary subsidence of the organic materials. Probably the soil is best used as a storage place for fresh water needed in the metropolitan area of Miami. Everglades peat would also serve as a wildlife refuge.

Everglades peat, shallow phase (Ec).—This soil differs from Everglades peat chiefly in having limestone at depths ranging from 12 to 36 inches. It occurs in the eastern edge of the Everglades basin, northwest and west of Miami.

Use and management.—Approximately 600 acres of this soil are used for crops, and about 1,700 acres as pasture for dairy cattle. Because it has a shallow deposit of organic material, this soil is probably less desirable for agriculture than Everglades peat.

Everglades peat, over shallow marl (Eb).—This soil occurs in association with the other Everglades soils and with the Loxahatchee peats in the eastern part of the Everglades basin. It differs from Everglades peat chiefly in having a thin layer of marl between the peat mantle and the underlying rocks. The thickness of the peat mantle ranges from 36 to 60 inches, and that of the marl layer, from a few inches to 24 inches. The marl acts as a water seal over the permeable rocks.

Use and management.—About 800 acres of this soil are used for vegetables. These crops are given rather heavy applications of potash and phosphorus but little nitrogen. The nitrogen is supplied partially or wholly by the decomposition of the organic matter. In most instances, some of the minor elements, particularly copper and manganese, are added with the fertilizer or by sprays. The treatments and yields of vegetable crops are similar to those described for the Perrine marls in the section, Use and Management of Cultivated Soils.

Everglades peat, shallow phase over shallow marl (Ee).—This soil occurs in association with the other Everglades peats and with the Loxahatchee peats near the eastern border of the Everglades basin, west and northwest of Miami. It differs from Everglades peat chiefly in having a peat mantle less than 36 inches thick that is separated from the underlying limestone by a thin layer of marl. The marl layer ranges from a few inches to 24 inches in thickness.

Use and management.—Only about 800 acres of this soil are used for crops, and about 200 acres for pasture. The cultural practices used and yields of the vegetable crops obtained are similar to those described for the Perrine marls in the section, Use and Management of Cultivated Soils. The thin mantle of peat subsides rapidly when artificially drained and cultivated; it therefore might not be economical to reclaim this soil for crops.

Everglades peat, shallow phase over deep sand (Ed).—This soil occurs in association with the other Everglades peats and with the Davie soils near the eastern border of the Everglades basin, northwest of Miami. It differs from Everglades peat chiefly in having a peat mantle less than 36 inches thick that is separated from the underlying limestone by a layer of sand 24 to 48 inches thick. Most of this soil is covered with sawgrass.

Use and management.—The thin mantle of peat subsides rapidly when artificially drained and cultivated. It is probably not economical to reclaim this soil.

Everglades peat, shallow phase over shallow sand (Ef).—This soil occurs in association with the other Everglades peats and with the Davie soils near the eastern border of the Everglades basin, northwest of Miami. It differs from Everglades peat chiefly in having a thin peat mantle, less than 36 inches thick, that is separated from the underlying limestone by a thin layer of fine sand. This sand layer ranges from 6 to 24 inches in thickness.

Use and management.—Approximately 500 acres are used for crops, and 300 acres are in pasture. The treatments and yields of vegetables are similar to those described for the Perrine marls in the section, Use and Management of Cultivated Soils.

Flamingo marl (Fa).—This soil occurs in association with the Perrine marls and Mangrove swamp (unclassified soils) in the extreme southwestern part of the county. It developed from very finely divided calcareous marine sediments laid down in brackish or salt water. It differs from the Perrine marls chiefly in being composed of fine-textured materials—silty clay or clay. Flamingo marl is very poorly drained and may be covered by brackish or salt water during very high tides.

The native vegetation is mainly saltgrass, coffeeweed, groundsel, mimosa, buttonwood, and black mangrove.

Profile description:

0 to 6 inches, light brownish-gray marl having a silty clay or clay texture; very sticky when wet, very hard when dry.
6 to 30 inches, very pale brown or light-gray marl with silty clay or clay texture; strongly plastic when wet, very hard when dry.
30 to 60 inches, light-gray marl with silty clay or clay texture; greenish tinge when moist; plastic when wet, very hard when dry.
60 inches +, limestone.

The soil is strongly alkaline throughout its entire depth. The surface soil varies from light brownish gray to dark grayish brown in color. The second layer ranges from very pale brown to dark gray. Limestone may be 60 to 72 inches below the surface. However, the third layer usually goes much deeper, sometimes to 20 feet, before the limestone is reached.

Use and management.—At present, all of this soil is too salty for cultivation and is a feeding and breeding area for birds and wild animals. In order to reclaim the soil for crops, it would be necessary to build dikes for the exclusion of the tidal water and to dig ditches and install pumps for water control. The fine-textured soil material hinders the movement of water, and reclamation would therefore be slow and tedious.

Gandy peat (Ga).—This soil occurs in the western half of the county. It is on the bay (laurel) and myrtle islands surrounded by fresh-water marsh vegetation in the central part of the Everglades basin. The islands probably started as floating masses of vegetation in the marsh. They eventually became anchored and stabilized and covered with a woody vegetation of bay and myrtle. These islands are from 1 to 3 feet higher than the surrounding marsh, which is covered with water during the greater part of the year. The marsh consists of the Loxahatchee peats. On some of the higher islands the upper 12 to 24 inches of the Gandy peat may be moderately well drained, but the lower part of the profile may be saturated with water. The native vegetation includes whitebay, myrtle bushes, small rubber-trees, ferns, and some sawgrass along the edges of the areas.

Profile description:

0 to 6 inches, reddish-brown to dark reddish-brown fibrous woody peat; some partially decomposed material gives this layer a slightly granular structure; medium acid.
6 to 20 inches, reddish-brown to grayish-brown partially oxidized fibrous woody peat; medium to slightly acid.
20 to 60 inches, brown to reddish-brown fibrous woody peat; slightly acid to neutral.
60 inches +, limestone.

The upper part of the soil profile is partially decomposed leaves and stems from the trees and shrubs. The lower part appears, in places, to be the remains of bonnet, lily, bladderwort, arrowhead, some sawgrass, and other aquatic plants.

In places the surface is covered by brown ashes and charcoal particles from the partial burning of the woody surface layer. In the

lower layers the peat varies from woody to fibrous. In many areas a thin layer of fine sand or marl is between the peat layer and the underlying limestone. The depth to the limestone ranges from 36 to 84 inches.

As this peat occurs in small isolated areas at great distances from good roads, none of it is used for crops. Some of the areas are used as camping sites by the frog hunters who operate in the surrounding marshes.

Gandy peat, shallow phase (Gc).—This soil differs from Gandy peat chiefly in having a peat mantle that ranges from 6 to 36 inches in thickness. In places a thin layer of sand or marl exists between the peat layer and the underlying limestone.

This peat occurs in small areas far from good roads, and none of it has been cleared for crops. Many of the soil areas are used as camping sites by hunters.

Hialeah mucky marl (Ha).—This soil has thin interstratified layers of marl and peat or muck. It occurs in association with the Perrine marls and Davie fine sands near the eastern border of the Everglades basin, west and northwest of Miami. It differs from the Perrine marls chiefly in having a stratum of peat or muck, and from the Davie fine sands in having a stratum of marl. Its natural drainage is very poor, but most areas have been artificially drained by canals and open ditches.

The native vegetation is sawgrass and other grasses, sedges, reeds, and other aquatic plants. Following drainage, myrtle, primrose-willow, and groundsel have become established on many areas.

Profile description:

0 to 6 inches, light-gray to dark-gray marl having a silt loam texture; strongly alkaline.
6 to 20 inches, brown to black nonfibrous peat or muck; slightly acid to neutral.
20 to 30 inches, light-gray fine sand; slightly acid to neutral.
30 inches +, limestone.

The soil as mapped includes areas in which the position of the first two layers is reversed. In places the soil seems to have had a covering of peat that has been burned. The thickness of the profile, as well as of each horizon, varies considerably. Limestone is usually at depths ranging from 24 to 60 inches.

Use and management.—About 2,500 acres of this soil are used for crops. Drainage problems, crops, fertilizer and management practices, and yields are similar to those described for the Perrine marls. However, the organic matter furnishes some nitrogen for the crops and therefore less is applied in the fertilizer mixture.

Loxahatchee peat (La).—This soil occurs in the central part of the Everglades basin in the western half of the county. It is associated with the Gandy and Everglades peats.

The native vegetation is lily, bonnet, arrowhead, pickerelweed, bladderwort, sedge, hyacinth, and some clumps of sawgrass. Numerous ponds containing frogs and other wildlife occur within the soil area.

Profile description:

0 to 10 inches, grayish-brown to dark grayish-brown, soft, felty fibrous peat; slightly acid to neutral.
10 to 48 inches, grayish-brown to reddish-brown, soft, felty fibrous peat; contains partially decomposed rhizomes and roots of aquatic plants such as sawgrass, sedge, bonnet, and arrowhead.
48 inches +, limestone.

This soil has 36 to 60 inches of very spongy fibrous material composed of the remains of succulent aquatic plants. The organic material, covered with water during the greater part of the year, rests directly upon limestone.

The surface layer varies from grayish brown to dark grayish brown. The second layer ranges from grayish brown to reddish brown.

Use and management.—None of this soil has been artificially drained, and there are several reasons why it should not be. When drained, the organic matter shrinks rapidly, and the low water-holding capacity of the soil material and the porosity of the underlying rock cause the soil to be droughty. Moreover, lowering of the water table by drainage causes the higher lying associated soils to be droughty. This soil should be left undrained as a wildlife habitat and water reserve.

Loxahatchee peat, deep phase (Lb).—This soil differs from Loxahatchee peat chiefly in having an organic layer that ranges from 60 to 96 inches in thickness. It occurs in the deepest part of the trough in the middle of the Everglades basin. This soil probably should remain in its natural condition as a breeding and feeding ground for birds, frogs, and other wildlife.

Loxahatchee peat, shallow phase (Ld).—This soil differs from Loxahatchee peat chiefly in having an organic layer less than 36 inches thick. It occurs in association with the other Loxahatchee peats and with the Gandy and Everglades peats. This soil probably should remain in its natural condition as a reserve for wild animals.

Loxahatchee peat, over shallow marl (Lc).—This soil differs from Loxahatchee peat mainly in having a 6- to 24-inch layer of marl between the layer of peat and the underlying rock formations. It can best be used as a wildlife and water-reserve area.

Loxahatchee peat, shallow phase over shallow marl (Le).—This soil differs from the typical Loxahatchee peat chiefly in having less than 36 inches of organic material and in having a 6- to 24-inch layer of marl overlying the limestone. It is apparently suitable as a breeding and feeding area for wild animals.

Loxahatchee peat, shallow phase over shallow sand (Lf).—This soil differs from Loxahatchee peat mainly in having a thin layer, less than 36 inches thick, of organic material that is separated from the underlying limestone by a 6- to 24-inch layer of fine sand. Its use is similar to that described for Loxahatchee peat.

Made land (Ma).—This land type was built up from dredgings from the bay bottoms in the vicinity of Miami and Miami Beach. Made land is used mainly as building sites for homes, hotels, and business establishments.

Mangrove swamp (unclassified soils) (MB).—This land type is mapped in the coastal areas of the county. Generally it supports a thick growth of mangrove trees. Small areas of salt-tolerant grasses, or tidal marshes, occur in the areas of mangrove trees. This land is frequently inundated by salt water. The soil material is sand, marl, or peat, or a mixture of these.

