AN ECOLOGICAL STUDY

of

THE KEY DEER

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Frontispiece. Key deer buck, 24 inches at the shoulder. Photo taken on Big Pine Key by Neil Bell and Al Schwartz, February 6, 1953.

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Key deer buck, 24 inches at the shoulder ..... Frontispiece

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INTRODUCTION

The information contained in this report was gathered by the writer as thesis material to be presented to the faculty of the Department of Botany, University of Miami, Coral Gables, Florida, as a partial fulfillment of the requirements for the degree Master of Science. The survey was a Pittman-Robertson project (W-34-R), financed by the Florida Game and Fresh Water Fish Commission and the U. S. Fish and Wildlife Service. The study covered the period from June 15, 1951, through September 1952. All of this was field work except for short trips to the University of Miami for library and laboratory use. The writer was stationed at Big Pine Key, Florida.

The objectives of the project were: (1) to determine the composition and size of the present key deer population and to gather information regarding its life history; (2) to determine the extent of the present key deer range, investigate the composition and ecology of the vegetation of the range, and determine the environmental requirements of the deer; and (3) to make such management recommendations as would be deemed necessary from the study for the preservation of these deer.

The botanical names of the plant species contained in this paper are, for the most part, those used by John K. Small (1933, 1938).

ACKNOWLEDGMENTS

The writer is deeply indebted to the following people and organizations for making this study a success: Dr. Taylor R. Alexander, Department of Botany, University of Miami, for his excellent supervision of the study and for his leadership in the organization of a deer drive which took place March 16, 1952; all the other members of the faculty in the Departments of Botany and Zoology, members of the Gifford Society and Beta Beta Beta Biological Fraternity, both of the University of Miami, and other students of the two Departments for their parts in the undertaking, as well as to those personnel of the Game Commission taking part; Dr. E. M. Miller, Department of Zoology for his guidance and for his making available to the writer key deer specimens through a loan from MCZ, Harvard College, Cambridge; Dr. H. F. Strohecker, entomologist and ecologist, Department of Zoology, for his advice and direction; Dr. Walter M. Buswell and Mr. Roy Woodbury of the University of Miami for their assistance in the identification of plant materials and use of the Buswell Herbarium; Dr. E. P. Killip for assistance in identification of plant species in the field; Mr. E. B. Chamberlain, Jr., Federal Aid Coordinator for the Game Commission for his direction and assistance; and other personnel of the Game and Fresh Water Fish Commission who may have furnished assistance in any way to the writer; Mr. Jack C. Watson, Refuge Manager, USFWS, in charge of protection of the key deer, who furnished useful information and assistance in many ways; other members of the USFWS who may have aided the writer in any way; Dr. Albert Schwartz who checked and compared deer measurements for the writer and furnished other useful information and advice; the Navy personnel who made possible the use of a Navy blimp for an attempted deer census from the air; and the old time hunters and residents of the Lower Keys who were very cooperative in furnishing much useful information regarding the deer.

HISTORY OF THE KEY DEER

The first mention of deer on the lower Florida Keys found in the literature by the writer is that by Fontaneda (1575) written in his *Memoir.* Fontaneda had been held captive by the Indians for 17 years. He had been made prisoner when he was 13 years old, and claimed he knew Florida better than any other man. Of the area and its animals he writes:

> . . . "On these islands are many deer, and a certain animal that looks like a fox, yet is not, but a different thing from it. It is fat and good to eat. On other islands are very large bears; and, as the islands run from west to east, and the land of Florida passes eastwardly towards these islands, that must be the reason of bears being on them; for the mainland is near, and they can cross from island to island. But what was a great wonder to the captives who were there, and to those of us in other places, was the existence of deer on the Islands of Cuchiyaga, the town of which I have spoken."

The second mention of deer on the lower Keys in recorded history found by the writer is that of Captain Bernard Romans (1775) who made a rather detailed study of Florida regarding its inhabitants and natural features. He found deer on Key Biscayo, Matacombe, Cayo Vacas, Pine Keys and Key West, but none on Key Largo.

On October 31, 1799, Major Andrew Ellicott (1803) of Pennsylvania who was commissioned by the government to survey the boundary between the American and Spanish possessions wrote in his journal:

> "Went on shore on Key Vaccas where our people in a short time killed four deer, of that small species, common to some of those islands. They are less than our ordinary breed of goats. (November 3) killed some more small deer and salted them up."

Commodore David Porter in a letter dated December 29, 1829 (as quoted by Browne, 1912) regarding Key West's advantages as a military post says:

> "The thick growth of wood with which the island is covered and which affords timber suitable for construction of small vessels, is filled with deer and other game and the seas abound in the finest fish in the world."

C. J. Maynard writing in 1872 regarding deer in Florida states "This animal is found in all sections, even on the keys."

DePourtales (1877) who was in the service of the United States Coast Survey engaged in sounding and dredging in the Gulf Stream mentions deer to "have wandered as far as Key West."

That deer used Key Vacas as late as 1927 is indicated by tracks found there in that year by Mr. W. A. Parrish of Marathon.

Barbour and Allen (1922) suggest that the early Spaniards may have introduced these deer into the keys. This is not likely since their presence here was a great wonder to Fontaneda.

Regarding deer on the upper keys (Long Key and northward) Barbour and Allen (1922) state: "at least within the memory of those now living, deer have never been found."

Although deer used to range on the Matecumbe Keys, Key Vacas and all the lower keys from Big Pine to and including Key West, today apparently the distribution is restricted to the Big Pine Key area.

HABITAT STUDIES

Geology

The lower (western) Florida Keys from East Bahia Honda Key to Key West are underlain by oolitic limestone, which is continuous with the Miami Oolite of the mainland (Cooke, 1939). The southeast point area of Big Pine Key, however, is composed of a coral formation which is continuous with the Key Largo Limestone which forms the outermost fringe of keys from Sands Key on the north to Loggerhead Key (south of Cudjoe Key) on the west (Cooke, 1945).

According to Cooke (1945) the Key Largo limestone began to develop as coral on the Floridian Plateau at the beginning of the Sangamon interglacial stage (Wicomico time) when the water was 100 feet above the present level of the sea. The sea level had dropped by Talbot time to 40 feet above the present level. The Key Largo limestone reef grew upward until it was within about 20 to 25 feet of the surface. At the same time the Miami oolite was accumulating in the shallow water behind the reef. The nearest land was in Highlands County, 150 miles to the north.

He says further that the reef was killed by the fall of the sea level during the Wisconsin glacial stage. It was again submerged briefly during the mid-Wisconsin recession (Pamlico Time) but soon emerged, however, and has remained above water except in the low passes between the keys.

The oolitic limestone of the lower keys is coated on top by a smooth thin hard laminated crust (Figures 2 and 12) which breaks up into large plates readily separating from the oolitic formation by the

activity of tree roots. This crust is apparently a hardened marl deposit similar to or the same as that formed today, possibly by blue-green algae found in the area. Crack lines which occurred before hardening took place show in many places on the crust; they are similar to the cracking of drying marl on the prairie flats of these keys.

Soils

The "soils" on the Keys in the key deer range may vary from a blue-grey marl (calcium carbonate) or coarse shell sand to a rich black peaty muck. Along the southeastern shores may be found dunes of shell sand, piled up by wave action. In low prairie areas the "soil" is

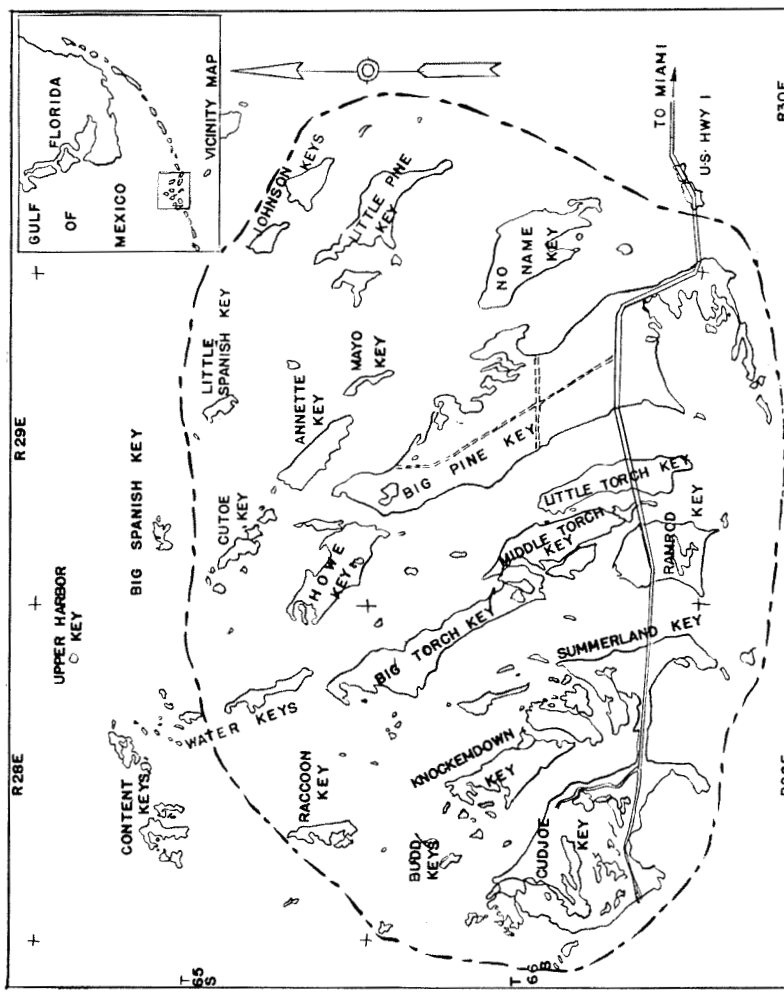


Figure 1. Range of Key Deer

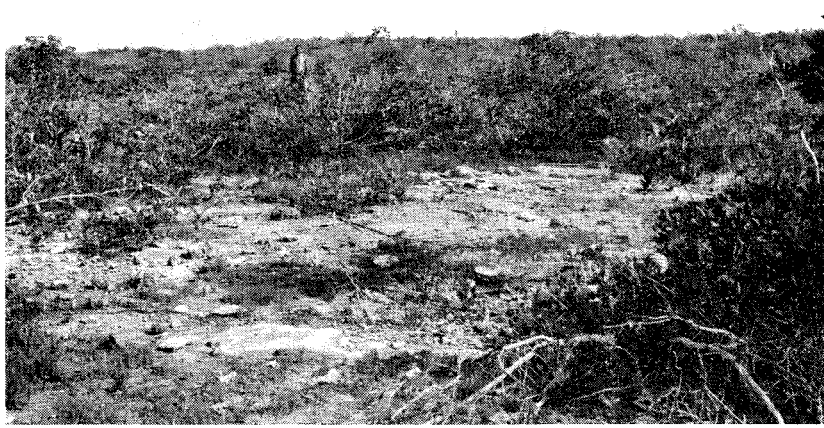


Figure 2. Scrub mangrove area on Big Pine Key showing bare exposed oolitic limestone with laminated crust in foreground.

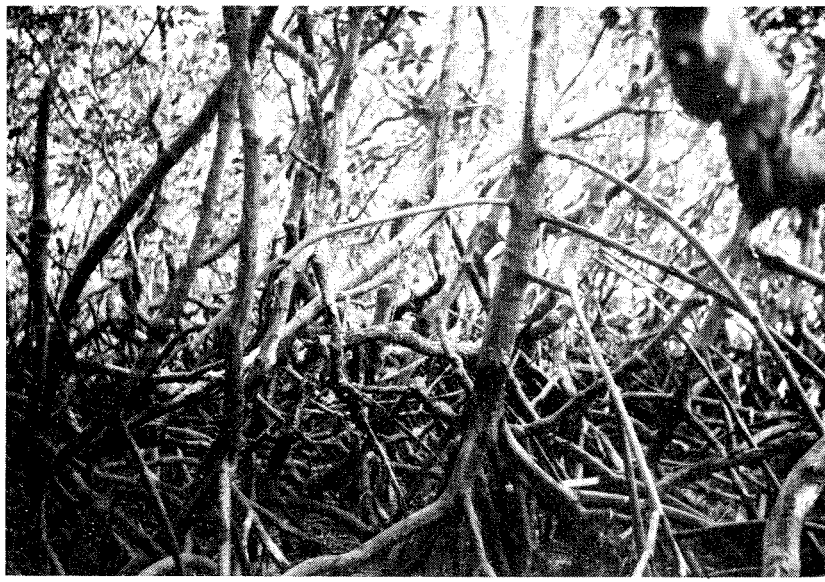


Figure 3. Red Mangrove *(Rhizophora mangle)* which forms the border of most of the keys. Note the thick mass of prop roots.

