

Issued September 30, 1914.

U. S. DEPARTMENT OF AGRICULTURE,

BUREAU OF SOILS—MILTON WHITNEY, Chief.

IN COOPERATION WITH THE FLORIDA STATE GEOLOGICAL SURVEY,
E. H. SELLARDS, STATE GEOLOGIST.

SOIL SURVEY OF PINELLAS COUNTY,
FLORIDA.

BY

GROVE B. JONES AND T. M. MORRISON.

HUGH H. BENNETT, INSPECTOR, SOUTHERN DIVISION.

[Advance Sheets—Field Operations of the Bureau of Soils, 1913.]



WASHINGTON:
GOVERNMENT PRINTING OFFICE.
1914.

BUREAU OF SOILS.

MILTON WHITNEY, *Chief of Bureau.*

ALBERT G. RICE, *Chief Clerk.*

SOIL SURVEY.

CURTIS F. MARBUT, *In Charge.*

G. W. BAUMANN, *Executive Assistant.*

COMMITTEE ON THE CORRELATION AND CLASSIFICATION OF SOILS.

CURTIS F. MARBUT, *Chairman.*

HUGH H. BENNETT, *Inspector, Southern Division.*

J. E. LAPHAM, *Inspector, Northern Division.*

MACY H. LAPHAM, *Inspector, Western Division.*

J. W. MCKERICHER, *Secretary.*

Issued September 30, 1914.

U. S. DEPARTMENT OF AGRICULTURE,

BUREAU OF SOILS—MILTON WHITNEY, Chief.

IN COOPERATION WITH THE FLORIDA STATE GEOLOGICAL SURVEY,
E. H. SELLARDS, STATE GEOLOGIST.

SOIL SURVEY OF PINELLAS COUNTY, FLORIDA.

BY

GROVE B. JONES AND T. M. MORRISON.

HUGH H. BENNETT, INSPECTOR, SOUTHERN DIVISION.

[Advance Sheets—Field Operations of the Bureau of Soils, 1913.]



WASHINGTON:
GOVERNMENT PRINTING OFFICE.
1914.

LETTER OF TRANSMITTAL.

U. S. DEPARTMENT OF AGRICULTURE,
BUREAU OF SOILS,

Washington, D. C., January 20, 1914.

SIR: In the extension of the soil survey in the State of Florida work was undertaken in Pinellas County during the field season of 1913. The selection of this area was made after conference with State officials cooperating with the bureau in the work of surveying and classifying the soils of Florida.

I have the honor to transmit herewith the manuscript report and map covering this area, and to recommend their publication as advance sheets of Field Operations of the Bureau of Soils for 1913, as provided by law.

Respectfully,

MILTON WHITNEY,
Chief of Bureau.

Hon. D. F. HOUSTON,
Secretary of Agriculture.

CONTENTS.

	Page.
SOIL SURVEY OF PINELLAS COUNTY, FLORIDA. By GROVE B. JONES and T. M. MORRISON.....	5
Description of the area.....	5
Climate.....	8
Agriculture.....	10
Soils.....	15
Gray soils.....	18
Sedimentary material—sands and clays.....	18
Norfolk series.....	18
Norfolk fine sand.....	18
Leon series.....	20
Leon fine sand.....	20
Parkwood series.....	22
Parkwood fine sandy loam.....	22
Parkwood silty clay loam.....	23
Plummer series.....	23
Plummer fine sand.....	24
Black soils.....	24
Sedimentary material—sands and clays.....	24
Portsmouth series.....	24
Portsmouth fine sand.....	25
Fellowship series.....	26
Fellowship fine sandy loam.....	26
Miscellaneous material.....	27
Muck.....	27
Swamp.....	28
Coastal beach.....	29
Tidal marsh.....	29
Summary.....	30

ILLUSTRATIONS.

PLATES.

	Page.
PLATE I. One of the larger water and grass ponds, east of Tarpon Springs.....	8
II. Fig. 1. Orange grove on Norfolk fine sand, east of Belleair, showing clean cultivation. Fig. 2. Young orange grove 2 miles east of Clearwater.....	8
III. Fig. 1. Showing abrupt change from Portsmouth fine sand to the Norfolk fine sand. Fig. 2. Characteristic topography and growth, Norfolk fine sand.....	16
IV. Portsmouth fine sand, swamp phase, locally known as "cypress ponds".....	16
V. Fig. 1. Characteristic growth on Leon fine sand, rolling phase, east of Clearwater. Fig. 2. Parkwood fine sandy loam, showing character of vegetation on uncleared portion.....	24
VI. Tidal marsh between Ozona and Sutherland.....	24

FIGURE.

FIG. 1. Sketch map showing areas surveyed in Florida.....	5
---	---

MAP.

Soil map, Pinellas County sheet, Florida.

SOIL SURVEY OF PINELLAS COUNTY, FLORIDA.

BY GROVE B. JONES AND T. M. MORRISON.

DESCRIPTION OF THE AREA.

Pinellas County is situated on the western coast of Florida, about midway between the northern and southern boundaries of the State, and occupies that section known as Pinellas Peninsula. It is bounded on the north by Pasco County; on the east by Hillsboro County and Tampa and Old Tampa Bays; on the south by Tampa Bay and the Gulf of Mexico; and on the west by the Gulf of Mexico. The total length of boundary of Pinellas mainland is 84 miles, only 18 of which is formed by land. The county is about 34 miles long and 15 miles

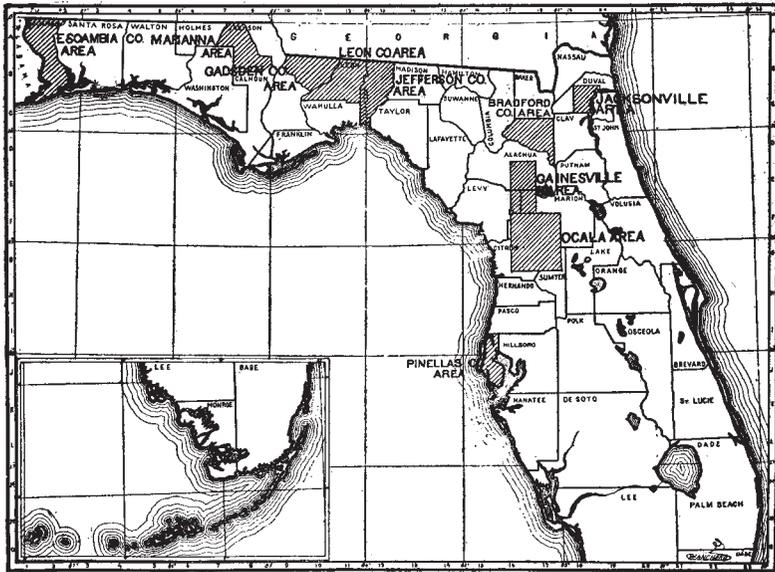


FIG. 1.—Sketch map showing areas surveyed in Florida.

wide at its widest point. It contains an area of 260 square miles, or 166,400 acres. Besides the mainland the county includes a chain of narrow keys and islands lying nearly parallel with the western shore, which gives it approximately 128 miles of water front.

The base map of the county, showing the location of roads, towns, schoolhouses, churches, dwellings, railroads, streams, etc., was made by plane-table traverse as the soil mapping progressed. The county

was originally plotted into sections, and although these are not of uniform size, few containing exactly 1 square mile, the base map has been made to conform to these long-established lines.

The level and undulating type of topography characteristic of the Coastal Plain predominates, although in some sections rolling to hilly country exists. The highest elevations are found north of Wall Springs and about the northern end of Lake Butler. Natural drainage is best established in the western part of the county, and this section shows the greatest development. At St. Petersburg and in the vicinity of Green Springs other well-drained areas are found.

The low and poorly drained areas known as "flatwoods" are most extensively developed southeast of Largo, extending nearly to St. Petersburg. These lie only a few feet above sea level and contain numerous water and grass ponds. (See Pl. I.) The few streams are small and sluggish, and during times of heavy rainfall this low-lying land is inundated and remains in a wet condition for a considerable period. South and east of Lake Butler and extending to the Hillsboro County line is another extensive area of poorly drained soils. This differs from the "flatwoods" in the southern part of the county in that it contains no water and grass ponds, but abounds in swamps and depressed areas which support a dense growth of cypress. No cypress trees are found in the southern part of the county.

The shore is indented by many tidewater estuaries and salt marshes. The only stream in the county of any importance is the Anclote River, which has its source in Pasco County. This is a tide-water stream and is navigated by small craft for a considerable distance. Lake Butler, the largest body of water within the boundaries of the county, is 6 miles long and about a mile wide, and has an underground outlet.