All of this land has a cover of wild vegetation and serves as feeding and breeding areas for many birds and animals. Commercial fishermen and sportsmen catch many fish in the streams, bays, and lagoons within and adjacent to the mangrove swamps. The mangrove trees are of low to medium height. They could be used as sources of tannin, charcoal, and lumber, but they occur in areas that were generally inaccessible at the time of survey.

Mines, pits, and dumps (Mc).—Areas of this land type occur mainly in the eastern half of the county. It includes areas from which Miami oolitic limestone has been quarried. The mines range from a few acres to several hundred acres in size. The size of the dumps also varies according to the thickness of the former sand mantle and the size of the mine. Abandoned mines are usually filled with water. In some places the dumps have been leveled for use as building sites.

Ochopee fine sandy marl, shallow phase (OA).—This soil occurs in large areas in the western part of the county. It is very poorly drained and may be covered by water during many months of the year. It differs from the other marls occurring in the county in containing a considerable quantity of fine sand mixed with the finely divided calcareous material. It is bordered on the east by the Loxahatchee peats.

The native vegetation is prairie, marsh, or forest. The prairies include a great variety of grasses, sedges, and rushes; the marshes, mainly sawgrass and spiderlilies; and the forested areas, mainly stunted or scrub cypress trees, 4 to 6 inches in diameter and 10 to 20 feet in height, and short grasses and sedges.

Profile description:

0 to 3 inches, dark grayish-brown very friable fine sandy marl having a loamy fine sand texture; strongly alkaline.
3 to 10 inches, grayish-brown very friable fine sandy marl with loamy fine sand texture; strongly alkaline.
10 inches +, limestone.

The surface layer varies from dark grayish brown to light brownish gray. The second layer ranges from grayish brown to light gray and from a loamy fine sand to a fine sand. A few mottles of light yellowish brown occur in places near the limestone. The depth to limestone varies from 4 to 12 inches within short distances.

Use and management.—As this soil is shallow over limestone and under water most of the year, it has not been drained for crop use. It is used as feeding and breeding areas for birds and other wildlife.

Palm Beach fine sand (PA).—This soil occurs principally on Key Biscayne, on Adams Key, and on smaller areas adjacent to Coastal beach and Mangrove swamp (unclassified soils) in the eastern part of the county. It has developed from thick beds of sand containing a large quantity of small shells or fragments of shells. It is well drained to excessively drained.

The native vegetation is seagrape, coconut palm, redcedar, cabbage palmetto, saw-palmetto, and a few subtropical hardwood trees.

Profile description:

0 to 10 inches, dark grayish-brown fine sand; moderate amount of partly decomposed organic matter; mildly to strongly alkaline.
10 to 20 inches, pale-brown fine sand; many small shells or fragments of shells; strongly alkaline.
20 to 40 inches, very pale brown to brownish-yellow fine sand; many small shells and fragments; strongly alkaline.
40 to 50 inches +, very pale brown fine sand; strongly alkaline.

The surface layer varies from very dark gray through dark grayish brown to brown in color and from 8 to 15 inches in thickness. The second layer ranges from pale brown to brownish yellow. The third layer contains a mixture of very pale brown and brownish-yellow fine sands and small shells. In places, marl is at depths of 40 to 50 inches.

None of this soil has been used for crops. On Key Biscayne about half the area of this soil is included in Crandon Park, and the rest will probably be used as building sites for winter homes.

Parkwood fine sand (Pb).—This soil occurs in the eastern part of the county on small areas having nearly level relief. It is poorly drained. The soil has developed from very thin beds of sand over marl or soft limestone. It occurs within areas of Perrine marl on islands that bear a dense subtropical vegetation consisting of cabbage palmetto, live oak and other hardwood trees, and an undergrowth of miscellaneous shrubs and vines.

Profile description:

0 to 10 inches, grayish-brown to dark-gray nearly loose fine sand; contains a considerable amount of partly decomposed organic matter; slightly acid to neutral.
10 to 18 inches, light-gray fine sand or loamy fine sand; neutral to slightly alkaline.
18 to 36 inches +, white or light-gray fine sandy clay loam (marl).

The surface layer varies from grayish brown to black in color and from 8 to 14 inches in thickness. The second layer ranges from light gray or light olive gray to gray in color and from 6 to 15 inches in thickness. The thickness of the sandy material over marl commonly ranges from 14 to 30 inches. The marl is generally a fine sandy clay loam, heavy fine sandy loam, or silty clay loam. The depth to limestone varies from 18 to 48 inches.

Owing to the high cost of clearing the dense vegetation from this soil, and because of the abundance of other soils more easily prepared for cultivation, none of Parkwood fine sand has been used for crops.

Perrine marl (Pc).—This is the dominant soil in the marl glades, which lie mostly east of the rocky pinelands from Miami to south of Florida City. It was derived from unconsolidated, finely divided, calcareous sediments that are mainly of fresh-water origin. The areas of this soil are nearly flat and only a few feet above sea level. The soil is poorly to very poorly drained. Large areas have been artificially drained by field ditches, laterals, and canals. A few of the canals contain check dams and pumps to assist in controlling the level of the ground water in the soil.

Perrine marl differs from Flamingo marl chiefly in having a higher content of silt and a lower content of clay. It differs from Ochopee

fine sandy marl, shallow phase, in having a lower content of fine sands mixed with the calcareous sediments. Generally it has a silt loam texture, whereas Flamingo marl has a silty clay loam or silty clay texture, and the Ochopee soil, a fine sandy loam or loamy fine sand texture.

The native vegetation is sedges and tall grasses, mainly switchgrass, reedgrass, needlegrass and sawgrass.

Profile description:

0 to 8 inches, grayish-brown friable marl of silt loam texture; strongly alkaline.
8 to 16 inches, very pale brown friable marl of silt loam texture; contains several small shells or fragments of shells; strongly alkaline.
16 to 30 inches, light-gray friable marl of silt loam texture; contains a few fragments and small shells; strongly alkaline.
30 inches +, limestone.

The surface layer ranges from light brownish gray to dark grayish brown in color and from 6 to 10 inches in thickness. In a few low-lying areas, a very thin layer of partly decomposed organic matter covers the surface. The second layer varies from light brownish gray to light gray in color and from 6 to 20 inches in thickness. The third layer may exhibit a few small pale-yellow mottlings within the light-gray color. The depth to the limestone ranges from 24 to 72 inches.

Included in this mapping unit are some small areas that consist of pale-yellow or yellow marl from the surface down to the limestone. These areas occur in the northeastern part of the county. As mapped, Perrine marl also includes small areas, or potholes, that are slightly lower and may be covered with water for longer periods than the typical soil. In many places these potholes support myrtle bushes and trees.

Use and management.—Perrine marl is used intensively for tomatoes (fig. 3), snap beans, potatoes, and other winter vegetables. About 17,000 acres of this soil are used for these crops. On this soil tomatoes

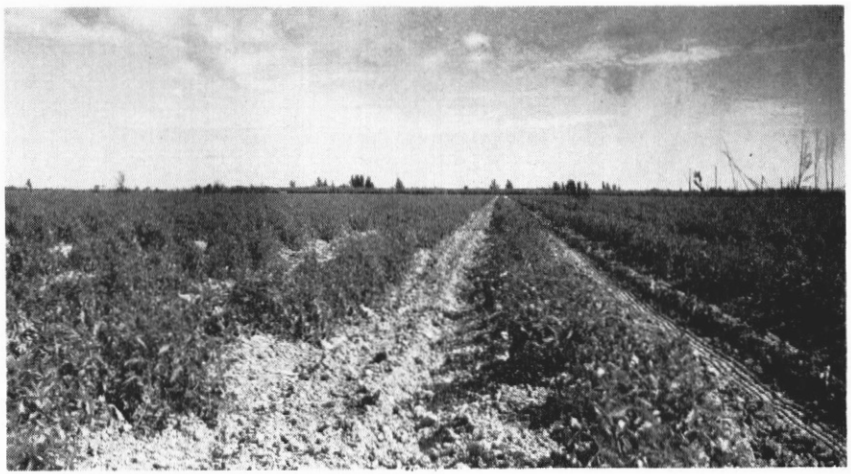

FIGURE 3.—Tomatoes on Perrine marl east of Homestead; crop is harvested from December to April and shipped mainly to northern markets.

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yield from 135 to 200 bushels per acre; Irish potatoes, from 150 to 250 bushels; and snap beans, from 100 to 300 bushels. Such yields require a high level of management. The management for the vegetable crops on this soil is discussed in the section, Use and Management of Cultivated Soils.

Perrine marl, shallow phase (Pe).—This soil occurs in association with the other Perrine marls in the southeastern part of the county. In many places small areas extend into areas of the Rockdale soils—Limestone complex, which lie on the low ridge extending from Miami to Florida City. This shallow phase differs from Perrine marl chiefly in having underlying limestone at depths ranging from 12 to 24 inches.

Use and management.—Approximately 16,000 acres of this soil are used for winter vegetables. The crops, tillage practices, and the yields are similar to those discussed for the Perrine marls in the section, Use and Management of Cultivated Soils. Water control, however, is rather difficult on this shallow phase because of the high permeability of the underlying rocks. The rocks are unavoidably reached in the installation of the drainage systems. In addition, potholes occur in some areas and may be covered with water for several days.

Perrine marl, very shallow phase (Ph).—This soil occurs in association with the other Perrine marls and mapping units of the Rockdale soils—Limestone complex near Kendall, Perrine, Goulds, Homestead, and Florida City. It differs from Perrine marl chiefly in having less than 12 inches of finely divided calcareous sediments over the limestone.

Use and management.—As this soil is shallow to highly permeable limestone, it is probably impractical to install drainage systems for removal of water during wet seasons. During normal dry seasons small areas of this soil, associated with the deeper phases of Perrine marl, are used for winter vegetables. The crops grown, tillage practices used, and the yields on these areas are about the same as those described for Perrine marls in the section, Use and Management of Cultivated Soils. During extremely droughty seasons, Perrine marl, very shallow phase, becomes too dry to permit normal crop growth. As this soil is droughty, it is desirable to plant crops early in the winter season to allow them time to mature before the soil becomes too dry.

Perrine marl, peat substratum phase (Pd).—This soil occurs in rather large areas, mostly in association with the other Perrine soils and with Mangrove swamp (unclassified soils). It is in the southwestern and southern part of the marl glades near Florida City. The soil differs from Perrine marl chiefly in having a 12- to 48-inch layer of brown fibrous organic material between the surface layer of marl and the underlying limestone. The marl ranges from 12 to 24 inches in thickness and from a silt loam to loam in texture. The depth to the limestone varies from 24 to 60 inches.

Use and management.—Only about 1,000 acres of this soil are used for winter vegetables. The crops, tillage practices, and yields are similar to those described for Perrine marls in the section, Use and Management of Cultivated Soils. Water-control systems are not

used on much of this soil; if they were, many hundreds of acres could be used for winter vegetables. Following drainage, the peat layer may subside somewhat and allow water from the underlying limestone to interfere with efficient water control.

Perrine marl, shallow, peat substratum phase (Pf).—This soil occurs in association with the other Perrine marls and Mangrove swamp (unclassified soils) in the southern and western parts of the marl glades near Florida City. It differs from the shallow phase of Perrine marl chiefly in having a 6- to 12-inch layer of brown fibrous organic matter between the surface layer of marl and the underlying limestone. The marl ranges from 4 to 12 inches in thickness. The depth to the limestone varies from 12 to 24 inches.

Use and management.—Only a small acreage of this soil has been used for winter vegetables. The crops, tillage practices, and yields are about the same as those described for Perrine marls in the section, Use and Management of Cultivated Soils. However, water control on this soil may become more difficult than on Perrine marl, shallow phase, because of shrinkage of the peat layer following drainage.