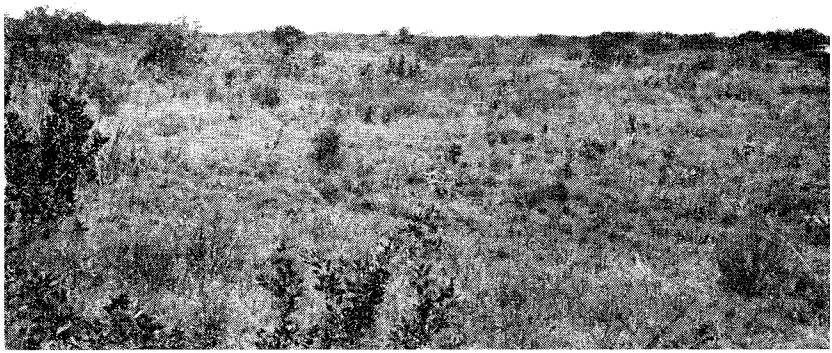


Figure 4. Grass prairie at northern end of Big Pine Key. Vegetation found here is listed in Table 33.

Figure 5. One of the many water holes in the pineland of Big Pine Key. This particular one is the one entitled "Waterhole southward of rock pit" in Table 2.

composed of blue-grey marl, sometimes with a reddish cast on the surface. There is only a thin layer of soil in the pinelands, made up to some extent by marl and eroded limestone. In certain of the potholes a reddish clay-like soil may be found which gives the appearance of the Rockdale series found on the mainland. In the hammocks* humus is found mixed with inorganic materials. Some of the buttonwood areas contain a rich black peat or peaty muck. The soil of the shell mound at Watson Hammock is also a rich black color, and contains a very high organic content.

Ten soil samples were obtained in the area and analyzed by the Department of Soils, Agricultural Experiment Stations, College of Agriculture, University of Florida. The pH and available minerals are shown in Table 1. All the soils were on the basic side. The pineland soils, marl prairie, and sand dune showed a pH above 8 and the hammock soils between 7.79 and 7.96, except for the buttonwood hammock which had a pH of 7.01. The latter contained a great deal of peat. The calcium content was high in all soils tested – even in the peat of the buttonwood hammock. This can probably be explained by the presence of oolitic limestone within a few inches of the surface of this material.

Water, Rainfall, and Temperature of the Area

Fairly fresh water (all of it originates as rainfall) is available on many of the higher keys in the key deer range throughout the year. Some of it contains very little salt. Such water in the solution holes and wells of these keys fluctuates a foot or so with the rise and fall of the tides; however, there is a delayed effect. There are many natural solution holes in the limestone containing this water and most of these are easily accessible to the deer. Figure 5 shows one of these waterholes on Big Pine Key. To obtain the salt content the water was titrated with silver nitrate 0.1N solution, using potassium chromate as an indicator. Table 2 shows salinity data monthly for 15 waterholes on some of these keys for the period July, 1951, through August, 1952. Some of these showed little fluctuation in salt content, others varied somewhat. Some had low salt content, others high. The pond on Little Torch Key fluctuated to an extreme extent in salinity caused by a concentration of the salt as the water evaporated. High tides and rainfall may also affect the salinity and at certain times salt water may

*In this paper hammock is the name applied to forested areas characterized by dense jungle-like growth of many species of broad-leaf trees and shrubs.

Table 1

SOIL ANALYSIS OF TEN SAMPLES OF SOIL TAKEN IN KEY DEER RANGE

(Analyzed by Department of Soils, Agricultural Experiment Station, College of Agriculture, University of Florida)

Type of Sample and Site	Organic Matter	Available				
		pH	Ca	Mg	P	NO_3
Pineland – Big Pine Key	Low	8.28	High	High	<1.0 ppm	Trace
Pineland – Cudjoe Key	Medium	8.28	High	High	<1.0 ppm	Trace
Shell Mound – Watson Hammock – Big Pine Key	Very High	7.79	High	High	<1.0 ppm	Medium
SE Pt. Hammock – Big Pine Key	Muck	7.93	High	High	<1.0 ppm	Medium
Hammock – Little Pine Key	High	7.96	High	High	<1.0 ppm	Low
Northern Prairie – Big Pine Key	Medium High	8.44	High	High	<1.0 ppm	Trace
Sand Dune – Big Pine Key	Very Low	8.71	High	High	<1.0 ppm	Trace
Marl – Big Pine Key	Fertilizer Material (organic)	8.11	High	High	<1.0 ppm	Medium
Buttonwood Hammock – Big Pine Key	Peat	7.01	Very High	High	<1.0 ppm	Low

TABLE 5.

AVERAGE TOTAL ANNUAL INCHES OF RAINFALL AND THE ANUAL MAXIMUM AND MINIMUM RECORDED FOR THE YEARS COVERED FOR TWO STATIONS, KEY WEST, FLORIDA, AND ONE STATION, LONG KEY

(From Observed Rainfall in Florida, Monthly Totals from Beginning of Records to December 31, 1947, State of Florida, Board of Conservation, Division of Water Survey and Research, Tallahassee, Florida, September 30, 1948, pp. 177-181, 204)

Station	Period Covered	Number Years Annual Precipitation Recorded	Average Rainfall	Maximum		Minimum	
				Year	Amount	Year	Amt.
Ft. Taylor, Key West	1833-1947	100	38.54	1870	69.69	1838	20.49
Key West Airport	1941-1947	6	40.39	1941	57.34	1944	28.99
Long Key	1916-1935	17	43.49	1922	64.92	1917	28.77

penetrate far inland in sloughs and marshy areas, covering with water land that is dry a good part of the year. The water in the hole on Howe Key in May reached a high of 40.75% sea water content, but in most of the other holes tested the salt content was much less.

The data shown in Table 2 are not necessarily taken from those holes containing the freshest water on the particular keys mentioned. During the field work of this survey, the writer was always able to find palatable water on the keys shown in Table 2. It might be mentioned that water containing up to 40% sea water was drunk by the crew of the Kon-Tiki (Heyerdahl, 1950) to alleviate their thirst. Since the deer have been living in this area a considerable time it is probable that the deer have adapted themselves, when necessary, to drink such brackish water.

The salinities of ten of the water holes are shown graphically in Figures 6 and 7. In these same figures the rainfall for the same period has been plotted. It can be seen that there is a definite correlation between the amount of rainfall and the salinity of the water holes. December, 1951, and January, 1952, showed the lowest amount of rainfall, however, March and May did not have much more. During periods of little rainfall, the salinity indicies rose, the extreme in salinity occurring in the well of Big Torch Key for March and May.

The total rainfall from February, 1951, through August, 1952, was 53.59 inches at Big Pine Key. This compares with 49.46 inches at Key West for the same period and with 39.66 inches (data for August, 1951, are missing) for Marathon, Florida, 16 miles to the eastward of Big Pine Key (table 4). The annual amount from February, 1951, through January, 1952 was 30.95 inches or from June, 1951 through May, 1952, 32.10 inches. Table 3 shows the rainfall at Big Pine Key by months for the above mentioned period, while average and extreme rainfall data at Fort Taylor, Key West, and the Key West Airport and Long Key are shown in Table 5. Key West is 30 miles westward from Big Pine Key, and Long Key 32 miles eastward.

Temperature may also play an important part in the amount of drinking water and soil moisture available. During high temperatures when there is little rainfall water is evaporated from the ground and water holes quickly. Salts in the waterholes may become highly concentrated. Table 6 shows the monthly mean maximum and minimum temperatures and the extremes for each month at Big Pine Key for the period February, 1951, through August, 1952. In Table 4 are the mean

TABLE 2.

SALINITY OF SOME WATER HOLES IN KEY DEER RANGE BY MONTHS, JULY, 1951 - AUGUST, 1952, SHOWING PER CENT OF TOTAL SALTS AND PER CENT OF SEA WATER

(Based on a sea water content of 3.5% Total Salts)

	July		August		September		October		November		December		January	
	Total Salt	Sea Water	Total Salt	Sea Water	Total Salt	Sea Water	Total Salt	Sea Water	Total Salt	Sea Water	Total Salt	Sea Water	Total Salt	Sea Water
Big Pine Key Water Hole No. 1	.242	6.93	.104	2.97	.194	5.55	.190	5.43	.128	3.68	.247	7.07	.564	16.13
Big Pine Key Water Hole No. 2	.024	0.70	.089	2.54	.016	0.46	.019	0.55	.013	0.38	Dry		Dry	
Big Pine Key Ferry Waterhole	.077	2.21	.029	0.84	0.52	1.52	.041	1.18	.041	1.18	.048	1.38	.078	2.26
Big Pine Key Rock Pit	.....	.....	.385	11.00	.402	11.48	.400	11.43	.316	9.05	.393	11.23	.399	11.40
Big Pine Key Typha Ditch	.....	.....	.076	2.18	.073	2.09	.051	1.47	.041	1.18	.051	1.47	.082	2.34
Big Pine Key South of Rock Pit	.....	.....	.082	2.34	.121	3.47	.082	2.34	.047	1.36	.063	1.81	.107	3.06
Big Pine Key Mariscus Hole	.....	.....	.146	4.18	.179	5.12	.263	7.52	.152	4.35	.190	5.43	.316	9.05
No Name Key Well	.119*	3.41*	.....	.....	.475*	13.58*	.....	.....	.....	.....	.....	.....	.253	7.24
Ramrod Key Typha Ditch	.051	1.47	.051	1.47	.....	.....	.063	1.81	.052	1.50	.063	1.81	.063	1.81
Ramrod Key Pond Back of Mary's	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.380	10.86
Little Pine Key Well	.295	8.44	.268	7.67	.127	3.65	.....	.....	.134	3.85	.266	7.61	.481	13.75
Little Torch Key Pond	.....	.....	.649	18.56	.760	21.73	.855	24.45	.860	24.59	1.261	36.00	1.876	53.61
Cudjoe Key Thompson Road	.....	.....	.....	.....	.....	.....	.114	3.27	.145	4.18	.221	6.33	.235	6.73
Big Torch Key Well	.....	.....	.....	.....	.042	1.21	.054	1.55	.....	.....	.051	1.47	.082	2.34
Howe Key Pond	.....	.....	.....	.....	.....	.....	.....	.....	.183	5.25	.209	5.98	.801	22.89

* Not same waterholes tested.