Pinellas County, formerly the western portion of Hillsboro County, was organized in November, 1911, and Clearwater, situated about midway on the western coast on Clearwater Harbor, was made the county seat. According to the census of 1910, this town has a population of 1,171, and besides being one of the main shipping points for citrus fruits is fast growing in favor as a winter resort. St. Petersburg, situated in the southeastern part of the county, on Tampa Bay, is the largest town. It has a population of about 4,127 year-round residents. It is widely known as a winter resort, being the largest on the west coast, and during the winter season accommodates as many as 10,000 tourists. It is admirably located for shipping purposes. Largo is a thriving town, lying about 4 miles south of Clearwater. It is the main shipping point for citrus fruit in the county, and handles the products of a large fruit-growing section. Dunedin is a prosperous little town, population 256, beautifully situated on

Clearwater Harbor. It is also a shipping point for citrus fruits. Tarpon Springs, population 2,212, the northernmost city on the peninsula, is located on the southern bank of the Anclote River. It is one of the greatest sponge markets in the world, the industry being principally in the hands of Greeks. The yearly sales range from one-half million to a million dollars. A boat-building industry also has been established here. Sutherland, the site of Southern College; Ozona, on the Gulf; Belleair, and Pinellas Park are thriving villages and winter resorts. Green Springs, situated on the eastern coast on Old Tampa Bay, is not only a shipping point for citrus fruits, but is also the site of Espiritu Santo Springs, well known for their medicinal value. Passagrille is a popular Gulf resort located on Long Key. Gulfport, on Boca Ceiga Bay, is a thriving community reached by trolley from St. Petersburg.

The more thickly settled rural districts are supplied with mail routes and telephone service. The school facilities of the county are good, graded schools and high schools being found in the towns and villages.

The Atlantic Coast Line Railroad, which enters the northeastern corner of the county, passes through the towns along the western coast and has St. Petersburg as its southern terminus. The Tampa & Gulf Coast Railroad extends from St. Petersburg, in the southern part of the county, to Clearwater, thence to Espiritu Santo Springs, bearing north, then east and out of the county. A line of the same system runs from Tarpon Springs east, where it makes connections with the Tampa Northern for Tampa and Brooksville. Another branch extends north from Lake Villa to Port Richey, in Pasco County. St. Petersburg is connected with a number of outlying points by electric lines. Steamboats ply between St. Petersburg and Tampa and points south.

The county roads have been greatly improved in the last two years, and many old roads are at present being reestablished and straightened. There is a stone-surfaced road connecting Largo and Tarpon Springs. Branching from this about a half mile south of Sutherland is the Tampa rock and shell road. Many of the sand roads are improved by the application of pine needles and are known as "straw" roads. A rock and straw road leading east and north from Clearwater through Green Springs joins the Tampa road where the latter crosses Moccasin Branch. The newly laid out roads in the southern part of the peninsula follow the section lines more closely than the older roads, but as yet are unimproved. A hard-surfaced road south from Largo to St. Petersburg is being constructed. As settlement progresses the roads of the county will doubtless be improved, thereby greatly enhancing the value of farm lands.

CLIMATE.

The winter climate of Pinellas County is mild and balmy. December, January, and February have a mean temperature of about 60° F., and light frosts are of frequent occurrence during this period. Killing frosts are not unusual, and disastrous freezes were recorded in 1894, 1895, and 1899. During the mildest winters flowers bloom, and vegetables are grown without protection throughout the season. As a rule vegetables and tender plants are not free from danger of frosts between November 28 and March 24; however, the records at Tampa and Manatee show that killing frosts ordinarily occur only between January 9 and February 8 at the former station and between January 3 and January 26 at the latter.

While the summer temperatures are not regarded as excessive, being moderated by breezes from the surrounding waters, discomfort is often experienced through spells of long-continued heat. June, July, and August, the hottest months, have a mean temperature of about 80° F. The absolute maximum for these months is 96° F., and the absolute minimum 65° F.

The mean annual precipitation at the Tampa station is about 51.5 inches and at Manatee 55.4 inches. The wettest season extends through the months of June, July, and August, and frequently into September. During this period the low-lying lands are inundated and truck crops are seriously affected and in some years even drowned out. On the other hand, during the months of scant rainfall, especially in March, April, and May, crops planted on Norfolk fine sand are apt to suffer from lack of moisture. Irrigation is therefore essential for the greatest success in trucking.

The records of the Weather Bureau stations at Tampa and Manatee, in counties adjoining Pinellas on the east and south, respectively, were taken in preference to those of Tarpon Springs, Pinellas County, as those of the latter station are not complete. The data given are believed to represent local conditions in the county. These tables give the normal monthly, seasonal, and annual temperature and precipitation. The presence of bodies of water on three sides of the county has a moderating effect on the temperature, rendering the summers cooler and the winters warmer than in adjacent inland counties.



ONE OF THE LARGER WATER AND GRASS PONDS, EAST OF TARPON SPRINGS.
[Portsmouth fine sand in foreground; hilly Norfolk fine sand in background.]



FIG. 1.—ORANGE GROVE ON NORFOLK FINE SAND, EAST OF BELLEAIR, SHOWING CLEAN CULTIVATION.



FIG. 2.—YOUNG ORANGE GROVE 2 MILES EAST OF CLEARWATER.

[Trees all of same age—about 3 years. Note the small size and unhealthy condition of those in the foreground, which are located on Portsmouth fine sand, when compared with those in the background on Norfolk fine sand.]

Normal monthly, seasonal, and annual temperature and precipitation at Tampa, Hillsboro County, Fla.

Month.	Temperature.			Precipitation.		
	Mean.	Absolute maximum.	Absolute minimum.	Mean.	Total amount for the driest year.	Total amount for the wettest year.
	° F.	° F.	° F.	Inches.	Inches.	Inches.
December.....	59.5	83	19	2.29	0.39	0.54
January.....	57.4	82	23	2.56	2.14	1.42
February.....	60.9	86	22	2.88	1.10	2.73
Winter.....	59.3			7.73	3.63	4.69
March.....	65.9	92	32	2.76	0.08	1.71
April.....	70.6	90	38	1.87	2.07	1.36
May.....	75.5	94	53	2.73	1.81	6.92
Spring.....	70.7			7.36	3.96	9.99
June.....	78.7	95	64	7.53	6.18	9.15
July.....	80.0	96	65	9.36	2.75	11.56
August.....	80.0	96	67	9.02	7.48	7.16
Summer.....	79.6			25.96	16.41	27.87
September.....	78.3	94	54	6.32	5.73	17.28
October.....	72.6	93	44	2.41	1.18	4.84
November.....	65.4	87	32	1.71	1.34	2.26
Fall.....	72.1			10.44	8.25	24.38
Year.....	70.4	96	19	51.49	32.25	66.93

Normal monthly, seasonal, and annual temperature and precipitation at Manatee, Manatee County, Fla.

Month.	Temperature.			Precipitation.		
	Mean.	Absolute maximum.	Absolute minimum.	Mean.	Total amount for the driest year.	Total amount for the wettest year.
	°F.	°F.	°F.	Inches.	Inches.	Inches.
December.....	61.8	85	19	2.37	5.19	4.41
January.....	60.7	88	20	2.78	0.36	3.36
February.....	62.3	89	23	3.01	1.40	3.87
Winter.....	61.6			8.16	6.95	11.64
March.....	66.6	90	31	2.71	0.00	8.59
April.....	70.6	92	39	1.91	1.84	3.20
May.....	76.2	97	47	2.92	2.54	4.13
Spring.....	71.1			7.54	4.38	15.92
June.....	80.1	100	59	7.80	8.11	9.23
July.....	81.0	99	61	10.84	6.46	11.05
August.....	81.2	96	65	9.16	6.73	15.45
Summer.....	80.8			27.80	21.30	35.73
September.....	80.0	97	56	7.57	6.12	6.64
October.....	73.9	93	39	2.71	1.55	3.30
November.....	67.1	88	29	1.62	1.14	2.55
Fall.....	73.7			11.90	8.81	12.49
Year.....	71.8	100	19	55.40	41.44	75.78

AGRICULTURE.

In Pinellas County citrus fruit growing is the principal industry and little attention is at present paid to general farming or other forms of agriculture.

Cotton and corn were grown quite generally in the early days and a considerable acreage was devoted to these crops for a period following the disastrous freeze of 1895, which seriously injured the citrus trees. This practice continued, however, only while the groves were recuperating.

The growing of citrus fruits has been carried on for some time in Pinellas County and each year the acreage in groves increases. As a result land values have advanced sharply in recent years. The Norfolk fine sand, or "piny-woods land," is generally recognized as the best soil in the county for growing citrus fruits, and all the profitable and well-established groves are situated on this type. (Pl. II, Figs. 1 and 2.) This soil occupies an area of 61.5 square miles. Since most

of this can be successfully used for citrus fruits, there is opportunity for a considerable extension of the industry, as probably not more than 10 per cent is at present used for fruit growing. The other soils are either too wet or too droughty for orange culture.

Groves ordinarily vary in size from 10 to 30 acres. Larger groves, usually controlled by companies, frequently contain a hundred acres or more.

