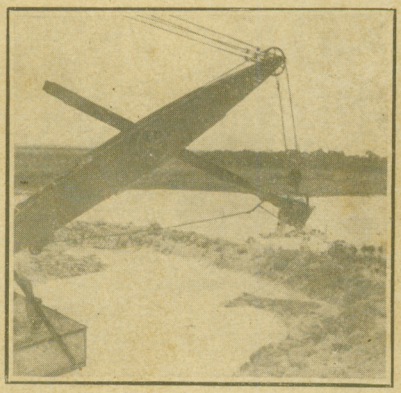
THE RECLAMATION OF THE FLORIDA EVERGLADES

By S. RODMOND SMITH

1909



The dipper in the modern constellation of beneficial devices that looks good to the drainage advocate, does the work and turns an unproductive wilderness into a fertile zone.

MIAMI CITY AND RIVER, ON BAY BISCAYNE, FLORIDA, LOOKING EAST.

TO

NAPOLEON B. BROWARD

THE PIONEER WHO BLAZED THE TRAIL WHICH LEADS TO THE RECLAMATION OF THE EVERGLADES OF FLORIDA; WHOSE SINGLENESS OF PURPOSE, RESOLUTE ACTION AND PATRIOTIC SERVICE FOR THE COMMON PEOPLE IN THIS BEHALF, WILL LONG BE REMEMBERED AFTER IT IS FORGOTTEN THAT HE WAS ONCE GOVERNOR OF THE STATE.

INTRODUCTION

BEING at present a permanent resident of Miami, Florida, I have been often surprised at the number of its citizens who are skeptical as to the feasibility of the drainage of the Everglades, and as to its desirability if it could be shown to be practicable. Nor is this sentiment confined alone to ignorant and illiterate persons, for I have found it entertained by many intelligent and well informed persons at home, and elsewhere.

The object of this pamphlet is to show if I may, that the project is not only feasible if energetically and properly handled, but is desirable from every point of view, except that of some secluded hermit or roaming Seminole, who may wish to pass his life in the solitudes of these vast inland plains.

Without any pretense of being a scientific expert on the subject, I have read attentively the work of authors, whose opinions are accepted as the best modern utterances on the subjects of irrigation, drainage, soil deposition, plant foods, soil bacteria, as well as the reports of Government, State and Corporation Engineers regarding the levels of the drainage area, and the latest bulletins of the U. S. Department of Agriculture by the Weather Bureau and Bureau of Soils. I have quoted largely from Professor Hilgard's standard work on "Soils," because of his familiarity with and study of the soils of Mississippi and Louisiana as well as of California; and further because his work is fortified by numerous authorities at home and abroad, which the limits of this article forbid stating more fully; for the last mentioned reason I have also quoted extensively from the valuable publications of the Weather Bureau and Bureau of Soils, U. S. Department of Agriculture.

From a careful study of the data mentioned, I have drawn deductions which I think cannot be controverted; and the result is a profound conviction that not only is the drainage of the Everglades perfectly feasible, but in view of the great and lasting benefits to be conferred upon the State of Florida at large, as well as upon the sections immediately adjacent to this development, it would be very culpable in the people of the State to longer neglect the opportunities presented by a kind Providence.

I hope that these convictions may be shared by those now differing with me in the belief above expressed.

I may say in conclusion that I do not own a single foot of Ever-

glade soil, nor am I interested in any way therein except so far as its reclamation will benefit me generally as a citizen of Florida, Dade County and the City of Miami.

S. RODMOND SMITH.

Miami, Fla., Nov. 13, 1909.

Reclamation of the Florida Everglades

THE EVERGLADES OF FLORIDA, LOCATION, EXTENT, ETC.

CHAPTER I.

The territory known generally as the Florida Everglades, meaning thereby the submerged and partly overflowed lands which are below the level of Lake Okeechobee and lie to the East, West and South of this lake, extends from Cape Sable in Latitude 25.10 degrees North to Latitude 27.10 degrees North, and embraces the whole Florida peninsula between those limits, except the elevated rim of higher land extending along the coast line of the peninsula, which holds back the waters of this extensive body of submerged land; and which rim varies in width from two or three miles to ten or fifteen.

This rim or strip of high land, for several hundred miles on the Atlantic and Gulf coasts of the lower peninsula, is penetrated by lateral depressions from the Glades, generally about two to four miles apart, which permit the Glade waters in times of freshet or protracted rains to overflow them, but which are sufficiently high at their outer ends to prevent the drainage of the Glade waters into the bays, sounds and rivers communicating with the ocean.

So that broadly speaking, it may be said that this territory some 120 miles long by say an average of 80 miles wide, and containing upwards of five million acres of land, is susceptible of drainage and irrigation, if it can be shown that the average level of Lake Okeechobee which is the natural storage reservoir—is sufficiently high in elevation to permit the discharge of its waters upon the lower lands beneath it; and that these lower lands are themselves sufficiently elevated to drain freely into the rivers, bays and sounds communicating with the ocean.

Any doubts which may have been or are still entertained upon this subject, have been completely set at rest by the reports of the U. S. Government Engineers, supplemented as they are by the results of the investigations of engineers in the service of the State of Florida, and in the employment of Railroad Corporations and of private parties. It has been, by these careful and thorough investigators, ascertained that the mean level of Lake Okeechobee, within its enclosing walls, is twenty-one feet above the mean level of the ocean, into which its surplus waters, after passing the submerged Everglade plateau below it, are discharged. (Report of Buckingham Smith to the U. S. Senate, June 1st,

1848; General Meigs U. S. Engineering Corps report of survey made March and April 1879; General Gilmore, report to U. S. Senate, June, 1882; Chas. F. Hopkins report to Chief Engineer Okeechobee Drainage Company, Feb. 4th, 1884; Capt. Wm. Black, U. S. Engineer Corps, report of survey made March and April 1887; Jos. M. Kreamer, Chief Engineer Okeechobee Drainage Company, report to R. Solinger, Sept. 10th, 1889; J. E. Ingraham, 3rd Vice-President F. E. C. R. R. Co., report of 1892; James W. Stewart, U. S. Drainage Engineer, field notes of his report May 18, 1907, to the Chief of Irrigation and Drainage Investigation U. S. Department of Agriculture, J. O. Wright, Supervising Drainage Engineer, U. S. Department of Agriculture, report of June 25th, 1909.)

It has also been ascertained by the same investigators, that the plane or horizon of the Glades proper, inside the coastal elevated rim to which reference is above made, is at an average elevation of seven to ten feet above the ocean mean; and that the submerged land in the main ascends gradually as the lake is approached.

This data is corroborated by the natural flow of the waters of Lake Okeechobee and of the Everglade terrace. At nearly all times except in periods of protracted drought or late in the spring before the summer rains begin, the lake is discharging its surplus waters into the Everglade horizon, and these submerged lands again are pouring their waters into the ocean by the ancient rivers and innumerable creeks and underground channels which have cut or worn their passage through the coastal rim referred to. Of such rivers and creeks heading in the Everglades, may be mentioned the Loxahatchie, St. Lucie, Hillsboro, New, Middle and Miami rivers, and Snake, Arch, Snapper and Black creeks on the East Coast, and Shark, Calusahatchie and Harney rivers and many creeks and outlets unknown to the writer on South and West coasts. Some of these rivers in the summer and autumn months, as at Miami, develop a current of four miles an hour, half way between the rapids at their source and their discharge into the bays and ocean.

So that it may be assumed, with the above mentioned data respecting the levels of the Everglade plateau, established, that there is no insuperable obstacle presented to its drainage; and that if the land when reclaimed is of greater value intrinsically than the cost of its reclamation, the project will go on uninterruptedly until the end is attained and this extensive territory is brought under the control of the husbandman.