TABLE 2 (Continued)

SALINITY OF SOME WATER HOLES IN KEY DEER RANGE BY MONTHS, JULY, 1951 - AUGUST, 1952, SHOWING PER CENT OF TOTAL SALTS AND PERCENT OF SEA WATER

(Based on a sea water content of 3.5% Total Salts)

	February		March		April		May		June		July		August	
	Total Salt	Sea Water	Total Salt	Sea Water	Total Salt	Sea Water	Total Salt	Sea Water	Total Salt	Sea Water	Total Salt	Sea Water	Total Salt	Sea Water
Big Pine Key Water Hole No. 1	.336	9.62	.596	17.03	.672	19.21	.665	19.01	.488	13.94	.063	1.81	.057	1.64
Big Pine Key Water Hole No. 2	.031	0.90	Dry		Dry		Dry		.048	1.38	.019	0.55	.016	0.46
Big Pine Key Ferry Waterhole	.076	2.18	.070	2.01	.076	2.18	.076	2.18	.070	2.01	.041	1.18	.048	1.38
Big Pine Key Rock Pit	.389	11.12	.368	10.52	.393	11.23	.399	11.40	.425	12.15	4.06	11.60	.368	10.52
Big Pine Key Typha Ditch	.057	1.64	.070	2.01	.082	2.34	.079	2.26	.079	2.26	.070	2.01	.063	1.81
Big Pine Key South of Rock Pit	.092	2.63	.108	3.09	.139	3.99	.114	3.27	.133	3.82	.054	1.55	.070	2.01
Big Pine Key Mariscus Hole	.235	6.73	.345	9.87	.348	9.96	.685	19.58	.427	12.20	.114	3.27	.057	1.64
No Name Key Well	.228	6.53	.171	4.89	.361	10.33	.368	10.52	.361	10.33	.190	5.43	.120	3.44
Ramrod Key Typha Ditch	.057	1.64	.063	1.81	.076	2.18	.095	2.71	.095	2.71	.076	2.18	.055	1.58
Ramrod Key Pond Back of Mary's	.202	5.78	.365	10.44	Dry		.576	16.46	.443	12.67	.526	15.03	.063	1.81
Little Pine Key Well	.646	18.48	.285	8.15	.723	20.65	.633	18.11	.691	19.75	.070	2.01	.089	2.54
Little Torch Key Pond	1.267	36.22	2.345	67.01	4.437	126.8	5.819	166.2	2.377	68.30	1.674	47.84	1.014	28.98
Cudjoe Key Thompson Road	.180	5.15	.216	6.18	.221	6.33	.244	6.98	.396	11.32	.203	5.81	.216	6.18
Big Torch Key Well	.089	2.54	1.172	33.49	.279	7.98	1.204	34.41	.330	9.45	.114	3.27	.044	1.27
Howe Key Pond	.646	18.48	1.040	29.40	1.007	28.78	1.426	40.75	1.179	33.70	.079	2.26	.166	4.75

TABLE 3.

INCHES OF RAINFALL BY MONTHS AT BIG PINE KEY FOR THE PERIOD FEBRUARY, 1951, THROUGH AUGUST, 1952

(Data obtained from original notes, U. S. Weather Station, Big Pine Key, Florida)

Month	Rainfall	Month	Rainfall	Month	Rainfall
February, 1951	2.33	September, 1951	3.16	March, 1952	0.97
March	1.25	October	4.74	April	2.75
April	3.10	November	2.16	May	1.36
May	0.46	December	0.38	June	3.41
June	2.58	January, 1952	0.35	July	7.95
July	6.83	February	3.21	August	2.99
August	3.61				

TABLE 4.

MEAN MAXIMUM AND MINIMUM MONTHLY TEMPERATURES AND MONTHLY RAINFALL IN INCHES AT KEY WEST AIRPORT AND MARATHON, FLORIDA, FOR PERIOD FEBRUARY, 1951, THROUGH AUGUST, 1952

(Data from U. S. Department of Commerce, Climatological Data – Florida, Vol. XXXVII No. 13 to Vol. XXXIX No. 8, February, 1951 - August, 1952)

Month	KEY WEST AIRPORT			MARATHON		
	Rainfall	Temperature		Rainfall	Temperature	
		Mean Max.	Mean Min.		Mean Max.	Mean Min.
February, 1951	0.97	73.1	61.6	1.75	74.6	60.1
March	0.27	78.9	67.9	0.98	79.6	65.7
April	2.43	81.2	69.4	2.91	82.5	68.2
May	0.42	85.4	72.8	0.40	86.3	70.6
June	3.09	90.0	76.7	0.69	91.1	74.5
July	6.34	90.5	76.7	3.28	91.1	74.8
August	4.04	91.3	78.5	-----	-----	-----
September	1.70	90.3	79.0	2.05	91.9	75.3
October	4.02	84.4	74.5	5.14	86.1	71.4
November	2.84	78.2	67.8	1.49	79.4	64.7
December	1.59	79.3	69.1	0.26	80.3	65.9
January, 1952	0.53	77.0	65.9	0.46	78.4	62.7
February	2.62	76.3	64.0	2.95	76.6	59.8
March	0.69	81.4	70.6	1.26	82.4	69.3
April	2.06	79.6	68.8	1.84	81.3	68.1
May	0.34	85.5	75.5	0.64	86.5	73.0
June	3.38	89.7	77.6	2.92	90.3	75.0
July	6.93	89.4	77.5	8.67	90.5	74.1
August	5.20	91.7	77.9	1.97	92.9	75.5
Total	49.46			39.66		

maximum and minimum temperatures for the Key West Airport and Marathon for the same period. Table 7 shows the mean maximum and minimum monthly temperatures for the period 1910-1926 for Key West, Florida.

Key Deer Range

The range of the key deer at present is essentially that shown in Figure 1. Sugarloaf Key in addition may be used to slight extent. Although certain keys may be separated by a mile of water, still they are used by the deer. The writer was never fortunate enough to observe any deer making such a crossing, however, he did talk to some of the old time residents of the area who could remember times when deer were harpooned while swimming from island to island.

The islands in the range are usually entirely surrounded by a thick growth of *Rhizophora mangle* (red mangrove) which begins its growth in shallow water (Figure 3). This species yields to some extent to *Avicennia* (black mangrove) at about mean tide level. These two grade into *Laguncularia racemosa* and *Conocarpus erecta* at about the high tide level. Sometimes the thick growth of mangroves is only a narrow strip, other times it may be rather extensive – even covering whole islands – depending, of course, on the elevation. It may grade into an open scrub mangrove type of bare oolitic rock (Figure 2) or oolitic rock covered with a few inches of blue-grey marl and overgrown by short grasses such as *Monanthochloe littoralis* or *Sporobolis virginicus* or the glassworts, *Salicornia* (Figure 8). On some of the keys rather extensive marl prairies exist. A few of the keys have small sand dunes piled up by wave action – these may be mostly open as that along the southeast point and Long Beach area of Big Pine Key (Figure 9) or hidden under and within a dense growth of mangrove fringe.

The above vegetational types grade either into broad-leaf hammock species or pineland. Rather extensive pineland may be found on Big Pine, Little Pine, No Name, Cudjoe, and Sugarloaf Keys.

During the course of this study deer tracks or droppings were noted by the writer on the following keys only:

Big Pine Key	Johnson Keys
Little Pine Key	Water Key (off Little Pine)
Big Torch Key	Howe Key
Middle Torch Key	Cudjoe Key
Little Torch Key	Annette Key
Ramrod Key	

TABLE 6.

MONTHLY MEAN MAXIMUM AND MINIMUM TEMPERATURES AND MAXIMUM AND MINIMUM TEMPERATURES RECORDED FOR THE MONTH AT BIG PINE KEY FOR PERIOD FEBRUARY, 1951, THROUGH AUGUST, 1952

(Data from original notes, U. S. Weather Station at Big Pine Key)

Month	Mean Maximum	Mean Minimum	Maximum Recorded for Month	Minimum Recorded for Month
February, 1951	76.2	60.7	84	42
March	81.5	65.3	85	54
April	83.1	69.2	87	55
May	87.2	69.8	91	62
June	91.3	74.3	94	68
July	91.1	76.0	94	70
August	92.8	77.7	95	73
September	92.0	77.3	95	72
October	86.5	73.1	91	67
November	81.0	66.8	89	54
December	82.1	68.1	87	51
January, 1952	80.5	64.5	86	54
February	78.7	61.4	85	50
March	84.5	68.6	89	53
April	82.9	67.5	88	59
May	87.5	72.8	91	65
June	90.8	76.2	94	72
July	90.0	75.8	93	71
August	92.5	76.2	95	72

TABLE 7.

MEAN MAXIMUM AND MEAN MINIMUM TEMPERATURE DATA FOR KEY WEST, FLORIDA, BASED ON YEARS 1910-1926

(From A. J. Mitchell and M. R. Ensign, The Climate of Florida, Bulletin No 200, University of Florida, Agricultural Experiment Station, Gainesville, November, 1928, p. 145)

Month	Mean Maximum	Mean Minimum
January	75.4	65.7
February	75.5	65.2
March	78.1	67.9
April	81.4	71.1
May	84.0	73.7
June	86.8	76.8
July	88.3	77.9
August	88.7	78.0
September	87.4	77.1
October	84.2	74.8
November	78.4	69.6
December	76.0	66.7

Reports were heard from time to time that deer had been seen or sign noted on Sugarloaf, Cudjoe, and Summerland Keys. The writer searched for sign on these keys but found only an old bunch of droppings in the pineland of Cudjoe Key.

A general description of the individual keys in the key deer range and their use by the deer is given later in the report.

Composition of Vegetation

Procedure. To study the vegetation of the area and be able to compare that found on the different keys, quadrats were established

