

SOIL SURVEY

DETAILED-RECONNAISSANCE

Collier County Florida

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How to Use THE SOIL SURVEY REPORT

FARMERS who have worked with their soils for a long time know about differences among soils on their own farms, and perhaps about differences among soils on the farms of their immediate neighbors. What they do not know, unless soil surveys have been made, is how nearly their soils are like those on experiment stations or other farms, either in their State or other States, where farmers have gained experience with new or different farming practices or enterprises. Farmers of Collier County can avoid some of the risk and uncertainty involved in trying new crop and soil management practices by using this soil survey report, for it maps and describes the soils in their county and therefore allows them to compare the soils on their farm with soils on which new developments have proved successful.

SOILS OF A PARTICULAR FARM

All the soils of Collier County are shown on the large colored soil map that accompanies this report. To determine what soils are on a farm (or any tract of land) it is first necessary to locate the farm on the map. First find the general locality of the farm by using section and township lines, and then locate its boundaries by using roads, streams, villages, dwellings, and other landmarks.

The next step is to identify the soils on the farm. Suppose, for example, one finds on a farm an area marked with the symbol Aa3. For the moment, ignore the figure 3 in this symbol. Look among the rectangles in the margin of the map and find the one with Aa printed on it. Just above this rectangle is the name of the soil—Arzell fine sand.

What is Arzell fine sand like, for what is it used, and to what uses is it suited? For this information turn to the section Soil Types and Phases, where each soil of the county is described and its use and management are discussed. Refer also to the section on Use and Management of the Soils, where management is discussed more generally.

How difficult would it be to clear this soil? The answer to this may be indicated by the figure following the soil symbol on the map. In our example

this was figure 3. Look at the Cover Classification Legend on the soil map and you will see that the figure 3 indicates a prairie vegetation, which is usually the kind most easily cleared from the land. Other areas of Arzell fine sand, however, are marked Aa5, the 5 indicating a cover of cypress that would be more difficult to clear. Yet others have simply the symbol Aa, which indicates the normal vegetation for Arzell fine sand. The description of Arzell fine sand in the section on Soil Types and Phases tells that the normal vegetative cover for the soil is slash pine and grasses.

SOILS OF THE COUNTRY AS A WHOLE

A general idea of the soils of the county is given in the section on Soil Series and Their Relations, which tells about the principal kinds of soils, where they are found, and how they are related to one another. After reading this section, study the Color Grouping legend on the soil map. It shows how soils of similar characteristics are grouped by color, each group in a different color or shade. The coloring brings out soil patterns on the map. These patterns are probably associated with well-recognized differences in type of farming, land use, and land use problems.

A newcomer to the county, especially if he considers purchasing a farm, will want to know about the climate; the types and sizes of farms; the principal farm products and how they are marketed; the machinery and other equipment on farms; the availability of churches, schools, roads, railroads, electric power, and water supplies; the industries of the county; and the centers of population. Information about all these will be found in the section on General Nature of the Area and in the section on Additional Facts about Collier County.

Those interested in how the soils of the county were formed and how they are related to the great soil groups of the world should read the section on Morphology, Genesis, and Classification of Soils.

This publication on the soil survey of Collier County, Fla., is a cooperative contribution from the—

SOIL SURVEY (DETAILED-RECONNAISSANCE) OF COLLIER COUNTY, FLORIDA

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¹ The Division of Soil Survey was transferred to the Soil Conservation Service on November 15, 1952.

COLLIER COUNTY has an ideal climate for growing vegetables for winter market. Its potentialities for this use were realized before 1910, but large-scale production of winter vegetables did not begin until 1927-28. The acreage now under cultivation is still only about 1 percent of the county. Vast areas of native forest or prairie now used as unimproved grazing land or left idle can be brought into cultivation or improved for grazing. Clearing and improving of more land will depend on market prices and costs of land improvement. The soils differ considerably in cost of clearing and installing water control and in the amount of fertilizer needed to assure successful production. To aid farmers in determining the best uses for their land, the United States Department of Agriculture and the Florida Agricultural Experiment Station made a cooperative soil survey of the county. They mapped in detail the soils suitable for cropland and in less detail, or reconnaissance, those soils better suited to forestry or some other less intensive use. The survey was completed in 1942 and rewritten in 1947. Unless otherwise specifically indicated, all management practices and fertilizer recommendations in this report are those considered appropriate in 1947.

GENERAL NATURE OF THE AREA

LOCATION AND EXTENT

Collier County occupies approximately 2,032 square miles, or 1,300,480 acres, in the southwestern part of the peninsula of Florida (fig. 1). It is bounded on the west by the Gulf of Mexico, on the north by Lee and Hendry Counties, on the east by Broward and Dade Counties, and on the south by the Gulf of Mexico and by Monroe County. At no place is it far from the coast. Even at its eastern boundary it is only about 45 miles from the Atlantic Ocean. Everglades, the county seat, is in the south-central part of the county. It is 75 miles west of Miami, 160 miles southeast of Tampa, and 310 miles south of Jacksonville.

PHYSIOGRAPHY, RELIEF, AND DRAINAGE

Physiographically, the county lies within the Floridian section of the Coastal Plain province (6).^{1a} It is part of the Coastal Lowlands, one of the five natural topographic regions into which Florida can be divided according to Cooke (2). The Lowlands form a coastal border around the State and for the most part are nearly level plains less than 100 feet above sea level. In Collier County the Coastal Lowlands consist of two marine terraces—the Talbot and Pamlico. The Talbot terrace occupies areas more than 25 feet above sea level, and the Pamlico, areas less than 25 feet. Only a small part of the county—the region around Immokalee—lies on the Talbot terrace.

Davis (4) divided the county into three physiographic regions (fig. 2): (1) the Flatlands, (2) the Big Cypress Swamp, and (3) the Southwest Coast and Ten Thousand Islands.

The Flatlands region extends northward from Gordon Pass across the western and northern parts of the county. This region includes

^{1a} Numbers in italics refer to Literature Cited, p. 71.

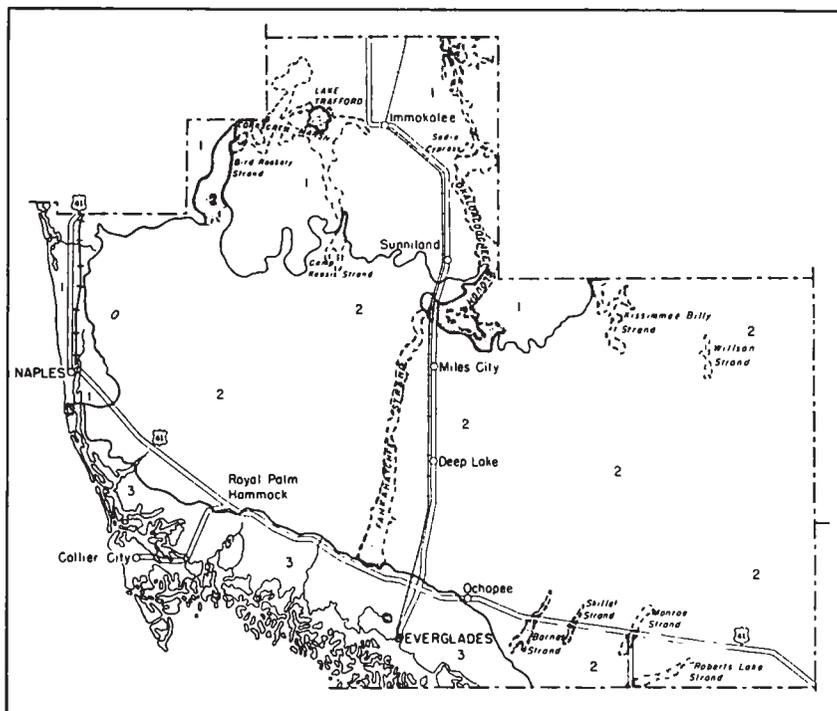


FIGURE 2.—Physiographic subdivisions of Collier County, Fla.: (1) The Flatlands, (2) the Big Cypress Swamp, and (3) the Southwest Coast and Ten Thousand Islands.

The mineral soil mantles that cover the harder rock and marl are composed mainly of marine sand deposited during the Pleistocene epoch (3). During this period the sand on the Talbot and Pamlico terraces was laid down by the high sea levels of the Sangamon and Peorian interglacial ages, respectively. Other sand and some marl and peat were deposited on top of some of the Pamlico sand during recent times, or since the end of the Wisconsin glacial stage of the Pleistocene series. All of this sand, except that in the northwestern part of the county, is underlain by the Tamiami formation, which was deposited in the open ocean during the Pliocene age (8). The Tamiami formation is a sandy limestone or calcareous sandstone and appears at the surface where the more recent sand deposits are absent. Near Sunniland this formation merges with the Buckingham marl (Pliocene age), which extends northward under the Pamlico and Talbot sands.

In the Flatlands region, the sand mantle on the Pamlico and Talbot terraces may be several feet thick. The most common soils of the region belong to the Immokalee, Blanton, Arzell, Pompano, and Charlotte series. A few areas of St. Lucie soils occur on the small ridges or knolls near the town of Immokalee and along the Gulf coast. Near Corkscrew Marsh and Okaloacoochee Slough, where the Pamlico sand is very shallow and overlies Buckingham marl or

other calcareous materials, the soils belong to the Sunniland, Felda, and Matmon series, and grains of phosphatic material may be found in the marl.

Most of the soils of Big Cypress Swamp have developed on shallow deposits of Recent and Pamlico sands overlying marl or limestone. The soils on the pine islands belong to the Broward, Copeland, and Keri series. In many places the Tamiami formation is exposed at the surface and contains many solution holes. The soils of the marl prairies, which occur in the interior of this region and extend along the southwestern coast, are of Recent geologic origin. They have developed from sediments washed in over the rocks and through the solution and redeposition of the calcareous material by calcareous algae (5). Ochopee and Tucker marls are on these prairies. Several small ponds and marshes support an abundant growth of marsh plants, which decay on the marl and rock floor and form peat.

Along the coast of the Gulf of Mexico, sand dunes of Recent geologic origin give rise to the Lakewood and St. Lucie soils. On lower elevations new materials are being deposited in the tidal marshes and mangrove swamps. The shore of the mainland and of the islands is gradually building up and extending outward, mainly through the extension of the areas on which mangrove trees are growing.

The regional slope of the county is gradual from the north to the south and southwest. The railroad station at Immokalee in the northern part of the county is 44 feet above sea level (7). The highest elevation in southern Florida (52 feet) is the top of the highest hill near Collier City, on Marco Island. Other elevations² in the county are: Bank of Everglades, 3.3 feet; railroad crossing at Carnestown, 5.9 feet; railroad station in Naples, 6 feet; and stone archway on the Tamiami Trail at the southeastern corner of the county, 8.4 feet above sea level.

Most of the county is so low and level that drainage is indefinite and sluggish. The coastal region has numerous embayments, rivers, creeks, and lagoons that permit tidewater to extend inland, in some places as far as 6 miles. The adjacent intertide areas change gradually to inland areas covered by fresh water. Some of the rivers and creeks flowing into the Gulf of Mexico are the Blackwater, Fahka Union, Fahkahatchee, Barrons, Turner, and New Rivers, and Cocohatchee, Henderson, Royal Palm Hammock, and Halfway Creeks. These streams extend inland and join the depressed cypress strands and grass sloughs that form the drainageways and channels in the interior. These indistinct drainageways generally flow in a southerly and southwesterly direction. Following heavy rains and during the rainy season in summer and early fall, the cypress strands, sloughs, wet prairies, and even the islands within the Big Cypress Swamp may be covered by a few inches to several feet of water.

The northern part of the county west of Immokalee is drained by Corkscrew Marsh and Lake Trafford. The lake is shallow, approximately 15 to 20 feet deep, and covers about 3 square miles. Part of the excess water in Corkscrew Marsh flows southwestward into Bird Rookery Strand and eventually into the Gulf through Cocohatchee

² UNITED STATES DEPARTMENT OF COMMERCE. TIDAL BENCHMARKS OF FLORIDA GULF COAST. U. S. Coast and Geod. Survey Mimeo. Pub. T-12: 6-10 1945.

Creek. The eastern branch of the marsh drains southward through Camp Keasis Strand and Fahkahatchee Strand into the Fahka loacoochee Slough forms a marshy drainageway for the sandy flatlands north of Big Cypress Swamp. The slough flows to the south near the Collier-Hendry County line and then southwest into Fahkahatchee Strand a few miles south of Sunniland. Some of the water from the slough, however, continues southward through other cypress strands to the Gulf.

Kissimmee Billy and Willson Strands help drain several townships in the northeastern part of the county. Part of the water from Kissimmee Billy Strand flows southwest, and the rest flows to the southeast into the Everglades Basin, which begins a few miles east of the county. Willson Strand also drains into the Everglades Basin.

There are many small ponds within the county but they are usually dry during winter and spring. Deep Lake, located near the village of the same name, is a solution hole in the limestone formations. The lake is approximately 300 feet wide and about 95 feet deep.

Drainage is also improved by canals along the Tamiami Trail from Naples to the southeastern corner of the county, along Highway No. 29 from Immokalee to Everglades, and along Highway No. 92 from Marco Island to Royal Palm Hammock. These canals were formed from materials excavated for the roadbeds. A few short canals have been dug for drainage near Ochopee and north of Copeland. In many sections not reached by drainageways, evaporation helps remove water.

CLIMATE

The climate of Collier County is subtropical but temperatures are greatly moderated by winds that sweep across the peninsula from the Gulf of Mexico and the Atlantic Ocean. Summers are long and warm. The humidity is relatively high but thundershowers occur almost every afternoon and prevent extremely high temperatures. Winters are short and mild. Most days are bright and sunny, and little rain falls. Cold spells accompanied by cold winds can be expected only a few times during the year and they last only 1 or 2 days. Frosts severe enough to kill vegetables and some fruits come about once every 5 years. Tomatoes, cucumbers, peppers, potatoes, sweet-potatoes, and lima beans usually can be grown throughout the winter months without much danger from frost. Wire, carpet, and other grasses are grazed continuously throughout the year, and the weather is mild enough to make shelters for livestock unnecessary.

Table 1 gives figures on normal monthly, seasonal, and annual precipitation compiled from records of the United States Weather Bureau stations at Fort Myers, Lee County,³ and Everglades, Collier County.

³ The climate in the northern part of this county is more like that at Fort Myers than that at Everglades, where the winters are warmer. Data from the Fort Myers station were therefore included in table 1 to show climatic conditions in the northern part of Collier County.

TABLE 1.—*Normal monthly, seasonal, and annual temperature and precipitation at Everglades and Fort Myers, Fla.*

EVERGLADES, COLLIER COUNTY, ELEVATION 6 FEET

Month	Temperature ¹			Precipitation ²		
	Average	Absolute maximum	Absolute minimum	Average	Total for the driest year	Total for the wettest year
	°F.	°F.	°F.	Inches	Inches	Inches
December.....	68.0	89	28	1.20	0.75	1.93
January.....	67.1	89	24	2.00	2.42	.78
February.....	67.5	90	34	1.30	1.90	1.49
Winter.....	67.5	90	24	4.50	5.07	4.20
March.....	69.5	91	34	1.85	1.76	5.77
April.....	74.1	96	42	1.35	.70	5.95
May.....	77.2	97	52	4.95	2.88	3.28
Spring.....	73.6	97	34	8.15	5.34	15.00
June.....	80.8	98	62	6.95	12.24	11.88
July.....	82.4	100	66	7.30	5.74	7.99
August.....	82.8	97	67	8.80	3.74	8.16
Summer.....	82.0	100	62	23.05	21.72	28.03
September.....	82.1	97	62	8.55	2.70	12.38
October.....	78.3	96	50	5.70	.32	10.96
November.....	72.2	92	34	1.45	1.35	7.62
Fall.....	77.5	97	34	15.70	4.37	30.96
Year.....	75.2	100	24	51.40	³ 36.50	⁴ 78.19

FORT MYERS, LEE COUNTY, ELEVATION 8 FEET

December.....	65.0	88	24	1.56	0.71	3.55
January.....	63.9	89	27	1.76	.30	4.29
February.....	65.0	88	27	2.02	.76	1.60
Winter.....	64.6	89	24	5.34	1.77	9.44
March.....	68.9	92	33	1.89	1.42	2.52
April.....	72.8	93	44	1.89	.80	2.20
May.....	77.2	97	50	4.12	1.23	1.79
Spring.....	73.0	97	33	7.90	3.45	6.51
June.....	80.0	97	58	8.91	8.04	25.58
July.....	81.4	95	66	8.16	8.78	6.35
August.....	81.7	96	65	8.82	3.14	10.38
Summer.....	81.0	97	58	25.89	19.96	42.31

See footnotes at end of table, p. 8.

TABLE 1.—Normal monthly, seasonal, and annual temperature and precipitation at Everglades and Fort Myers, Fla.—Continued

Month	Temperature ¹			Precipitation ²		
	Average	Absolute maximum	Absolute minimum	Average	Total for the driest year	Total for the wettest year
	°F.	°F.	°F.	Inches	Inches	Inches
September.....	80.5	95	61	7.45	5.59	22.10
October.....	75.9	95	47	4.48	1.78	1.49
November.....	69.5	89	35	1.33	.30	.79
Fall.....	75.3	95	35	13.26	7.67	24.38
Year.....	73.5	97	24	52.39	³ 32.85	⁶ 82.64

¹ Everglades: Average temperature based on 25-year record, 1926 to 1950; highest and lowest temperatures from 18-year record, 1927 to 1944, kept by the University of Florida. Fort Myers: Average temperature based on 60-year record, 1891 to 1950; highest and lowest temperatures from 40-year record, 1891 to 1930.

² Everglades: Average precipitation based on 25-year record, 1926 to 1950; wettest and driest years based on 26-year record, 1925 to 1950. Fort Myers: Average precipitation based on 60-year record, 1891 to 1950; wettest and driest years based on 51-year record, 1900 to 1950.

³ In 1930.

⁴ In 1947.

⁵ In 1927.

⁶ In 1853.

Frosts may occur from the first of December to the middle of March. Nevertheless, many winters, sometimes several in succession, pass without frost or freezing temperatures. During the 59-year period, 1891–1950, frosts occurred only seven times in the fall and twice in the spring at the Fort Myers station. At Everglades frosts occurred only three times during the 20-year period 1930 to 1950. The earliest killing frost recorded at Everglades came on December 12, and the latest on January 29. The dates differ in various parts of the county, depending on elevation, relief, drainage, vegetation, and nearness to bodies of water.

In general, the rainy season begins in June and ends in September. During this period the rainfall comes mostly in the form of heavy thundershowers that frequently last only an hour or two. The precipitation during the rest of the year is very light.

Moderately high winds may accompany thunderstorms at all seasons of the year, and from August through November disturbances of the West Indian hurricane type occasionally move northward across the county from the Tropics. These hurricanes vary in intensity, however, and usually the accompanying rain does more damage than the wind.

WATER SUPPLY

The county is well supplied with water. Numerous ponds, lakes, cypress strands, and swamps furnish water for livestock on the range. In many of the small towns and villages, shallow wells (10 to 15 feet deep) supply water for home use. The water is pumped mainly by hand, although electric and gasoline motors are also used. Many farmhouses are supplied with running water. In Everglades and Naples the water is obtained from artesian wells drilled to depths of 400 to 600 feet. Good artesian water is found at these depths in all parts of the county. Cisterns afford the main source of water for family and small-farm use on some of the islands along the Gulf of Mexico.

In dry periods water is used for furrow irrigation on a few of the vegetable farms near Immokalee. Irrigation water is obtained mostly from wet sloughs and cypress strands and carried by gravity flow through open ditches to the fields. A few small areas are irrigated from shallow (15 feet deep) wells.

VEGETATION

The natural vegetation is that characteristic of extensive areas in southern Florida. It consists of a great variety of plants, some of tropical and some of temperate species. The kinds of plants vary with the climate and locally with differences in the soils and water levels (pl. 1). Most of the tropical plants are found in the dense hammock forests which grow as islands and in elongated strips along the outer border of many of the large cypress strands and also along the streams and rivers. Nearly all the vegetation now growing is similar to that found under virgin conditions. Not more than 15,000 acres of the county have been farmed or altered by pasture improvement, and some of the areas previously farmed on the marl prairies have reverted to nearly natural vegetation.

The natural vegetation may be classified as follows (4): (1) Pine forests, (2) saw-palmetto prairies, (3) hammock forests, (4) inland swamps and cypress forests, (5) scrub forests, (6) coastal mangrove swamp forests, (7) fresh-water marshes and wet prairies, (8) salt-water marshes, and (9) beach and dune vegetation.

The pine forests grow on the flatlands and on islands within the Big Cypress Swamp region. Slash pine, saw-palmetto, wiregrass, and other shrubs and grasses are the principal vegetation. Where calcareous subsoils, limestone, or marl are near the surface, cabbage palmettos are abundant. Only about 10 percent of the pine forests contain mature uncut timber. Most of the cut-over pinelands have second-growth trees still under sawlog size.

A complete list of the plants in the pine forest will be found on pages 67 to 71. The soils supporting this growth are the Blanton, Pompano, Immokalee, Arzell, Charlotte, Sunniland, Keri, Broward, and Matmon.

The saw-palmetto prairies have the same grasses and shrubs as the pine flatlands but very few pine trees, or none at all. The soils on these prairies are the Immokalee, Sunniland, and Broward.

The hammock forest consists of a dense growth of many tropical or subtropical trees, shrubs, vines, and ferns. Among the plants growing in the hammocks are gumbo-limbo, mastic, bustic, royal palm, mahogany, Florida strangler fig, wild tamarind, lancewood, wild-coffee, Boston fern, and orchids. The list in the back of this report gives scientific and common names for hammock vegetation as it is found on Copeland soil and the Keri-Copeland complex.

The inland swamps and cypress forests have many plants found in the hammocks and in addition bald and pond cypresses, red maple, blackgum, and an abundance of air plants. Large areas, however, have only sparse vegetation between the small- and medium-sized cypress trees. Most of the cypress forests are still in their natural state. An exception is Fakahatchee Strand, from which the large cypress trees are now being cut for lumber, and from which many of the royal palms have been removed for replanting at the Hialeah race track in Miami. A complete list of the plants found in the inland swamp and cypress forests is given on pages 68 to 69 of this report under the heading "Cypress swamp."

The scrub forests characteristic of the sand dunes on Marco Island, ridges and knolls along the Gulf coast, and the area near Immokalee have the plants shown under the heading "St. Lucie and Lakewood fine sands," page 71 of this report.

The mangrove swamps contain principally the American mangrove (*Rhizophora mangle*), black-mangrove (*Avicennia nitida*), and a few other salt-tolerant plants. The American mangroves form the outer zone of the mangrove swamps, and the black-mangroves grow on the inshore mud flats. Salt-water marshes usually lie as a narrow zone between the mangrove swamps and the fresh-water marshes and wet prairies farther inland. Salt-tolerant plants such as saltgrass (*Distichlis spicata*), big cordgrass (*Spartina cynosuroides*), bunch witchgrass (*Spartina bakeri*), and blackrush (*Juncus roemerianus*) grow on the salt-water or tidal marshes. Other plants common to the area are given on page 71 of this report under Tidal marsh.

The vegetation on the fresh-water marshes and wet prairies consists largely of short grasses—such as poverty grass, wire grass, and carpetgrass—with broomsedge, and a few rushes and sedges. Plants growing in fresh-water marshes are given under the heading "Fresh water marsh, page 69 of this report, and plants common to the wet prairies on page 67 under "Arzell and Charlotte fine sands" and on page 70 "Ochopee and Tucker marls."

The first plants to take over on the shifting saline sands on the coastal beaches are beach morning-glory, sea oats, marsh-elder, common rush-grass, sea-rocket, and shore spurges.

The correlation of dominant vegetation with soil types is of considerable importance in this region, since production of natural forage for livestock is the principal function of many of the soils. Some plants are more valuable than others for grazing. Observation has proved that certain communities, or types, of vegetative growth are more or less consistently associated with certain soils. A correlation of soil types with natural vegetation, based on observations in the field, is shown in the list, pages 69 to 70.

LAND USE AND TYPES OF FARMING

About 85 percent of the county is covered with forest consisting largely of pine and cypress trees. Much of the forested area, as well as the small prairies in the northern part, is used as range pasture for cattle and hogs.

Most of the saleable pine has been cut from the range land, but the cypress trees in pastures remain intact. Vast acreages of pine and cypress forest and short-grass prairie have never been cleared for crops and are not used for grazing.

