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	1.66	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	2.84
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.

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	6| 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	6| 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 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 uplands, 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 coralline 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