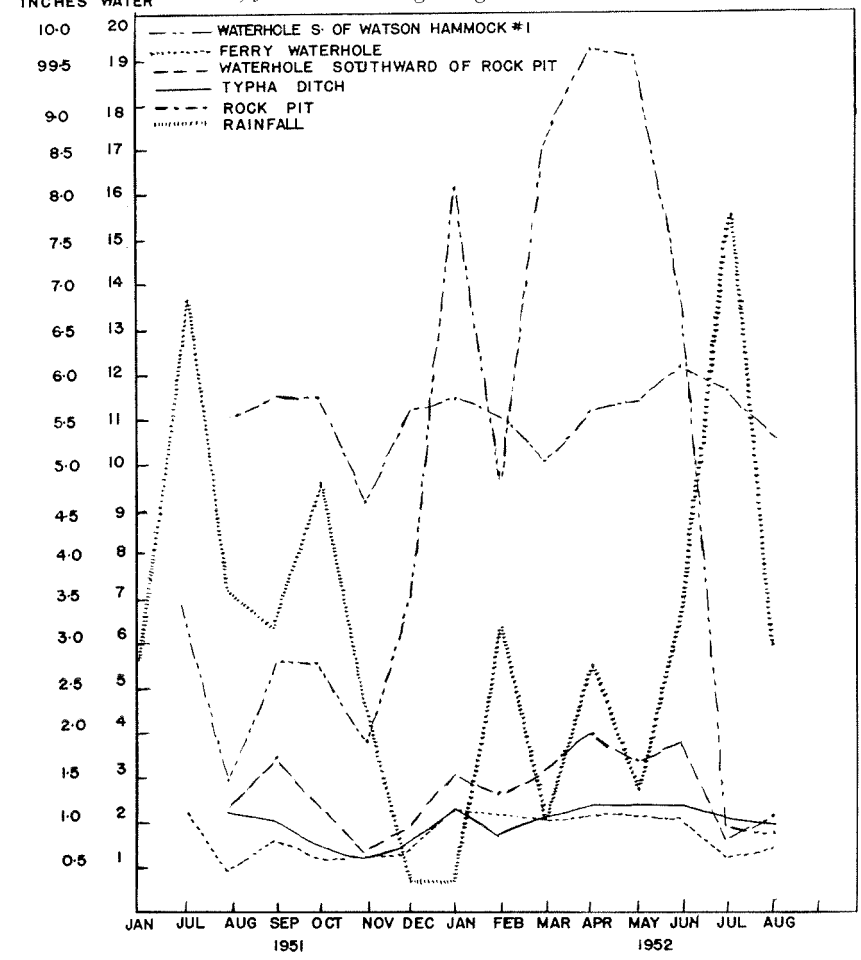
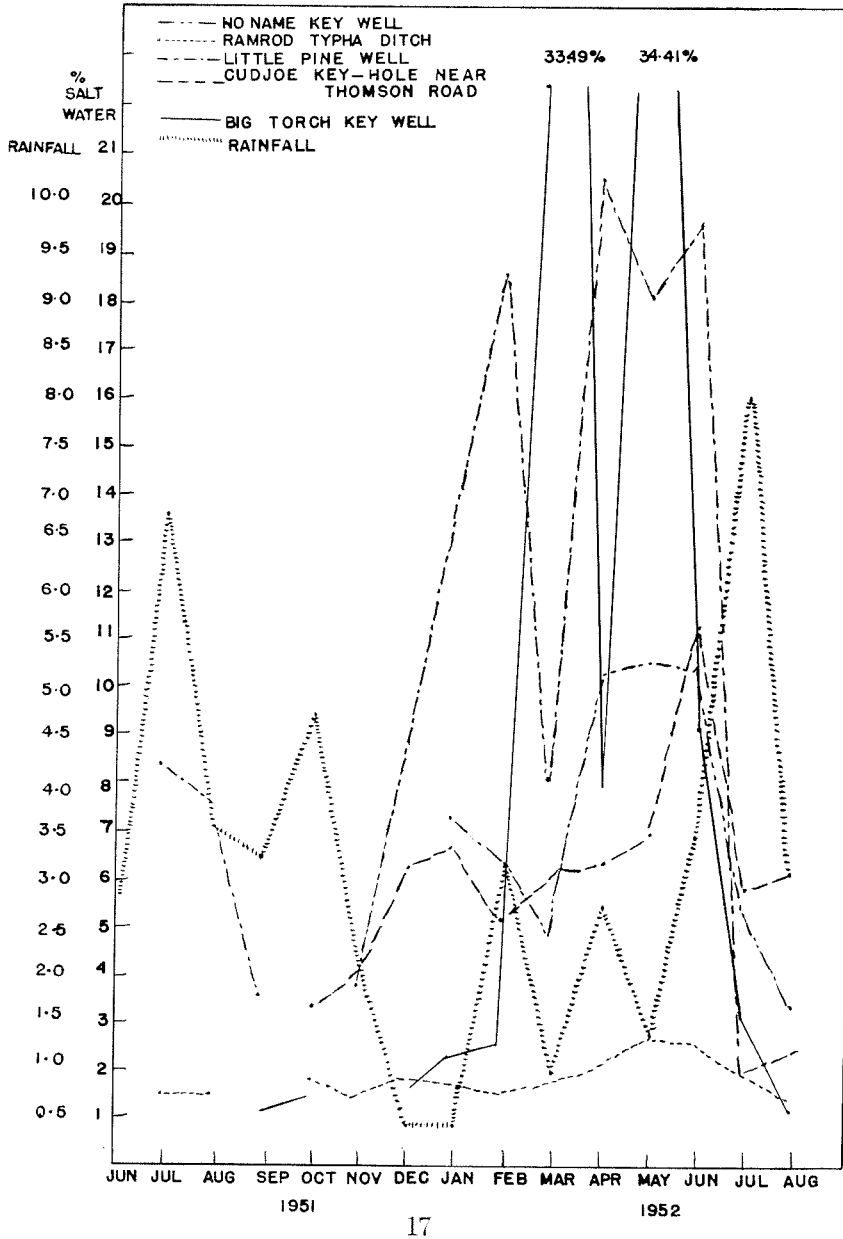


Figure 6. Rainfall for Big Pine Key area and salinity of five water holes, June 1951 through August 1952.

and the plant species counted. These counts for the tree and shrub species were converted to numbers per acre for comparative purposes. For the study of the tree and shrub species of the pineland habitat,

Figure 7. Rainfall for Big Pine Key area and salinity of water holes on five keys, June 1951 through August 1952.



ten 3 x 100 feet quadrats were made in each of the four pineland stands* studied. This number was more than enough for a sufficient sample – thus they give a good show of frequency of the species and cover the entire stand of each key effectively. There were a number of reasons for selecting a long rectangular quadrat instead of some other type: (1) it has been shown that a rectangular plot is more efficient in sampling than a square one (Oosting, 1948); (2) it proved to be the most efficient for one person counting the species; and (3) it aided in many instances in making the site of the quadrat more randomized. For example, on Little Pine Key no matter where the first stake of the quadrat was set the vegetation was so thick that only the first few feet could have been selective at the most. The quadrats were spaced more or less by selection because, except for Big Pine Key, the spacing by a compass course or mark on a chart to be measured off would have been most difficult and time-consuming and would not have been worth the effort. These ten quadrats in each stand were spread over the whole stand. After picking the vicinity the writer would then take about 100 paces in a particular direction before setting the stake, thus making the sample somewhat more randomized. For understory species (mostly herbaceous) three one-yard square quadrats placed within the larger 3 x 100 feet quadrat were used. These were taken at the beginning, middle, and end of the larger quadrat thus making a total of 30 quadrats for each stand. No pineland quadrats were run into the sinks which consisted of a different type of community**: *Conocarpus* and *Mariscus* or *Serenoa* and *Mariscus*. All tree and shrub seedlings were included in the tree and shrub lists and are listed according to four size classes for height: under 1′, over 1′ to 4′, over 4′ to 12′, and over 12′ to 55′. The height of each plant was estimated. The canopy was noted as to diameter of cover it afforded. In computing the data for cover classes in the tables from the field notes the figure is squared to give the approximate square feet of cover. Any diameter more than three feet is multiplied only by three since this is the width of the quadrat. From this the total per cent of cover furnished by a species could be determined by dividing the total canopy by the total square feet in the ten quadrats. Plants which sucker at the base were counted as separate plants if they did this below the ground. Among such plants are: *Eugenia axillaris, E. buxifolia, Mosiera longipes, Guettarda scabra, Metopium*

*Stand, in this paper, applies to that particular association of species in a certain area of the entire community: e.g., the pineland of each key is considered a separate stand; the total of all stands make up the pineland community.

**Community, in this paper, applies to those species associated together with one to several dominant plants (e.g., pineland community – dominated by pines and several palms).

toxiferum, Pisonia rotundata, Pithecolobium guadalupense, Randia aculeata, Rapanea guayanensis, and *Torrubia longifolia.*

About the same procedure was followed in running the hammock quadrats except that in this case the minimum number of quadrats (when an additional quadrat increased the number of species no more than 10 per cent) was run and the quadrats were reduced to 3 x 50 feet. A total of 35 such tree and shrub quadrats was made on the major keys in the key deer range. These data have been combined in Tables 23 and 24 to show species and information about the hammock community for the entire area. Two 3 x 3 feet understory quadrats were made within the large quadrat – one at the end where the first stake was set, the other at the opposite end. In addition to the above, quadrats were also made in hammock on Annette Key and the southeast point of Big Pine Key.

Ten 3 x 10 feet quadrats were run on an open prairie area at the north end of Big Pine Key. These were placed along a trail every 50 or 100 paces and seven paces from the trail.

A line transect (counting anything that had a canopy over the line) and three 3 x 100 feet quadrats were used to study the transition from mangrove to pineland or hammock.

Other vegetational types such as the open scrub mangrove prairie and beach sand dune have been described from general observation.

In addition a plant check list was maintained for many of the keys in the area (Appendix I lists the species for 15 of the keys). A general description of the individual keys is also given. The U. S. Coast and Geodetic Survey charts #T5544 and T5545, (supplemented to April 4 and 9, 1938, respectively) were used extensively in these studies and they show the vegetational types rather well for each of the keys.

Herbarium specimens of all plants in the list except palms and cacti are deposited in the Buswell Herbarium, University of Miami. A seed collection was also maintained and is deposited in the Buswell Herbarium.

To check growth recovery in the pineland on Big Pine Key after fire four 3 x 50 feet quadrats were set up in a burn which occurred May 4, 1952 east of the Big Pine Inn. The data were taken following principally the same procedure that was used in the pineland and hammock habitats. Counts were begun May 26 and were made monthly for four months after the fire.

The center of this burn was about N. Lat. 24° 40′ 5″, W. Long. 81° 21′ 0″. The east and west edges were about 1250 feet from the center and the north and south edges 415 feet.

General Description of Some Keys in the Key Deer Range and Their Use By the Deer

Big Pine Key. Big Pine Key is about two miles wide at the widest point and 8.3 miles long and contains about 6000* acres. It is one of the highest and largest keys in the area, and contains the greatest number of plant species (check list in Appendix I). Open pineland (Figure 10) forms about 38 per cent of the key. The oolitic limestone with laminated crust is exposed throughout. On the east side of the northern end of the key is an open grass prairie about a half mile long and a sixth of a mile wide. A little farther north it grades into hammock. A rather large shallow salt water lake here is surrounded on the west and northern sides by red mangrove. Along the shore lines are mangrove and buttonwood strips. In places the buttonwood strips encroach upon the pineland and cross through. Rather extensive hammocks can be found on the southwest point, north of the pineland near the northern end of the key, north of the county road on the east side (main part of key), Doctor's Arm, Watson Hammock and the south-

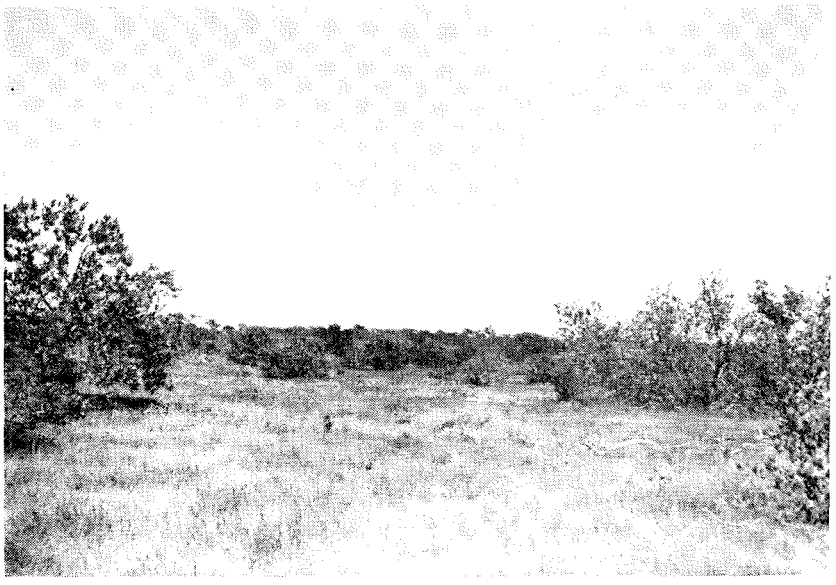


Figure 8. Marl prairie on Little Pine Key showing scattered trees of *Avicennia nitida.* **Ground cover dominated by** *Salicornia ambigua* **and** *Monanthochloe litteralis.*

*This figure and those for acreage on the other keys (except Cutoe) are for the most part approximate and have been figured from acreage in the Township plats of nine townships in the key deer range as surveyed by U. S. Coast Survey Office, March 19, 1858, and December 1870. That of Cutoe Key has been figured from Topographical Chart T 5544.

east point. Along the shore of the southeast peninsula is a beach dune covered with dune vegetation (Figure 9).

Fresh water can be found in many places throughout the pineland and buttonwood hammock areas. U. S. Highway 1 crosses the key near the southern end. A state road runs northward from U. S. 1, dividing the key most of the way in a north-south direction.

This key was used most extensively by the deer and tracks and signs were always to be found. Even the cactus area of the southeast point was used to some extent. Hunters claim that if the deer ever led the dogs into this area the dogs were no more good for hunting.

Little Pine Key. Little Pine Key is separated from the main deer range by Big Spanish Channel for a distance of more than a mile. It is approximately three miles long and one mile wide at the greatest distance and contains 600 acres. Nineteen per cent of the land is pineland. This pineland is very thick and rapidly changing to a hammock formation (Figure 11). At the southern and southwestern part of this key there are grass marl prairies (Figure 8). Hammock growth surrounds nearly all the pineland. The shores are lined with mangroves. A few deer tracks were found on this key at all times during the study. Fresh water is available.

Although searched for a number of times certain plant species were never found on this key even though they were numerous and conspicuous on adjacent keys. These plants are noted in Appendix I.

