

UNITED STATES DEPARTMENT OF AGRICULTURE

Soil Survey
of
Polk County, Florida

By

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This number is the last Soil Survey Report for the Year 1927



Bureau of Chemistry and Soils

In cooperation with the Florida State Geological Survey

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By EARL D. FOWLER, in Charge, ARTHUR E. TAYLOR, E. W. KNOBEL, S. W. PHILLIPS, F. R. LESH, A. L. GRAY, A. T. SWEET, M. J. EDWARDS, H. M. SMITH, R. E. DEVEREUX, A. H. HASTY, AND ROBERT WILDERMUTH

COUNTY SURVEYED

Polk County is almost exactly in the center of the peninsular part of Florida. (Fig. 1.) Tampa lies 50 miles due west of the geographical center of the county and Jacksonville approximately 190 miles due north. The county includes a total area of 1,863 square miles, or 1,192,320 acres.

The three outstanding physiographic divisions of the county are as follows: (1) The comparatively high rolling upland or lake region in the central and northeastern parts; (2) the flatwoods region bordering the uplands; and (3) the stream valleys along Peace, Withlacoochee, and Kissimmee Rivers and their tributaries.

Important features of the lake region are the broad ridge entering the county north of Haines City and extending south to Frostproof, the broken ridge extending from north of Polk City south almost to Fort Meade, and the highlands at Lakeland. Lakes, ponds, and saucerlike depressions are numerous and streams are few, though many of the larger lakes have either natural or artificial connections.

Most of the slopes are gradual. Steeper slopes, ranging from 15° to 25° , border a few of the lakes, but these slopes are not subject to destructive erosion, owing to their sandy covering. The lake region averages many feet higher than the flatwoods and river valleys. Iron Mountain, a high point located on the main ridge about 2 miles north of the city of Lake Wales, has an elevation of 324.3 feet above sea level. The elevation at Lakeland is 211 feet and at Bartow, on the edge of the ridge region, is 115 feet.¹

The flatwoods proper is a low-lying, nearly level wooded country. It is characterized by numerous shallow depressions locally termed "grass and water ponds" and "cypress ponds" according to the predominant vegetation. Many of them contain water permanently. They range in size from less than 1 acre to 100 or more acres. Many of them are connected by small narrow winding channels, but water flows into the creeks only intermittently during the rainy season. Slash and longleaf pines are the common trees, with saw palmetto and wire grass as the characteristic undergrowth. Low knolls are scattered throughout the flatwoods and invariably support a growth of dwarf oaks, upland willow oak, and scattered longleaf pine.

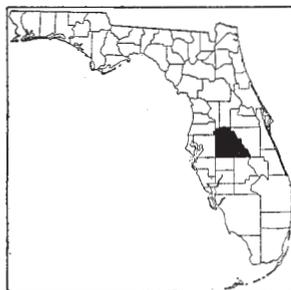


FIGURE 1.—Sketch map showing location of Polk County, Fla.

¹ UNITED STATES DEPARTMENT OF AGRICULTURE, WEATHER BUREAU. SUMMARIES OF CLIMATOLOGICAL DATA BY SECTIONS, SOUTHERN FLORIDA. U. S. Dept. Agr., Weather Bur. Bul. W, Ed. 2, v. 3, sec. 84, 16 p., illus. 1926.

Lying at an intermediate elevation between the flatwoods and the ridge land is a nearly level region of dark-brown soils, occurring principally in the vicinity of Fort Meade and bordering both sides of Peace River. These areas are naturally better drained than the flatwoods or wet depressions. Included with the flatwoods region is a broad prairie region bordering Kissimmee River on the west, which in relief and drainage is similar to the flatwoods belt but has not been invaded by timber, though apparently the timber is very slowly encroaching on it.

The stream valleys are comparatively shallow, with very gradual slopes from the bordering flatwoods to the marsh, swamp, or overflow land through which the poorly defined channel meanders. The only exception is Peace River Valley from Bartow to the south county line, where the channel is well defined and the valley walls are more abrupt, with bluffs ranging up to 20 or 30 feet high in places. A few swampy and marshy areas, including the peat bogs of the county, occur around the lakes lying at the headwaters of streams.

Peace River and its tributaries drain the central and southwestern parts of the county, Withlacoochee River drains the northern part, and Kissimmee River the eastern part. These streams do not furnish adequate drainage to all the regions bordering them, therefore many farms are drained by a system of open ditches or by wells bored into small depressions. The narrow poorly defined channels of the streams readily overflow, and water spreads out over the shallow valleys, reaching a maximum width of 2 miles or more along Withlacoochee and Kissimmee Rivers. The water of these streams is dark brown, as they carry a high content of organic matter and very little clay in suspension.

The hundreds of lakes in the rolling upland region are the only visible drainage basins for this region. These lakes no doubt receive, by lateral seepage or by springs, the greater part of the water which rapidly penetrates the sandy soil of the ridges. The smaller isolated lakes contain very clear pure water, but the larger ones and those that receive water from connecting runs or creeks are dark brown in color. They vary in depth from only a few inches to 50 or more feet, the steepness of the slopes surrounding the lakes indicating roughly their relative depths. The seasonal fluctuation in depth is only a few inches as a rule, but 3 or 4 feet is not uncommon in some of the larger ones.

In general it may be said that the rolling upland section, or lake region, is the only well-drained part of the county. Some of the deeper sand areas in this region are excessively drained, but the fact that the heavy rainfall occurs during the growing season and hotter months prevents damage from this cause.

Polk County was organized in 1861 from parts of Brevard and Hillsborough Counties, and in 1890 and 1900 additional territory was annexed from Pasco County. In 1849 a fort was established on Peace River in the southern part of the county. The soldiers who remained in the vicinity after the abandonment of the fort in 1857 formed the first group of permanent settlers within the present county boundaries. They established the town of Fort Meade, naming it after the old Government fort. Bartow, the county seat, was incorporated shortly after the Civil War and in 1930 had a

population of 5,269.² Lakeland, in the west-central part of the county, was incorporated in 1885 just after the opening of the Atlantic Coast Line Railroad in 1884. It has gradually grown until it is now the largest city in the county, having a population of 18,554 in 1930. Other incorporated towns, which are local shipping and trading centers, are Lake Wales in the east-central part, Winter Haven in the central part, Haines City in the northeast part, and Fort Meade in the southwest part. Settlements in the poorly drained flatwoods of the northern, eastern, and south-central parts of the county are small and scattered.

The county is well served by the Atlantic Coast Line Railroad and the Seaboard Air Line Railway. The main line of the Atlantic Coast Line between Jacksonville and Tampa passes through Haines City and Lakeland and forms a junction point with the Jacksonville, Ocala, West Palm Beach & Miami division of the Seaboard Air Line at Auburndale. Branch lines of the Atlantic Coast Line traverse the county from north to south. One passes through Lakeland, Bartow, and Fort Meade; and another, branching off the main line at Haines City, runs southward through Lake Hamilton, Dundee, Lake Wales, and Frostproof.

An excellent system of hard-surfaced roads forms highway connections between all the towns in the county. These roads are continually being improved and extended. Two State highways cross the county from north to south, and one from east to west. All parts of the county except the sparsely settled regions are reached by this system, and even those regions are crossed by through highways from which secondary roads and logging trails branch off.

A small volume of water transportation takes place on Kissimmee River along the eastern boundary of the county.

Practically all towns and villages have water, light, and telephone facilities, and many rural sections also are served.

Lakeland, Bartow, Winter Haven, and Lake Wales are the principal city markets within the county. The citrus producers, strawberry growers, and truckers ship their products to all the larger markets east of the Mississippi, and citrus fruits are occasionally shipped into Canada and other parts of the world.

CLIMATE

The climate of Polk County is subtropical. The temperature, however, is greatly moderated by the influence of numerous lakes and by the winds which sweep across the peninsula from the Gulf and the Atlantic Ocean.

The extreme maximum temperature of 101° F. recorded at Bartow is rare, though temperatures of 90° or more may be reached occasionally between the last of February and the first of December. The warmest weather occurs from June to September, inclusive, the mean for these summer months being 80.4°. The influence of atmospheric circulation and of the many showers during the warm weather greatly mitigate the unpleasantness of the long, warm days.

The winters, as a rule, have many bright sunny days with very little rainfall and only occasional frosts. Freezing temperatures occur only a few times during the year and then usually last for

² Soil survey reports are dated as of the year in which the field work was finished. Later census figures are given whenever possible.

only a few hours during the night. These are not always destructive to fruits and vegetables. However, records of the Weather Bureau show that from 1871 to 1912 there were severe freezes causing widespread damage to fruits and vegetables during January, 1886; December, 1894; and February, 1895 and 1899. Many fruits and vegetables were seriously injured in January, 1927. The injury to the citrus groves occurred only in the lower situations where water and air drainage were apparently unfavorable, and in these places many young trees were killed and bearing trees, together with their fruit, were greatly damaged.

The average date of the first killing frost recorded at Bartow is December 9, and for the last is February 14. The very earliest killing frost on record is November 12, and the latest in the spring is March 25. These dates vary a few days in various parts of the county, depending on elevation, relief, drainage, vegetation, and nearness to bodies of water.

The average annual rainfall is 52.65 inches at Bartow. As a rule there is a definite rainy season beginning in June and ending in September, and during the remainder of the year precipitation is very light. This condition is favorable for citrus production. Droughts may occur during the normal rainy period but average only once in four or five years. The injurious effects of occasional droughts have been greatly lessened by better cultural methods, such as frequent stirring of the surface soil.

Moderately high winds may be expected from August to October, and occasionally disturbances of varying intensity of the West Indian hurricane type may move northward from the Tropics and reach this region. However, they are generally less severe than on the coast.

Tables 1 and 2 give the climatic data compiled from the Weather Bureau records taken at Bartow and Lakeland.

TABLE 1.—Normal monthly, seasonal, and annual temperature and precipitation at Bartow, Fla.

[Elevation, 115 feet]

Month	Temperature			Precipitation		
	Mean	Absolute maximum	Absolute minimum	Mean	Total amount for the driest year (1889)	Total amount for the wettest year (1924)
	^{°F.}	^{°F.}	^{°F.}	<i>Inches</i>	<i>Inches</i>	<i>Inches</i>
December.....	61.3	87	20	2.31	0.00	0.34
January.....	61.0	89	18	2.41	7.45	3.71
February.....	62.8	90	22	2.78	4.20	5.76
Winter.....	61.7	90	18	7.50	11.65	9.81
March.....	67.2	97	28	2.47	1.20	6.45
April.....	71.2	99	34	2.11	1.40	3.32
May.....	76.7	100	46	3.69	1.40	2.96
Spring.....	71.7	100	28	8.27	4.00	12.73
June.....	78.2	101	53	8.02	6.55	13.74
July.....	81.5	100	61	7.46	4.50	16.91
August.....	81.4	100	65	7.98	5.90	4.24
Summer.....	80.4	101	53	23.46	16.95	34.89
September.....	79.6	87	53	7.92	5.65	3.25
October.....	74.2	97	38	3.65	.15	10.22
November.....	66.3	91	28	1.85	.20	.13
Fall.....	73.4	97	28	13.42	6.00	13.60
Year.....	72.0	101	18	52.65	38.60	71.03

TABLE 2.—Normal monthly, seasonal, and annual temperature and precipitation at Lakeland, Fla.

[Elevation, 211 feet]

Month	Temperature			Precipitation		
	Mean	Absolute maximum	Absolute minimum	Mean	Total amount for the driest year (1921)	Total amount for the wettest year (1919)
	°F.	°F.	°F.	Inches	Inches	Inches
December.....	63.8	86	27	1.84	2.53	3.26
January.....	63.5	89	30	1.94	.82	3.40
February.....	64.1	91	24	2.29	2.62	5.55
Winter.....	63.8	91	24	6.07	5.97	12.21
March.....	68.7	92	39	2.99	1.60	5.72
April.....	72.5	92	43	2.51	1.39	.94
May.....	76.2	95	52	6.49	8.21	7.96
Spring.....	72.5	95	39	11.99	11.20	14.62
June.....	79.9	94	63	6.94	6.64	6.84
July.....	80.9	96	68	8.10	6.73	10.16
August.....	81.5	96	68	7.94	3.58	8.99
Summer.....	80.8	96	63	22.98	16.95	25.99
September.....	80.0	95	64	6.00	.31	5.30
October.....	75.4	94	49	3.69	3.49	1.96
November.....	67.1	90	58	2.27	2.59	3.71
Fall.....	74.2	95	38	11.96	6.39	10.97
Year.....	72.8	96	24	53.00	40.51	63.79

AGRICULTURE

Until about 1890 agriculture in Polk County consisted chiefly in the production of corn, sweetpotatoes, rice, sugarcane, and some cotton and peanuts. Oranges had been grown for many years, and attempts had been made to establish a market for them. Long hauls over bad roads to a seaport town and from there slow journeys in ill-equipped vessels to the seaport market delayed the successful establishment of the industry until the advent of the railroads. A very important aid in the production of citrus fruits was the introduction of commercial fertilizer, which made citrus-fruit growing possible on the high pinelands where frost damage was least. With better transportation facilities, with new settlers, and with commercial fertilizer available, the citrus industry progressed with leaps and bounds in spite of occasional setbacks by freezes until it reached the present state of outstanding importance.

As indicated by the censuses, agriculture has been somewhat diversified and attempts have been made to establish cash crops and supplement them with subsistence crops. By 1900 there was a marked increase, not only in the variety of crops grown but also in total production, and since that time the increase has been steady.

The 1925 Federal census reports 89.4 per cent of the farms operated by owners, 1.9 per cent by managers, and 8.7 per cent by tenants. The average size of farms has not changed greatly, but there has been a steady increase in the value of land. Expenditures for farm labor, feed, and fertilizer have steadily increased.

The type of agriculture practiced at the present time differs considerably from the type which was established by the earlier settlers. It consists primarily of the production of citrus fruits, truck crops, and small fruits as cash crops and the growing of corn and hay for feed.

The citrus-fruit industry ranks first in importance. It is said that Polk County produces more citrus fruit than any other county in the State. Oranges, grapefruit, tangerines, and a few lemons, kumquats, and limes, named in the order of their total production, are grown. The production of citrus fruits reached a total of more than 1,700,000 boxes in 1919, and the value of all fruits and nuts totaled \$4,139,881. County records show that more than 3,500,000 boxes of citrus fruit are now shipped annually to widely distributed markets, a large proportion reaching Canada and some of the larger European markets.

The State marketing bureau reported that during the 1925-26 season Polk County shipped 3,804 carloads of oranges and tangerines and 5,025 carloads of grapefruit, or a total of 8,829 carloads. The United States Census of Agriculture for 1925, in its farm census for Florida, states that in 1924 in Polk County there were 1,574,344 bearing orange trees, 571,692 bearing grapefruit trees, and 24,988 bearing lemon trees. There were nearly as many trees which had not reached bearing age. The Florida Citrus Exchange is an important marketing association operating successfully in the county.