Census releases for 1950 list 466,874 acres, or about 35.9 percent of the county, as land in farms. Of this area in farms, only 3,080 acres is listed as cropland harvested in 1949. Much more land than this has been cleared for crops, but it is not used every year. The number of acres under cultivation at one time or another in recent years actually totals 12,000 to 13,000.⁴

Most of the cultivated land is on the wet marl prairies and wet sand prairies; only a few hundred acres of forest land has been cleared. The marl prairies under cultivation are east and north of Ochopee and along State Highway No. 29 from Copeland to Miles City. The sand prairies under cultivation are situated mostly south and east of Immokalee. An area of several hundred acres near Naples is cultivated.

Almost all the land cleared is used to grow winter vegetables for shipment to northern markets. Of the 3,080 acres cropped in 1949, 1,326 acres was in tomatoes, 1,078 acres in cucumbers, 30 acres in sweet corn, and all the rest in small acreages of field corn, sugarcane, cowpeas, sweetpotatoes and yams, Irish potatoes, green lima beans, sweet peppers, green peas, squash, cabbage, and other vegetables.

Census releases for 1950 report 193 farms in the county, and the average size as 2,419 acres. Small farms owned by operators and vegetable farms and ranches leased from other owners are included in the total number of farms. Vegetable farms range from 3 to 300 acres in size; the ranches usually occupy several thousand acres.

SOILS OF COLLIER COUNTY, THEIR USE AND MANAGEMENT

The soils of the county greatly differ in many characteristics including color, texture, consistence, relief, drainage, reaction, stoniness, fertility, permeability, and tilth (11).

The soils exhibit many shades of color ranging from nearly white through gray, yellow, and brown to nearly black; but most of the mineral soils have light-colored surface soils. Exceptions are mineral soils of the hammock areas and some of the depressions, where partly decayed vegetable matter has accumulated and gives a dark color. The subsoils are chiefly light gray, but in places they are mottled with numerous shades of gray, yellow, and brown.

For the most part, the soils are low in organic matter. Many of them have a considerable quantity of loose partly decayed vegetable matter in the first few inches of the upper layer, but these remains

⁴ Information obtained from Ed Scott, Clerk of the Court, Everglades, Fla.

are not well incorporated and usually disappear when the soil is cultivated. Under low hammock vegetation, enough organic matter has been mixed with the sands to make the soils black to a depth of about 10 inches. On some of the densely vegetated marshes, peat or muck has accumulated to depths varying from a few inches to 30 inches or more.

The texture of the soils is predominantly fine sand, although the amount of organic matter in some tends to make them feel loamy. The soils on a few of the marl prairies contain enough silt and clay to be classified as fine sandy loams and clay loams. The soils usually have mellow and very friable surface layers. In many places the fine sands are loose and incoherent. The subsoils in most places consist of fine sands, although some are friable fine sandy clay loams.

Because the county is on a nearly level plain sloping very gently from its northern part southward and southwestward toward the coast, it is naturally poorly drained and the water table is usually near the surface. The only exceptions are the comparatively small knolls and low ridges along the western coast and near Immokalee.

Many of the soils are acid. Others have an acid surface soil and, depending on the depth to the underlying limestone or calcareous materials, a nearly neutral or alkaline subsoil. In some localities the calcareous drainage waters may make low wet sandy soils neutral or alkaline.

The soils vary considerably in depth to limestone. Rock outcrops are common in some places, whereas in others the soil mantle may be several feet thick. The flatlands in the western and northern part of the county probably have a predominant 10- to 30-foot range in depth to limestone. In the Big Cypress and Southwest Coast regions, the limestone ranges from above the surface to a depth of 5 feet.

Most of the soils have a relatively low natural fertility. The dark-colored soils and those underlain by finer textured materials are higher in natural fertility than the light-colored and coarse-textured soils.

Roots of trees and grasses penetrate the soils readily. Even in areas where limestone rocks are on the surface, trees and grasses grow in small crevices in the porous rocks where soil materials have accumulated.

The tilth of most soils is favorable to cultivation, but some of the marls are subject to puddling and clodding when tilled under unfavorable moisture conditions.

The types of vegetative cover materially affect the ease with which the soils can be placed under cultivation. Practically none of the forested areas have been cleared and cropped. All of the areas used for growing vegetables are on the wet sand and marl prairies. The soils on these prairies are easily plowed or disked and planted; whereas many trees and palmettos must be removed before farming can begin on the forested areas.

SOIL SERIES AND THEIR RELATIONS

The soils of the county can be classified according to texture as: (1) Deep sands, (2) shallow sands over limestone and marl, (3) marls and sandy marls, (4) mixed soils, and (5) miscellaneous land types.

The deep sandy soils may be divided further into excessively, well, somewhat poorly, and poorly drained soils. The shallow sands over limestone, marls, and sandy marls, and the mixed soils are somewhat poorly, poorly, or very poorly drained. The relief, drainage, parent material, and other important characteristics of the soil series are indicated in table 2. The mixed soils and the miscellaneous land types are not listed in table 2. The characteristics of the mixed soils, Broward-Ochopee complex, for example, are essentially those listed in table 2 for the respective soil series to which the soils of the mixture belong. Miscellaneous land types are not classified by soil series.

TABLE 2.—*Principle characteristics of the soils series of Collier County, Florida*

DEEP SANDS

Soil series	Relief	Drainage	Source of parent material	Surface soil	Lower layers
Arzell.....	Level or nearly level; slight depressions.	Poor.....	Moderately thick beds of fine sand over limestone or marl.	Light-gray to light brownish-gray loose fine sand, 2 to 4 inches thick.	Light-gray or white loose fine sand underlain by limestone below 48 inches.
Blanton.....	Level to slightly undulating.	Good.....	Moderately thick beds of unconsolidated sand.	Gray loose fine sand, 2 to 5 inches thick.	Light-gray loose fine sand to depths of 18 to 24 inches, underlain by white fine sand mottled slightly with pale yellow.
Charlotte.....	Level or nearly level; slight depressions.	Poor.....	Moderately thick beds of fine sand over limestone or marl.	Dark grayish-brown to yellowish-brown loose fine sand, 4 to 6 inches thick.	Brownish-yellow or yellowish-brown loose fine sand to depths of 20 to 30 inches, grading with increasing depth to white; underlain by limestone or marl at 42 to 48 inches.
Immokalee.....	Level or nearly level..	Somewhat poor..	Dominantly thick beds of unconsolidated sand.	Gray to dark-gray loose fine sand, 2 to 5 inches thick.	Light-gray loose fine sand to depths of 30 to 40 inches, underlain by dark grayish-brown to very dark-gray feebly or weakly cemented organic layer, 3 to 10 inches thick, that grades to light-gray fine sand with increasing depth.
Lakewood.....	Hummocks; gently rolling to level.	Excessive.....	Thick beds of very loose sand.	Light-gray loose incoherent fine sand, 2 to 4 inches thick.	White incoherent fine sand to depths of 20 to 30 inches, underlain by brownish-yellow and yellow fine sand.
Pompano.....	Level or nearly level; slight depressions.	Poor.....	Moderately thick beds of fine sand over limestone or marl.	Dark-gray to grayish-brown loose fine sand, 4 to 6 inches thick.	Light grayish-brown or light-gray loose fine sand grading to white at 20 to 30 inches; in places underlain by limestone below 48 inches.
St. Lucie.....	Low ridges, knolls, hummocks; undulating.	Excessive.....	Thick beds of very loose sand.	Light-gray loose incoherent fine sand, 2 to 4 inches thick.	White incoherent fine sand to great depths.

SHALLOW SANDS OVER LIMESTONE AND MARL

Broward.....	Level, nearly level, or very slightly undulating.	Somewhat poor.	Dominantly thin beds of fine sand, 12 to 40 inches thick, over limestone.	Dark-gray to gray loose fine sand, 2 to 8 inches thick.	Light-gray to pale-yellow loose fine sand to depths of 12 to 18 inches; then yellowish-brown fine sand or loamy fine sand 1 to 6 inches deep overlying limestone.
Copeland.....	Level or nearly level.	Poor to somewhat poor.	Thin (6- to 18-inch) coverings of fine sand overlying or partly mixed with residuum from limestone.	Black to very dark-gray fine sand, 6 to 12 inches thick.	Gray to grayish-brown loose fine sand, grading into 2- to 6-inch layer of mottled light-gray, brownish-yellow, and yellow fine sandy clay loam at 18 to 20 inches; then moderately hard limestone.
Felda.....	Nearly level, level, or slightly depressional.	Poor.....	Thin beds of fine sands and sandy clay materials over limestone or concretions of limestone.	Dark-gray to gray loose fine sand, 4 to 8 inches thick.	Light-gray to light brownish-gray loose fine sand to depths of 18 to 24 inches, underlain by light-gray fine sandy clay loam mottled with brownish yellow or yellowish brown; concretions and fragments of limestone at 36 to 60 inches.
Keri.....	Level or nearly level.	Somewhat poor.	"Marl sandwiches", (thin layer of marl between layers of fine sand) underlain by limestone at 4 to 5 feet.	Dark-gray to grayish-brown fine sand, 2 to 6 inches thick.	Light-gray to grayish-brown loose fine sand to depths of 12 to 18 inches; light-gray marl with streaks of brownish yellow and 2 to 10 inches thick, overlying white fine sand streaked with brownish-yellow.
Matmon.....	Nearly level.....	.....do.....	Thin layer of fine sands over moderately soft to hard limestone or marl.	Dark-brown to brown loamy fine sand, 4 to 6 inches thick.	Yellowish-brown to brown loamy fine sand to depths of 10 to 14 inches; yellowish-brown fine sandy clay loam 2 to 6 inches thick overlying moderately hard limestone or marl; numerous rocks throughout profile.
Sunniland.....	Nearly level; gently sloping to lower lying soils.	.....do.....	Thin beds of fine sand and sandy clay materials over limestone or concretions of limestone.	Gray to dark-gray loose fine sand, 4 to 8 inches thick.	Light-gray loose fine sand to depths of 18 to 30 inches, underlain by mottled yellowish-brown and light-gray fine sandy clay loam; soft or hard limestone rocks at 36 to 60 inches.

MARLS AND SANDY MARLS

Ochopee.....	Level or nearly level.	Very poor.....	Unconsolidated finely divided calcareous sediments with high content of fine sand; mainly of fresh-water origin, and 4 to 60 inches deep over limestone.	Dark-gray to dark grayish-brown friable marl, having a loamy fine sand texture, 6 to 12 inches thick.	Grayish-brown fine sandy marl to depths of 16 to 20 inches, underlain by light-gray fine sand streaked with yellow; limestone rocks at 6 to 24 inches.
Tucker.....	.....do.....	.....do.....	Unconsolidated finely divided calcareous materials with moderate quantity of fine sand; mainly of fresh-water origin, and 4 to 24 inches deep over limestone.	Dark-gray to dark grayish-brown friable marl of clay loam texture, 3 to 8 inches thick.	Gray to light-gray marl of clay loam texture to depths of 12 to 18 inches; then hard to moderately soft limestone.

SOIL TYPES AND PHASES

On the following pages the different soils, identified by the same symbols as are used on the soil map, are described in detail and their agricultural relationships are discussed. Their location and distribution are shown on the accompanying soil map, and their acreage and proportionate extent are given in table 3.

TABLE 3.—*Approximate acreage and proportionate extent of the soils mapped in Collier County, Fla.*

Soil	Acres	Per- cent	Soil	Acres	Per- cent
Arzell fine sand.....	98, 199	7. 6	Made land.....	443	(¹)
Blanton fine sand.....	3, 180	. 2	Mangrove swamp.....	83, 788	6. 4
Broward fine sand.....	9, 896	. 8	Matmon loamy fine sand.....	10, 910	. 8
Heavy substratum phase.....	27, 308	2. 1	Ochopee fine sandy marl.....	7, 914	. 6
Shallow phase.....	32, 412	2. 5	Shallow phase.....	263, 793	20. 3
Broward-Ochopee complex.....	40, 672	3. 1	Tidal phase.....	4, 875	. 4
Charlotte fine sand.....	17, 039	1. 3	Ochopee marl.....	9, 770	. 8
Coastal beach.....	2, 339	. 2	Deep phase.....	5, 610	. 4
Copeland fine sand.....	2, 081	. 2	Shallow phase.....	35, 296	2. 7
Low phase.....	8, 302	. 6	Pompano fine sand.....	61, 036	4. 7
Shallow phase.....	4, 212	. 3	Rockland.....	72, 360	5. 6
Cypress swamp.....	241, 330	18. 6	St. Lucie fine sand.....	4, 595	. 4
Felda fine sand.....	9, 151	. 7	Shell mounds.....	576	(¹)
Fresh water marsh.....	53, 507	4. 1	Sunniland fine sand.....	24, 456	1. 9
Immokalee fine sand.....	94, 477	7. 3	Tidal marsh.....	36, 285	2. 8
Keri-Copeland com- plex.....	1, 490	. 1	Tucker marl.....	9, 024	. 7
Keri fine sand.....	23, 956	1. 8			
Lakewood fine sand..	198	(¹)	Total.....	1, 300, 480	100. 0

¹ Less than 0.1 percent.

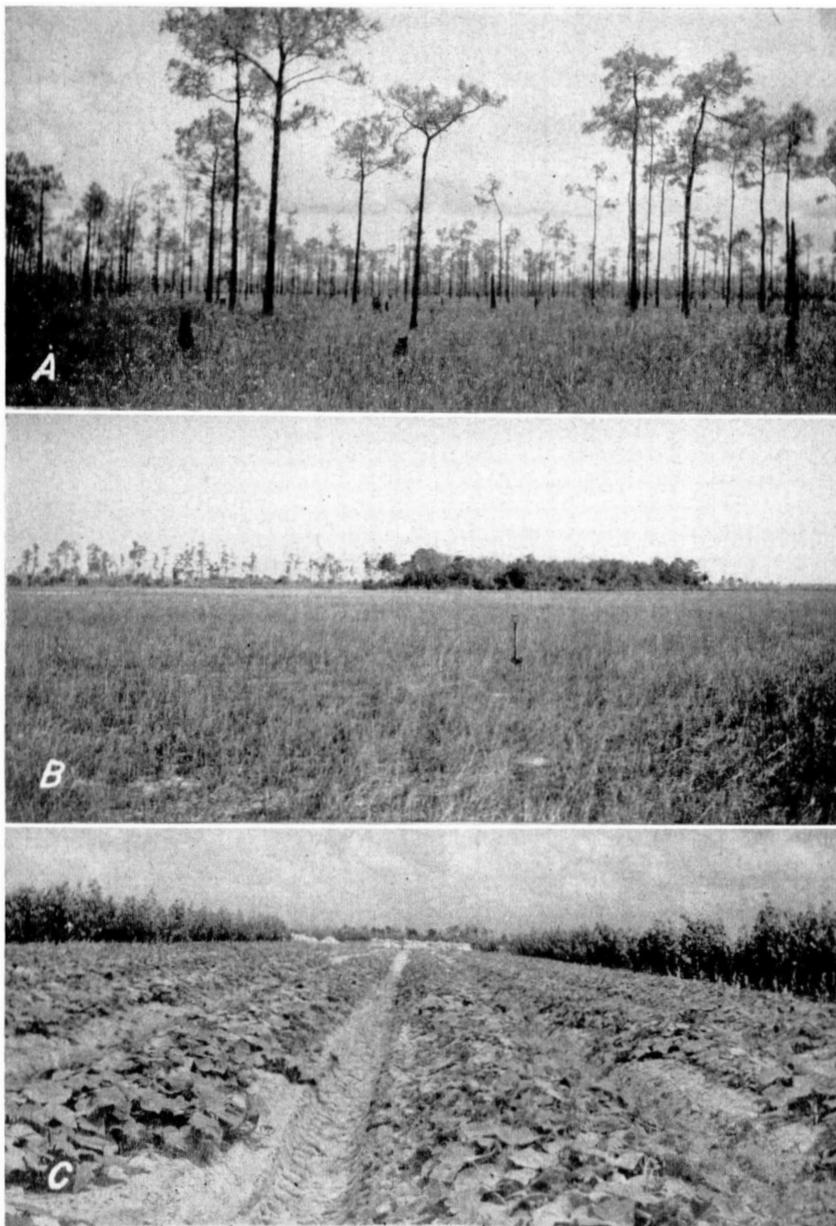
Arzell fine sand (AA).—Small to fair-sized areas of this soil are well distributed in the western and northern parts of the county—mainly north and northeast of Naples and Royal Palm Hammock and west and southwest of Immokalee and Sunniland. The soil occurs in nearly level or level positions or in depressions surrounded by the Immokalee, Sunniland, Broward, or St. Lucie soils.

The soil is less acid, more nearly level, and more poorly drained than the St. Lucie soil, and though closely associated with the Pompano and Charlotte soils, is lighter colored than Pompano fine sand and lacks the yellow and yellowish-brown layers of Charlotte fine sand. It has developed from a moderately thick bed of marine sands that is 48 to 80 inches deep over limestone or marl. The level relief causes very slow or ponded surface runoff, particularly in wet seasons, but the coarse texture of the soil makes internal drainage very rapid.

The vegetation (pl. 2, A) consists principally of second-growth slash pine, poverty oatgrass, switchgrass, broomsedge, and wire, carpet, and three-awn grasses, waxmyrtle, buttonbush, St. Johnswort, maidencane, whitetop sedge, arrowhead, and a few scattered saw-



A, Native royal palms in Collier-Seminole State Park, Royal Palm Hammock
Dense growth of subtropical plants surrounds cleared areas.
B, Characteristic vegetation on the rolling relief and sand dunes typical of Lake-
wood fine sand, near Collier City, Marco Island.



A, Typical Arzell fine sand with a fair growth of slash pines and an undergrowth of short grasses and a few shrubs.
B, Prairie area of Arzell fine sand in the foreground; Copeland soils with subtropical hammock vegetation and Sunniland soils in the background.
C, Cucumbers on Arzell fine sand. Water-control systems provide drainage in wet seasons and irrigation in dry.

palmettos. Areas where slash pine does not grow (pl. 2, *B*) are shown by prairie symbols on the map.

Profile description:

- 0 to 3 inches, light-gray to light brownish-gray loose fine sand; some coarsely divided organic matter; slightly acid to neutral.
- 3 to 10 inches, light-gray loose fine sand; slightly acid to neutral.
- 10 to 54 inches, white loose fine sand having a few splotches or streaks of pale yellow; slightly acid to neutral.
- 54 inches +, limestone.

In some depressional areas the surface soil has a very thin covering of mucky materials. Occasionally, the third layer is pale yellow mottled with white and light gray. In other places this layer may have gray or dark-gray organic stains.

Large acreages of this soil are used for range land and provide fair grazing for cattle and hogs. The carrying capacity of the pasture ranges from 15 to 25 acres for each animal unit. Most of the land has been cut over and the saleable timber removed, and the second growth of slash pine has not attained sawlog size. Little of the area has been cleared for crops.

In some slightly lower places natural strands of cypress take the place of the slash pines that usually grow with short grasses. These cypress-covered areas are shown by symbol on the map. Individual trees are small to intermediate in size—about 3 to 8 inches in diameter at breast height and 20 to 40 feet high. In these places the soil is very poorly drained and covered with water the greater part of the year. Many areas serve as natural drainageways within the Big Cypress region. Included with these low areas of Arzell fine sand are small areas of Charlotte fine sand, which support a natural growth of small cypress trees.

All the cypress-covered areas are in native vegetation and are used for range pasture, which provides poor to fair grazing for cattle and hogs.

About 150 acres of the prairie areas has been used for cucumbers, tomatoes, peppers, squash, lima beans, and cabbage (pl. 2, *C*). The Arzell soil is very low in organic matter and mineral plant nutrients. Nearly all the nutrients necessary for crops must be supplied by applying fertilizers frequently. With favorable weather and a high level of management, which includes application of 2,000 to 3,000 pounds of 5-7-5⁵ mixture, 2,000 to 3,000 pounds of compost,⁶ 75 to 100 pounds of nitrate of soda-potash, and 50 to 100 pounds of manganese sulfate an acre, cucumbers yield 225 to 300 bushels; tomatoes, 175 to 250 bushels; and peppers, 300 to 400 bushels. Soil management practices for these crops are given on pages 38 to 43.

On a few small areas water is controlled by dikes, ditches, and pumps. In wet seasons excess water is pumped from the fields, and during dry seasons it is obtained from adjacent ponds, cypress strands, or shallow wells and used for furrow irrigation. As soon as water-control systems can be installed, many hundreds of acres of this land

⁵ Percentages, respectively of nitrogen, phosphoric acid, and potash.

⁶ Compost is prepared for tomatoes by adding 100 pounds of superphosphate to 2,000 pounds of stable manure. For cucumbers on the Arzell soils, about 200 pounds of superphosphate are added to the 2,000 pounds of stable manure.

can be farmed during the normally dry winter season without too great danger from unseasonal rains.

Blanton fine sand (BA).—This soil occupies low ridges and knolls within the flatwoods area along the western coast, and in the northern part of the county, chiefly north and southeast of Naples and northwest and southeast of Immokalee. It is associated with the St. Lucie and Immokalee soils, but is not so droughty as the St. Lucie. It occurs on higher relief than the Immokalee soil and does not have the stained organic layer usually present in that soil. Blanton soil developed from moderately thick beds of unconsolidated sands and is well drained. Surface runoff is slow to medium, and internal drainage is rapid. The content of organic matter and mineral nutrients is relatively low.

The vegetation consists mainly of second-growth slash pine, blue-jack, live, myrtle, and running oaks, broomsedge, three-awn wire-grasses and a few scattered saw-palmetto.

Profile description:

0 to 3 inches, gray loose fine sand of salt-and-pepper appearance.

3 to 7 inches, light-gray to light brownish gray loose fine sand.

7 to 20 inches, light-gray to white loose fine sand with a few pale-yellow mottles.

20 to 60 inches +, pale-yellow loose fine sand splotted or streaked with light gray, white, and yellow.

This soil is strongly acid. In places its surface layer is as loose and incoherent as that of the St. Lucie soil but less droughty and capable of supporting a better growth of grasses and pine trees. Near Immokalee and north of Naples this soil occurs near the Immokalee soil and has a brown stained layer at depths of 45 to 60 inches.

Nearly all of this soil is used for range pasture, which provides fair grazing for cattle and hogs. The carrying capacity is about 1 cow for 15 to 25 acres. Most of the acreage has been cut over, and the saleable timber removed. The young pine trees are less than sawlog size. About 40 acres near Immokalee is planted to orange and grapefruit trees, which produce fair to good yields.

Broward fine sand (BB).—This soil occupies many of the pine and saw-palmetto islands in the Big Cypress region. It occurs east and northeast of Naples and Royal Palm Hammock; northwest, north, and northeast of Copeland and Ochopee; southwest of Immokalee; and southwest and east of Sunniland. It has developed from a thin mantle of sands over limestone and is somewhat poorly drained. Surface runoff is slow, and internal drainage is slow to rapid. Associated with this soil are the Pompano, Arzell, Charlotte, and Sunniland soils. Unlike the Sunniland soil, which characteristically has a layer of fine-textured material overlying limestone, this Broward soil usually consists of sands lying directly on the limestone. Compared with the Pompano, Arzell, and Charlotte soils, the Broward soil is browner in the upper profile, usually shallower over limestone, and slightly better drained.

The vegetation consists principally of second-growth slash pine, cabbage palmetto, running oak, bitter gallberry, a rank growth of saw-palmetto, and carpetgrass and wiregrass.

Profile description:

- 0 to 6 inches, dark-gray loose fine sand of salt-and-pepper appearance; small amount of organic matter; slightly acid to neutral.
- 6 to 18 inches, light-gray to pale-yellow loose fine sand; slightly acid to neutral.
- 18 to 28 inches, yellowish-brown or light yellowish-brown fine sand with a few light-gray mottlings; neutral to alkaline.
- 28 inches +, limestone.

The surface soil varies from light brownish gray to very dark gray and from 3 to 8 inches in thickness. The second layer ranges from light gray or white to pale yellow, or contains light-gray or white to pale-yellow mottles. The normal depth to limestone is 18 to 36 inches but in localized areas the depth is greater. In some places a 1- to 2-inch layer of mottled yellow and gray fine sandy clay loam overlies the limestone, and in others the soil contains a brown- or black-stained layer directly above the limestone.

Included with this soil are areas occurring principally near the Okaloacoochee Slough, east and southeast of Immokalee, that contain islands of saw-palmetto and cabbage palmetto separated by narrow short-grass runways. In the island areas, Broward fine sand has an admixture of limestone at depths of 24 to 40 inches; the runways consist of Charlotte fine sand or Ochopec fine sandy marl.

Practically all of this soil is under natural vegetation and is used for grazing cattle and hogs. Its carrying capacity is about 1 cow for 15 to 25 acres. Much of it is cut over, and the pine trees have not yet reached sawlog size.