Water Key (off Little Pine Key). This key is approximately .8 mile long and .6 mile wide and contains about 100 acres. There is a thick hammock growth at the southern end. The rest of the key is made up of an open mangrove-prairie area and thick mangroves surround the key along the shores. Deer tracks were noted here by the writer a number of times during the course of the study. Fresh water is available at least part of the year.

Johnson Keys (Northern). The northern key is about .8 mile long and .4 mile wide. It contains about 105 acres. Within the mangroves that line the shore is a somewhat open marl prairie of scattered *Conocarpus erecta* and *Laguncularia racemosa* which covers a good portion of the key. A fair-sized hammock and thicker scrub buttonwood areas make up the balance of the island. Tracks of several deer were found here in January and April, 1952. No fresh water was found here by the writer.

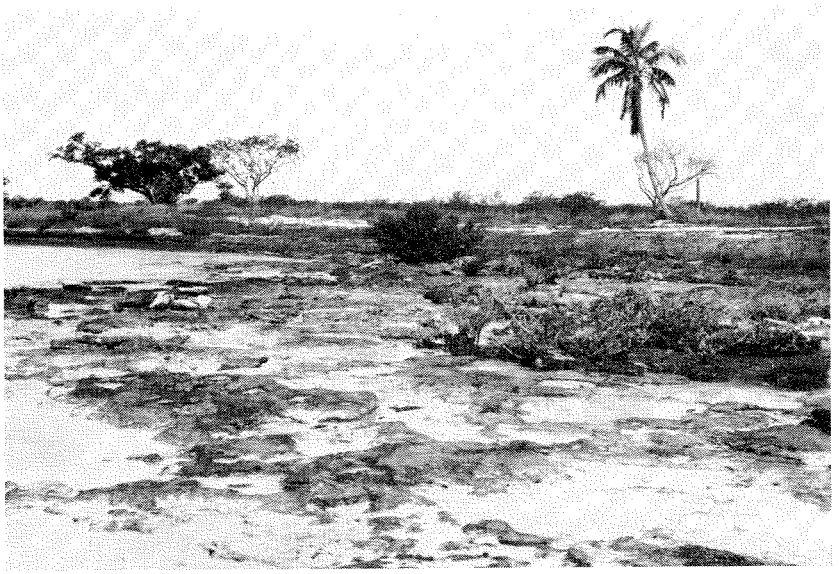


Figure 9. Sand dune at the Southeast Point of Big Pine Key. Note the Key Largo (coral) limestone in the foreground.

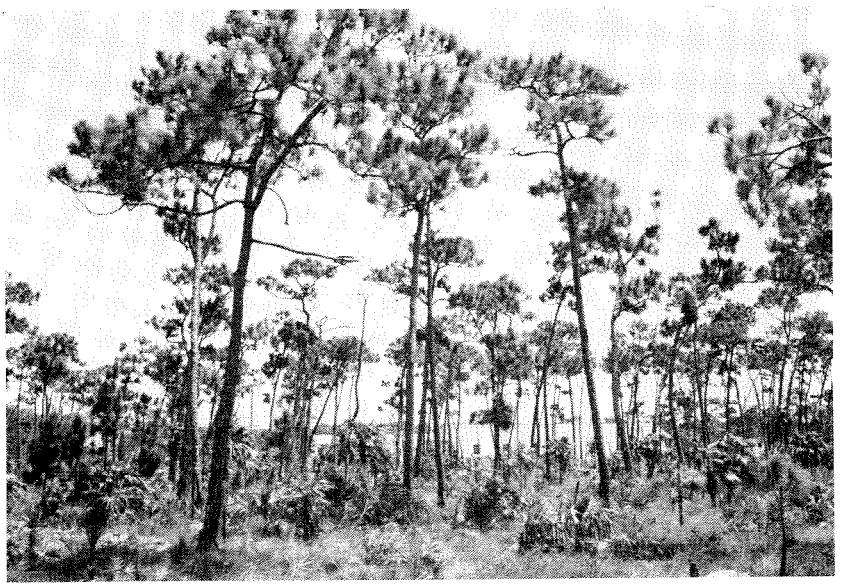


Figure 10. Pineland of Big Pine Key. Note the openness of the vegetation as compared to the pinelands of the other keys. The prison camp buildings can be seen in the background.

Johnson Keys (Middle). The Middle key is about twice as large as the northern one (about 200 acres). It is made up of a hammock along the center which is surrounded by open mangrove-marl prairie. Mangroves border the shore. Tracks of several deer were found here in January and April, 1952. No fresh water was found.

Big Spanish Key. This is a small irregular key comprising about 73 acres. It is made up of a dense growth of red mangrove with a few black mangrove scattered about. No deer sign was noted, nor was fresh water to be found.

Little Spanish Key. This is another small key which comprises about 39 acres and is made up mainly of mangrove in a dense mass. A portion of the key is more open and here it is comparatively easy to walk. There is a sandy shore dune up under the mangroves where a few other species of plants occur. The following species were noted: *Avicennia, Batis, Chloris petraea, Cyperus brunneus, Hymenocallis, Rhizophora,* and *Sesuvium portulacastrum.* No deer sign or fresh water were found.

Cutoe Key. Cutoe Key, made up of several islands and a shoal area between, is about a half mile wide and extends for more than a mile and a half. The islands comprise a total of about 175 acres. These islands are made up almost entirely of dense mangrove and scattered mangrove-marl prairie types. Only a few species were found growing here:

Ageratum littorale
Aster braceii
Avicennia nitida
Batis maritima
Borrichia frutescens
Conocarpus erecta
Laguncularia racemosa
Lycium carolinianum
Maytenus phyllanthoides
Monanthochloe littoralis
Philoxerous vermicularis
Salicornia ambigua
Sesuvium portulacastrum
Sporobolis virginicus
Rhizophora mangle

No deer sign or fresh water were found.

Annette Key. Annette Key contains about 390 acres and is approximately 1.7 miles long and .5 mile wide. It has an extensive grass prairie along the western shore within a narrow strip of mangrove. There are two rather small hammock areas toward the southern end of the key. The rest of the key is made up of a dense growth of mangrove. This key appears to be used rather sparingly by the deer. No fresh water is available.

Mayo Key. This key is about a mile long and about .1 mile wide and comprises some 65 acres. Mangroves border the shore. For the

most part the island is made up of an open mangrove prairie containing the four mangroves and *Monanthochloe, Salicornia ambigua,* and *Sporobolis virginicus.* There are a few hammock trees but no hammock. Walking is easy throughout the island. No deer sign was noted here by the writer and no fresh water is available.

Porpoise Key. Porpoise Key of about 20 acres is about .3 mile long and .1 mile wide. There is a thick growth of mangrove on the western side and a small hammock at the western point. A rather large marsh prairie makes up a good portion of the key, which has a sand dune along the northern shore. Only a few species of plants were found growing here, and no deer sign was noted by the writer. There is no fresh water available.

Howe Key. Howe Key contains 930 acres and is about 2 miles long and .7 mile wide. At the southeastern end is a large mature hammock with a few pines scattered in the more open areas. Another hammock area extends through the center of the key a little farther north. The two hammocks are separated by a marshy buttonwood-mangrove area. Mangroves border the shore lines. A few tracks were always found on this key. Water is available.

Water Key (North of Big Torch Key). This key contains 216 acres and is approximately 1.7 miles long and .2 mile wide. There is an extensive marl prairie dominated by *Sporobolis virginicus* and *Monanthochloe littoralis* with only a very few other plants growing there. The prairie is bordered along some of the shore by large mangroves. At a small spot near the southern tip there is a bed of *Opuntias* and *Acanthocereus floridanus.* Quite a number of *Thrinax parviflora* are scattered along the prairie. No fresh water is available and no deer sign were found here.

Big Torch Key. Big Torch Key, which is about 4.5 miles long and 1 mile wide at widest point, comprises some 1400 acres. Hammock growth extends throughout most of the key with many buttonwood or mangrove encroachments. Near the southern end of the west side is a large grass prairie made up to a large extent of *Panicum virgatum.* Deer used this prairie as well as the area surrounding it. There were also plenty of deer sign at the northern end of the key and at the crossing to Middle Torch Key tracks were always to be found. Fresh water is available. The remains of a few pine trees have been found near the western shore of this key.

Middle Torch Key. This key is approximately 3.4 miles long and .6 mile wide and comprises about 1,000 acres. Hammock growth covers

most of the interior and mangroves form the vegetation along the shore line within which is a buttonwood strip. Deer sign were always found on this key along the buttonwood strips and to some extent in the open areas of the hammocks. At the northern end of the key is a small area containing a few pines.

Little Torch Key. Little Torch Key, approximately 3 miles long and .5 mile wide, comprises 770 acres and is made up mostly of hammock growth and open prairie areas. Near the northern tip a few pines can be found. The only deer sign noted by the writer was near the crossing to Middle Torch Key and along the hammock at the northern end.

Ramrod Key. This key, about 1.6 miles long and 1.1 miles wide, contains some 900 acres and is composed of hammock growth over a large part of the key. Some of the area is in a thick stand of *Pteris caudata* where land has previously been cultivated. In the southern part there is a large shallow salt-water lake surrounded for the most part by open mangrove. Most of the deer activity was found north of the highway in the hammock, *Pteris* area, and along a buttonwood slough. Mangroves surround most of the key. A few young pines are to be found on this key. Plenty of good fresh water is available.

No Name Key. No Name Key, approximately 2.8 miles long and 1.1 miles wide, containing 1,000 acres, is made up of about 16% pineland around which there is quite an amount of hammock growth. Large areas, previously cultivated, are grown up in *Pteris caudata.* There are some open mangrove-prairie areas to the north and to the south. Mangroves border the shore. There was plenty of deer sign on this key at all times. Water is available.

Toptree Hammock Key. This is a long narrow key, approximately 1.4 miles long and .3 mile wide at the widest point. It contains about 140 acres. A narrow hammock runs along the center of the key. Otherwise it is mostly prairie type with mangroves along the shore. No tracks or sign were noted here by the writer. No fresh water is available.

Cudjoe Key. Cudjoe Key, about 5 miles long and 2.5 miles wide, contains about 3,300 acres of which 7 per cent is pineland. There is hammock growth extending westward, northward, and eastward of this pineland. Many bays and shallow lakes cut into this key. Around these lakes are found scrub mangrove and buttonwood areas. Southward of the lakes is more hammock. Although many deer are supposed to have roamed this key at one time, there was little evidence that it was being used to any extent during the time of this study. Fresh water is available.

Knock'emdown Keys. These keys to the eastward of Cudjoe Key are fairly large keys comprising about 1,100 acres. They were formerly used to some extent by the deer. They contain good hammock growth and mangrove areas and a few pines. Although they were searched diligently in December, 1951, and June, 1952, the writer was unable to find any trace of deer. The writer found no fresh water.

Summerland Key. Summerland Key, about 3 miles long and about .6 mile wide, contains about 1,100 acres. A good portion of the key is made up of hammock growth. At the northern end it grades into open buttonwood areas and marl-prairie types. There has been little if any deer activity on this key during the past year. Fresh water was reported to be present.

In August 1952 while searching for deer tracks on this key the writer stumbled upon what appeared to be a burying or dumping ground. In the excavated marl and mangrove peat which had dried out, hardened, and cracked were found the bones of several animals. Three lower jawbones of deer were found, as well as two teeth and parts of several others and parts of antlers. The jawbones were in fair condition. The antlers, which appeared very old, broke very easily. Bones of raccoons, snakes, crocodiles, birds, turtles (carapaces), and the shells of many conchs were also found.

Sugarloaf Key. Sugarloaf Key is a large, very irregular mass of land broken up by many bodies of water. Along the eastward side, the arm of land extending northwestward is made up of a large hammock area and some pineland. Southward there is more hammock and some mangrove areas. Mangroves surround the key. Although deer are known to have roamed this key extensively in the past the writer was unable to find any trace. However, reports of deer having been here were heard occasionally during the course of the investigation. Fresh water is available.