The average yield of grapefruit is about 182 boxes to the acre, of oranges 152 boxes, and of tangerines 186 boxes. The average price in recent years has ranged around \$1.61 a box for grapefruit, \$2.59 for oranges, and \$3.70 for tangerines. The yields are directly dependent on the age of the trees, variety of fruit, number of trees to the acre, and the quantity of fertilizer used. The three principal varieties of oranges grown are the Parson Brown for the early crop, the Pineapple for the main winter crop, and the Valencia for the late crop. These varieties range in time of maturing from late October to June. Many other varieties are grown to greater or less extent. The Marsh, Walters, Duncan, and several other varieties of grapefruit are grown. The Dancy, which ripens from December to March, is the principal variety of tangerine.

The general trend at present is to stabilize the citrus-fruit industry by reducing the number of varieties grown to the more profitable ones and by utilizing better methods of growing, shipping, and marketing. This has been necessary owing to the increased production, not only in Polk County but in all the citrus-producing centers of the United States. It has also been necessary in order to counteract the unfavorable effect of placing a great many varieties of each kind of citrus fruit on the market without sufficient regard for quality and standardized grades. For a fuller discussion of the citrus industry see Department Bulletin No. 1435.³

The trucking industry, also, has expanded greatly within the last few years. It ranks second to the citrus industry in importance.

³ SWINSON, C. R., and FUNK, W. C. ECONOMIC ASPECTS OF CITRUS-FRUIT GROWING IN POLK COUNTY, FLA. U. S. Dept. Agr. Bul. 1435, 40 p., illus. 1926.

The 1920 census gives the total value of vegetables produced in 1919 as \$501,813. At present cabbage, lettuce, beans, potatoes, sweet-potatoes, and tomatoes are the most important truck crops grown; among others are bell peppers (mangoes), squash, asparagus, peas, spinach, beets, radishes, onions, okra, cauliflower, celery, and cucumbers. The yields obtained vary with the quantity of fertilizer used, quality of seed, care in planting, cultivating, and irrigating the crop, and weather conditions. Crop failures sometimes occur, but the length of the growing season allows an opportunity for many attempts during the year. A great variety of vegetables for which records are not obtainable are grown in the home gardens for family use.

A number of small fruits are produced. The production of early strawberries for northern markets is the most important. The 1920 Federal census reported a total of 174,088 quarts grown on 101 acres in 1919, and county records show that more than 1,000 acres are devoted to this crop at the present time. The ripening and shipping season begins in December and continues to April or May, the close of the shipping season depending on the pressure of competition from more northern regions. Prices range from \$1 to \$1.50 a quart at the beginning of the season and decrease to only a few cents at the close, as a rule, though severe frosts and freezes keep prices up to high averages in some years. Yields vary from 800 to 2,400 or more quarts to the acre. The most popular varieties are the Missionary, Klondike, Dunlap, and Aroma. The strawberry industry is centered around Galloway, Kathleen, and Lakeland.

Other fruits which are gaining in favor include grapes, watermelons, peaches, blackberries, pears, figs, and bananas.

A number of vineyards are in the vicinity of Bartow, Lakeland, and Winter Haven. The Carman and Munson are the popular bunch varieties and the Scuppernong and Thomas the muscadine varieties.

Watermelon growing on a commercial basis is carried on chiefly in the Bartow and Fort Meade trucking section.

Peach trees are grown in young citrus groves and as fillers in older groves. They are removed from the young groves when the citrus trees come into bearing.

The quantity of cereals produced does not meet the demand, and large consignments are shipped into the county.

Tame or cultivated grasses were grown on 2,031 acres in 1919 and yielded a total of 1,486 tons. There were also 170 acres of wild grasses cut, yielding 192 tons. The total acreage devoted to hay grasses in 1929 was 1,075 acres, and the total yield was 974 tons. Beggarweed, cowpeas, velvetbeans, and Natal grass are cut for hay or used for green-manure crops.

Sugarcane is grown for sirup production. A total of 470 acres, with a production of 66,388 gallons of sirup, was reported for 1919, but both acreage and production have decreased greatly since that time, owing to the increased use of the land for truck and citrus crops.

A large number of cattle and hogs range the flatwoods and swampy parts of the county and provide an important contribution to the

meat supply. Practically all the native beef and pork is consumed in the county. In recent years Brahman bulls have been introduced into the native cattle herds. By this method a type of cattle immune to the cattle-tick fever is produced and it is also a desirable beef type which may be raised on the vast areas of idle land in the county.

The dairy industry is growing, but not rapidly enough to meet the increasing demand for dairy products. A number of good dairy herds are kept in the vicinity of Bartow, Lakeland, and Winter Haven. (Pl. 1.) The Jersey is the popular breed of dairy animal, though a number of grade Holstein and Guernsey cattle are kept. Practically all the feed, including both the concentrates and forage, for the dairy herds is purchased, the greater part from outside the county.

Horses and mules are the principal work animals. A few oxen are used in the lumbering industry.

The poultry industry does not meet the local demand for poultry products, though it has gradually expanded in recent years. A number of small producers are now specializing in egg production. The White Leghorns are popular among the producers. The ordinary farm flocks are small and consist mainly of the heavier breeds, such as Plymouth Rocks, Orpingtons, Rhode Island Reds, and mixed breeds.

Lumbering and phosphate mining are two important industries which are closely allied with agriculture, as they bring considerable capital into the county and afford employment for some farmers during part of the year.

The topography and physiography of the county have a marked influence on the agriculture. The citrus industry has been established in the lake region and on the higher sandy soils, including the Norfolk, Fort Meade, Orlando, Eustis, and Blanton soils, because the air drainage is more favorable, the soil is more open in character, and the danger of frost is less, owing to the movement of colder air to lower elevations and also owing to the presence of bodies of water which equalize the temperature. The most favorable situation for groves, as a rule, is on an east-west divide, with lakes lying to the north and south of the grove.

The principal development of the trucking industry and the production of small fruits has taken place on the dark-colored soils and on the brown soils of the Fort Meade, Portsmouth, Norfolk, and Eustis series in the vicinity of Fort Meade, Bartow, and Lakeland. The organic content, level surface, and adaptability of these soils, together with their quick response to commercial fertilizer, have rendered them desirable to truckers and small-fruit growers.

The problem of finding the proper rootstock, varieties, and kinds and amounts of fertilizer for citrus trees has been fairly well worked out. It is generally recognized that the trees should be budded on rough lemon stock. Complete fertilizer must be added at frequent intervals owing to the rapid leaching in these soils, and organic matter must be added year after year. The grower applies fertilizer according to the age and health of the tree. During the rainy season, from June to early October, cover crops such as beggarweed, Natal grass, and cowpeas are allowed to grow in the groves. These are plowed under in the fall, and the grove is harrowed a number of

times during the dry season. Trees in good condition and more than 10 years old each receive an average of 50 pounds of a 3-8-8 fertilizer.⁴ Grapefruit trees receive slightly more fertilizer than orange trees, and tangerine trees about 6 pounds more than orange trees. An application of fertilizer is made following the fall plowing, a second one in February, and a third one later in the spring. After this the groves are intensively cultivated until the rainy season begins. The trees are pruned and sprayed. Many farmers bank the dirt around young trees as a precaution against freezes.

The truck growers in general practice crop rotation. Lettuce, cabbage, and potatoes are, as a rule, followed by beans, corn, sweet corn, or sweetpotatoes. The follow-up crops receive little additional fertilizer, since the lettuce, cabbage, and potatoes are fertilized very heavily.

An average of \$500 a farm was expended for fertilizer in 1924, according to the Federal census. All crops are fertilized either by direct application or indirectly by following a heavily fertilized crop. The kinds and amounts of fertilizer are not determined by the various soil types but by the climate, available finances, and the assimilating ability of the particular crop.

The larger farms are well equipped, and the homes are modern in every respect. Tractors are used on many farms. In general the sandy soils may be economically cultivated with light implements drawn by horses and mules. Many of the truck growers have installed overhead sprinkling systems in order to insure production during the dry season and to force special crops.

The production of citrus and other highly specialized crops requires skilled labor and competent management. Most of the farms are operated by the owners. The greatest demand for labor is during citrus-fruit harvest. This coincides largely with the tourist season, and enough help to meet the extra demand arrives at this time.

The 1930 Census report states that 26.1 per cent of the land of the county is in farms, and that the average size of farms is 68.3 acres.

There is considerable variation in land values due to improvements and to location with respect to roads, schools, churches, markets, and lakes. The Norfolk, Fort Meade, Orlando, Eustis, and Blanton soils, which are utilized extensively for the production of citrus, truck, and small-fruit crops, are the highest-priced soils in the county.

Small scattered areas of the Portsmouth, Parkwood, Bladen, and part of the Leon soils have been more or less effectively drained, and are thereby rendered valuable for trucking and general farm crops. However, land values of the greater part of these soils, together with the St. Lucie, St. Johns, and Plummer soils, and peat, peaty muck, swamp, and ponds, have a low valuation. Choice stands of merchantable timber enhance the value of the less desirable soils.

All the light-colored, well-drained upland soils are deficient in organic matter and low in total phosphorus and potassium, and, owing to the fact that leaching in these soils is comparatively rapid, these deficiencies must be supplied if production is to continue. Legumes, grasses, and other vegetal remains should be regularly plowed under.

⁴ Percentages, respectively, of nitrogen, phosphoric acid, and potash.

The Parkwood soils, which are inherently the most fertile soils in the county, are capable of producing great quantities of hay even though their drainage is not the best. Reasonable sums spent in draining and improving these soils should prove to be good investments.

SOILS SERIES AND TYPES⁵

The soils of Polk County are grouped into series according to color, origin, and structure. The series are subdivided into soil types on the basis of texture, or the relative content of clay, silt, and sand in the surface soil. The soils of the county have been classed in the Norfolk, Fort Meade, Blanton, Eustis, Orlando, Portsmouth, Parkwood, Bladen, Leon, St. Johns, St. Lucie, and Plummer series. Seven miscellaneous materials, including peat, peaty muck, water and grass, cypress ponds, swamp, coastal beach, and mine pits and mine dumps are mapped.

The Norfolk soils, locally termed "high pinelands," are readily identified by their yellowish layer of sand from 2 to 7 or more feet in thickness, which overlies red, yellow, and gray beds of clayey sands or sandy clay locally termed clay beds.

The Fort Meade soils have a very dark brownish-gray layer of sand, from 10 to 24 or more inches in thickness, which changes gradually into brown sand extending to a depth ranging from 5 to 10 feet, where it is rather abruptly underlain by gray and brown phosphate beds of clay and rock. These soils occupy broad, comparatively level but well-drained stretches in the vicinity of Bartow and Fort Meade.

The Blanton soils resemble the Norfolk soils, but the sand layer is much grayer in the Blanton than in the Norfolk soils, being typically light gray to a depth ranging from 10 to 20 inches. This layer grades into very pale yellow material with gray-white spots appearing just above the beds of clayey sand.

The Eustis soils are characterized by a brownish layer of sand which ranges from 3 to 8 or more feet in thickness and overlies a bed of sandy clay streaked and spotted with gray, yellow, brown, and reddish brown. The sand layer grades from a dark grayish-brown surface soil, through brown and yellowish-brown slightly loamy sand, into lighter yellowish-brown sand directly overlying the mottled beds of sandy clay. These soils occupy level or gently sloping well-drained areas, locally termed "high hammocks."

The Orlando soils have very dark-gray or dark brownish-gray surface layers from 10 to 24 inches in thickness, underlain by a layer, ranging from 2 to 4 or more feet in thickness, of light-gray or light yellowish-gray sand which rests on sandy clay beds streaked and mottled with brown, gray, yellow, and, in places, reddish colors. The gently undulating relief affords fair surface drainage, and internal drainage is adequate as a rule.

The Portsmouth soils consist of very dark-gray or almost black sandy material to a depth ranging from 6 to 12 inches. This material

⁵ Fort Meade fine sand and Bladen fine sand of Polk County are mapped adjoining Scranton fine sand in Hillsborough County; St. Johns fine sand of Polk County adjoins areas of Portsmouth fine sand, Leon fine sand, and muck, prairie phase, in Hillsborough County; and some areas of water and grass in Polk County are mapped against muck, prairie phase, in Hillsborough County. These differences are due to more detailed mapping and a better understanding of the soils since Hillsborough County was mapped.

is underlain by bleached or light-gray sand. These soils differ decidedly from the Orlando soils in location, having developed in shallow poorly drained depressions and along the borders of shallow, marshy, and peaty intermittent ponds and poorly defined drainage ways.

The Parkwood soils consist of very dark-gray or gray sand and loamy sand to a depth ranging from 5 to 20 inches. This layer grades into a lighter-gray or bluish-gray iron-stained heavier layer of sandy loam or sandy clay which, at a depth ranging from 24 to 60 inches, rests on beds of marly sand and clay. These soils are only moderately well drained. They occur along the borders of the larger stream valleys where the base level has approached the marly formation.

Within the Bladen series are included poorly drained sandy soils consisting of gray or dark-gray layers of sand or loamy sand, from 6 to 12 inches in thickness, underlain by lighter-gray sand to a depth ranging from 1 to 2 feet. Below this the material is slightly heavier and is characteristically light gray, mottled or specked with gray, yellow, or brown. Beds of sandy clay or clayey sand are reached at depths ranging from 60 to 140 or more inches.

The Leon soils are distinguished by their leached light-gray surface layer of sand overlying a very dark brown compact organic layer, often termed "hardpan," which is from 2 to 10 inches in thickness and occurs at a depth ranging from 18 to 30 inches in most places. Below this the sands are loose and yellowish gray, changing gradually to light gray and extending to the beds of mottled yellow, gray, and brown sandy clay lying at a depth ranging from 40 to 90 or more inches. These soils occur on the broad flats in the flatwoods and prairie sections of the county. The organic layer is extremely acid, and the soil throughout has a strongly acid reaction.

Closely associated with the Leon soils but occupying slightly lower and more poorly drained situations along the borders of ponds and winding depressions are the St. Johns soils. They have a very dark gray or almost black sandy surface layer a foot or more in thickness, underlain by a thin light-gray or brownish-gray layer. At a depth ranging from 18 to 24 inches is a very dark brown organic layer from 2 to 10 inches in thickness. Directly below this is light-yellow and gray sand extending to the heavier sandy clay beds which lie from 40 to 100 or more inches below the surface.

The soils occurring on the sandy knolls with a characteristic scrub growth are classified with the St. Lucie soils. White or very light gray incoherent sand or almost pure crystalline quartz extends to a depth ranging from 8 to 20 feet with very little variation except in the amount of iron staining in the subsoil and substratum. The sand rests on a mottled sandy clay bed similar to that underneath the Norfolk and Blanton soils. Drainage of these soils is excessive on the surface and through the deep sand layer.