Perrine marl, tidal phase (Pg).—This soil occupies narrow belts between the other Perrine marls and Mangrove swamp (unclassified soils). It occurs near the coast, east of Perrine, Goulds, and Homestead and southeast, south, and southwest of Florida City. It differs from the Perrine marl chiefly in having slight amounts of salts in its various layers. These salts come from the water that covers the areas during high tide. The native vegetation consists of salt-tolerant grasses and mangrove trees.

Use and management.—None of this soil has been reclaimed for crops. By constructing dikes to exclude the salty water, digging ditches, and installing pumps to assist the removal of the excess salts by leaching with rainwater, the deeper portions of this soil probably could be reclaimed. Several years of pumping and leaching might be necessary to reduce the salt content to a level satisfactory for plant growth.

Rockdale fine sandy loam, level phase–Limestone complex (Rc).—This complex occurs on the low ridge that extends southwestward from Kendall to a short distance west of Florida City. It is associated with the Perrine marls and Rockland. There are numerous places where the porous limestone is exposed. Many small cavities or solution holes are filled with a mixture of light-gray fine sand and brown clayey limestone residuum. These cavities range from 2 to 24 inches in depth. This soil is known locally as red land. Slopes are 0 to 2 percent. Drainage, both external and internal, is generally good.

The native vegetation consists of slash pine, saw-palmetto, and various subtropical plants; live oak, palm, and other subtropical trees occur on scattered hammocks.

Profile description (cavity deposit):

0 to 1 inch, dark grayish-brown friable fine sandy loam; contains numerous angular limestone fragments ¼ to 1 inch in diameter.
1 to 6 inches, reddish-brown moderately friable silty clay loam; contains a few small rock fragments.
6 inches +, white or pale-yellow limestone.

The surface layer varies from dark grayish brown to brown in color.

In places the texture of the surface soil is a clay loam. In many areas the brown surface layer rests directly on the limestone or is entirely absent.

Use and management.—About 6,000 acres are in crops. The cultivated areas are used mainly for avocados, limes and other citrus fruits, and mangoes and other subtropical fruits. Other areas are planted to tomatoes, snap beans, squash, and other vegetables. All crops are fertilized frequently with a complete fertilizer, and many crops are irrigated by overhead systems. Tillage practices, soil scarification, and yields of different crops are discussed in the section, Use and Management of Cultivated Soils.

In clearing and preparing this soil for agriculture, heavy equipment is used to remove the pine trees and to break up the limestone. For example, the upper 12 to 18 inches of this soil on the Subtropical Experiment Station, a branch of the University of Florida Agricultural Experiment Station, has been scarified by heavy power machinery as described elsewhere in this report. After the soil is scarified, the resulting soil mixture is composed of fine angular gravel-like limestone material, ¼ to 4 inches in diameter, and a small quantity of clayey residuum and fine sand.

Rockdale fine sandy loam, undulating phase—Limestone complex (RD).—This complex occurs as elongated areas (1) along the marl glades beginning about 1½ miles southeast of Princeton and extending southeastward for a distance of approximately 2 miles; (2) about 1 mile north and east of Perrine; and (3) southwest of the village of Rockdale. It lies as a narrow belt adjacent to the lower lying Perrine marls. It differs from Rockdale fine sandy loam, level phase—Limestone complex chiefly in occupying more sloping areas (2- to 5-percent gradients). The vegetation is slash pine, saw-palmetto, a few other species of shrubs, and various grasses.

The soil is suitable for crops but it is probably less desirable for clearing and development than the level phase. For discussion of the crops, their management, and their yields, see the section, Use and Management of Cultivated Soils.

Rockdale fine sand, level phase—Limestone complex (RA).—This complex occurs on the low ridge from Miami Shores to near Princeton in the eastern part of the county. Slopes are less than 2 percent. It is associated with Rockdale fine sandy loam, level phase—Limestone complex but differs from that complex primarily in consisting of cavities or solution holes filled with fine sands instead of a mixture of fine sands and clayey materials. The depth of the deposits of fine sands varies from 2 to 24 inches. In the northern part of the soil-complex area, the average depth to the limestone is about 12 inches. Generally cavity deposits consist of 2 or 3 inches of dark grayish-brown fine sand that is underlain by light-gray or pale-yellow to yellowish-red fine sand. In places a thin layer of reddish-brown fine sandy clay loam overlies the porous limestone.

Use and management.—This soil is used for the same crops as Rockdale fine sandy loam, level phase—Limestone complex, but locally is considered less productive. The soil preparation, tillage practices, crops, and yields are discussed in the section, Use and

Management of Cultivated Soils. Some areas of this complex are used as building sites for houses and business establishments.

Rockdale fine sand, undulating phase—Limestone complex (RB).—This complex differs from Rockdale fine sand, level phase—Limestone complex chiefly in occupying more sloping areas (2- to 5-percent gradients). Most of it is adjacent to the lower lying Perrine marls. It occurs as narrow elongated areas about 2½ miles northeast and east of Howard, about 2½ miles east of Kendall, and within the city limits of South Miami, Coral Gables, and Miami.

Use and management.—Much of this complex has a natural vegetation of slash pine, saw-palmetto, other shrubs, and various grasses. Within and adjacent to the cities, this soil is used as building sites for houses and business establishments. It could no doubt be used in much the same fashion as the level-phase complex but is probably less desirable for cultivation because of its greater slopes.

Rockland (RE).—This land type consists of extensive areas of Miami oolite or of Tamiami limestone that have a very thin covering of unconsolidated soil material in places. It occurs principally in the southeastern part of the Everglades basin, between areas of the Loxahatchee peats and the Rockdale soils—Limestone complex on the low ridge. Large areas are located about 6 miles west and northwest of Homestead and Perrine. This land type in the eastern part of the county supports various grasses and sedges; whereas in the western part slash pine and cypress may also occur. The treeless areas support some grasses suitable for grazing during part of the year, and the forested areas yield some timber.

St. Lucie fine sand (SA).—This soil was derived from moderately thick beds of very loose sands. It occurs in the nearly level to undulating areas on the higher lying parts of the sandy pinelands near Ojus and North Miami. It is excessively drained. Owing to the coarse-textured sandy layers, this soil has a very low water-holding capacity. This soil is closely associated with the Dade and Arzell soils. It differs from Dade fine sand chiefly in having the underlying limestone at depths greater than 48 inches, and from the Arzell fine sand primarily in being better drained.

The vegetation is scrub oak, saw-palmetto, and a sparse growth of slash pines and short grasses.

Profile description:

0 to 3 inches, light-gray, loose, incoherent fine sand containing a small amount of partly decayed organic matter.
3 to 60 inches, white, loose, incoherent fine sand.
60 inches +, limestone.

This soil is medium to strongly acid in reaction, except at the point of contact with the limestone, where it is neutral to mildly alkaline. The surface layer varies from light gray to gray in color and from 2 to 4 inches in thickness. The depth to the underlying limestone ranges from 48 to 96 inches or more.

Use and management.—This soil is used primarily as building sites for houses and business establishments. Small acreages of wild vegetation provide poor grazing for cattle. Low fertility and low moisture-holding capacity make the soil unsuitable for agriculture unless it is fertilized heavily and irrigated.

USE AND MANAGEMENT OF CULTIVATED SOILS[7]

Nearly all the cultivated land in Dade County is on the marls and the rocky soils. The marls of the Perrine series are the most extensive and typical. The rocky soils are all of the Rockdale series. The sandy soils and the peat soils have cultivated areas of only minor agricultural importance.

Perrine marls.—On these and all the marls, crops need special attention for control of the water table. The Perrine marls range from 5 to 8 feet above sea level. They are poorly drained, except for large areas artificially drained by canals. The undrained soils become waterlogged during the rainy season (May through September) and during occasional wet periods of the winter growing season. They are sometimes covered by a few inches of water. At some periods during the growing season they may become too dry for plant growth. Therefore, these soils need both drainage and irrigation.

The present water-control system consists of field ditches, laterals, and canals containing a few check dams and pumps. The laterals and canals are usually spaced at half-mile intervals on the section and half-section lines. The field ditches occur at right angles to the laterals and are spaced from 660 to 1,320 feet apart. This drainage is usually effective during the normally dry winter season, but pumping may be required during occasional wet periods and during the rainy season.

Experiments performed by the Soil Conservation Service show that a 40-acre field from which the surface water has been pumped can be worked 2 weeks earlier than a similar unpumped area. A 40-acre field is about the largest size for economical pumping. The field should be diked to prevent surface water from entering from adjoining lands. Because the rocks are porous and water-bearing, about 4 inches of marl is left between the bottom of the field ditches and the underlying rocks. It is also suggested that a series of check dams and pumps be installed in the main laterals and canals for better water control.

The marls are generally strongly alkaline in reaction. They are low in organic matter, nitrogen, available phosphorus, and potassium. The lack of enough mineral nutrients for crops is made up by frequent fertilizer applications. These vary from 700 to 3,000 pounds per acre, the amount depending on the kind of crop grown. Mixed fertilizers such as 5–7–5 or 4–8–8 are used. Adding minor elements, such as copper, zinc, manganese, and boron, helps to increase the yield and to improve the quality of many crops. Some of these elements are applied in the dusts and sprays used for insect and disease control.

The marls vary in depth from 1 to 20 feet. Crop yields on the shallow marls are about the same as those on the deeper marls, but it is desirable to plant as early as possible on the shallow marls so the crops can mature before the soil becomes too dry.

The tillage practices depend largely on the nature of the crop grown. On all the marls, seedbeds are prepared by tractor plowing and disk harrowing. Roadways are usually made 600 to 1,320 feet apart.

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[7] Information on agricultural practices and yields supplied by farmers and by C. H. Steffani, County Agent, Dade County, Fla.

Tomatoes are planted in shallow furrows 5 to 7 feet apart. They are set in the rows at intervals of about 20 inches. Fertilizer is applied at planting time and at intervals of 3 or 4 weeks until the beginning of the harvest season. In some seasons, farmers apply side dressings of 100 to 200 pounds of nitrate of soda, sulfate of ammonia, or nitrate of soda-potash. Fifty pounds per acre of manganese sulfate is beneficial if applied with the mixed fertilizer. If heavy rains occur, more fertilizer is applied.

The harvested tomatoes are shipped by truck and rail to northern markets. On the Perrine marls, tomatoes usually yield 135 to 200 bushels per acre, but sometimes as much as 600 bushels. The varieties best adapted to these soils are Rutgers, Homestead, Grothem Globe, Pritchard, and Scarlet Topper.

Potatoes are planted at intervals of about 8 inches in rows about 32 inches apart (fig. 4). At the time of planting, 1,500 to 2,000 pounds

FIGURE 4.—Potatoes on Perrine marl east of Homestead; crop normally is harvested for market during January and February.

of mixed fertilizer is applied per acre. The fertilizer is the same as that used for tomatoes but usually includes 100 pounds of manganese sulfate per ton. Fertilizer applied at these rates should analyze at about 4–8–4 (*6*). Experiments in recent years indicate that the nitrogen fertilizer may be reduced to 2 percent on land previously planted to potatoes. All fertilizer is applied beside or below the seed pieces.

Potatoes are cultivated every 14 to 21 days. After harvesting, they are washed, dried, graded, and packed in sacks for shipment to market by rail and truck. The whole potato-growing operation is mechanized (fig. 5).

On the Perrine marls, potatoes yield about 190 bushels per acre, but yields range from 80 to 500 bushels. The varieties grown are Bliss Triumph and Pontiac.