New Found Harbor Keys. The largest island of the New Found Harbor Keys is approximately 1.1 miles long and .4 mile wide at the widest point and comprises about 90 acres. Along the ocean side is a sandy beach and rather high dune. At the eastern tip there is a mangrove area. The vegetation of this key is not as thick as that of the typical hammocks but it would afford good cover for deer. No sign was found here by the writer. Mr. Henry Watkins of Key West told the writer that deer once used these keys for months at a time even though no water is available.

The small key east of the above mentioned one is a sandy key of about 9 acres. The undergrowth had been mostly cleared and the key had been homesteaded but the houses are now in ruin. Heavy clearing and dredging machinery has been used here recently. No deer sign was found.

Spanish Harbor Keys (West Summerland Key). Formerly three small islands comprising about 75 acres made up this group. Today the channels between have been filled in so that the land composes one island. The key is rather narrow and consists for the most part of open prairie with scattered large trees of *Cocos nucifera, Elaphrium simaruba, Ichthyomethia piscipula* and *Avicennia nitida* over the higher sand dune. There is a very small hammock made up of a thick growth of plants, generally not over six to ten feet high. On the northern shore the mangroves are rather thick and mostly in a narrow strip. No deer sign was found nor was fresh water available.

Comparison of Vegetation

1. **The Pineland Community.** The four pineland stands studied and compared occurred on Big Pine, Little Pine, No Name, and Cudjoe Keys. The amount of pineland on these keys varies to some extent. Big Pine Key contains the most: 38 per cent of the key is pineland. The others vary from six to 19 per cent. These are approximate figures and are based on the U. S. Coast and Geodetic Survey Topographical Charts No. T-5544 and T-5545. Table 8 shows the per cent of pineland for each key and the percent of pineland in comparison with that of Big Pine Key.

Tables 9, 10, 11 and 12 show the density per acre of tree and shrub species in the pineland of the four keys and the per cent of cover. Table 13 shows the frequency per cent for each of the tree and shrub species in the individual ten quadrats of each stand. Table 14 lists the pineland understory (mostly herbaceous) species giving the frequency, density, and cover for each in the four stands. From the data presented in these tables it can be seen that there is a definite difference among the four stands.

The pineland of Big Pine is an open woods (See Figure 10). There is little or no soil. This condition has come about because of a repetition of fires year after year. Whenever a tree is felled by the wind on Big Pine Key or the other keys the roots come up from the rock in one solid mass leaving a clean smooth rock exposed (Figure 12). When this smooth crust which overlays the Miami oolite is broken up by tree roots and by other causes it comes up in large thin slabs.

Because of the openness of the pineland on Big Pine there are more understory species here than in the pineland of the other three keys. This shows up well from the understory quadrat studies (Table 14) in which a list of 46 species was obtained for Big Pine Key. This number is about two and one-half times that obtained in any of the other pineland stands. Little Pine Key has a list of only 10. Grasses are in 93 per cent of the quadrats on Big Pine and cover 25-50 per cent of the ground. On No Name Key they cover 5-25 per cent of the ground and are in 63 per cent of the quadrats. On Cudjoe Key they are again in cover class III but are found in only 33 per cent of the quadrats. On Little Pine Key they are in category I for cover and have a frequency of only six per cent. From these data it can be seen that the more sparse the tree and shrub species the more grassy the understory will be. Most of the understory species are widely scattered and afford only a small canopy.

Little Pine Key has had no fires in recent years and the vegetation is very thick throughout the pineland. It is so thick that there is little difference in effort between walking through the pineland and walking through one of the immature hammocks in the area (Note Figure 11).

No Name Key pineland is somewhat open and walking is fairly easy. Hammock species are beginning to take over (Compare Table 11 with Tables 15-23 of tree and hammock species). The succession of hammock species in the pineland of Cudjoe Key is more advanced than that of No Name Key but still is behind that of Little Pine Key (Compare Figures 10, 11, 13, and 14). Cudjoe pineland differs from the others in having a great number of *Sabal* and *Caesalpinia.*

It will be noted that such hammock species as *Eugenia axillaris, E. buxifolia, Elaphrium, Coccolobis laurifolia, Icacorea,* and *Ichthyomethia* did not show up in the pineland quadrats of Big Pine Key.

TABLE 8.

COMPARISON OF PINELAND AREA FOR THE FOUR KEYS

Key	Percent Pineland	Percent Pineland Compared to That of Big Pine Key
Big Pine	38	100
Little Pine	19	6
No Name	16	8
Cudjoe	7	11

TABLE 9.

DENSITY PER ACRE OF TREE AND SHRUB SPECIES BY FOUR SIZE CLASSES IN PINELAND STAND OF BIG PINE KEY (Based on 10 quadrats 3 x 100 feet). Per cent of cover is also shown by 6 classes: I—covering less than 1% of ground, II—1 to 5%, III—5 to 25%, IX—25 to 50%, V—50 to 75%, and VI—75 to 100%

Species	Under 1′	Over 1′ to 4′	Over 4′ to 12′	Over 12′ to 55′	Total	Cover
Brysonima cuneata	58	159	15		232	II
Coccothrinax argentea	1844	726	58		2628	III
Conocarpus erecta	44	29	29		102	II
Erithalis fruticosa	15	87			102	I
Jacquinnia keyensis		15			15	I
Metopium toxiferum	479	29			508	I
Mosiera longipes	595	566			1161	III
Pinus caribaea	43		102	378	523	IV
Pisonia rotundata	218	450			668	II
Pithecolobium guadalupense	247	639	116		1002	I
Randia aculeata	1162	188			1350	I
Rapanea guayanensis	44	43			87	I
Reynosia septentrionalis	44	261			305	II
Rhacoma crossopetalum			15		15	I
Serrenoa repens	87	392			479	III
Sophora tomentosa	15				15	I
Suriana maritima	15				15	I
Thrinax microcarpa	29	145	44		218	II
Torrubia longifolia			15		15	I
Vachellia peninsularis		29			29	I
TOTAL	4939	3758	384	378	9649	

TABLE 10.

DENSITY PER ACRE OF TREE AND SHRUB SPECIES BY FOUR SIZE CLASSES IN PINELAND STAND OF LITTLE PINE KEY

(Based on 10 quadrats 3 x 100 feet). Per cent of cover is also shown by 6 classes: I—covering less than 1% of ground, II—1 to 5%, III—5 to 25%, IV—25 to 50%, V—50 to 75%, and VI—75 to 100%.

Species	Under 1′	Over 1′ to 4′	Over 4′ to 12′	Over 12′ to 55′	Total	Cover
1. Bumelia angustifolia		15			15	I
2. Byrsonima cuneata		15	14		29	I
3. Coccolobis laurifolia	44	958	334	14	1350	III
4. Coccothrinax argentea	232	1089	203		1524	III
5. Elaphrium simaruba	29	145	145		319	II
6. Eugenia axillaris		145	290		435	II
7. Eugenia buxifolia	29	159	160		348	I
8. Icacorea paniculata		101	15		116	I
9. Lantana involucrata		15	14		29	I
10. Metopium toxiferum	378	232	610	14	1234	III
11. Pinus caribaea				131	131	III
12. Pithecolobium guadalupense	407	7289	3993		11689	IV
13. Randia aculeata	741	4501	29		5271	II
14. Reynosia septentrionalis		102	87		189	I
15. Rhacoma crossopetalum			15		15	I
16. Sabal palmetto	44				44	I
17. Serrenoa repens		15			15	I
18. Thrinax microcarpa	290	2076	915	15	3296	V
19. Torrubia sp.		479	1641		2120	III
20. Ximinea americana		58			58	I
Total	2194	17394	8465	174	28227	

TABLE 11.

DENSITY PER ACRE OF TREE AND SHRUB SPECIES BY FOUR SIZE CLASSES IN PINELAND STAND OF NO NAME KEY

(Based on 10 quadrats 3 x 100 feet). Per cent of cover is also shown by 6 classes: I—covering less than 1% of ground, II—1 to 5%, III—5 to 25%, IV—25 to 50%, V—50 to 75%, and VI—75 to 100%.

Species	Under 1′	Over 1′ to 4′	Over 4′ to 12′	Over 12′ to 55′	Total	Cover
1. Bumelia angustifolia		15			15	I
2. Byrsonima cuneata		29			29	I
3. Cassia bahamensis		15			15	I
4. Coccolobis laurifolia		15			15	I
5. Coccothrinax argentea	479	1132	189		1800	III
6. Conocarpus erecta	15				15	I
7. Elaphrium simaruba			15		15	I
8. Erithalis fruticosa	15	14			29	I
9. Eugenia axillaris	29	348	15		392	I
10. Eugenia buxifolia		29	29		58	I
11. Guettarda scabra	102	276	29		407	I
12. Ichthyomethia piscipula		15	116		131	I
13. Lantana involucrata	15	116	43		174	I
14. Metopium toxiferum	73	29	14		116	I
15. Mosiera longipes	15	101			116	II
16. Myrica cerifera		87			87	I
17. Pinus caribaea	102	174	44	116	436	III
18. Pisonia rotundata	131	784			915	II
19. Pithecolobium guadalupense	668	9728	523		10919	III
20. Randia aculeata	189	653			842	I
21. Reynosia septentrionalis	15	609			624	I
22. Rhacoma crossopetalum		73			73	I
23. Serrenoa repens		116			116	II
24. Thrinax microcarpa	102	392	116		610	III
25. Torrubia sp.		420	668		1088	II
26. Ximinea americana		73			73	II
TOTAL	1950	15243	1801	116	19110	

TABLE 12.

DENSITY PER ACRE OF TREE AND SHRUB SPECIES BY FOUR SIZE CLASSES IN PINELAND STAND OF CUDJOE KEY

(Based on 10 quadrats 3 x 100 feet). Per cent of cover is also shown by 6 classes: I—covering less than 1% of ground, II—1 to 5%, III—5 to 25%, IV—25 to 50%, V—50 to 75%, and VI—75 to 100%.

Species	Under 1′	Over 1′ to 4′	Over 4′ to 12′	Over 12′ to 55′	Total	Cover
1. Byrsonima cuneata		58	15		73	II
2. Caesalpinia pauciflora	116	827	102		1045	II
3. Calypthranthes pallens			15		15	I
4. Coccolobis laurifolia	15	102	14		131	II
5. Coccolobis uvifera		29			29	I
6. Coccothrinax argentea	145	697	29		871	III
7. Conocarpus erecta	29	87	145	15	276	II
8. Drypetes diversifolia		15			15	I
9. Erithalis fruticosa	15		14		29	I
10. Eugenia axillaris	102	130	218		450	II
11. Eugenia buxifolia	102	72	15		189	I
12. Guettarda scabra	58	407	130		595	II
13. Metopium toxiferum	682	363	174	203	1422	III
14. Mimusops emarginata			15		15	I
15. Mosiera longipes	290	1263	857		2410	III
16. Myrica cerifera		29			29	I
17. Pinus ceribaea		15	43	261	319	IV
18. Pisonia rotundata	116	639	87		842	II
19. Pithecolobium guadalupense	668	3717	6170		10555	IV
20. Randia aculeata	1481	2279	73		3833	II
21. Rapanea guayanensis	44	755	217		1016	II
22. Reynosia septentrionalis	102	276	130		508	II
23. Rhacoma crossopetalum		44			44	I
24. Sabal palmetto	131	479	145	29	784	III
25. Serrenoa repens	73	493			566	III
26. Sophora tomentosa		29			29	I
27. Thrinax microcarpa	15	436	188		639	III
28. Torrubia longifolia		29	44		73	I
29. [illegible] peninsularis	15	29			44	I
	[illegible]	[illegible]	[illegible]	[illegible]	28846	

TABLE 13.