Broward fine sand, heavy substratum phase (Bc).—This phase occurs west and east of Sunniland. It differs from Broward fine sand chiefly in having a 2- to 6-inch layer of mottled yellowish-brown and light-gray fine sandy clay loam overlying the limestone. The limestone occurs at depths of 12 to 24 inches.

The natural vegetation is similar to that found on Broward fine sand, except that some areas are without slash pines. The places lacking the pine are shown by symbol on the map.

None of the phase is cleared for farming, but a large acreage is used for range pasture, which has a carrying capacity of 1 cow for 10 to 25 acres. Most of the merchantable pine timber has been cut, and the second growth has not yet reached sawlog size. If the vegetation were cleared from this soil, it would probably produce very good yields of winter vegetables, sugarcane, and other crops.

Broward fine sand, shallow phase (Bd).—This phase, well distributed throughout the Big Cypress region, differs from Broward fine sand chiefly in having the underlying limestone at depths of 6 to 18 inches instead of 18 to 36 inches. In places a 1- or 2-inch layer of mottled yellowish-brown and gray fine sandy clay loam overlies the limestone. Some areas indicated on the map by symbol, as for example Bd4, have no slash pine. These areas are slightly lower than other parts of the phase.

This shallow phase is used for range pasture and provides fair grazing for cattle and hogs. Its carrying capacity is about 1 cow for 15 to 25 acres. Most of the saleable timber has been cut, and the young slash pines are still small.

Broward-Ochopee complex (BE).—This complex consists of areas of Broward and Ochopee soils so intricately associated they cannot be separated on a map of the scale used. Islands of Broward soil separated by runways of Ochopee soils make up the complex. The largest bodies occur in the Big Cypress region between Sunniland and Naples, and east and northeast of Copeland and Ochopee.

The Broward areas consist mainly of the shallow phase of Broward fine sand; the Ochopee areas, mainly of the shallow phase of Ochopee fine sandy marl. A few areas of Ochopee marl, shallow phase, are included. Commonly limestone is at depths of 3 to 12 inches, but in places limestone rocks are exposed around the islands of Broward soils.

The Broward areas are covered by slash pine, cabbage palmetto, saw-palmetto, other shrubs, and grasses. The Ochopee areas have a short-grass cover. Some of the Broward soils, however, have no pine trees, and some of the Ochopee areas support growths of small cypress.

Practically all the merchantable timber on the islands has been cut, and the second growth of slash pine is still too small for logging. None of the prairie areas have been used for crops, for the complex is a great distance from roads.

Charlotte fine sand (CA).—This soil occupies level, nearly level, or slightly depressed areas in the Big Cypress region. It has a bright-yellow or yellowish-brown subsoil and it developed from moderately thick beds (40 to 60 inches deep) of fine sand over limestone or marl.

This Charlotte soil is associated with the Pompano and Arzell soils but differs from them mainly in that it has a layer of brownish-yellow or yellowish-brown fine sand below 10 to 15 inches and is slightly more alkaline. It has higher natural fertility than the Arzell soil but is poorly to very poorly drained and needs artificial drainage if it is to be cultivated.

The natural vegetation consists principally of second-growth slash pine, cabbage palmetto, a few saw-palmetto, poverty oatgrass, broomsedge, wire, switch, and carpet grasses, maidencane, rushes, sedges, pickerelweed, arrowhead, and a few dwarf cypress trees. Some areas shown on the map by prairie symbol are covered with short grasses and have little or no slash pine.

Profile description:

- 0 to 4 inches, dark grayish-brown or grayish-brown loose fine sand containing enough organic matter to give a salt-and-pepper appearance; slightly acid to neutral.
- 4 to 12 inches, yellowish-brown loose fine sand; neutral to alkaline.
- 12 to 26 inches, brownish-yellow or yellowish-brown loose fine sand; neutral to alkaline.
- 26 to 48 inches, light-gray or white loose fine sand slightly spotted with yellow and brown; slightly acid to neutral.
- 48 inches +, moderately soft to hard limestone or marl.

In most places the surface soil is covered by a very thin layer of organic scum deposited by surface waters. The surface layer ranges from grayish brown to gray or light gray and is 2 to 10 inches thick.

The lighter colored areas of Charlotte soil usually occur near areas of Arzell soil. In these positions the second layer is light gray or white to depths of 10 to 20 inches, where the brownish-yellow or yellowish-brown layer begins. This yellowish layer varies from 10

to 40 inches in thickness. In places it lies directly on the limestone and marl and the light-gray or white layer is missing. Small iron concretions are found immediately above the limestone in some areas, and the surface soil may contain small amounts of marl mixed with the fine sands.

Practically all of this soil has a cover of natural vegetation that provides fair grazing for cattle and hogs. The carrying capacity is about 1 cow for 10 to 20 acres. Most of the salable timber has been cut, and the young pine trees are still small.

Approximately 300 acres of the prairie areas of this soil is planted in winter vegetables (pl. 3, A). Crop yields are fair to good if the winter rains are not so frequent or heavy that the plants are injured or drowned out. Under a high level of management that includes applications of 2,000 to 3,000 pounds of fertilizer mixture, 1,000 to 1,500 pounds of compost, 75 to 100 pounds of nitrate of soda-potash, and 50 to 100 pounds of manganese sulfate an acre, tomatoes yield about 200 to 250 bushels an acre; cucumbers, 225 to 300 bushels; string beans, 200 bushels; lima beans, 300 bushels; and peppers 400 to 450 bushels.

Recently, some of this land was placed under a water-control system that protects it from abnormally heavy winter rains. If water control adequate to protect crops against excess surface water were installed, many hundreds of acres of this soil could be used. It is easily prepared for cultivation, for there are no trees, and only a few palmettos must be removed before it can be planted.

Coastal beach (Cb).—This land type occurs as narrow strips paralleling the western coast of the county and the shores of some of the Ten Thousand Islands. The beaches are composed largely of a thick accumulation of finely ground sea shells mixed with a small percentage of sand. Most areas are devoid of vegetation on the seaward side or have a scattered growth of beach morning-glory, sea oats, marsh-elder, common rush-grass, sea-rocket, and the shore spurges. The plants near the shore are affected by the salt in the soil and air, and by the winds. On the landward side cabbage palmetto and saw-palmetto are present. The more heavily vegetated areas are grazed. They support 1 cow on 25 to 40 acres. The beaches of Naples and Marco Island are used for recreational purposes.

Copeland fine sand (Cc).—This soil is level or nearly level. It occurs principally on the northern edge of the marsh surrounding Lake Trafford, 3 miles west of Immokalee. The soil developed from very thin coverings of fine sands over moderately hard limestone or marl. The depth to limestone is 12 to 24 inches. Generally, a layer of fine sandy clay loam 2 to 6 inches thick overlies the limestone.

This soil is associated with the Sunniland, Keri, and Matmon soils but has a black or very dark-gray surface layer instead of the dark-gray and gray surface soil of the Sunniland and Keri, or the brown surface soil of the Matmon. Unlike the Keri soils, which have a layer of marl between layers of fine sands, the Copeland soil is underlain by moderately hard limestone or marl. It is usually poorly drained but has medium internal drainage in some places.

The natural vegetation is cabbage palmetto, oaks, maples, a few magnolias, slash pine, and an undergrowth of vines and ferns and large saw-palmetto (pl. 3, B).

Profile description:

- 0 to 6 inches, black fine sand containing abundant organic matter; slightly acid.
- 6 to 16 inches, dark grayish-brown to dark-gray nearly loose fine sand; slightly acid.
- 16 to 22 inches, mottled yellowish-brown and light brownish-gray fine sandy clay loam; sticky and moderately plastic when wet; neutral to alkaline.
- 22 inches +, white moderately hard limestone or marl.

Most of this soil is under natural vegetation and is used for range pasture. The carrying capacity is about 1 cow on 15 to 25 acres. Small areas near Lake Trafford have been cleared and used for truck crops—peppers, cabbage, tomatoes, cucumbers, lima beans, and watermelons. In normal seasons and under a high level of management, good yields are obtained from these crops after the soil has been treated with about 2,000 pounds of fertilizer mixture and 50 to 100 pounds of manganese sulfate an acre.

Copeland fine sand, low phase (Cd).—This soil is associated chiefly with the other Copeland soils and Cypress swamp but differs from Copeland fine sand in position. It is low and covered with water many months of the year and has only a very thin layer of fine sandy clay loam over the limestone, and in some places none at all. Internal drainage is rapid when the soil is freed of the high water table.

Large areas occur east and south of Deep Lake and Jerome, and west of Miles City within the Fakahatchee Strand. All of this land is covered with cabbage palmetto, saw-palmetto, vines, ferns, and a few slash pine and cypress trees.

Copeland fine sand, shallow phase (Cf).—This phase occurs principally at the site of the abandoned citrus grove at Deep Lake and northwest and east of that village. It differs from Copeland fine sand mainly in having a shallow sandy layer over the limestone rocks and in occupying lower positions.

Internal drainage is rapid when the high water table is lowered. The normal range in depth to limestone is 3 to 12 inches, but in places limestone rocks are at the surface. The black or very dark-gray fine sand rests almost directly on the limestone; only a trace of fine sandy clay loam separates it from the limestone.

Because of its position—on islands within or adjacent to sloughs, marshes, and cypress strands—this phase has a dense growth of many subtropical plants mixed with cabbage palmettos, oaks, maples, and a few pine trees. Practically all of this soil still supports native vegetation. Exceptions are the site of the abandoned citrus grove at Deep Lake and the small areas that have been cleared and used for gardening and growing of papayas, mangoes, avocados, and other subtropical fruits.

Cypress swamp (Cf).—This land type consists of low-lying forested areas covered with water the greater part of the year. It occurs mainly as cypress strands and mixed swamps that serve as natural drainageways for the Big Cypress region in the interior of the county. The soils in these areas vary within short distances in color, texture, composition, and thickness of the various layers. In some places the topmost 2- or 3-inch layer is black or dark-gray mucky fine sand or

peaty muck, and in others it is brown peat. The subsoil, or lower layer, is usually gray or light-gray fine sand. Intermingling of soils, dense undergrowth in many areas, and wetness make separation into soil types and phases impractical, though some of the soils are known to be Pompano fine sand, Arzell fine sand, and Copeland fine sand. Also there are areas classified as peaty mucks or as peat.

Relatively large areas are made up of cypress strands and mixed swamps. The cypress strands support mainly medium to large bald and pond cypress trees and an undergrowth of buttonbush, some marsh rushes, grasses, ferns, and vines. Air plants are numerous on the cypress trees. In the mixed swamps grow red maple, willow, water, and laurel oaks, Florida ash, and in places some bay trees, sweetgum, mulberry, waxmyrtle, and Florida strangler fig. In places several varieties of orchids grow on the trees, and on Fahkahatchee Strand there are many royal palm trees. Small areas in the eastern part of the county that support pop-ash and willows are included with this land type.

All of Cypress swamp lies at a very low elevation or in sloughlike depressions and may be covered by several feet of water part of the year. The water levels tend to vary widely from season to season and from year to year. Sometimes the surface is dry.

As it is now, this land type is best used for forest. Reclamation for crops would not be practical and would destroy the water reservoirs for other soils in the county. Only a small part of the merchantable cypress timber on Fahkahatchee Strand has been cut.

Felda fine sand (FA).—This level or nearly level soil occurs on the short-grass prairies adjacent to the Sunniland soil. Fairly large bodies of it are near Corkscrew Marsh, south and southeast of Immokalee, and in and near the Okaloacoochee Slough east of Sunniland. The soil developed from thin beds of fine sand over clayey materials that contain limestone or moderately hard marl. The soil is poorly drained; it has no appreciable runoff and a high water table. During rainy seasons water drains from the higher soils and stands for many days on these depressional prairies.

This soil is associated with the Pompano, Charlotte, and Arzell soils but differs from them in having a thin (18- to 36-inch) sandy layer over clayey sediments and limestone. It is more poorly drained and is grayer in the deeper layers than the Sunniland soil.

The native vegetation consists chiefly of switch, carpet, threc-awn, and poverty grasses, broomsedge, maidencane, rushes, sedges, pickerelweed, arrowhead, and half-penny.

Profile description:

- 0 to 6 inches, dark-gray nearly loose fine sand containing a large amount of organic matter; slightly acid.
- 6 to 18 inches, light-gray or light brownish-gray nearly loose fine sand; slightly acid.
- 18 to 30 inches, light-gray friable fine sandy clay loam mottled with yellow and brownish yellow; slightly sticky when wet; slightly acid to neutral.
- 30 to 48 inches, mottled light-gray, brownish-yellow, and yellow friable but slightly sticky fine sandy clay loam; contains some small limestone concretions 1 to 4 inches in diameter; alkaline.

This soil varies considerably, particularly in the colors of the sandy layers overlying the clayey materials. In some places these layers

have almost the gray and light gray or white colors characteristic of the Arzell soil, but in other places the sandy layers are yellowish-brown to pale yellow, as in the Charlotte soil. Where the sandy layers resemble those of the Charlotte soil, the clayey materials are predominantly brownish yellow mottled with light gray and white. In some of the wettest areas near the ponds and along the borders of Corkscrew Marsh and Okaloacoochee Slough, this soil has been mapped to include a mucky fine sand, 3 to 6 inches thick, that overlies the light-gray fine sand layers and the mottled calcareous clayey materials.

Practically all of this soil supports a natural vegetation of grasses and shrubs. Only about 200 acres southeast of Immokalee has been used for winter vegetables. In normal seasons and under a high level of management tomatoes yield about 200 to 250 bushels; cucumbers, 225 to 300 bushels; string beans, 200 bushels; lima beans, 300 bushels; and peppers, 400 to 450 bushels. A high level of management requires, among other good practices, the application of 2,000 to 3,000 pounds an acre of mixed fertilizer, 1,000 to 1,500 pounds of compost, 75 to 100 pounds of nitrate of soda-potash, and 50 to 100 pounds of manganese sulfate.

If water control were established and maintained, many hundred acres of this soil could be used for vegetables and sugarcane without too great danger that the crops would be destroyed by heavy rains. Large acreages are used for range pastures that support about 1 cow on 10 to 20 acres.

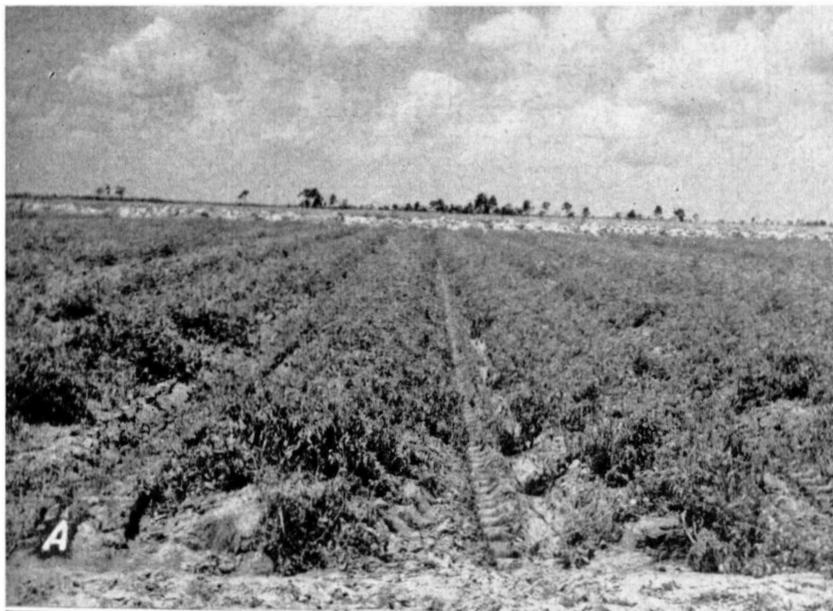
Fresh water marsh (FB).—This land type consists of shallow ponds and marshes covered with a few inches to 3 feet or more of water the greater part of the year. Large areas occur in Corkscrew Marsh about 4 miles west of Immokalee, and in Okaloacoochee Slough about 7 miles east of Immokalee. The marshes extend several miles from north to south and serve as natural drainageways in the northern part of the county. The soils in the marshes and smaller ponded areas vary a great deal within short distances and therefore are not separated into types and phases.

Most of the soils within the wettest section have 3 to 12 inches of partly decayed vegetative matter mixed with fine sands. The surface layer is underlain by gray fine sands, which grade into light-gray to white fine sands at depths of 15 to 30 inches. Calcareous clayey material, marl, or limestone rock occurs at depths of 36 to 48 inches.

In the northern part of Corkscrew Marsh and in some of the small ponded areas east and northeast of Deep Lake, the vegetation consists mainly of saw-grass and some water lilies and arrowhead. In these areas the dark-brown mucky materials are mixed with sand, range from 2 to 12 inches deep, and are underlain by dark-gray or gray fine sands. Calcareous clayey material or marl is encountered at 24 to 36 inches.

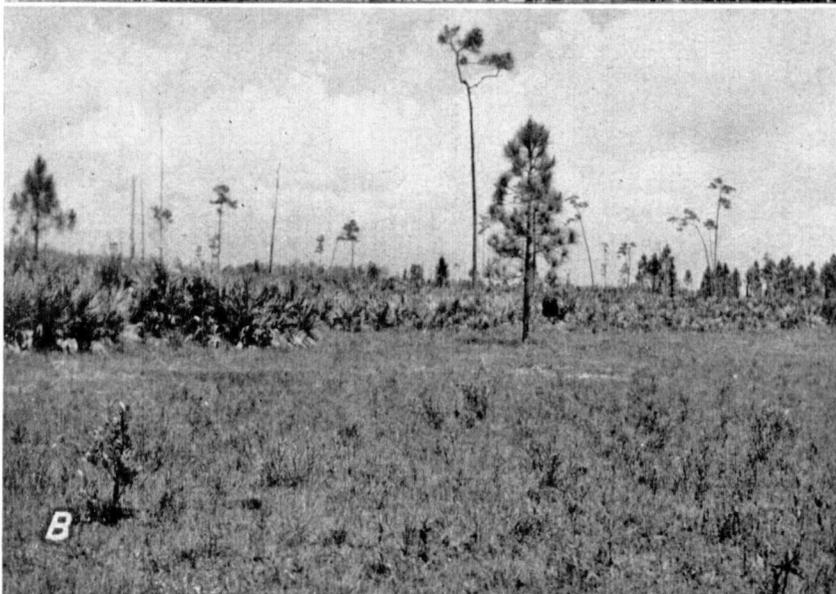
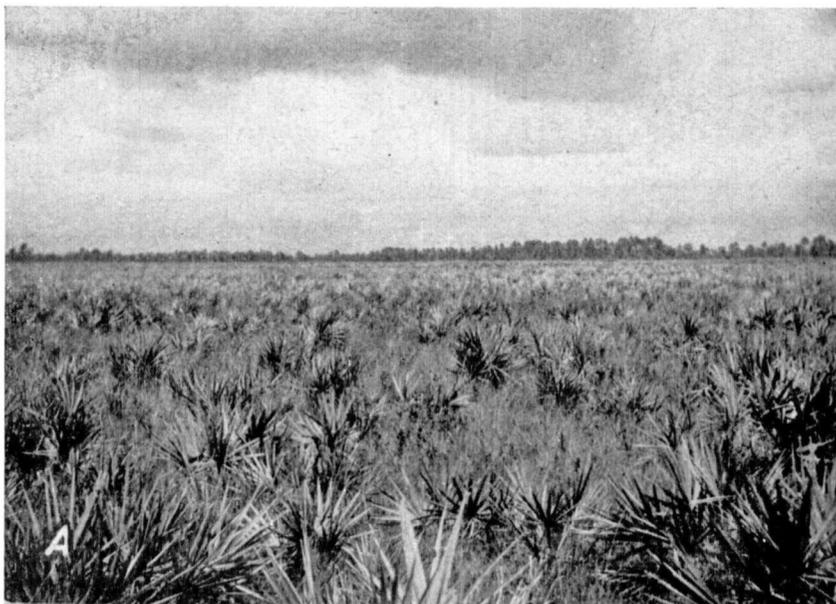
In the southern part of Okaloacoochee Slough, the brown fibrous peat is about 6 inches thick and overlies very dark-gray fine sands that contain much organic matter. At a depth of 36 to 42 inches occur calcareous clayey materials, marl, or limestone.

This marsh usually supports a thick growth of water lily, pickerel-weed, arrowhead, bonnets, bladderwort, maidencane, waxmyrtle,



A, Tomatoes on a prairie area of Charlotte fine sand. A system of dikes, ditches, and pumps removes excess water during wet seasons and supplies irrigation during dry.

B, Typical Copeland fine sand with a natural cover of many subtropical trees, vines, and shrubs, cabbage palmettos, and pines.



A, Typical Immokalee fine sand covered with saw-palmetto, running-oak, wire-grass, and other grasses.
B, Immokalee fine sand in foreground has been cleared of saw-palmetto, running-oak and other shrubs, and a few slash pines in preparation for planting improved pasture. Native vegetation in the background.

sedges, saw-grass, and cattails. A few marshy areas along the Tamiami Trail are near brackish water and adjacent to tidal marshes; they support cattails, grasses, and sedges. The soils in this included area vary from dark-gray mucky fine sands to grayish-brown fine sand overlying light-gray fine sand. They are usually alkaline.

Most areas of Fresh water marsh are included in range pastures that contain Sunniland, Broward, Keri, Immokalee, Pompano, Felda, Charlotte, and Arzell soils. During extremely dry seasons, small areas within the marshes have been used for growing winter vegetables. Fair to good yields are obtained from cucumbers, peppers, and tomatoes after 1,500 to 3,000 pounds of mixed fertilizer is applied. Fresh water marsh should not be drained and cultivated, for it is extremely wet and its peaty and mucky materials are shallow. Drainage and cultivation would cause loss of most of the organic matter within a few years and would lower the water table of surrounding soils to such an extent that they could not be cropped satisfactorily.

Immokalee fine sand (IA).—This soil occupies predominantly level, nearly level, or very slightly undulating areas in the Flatland region. It developed from relatively thick beds of unconsolidated sands laid down by former high seas. It is characterized by a dark-gray to black soft organic "hardpan" at 30 to 40 inches.

The Immokalee soil is associated with the Charlotte, Arzell, and Pompano soils and differs from them chiefly in being more acid and in having an organic hardpan and a thicker layer of sand over limestone. Drainage is somewhat poor. The water table generally occurs very near the stained organic layer.

The vegetation consists of second-growth slash pine, saw-palmetto, gallberry, running oak, broomsedge, wire and carpet grasses, and some waxmyrtle (pl. 4, A). A few cabbage palmettos grow in places. Some areas have few if any slash pines.

Profile description:

- 0 to 4 inches, dark-gray loose fine sand of salt-and-pepper appearance that contains a small amount of organic matter; medium to strongly acid.
- 4 to 30 inches, light-gray loose fine sand with light brownish-gray spots or splotches around old root channels; medium to strongly acid.
- 30 to 39 inches, very dark-brown or dark grayish-brown fine sand; weakly cemented, chiefly with organic matter; many old roots; strongly acid.
- 39 to 44 inches, brown or yellowish-brown loose fine sand; strongly acid.
- 44 to 48 inches +, light-gray loose fine sand; strongly acid.

The profile varies considerably. The depth to the soft organic "hardpan" layer averages about 30 inches but it may be anywhere from 24 to 40 inches. In thickness this stained organic layer varies from 3 to 10 inches.

Included with this soil are several small areas northwest of Immokalee and north of Naples that have a dense hardpan cemented mainly by organic matter. The hardpan layer occurs at 18 to 26 inches and is almost as compact as a similar layer in the Leon soils, which are mapped in other counties in Florida. These included areas occupy slightly higher positions but have been included with the Immokalee soil because of their limited extent.

Also included are several small islands near the concurrence of the tidal marshes and the marl prairies that have soils similar in many

characteristics to the Immokalee. On these small islands the surface soils are somewhat darker and deeper than that of the Immokalee soil, and in places marl or moderately hard limestone underlies the light-gray loose fine sand at depths of 10 to 18 inches below the organic-stained layer. The natural vegetation on this inclusion differs somewhat from that on the typical soil, for many cabbage palmettos and very few slash pines are mixed with the undergrowth of saw-palmettos, shrubs, and grasses. These included areas occur mainly near the Tamiami Trail from Royal Palm Hammock to Ochopce.

Practically all of the Immokalee fine sand is used as range pasture and provides fair grazing for cattle and hogs. The carrying capacity is 1 cow on 15 to 25 acres. In a few places the saw-palmettos have been removed and grasses have been sown (pl. 4, *B*). After treatment with fertilizers and lime, these improved pastures support 1 cow on 3 to 5 acres. Most of the merchantable timber has been cut, and the second-growth slash pines are not yet of sawlog size.