Snap beans are planted 3 pecks per acre in rows 30 to 36 inches apart (fig. 6). They are cultivated every 7 to 10 days to control weeds. From 800 to 1,200 pounds per acre of 4–8–8 or 4–7–5 ferti-

FIGURE 5.—Harvesting potatoes with a tractor-drawn two-row digger. After adhering soil particles dry, the potatoes are gathered by hand, hauled to modern sheds, and packed for northern markets.

FIGURE 6.—Snap beans (foreground) on Perrine marl east of Homestead; crop is harvested from January to April and shipped mainly to northern markets. Pole beans in background.

lizer is applied with the seed by the planting machinery. About 100 pounds of manganese sulfate is added per ton of fertilizer. Some farmers also apply a side dressing of 100 to 200 pounds per acre of ammonium sulfate. On newly cultivated cropland, it is sometimes necessary to apply additional manganese to the plants with the spray or dust used to control insects and diseases.

Snap beans are picked by hand, packed in bushel hampers, and shipped by truck and rail to northern markets. On the Perrine marls, the average yield is about 150 bushels an acre, but yields range

from 100 to 300 bushels. The varieties grown are Tendergreen and Black Valentine.

Pole beans are planted in rows about 48 to 60 inches apart. Various methods are used for providing structures for the beans to climb on. Some growers use posts at 30- to 50-foot intervals. The posts extend 72 inches above ground and are connected by three strands of wire. Twine or cord is tied to the wire in a vertical position at intervals of 9 to 12 inches (fig. 7). Others use small poles or stakes at 24- to 30-

FIGURE 7.—Pole beans on Perrine marl east of Homestead.

inch intervals in the rows. Stalks of old sesbania plants are sometimes used for the vines to climb on. Pole beans are not planted as extensively as snap beans.

Fertilization for pole beans is about the same as for snap beans. However, an additional 200 to 300 pounds per acre of mixed fertilizer is applied shortly before the first picking. Sometimes, a topdressing of 100 to 200 pounds per acre of nitrate of soda is applied at the time of first picking.

The beans are picked by hand, graded, packed in hampers, and usually shipped to markets in Atlanta (fig. 8). Yields and prices for pole beans on Perrine marls are slightly higher than those for snap beans. Varieties grown are the McCaslan and Kentucky Wonder.

Other vegetables such as squash, cabbage, peppers, sweetpotatoes, celery, and corn are grown on small acreages of the Perrine marls. These crops receive about 1,000 to 1,800 pounds per acre of 4–7–5 or 4–8–8 fertilizer that contains manganese sulfate. Sweetpotatoes are fertilized with 700 to 1,000 pounds of a 3–8–8 mixture. Corn grown after potatoes generally is not fertilized, nor are cover crops grown after potatoes and tomatoes.

Squash yields average about 160 bushels per acre, but yields of 275 bushels have been obtained. The variety grown is Early Summer Yellow Crookneck. Cabbage yields about 7 tons per acre, but yields range from 3 to 12 tons. The varieties grown are Copenhagen Market, Golden Acre, and Jersey Wakefield. Pepper varieties are

FIGURE 8.—Pole beans in bushel hampers for shipment to northern markets.

California Wonder and Florida Giant. Sweetpotato varieties are Porto Rico and Nancy Hall.

In vegetable rotations, sesbania usually follows tomatoes, and velvetbeans follow potatoes. These cover crops make a rank growth during the spring and summer months. Generally it is desirable to plow them under about 6 weeks before planting the next vegetable crop.

Some of the vegetables are consumed locally, but most are shipped by truck and rail to northern markets.

Rockdale soils—Limestone complex.—Only limited cultivation is possible on these soils. If the land is suitably prepared and irrigated, and properly managed and fertilized, it will produce good crops of subtropical fruits and winter vegetables.

These soils are deficient in organic matter and in available plant nutrients, but they are generally well drained, though the water table fluctuates greatly. The Subtropical Experiment Station near Homestead is about 11 feet above sea level. Its records show that the water table may rise to within 1 foot of ground level during wet periods, or drop to 10 feet below it during dry periods. During extended rainy periods, low areas of these soils may become flooded for several days. In long droughty periods, these same areas need irrigation to maintain normal crop growth. Because of this, the low areas are not suited to some fruit, such as avocados. Killing frosts are too frequent to permit growing of tropical plants without some kind of protection. Generally, areas of Rockdale soils—Limestone complex near the Atlantic Ocean have less frost than areas located further inland.

Preparation of Rockdale soils—Limestone complex is essentially the same for all crops. In the northern areas, sand overlies most of the rocks to depths that permit cultivation without scraping bedrock. Further south many rocks outcrop and there is no tillable soil except in the potholes or cavities.

In the old fruit groves, trees were planted in the potholes or near old pine-tree stumps. In later years, shallow holes were dug or dynamited in the rock and trees were planted in straight rows. The plantings were covered with a mixture of compost, sand, and broken rock.

The modern method of preparing areas of Rockdale soils—Limestone complex for fruit groves is to remove the pine trees and shrubs and scarify the land. The soil for the rows of trees is plowed or disturbed by powerful scarifiers to depths ranging from 16 to 20 inches (fig. 9). When the soil material is leveled, there is ample depth of

FIGURE 9.—Tractor, equipped with an angle-dozer, clearing Rockdale soils, level phase-Limestone complex for planting avocado trees.

loose material in the rows to plant the young trees and there is from 6 to 8 inches of loose material between the rows for their lateral roots. Land preparation by this method costs less than shallow scarifying and blasting.

After scarifying the land, a tree or vegetable crop may be planted at once (fig. 10). Because of the abundance of free lime in the freshly scarified soil, it is better to prepare the land at least 1 year before planting trees. But a cover crop should be established as soon as possible to increase the organic-matter content of the soil. Crotalaria and annual sweetclover are adapted cover crops on these soils. However, many farmers rely upon weeds to cover the soil.

Crops on Rockdale soils—Limestone complex receive a minimum of cultivation. In old groves, the weeds or cover crops are mowed by power machinery several times during the dry season, mainly to conserve moisture but also to reduce fire hazards and to facilitate spraying, fertilizing, and harvesting. The mowed material is left on the ground or gathered under the trees for mulching the root zone. In some of the old groves, where the land was not cleared of pine stumps, mowing machinery cannot be used. In these groves, the weeds are usually

FIGURE 10.—Avocado trees recently planted on scarified Rockdale soils, level phase-Limestone complex; many angular fragments of limestone ¼ to 4 inches in diameter are on the surface.

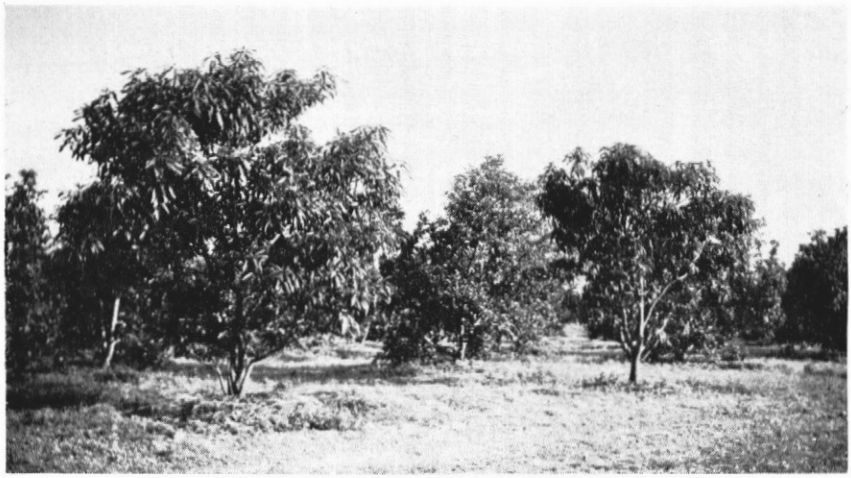

FIGURE 11.—Avocado trees on Rockdale fine sandy loam, level phase—Limestone complex; the fruit is shipped to northern markets from September to January.

dragged down with small scarifying machinery. This practice damages the roots of small trees, but by removing some of the weeds, it reduces fire hazard and conserves moisture.

Fruit crops are grown almost exclusively on Rockdale soils—Limestone complex (fig. 11). About 20,000 acres are planted to fruit trees; the most important are avocado, citrus fruits (fig. 12), and papaya. The trees are usually planted from April to early June and during September and October. At these times temperature and rainfall are favorable for tree growth.

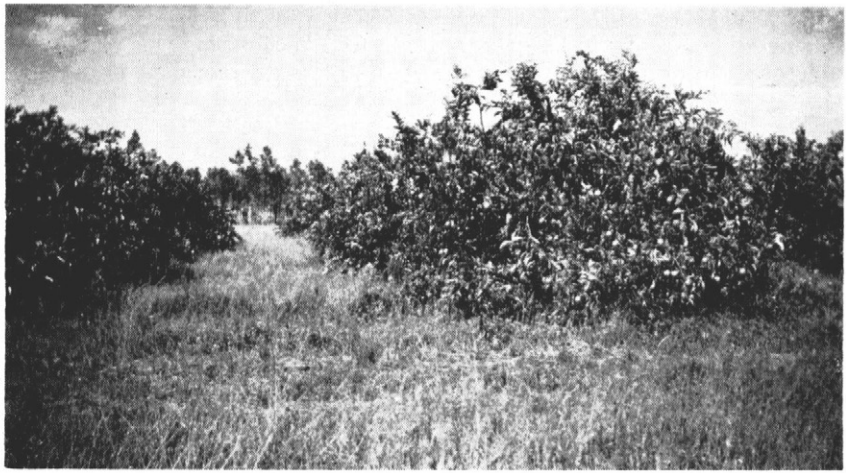

FIGURE 12.—Lime trees on Rockdale fine sandy loam level phase—Limestone complex; the fruit is sold locally and on northern markets.

At present a total of about 2,300 acres is planted to avocados, and the acreage is increasing rapidly. The quantity of fruit has been increased by culling, by grafting the older trees with more prolific varieties, and by better cultivation. The avocado trees are spaced 25 feet by 25 feet. New plantings are clean cultivated for a few years before weeds are allowed to grow between the trees.

Sometimes, the newly planted grove is leased to farmers to grow snap beans or other vegetables between the trees. By this method the young trees are cultivated and the land also yields a vegetable crop. After the vegetables, a cover crop is established; this may be crotalaria, annual sweetclover, or native weeds. This growth is mowed several times a year to prevent fires and conserve moisture.

Each tree, depending on its size, is fertilized three or four times a year with 7 to 15 pounds of 4–7–5, 4–8–6, or 5–7–5 fertilizer containing 2 or 3 percent magnesium oxide (*12*). Some growers give the fruit-bearing trees three applications of 7 to 12 pounds of ammonium sulfate. The trees are sprayed once a year with a nutritional mixture containing zinc, manganese, and copper.

The fruit is picked by hand, polished and graded by machines, and then packed by hand in 12-pound lugs. The packed fruit is sold locally or shipped by rail and truck to northern markets. The normal yield is about 2 to 3 bushels per tree, but yields of 10 bushels have been obtained from some of the large trees. The varieties grown on these soils are mainly Booth 1, 7, and 8, Waldin, and Lulu.

The lime is the most valuable citrus fruit in the county. About 2,100 acres of this fruit are in commercial production, and the plantings are increasing. Usually 100 trees are planted to an acre.

The space between the trees is planted to a cover crop of crotalaria and then allowed to grow up in weeds. Sometimes, the newly planted groves are intertilled for a couple of years with snap beans or similar crops. After the removal of the vegetable crops, a cover crop is planted and weeds allowed to grow. The weeds are mowed at least

once a year to lessen the danger of fire and to conserve moisture during dry seasons. The mowed material is left on the ground to increase the organic-matter content of the soil or is gathered under the trees to mulch the root zone.