Plummer soils, commonly known as "sand soaks," have gray surface layers from 4 to 8 inches in thickness, underlain by light-gray or almost white sublayers of water-soaked sand. Heavier layers of sandy clay or clayey sand occur at a depth ranging from 40 to 120 inches. These soils occupy poorly drained flats and shallow depressions in the flatwoods or prairie section of the county.

Peat consists of almost pure plant remains, partly disintegrated and decomposed, which have accumulated in the presence of water. Peaty muck is an organic accumulation in a more advanced stage of decomposition, having a greater admixture of silt, sand, or other mineral particles than peat, but the organic material has not reached the well-decomposed state of muck nor does it have the high content of mineral soil particles.

Coastal beach consists of light-gray or white sand which has accumulated through wind and water action along some of the lake beaches. It occurs as narrow ridges ranging in depth from 3 to 10 or more feet. Shell fragments are of common occurrence through the sand.

The numerous water and grass ponds, cypress ponds, and swamps have been mapped without attempting a detailed separation of the soils in such places. The extensive areas of mine pits and mine dumps consist of worked-over material from the phosphate mines.

In the subsequent pages of this report the soils of the county are described in detail and their relation to agriculture is discussed. Their distribution is shown on the accompanying soil map. Table 3 shows the actual and proportionate extent of each soil type mapped in the county.

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

Type of soil	Acres	Per cent	Type of soil	Acres	Per cent
Norfolk fine sand.....	98,368	8.4	Leon fine sand.....	288,000	27.0
Shallow phase.....	2,944		Loamy phase.....	19,648	
Norfolk sand.....	104,384	8.8	Prairie phase.....	15,296	
Fort Meade fine sand.....	31,744	2.7	Leon sand.....	19,328	1.6
Blanton fine sand.....	83,136	7.1	St. Johns fine sand.....	37,056	3.1
Shallow phase.....	640		St. Lucie fine sand.....	36,288	3.0
Eustis fine sand.....	7,104	.6	Plummer fine sand.....	38,208	3.2
Orlando fine sand.....	896	.2	Peat.....	19,776	1.7
Hardpan phase.....	448		Peaty muck.....	93,888	7.9
Portsmouth fine sand.....	63,296	6.1	Water and grass.....	57,152	4.8
Swamp phase.....	9,984		Cypress ponds.....	27,712	2.3
Parkwood fine sandy loam.....	4,480	1.4	Swamp.....	72,832	6.1
Deep phase.....	12,288		Coastal beach.....	576	.1
Parkwood clay loam.....	5,184	.4	Mine pits and mine dumps.....	15,232	1.3
Bladen fine sand.....	19,776	2.2	Total.....	1,192,320	-----
Prairie phase.....	6,656				

COMPOSITION OF POLK COUNTY SOILS

The Fort Meade and presumably the Orlando soils, since they are very similar to the Fort Meade, in Polk County contain, however, a much higher percentage of phosphoric acid than does Norfolk sand. The subsoils, especially the deep subsoils of some of the other soils, such as Leon fine sand in the southwestern part of the county and some others, contain important percentages of this constituent. This is shown in the partial analyses in Table 4. The occurrence of these soils overlying the phosphate beds in the southwestern part of the county explains this high percentage. The physical characteristics of these soils above the subsoils, in that part of each of these soils in which the plant must grow mainly, is not favorable to crop growing without drainage and the addition of fertilizers.

TABLE 4.—Percentages of phosphoric acid in Fort Meade fine sand, Leon fine sand, Leon sand, and Blanton fine sand from Polk County, Fla.¹

Soil type	Location	Soil survey No.	Laboratory sample No.	Depth in inches	P ₂ O ₅	H ₂ O at 110° C.
Fort Meade fine sand	3 miles east of Fort Meade	34232	3256	5-28	<i>Per cent</i>	<i>Per cent</i>
		34233	3257	28-50	0.38	0.80
		34234	3258	50-72+	.40	.76
Leon fine sand	2½ miles north of Mulberry	34238	3259	26-32	.38	.67
		34240	3260	60-84	(?)	.21
		34241	3261	84-120+	.59	1.14
Leon sand	6¼ miles east of Lake Hamilton	34245	3262	30-40	2.95	2.49
		34246	3263	40-80+	.02	.37
		34250	3264	75-110	.04	.12
Blanton fine sand	1¼ miles northwest of Mulberry	34251	3265	110-180+	.09	.36
					.42	.49

¹ Analyzed by G. Edgington.

² Trace.

The determination of the total quantity of any constituent does not determine the quantity of that material available to the plant. There has not yet been developed a method, recognized universally by scientific men as effective, for doing this. The determination of the percentages of the mineral plant-food constituents in a soil soluble in a number of kinds of solvents of different strengths, acting through different lengths of time, is regarded, each combination by its own group, by some agronomists as reasonably effective.

A complete chemical analysis of only one of the soil types from Polk County has been made. This shows the composition of Norfolk fine sand at Lake Wales. The important agriculture of the county, that on the very light colored very sandy soils, is well known to have been located on them because of their good drainage and because of their occurrence on ridges where air drainage is good. It is well known that these soils, like all sands, have a very low content of the constituents commonly regarded as plant food. The composition of Norfolk fine sand at Lake Wales is shown in Table 5. This table shows the results of a complete analysis, giving the total percentages present of all the constituents usually determined in a soil analysis.

TABLE 5.—Composition of Norfolk fine sand, Lake Wales, Polk County, Fla.

CHEMICAL¹

Sample No.	Horizon	Depth	SiO ₂	TiO ₂	Fe ₂ O ₃	Al ₂ O ₃	MnO	CaO	MgO	K ₂ O
		<i>Inches</i>	<i>Per cent</i>	<i>Per cent</i>	<i>Per cent</i>	<i>Per cent</i>	<i>Per cent</i>	<i>Per cent</i>	<i>Per cent</i>	<i>Per cent</i>
28552	1	0-3	97.60	0.11	1.43	None.	0.003	0.16	0.09	0.14
28553	2	3-60	98.15	.24	.41	.68	.006	.06	.06	.22
28554	3	60-72	96.31	.66	.96	1.18	.01	.20	.08	.08
28555	4	72-90	91.49	.50	1.75	4.51	.007	.01	.02	.16

Sample No.	Horizon	Depth	N ₂ O	P ₂ O ₅	SO ₃	Ignition loss	Total	N	CO ₂ from carbonates	H ₂ O at 110°
		<i>Inches</i>	<i>Per cent</i>	<i>Per cent</i>	<i>Per cent</i>	<i>Per cent</i>	<i>Per cent</i>	<i>Per cent</i>	<i>Per cent</i>	<i>Per cent</i>
28552	1	0-3	(?)	0.01	0.04	0.43	100.01	0.011	None.	0.01
28553	2	3-60	(?)	.01	.05	.40	100.28	.004	None.	.12
28554	3	60-72	0.16	.02	.01	.30	99.97	None.	None.	.10
28555	4	72-90	(?)	.05	.05	1.83	100.37	.02	None.	.42

¹ Analyzed by J. G. Hough, S. Mattson, and G. Edgington.

² Trace.

TABLE 5.—*Composition of Norfolk fine sand, Lake Wales, Polk County, Fla.—Continued*MECHANICAL ³

Sample No.	Horizon	Depth	Fine gravel (diameter 2-1 mm.)	Coarse sand (diam- eter 1-0.5 mm.)	Medium sand (diam- eter 0.5-0.25 mm.)	Fine sand (diameter 0.25-0.1 mm.)	Very fine sand (diameter .1-0.05 mm.)	Silt (diameter 0.05-0.005 mm.)	Clay (diameter 0.005-0.00 mm.)	Total mineral constit- uents
		<i>Inches</i>	<i>Per cent</i>	<i>Per cent</i>	<i>Per cent</i>	<i>Per cent</i>	<i>Per cent</i>	<i>Per cent</i>	<i>Per cent</i>	<i>Per cent</i>
28552-----	1	0-3	0.2	9.7	24.0	64.2	0.1	0.5	1.3	100.0
28553-----	2	3-60	.2	13.4	28.8	55.2	.2	.5	1.6	99.9
28554-----	3	60-72	.2	12.4	26.0	60.0	.2	.2	.9	99.9
28555-----	4	72-90	.4	16.2	23.6	46.2	.6	.5	12.5	100.0

³ Analyzed by A. A. White.

The percentage of potash ranges from 0.08 to 0.22 per cent. In the Corn Belt soils the percentage of potash present is 1½ or more. The percentage of lime, phosphoric acid, and nitrogen are all very low. The soil is made up mainly of silica, and the field examination shows clearly that it is practically all quartz.

Two methods of analysis have been used to a considerable extent in this country. One is the so-called official method, or the method agreed on by the official agricultural chemists of the United States. This consists of treating the soil with hot hydrochloric acid of a specific gravity of 1.115, or a 20 per cent solution of hydrochloric acid, and determining the amounts of the several constituents dissolved in proportion to the weight of the dried soil.

The other method used consists in the treatment of the soil with a twentieth-normal hydrochloric acid solution and determining the percentages of each constituent dissolved as in the other method. H. G. Byers, chief of the division of soil chemistry and physics, says the latter method determines approximately the percentages of the various bases present in an absorbed condition in the soil. He states that by the application of the official method, not merely the absorbed bases are dissolved but some of the undecomposed minerals present may be dissolved also.

Table 6 gives the results (expressed in percentages) of the treatment of samples of Portsmouth, Orlando, Plummer, Blanton, and Norfolk fine sands, Blanton loamy fine sand, Norfolk fine sand, shallow phase, Leon loamy fine sand, and Leon sand—both treatments having been used. It is evident that the official method dissolves more material from these soils than the twentieth-normal method.

TABLE 6.—Chemical analyses of samples of several soils from Polk County, Fla.

Soil type	Location	Sample No.	Depth	Fe ₂ O ₃		Al ₂ O ₃		CaO		MgO		K ₂ O		Na ₂ O		P ₂ O ₅		SO ₃	
				Per ct. ¹	Per ct. ²	Per ct. ¹	Per ct. ²	Per ct. ¹	Per ct. ²	Per ct. ¹	Per ct. ²	Per ct. ¹	Per ct. ²	Per ct. ¹	Per ct. ²	Per ct. ¹	Per ct. ²	Per ct. ¹	Per ct. ²
Portsmouth fine sand.	1½ miles southeast of Brewster.	262305	Inches 0-12	0.12	0.0088	0.49	0.3334	0.03	0.0015	0.01	0.0006	0.000	0.0056	0.013	0.0016	0.03	0.0038	0.063	0.0021
		262306	12-28	.14	.0106	.58	.3498	.03	.0004	.01	.0015	.000	.0065	.033	.0000	.15	.0901	.000	.0031
		262307	28-48	.14	.0110	.54	.3117	.03	.0003	.02	.0011	.000	.0029	.026	-----	.09	.0558	.000	.0003
Orlando fine sand.	2¾ miles north of Gib-sonia.	262378	0-12	.11	.0116	.72	.2084	.03	.0037	.02	.0020	.006	.0044	.028	.0019	.13	.0345	.010	.0015
		262379	12-24	.10	.0112	.86	.2181	.03	.0006	.01	.0004	.003	.0014	.038	.0007	.13	.0242	.002	.0003
		262380	24-54	.08	.0121	.92	.1824	.04	.0009	.02	.0051	.007	.0015	.051	.0019	.15	.0455	.003	.0013
Blanton loamy fine sand.	2½ miles east of Fox-town.	262348	0-3	.10	.0078	.45	.0814	.00	.0012	.02	.0007	.000	.0018	.018	.0007	.04	.0128	.006	.0007
		262349	3-24	.11	.0129	.62	.0988	.00	.0014	.01	.0004	.000	.0027	.015	.0007	.03	.0083	.004	.0003
		262350	24-34	.11	.0082	.63	.0369	.03	.0005	.01	.0004	.002	.0032	.013	.0008	.01	.0019	.000	-----
		262351	34-40	.39	.0129	2.40	.0341	.04	.0006	.04	.0682	.009	.0043	.019	.0015	.05	-----	.05	-----
		262352	40-60	2.73	0.103	10.33	.0847	.12	.0002	.07	.0075	.018	.0021	.007	-----	.33	-----	.022	-----
Blanton fine sand.	1½ miles northwest of Mulberry.	262318	0-5	.13	.0151	.50	.1259	.20	.0314	.03	.0007	.004	.0028	.163	.0024	.13	.0840	.010	.0024
		262319	5-22	.08	.0088	.48	.0797	.00	.0009	.01	.0000	.000	.0010	.032	.0023	.02	.0010	.000	.0008
		262320	22-75	.06	.0082	.22	.0057	.00	.0004	.01	-----	.000	.0011	.019	.0010	.01	.0006	.000	.0006
		262321	75-100	.64	.0347	2.60	.0881	.00	.0004	.04	.0002	.005	.0015	.016	.0006	.13	.0032	.005	.0006
		262322	110-180	.34	.0034	4.20	.0388	.20	.0013	.05	.0044	.005	.0025	.037	.0024	.39	.0048	.004	.0003
Plummer fine sand.	4 miles east of Mulberry.	262308	0-9	.03	.0030	.01	.0007	.01	.0029	.00	.0029	.000	.0020	.018	-----	.00	.0013	.003	.0007
		262309	9-24	.03	.0021	.02	-----	.00	.0003	.00	.0007	.000	.0006	.003	-----	.00	.0010	.000	-----
		262310	24-50	.02	.0017	.04	-----	.01	.0006	.00	.0002	.000	.0028	.010	-----	.00	-----	.000	.0003
Norfolk fine sand.	4½ miles east and ¾ mile north of Fort Meade.	262369	0-3	.29	.0099	.76	4.056	.02	.0029	.03	.0011	.006	.0028	.029	.0006	.05	.0050	.004	.0002
		262370	3-38	.30	.0127	.86	.0511	.01	.0011	.03	.0000	.005	.0018	.037	.0000	.04	.0027	.005	.0003
		262371	38-70	.29	.0097	.75	.0355	.01	.0012	.02	-----	.002	.0019	.040	.0008	.04	.0015	.004	.0003
		262372	70-80	2.67	.0127	7.24	.0853	.09	.0044	.15	.0169	.032	.0028	.055	.0011	.34	.0000	.023	.0003
		262373	80-120	3.66	.0088	9.59	.0531	.30	.0024	.09	.0094	.037	.0017	.062	.0024	.60	-----	.048	.0002
Norfolk fine sand, shallow phase.	1¼ miles east and ¾ mile north of Poyner.	262353	0-1	.21	.0099	.61	.0447	.07	.0100	.01	.0091	.000	.0037	.044	-----	.02	.0029	.004	.0015
		262354	1-10	.23	.0060	.74	.0390	.01	.0012	.02	.0017	.006	.0012	.040	.0008	.01	.0000	.003	.0001
		262355	10-24	.35	.0082	1.01	.0246	.00	.0004	.02	.0017	.005	.0033	.026	-----	.01	.0002	.003	.0003
		262356	24-36	2.33	.0099	7.30	.0681	.04	.0008	.07	.0125	.020	.0053	.038	.0029	.11	-----	.021	.0003
		262357	36-80	1.38	.0082	6.44	.0423	.03	.0005	.02	.0056	.011	.0006	.041	.0024	.14	-----	.015	.0005
Leon sand.	4 miles east of Mulberry.	262313	0-5	.07	.0172	.15	.0044	.09	.0142	.03	.0272	.004	.0062	.084	.0028	.00	.0024	.009	.0008
		262314	5-21	.05	.0138	.09	-----	.02	.0004	.00	.0033	.000	.0015	.061	.0007	.00	.0006	.005	.0001
		262315	21-30	.07	.0138	1.17	.6601	.02	.0006	.01	.0026	.005	.0065	.056	.0043	.00	.0006	.000	.0053
		262316	30-40	.08	.0108	.68	.2432	.01	.0006	.00	.0015	.004	.0068	.041	.0029	.01	.0005	.000	.0024
		262317	40-80	.08	.0103	.47	.0697	.00	.0003	.00	.0026	.003	.0009	.062	-----	.00	.0015	.000	-----
Leon loamy fine sand.	½ mile north and ¼ mile west of Carters; 5 miles east of Lake-land.	262340	0-5	.02	.0054	.00	.0082	.07	.0104	.03	.0122	.001	.0054	.076	.0043	.00	.0029	.010	.0020
		262341	5-22	.02	.0032	.00	-----	.00	.0006	.00	.0049	.000	.0025	.039	.0024	.00	.0003	.002	.0008
		262342	22-30	.27	.0205	.53	.1745	.05	.0071	.02	.0026	.004	.0058	.052	.0025	.00	-----	.000	.0006
		262343	30-48	1.73	.0069	4.90	.0341	.34	.0549	.22	.0276	.013	.0036	.094	-----	.00	-----	.006	.0005
		262344	48-60	.96	.0060	4.08	.0475	.27	.0391	.15	.0161	.018	.0058	.121	.1660	.06	.0005	.001	.0005

¹ Results by official method.