All the old groves are "seedling groves," while the young orchards consist entirely of budded stock. Seedlings, as a rule, are irregular in yield, seldom having two large yields of fruit in succession. They also are said to require more fertilizer than budded trees.

The native forest growth on the Norfolk fine sand consists principally of longleaf pine, which should be removed before the land is used for orange culture. The cost of clearing ranges from \$20 to \$75 an acre, depending upon the growth and the method employed. Sawmill companies frequently buy the standing timber at \$8 to \$15 an acre. The tops of trees and those undesirable for lumber may be cut into cordwood, which sells for \$2 to \$3 a cord.

Stumps are either burned or cut out and frequently dynamite is employed. Considerable land is cleared by contract, which includes the removal of all timber growth and the grubbing out of all underbrush.

In some instances groves have been planted in clearings where the pines have been girdled and left standing. This is not a good plan, for when the dead pines are later removed or blown down the young fruit trees are not infrequently injured. The dead trees also serve as a breeding place for wood-lice and other insects injurious to young citrus trees.

The price of land planted in citrus fruits depends upon the age of the trees, varieties, location, improvements, etc., and ranges from \$300 to \$1,000 or more an acre.

While the rainfall is usually sufficient to produce the citrus fruits, irrigation is sometimes practiced. A few groves are equipped with the Skinner overhead system. Some means of irrigating the trees will be found especially valuable in the areas mapped as the hilly phase of the Norfolk fine sand, around Tarpon Springs and east of this point.

Besides the orange, the pomelo (grapefruit) is produced commercially. The latter is said to be even more profitable than the orange. The shaddock, lime, and lemon are grown only as ornamentals or novelties.

The prices paid for citrus fruits vary from year to year, and during the different periods of the same season. Early oranges bring from 75 cents to \$1.50 a box, and late oranges, principally the Tar-

diff, from \$1.50 to \$2 or even more a box. The price of grapefruit ranges from \$1.50 to \$3 a box.

Besides the production of citrus fruits some attention is paid to trucking, but this industry has not been developed along commercial lines to any great extent. Many different vegetables are grown for home use and for the local markets. The latter are not at all times supplied, and there appears to be opportunity for some extension of the trucking industry, especially during the winter months, when the local demand is greatest.

Cucumbers are grown to some extent for shipping and when not injured by fungous diseases prove a very profitable crop. Both the Norfolk fine sand and the well-drained Portsmouth fine sand are suited to this crop. Small shipments of other vegetables are not infrequently made, but these are exceptional. Cabbage may be grown during the winter months, but the more tender vegetables are frequently injured by frost as late as February. This winter (1912-13) the most tender vegetables and foliage were uninjured by frost and grew luxuriantly without protection.

Tomatoes, English peas, early Irish potatoes, snap beans, egg-plant, peppers, okra, squash, lettuce, and radishes all do well. Heavy applications of commercial fertilizer or barnyard manure are required, and in order to secure best results some form of irrigation is necessary.

The growing of celery would doubtless prove remunerative, as the Muck soils of the county are well suited to its production. Irish potatoes also do well on the same land. Sweet potatoes are grown on the Norfolk fine sand. Watermelons and cantaloupes are grown principally for home markets, although some watermelons have been shipped to outside markets. The Norfolk fine sand is especially well suited to their production.

Sugar cane is grown to a limited extent by nearly every farmer, chiefly for the manufacture of sirup for home use. A few planters produce some for the local markets. The county embraces large areas of land well suited to the growing of this crop, and the production of sirup on a commercial basis may prove a profitable industry. The Norfolk fine sand, flat phase, is the best soil of the county for the production of sugar cane, the sirup being of excellent quality. The deeper phase of this type produces a very desirable sirup, but the yield is not so large, and heavier applications of fertilizers are required. Heavy yields of sirup are secured on the Portsmouth fine sand, but usually the quality does not equal that produced on the Norfolk soil. The Parkwood fine sandy loam and silty clay loam and the Fellowship fine sandy loam are highly adapted to this crop, but as a rule dark-colored soils do not produce as bright sirup as lighter colored soils.

Sugar cane is planted in rows or on ridges, usually 5 feet apart. Sections of the cane stalk about 18 inches long are laid end to end and then covered with 3 or 4 inches of soil. Planting is usually done in January. Various brands of commercial fertilizers are used, as well as cottonseed meal and barnyard manure. The time of applying and the amounts used vary. Some growers apply stable manure to the land about two weeks before planting and follow this up with 1,000 pounds of cottonseed meal per acre, in two equal applications, the first half when the cane is sufficiently high to cultivate and the remainder when the crop is ready to lay by.

Another method of procedure in fertilizing sugar cane is to apply 800 pounds of commercial fertilizer (analyzing approximately 7 per cent phosphoric acid, 3 per cent nitrogen, 4 per cent potash) at seeding time, followed by two applications, each of 200 pounds, of cottonseed meal, when the cane has attained a height of 2 feet and 4 feet, respectively. Muriate of potash should not be included in cane fertilizers on account of its tendency to give the sirup an unpleasant chlorine or salty taste.

The Japanese, Red, and other varieties of sugar cane are grown. The yields of sirup range from 250 to 400 gallons per acre, and the price varies from 50 to 80 cents a gallon.

Strawberries do well on the better drained Portsmouth fine sand and the Norfolk fine sand, flat phase, and thoroughly drained Muck. The demands of the local markets are far from being supplied, and the growing of strawberries would prove decidedly profitable. The Klondike, Missionary, Lady Thomson (an early variety), Excelsior, and other varieties are grown.

Guavas are grown to some extent for home use, usually appearing in the yard as an ornamental shrub. Some of the fruit is canned, but its chief usefulness is in the making of jelly.

Wild varieties of blackberries and dewberries grow abundantly, but there has been no attempt to produce the cultivated varieties. The Scuppernong grape does well and is found in nearly every yard.

Peaches and plums are grown to some extent, but the results can not be said to be satisfactory. The peach tree is short lived, and the yields are uncertain. The South China type of peach probably does better than any other. It ripens early and is of good quality and flavor.

The pomegranate, grown usually as an ornamental shrub, gives an abundant yield and can be grown with but little attention. The fruit is used in making jellies, marmalades, and acid drinks. It would seem to have commercial possibilities in the county.

The Japanese persimmon is grown only as an ornament or novelty, and the fruit is not held in high favor. Figs are not grown. The avocado, or alligator pear, is grown simply as a novelty.

Pineapples were at one time successfully produced under shade at Clearwater. Some were seen growing near Green Springs under shade, but more as an experiment than for profit.

The pecan industry has not been developed in Pinellas County, although the tree thrives in the climate and soil of this region. A few bearing trees of considerable size and thrift indicate what may be expected of the few young trees just approaching the bearing stage. The Norfolk fine sand is thought to be the soil best suited for the pecan in this region.

Small patches of corn are grown by a few farmers. The harvested corn is usually badly damaged by the weevil. It is the general practice to buy all feeds for stock and it is considered cheaper than to attempt to produce them locally. However, a number of forage crops can be grown, and if given as much attention as is given to citrus fruits they should give profitable returns.

Oats do well on the Norfolk fine sand, and when cut either in the milk stage or when ripe make a splendid feed. Spanish peanut vine hay is considered locally the best hay for all purposes. Beggarweed, crab grass, and sandspur are also valuable hay crops. Crab grass is cut to a considerable extent from the groves and forms the bulk of the hay produced. Beggarweed when once started reseeds each year. It makes a good hay, and when turned under is a good fertilizer.

Cowpeas and sorghum sown together make a nutritious feed. Hairy vetch has been successfully grown, the best results being obtained when broadcasted with cowpeas.

Chufas, for fattening hogs, grow more satisfactorily than the peanut, which does not always fill out unless limed. Cassava is another good feed for hogs, and it seems it should find greater favor with those who produce pork for the market. Velvet beans produce a large quantity of vine hay and are grown to some extent. They do especially well on the Norfolk fine sand, and besides affording an abundance of feed, are an excellent soil renovator. Japan clover is another leguminous plant which does well locally, and besides making a fine quality of hay, affords good pasturage.

These and other forage crops can be cheaply produced and should be an incentive for the raising of dairy and beef cattle. Dairy farming should prove a profitable business in Pinellas County. The only existing dairies, located near the larger towns, do not begin to supply the demand, especially during the winter months, when it is greatest. There are some Jersey and Guernsey cows in the herds. Sweet milk finds a ready market at 12½ cents to 14 cents a quart, and butter brings from 40 to 50 cents a pound.

Large tracts of land are owned or controlled by companies and land syndicates which place their holdings on the market in tracts varying from 10 to 30 acres. The price ranges from \$25 to \$75 an acre for

Portsmouth fine sand (truck soils) to \$50 to \$150 an acre for unimproved Norfolk fine sand (fruit land).