It should be remarked that in addition to the territory comprising the Everglades proper, there are some four million acres of half swamp lands intimately connected with it, which will be affected beneficially by its reclamation. These lands lie to the North, Northeast and Northwest of Lake Okeechobee and constitute the low water shed tributary to

this lake. They extend as far North as the latitude of Lake Kissimmee and beyond, and are so flat and nearly level that when Lake Okeechobee reaches its high water stage, this country is saturated and partly submerged except in the cases of isolated hammocks and pine lands. (Report of J. O. Wright, Supervising Engineer U. S. Department of Agriculture, Office of Experimental Stations, June 25, 1909, and also field notes of J. T. Stewart, U. S. Drainage Engineer in his report to Dr. Elwood Meade, Chief of Irrigation and Drainage Investigations, May 18, 1907, U. S. Department of Agriculture.)

Allusion is made to this phase of the subject, in order to emphasize the great importance of the drainage scheme, not only for the reclamation of the Everglades proper; but as a collateral and necessary adjunct thereto, the further reclamation of these other millions of acres of lands.

Character of the Everglade Soil When Drained.

CHAPTER II.

It is therefore pertinent to consider very generally the structure of the formation underlying the Everglades; the present character of the soil as it now exists in a submerged condition, and incidentally its favorably changed condition when drained and surface dried; the climate with respect to its temperature and the permanency of the same and its humidity; the plant growth of the Everglades and of similar adjacent lands, as affording inferences for the successful growth of like vegetation on the reclaimed areas; the fertility of the lands when drained; the transportation facilities after the reclamation is accomplished; the expense of the drainage operations; and finally whether the results to be accomplished are sufficiently great to justify the expense incurred in the reclamation project.

The formation of the lower Florida peninsula, so far as observed, appears to be almost universally a cream colored corraline limestone, slightly changed in some localities, as at Redlands in the rich Homestead country below Miami, by a red clay admixture.

Whether this formation arises from the deposit of limestone particels originally found on the ocean beaches, and blown inland by the winds during past ages, so as to form extensive basins with a ridge of hardened sand hills enclosing them—as has been suggested by some geologists, or is the result of the work of corralline organisms at dif-

ferent levels of submergance during several periods of geological time as suggested by others; is a matter of but little consequence, so far as this present inquiry is concerned.

It is enough to know that the substratum of rock underlying the soil of the Everglades is a corralline limestone; that the basin of the Everglades is fed by the overflow from Lake Okeechobee, by subterranean currents of lime carbonated waters from upper distant levels, and also by the surface rain fall on its own terrace; and that these overflows and subterranean waters not only have carried down large quantities of sand and marl in past ages, and deposited them on the limestone floor of the Everglades, but are doing so at the present time with the finer particles of silt held in suspension.

It may therefore be said, that by whatever means it has occurred, the character of the Everglades soil so far as is derivable from the wearing away and decay of the country rocks, is essentially limestone, modified by sand, clay and marl deposits washed down from above, and by such chemical changes as have taken place during the past ages by reason of the soil saturation with the carbonated waters flowing over its surface.

The inquiry heretofore has been limited to the mineral constituents of the soil. Much the larger portion of the soil content, however, consists of a black mass or mold, locally known as "muck," which covers the silt deposits on the bottom of the Everglades like a blanket, to the depth of six inches near the outer rim of the Everglades and up to ten or more feet in the deeper interior part of the basin. This "muck" deposit arises almost entirely from the decay of aquatic vegetation, chiefly saw grass, splatter docks, pond lillies, rushes and the like during past ages over the Everglade area, together with fallen leaves, twigs, branches and roots of the forest trees common to this latitude, which have become rotted by the lapse of time.

If this soil, composed of the constituent parts above noted, when drained, surface dried and areated possesses resources of fertility under the continuous summer climate Nature has given it, common to other limestone soils of similar appearance in the Mississippi and Yazoo bottom lands,—the richest in the world—there is no need to ask the question whether it will pay to drain it, even though the expense per acre should prove greater than the Government reclamation projects in the arid West.

Everglade Soil—Continued.

CHAPTER III.

We will now proceed to inquire whether this soil, when drained and areated, contains the necessary humus to produce and sustain vegetable growth and plant life; and no attention will be paid here to the usual distinction between soil and subsoil; because the muck blanket with its silt intermixture, which will when drained constitute the Everglade soil, is when wet of a uniform black color, and apparently of a uniform consistency, whether at six inches or six feet in depth.

Humus is defined to be "a complex mixture of dark tinted substances known as vegetable mold, which is the result of the decomposition of organic matter, by the natural processes of decay to which such matter is subject after death." (Hilgard on Soils, p. 21.)

Such product of decaying vegetation when formed in the presence of an excess of water impeding the circulation of the atmosphere, is known as "sour humus"; and such soil thus produced in nature bears only sour growth, sedges, rushes, and the like; and requires reclamation before being adapted to ordinary crops. (Ibid, p. 122.)

The normal process of humification or the sweetening of "sour humus" soil, occurs when such soil is properly drained and oxigenized by the rapid circulation of air over it and through its interstices; and this should take place under a warm temperature with moderate moisture, and when carbonates, especially that of lime, are present to prevent the formation of noxious acids or to neutralize them it formed. (Ibid, p. 122.)

Under such conditions the black humus soil, particularly at or near the surface, becomes the home and industrial center of myriads of nitrogenous bacteria, whose function consists in segregating the nitrogen from the unlimited quantities in the surrounding atmosphere and fixing it and converting it into nitric acid. This acid unites with the potash, soda, lime and magnesia salts if present in carbonated waters, and forms the indispensable plant food necessary for the growth and maturity of all higher vegetation. (Ibid, p. 143 and following pages with numerous authorities there cited.)

The fertility of all lands depends upon the amount of humus existing in its surface soil; and lands otherwise most valuable and best situated for crop production, when their humus ingredient becomes exhausted by improvident tillage, rapidly becomes sterile and undesirable. (Ibid, p. 131.)

It thus appears that the black muck soil overlying the corralline

rock bottom of the Everglades, and which is submerged by the overflow waters of Lake Okeechobee and by the surface and subterranean waters to which reference has been made, is until drained a "sour humus" soil, and fit only to bear sedges, rushes, etc.

That this is so, is amply borne out by its actual present growth, which is chiefly a heavy and almost impenetrable "saw grass" with other fresh water aquatic plants here and there interspersed, excepting on the occasional hammock islands, which rise a few inches above the flood level and thus permit a limited forest growth of mastic, pidgeon plum, cypress, palms, pine, etc.

That much of the noxious substance formerly present in this "sour humus" soil has been neutralized and precipitated by the intermixture of waters containing lime salts, sufficiently appears by the change from the coffee colored waters, characteristic of swamp drainage, into the clear, translucent wholesome waters of the Everglades. Comparatively little will therefore have to be done to convert the sour humus soil of the Everglades into a productive and rich humus, and this will consist chiefly in draining the soil, so as to permit the air to penetrate and revivify it.

That all soils, irrespective of location, contain an excess of alkali injurious to plant life and growth, except where the rain fall or irrigation waters have leached them from the surface, is indisputable. (Ibid, p. 422.)

In humid climates this is shown to be true by too radical a drainage of swamp overflowed lands. In such cases, as well as in semi-arid tracts under irrigation, a thin white scum of alkali is frequently seen on the dried surface of the soil after the subsidence of the waters. In arid lands, following the heavy rain falls occurring at rare intervals, the evaporation of the waters leave large tracts covered with a layer of alkali brought up by capillary action from below. (Ibid, p. 422 and following pages.) Which is frequently of the thickness of a pane of window-glass.

It is one of the purposes of all irrigation projects to correct this excessive drainage of the soil, by retaining sufficient moisture in the subsoil or at a short distance below the surface, so that the roots of growing plants may readily penetrate this saturated sub-stratum, and obtain the requisite water and plant food to promote their life function and growth. At the same time the drainage flow to lower levels, carries down the excess of alkali which would otherwise rise and form a scum on the surface of the soil. (Ibid, p. 422.)