The lime trees, depending on size, are fertilized 3 to 5 times each year with 7 to 15 pounds per tree of 4–7–5, 4–8–6, or 5–7–5 fertilizer containing 2 or 3 percent magnesium oxide. Once a year the trees are given a nutritional spray containing zinc sulfate, manganese sulfate, and copper sulfate. During dry seasons, the grove is usually watered by an overhead irrigation system. The irrigation water is pumped from wells drilled 15 to 40 feet deep.

From October to January, the fruit is harvested by hand, polished and graded by machines, and then packed by hand in cardboard lugs. The best grade of fruit is shipped to northern markets by rail or truck. The second and third grades are sold or processed locally. The average yield for a 10-year-old tree is 3 to 5 bushels. The variety of lime grown is the Persian seedless.

Grapefruit is the leading citrus fruit in acreage. About 3,000 acres of grapefruit trees are in commercial production, but this acreage is decreasing rapidly because of low returns. Some of these trees are being topworked to Tahiti limes or are being replaced by avocados or lime trees. Grapefruit trees receive about the same treatment as that described for limes.

About 2,000 acres of orange trees are grown commercially. Owing to the low margin of profit on oranges on the soils of the area, only a few new orange groves have been planted. Although the quality of the fruit is good, the cost of production is very high compared with that of other citrus areas of Florida. Management of orange trees is similar to that described for lime trees.

The papaya is a promising fruit and is well adapted to the area. The total papaya acreage has fluctuated greatly from year to year because it is easy to start new plantings and remove old ones. Considerable research, particularly in insect and disease control and plant breeding, is still necessary to establish an important papaya industry. The papaya plant is a perennial and bears fruit 16 to 18 months after seed planting. Generally commercial growers maintain plantings through the first bearing season and then start over with new plants. The present plantings probably do not exceed 150 acres.

Other crop trees adapted to the area and grown commercially include mangoes, guavas, lemons, tangelos, tangerines, kumquats, coconuts, bananas, pears, and peaches.

Several other fruits are adapted to the Rockdale soils—Limestone complex and to the climate of the area. They include the canistel, yellow sapote, white sapote, sapodilla, carambola, loquat, tamarind, bignay, Mexican limes, and several kinds of annonas. These fruits are grown mainly for home use, but some are sold locally.

Some vegetables are raised on the Rockdale soils—Limestone complex during the fall months when the soil contains enough moisture to carry the plants to maturity. The vegetables are planted in September and harvested in December, usually before the crops on the Perrine marls are harvested.

Management practices for tomatoes on the Rockdale soils—Limestone complex (*6*) are similar to those described for the crop on the

Perrine marls. The average yield of tomatoes on the Rockdale soils—Limestone complex is about 75 to 150 bushels per acre, but under more intensive management, yields of 800 to 1,000 bushels are obtained.

About 700 to 1,500 pounds of 4–7–5 or 4–8–6 fertilizer per acre are applied to squash on the Rockdale soils. This crop yields from 50 to 175 bushels per acre, but the average yield is about 100 bushels.

Snap beans on these soils are fertilized with 1,000 to 2,000 pounds of 4–7–5 or 4–8–6 fertilizer per acre. The fertilizer is applied in 5 to 7 applications. Yields of snap beans range from 50 to 150 bushels per acre; the average yield is about 100 bushels.

Pineapples are grown on a small acreage in the northern part of the county. This crop occupies about 80 acres on Dade fine sand. The land is disked thoroughly, and 5-foot beds are prepared with 4-foot aisles. The slips are planted in the beds in 4 rows at intervals of 16 inches. The plants are fertilized with organic fertilizer or with 2,000 to 3,000 pounds of poultry manure per acre. The organic fertilizer is composed usually of two parts of a meal, such as cottonseed meal, and one part of ground tobacco stems or dust. This mixture is applied 2 or 3 times a year to the lower leaves of the plants at the rate of 500 pounds per acre. Rain washes the mixture to the plant roots. The area between the plants is mulched with oak leaves, hay, or similar material. The new plants produce fruit within 18 to 24 months. After removing the fruit, the slips at the base of the plant begin growth for the new fruit. Yields of 200 to 250 crates of pineapples per acre have been obtained. The fruit is sold both locally and to out-of-the-county buyers. Some of the fruit is quick-frozen and some is preserved. The varieties of pineapples grown are the Smooth Cayane, Golden Abachi, Eleuthera, and Natal Queen.

SOIL CAPABILITY GROUPING

Capability grouping is the orderly arrangement of soils to show their relative suitability for crops, pasture, woodland, wildlife, or other uses, and the degree to which problems or hazards are involved in their proper use, management, and maintenance.

Eight broad classes are recognized in the capability arrangement, although some of these classes do not occur in Dade County. Each soil is placed in one of these broad classes after study of its characteristics, qualities, adaptation, and response to treatment and use.

Soils that are easy to farm and have no serious limitations in use are placed in capability class I. All soils of Dade County, however, require special management for one reason or another. The easiest to use and best suited to cultivation are in capability class II. Soils are placed in class II if they have some special problem in use and management and thus are less widely adaptable and are more limited in capability than those in class I. For example, a wet soil may require supplemental drainage for normal cultivation. Other soils may be placed in capability class II because they are too infertile, too droughty, too shallow, or too much influenced by other problems to be in class I.

Capability class III contains the soils that are suitable for regular cropping but have greater management requirements than those in

class II. Intensity of the problems involved in use, management, and maintenance determines the class. In the same way, soils are placed in capability class IV if they have characteristics or qualities which make them very limited in usefulness or very narrow in crop adaptation. Use and management problems are great on soils of this class. The problems reach a degree of complexity that discourages use of the soils for cultivated crops under existing agricultural conditions.

Soils considered unsuitable for cultivation, or on which cultivation is not advisable, are placed in capability classes V, VI, VII, or VIII. Class V consists of wet soils subject to standing water or frequent overflow; they have strongly limiting characteristics and qualities that render them unsuitable for cultivation, even though the problems in water management are overcome. Most operators would not find it practical to carry out the management practices required for intensive use and maintenance.

Class VI consists of soils that have very undesirable qualities but are capable of producing fairly good yields from some form of permanent vegetation, such as forage crops or forest. Soils in capability class VII are more limited in usefulness than those in class VI. They have very severe problems in use and management that greatly restrict adaptation, and, as a result, the adapted permanent vegetation produces only fair to poor yields. Class VII soils are not suited to uses involving cultivation. Soil conditions in class VII are the most severe under which production of vegetation is practical.

Class VIII includes all soils and miscellaneous land so severely limited in capability that they normally produce little or no useful vegetation. They may provide attractive scenery, or may be valuable areas for buildings and recreation. Like soils in all other classes, they may be suitable as a home for wildlife.

Placement of soil units in the various capability classes is not a fixed process. It is simply a useful way of interpreting soil survey information. Knowledge of the soils is used to predict their behavior under various levels of management. As this knowledge changes, or as other changes come about that tend to alter the extent to which operators can work to overcome problems of use and management, concepts of capability classification require adjustment. The following table shows the current capability classification for the soils of Dade County:

CLASS II: *Soils with only moderate limitations or restrictions in use; require minimum special management for cultivation and maintenance.*

Hialeah mucky marl (HA)
Perrine marl (PC)
Perrine marl, peat substratum phase (PD)

CLASS III: *Soils with severe limitations or restrictions in use; require intensive special management for cultivation and maintenance.*

Davie fine sand (DB)
Davie mucky fine sand (DD)
Davie mucky fine sand, shallow phase (DE)
Everglades peat (EA)
Everglades peat, over shallow marl (EB)
Parkwood fine sand (PB)
Perrine marl, shallow phase (PE)
Perrine marl, shallow, peat substratum phase (PF)

CLASS IV: *Soils with very severe limitations or restrictions in use; require most exacting special management for cultivation and maintenance.*
- Arzell fine sand (AA)
- Broward fine sand (BA)
- Davie fine sand, shallow phase (DC)
- Everglades peat, shallow phase (EC)
- Everglades peat, shallow phase over shallow marl (EE)
- Everglades peat, shallow phase over deep sand (ED)
- Everglades peat, shallow phase over shallow sand (EF)
- Gandy peat (GA)
- Palm Beach fine sand (PA)
- Perrine marl, very shallow phase (PH)
- Rockdale fine sandy loam, level phase—Limestone complex (RC)
- Rockdale fine sandy loam, undulating phase—Limestone complex (RD)
- Rockdale fine sand, level phase—Limestone complex (RA)
- Rockdale fine sand, undulating phase—Limestone complex (RB)

CLASS V: *Soils with moderately unfavorable qualities or characteristics; generally unsuitable for cultivation; require relatively little special management for maintenance in other less intensive uses.*
- Gandy peat, shallow phase (GC)
- Loxahatchee peat (LA)
- Loxahatchee peat, deep phase (LB)
- Loxahatchee peat, over shallow marl (LC)

CLASS VI: *Soils with very unfavorable qualities or characteristics; unsuitable for cultivation; moderately restricted or limited in use for permanent vegetation or other purposes.*
- Dade fine sand (DA)
- Loxahatchee peat, shallow phase (LD)
- Loxahatchee peat, shallow phase over shallow marl (LE)
- Loxahatchee peat, shallow phase over shallow sand (LF)
- Ochopee fine sandy marl, shallow phase (OA)

CLASS VII: *Soils with severely unfavorable qualities or characteristics; unsuitable for cultivation; severely restricted or limited in use for permanent vegetation or other purposes.*
- Flamingo marl (FA)
- Perrine marl, tidal phase (PG)
- Rockland (RE)
- St. Lucie fine sand (SA)

CLASS VIII: *Soils or miscellaneous land types with extremely adverse qualities; unsuitable for production of useful vegetation.*
- Coastal beach (CA)
- Mines, pits, and dumps (MC)

UNCLASSIFIED MISCELLANEOUS LAND TYPES

- Cypress swamp (unclassified soils) (CB)
- Made land (MA)
- Mangrove swamp (unclassified soils) (MB)

AGRICULTURE

LAND USE AND TYPES OF FARMING

According to the United States census for 1950, only about 7 percent of the county, or 94,780 acres, was in farms. Of this acreage, 62,040 was in cropland, divided as follows: 33,870 acres, cropland harvested; 13,033 acres, cropland used only for pasture; and 15,137 acres, cropland not harvested and not pastured. Farm woodland covered 3,886 acres, and other land in farms, 28,854 acres.

In 1950 there were 1,301 farms in Dade County ranging in size from less than 3 acres to more than 1,000. Of these, 968, or nearly 75 percent, of the farms were 29 acres or less; 203, or 15 percent, were from 30 to 99 acres; 90, or 7 percent, were from 100 to 499 acres, and 40, or 3 percent, were 500 or more acres in size.

The farms of Dade County were classified in 1950 as follows:

	Number
Vegetable	224
Fruit and nut	181
Field crop other than vegetable, and fruit and nut	41
Dairy	42
Poultry	88
Livestock other than dairy and poultry	14
General	23
Miscellaneous and unclassified	688

The 1950 census shows that full owners operated 944 farms; part owners, 81; managers, 55; and tenants, 221. About 75 percent of the tenants are cash tenants, and most of the rest are sharecroppers. Cash rental is usually paid when signing the lease. Expenses for planting, cultivating, fertilizing, and harvesting are paid by the tenant. Before harvesting, the tenant usually requests renewal of the lease. After harvesting, a cover crop is planted as green manure for the next vegetable crop.

FARM EQUIPMENT

About 90 percent of the farms have electricity, and electric power machinery is extensively used on farms throughout the county. In 1950, 420 farms had 1,014 tractors and 635 farms had 1,376 trucks.