So much depends upon the proper selection of the type of soil best suited and adapted to certain crops that it behooves the intending purchaser personally to inspect the land he contemplates buying, whether it be for the growing of citrus fruits or for trucking. Drainage is the main thing to be considered, and this should be determined, not during the dry months, but when the rainy period is at its height. The Norfolk fine sand and Leon fine sand, rolling phase, are the only soils that have adequate natural drainage. In the better drained situations of the Portsmouth fine sand crops may be grown successfully without the aid of artificial drainage, but the greater part of the type must be drained to produce crops successfully. The Parkwood, Plummer, and Fellowship soils can not be utilized in their present condition.

SOILS.

The underlying geological formations of Pinellas County belong to the Upper Oligocene. These are exposed at a number of different points in the county. At Bay View and a few other places the exposures consist of a hard impure limestone, while in other places plastic dark-colored clays are found. These materials, however, influence the soil in but a comparatively small part of the county.

The county as a whole is covered with a mantle of fine sand several feet in thickness. At Clearwater the bluff along the bay exposes a section of this deposit, which shows it to be 12 to 15 feet thick. The deposit is deepest in the northern part of the county and in many places gives evidence of having been drifted about by the wind. This action, together with the uneven dissolution of the underlying limestone, has given the region a more varied topography than is found farther south. Most of the soils have been derived from this sandy deposit.

Difference in topography and depth of the sandy mantle has given rise to two broad groups of soils—those that are well drained and those having poor natural drainage. The poorly drained soils predominate in number and extent, there being but two types that have ample natural drainage—the Norfolk fine sand and the Leon fine sand. The surface soils of the county are fine in texture, and with one exception—a silty clay loam of small development—they fall into two classes: The fine sand and fine sandy loam.

The soils of Pinellas County are in general designated by local terms descriptive of their topographic features and forest growth. To the highest and excessively drained types the term "sand hill" is applied. The forest growth, now almost entirely removed, originally consisted of longleaf pine. Blackjack oak has taken possession

of some of this land. The hilly phase of the Norfolk fine sand occupies these elevations.

"Scrub" is a local term given to hills and ridges of the Leon fine sand, rolling phase. It supports a dense growth of shortleaf pine, locally called "spruce pine," and a thick undergrowth of rosemary, palmetto, and low-growing shrubs and vines, and has a very low agricultural value.

"Piny woods land" and "high hammock land" are equivalent terms used to designate that class of land in which drainage is sufficiently well established to permit citrus fruit growing, and other forms of agriculture. Vegetation on such areas consists of longleaf pine, scattering blackjack oak, clumps of live oak and saw palmetto, wire grass, myrtle, some "oak runners," and gallberry in the depressed positions.

This local classification includes the typical Norfolk fine sand, and frequently the flat phase of this type, although the latter is often referred to as "hammock land," on account of its level surface and dark color.

"Low hammock" applies to low semiswampy areas occupied by the Parkwood series, of which there are two members, the fine sandy loam and silty clay loam. These soils are dark colored and have a marly subsoil, but owing to their swampy nature have not been developed agriculturally.

"Bays" and "bay heads" are wet, swampy depressions, in which the accumulation of decaying vegetable material is continually in progress, forming muck and peat.

The "flatwoods" constitute the low-lying, nearly level areas in which drainage is immaturely established. After heavy rainfall water remains on the surface for several days and the soil continues in a saturated condition for a considerable period. The Portsmouth fine sand is the typical soil of the "flatwoods," although it is found also on slopes and in depressions in higher lying country. The surface soil is a dark fine sand containing a high percentage of organic matter, which is usually underlain at about 2 feet by a brown substratum known as "hardpan." This compact layer, consisting of sand cemented or made compact by iron salts and organic matter, varies from a few inches to a foot or more in thickness and is found at the permanent water-table level. The hardpan lies at a remarkably uniform depth throughout the flatwoods, where the more extensive and more typical areas of the Portsmouth fine sand occur. It doubtless prevents to a considerable degree the free movement of soil moisture. It is not readily penetrated by tree roots, as is evidenced by the shorter growth and gnarly, spreading tops of pine trees. Saw palmetto grows in profusion and in lower lying areas

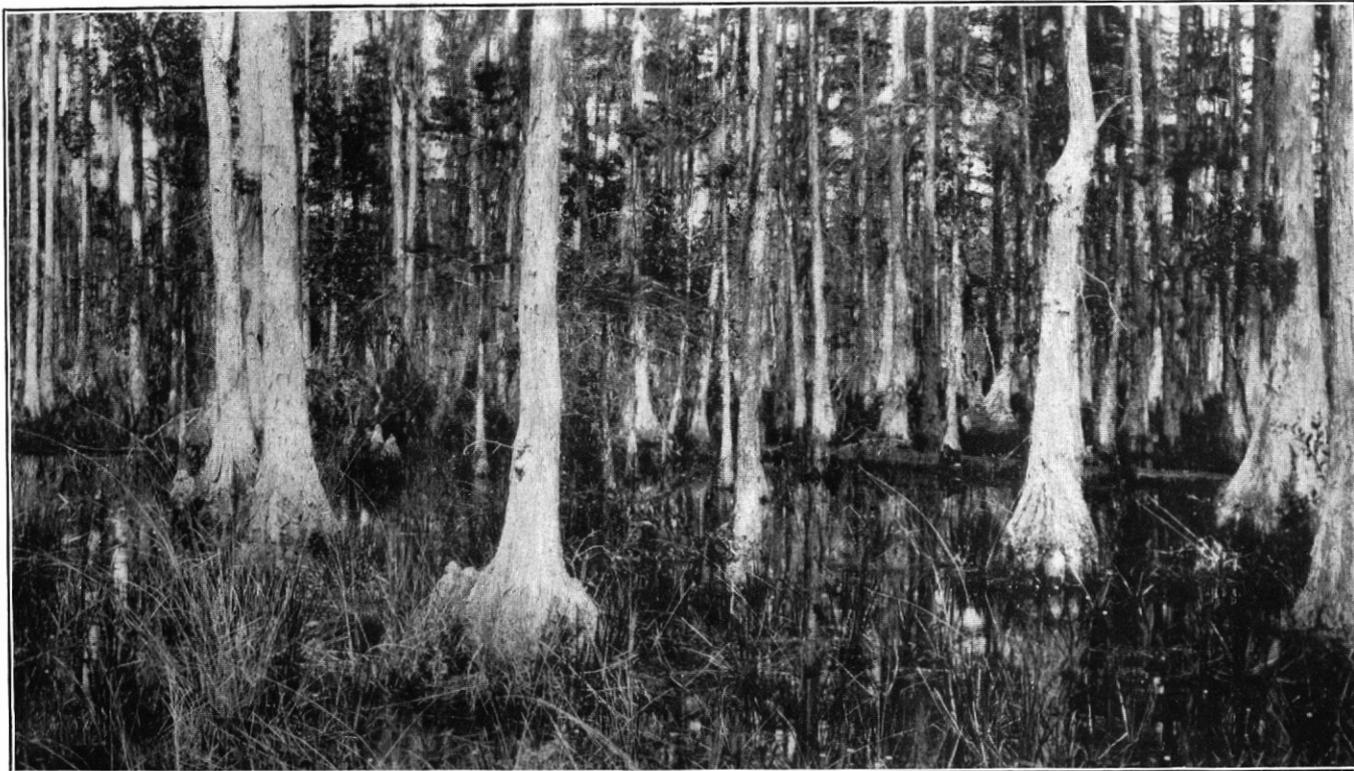


FIG. 1.—VIEW SHOWING ABRUPT CHANGE FROM PORTSMOUTH FINE SAND TO NORFOLK FINE SAND.

[The saw palmetto growing on the former soil.]



FIG. 2.—CHARACTERISTIC TOPOGRAPHY AND GROWTH, NORFOLK FINE SAND.



Report of Bureau of Soils, U. S. Dept. of Agriculture, 1913.

PLATE IV.

PORTSMOUTH FINE SAND, SWAMP PHASE, LOCALLY KNOWN AS "CYPRESS PONDS."

gallberry is found. The swamp phase of the Portsmouth fine sand is confined entirely to the numerous cypress ponds that occupy the low depressions. These are either covered with water or are in a saturated condition the year around. Other low areas are shown on the map as water and grass areas. They have no tree growth, but support a fresh-water vegetation consisting of reeds, rushes, grasses, and lilies. Both the cypress ponds and these water and grass ponds, as well as the lakes and clear water ponds of the county, have probably resulted through the formation of basins by the solution of underlying limestone.

The Leon fine sand is a flatwoods type occupying a position slightly elevated above the Portsmouth fine sand. It is excessively drained, except at times of heavy rainfall, when it is usually covered with water. The objectionable hardpan is present, which adds to the low productiveness of the soil. Longleaf pine, scrub palmetto, wire grass, and "oak runners" constitute the characteristic vegetation.