So that we have under the equable climatic conditions present in the Everglade horizon, as evidenced by the Government reports for the past ten years at Miami and Fort Myers, Florida, near the middle of

this territory, and to which reference is hereafter made, all the essential constituents, when this soil is drained, necessary for a fertile and productive zone:—namely, a climate practically free from frost with ample precipitation; a territory possessing physical features which permit thorough drainage of the entire area, and at the same time an adequate irrigation system in times of drought; a black, rich limestone soil when drained, with abundance of humus and nitrates, capable of maturing its citrus fruits from November to the following May, and its vegetable crops of tomatoes, peppers, egg-plant, white potatoes, celery, spinach and the like, during the winter months of January, February, March and April,—when prices range high, and there is no competition at the North, except in the artificial products of expensive hot houses.

It is as though Nature had provided an exceptionally good soil, upon a terrace susceptible of easy drainage to the ocean, and had arranged an invisible and strongly constructed glass house as a protection against frost, and then had maintained an even warm temperature, by means not perceptible to the natural eye, for the luxuriant growth of plant life; and had done all this without any expense to the land owner; and then to make the gift complete, had provided a storage tank, some forty miles in diameter at a higher level, to corral the drainage and rain waters, and permit their distribution upon the lower lands in time of drought. And that all these benefits would be available upon the construction of adequate drainage canals through an easily excavated soil, at the inconsiderable expense of seven cents a cubic yard for the material removed and deposited upon the sides of the canals.

The Internal Improvement Board of the State of Florida is now, and has been for the past three years engaged in this reclamation project, having at present four large dredges in operation and having excavated about twenty miles of canals, each having an average width of sixty feet and an average depth of ten feet below the earth's surface.

From the proceeds of the sales already made, and from the taxation of five cents an acre on the lands to be benefited a fund of about one million dollars is available for this project. There is yet belonging to the State and unsold about a million and a half acres in this territory.

It is the expectation that in the near future an increased number of dredges will be put on the work, and the excavation of the drainage canals expedited, so that this healthy and attractive country will be rapidly settled, and a veritable new Holland with thrifty and prosperous inhabitants will be planted in America.

Climate of the Everglades.

CHAPTER IV.

In considering this subject with reference to plant growth it is well to recall the fact that although the maximum annual rainfall over this territory is 55.87 inches, three-fourths of this amount is precipitated during the summer months from May to November, when the pineapple, mango, avocado, sapodillo and other tropical plants fruit; and only one-fourth or say about 13.87 inches falls during the remaining autumn, winter and early spring months, when the grapefruit, orange, lemon, tangerine and all other citrus fruits mature, as well as the tomato, egg-plant, luttuce, cucumber, pepper, potatoes and all vegetables commonly included under the head of "market truck."

So that there is commonly recognized to be a rainy and a dry season; the former comprising the summer months above named, and the latter including the late autumn, winter and early spring months above stated.

With this distinction in mind, I have taken the weather reports, as exhibited in the Government climatic statistics by the Weather Bureau, for Miami on the East coast and for Fort Myers on the West coast of Florida,—both being near the latitude of the center of the Everglade territory, as being typical of the entire tract; although thirty or forty miles further South, the climate is somewhat warmer in winter and undoubtedly more exempt from low temperatures approaching the frost limit.

With these reports as a starting point in this inquiry, I have made three tables; one showing the averaged total precipitation at the two stations mentioned of each of the summer wet season months for the six years ending 1906; another the like data for each of the dry season months for the corresponding period; and still another furnished by the courtesy of the chief of the Weather Bureau at Washington, D. C., showing the total averaged precipitation per month for 15 years ending 1903, at Miami and Fort Myers, as well as the extremes of temperature for a like period at the stations above named and at Washington, D. C., for contrast, and also the averaged total number of rainy days during each month for a like period.

They are as follows: viz, Table A, showing the total amount of rainfall in inches at Miami and Fort Myers, Florida for each of the wet months from May to October inclusive, for the six years ending 1906,

according to the weather bureau reports of the U. S. Department of Agriculture.

MIAMI

MONTHS	1901	1902	1903	1904	1905	1906
May	10.42	0.94	1.35	12.28	3.93	7.89
June	21.72	6.01	10.48	6.06	7.61	8.60
July	8.18	3.28	.00	2.94	3.63	9.26
August	10.85	5.33	2.35	9.15	13.71	8.94
September	15.30	7.81	12.54	8.43	11.99	2.39
October	4.92	4.17	4.48	10.08	.00	13.68
TOTALS	71.39	27.54	31.20	48.94	40.87	50.76

TABLE A.—Continued.

FORT MYERS.

MONTHS	1901	1902	1903	1904	1905	1906
May	2.30	1.23	0.71	3.57	3.97	6.12
June	20.28	8.63	10.45	14.86	5.87	11.00
July	5.23	4.60	11.40	5.60	13.90	9.69
August	12.41	3.97	.00	6.30	10.52	12.02
September	6.86	6.60	4.15	3.07	9.09	3.39
October	0.78	7.46	1.62	1.78	1.51	2.41
TOTALS	47.86	32.49	28.33	35.18	44.86	44.63

Table B, showing total amount of rainfall at Miami, and at Fort Myers, Florida, for each of the dry months from November to April inclusive for the six years ending 1906, compiled from the weather bureau reports, U. S. Department of Agriculture.

MIAMI

MONTHS	1901	1902	1903	1904	1905	1906
November	.00	7.12	3.70	5.21	3.65	7.56
December	1.55	1.86	.00	0.40	12.38	.00
January	.00	.00	4.99	1.70	2.65	3.20
February	.00	5.30	4.70	1.65	0.64	3.78
March	1.67	.00	3.82	3.10	1.69	4.38
April	1.97	1.85	.00	2.04	1.32	2.33
TOTALS	5.19	16.13	17.21	14.10	22.33	21.25

TABLE B.—Continued

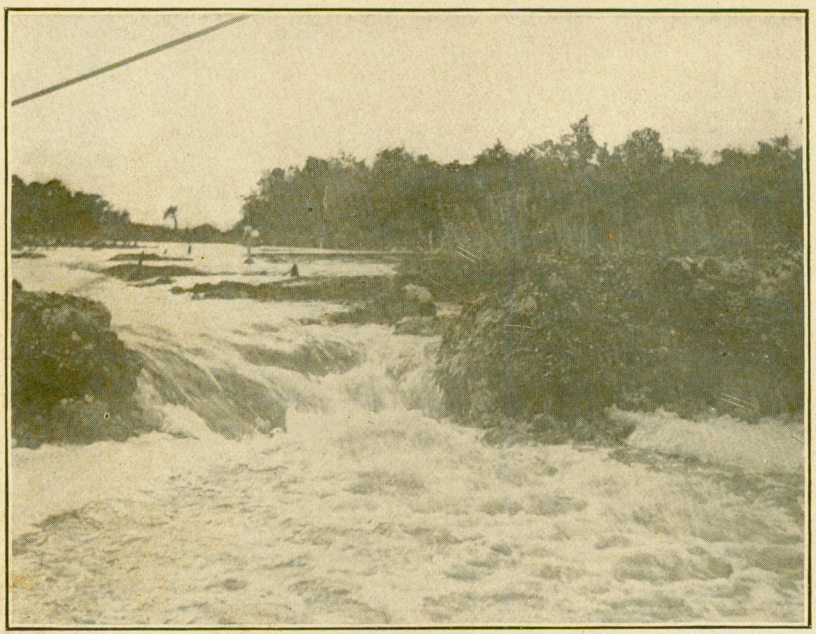
FORT MYERS

MONTHS	1901	1902	1903	1904	1905	1906
November	0.52	0.96	2.02	1.93	0.06	0.32
December	1.62	2.93	1.61	0.83	6.21	0.02
January	0.50	0.52	4.76	3.12	0.50	2.02
February	0.72	6.79	3.37	2.00	0.10	2.18
March	2.67	0.18	7.78	1.90	0.18	2.8
April	1.89	1.03	.00	1.10	4.83	0.21
TOTALS	7.92	12.41	19.54	10.88	11.88	7.59

TOTAL AVERAGE PRECIPITATION

Table C, showing the total average precipitation per month for 15 years ending 1903, at Miami, and Ft. Myers, as well as the extremes of temperature at Miami, Ft. Myers, Florida, and Washington, D. C. during said period, and the averaged total number of days, rainy, during each month of same period.

