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N. L. BRITTON,
Director-in-Chief.

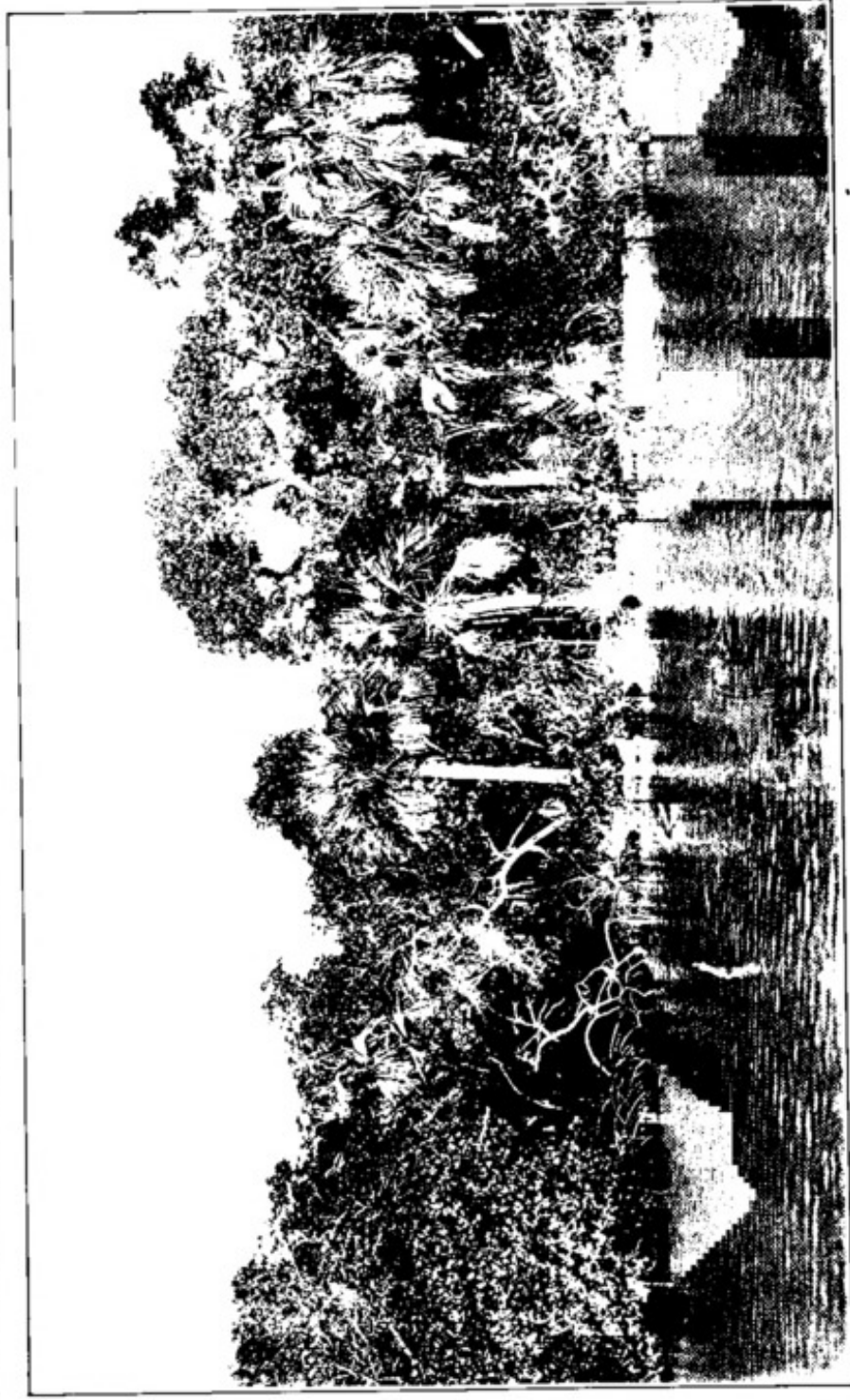
BOTANICAL EXPLORATION IN SOUTHERN FLORIDA IN 1916

WITH PLATES 195-199

DR. N. L. BRITTON, DIRECTOR-IN-CHIEF.

Sir: With your permission I spent January of last year in southern Florida in continuation of general botanical exploration and in photographing the vegetation of the region. During the first two days devoted to field-work, I had the company of Professor R. A. Harper, Professor Tracy Hazen, and Dr. Cecil Yampolski, all of Columbia University.