² Results by twentieth-normal extract method.

Table 6 shows that the percentages of plant-food constituents available to the plant in the surface soils of these soils is low in all except Orlando fine sand and Blanton fine sand. Even in these the amount of material extracted by the twentieth-normal method was very small. The subsoils at considerable depth in most of these soils contain rather high percentages of phosphoric acid, as shown by the complete analysis. Leon sand and Leon loamy fine sand have very small percentages throughout the soil. Neither of these samples was taken from the southwestern part of the county.

These results make it clear that the great value of these soils lies in their physical characteristics and in their location rather than in their chemical composition.

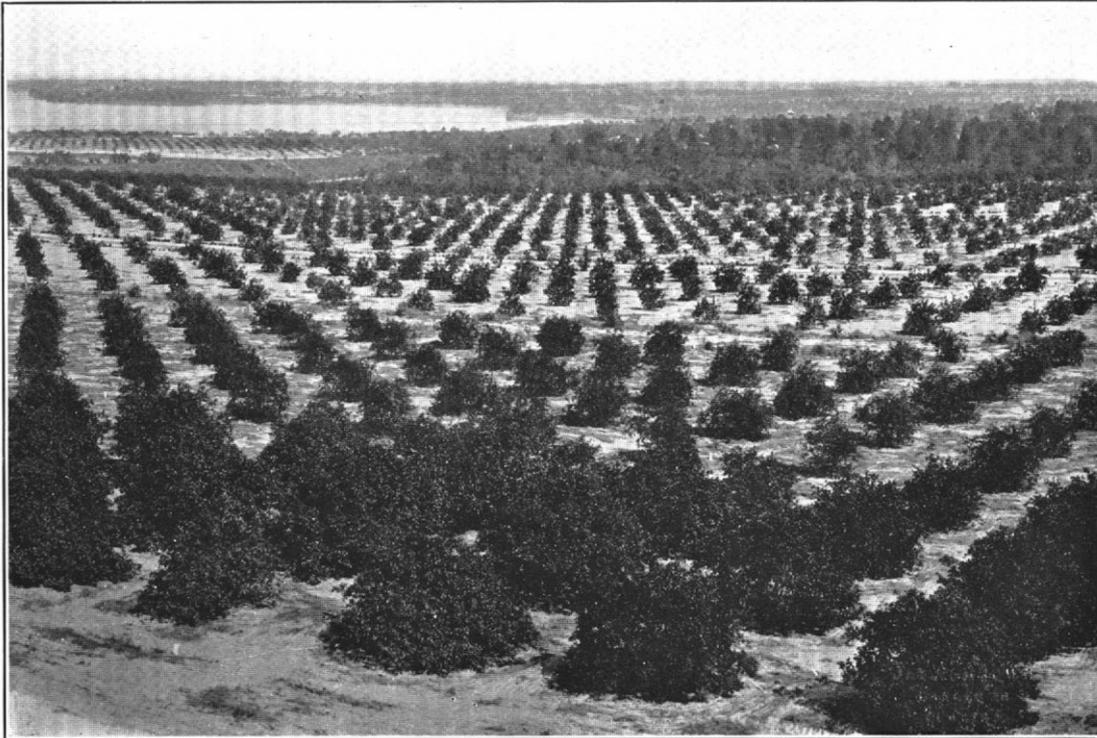
NORFOLK FINE SAND

Norfolk fine sand, where forested, has a 2 or 3 inch surface soil of dark-gray or grayish-brown fine sand which is loamy, owing to the organic matter present. Below this and continuing to a depth ranging from 3 to 4 feet is a layer of yellow rather loose fine sand which grades into loose brownish-yellow fine sand. This material extends to the so-called clay beds which lie at a depth ranging from 50 to 80 inches in most places, and it consists of yellowish-brown friable and mellow fine sandy loam, from 6 to 12 inches in thickness, overlying compact clayey sand spotted and streaked with yellow, light-gray, and reddish colors. In its natural condition this soil is very strongly acid in reaction except in the upper 2 to 4 inches of the surface soil and in the upper few inches of the sandy clay layer, where the reaction ranges from medium to strongly acid. Under cultivation the color of the surface soil changes to light yellowish gray, owing to the depletion of the organic material and to the mixing of organic matter with the yellow layer below. However, in some of the older citrus groves the surface soil remains dark and in places has increased in darkness and depth. This is true especially in the older groves in which the ground is shaded most of the time and in which it has been the practice to fertilize heavily with commercial fertilizer and to plow under a growth of grasses and weeds each year.

Minor variations occur where this soil grades into adjoining soils. This is particularly noticeable in its association with the Blanton and Fort Meade soils and with Norfolk sand. Some small areas of Blanton fine sand and Norfolk sand are included in mapping. The boundary between Norfolk fine sand and Norfolk sand is more or less arbitrarily drawn since the change in texture is very gradual over a distance of 2 or 3 miles. In the vicinity of Fort Meade, where this soil is associated with Fort Meade fine sand, narrow strips and smaller isolated spots occur, representing the gradation between the two soils. In these places the color is darker gray to a depth of about 6 inches and is more brown in the normally yellow second layer. A very few areas of Norfolk fine sand have a hammock, or predominantly hardwood, growth. In such places the surface soil is somewhat darker and the sandy layers are brownish yellow. This variation is generally considered a stronger soil than the high pineland of the typical soil.



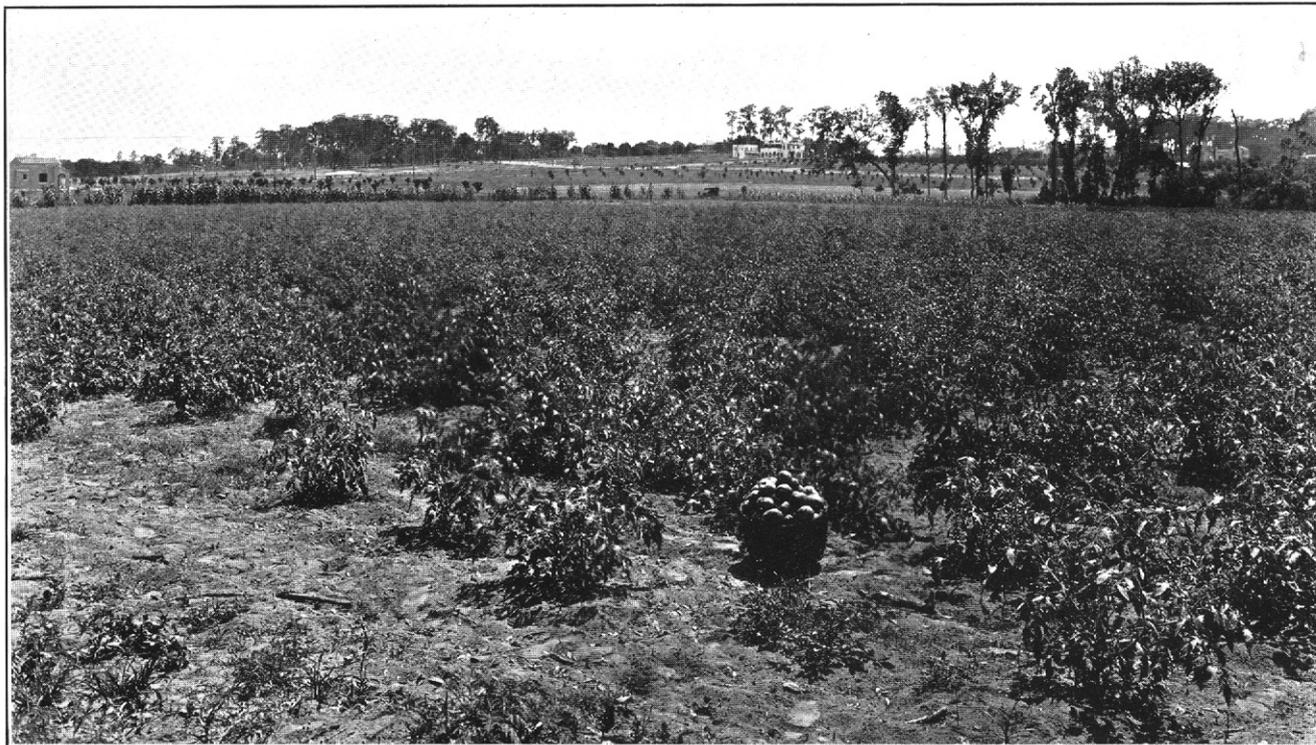
Dairy herd on pasture lot of Blanton fine sand in foreground, corn on Fort Meade fine sand beyond, and dense hardwood growth on Parkwood fine sandy loam and swamp in background



An orange grove on Norfolk fine sand near Lakeland



Large watermelon patch on Norfolk fine sand



Tomatoes on Fort Meade fine sand

A total of 153.7 square miles of Norfolk fine sand is mapped. It occupies the highest elevations in the county and has a rolling to gently undulating relief. Extensive areas occur in the vicinity of Lakeland, Winter Haven, Frostproof, Lake Wales, and Bartow.

The soil is naturally well drained, owing to its sandy porous character, though no definite surface drainage ways are developed. On the crests of ridges where surface sands are deepest and percolation is rapid, drainage and aeration may become excessive, and during periods of drought may be injurious unless counteracted. The soil does not erode and wash away even on the steeper slopes, and in most places there is apparently no necessity for terracing.

Approximately 95 per cent of this soil is cultivated. Three-fourths of the cultivated land is in citrus groves, and the remainder is utilized mostly for grapes and melons. (Pls. 2 and 3.) Only a very few small timbered areas remain, and these support a growth of longleaf pine, turkey oak, and blackjack oak. The grass consists mainly of scattered clumps of wire grass.

Norfolk fine sand is one of the most highly prized citrus soils in the State because of its excellent air drainage, water drainage, and favorable relief; also because it responds well to treatment and is easily cultivated. It is deficient in all the plant-food elements, and no attempt is made to grow commercial crops of fruit without fertilizing. Considerable organic matter is added by plowing or disking in a growth of beggarweed and Natal grass, which is allowed to grow after the last cultivation in summer. These plants reseed themselves each year. An important factor in growing citrus trees on this soil is the selection of trees which have been budded to rough-lemon rootstock, since the open porous layer of deep sand is apparently not well suited to trees grown on sour-orange or other rootstocks.

Oranges, grapefruit, and tangerines are the most important citrus fruits grown on this soil, ranking in acreage in the order named. Orange yields range from less than 100 to more than 500 boxes to the acre but average between 150 and 175 boxes. Grapefruit and tangerines average 175 or 200 boxes to the acre. Lemons, limes, kumquats, avocados, loquats, figs, and peaches are grown in comparatively small quantities around the homes. Bunch grapes are increasing in favor, and yields from vineyards 4 to 6 years old range from 1½ to 2 tons to the acre. Since practically all the citrus fruits of the county are grown on the Norfolk soils, facts regarding the management, fertilization requirements, yields, and varieties of citrus fruits, which are discussed in the chapter on agriculture, are applicable to the Norfolk soils.

Watermelons receive an average of 1,000 pounds of a high-grade complete fertilizer to the acre, 7-7-5 representing the common proportion. Nitrate of soda at the rate of 100 to 200 pounds to the acre is applied to corn just after the ears have formed.

Norfolk fine sand, shallow phase.—The shallow phase of Norfolk fine sand differs from the typical soil principally in the slighter depth to the sandy clay layer. The phase occurs in the more broken areas of the Norfolk soils where erosion has apparently prevented a thick accumulation of sand. A typical profile in forested areas con-

sists of a surface layer from 1 to 3 inches thick of dark-gray loose slightly loamy fine sand overlying 8 or 10 inches of light-yellow fine sand. Below this is a yellow fine sand layer which is loamy in the lower part and which grades into the typical sandy clay material at a depth of 30 inches or less.

The largest bodies of this shallow soil occur near Lakeland, one along the western side of Lake Hollingsworth and others about 2 miles northwest of the city. Small scattered areas lie farther northwest in the vicinity of Kathleen, Galloway, Gibsonia, and Socrum. Small isolated patches occur near Polk City and near Poyner.

Approximately 50 per cent of the land is under cultivation and mainly in citrus groves; the remainder is forested with longleaf pine and short scrubby oaks. Like other soils of the Norfolk series, this soil responds well to fertilizer treatment. It requires a complete fertilizer. Its greatest possibilities for utilization other than for citrus fruits are for feed crops, tobacco, and trucking where the relief is favorable. Yields, in general, average a little higher on the phase than on typical Norfolk fine sand or Norfolk sand.

