

# MIAMI: A Study in Urban Geography

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*This type study of the location and growth of a city as influenced by its location is a spectacular example in urban geography. Written in French in 1931, it was prepared for a volume of researches by the students of Professor Raoul Blanchard of the University of Grenoble to celebrate the twenty-fifth anniversary of his founding of the Institute of Alpine Geography. It was published in full by that institution.\* In abbreviated form the paper was presented, with slides, before the International Congress of Geography in Paris, September, 1931.† To the European audience it was a startling thought that a small settlement could have grown into a metropolis in the brief space of thirty-five years. The study is here made available in English for the first time.*

Last February when I was in southern Florida, I had just returned one morning from a very early trip out into the Everglades to see the birds—clouds of herons, ducks, and ibises—darkening the sky with their flight, filling the air with the rustle of their myriad wings. We had followed the road fifty miles or more straight across the swamp without a turn, without the sight of a single house or a single human face. Yet here I was once more back in the midst of a city—a great noisy modern city, its silhouette of incongruous sky-scrapers rising through the tropical haze above the bay.

Miami, this city beside the Everglades, has grown up like the cities of the fairy tales, almost over night. Twenty years ago it was a sleepy little tropical town, with gentle Southerners in hammocks of rattan dozing at noonday beneath the palms. And now, during the winter season it is a bustling metropolis of over 200,000 inhabitants. It has been groomed until all the old landmarks have been swept away. The ibises and roseate spoonbills that used to wade in the quiet lagoons know it no more, and the wildcats that prowled out of the Everglades at night to prey upon the chicken

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\* Millicent Todd Bingham, "La Floride du sud-est et la ville de Miami," *Mélanges géographiques* offerts par ses élèves à Raoul Blanchard, à l'occasion du vingt-cinquième anniversaire de l'Institut de Géographie Alpine de Grenoble, 1932. Pp. 89-133.

† M. T. Bingham, "Miami," *Comptes rendus du Congrès International de Géographie*, Vol. III, 1934. Pp. 423-431.

yards now follow their trails through the tall sedges to the rookeries of herons within the swamp, but not beyond. Only a short time ago this was a pioneer belt, where brawny men in wide-brimmed hats rode on horseback into the wilderness along narrow trails and alligators lounged in stagnant pools in antediluvian languor.

Miami, the incarnation of the restless American spirit, juxtaposed against a wilderness, undisturbed, drenched in the quiet of prehistoric calm. What could explain this startling contrast? Why did this city grow here rather than elsewhere? What do the people who live here do?

While I was meditating, the postman handed me an invitation to contribute to this volume. The present paper exists by virtue of this coincidence. My meditation changed with amazing rapidity to questioning whether, among the reasons for the growth of this modern city on the edge of a remote uninhabited area, might not be found problems which could be explained by a geographer? The locality is comparatively unknown, and unique, with unique resources. It is the only tropical, humid part of the United States of America, the only area of growing coral reefs, and it is all less than twenty feet above sea-level. A curious region to include in a volume of studies published by the *Institut de Géographie Alpine!* However, the very novelty of its problems, I thought, might be of interest to students of mountain geography.

And so I began to see what I could discover. I present herewith the result—an outline of a study of Miami and its hinterland, a study complicated by the fact, I may say, that no surveys of Southern Florida as a whole have been made, and no detailed maps of it exist.<sup>1</sup>

#### INTRODUCTION

The Florida peninsula is a finger of land stretching more than 400 miles in a southerly direction from the southeast corner, so to speak, of the United States of America. Its average width is 120 miles. On the east it is bounded by the Atlantic Ocean, on the west by the Gulf of Mexico. Its southern tip is farther south than any other part of the country, and is swept by the tepid waters of the Gulf Stream as it is forced through the narrow Straits of Florida between Key West and Cuba. On the north, the peninsula is continuous with the coastal plain of southern Georgia and the east-west extension of the state of Florida along the Gulf Coast, but assumes, the farther south one goes, a totally different character.

The southern half of the peninsula is largely covered by the Everglades, a vast swamp about 40 miles wide and 150 miles long, from the head of Lake Okeechobee to the Bay of Florida—a region of more than 3,000,000

acres, level as the surface of the ocean on a quiet day, stretching off to the misty horizon. But Southern Florida includes something more: the southeastern shore with the long stretch of fringing islands or keys habitable for white men.

Except for the keys, the area of our study is roughly co-terminous with Dade County, its focal point the city of Miami, located on the east coast near the tip of the peninsula, on Biscayne Bay.

After summarizing the structure and relief of southeastern Florida and briefly discussing the climate, I shall describe the natural regions of the mainland, differentiated one from another by soil and vegetation, the keys and shoreline features being treated separately. The denizens of the wilderness, birds, animals and wandering Seminole Indians, will be contrasted with the city of Miami, creature of its environment and a spectacular example for students of urban geography. Its history and evolution are so brief that its *éléments de fixation* still characterize the city today, though a brand-new factor hitherto unknown, which is a function of geographical location, may be about to start a new era of growth and of prosperity.

## PART I

### SOUTHEASTERN FLORIDA

#### A. STRUCTURE AND RELIEF

From the point of view of structure and relief it would be hard to imagine a region more uniform and simple than southeastern Florida. The strata are almost horizontal. The elevation above sea-level is so slight and the surface so flat that no altitude exceeds 20 feet. The uniformity is further accentuated by the fact that the rock is all limestone, though of varying formations, and though in great part overlaid by surface marl, muck or sand. There is nothing older than Pleistocene, and fossils revealed by excavations are identical with forms now living in the sea. In places the land forms are so fresh, so unmodified by wind and rain, that they look as if they had but yesterday been raised from the sea-bottom. An uplift of twenty feet would add hundreds of square miles to our area, while a depression of a like amount would obliterate all traces of it. Why such delicate adjustments?

#### I. STRUCTURE

Peninsular Florida cannot be considered apart from its under-sea extension. The name "Floridian Plateau" is applied to the great projection of the continent of North America which separates the deep water of the Gulf of Mexico from the deep water of the Atlantic Ocean. The plateau includes

not only the visible peninsula, but a larger area that lies submerged beneath water less than 50 fathoms deep, mostly very much less. (See U. S. Coast and Geodetic Survey relief-model of the Bay of North America reproduced in bibliographical reference No. 6.)

Though the Floridian Plateau has been in existence since very ancient times, it has undergone repeated changes of elevation and consequent changes of form and area. Not to go further back than Pleistocene times, there was an elevation of a few feet early in that epoch, followed by subsidence of a similar amount in middle Pleistocene, when the coral-reefs along the Floridian border of the Gulf Stream (Upper Keys) were built up, and most of the limestone laid down in shallow water. Then came a period of slight elevation in late Pleistocene when the southern tip of Florida assumed its present form.

There are many proofs of this last elevation: an old coastal-reef in the Everglades (Everglades Keys); elevated sand dunes north of Miami, half a mile inland from the present shore-line; sub-aqueous caverns (near Cape Sable) with immense stalactites which must have been formed above the water-table.

That the coast is at present subsiding, however, is abundantly shown, not only by stumps of live oaks and other trees in the localities where they undoubtedly grew and now below high-tide level, but by drowned shoreline topography. That both emergence and subsequent submergence have taken place in Recent times will not be questioned. The only point in doubt is the magnitude of these movements.

During these fluctuations, deposits have accumulated both on land and under the sea: marine formations such as shell marl, sandy limestone, oölitic limestone, coral-reef rock and sand; terrestrial, wind-blown sand, muck, peat, cavity-fillings in limestone, and residual sand and clay.

The contorted mica-schists, quartzites and other rocks that make up the foundation of the plateau have been reached by only one deep well considerably north of our area (29° North), but as has been said, the sedimentary deposits that overlie the basement rocks have suffered very little deformation. They appear to retain very nearly the attitude in which they were originally laid down.

Throughout the Miami area the surface rock is an oölitic limestone (Miami oölite) of Pleistocene origin. It extends from a point forty-three or forty-four miles north of Miami southward and southwestward along the coast almost to Cape Sable. Where it is not exposed at the surface in bare ridges or outcrops, it is covered by loose sand or by peat, muck or fresh-

water marl. Typical Miami oölite is pure soft white limestone which includes occasional layers of calcite and usually more or less sand, particularly toward its northern boundary. It shows cross-bedding, hardens on exposure and makes good road material and building stone. Oölite is distinguishable from other calcareous deposits by its content of small spherules of carbonate of lime which resemble the roe of a fish. Its surface is a nearly level plain that ranges in altitude from less than 15 feet above sea-level on the mainland to less than 15 feet below in the lagoons.

The Lower Keys are composed of oölitic limestone like that of the mainland, the chief difference being that it shows fewer signs of surface roughening. But the Upper Keys are different. The rock of which they are composed (Key Largo limestone, the name taken from the largest key), has a coral-reef facies. This elevated coral-reef appears to have been built up in large part by corals, calcareous algae and other organisms on the edge of the deep water of the Straits of Florida at the same time that Miami oölite was accumulating in shallow water on the submerged part of the Floridian Plateau. It is found nowhere else.