A few hundred acres north of Naples have been cleared and are now used to produce feed for chickens, hogs, and dairy cattle. Pangola, carpet, and Bermuda grasses, and cowpeas are the principal crops in this area. The nearly level fields are drained of excess surface water by open ditches dug at intervals of about 700 feet. About 1,500 pounds an acre of burned lime has been spread on most of this land, and fertilizers are used on the different crops. Fair to good yields of cowpeas are obtained, and the grasses grow fairly well.

About 50 acres of the nonforested part of this soil, located near the emergency airport 5 miles southeast of Immokalee, has been cleared of palmettos, drained by open ditches, and planted to tomatoes and cucumbers. In normal seasons and under a high level of management tomatoes yield about 175 to 250 bushels; and cucumbers, 200 to 275 bushels. A high level of management implies use of 1 to 2 tons of lime an acre, 2,000 to 3,000 pounds of 5-7-5 fertilizer, 1,500 to 2,000 pounds of compost, 75 to 100 pounds of nitrate of soda-potash, and 50 to 100 pounds of manganese sulfate.

Keri fine sand (K_B).—This soil has developed from stratified beds of marine sand and marl overlying limestone. It occurs in the Big Cypress region as islands within the wet lower lying Charlotte, Pompano, and Arzell soils or as narrow areas between those soils and the Immokalee and Broward soils. Unlike the associated soils, Keri fine sand has a layer of marl 2 to 10 inches thick and usually within 18 inches of the surface. The marl is normally underlain by fine sand. In places, however, the fine sand may be only a few inches thick or entirely absent. This soil has slow internal drainage through the marl layer. It is usually 48 to 60 inches deep to bedrock.

The soil supports cabbage palmetto, second-growth slash pine, and a rank growth of saw-palmetto, gallberry, running oak, wiregrass, carpetgrass, and other grasses and shrubs.

Profile description:

- 0 to 4 inches, dark-gray to grayish-brown fine sand of salt-and-pepper appearance; strongly acid.
- 4 to 12 inches, light-gray loose fine sand; strongly acid.
- 12 to 16 inches, grayish-brown or light brownish-gray loose fine sand; slightly acid.

- 16 to 26 inches, light-gray soft marl streaked with brownish yellow and yellow; clay loam texture; strongly alkaline.
26 to 48 inches, white or light-gray loose fine sand with streaks or spots of brownish yellow or yellow; strongly alkaline.
48 inches +, limestone.

Included with the Keri fine sand are areas where the marl layer lies directly on limestone. Frequently these areas are on slightly lower positions that support more grasses and a sparser undergrowth of saw-palmettos and gallberry than the typical soil. This particular kind of included soil is found in small areas northeast and east of Naples and south of Immokalee.

In places small amounts of marl may be found at the surface. Where this occurs there may be palmetto clumps separated by narrow grass runways. The soil under the palmetto clumps is typical Keri fine sand, but that in the runways is similar to the Charlotte or Pompano soils. Occasionally, where the marl layer is deep below the surface, a thin organic-stained layer is found above the marl.

Most of the saleable pine timber has been cut from Keri fine sand, and the new trees are small. Practically all of it is used for range pasture, and 10 to 20 acres is necessary to support 1 cow. Only a few small areas located near the cultivated Charlotte, Pompano, and Arzell soils have been cleared and are used for production of winter vegetables. In normal seasons and under a high level of management, tomatoes and cucumbers produce fair to good yields.

Keri-Copeland complex (K_A).—This complex consists of areas of Keri and Copeland soils so intricately associated that it is impractical to separate them on a map of the scale used. It occupies low places near wet marshes and cypress strands and has poor drainage.

Most of the Keri soils in the complex have a darker surface and a shallower sandy layer above the marl than typical Keri fine sand. The 4- to 6-inch surface soil consists of black or very dark-gray fine sand. This layer has some loaminess, which is imparted chiefly by a considerable amount of organic matter. The underlying marl (3 to 18 inches deep) is of clay loam texture and is light gray or light brownish gray, slightly mottled with yellow. The fine sands beneath the marl are yellowish brown mottled with light gray; they grade to light gray or white with increasing depth. Moderately hard limestone usually occurs at 48 to 54 inches, though in places it is at the surface. The sandy layer beneath the marl may be very thin or absent; consequently, the marl may lie directly on the limestone.

The Copeland soils in this complex are Copeland fine sand and its shallow phase. The surface layer, 5 to 8 inches thick, is black fine sand containing a considerable amount of organic matter. Below this lies gray fine sand that contains a few small yellow mottlings. The gray sand usually rests on limestone at depths of 6 to 24 inches. In places, however, a very thin layer of fine sandy clay loam lies directly above the limestone.

The dense subtropical vegetation on these areas consists mainly of cabbage palmetto, saw-palmetto, live and laurel oaks, slash pine, gums, red maple, Florida strangler fig, wildcoffee, willow, ferns, vines, and grasses. A few royal palms, mastic, gumbo-limbo, and mahogany trees are growing in some areas. There are many air plants on the trees, and a few orchids grow in some areas.

All of the complex is covered with natural vegetation and is used as range pasture for cattle and hogs. The grazing is good. A few small garden sites are being cultivated on this complex. These soils could be very productive of winter vegetables if they were cleared, drainage were properly controlled, and a high level of management were practiced.

Lakewood fine sand (LA).—This soil is commonly known as scrubland because its natural cover is sand pine, dwarf live oak, and a scattered growth of saw-palmetto, rosemary, running oak, prickly-pear, wiregrass, and other grasses. It occurs principally on the sand dunes on Marco Island and on an adjacent island to the southeast. Areas occur within the St. Lucie soil southeast and north of Naples but are too small to be shown separately on the map.

The soil has developed from thick beds of very loose sand. It is associated with the St. Lucie soil and differs from it chiefly in having a yellow fine sand layer within 20 to 36 inches of the surface. The slope of some of the dunes is as much as 15 percent. Lakewood soil is excessively drained and strongly acid.

Profile description:

- 0 to 3 inches, light-gray loose fine sand of salt-and-pepper appearance that contains a small amount of coarse organic matter.
- 3 to 28 inches, white loose incoherent fine sand.
- 28 to 40 inches, brownish-yellow loose incoherent fine sand.
- 40 to 60 inches, pale-yellow loose incoherent fine sand grading to white with increasing depth; yellow coloration goes downward for several inches around old plant roots.

This soil is used as range pasture, though it provides very poor grazing for cattle and hogs. The carrying capacity is about 1 cow on 25 to 40 acres. Formerly some of this soil on Marco Island was used for pineapples, which yielded well under good management.

Made land (MA).—This land type occurs in or adjacent to the towns of Everglades, Naples, and Marco. It consists largely of sandy and marly materials that were dredged out during the widening and deepening of adjoining boat channels. Made land is used as sites for homes and business establishments.

Mangrove swamp (MB).—This land type occurs along the western and southwestern coast and on most of the Ten Thousand Islands. It occupies low-lying areas always covered by salt water during high tide and in some places covered even at low tide.

The layers vary in color, texture, composition, and thickness. The surface layer is usually brown peat, composed of partly decayed leaves, limbs, and roots from dead mangrove trees and remains from a few other salt-tolerant plants. The peat is a few inches to several feet deep. It is underlain by light-gray or gray fine sands or marl. In places the very shallow peat layer is underlain by moderately hard limestone.

The natural vegetation consists mainly of different varieties of mangrove, buttonwood, saltwort, glasswort, and a few grasses. The red mangroves occur on the outer zone of the mangrove swamps and are characterized by their many arching prop roots. These roots collect soil materials and aid materially in building the coasts farther into shallow waters, in forming islands, and in protecting the shores

from storms. The soils in the red mangrove areas are nearly always flooded, even at low tides. The black and the white mangroves grow on the inshore mud flats that are usually exposed during low tide and covered by water at high tide.

All of this land is covered with natural vegetation and serves as feeding and breeding ground for many birds and animals. The streams, bays, and lagoons within and adjacent to the mangrove swamps contain many fish, clams, crabs, and oysters, which are caught by sportsmen and commercial fishermen. The trees in the mangrove swamps are of low or medium height. They could be used as sources of tannin, charcoal, and lumber but usually occur in inaccessible areas.

Matmon loamy fine sand (Mc).—Most of this soil occurs in a large area near the concurrence of Okaloacoochee Slough and Fakhahatchee Strand, north and northeast of Miles City. It is associated with the Copeland and Broward soils and differs from them chiefly in color. It is brown, whereas the Copeland soil is black and the Broward soils are gray. The soil developed mainly from a very thin layer (0 to 18 inches) of marine sands mixed with residuum from moderately soft to hard limestone or marl. It occupies nearly level areas and is somewhat poorly drained. Both external and internal drainage are medium to slow.

The vegetative cover consists of cabbage palmetto, second-growth slash pine, and a rank growth of saw-palmetto, running oak, gallberry, waxmyrtle, pipewort, wiregrass, and carpetgrass.

Profile description:

- 0 to 4 inches, dark-brown very friable loamy fine sand; alkaline.
- 4 to 8 inches, yellowish-brown to brown loamy fine sand; alkaline.
- 8 to 14 inches, yellowish-brown friable fine sandy clay loam; alkaline.
- 14 inches +, white moderately hard limestone or marl.

The depth to limestone varies greatly within short distances. In some places the limestone is exposed at the surface and in others it is several inches below the surface. Numerous limestone rocks 2 to 8 inches in diameter are scattered over the surface and within the profile.

Practically all of this soil is in range pasture. From 10 to 20 acres is needed to graze 1 cow. Approximately 10 acres of this soil west of State Highway No. 29 and 3 miles north of Miles City has been cleared for crops. The rounded limestone rocks have been removed and piled along the edges of the field. Part of the field is used for sugarcane, which produces good yields. The rest is used for garden crops and pasture. Other areas in this general location could be cleared of trees and rocks and used for growing winter vegetables and other crops.

Ochopee fine sandy marl (OA).—Slight depressional or sloughlike areas in the wet marl prairies are occupied by this soil. Areas of it occur in the Big Cypress region and between that region and the tidal marshes of the Southwest Coast region. Fairly large areas are northwest, northeast, and east of Ochopee.

This soil has developed from a mixture of marine sands and recent deposits of marl, but the sands are dominant. It is associated with the Ochopee marls but differs from them chiefly in having more sands mixed with the marl and in occupying slightly lower positions. It is

very poorly drained. Narrow natural drainageways run through most areas of this soil and carry off excess surface water flowing from soils that occupy higher positions.

The native vegetation consists of saw-grass, poverty grass, switch-grass, bunch switchgrass, maidencane, sedges, rushes, half-penny, and arrowhead.

Profile description:

- 0 to 4 inches, dark grayish-brown very friable sandy marl having a loamy fine sand texture; strongly alkaline.
- 4 to 8 inches, grayish-brown very friable marly fine sand that shows a few light brownish-gray mottles; strongly alkaline.
- 8 to 14 inches, gray fine sand mottled or streaked with light brownish gray and light yellowish brown; neutral to alkaline.
- 14 inches +, limestone.

The depth to limestone ranges from 12 to 36 inches, and variation from one extreme of this range to the other may occur within a short distance. In some of the wettest areas the top 2 or 3 inches of the surface layer is mucky material mixed with fine sandy marl. Also included with this soil in mapping are cabbage-palmetto islands, too small to delineate separately on the soil map, that consist of Broward and Keri soils.

Practically all of Ochopee fine sandy marl has a natural vegetation of short grasses. An exception is about 100 acres included in fields with other Ochopee soils and Tucker marl that has been used at one time or another for winter vegetables, mainly tomatoes. In normal seasons and under a high level of management, tomatoes yield about 225 to 300 bushels an acre in this area. Good management for tomatoes requires application of 2,000 to 3,000 pounds of a good fertilizer mixture an acre, 75 to 100 pounds of nitrate of soda-potash, 1,000 to 1,500 pounds of compost, and 50 to 100 pounds of manganese sulfate. Other management practices for this soil are described on pages 38 to 43. If water-control systems were installed, large acreages of this soil could be farmed during normally dry winter seasons with comparatively little danger of damage from heavy unseasonal rains.

Ochopee fine sandy marl, shallow phase (O_B).—Most of this phase is in the east-central part of the county. It is associated with other Ochopee soils and with Tucker marl. It differs from Ochopee fine sandy marl chiefly in having limestone at shallower depths, or 6 to 12 inches below the surface instead of 12 to 36 inches. It is very poorly drained and has fewer narrow natural drainageways than the Ochopee fine sandy marl.

The surface layer, 3 to 4 inches thick, is dark grayish-brown or dark-gray fine sandy marl of loamy fine sand texture. This layer is underlain by grayish-brown marly fine sand that has a few light-gray and light yellowish-brown mottles. The depth to the limestone varies within short distances, primarily because of solution holes in the limestone formation. In places limestone rocks appear at the surface. Included with this soil are very small areas of Broward and Keri soils or Rockland, which occur as islands covered with cabbage palmettos.

The greater part of this soil has a cover of short grasses. Some areas, however, support stunted cypress, slash pine, and other trees.

These are shown on the map by symbols. Approximately 200 acres of the nonforested part is used for winter vegetables, mainly tomatoes.

With favorable weather and a high level of management, tomatoes yield about 225 to 300 bushels; string beans, 175 bushels; squash, 150 bushels; peas, 60 bushels; and Irish potatoes, 225 bushels. A high level of management includes, among other good practices, the application of 2,000 to 2,500 pounds of 5-7-5 fertilizer, 1,000 to 1,500 pounds of compost, 75 to 100 pounds of nitrate of soda, and 50 to 100 pounds of manganese sulfate.

Vegetables have been produced without any definite water-control system. In winter seasons that have sufficient rainfall, crops usually bring tremendous returns, but if heavy unseasonal rains fall the crops may be killed by excess surface water. New crops have to be planted after such rains, sometimes as many as three or four times, or the enterprise may be abandoned entirely for the year. When this happens the farmer suffers great financial loss. If efficient water-control systems were installed, many hundred acres of this soil could be used for sugarcane and other crops.

Ochopee fine sandy marl, tidal phase (Oc).—This phase occurs principally near the Tamiami Trail from a point south of Royal Palm Hammock to a point southeast of Ochopee. It is similar to the typical Ochopee fine sandy marl in many respects; the chief difference is the slight amount of salt in its various layers. The salt is absorbed from the salt water that covers the soil during very high tides. Narrow belts of this soil run northwest-southeast between other Ochopee soils, cypress swamps, Pompano, Immokalee, and Broward soils, and the tidal marshes and mangrove swamps.

Practically all of this phase supports short grasses similar to those on other Ochopee soils. A few small areas have been included in fields with other Ochopee soils and are used for producing tomatoes. Tomatoes grown on this soil seem to be affected by the salt. The fruits are small, have very thick skins, and are damaged badly in shipment to northern markets.

Ochopee marl (Od).—This soil occurs on level or nearly level wet marl prairies that usually lie less than 6 feet above sea level. It is found principally north and northwest of Ochopee, north and southwest of Copeland, west and east of Jerome, and north and northeast of Deep Lake. The soil has developed from recent deposits of unconsolidated finely divided calcareous sediments that contain noticeable quantities of fine sand. The marl layer is underlain by fine sand and limestone.

Ochopee marl is associated with other Ochopee soils and Tucker marl. It differs from Tucker marl chiefly in having more marine sand and in having a layer of fine sands between the marl and the underlying limestone. Also, it occurs at slightly lower elevations. Ochopee marl has very poor natural drainage, but some areas have been artificially drained by canals and open ditches.

The vegetation consists mainly of short grasses, including poverty grass, foxtail, needlegrass, and switchgrass, and maidencane, sedges, rushes, common reed, half-penny, arrowhead, and red milkweed (pl. 5, A).

Profile description:

- 0 to 8 inches, dark grayish-brown marl of fine sandy loam texture; strongly alkaline.
- 8 to 18 inches, grayish-brown to gray marl of fine sandy loam texture; strongly alkaline.
- 18 to 30 inches, mottled light brownish-gray, light-gray, and light yellowish-brown fine sand; neutral to slightly alkaline.
- 30 inches +, hard to moderately hard limestone.

The surface layer ranges from dark grayish brown or very dark gray to gray. In places the surface layer may be slightly mucky or sandier, and the second layer may be light-gray fine sand slightly mottled with yellowish brown. The marl layer ranges from 10 to 24 inches in thickness, and the underlying fine sand from 4 to 16 inches. The depth to the limestone is 12 to 36 inches. Where the profile is shallower there is usually a thinner layer of sand over the limestone.

Approximately 4,000 acres of this soil has been cultivated at one time or another. About 600 to 1,000 acres is cultivated each year. Most of the acreage has been used for the winter vegetables, mainly tomatoes (pl. 5, *B*). With favorable weather and a high level of management, tomatoes yield about 250 to 300 bushels. A high level of management includes application of 2,000 to 3,000 pounds of good mixed fertilizer an acre, 75 to 100 pounds of nitrate of soda-potash, 1,000 to 1,500 pounds of compost, and 50 to 100 pounds of manganese sulfate.

Small acreages of this soil have been used for growing lima beans, squash, Irish potatoes, peas, peppers, eggplant, and cabbage. In normal seasons and under a high level of management that includes fertilization with about 1,800 pounds of fertilizer mixture plus nitrate of potash, compost, and manganese sulfate, lima beans yield about 175 bushels an acre; squash, 150 bushels; potatoes, 225 bushels; and peas, 60 bushels.

Only a few short canals and open ditches have been dug to help remove excess surface water caused by rainfall or drainage from higher elevations. These canals and ditches do not remove enough water during heavy rains, so crops may be seriously damaged or ruined before the water drains away. If additional canals and ditches were dug and an efficient system of dikes and pumps were installed, several thousand acres of this soil could be planted to vegetables, sugarcane, and other crops without much danger of loss from excess water.

Ochopee marl, deep phase (OE).—Most of this phase occurs north and northwest of Ochopee and north and southwest of Copeland. It is associated with Ochopee marl, from which it differs chiefly in having a greater depth to underlying limestone, or a depth of 36 to 60 inches. The layer of fine sand beneath the marl surface soil is light brownish gray or light gray, mottled slightly with yellowish brown. At depths of 30 to 36 inches it grades to white incoherent fine sand.

Recently about 900 acres of this soil has been used for crops, mainly tomatoes. From 100 to 300 acres is cropped each year. Yields of tomatoes and other vegetables are good, or similar to those produced on Ochopee marl, if a high level of management is prac-



- A, Typical Ochopee marl with short grass vegetation in the foreground. Cypress trees on the left are on Ochopee fine sandy marl, shallow phase, and the pine-and-cabbage-palmetto island to right is on Broward fine sand, shallow phase.
- B, Field of tomatoes on Ochopee marl; pine-and-cabbage-palmetto island to the left is on Broward fine sand, shallow phase.
- C, Area of Sunniland fine sand with a rank growth of saw-palmetto between the pine trees. Soil is used for range pasture but is suitable for winter vegetables and general farm crops when cleared.

ticed. Several thousand acres of this phase could be farmed continuously if the water level were controlled.

Ochopee marl, shallow phase (Of).—Extensive areas of this phase occur east and northeast of Ochopee and north and northeast of Deep Lake. The underlying limestone is at depths of 3 to 12 inches, as compared to 12 to 36 inches in Ochopee marl. In most other respects, the two soils are similar.

The surface layer, 3 to 8 inches thick, is a dark grayish-brown or dark-gray marl of fine sandy loam texture. Below this occurs grayish-brown or light-gray fine sandy marl of loamy fine sand of fine sand texture. In many places this fine sand layer is very thin or entirely absent and the marl surface layer lies directly on limestone. In a few instances a very thin layer of fine sandy clay loam overlies the limestone.

This soil is associated with other Ochopee soils and the Tucker and Broward soils. Where this phase is near Tucker marl, its surface layer varies within short distances from a fine sandy loam to a clay loam, and in some lower positions consists of a mixture of mucky materials and marl.

Recently about 600 acres has been used for growing tomatoes. The area in vegetables now ranges between 200 and 500 acres each year. With favorable weather and a high level of management, tomatoes may be expected to yield as well as on Ochopee marl. If adequate water control were installed, many hundreds of acres of this soil could be farmed without too great danger of loss from excess surface water.

Pompano fine sand (PA).—This soil is well distributed in the western and northern parts of the county. It occurs in level, nearly level, or slightly depressed places within the Big Cypress region and has developed from moderately thick beds of marine sands over limestone or marl. It is poorly drained. Surface runoff is slow, and internal drainage is rapid when the water table is lowered.

This soil is associated with the Charlotte, Arzell, Felda, Broward, and Immokalee soils. It consists of fine sands to a depth of more than 30 inches and has darker colored upper layers than the Arzell soil and lower layers not so yellow as those of the Charlotte soil. It does not have a clayey layer at 18 to 30 inches, such as appears over the limestone in the Felda soil.

The vegetation consists of second-growth slash pines, a few cabbage palmettos, and an undergrowth of wiregrass, broomsedge, maidencane, tall sandweed, waxmyrtle, and scattered saw-palmettos. Some areas are grass-covered and have no slash pines; other lower lying ones support a stand of medium-sized cypress.

Profile description:

- 0 to 6 inches, dark-gray or dark grayish-brown loose fine sand; contains enough organic matter to have a salt-and-pepper appearance; slightly acid to neutral.
- 6 to 14 inches, grayish-brown loose fine sand; slightly acid to neutral.
- 14 to 30 inches, light brownish-gray to light-gray loose fine sand; slightly acid to neutral.
- 30 to 54 inches, white loose fine sand; slightly acid to neutral.
- 54 inches +, limestone.

The color of the surface soil ranges from very dark gray, dark gray, and dark grayish brown to gray. Sometimes the third and fourth layers are faintly mottled with yellow or brown, and there may be a thin layer of gray or light-gray fine sandy clay loam overlying the limestone. The depth to the limestone ranges from 48 to 80 inches.

Practically all this soil remains under natural vegetation and is used for grazing cattle and hogs. The carrying capacity is 1 cow to 10 to 20 acres. Most of the merchantable timber has been removed from the pine-covered areas, and the second-growth slash pines have not reached sawlog size.

Approximately 200 acres in the prairie areas of this soil have been used for winter vegetables at one time or another. Where there has been a high level of management and proper control of water, tomatoes, cucumbers, peppers, and corn have produced good yields. The management practices used and the yields obtained are similar to those described for Charlotte fine sand. Many hundred acres of this soil could be farmed if adequate water control were provided.

Rockland (RA).—This land type occupies nearly level areas that contain small depressions. It occurs as islands within the Big Cypress region, where it is associated with the Broward, Ochopee, Tucker, Charlotte, Pompano, Keri, and Copeland soils. It is commonly referred to as pine rockland.

At the surface, outcrops of Tamiami limestone predominate but there is soil material between the outcrops similar to that described for the shallow phase of either Broward fine sand or Ochopee fine sandy marl. The soil material in the solution holes ranges from a few inches to several feet in thickness. It is somewhat poorly drained. Some of the surface water drains into the numerous sandy areas between the rocks and thence into underground channels.

The vegetative cover consists primarily of second-growth slash pine, cabbage palmetto, saw-palmetto, running oak, wiregrass, and other grasses, and shrubs, but some of the areas support cypress trees, or grasses and a few trees, or grasses only. Practically all of the saleable pine timber has been cut. The second-growth slash pines have not reached sawlog size.

Shell mounds (SB).—This land type occurs principally as islands within or adjacent to mangrove swamps near the Gulf of Mexico. It occupies most of Chokoloskee Island, Santa Celeste Island, Dismal Key, and Russel Key, and other small areas within the Ten Thousand Islands. Although it consists mainly of oyster and clam shells and an admixture of sands, a very dark grayish-brown to black loam 1 to 2 inches thick has developed from the shells and sands in some places. Some of the mounds extend 10 to 20 feet above sea level and cover over 60 acres. Several small mounds are along the rivers and streams near the Gulf. These shell mounds were presumably made by men during pre-Columbian times.

Some of the shell mounds support a heavy, hammock vegetation consisting of cabbage palmetto, gumbo-limbo, cactus, and a very dense undergrowth of shrubs. A few small areas have been used for the cultivation of truck crops, avocados, and mangoes. The shells also serve as an important source of road-building material.

St. Lucie fine sand (SA).—This soil occurs north and southeast of Naples and northwest of Immokalee and is commonly referred to as scrubland because it supports a natural growth of scrub live oak and sand pine. The scattered undergrowth consists of rosemary, saw-palmetto, pricklypear cactus, and wiregrass and other grasses. The soil occupies low ridges and slightly billowy knolls. It is associated with the Immokalee soil and the Lakewood soil. It differs from the Lakewood chiefly in having white instead of yellow fine sand in its lower layers.