FREQUENCY PER CENT: OCCURRENCE OF SPECIES IN THE TEN QUADRATS FOR EACH OF THE FOUR PINELAND STANDS

Species	Big Pine Key	Little Pine Key	No Name Key	Cudjoe Key
1. Bumelia angustifolia	0	10	10	0
2. Byrsonima cuneata	80	20	20	40
3. Caesalpinia pauciflora	0	0	0	40
4. Calypthranthes pallens	0	0	0	10
5. Cassia bahamensis	0	0	10	0
6. Coccolobis laurifolia	0	90	10	10
7. Coccolobis uvifera	0	0	0	10
8. Coccothrinax argentea	100	90	100	100
9. Conocarpus erecta	30	0	10	40
10. Drypetes diversifolia	0	0	0	10
11. Elaphrium simaruba	0	50	10	0
12. Erithalis fruticosa	10	0	20	20
13. Eugenia axillaris	0	50	30	50
14. Eugenia buxifolia	0	40	20	50
15. Guettarda scabra	0	0	10	20
16. Icacorea paniculata	0	10	0	0
17. Ichthyomethia piscipula	0	0	30	0
18. Jacquinnia keyensis	10	0	0	0
19. Lantana involucrata	0	20	30	0
20. Metopium toxiferum	20	90	50	100
21. Mimusops emarginata	0	0	0	10
22. Mosiera longipes	90	0	60	90
23. Myrica cerifera	0	0	20	10
24. Pinus caribaea	90	70	80	100
25. Pisonia rotundata	90	0	70	80
26. Pithecolobium guadalupense	40	100	100	100
27. Randia aculeata	50	90	40	80
28. Rapanea guayanensis	30	0	0	40
29. Reynosia septentrionalis	10	30	60	60
30. Rhacoma crossopetalum	10	10	20	10
31. Sabal palmetto	0	10	0	100
32. Serenoa repens	60	10	20	80
33. Sophora tomentosa	20	0	0	10
34. Suriana maritima	10	0	0	0
35. Thrinax microcarpa	70	100	90	90
36. Torrubia sp.	10	100	80	30
37. Vachellia peninsularis	10	0	0	10
38. Ximinea americana	0	20	10	0

TABLE 14.

PINELAND UNDERSTORY (MOSTLY HERBACEOUS SPECIES) BY KEYS FOR THE FOUR KEYS STUDIED

The figures in the table are based on 30 3x3-feet quadrats. Cover classes are shown by six classes: I—covering less than 1% of ground, II—1 to 5%, III—5 to 25%, IV—25 to 50%, V—50 to 75%, and VI—75 to 100%. Per cent frequency and density are also shown.

	Species	BIG PINE KEY % Frequency	Density	Cover
1.	Agalinis purpurea	23.33	.47	II
2.	Aletris bracteata	3.33	.03	I
3.	Anemia adiantifolia	6.66	.30	I
4.	Bletia purpurea	3.33	.03	I
5.	Borreria terminalis	10.00	.17	I
6.	Cassytha filiformis	23.33	.23	I
7.	Chamaecrista keyensis	36.66	.90	II
8.	Chamaesyce conferta	10.00	.20	I
9.	Chamaesyce scoparia	16.66	.33	I
10.	Chamaesyce sp.	10.00	.17	I
11.	Chiococca pinetorum	6.66	.07	I
12.	Chloris petraea	3.33	.03	I
13.	Cirsium horridulum	3.33	.03	I
14.	Crotalaria maritima	6.66	.13	I
15.	Croton linearis	20.00	.27	III
16.	Cynoctomum sessilfolium	6.66	.57	I
17.	Dichromena colorata	26.66	.87	I
18.	Dyschoriste angusta	3.33	.07	I
19.	Echites echites	3.33	.03	I
20.	Ernodea angusta	6.66	.13	I
21.	Flaveria linearis	13.33	.27	I
22.	Galactia parvifolia	20.00	.23	I
23.	Heliotropium leavenworthii	3.33	.03	I
24.	Indigofera miniata	6.66	.10	I
25.	Leucopterum parvifolium	6.66	.07	I
26.	Mariscus jamaicensis	6.66	1.26	II
27.	Melanthera parvifolius	3.33	.07	I
28.	Mikania batatifolia	6.66	.13	I
29.	Morinda roioc	13.33	.63	I
30.	Phyllanthes pentaphyllus	23.33	.23	I
31.	Physalis angustifolia	10.00	.37	I
32.	Pluchea foetida	3.33	.03	I
33.	Poinsettia heterophylla	3.33	.03	I
34.	Polygala praetervisa	3.33	.07	I
35.	Pteris caudata	6.66	.47	II
36.	Pterocaulon undulatum	13.33	.13	I
37.	Pycnadora bahamensis	3.33	.03	II
38.	Rhabdadenia corallicola	3.33	.03	I
39.	Rhacoma ilicifolia	3.33	.07	I
40.	Ruellia hybrida	36.66	.83	I
41.	Samodia ebracteata	3.33	.13	I
42.	Smilax havanensis	23.33	.43	I

TABLE 14 (Continued).

PINELAND UNDERSTORY (MOSTLY HERBACEOUS SPECIES) BY KEYS FOR THE FOUR KEYS STUDIED

The figures in the table are based on 30 3x3-feet quadrats. Cover classes are shown by six classes: I—covering less than 1% of ground, II—1 to 5%, III—5 to 25%, IV—25 to 50%, V—50 to 75%, and VI—75 to 100%. Per cent frequency and density are also shown.

	Species	% Frequency	Density	Cover
43.	Stylosanthes hamata	3.33	.13	I
44.	Vernonia blodgettii	3.33	1.30	I
45.	Unknown seedling	3.33	.03	I
46.	Grasses (unidentified)	93.33	8.30	IV
	LITTLE PINE KEY			
1.	Agalinis purpurea	3.33	.03	I
2.	Chamaesyce scoparia	3.33	.07	I
3.	Echites echites	10.00	.10	I
4.	Ernodea angusta	70.00	3.86	III
5.	Galactia parvifolia	6.66	.07	I
6.	Galactia spiceformis	3.33	.03	I
7.	Morinda roioc	50.00	1.56	II
8.	Pteris caudata	3.33	.03	I
9.	Smilax havanensis	86.66	2.16	III
10.	Grasses (unidentified)	6.66	.06	I
	CUDJOE KEY			
1.	Agalinis purpurea	6.66	.07	I
2.	Cassytha filiformis	6.66	.10	I
3.	Chamaecrista keyensis	6.66	.10	I
4.	Chamaesyce scoparia	10.00	.23	I
5.	Chiococca pinetorum	36.66	.70	III
6.	Chloris petraea	3.33	.03	I
7.	Cirsium horridulum	3.33	.03	I
8.	Dichromana colorata	6.66	.27	I
9.	Ernodea angusta	63.33	3.80	III
10.	Morinda roioc	33.33	.63	II
11.	Phyllanthes pentaphyllus	3.33	.03	I
12.	Physalis angustifolia	3.33	.07	I
13.	Rhacoma ilicifolia	6.66	.10	I
14.	Ruellia hybrida	13.33	.33	I
15.	Samodia ebracteata	3.33	.03	I
16.	Smilax havensis	10.00	.17	II
17.	Grasses (unidentified)	33.33	2.20	III
	NO NAME KEY			
1.	Agalinis purpurea	26.66	.30	II
2.	Asemeia leoides	3.33	.03	I
3.	Andropogon sp.	6.66	.13	I
4.	Cassytha filiformis	43.00	.47	II
5.	Chamaecrista aspera	16.66	.40	I
6.	Chamaescyce scoparia	30.00	1.30	I
7.	Chiococca pinetorum	26.66	.53	II

TABLE 14 (Continued).

PINELAND UNDERSTORY (MOSTLY HERBACEOUS SPECIES) BY KEYS FOR THE FOUR KEYS STUDIED

The figures in the table are based on 30 3x3-feet quadrats. Cover classes are shown by six classes: I—covering less than 1% of ground, II—1 to 5%, III—5 to 25%, IV—25 to 50%, V—50 to 75%, and VI—75 to 100%. Per cent frequency and density are also shown.

	Species	% Frequency	Density	Cover
8.	Cirsium horridulum	6.66	.07	I
9.	Chrysopsis graminifolia	10.00	.33	I
10.	Croton linearis	13.33	.20	II
11.	Dichromena colorata	6.66	.07	I
12.	Echites echites	3.33	.03	I
13.	Ernodea angusta	83.33	3.60	III
14.	Flaveria linearis	13.33	.23	I
15.	Galactia parvifolia	13.33	.13	I
16.	Mariscus jamaicensis	3.33	.40	II
17.	Mikania batatifolia	3.33	.03	I
18.	Metastelma blodgettii	3.33	.07	I
19.	Morinda roioc	23.33	.70	II
20.	Phyllanthes pentaphyllus	6.66	.10	I
21.	Physalis angustifolia	16.66	.40	I
22.	Pteris caudata	10.00	.30	II
23.	Pycnadora bahamensis	3.33	.03	I
24.	Rhacoma ilicifolia	23.33	.47	II
25.	Ruellia hybrida	3.33	.03	I
26.	Smilax havanensis	13.33	.27	I
27.	Toxicodendron toxicodendron	3.33	.03	I
28.	Grasses (unidentified)	63.33	4.47	III

The three pineland stands other than Big Pine Key contained much the same number of the most abundant species, *Pithecolobium guadalupense*. It will be noted that there are 915 individuals of *Thrinax microcarpa* on Little Pine Key in the 4-12 foot bracket which is more than the total number for that species in any of the other pineland stands. This species here also shows the greatest ground cover, category V – covering 50-75% of the ground.

If conditions continue the same, in a number of years – there being no fires in the pineland of the latter three keys – this pineland will have changed to hammock with perhaps some of the old pines remaining as relicts. Table 11 shows that No Name pineland has the most young pines. This is true only because the land was sufficiently open for these to have gotten started but the habitat is rapidly changing.

2. **The Hammock Community.** Thirty-five 3 x 50 feet shrub and tree quadrats were run in the hammocks of eight of the major keys in

Figure 11. Pineland of Little Pine Key. Note the high growth of the vegetation (the white bag in the center is seven feet above the ground). Vegetation is very thick and visibility poor throughout the pineland.

Figure 12. Wind felled pine on Big Pine Key. When the roots come up they carry every bit of soil with them.

the key deer range, taking a minimum number of quadrats for each key. The community of each key has been compared individually and then all the data from the total 35 quadrats have been lumped together to give an overall picture of a typical West Indian type of community for the area. These data are shown in tables 15-24 with Table 24 showing the frequency per cent of each species on the eight keys. Table 25 gives information on the hammock understory.

A total of 48 species was recorded for the 35 tree and shrub hammock quadrats. Of this number the Ramrod Key community had 29, Big Pine Key 25, No Name Key 28, Cudjoe Key 19, Little Torch Key 20, Big Torch Key 21, Howe Key 16, and Little Pine Key 17.

Table 23 shows *Eugenia buxifolia* as the most prominent plant in the hammock. For the hammock community of the area there is a total of 13,753 plants per acre with a frequency of 94% (Table 24) and a canopy of 25-50% (Table 23). This species has a frequency per cent of 100 on each of the individual keys except on Ramrod Key where it drops to 66 per cent. It is the most numerous plant on all the keys except on Little Torch Key (where *Savia* exceeds it in number) and Ramrod Key (where several species exceed it in number). *E. buxifolia* also furnishes the most cover in the majority of the hammocks on these keys. For the typical community *Savia* is next in number, but here most of the plants are seedlings and they are found in only 17% of the quadrats. (This species was recorded in quadrats only from Little Torch Key and Ramrod Key).

By comparing Table 23 with Tables 9, 10, 11, and 12 it will be seen that many of the hammock species are also found in the pineland community but in the latter are generally in lesser numbers. Since these are the ones that can reproduce in sunlight or shade they are the ones that eventually produce a hammock. The following pineland quadrat species did not show up in the hammock quadrats: *Pinus*, *Pisonia rotundata, Suriana, Vachellia peninsularis, Cassia,* and *Caesalpinia.* From the evidence of these data it can be seen that fire does hold back the hammock climax in this area and allows the pine woods to continue as such.