The mention of these two formations is sufficient for our purpose, which is to emphasize the simplicity of structure of the Floridian Plateau.

## II. RELIEF

The topography of southeastern Florida reflects the simplicity of structure: a former shallow sea-bottom, recently lifted to its present level. As previously stated, most of the area is a flat plain that slopes imperceptibly southward from an altitude of 18 feet near Lake Okeechobee. (See section on Everglades.) On a floor of shell-marl or limestone, this plain is generally covered by 6 or 8 feet of peaty muck, thicker toward the north. There is but little difference in elevation between the Everglades and the Miami oölite area.

The topography has all the aspects of infancy: defective drainage—defective to such an extent that most of the Everglades is under water from June to October; consequently, no well-defined river systems or stream valleys, the streams being mere drainage lines. In the Miami oölite area, where the limestone reaches the surface, there is subterranean drainage and the soil is dry. Minor topographic forms and surface-features are an integral part of the rock of which they are formed. This oölite is so soft and porous that it is easily eroded. The effects are everywhere visible: potholes, large and small, caverns, sinks and natural wells which communicate with underground solution channels and subterranean springs, sometimes gushing with

clear, sweet water below tide-level, as in Coconut Grove. Nearly everywhere water is near enough to the surface to be brought up by suction pumps, larger supplies obtainable from wells, the water of which contains lime, sulphur or salt, though not sufficient in quantity to make the water undrinkable, except on the keys. But erosion has resulted in a surface so rough and ragged, with such angular shapes and knife-edges, that it is dangerous to walk upon it. In places the honeycombed rock becomes so undermined that it breaks under the foot and a fall may result in an ugly wound.

In an area where topographic contrasts are lacking, vegetation, which reflects the composition of the soil, serves to differentiate natural regions, the more so since it is still largely native, in spite of the fact that "developers" are destroying it as fast as they can, to make way for problematical farms and towns.

Before considering vegetation, however, we must briefly sum up the climatic characteristics of the region.

#### B. CLIMATE

After all, it is not so much the topography and soil which constitute the difference between southern Florida and the rest of the country, as the climate. At the extreme end of the Atlantic coast temperature-ladder, lying between the warm waters of the Atlantic Ocean and those of the Gulf, in sub-tropical latitudes, the region enjoys an almost tropical climate. The winters are extraordinarily mild and equable, interrupted now and then by moderate cold spells which, on relatively infrequent occasions, are sufficiently severe to bring frost.

The climate of the city of Miami, where there is a station of the U. S. Weather Bureau, may be considered typical of the region as a whole. Records cover the last 34 years with scattering records for the past 50 years. That city has a modified tropical climate. During the summer months it is only slightly, if at all, affected by continental influences; but in winter the areas of high and low pressure which control the weather of the rest of the country, move far enough south to reach our area.\*

#### I. TEMPERATURE

Average seasonal temperatures are as follows: winter, 68°,<sup>2</sup> spring, 74°, summer, 82°, and autumn, 77°, with a mean annual of 75.1°. The winter mean is about twenty degrees warmer than that of Nice. Freezing tempera-

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\* At this point in the original text charts were introduced depicting extremes of temperature (1895-1930), and average annual and monthly rainfall, as given in the *Annual Meteorological Summary*, Miami, Florida, 1930.

tures have been recorded on only seven days in a period of thirty-four years, and then only for a few hours, the absolute minimum for the same period being  $27^{\circ}$ . There is on the average only one day in the year when Miami does not have a temperature of  $60^{\circ}$  or more. The sea-water at Miami Beach is always  $70^{\circ}$  or warmer.

Though continuously warm in summer, excessively high temperatures do not occur. The average number of days in the year with temperature of  $90^{\circ}$  or above at Miami Beach is four, while Boston has nine such. The absolute maximum at Miami in a period of thirty-four years was  $96^{\circ}$ .

The temperature of the Gulf Stream is  $80^{\circ}$  in mid-summer and the air above is about the same during both day and night. Diurnal sea-breezes reinforce the prevailing onshore wind during the warmer hours of the day. When the air reaches Miami Beach it is about as warm as when above the Gulf Stream, with a maximum of  $86^{\circ}$  or  $87^{\circ}$  at midday. It grows progressively warmer as it proceeds, reaching perhaps  $89^{\circ}$  above Miami, while a mile or two inland it may reach  $96^{\circ}$  or  $97^{\circ}$ , a difference of seven degrees. Mean annual ranges of temperature are less than anywhere else in the country except in Key West. Miami's average daily range is  $11.8^{\circ}$  and its average yearly range of mean monthly temperatures is  $14.4^{\circ}$ .

## II. INSOLATION

Miami averages only six days a year without sunshine. The cloudy days usually occur in the summer and fall. Because of the low latitude the variation of sun-angle is less than for any other city in the United States. These several conditions combine to provide a large amount of sunshine of quite constant quantity, particularly valuable at the time of year when the rest of the country has very little. An observatory for investigating the qualities of the sun's rays has been established, but as the records began only in November, 1929, it is too early as yet to predict their value, though important discoveries as to therapeutic effects of the sun's rays are confidently expected.

## III. WINDS AND RAINFALL

Most of the United States lies in the belt of the storm-bearing prevailing westerly winds, but the southern tip of Florida reaches into the belt of the northeast trades. By reason of latitude, therefore, Miami should enjoy the trade-winds. But though the summer winds have the constancy of the trades, they are persistently from the southeast and east, not northeast. This is because a branch of the trades is under the control of the Atlantic high-pressure area, as a result of which they shift to southeasterlies. These prevailing winds blow in summer across the warm Gulf Stream and consequently be-

come a source of plentiful water-vapor-supply near at hand, which explains the high relative humidity, 75 to 80 per cent throughout the year. Few fogs occur, and those that do, always lift with the rising of the sun. Day-time fog is almost unknown.

The rainfall is of a distinctly tropical type, with a total for the year of about 60 inches. From June to September or October there is a true rainy season, the maximum tending to occur in September-October. Maximum precipitation may be as much as 8 inches in 24 hours, the result of local convectional thunderstorms or tropical hurricanes with their flooding downpours. This is the only district in the United States with over 35 per cent of its annual rainfall in autumn. The average winter rainfall is as follows: December, 1.89 inches; January, 2.9; February, 2.05; March, 2.52. No severe storm has ever been recorded during the winter months. The average wind velocity for the year is 9 miles per hour, the highest recorded wind-velocity, December to April inclusive, being 38 miles per hour. Much higher velocities during the summer and fall are due to West Indian hurricanes, the one adverse element in the climate of southeastern Florida.

Hurricanes are tropical cyclones which occur during the months of June to October inclusive, with 35 per cent in September and 32 per cent in October. During fifty years there has been a total of 316, or an average of 6.3 per annum. (The number varies greatly from year to year, the least number, one, the greatest, sixteen in a single year.) But of all the storms so classified, only a few were of hurricane intensity, by which is meant a central pressure of 29.00 inches or lower, and winds near the center of more than 60 miles an hour. (The highest recorded velocity at Miami was 138 miles on September 16, 1926, after which the anemometer blew away.) Eighty-four of the 316 have been of hurricane intensity along the east coast of the United States, sixteen of which could be classed as "great," both as to intensity and diameter of storm-area.

Great hurricanes deface the landscape to such an extent that even if trees are not uprooted, it takes several weeks or months for them to grow a new set of leaves. These storms cause tides which make it dangerous for persons to remain in houses located on the beach. But they do not seriously damage any properly constructed building, and there is no reason for anyone to be injured in a hurricane if he will remain in a substantial house until the storm is over. Fortunately, no one need be taken unawares as their appearance can be predicted several days in advance.

Though southern Florida is included in the Gulf Province among the climates of the United States, its climate is very different from that of north-



ern Florida, which, in turn, differs from that of the rest of the eastern seaboard. Southern Florida has in general higher temperatures, milder winters, weaker cyclonic control—summer cyclonic control being hardly perceptible—the wind, temperature and weather changes are fewer, less sudden and less emphatic, and rainfall is heavier, with a marked late-summer or early-autumn maximum. In other words, conditions are more settled, except for an occasional hurricane.

Since the climate of Miami is typical of southeastern Florida as a whole, and since its topography is uniform, the natural regions must be differentiated by soil and vegetation, of which the latter is the more convenient measure.

### C. VEGETATION AND NATURAL REGIONS OF THE MAINLAND

In the broadest sense there are but two natural regions in southeastern Florida, that in which Miami oölite reaches the surface, and the far larger area of swamp land surrounding it. But it is not so simple as this. For both of these regions have an important characteristic in common, one with more or less uniform traits, yet utterly unlike either matrix in which it is found, namely, islands of vegetation, large and small, different from either pineland or swamp, but superficially resembling one another. These islands are called "hammocks," the latter a word of presumably Indian origin meaning dense tropical vegetation. Their importance from a human point of view is out of all proportion to their area. In addition to the hammocks, salt marshes along the coast, irrespective of soil or hinterland, become mangrove-swamps. If a natural region were defined as an area geographically distinct from those surrounding it, each mangrove-swamp, each hammock, should be entitled to separate consideration, which is manifestly impossible.