The initial trip was to Sands' Key. We went there in search of a slender-stemmed cactus that had been reported to occur on that island. Our search was successful, but instead of finding an addition to our cactus flora, we discovered that the seedling plants of the large, and viciously armed dilldoe, *Acanthocereus pentagonus*, are little plants with elongate slender stems about



Madeira Bay region, Fla. Shore of Madeira Bay in foreground. Edge of Mackira Hammock in background. This is the southernmost hammock on the Florida peninsula, except those of the Cape Sable region. It received its name from the Madeira-redwood or Mahogany-tree which grows mostly everywhere in the hammock.

as thick as an ordinary lead-pencil and armed with quite soft spines; altogether so different from the mature state of the plant, that one would not suspect that the two extremes represented the same species, if he had not seen the seedling plants further developed and with the new growths by successive steps taking on the form of the adult. In addition to this discovery, we settled the question about the eligibility of *Maytenus* to our tree-flora list. Its right to inclusion among the trees has always been questioned or disputed except by the writer. On Sands' Key we found tree trunks over a foot in diameter, a fact that should remove all doubts as to whether this plant is a tree or not, and in addition to this evidence, last year Mr. George A. Orrok reported to me the occurrence of trees equal in size to those on Sands' Key growing on Captiva Island on the western coast of Florida near the mouth of the Caloosahatchee River. Another interesting discovery was the Bahamian nightshade, *Solanum bahamense*, growing as a vine, and climbing high in the trees.

The following day was devoted to an excursion to Royal Palm Hammock.* Four subsequent visits were made to this hammock during the month, and much of its area was then explored. The royal palms were in the height of their flowering during January. The massive plumes of white flowers in contrast to the crown of bright green leaves above them presented an impressive sight. Many interesting observations were made and several may be recorded here. The myrtle-of-the-river, *Calypttranthes Zyzugium*, mentioned in my report of last year's work, was found to be one of the most abundant of the shrubs and trees of the island. It grows nearly everywhere, except in the low places. The foliage is peculiarly conspicuous on account of the striking shade of green in its leaves. Another vine was added to our list of climbing plants, namely, the French-mulberry, *Callicarpa americana*. This common shrub was found in the jungle clambering quite high over other shrubs and up into the branches of the trees. It is one of the few shrubs that range all the way from

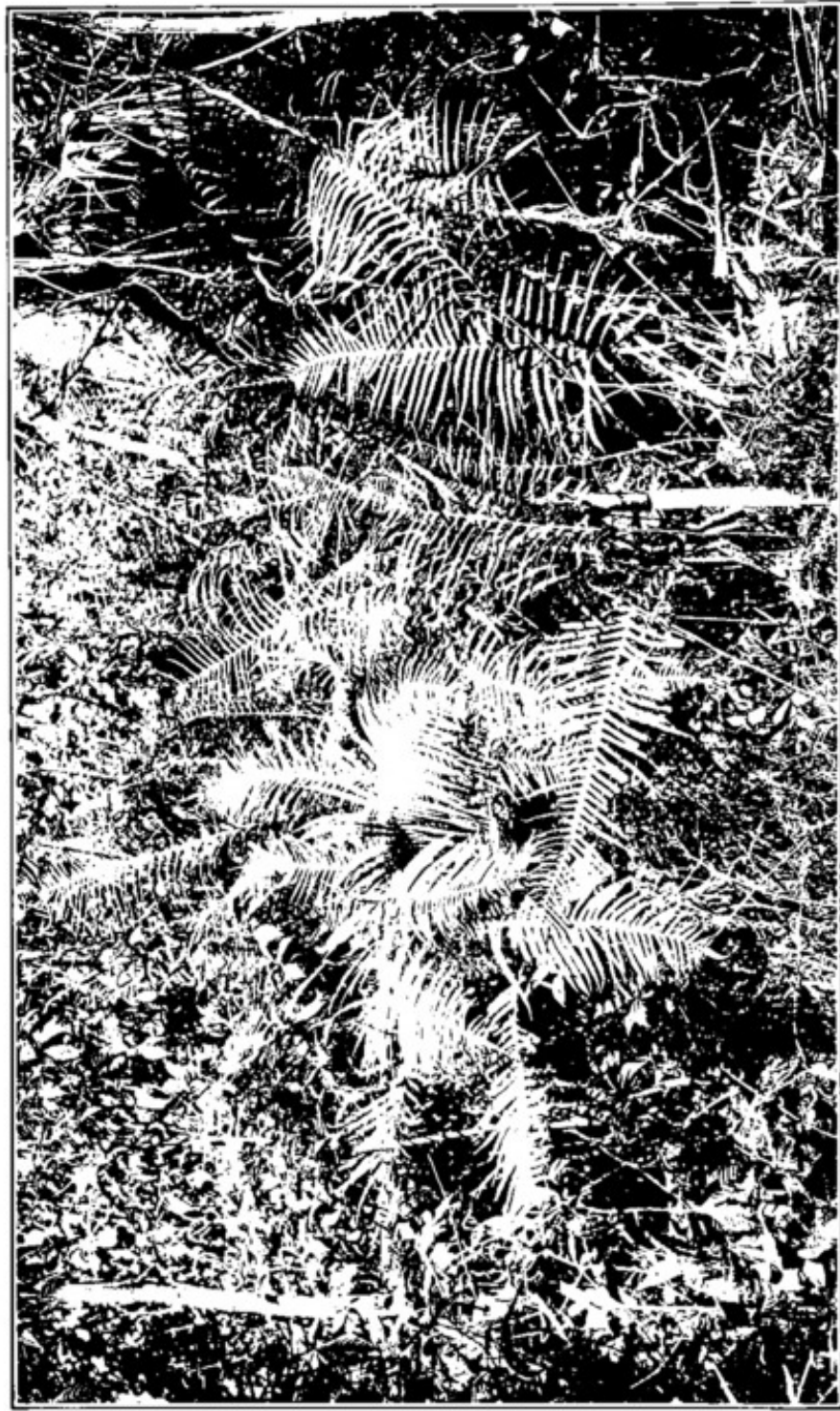
* A separate paper has been devoted to Royal Palm Hammock which has recently become a public reservation. *Journal of the New York Botanical Garden* 17: 165-170. 1916.