The Fellowship series, represented only by the fine sandy loam, occupies a position in the flatwoods similar to that of the Portsmouth fine sand. The surface, dark with organic matter, is underlain by orange and ocherous fine sand, grading into similar colored fine sandy clay. Beneath this is found shell fragments and shell limestone. The material, of the subsoil at least, may be partly residual in origin. The marly character of the subsoil of the Parkwood soils is thought to represent a more advanced stage in the decomposition of the underlying marine deposits than is found beneath the Fellowship fine sandy loam. The vegetation is the same as on the Fellowship and Portsmouth soils.

The Plummer fine sand occupies low, flat semiswampy areas which are at present of no agricultural value. Water stands on the greater part of the type much of the time and cypress is the main tree growth. In many respects the Plummer fine sand closely resembles the more recent deposit of Tidal marsh, which is still in process of formation, and may be closely related to it in origin.

In mapping Swamp the classification has been confined to low-lying areas along stream courses and bordering the larger bodies of fresh water. Swamp material varies considerably, but a great deal of it consists of areas of muck and peat too low lying and wet to be of any value in their present condition.

Coastal beach is a self-explanatory term. It consists of sand and shells and is unsuited for agriculture.

Including Coastal beach, Tidal marsh, Muck, and Swamp as types, 11 types of soils were mapped, and several type phases were recognized.

The following table gives the name and actual and relative extent of each soil mapped in Pinellas County:

Areas of different soils.

Soil.	Acres.	Per cent.	Soil.	Acres.	Per cent.
Portsmouth fine sand.....	65,088	40.7	Plummer fine sand.....	4,736	2.8
Swamp phase.....	2,624		Muck.....	4,608	2.7
Norfolk fine sand.....	32,832	23.6	Swamp.....	4,288	2.6
Flat phase.....	4,224		Tidal marsh.....	3,264	2.0
Hilly phase.....	2,304		Parkwood fine sandy loam.....	256	.1
Leon fine sand.....	21,056	16.7	Parkwood silty clay loam.....	64	.1
Rolling phase.....	6,592		Total.....	166,400
Fellowship fine sandy loam.....	7,680	4.6			
Coastal beach.....	6,784	4.1			

GRAY SOILS.

SEDIMENTARY MATERIAL—SANDS AND CLAYS.

NORFOLK SERIES.

The Norfolk soils are characterized by the light-gray to grayish-yellow color of the surface soils, and by the yellow color and friable structure of the subsoils. They occupy nearly level to rolling uplands throughout the Atlantic and Gulf Coastal Plain, and have been derived from unconsolidated Coastal Plain deposits.

NORFOLK FINE SAND.

The Norfolk fine sand consists of gray or brownish-gray fine sand, 6 to 8 inches deep, underlain by a yellow or pale-yellow fine sand of rather loose texture. The grayish color of the surface soil is due to the presence of organic matter, which is present in sufficient quantity to make it more loamy in texture than the subsoil.

The Norfolk fine sand is found principally in the western half of the county. It is also well developed in the vicinity of Green Springs and St. Petersburg.

The surface ranges from nearly level or gently undulating to rolling. The land is thoroughly drained, but the texture of the soil is fine enough to make it retentive of moisture and crops are affected but little by ordinary periods of drought.

This is the most important and highest priced soil in Pinellas County. It is especially well adapted and extensively used for growing oranges and grapefruit. It is also well adapted to the production of truck crops, such as Irish potatoes, sweet potatoes, English peas, radishes, onions, lettuce, snap beans, peppers, eggplant, tomatoes, cucumbers, watermelons, and cantaloupes. Peaches and plums are grown to a limited extent, but the trees are usually short lived and

the fruit of an inferior quality. The pecan trees seen were in a thrifty condition.

A few patches of velvet beans have been grown. This crop seems to be better suited to the type, under local conditions, than any other of the leguminous crops. Cowpeas also do well and beggarweed once started reseeds itself.

Both in citrus fruit and truck growing commercial fertilizers are used. Commercial fertilizers are found more beneficial and lasting in their effect if the soil contains a reasonable amount of organic matter.

The principal tree growth on this type is longleaf pine. An occasional clump of live oak is found and in places scattering blackjack oak. The undergrowth consists mainly of wire grass and patches of oak runner, with occasional clusters of saw palmetto. (Pl. III, Figs. 1 and 2.)

Unimproved tracts of land of this type of soil range in price from \$30 to \$150 an acre, the difference depending upon location. It is said to cost from \$250 to \$400 to clear, fence, and plant an acre in oranges or grapefruit. Groves in good bearing are valued at \$500 to \$1,000 or more an acre.

Norfolk fine sand, flat phase.—The Norfolk fine sand, flat phase, consists of a dark-gray to nearly black fine sand, underlain at 3 to 6 inches by light-gray fine sand, which grades below into yellow or yellowish-gray fine sand. The darker color and more loamy texture of the surface soil are due to a higher organic content than is present in the typical soil. The subsoil is almost identical with that of the typical soil both in color and texture.

This phase of the Norfolk fine sand, known locally as "hammock land," occupies a position intermediate between the Portsmouth fine sand and the typical Norfolk fine sand. It has a nearly level surface. The principal areas occur south of Largo.

The vegetation consists of longleaf pine, wire grass, and saw palmetto. Natural drainage for the most part is fairly well established and only a small proportion of the area would be benefited by ditching or tiling. On the other hand, the presence of a high percentage of humus in the surface soil, together with the open-textured subsoil, assists in the conservation of moisture.

The Norfolk fine sand, flat phase, is very well adapted to the growing of citrus fruits, some of the best paying groves in the county being located on it.

Vegetables of all kinds do exceptionally well, and there is less danger of damage from drought than on the typical soil. Taken as a whole, this soil is the best in the county. It is better suited to a wide range of crops, and is the most certain to produce good average yields. Its smooth surface fits it for the use of labor-saving machinery.

The value of unimproved land of the flat phase of the Norfolk fine sand ranges from \$60 to \$150 an acre.

Norfolk fine sand, hilly phase.—The Norfolk fine sand, hilly phase, locally called “sand hills,” consists of a few inches of light-gray fine sand resting on a subsoil of light-yellow fine sand, which extends to a depth of several feet. The structure of both soil and subsoil is rather incoherent, and except for the darker surface, there is little variation within the 3-foot section.

The Norfolk fine sand, hilly phase, is confined entirely to the northern part of the county. It appears north of Wall Springs and extends around the north end of Lake Butler. East of the lake are a few ridges and hillocks which have the form of dunes.

The phase is excessively drained, and no attempts have been successfully made to cultivate the higher lying portions. On account of its uneven surface, irrigation for much of this phase would be impracticable and in some locations impossible. Irrigation, nevertheless, would be necessary to prevent crops from burning out during periods of scanty rainfall.

Nearly all of the longleaf pine from this phase of the Norfolk fine sand has been removed. The present growth consists of blackjack oak, occasional clumps of live oak, and scattering longleaf pine.

Areas of Norfolk fine sand, hilly phase, are placed on the market in small tracts at \$25 to \$50 and more an acre.

LEON SERIES.

This series comprises the loose, light-gray to white sandy soils of the South Atlantic and East Gulf coast flatwoods region, which in their typical development have a subsurface hardpan stratum, encountered usually at a depth of 12 to 24 inches. This stratum averages from 8 to 10 inches in thickness and consists of a compact layer of fine sand or sand ranging in color from black to dark rusty brown in the upper 2 or 3 inches to rusty brown or slightly darker in the lower portion. It becomes less compact and lighter in color as the lower part of the stratum is approached, a white sand being frequently encountered underlying the stratum and within the 3-foot section. The material of this layer runs high in organic matter and very low in iron, and although the rusty brown color would suggest cementation with iron the analyses indicate that the compactness is due to the presence of organic matter. The substratum is lacking in some phases.

LEON FINE SAND.

The surface soil of the Leon fine sand consists of from 4 to 6 inches of light-gray or white fine sand, frequently containing sufficient organic matter to give it a dark-gray color. To an average

depth of 28 inches an incoherent, white fine sand practically free from humus is found, usually resting upon a stratum of hardpan. This hardpan stratum is a compact layer of fine sand of varying thickness, containing considerable organic matter. The upper part of the stratum is dark brown to almost black, the material grading into brown, looser fine sand below. In some localities this hardpan is not encountered within the 3-foot section.

The type occupies level to gently undulating country. The natural drainage is poor, partly on account of the level surface and partly as a result of the underlying hardpan, which doubtless hinders to a greater or less extent the free movement of soil moisture, rendering the soil wetter in rainy seasons and more droughty in dry seasons. This is one of the "flatwoods" soils. It is usually associated with the Portsmouth fine sand, but occupies a slightly higher position.

The forest growth consists of scattering longleaf pine and scrub oak. Besides this, it supports also a thick growth of palmetto, gallberry, myrtle, oak-runner, and wire grass. It is generally considered an unproductive soil and practically no attempt has been made to place it under cultivation.