So, our method is indicated: after describing the pineland and asking the reader to bear in mind its boundaries and extent as well as those of the swamp area, both of which, though topographically equally flat, are distinct from the point of view of soil—limestone in the pinelands, and peat, muck or marl in the swamps—we shall proceed to describe hammocks and mangrove-swamps irrespective of location, belonging as they do to pineland, Everglades and coast prairie alike. In describing the Biscayne pineland it should not be forgotten, however, that the first thing to strike the eye is the two types of vegetation—plant-associations, to use the ecological term—pine woods and hammock, of which the pine woods occupy by far the larger area.

#### I. BISCAYNE OR MIAMI PINELAND

This region coinciding with the outcrop of Miami oölite, begins on the coast about forty-five miles north of Miami, where it averages 20 miles in

width. Its eastern edge follows the shore until, in the vicinity of Miami, it turns, and in crescentic form the outcrop extends south and southwest for about fifty-five miles, gradually dwindling to less than two miles in width. West of Homestead it tapers off in a series of rocky "islands" known as "Everglades Keys," surrounded by swamp. The trend indicates that formerly these inland islands were part of the Antilles. Though their average elevation is but a few feet, it is sufficient to enable them to support a flora different from that of the surrounding country.

This essentially flat area has a surface of exposed, honeycombed limestone, the innumerable cavities of which are mostly filled with sand north of Coconut Grove, and with residual clay in the Redlands district near Homestead. It is intersected by numerous transverse glades averaging a few hundred feet in width, to be described in connection with the Everglades, of which, although not identical in all respects, they may nevertheless be considered a part.

The pine woods are composed of *Pinus caribaea*, a long-leaf pine peculiar to the locality. It is handsome when young, with luxuriant masses of long rich-green needles, stately in its prime and picturesque in old age, the gnarled branches spreading flat at the top of the tall trunk. The undergrowth is sawpalmetto, scrub-oak and coontie, with a few annual and perennial herbs. The surface of the soil is almost always dry, as the rain that falls quickly disappears in the porous rock. The woods are so often fire-swept that the soil, sand or rock, is nearly if not quite, devoid of humus. As a result there is no tall growth aside from the pines, which do not require humus as do broad-leafed trees. In fact, it is said that they die when cultivated. If the pines survive fire in their youth, they become immune to it, unless the bark is broken so that the flames can get through to the resinous heart of the tree.

Fire is constantly modifying Florida ecology. As one passes through on the train it seems as if the entire state were burning. The crackle of the flames close at hand blends with the smouldering blue distance. It is incredible to the observer how any vegetation can remain. Yet these fires are not casual. They are part of the policy of the Florida "cracker," as the native is called, who is greedy to make his state attractive to winter visitors, yet thinks the way to do so is to denude it of all plant growth! Nor can he be made to see that to the northern tourist native vegetation is one of the chief attractions. The pine woods in particular are the object of the cracker's attack, and fire is his weapon. But the study of fire in Florida belongs perhaps in the field not so much of geography as in that of psychology.

Two other fire-resistant plants are abundant in the pine woods. The coontie (*Zamia*) of four endemic species, a cycad, has a subterranean stem and is thus protected. It has been so much modified from its original form that the healthier and more robust plants are now found in areas that are periodically fire-swept. Its root is a storage-organ for starch. The other low plant particularly prominent in the landscape is the saw-palmetto (*Serenoa repens*), which, like the coontie, thrives on fire. Tannic acid is stored in the stem. The trunks are typically prostrate. After being exposed to fire, the plants show only blackened trunks resembling large reptilian monsters, with the charred stubs of petioles where the crown once stood. After a short period of rest, however, the bud breaks forth with renewed vigor, develops a fresh crown of leaves and is soon in readiness for the next fire.

What are the uses to which these resources can be put? For lumber, *Pinus caribaea* is inferior to the larger and straighter pines farther north, but for most purposes it is more economical to use it than to pay freight on better material. Though the pines are used extensively for lumber, the turpentine industry has not yet reached as far south as Miami, fortunately. The coontie has been drawn on recklessly for many decades for the manufacture of starch in commercial quantities. Wire-grass (*Aristida*) would furnish good grazing for cattle were it not for the honeycombed surface of the limestone. Less than 5 per cent of the Biscayne pineland has so far been cultivated. Possibly ten per cent of it is occupied by settlements, with their groves of citrus and other tropical fruit-trees. (See Part II, C, II, Role of Present City.)

The Biscayne Pineland is surrounded by swamplands of different types which include Everglades on the west and south, salt meadows and mangrove-swamps along the coast. Scattered over both pineland and swamp are hammocks of various sizes, from a few square miles to a few square yards in area.

## II. THE HAMMOCK

As previously stated, hammocks are covered with dense tropical jungle of broad-leafed trees, palms and shrubs characteristic of the Antillean flora, all wreathed in an epiphytal covering of orchids, bromeliads, resurrection ferns, Spanish moss and climbing lianas of giant proportions. The ground is covered with rich, loose black mold. The hammock cannot be correlated with altitude or with subsoil, for beneath the humus resulting from the decaying vegetable matter, may be found sand, clay, marl or rock. Problems as to whether hammocks are increasing or diminishing in number, their relation to fire and how they originated, are of absorbing interest to the botanist.<sup>3</sup>

Tropical hammocks are most common southwest of Miami. They are usually encircled by live oaks (*Quercus virginiana*). In a typical hammock

most of the trees have crooked trunks, hard heavy wood, and stiff evergreen leaves. They make so dense a shade that few herbs grow on the ground, but a profusion of air-plants cling to limbs and leaning trunks of live oak, and other rough barked trees: massive gumbo limbo (*Bursera*), mastic (*Sideroxylon*), buttonwood (*Conocarpus*), red bay (*Persea*), ironwood (*Eugenia*), satin-leaf (*Chrysophyllum*), pigeon plum (*Coccolobis*), various figs including *Ficus aurea* which strangles its host, papaw, (*Carica papaya*), Spanish bayonet, (*Yucca aloifolia*), palmettoes and an occasional majestic royal palm (*Roystonea*) sometimes as much as one hundred feet tall. Small trees, vines, climbers and creepers, briars, shrubs and air-plants, ferns and tillandsias fill every inch of space. This profusion of vegetable life contrasts with the dry monotony of the pineland. The hammock is a striking and welcome feature of the landscape. Different hammocks, though alike in general appearance, have rare plants peculiar to themselves. Even the beautifully colored tree-snails (*Liguus*) are different in neighboring hammocks, a fact which fires the imagination of the zoologist. Thirteen species of palm are said to grow wild in Dade County, including the non-indigenous coconut palm which is found everywhere, from the saltiest marsh to pineland and hammock. There are in addition over one hundred and fifty other exotic species, now so common as to appear native.

Very little use has as yet been made of hammock trees, for the wood is hard to work. Roads have now been cut through some of the finest hammocks and a few others have been "improved"—shocking misnomer—for valuable building sites.

### III. MANGROVE-SWAMPS

Wherever hammocks reach to the water's edge they blend with those strangest of all plant-associations, mangrove-swamps. Dr. David Fairchild, distinguished botanist, having visited the mangrove-swamps of the eastern hemisphere says, "Nowhere have I seen such magnificent mangrove vegetation as that which characterizes the southern Everglades of Florida." It flourishes wherever there is shallow or brackish water not too much exposed to wave-action. The nature of the soil seems to make but little difference. The width of the strip occupied along the shore is extremely narrow since mangroves cannot live on dry land, nor can they thrive if the water is too deep.

In addition to the red mangrove (*Rhizophora*) which forms the bulk of such swamps, are black mangrove (*Avicennia*), white mangrove (*Laguncularia*), buttonwood (*Conocarpus*), sea-grape (*Coccolobis*) and a few other plants. Little use has been made of the wood of these trees, though the red

mangrove has served for tan-bark and the buttonwood is the favorite source of charcoal for the kitchens of Key West. Though mangrove soil is never cultivated, in recent years a good deal of the swamp has been converted into building sites by pumping sand into it, a dismal process which slowly kills the trees.

#### IV. EVERGLADES

As previously said, most of southern Florida is occupied by the Everglades, a great swamp owing its existence to low altitude, flatness and abundant rainfall. It is hard for one who has not seen it to imagine the endless expanse of sedges, stretches of shallow water, scattered clumps of bushes and small islands (hammocks) which constitute the region. Photographs cannot convey an idea of the distance and remoteness, the aloofness of this virgin wilderness.

This area, south of Lake Okeechobee, five to six thousand square miles in extent, is one in which a difference of two feet in water-table, the normal range between high and low water in the Everglades, makes the difference between shallow lake and dry land. These relationships, moreover, are constantly changing, drastically so with the seasons. Okeechobee, though shown on the map as a lake thirty-five miles across, a body of water apparently second in area to any in the United States, is in reality merely a part of the Everglades in which the water is a little too deep for sedges to grow. Its average depth is under ten feet. Moreover, the borders are impossible to define, particularly on the south where, in seasons of high water, the overflow takes place. The movement of the water, though almost imperceptible, is in general toward the south-southwest, the average elevation of the lake-surface being 18 feet.