the Appalachian mountains of Virginia and North Carolina to the southern end of the Everglades. It flourishes about equally well at both extremes of its range.

Royal Palm Hammock furnishes an interesting reversal of the normal phytogeographic conditions of the region. On the Everglade Keys we have extensive pinelands. These surround, here and there, small areas with hammock growth. Royal Palm Hammock is, as the word hammock means, a dense growth of broad-leaved shrubs and trees; but the wind, during hurricanes, or perhaps in less violent storms, has carried seeds from the pine trees growing in distant pinelands and dropped them in the more open places on this everglade hammock. Thus in open and otherwise favorable spots pine trees have sprung up, singly or in groups, and here and there we find small areas of pineland in a hammock. These areas of pine-woods are small, but they are characteristic and even have the saw-palmetto which is nearly always present in the pine-woods on the Everglade Keys. The seeds of this plant were not, however, carried there by the wind, but by animals, most likely by the bear, which up to a few years ago was very abundant throughout this region. Perhaps, if the rock surface of Royal Palm Hammock and the surrounding Everglades were slightly more elevated and the natural protection from fire thus removed, Royal Palm Hammock would long ago have been transformed into a pine island, nearly or quite devoid of hammock.

About ten of the more interesting hammocks mentioned in my report on exploration in 1915 were visited for the purpose of collecting certain plants and making photographs of especially interesting objects.

Two short periods, between visits to the hammocks of the Everglade Keys, were spent in further exploration of the Florida Keys. On one of these cruises the northern end of Key Largo, Angelfish Key, and Palo Alto Key were visited. Key Largo and Palo Alto Key both have some beautiful original forest in which many interesting plants grow. There we found an orchid not before collected on the Florida Keys, and a tree not before found on the Upper Florida Keys. On Angelfish Key we were



In a hammock on the Long Key pineland, Fla. Bed of a very rare wood fern, *Dryopteris angustata*, in foreground. Some of the fern-leaves measured over nine feet in length, and some of the blades were almost three feet wide.

surprised to meet with a copious growth of perhaps our hitherto rarest shrub, *Vallesia*, a member of the dogbane family. Previously it was known in our flora only on Key West. Outside of Florida it is known in the West Indies, in Lower California, and in Chile. On a subsequent cruise the flora of other parts of Key Largo was investigated, and the hammocks of Meig's Key and of Elliott's Key were also visited.

Of the several new hammocks explored, the two more interesting ones are located at the extremities of our field of activities on the mainland during the period under consideration. The one is located in the Long Key pineland, the other in the Everglades west of Little River. At each of these hammocks I was accompanied by Mr. Charles A. Mosier, who discovered the former hammock accidentally several months previous to my visit and who had visited the Everglade hammock several years previously.