NORFOLK SAND

Norfolk sand is developed most extensively on the northern half of the high rolling pineland ridge which extends north and south through the eastern part of the county. This soil consists of a loose, rather incoherent sand layer averaging about 4 feet in thickness, overlying sandy clay beds. Timbered areas have a surface inch or two of sand to which finely divided organic matter has imparted a dark-gray or yellowish-gray color. This grades rather abruptly into a layer of pale-yellow sand from 14 to 24 inches in thickness, which in turn rests on a layer of yellow or light-yellow sand extending in most places to a depth ranging from 4 to 6 feet but reaching a maximum depth of 20 or more feet in a few places. The heavier material, or so-called clay bed, has a layer from 1 to 12 inches thick of deep-yellow and in places red sandy loam in the upper part, below which is a firm layer of red, gray, brown, reddish-brown, and yellow clayey sand with the various colors rather intricately associated in streaks and splotches of red and gray. These colors grade from one to the other through the transitional colors. The gray color increases with depth and finally predominates, whereas yellow and red predominate in the upper part. The soil is acid in reaction throughout.

Locally small areas having a rather uniform red or yellowish-red color in the sandy clay or clayey sand layers occur. The size of the sand grains varies from fine to coarse but averages medium. The principal development of this included soil is near the towns of Lake Wales and Lake Hamilton.

Norfolk sand has a total area of 163.1 square miles. It occurs only in the northeast part of the county, where it occupies broad areas east of Winter Haven and north and east of Lake Wales, extending to the north county line.

Like Norfolk fine sand, this soil is well drained throughout, though in general the coarse texture is more likely to allow excessive internal drainage during long droughts.

About 75 per cent of the land is planted to citrus fruits. The remainder is largely forested with the same kind of trees as are on Norfolk fine sand. The utilization, management, and fertilizer requirements for this soil are practically the same as for Norfolk fine sand.

FORT MEADE FINE SAND

Fort Meade fine sand in the undisturbed forested condition has a surface layer from 4 to 6 inches thick of very dark gray or very dark brownish-gray slightly loamy loose fine sand which grades into dark brownish-gray loose mellow fine sand extending to an average depth of 28 inches. Below this and continuing to an average depth of 50 inches is a dark grayish-brown layer of rather loose incoherent fine sand which gradually changes to brown or brownish-yellow fine sand in the lower part. This layer rests on the upper part of the pebble-phosphate beds which occur at a depth ranging from 60 to 100 or more inches. The upper part of these beds consists of pebbly clayey sand and sandy clay of gray, yellow, brown, and, in places, red colors, the brown and gray predominating. The dark surface layers are slightly to medium acid, but lower down the materials are strongly acid in reaction.

Included with this soil in mapping is a dark phase which occurs in small shallow depressions and on the lower parts of slopes, where the texture is more loamy and the color much darker than typical. This dark soil extends to a depth of 3 or 4 feet in places. Where Fort Meade fine sand adjoins areas of Norfolk and Blanton fine sands there is a gradual change to a lighter-colored and thinner surface layer. Fort Meade fine sand occupies much better drained situations than either the Portsmouth or the St. Johns soils, but a gradation through a darker surface layer and a light-gray subsurface layer occurs where it adjoins these soils.

The total area of Fort Meade fine sand is 49.6 square miles. The largest development is in the vicinity of Fort Meade, where the soil occupies broad gently undulating areas from 2 to 3 miles in width on each side of Peace River. The soil occurs only in the southwest third of the county where the pebble-phosphate beds are known to lie at comparatively slight depths. Numerous small isolated areas occur as far east as Frostproof and northward 10 miles north of Lakeland.

Drainage of this soil is adequate. The ground-water level averages 15 or more feet below the surface. The moisture-holding capacity is greater than in most of the well-drained upland soils, but overhead sprinkling systems are generally installed where this soil is used for intensive truck gardening.

Approximately 80 per cent of the land is under cultivation and is utilized in about equal proportions for trucking, fruit growing, and general farming. The rest is cut-over land, utilized for grazing or held for speculation. The natural vegetation consisted of an excellent growth of longleaf and slash pines, with scattered clumps of live oak, turkey oak, and upland willow oak, and some hickory, dogwood, ironwood, magnolia, and cabbage palmetto. Wire grass and broom sedge are the principal grasses.

This is one of the most desirable general-purpose soils in the county. It produces strong thrifty citrus trees which yield a fine

quality of fruit, but the damage from freezing is in general greater on this soil than on the high rolling pinelands because it is less favorably situated with respect to water protection and air drainage.

Oranges, grapefruit, tangerines, lemons, strawberries, dewberries, and watermelons are the principal fruit crops grown, and yields average a little higher than on the Norfolk soils. Heavy applications of fertilizer are made.

Cabbage, tomatoes, beans, potatoes, peppers, sweetpotatoes, and sweet corn are the principal truck crops. Most growers use heavy applications of fertilizer and many have overhead sprinkling systems. Yields vary according to the season, management, and fertilizer applications. Tomatoes yield from 250 to 600 or more crates to the acre. (Pl. 4.)

Corn, peanuts, and velvetbeans produce well on this soil, and yields average higher than on other soils of the county, corn yielding from 25 to 50 bushels, peanuts about three-fourths ton, and velvetbeans 1,000 or more pounds to the acre.

The possibilities of successfully producing a great variety of crops on this soil are probably greater than on any other soil in the county. In general the land prices are about the same as for the Norfolk soils, though they depend on location with regard to shipping facilities, roads, schools, churches, and other facilities. All areas of the soil are of rather uniform quality, and undeveloped tracts offer attractive possibilities for further expansion of agriculture in the county.

BLANTON FINE SAND

Typical Blanton fine sand occupies slight knolls and ridges within and surrounding the flatwoods section of the county. The soil profile shows two distinct layers, moderately loose and incoherent fine sand ranging from 60 to 120 inches in thickness and, rather sharply divided from this, clayey or loamy fine sand, on which the loose sand rests. In virgin areas the surface 3 to 6 inch layer consists of moderately loose mellow gray fine sand, grading downward into a layer of light grayish-yellow loose fine sand from 14 to 20 inches in thickness. Below this, a layer of pale-yellow fine sand specked with white and yellow and ranging from 24 to 54 inches in thickness rests on weakly cemented yellow fine sand streaked and splotched with white, brown, and pale yellow. In places the pebble-phosphate beds lie just below this layer, but as a rule from 3 to 6 feet of light-purple clayey fine sand with small brownish-yellow and white stains and spots occur just above the beds. The soil is strongly acid in reaction in the upper 4 to 8 inches and very strongly acid to a depth just above the phosphate beds, below which depth the acidity decreases slightly.

Under cultivation the color of the surface soil changes to light gray, owing to the mixing of the surface layers and to depletion of the organic matter. However, heavy applications of fertilizer and continued plowing under of organic matter in shaded groves tend to make the surface layer darker and deeper.

The soil, as mapped, is rather uniform except where it occurs in close association with the Norfolk and St. Lucie soils. The grada-

tion to the more yellow colors of the Norfolk soils, on the one hand, and to the white colors of the St. Lucie, on the other, is gradual for a distance of several yards in places. A few small areas of medium sand texture were included in mapping. The largest of these is 3 miles northeast of Lake Wales, and the others lie due north of Polk City near the Lake County line. Some hammock growth occurs in places. The inherent fertility of these areas is generally believed to be greater than that of the typical soil.

A total of 129.9 square miles of Blanton fine sand were mapped. The most extensive developments are in the vicinity of Auburndale, Winter Haven, and West Lake Wales. Large areas occur around Lake Gibson and between Lakeland and Socrum, and smaller bodies are scattered throughout the county.

Drainage is good. Most of the larger areas are flat, but other areas range from flat to undulating or gently rolling. Approximately 35 per cent of the land is cultivated, the remainder supporting a scattered growth of longleaf pine and a moderately dense growth of upland willow oak mixed with blackjack, turkey, and live oaks.

In the order of their importance, the crops grown on this soil are citrus fruits, strawberries, truck crops, watermelons, and general farm crops, consisting principally of corn, peanuts, cowpeas, and velvetbeans. Fertilizer requirements, yields, and crop management are the same as for the Norfolk soils, but the soil as a whole is not so favorable for citrus fruit, owing to the greater danger from freezes in the flatwoods part of the county. The soil is low in plant-food elements but responds quickly to fertilizer and to green-manure crops. Heavy applications of fertilizer are given to all special commercial crops.

Blanton fine sand, shallow phase.—The shallow phase of Blanton fine sand differs from the typical soil mainly in the comparatively slight depth at which the sandy clay layer occurs. The shallow soil is also more loamy, owing to a greater proportion of fine material throughout the soil. Yields average somewhat greater than on the typical soil, though in general the danger from frosts and freezes is greater because of the lower elevation and higher water table of the phase.

A representative profile of Blanton fine sand, shallow phase, shows the following layers from the surface downward: From 0 to 3 inches, dark-gray fine sand; from 3 to 24 inches, light-gray fine sand having a pale-yellow tinge in places; from 24 to 34 inches, pale-yellow medium slightly loamy fine sand with white splotches scattered throughout; from 34 to 40 inches, brown, yellow, and light-gray light fine sandy loam, representing a transitional zone; and from 40 to 60 or more inches, red, yellow, and gray friable sandy clay, with the colors arranged in numerous streaks and spots.

Only 1 square mile of this soil is mapped in the county. A few small areas occur southwest of Frostproof, 1½ miles and 7 miles west of Lake Streaty. Other small scattered areas are mapped in the vicinity of Polk City, Poyner, Winston, and Galloway.

Most of the land supports a growth of longleaf and slash pines, scrubby upland willow oak, live oak, wild cherry, dogwood, and very scattered saw palmetto. Short myrtle bushes and wire grass are common.

EUSTIS FINE SAND

Eustis fine sand under forested conditions consists of a surface layer, from 2 to 4 inches thick, of dark grayish-brown mellow fine sand which gradually changes to brown incoherent fine sand. At a depth ranging from 12 to 16 inches this material grades into light reddish-brown fine sand which extends to a depth ranging from 60 to 80 or more inches. Below this is the heavier part of the soil, which consists of mottled light-gray, pale-yellow, and brown loamy fine sand grading downward through 2 or 3 inches of light sandy loam into highly streaked yellow, gray, brown, and reddish-brown sandy clay. Small scattered angular siliceous fragments occur on the surface and throughout the entire soil. The soil material to a depth of a few inches below the surface is medium acid in reaction, gradually changing with depth to strongly acid and below a depth of 24 inches to very strongly acid. Plowing mixes the materials of the upper layers and develops a brown color with a slightly reddish tinge.

The depth to sandy clay, the intensity of the brown coloring, and the degree of redness vary considerably in mapped areas of this soil, and in places small patches of Norfolk sand are included. Eustis fine sand is not extensive, its total area being 11.1 square miles. The largest development is at Bartow and in the vicinity of that place, where the soil occupies comparatively level, gently sloping, or undulating areas. Scattered patches occur northwest of Bartow on the divide which extends from northwest to southeast through Lakeland, Galloway, Kathleen, and Socrum. A small area is mapped about 6 miles southeast of Fort Meade.

Eustis fine sand is naturally well drained. Its moisture-holding capacity is fair, but the soil is greatly benefited by the addition of organic matter. Overhead irrigation systems are installed for intensive trucking operations.

Approximately 90 per cent of this soil is under cultivation. The remainder is either utilized for home sites or is left forested with live oak, turkey oak, blackjack oak, longleaf pine, and magnolia. The cultivated area is about equally divided between fruit growing, principally citrus fruits, and truck gardening. The soil is especially desirable for grape and berry production, and these crops are rapidly gaining in favor, as the yields and quality average better than on other soils of the county. Strawberries, watermelons, and dewberries are grown successfully. The principal truck crops are cabbage, tomatoes, and beans, but the soil is adapted to a great variety of other crops. (Pls. 5 and 6.) In general it is considered too valuable for general farming, except that corn, peanuts, or a legume crop may be added to the annual rotation.

ORLANDO FINE SAND

Orlando fine sand has a surface layer ranging from 8 to 12 inches in thickness of very dark-gray moderately loamy fine sand containing a high proportion of finely divided organic matter. It is underlain by dark-gray rather loose fine sand. At an average depth of 24 inches the color gradually becomes lighter, and a layer of light-gray fine sand with scattered yellow and brown iron stains is reached.

This extends to a depth of about 54 or 60 inches and rests on sandy clay. The soil ranges from medium to strongly acid in the upper part and very strongly acid in the lower part. In virgin areas the surface layer consists of almost black smooth loamy fine sand to a depth of 4 inches, and below that the material is a shade lighter and looser.

The upper part of the soil varies somewhat in degree of darkness and depth, and the lower part is pale. Where the soil grades into Portsmouth fine sand the lower layer gradually becomes whiter and the water table is nearer the surface. Small areas are included which have a second organic layer, occurring at various depths, which is similar to the compact organic layer of the Leon soils.

The total area of this soil mapped in Polk County is only 1.4 square miles. The land occupies topographic positions similar to those of the Fort Meade soils, but it lies outside of the principal region of the pebble-phosphate beds. Practically all the soil occurs in the vicinity of Lakeland.

Good drainage prevails both on the surface and internally. The ground-water level ranges from 5 to 10 or more feet below the surface.

Practically all the land is under cultivation. It is especially desirable for strawberries and truck (pl. 7), as well as for citrus fruits. Yields are comparable to those prevailing on the Fort Meade soils, and the management and fertilizer applications are about the same. More extensive areas of this soil occur in Lake and Orange Counties to the north.

Orlando fine sand, hardpan phase.—A few scattered areas of Orlando fine sand, hardpan phase, are mapped near Lakeland and on the hammocks along Kissimmee River in the southeastern part of the county. Soil of the phase differs from the typical soil in having a dark-brown organic layer similar to that in the Leon soils but less indurated. Drainage is good on the surface and in the upper part of the soil. The ground-water level is from 6 to 10 feet below the surface.

The hammock areas along Kissimmee River occur as narrow low-lying ridges and support a heavy growth of cabbage palmettos and live oaks.

Only 0.7 square mile of this soil is mapped in the county. About 50 per cent of the land is cultivated. Crops, yields, requirements for fertilizer, and farm management are comparable to those on Orlando fine sand and Fort Meade fine sand.

PORTSMOUTH FINE SAND

Portsmouth fine sand is characterized by a very dark gray or almost black surface layer of loamy fine sand from 10 to 14 inches thick, underlain by light-gray loose incoherent fine sand which is saturated with water most of the time. This material continues downward to a depth of about 30 inches and gradually changes to light grayish-yellow fine sand which extends to the mottled yellow, gray, and red sandy clay beds lying at a depth ranging from 50 to 100 or more inches below the surface. In the southwest corner of the county a sandy marly formation underlies this soil at depths ranging from 60 to 120 inches. The soil is strongly acid in reaction

in the upper part, becoming medium acid lower down, and neutral or alkaline at a depth ranging from 48 to 120 or more inches.

Spots of St. Johns fine sand and a medium-textured Portsmouth soil are included in mapped areas of this soil. The thickness and darkness of the surface layer vary within short distances. Around the edges of marshes and in shallow wet depressions the topmost part of the surface soil is mucky in many places, owing to the accumulation and subsequent incomplete decomposition of organic matter.