PRECIPITATION	Jan.	Feb.	Mar	Apl.	May	June	July	Aug	Sept.	Oct.	Nov.	Dec.	An'l
Miami, Fla.....	4.00	2.05	3.10	3.50	4.50	8.20	7.00	5.40	9.10	7.10	2.30	1.60	58.3
Ft. Myers, Fla.....	2.10	3.10	2.80	2.50	3.20	11.00	8.00	7.60	8.10	3.10	1.10	1.90	55.1
Key West, Fla.....	2.00	1.60	1.20	1.20	3.10	4.20	3.70	4.70	7.00	5.40	2.10	1.70	37.9
Washington, D. C....	3.40	3.60	4.10	3.20	3.80	4.00	4.50	4.00	3.80	3.10	2.80	3.10	43.1
EXTREME TEMPERATURE HIGHEST													
Miami, Fla.....	85.	88.	90.	92.	96.	94.	92.	94.	95.	93.	88.	91.	96.
Ft. Myers, Fla.....	89.	85.	88.	90.	94.	94.	94.	93.	93.	89.	87.	84.	94.
Washington, D. C....	76.	78.	83.	93.	96.	102.	103.	101.	104.	92.	80.	73.	104.
LOWEST													
Miami, Fla.....	35.	29.	39.	46.	52.	65.	69.	60.	62.	54.	38.	37.	29.
Ft. Myers, Fla.....	28.	28.	39.	45.	50.	58.	67.	69.	61.	48.	35.	24.	24.
Washington, D. C....	-14.	-15.	4.	22.	34.	43.	52.	49.	38.	26.	12.	—13.	—15.
RAINY DAYS (with .01 in. or more)													
Miami, Fla.....	4.	3.	4.	4.	5.	8.	7.	7.	12.	7.	2.	2.	65.
Ft. Myers, Fla.....	5.	5.	4.	4.	7.	15.	15.	14.	14.	7.	4.	4.	98.
Washington, D. C....	12.	10.	12.	11.	12.	10.	11.	11.	8.	9.	10.	10.	126.



RAPIDS AT HEAD OF MIAMI RIVER BEFORE DRAINAGE OPERATIONS COMMENCED.

RECAPITULATION.

Miami Precipitation Seasons.

	Dry	Wet
1901	5.19	71.39
1902	16.13	27.54
1903	17.21	31,20
1904	14.10	48.94
1905	22.33	40.89
1906	21.25	50.76
6	96.21	270.70
	16.03	45.12
Fort Myers' dry season	11.70	
2	27.73	
	13.865 Ins.	

Average between the East and West coast, during the Dry Season.

Ft. Myers' Precipitation Seasons.

	Dry	Wet
1901	7.92	47.86
1902	12.41	32.49
1903	19.54	28.33
1904	10.88	35.18
1905	11.88	44.86
1906	7.59	44.63
6	70.22	233.35
	11.70	38.89
Miami wet season		45.12
2		84.01
		Ins. 42.005

Average between the East and West coast, during the Wet Season.

The last table "C," does not embrace the years 1904, 1905 and 1906, but substantially confirms the data shown by the two former tables. The total rainfall by table "C," as averaged at the two stations on the opposite side of the peninsula, being 15.2 inches during the dry season and 41.5 inches during the rainy season, respectively 26.8 per cent and 73.2 per cent of the total precipitation, as against 13.86 inches for the dry season, and 42 inches for the wet season, respectively 24.8 per cent and 75.2 per cent of the total precipitation, as shown by Tables A and B.

It will also be noted by an examination of table "C," that while Miami had a somewhat higher temperature than Fort Myers,—on one occasion reaching its extreme of 96 degrees, it also had a slightly warmer winter climate than the western station. There was only one instance in these 15 years, when the temperature dropped below the freezing point at Miami, and only three like instances at Fort Myers.

Again, while the average annual rainfall at Miami during 15 years as shown by the above table, is over three inches in excess of the average for Fort Myers, yet the number of days upon which at least .01 inches of rain fell, was less by an average of over thirty.

It appears from these exhibits, that the average yearly precipitation during the summer wet season for six years ending 1906 amounts to 42 inches, and that therefore it is the summer wet season rains as distinguished from the winter dry season precipitation that fill up the Lake Okeechobee reservoir, and flood the plateau of the Everglades

HARVESTING A DADE COUNTY TOMATO CROP—ON MUCK SOIL.

proper, necessitating the extensive drainage operations for the reclamation of these lands.

It also appears that the similar precipitation during the dry season winter months for the like period, amounts to 13.86 inches only; and that therefore when this large area has been effectually drained, this normal rain fall, approaching semi-arid conditions, will have to be supplemented by irrigation from the storage waters of Lake Okeechobee, through the lateral ditches communicating with the drainage canals, by means of temporary stanks or other devices to back the seaward flow of water, or from drilled wells by means of wind mills and pumping engines.

We seem to have here, all the conditions for a complete humid climate during the summer wet season, and for a sub-arid climate during the dry winter portion of the year. These conditions should be constantly borne in mind, when considering the character of the climate and the necessities of the soil both for drainage and irrigation.

In view of the results of the analyses of the tabulated weather reports above noted, it is inexact to say without qualification that the Everglade climate is a humid climate, although there is an average annual yearly rainfall of nearly 56 inches. It has a very necessary and heavy precipitation during the wet season, to fill up the natural lake and underground storage reservoirs, and to promote the growth of the tropical vegetation common to this latitude; but it also has during the dry season a deficiency of rain fall and humidity, approaching the semi-arid conditions of Western Kansas and Texas, although with moisture enough on the lowlands, which have been submerged during a part of the wet season, to produce lavishly all truck vegetation; and to mature in perfection the citrus fruits growing on the uplands, through the saturation of the spongy coral rocks underlying the formation.

Some apprehensions have been felt that the result of these extensive drainage operations will be the drying up of the muck deposits covering the bottom of the Everglades; and that in the event of fire, either by accident or design, being communicated to this dried mass of decomposed vegetation partly mixed with silt from the uplands, large areas would be burned and reduced to ashes, leaving nothing in the track of such combustion to compensate for the expense incurred in the drainage operations; and that such obscure fires if once started, could not be stopped until the whole area was burned out.

Two fallacies underlie these fears; the first is that the muck deposits of the Everglades are peat, which when dried makes a good and useful fuel; on the contrary they are an unhumified vegetable mold or "sour humus," mingled with a small percentage of silt from the up-

lands, and are saturated with carbonated lime water. None of this when dried is inflammable.

The composition of Florida muck deposits is as follows:

Analysis of Florida muck soils, by the U. S. Department of Agriculture, Bureau of Soils publications.

	Sample No. 16	Sample No. 53
Nitrogen	1.23 per cent	1.45 per cent
Insoluble residue	59.80 per cent	43.06 per cent
Potash	.02 per cent	Trace
Soda	.50 per cent	.13 per cent
Lime	4.00 per cent	.15 per cent
Magnesia	.00 per cent	.09 per cent
Ferric Oxyde	.39 per cent	3.25 per cent
Alumina	2.20 per cent	3.25 per cent
Phosphoric acid	0.15 per cent	0.11 per cent
Chlorine	Trace	Trace
Sulphuric acid	.14 per cent	.12 per cent
Carbonic acid	3.49 per cent	.00 per cent
Water and Organic	29.66 per cent	53.07 per cent
	101.58	101.43

Sample No. 16 from near Lemon City, Fla., is a mixture of soil and subsoil to a depth of three feet. The growth upon it was principally saw grass interspersed with maiden cane, lillies, etc. It is unusually rich in Nitrogen and Lime and well supplied with Phosphoric acid.

Sample No. 53 is reclaimed bay-muck in the vicinity of Kissimmee, Fla., taken at a depth of fourteen inches. It is very deficient in potash and would be probably classified as "sour humus."

It will be readily seen from these analyses, that there are but little, if any inflammable constituents present unless they are contained in the insoluble residue, (which is more likely to consist largely of refractory sillicates) or in the organic matter which is classified with water.