At the extreme south, the Everglades merge with mangrove-swamp, where the shoreline is disguised by impenetrable jungle, or with sandy beaches strewn with coconut palms. On the west, the Everglades blend with the Big Cypress Swamp, a vast lonely region of undetermined area. The cypress stands in water, a deciduous tree with an abruptly enlarged base, the buttresses reaching to high-water mark. Its wood, being very durable, is much in demand for poles and shingles. On the east the swamp land reaches to the pineland.

The Seminoles' name for the Everglades is "grassy-water," for the vegetation is mostly saw-grass (*Mariscus jamaicensis*, a variety of *Cladium*). It is, in fact, the largest saw-grass marsh in the world. This plant is a sedge with grasslike, folded leaves seven feet long. They "spring in a great tuft from the root and the slender leaves are armed on their edges with sharp

teeth like those of a rip-saw." There are other reed-like plants, phragmites, foxtails and bulrushes as much as fifteen feet tall, *Sagittaria*, boneset, gama grass, floating-leaved aquatics in the open spaces where water is deepest, water-hemp, pickerel weed (*Pontederia*), water-hyacinth, water-lettuce (*Pistia*), water-lilies and many other species derived from Middle America. All these plants by their partial decay under water have formed the peat or muck deposits which are gradually building up the soil. If it were not for this accumulation, most of the area would be a shallow lake.

But the character of the Everglades is by no means uniform. In addition to small areas of cypress there are myriads of hammocks, standing out on the plains of saw-grass like oases on a green Sahara, with their wealth of low trees covered with air-plants. Dr. Fairchild says, "In no other tropical region of the world have I seen anything like these hammocks. The nearest approach to them I encountered on the so-called Winneba Plains of the African Gold Coast."

The greater part of the Everglades is covered with peat or muck before mentioned, in layers ranging in thickness from a feather-edge to several feet, which has to be drained before it can be cultivated. This they have been trying to do for twenty-five years, but though many canals have been cut, not more than two per cent of the area was under cultivation in 1927 and since then it has doubtless diminished. The most marked effect of the preliminary work is that along the banks of the canals and on all slightly elevated spots trees and shrubs are springing up, so that where formerly the eye swept over an unbroken, monotonous expanse of saw-grass, there are now patches of incipient forest. When drained the soil is rich in nitrogen and in nearly every other necessary constituent except potash, which must be artificially added at great expense. The supply of peat is practically unlimited, and it could be used for fuel or fertilizer-filler were it not for the cost of labor. But in southern Florida little fuel is needed and there is an easily obtainable supply of wood. Moreover, in wet seasons it is hard to get rid of the water, and in dry seasons the drained peat sometimes catches fire. If that happens the soil merely goes up in smoke. This is on the whole a discouraging country for the farmer, imperilled as he is by both fire and water.

The soil of the southern end of the Everglades, with the numerous narrow glades intersecting the pineland before mentioned, and the coast prairie is different. It is not muck or peat but a soft gray marl lying beneath the muck toward the northwest, but exposed over more than one hundred square miles at the south. The glades are elongated depressions at most a few feet deep

and from fifty yards to a half mile in width. Inundated in the wet season, they are grass-covered and edged by water-worn pillars of limestone a foot or two in height. Some of them extend through from the Everglades on the west to the salt coast prairie and mangrove-swamps on the east, while others open only into the latter. For our purposes they may be considered part of the Everglades although both soil and vegetation are slightly different.

The salt coast prairie, southeast and east of the Biscayne pineland, reaching from the shores of Biscayne Bay to the Bay of Florida, is another perfectly flat area, nearly all of which is subject to inundation either by high tides or by fresh water during the rainy season. Although continuous with the Everglades it is quite distinct, for they are never touched by salt water. There is very little farming in the coast prairie (about one per cent of the total) except at its inner edge, where vegetables, especially early spring tomatoes, are raised. To the eye, the expanse of sedges in both narrow glades and prairie is indistinguishable from the Everglades with which they blend. All are equally negligible from a utilitarian point of view.

#### D. KEYS

The structure and climate of the keys have already been touched upon during the course of our study of the mainland. This long fringe of islands curving southwestward along the edge of the Straits of Florida from Bay Biscayne to Key West, includes outlying islands as far west as the Dry Tortugas. They are of all sizes, from Key Largo, 30 miles long by 3 miles wide, to a single struggling mangrove on a submerged bank. All stages of island growth are visible. Shorelines are ephemeral, often being impossible to define, on account both of shallow water and dense vegetation. The keys are famous as a fisherman's paradise.

A glance at the map shows two different types of key, the Upper and the Lower. East of Bahia Honda Channel, the Upper Keys lie along a sweeping arc curving toward the east and gradually more and more toward the north. West of the channel the Lower Keys form a triangular archipelago, its axis perpendicular to the arc, reflecting a difference in rock structure and in the forces which have shaped the islands. As I have said, the Upper Keys are remnants of an old coral reef while the Lower Keys are composed of the same rock as the mainland, of which they are the partly submerged extension.

#### I. UPPER KEYS

From Soldier Key, eleven miles south of Miami, to Bahia Honda Channel, a distance of about one hundred miles, the Upper Keys are of different lengths, but average less than a mile in width with a maximum of three

miles, the long axis distributed along the curve determined by the direction of the Gulf Stream. The rock surface looks new and fresh, its major inequalities not the result of sub-aerial decay. The highest elevation is 18 feet above sea-level on Key Largo. All are of Key Largo limestone, an uplifted, unchanged fossil coral much in demand for building material because of its beauty. After exposure this rock is harder than oölite.

The vegetation is sparse tropical hammock: buttonwood, ironwood and madeira, with mangroves below the level of high tide. The forests which were luxuriant before the building of the Florida East Coast Railroad (1908-1909) have been nearly exterminated and the soil along with them. As it is impossible to use either plough or hoe, citrus-groves, principally limes, are grown in holes blasted out of the rock. On account of scarcity of soil and water the population is sparse, but the Upper Keys shared nevertheless in the boom of 1925-1926 when much land was sold at fancy prices.

## II. LOWER KEYS

The Lower Keys extending from Bahia Honda Channel for about 40 miles to Key West are not part of the coral-reef, but are composed of oölitic limestone. Although irregular in shape, the long axis of each key is nearly north and south, as previously stated, while that of the adjacent Upper Keys is east and west. The rock, Key West oölite, though of the same age as Miami oölite, is more solid, less sandy, and with a smoother surface. The highest elevation in the Lower Keys is 13 feet. Wells yield water too salt to drink, so the city of Key West depends on rain, or on water hauled by rail from Homestead more than one hundred and twenty miles away. Though the vegetation is more diversified than that of the Upper Keys, with some forests of pine, they were probably never as tall and dense as those on the mainland, as this is not only the driest part of Florida, it is also subject to severe hurricanes every few years. Many varieties of fish and sponges marketed at Key West are the chief resources of the region. It used to be the center of the sponge industry, now shifted to the west coast.

The water-areas enclosed behind the keys are, from the north to south, Biscayne Bay, Card Sound, Barnes Sound and south of about 25°, the great horn-shaped Florida Bay, the water in which is so shallow, seldom as much as 10 feet deep, that the bottom can everywhere be seen. What are some of the characteristics of this coast, this ill-defined meeting place of land and sea?

## E. SHORELINE FEATURES

On the ocean side of southern Florida there is shoal water for a mile or so, but as the distance increases, the water deepens up to the point where a barrier reef is forming, 4 to 7 miles off shore. The seaward face of this reef



lies along an arc roughly concentric with the outer edge of the old coral-reef, or present Upper Keys. Seaward from the barrier reef, the bottom falls away and the hundred-fathom line is within 4 to 10 miles of the line of outer coral patches. This, however, should not be mistaken for an abrupt descent to abyssal depths. A glance at the relief model of the Bay of North America already referred to, shows that the sudden deepening indicates the channel of the Gulf Stream across the continental shelf, a furrow gouged out as that great river flows north from the Straits of Florida. The eastern boundary of the Floridian Plateau is, in fact, more than one hundred miles to the east. The Gulf Stream is nearer the coast here than ever again throughout its course, being but three miles distant opposite Bay Biscayne. The proximity of this mass of warm water helps to make the climate of Miami unique.

Sandy beaches follow the outer shore. On the keys they are composed not of grains of quartz, but of limestone, shell fragments and powdered coral. Such calcareous sand, once packed, does not blow. From Key Biscayne north, on the other hand, where beaches are composed of silicious sand, the great seas accompanying hurricanes pile it up into dunes. Contrary to what might be expected, however, there are no active dunes higher than 5 or 6 feet. But beginning a few miles north of Miami, dunes run parallel to the shoreline about half a mile inland. Though aeolian in origin, they are not growing at present, but are quiescent. Instead of burying forests in their advance, they are themselves covered with large pine trees, where not denuded by man.

Shoreline topography shows such adolescent forms as cusped forelands, bay bars and long beaches with gentle curves. As dominant currents move toward the south between the Gulf Stream and the coast, sand bars lengthen toward the south. The water thus surrounded becomes a lagoon, which in turn gradually fills with silt until transformed into marsh or mangrove-swamp, a network of channels and islands, nearly impenetrable.