The 98.9 square miles of this soil mapped are distributed in all parts of the county, but the most extensive development is in the southern part, particularly in the vicinity of Brewster and Fort Meade and around Lakes Arbuckle and Weohyakapka (Walk in the Water). Narrow strips occur along Kissimmee River and above the shallow valleys of many small streams in the southern part of the county.

Natural drainage is poor, as the soil is either permanently saturated or alternately wet and dry, owing to its low position in flats and shallow depressions in the flatwoods. Many of the areas may be efficiently drained by open ditches, and a few have been drained and are successfully utilized for truck gardening and strawberry production. A great variety of truck crops may be grown on this soil after it has been properly drained. Yields average more than on some of the better-drained soils, but the hazard from low temperature is, in general, greater than on higher land.

Not more than 5 per cent of Portsmouth fine sand is cultivated. The natural vegetation consists of slash, black (locally known as loblolly), and longleaf pines, scattered turkey oak, cabbage palmetto, and an undergrowth of saw palmetto, myrtle, carpet grass, and wire grass, which together with briars, smilax, and other vines form a dense mass.

Portsmouth fine sand, swamp phase.—Portsmouth fine sand, swamp phase, has the same succession of layers as the typical soil but is, in general, darker in color. The agricultural possibilities are less favorable, as the land is flooded during the greater part of the year and artificial drainage would be much more difficult than on the typical soil. The principal development of this swampy soil is southeast of Frostproof along Arbuckle Creek, where the land supports a growth of water oak, cypress, sweetgum, black gum, red maple, bay, and scattered slash and loblolly pines, cabbage palmetto, and water-loving plants. The land is utilized exclusively for grazing and forestry.

PARKWOOD FINE SANDY LOAM

To a depth ranging from 12 to 16 inches, Parkwood fine sandy loam in its virgin state consists of a 3 to 5 inch layer of mellow, strongly acid, very dark gray loamy fine sand underlain by like material, the color of which changes gradually to gray with a faint brownish tinge in the lower part. When moist the soil adheres slightly, but when dry it is loose and incoherent. This layer changes abruptly to a calcareous sandy clay layer, which extends to a depth ranging from 54 to more than 60 inches. The upper 6 or 8 inches of this layer are sticky and plastic gray sandy clay with small yellow and brown stains or splotches, and this material grades through a

3 to 6 inch layer of light-gray sandy clay into grayish-white gritty sandy clay loam which is apparently a formation of marl having a high lime content. This marly material occurs at various depths but is within easy reach of plant roots. Angular flint-rock fragments, ranging from a few inches to 2 or more feet in diameter, occur on the surface and throughout the soil in places. As mapped, this soil includes small areas of Leon loamy fine sand.

The total area of Parkwood fine sandy loam is 7 square miles. It occurs in irregular patches roughly paralleling Withlacoochee River in the northwest part of the county and Saddle Creek east of Lakeland. Other small areas occur as low hammocks 5 or 6 miles southeast of Nalaca.

Parkwood fine sandy loam is not sufficiently drained, as a rule, for best results in farming. However, a number of areas could be cleared and drained with little expense. Most of the soil could be utilized for hay crops, for permanent pasture, or for trucking. Only about 1 per cent has been cultivated. The remainder is timbered with an excellent growth of slash pine, longleaf pine, together with scattered saw palmetto, cabbage palmetto, and wire grass. The wetter parts support dense thickets of myrtle bushes. Corn yields from 30 to 50 bushels, and cowpeas and velvetbeans yield from 1 to 2½ tons of hay to the acre. Potatoes, beans, cabbage, lettuce, beets, tomatoes, and many other vegetables and fruits produce well when the soil is properly drained. Less fertilizer is used on this soil than on other soils of the county. The soil can be built up to a good state of productivity.

Parkwood fine sandy loam, deep phase.—Except for the greater thickness of the sandy surface layer and greater depth to calcareous material, the deep phase of Parkwood fine sandy loam is similar to the typical soil. The normal soil profile shows 3 or 4 inches of very dark-gray mellow loamy fine sand overlying a layer of gray fine sand stained and specked with yellow and brown and gradually changing to light brownish gray. This rests on a bluish-gray plastic, sticky, and rather tough sandy clay layer at a depth ranging from 17 to 50 inches. Marly material containing sufficient lime to effervesce freely with cold dilute hydrochloric acid occurs below a depth of 50 or 60 inches.

This deep phase of soil occupies shallow depressions or occurs along intermittent drainage ways in the flatwoods. The largest areas are southwest of Fort Meade, and small scattered patches occur in other parts of the county.

This soil requires artificial drainage. Less than 5 per cent of the land is under cultivation. The crops, fertilizer requirements, and methods of handling the soil are similar to those prevailing on typical Parkwood fine sandy loam. Yields average somewhat less.

The natural vegetation consists of slash pine, loblolly pine, sweetbay, water oak, cabbage palmetto, myrtle, and a luxuriant undergrowth of moisture-loving vines and bushes.

PARKWOOD CLAY LOAM

Parkwood clay loam, in its virgin condition, has a thin veneer of leaf litter below which is a 1 or 2 inch layer of very dark gray or almost black loamy fine sand. This layer grades into a 2 or 3

inch layer of dark-gray loose loamy fine sand which passes rather abruptly into very dark gray heavy waxy sticky loam tinged with brown and spotted with yellow. This material extends to a depth ranging from 10 to 14 inches and is underlain by a grayish-white marly layer containing a high proportion of lime. Limestone fragments are scattered throughout this marly formation. The sandy surface layer ranges from medium to strongly acid in reaction, but the heavier layer becomes neutral or alkaline within the first few inches.

The depth to the marl layer varies considerably. In places the marl outcrops at the surface, and in other places 18 or 20 inches of sand overlie it.

Of the 8.1 square miles of Parkwood clay loam mapped, less than 40 acres are under cultivation, chiefly because of the poorly drained condition of the land but also because of a lack of appreciation of the inherent value of the soil. When drained this soil is capable of producing good yields of grains, vegetables, small fruits, citrus fruits, and hay crops including many legumes. The danger from freezes is greater than on higher-lying soils. This soil requires much more power for cultivation than the sandier types. Where the marly material lies within plow depth the ground should be worked for a year or two before planting special crops, though corn and hay may be grown. The tilth and productiveness become more desirable with cultivation. The fertilizer requirement of this soil is less than of any other soil in the county.

This soil supports a hammock growth of water oak, cypress, magnolia, bays, gums, cedar, hickory, and ash. Large cabbage palmettos are common.

The principal areas mapped are in the Peace River Valley below Fort Meade, along the south bank of Withlacoochee River west of Rock Ridge School, and along Saddle Creek east of Lakeland.

BLADEN FINE SAND

A representative profile of Bladen fine sand, where forested, shows a thin surface accumulation of leaf litter overlying a layer from 2 to 4 inches thick of very dark gray loamy fine sand. Below this the material grades through an 8 or 10 inch layer of dark-gray and gray slightly loamy fine sand into light-gray fine sand thickly specked with dark-brown stains. The stains become more numerous to an average depth of 3 feet, where brownish-gray slightly sticky loamy fine sand or light fine sandy loam specked with dark brown is reached. This material gradually becomes heavier with depth, and at a depth ranging from 60 to 90 inches it rests on heavy sticky plastic fine sandy clay having a bluish tint with scattered spots of yellow and brown in places. The surface soil is very strongly acid, the sandy clay layer is medium acid, and below a depth of 10 feet the material is alkaline in most places. The change in reaction is gradual.

This soil varies in the shade of gray and brown in the sandy part of the profile and in depth to the sandy clay material. The depth to this material ranges from 48 to 100 or more inches. In cultivated fields the two upper natural layers of the virgin soil become mixed and appear as gray, rather loose, fine sand. The organic matter

is rapidly depleted unless an effort is made to retain it by plowing under green-manure crops and crop residues.

Bladen fine sand occurs mainly in the southeast part of the county between Frostproof and Kissimmee River. Small scattered areas occur in all parts of the county, occupying shallow depressions in the flatwoods and flats bordering the lakes and swamps.

Natural surface drainage and internal drainage are inadequate. Water stands on the surface in many places during the rainy season.

Less than 5 per cent of the soil is cultivated. Corn, cowpeas, and peanuts are the principal farm crops. Yields of corn range from 10 to 30 bushels to the acre; of cowpeas and other hay crops, from one-half to 1 ton; and of peanuts, from one-fourth to three-fourths ton. Sugarcane, potatoes, beans, sweetpotatoes, tomatoes, bell peppers (mangoes), lettuce, radishes, and many other truck crops may be grown successfully when the soil has been properly drained and heavy applications of fertilizer have been made. General management and methods are similar to those prevailing on the other poorly drained soils of the county.

In its present state the soil is utilized for grazing and forestry purposes. Wire grass, broom sedge, very scattered saw palmetto, wild grapes, gall berry, pitcherplants, and myrtle bushes form the principal undergrowth. The native trees are chiefly slash pine, scattered longleaf pine, live oak, cabbage palmetto, and some maple and hickory.

Bladen fine sand, prairie phase.—Bladen fine sand, prairie phase, occurs in the southeast part of the county in a treeless area roughly paralleling Kissimmee River. This soil differs from the typical soil not only in having a prairie vegetation but also in its physical characteristics. The surface soil to a depth ranging from 6 to 10 inches is dark brownish-gray fine sand. It is underlain by a layer of bright-yellow fine sand from 12 to 24 inches thick. In places reddish-brown spots and numerous small iron concretions occur in the lower part of the yellow layer. Below this is very light gray water-saturated fine sand which rests rather abruptly on bluish-gray sticky plastic fine sandy loam or fine sandy clay at an average depth of 40 inches. In places this material is mottled with yellow and brown. The soil is alkaline throughout, becoming strongly alkaline in the sandy clay layer. As mapped, many small areas, in which the bright-yellow layer does not occur, are included. The soil in these areas resembles typical Bladen fine sand.

The prairie phase of Bladen fine sand occupies long shallow depressions ranging in width from a few yards to one-half mile in places. Most of the land is in a saturated condition with water standing on the surface during the rainy season. It is utilized only for pasture land, but with drainage conditions corrected it would require little effort to bring the land into cultivation. It supports a growth of coarse grasses, pitcherplants, and small myrtle bushes.

LEON FINE SAND

A typical profile of Leon fine sand shows a fine sandy surface layer ranging from 18 to 24 inches in thickness which contains sufficient finely divided organic matter in the topmost 3 to 6 inches to impart a dark-gray color to the leached light-gray fine sand. The content

of organic matter decreases with depth until the color is light gray or almost white in places. The surface soil, as a rule, is divided by a sharply defined line from the underlying brown, very dark brown, or almost black hard compact fine sand, commonly termed "hardpan," which averages from 3 to 6 inches in thickness and grades downward through 6 or 8 inches of loose light-brown fine sand into very light yellowish-gray or white sand which continues to a depth ranging from 60 to 80 inches, where bluish-gray fine sandy clay streaked and spotted with dark brown is reached. The soil materials are rather sticky and plastic when wet.

The soil is strongly acid throughout. The dark-brown organic layer, or so-called hardpan stratum, is extremely acid and contains a concentration of organic acids and iron salts in many places. This layer has apparently developed at approximately the average ground-water level. It retards both the downward movement of percolating water and the upward movement of water by capillarity. In its natural state penetration with hand implements is difficult. In many places the roots of plants and trees have turned and spread out horizontally through the layer. Below the main hard stratum tongues, seams, and streaks of the dark-brown organic material extend down root channels and crevices through the fine sand layers.

The different layers of Leon fine sand vary in thickness. The surface soil varies in content of organic matter, and the organic hardpan stratum varies from place to place. The depth to the hard layer varies from 6 to 40 inches and the thickness of this layer ranges from 1 to 100 or more inches. Two or more successive hard layers may occur in places where the sandy clay beds lie at a depth of several feet. Small areas having medium-sand texture are included with the soil as mapped.

Leon fine sand is the most extensive soil in Polk County, a total of 450 square miles having been mapped. It occurs in the flatwoods in all parts of the county except in that part lying north from Haines City and Polk City to the county line. Large areas are between Frostproof and Kissimmee River, south and west of Fort Meade, extending to the county line, in the northwestern part of the county, and between Lakeland and the county line.

Areas of this soil are flat or very gently undulating. This, together with the high water table, renders surface drainage as well as internal drainage poor. Water stands on the surface in many places during the greater part of the rainy season. Where sufficient fall for an outlet is obtainable, large open ditches would greatly improve drainage conditions, but only on small scattered patches have attempts been made to drain the soil. An extensive drainage project would probably not be justified, owing to the low content of plant food and the looseness of the fine sand both above and below the compact stratum.

Ninety per cent or more of this soil is utilized for grazing and forestry or has been mined for land-pebble phosphate. (Pl. 8.) A few small patches have been cultivated intensively for shallow-rooted truck crops, such as potatoes, beans, peas, lettuce, radishes, cucumbers, squash, okra, and salsify, but only fair yields have been obtained in the most favorable seasons. Corn, hay, and strawberries are grown to a small extent. Heavy applications of fertilizer are required for all crops.

The tree growth is predominately longleaf and slash pines. The mature trees are not so large on this soil as on soils lacking the compact or cemented layer. A rather dense stand of short saw palmettoes forms the common undergrowth. Wire grass affords some grazing in the more open places. Gall berry, oak runner, and some myrtle grow in the slight depressions. Timber production, as a permanent industry, should be profitable on this soil, as the initial cost is usually low, and not only lumber but also turpentine and other naval stores can be produced. With particular attention given to reproduction, care of young growth, fire prevention, careful boxing for turpentine, and cutting of mature timber only, a profitable and permanent industry could be developed.

Leon fine sand, loamy phase.—The loamy phase of Leon fine sand differs from the typical soil primarily in having clayey material at a depth, in most places, ranging from 34 to 40 inches and in having more fine material in the layer above the clayey substratum. The soil has a surface layer of very dark gray loamy fine sand from 3 to 6 inches deep, which changes gradually into light-gray fine sand which, in turn, rests on a very dark brown or almost black hard, compact, organic layer at a depth ranging from 20 to 30 inches. The upper and lower boundaries of this layer may be very clearly defined or may show a gradual blending of colors, depending on whether the concentrated part of the compact stratum occurs in the upper, middle, or lower part. As a rule, from 4 to 6 inches of light-brown, yellowish-brown, or light-gray loamy fine sand occur between the compact layer and the fine sandy clay beneath. This layer is predominately gray white with numerous small specks and stains of yellow and brown. It grades into bluish-gray and white sticky plastic calcareous sandy clay. In places the organic hardpan directly overlies the clayey formation.

Soil of this phase occurs chiefly in the northwest part of the county along Withlacoochee River and its headwaters northeast of Polk City. A small area lies west of Lakeland near Winston, and several are between Lakeland and Auburndale.