CROPS

The acreage of principal crops and the number of bearing fruit trees and nut trees, compiled from United States census figures, are given in table 4.

Vegetables are grown primarily on the Perrine marls near Homestead, Florida City, and Goulds. Some vegetables are grown on small acreages of Rockdale soils—Limestone complex near Redland, Richmond, Homestead, and Perrine; additional areas are on Davie, Arzell, and Everglades soils, west and northwest of Miami.

Most of the cropland used only for pasture was planted with Pangolagrass, Bahiagrass, St. Augustinegrass, common bermudagrass, St. Lucie grass, Paragrass, Caribgrass, and Napiergrass. Such pastures are fertilized. Only a few pastures remain under native vegetation. Most pastures occur on the outskirts of Miami and other towns in the eastern part of the county. They are used primarily to supply forage for the 13,000 dairy cattle in the county. Nearly all the crops, vegetables, fruits, and pasture grasses are produced in the eastern half of the county.

Groves of lime, grapefruit, orange, avocado, mango, papaya, and other tropical and subtropical fruits are on former pinelands near Redland, Perrine, Homestead, and Florida City. Only a few groves occur west and northwest of Miami. Many of the citrus growers are cutting out their grapefruit and orange trees and planting lime or avocado trees. Other plantings of lime and avocado are increasing on newly cleared pineland. Pineapples are grown on a small acreage north of Miami.

Vegetables are grown mostly during the winter months. The largest acreages are planted to tomatoes, potatoes, and snap beans, as shown in table 4. These crops usually mature without much damage from occasional freezing temperatures. On the marls, the

vegetables are planted in October, November, and December. Generally tomatoes, potatoes, and beans are harvested and shipped to northern markets from January to April 15. Harvesting of other vegetables goes on through May. Some of the tomatoes and snap beans are processed by local canneries. On the pineland Rockdale soils-Limestone complex, the seedbeds are prepared in August for tomato, squash, and bean plantings in September. The crops on these soils are harvested in December and January.

TABLE 4.—*Acreage of principal crops and number of bearing fruit trees and nut trees in Dade County, Fla., for stated years*

Crop	1929	1939	1949
	Acres	*Acres*	*Acres*
Corn for all purposes	140	492	116
Sorghum for all purposes	40	470	(1)
Cowpeas	56	257	47
All hay	474	1, 415	626
Vegetables:			
Cabbage	44	171	395
Cucumbers	10	13	282
Green beans (snap, wax, string)	413	1, 904	1, 568
Green lima beans	2	140	293
Potatoes	857	4, 232	6, 567
Okra	9	72	107
Squash	108	437	888
Sweet corn	3	28	503
Tomatoes	13, 097	9, 139	11, 649
Velvetbeans	6	(1)	835
Trees:	*Number*	*Number*	*Number*
Grapefruit	207, 272	117, 800	32, 938
Lemon	1, 258	4, 357	497
Lime	(1)	91, 263	187, 958
Orange	(1)	[2] 119,831	51, 389
Tangerine and mandarin	(1)	9, 879	4, 506
Avocado	113, 727	78, 298	198, 175
Guava	656	2, 017	(1)
Mango	(1)	3, 192	(1)
Papaya	(1)	8, 395	(1)
Peach	299	104	114
Pear	(1)	27	4
Coconut	(1)	5, 077	(1)

[1] Not reported.
[2] Includes tangerine, mandarin, and satsuma.

ROTATIONS AND FERTILIZERS

Crop rotation, in the usual sense, is not practiced in Dade County. Some farmers plant cover crops following the harvesting of vegetables to shade the ground and to control bermudagrass, nutgrass, and weeds. On the marl glades sesbania is usually planted following harvest of tomatoes; and velvetbeans, following potatoes. On the pinelands, crotalaria, alyceclover, and white sweetclover are used as cover crops. The same vegetable crop may be grown for a number of years in succession on the same piece of land. The land is occasionally

fallowed for 1 or 2 years to control plant diseases and to maintain crop quality.

Fertilizers are used in rather heavy applications on all of the land cultivated for vegetables and fruits. Popular mixtures are 4–8–6, 4–7–5, 4–8–8, 3–8–8, 5–7–5, and 5–10–5. Nitrate of soda-potash, superphosphate, sewage sludge, and nitrate of soda accounted for 80 percent of the other fertilizer materials. About 40 percent of these materials was nitrate of soda-potash.

Practically no lime is used on the soils of the county, as most of them are neutral to alkaline. Manganese and other minor elements are needed; they are applied to the soil in fertilizers or to the plants in the sprays used for disease control.

PERMANENT PASTURES

The acreage of permanent pastures in the county has increased immensely. From the beginning of the pasture program of the Agricultural Adjustment Administration in 1936 through the 1944 season, about 20,000 acres of permanent pastures were established, mainly on the dairy farms near Miami. These pastures are chiefly on the poorly drained Arzell and Davie soils and on small acreages of the Perrine and Everglades soils.

About one-third of the improved pastures were established by seeding and two-thirds by sodding. Grasses established by seeding contain Bahia, Pensacola Bahia, and Dallis grasses; whereas those established by sodding contain mainly Pangola, St. Lucie, Coastal bermuda, common bermuda, Para, Carib, Napier, and St. Augustine grasses. Some of the pastures include white clover and California burclover.

The improved pastures are maintained by an application of 32 to 48 pounds of nitrogen, supplied alternately by 8–8–8 mixed fertilizer or a nitrogen material at intervals of 60 to 120 days during the growing season. Minor elements such as copper, zinc, and manganese should be applied every 3 to 6 years in the amounts of 20 pounds of copper sulfate, 10 pounds of zinc sulfate, and 20 pounds of manganese sulfate per acre. In addition to these fertilizers, the pastures on mucky soils receive each year about 20 to 30 pounds of copper sulfate per acre.

LIVESTOCK AND LIVESTOCK PRODUCTS

The number of domestic animals on farms and livestock and livestock products sold for stated years are shown in table 5.

Dairying is the most important livestock industry in the county. Of all cattle and calves shown in the table, about 70 percent are milk cows. The local demand for dairy products has caused a rapid increase in the number of milk cows. Almost all the dairy products are sold and used in the county, but some of the milk is trucked to Key West and other towns. The principal dairy breeds are Jersey, Guernsey, and Holstein.

Poultry farming is also rapidly increasing and is now second to dairying in importance. The eggs and poultry are sold and used locally. The common breeds of chickens are White Leghorn and New Hampshire Red. Some turkeys, ducks, and geese are also raised.

Beef cattle, hogs, and goats are raised in limited numbers. There are a few beef herds, mostly Aberdeen Angus, Hereford, Santa Gertrudis, and scrub cattle. The scrub cows are bred mainly to Brahman and English breed bulls. The beef cattle are sold at auction in Miami and slaughtered for local use.

The swine are mostly of common grades, but there are a few registered herds of Hampshire and Duroc-Jersey. Much of the hog feed is sterilized garbage from the Miami Urbanized Area. The hogs are sold, slaughtered, and used locally.

TABLE 5.—*Number of domestic animals on farms, and livestock and livestock products sold in Dade County, Fla., in stated years*

LIVESTOCK ON FARMS

Item	1930	1940	1950
	Number	*Number*	*Number*
Horses and colts	96	[1] 278	512
Mules and mule colts	144	[1] 280	66
Cattle and calves	7, 036	[1] 11, 976	19, 427
Hogs and pigs	2, 220	[2] 3, 022	3, 805
Sheep and lambs	60	[3]	104
Chickens	[1] 38, 947	[2] 54, 947	[2] 88, 088
Turkeys	1, 733	1, 755	913
Ducks raised	2, 077	9, 565	1, 453

LIVESTOCK AND LIVESTOCK PRODUCTS SOLD

Item	1929	1939	1949
Milk, whole—gallons	2, 045, 303	4, 399, 395	8, 539, 132
Cattle and calves (alive)—number	[3]	[3]	6, 608
Eggs—dozens	221, 943	[4] 375, 673	546, 024
Chickens (alive and dressed)—number	32, 509	291, 959	329, 531
Hogs and pigs (alive)—number	[3]	[3]	3, 081
Honey [4]—pounds	7, 566	13, 547	2, 030

[1] Over 3 months old, Apr. 1.
[2] Over 4 months old, Apr. 1.
[3] Not reported.
[4] Total produced

Bees are kept for pollination of fruit trees and vegetables. Recently, the sale of packaged bees to northern apiaries has become an important enterprise. Honey is produced in quantity and sold mostly to the northern markets.

Mules have been replaced by tractors on many farms. Horses, however, have increased in the county. Horses are used for herding dairy cattle. Many of the horses are bred and trained for racing on the local tracks.

FORESTS

The principal forested areas are in the eastern, southern, and western areas of Dade County. Slash pine is the most important native species. It grows on the Dade, Rockdale, Palm Beach, Broward, Parkwood, and St. Lucie soils, which occur mostly on the low ridge in the eastern part of the county. Slash pine is used extensively for lumber, veneer, crossties, and pulpwood. Several tropical species of trees and some hardwoods occur on Parkwood fine sand and Broward fine sand. Cabbage palmetto grows on the Parkwood, Rockdale, Palm Beach, and a few other soils. The cabbage palmettos may be used for fiber, raffia, building blocks, palm leaves, and novelties.

In the extreme western part of the county, scrub cypress grows on some areas of Ochopee fine sandy marl. These trees are 6 to 8 inches in diameter at breast height and are 15 to 20 feet tall. They have possible value as pulpwood or fence posts. In a few places the larger baldcypress grows in limited quantities in elongated areas that form part of the natural drainageways. In the Everglades basin, small islands surrounded by peaty marsh have a growth of whitebay and myrtle bushes.

In the coastal region of the southeastern part of the county, red and black mangrove and buttonwood occur in considerable quantity. Tannin extract from the bark and wood of the buttonwood and from the bark of the red mangrove has commercial possibilities. These trees, however, occur in areas generally difficult to reach.

Frequent fires occur in the woodlands every year and are a serious threat to forest growth. The greatest problem in management is forest fires. In the eastern part of the county, the shallow soils over limestone retard the growth of slash pine. In the western part, the shallow depth to limestone and the poor drainage of the low-lying soils prevent rapid growth of cypress.

When slash pine is cut, 4 or 5 seed trees, measuring at least 10 inches in diameter at 4½ feet above the ground, should be left on each acre. These trees will reseed the surrounding area, providing it is protected from fires. This natural reseeding, with fire protection, is by far the cheapest and easiest method of reforestation.

MORPHOLOGY, GENESIS, AND CLASSIFICATION OF SOILS

FACTORS OF SOIL FORMATION

Soil is the product of the forces of weathering and soil development acting on materials deposited or accumulated by geologic agencies. The characteristics of the soil at any given point are determined by (1) the physical and mineralogical composition of the parent material; (2) the climate under which that soil material has accumulated and has since existed; (3) the plant and animal life in and on the soil; (4) the relief, or lay of the land; and (5) the length of time the forces of soil development have acted on the material.

Nearly all of the county is underlain at depths of 96 inches or less by Miami oolitic limestone or by the Tamiami formation of sandy limestone or calcareous sandstone. The oolitic limestone (*9*) reaches its maximum thickness near the Atlantic coast and thins out to a feather edge in the Everglades basin. The underlying Tamiami formation, considered of Pliocene age, appears on or near the surface in the western part of the county and also in small areas in the northeast. The Miami oolite has jagged surfaces and is pitted with solution holes that are commonly filled with sand, marl, organic material, or a mixture of any of these materials.