So this apprehension does not appear to be well founded.

It will be interesting in this connection to note the high percentages of the four chief elements of plant life, in two samples of muck taken on the route of the U. S. Survey across the Everglades by the Department of Agriculture. One at 8 miles West of Pompano on the East coast, and the other at 18 miles West of the same place.

Analyses by the Department of Agriculture:

	Soil No. 8 b.	Soil No. 11 c.
Lime	2.25 per cent	2.21 per cent
Potash	.15 per cent	.08 per cent
Phosphoric acid	.19 per cent	.19 per cent
Nitrogen	3.16 per cent	2.58 per cent

The other fallacy is, that if extensive peat bogs were encountered in the drained areas, and were to be fired after becoming sufficiently dry to burn, that such combustion could not be arrested by the natural resources at hand.

It would be an easy proposition to dam the drainage canal or a series of drainage canals adjacent to the scene, by temporary breasts sufficiently high to back the waters and flood the area under consideration before such a fire had gained any headway, or to extinguish it promptly if any progress has been made.

The scheme of irrigating these lands in time of drought, from the storage reservoir of Lake Okeechobee, necessarily contemplates a series of locks or dams on the several drainage canals heading in the lake, as well as in the outlets themselves from the lake, and when these are installed, as they must be concurrently with the progress of the drainage work, the whole matter of drainage and irrigation will be under the complete control of the engineers in charge.

The War Department, which is charged by law with the control and regulation of the navigable waters of the United States has approved the recommendation of Gen'l W. L. Marshall, "that no connection shall be made between any of the canals to be dredged and Lake Okeechobee, and that no outlet shall be constructed for said lake, until suitable plans in detail, showing the proposed controlling works and other features, have been submitted to and approved by the chief of engineers and the Secretary of War." (Report of Gen'l Marshall to the Secretary of War, dated May 3rd, 1909, and approved May 8th, 1909.)

So that all apprehensions of loss by destructive peat bed fires, may be dismissed as baseless.

There are many people of intelligence and close observation, who are firmly of the opinion that the drainage of the Everglades will result in the lowering of the winter temperature of the Southern Florida peninsula to the freezing point, and that a consequent widespread destruction of fruits and vegetables growing at this season will be inevitable, to the great detriment of the trucking and fruit growing interests of this section.

It is useless to tell such objectors that in the opinion of professional experts who have given the subject much consideration, these results which are feared from the Everglade drainage, are not warranted; or to affirm that climate is always the result of great cosmic influences; or to advance the opinion that in the case of the Florida Everglades, with enormous bodies of tepid salt water, from 600 to 3000 miles in extent, to the Northwest, West, Southwest, South, Southeast, East and Northeast the drainage of the shallow waters from the inland submerged lands, can have no appreciable effect on the climate. (Messrs F. K. Cameron

and F. E. Gallagher of the Scientific staff of the Bureau of Soils, U. S. Department of Agriculture in personal interview with the writer.)

The answer of these critics to such suggestions is, that their observations do not agree with those of the experts; and that as long as it is merely one opinion against another they are not convinced.

I have accordingly made an effort to demonstrate from carefully observed data, that under a still atmosphere kept at a uniform temperature of 25 degrees C—45 degrees F., over a muck soil saturated with water to 190 per cent of its volume—the saturation limit being 217 per cent, the temperature of the soil surface and of the air immediately about it is warmer than the surface of an equivalent area of water and the air above it under similar conditions; and if this distinction is true with the atmosphere in a quiescent state, it must be relatively true with a moving column of air passing over the respective surfaces.

The rate of evaporation for saturated muck over 95 per cent sulphuric acid in a desiccator at 25 degrees C, according to Cameron and Gallagher in Bulletin No. 50, Bureau of Soils, Department of Agriculture, pages 48 and 49, is as follows:

Mean Moisture Content	Loss per Hour Gram.	Mean Moisture Content	Loss per Hour Gram
Per Cent	Gram.	Per Cent	Gram.
190.	0.0669	110.	0.0551
183.	.0032	95.	.0505
174.	.0600	84.	.0469
168.	.0596	74.	.0425
154.	.0581	60.	.0387
147.	.0575	52.	.0363
141.	.0576	44.	.0331
135.	.0566	37.	.0307
121.	.0564	30.	.0279

This table indicates that for a wide change in the moisture content of the soil, it exhibits very little change in the rate of evaporation. At about 120 per cent there is a rapid decrease in the rate of evaporation, indicating that the "critical moisture content" as well as the "optimum water content" in the soil has been reached; that is, the amount of water necessary for such soil at which plants grow best, other conditions being the same. (Ibid, p. 26 to 39 and 57.)

It is also a fact that when the soil moisture is held in the larger pore spaces in the soil, the rate of evaporation is fairly constant and not very much less than would be obtained under similar conditions from a free water surface. (Ibid, p. 35.)

Up to this point it would appear that in a quiescent atmosphere at

a temperature of 25 degrees C, there is but little if any difference in the amount of evaporation from the surface of a muck soil, having a moisture content sufficient to promote plant growth, and from a free water surface under similar conditions; and that therefore the protection from frost by reason of the evolution of heat during the process of evaporation, would be about the same in either case, if the water table in the muck soil be near enough the surface to replenish the losses by evaporation,—which would be the normal condition.

We now come to another principle; that is the evolution of heat by the process of absorption of water.

It is well settled that the absorptive capacity of soils for water vapor, is generally higher the finer the texture of the soil, and the greater the content of humus,—as in a muck soil. (Patten and Gallagher, Bulletin No. 51, Bureau of Soils, U. S. Department of Agriculture, p. 49.)

It has also been demonstrated that heat is evolved during the process of absorption, and that this heat is greatly in excess of that given out by the condensation of the vapor to a liquid. (Ibid, p. 49, and the authorities there cited.)

It would appear therefore on the strength of the foregoing authorities, that in a still atmosphere at 25 degrees C, the drained muck soil, possessing the normal "optimum water content" of 120 per cent with a water table constant and capable of replenishing itself from the tepid waters below, has a substantial advantage over a like area of free water surface, in the heat evolved in the processes of evaporation and absorption; and consequently that the drained muck surface in parting with its heat to the air, would chill less and therefore continue to warm the air longer than the free water surface under like conditions. The soil having two sources of heat supply as against only one in the case of free water.

However this may be, the conditions in nature rarely approximate those in a laboratory. It is seldom "wind still" in these latitudes when a frost is threatened. It is generally a cold blizzard blowing down from the North, that fills the growers with apprehension.

We must rest under the conviction that climate is always the result of great cosmic influences; and that in the case of the Florida Everglades, the tepid waters of the Gulf of Mexico, the Carribbean Sea and the Atlantic Ocean with its Gulf stream on our eastern borders, possess themselves the controlling influences, regardless of the shallow inland waters of the Everglades.

The instances of frost during the past fifteen years can be counted on the fingers of one hand, and appear authoritatively in the foregoing table.

So far as the climate of the lower Florida peninsula with respect

to its effect on the health of its inhabitants is concerned, it may be observed that a study of the climatic statistics at Miami and Fort Myers, discloses conditions of moderate humidity, even temperature and sunshine days, unequalled during the dry winter season by any portion of the United States; and that even in the wet summer season of abnormal precipitation, the temperature never rises above 96 degrees, and the average humidity is relatively low, because blue skies are the rule immediately after a downpour, and totally overcast days are almost unknown.

So it appears from the foregoing data, that if health is dependent on a mild equable climate, with only moderate humidity in summer and even less in winter; with but few cloudy days in summer and practically none in winter; with ample precipitation in summer and but little in winter; with the purest of ozone breezes from the ocean or gulf, and with blue skies and brilliant sunshine for over 299 days in the year, it may be better found and maintained here than in any other portion of our country.

Added to this is the advantage of a quickly drying soil, either of sand, loam or corralline rock formation, which rapidly absorbs the rainfall, rendering the formation of mud a forgotten fancy and damp feet a memory of other lands.