The surface configuration and drainage conditions are similar to those of the typical soil. The land is chiefly utilized for forestry and grazing. This loamy soil is more favorable for agricultural development than typical Leon fine sand because the sandy layers have more body, and calcareous clayey layers occur at comparatively slighter depths, and fewer saw palmettos occur in the undergrowth. It is suited to the same farm and truck crops as the typical soil, and the fertilizer requirements, methods, and management are similar.

Leon fine sand, prairie phase.—The prairie phase of Leon fine sand occurs along Kissimmee River in the southeast part of the county. It is similar to the typical soil in its physical characteristics, but it does not have the same tree growth. Oak runner, very scattered saw palmettos, and wire grass form the principal vegetation. Land of this kind can be brought under cultivation without the usual heavy expense for clearing, and for this reason the untimbered areas were separated from the typical Leon fine sand in mapping. Drainage requirements, crop adaptations, and fertility are identical with those of the typical soil.

LEON SAND

Leon sand is similar to Leon fine sand except that the texture is coarser, being medium sand. A normal profile of Leon sand shows a 4 or 5 inch surface layer of gray rather loamy sand, underlain by a 16-inch layer of very light gray incoherent sand. The hard organic layer lies below this and averages about 9 inches in total thickness, though the hardest and darkest part rarely exceeds 3 or 4 inches. This material grades into an 8 or 10 inch layer of brown sand having some dark seams caused by penetration of the overlying material. Below this is a layer, ranging from 3 to 5 or more feet in thickness, of pale yellowish-gray sand which is loose, incoherent, and saturated with water.

Variations occur where this soil grades into the associated Plummer, St. Lucie, and Bladen soils, and into peaty muck and swampy areas. Here the organic hardpan gradually thins out and disappears. Along the borders of swampy areas and near the Bladen soil, the sandy clay layer is, as a rule, nearer the surface.

This soil occurs only in the northeast part of the county and is one of the less extensive soils of the county. The largest area lies $6\frac{1}{2}$ miles east of the village of Lake Hamilton. Smaller, scattered patches occur around Lake Pierce and in the swampy sections west and northwest of Haines City and north of Polk City.

The soil occupies flat, slightly depressed, or gently undulating areas. The water table stands within about 40 inches of the surface even during the dry season, and water frequently covers the surface during the rainy season. The land is chiefly utilized for forestry and grazing, for which purposes it is best suited under present conditions.

ST. JOHNS FINE SAND

St. Johns fine sand is very dark gray or almost black to a depth ranging from 6 to 14 inches. Owing to the high organic-matter content, the material in this layer has a loamy feel. It is underlain by a very dark brown layer in which organic materials are concentrated. This layer ranges from 5 to 14 inches in thickness, is, as a rule, very compact and hard in the upper 2 to 4 inches, and becomes less compact and lighter brown with increasing depth. The material changes to light-brown fine sand which extends to a depth of 48 or more inches, at which depth it rests on the clayey layer.

Many small areas of this soil were included with Leon fine sand in mapping, owing to the intricate association of the two soils in the northern part of the county. The color and depth of the different layers vary considerably, but their relative arrangement is maintained except that in places an additional thin light-gray layer occurs just above the hardpan stratum. Around the borders of some of the ponds and mucky areas the organic content is very high and the surface layer has a thin covering of black mucky material.

The largest development of this soil is in the southwest part of the county, south of Brewster and Fort Meade, but areas are distributed over the entire county, occurring in small patches, such as those northeast of Polk City, or in long narrow strips in winding depressions, such as those in the southeast part of the county east of Lake Arbuckle.

St. Johns fine sand occupies low-lying flatwoods country slightly lower than the Leon soils with which it is associated. It is naturally very poorly drained, being water-logged the greater part of the year.

The natural vegetation is like that on the Leon soils. Pines, as a rule, grow taller than on the Leon soils. The undergrowth of palmetto, gall berry, sedges, and myrtle is dense and rank. More than 95 per cent of the land is utilized for forestry and grazing. Of the remainder, a part has been stripped and mined for land-peat phosphate, or an attempt has been made to drain and cultivate it.

The soil is suited to the same agricultural utilization as Leon fine sand and is approximately of equal value, considering possible yields and natural fertility. Reclamation would be expensive owing to the rank growth of palmettos and timber, to the sourness of the soil, and to the poorly drained condition.

ST. LUCIE FINE SAND

St. Lucie fine sand is commonly known as "scrub land" because of its natural growth of spruce pine, dwarf evergreen oaks, and a scattered growth of rosemary, saw palmetto, and, in places, prickly-pear (a cactus). Grasses are almost entirely lacking. The sand contains a mingling of dark organic matter in the upper 2 or 3 inches, giving it a salt-and-pepper appearance. Below this is white loose incoherent fine sand with very scattered brown stains and streaks along root channels. This material continues without variation to the clayey beds which occur at a depth ranging from 6 to 20 or more feet. The soil is acid in reaction to a depth ranging from 4 to 6 feet, and, below this, in places, the reaction is only slightly acid or almost neutral.

Of the 56.7 square miles of this soil occurring in Polk County, the greatest developments are immediately west and northwest of Frost-proof on the west and south sides of Clinch Lake, and west of Lake Livingston and Lake Caloosa. Comparatively large areas occur near Lake Rosalie, west of Winter Haven and Bartow, and around Lakeland.

The soil occupies undulating hammocky land or ridges and slight knolls between the high pineland and flatwoods regions. Drainage is excessive throughout. Even in the rainy season the ground remains comparatively free of moisture.

St. Lucie fine sand is practically nonagricultural. Pineapples and oranges are grown in a few places. Locally, where the sand is suitable in texture and sharpness, it is quarried for cement work, silica bricks, and other building materials.

PLUMMER FINE SAND

Plummer fine sand or "sand soaks," as it is locally termed, consists of a layer, from 6 to 13 inches in thickness, of gray loose fine sand grading to light-gray fine sand which changes to almost white water-soaked fine sand at an average depth of 24 inches. It is underlain at a depth ranging from 6 to 10 or more feet by bluish-gray sandy clay. The surface layer is very strongly acid in reaction, the light-gray layer is strongly acid, and the water-soaked layer is neutral or slightly alkaline.

The texture, organic content, and thickness of the different layers are variable. In the southeast part of the county in the vicinity of Lake Weohyakapka and Lake Arbuckle the organic content in the surface layer is greater than is typical. These areas grade into the Portsmouth and Bladen soils with which they are closely associated, and in places a yellowish subsoil layer occurs. West of Lake Livingston and in the northeast part of the county small areas having a medium texture have been included with Plummer fine sand in mapping.

Plummer fine sand is extensively developed in the more poorly drained sections of the eastern part of the county and in broad shallow depressions and on margins of lakes and ponds in all parts of the county. Large areas occur east of Frostproof, northeast of Davenport, and east of Lake Hamilton. Other extensive areas are around Winter Haven and between Bartow and Mulberry.

The surface is flat, and the soil is naturally very poorly drained both internally and on the surface. Water commonly stands on the surface during rainy periods.

Longleaf and slash pines, saw palmetto, wire grass, gall berry, and myrtle constitute the chief natural vegetation. The coarse grasses afford some grazing, and this, together with forestry, are the uses for which the soil is best suited. The land is not cultivated, and under present conditions an attempt to bring it into cultivation is considered uneconomical.

PEAT

In Polk County peat in its natural state consists of brown or dark-brown partly decomposed remains of saw grass, water-hyacinth, bonnets (yellow pond lilies), bulrushes, bay, and other water-loving plants. It contains little mineral matter. As a rule the material in the topmost 2 or 3 inches is finer, less fibrous, and darker than the remainder, the color ranging from dark brown to almost black. This material is underlain by brown or dark-brown spongy fibrous material containing scattered woody fragments and plant remains and, in places, shells. This layer, in turn, rests on a gray sandy layer at a depth ranging from 1 to 15 or more feet.

Large areas of peat occur just northwest of Davenport, south of Lake Hamilton, and southwest of Lake Wales. A total of 30.9 square miles is mapped. Small irregular-shaped areas have developed around the borders of many lakes.

Peat forms in lakes, swamps, and marshes and along their borders, and always in the presence of water. In its natural state it is permanently water-logged, and the surface is covered with water most of the year.

A few areas of peat have been drained by open ditches, and attempts have been made to utilize them for the production of such crops as potatoes, beans, cabbage, blackberries, and sweet corn. One planting of bananas has been made. However, as these attempts have been followed by many failures no recommendations can be made for the utilization of the peat land for cultivated crops. The expense of draining, the hazards from frosts, the deficiency of available plant food, the high acidity, the tremendous shrinkage of the material on exposure to air, and the consequent difficulty of maintaining a con-



Cabbage, irrigated by the overhead system, on Eustis fine sand



String beans on Eustis fine sand



Strawberries on Orlando fine sand in foreground, and orange grove on the higher-lying Blanton fine sand in background



Hydraulic mining of pebble phosphate underlying Leon fine sand

stant relative height of the water table are factors which practically eliminate the peat areas as possible permanent agricultural land.

Peat for fertilizer filler has been shipped from the county for some years.

PEATY MUCK

Peaty muck represents material in a further stage of decomposition than peat and generally it is more variable in composition, contains more mineral matter, and, though covered with water during the greater part of the year, supports a very dense growth of vegetation. A representative profile shows a surface layer of leaves, limbs, logs, moss, and woody peat, from 8 to 12 inches in thickness, underneath which is a layer of black or very dark brown rather finely divided organic matter and fibrous peat with some admixture of mineral soil, though much less than occurs in typical muck. This layer varies greatly in thickness in various parts of the county and also in different parts of a particular area, ranging from 20 inches to 10 or 12 feet. Gray sand and, at a greater depth, sandy clay underlie the lower organic layer. The materials of the upper organic layers are, as a rule, strongly acid.

Scattered areas of peaty muck occur in poorly drained situations in all parts of the county, along poorly defined drainage ways, at the heads of streams, and around the margins of shallow-water lakes. The largest area, which is more than 2 miles wide in places, occurs east of Davenport and Haines City, extending from the county line near Loughman south to Lake Hatchineha.

The dense vegetation consists of slash pine, loblolly pine, sweetbay, tupelo gum, sweetgum, black gum, pondcypress, red maple, magnolia, titi, and myrtle, and also many species of ferns, vines, moss, and herbaceous plants.

Practically none of the peaty muck has been brought into cultivation, owing to the cost of drainage and clearing. Small areas favorably situated have been utilized for truck crops. The hazard attending attempts at the utilization of this material for agriculture is similar to that of peat, though, in general, the available plant food is greater in the peaty muck than in the raw peat.

WATER AND GRASS

The areas classified as water and grass are characterized by shallow ponds having a thick growth of coarse water-loving grasses and sedges. They occur in all parts of the county but are most numerous in the southern part, especially northeast of Frostproof between Lake Weohyakapka and Lake Reedy.

A variety of soils occurs in these ponds, but owing to their permanently saturated condition and variability a separation into series and types was not warranted. As a rule the surface layer is dark-gray sandy material high in organic matter, ranging from a thin veneer similar to the surface soil of Plummer fine sand to material like peaty muck. Below this, light-colored sand, ranging in texture from fine sand to sand, commonly occurs, and it is underlain at varying depths by beds of sandy clay, marl, or clayey sand. The poorly drained phases of the Portsmouth, Plummer, and Bladen soils most

commonly occur in these areas. The water and grass ponds are not utilized for agriculture, but they afford some grazing when the water is low.

CYPRESS PONDS

Cypress ponds is a term used to designate the numerous ponds which support a dense growth of pondcypress trees and a water-loving undergrowth. This is purely a vegetative and topographic separation, since the expense of a detailed separation of the soils is not justified under present conditions. However, numerous examinations indicate that the principal soils are poorly drained phases of the Plummer, Bladen, Portsmouth, and Parkwood soils. A few inches of brown or dark-brown peaty material covers the surface of most areas, and this material is underlain by gray sand or fine sand which in turn rests, at depths varying from 2 to 6 feet, on gray or bluish-gray sticky plastic sandy clay or fine sandy clay. Most of the smaller ponds and narrow winding areas are in reality a cypress-pond phase of Plummer fine sand. Many of these are dry during part of the year. The larger ponds, which generally contain water throughout the year, are underlain by clay at a comparatively slight depth.

The total area of cypress ponds is 43.3 square miles. By far the greater number occur north and northwest of Lakeland, though small scattered ponds occur in all parts of the county.

These areas afford some grazing for hogs and cattle but are chiefly utilized as a source of fence posts, telephone and telegraph poles, and bridge timbers.

SWAMP

Swamp, as mapped in Polk County, includes low-lying timbered areas along streams. They are subject to overflow and are permanently saturated with water. The soils comprising these areas vary in texture, color, composition, and thickness of the various layers within short distances. The most extensive bodies of swamp lie along the headwaters of Withlacoochee and Peace Rivers northeast and south of Polk City. In these areas the swamp most commonly has from 8 inches to 4 or more feet of water over brown fibrous and woody peat which averages 10 inches in thickness. The peat is underlain by a few inches of gray or very light gray sand or fine sand which grades into bluish-gray sticky plastic sandy clay or fine sandy clay streaked and splotched with yellow and brown iron stains.

Swamp phases of St. Johns, Portsmouth, and Plummer soils are included in swamp as mapped in Polk County, as are also peat, peaty muck, and fresh-water deposits.

The characteristic tree growth consists of pondcypress, bay, gums, together with some loblolly pine, ash, water oak, swamp chestnut oak, and a very thick undergrowth of vines, briars, and herbaceous plants.

Owing to the difficulty and expense of classifying the soils under prevailing conditions, no detailed mapping was done in the swamp areas. At present these areas are not used for agricultural purposes. Their chief value is for forestry. Hogs and cattle range over the swamp during low-water periods.

COASTAL BEACH

Coastal beach includes strips of light-gray and white sand containing shells, shell fragments, and pieces of grass, limbs, and drift-wood. These strips occur on the western shore of Lake Kissimmee, having been formed by the action of winds and waves. They have no agricultural value, but afford desirable sites for camps and cottages. The larger areas support a scattered growth of live oak and cabbage palmetto.

MINE PITS AND MINE DUMPS

In the process of mining land-pebble phosphate, comparatively large areas are stripped of the overburden of soils, and large pits are made. The overburden and the waste material remaining after washing the gravel are returned to the excavations or dumped on adjoining land. The extent of these dumps and pits has been shown on the accompanying map. Most of them lie as waste land, though grasses and shrubs have gained a foothold on some of the older ones which afford some grazing. Such land is not utilized for agriculture, though it is probable that after exposure, for a number of years special crops may be grown, especially legumes for hay or pasture. Some of the open pits are wide and are several feet deep, and in some of them water stands to a depth of several feet. The dumps give a rugged appearance to the country.