Geologists have good evidence that the land surface of southern Florida was greatly affected by events during the ice age. The Miami oolite apparently was laid down, probably as a bar in the ocean, during the Sangamon interglacial stage. During that time the ice melted off much of North America and the ocean stood for a while as much as 100 feet above its present level. Later, ice again formed farther north and the sea fell during at least two Wisconsin glacial stages; a warmer period with a higher sea level occurred between these stages. Solution holes were formed in the oolite while the ocean was low, and some of the present sandy soils were laid down as beaches or underwater deposits while the ocean was high. As the ice of the latest glacial stage melted and the ocean came up to its present level, some of the sand dunes were partly drowned to make the Ten Thousand Islands off the coast of Collier and Monroe Counties. Still later, during recent geological time, peats and the present marl soils were formed in the swamps and marshes.

Most of the rock floor has been covered by more recent deposits of soil materials. In the western part of the county, the Tamiami formation is overlain by a thin layer of sandy marl. The fine-grained calcareous ocean sediments were washed in over the rocks or deposited by calcareous algae (*4*). The Tamiami formation is sometimes covered by a thin layer of organic matter derived from various plant remains. Farther to the east or in the Everglades basin, the Miami oolite is overlain by a thin layer, 6 to 24 inches thick, of gray calcareous clay. This is Lake Flirt marl, of very late Pleistocene age. It is covered by recent organic materials from the remains of succulent aquatic plants. In the eastern part of the county, much of the Miami oolite is covered by a layer of sand, a few inches to several feet thick. This sand is considered a part of the Pamlico formation, which was deposited during the Peorian interglacial stage of the Pleistocene epoch. In places a very thin layer of clayey material, residuum from the limestone or residuum partly mixed with the sands, lies directly on the rock. In the southeastern part of the county, finely divided calcareous sediments or marl, ranging from 6 to 48 inches in thickness, overlie the limestone.

The soils of the county have developed under the influence of a humid, subtropical climate. The average annual temperature is 74.0° F. at Homestead, The annual precipitation is about 62 inches. The rainfall is heavier during the summer months, May to October.

Owing to the warm climatic conditions and to the high rainfall, soil-forming processes are active during most of the year.

Many of the sandy soils in the northeastern part of the county are medium to strongly acid in their upper parts, but they are nearly neutral to alkaline near the underlying limestone or marl. The organic soils in the Everglades basin are slightly acid to neutral in reaction in their upper layers and are alkaline near the underlying rocks.

Most of the higher lying mineral soils near the eastern coast of the county support a vegetative growth of slash pines, saw-palmettos, and a few other shrubs and grasses. A few areas of mineral soils occur under a vegetative cover of short grasses. The marl glades in the southeastern part of the county grow many grasses, and areas near the coast also support mangrove trees. In the western part of the county, scrub or dwarf cypress trees and a few grasses and shrubs grow on the fine sandy marl. Various succulent aquatic plants grow in the Everglades basin in the central part of the county; they have caused the accumulation of organic materials to depths ranging from 6 to 96 inches.

The county is a nearly level plain except for a few low ridges in its eastern part. Much of the county is less than 13 feet above sea level, but a few small areas are slightly more than 20 feet. The configurations of the land are essentially those laid down by the high seas that covered this part of Florida many thousand years ago. Owing to the low and nearly level relief, many of the soils in the county are naturally poorly or very poorly drained. Only those soils on the ridge in the eastern part of the county are well drained to excessively drained. During the rainy seasons most of the soils, except those on the ridge, are covered with water that may be several feet deep. During dry seasons, most of the marl glades in the southeastern part of the county and some of the low-lying sandy soils in the eastern part become dry enough to permit cultivation of crops. Even after lengthy dry periods, much of the area of soils in the Everglades basin is still covered or saturated with water. In the western part of the county, the natural drainage is in a southerly or southwesterly direction through the broad shallow sloughs. In the eastern part, the indistinct drainageways of the interior join many of the canals and ditches extending to the Atlantic Ocean. These canals and ditches have been installed to assist in controlling the water table in the soils.

Over the greater part of the county the soils are young and the soil-forming processes have not acted long enough to form noticeable horizons of eluviation and illuviation. The present characteristics of most of the soils are primarily results of the character of the geological materials laid down. These characteristics are also partly caused by aging of these materials under the influences of excessive,

imperfect, poor, or very poor drainage; the subtropical climate; the plant cover; and the soil organisms. Most of the mineral soils lack genetic horizons and consist of layers of undifferentiated sands. Many of these sands rest on a rock or marl stratum that is generally of entirely different composition. In the Everglades basin, new growth of the succulent aquatic plants continues to increase or replenish the organic materials.

The mineral soils of the county are generally light in color, low in organic matter and nitrogen, and comparatively low in other mineral nutrients. The surface soils, 2 to 6 inches thick, generally contain small amounts of partly decomposed organic matter. In low hammocks, in cypress and mangrove swamps, and in wet marshes partly decayed vegetal matter has accumulated to depths ranging from a few inches to 12 inches. In the Everglades basin, organic materials are still accumulating and range from 6 to 96 inches in depth.

CLASSIFICATION OF SOILS

In this section the soil series are classified by great soil groups and soil orders (table 6), and a representative profile of a soil of each great soil group is given. The classification of soil series in higher categories is based on limited data, principally on characteristics observable in the field. The correct classification of some of the soil series is not known; that of others is reasonably well known. An attempt has been made to place each series in the correct great soil group, but further study may prove the classification to be incorrect in some instances.

Although Dade County is in the region of Red-Yellow Podzolic soils, no zonal soils occur. However, soils of both the intrazonal and azonal orders are mapped. Intrazonal soils are members of any of the great soil groups that have more or less well-developed soil characteristics that reflect the dominating influence of some local factor of relief, parent material, or age over the normal effect of climate and vegetation. Azonal soils are any group of soils that have been prevented by their youth or conditions of parent material or relief from developing normal profile characteristics.

The intrazonal order is represented by the Bog soils and Low-Humic Gley soils. The Bog soils are members of the Everglades, Loxahatchee, and Gandy series. The Arzell, Davie, Hialeah, Perrine, Ochopee, Flamingo, Parkwood, and Broward series belong to the Low-Humic Gley group.

The azonal soils are the Rockdale, Dade, Palm Beach, and St. Lucie. The sands are Regosols, which are weakly developed soils in soft materials. Rockdale soils are Lithosols, shallow or extremely shallow over hard rock.

TABLE 6.—*Classification of the soil series of Dade County, Fla., by orders and great soil groups, and some of the factors that have contributed to their morphology*

INTRAZONAL SOILS

Great soil group and series	Parent material	Relief	Drainage
Bog soils:			
Everglades	Remains of sawgrass, lily, sedge, and myrtle over limestone, or shallow layer of sand or marl over limestone.	Flat; a few slight depressions and rises.	Very poorly drained.
Loxahatchee	Remains of bladderwort, lily, sedge, arrowhead, and sawgrass over limestone, or shallow layer of sand or marl over limestone.	Flat or nearly level; slight depressions.	Very poorly drained.
Gandy	Remains of whitebay, myrtle, rubbertree, fern, sawgrass, and aquatic plants over limestone, or shallow layer of sand or marl over limestone.	Nearly level islands 1 to 3 feet above the peat marshes.	Very poorly drained.
Low-Humic Gley:			
Arzell	Moderately thin beds of fine sand over limestone.	Flat or nearly level; slight depressions.	Poorly drained.
Davie	Thin beds of fine sand, 12 to 40 inches thick, over limestone. (Peat layer formerly covered the fine sand but most of the organic materials have burned.)	Flat or nearly level; slight depressions.	Poorly drained.
Hialeah	Unconsolidated layers of finelydivided calcareous sediments, organic remains, and fine sand; or organic remains over calcareous sediments and fine sand over soft limestone.	Flat or nearly level; 1 to 8 feet above sea level.	Very poorly drained.
Perrine	Unconsolidated finely divided highly calcareous sediments, 6 to 60 inches deep over limestone; mainly of fresh-water origin.	Flat or nearly level; slight depressions.	Poorly to very poorly drained.
Ochopee	Unconsolidated finely divided calcareous sediments (high content of fine sand), 4 to 12 inches deep over limestone; mainly of fresh-water origin.	Flat or nearly level; slight depressions.	Very poorly drained.

Flamingo	Unconsolidated very finely divided highly calcareous marine sediments, 60 to 240 inches deep over limestone; mainly formed in brackish or salt water.	Flat to very gently sloping; 1 to 4 feet above sea level.	Very poorly drained.
Parkwood	Very thin beds of sand over marl or soft limestone.	Flat or nearly level	Poorly drained.
Broward	Thin beds of fine sand, 12 to 40 inches thick, over limestone.	Nearly level	Imperfectly drained.

AZONAL SOILS

Lithosols:			
Rockdale	Small pockets of fine sand or fine sandy loam and clay loam in soft limestone.	Flat to nearly level; some gentle slopes.	Well drained.
Regosols:			
Dade	Thin beds of fine sand, 12 to 40 inches thick, over limestone.	Nearly level to very gently sloping.	Well drained to excessively drained.
Palm Beach	Thick beds of sands, small shells, and fragments of shells.	Nearly level to undulating	Well drained to excessively drained.
St. Lucie	Thick beds of very loose sand	Low ridges, knolls	Excessively drained.

PROFILES OF SOILS REPRESENTING THE GREAT SOIL GROUPS

BOG SOILS

Everglades peat, a representative Bog soil, has developed from the remains of sawgrass, lilies, sedges, native grasses, and clumps of myrtle bushes. These remains are underlain by limestone or a shallow layer of fine sand or marl over the limestone. This soil is very poorly drained and may be covered with water during many months of the year.

Representative profile of Everglades peat:

0 to 10 inches, black or very dark brown (10YR 2/1 or 2/2, moist) nonfibrous peat consisting of fairly well decomposed organic remains that include 6 to 15 percent of mineral matter; shrinks and cracks upon drying; grayish-brown or dark grayish-brown (10YR 5/2 or 4/2) when dry; slightly acid to neutral.

10 to 48 inches, grayish-brown or dark grayish-brown (10YR 5/2 or 4/2, moist) soft fibrous and felty peat containing some partially decayed roots and rhizomes of sawgrass and sedges; grayish brown (10YR 5/2) when dry; slightly acid to neutral.

48 inches +, white (10YR 8/2) moderately hard limestone.

LOW-HUMIC GLEY SOILS

Davie fine sand is considered a Low-Humic Gley soil of the Red-Yellow Podzolic soil region. It has been developed from thin beds of marine fine sands over limestone. The depth to the limestone ranges from 24 to 48 inches. This soil occupies predominantly flat or nearly level sites formerly covered by peat or muck to depths of 24 to 48 inches. After these areas had been drained, most of the organic material disappeared because of oxidation and shrinkage or destruction by fires. Davie fine sand has poor to very poor natural drainage, but under present conditions large areas are overdrained by the many canals and ditches. The vegetation was dominantly sawgrass, but following drainage, myrtle, groundsel bush, primrose-willow, and few wild grasses have become established on most areas.

Following is a description of a profile of Davie fine sand, as observed in a nearly level pasture 3 miles west of Opalocka.

0 to 8 inches, gray (10YR 5/1, moist) nearly loose fine sand containing moderate quantity of partly decomposed organic matter; has a salt-and-pepper appearance; light gray (10YR 7/1) when dry; many fibrous medium-sized roots; slightly acid.

8 to 30 inches, light-gray (10YR 7/1, moist) loose fine sand; white (10YR 8/1) when dry; slightly acid.

30 to 34 inches, light-gray to pale-yellow (2.5Y 7/2 or 7/4, moist) loose fine sand; when dry, white (2.5Y 8/2), slightly acid to neutral.