The exact location of this Long Key hammock is not determined, but if, after crossing the Everglades from a point where the Ingraham Highway emerges from the western side of Royal Palm Hammock, to the nearest point on Long Key, a north-western course is followed through the pine forest and across two prairies, one cannot fail to encounter the hammock. This hammock conforms to the invariable rule of the hammocks of the Everglade Keys, in that its flora has individual characteristics and its vegetation, to some extent, is distinctive. Its lime-sinks yielded one kind of West Indian maiden-hair, not known elsewhere on the North American continent. This fern is of interest otherwise in that it has the fragrance of the northern sweet vernal grass in drying. This hammock is rich in orchids. Many of the widely distributed species are present, and in addition to these the *Brassia*, heretofore known in the United States only from the Nixon-Lewis Hammock in the Biscayne pineland, and the *Macradenia* known hitherto only on Royal Palm Hammock, are both quite plentiful.

The incursion to Roberts Island, as the Everglade Key above referred to is locally known, after plans for going there had miscarried many times, took place on January 23. We went by

automobile through the pinewoods to the edge of the Everglades. There afoot we took to the water and mud, and waded for a distance of three miles in a westerly direction in water mostly knee-deep and mud at the same time half as deep or of equal depth, until we reached the hammock. The trip requires strenuous wading, which must of necessity be made at a pace compared with which a funeral march would seem quite rapid; but the objective is worth the effort. This island is several miles long, standing north and south in the Everglades, and about a quarter of a mile wide. It is densely forested throughout. Much of its surface is so low that it is submerged during the rainy season. The soil of the low parts is mud and humus. This supports an almost impenetrable jungle made up mainly of pond-apple trees, cocoa-plum trees, and red-bay trees, and ferns. There are ferns by the square rod and ferns by the acre. The Boston fern and the sword-fern constitute the largest and most beautiful beds. Several kinds of epiphytic ferns and a few species of air-plants often cover the limbs of the trees. The higher ground of the island is sandy. There the live-oak is the dominating tree of the forest, and each tree constitutes a hanging garden. Orchids, air-plants, and ferns completely clothe the limbs of the larger trees. However, plants do not have a monopoly of the trees. There are also epiphytic lizards and epiphytic snakes! There is everywhere present a beautiful green snake. It inhabits the hammocks and it is especially abundant in those of the Everglades. It lies outstretched on the branches of shrubs and trees and glides along the branches from one tree to another with surprising ease. One has usually to be careful to look before laying hold of the limb of a tree for support, or he may grasp something of quite different consistency from that of wood!

The shrubs and herbs here represent more northern kinds than are met with in the hammocks of the nearby Everglade Keys. Among the more interesting discoveries on this island was a gigantic plant of the comptie, *Zamia pumila*, a cycad related to the Florida arrowroot, *Zamia floridana*, which is very common in the pinewoods of the Everglade Keys. The former cycad grows in the hammocks of peninsular Florida mostly north of

the New River, and it had not previously been found south of Fort Lauderdale. The specimen mentioned had a very large branched underground stem, and an unusually fine cluster of leaves each one over four feet tall. So striking was the plant, that we dug it up, photographed it, and replanted it.

After a profitable day on this island, we retraced our steps through the Everglades and found our automobile without special incident, except that one member of the party got his legs tangled in the coils of a large water-moccasin, and in the excitement and confusion of trying to get away in a hurry he fell prone in the mixture of mud and water. Both snake and man were equally surprised at the sudden meeting and neither had time to harm the other.

About the spot where this incident happened we discovered the beefwood or Australian-pine growing in the wet Everglades. The seeds had evidently been blown in during a storm or hurricane from trees growing near the coast.

The last week of field-work was devoted to a cruise to the lower Florida Keys. We sailed from Miami one forenoon and late in the evening of the same day we cast anchor for the night in the Bay of Florida just off the mouth of Tavernier Creek at the southern end of Key Largo. The night was warm and calm and the sky was cloudless; but simultaneous with daybreak we were suddenly awakened by the breaking of a "norther" which was ushered in by several flashes of lightning and a wind-squall that nearly swept loose objects from our decks. The gale caused our anchor to drag, thus blowing us rapidly toward the neighboring shore. The storm was accompanied as usual by an uncomfortable chillness caused by the sudden fall in temperature and by the continued strong wind from the north. We got under way at once to avoid being blown on shore, and as the engine was working well we continued southwestward on our proposed course without further delay. The sea became very rough as we went on and on emerging into the open part of the Bay of Florida we were forced to seek the shelter of Lignum-vitae Key for a short respite, both in order to get the salt out of our eyes and to avoid taking too much water aboard.

There we made collections on that island, which somewhat resembles Pumpkin Key in Card Sound, but with a less interesting hammock.