Leon fine sand, rolling phase.—The surface 4 inches of the Leon fine sand, rolling phase, is a light-gray fine sand, resting on a white fine sand to a depth of 3 feet or more. Several feet below the surface there is frequently encountered a layer of pale-yellow sand of similar texture. The material consists almost wholly of quartz particles. Besides the difference in topography the rolling phase departs from the typical soil in that the usual hardpan stratum is not found within the 3-foot profile.

The rolling phase is not extensive; neither is it restricted to any particular locality. This land stands somewhat higher than the Portsmouth fine sand, frequently occupying a slight elevation along the water front. It is locally known as "scrub," because of the dense growth of spruce pine which is found in the county only upon this type. Scrub oak, dwarf palmetto, and rosemary constitute a thick undergrowth. (Pl. V, Fig. 1.) On account of the position of the type and its loose, porous character, the natural drainage is excessive. As a result little organic matter has accumulated. The topography in places closely resembles that of the sand dunes, and its origin is probably due in part at least to wind action.¹

None of the Leon fine sand, rolling phase, is under cultivation, but it is believed that with proper management it would prove a desirable soil for the growing of pineapples. In the southern part of the State pineapples are successfully grown on soil similar to this, but no attempt has been made to produce them here.

¹ In the opinion of E. H. Sellards, State geologist, the areas east of Clearwater are old sand dunes.

PARKWOOD SERIES.

The distinguishing feature of the Parkwood series is the gray to white lower subsoil of marl. The soils are grayish to grayish brown in color, with subsoils of grayish-brown to grayish-yellow sandy clay to heavy clay loam in the upper portion, resting upon beds of marl at a depth of 29 inches.

PARKWOOD FINE SANDY LOAM.

The Parkwood fine sandy loam as mapped presents considerable variation. The soil as mapped in this survey consists of a black or nearly black fine sandy loam, being darker than usual. It is underlain by grayish-brown to nearly white silty clay loam containing some calcareous material from limestone or marl. The subsoil in places is a mottled dull-brown and yellow plastic clay or sandy clay. It also in places carries a greenish-yellow material, which probably consists of bog-iron ore. As mapped, the type includes patches in which the soil varies from dark-gray fine sand to black heavy fine sandy loam, ranging from a few inches to about 30 inches in depth. Limestone or marl, with shells, occurs in places within the 3-foot section and occasionally outcrops. The clayey material is derived from the marl or limestone. The type occupies a position intermediate between the heavier Parkwood soils and the sandy types such as the Portsmouth fine sand. The sandy surface material largely represents originally unconsolidated Coastal Plain deposits. Shells are often scattered throughout the soil and subsoil.

In Pinellas County the Parkwood fine sandy loam was found to be of small extent, being confined to a few bodies of a total area of 256 acres. One of the larger of these areas lies one-half mile north of Maximo Point. Another is situated $1\frac{1}{2}$ miles south of Ulmerton. The other areas, which are of considerably smaller extent, occur as islands in a water and grass pond near Pinellas Park. It appears that the two larger areas of Parkwood fine sandy loam represent old inland tidewater basins.

Cabbage palmetto, dense clumps of saw palmetto, saw grass, bulrushes, myrtle, and pine constitute the natural vegetation on this type. Plate V, figure 2, shows the character of vegetation on uncleared portions.

None of the Parkwood fine sandy loam is at present under cultivation, although attempts have been made in the past to utilize it. Owing to its low-lying position and its somewhat impervious subsoil, the type is badly in need of drainage. The soil, however, is naturally productive and, owing to its marl content, free from any trace of acidity. It has been found elsewhere in the State to be adapted to truck crops, especially cabbage, tomatoes, and Irish potatoes, and

there is apparently no reason why it should not be used locally for the production of these crops.

PARKWOOD SILTY CLAY LOAM.

The typical soil of the Parkwood silty clay loam is an ashy-gray or drab silty clay loam, passing below into lighter drab to nearly white, heavy silty clay loam, containing a considerable quantity of white lime concretions, shells or fragments of shells, and partially decomposed material from limestone. The type shows some variations from this typical description. In places the soil consists of black or dark-gray loam to silty clay loam, which may either grade below into drab or nearly white material like the typical subsoil, or into mottled drab and yellow or greenish-yellow plastic clay or sandy clay. Limestone and marl come within the 3-foot section in places, and sometimes outcrop at the surface. Where this limestone is exposed it becomes hard and flinty.

The Parkwood silty clay loam is residual in origin and has been derived from the underlying soft and impure limestone and deposits of marl. It occupies poorly drained depressions and flats. The natural vegetation consists of live oak, water oak, white oak, myrtle, bay, sweet gum, and cabbage and saw palmetto.

Only one area of Parkwood silty clay loam was mapped in the county. It is situated in the southern part of the county at the western end of Salt Lake. It is neither cleared nor under cultivation, and better drainage will have to be established before it can be used for agriculture. In the vicinity of Coleman, Fla., the same type of soil has been found to be productive where good drainage has been established. It is used there in growing citrus fruits, which are of good quality, and for trucking, tomatoes and cabbage being the important crops.

PLUMMER SERIES.

The soils of this series are gray and frequently mottled with dark-brownish colors and underlain at a depth varying from 8 to 20 inches by compact, light-gray material more or less mottled with streaks of brown and yellow. The lower portion of the subsoil usually consists of sandy clay or sticky sandy material, including pockets or layers of yellowish, plastic sandy clay. The soils are derived from reworked Piedmont-Appalachian material. They are nearly always in a sticky condition, water frequently standing on the surface after heavy rains. A scattered growth of cypress and pine, and occasionally cabbage palmetto constitutes the principal tree growth. This series is typically developed in the flatwoods region of the South Atlantic and Gulf Coastal Plain.

PLUMMER FINE SAND.

The Plummer fine sand consists of a brownish-gray to whitish fine sand, from 8 to 15 inches deep, underlain by a brown or brownish-gray fine sand to a depth of 36 inches.

A thin layer of material—accumulated deposits of material resulting from repeated inundations—gives the immediate surface a dark color. Upon drying this layer cracks and curls and is very brittle and friable.

The Plummer fine sand is confined to the northeastern part of the county. It occurs as flat areas in which are found many shallow depressions and ponds separated from one another by slightly higher, narrow bodies of land.

In wet seasons the entire type is covered with water and not infrequently water remains in the ponds the greater part of the year.

There is no textural difference in the typical soil and that of the included ponds, but it is not uncommon to find the soil in the latter lighter in color. The ponds support a heavy growth of cypress, but in the less depressed areas the timber growth is more scattered and consists of mixed longleaf pine and cypress. The areas also support a good growth of coarse grasses. The slightly depressed areas which are narrow and winding closely resemble shallow stream channels and probably represent the floors of ancient lagoons or sounds.

The higher lying areas of Plummer fine sand support a light growth of longleaf pine. A scattering growth of scrub palmetto is also present, but this is not characteristic of the type and occurs only where small areas of Portsmouth fine sand were of necessity included in the Plummer fine sand.

Owing to poor drainage, none of this type is at present under cultivation, and in its present state it is of no agricultural value except for pasture.

BLACK SOILS.

SEDIMENTARY MATERIAL—SANDS AND CLAYS.

PORTSMOUTH SERIES.

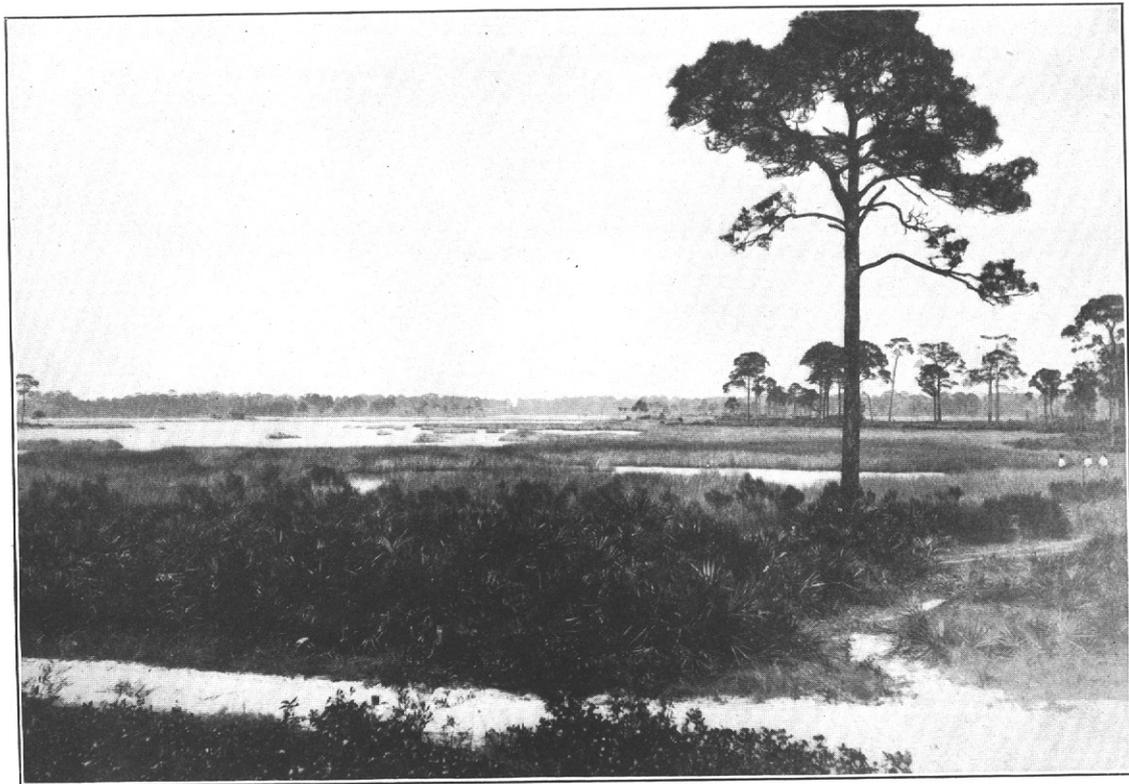
The soils are dark gray to black, and are high in organic matter. The subsoils are light gray to mottled gray and yellow, and the heavier members are always plastic, though usually carrying a noticeable amount of sand. These soils are developed in flat to slightly depressed, poorly drained situations, and require ditching before they can be used for agriculture. The series is most extensively developed in the flatwoods, or the low region of the Coastal Plain, east of the Mississippi River.