On beaches and low dunes there is a rather sparse vegetation, resembling that of northern sea-beaches except for having more woody plants, and except for the coconut palm, now common everywhere though not native. Most species are tropical, having overflowed from adjacent hammocks or mangrove-swamps. The more noticeable shore plants are sea-grape (*Coccolobis*) and Spanish bayonet (*Yucca*). Beautiful vines with shining leaves, *Ipomoea* in particular, grow to immense lengths, trailing across the sand.

#### F. ANIMALS

There are still about forty species of land mammals in swamp and pine-land. Unlike plants, however, their relationships are with the north instead

of with the tropics: opossum, wild cat, panther, now nearly extinct, otter, raccoon, and the small Florida white-tailed deer. The manatee or sea-cow, one of the strangest beasts alive, can still be found in remote swampy districts. The trapping of fur-bearing animals, principally raccoon and otter, is still an important industry in such districts.

The Everglades teem with bird-life, water-birds in particular. The greed of man has led to the shooting of these beautiful creatures in their rookeries until several species including the most beautiful of all—great white heron and roseate spoonbill\*—are nearly, if not quite exterminated. But myriads belonging to other species still remain.

Mammals and birds, however, are not the only creatures of interest, for reptiles and amphibia include crocodiles, alligators, lizards, snakes, turtles, frogs, toads and salamanders of rare species. Skins and tortoise-shell constitute the basis of a small industry.

The variety of salt-water fish is almost endless. There are 83 species of commercial importance, in addition to those noted for their grotesque or beautiful appearance which are shipped to aquaria in the north. One of the chief attractions to the winter visitor is fishing in the Gulf Stream, especially for tarpon and sail-fish.

There are literally thousands of species of insects. Mosquitoes are most abundant on the keys, Cape Sable and Ten Thousand Islands, and least so in the Everglades and on the pineland. Though *Anopheles* has been reported from a few places malaria has never been prevalent.

Crustaceans include the salt-water crawfish (*Palinurus*), an article of commerce, and the fresh-water crawfish (*Cambarus*) of the Everglades. Another delicacy is the stone-crab (*Menippe mercenaria*) which sometimes weighs as much as a pound. The land-crab (*Gecarcinus*), on the other hand, is not only inedible, it is a pest which ravages plants and gardens.

Mollusks are more abundant in southern Florida than in any equal area in the United States. Shells are everywhere, on the ground and beneath its surface, on the beach, in the water, even on the trees. Clam digging is an important industry. Nor was it different in previous ages, so archaeologists tell us. The Stone Age of America was almost the Shell Age in this region, for prehistoric Indians had hoes and axes of shell, shell cups and ornaments, as well as war-clubs made of shell.

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\* These birds, thanks to the efforts of the National Audubon Society, are now (1948) increasing in numbers.

## G. INDIANS

### I. PREHISTORIC INDIANS

When Ponce de Leon and his companions reached Florida in 1512-1513 they found the peninsula peopled by sedentary Indians. These were divided into tribes of which the most powerful were the Caloosas. The Tequestas occupied the southeastern shore. These Indians had grouped villages along both coasts, around the inland lakes and beside the streams. A man named Fontaneda, who lived as a captive among them a little later, reports that they were cruel, naked savages, living on mollusks, fish, game, roots, wild fruit, acorns of the live oak and vegetables raised in small patches. The men were fighters, equipped with bows, arrows, knives and spears. They traded in fish, skins and ambergris and went about in canoes. Living predominantly on low, insect-plagued coasts and keys liable to inundation, they built extensive shell-heaps that would serve as dry platforms on which to live.

French Huguenots attempted to settle on the east coast (1562-65), but their villages were destroyed by the Spanish and their Indian allies. During the eighteenth century invasions by the English from the Carolinas and their savage Indian allies, Creek, Catawba, Seminole and others, were attended by great destruction and bloodshed. The native Indians, who were loyal to the Spaniards, rapidly dwindled with the decline of Spanish power until, on the transfer of the territory to the United States in 1821, only a handful remained. After seeking refuge on the keys they finally disappeared, not a living trace of them having been seen since 1821. The only material proof that they ever existed is in their mounds and shell-heaps. These are not simple kitchen-middens, but structures built with a purpose from all available shell.

Matthew W. Stirling, of the Bureau of American Ethnology, has recently (May, 1931) returned from several months of archaeological exploration in Florida. On the edge of the Everglades, near Lake Okeechobee, he found great earthworks, elaborately laid out, covering an area a mile square. The most prominent feature is a flat-topped rectangle of earth, 30 feet high and 250 feet long. He says, "The whole plan is laid out with remarkable precision. The parallel lines are straight as a string, and the semi-circles are so perfect that we can imagine some Indian walking around a fixed point with a string held taut, to mark the outline." Excavations on this important site will be made next season.

The peopling of Florida was a relatively late event in the peopling of the continent, which may have been due to several causes: its meagre fitness

for agriculture, plagues of mosquitoes and other insects, and chiefly to the fact of under- rather than over-population on the adjacent mainland. The prehistoric population never reached numerical, cultural or political importance. The same can be said of their successors, the Seminoles.

## II. SEMINOLES

These Indians of the Everglades seem to be a part of the environment, a product of it, inseparable from it. Of Muskogee stock, related to Choctaws, Chickasaws and Creeks of the Mississippi Valley, they migrated eastward before the discovery of America by Columbus, settling north and west of the Florida peninsula. Gradually reduced by war and disease, in 1740 their warriors numbered only about 1500. Hrdlicka says they united with Negroes in the English and Spanish colonies, a blend which formed the nucleus of the nation called *ishti semoli* (wild men), corrupted to Seminole. They subsequently possessed the whole peninsula. Driven by persecution from one place to another, however, they have finally reached the most undesirable part, the Everglades, where their adaptation to life in the great swamp, with the name of which they are indissolubly associated, is a spectacular instance of geographical adjustment.

Ever since their first settlement in Florida late in the eighteenth century, the Seminoles have been engaged in strife with the whites. The so-called Seminole Wars (1817 and 1836-1843), their last stand against superior arms and numbers, resulted in complete defeat for the Indians. The remnant of the once fierce tribe, now mild and docile, roams about in the wildest regions of the swamp. In 1930 there were, according to Lucien Spencer, Seminole Agent, but 578 left.

The Seminoles live in a primitive state, a few families together in widely scattered camps on hammocks in the swamp. The dwellings are the merest shelters, a platform of small logs seven or eight feet square built on posts a foot or two above the ground. A low roof of palmetto-thatch shelters the platform which is open to wind and weather on all sides. They live mostly by hunting and trapping. It is estimated that for their furs they receive a total annual income of perhaps \$25,000, most of which is spent on bad whisky. The illegal sale of venison further augments the income. In the fall of 1930, for the first time, they shipped their furs direct to Sears, Roebuck and Company. But their life as hunters is doomed, for the Seminole is now being beaten at his own game. In a dugout canoe, with a torch and by great prowess, he can kill eleven alligators in one night, while the white man in a gasoline launch, with a powerful reflector, can kill over a hundred in the same length of time.

The Indian sometimes has a garden patch, never more than an acre in extent, on which he raises, with axe and hoe, corn, sweet potatoes, squash, melons and a small, sweet pumpkin. Though hogs are still bred to some extent he has been obliged to give up cattle, because the lawless class of white men who roam the swamps kill them as if they had no owners. Such men have been known to shoot a hog, cut off a ham and leave the rest for the buzzards. Fortunately the food supplied by nature is still abundant: meat, coontie flour, berries, saw-palmetto buds, cocoplums, sea-grapes, prickly pears, sour oranges—all of which are to be had for the picking. The Indians weave no rugs and fashion no pottery, but the women make dolls, bead-work and trinkets which they sell to tourists.

Driven by force into this dreary morass, the Seminole has made himself gay in appearance as a parrot. The women wear skirts which trail on the ground, made of horizontal strips of the most brilliant colors, and a short cape bordered with a highly-colored fringe. Countless strings of glass beads are wound about the neck and over the shoulders, the set sometimes weighing twenty-five pounds. The men wear a shirt of the same bright colors reaching to the knees and belted around the waist. The majority go bare as to head, legs and feet. They are quiet and dignified in manner, their chief vice being fondness for liquor. They prefer not to work for the white man though they occasionally do so, at a very low wage. They are seldom seen in the city, except the few who live in camps to exhibit themselves to tourists and to sell Indian souvenirs. They prefer to live freely in the wilderness and thus far have asked only to be let alone.

In 1880 Clay MacCauley was sent by the U. S. Bureau of Ethnology to report upon the condition of the Seminoles. He found them keeping up their customs and traditions independently of the world beyond the Everglades. With the settlement of southern Florida, however, the building of roads and railroads and partial drainage of the Everglades—though this last is less important—the question of rights of the Seminoles has again come up, ostensibly wards of the government as they are. Just as I am about to send off this article, an exhaustive study of every phase of the life of the Seminole in his environment has appeared; an authoritative, contemporaneous account of this remnant of Indian life, destined so soon to be absorbed by the industrial civilization closing in upon it.