After several hours delay, during which time the wind abated slightly, we again started toward our destination, and made a harbor near the western end of Vaca Key just after dark. An early start next morning brought us to Big Pine Key in the forenoon. Before crossing over to No Name Key, our objective, we called on the oldest resident, the leading citizen, the postmaster, the express agent, the station agent, the merchant, and the banker, and also a good friend of all visitors to Big Pine. This formality and pleasure did not consume much of our time, as these distinctions, offices, and vocations are invested in one man, namely, Mr. Thomas Knowles, who has helped our exploration there by his personal company, by information, and by putting his house at our service. After casting anchor in a harbor on the western side of No Name Key, we at once went ashore to investigate the island. No Name Key, like a half dozen of the neighboring islands, has extensive areas of both pineland and hammock.

These islands, and the other keys west of the region of Bahia Honda channel, are of limestone similar to that of the Everglade Keys, and not of coral rock of which the Upper Florida Keys are built up. The naturalists of a generation back considered the Florida Keys to be a uniform chain of islands. However, our studies in the plants of the region in connection with our exploration of the Everglade Keys, and Mr. W. J. Krome's investigations during the construction of the Key West Extension on the Florida East Coast Railway, disclosed the fact that the groups of Keys we have designated elsewhere* as the Upper Florida Keys and the Lower Florida Keys are of different rock, of different geological ages, and thus quite naturally support different floras. Although of the same kind of limestone, the exposed surfaces of the Lower Florida Keys and the Everglade Keys are different in appearance. However, this difference is superficial, and it is easily explained. The superficial erosion

* *Flora of the Florida Keys*, iii-iv. 1913.



Lime-sink in hammock on Key Largo, Fla. Fallen tree-trunk clothed with resurrection-fern in foreground. Leather-fern in bottom of sink in background.

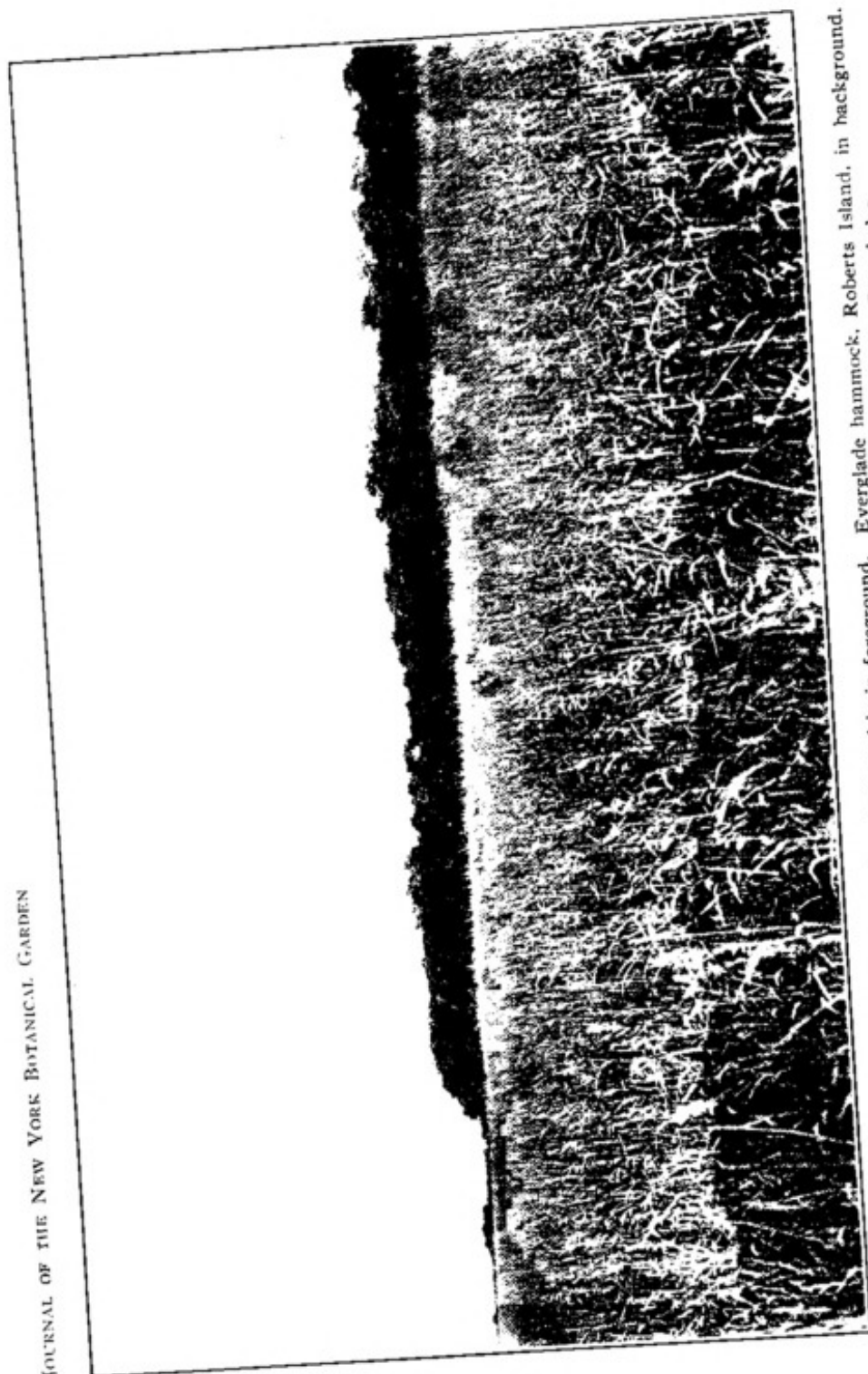
of the rock of the Florida Keys has resulted in a plate-like surface. It has the appearance of having been swept and polished. The storms and hurricanes of ages have brought this condition about. The exposed position of the islands and their slight elevation above-tide has permitted the sea to sweep over them from all directions and thus wear down uneven places on the surface, as well as to carry away the decaying vegetable matter and the humus. Thus important factors in the superficial erosion, the acids of the decaying leaves and other vegetable matter and those of the resulting humus, have been largely eliminated. The natural accumulation of humus would produce the opposite condition from that which there obtains. In other words, the leaching-out process is mostly wanting on the Lower Florida Keys, except along the shore lines where the continual action of the tide and the waves leaches out the softer parts of the rock mechanically rather than chemically. The results of chemical leaching are clearly shown on the neighboring mainland of the peninsula.