This soil has developed from thick beds of very loose sands. The outer borders of some areas have a stained organic layer at depths of 48 to 60 inches. The soil is excessively drained and remains comparatively free of moisture even in the rainy season.

Profile description:

0 to 2 inches, light-gray loose incoherent fine sand containing a small quantity of partly decayed organic material.

2 to 60 inches +, white loose incoherent fine sand that shows a few light brownish-gray spots around old root channels.

The soil is extremely low in organic matter and mineral plant nutrients and is strongly acid. Included with it are areas of Lakewood fine sand too small to delineate separately on the map.

Practically all of St. Lucie fine sand is range land that provides poor grazing for cattle and hogs. The carrying capacity is 1 cow on 25 to 40 acres. Some of this soil at Immokalee is used as building sites.

Sunniland fine sand (Sc).—This soil occupies nearly level areas that usually slope gently toward lower lying soils.

It has developed from thin beds of marine sands overlying alkaline clayey materials that frequently contain calcareous concretions, limestone fragments, or pieces of shells. It is somewhat poorly drained. Surface runoff is low; and internal drainage is medium to slow.

This soil is associated with the Felda, Copeland, Immokalee, Charlotte, Pompano, and Arzell soils. It occurs near Corkscrew Marsh and Okaloacoochee Slough. From the Felda soils it differs chiefly in having better drainage and brighter colors in the profile. It is lighter colored and better drained than the Copeland soil, which overlies limestone at shallow depths.

The vegetation consists of second-growth slash pine, cabbage palmetto, a rank growth of saw-palmetto, gallberry, running oak, carpet-grass, wiregrasses, pipewort, and waxmyrtle (pl. 5, C). Some areas have few or no pine trees.

Profile description:

0 to 4 inches, dark-gray nearly loose fine sand of salt-and-pepper appearance; strongly acid.

4 to 10 inches, light brownish-gray to light-gray loose fine sand; strongly acid.

10 to 18 inches, light-gray loose fine sand mottled slightly with pale yellow and gray; medium to strongly acid.

18 to 22 inches, pale-yellow fine sandy loam mottled with brownish yellow and light gray; slightly acid to neutral.

22 to 36 inches, brownish-yellow to yellowish-brown fine sandy clay loam; pale-yellow and light-gray mottling; neutral to alkaline.

36 to 48 inches +, mottled light-gray, brownish-yellow, and yellowish-brown fine sandy clay loam; many lime concretions $\frac{1}{4}$ to 3 inches in diameter.

The surface layer ranges from gray to very dark gray, is 4 to 8 inches thick, and in places contains a considerable amount of organic matter that tends to make the soil loamy. The clayey material occurs at depths ranging from 16 to 30 inches and generally ranges from 6 to 24 inches in thickness. The calcareous concretions, limestone fragments, or marl occur at depths ranging from 36 to 60 inches. The shallower profiles overlying the clayey materials are generally near the marshes; the deeper ones are adjacent to the Immokalee, Charlotte, Pompano, and Arzell soils. Adjacent to the Immokalee soil, the Sunniland soil has an organic-stained layer a few inches thick that overlies the clayey material. This variation occurs east of the Corkscrew Marsh; west, south, and east of Immokalee; and north and northeast of Sunniland.

Practically all of this soil is used as range pasture and provides fair grazing for cattle and hogs. The carrying capacity is about 1 cow to 10 to 20 acres. Most of the merchantable pine timber has been cut, and the second-growth slash pines are still small. These trees, however, are making fast growth where they are protected from fires. Near the village of Corkscrew, a few small areas have been cleared of trees and shrubs and used for truck crops and general crops. With favorable weather and a high level of management, fair to good yields have been obtained. Cleared areas are now used for pasture and contain many guava trees. In the future many acres may be cleared and planted to improved grasses for pasture or tilled crops. This soil may become one of the most productive in southern Florida.

Tidal marsh (TA).—This land type occupies level or nearly level positions only a few feet above sea level, principally in a narrow belt between the mangrove swamps along the Gulf and the fresh-water areas from south of Naples to south of Ochopee. Most of this marshland is covered by or affected by salt water or brackish water during high tide. The surface soils, which are a few inches thick, vary from very dark-gray mucky fine sand to muck or brown fibrous peat. These materials overlie light-gray or gray sands.

The native vegetation consists of saltgrass, big cordgrass, switchgrass, and needlegrass, black rushes, broomsedge, cattail, spider lily, some ferns, and a few salt-tolerant shrubs. All this land is under natural vegetation and provides food and nesting places for birds and other wildlife.

Tucker marl (TB).—This soil occupies level or nearly level marl prairies, 6 to 15 feet above sea level, that occur principally between Deep Lake and Miles City and east and northeast of these villages. It is associated with the Ochopee, Broward, Matmon, Sunniland, Charlotte, Pompano, and Felda soils. It differs from the Ochopee soils chiefly in its lower content of sand and higher content of clay. It has developed from recent deposits of finely divided calcareous sediments or marl mixed with appreciable quantities of fine sand and clay. The marl lies directly on moderately hard limestone at depths ranging from 4 to 24 inches. Natural drainage is very poor, and water covers the soil several months each year. Artificial drainage has been established in small areas.

The native vegetation consists of saw-grass, switchgrass, poverty grass, and carpetgrass, broomsedge, maidencane, arrowhead, half-penny, water carrot, rushes, and sedges.

Profile description:

- 0 to 6 inches, grayish-brown to dark-gray friable marl; clay loam texture.
- 6 to 16 inches, light-gray to gray friable marl; clay loam texture.
- 16 inches+, moderately hard limestone.

This soil is strongly alkaline and its layers are of variable thickness. The surface layer is 3 to 8 inches thick; the second layer, 6 to 18 inches. The average depth to limestone is 14 inches, but the range is from 4 to 24 inches. In a few instances no rock is reached within a depth of 42 inches. Sometimes a thin layer of gritty materials—a mixture of sands, small limestone fragments, and marl—overlies the limestone. In small areas the surface texture approaches a fine sandy loam, but usually it is clay loam or silty clay loam. In other places the surface layer may be slightly mucky.

Included with this soil are several cabbage-palmetto and saw-palmetto islands where the areas are known to be Rockland or soils of the Broward or Matmon series. In a few instances the limestone is more shallow adjacent to these islands and outcrops. Small limestone outcrops are scattered within areas of this soil.

Approximately 6,000 acres of this soil has been used at one time or another for winter vegetables. In most years, however, the area cultivated is 600 to 1,000 acres. The main crop is tomatoes, but Irish potatoes, peppers, lima beans, cabbage, cauliflower, squash, cucumbers, sugarcane, and corn are also grown. Crops produce good yields under favorable weather conditions and a high level of management. Tillage practices, fertilizer treatments, and yields are similar to those described for Ochopee marl.

At present only a few open ditches have been dug to assist in removing excess surface water. If good water-control systems consisting of canals, ditches, dikes and pumps were built, many thousand acres of this soil could be planted to vegetables, sugarcane, and other crops. Pumps could be used to remove excess water during wet seasons and to pump water into the controlled areas whenever the water table became low and the crops needed irrigation.

USE AND MANAGEMENT OF THE SOILS

LAND USE

The soils of this county now used for crops are those that formerly supported short grasses. Such soils are easily brought under cultivation by cutting and removing the grasses and then preparing a seedbed. These grass-covered soils are so abundant that almost none of the land covered with trees, palmettos, and other shrubs has been cleared for cultivated crops. Many thousands of acres of virgin short-grass soil yet remain that could be brought under cultivation if good water-control systems were installed.

Clearing of more land will depend on the market for early vegetables. When that market expands, clearing of new land can be expected. The soils offering the best possibilities for development are the Sun-

niland, Copeland, Keri, Broward, Matmon, and probably some areas of the Immokalee. The Sunniland soil is particularly promising.

In recent years 12,000 to 13,000 acres has been used at one time or another for crops, mainly winter vegetables. The acreage cropped each year is considerably less, or 2,000 to 2,500 acres. The wide difference between acreage cropped each year and the acreage available for cropping results from the method of weed, crop disease, and insect control practiced. Weeds, crop diseases, and insects greatly increase after 1 or 2 years of cultivation, so fields that have become infested are left idle until they revert to natural growth or become free of diseases and insects and are then cleared and cropped again.

About two-thirds of the total acreage cropped is planted to tomatoes. The rest is used for cucumbers, peppers, lima and string beans, peas, squash, Irish potatoes, sweetpotatoes, cabbage, cauliflower, okra, eggplant, watermelon, sugarcane, corn, German millet, cowpeas, and oats. The soils used for these crops are chiefly the Ochopee, Tucker, Charlotte, Pompano, Felda, and Arzell, all of which have a native vegetation of short grasses. Small areas of Immokalee soil that have no pine trees have been cleared of palmettos and other shrubs and planted to crops. Very small areas of the Blanton and Copeland soils have been cleared of trees and shrubs and planted to grapefruit, oranges, and other subtropical fruits.

MANAGEMENT PRACTICES ⁷

Most of the cultivated soils are deficient in organic matter and nitrogen and low in total phosphorus and potassium. They leach comparatively rapidly, so fertilizers must be applied frequently. Each acre under cultivation ordinarily receives 2,000 to 3,000 pounds of a good mixed fertilizer and 75 to 100 pounds of nitrate of soda-potash. The mixed fertilizer should have 25 to 40 percent of nitrogen from organic sources and include enough manganese and minor elements for good plant growth.

The fertilizer is applied when the crop is planted and later as side dressings. The nitrate of potash is usually added when the crops are beginning to bear fruits. Compost is added to all the soils when tomatoes are planted. The Arzell and Immokalee soils generally receive compost for all crops.

With favorable weather and a high level of management, the yield of each vegetable crop is nearly the same for all the soils. This similarity in yield probably results from the addition of fertilizers in quantities sufficient to counteract the lower natural fertility of some of the soils.

Only a few hundred acres are cultivated under complete water-control systems. The rest of the land is cultivated during normally dry winter seasons and generally produces high yields. During wet years, however, the fields may be planted several times before a crop is obtained, or the enterprise may be abandoned entirely. These crop failures cost the farmers many thousands of dollars. If good water-control systems were installed, vast acreages of land could be farmed without too great danger of damage from excess water.

⁷ Information on tillage practices, fertilizer treatments, and yields was supplied by farmers within Collier County.

The land is usually cropped 1 or 2 years and then abandoned or left idle a number of years. During the time it is idle the weeds die or are smothered by the normal short-grass vegetation. Probably a better method of land use would be to plant suitable cover crops during summer months and then use the fields for row crops again during the following dry winter season.

The management practices vary according to the type of soil and the kind of crop grown. They are discussed for various crops in the following pages.

TOMATOES

Tomatoes, the leading vegetable crop in the county, are grown mainly on (1) the Ochopee and Tucker soils and (2) the Charlotte, Pompano, Felda, Arzell, and Immokalee soils. The management differs somewhat on the soils of the two groups.

Ochopee and Tucker soils.—On these soils the grass is cut, raked, removed, and burned and roadways are laid out at 210-foot intervals. The rows, generally 6 or 7 feet apart, are made by turning two 6- to 7-inch furrows in the same direction with a small moldboard plow drawn by one horse or mule. Some of the furrows are now turned with a double moldboard plow or tractor-drawn disk plow.

The tomato seedlings are planted on the edge of the last turned furrow, 36 to 42 inches part in the row. The plants are dropped by hand into holes containing a handful of compost, and the holes are then closed by foot.

The second day after the plants are set out, 200 pounds an acre of mixed fertilizer containing 25 to 40 percent organic nitrogen is placed near the plant roots. The mixtures used are 3-8-8, 4-7-5, or 5-7-5. When the plants are about 6 inches high, 500 pounds an acre of mixed fertilizer is placed in the bottom of the furrows and covered by turning another furrow with the moldboard plow (pl. 5, *B*). It is customary to cultivate only one side of the rows, but if weeds are to be controlled on land previously cropped, it may be necessary to cultivate both sides. A small roller is used in the furrows to break clods and to tighten the soil around the plants.

At intervals of 7 to 10 days, 600 to 800 pounds an acre of mixed fertilizer (3-8-8, 4-7-5, or 5-7-5) is applied. This means that about four applications of fertilizer, in addition to the one at planting time, are made. About 75 to 100 pounds an acre of nitrate of soda-potash is used with the fourth application of mixed fertilizer. Another 75- to 100-pound application of nitrate of soda-potash is distributed as a side dressing after the second picking. Also, 50 to 100 pounds an acre of manganese sulfate is applied with the other fertilizer. If heavy rains occur, additional fertilizer is used to keep the plants growing and healthy.

When it is necessary to kill insects and to control diseases, the young plants are dusted with insecticides and fungicides by tractor-drawn machinery. When the vines have covered the ground between the rows, the plants are dusted once a week by airplane.

During the last few years, late blight has damaged the vines and fruits considerably. During dry seasons the blight is controlled by spraying once a week with a solution of copper sulfate and lime or by spraying or dusting with Dithane at the rate of about 35 pounds an

acre. In wet and damp weather the blight fungus is very hard to control and may severely damage or totally destroy the tomato crop.

The tomato plants are usually set in the fields at any time between the first week in November and February. The fruits are harvested about 90 days after the plants are set out. The tomatoes are harvested by hand and hauled to packing sheds, where they are washed and graded by machines and packed by hand in one-half bushel lugs. The lugs are shipped by rail and truck to northern markets. The average yield of tomatoes on the Ochopee and Tucker soils is 250 to 300 bushels an acre, but sometimes the yields range up to 600 or 700 bushels an acre. The varieties best adapted to these soils are the Grothen's Globe and the Collier County Globe's.

Charlotte, Pompano, Felda, Arzell, and Immokalee soils.—These sandy soils are turned with a moldboard or disk plow, or disked with a tandem disk-harrow. Roadways are placed at intervals of 150 to 225 feet in the fields. Seedbeds are prepared at 7-foot intervals between the roadways. The tomato seedlings are set by hand in holes in the middle of the beds. About 1,500 pounds of compost an acre and 200 to 400 pounds of 3-8-8, 4-7-5, or 5-7-5 commercial fertilizer are placed under the rows before setting the plants. The rows are cultivated on both sides. About 600 to 800 pounds an acre of one of the fertilizer mixtures is applied at intervals of 7 to 10 days as a side dressing. Each application is followed by a cultivation. From 2,500 to 3,000 pounds of fertilizer an acre is applied during the growing season. Usually 50 to 100 pounds of manganese sulfate an acre is distributed with the other fertilizer mixtures. When the plants are producing fruits, 75 to 100 pounds an acre of nitrate of soda-potash is added as a side dressing. Before the preparation of the seedbeds, a ton of dolomitic limestone an acre is usually placed on the Immokalee soil.

Tomatoes on the Charlotte, Pompano, and Felda soils yield 200 to 250 bushels an acre. Yields on the Arzell and Immokalee soils are slightly less. The varieties planted are Grothen's Globe, Rutgers, Livingston's Globe, and Collier County Globe.

In recent years late blight has injured some of the plants and fruits. The method of controlling the blight is the same as that described for tomatoes on the Ochopee and Tucker soils. The control of other diseases and pests is the same on the sandy soils as on the marls.

Recent plantings of tomato seeds directly on the beds have given thicker foliage, more suckers, and heavier yields than transplanted tomato plants. The dense foliage, however, has prevented the complete control of worms. Most of the sandy soils used for tomatoes are under water-control systems consisting of dikes, ditches, and pumps. During dry seasons water is pumped into the ditches for furrow irrigation of the crop.

CUCUMBERS

Cucumbers are raised mainly on the Arzell, Charlotte, Pompano, Felda, and Immokalee soils. Much of the land planted to this crop is now protected by water-control systems. During wet seasons excess water is pumped from the cultivated areas, and in dry seasons water for furrow irrigation is obtained from adjacent ponds or sloughs by gravitational flow or by pumping from shallow wells.

Tillage practices for cucumbers are somewhat similar to those used for tomatoes on the sandy soils. Roadways are made at 150- to 225-foot intervals, and the land between the roadways is prepared by forming beds 5 feet wide with moldboard or disk-plows or by tandem disk-harrows drawn by tractors.

A row of sunflowers is planted every 10 to 12 rows to keep the wind from blowing sand and injuring the plants. On the Arzell soil about 2 to 5 tons an acre of compost is added to the seedbeds. Little or no compost is placed under the beds on the other soils. About 1,000 pounds an acre of 5-7-5 fertilizer is added to the beds 7 to 10 days before planting the cucumber seeds.

The seeds are planted 2 feet apart in the row on the beds (one row to each 5 foot bed), and the young plants are thinned one to a hill. When the first leaves appear, another 1,000 pounds an acre of mixed fertilizer is applied as a side dressing. A third application of 1,000 pounds of fertilizer is distributed when the plants begin to fall over. Nitrate of potash is applied at the rate of 200 pounds an acre 7 to 10 days before the first picking. The fertilizers are placed at the side of the plant roots and covered by a cultivator. Insecticides and fungicides are used to control insects and diseases.

With these treatments and favorable weather, the yield on the Arzell soil is about 225 to 300 bushels an acre. Yields up to 600 bushels have been obtained. On the Charlotte, Pompano, and Felda soils 225 to 300 bushels an acre of cucumbers have been obtained with the application of 2,000 to 3,000 pounds of 5-7-5 fertilizer mixture an acre and no compost. To obtain about the same yields on the Immokalee soil, about 1,000 pounds an acre of burned lime or 2,000 pounds of ground limestone has been added along with the fertilizers. From 50 to 75 pounds of manganese sulfate an acre is applied to all of the soils for the production of cucumbers.

Usually, two crops of cucumbers are raised on the same land during the same season. The fall crop is seeded in October, and the spring crop in the latter part of January. The fall crop is harvested within 40 to 45 days after planting, and the spring crop 50 to 65 days after planting. Usually, only three crops are grown on the same land, as the weed infestation is so great after fertilization that production is hindered. The varieties of cucumbers grown are Early Green Market, Burpee Hybrid, Straight Eight, and Landis Early Green.

OTHER VEGETABLES

Small acreages of lima and string beans, peppers, peas, eggplants, squash, cabbage, cauliflower, okra, Irish potatoes, sweetpotatoes, and other vegetables are grown on the sand and marl soils. These vegetables are usually planted on 5-foot beds. The beans, peppers, and peas are seeded two rows to a bed.

With favorable weather and a high level of management, string beans planted on a few acres of Ochopee soil have yielded about 175 bushels an acre when treated with 1,200 pounds an acre of 4-7-5 fertilizer and 100 pounds of manganese sulfate. After removal of the cucumber crop from Charlotte, Pompano, and Felda soils, string beans have yielded about 200 bushels an acre. Approximately 800 pounds an acre of 4-7-5 fertilizer and 200 pounds of nitrate of

soda-potash were added to the soils for the beans, and they also were benefitted from fertilizers previously used for the cucumbers. With addition of 800 pounds of 4-7-5 and 200 pounds of nitrate of soda-potash to fields previously cropped to cucumbers, lima beans have yielded 300 bushels an acre on Charlotte, Pompano, and Felda soils.

Peppers grown on the Charlotte, Pompano, Felda, and Arzell soils have yielded about 400 to 450 bushels an acre after the soils were treated with 3,000 pounds of 5-7-5 fertilizer mixture and 200 to 300 pounds of nitrate of soda-potash. The nitrate of potash was added in four applications with the other fertilizer. The varieties of peppers grown were California Wonder, Worldbeater, and Florida Giant.

Squash planted on the Ochopee and Tucker soils has yielded 150 bushels an acre after the soils were treated with 1,300 pounds of 4-7-5 fertilizer mixture and 100 pounds of manganese sulfate. The summer varieties of squash were grown—Yellow Crookneck Baby, Patty Can, and Italian.

No figures on yield of sweetpotatoes, eggplant, okra, cauliflower, and cabbage are available. The varieties of eggplant adapted to the soils in the county are the Fort Myers Market and Florida Highbush. The varieties of sweetpotatoes are Porto Rico and Nancy Hall. The varieties of okra grown are Giant-pod and Velvet-pod.

OTHER CROPS

Watermelons are grown on a moderate scale on the sandy soils. The melons are planted about the last of December on land from which an early fall crop of tomatoes has been harvested, and then are picked in April. Corn, German millet, and oats are planted in some fields before the harvesting of the tomatoes. Corn yields about 18 bushels an acre on Tucker and Ochopee marls. The varieties of corn are Cuban Flint, Nassau, and Florida Dent. German millet has yielded 2,000 to 3,000 pounds an acre on Tucker and Ochopee marls.

Small areas of Blanton soil in the vicinity of Immokalee are planted to citrus. The citrus groves commonly receive two disk-harrowings, one in spring following application of fertilizer, and one in fall after the summer cover crops have produced seed. Each year the groves receive 1,000 to 2,000 pounds of 4-7-5 fertilizer containing minor elements such as manganese, copper, and zinc.

Growing of tobacco plants and shipping them to counties in central and northern Florida for planting stock offers possibilities for cash income. Sugarcane has been grown on small acreages of Matmon, Sunniland, Ochopee, Tucker, Charlotte, and Pompano soils. Usually about 1,000 pounds an acre of mixed fertilizer is added each year for sugarcane. Most of the sugarcane is processed into sirup, which is consumed on the farm or sold at local markets. Some of the sugarcane stalks are fed to livestock. Increasing acreages are used for cantaloups and sweet corn. These crops are grown for harvesting during the winter and early spring months.

Census releases for 1950 list 454 grapefruit and 1,823 orange trees of bearing age in the county. Some fruit is sold at local markets, and

some is packed and shipped to northern markets. A few lime, lemon, avocado, guava, mango, papaya, and coconut trees produce fruits for home consumption and sale at local markets. Bananas are grown for home consumption.

PASTURE

Most of the livestock in this county get their feed exclusively from pasture. Beef cattle and hogs are kept chiefly on range, or unimproved, pastures.

The range pastures vary considerably as to kind, quantity, and quality of native forage they provide. The forage on the flat pine-lands, rockland pine forests, and saw-palmetto prairies consists mainly of wiregrass, poverty grass, broomsedge, carpetgrass and other broad-leaf grasses, and acorns. On the wet prairies the pasture consists of poverty grass, maidencane, lovegrass, carpetgrass, switchgrass, sedges, hyacinths, and various aquatic plants. On the hammock lands the forage includes broadleaf grasses, sedges, buds and tender shoots of various shrubs, and some Spanish moss. The scrub ridges support mainly wiregrass, but there are a few other grasses, sedges, and acorns.

The estimated carrying capacities of the different types of range land are as follows: Wet prairies, 1 cow to 10 to 20 acres; hammock land, 1 cow to 15 to 25 acres; flat pineland, 1 cow to 15 to 25 acres; and scrub ridges, 1 cow to 25 to 40 acres.

The hammock lands furnish fairly good grazing most of the year. They are seldom burned over, for burning does not improve the quality of the forage. The flat pineland, saw-palmetto land, wet prairies, and scrub ridges are burned over annually or every second or third year to improve the quality of the wiregrass and other grasses. Following burning, which is usually done in February, wiregrass puts on a new growth and is very palatable and highly nutritious for about 90 days. Apparently late summer and early fall grazing is better on unburned than on burned areas, for the burning tends to destroy the broadleaf grasses. On ranges where wiregrass is dominant, it has been suggested that rotational burning under controlled conditions should be practiced (1). A comparison of burned and unburned flatwood ranges was made. Steers on areas burned over annually gained approximately twice as much as those on the unburned areas (9). Burning is not recommended for ranges where highest returns from forest products are desired.

A few areas formerly planted to vegetable crops have been allowed to revert to pasture and now support a good growth of Bermuda grass and carpetgrass and other broadleaf grasses.

Hogs are kept on the range pastures throughout the year without any supplemental feed. Most of their forage consists of grasses, acorns, and berries from the saw-palmettos and cabbage palmettos. Hogs slaughtered for home consumption receive some corn and other feeds before they are butchered.

Recently, considerable attention has been given to the improvement of range pastures, particularly on the pine flatlands and prairies.

Research⁹ conducted at the Range Cattle Experiment Station, Ona, Fla., has shown that a number of permanent pasture plants are adapted to soils similar to many of those occurring in Collier County. Some of these are Pangola grass, carpetgrasses, common and Pensacola Bahia grasses, Coastal Bermuda grass, Tifton No. 99 Bermuda grass, common Bermuda grass, Vasey grass, Dallis grass, Para grass, white clover, Black Medic clover, Hubam or annual sweetclover, and common and Kobe lespedeza. The Para grass seems to grow in the wettest lands and withstands a covering of a few inches of water for a few weeks. The other plants are better adapted to the imperfectly drained soils.