All natural forces having thus conspired to produce an area geographically unique in the United States—the only humid, tropical part of the country, situated at the end of a peninsula reaching far into a tropical sea, with a predominantly tropical flora and fauna, much of both peculiar to the

locality—its protection hitherto has been that it has been undiscovered. But now, with its myriads of birds, its strange animals and its isolated little groups of Seminoles, if it is to survive all the plans for its improvement, an enlightened public opinion must intervene. And it is trying to do so. The Federal Government has at present under consideration a project for the reservation of a part of the southern tip of Florida as a National Park before it is too late. If it should become law, this strange beautiful region with its wealth of natural wonders will remain to intrigue the minds and rejoice the hearts of Americans of the future, when the age of the machine shall have passed away.

## PART II

### THE CITY OF MIAMI

Our study culminates in an extraordinary town—Miami, “The Magic City,” focal point for southeastern Florida. The geographical factors of its location will be briefly summarized before examining the evolution of the city itself.

#### A. GEOGRAPHICAL FACTORS

These factors are of two kinds, general and local: the general, called the situation; the local, called the site.

##### I. SITUATION

The Miami region is flat and less than twenty feet above sea-level. The underlying limestone either crops out at the surface, or is covered, as north of the city, by a thin layer of sand, or in places south of it, by marl. The total area of the Miami or Biscayne pineland region, in which the soil is dominated by rock too near the surface and too compact to plough, is perhaps 500 square miles.

The chief asset is the climate, of modified tropical-marine type: average winter minimum of 62°; average summer maximum of 86°; mean annual temperature of 75.1°. Days without sunshine are so rare as to cause comment. The mean annual rainfall is about 60 inches, most of which falls in late summer and early autumn. The prevailing wind is off the ocean and is agreeable except when, in early autumn, it sometimes reaches hurricane intensity.

The native vegetation is slash pine with undergrowth of saw-palmetto, sprinkled with tropical hammocks. About five per cent of the limestone area is under cultivation.

In so low an area water-courses are hardly more than drainage ditches from the Everglades on the west to the bay on the east. Travel by water is

in small boats, except in artificially deepened channels. Transportation is preferably by land, or by air—a topic taken up in a later connection.

The raw materials are mostly those peculiar to a tropical and sub-tropical country. The waters teem with edible fish and crustaceans. Fibre-yielding plants are a source of paper-pulp and other substances; the bark of the mangrove of dyeing and tanning material; the root of the coontie of starch; pines, of timber for lumber-mills and mill-works. Tropical fruits abound. (See Present City, Agriculture.) Mineral resources are largely limestone derivatives, cement and lime. Though oil-production is being curtailed throughout the country as a whole, they are at present drilling near Miami. I visited a well about forty miles west of the city on the Tamiami Trail which had reached a depth of 4565 feet in February, 1931. No oil has as yet been reached but expectation runs high.

The region has industrial possibilities, for, in addition to many raw materials, it has excellent transportation facilities and a labor-supply which could be indefinitely augmented as necessity arises, since it requires little inducement for a working-man from the north to go to Miami to live. Its advantages include elimination of fuel bills and reduced expenses for clothing, as only the lightest materials are worn. At present labor is not plentiful, though more than twenty per cent of the population are Negroes, mostly unskilled laborers. Water-power is lacking, but public utility development during the past few years is one of the marvels of the region. The power-system is supplied by new and modern generating stations. Another source of power as yet but little utilized is the heat of the sun. Now, it is much used for water-heating in private houses; after initial installation of equipment the cost of upkeep is negligible.

Within this area, what were the reasons underlying a choice of the city site?

## II. SITE

The sand-bars which parallel the east coast of Florida are separated from the mainland as we have seen by salt-water bays or lagoons, usually too shallow for navigation. Biscayne Bay is one of these, separated from the Atlantic Ocean by Virginia Key, Biscayne Key and the Miami Beach peninsula, joined to the mainland at its northern end. The bay is about 38 miles long and from three to nine miles wide. The city of Miami is located on the west shore of the bay at 25° 48' N. and 80° 12' W., midway between its head and its principal entrance at Cape Florida.

Advantages of the site of Miami exist only by virtue of its relation to bodies of water. But for this relation it might have been located anywhere

else on the oölite shore. The city originated on the north bank of the Miami River where it empties into Biscayne Bay. The name, Miami River, gives a false impression, however, for this so-called "river" is only 4.5 miles long. It rises in the Everglades and flows southeast and east, emptying into the bay opposite the tip of the Miami Beach peninsula. Canals join it at its upper end, thereby prolonging its drainage area. The river proper is entirely within the city-limits. It is about 200 feet wide at the mouth and tidal at its lower end. The normal fresh-water discharge is about 200 cubic feet per second, which, during floods, can approach 1500 cubic feet. The limiting depth in the lower river is seven feet at mean low water in the bay, and about five feet at the junction with the drainage canal 3.7 miles above the mouth. The lower reaches have been improved by dredging and the construction of small docks and yacht piers, now forming part of Miami harbor.

The city has been connected with deep water by a 25-foot channel, 200 feet wide at mean low water, the work of government engineers. The harbor includes the artificial turning-basins as well as channels dredged along the water-front and through shoal water to the ocean. The greatest natural depth averages 6 to 10 feet, with a mean tidal variation of 1.5 feet to 2.2 feet at the entrance, varying a foot or more according to the wind. The terminal facilities, not including the municipal piers, consist of eight wharves with a total frontage of 3500 feet. Two of these have railway connections. The municipal piers, with 25 feet of water, provide berthing space of about 5775 feet, with warehouses and storage yards.

Lines of coastwise vessels are now making Miami their southern terminal, the most important of which are the Clyde Line, Merchants and Miners Transportation Company, Munson Steamship Line and the Baltimore and Carolina Steamship Company.<sup>4</sup>

The land on which Miami is built is geologically so recent that in places it looks as if it had risen from the sea but yesterday. The evolution of the land has taken place during the last chapter of geological history. So, likewise, the development of the city is confined to the very last chapter of human history, contained in its entirety within the memory of a not yet very old man. Though there has been a sprinkling of white settlements in southeastern Florida for one hundred years, as late as 1885 there were but two families living in what is now a metropolis. The founding of Miami has possibilities to attract a writer of romance.

#### B. CITY GROWTH

Henry M. Flagler was a builder of railroads who began in the 1880's to extend a line south along the Florida coast from St. Augustine, thereby



making a wilderness accessible. The immediate cause of the founding of Miami is a geographical one—devastating frosts in the winter of 1894-95. The citrus crop was the principal source of revenue for Florida. On the 29th of December, 1894, the temperature dropped so low that the fruit, still ungathered, was frozen on the trees. Most of the young groves were killed. And then, just as the survivors had begun to put out new growth, on February 7th, 1895, a still more severe freeze occurred, and most of the trees which had escaped the first, were killed by the second frost. The state was financially ruined. Mr. Flagler was at Palm Beach at the time, the railroad finished to that point. When he heard that in Miami and in the regions to the south of it the orchards had not suffered he is said to have remarked, "If there is a place in Florida where the freeze did not reach, there we will build a city." And so the railroad was straightway extended 50 miles farther south, as far as Miami, and the city founded in 1895.<sup>5</sup> It was incorporated July 28, 1896, with barely the three hundred registered voters required for incorporation. In thirty-five years it has changed from a sleepy little settlement of 480 inhabitants to a city with a permanent population of 110,637.

For the first fifteen years or so the growth of the city was slow. In 1910 it covered but two square miles. In 1931 it covers 46 square miles, including made land, dredged from the bottom of the lagoon.

The Federal Census gives the growth of permanent population as follows:<sup>6</sup>

YEAR	POPULATION
1896_____	480
1900_____	1,681
1910_____	5,471
1915_____	15,592
1920_____	29,571
1925_____	69,754
1926_____	131,286
1927_____	147,000
1930_____	110,637

The tremendous jump in 1926 was due to the following cause. As population grew, real-estate values increased correspondingly, culminating during the winter of 1925-26 in one of those wild orgies of speculation impossible, perhaps, elsewhere than in the United States where mob-psychology sweeps the country with the rapidity of a spark along a train of gunpowder. A count of the entire population that winter would have shown close to a quarter

of a million people in Greater Miami. Not only was the entire section overrun by real-estate operators from the North, but every small shop-keeper, every local truck-man was caught in the frenzy. They gave up their business to speculate in real-estate. New cities were laid out at an expense of millions of dollars, paved streets built for miles and miles out into the pine barrens—tangible highways for ghost inhabitants. Now, as you explore them, the asphalt street with its sidewalks and elaborate lamp-posts suddenly stops, leaving you in a desert of gaunt pines and palmetto-scrub—a dream of expansion abruptly ended. For the bubble burst.

In that extravaganza of speculation land values soared to fantastic heights. Such a boom reflected in the statistics not only of population, but of commerce and of business as a whole, can with difficulty be imagined by one who has not himself experienced the hysterical excitement. Although it may not be within the province of geography to do so, a thorough study of that phenomenon should certainly be made.