In the case of the Everglade Keys, all of which are sheltered from the sweeping effect of the sea, we have a quite different rock surface resulting from a quite different mode of erosion. Here the action of rain-water is not counteracted, and the more or less extensive accumulation of humus with its dissolving acids has leached out the softer spots and thus instead of a pavement-like surface we find a surface honeycombed with all sizes of cavities. Further, in the pinelands whose humus has been burned up for ages by forest fires, first as a result of lightning, later by the carelessness or wantonness of man, we find a surface honeycombed with apparently small and shallow cavities; in the hammocks, which have been fire-proof, so to speak, and consequently with copious humus and a perpetual humid atmosphere, we find a surface honeycombed with large and deep cavities. There the surface is so different from that of the pinelands that the cavities are called "pot-holes," "lime-sinks," or "erosion-holes." It is the hammocks that have made the lime-sinks. The lime-sinks are not responsible for the hammocks as is commonly believed.

No Name Key is the type locality or the place where several kinds of flowering plants new to science were first found during the last century. We rediscovered some of these species and, in addition, found the Bahamian *Savia*, a shrub or tree of the spurge family, heretofore known in the United States only from Big Pine Key. Many interesting plants, herbs, shrubs, and trees, clothe the plate-rock surface of this island. The rocks seem too smooth and dry to support vegetation at all, particularly in the pinelands where the humus is scant, and where rays of the tropical sun have direct access to most of the pavement-like surface. Palms thrive exceedingly well. In the pinelands of the Everglade Keys we have a copious growth of stunted saw-palmetto, and occasional stunted silver-palms, or half-starved cabbage-palms. On No Name Key the pine trees are accompanied by a growth of wonderfully developed thatch-palm and silver-palm which sometimes rivals the pines themselves. The young trees of both these palms are very thrifty, with stout trunks and heavy crowns; but as the trees get older the trunks increase greatly in length but not so much in diameter, and the crown of leaves is much diminished in size. The older trees often suggest slender fish-poles with a small brush-like tuft of leaves on the top.

The second day on this island was devoted to crossing to the eastern shore through pineland and hammock towards the southern end and then recrossing to the western side further north. The western side of the Key is mostly pineland, while the eastern side is mostly hammock. The hammock is rather stunted, but dense, and it has formed considerable humus on the floor. This condition leads the inhabitant there, as elsewhere, to clear the land for the cultivation of crops.

As we have already said, natural agencies are slowly destroying the Florida Keys and consequently, in all probability, many kinds of plants that once grew on them have disappeared. Man is destroying hammock and pineland, both wantonly and of necessity, much more rapidly than nature. Before long much of the natural vegetation of the region will be known only in places to which it may have been transplanted, or in the herbarium specimens we secure and preserve in our museum collec-



— 1. Easternmost of Little River, Fla. Everglade prairie in foreground. Everglade hammock, Roberts Island, in background.

tions. On the return trip we stopped to make collections on several keys.