At the time of survey, the initial cost of establishing a good improved pasture on the flatwood soils amounted to as much as \$45 an acre. Approximately half of the initial cost of establishing improved pasture is for removal of tree stumps, one-fourth for chopping and removal of palmettos and other plants and preparation of the seedbed, and the remaining one-fourth for seeding and initial fertilizing. Good improved pastures support one cow each 2 to 4 acres, or yield approximately four times as much forage as the native range pastures.

The number of improved pastures in southern Florida is increasing. They seem well worth the time and expense necessary to obtain them. Fertilization is very important. There is no value in clearing the land of palmettos and trees and planting grasses if fertilizer is not applied. Cross fences should be built in the improved pastures to permit rotation of animals from one area to another.

Method of pasture improvement.—Pasture improvement includes: (1) removal of most of the pine trees; (2) chopping and removal of the saw-palmettos and other shrubs; (3) planting of grasses; (4) fertilization of the grasses; and (5) pasture maintenance.

The palmettos and shrubs are destroyed by running a heavy tandem chopper twice over the land and then disking twice. There is a 2- or 3-week interval between each chopping and each disking. After the disks the seedbed is usually in condition for the planting of grass seeds or sprigs. For most satisfactory results, seeding should be completed during the rainy season in summer. Recommended rates of seeding are as follows:

	<i>Pounds an acre</i>
Common Bahia grass.....	15
Pensacola Bahia grass.....	10
Common Bermuda grass.....	10
Carpetgrass.....	10
Dallis grass.....	10
Pangola grass.....	¹ 500
Coastal, Tifton No. 99, Bermuda grass.....	¹ 500

¹ Pounds (grass sprigs).

Grass seed is sown and then covered by a cultipacker. When living sprigs of grass are used, they are scattered on the land and slightly chopped and covered by a light disking. Then the soil is compacted by the cultipacker.

It is recommended that 500 pounds an acre of 6-6-6 or 5-7-5 fertilizer be applied following the planting of the grass. The Florida

⁹ Information on improvement of pastures and beef animals obtained from Dr. W. G. Kirk, Vice Director, in charge, Range Cattle Experiment Station, Ona, Fla.

Agricultural Experiment Station recommends that 400 to 500 pounds an acre of 6-6-6 or 5-7-5 fertilizer be added each year to the improved pasture. The addition of 2,000 pounds an acre of lime every 4 to 6 years very much benefits grass on acid soils. Copper, zinc, manganese, and other minor elements should be applied every 3 to 6 years at the rate of 20 pounds of copper sulfate, 10 pounds of zinc sulfate, and 20 pounds of manganese sulfate an acre.

If gallberry and saw-palmetto begin growing on the pastures, they can be killed by running the chopper over the infested areas. The same method can be used on grasses that attain so rank a growth that they become a fire hazard. Light disking every 2 or 3 years helps the growth of Bermuda-grass.

The growing of legumes with pasture grasses appears to be making some headway on the imperfectly drained flatwood soils. The legumes tend to improve the quality and quantity of the forage and benefit the grazing animals. Only a small acreage should be planted to legumes at first to see if they are adapted to the land.

A mixture of Louisiana White, Black Medic, and Hubam clovers or of common and Kobe lespedezas seems adapted to the Immokalee soil on the experiment station at Ona. The clovers are usually sown early in fall. They may be seeded on closely grazed sod or on a new seedbed with the grass seeding. The acre rate of seeding is 2½ to 3 pounds of white clover, 3 to 4 pounds of Black Medic clover, and 4 to 5 pounds of Hubam clover. The common and Kobe lespedezas are seeded in the spring at the rate of 20 pounds an acre.

Clover and lespedeza seed should be obtained from adjacent Southern States. Before planting, the seed should be heavily inoculated with the proper root-nodule bacteria. About 2 tons of lime and 500 to 600 pounds an acre of 0-14-0, 0-10-10, or an equivalent fertilizer should be applied at the time of planting.

No nitrogen fertilizer will be needed for the grasses, once the legumes are growing. The grasses utilize the nitrogen the bacteria fix in the nodules on the roots of the legumes.

From 400 to 500 pounds an acre of 0-14-10, 0-10-10, or an equivalent fertilizer (50 pounds of P₂O₅ and 50 pounds of K₂O an acre) are needed to treat the legume-grass pastures each fall. The phosphate could be supplied by applying 400 pounds of superphosphate or 600 pounds of basic slag every 1 or 2 years. If rock phosphate or colloidal phosphate is used, 2,000 pounds an acre should be applied every 3 to 5 years. A ton of lime an acre is usually needed every 4 to 6 year .

Other range practices.—Mineral supplement should be fed to animals on all kinds of pastures. Molasses and meal are added to the mineral supplement to increase palatability. The mineral mixture fed at the Range Cattle Experiment Station consisted of the following:

	Pounds
Steamed bonemeal.....	29
Deflorinated superphosphate.....	29
Modified salt-sick mineral consisting of:	
Common salt.....	34. 22
Red oxide of iron.....	3. 42
Copper sulfate.....	. 34
Cobalt chloride.....	. 02
Blackstrap molasses.....	2. 00
Cottonseed, peanut, or soybean meal.....	2. 00

The improvement of the cattle by breeding should go hand in hand with the improvement of the pastures. It is recommended that native cows be bred to Brahma bulls for a couple of crosses. Then if the pastures have kept pace with the breeding, the three-quarter Brahma cows can be bred to bulls of any of the English beef breeds, as Hereford, Shorthorn, Aberdeen-Angus, and Devon. If the breeding of animals advances more rapidly than pasture improvement, it is necessary to breed the cows back to Brahma bulls.

FORESTS ¹⁰

Approximately 1,114,400 acres, or about 85 percent of this county, is woodland. Even with a substantial increase in cultivation or other uses, the proper care and utilization of woodland will play a vital part in the future of the county.

The forests are classified into three major types: (1) slash-cypress, (2) scrub-cypress, and (3) cypress-hardwoods. There are also a few thousand acres of palms and hardwoods.

The predominant species are slash pine, cypress, and cabbage palmetto. Some sand pines and pond pines grow in places; a few mahogany trees and other valuable hardwood trees grow on the hammocks and are used locally. American mangrove, black-mangrove, and white-mangrove occur in considerable numbers and have commercial possibilities. Royal palm, a stately and ornamental tree, also grows in the diversified forest area.

Slash pine ranks as perhaps the most important native species because of its widespread use for lumber, veneer, cross ties, naval stores, and pulpwood. It grows on the sand soils in the flatwood region and on the shallow sandy soils on the islands within the Big Cypress Swamp. Slash pine grows in the Immokalee, Blanton, Sunniland, Broward, Matmon, Keri, Copeland, Pompano, Charlotte, and Arzell soils. The sand pines and pond pines are of no commercial importance. The sand pines grow on sand dunes of the St. Lucie and Lakewood soils. A few pond pines are found on the Arzell, Charlotte, Pompano, and other poorly drained soils.

Baldcypress grows on perhaps 20 percent of the area and is second to slash pine in commercial importance, even though its slow growth reduces its future value. This cypress grows in Fakahatchee Strand, Camp Keasis Strand, Bird Rookery Strand, Kissimmee Billy Strand, Willson Strand, and other cypress swamps. Baldcypress is well adapted to soils that may be submerged by 1 or more feet of water for long periods. Cypress trees are now being harvested from Fakahatchee Strand at the rate of approximately 35,000,000 board feet each year. It is estimated that it may require 20 years to complete the cutting.

"Scrub" or Pond cypress, a stunted extremely slow-growing small-sized tree, grows in the Big Cypress region on the Arzell and Pompano soils and the shallow phases of the Ochopee soils. It has possible value as pulpwood and fence posts.

Cabbage palmettos grow fairly widely throughout the slash-cypress area and on the fringe of other areas. They have possible future value

¹⁰ This section was prepared by C. H. Coulter, state forester, Florida Board of Forestry and Parks, Tallahassee, Fla.

for fiber, raffia, and novelties. These palmettos grow on the Sunniland, Broward, Keri, Copeland, Matmon, Charlotte, and Pompano soils, which have calcareous materials at shallow depths.

The possibility of extracting tannin from the bark and wood of white-mangrove and from the bark of the American mangrove is worthy of consideration. Other species, including mahogany, sea-grape, and Australian pine, have sufficient tannin in their barks to be considered important. American mangrove trees occur in the outer zone of the mangrove swamps near the Gulf of Mexico. The white-mangrove and black-mangrove are inland from the American mangrove along the Gulf. The mahogany and other hardwood trees occur on the Copeland soils in the low hammocks.

MANAGEMENT

Annual and periodic wildfires are the most serious threat to the future of the forests in this county. Poor soil drainage also retards tree growth, but the devastating effect of wildfires on merchantable trees, and particularly on young growth, represents 80 to 90 percent of the management problem, whereas drainage is only about 10 percent of it.

Studies in Lee County, plus growth borings in Collier County, indicate that slash pines that have undergone annual or periodic burning have had a¹¹ growth value of about 25 cents an acre a year. In contrast, the growth in areas not burned or only lightly burned once or twice during the life of the existing trees has been \$1.50 to \$3.00 an acre a year.

Forest-fire protection should be provided. Protection can be obtained from the county in conjunction with the Florida Board of Forestry and Parks, but care in forest use and the cooperation of logging crews, cattlemen, and the general public in confining the fires will also help.

When slash pine stands are cut, four or five seed trees an acre should be retained. These trees should be 10 inches or more in diameter at 4½ feet above ground. They will reseed the area if protected from wildfires. Retention of these seed trees is by far the cheapest and easiest method of reforestation.

Cajuput trees that have spread naturally in wet areas a few miles north of the county line in Lee County exhibit erect and vigorous growth on the Arzell and Pompano soils. They are in decided contrast with the forked, crooked growth of wide-spaced cajuput trees planted ornamentally. Because of the possibilities of using the cajuput tree for its wood, bark, honey, and perhaps the oil from the leaves, it could be planted in the cypress and scrub-cypress areas.

Planting of slash pines and perhaps cajuput trees on representative soil types should be started experimentally on a test basis. The setting of a few thousand trees of both species in lots of 200 to 300 each would form the basis for future work. The survival, growth, and commercial possibilities of these trees could soon be determined if plantings were made immediately.

No extensive need for thinning the present stands of pine trees is apparent, for most of the tree growth is too widely spaced. In a few

¹¹ Represents value at time the survey report was written.

dense clumps, one-tenth to one-fourth-acre thinning plots should be established to determine the cost and to learn the increased growth of the trees selected to remain for future crops.

Pruning is an expensive and time-consuming means of forest improvement. It should be tried only experimentally on open stands that are too limby to produce saleable products. It is recommended that trees selected for pruning be 3 to 7 inches in diameter.

Experiments should be made to determine the feasibility of producing and using pond cypress, cabbage palmetto, and tannin-bearing and other native species of trees. Cajeput trees, Australian pine, and other exotic, or introduced, species should be tried to learn their growth habits, adaptability, and commercial uses.

It is estimated that adequate provisions for planting and fire protection would increase the value of the annual growth at least five times over that obtained in areas not so managed, and that the wholesale value of the forest products cut and processed from areas adequately planted and protected would be seven times the value from areas not so managed. It is evident therefore that use of reasonable forestry practices can produce a substantially increased and dependable income for the county.

ADDITIONAL FACTS ABOUT COLLIER COUNTY

SETTLEMENT

Mound builders of unknown origin occupied the territory now in Collier County, and then Indian tribes of which our history has record.¹² Archeologists have dug quantities of relics left by the mound builders from enormous shell mounds that extend along the mangrove coast line from the northwestern corner of the county to Chokoloskee Island, and also from large earth mounds scattered throughout the county from the Everglades Basin, located in Dade County, to Fakahatchee Strand.

The first historical account relating to this part of Florida dates back to 1513, when Ponce de Leon explored the area. De Leon, and later Menendez, attempted a permanent settlement on Marco Island. Both were so inhospitably received by the Calusa Indians that they abandoned their efforts at colonization.

During the eighteenth century the Seminole Indians, driven by Spanish and French settlers, sought refuge in Florida and finally settled among the dark recesses of the Big Cypress Swamp. Despite the casualties of the Second and Third Seminole Wars and eventual removal of most of the tribe to the Indian Territory, enough remained in Florida to become the nucleus from which sprang the present Seminole Nation.

Several white settlements were started in the area now within Collier County, but the settlers soon moved to other areas or were captured and killed by the Indians. Williams (13), however, mentions several plantations on Marco Island in 1831, and old coast charts of 1856 indicate that a family was living near Gordon Pass, south of Naples. White settlers living on Chokoloskee Island were reported

¹² Most of the historical data for Collier County was obtained from Mr. D. Graham Copeland.

to be carrying on a brisk trade in furs, hides, fish, and vegetables with the Indians in 1870. They are said to have named the entire coastal region "Chokoloskee," meaning "Deserted Shanty." Only scattered settlements were made up to the 1890's, chiefly at Everglades, Marco, Lake Trafford, and Immokalee. Most of the early settlers came from other Florida counties and from Georgia, Alabama, and the Carolinas.

The county, originally a part of the area known as Spanish East Florida, did not attain its present boundaries until May 8, 1923, when by act of the State Legislature it was formally created and named in honor of its largest landowner, Barron Gist Collier.

POPULATION

The population of Collier County was 6,488 in 1950. Most of the inhabitants live within or near the small towns or villages located along the main highways. Naples, population 1,465 in 1950, is the largest town. It is located in the western part of the county near the Gulf of Mexico and is an important local trading center and popular winter resort. Everglades, the county seat, had a population of 625 in 1950. It is widely known for hunting and for both pleasure and commercial fishing. Other population centers in the county are Immokalee, an important trading center and shipping terminal for the northern part of the county, Copeland, Ochopee, Deep Lake, Corkscrew, Sunniland, Jerome, Collier City, and Marco.

TRANSPORTATION AND PUBLIC IMPROVEMENTS

The early settlers traveled by boat along the Gulf Coast and by ox wagon in the interior. Boats made stops at Naples, Marco, and Everglades on their runs between Fort Myers and Key West. They brought staple goods for the settlers and loaded tomatoes, cucumbers, sugarcane, and some fruits for shipment to Key West. The production of vegetables and fruits gradually increased. They were shipped via steamer from Turner River, Everglades, and Marco Island to Key West, and thence to New York markets, in about the same time as is required today.

The trails through the Big Cypress Swamp in the interior of the county were only slowly passable by ox teams and by auto. The work begun before World War I on the Tamiami Trail connecting Tampa and Miami was insufficiently financed and the construction lagged, but new interests brought about its completion in 1930. The highway connecting Everglades and Immokalee was built at a slightly later date. The railroad between these towns was built about 1929.

Railroad transportation is now provided by two branches of the Atlantic Coast Line that enter the county from the north. One branch crosses the western part of the county and serves Naples; the other enters the north-central part, passes through Immokalee, Sunniland, Miles City, Deep Lake, Jerome, and Copeland, and continues to Everglades.

The Tamiami Trail, United States Highway No. 41, crosses the county north to south near the Gulf of Mexico, and from Naples U. S. Highway 41 goes southeast to the southeastern corner of the county. State Highway No. 29 parallels the railroad from Everglades

to Immokalee and extends northward to La Belle in Hendry County. State Highway No. 92 connects Marco Island with the mainland and intercepts the Tamiami Trail at Royal Palm Hammock, about half-way from Naples to Ochopee.

At the time this survey was made, two State highways were being built in the northern part of the county, one to extend east from Immokalee to the Collier-Hendry County line, and the other to connect Immokalee and Fort Myers. A few graded roads extend short distances into the interior from the highways, but most of the interior is reached by trails, many of which are passable only during dry seasons unless one has special equipment such as a glade buggy.¹³

Census releases for 1950 report that the farms are, on the average, 9 miles from the trading center most frequently visited, and that 1.9 miles of this must be traveled over dirt or unimproved road.

Airports with paved runways have been built near Naples and Immokalee. They were built in 1942 and used by the United States Army. The mail is brought into Immokalee by train, and to other towns by truck from Fort Myers or bus from Miami. Freight service is available on all of the highways, and passenger service by bus on the Tamiami Trail. Small boats and barges sometimes carry supplies to Everglades, Naples, and Marco. All railroad lines, airports, highways, secondary roads, and many of the trails are shown on the soil map.

Consolidated schools for both white and colored students are in Everglades, Naples, Collier City, Immokalee, and Chokoloskee. Students from adjacent communities travel to these schools by buses. The schools at Immokalee and Collier City have classes through the ninth grade, and those in Everglades and Naples have twelve grades. Churches are located in Everglades, Naples, Immokalee, Jerome, Copeland, Chokoloskee, Collier City, and Marco. Electricity for light and power is available in most communities from local power plants, and telephone lines reach most towns and villages.

INDUSTRIES

The logging of pine timber in the county began about 1924. Small mills were located near Everglades, Copeland, and Sunniland. These mills sawed lumber for bridges on the Tamiami Trail and for buildings in the town of Everglades. The present large-scale lumbering operations were started in 1934, when mills were erected at Naples, Sunniland, and Immokalee. These mills have been replaced by a large one at Jerome and a small one at Naples. The lumber is transported to outside markets by rail and motortruck.

Logging of cypress timber began in 1942 near Copeland, where a logging camp was built for the people cutting the large cypress trees in the Falkahatchee Strand. The logs are shipped by train to a mill at Perry in northern Florida.

¹³ A glade buggy is usually a light truck stripped down to eliminate unnecessary weight of the cab and rear compartment. Tools and other supplies are carried in a lightweight box built at the rear of the driver's seat. The wheels are of large diameter to permit passage through deep ruts and over low tree stumps. The front wheels are fitted with regular truck tires; the rear wheels are usually equipped with partly worn airplane tires 40 to 60 inches in total diameter. Even so, it is frequently necessary to put chains on the rear wheels to negotiate the extremely wet, or soft, places.

Sheds for packing vegetables are located at Ochopee, Copeland, Deep Lake, and Immokalee. The packed vegetables are shipped by rail and truck to northern markets. A tomato-canning factory furnishes seasonal work for some of the women in Ochopee.

Drydocks for repairing fishing boats are located in Everglades, Chokoloskee, Naples, and Marco. A few oil wells near Sunniland give employment to a limited number of people. Several Seminole Indian camps located along the Tamiami Trail are tourist attractions.

PARKS AND WILDLIFE

The Collier-Seminole State Park (pl. 1, A) is located along the Tamiami Trail at Royal Palm Hammock, or about halfway between Naples and Ochopee. The park contains many royal palm, gumbo-limbo, mastic, rubber, mahogany, and many other tropical trees, vines, and ferns. Many varieties of wild orchids and other tropical plants grow in several of the dense cypress strands and hammocks in the county. The northern boundary of Everglades National Park is a few miles south of this county.

Many showy long-legged wading birds make their home in the mangrove swamps and tidal marshes near the Gulf coast. Some of these are the American and snowy egrets, white and wood ibis, Florida crane, roseate spoonbill, cormorant, white, blue, Ward's, Louisiana, and little blue herons, and brown and a few white pelicans. Rookeries, roosts, and feeding grounds for many of these birds are located in this section of the State. Ducks frequent the county. On the mainland wild turkeys were once abundant but are now rapidly decreasing, largely because too many hens are killed by hunters. Quail are still common on some of the prairies and pine flatlands.

Wild animals common to the area are the gray fox, opossum, raccoon, squirrel, rabbit, black bear, Florida cougar, bobcat, otter, and deer. Most of the deer were killed between 1940 and 1942, as they were thought to be carrying cattle ticks. Since that time several hundred deer have been turned loose to restock the county. Alligators still make their home in many wet areas, and snakes are common. The poisonous snakes are the diamondback and pigmy rattlesnakes, cottonmouth moccasin, coral snake, and copperhead moccasin.

Some of the best salt-water game fish are caught in the bays, estuaries, rivers, and coastal shoals along the Gulf of Mexico. These are the tarpon, barracuda, bonito, sailfish, jewfish, snook, amber jack, sea trout, and shark. Some of the food fish caught by the commercial fisherman and sportsmen are mullet, mackerel, pompano, grouper, snapper, kingfish, redfish (red drum), sea trout, sheepshead, and snook. Bass, perch, and bream are caught in the fresh-water lakes and canals.

AGRICULTURE

CROPS

Sizable crops of tomatoes, cucumbers, sugarcane, and fruit were grown and shipped by water even before 1910. Then the building of highways and the railroad improved transportation and made feasible

the cultivation of many thousands of acres of virgin lands. In 1925 a large field about a mile south of Copeland was planted to tomatoes; it produced excellent yields but the enterprise failed because it took too long to get the crop to the railroad for shipment. In 1927-28 a planting of 250 acres of tomatoes at Ochopee brought tremendous returns and stimulated the commercial planting of tomatoes now conducted in the county. Recently, from 2,000 to 2,500 acres has been planted each winter to tomatoes, cucumbers, peppers, squash, Irish potatoes and sweetpotatoes, cabbage, lima and string beans, and peas. A few acres are planted to corn and sugarcane. In most years, about 80 percent of the cultivated cropland is planted to tomatoes. The vegetables are packed and shipped to the northern markets by truck and rail.

The citrus industry was started in the county about 1900, when 120 acres of land at Deep Lake was planted, mainly to grapefruit and oranges. The fruit was packed in boxes, hauled to the seaport at Everglades on a small tramroad built from Deep Lake to Everglades in 1910, and then shipped by water to Key West and thence to New York. In the late 1930's a small canning plant was built at Deep Lake to process a part of the fruit. Some tomatoes were canned at this plant before it was closed in 1940. The citrus grove at Deep Lake was abandoned about 1940 because of high production costs and low market prices. Shortly after the planting of the grove at Deep Lake, however, citrus groves consisting of 40 acres each were planted at Immokalee and Naples. These groves consisted largely of grapefruit and orange trees and are still in production.

During the early 1900's several hundred acres of pineapples grew profusely on the sand hills on Marco Island. The fruit was shipped along with the vegetables to markets, but the project became unprofitable upon the growth of the industry in Hawaii and the beginning of pineapple production on the Isle of Pines.

Approximately 110 acres (excluding about 200 acres in citrus groves) was being cropped in 1925. Since then the acreage has increased to approximately 2,000 or 2,500. The area in crops varies from year to year according to the amount of unseasonal rainfall during the normally dry winter seasons.

LIVESTOCK AND LIVESTOCK PRODUCTS

The beef cattle industry began in what is now Collier County in 1890, but fencing the ranges and improving the cattle did not start until 1935. Since that date the quality of the cattle has been steadily improved by cross-breeding native cows to Brahma bulls or to bulls of Hereford, Aberdeen-Angus, Shorthorn, Devon and other English beef breeds. Before 1920, or before the railroad from the north reached Immokalee, practically all of the cattle raised in the area were driven overland from Immokalee to Fort Myers or Punta Rassa and then shipped by schooner to Cuba. Since 1920 most of the cattle have been shipped by rail, or since 1930, by motortruck. They go to the various beef centers, chiefly Tampa, Miami, and Jacksonville. Many cattle, however, are sold at auction sales in Goodno, near La Belle, Hendry County.

Census releases for 1950 report 45,015 head of cattle on farms and ranches in the county, an increase of 22,746 since 1945. This increase

was due to the high price of beef. The cattle graze on the range pastures and improved pastures which include many areas once used for winter vegetables. Beef cattle are raised on range pastures in the western and northern parts of the county. The pastures are principally on Immokalee, Sunniland, Broward, Blanton, Keri, Copeland, Matmon, Charlotte, Felda, Pompano, and Arzell soils. Most native pastures furnish only fair grazing. Recently, some pastures have been improved by destroying the palmettos and other shrubs, planting improved grasses, and applying fertilizer. Most of the beef cattle are grade animals that have been greatly improved since 1935 by breeding programs.

Census releases for 1950 list only 19 milk cows in the county. In 1949, only 233 gallons of milk and no cream or butterfat were reported as sold from farms of the county.

Hogs are of common stock or of Poland-China and Duroc grades. Most of the hogs graze on the range pastures for all of their food. They are sold mainly at auction sales in Goodno and other towns. A few hogs are butchered for home consumption.

The number of chickens rose considerably from 1930 to 1940, decreased in 1945, and more than regained the 1940 level in 1950. Poultry diseases and high production costs are the reasons given for the decline in 1945. Rhode Island Red, White and Barred Plymouth Rocks, and White Leghorn are the common breeds. Only a few turkeys and ducks are raised. Most of the poultry and eggs are sold locally.

Honey production is an important industry in some sections of the county. G. H. Lowe of Marco, operator of the largest apiary in the county, reports that honey production was 80,000 pounds in 1944.