### C. THE PRESENT CITY

The period of city evolution has been so short that the reasons for the founding of Miami, its *éléments de fixation*, so-called, are those which still cause it to prosper. One of the factors explanatory of its growth has been so incorporated that it serves to characterize the present city. Climate was the decisive reason for its founding thirty-six years ago, and it remains today the chief asset. The word "Miami" is synonymous with soft breezes of a tepid ocean, dazzling sunshine and tropical verdure.

### I. DESCRIPTION

The physical aspect of the city has undergone a miraculous change. During the past ten years frame-shacks have given way to towering structures of brick and cement—modern stores and office buildings, great hotels and apartment-houses—a towering sky-line beside the tropical bay; white roads to concrete thoroughfares; mangrove-swamps to parks, of which there are 37, totaling 173.31 acres in area. Bay Front Park, half a mile in length, skirts the bay, its water-front gay with yachts. It is planted with palms of many species, poinciana, almond, rubber, mango, hibiscus, oleander and poinsettia.<sup>7</sup> (There are said to be over one hundred and fifty species of exotic plants in the vicinity of Miami, some now so common as to seem indigenous.)

The city area extends two miles west, south and east of its original boundary lines, with outlying towns reaching many miles beyond. To the west is Hialeah, with the Jockey Club, the racetrack, municipal water-supply pumping station, and air-ports. To the south are Coconut Grove, South Miami

and Coral Gables, to reach which the Miami River is crossed on four modern bridges. The over-expansion due to the boom of 1925-26 is chiefly visible in Coral Gables, a residential city planned on a grandiose scale. With a hundred miles or more of paved streets and twice that amount of sidewalks, for instance, it has a present population of 5,697. (U. S. Census, 1930.) To the north are Buena Vista, Lemon City, Little River, Arch Creek, Fulford and Hollywood. The intervening areas are filled with subdivisions in process of development.

East of the city the bay is crossed to the Miami Beach peninsula by three causeways. The first is a solid-fill causeway, paralleling the channel to the ocean already described, and complementary to it. North of it and connected with it by bridges, are several artificial islands with palatial homes. Less than a mile north of this solid causeway is a concrete viaduct spanning several artificial islands between Miami Beach and the mainland. The third causeway is at northeast 79th street, while another still farther north is now building.

With regard to the area of artificial land in Biscayne Bay, a letter dated April 6, 1931, from Ernest Cotton, Director of Public Service in the City of Miami, says that "approximately 6,000 acres have been filled, which area is about equally divided between island fill, *i. e.*, where wholly new land has been made, and low-lying areas that have been raised and made tenantable."

## II. ROLE

Cities are usually classified as industrial, commercial, agricultural, administrative, military or intellectual. Does Miami belong in any of these groups?

### a. INDUSTRY AND COMMERCE

The number of manufacturing plants in Greater Miami today is 210 (U.S. Census 1930), from the smallest, employing but a few workers, to those with several hundred employees. In order of capital invested these industries are rated as follows: newspapers, \$4,250,000; ice manufacture, \$2,090,000; cement products, \$1,515,000; ice cream manufacture, \$1,275,000. Those involving a capital of less than \$1,000,000 include mill-works, bakeries, bottling-works, sheet metal works, boat building slips, printing establishments, nurseries, canning factories, and chemical manufacture. The list is not impressive and Miami cannot be called an industrial city. How is it with commerce and other business?

Of the total volume of wholesale business, 53.3 per cent, or 89 of the 175 wholesalers, are engaged in the food- and tobacco-products business. Next in

order are petroleum-products, iron and steel, chemicals, lumber and building materials. In retail trade the two leading groups are the automotive, with 469 establishments, doing an annual business of \$16,097,198, or 22 per cent of the total, and food-stores with sales amounting to \$14,957,888, or 21 per cent of the total retail business.

The elements of import by sea are mostly materials for building construction and food for local consumption. For 1929 the list included asphalt, automobiles, beverages, building supplies, canned foods, cement, crushed stone, feed, flour, fruits, grain, lumber, paper, petroleum products, sand, sugar, vegetables and general merchandise. The tonnage for the year was 961,570 short tons, of which 408,845 was local traffic, 403,847 was coastwise commerce, and the remainder, cargoes in transit. Though this was a total increase of over 16 per cent as compared with the preceding year, the tonnage during the boom year, 1925, amounted to 2,401,472 short tons. For export, ships carry out little for either foreign or coastwise trade other than fruits and vegetables. Up to the present time commerce has not bulked large in the city's activity.

If Miami is neither an industrial nor a commercial city, then, can it be classified as agricultural?

#### b. AGRICULTURE

The estimated area of Dade County, of which Miami is the county seat, is 1,292,160 acres, of which 50,620 are at present in farms mostly on the pineland. There were, in 1930, 1167 farms, mostly of less than 100 acres each. In the county there is every variety of soil, from sandy loam to Everglades muck. These soils combined with the climate will, with proper fertilization, produce almost all useful tropical and sub-tropical plants, as well as every garden vegetable grown in the United States. The climate, moreover, permits from two to four crops annually, making it possible to market them at a time of year when they cannot be produced elsewhere. The tomato industry of the Redlands district, south of Miami, already referred to, is an illustration. Tropical fruits include avocados, pineapples, papayas, mangoes, sapodillas, coconuts, guavas, grape fruit, oranges, limes, and other citrus fruits. Small-scale intensive farming is also being carried on, with approximately 30,000 acres in truck gardens. This sometimes results in the value of property per farm and of crops per acre being inversely proportional to fertility, some of the highest yields being on white sand near the eastern coast. While the number of chickens has doubled during the past ten years, the number of milk cows has almost tripled, 1557 in 1920, 4004 in 1930.

Over sixty dairies are now producing an average of 300,000 gallons of milk per month.

The annual value of agricultural products in Dade County is estimated at \$15,000,000. But the industry is still in its infancy. One of the projects which is geographically sound is to make Miami a center of perfume manufacture comparable to that of the Côte d'Azur. Nothing to realize this project, however, has as yet been done.

Agriculture in Dade County must face many adverse conditions. As it is impossible to use plows in the limestone, when a fruit-tree or any other not native to the pineland is to be planted it is first necessary to blast a hole several feet across, which, when filled with suitable soil, receives the young tree. Clearing the land is a difficult and expensive task—dynamiting, burning and removing the trees, carrying off the blasted rock and destroying the three or four species of palmetto as well as other scrub. When it is done there is an uninviting waste of dry, sandy soil. During the last five years, moreover, three severe windstorms in succession have destroyed a large part of the citrus crop, while disastrous speculation in land has upset the normal development of agriculture as of other undertakings.

No reliable statistics are available, but number of car-load shipments, an index of production, are as follows:

SEASON	NO. OF CAR-LOADS
1925-26_____	1900
1926-27_____	4400
1927-28_____	4275
1928-29_____	3685
1929-30_____	3325

Estimates indicate that car-load shipments for the present season, 1930-31, however, have been between six and eight thousand. But agriculture is obviously not a major source of revenue to the city.

If Miami is not an industrial, commercial or agricultural city, neither is it administrative (though it is the county-seat of Dade County, three-quarters of whose population live within the city-limits). And it is certainly neither military nor intellectual in type. How, then, can it be classified?

### c. TOURIST TRADE

A function of its greatest asset, climate, the chief *raison d'être* of Miami is the tourist. The number of those who wish to escape the rigors of a northern winter is growing by leaps and bounds. The estimated number of winter visitors to Miami, Miami Beach and Coral Gables, compiled for

1929-30 from a survey of automobile, railroad and steamship travel, gives an idea of what happens during the height of the season.

AVERAGE NUMBER OF VISITORS PER DAY

December.....	18,000
January .....	35,000
February .....	52,000
March.....	30,000

Supposedly the population is at least doubled during the winter. To provide accommodations for this constantly increasing throng it has become necessary to build hotels, apartments and houses. Miami is now the fourth city in the United States in hotel accommodations. According to a statement published by the city in October, 1930, there are 140 hotels with number of rooms in excess of 20,000; 1606 apartment structures, number of units, 16,589; number of housing units of all types other than hotels, over 51,000. A capacity tourist crowd means, in one season, a gross revenue to the city of about \$100,000,000.

Thus, the tourist trade is by far the greatest source of revenue, and one which is growing because of Miami's accessibility from the population-centers of the country. The largest conventions have chosen it as their place of meeting. The throng of visitors comes from every state in the union as well as from foreign countries. Each year some of them remain at the end of the season, thus adding to the permanent population. This is truly cosmopolitan, giving Miami the characteristics of a wide-awake northern city, to which its latitude would hardly entitle it.

An orgy of expenditure is taking place at Miami Beach. Twenty years ago it was a mangrove-swamp. Now it is one of the most luxurious beach resorts in America with a developed ocean frontage of seven miles or more. With a permanent population of 6,494, it has a winter population of more than 35,000 and an assessed valuation of \$50,000,000. Palatial residences, 196 apartment houses of from four to fifty units each, 65 hotels ranging from one of 25 rooms to a \$2,000,000 hostelry, 500 store and office buildings with branches of the most expensive New York establishments, casinos and bathing pools, polo fields, golf courses, tennis courts, ocean-front parks—these supply the demands of a pleasure-seeking horde. The outstanding feature of Miami Beach during this past year of business depression is the construction of an elaborate Surf Club on the strand, and a Golf Club on Indian Creek, the 125 acres of land for the golf course of which have been dredged from the bottom of the lagoon. The cost of these shockingly extravagant structures mounts into eight figures.