The winter climate of the lower Florida peninsula cannot be surpassed, and the summer heat never approaches the high temperature of the lands twelve hundred miles farther north. The climate of the entire year is temperate, enjoyable and conducive to health, and sunstroke is unknown.

The Flora of the South Florida Peninsula.

CHAPTER V.

Among practical hard headed farmers the kind of forest trees and their vigorous and symmetrical growth upon any land under observation has long been regarded as a reliable indication of the quality of the soil.

This conclusion is reached from the obvious facts that such trees as hickory, walnut, etc., in the temperate regions, and mahogany, dogwood, mastic, pidgeon plum, cocoanut, etc., in the tropical regions, attain full growth only on the richest soils; and that therefore if they are found growing without being stunted on virgin lands untested by the

plow, it is safe to assume that these lands, which by natural selection are occupied by such a growth, are rich and strong in fertility.

The successful farmer will closely gauge the character of any soil with respect to its excellence, by observing the variety of the plants and the strength of their growth, upon adjacent tracts under cultivation, which seem to have the same physical appearance in color, construction and constitution.

I have therefore thought it well, as affording an index by this means to a knowledge of the productive value of these lands, to collate and exhibit herewith a partial list of the kinds of forest trees found growing on the slightly elevated hammocks in the Everglade plateau, and also upon the adjacent hammock lands of the East Coast, as well as a similar list of the citrus and tropical fruit trees, and vegetables grown upon such adjacent lands. The list is necessarily incomplete, as I have enumerated only those trees and vegetables which have come under my own observation, or have been noted by casual visitors and reported in the newspapers.

They are as follows:

Native forest trees, Mahogany, Mastic, Dogwood, Live Oak, Palmetto, Buttonwood, Mangrove, Cedar, Cocoanut, Cypress, Pine, Gumbo Limbo, Sea Grape, Rubber, Royal Palm, Castor oil tree, Pidgeon Plum.

Tropical trees, Mango, Avocado, Sapodilla, Mammee, Paw-paw, Soursop, Guava, Banana, Fig, Surinam Cherry, Mulberry, Tobasco Pepper, Cotton Tree, Camphor.

Citrus trees, Grapefruit, Orange, Tangerine, Lemon, Lime, Kumquat, Citron.

Vegetables, Pineapple, Watermelon, Tomato, Celery, Lettuce, Squash, Cucumbers, Onions, Beans, Peas, Peppers, Egg-plants, Cabbage, Cauliflower and generally all vegetables comprised under the head of "market truck."

Professor John Gifford of Cocoanut Grove, Florida, in a list of the trees in the State of Florida, compiled for the Forestry Department of the Florida Federation of Women's Clubs and recently published, enumerates 281 varieties, and not counting several species of citrus and eucalyptus not listed; and says that Florida possesses a greater variety and number of trees than any State in the Union.

Among these, and which are found growing only on the lower Florida peninsula and island keys, are Lignum Vitae, Tamarind, Satin Wood, Yellow Wood, Cinnamon Bark, Boxwood, Ironwood, Nakedwood, East India Rubber, Sausage Tree, Candlenut Tree, Joe Wood, Satin Leaf, Wild Dilly, Bamboo, Coffee, Date.

From the above data it will be observed that there is a great vari-

ety of plants and vegetables which find a congenial home in the tropical climate and rich soils of the Everglades and adjacent lands. The produce of these plants and vegetables find a ready market in the great cities of the North during a period when snow covers the ground and there is no competition from the local growers. That these products, which even now are very considerable, will be be of great commercial value in the near future is indisputable.

With the settlement and cultivation of the drained and reclaimed Everglades, the increased production from this vast and rich territory will demand greatly increased transportation facilities. That railroads will follow the settler, penetrate this territory and compete for the carriage of these products cannot be doubted; and that the demands in the near future on the seaport facilities of Miami on the East coast and of Fort Myers on the West coast, for adequate water transportation will be very persistent, also cannot be doubted.

Neither can it be doubted that these demands will be met as they arise and that the needed facilities will be provided.

Fruit and Vegetable Products, Yield Per Acre, Etc.

CHAPTER VI.

From a study of the climatic conditions of the Everglade terrace, as exhibited in the foregoing statistics, it will appear that only on the lower Florida peninsula, and below the 27th parallel of North latitude, can such tropical fruits as the banana, mango, avocado, pineapple, cocoanut, sapodilla, sour-sop, mammee, dates, etc., be grown on a commercial scale; while grapefruit, oranges, tangerines, limes, lemons and other citrus fruits can be produced equally as well, and with more assurance of success from the absence of frost, as in any other part of the world.

The castor oil bean and the cassava, the tobasco pepper and the sugar cane all grow here with great luxuriance and hardihood, as well as the seisal hemp and rice.

The usual market truck vegetables are strong growers and mature their crops from December until the following May according to the date of planting. Three months from the seed to the crop is the general time allowance. Tomatoes, Egg-plants, Peppers, Cucumbers, Beans, Lettuce, Potatoes, Onions, and other market garden produce are all grown with great success.

The yield per acre, and the prices realized are stated below very

conservatively; and while the maximum yield and prices have been frequently exceeded by the best growers, it is safer to assume that beginners will attain the minimum. They are as follows:

Vegetables.	Yield per acre, crates.	Price per crate, f. o. b. cars
Tomatoes	250 to 900	$1.12 to $2.02
Egg-plants	350 to 800	1.00 to 5.00
Peppers	400 to 800	1.00 to 4.00
Cucumbers	300 to 1000	1.00 to 4.00
Beans	200 to 400	1.00 to 6.00
Lettuce	400 to 600	1.00 to 3.00
Potatoes (white)	20 to 40 bbls.	5.00 to 8.00
Citrus fruits.	**Yield per acre, crate.**	**Price per crate, f. o. b. cars**
Grapefruit	500 to 800	$1.35 to $5.00
Oranges	300 to 500	1.00 to 2.50
Limes	20 to 70 bbls.	5.00 to 15.00

The above data is furnished by Mr. W. E. March of Miami, Florida,—a large grower of market vegetables, citrus and tropical fruits in that vicinity. It is substantially confirmed by the communications of Mr. Walter Waldin of Fernview, near Miami, Florida, and by many other conservative growers, to the public press of Dade county.

Owing to the comparatively recent production of budded Mangoes and Avocadoes on a commercial scale; and the very limited output, on account of the difficulty of grafting or budding these plants successfully, it is estimated by Mr. George B. Cellon, of Miami, who is the principal expert in this line, that there are not over 2,500 budded Mangoes, nor more than 5,000 budded Avocadoes in Florida and the West India islands. These delicious fruits are consequently a rich man's luxury, and readily bring prices which are hardly credible, but which can be easily verified by inquiry at Miami, Florida. The budded Mulgoba Mango sells by the single fruit and brings from 25 to 50 cents each. The budded Avocado sells from $3.00 to $6.00 a dozen, and I have known 75 cents to be paid for a single prime fruit after New Year. They are hard to get and command fancy prices.

Pineapples are raised very extensively and there are none of better flavor or of superior quality, than those grown on the East coast. They produce from 1,000 to 2,500 crates to the acre, and bring in the Northern markets from $1.00 to $3.75 per crate.

The cotton plant becomes here a perrennial; and I have seen the long staple plant 5 years old in tree form with a trunk three inches in diameter.

TRANSPORTATION.

CHAPTER VII.

The methods of transportation of the products of the Everglade terrace when drained and cultivated to the markets and of supplies from the markets inland, will be primarily by means of steam or gasoline launches navigating the drainage canals which lead to the seaports of Miami and Fort Myers on the East and West coasts respectively of the lower Florida peninsula, and to the railroad stations of the present systems, where they are crossed by the drainage canals or the rivers into which they discharge their waters.