FIG. 1.—CHARACTERISTIC GROWTH ON LEON FINE SAND, ROLLING PHASE, EAST OF CLEARWATER.



FIG. 2.—PARKWOOD FINE SANDY LOAM, SHOWING CHARACTER OF VEGETATION ON UNCLEARED PORTION.



Report of Bureau of Soils, U. S. Dept. of Agriculture, 1913.

PLATE VI.

TIDAL MARSH BETWEEN OZONA AND SUTHERLAND.

PORTSMOUTH FINE SAND.

The surface soil of the Portsmouth fine sand, as typically developed, consists of a dark-gray or black fine sand, with an average depth of 10 inches and containing considerable organic matter. The sub-soil is a light-gray fine sand, practically free from humus, passing at about 24 inches into a hardpan stratum. This layer sometimes lies directly beneath the dark surface soil, while in other places it is either separated from the dark surface soil by a layer of gray or white fine sand of varying thickness or is not developed at all within the 3-foot section. The stratum is composed of a compact fine sand carrying considerable organic matter. The color is usually dark brown to almost black in the upper part and of a lighter brown or coffee-grounds color beneath. The color is imparted by organic matter. Sometimes the material is underlain within the 3-foot section by gray or white sand, but infrequently it continues to a depth of considerably more than 3 feet. On account of its compact nature, this layer is said to be impervious to water, checking underdrainage in wet seasons and retarding the upward capillary movement of moisture in dry seasons.

This is the principal soil of the "flatwoods" section. It is most extensively developed in the eastern half of the county. Large areas occur southeast of Largo, extending toward St. Petersburg, and to the north and west of Green Springs. Numerous water and grass ponds occur in the development of this type southeast of Largo, while in the areas farther north the level topography is varied by innumerable cypress ponds, many too small to be mapped.

The type also occurs on gentle slopes where the land is equally as wet and sometimes even more completely saturated than that of the flatwoods. There is considerable seepage on these slopes, probably on account of the resistance offered underdrainage by the hardpan layer. The soil of such slope situations is frequently black to a depth of 15 inches or more.

The characteristic growth on the Portsmouth fine sand consists of longleaf pine, saw palmetto, myrtle, and gallberry. Saw palmetto is an indication of the existence of the hardpan layer already described. (Pl. III, Fig. 1.) In the wetter situations the undergrowth of myrtle and gallberry is much more luxuriant than elsewhere. During the rainy season this soil is inundated and extensive drainage systems must be established before it can be successfully cultivated. Up to the present time little of the type has been utilized, but when reclaimed it should prove an excellent soil for truck crops. It is not adapted to citrus fruits. The unimproved land is held at prices ranging from \$15 to \$75 an acre.

Portsmouth fine sand, swamp phase.—This phase of Portsmouth fine sand is found only in the northern part of the county and is mainly confined to small depressed areas within the typical soil. These are covered with water all or the greater part of the year, and even when not covered the soil is always in a saturated condition. The soil for the first few inches consists of a black, mucky fine sand, containing somewhat more organic matter than the higher lying typical soil. Below this is a gray to white fine sand extending to a depth of 3 feet and more. Hardpan is not encountered in these depressed areas. In all respects except vegetation, these areas—locally known as cypress ponds or swamps—resemble the water and grass ponds in the southern part of the survey. They are distinguished by a growth of cypress and bay, with some swamp maple and myrtle around the edges. (Pl. IV.)

No attempt has been made to clear and drain any of these areas. If drainage could be successfully accomplished, the soil would no doubt be productive. Their position, however, makes it impracticable to drain the greater part of these areas and their value must lie mainly in the forest growth which they support.

FELLOWSHIP SERIES.

The Fellowship series is characterized by the black to dark-gray or brownish-gray color of the surface soils and by the plastic, sticky character of the subsoil or substratum, which is dominantly drab in color or drab mottled with shades of yellow and brown and sometimes red. These soils occupy rolling, low, flat or nearly flat areas. The rolling portion has good surface drainage, but frequently is poorly drained in the subsoil on account of seepage resulting from the imperviousness of the plastic clay subsoil and substratum. The low, flat areas are always poorly drained and require ditching or tiling for their profitable utilization. The Fellowship soils support a "hammock" growth and forests of pine. The hammock growth consists ordinarily of several varieties of oak, including especially water oak, along with cabbage palmetto, magnolia, bay, sweet gum, and hickory. The material is derived largely, or in part, from limestone and associated sandstone or arenaceous sandstone belonging to the Vicksburg and related formations. A portion of the sandy surface material may represent originally unconsolidated Coastal Plain deposits.

FELLOWSHIP FINE SANDY LOAM.

The soil of the Fellowship fine sandy loam is a gray to dark-gray or black fine sand 6 to 8 inches deep. The subsoil to a depth of 14 inches is an orange to ochreous-yellow fine sand, grading into a fine

sandy clay of the same color. Below this is found a yellow to gray fine sandy clay mottled with orange or brown. In the lower portions of the section shell fragments occur, and in places an underlying shell limestone comes within the 3-foot profile. Between the orange sand and the darker colored surface soil there is frequently a layer of almost white fine sand.

The Fellowship fine sandy loam is found in quite extensive areas through the "flatwoods" region north of Sawgrass Lake and extending in a southwesterly direction through Pinellas Park. It seems to occur where the water and grass ponds are most numerous. The areas are flat and represent bodies of the unconsolidated sandy deposits so thin that the underlying country rock lies within or not far below the 3-foot limit of the soil profile. Where the sand covering is deeper the Portsmouth fine sand is developed, and as a result these two types are closely associated. The color and texture of the subsoil of the Fellowship fine sandy loam are due to the proximity of this underlying rock, and in some instances the subsoil may be composed entirely of residual material resulting from the weathering of the rock. The difference between the subsoils of the Parkwood types and the Fellowship fine sandy loam lies in the fact that the material underlying the former has been more thoroughly decomposed and has reached the marl stage and is typically of a lighter color.

Owing to the character of the underlying material, which greatly retards percolation, the Fellowship fine sandy loam is very poorly drained, the surface being covered with water for some time after heavy rains.

The characteristic natural vegetation on the Fellowship fine sandy loam is wire grass, saw palmetto, and longleaf pine.

No portion of this type was seen under cultivation. It would, in all likelihood, prove a strong soil were good drainage established. On account of the nature of the substratum and the extreme flatness of the country, however, drainage would be in all cases costly and in some instances next to impossible, owing to the lack of fall and suitable outlets.

MISCELLANEOUS MATERIAL.

MUCK.

Muck is derived from decayed plant remains which have accumulated in low-lying positions under poor drainage conditions. During the process of decomposition the vegetable material assumes first a loose, fibrous character, in which stage it is known as Peat. The color of this is usually reddish brown. Further decay results in the formation of a black organic mass in which the original structure and fibrous nature of the plant or vegetative remains are unrecognizable.

There is usually present varying though small proportions of mineral matter.

There is considerable variation in Muck as it occurs in Pinellas County. In depth it varies from a few inches to 3 feet or more, and the subsoil may be either a dark-colored fine sand or a black to drab fine sandy clay.

A few of the areas mapped were recognized to be more properly classed as Peat than true Muck, but it was not found practicable to make the separation. These areas no doubt possess a lower agricultural value and are less desirable than the typical soil.

Muck is found scattered throughout the survey in areas of varying size. Several good-sized areas occur in the northeastern part of the county and west and northwest of St. Petersburg. These areas, from the prevalence of the bay tree, are locally called "bays." The large area at Clearwater, known as the "prairie," has only a scattering growth of myrtle and bay, with some clumps of the latter. The Muck surface of this area is very shallow in places, and there are some small knolls of sand which could not be shown on the soil map. There are also in the "prairie" some patches of deeper organic surface soil which catch fire and burn for considerable periods of time. Such patches are more properly Peat.