The bees obtain nectar from saw-palmettos, mangroves, goldenrod, and other native plants. They help greatly in the pollination of vegetables and fruits. The bees produce more honey during dry seasons than at any other time. Recently, the shipment of package bees to the northern apiaries has become important. In 1946, 1,200 packages of bees were shipped.

Table 4 gives data on the number of domestic animals on farms and ranches and on the sale of livestock products in stated census years.

FARM POWER AND MECHANICAL EQUIPMENT

Mules were the principal work animals from 1930 to 1940, but census releases for 1950 list more horses than mules. Work animals are small to medium in size. The number of work animals on each farm ranges from 1 to 4. During recent years nearly all of the replacements have been raised on the farms.

Recently, tractors have been used for most of the heavy work previously done by the work animals. There were 30 tractors in the county in 1940, whereas census reports for 1950 put the total at 93. Of the 193 farms in the county in 1950, 57 farms had neither a tractor nor work animals, 33 had no tractor and only one work animal, 18 had no tractor and 2 or more work animals, 24 had both tractors and work animals, and 61 had a tractor but no work animals.

The tractors, many of which are the caterpillar or all-purpose type, are used for plowing, disk-harrowing, row cultivation, and spraying and dusting chemicals on the crops. The tillage implements used

TABLE 4.—*Number of domestic animals on farms and ranches and quantity of livestock and livestock products sold in Collier County, Fla., for stated years*

Livestock on farms	1930	1940	1950	Livestock and livestock products sold	1929	1939	1949
Horses.....number.....	3	¹ 34	171	Cattle and calves.....number.....	(²)	545	16,509
Mules.....do.....	34	¹ 75	43	Hogs and pigs.....do.....	(²)	92	370
Cattle.....do.....	3	¹ 3,257	45,015	Chickens.....do.....	30	3,855	667
Swine.....do.....	(²)	³ 466	1,192	Eggs.....dozen.....	80	⁴ 2,797	5,450
Chickens.....do.....	¹ 20	³ 1,060	³ 1,854	Milk.....gallons.....	225	18,730	233
Beehives.....do.....	(²)	1,515	364	Honey.....pounds.....	(²)	⁴ 101,080	16,260

¹ Over 3 months old.

² Not reported.

³ Over 4 months old.

⁴ Total produced.

with the tractors are moldboard and disk plows, disk-harrows, cultivators, cultipackers, and dusting and spraying apparatus. Horses and mules are used to draw moldboard plows, rollers, and double shovels.

FARM TENURE

In 1950 full owners operated 10 farms; part owners, 46; managers, 2; and tenants, 135. Many of the full and part owners operate small farms. Most of the land in ranches and cultivated crops is leased from companies owning large acreages. Over 90 percent of the total land area is owned by 7 holders.

Most tenants pay cash rentals. Ranch lands were leased for about 10 cents an acre at the time of this survey. The contracts ordinarily run for 3 years, and the terms of payment are usually cash in advance, semiannually, or annually. If the ranchers improve the pastures by removing trees and shrubs, planting and fertilizing grasses, and building fences, the rental price continues at the same rate. Also, the ranchers leasing the land have the privilege of renewing their contracts before it is offered to others for leasing.

The cash rental charged for croplands depends on their distance from a hard-surfaced highway. The terms of the contract usually require that half of the rental be paid at the time the lease is signed and the rest at harvest time. Expenses involved in planting, fertilizing, and harvesting the crops are paid by the tenants. Some of the renters have installed dikes, ditches, and pumps to help control the water on their croplands. The initial cost of construction and cost of maintenance are borne by the tenants.

LABOR SUPPLY

Most of the labor is done by Negroes, but a few Indians and whites work in the fields. Demand for laborers is high when tomatoes, cucumbers, other vegetables, and fruits are harvested. Transient Negro and white workers do most of this seasonal labor. Most of the migratory white workers are used to grade and pack vegetables. During the war years, 1942-45, Negro laborers were imported from the Bahama Islands to work in the vegetable fields. All of the seasonal workers are housed in labor camps, and after the harvesting of crops they move to other vegetable-producing areas.

MORPHOLOGY, GENESIS, AND CLASSIFICATION OF SOILS

Soil is the product of forces of weathering and soil development acting on materials deposited or accumulated by geologic agencies. The characteristics of the soil at any given point depend on (1) the physical and mineralogical composition of the parent material, (2) the climate under which the soil material has accumulated and existed since accumulation, (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 development have acted on the material. Soils are classified on the basis of their characteristics, which are determined by these factors. It therefore follows that development of the different series of soils should be explainable on the basis of differences in one or more of these five factors.

FACTORS OF SOIL FORMATION

Collier County lies in the Floridian section of the Atlantic Coastal Plain and is in the region of the Red-Yellow Podzolic soils (10). Certain geologic factors and events have had a bearing on the physical and chemical characteristics of the soils. Many thousand years ago all of the county was covered by sea water, which deposited the materials from which the soils have been derived.

Most of the county has a mantle of marine sand deposited by the Talbott and Pamlico seas during the Sangamon and Peorian interglacial stages of the Pleistocene epoch, or Ice Age. In the western and northern parts, this sand mantle is 5 to 30 feet or more thick. In the central, eastern, and southern parts, it is very thin and the underlying Tamiami formation of sandy limestone and the Buckingham marl, both of the Pliocene Age, are at or near the surface. The Buckingham marl merges with the Tamiami formation near the village of Sunniland, but it extends northward under the Pamlico and Talbott sands.

Tamiami limestone is exposed frequently in the eastern and southeastern parts of the county. In places a thin layer of clayey materials that seems to have formed from limestone through weathering processes overlies the moderately soft or hard limestone. In the extreme southeastern corner of the county, a thin layer of Miami oolitic limestone covers the Tamiami formation. Also, near the Gulf coast and extending into the interior, recent deposits of sands, marl, and peat cover the older deposits of sand and limestone. The marls have developed from sediments washed in over the rocks and by the solution and redeposition of the calcareous materials through the agency of calcareous algae (5).

The soils of the county have developed under the influence of a humid subtropical climate. The annual temperature is about 75.2° F.; the annual precipitation, about 52 inches. The heaviest rainfall comes in the period from May to October; during the rest of the year it is light. The warm temperatures and high rainfall cause fairly continuous leaching of the soil, and other soil processes are active the entire year. Most of the sandy soils in the western and northern parts of the county are medium to strongly acid. The calcareous soil solutions moving from underlying materials and from adjacent calcareous soils have made many of the shallow sandy soils that rest on limestone or marl nearly neutral or alkaline.

Over 80 percent of the land in the county is covered by forests, which consist largely of pines and cypress. The pine forests generally have an undergrowth of short grasses, saw-palmettos, and other shrubs. The cypress forests contain few shrubs and grasses or trees of other species. The rest of the county has a growth of short-grass native vegetation.

Because of the humid subtropical climate and the very porous coarse-textured soil materials, the soils are mainly light in color, low in organic matter and nitrogen, and comparatively low in other mineral nutrients. The surface soils, 2 to 6 inches thick, usually contain small quantities of partly decayed organic matter that gives them a salt-and-pepper appearance. In low hammocks and in some cypress swamps, however, the surface soils are dark to a depth of about 12

inches. This results because water covers the ground the greater part of the year and permits the accumulation of more decayed vegetable matter in the soil. Likewise in wet marshes, partly decayed vegetable matter has accumulated to depths ranging from a few inches to 30 inches or more.

Except for comparatively small areas in the western and northern parts of the county, the land is naturally poorly drained and the water table is usually near the surface. The natural drainageways in the interior of the county are very indistinct and sluggish; they usually follow the cypress strands and sloughs. The configurations of the land are essentially those laid down by the sea. Very slight differences in elevations cause distinct variations in the soils and in the soil-water conditions.

The land is nearly level with the exception of a few low ridges and knolls. A few sand dunes on Marco Island have slopes ranging up to 15 percent. One of these dunes, slightly over 52 feet above sea level, is the highest point in southern Florida. From Immokalee, at 44 feet above sea level, the general gradient is about a foot to a mile in a southwesterly and southerly direction to the Gulf coast. Nevertheless, several miles can be traversed in the interior before there is a change of 1 foot in elevation. During the rainy seasons most of the land in the central part of the county is covered by a few inches of water for several days. During dry seasons the shallow sandy and marl soils may become too dry to support good plant growth. Furthermore, some of the deep sand soils become very dry as the water table recedes.

Over the greater part of the county the soils are young; the soil-forming processes have not acted on them long enough to form noticeable horizons of eluviation and illuviation. The characteristics that most of the soils now have are caused primarily by the character of the geological materials that have been laid down, but partly by the aging of these materials under the influences of somewhat poor to very poor drainage, a subtropical climate, different plant covers, and the action of soil organisms. Most of the soils have no developed horizons; they consist of layers of undifferentiated sands, and in many of them the sands rest on a rock or marl stratum that is generally entirely different from the sands. The B horizon is probably lacking in all the soils except Immokalee fine sand, which has an organic-stained layer or soft hardpan. This hardpan may be defined as a B horizon having an accumulation of mineral and other constituents.

CLASSIFICATION OF SOILS

Collier County is in the region of Red-Yellow Podzolic soils, but has no soils belonging to that great soil group or any other zonal soils. It has only intrazonal and azonal soils.

Intrazonal soils are defined (10) as soils having more or less well-developed soil characteristics that reflect the dominating influence of some local factor of relief or parent material over the normal effect of climate and vegetation. The characteristics of such soils are generally the result of level relief, greatly influenced by the nature of the parent material and by restricted drainage.

The azonal soils are defined (10) as a group of soils that have no well-developed soil characteristics; they lack these characteristics

because they are too young or because conditions of parent material and relief have been such that definite characteristics could not develop.

In Collier County the intrazonal order is represented by the Low-Humic Gley and Humic Gley soils and by the soils of the Ground-water Podzols great soil groups; the azonal order, by soils of the Regosol and Lithosol great soil groups.

The soil series of the county are classified by higher categories in table 5, which also lists some of the factors that have contributed to their morphology. The classification is based on limited data, principally characteristics observed 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 soil series in the correct great soil group, but further study may prove that the classification is incorrect in some instances.

MORPHOLOGY OF SOILS REPRESENTING THE GREAT SOIL GROUPS

The soils of this county can best be interpreted by studying, for the important soils, profile descriptions at definite locations.

GROUND-WATER PODZOLS

The somewhat poorly drained Immokalee fine sand is a Ground-Water Podzol. It has developed from thick beds of unconsolidated sand on predominantly level or nearly level relief. The water table seldom descends lower than the level of the soft hardpan layer, which is usually at 30 to 40 inches. All the horizons are medium to strongly acid, except the very strongly acid 30- to 38-inch layer.

Following is a description of a profile of Immokalee fine sand, as observed in an excavation in a nearly level forested area 0.7 mile northeast of Immokalee:

- A₁ 0 to 4 inches, loose fine sand; dark gray ¹⁴ (10YR 4/1) when moist; small amounts of partly decayed organic matter that give a salt-and-pepper appearance; many fibrous medium-sized roots; gray (10YR 5/1) when dry.
- A₂ 4 to 30 inches, loose fine sand; light gray (10YR 7/1); shows a few splotches of light brownish gray (10YR 6/2) around partly decayed roots when moist; white (10YR 8/1) when dry.
- B 30 to 38 inches, weakly cemented fine sand; very dark brown or dark grayish brown (10YR 2/2 or 3/2) when moist; cementing material is mainly organic matter containing numerous partly decayed medium-sized roots; dark gray (10YR 4/1) when dry.
- 38 to 44 inches, loose fine sand; dark yellowish brown (10YR 4/4) when moist; several partly decayed roots; yellowish brown (10YR 5/4) when dry.
- 44 to 50 inches, loose fine sand; very pale brown (10YR 7/3) when moist; very pale brown (10YR 8/3) when dry.
- C 50 to 60 inches +, loose incoherent fine sand; light gray (10YR 7/1) when moist; white (10YR 8/1) when dry.

LOW-HUMIC GLEY SOILS

The Sunniland and Felda are Low-Humic Gley soils associated with the Immokalee soil in the northern part of the county. They differ from the Immokalee soil mainly in having a substratum of calcareous

¹⁴ Provisional soil color names proposed by 1946 Committee on Color.

TABLE 5.—*Classification of the soil series of Collier County, Fla., by higher categories, and some of the factors that have contributed to their morphology*

Order, great soil group, and series	Parent material	Relief	Drainage
Intrazonal:			
Ground-Water Podzol: Immokalee.....	Dominantly thick beds of unconsolidated sand.	Level or nearly level.....	Somewhat poor.
Low-Humic Gley: Sunniland.....	Thin beds of fine sand and sandy clay materials over limestone.	Nearly level; gently sloping to lower lying soils.	Do.
Felda.....	do	Level or slightly depressed.....	Poor.
Pompano.....	Moderately thick beds of sand over limestone or marl.	Level, nearly level, or slightly depressional.	Do.
Charlotte.....	do	do	Do.
Arzell.....	do	do	Do.
Humic Gley: Copeland.....	Thin layer of sandy material overlying or partly mixed with residuum from limestone.	Level or nearly level.....	Do.
Azonal:			
Lithosols: Matmon.....	Thin layer of fine sands mixed with residuum from moderately soft marl to hard limestone.	Nearly level.....	Somewhat poor.
Broward.....	Dominantly thin beds of fine sand, 12 to 40 inches thick, over limestone.	Level, nearly level, or very slightly undulating.	Do.
Keri.....	"Marl sandwiches," or thin layer of marl between layers of fine sand, all over limestone, which is at depths of 4 to 5 feet.	Level or nearly level.....	Do.
Ochopee.....	Unconsolidated finely divided calcareous sediments with high content of fine sand; mainly of fresh-water origin, and 4 to 60 inches deep over limestone.	Level or nearly level; elevations up to 6 feet above sea level.	Very poor.

TABLE 5.—*Classification of the soil series of Collier County, Fla., by higher categories, and some of the factors that have contributed to their morphology—Continued*

Order, great soil group, and series	Parent material	Relief	Drainage
Azonal—Continued Lithosols—Continued Tucker.....	Unconsolidated finely divided calcareous materials with moderate quantities of fine sand; mainly of fresh-water origin, and 4 to 24 inches deep over limestone.	Level or nearly level; elevations 6 to 15 feet above sea level.	Very poor.
Regosols: St. Lucie.....	Thick beds of very loose sand.....	Low ridges, knolls, hummocks; slightly undulating.	Excessive.
Lakewood.....	do.....	Hummocks; gently rolling to level.	Do.
Blanton.....	Moderately thick beds of unconsolidated sand.	Level to slightly undulating.....	Good.

clayey materials and in their lack of an organic-stained layer in most of their profiles. They have developed from thin beds of fine sands overlying calcareous clayey materials that frequently contain concretions or fragments of limestone or pieces of shells. The Sunniland soil differs from the Felda soil chiefly in having better drainage and brighter colors. The Sunniland is somewhat poorly drained, and the Felda is poorly drained.

The following describes a profile of Sunniland fine sand taken south of State highway No. 82, half a mile east of Corkscrew:

1. 0 to 4 inches, nearly loose fine sand; dark gray (10YR 4/1) when moist; moderate amount of partly decayed organic matter; salt-and-pepper appearance; numerous fibrous medium-sized roots; strongly acid; gray (10YR 5/1) when dry.
2. 4 to 12 inches, loose fine sand; light brownish gray to light gray (10YR 6/2 to 6/1) when moist; a few small roots; medium to strongly acid; light gray (10YR 7/1) when dry.
3. 12 to 24 inches, loose fine sand; light gray (10YR 7/1) when moist; medium to strongly acid; white (10YR 8/1) when dry.
4. 24 to 28 inches, very friable fine sandy loam; pale yellow (2.5Y 7/4) mottled with brownish yellow and light gray (10YR 6/8 and 7/1) when moist; pale yellow (2.5Y 7/4) mottled with light yellowish brown (2.5Y 6/4) and light gray (10YR 7/1) when dry; slightly acid to neutral.
5. 28 to 40 inches, friable fine sandy clay loam; brownish yellow (10YR 6/8) mottled with light gray (10YR 7/1) when moist or dry; contains some yellow calcareous soil particles, and a few scattered limestone concretions $\frac{1}{8}$ to $\frac{1}{2}$ inch in diameter.
6. 40 to 60 inches +, friable fine sandy clay loam; light gray (10YR 7/2) mottled with brownish yellow (10YR 6/8) when moist; light gray (10YR 7/1) mottled with yellow (10YR 7/8) when dry; many calcareous concretions or limestone fragments $\frac{1}{8}$ to 2 inches in diameter.

Felda fine sand occurs on level or slightly depressed areas within or adjacent to areas of Sunniland fine sand. It is usually grayer in its deeper layers than Sunniland fine sand. In Felda fine sand the clayey materials are generally light gray (10YR 7/1) mottled with brownish yellow and yellow (10YR 6/8 and 7/8). Native vegetation on Felda fine sand consists mainly of short grasses; whereas on the Sunniland fine sand it consists of a few short grasses, saw-palmetto, cabbage palmetto, other shrubs, and pine trees.

The Pompano, Charlotte, and Arzell soils are also in the Low-Humic Gley great soil group. They are poorly drained sands. They have developed from moderately thick beds of fine sand over limestone or marl. They occur in level, nearly level, or slightly depressional areas and have poor external drainage. They have rapid internal drainage because their profiles are porous. During wet seasons they are usually covered by a few inches of water for many days. The Pompano and Arzell soils occur on areas classified according to vegetative cover as pine forest, cypress forest, and short-grass prairie. The Charlotte soils support a cover of pine forests interspersed with small short-grass prairies.

Following is a description of a profile of Pompano fine sand in a pasture immediately west of the airport, 5 miles southeast of Immokalee.

1. 0 to 5 inches, loose fine sand; dark gray to grayish brown (10YR 4/1 to 4/2) when moist; moderate amount of organic matter gives a salt-and-pepper appearance; numerous roots in the upper 2 or 3 inches; slightly acid to neutral; gray (10YR 5/1) when dry.

2. 5 to 15 inches, loose fine sand; grayish brown to light brownish gray (10YR 5/2 to 6/2) when moist; slightly acid to neutral; contains a few small roots; light gray (10YR 7/2) when dry.
3. 15 to 28 inches, loose fine sand; light gray (10YR 7/2 to 7/1) mottled or spotted slightly with light brownish gray (10YR 6/2) when moist; slightly acid to neutral; white (10YR 8/2 to 8/1) mottled slightly with light gray (10YR 7/2) when dry.
4. 28 to 60 inches, loose fine sand; white (10YR 8/2) mottled slightly with light brownish gray (10YR 6/2) and pale yellow (2.5Y 7/4) when moist; slightly acid to neutral; white (10YR 8/1) with a few small splotches of pale yellow (2.5Y 8/4) and light gray (10YR 7/2) when dry.
5. 60 inches +, moderately hard limestone; white (10YR 8/2 or 8/1) when moist.

Charlotte fine sand differs from Pompano fine sand chiefly in having a layer of yellowish-brown or brownish-yellow fine sand below the surface layer. It is also slightly more alkaline than Pompano fine sand. Under moist conditions the 4- to 15-inch surface layer is a dark grayish-brown to grayish-brown (10YR 3/2 to 5/2) loose fine sand. The subsurface layer, 15 to 30 inches thick, is yellowish-brown or brownish-yellow (10YR 5/6 or 6/6) loose fine sand. Below the subsurface layer is light-gray or white (10YR 7/1 or 8/1) loose fine sand, mottled with brownish yellow (10YR 6/8). The mottles decrease in size and number with depth. The sand layers are underlain by moderately soft to hard limestone at 40 to 60 inches or more.

Arzell fine sand differs from Pompano fine sand mainly in having a shallower surface layer and lighter colored lower layers. The surface soil, 2 to 4 inches thick, is light grayish-brown or light-gray (10YR 6/2 or 7/2) loose fine sand that contains a small quantity of partly decayed organic matter that imparts a salt-and-pepper appearance. Below this layer is light-gray or white (10YR 7/1 or 8/1) loose fine sand, mottled slightly in its upper part with pale yellow (2.5Y 8/4). This fine sand is underlain by moderately soft to hard limestone at depths of 50 to 72 inches or more. The sand layers are slightly acid to neutral in reaction, owing partly to the effects of calcareous soil solutions that pass through and over the soil.

HUMIC GLEY SOILS

Copeland fine sand is classified as a Humic Gley soil of the Red-Yellow Podzolic region. It has developed from a thin layer of sandy material overlying or partly mixed with residuum from moderately hard limestone or marl. This soil occupies low positions. It has very low to low surface runoff and poor internal drainage. The surface soil is nearly black to depths of 6 to 12 inches and contains a considerable amount of organic matter. The subsurface layer is dark-gray fine sand, 3 to 8 inches thick. Below this layer is a thin one (2 to 6 inches) of mottled yellowish-brown and light brownish-gray friable slightly sticky fine sandy clay loam. This last layer overlies moderately hard limestone or marl. The depth to the limestone generally ranges from 12 to 24 inches. In many places the limestone is at shallow depths, or 3 to 12 inches below the surface, and dark-colored sands rest directly on the limestone. The native vegetation consists of a dense growth of cabbage palmettos mixed with pine trees and many subtropical trees and shrubs.

LITHOSOLS

The soils of the Matmon, Broward, Keri, Ochopee, and Tucker series belong to the Lithosol great soil group. Matmon loamy fine sand is classified as a dark-colored lithosolic soil. It has developed from a thin layer of marine sands mixed with residuum from moderately soft marl to hard limestone. The soil is somewhat poorly drained. Its surface layer, a dark-brown loamy fine sand, is underlain by yellowish-brown friable slightly sticky fine sandy clay loam. Below this layer of clay loam, generally at depths of 5 to 15 inches, is limestone or marl. There are numerous limestone rocks 2 to 8 inches in diameter on the surface and scattered throughout the profile.

The Broward soils have developed from thin beds of marine sands over the limestone. They occur principally on pine islands within or adjacent to the sand and marl prairies and cypress forests. These soils are somewhat poorly drained. The surface soil, 4 to 8 inches thick, is a dark-gray or gray fine sand containing a small amount of organic matter. The subsurface layer is light-gray, mottled slightly with yellowish-brown, nearly loose fine sand that rests on moderately hard limestone. The depth to the limestone ranges from 6 to 36 inches. In places a thin layer (2 to 6 inches) of mottled yellowish-brown and light-gray friable slightly sticky fine sandy clay loam overlies the limestone.

Keri fine sand has developed from moderately thin layers of marine sands interbedded with a thin layer of marl. The soil is somewhat poorly drained. The 3- to 6-inch surface layer is a dark-gray or grayish-brown fine sand containing a small amount of organic matter. The subsurface layer, 4 to 10 inches thick, is a light-gray loose fine sand. Below this is a 2- to 12-inch layer of light-gray or pale-yellow soft marl having a clay loam texture. Below the marl is a light-gray or white loose fine sand that overlies moderately hard limestone at depths ranging from 36 to 60 inches or more.

The Ochopee and Tucker soils have developed from recent geological materials—unconsolidated finely divided calcareous sediments containing noticeable quantities of sand. The calcareous sediments or marls have been deposited over the rocks by water or by the solution and redeposition of materials by calcareous algae. Most of these marls are probably of fresh-water origin.

The Ochopee and Tucker soils are very poorly drained. They occur on level or nearly level places covered by surface water for a number of months each year. The native vegetation consists mainly of short grasses. The Ochopee soils generally are at very low elevations, or less than 6 feet above sea level; the Tucker soil has slightly higher positions, or 6 to 15 feet above sea level. Following is a description of a profile of Ochopee marl in a prairie 1½ miles northwest of Ochopee.

1. 0 to 10 inches, friable marl of fine sandy loam texture; dark grayish brown (10YR 3/1) when moist; contains many broken and whole shells; gray (10YR 5/1) when dry.
2. 10 to 16 inches, friable marl; grayish brown (10YR 4/2) when moist; fine sandy loam texture; light gray (10YR 7/2) when dry.

3. 16 to 24 inches, very friable fine sandy marl; light brownish gray (2.5Y 6/2) when moist; loamy fine sand texture; mottled slightly with light yellowish brown (2.5Y 6/4); light gray (2.5Y 7/2) when dry.
4. 24 to 34 inches, fine sand; mottled light gray (10YR 6/1), light yellowish brown (2.5Y 6/4), and light brownish gray (2.5Y 6/2) when moist; light gray (10YR 7/1) mottled with pale yellow (2.5Y 7/4) and white (10YR 8/2) when dry.
5. 34 inches +, moderately hard limestone; white (10YR 8/1 or 8/2 when moist).