In this connection it is well to call attention to the fact that the seaport of Miami on the west shore of Biscayne Bay, at a width here of three miles, is within four miles of the Gulf stream and the deep water of the Atlantic, by means of a ship canal of a quarter of a mile in length, through the narrow sandy peninsula bordering the bay on the east as a breakwater; and that the U. S. Government has already expended very nearly half a million dollars excavating this cut to a depth of 18 feet, and in building north and south jetties some 1,600 feet seaward to the edge of the gulf stream, in order to protect the entrance. There is a dredged channel of 11 feet from the 18 foot Government canal mentioned to the Miami docks and wharves; and a contract between the Government and Mr. Flagler of the Florida East Coast Railway for the further excavation of this channel to a total depth equal to that in the Government cut of eighteen feet.

The normal rise and fall of the tide in Biscayne Bay, as determined by observations extending over a year, taken by Capt. O. N. Bie, U. S. Engineer supervising work on Government canal and jetties, is thirteen and two-tenths inches; and the mean tidal rise and fall at Fort Myers on the west coast, is one foot seven inches. (Gen'l Meigs, U. S. Engineering Corps, report of survey of Caloosahatchie river, March and April, 1879.)

The main canals of the State drainage project are all of a uniform width of sixty feet, and of a depth of ten feet; and they will doubtless be eventually paralleled by other main canals, at such distances apart as experience has demonstrated to be adequate to secure the success of the project.

It will also be requisite to erect the necessary locks at the several drainage canal outlets of Lake Okeechobee, in order to control the flow of water on the Everglade horizon, and to prevent the reckless lowering of the water level below the point authorized by the Government; and

it will also be requisite in any well considered scheme embodying both drainage and irrigation features, to provide necessary locks on the drainage canals to hold back the waters necessary for irrigation in times of drought, as well as to admit the raising and lowering to the different water levels, of such transportation vessels as are permitted by the rules to navigate these waters.

In order to render the State drainage project effective, the main canals must be intersected by smaller drainage canals, probably at the township and section lines, so as to permit the drainage of the tracts tributary to them between the main canals, as well as the passage of permissable vessels in the carriage of the various products of these drained lands to and from the seaports and railroads.

That these smaller canals will themselves be the drainage or irrigation sources for still smaller and innumerable private canals cannot be doubted, if the scheme of the drainage project is to be carried out to its legitimate conclusion; and that is, a multitude of small, well watered and well drained tracts of very rich land, tilled by intensive husbandry to its best productive capacity.

In the wake of these primitive methods of transportation and at a very early period will come the construction of roads, highways and bridges. At first upon the elevated banks of the main canals, and formed from the glade soil of humus, sand and marl with a top dressing of coral rock resulting from the excavation of the material forming the bottom of the canal; and later on similar roads upon the banks of the smaller canals.

Following closely on these constructions, and contemporaneously with them, as soon as these drained lands are settled sufficiently to show their value by their yields, and their salubrity as a place of residence, will inevitably come the railways of commerce.

No sentiment will attract them. It will be properly and purely a question of business, and not of patriotism. The first five hundred families who settle and build homes on these beautiful and healthful lands, and show by their intensive system of farming what these rich lands are susceptible of producing, will bring extensions of the railways from the East, West and North in the commercial struggle to reap the golden harvest from the carriage of the inbound and outbound passengers and freight from this district.

And with or without the advent of railroads, the demonstration of thrift, comfort, health and independence afforded by the example of the first setlers, will cause a rush of homeseekers to this favored section, paralleled only by the throngs of earnest men and women who have peo-

pled Oklahoma, and planted the seeds of liberty, intelligence, sobriety and good citizenship in that once sparsely inhabited country.

The Expense of the Undertaking.

CHAPTER VIII.

In order to answer the question put at the outset of this inquiry; that is, whether the value of the Everglades when drained is worth the expense of the operation, it is necessary to consider the proposition from two or three different standpoints; that of the citizen, the state and the nation.

Let us consider first the question from the standpoint of the citizen.

At present, except a few small drainage canals, now under construction near Miami and Fort Lauderdale, the work is being conducted exclusively by the State of Florida, without aid from the Government other than the services of a competent corps of engineers in determining levels, etc.

The cost of the reclamation of these lands has been reckoned at one dollar per acre. This seems to be too low an estimate, in view of the fact that the average operating expenses for the removal of the excavated material is reported to be seven cents per cubic yard. Bearing in mind that the canals are sixty feet wide and ten feet deep below the soil surface, and that the two dredges engaged on this work are capable of an average progression forward of the dimensions stated of one hundred and fifty feet per day for 25 days in each month, (the dredge Okeechobee has a record of over 6,000 feet during one month) the daily excavation would be 3,333 cubic yards. In one month the progress would be 3,750 feet forward of the dimensions stated, and the material excavated would be 83,333 cubic yards.

The canals now projected and underway are the West canal from Ft. Lauderdale and the West canal from Miami, the North canal from Fort Lauderdale toward Lake Okeechobee, and the North canal from the Caloosahatchie river toward the same lake. Only the two former will be considered in this inquiry.

These two canals it is reported are to be run West for twenty miles each and then to be joined by a North and South canal of approxi-

mately twenty-five miles in length; the dredges working from the ends of the West canals toward each other. These canals will form the North, West and South barriers to the encroachments of the Everglade waters from those directions, and the elevated rim of the Everglades to the East will be fastland in this direction.

It will therefore require some sixty-five miles of canals to enclose the tract in question which will approximate 320,000 acres in area.

At the monthly rate of forward progression for each dredge of 3,750 feet, or 71-100 of a mile, of the dimensions stated, it would require about three years and nine months to finish the work; and the amount of the excavated material would be 91.5 X 83.333 equals 7,624,969 cubic yards.

If the area reclaimed by these operations be 320,000 acres, and the expense be assumed to be one dollar an acre, the excavation and removal of seven million, six hundred and twenty-four thousand, nine hundred sixty-nine cubic yards would cost only four and two-tenth cents per yard,—an estimated cost which is probably much too low, notwithstanding the maximum capacity of each of these dredges is much greater than the figures used in his calculation.

Let us assume, however, that the actual cost is seven cents per yard as reported,—about seventy per cent more than the theoretical cost. This would mean that the excavation and removal of seven million, six hundred and twenty-five thousand cubic yards and the reclamation thereby of 320,000 acres of Everglade lands, would cost one dollar and sixty-eight cents per acre.

It seems nonsensical to ask seriously, from any point of view whether this is too much to pay for the reclamation of these rich and fertile lands. Contrasted with the government expense of the reclamation of the desert lands of the great arid states of the West, it seems so trivial as to be hardly credible.

Out of the dozen or more reclamation projects in the western arid territory, the expense of which is cheerfully borne by the government, and the management of which is under the direct control of its able corps of engineers, the average expense per acre for a perpetual water right, aside from the initial cost of the soil itself, is about twenty-five dollars; but in some instances as in the Uncompahgre valley in Colorado, where exceptional difficulties have been encountered, the government prices for perpetual water rights run up to forty dollars per acre; and the settler has to acquire the land besides. This can be readily verified by the statements in the official time table books published by the railroads

traversing Colorado, Utah, New Mexico, Arizona and other Western States; and by the advertisements of the real estate agencies at such centers as Grand Junction and Montrose in Colorado and Phoenix, Arizona, etc.

In comparison with these reclamation expenses of the arid western lands, the apparent costs of the Everglade project are insignificant.

From the standpoint of the citizen—the homeseeker and settler, it does seem worth while to be able to buy lands as rich and productive as any on the continent, in a healthy, salubrious climate free from malaria, for a moderate price and without being obliged to purchase an expensive perpetual water right, or as an alternative to be at the mercy of the water owners as a tenant.

If these facts be true as we state them and believe them to be, no argument is necessary, and actual inspection only is needed, to convince the homeseeker that the expense to be incurred in the reclamation of the Everglades is amply justified in providing homes for the yeomanry of the country.

From the State standpoint, the expense is more than justified, because with approximately a million and a half acres of Everglade lands still unsold, the successful reclamation of the 320,000 acres of lands above mentioned will raise the values of all Everglade lands. The prices have already advanced very substantially, by reason of the work already done, from the original State price of two dollars an acre. It is not by any means an unreasonable expectation to see these reclaimed lands selling for the current prices of the irrigated lands of the arid West:—that is unimproved lands at from $50.00 per acre and upwards with perpetual water rights, and the improved orchard lands with similar rights at five hundred dollars an acre and upwards.