SOILS AND THEIR INTERPRETATION

The soils of Polk County have developed under the influence of a humid subtropical climate and a vegetation consisting chiefly of forest trees. Under these conditions weathering, with its accompanying agencies, has been little restricted on the higher-lying well-drained parts of the unconsolidated deposits of the lower coastal plain. This, together with the fact that most of the deposits are comparatively sandy and the strata underlying them are more or less porous, has resulted in the accumulation of thick layers of surface sands. The finer particles have been removed from these layers by percolating water and have been redeposited at lower levels or have been carried away to the streams. The leaching of soluble salts and the oxidation of organic matter have been rather thorough. In the upper 3 or 4 inches of soil finely divided organic matter is mingled with the particles of sand, particularly in the areas still forested and in old citrus groves, where oxidation has not been so rapid. The surface sands are generally light gray or brown and are strongly acid in reaction.

In the Fort Meade and Orlando soils the layers of surface sand are dark colored and well humified, presumably owing to the difference in the character of their parent material and to the more recent emergence of the parent material from a poorly drained condition. In their distribution these soils coincide very closely with the region underlain at comparatively slight depths by the land-pebble phosphate formations. The thickness of the surface sands depends primarily on local topographic and drainage conditions and also on the character of the parent material. Disintegration of the

parent deposits and the subsequent thickening of the surface sands apparently proceeds most rapidly in places where the water table is highest and the clay content least. Such conditions prevail in the high pineland region. A rather sharp line of demarcation separates the accumulated surface sands from the clayey sand beds below, and in cuts where this dividing line occurs it may be seen to follow the contour of the surface configuration very closely except where erosion and surface wash or other factors have entered.

Norfolk fine sand and Norfolk sand most nearly represent the normally developed soils of the region. Virgin Norfolk fine sand has only a scant covering of leaf litter on the surface, and, as a rule, the leaf mold is practically negligible. A dark-gray slightly loamy fine sand darkened by a mingling of finely divided organic matter with the mineral particles forms the upper 2 or 3 inch layer, or A_1 horizon. The organic content decreases rapidly below this, and the color becomes correspondingly lighter. The second layer, or A_2 horizon, consists of light grayish-yellow or yellow rather loose incoherent fine sand to an average depth of 36 inches. Below this a layer of brownish-yellow loose fine sand extends to a depth ranging from 60 to 120 or more inches, constituting the A_3 horizon.

The B horizon consists of yellowish-brown friable and mellow fine sandy loam or loamy fine sand which is massive, uniform in color, and has no definite breakage lines. At the lower boundary or gradational zone reddish-brown splotches occur in places. This layer ranges in thickness from a fraction of an inch to 20 inches, evidently depending mainly on the clay content of the parent material.

The C horizon, representing the later stage of the disintegration of the parent material, is reddish, yellowish, and light-gray clayey fine sand or light fine sandy clay. The colors are about equally divided and appear in a vertical cross section as separate spots or as streaks and seams intersecting at various angles. The reddish spots occur in various stages of hardness where exposed to the atmosphere, in a few places forming soft pebbles. The sand grains are softly cemented with clay or other cementing agencies. This characteristic, together with the crusting or induration of exposed faces, prevents crumbling in a vertical wall. The combined materials are rather compact and hard but crumble to a sandy mass when pressed firmly in the hand.

In most places the soil is acid in reaction to a depth of several feet. It grades downward from a strongly acid surface layer to very strongly acid material in the A_2 , A_3 , B, and C horizons. In places the B horizon is a little less acid than the layers directly above and below.

The sand grains are chiefly iron-stained crystalline quartz fragments which are angular, as a rule, but not sharp.

The soil profile is essentially uniform over most of the sand-ridge section, where the texture of the surface soil is fine sand, except for variations in thickness of the layer and minor variations in color.

Norfolk sand differs from Norfolk fine sand primarily in the size of the individual particles of sand, but in places the A_3 and B layers are brownish red or red, presumably owing to the freer circulation of air and water in the coarser deposits, and possibly owing to a greater amount of iron in the parent material.

Eustis fine sand is the soil most closely related to Norfolk sand, but greater oxidation or higher iron content has caused the A and B layers to develop brown and reddish-brown colors.

Blanton fine sand is very closely related to Norfolk sand. It differs chiefly in having lighter-colored sands in the A and B layers. It occupies slightly lower positions, occurring as knolls, in ridges rising a few feet above the flatwoods proper, or as long flat slopes from the flatwoods to higher levels.

The topographic situation and surface configuration of St. Lucie fine sand suggest that the materials of this soil may have originally been a coastal beach or dune formation. This is also indicated by the uniform size of the clear crystalline quartz sand particles, by the absence of organic material and fine mineral matter, and by the low degree of acidity in the soil at comparatively slight depths.

Another group of soils occur in which the soil-forming agencies common for this latitude have failed to reach their maximum results owing to poor drainage, to resistant parent material, or to recent deposition. Intermediate stages of development exist between soils of this group and the first group. Generally speaking, the group of more poorly drained soils has greater accumulations of organic matter, less acidity, and thinner accumulations of superficial sands than the higher-lying soils. Extreme examples of this group are the areas of peat and peaty muck which consist predominantly of organic accumulations. The St. Johns, Portsmouth, and Parkwood soils result from a less imperfectly drained condition, and the Plummer, Bladen, and Leon soils may be considered intermediate in stage of development. The striking characteristics of the Parkwood soils, namely, their dark surfaces and calcareous substrata, are the result not only of imperfect drainage but also of the marly character of the parent material as distinguished from the clayey sands common to a greater number of other soils of the region.

Of the imperfectly developed soils, those of the Leon series are the most extensive and also the most striking in natural features. Leon fine sand is typical of the series. Where timbered, it is characterized by 4 or 6 inches of dark-gray slightly loamy fine sand with a sparse mixture of grass, leaves, twigs, and other forest débris on the surface. This layer contains numerous fine roots, and in its natural state is moderately compact and firm. It is underlain to an average depth of 20 inches by light-gray loose fine sand, penetrated by the larger roots of trees, shrubs, and palmettos. The lower boundary of this layer, as a rule, is rather sharp though somewhat wavy. Beneath this layer is a layer of fine sand in which organic matter, apparently acting as a binding or cementing agency, is concentrated. In most areas the sand particles are stained very dark brown or almost black to a depth of 3 or 4 inches below the sharp upper boundary. Below this the material is less compact, is lighter brown in color, and grades through 4 or 6 inches of light-brown fine sand into very light grayish-yellow loose fine sand streaked vertically with dark-brown organic coloring. At an average depth of 60 inches the light bluish-gray fine sandy clay bed occurs. The material is streaked and splotched with rust brown and is very plastic, sticky, and rather heavy. It grades downward into a

geologic formation having a brown or drab fine sandy clay matrix and containing numerous pebbles of phosphate rock. The compacted organic layer, which is uniform over large comparatively level areas, apparently lies at the average height of the ground water. A gradual thinning out of the hardpan occurs in places where sandy knolls rise above the general surface level. The concentrated and hardest part of the compact layer is generally in the upper part. In some places this organic concentration is 10 or more feet in thickness and in other places two and even three distinct layers occur separated by light-colored sands.

The reaction of the layers above and including the so-called "hardpan" layer is strongly acid or very strongly acid, reaching a maximum of acidity in this hard organic layer. Below this a gradual decrease in acidity occurs, and in many places a calcareous formation is found at a depth ranging from 46 to 100 or more inches.

The characteristic vegetation of the Leon soils is chiefly longleaf pine, slash pine, and an undergrowth of saw palmetto, wire grass, and sedge. Apparently there is a close relationship between the occurrence of dense growths of palmetto and the hardpan layer, as the hardpan is found only under areas which support the saw palmetto and, so far as is known, it does not occur where this plant does not grow.

The alluvial deposits are very limited in extent and consist mainly of sands and fine sands.

SUMMARY

Polk County is in the central part of peninsular Florida. It has an area of 1,863 square miles.

Three outstanding physiographic divisions occur in the county: (1) The comparatively high rolling upland or lake region in the central and northwestern parts; (2) the flatwoods region bordering the uplands; and (3) the stream valleys along Withlacoochee, Kissimmee, and Peace Rivers and their tributaries. The upland is well drained and has many clear-water lakes. The flatwoods and stream valleys are poorly drained. Considerable areas have water standing on or near the surface during the rainy season and have comparatively high water tables all the year round.

The climate is subtropical, but the summer heat is moderated by winds that sweep across the peninsula and by the influence of the great number of lakes. From late October to June very little rain falls and freezing temperatures rarely occur. The delightful winters attract many tourists. The mean annual temperature at Bartow is 72° F., and the mean annual rainfall is 52.65 inches.

Polk County is well served by the Atlantic Coast Line Railroad and the Seaboard Air Line Railway. An excellent system of paved roads, aggregating approximately 600 miles in total length, connects all the principal towns of the county. Three State highways cross the county.

Polk County products reach many of the important markets of eastern United States, of Canada, and of Europe.

The well-drained soils of the county are characterized by light-colored sandy surface soils underlain, at depths ranging from a few inches to several feet, by sandy clay or clayey sand locally termed

"clay beds." The dark-colored well-humified sandy surface soils of the Orlando and Fort Meade soils are striking exceptions, although these soils have the thick surface layers of sand.

The poorly drained soils, as a rule, have darker-colored and thicker organic layers and gray or grayish-white subsoils which are saturated the greater part of the year. The Leon and St. Johns soils of this group have hardened organic layers known as hardpan.

The predominant soil texture in the county is fine sand. In the northeast part of the county medium sand predominates. Small areas of coarse sand, clay, clay loam, and fine sandy loam soils occur.

Peat and peaty muck constitute areas of accumulated organic material in various stages of disintegration and decomposition, ranging from brown woody or fibrous peat to very dark brown or almost black moderately well decomposed peaty muck.

Soils of the well-drained group, including the Norfolk, Fort Meade, Eustis, Orlando, and Blanton soils, are intensively utilized in the production of oranges, grapefruit, tangerines, lemons, watermelons, strawberries, and grapes, and also for truck crops, such as cabbage, lettuce, potatoes, beans, and corn. The Norfolk soils are generally considered best for citrus fruits, owing to their good air drainage and water drainage, to their rapid response to fertilizer, and to their favorable topographic situation. The greater part of the most desirable soils is under cultivation.



[PUBLIC RESOLUTION—No. 9]

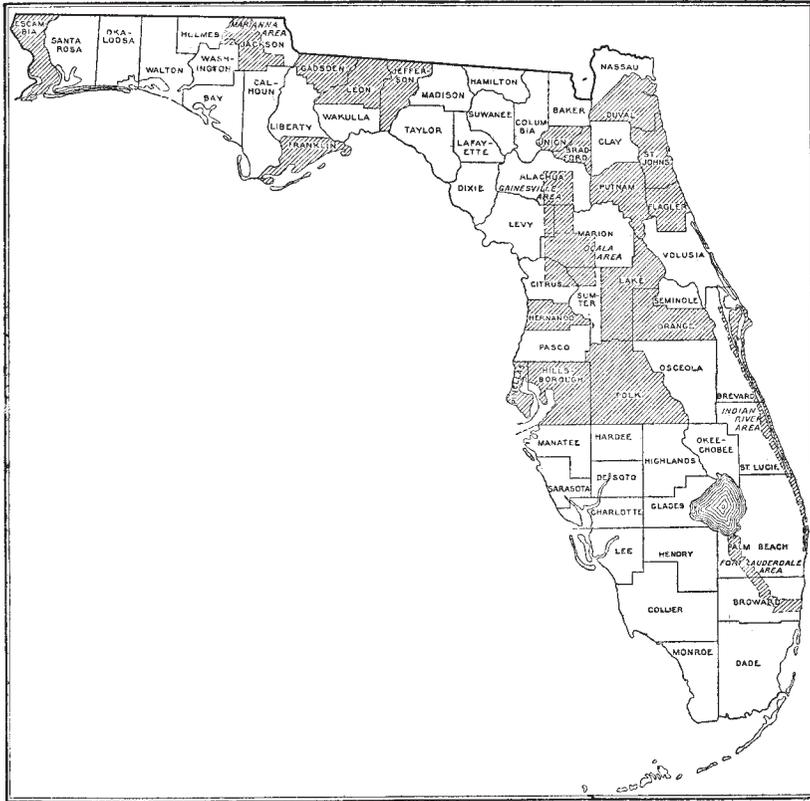
JOINT RESOLUTION Amending public resolution numbered eight, Fifty-sixth Congress, second session, approved February twenty-third, nineteen hundred and one, "providing for the printing annually of the report on field operations of the Division of Soils, Department of Agriculture."

Resolved by the Senate and House of Representatives of the United States of America in Congress assembled, That public resolution numbered eight, Fifty-sixth Congress, second session, approved February twenty-third, nineteen hundred and one, be amended by striking out all after the resolving clause and inserting in lieu thereof the following:

That there shall be printed ten thousand five hundred copies of the report on field operations of the Division of Soils, Department of Agriculture, of which one thousand five hundred copies shall be for the use of the Senate, three thousand copies for the use of the House of Representatives, and six thousand copies for the use of the Department of Agriculture: *Provided,* That in addition to the number of copies above provided for there shall be printed, as soon as the manuscript can be prepared, with the necessary maps and illustrations to accompany it, a report on each area surveyed, in the form of advance sheets, bound in paper covers, of which five hundred copies shall be for the use of each Senator from the State, two thousand copies for the use of each Representative for the congressional district or districts in which the survey is made, and one thousand copies for the use of the Department of Agriculture.

Approved, March 14, 1904.

[On July 1, 1901, the Division of Soils was reorganized as the Bureau of Soils, and on July 1, 1927, the Bureau of Soils became a unit of the Bureau of Chemistry and Soils.]



Areas surveyed in Florida, shown by shading

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If you wish to file an employment complaint, you must contact your agency's EEO Counselor (http://directives.sc.egov.usda.gov/33081_wba) within 45 days of the date of the alleged discriminatory act, event, or personnel action. Additional information can be found online at http://www.ascr.usda.gov/complaint_filing_file.html.

To File a Program Complaint

If you wish to file a Civil Rights program complaint of discrimination, complete the USDA Program Discrimination Complaint Form, found online at http://www.ascr.usda.gov/complaint_filing_cust.html or at any USDA office, or call (866) 632-9992 to request the form. You may also write a letter containing all of the information requested in the form. Send your completed complaint form or letter by mail to

U.S. Department of Agriculture; Director, Office of Adjudication; 1400 Independence Avenue, S.W.; Washington, D.C. 20250-9419; by fax to (202) 690-7442; or by email to program.intake@usda.gov.

Persons with Disabilities

If you are deaf, are hard of hearing, or have speech disabilities and you wish to file either an EEO or program complaint, please contact USDA through the Federal Relay Service at (800) 877-8339 or (800) 845-6136 (in Spanish).

If you have other disabilities and wish to file a program complaint, please see the contact information above. If you require alternative means of communication for program information (e.g., Braille, large print, audiotape, etc.), please contact USDA's TARGET Center at (202) 720-2600 (voice and TDD).