Abundant sunshine; a dry soil; relatively few stormy days; a soft, balmy air; the beauties of tropical vegetation; every inducement to an outdoor life which natural conditions and the ingenuity of man can devise; luxurious hotels and sea-bathing even in mid-winter—these are sufficient to insure the popularity of Miami as a winter resort (*ville hivernale*). And Miami is today a tourist city most of whose permanent population remains but to supply the needs of the winter visitor. But we have not yet reached the end of the story.

### III. TRANSPORTATION FACILITIES

Flagler's Florida East Coast Railroad enabled travelers to reach Miami in the beginning, but once there, cause and effect were reversed. More and more was demanded of transportation facilities, construction of which has been feverishly trying to keep pace with demand. Miami is now served by two main trunk-lines, the East Coast and the Seaboard Air Line. Traction companies operate both tramways and busses to outlying districts. There are now approximately 700 miles of oiled macadam and paved streets which connect with hard-surfaced roads, enabling the automobilist to go from one end of the state to the other. This makes it possible for many to visit Miami who could not otherwise afford to do so, and the city furnishes free camping-space for such tourists. The Dixie Highway runs from Jacksonville to Miami and on to Key West, with the help of two ferries. Within the last two years the first road has been built across the Everglades, connecting Miami with Tampa, on the Gulf Coast. It is called the Tamiami Trail. It has an excellent surface and is skirted by a canal, the remnant of excavation for road-material. Both of these are Federal highways and connect with centers of population farther north.

Yet another factor, and one of central importance, has come to the front during the past three years: I refer to aviation. This new method of transportation insures the prosperity of Miami not only as a city of the future, but, in a peculiar sense, as a geographical city of the future, and for this reason.

As we have seen, the growth of the city hitherto has been due largely to a geographical cause, climate. Future growth will tighten dependence on geography. For not only will the climate continue to draw winter visitors, geographical location will become a greater and greater asset as the system of airways connecting the United States with the countries to the south of it develops. For, except for northern Mexico, Miami is the nearest city in the United States to Latin America.

One of the crucial problems of today is our Latin-American relations. Due to air transportation connections are becoming closer. Trade and travel follow these lines.

Fully to appreciate the significance of aerial transportation for South America, one must realize that it serves a region still largely in the pioneer stage of development. Until the advent of the air-plane the greater part of Latin America depended on the pack-train, the river boat, the coastwise steamer and a few short railway lines. Air-transportation thus enables it to hurdle the most costly stages of transportation development, particularly expensive in mountainous countries where the modern demand for rapid transportation can be satisfied only by aircraft. The air-plane has found in Latin America a realm prepared by nature for its enthusiastic reception. Air-mail service is revolutionizing past methods of conducting Latin-American trade, due to the great saving in time.

The entire area of Central and South America is served by a single, privately-owned company, Pan American Airways, Inc., with headquarters in Miami. The growth of this company during the past three years is spectacular. On October 19, 1927, it obtained the first United States Government foreign air-mail contract. Since then its planes have flown more than 19,000,000 passenger-miles, carried 77,797 passengers and transported more than 4,600,000 pounds of mail, express and baggage. It now has (May, 1931) 18,500 miles under contract and in operation, serving thirty-two countries and colonies, 87 airports, and a fleet consisting of 101 air-liners and 14 sea-going flying boats which carry from twenty to thirty-two passengers. Passenger-traffic, measured in passenger-miles flown, has increased from 5,400,000 in 1929 to 9,100,000 in 1930. Air-mail ton-miles during the year were more than quadrupled over 1929.

The northern terminal of this company is called the Pan American Airways International Airport and is situated in Hialeah. On February 22, 1931, the company began work on construction of a large sea-plane base at Dinner Key, which, during the World War, was the United States Naval Air Corps sea-plane base. It will eventually become the point of entry for Central and South America.

Connecting with the Pan American passenger and mail service from Miami through the West Indies, Canal Zone and Central America to the north, east and west coasts of South America, the Eastern Air Transport, Inc., operates from New York to Miami serving in all 19 cities. It has flown the air-mail for the U. S. Government for the past three years and began its air-passenger



system in August, 1930, with an increase in passengers carried since that date of 500 per cent.

Not only is Miami the indicated point of departure for the south, from the point of view of meteorological conditions it is also well-placed as a port of entry from Europe. Columbus followed the trade-winds and landed in the Antilles. The Graf Zeppelin on its flight from Germany last year took the same favorable course. Future lighter-than-air craft, if following favorable winds from Europe, would conveniently land in Miami, whence they could continue up the coast, thereby avoiding encounters with the prevailing westerlies of the North Atlantic.

The climate still further favors Miami as an air-terminal, for it is the only part of the Atlantic seaboard practically free from fog. It has an average of eight hours' fog for a twelve-month period, less than two fogs a year. This, together with the fact that there is so little manufacture that the atmosphere is free from dust and smoke, makes for good visibility. With a low average wind velocity it seems an ideal aviation center. Hurricanes are not a serious menace since their paths can be predicted several days in advance, and consequently avoided. Thus, though its strategic geographical location is the chief reason for its development as an international airport, climate, the presiding genius of its prosperity from the start, helps to make it so.

The city has a Greater Miami Airport Association which has organized the Aviation Department, an integral part of the city government. It sponsors expansion of all companies operating in the region. Miami Municipal Airport is a field of 120 acres, also located at Hialeah. There are four sea-plane bases on the artificial islands in the bay, one of which is operated by the city.

#### CONCLUSION

And so, the questions raised at the beginning of this paper, why Miami with its phenomenal growth is located where it is, and what its inhabitants do, have in part been answered. The city is where it is primarily because of its climate which is in turn explained by the location. Few profited by the climate, however, before the era of modern transportation. Miami is the creature of both elements and would not exist without either. Child of climate and child of transportation by land and sea, such it is and such it will remain.

But still another advantage of its location has recently developed, because of which Miami is emerging in a new role: to preside over the destinies of those who travel by air. The city of the future will have a double part to

play—as winter resort and as gateway of air-transportation to the continent of South America. And both of these roles, being sponsored by geography, have presumably come to stay.

#### N O T E S

- <sup>1</sup> The following maps have been used:  
 U. S. Geological Survey  
   State of Florida. 1:500,000. Partially revised 1925.  
 U. S. Coast and Geodetic Survey  
   Miami Harbor and Approaches, No. 583. 1:40,000. 1931. Florida Inside Route,  
   Jupiter Inlet to Key West, Nos. 3260-3261. 1:80,000. 1929.  
 Florida State Geological Survey  
   Generalized Soil Map of Florida. 1:1,000,000. 1925. Geological Map of Florida.  
   1:1,000,000. 1929.  
 Squires, Karl. Miami, Florida.  
   Street Map of Greater Miami. 1929.
- <sup>2</sup> Temperature measurements in this article are in degrees Fahrenheit.
- <sup>3</sup> This problem, together with most others relating to the flora of southern Florida, have been studied for the past thirty years by Dr. John K. Small, Director of the New York Botanical Garden. The titles of his publications on this subject are more than fifty, largely contained in the *Journal* of the N. Y. Botanical Garden.
- <sup>4</sup> The intracoastal waterway, known as the East Coast Canal, extends from Miami to Jacksonville, a distance of 335 miles, between the fringing islands and the coast. It enters Biscayne Bay at its northern end and traverses the bay to the city, its southern terminus. In the artificial sections the width is 50 feet, the depth, now from 3 to 5 feet, will be 8 feet at local mean low water throughout, when the existing Federal project is completed. At present this waterway is used by small commercial boats carrying freight and passengers to and from the towns along its route, and by yachts and other pleasure craft. It enables such boats to ply up and down the coast without risking the dangers of the open ocean.
- <sup>5</sup> Flagler did not stop at Miami. After building the Royal Palm Hotel at the mouth of the Miami River—until 1930 when it was torn down the most famous hostelry on the southeastern coast—he pushed on toward the south. From one wind-swept and often wave-swept key to another, across intervening shoals, the road was built, until on January 22, 1912, the first through train arrived at Key West. The once isolated island city was united to the continent. Meanwhile, all along the east coast towns had sprung up, harbors and ports had been improved and the whole territory was started on a career of such sensational development as to be almost incredible to one who has not watched it from the start.
- <sup>6</sup> The population of Greater Miami, including Coral Gables, Miami Beach, Hialeah, Miami Shores and other smaller communities, is now about 162,000. It has had an increase of 274.1 per cent since 1920. Of the total population (1930) native whites form 69.8 per cent or 77,243 persons; foreign-born whites, 7.4 per cent or 8,218 persons; and Negro, 22.7 per cent or 25,116, while other races contribute .1 per cent, or 60 inhabitants.
- <sup>7</sup> This property was acquired in 1922 and, with a forty-acre fill, now includes 62.5 acres of park as well as wharves and harbor-construction. The 1,014,510 cubic yards of material dredged to make it provided a yacht anchorage half a mile long, 800 feet wide and twelve to twenty feet deep.

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