34 to 36 inches, yellowish-brown (10YR 5/4, moist) nearly loose fine sand containing few fragments of limestone; light yellowish brown (10YR 6/4) when dry; neutral to alkaline.

36 inches +, white (10YR 8/2) moderately hard to soft limestone.

Perrine marl is considered a Low-Humic Gley soil of the Red-Yellow Podzolic region. It was derived from recent geological materials consisting of unconsolidated finely divided calcareous sediments that were deposited mainly by fresh waters. The texture of Perrine marl is predominantly silt loam. The soil is naturally very poorly drained, but some areas have been artificially drained by canals and ditches. The vegetative cover consists chiefly of short and tall grasses and a few shrubs. Mangrove trees are growing on some of the Perrine marls near the coast.

A representative profile of Perrine marl observed 2 miles east of Florida City is as follows:

0 to 10 inches, light brownish-gray (10YR 6/2, moist) marl consisting of finely divided calcium carbonate that has a very friable silt loam texture; light gray (10YR 7/2) when dry; strongly alkaline.
10 to 18 inches, very pale brown (10YR 7/3, moist) marl having a silt loam texture; light gray (10YR 7/2) when dry; strongly alkaline.
18 to 32 inches, light-gray (10YR 7/2, moist) marl having a silt loam texture; white (10YR 8/2) when dry; strongly alkaline.
32 inches +, white (10YR 8/2) moderately hard to soft limestone.

LITHOSOLS

The Rockdale soils may be considered Lithosols. They are mapped in complex with limestone in Dade County. Rockdale fine sandy loam soils consist of numerous outcrops of light-gray, soft, porous, honeycombed limestone having many small cavities or solution holes, 2 to 24 inches deep. The holes are filled with a mixture of gray or light-gray fine sand and brown clayey residuum from the limestone. Many angular rock fragments, ¼ to 4 inches in diameter, occur on the surface. The Rockdale soils are well drained. It is necessary to scarify or to dig holes in the limestone before planting citrus, avocado, or other trees on Rockdale soils. These soils, after scarification, are a mass of fine, angular gravel-like material, ¼ to 4 inches in diameter, and a small amount of fine earth.

The native vegetation consists of slash pine, saw-palmetto, wiregrass, and various subtropical plants. A few hammocks covered by live oaks and palms and several subtropical trees occur within the Rockdale soils.

REGOSOLS

Dade fine sand is considered a Regosol of the Red-Yellow Podzolic soil region. It has formed from a dominantly thin layer of marine sands over limestone. The depths to limestone range from 12 to 48 inches. This soil occupies low ridges in the northeastern part of the county. It is well drained or excessively drained. The plant cover consists of second-growth slash pine, saw-palmetto, tall and short grasses, low cycads or coonties, scrub oak, and a few cabbage palmettoes. A representative profile observed in an excavation 2 miles west and 1 mile north of North Miami Beach is described as follows:

0 to 4 inches, gray or light-gray (10YR 5/1 or 6/1, moist) loose fine sand; contains small quantity of partly decayed organic matter that gives a salt-and-pepper appearance; light gray (10YR 7/1) when dry; medium to slightly acid.
4 to 30 inches, light-gray or white (10YR 7/1 or 8/1, moist) loose, incoherent fine sand; white (10YR 8/1) when dry; medium to slightly acid.
30 to 48 inches, light brownish-gray (10YR 6/2, moist) loose fine sand; light gray (10YR 7/2) when dry; neutral to mildly alkaline.
48 inches +, white (10YR 8/1) soft limestone.

SOIL SURVEY METHODS AND DEFINITIONS

The scientist who makes a soil survey examines soils in the field, classifies the soils in accordance with facts that he observes, and maps their boundaries on an aerial photograph or other map.

Field study.—The soil surveyor bores or digs many holes to see what the soils are like. The holes are not spaced in a regular pattern; they

are located according to the lay of the land. Usually they are not more than a quarter of a mile apart and sometimes they are much closer. In most soils such a boring or hole reveals several distinct layers, called horizons, which collectively are known as the soil profile. Each layer is studied to see how it differs from others in the profile and to learn the things about this soil that influence its capacity to support plant growth.

In the detailed-reconnaissance survey of Dade County the soils of the sandy pinelands, rocky pinelands, sandy prairies, and the developed parts of the marl glades were examined less than a quarter of a mile apart. The soil boundaries were located accurately. The soils of the rocky glades, the peat marshes, the cypress and mangrove swamps, and the undeveloped parts of the marl glades were examined along the roads and at 6-mile intervals between roads. Soil boundaries were located fairly accurately along the lines of traverse and were projected on aerial photographs between the lines of traverse.

Color is usually related to the amount of organic matter. The darker the surface soil, as a rule, the more organic matter it contains. Streaks and spots of gray, yellow, and brown in the lower layers generally indicate poor drainage and poor aeration.

Texture, or the content of sand, silt, and clay, is determined by the way the soil feels when rubbed between the fingers and is later checked by laboratory analysis. Texture determines how well the soil retains moisture, plant nutrients, and fertilizer, and whether it is easy or difficult to cultivate.

Structure, which is the way the individual soil particles are arranged in larger grains and the amount of pore space between grains, gives us clues to the ease or difficulty with which the soil is penetrated by plant roots and by moisture.

Consistence, or the tendency of the soil to crumble or to stick together, indicates whether it is easy or difficult to keep the soil open and porous under cultivation.

Other characteristics observed in the course of the field study and considered in classifying the soil include the following: The depth of the soil over bedrock or compact layers; the presence of gravel or stones in amounts that will interfere with cultivation; the steepness and pattern of slopes; the degree of erosion; the nature of the underlying rocks or parent material from which the soil has developed; and acidity or alkalinity of the soil as measured by chemical tests.

Classification.—On the basis of the characteristics observed by the survey team or determined by laboratory tests, soils are classified into types, phases, and series. The soil type is the basic classification unit. A soil type may consist of several phases. Types that resemble each other in most of their characteristics are grouped into soil series.

Soil type.—Soils similar in kind, thickness, and arrangement of soil layers are classified as one soil type. Davie fine sand is a soil type mapped in Dade County.

Soil phase.—Because of differences other than those of kind, thickness, and arrangement of layers, some soil types are divided into two or more phases. Within certain soil types in Dade County special significance is attached to the thickness of the soil material and the

kind of underlying formations. Davie fine sand, shallow phase, is a soil phase mapped in the county.

The soil phase (or the soil type if it has not been subdivided) is the unit shown on the soil map. It is the unit that has the narrowest range of characteristics. Use and management practices therefore can be specified more easily for phases than for soil series or yet broader groups that contain more variation.

Soil series.—Two or more soil types that differ in surface texture but are otherwise similar in kind, thickness, and arrangement of soil layers are normally designated as soil series. In a given area, however, a soil series frequently is represented by only one soil type. Each series is named for a place near which the soil was first mapped. Dade, Davie, Perrine, Hialeah, Flamingo, and Rockdale are names of some of the soil series first identified in Dade County.

Miscellaneous land types.—Land that has little true soil is not classified into types and series but is identified by descriptive names, such as Rockland, Coastal beach, and Mangrove swamp.

Soil complex.—When two or more soils are so intricately associated in small areas that it is not feasible to show them separately on the soil map, they are mapped together and called a soil complex. Rockdale fine sandy loam, level phase—Limestone complex is an example.

SPECIAL TRANSPORTATION USED

The sandy pinelands, rocky pinelands, sandy prairies, and developed parts of the marl glades are easily reached on foot or by automobile. In these areas the soils were examined frequently and their boundaries were located accurately. The rocky glades, the peat marshes, the cypress and mangrove swamps, the tidal marshes, and the undeveloped parts of the marl glades were more difficult to reach even with the special types of equipment available to the survey parties. These areas were traversed along the roads and at 6-mile intervals between roads. Soil boundaries were located fairly accurately along the lines of traverse. In projecting the soil boundaries between the lines of traverse, the aerial photographs, which were used as base maps, were helpful guides.

Several types of special equipment were used for transportation of the parties in areas not accessible by ordinary means of travel. In those parts of the peat marshes covered with water, air-propelled boats were used. These boats were flat-bottomed, square-nosed craft about 6 by 16 feet. They were propelled by a motor-driven airplane propeller mounted over the after part of the boat and were guided by a large rudder mounted above the stern in the propeller blast. These boats were able to travel at speeds of 15 to 20 miles an hour. The weasel, a land-and-water vehicle developed for the Navy, was especially useful in areas of soft soils that had scattered ponds and water channels too deep for nonfloating vehicles. The weasel travels on hard roads at speeds up to 25 miles an hour.

On the parts of the peat marshes covered by sawgrass, crawler-type tractors with the bearing surface increased by wooden cleats, 4 by 6 by 60 inches, were used. A 4- by 10-foot sled was pulled behind the tractor. Camping equipment and supplies were carried by tractor and sled. Camp was pitched where night overtook the crew

The transportation over the marl glades and the rocky glades was by means of "glades buggies". The most satisfactory design had an axle mounted near the middle of the chassis driven from a secondary drive shaft. The rear axle had two tires on each side, the middle axle had three tires, and the front axle had one tire on each side. The wheelbase was about 9 feet, and the weight was balanced over the middle axle. Each driven axle was suspended separately so that it could adjust itself independently of the others when passing over very uneven ground. Cleats of light angle iron were chained to the driven wheels when travel was over soft or slippery ground. Two sets of transmission gears connected in series permitted several speeds ranging from ½ to 25 miles per hour.

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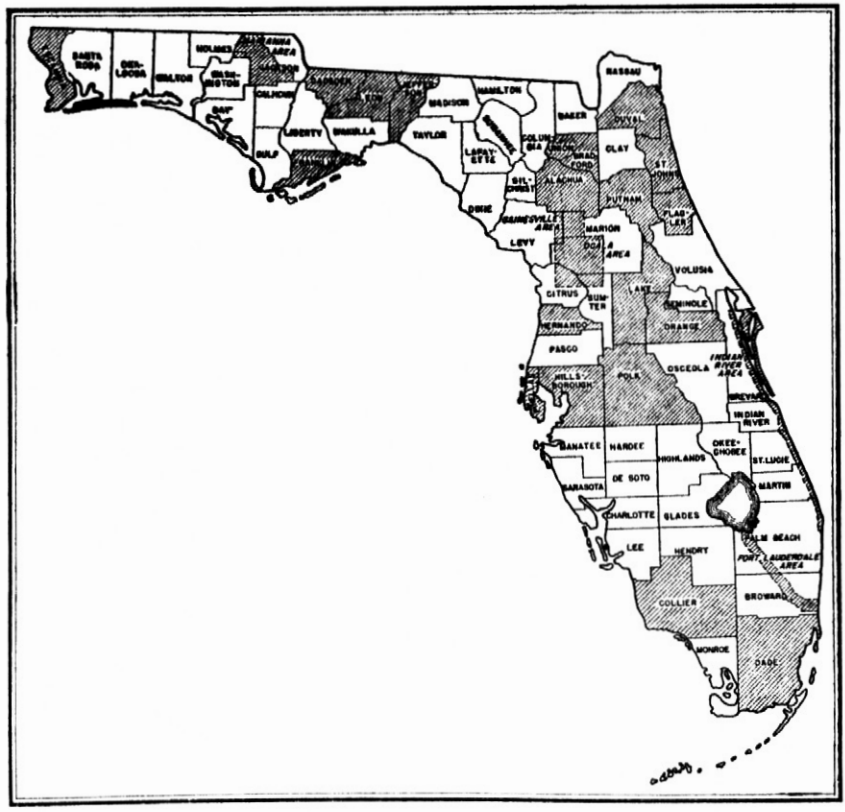

Areas surveyed in Florida shown by shading.

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