We first visited Johnson's Keys, which lie eastward of No Name Key. The next landing was on Bahia Honda Key, where several plants grow that are not known elsewhere in the flora of the United States. After this we visited, successively, Ohio Key, Rachel Key, Bamboo Key, and Key Largo. Rachel Key may be recognized by its lone cocoa-nut tree. Its rocky surface is clothed with dense hammock, except where it has been cleared for cultivation. There we found the aloes growing naturally. This discovery adds an African plant to our naturalized flora. Bamboo Key may be recognized by the absence of bamboo, or any plant like it, and also by the absence of shrubs and trees, except scattered plants of the wild-cotton. Its surface, unlike that of Rachel Key, is composed of loose small fragments of sea-shells. There, also, we found quantities of aloes growing naturally; but its most interesting plant is the common asparagus! Asparagus plants were evidently introduced there in some way, and now they have taken possession of large areas. This plant of temperate regions seems to thrive just as well on this tropical island; there it has no winter resting period, but grows from one end of the year to the other, and, like the wild-cotton plants with which it grows, it both flowers and fruits without cessation.

Card Point, a small cape projecting eastward from the mainland, was visited and its hammock explored. Here, as along most of the coast-line of the Florida peninsula south of Cutler, the mangrove lines the shore. Several projections also support hammock. Growing with the native plants in this hammock we found the beefwood or Australian pine. This tree is becoming more and more common as a naturalized plant in southern Florida. It will grow well in almost any situation; from a distance we noticed it along the uninhabited shore of the peninsula at several points where seeds had evidently been blown by storms or had been washed ashore during high tides. After a short stop on Key Largo for the purpose of making some photographs of ferns, we weighed anchor and proceeded back to Miami and Buena Vista.

An unexpected call to southern Florida during the latter part of November and the first part of December gave opportunity for further exploration. The time was devoted largely to hitherto unvisited territory. A dozen points in the Everglades not previously visited were investigated, and each one disclosed plants of interest. Several new hammocks were found and portions of the Biscayne pineland not previously traversed by the writer were examined.

A week was devoted to further exploration in the Cape Sable region. Only new localities were visited. We had planned to revisit the Cuthbert Lake and the Coot Bay regions, but a strong easterly wind had blown most of the water out of the Bay of Florida east of Flamingo and recent rains had filled the sloughs on the mainland north of Flamingo and had made them impassable. Consequently, our plans were frustrated by too little water in the sea and too much water on the land.

Although a continued strong easterly wind had perceptibly lowered the water in the bay, we sailed without difficulty as far east as Joe Kemp's Key, where we anchored. There leaving the "Barbee" we went ashore on the key. This was the first time botanists had set foot on the island, and I might say in passing that there are over a hundred Florida Keys upon which collectors have not yet set foot, and what strange plants may be hidden in their hammocks we do not know!

We spent the forenoon collecting on the sand-dunes of the key and in its hammocks, as well as in the hammocks of the adjacent mainland. The wind increased in velocity and we noticed that the water in the bay was rapidly getting lower. We then made haste to go to the "Barbee," which we managed to reach with difficulty, for when we approached her she was resting high and dry on the soft mud bottom of the bay.

This condition of low water afforded an unusual opportunity for collecting the kinds of aquatic flowering plants that grow only on the bottom of the bay. Three kinds were present there, the turtle-grass, the manatee-grass, and a third kind quite similar to the manatee-grass in habit, but with flat leaves. Previously, this plant was apparently one of the very rare plants in our



In hammock on Roberts Island in Everglades west of Little River, Fla. A strangling-fig, pale-barked tree, grappling a cocoa-plum, horizontal tree-trunk in front, and a swamp-bay, erect trunk behind. Note strongly buttressed trunk of strangling-fig.

flora and no definite locality for it was known. Our observations prove it to be exceedingly common. Its botanical name is *Halodule*. It has no common name, but it would ordinarily pass for manatee-grass, which it very closely resembles.

As the tide came in the wind abated slightly, and as soon as the "Barbee" floated we moved westward a few miles and sought shelter for the night behind a small cape. The velocity of the wind increased again, and at dusk we were compelled to drive a long stake through the anchor ring to keep from being blown out into the Gulf of Mexico.