Even at the minimum prices of these Western irrigated lands the one and a half million acres of State lands yet unsold would be worth a collosal sum; and the portion of this asset, which the law sets aside for the educational fund, would make the Florida State School reserve among the largest in the Union. Added to this, and also to be taken into consideration, are the taxes to be derived from the lands benefited by the drainage operations,—at present approximately $200,000 per annum.

From a National standpoint, the same conclusion must be reached.

The population of this country is increasing with great rapidity. It has doubled within thirty-five years and for thirty-five years prior to this period, the increase was about in the same proportion. If this ratio is maintained as there is every reason to believe will be the case, we will have in the neighborhood of two hundred millions of people by

the middle of this century,—a population nearly as dense as that of India.

Competition in the large cities is already very keen among applicants for clerical positions, and places however insignificant under the Government or State control. Unless avenues for employment are provided outside the cities the congestion of labor will inevitably result in diminished prices, as is shown by the wage conditions in thickly populated England, France, Germany and Russia, not to speak of the deplorable conditions in India and China; and the universal American rule of maintaining good prices and shorter hours for labor,—on the theory that leisure and plenty insure intelligence and contentment, will be seriously jeopardized.

If this American rule is worth encouragement and maintenance, the expense of the reclamation of the Florida Everglades is not only justified from a National standpoint, but the Government should as cheerfully and unhesitatingly as it has done in the West, contribute materially to the carrying out of the project or, better still, take it in hand by its irrigation and drainage bureaus, and carry it to a successful conclusion.

It should not be overlooked that of the 320,000 acres to which reference is above made, the Northern boundary canal running West from Fort Lauderdale, has already been cut to a point where the dredge Okeechobee is working about eighteen miles in the Glades; and the Southern boundary canal running West from Miami has reached a point about three miles in the Glades. It will thus be seen that only about forty-four miles of canals are still to be cut in order to isolate this body of land from the other part of the Everglades. The completion of this remaining forty-four miles of canals, with the two dredges working at opposite ends toward each other, it is estimated will take about thirty-one months or two and a half years. If double or night shifts are worked, the time of completion will be much hastened.

The conclusions to be drawn from the foregoing statements of fact and warrantable inferences, by any disinterested persons, it seems are

1st. That the effective drainage of the Everglades is feasible.

2nd. That an enormous natural reservoir or tank, exists in Lake Okeechobee at an adequate high level, to supply the Everglade plateau with water for irrigation in times of drought.

3rd. That the reclaimed soil of the Everglades is a black humus incorporated with sand, clay and marl carried down from the decomposed sedimentary rocks from above; and is very rich in the elements required for plant life and growth.

4th. That the climate of the lower Florida peninsula, if affected in any appreciable degree by the drainage and irrigation of these lands,

will become somewhat warmer and further removed from the frost point instead of cooler.

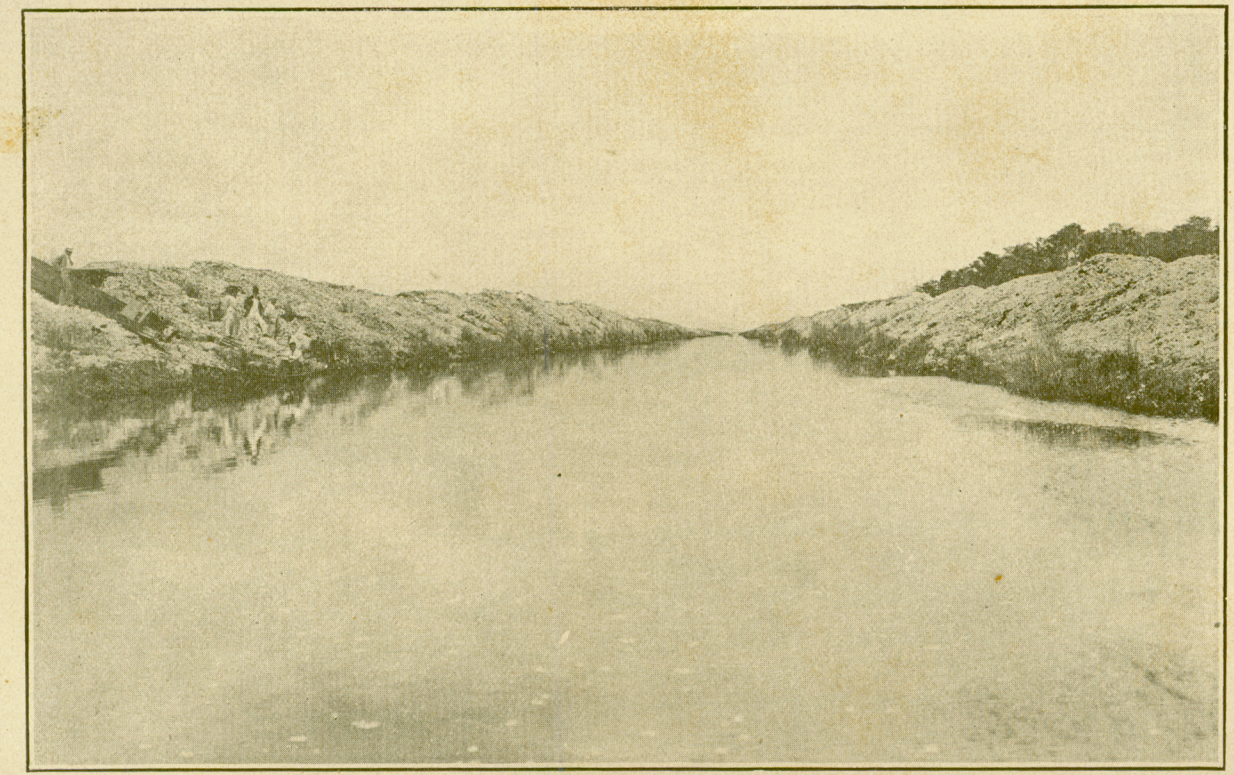
5th. That the irrigation features of the project will, by the adequate control of the drainage waters through its locks and dams, enable any bog or peat fires to be quickly extinguished.

6th. That the expense of the undertaking is trivial, compared with any other reclamation project under the charge of the general Government.

7th. And that the benefits to be derived from this reclamation service, whether considered from the standpoint of the citizen, the State or the Nation, are inestimable.

Since the foregoing was written, the report of the Legislative Committee of the Florida Senate and House of Representatives, on the drainage operations during the spring of the present year, has been made public in the excellent Everglade edition of the Miami Metropolis. It appears from this report that up to March 1st, 1909, the canal on the south fork of the New River had only been cut about seven and a half miles, and that it is the intention to continue the canal in its westerly present direction about six miles, at which point it will turn southward toward Miami. The dredge Miami which is to work northwesterly and then northward to meet the other dredge had then only recently commenced work at the head of the north fork of the Miami river.

If these two dredges have each cut an average of 3,750 feet per month since that time, it would advance the total length of canal for the eight months intervening, 71X2X8 equals 11.36 miles; and the New river dredge should be near the turning point southward. I am informed however that this average progression has not been maintained; and with no definite data on the subject at hand, it is impossible to forecast the date when the first large block of Everglade muck lands will be reclaimed, through the agency of the canals under construction. The Trustees of the State Internal Improvement Fund, who are in charge of the work are earnestly pushing the operations in this direction; and they have recently advertised for bids for the excavation of three hundred miles of main canals in this territory. The bids to be opened at Tallahassee, Fla. on December 22nd, 1909. This action is in line with the recommendations of the joint committee of the Florida Legislature in their report of May last, on the conduct of the drainage operations, and with the spirit of the House resolutions of June 1st, 1909, and is very significant of an intention to brook no further delay in the prosecution of this great work.



EVERGLADE DRAINAGE CANAL, SIXTY FEET WIDE, AND TEN FEET BELOW SOIL SURFACE WITH EXCAVATED MUCK AND CORAL ROCK DEPOSITED ON EACH SIDE.