Ochopee fine sandy marl differs from the Ochopee marl chiefly in having a coarser texture; that is, a loamy fine sand texture instead of a fine sandy loam texture. In general the profiles of the two types are similar, though the surface layer of the fine sandy marl is looser and in places shallower. The depth to the limestone varies from 4 to 60 inches for both. In the shallow phase of Ochopee fine sandy marl the limestone is found at depths of 4 to 12 inches, but in the regular Ochopee fine sandy marl it is at depths of 12 to 36 inches. No deep phase of the fine sandy marl has been mapped in the county, but the depth to limestone for a deep phase would be 36 to 60 inches.

Tucker marl differs from Ochopee marl mainly in that it contains less sand and more clay. In the Tucker soils the marl lies directly on the limestone. Tucker marl has a clay loam texture. The depth to the limestone is generally about 12 to 14 inches, but the extreme range is from 4 to 24 inches.

REGOSOLS

The St. Lucie, Lakewood, and Blanton soils belong to the Regosol great soil group. The St. Lucie and Lakewood soils have formed from thick very loose beds of sand and are excessively drained. They occupy low ridges and knolls along the Gulf Coast and in the northern part of the county, where they are associated with the Immokalee soil. The St. Lucie soil differs from the Immokalee soil mainly in having lighter colored, deeper, and looser sands in the upper layers and no soft hardpan layer within depths of 48 inches. One or more organic-stained layers may occur at greater depths. The St. Lucie soil differs from the Lakewood soil chiefly in having light-colored lower layers instead of the brownish-yellow layer commonly found in the Lakewood profile at depths of 24 to 40 inches. The St. Lucie and Lakewood soils are strongly acid. Following is a description of a typical profile of St. Lucie fine sand located 2½ miles southeast of Naples.

1. 0 to 3 inches, loose incoherent fine sand; light gray (10YR 6/1) when dry; contains a small quantity of partly decayed woody materials.
2. 3 to 60 inches +, loose incoherent fine sand; white (10YR 8/1) when dry, with a few light brownish gray (10YR 6/2) splotches near the partly decayed roots.

Lakewood fine sand occurs principally on the sand dunes on Marco Island. The slopes of the dunes range up to 15 percent. Following is a description of a profile of Lakewood fine sand 1½ miles north of Collier City:

1. 0 to 3 inches, loose incoherent fine sand; light gray (10YR 6/1) when dry; contains a small amount of organic matter, largely partly decayed woody materials.
2. 3 to 26 inches, loose incoherent fine sand; white (10YR 8/1) when dry.

3. 26 to 40 inches, loose incoherent fine sand; brownish yellow (10YR 6/6) when dry; a few white channels $\frac{1}{4}$ to 1 inch in diameter and about 12 inches long extend downward from horizon 2; these channels probably represent former locations of roots.
4. 40 to 54 inches, loose incoherent fine sand; pale yellow to yellow (2.5Y 8/4 to 8/6) when dry.
5. 54 to 72 inches +, loose incoherent fine sand; white (10YR 8/1) when dry.

Blanton fine sand is associated with Immokalee fine sand but differs from it in having better drainage and in occurring at slightly higher elevations. Usually it is without the soft hardpan layer. It has developed from moderately deep sands under good to somewhat excessive drainage and is strongly acid.

Following is a description of a profile of Blanton fine sand in a forested area half a mile northeast of Immokalee:

1. 0 to 3 inches, loose fine sand; gray (10YR 5/1) when dry; contains a small amount of organic matter and has a salt-and-pepper appearance.
2. 3 to 9 inches, loose fine sand; light gray to light brownish gray (10YR 7/1 to 6/2) when dry.
3. 9 to 24 inches, loose fine sand; light gray to white (10YR 7/1 to 8/1) when dry; contains a very few pale-yellow (2.5Y 8/4) mottles.
4. 24 to 34 inches, loose fine sand; pale yellow (2.5Y 8/4) when dry; contains few splotches of light gray (2.5Y 7/2) and white (10YR 8/1).
5. 34 to 60 inches +, loose fine sand; pale yellow (2.5Y 8/4) when dry; light-gray, white, and yellow mottles.

SOIL SURVEY METHODS AND DEFINITIONS

Soil surveying (12) consists of examining, classifying, and mapping of soils in the field. The soil scientist walks over the area at intervals not more than a quarter of a mile apart and bores into the soil with an auger or digs holes with a spade. Each boring or hole shows the soil to consist of several distinctly different layers, known collectively as the soil profile. Each layer is studied carefully for the things about it that affect the growth of various crops, grasses, and trees.

The color of each layer is noted. The darkness of the topmost layer is usually related to its content of organic matter; streaks and spots of gray, yellow, and brown in lower layers generally indicate poor drainage and poor aeration. Texture, or the content of sand, silt, and clay in each layer, is determined by the way it feels when rubbed between the fingers and is checked by mechanical analyses in the laboratory. Texture has much to do with the quantity of moisture the soil will hold available to plants, whether plant nutrients or fertilizers will be held by the soil in forms available to plants or will be leached out, and how difficult the soil may be to cultivate.

Structure, or the way the soil granulates, and the amount of pore or open space between particles indicate how easily plant roots and water can penetrate the soil. Consistence, or the tendency of the soil to crumble or stick together, indicates how difficult it will be to keep the soil open and porous under cultivation. The kinds of rocks or materials from which the soil has been developed affect the quantity and kind of plant nutrients the soils may contain. Simple chemical tests indicate the acidity of the soil.¹⁵ The depth to bedrock or to

¹⁵ 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.

compact layers is determined. The quantity of gravel or rocks that may interfere with cultivation, the relief or lay of the land, the quantity of soil lost by erosion, and other external features are observed.

The soils are classified according to their characteristics, both internal and external, with special emphasis on the features that influence their suitability for growing crop plants, grasses, and trees. On the basis of these characteristics, the soils are grouped in classification units, the three principal ones of which are (1) series, (2) type, and (3) phase.

The soil series consists of a group of soils having similar parent material and the same genetic horizons, which are similar in their important characteristics and arrangement in the soil profile; or, to define it more specifically, a soil series consists of soils having essentially the same surface layer, color, structure, natural drainage conditions, and other internal characteristics, and the same range in relief. The texture of the upper part of the soil, including that commonly plowed, may vary within a series. The series are given geographic names taken from localities near where they were first found. Sunniland, Immokalee, Broward, Ochopee, and Tucker are names of important soil series in Collier County.

Within a soil series are one or more types, which are defined according to the texture of the upper part of the soil. Thus, the class name of the texture, such as fine sand, loamy fine sand, or marl, is added to the series name to give the complete name of the soil type. For example, Ochopee marl and Ochopee fine sandy marl are soil types of the Ochopee series. Except for the texture of the surface soil, these soil types have approximately the same internal and external characteristics.

A phase of a soil type is recognized by the separation, within a type, of soils differing in some minor profile characteristic or some characteristic other than that of profile that may, nevertheless, have an important practical significance. Among the characteristics by which the phase of a soil type is identified are: the slope, the frequency of outcropping bedrock found in it, the depth of the soil material, or the extent of artificial drainage necessary to make it productive. Ochopee marl is divided into two phases because some of it is shallower and some of it is deeper to limestone than the typical soil type. These two phases are Ochopee marl, shallow phase, and Ochopee marl, deep phase.

Where two or more kinds of soil are so intricately mixed that they cannot be shown separately on a map of the scale used, they are mapped together, and the areas of the mixture are called a soil complex. The Keri-Copeland complex for example, is a mixture of Keri fine sand and Copeland fine sand in Collier county.

Areas that have little true soil and those in which it is impractical to identify the ordinary soil mapping units are not designated with series and type names but are given descriptive names, as Rockland, Coastal beach, Made land, Tidal marsh, Mangrove swamp, and Cypress swamp.

Wherever native vegetation differs greatly on the same soil type in this county, the difference is noted by symbols on the soil map. This designation of differences will give an indication of the cost of preparing the virgin land for cultivation or improvement of pastures. For

example, Arzell fine sand typically has a wiregrass and pine vegetation, but some of it bears only a grass vegetation. The areas supporting grass vegetation are brought under cultivation simply by turning them; whereas, typical Arzell fine sand must be cleared of trees before cultivation.

The soil type, or where the soil type is subdivided, the soil phase, is the unit of mapping in soil surveys. It is the unit or the kind of soil that is most uniform and has the narrowest range of characteristics. For this reason land use and soil management practices can be more definitely specified for it than for broader groups of soils that contain more variation. One can say, for example, that soils of the Ochopee series need water control for cultivation of crops; but more specifically it can be said that Ochopee marl, shallow phase, in addition to needing water control, has limestone rocks near the surface that may interfere with the cultivation of crops.

The soil scientist makes a map of the county or area, showing the location of each of the soil types, phases, complexes, and miscellaneous land types, in relation to roads, houses, streams, lakes, section and township lines, and other local cultural and natural features of the landscape. To accompany the map he prepares a report that describes the soils, agriculture, and other significant natural and cultural features, and points out important relations among all these.

CORRELATION OF VEGETATION AND SOIL TYPES, COLLIER COUNTY, FLA.

ARZELL AND CHARLOTTE FINE SANDS

Scientific name	Common name
<i>Centella repanda</i>	Half-penny.
<i>Cephalanthus occidentalis</i>	Buttonbush.
<i>Flaveria linearis</i>	Yellowtop.
<i>Bacopa (Hydrotrida) caroliniana</i>	Waterhyssop (scented leaf).
<i>Hypericum fasciculatum</i>	St. Johnswort (tall sandweed).
<i>Lachnocaulon anceps</i>	Hairy pipewort.
<i>Myrica cerifera</i>	Waxmyrtle.
<i>Oxyptis filiformis</i>	Water carrot.
<i>Pontederia lanceolata</i>	Pickerelweed.
<i>Sagittaria lancifolia</i>	Arrowhead.
<i>Stillingia sylvatica</i>	Queens root.
<i>Xyris elliotii</i>	Yellow-eyed-grass.

BLANTON FINE SAND

<i>Andropogon elliotii</i>	Beardgrass.
<i>A. virginicus</i>	Broomsedge.
<i>Aristida purpurascens</i>	Arrowfeather.
<i>A. spiciformis</i>	Three-awn grass (spike wire-grass).
<i>A. stricta</i>	Pineland three-awn (wiregrass).
<i>Chamaecrista brachiata</i>	Partridge-pea.
<i>Chrysobalanus oblongifolius</i>	Deer plum (gopher apple).
<i>Chrysopsis floridana</i>	Golden-aster.
<i>Eupatorium capillifolium</i>	Dogfennel.
<i>Pinus caribaea</i>	Slash pine.
<i>Quercus chapmani</i>	Chapman oak.
<i>Q. cinerea</i>	Bluejack oak.
<i>Q. myrtifolia</i>	Myrtle oak.
<i>Q. virginiana</i>	Live oak.
<i>Serenoa repens</i>	Saw-palmetto.

CHARLOTTE FINE SAND

Scientific name	Common name
<i>Hypericum</i> sp.....	St. Johnswort.
<i>Myrica cerifera</i>	Waxmyrtle.
<i>Pinus caribaea</i>	Slash pine.
<i>Stillingia aquatica</i>	Corkwood.
<i>Tazodium ascendens</i>	Pondcypress.

COPELAND FINE SAND

<i>Ampelopsis arborea</i>	Peppervine.
<i>Ardisia escallonioides</i>	Marbleberry.
<i>Blechnum serrulatum</i>	Sawfern.
<i>Callicarpa americana</i>	French mulberry.
<i>Celtis mississippiensis</i>	Southern hackberry.
<i>Epidendrum</i> sp.....	Orchid.
<i>E. tampense</i>	Orchid.
<i>Eugenia axillaris</i>	White-stopper eugenia.
<i>E. dicrana</i>	Twinberry eugenia.
<i>Ficus aurea</i>	Florida strangler fig.
<i>Ilex cassine</i>	Dahoon holly.
<i>Nephrolepis exaltata</i>	Common swordfern.
<i>Panicum agrostoides</i>	Panicgrass.
<i>Polystachya minuta</i>	Orchid.
<i>Psychotria nervosa</i> var. <i>lanceolata</i>	St. Augustine wildcoffee.
<i>Rhus radicans</i>	Poison ivy.
<i>Quercus laurifolia</i>	Laurel oak.
<i>Q. virginiana</i>	Live oak.
<i>Sabal palmetto</i>	Cabbage palmetto.
<i>Smilax</i> sp.....	Greenbrier, catbrier.
<i>Tillandsia aloifolia</i>	} Air plants.
<i>T. fasciculata</i>	
<i>T. utriculata</i>	
<i>Vitis munsoniana</i>	Little muscadine grape.

CYPRESS SWAMP

<i>Acer rubrum</i>	Red maple.
<i>Annona glabra</i>	Custard-apple (Pond-apple).
<i>Blechnum serrulatum</i>	Sawfern.
<i>Carya glabra</i>	Pignut hickory.
<i>Castalia odorata</i>	Waterlily.
<i>Celtis mississippiensis</i>	Southern hackberry.
<i>Cephalanthus occidentalis</i>	Buttonbush.
<i>Chrysobalanus icaco</i>	Icaco coco-plum.
<i>Dryopteris normalis</i>	Woodfern.
<i>Echinochloa crusgalli</i>	Barnyard grass.
<i>Epidendrum anceps</i>	Orchid.
<i>Frazinus caroliniana</i>	Pop-ash.
<i>Hypericum fasciculatum</i>	St. Johnswort (tall sandweed).
<i>Ilex cassine</i>	Dahoon holly.
<i>Itea virginica</i>	Virginia-willow, sweetspire.
<i>Leptochloa fascicularis</i>	Sprangletop grass.
<i>Magnolia virginiana</i>	Sweetbay.
<i>Nyssa biflora</i>	Sourgum.
<i>Osmunda regalis</i>	Flowering fern.
<i>Panicum ciliatum</i>	Panicgrass.
<i>P. hemitomon</i>	Maidencane.
<i>P. laxiflorum</i>	Panicgrass.
<i>Persea borbonia</i>	Redbay.
<i>Polystachya minuta</i>	Orchid.
<i>Pontederia lanceolata</i>	Pickerelweed.
<i>Quercus laurifolia</i>	Laurel oak.
<i>Rhynchospora filifolia</i>	Beakrush.
<i>Sabal palmetto</i>	Cabbage palmetto.
<i>Sagittaria lancifolia</i>	Arrowhead.
<i>Salix amphibia</i>	Willow.

Scientific name	Common name
<i>Taxodium ascendens</i>	Pondcypress.
<i>T. distichum</i>	Baldcypress.
<i>Tillandsia balbisiana</i>	} Air plants.
<i>T. fasciculata</i>	
<i>T. recurvata</i>	
<i>T. usneoides</i>	
<i>Ulmus floridana</i>	Spanish-moss. Florida elm.

FRESH WATER MARSH

<i>Castalia odorata</i>	Waterlily.
<i>Eichhornia crassipes</i>	Common water-hyacinth.
<i>Mariscus jamaicensis</i>	Saw-grass.
<i>Nymphaea macrophylla</i>	Bonnets.
<i>Nymphoides aquatica</i>	Floatingheart.
<i>Panicum hemitomon</i>	Maidencane.
<i>Pistia stratiotes</i>	Waterlettuce.
<i>Polygonum</i> sp.....	Smartweed.
<i>Pontederia lanceolata</i>	Pickerelweed.
<i>Sagittaria lancifolia</i>	Arrowhead.
<i>Thalia</i> sp.....	Big flag.
<i>Typha angustifolia</i>	Cattail.

IMMOKALEE FINE SAND

<i>Andropogon brachystachys</i>	Beardgrass.
<i>A. eliottii</i>	Beardgrass.
<i>A. virginicus</i>	Broomsedge.
<i>Aristida affinis</i>	Three-awn grass (poverty grass).
<i>A. gyrans</i>	Poverty grass.
<i>A. spiciformis</i>	Three-awn grass (spike wiregrass)
<i>A. stricta</i>	Pineland three-awn (wiregrass).
<i>Asimina reticulata</i>	Pawpaw.
<i>Azopopus compressus</i>	Carpetgrass.
<i>Buchnera floridana</i>	Blue-hearts.
<i>Chamaecrista brachiata</i>	Partridge-pea.
<i>Chrysobalanus oblongifolius</i>	Deer plum (gopher apple).
<i>Chrysopsis floridana</i>	Golden-aster.
<i>Dichromena colorata</i>	Whitetop sedge.
<i>Dicranum condensatum</i>	Moss.
<i>Drosera capillaris</i>	Pink sundew.
<i>Hypericum aspalathoides</i>	St. Johnswort (low sandweed).
<i>Hyptis radiata</i>	Tall mint.
<i>Ilex glabra</i>	Bitter gallberry, inkberry.
<i>Juncus scirpoides</i>	Common rush.
<i>Liatris laxa</i>	Blazing-star!
<i>Lyonia nitida</i>	Tetter-bush.
<i>Myrica cerifera</i>	Waxmyrtle.
<i>Paspalum ciliatifolium</i>	Paspalum.
<i>Pinus caribaea</i>	Slash pine.
<i>Polygala</i> sp.....	Milkwort.
<i>Pycnothymus rigidus</i>	Pennyroyal mint.
<i>Quercus pumila</i>	Running oak.
<i>Rhynchospora dodocandra</i>	Beakrush.
<i>R. filifolia</i>	Beakrush.
<i>Sabatia eliottii</i>	White marsh-pink.
<i>Serenoa repens</i>	Saw-palmetto.
<i>Siphonochia diffusa</i>	
<i>Solidago chapmani</i>	Goldenrod.

KERI-COPELAND COMPLEX

Same as Copeland fine sand with these in addition:

<i>Baccharis halimifolia</i>	Groundsel-tree.
<i>Bursera simaruba</i>	Gumbo-limbo.
<i>Coccolobis laurifolia</i>	Doveplum, pigeon seagrape.
<i>Diospyros virginiana</i>	Persimmon.

Scientific name	Common name
<i>Diphotis salicifolia</i>	Willow bustic.
<i>Magnolia virginiana</i>	Sweetbay.
<i>Nyssa aquatica</i>	Cotton gum (water tupelo).
<i>Ocotea coriacea</i>	Jamaica ocotea.
<i>Persea borbonia</i>	Redbay.
<i>Phlebodium aureum</i>	Snake fern.
<i>Psidium guajava</i>	Common guava.
<i>Roystonea regia</i>	Cuban royal palm.
<i>Salix amphibia</i>	Willow.
<i>Sambucus simpsonii</i>	Florida elder.
<i>Sideroxylon foetidissimum</i>	False-mastic.
<i>Simarouba glauca</i>	Paradise-tree.
<i>Swietenia mahagoni</i>	West Indies mahogany.
<i>Vittaria lineata</i>	Grass fern.
<i>Zanthoxylum fagara</i>	Lime prickly-ash (wild lime).

OCHOPEE AND TUCKER MARLS

<i>Aristida affinis</i>	Three-awn grass (poverty grass).
<i>A. patula</i>	Three-awn grass (switchgrass).
<i>Asclepias lanceolata</i>	Red milkweed.
<i>Centella repanda</i>	Half-penny.
<i>Chloris</i> sp.....	Fingergrass.
<i>Crinum americanum</i>	Florida crinum (swamp-lily)
<i>Dichromena colorata</i>	Whitetop sedge.
<i>Eleocharis cellulosa</i>	Needlegrass.
<i>Eragrostis elliottii</i>	Lovegrass.
<i>Helenium nuttallii</i>	Sneczeweed.
<i>Bacopa (Hydrotrida) caroliniana</i>	Waterhyssop (scented leaf).
<i>Juncus microcephalus</i>	Common rush.
<i>Lobelia glandulosa</i>	Lobelia.
<i>Mariscus jamaicensis</i>	Saw-grass.
<i>Muhlenbergia capillaris</i> var. <i>filipes</i>	Hairgrass.
<i>Oxyplotis filiformis</i>	Water carrot.
<i>Panicum hemitomon</i>	Maidencane.
<i>Phragmites communis</i>	Common reed.
<i>Rhynchospora corniculata</i>	Horned-rush.
<i>R. torreyana</i>	Torreys beakrush.
<i>R. tracyi</i>	Tracys beakrush.
<i>Sagittaria lancifolia</i>	Arrowhead.
<i>Schoenus nigricans</i>	Black sedge.
<i>Setaria</i> sp.....	Foxtail grass.
<i>Spartina bakeri</i>	Cordgrass.
<i>Stillingia aquatica</i>	Corkwood.

OCHOPEE FINE SANDY MARL, SHALLOW PHASE

<i>Euphorbia polphylla</i>	Spurge.
<i>Hyptis radiata</i>	Tall mint.
<i>Mikania</i> sp.....	Climbing hempweed.
<i>Myrica cerifera</i>	Waxmyrtle.
<i>Polygala</i> sp.....	Milkwort.
<i>Taxodium ascendens</i>	Pond cypress.
<i>Utricularia purpurea</i>	Bladderwort.
<i>Xyris elliottii</i>	Yellow-eyed-grass.

POMPAÑO FINE SAND

<i>Andropogon brachystachys</i>	Beardgrass.
<i>A. capillipes</i>	Beardgrass.
<i>A. virginicus</i>	Broomsedge.
<i>Aristida purpurascens</i>	Arrowfeather.
<i>A. stricta</i>	Pinecland three-awn (wiregrass).
<i>Asimina reticulata</i>	Pawpaw.
<i>Centella repanda</i>	Half-penny.
<i>Dichromena colorata</i>	Whitetop sedge.

Scientific name	Common name
<i>Flaveria linearis</i>	Yellowtop.
<i>Bacopa (Hydrotrida) caroliniana</i>	Waterhyssop (scented leaf).
<i>Hypericum aspalathoides</i>	St. Johnswort (low sandweed).
<i>H. fasciculatum</i>	St. Johnswort (tall sandweed).
<i>Hyptis radiata</i>	Tall mint.
<i>Lachnocaulon anceps</i>	Hairy pipewort.
<i>Myrica cerifera</i>	Waxmyrtle.
<i>Panicum hemitomon</i>	Maidencane.
<i>Pinus caribaea</i>	Slash pine.
<i>Rhynchospora corniculata</i>	Horned-rush.
<i>Serenoa repens</i>	Saw-palmetto.

ST. LUCIE AND LAKEWOOD FINE SANDS

<i>Bejaria racemosa</i>	Tarflower.
<i>Ceratiola ericoides</i>	Broom-crowberry.
<i>Chrysobalanus oblongifolius</i>	Deer plum (gopher apple).
<i>Clinopodium</i> sp.....	Savory.
<i>Garberia fruticosa</i>	Garberia.
<i>Opuntia floridana</i>	Pricklypear cactus.
<i>Pinus clausa</i>	Sand pine.
<i>Pithecellobium unguis-cati</i>	Blackbead.
<i>Quercus chapmani</i>	Chapman oak.
<i>Serenoa repens</i>	Saw-palmetto.

SUNNILAND, KERI, AND BROWARD FINE SANDS AND MATMON LOAMY FINE SAND

<i>Aristida spiciformis</i>	Three-awn grass (spike wiregrass)
<i>A. stricta</i>	Pineland three-awn (wiregrass).
<i>Ilex glabra</i>	Bitter gallberry, inkberry.
<i>Lachnocaulon anceps</i>	Hairy pipewort.
<i>Lyonia nitida</i>	Tetter-bush.
<i>Myrica cerifera</i>	Waxmyrtle.
<i>Paspalum ciliatifolium</i>	Paspalum (carpetgrass).
<i>Phlox</i> sp.....	Phlox.
<i>Pinus caribaea</i>	Slash pine.
<i>Pycnothymus rigidus</i>	Pennyroyal mint.
<i>Quercus pumila</i>	Running oak.
<i>Sabal palmetto</i>	Cabbage palmetto.
<i>Serenoa repens</i>	Saw-palmetto.
<i>Smilax</i> sp.....	Greenbrier, catbrier.
<i>Solidago fistulosa</i>	Goldenrod.

TIDAL MARSH

<i>Acrostichum daneaeifolium</i>	Fern.
<i>Andropogon glomeratus</i>	Bushy beardgrass.
<i>Crinum americanum</i>	Florida crinum.
<i>Distichlis spicata</i>	Saltgrass.
<i>Eleocharis cellulosa</i>	Needlegrass.
<i>Juncus effusus</i>	Soft rush.
<i>J. roemerianus</i>	Black rush.
<i>Lycium carolinianum</i>	Matrimony-vine.
<i>Spartina cynosuroides</i>	Big cordgrass.
<i>Spartina</i> sp.....	Cordgrass.
<i>Typha angustifolia</i>	Cattail.

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