After sunrise the next morning we went ashore at Flamingo and started westward across the prairie in the direction of Cape Sable. Between the Cape and the Flamingo region are extensive prairies almost as level as a floor, except for occasional "gator" holes. Hammocks are scattered here and there on the prairies. These, however, are more numerous toward the shore of the bay on the south and along the evidently lower parts of the prairie several miles toward the north. Strong winds sweep the prairies almost unceasingly.

We walked westward nearly to the East Cape, and along the course discovered a number of plants not before known in our flora except on the Florida Keys. The prairie region and adjacent parts are full of bird-life. There is much evidence of it in the hammocks, which often are large rookeries. Reptiles, too, are plentiful. Poisonous snakes are represented by moccasins in the low parts of the prairies and diamond-back rattlers about the hammocks. In a hammock midway between the Cape and Flamingo one member of our party serenely stepped over two "bell-cows," as the rattlesnakes are locally known in parts of Florida; but he was not aware of his daring feat until his attention was directed to the snakes by a companion walking behind him. The reptiles were each over six feet in length.

By sunset we had retraced our steps to Flamingo. During the day we had gathered a wagon load of living plants and herbarium specimens, all of which we transferred to the "Barbee." The following morning we began our homeward journey. We proceeded directly to Cape Sable and made a landing on each

of the three capes, where we examined new localities. At each cape we were rewarded by discovering plants new to our flora. After going northward to the boundary line separating Cape Sable and the Ten Thousand Islands, we boarded the "Barbee" and headed her toward Lower Matecumbe Key. We made a harbor on the inner side of this key after sunset and the following morning went ashore to hunt for plants in parts of the hammock which had not before been visited. The most interesting plant encountered was a rare cactus with simple or nearly simple stems often growing between twenty and thirty feet tall.

After starting on another tangent of our homeward journey late in the afternoon, we decided to visit Madeira Bay. Night fell before we reached Pigeon Key, at which point one must turn north in order to reach Madeira Bay. As a matter of saving time for field-work we determined to attempt to cover the course in the dark. We dodged islands by keeping a sharp lookout and missed running aground on sand-bars by mere luck. All went well and before midnight we anchored at what we unanimously decided was the entrance to Madeira Bay. The next morning at sunrise the outlook seemed quite different and we sighted the entrance to the bay about a half a mile eastward from where we lay. Our collections in and about Madeira Hammock added more plants to our flora. The same afternoon we started on the final portion of our homeward journey, and reached our destination late in the evening of the same day.

All the field-work described and accomplished, which made possible the many interesting discoveries, was due to the interest of Mr. Charles Deering.

The results of the exploration may be stated as follows: first, a number of plants, representing chiefly liverworts, mosses, ferns, and flowering plants, either new to science or new to the flora of the United States; second, additions to our list of plants growing naturally in the Everglades, a descriptive flora of which is contemplated; third, further information on the geographical distribution of the plants of southern, particularly tropical, Florida; fourth, much information on the physiography of south-

ern Florida which will be recorded in a subsequent paper; fifth the collection and preservation of the rarer native plants from localities that are rapidly changing or disappearing, for our herbarium, and for distribution to other herbaria, and the transplanting of living specimens to reservations, where they will be preserved from destruction.

Respectfully submitted,

JOHN K. SMALL.

HARDY WOODY PLANTS IN THE NEW YORK BOTANICAL GARDEN

(Continued)

Picea pungens. COLORADO SPRUCE.

Location: Pinetum, knoll northwest of Conservatory Range 1.

Natural distribution: Wyoming to New Mexico.

Picea pungens var: **glauca.** BLUE COLORADO SPRUCE.

Location: Pinetum, with the above; also at Fountain Enclosure.

West end of Long Bridge. Woodlawn Road Bridge.

Picea pungens var: **glauca pendula.** WEEPING COLORADO BLUE SPRUCE.

Location: Pinetum, near Fountain Enclosure.

Picea pungens var: **Kosteri.** KOSTER'S BLUE SPRUCE.

Location: Pinetum, knoll northwest of Conservatory Range 1;
also at Fountain Enclosure. Woodlawn Road Bridge.

Picea pungens var: **Kosteri compacta.** KOSTER'S DENSE-LEAVED SPRUCE.

Location: Pinetum, northwest of Conservatory Range 1.

Picea Schrenkiana. SCHRENK'S SPRUCE.

Location: Pinetum, along west border south of Station Plaza
near Hydrangea group.

Natural distribution: Siberia to northern China.

Picea Smithiana. SMITH'S SPRUCE.

Location: Pinetum, with the above.

Natural distribution: Himalayan Region.



Small, John Kunkel. 1917. "Botanical Exploration in Southern Florida in 1916." *Journal of the New York Botanical Garden* 18(209), 98–111.

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