Smaller bodies of Muck are numerous and many could not be represented on the map on account of their limited extent. These are called "bay heads," on account of the tree growth and the fact that they are usually the source of small streams.

Although 4,608 acres of Muck were mapped in Pinellas County, a very small acreage is under cultivation. A few patches have been drained and used for crops, and on areas around the edge of some of the larger bodies vegetables and strawberries have been successfully produced. Many areas could be profitably cleared and drained. The soil is well adapted to the production of celery, lettuce, onions, cabbage, carrots, Irish potatoes, corn, strawberries, and all garden truck suited to the county. At Sanford, Fla., Muck is considered an excellent soil for the growing of celery, while at Hastings, Fla., it is held in high favor for the production of Irish potatoes.

It is surprising that utilization of Muck has not received more consideration in Pinellas County. It is believed that with drainage and proper methods of management it would prove the most valuable of any of the soils for truck growing.

SWAMP.

In the survey of Pinellas County the term Swamp has been confined to the low-lying soils along stream courses and around the larger inland bodies of water. Other wet, swampy, and poorly drained areas forming cypress ponds, bays, bay heads, and sand ponds have been classified as other types of soil.

The Swamp areas are subject to overflow and are more or less wet the greater part of the year. They support a water-loving vegetation, consisting mainly of cypress, with cabbage palmetto, gum, swamp maple, bay, myrtle, alder, and numerous vines.

The extent of Swamp is small, the largest areas occurring along Brooker Creek and its tributaries and around Lake Butler and Lake Largo.

Swamp soil is rich in organic matter and may consist of mucky black sand, Muck, or Peat. The subsoil varies from a white or black sand to drab or dark-colored fine sandy clay.

The areas of Swamp have no agricultural value, on account of the impracticability of draining them. Location and the character of cypress growing on it determine the prices asked for land of this kind.

COASTAL BEACH.

The Coastal beach includes strips of white and light-gray sand containing varying amounts of shells and shell fragments, occupying a position along the water front. These areas, which owe their formation to the action of waves and tides, have no agricultural value at present.

The keys or islands lying off the mainland are the largest and most important areas. The higher elevations, which are modified by wind action, support a scattering growth of pine, cabbage palmetto, scrub palmetto, and a number of salt grasses. The side of these islands bordering the bay is usually lower than the side bordering the Gulf, and here mangrove bushes grow in profusion. Many of the smaller islands are only slightly elevated above water and are covered with a dense growth of mangrove.

At Green Springs a low, narrow ridge consisting almost entirely of oyster shells has been included in this classification. The ridge, which is over one-half mile in length, supports a dense growth of cedar and scattering live oaks. A few small areas of "made land," composed of material dredged from the Bay of St. Petersburg, were also mapped as Coastal beach.

While the Coastal beach lands are of no practical value for agricultural purposes, the most desirable areas, especially those located along the Gulf shore, command high prices as sites for cottages.

TIDAL MARSH.

Along the coast in many places and fringing the tidal streams and bayous are found low, treeless areas of a marshy character. (See Pl. VI.)

The material in these areas consists of a black or brownish-gray fine sandy or silty loam, containing considerable vegetable matter undergoing the process of decomposition. In many places Tidal

marsh resembles Muck, except for the timber growth, and the separation of the two was frequently made solely upon this character.

The largest areas of Tidal marsh occur along the Anclote River, which divides into a number of tortuous channels shortly after entering the county. Other good-sized areas are found bordering the larger bayous and around the numerous inlets.

All areas are subject to frequent tidal overflow and at present are of no agricultural value. They support a water-loving vegetation consisting of marsh grass, reeds, and rushes.

The Tidal marsh when drained and freed from excess salt is productive. Many of the areas could be reclaimed. After drainage the injurious salt will be washed out by the rains. The soil when fitted for cultivation is especially desirable for trucking.

North of Tarpon Springs considerable areas of the Tidal marsh are underlain by limestone, frequently within less than 3 feet of the surface.

SUMMARY.

Pinellas County lies on the west coast of Florida about midway between the northern and southern boundaries. It comprises an area of 166,400 acres, or 260 square miles. It was formed from the western part of Hillsboro County in 1911. The topography is varied, ranging from flat to hilly, the highest points being found in the northern part.

The climate is subtropical. The mean annual rainfall is over 50 inches; the mean annual temperature about 70° F. The winter mean is approximately 60° F., and the summer mean close to 80° F. The climate is one of relatively stable temperature. On account of the pleasant winter weather, thousands of tourists flock to the resorts along the coast.

Transportation facilities are good over a large part of the county. Much shipping is done by water.

Clearwater, the county seat, has a population of about 1,171. St. Petersburg, with a population of 4,127, is in the southern part of the county. Tarpon Springs, in the northern part, with a population of 2,212, is one of the greatest sponge markets in the world. Sutherland, Ozona, and Dunedin are smaller towns in the western part of the county. These are shipping points for citrus fruits grown in their respective communities. Green Springs, the site of Espiritu Santo Springs, is a noted health resort. It is also an important shipping point for the east coast. Largo is one of the chief shipping points for citrus fruits.

Citrus fruits constitute the money crop of the county. Trucking is carried on to a limited extent. No general farming is practiced and practically all grain and hay are imported.

Land values have advanced considerably during the last five years. Unimproved land can be bought for \$10 to \$75 an acre, and well-established citrus groves for \$300 to \$1,000 or more an acre.

Eleven types of soils are mapped in the county. These are grouped in six series, with miscellaneous types, as follows: Swamp, Muck, Tidal marsh, and Coastal beach. Types of the fine sand class predominate, there being but two fine sandy loams and one silty clay loam.

The Norfolk fine sand is the most important and valuable soil. It is practically the only type used for citrus orchards and commands the highest price. The hilly phase is a loose, droughty soil. The flat phase contains a high percentage of organic matter and is a strong, productive soil for truck and citrus fruits.

The Portsmouth fine sand is a poorly drained soil, usually underlain by hardpan. When artificially drained it is best adapted to trucking. It is not at all suited to citrus fruit production. The swamp phase supports a heavy and valuable growth of cypress. No attempts have been made to clear and drain these wet areas.

The Leon fine sand occurs typically and in a rolling phase.

The typical soil closely resembles the Portsmouth fine sand in texture and topographic position. It is a flatwoods soil and usually underlain by a brown hardpan layer. It is of low agricultural value. The rolling phase is very droughty and has no agricultural value. The characteristic timber growth is spruce pine, which is not found on any of the other soils of the county.

The Plummer fine sand is an unimportant type occurring only in the northeastern part of the county. It is poorly drained and best suited for pasture land.

The Parkwood soils, consisting of a fine sandy loam and a silty clay loam, are not extensively developed. They occupy low, naturally wet country, but constitute the strongest soils of the county.

The Fellowship fine sandy loam is low lying, and under present conditions not suited for the growing of any crop. With drainage this soil should prove highly productive.

Up to the present time Muck has not been extensively placed under cultivation. If drained, it would be adapted to Irish potatoes, celery, strawberries, and other truck crops.

Coastal beach has no agricultural value. The keys or islands form the largest development of this type.

Tidal marsh represents lowlands along the coast and streams subject to tidal overflow. Many of these areas could be diked and drained and converted into valuable farm lands.

There is a large acreage of undeveloped land in the county, some of which is adapted to the production of citrus fruits and some to the growing of truck. Either of these lines may be profitably extended.

[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.]

NRCS Accessibility Statement

This document is not accessible by screen-reader software. The Natural Resources Conservation Service (NRCS) is committed to making its information accessible to all of its customers and employees. If you are experiencing accessibility issues and need assistance, please contact our Helpdesk by phone at 1-800-457-3642 or by e-mail at ServiceDesk-FTC@ftc.usda.gov. For assistance with publications that include maps, graphs, or similar forms of information, you may also wish to contact our State or local office. You can locate the correct office and phone number at <http://offices.sc.egov.usda.gov/locator/app>.

The U.S. Department of Agriculture (USDA) prohibits discrimination in all its programs and activities on the basis of race, color, national origin, age, disability, and where applicable, sex, marital status, familial status, parental status, religion, sexual orientation, genetic information, political beliefs, reprisal, or because all or a part of an individual's income is derived from any public assistance program. (Not all prohibited bases apply to all programs.) Persons with disabilities who require alternative means for communication of program information (Braille, large print, audiotope, etc.) should contact USDA's TARGET Center at (202) 720-2600 (voice and TDD). To file a complaint of discrimination write to USDA, Director, Office of Civil Rights, 1400 Independence Avenue, S.W., Washington, D.C. 20250-9410 or call (800) 795-3272 (voice) or (202) 720-6382 (TDD). USDA is an equal opportunity provider and employer.