Pithecolobium guadalupense is a plant of both pineland and the hammock community. However, it seems to "like" partial shade only. On Big Pine Key in the open pineland it is not abundant (See Table 9) while in the other three pineland stands the numbers increase (Tables 10, 11, and 12). In the thick hammock community the number again drops to some extent (see Tables 15-23).

TABLE 15.

DENSITY PER ACRE OF TREE AND SHRUB SPECIES BY FOUR SIZE CLASSES IN HAMMOCK COMMUNITY OF BIG PINE KEY (Based on 6 quadrats 3 x 50 feet). Per cent of cover is also shown by 6 classes: I—covering less than 1% of ground, II—1 to 5%, III—5 to 25%, IV—25 to 50%, V—50 to 75%, and VI—75 to 100%.

Species	Under 1′	Over 1′ to 4′	Over 4′ to 12′	Over 12′ to 55′	Total	Cover
1. Bumelia angustifolia	194	484	145		823	II
2. Capparis flexosa		97			97	I
3. Chiococca alba			48		48	II
4. Coccolobis laurifolia	97	339	484		920	III
5. Coccolobis uvifera	48	194	48		290	II
6. Coccothrinax argentea	97	145	97		339	II
7. Conocarpus erecta	48	48	48	48	192	II
8. Elaphrium simaruba	1597	97	48	145	1887	III
9. Erithalis fruticosa	97	97	1016		1210	III
10. Eugenia axillaris	774	387	194		1355	II
11. Eugenia buxifolia	1549	2904	2662		7115	IV
12. Ichthyomethia piscipula				339	339	III
13. Jacquinnia keyensis	97	48	145		290	II
14. Metopium toxiferum	2614	1162	726	436	4938	IV
15. Mimusops emarginata	48		48	48	144	II
16. Pithecolobium guadalupense	823	2130	2565	290	5808	III
17. Psychotria nervosa	194	48			242	I
18. Randia aculeata	581	1258	436		2275	II
19. Rapanea guayanensis		97			97	I
20. Rhacoma crossopetalum			48		48	I
21. Reynosia septentrionalis	436	145	436		1017	II
22. Serenoa repens		48			48	I
23. Thrinax microcarpa	194	436	242		872	III
24. Torrubia longifolia			678	387	1065	III
25. Ximinea americana	48	48	242	48	386	III
TOTAL	9536	10212	10356	1741	31845	

TABLE 16.

DENSITY PER ACRE OF TREE AND SHRUB SPECIES BY FOUR SIZE CLASSES IN HAMMOCK COMMUNITY OF HOWE KEY

(Based on 3 quadrats 3 x 50 feet). Per cent of cover is also shown by 6 classes: I—covering less than 1% of ground, II—1 to 5%, III—5 to 25%, IV—25 to 50%, V—50 to 75%, and VI—75 to 100%

Species	Under 1′	Over 1′ to 4′	Over 4′ to 12′	Over 12′ to 55′	Total	Cover
1. Amyris elimifera	194		96		290	II
2. Bumelia angustifolia	97	290	678		1065	III
3. Byrsonima cuneata			97		97	III
4. Conocarpus erecta			97	97	194	III
5. Elaphrium simaruba	97			97	194	II
6. Eugenia axillaris	97	871	581		1549	III
7. Eugenia buxifolia	3098	8034	5808		16940	V
8. Ficus brevifolia				97	97	III
9. Hippomane mancinella	484		97		581	III
10. Ichthyomethia piscipula				194	194	III
11. Metopium toxiferum		97	97		194	III
12. Mimusops emarginata			194		194	III
13. Pithecolobium guadalupense	484	484	1065		2033	III
14. Randia aculeata	484	1839	387		2710	II
15. Reynosia septentrionalis	1258	290	1742		3290	III
16. Thrinax microcarpa			194		194	III
TOTAL	6293	11905	11133	485	29816	

TABLE 17.

DENSITY PER ACRE OF TREE AND SHRUB SPECIES BY FOUR SIZE CLASSES IN HAMMOCK COMMUNITY OF LITTLE PINE KEY

(Based on 4 quadrats 3 x 50 feet). Per cent of cover is also shown by 6 classes: I—covering less than 1% of ground, II—1 to 5%, III—5 to 25%, IV—25 to 50%, V—50 to 75%, and VI—75 to 100%

Species	Under 1′	Over 1′ to 4′	Over 4′ to 12′	Over 12′ to 55′	Total	Cover
1. Bumelia angustifolia	73	290	508	218	1089	III
2. Byrsonima cuneata				73	73	II
3. Coccolobis laurifolia		508	2396	145	3049	IV
4. Coccothrinax argentea		73			73	I
5. Conocarpus erecta				218	218	III
6. Elaphrium simaruba			73	145	218	III
7. Eugenia buxifolia	436	1597	4574	363	6970	IV
8. Icacorea paniculata		218	145		363	II
9. Ichthyomethia piscipula			145		145	II
10. Metopium toxiferum	145	145	73	799	1162	IV
11. Mimusops emarginata			73		73	III
12. Pithecolobium guadalupense	290	2105	1670		4065	III
13. Randia aculeata	218	726	726		1670	II
14. Reynosia septentrionalis	73	363	1307	72	1815	III
15. Thrinax microcarpa	508	871	436		1815	III
16. Torrubia longifolia			218	145	363	III
17. Ximinea americana		73			73	II
TOTAL	1743	6969	12344	2178	23234	

TABLE 18.

DENSITY PER ACRE OF TREE AND SHRUB SPECIES BY FOUR SIZE CLASSES IN HAMMOCK COMMUNITY OF CUDJOE KEY

(Based on 3 quadrats 3 x 50 feet). Per cent of cover is also shown by 6 classes: I—covering less than 1% of ground, II—1 to 5%, III—5 to 25%, IV—25 to 50%, V—50 to 75%, and VI—75 to 100%

Species	Under 1′	Over 1′ to 4′	Over 4′ to 12′	Over 12′ to 55′	Total	Cover
1. Bumelia angustifolia	97	774	194		1065	II
2. Byrsonima cuneata			194		194	III
3. Coccolobis laurifolia			387		387	II
4. Coccothrinax argentea			194		194	II
5. Conocarpus erecta		678	774	290	1742	III
6. Erithalis fruticosa			97		97	I
7. Eugenia buxifolia	5227	10745	10938		26910	V
8. Jacquinnia keyensis			97		97	I
9. Metopium toxiferum		290	290	97	677	III
10. Mimusops emarginata			97		97	II
11. Mosiera longipes	194	1258	1549		3001	III
12. Pithecolobium guadalupense		387	3001	97	3485	III
13. Randia aculeata	97	968			1065	II
14. Rapanea guayanensis		194			194	I
15. Reynosia septentrionalis	290	1162	2614		4066	III
16. Sabal palmetto		194	387		581	III
17. Sophora tomentosa		97			97	I
18. Thrinax microcarpa			97		97	II
19. Torrubia longifolia		97	1646		1743	III
TOTAL	5905	16844	22556	484	45789	

TABLE 19.

DENSITY PER ACRE OF TREE AND SHRUB SPECIES BY FOUR SIZE CLASSES IN HAMMOCK COMMUNITY OF LITTLE TORCH KEY

(Based on 4 quadrats 3 x 50 feet.) Per cent of cover is also shown by 6 classes: I—covering less than 1% of ground, II—1 to 5%, III—5 to 25%, IV—25 to 50%, V—50 to 75%, and VI—75 to 100%

Species	Under 1′	Over 1′ to 4′	Over 4′ to 12′	Over 12′ to 55′	Total	Cover
1. Amyris elimifera		73	290		363	II
2. Bumelia angustifolia		73	72		145	I
3. Byrsonima cuneata	73	72			145	I
4. Coccolobis laurifolia	73	290	290	73	726	III
5. Conocarpus erecta	73	145	435	73	726	III
6. Dipholis salicifolia		73	145		218	I
7. Elaphrium simaruba	145				145	I
8. Erithalis fruticosa	145	871	290		1306	II
9. Eugenia axillaris	581	363	1089	72	2105	III
10. Eugenia buxifolia	2904	6679	12632		22215	V
11. Guettarda scabra		218	72		290	I
12. Ichthyomethia piscipula			145	436	581	III
13. Metopium toxiferum	363	73	145	145	726	III
14. Mimusops emarginata			73		73	I
15. Mosiera longipes			145		145	II
16. Myrica cerifera		73			73	I
17. Randia aculeata	1379	2541	363		4283	II
18. Rapanea guayanensis	73	726	290	72	1161	III
19. Reynosia septentrionalis	73	290	1307		1670	III
20. Savia bahamensis	30274	1089	944	435	32742	III
TOTAL	36156	13649	18727	1306	69838	

TABLE 20.

DENSITY PER ACRE OF TREE AND SHRUB SPECIES BY FOUR SIZE CLASSES IN HAMMOCK COMMUNITY OF BIG TORCH KEY

(Based on 5 quadrats 3 x 50 feet). Per cent of cover is also shown by 6 classes: I—covering less than 1% of ground, II—1 to 5%, III—5 to 25%, IV—25 to 50%, V—50 to 75%, and VI—75 to 100%.

Species	Under 1′	Over 1′ to 4′	Over 4′ to 12′	Over 12′ to 55′	Total	Cover
1. Amyris elimifera			290		290	II
2. Bumelia angustifolia			58		58	I
3. Casasia clusiifolia		58	58		116	I
4. Coccolobis laurifolia		116	116		232	II
5. Conocarpus erecta			58	58	116	II
6. Drypetes diversifolia		58	58		116	I
7. Elaphrium simaruba			174	174	348	III
8. Erithalis fruticosa	348				348	I
9. Eugenia axillaris		348	174		522	II
10. Eugenia buxifolia	3659	6156	15449	1104	26368	V
11. Gymnanthes lucida		290	580		870	II
12. Ichthyomethia piscipula	58		58	116	232	III
13. Metopium toxiferum	116	58		290	464	III
14. Mimusops emarginata			58		58	III
15. Pithecolobium guadalupense		232	232		464	II
16. Randia aculeata	232	1975	290		2497	II
17. Rapanea guayanensis		116			116	I
18. Reynosia septentrionalis	58	58	755		871	III
19. Solanum bahamense		58	58		116	I
20. Thrinax microcarpa			116		116	III
21. Torrubia longifolia			58		58	II
TOTAL	4471	9523	18640	1742	34376	

TABLE 21.

DENSITY PER ACRE OF TREE AND SHRUB SPECIES BY FOUR SIZE CLASSES IN HAMMOCK COMMUNITY OF NO NAME KEY (Based on 4 quadrats 3 x 50 feet). Per cent of cover is also shown by 6 classes: I—covering less than 1% of ground, II—1 to 5%, III—5 to 25%, IV—25 to 50%, V—50 to 75%, and VI—75 to 100%

Species	Under 1′	Over 1′ to 4′	Over 4′ to 12′	Over 12′ to 55′	Total	Cover
1. Amyris climifera		2251	218	72	2541	III
2. Bourreria ovata		653	1234	73	1960	III
3. Bumelia angustifolia		73			73	I
4. Byrsonima cuneata		73		145	218	III
5. Coccolobis laurifolia	73	436	508	217	1234	III
6. Coccolobis uvifera			73		73	I
7. Conocarpus erecta				145	145	III
8. Elaphrium simaruba	145	73	145	145	508	II
9. Eugenia axillaris	2033	2396	653		5082	III
10. Eugenia buxifolia	2614	2904	4574	145	10237	IV
11. Exothea paniculata	218		72		290	I
12. Guettarda scabra	73		72		145	I
13. Gyminda latifolia			363	363	726	III
14. Icacorea paniculata			218		218	II
15. Ichthyomethia piscipula			72	218	290	III
16. Krugiodendron ferreum	145				145	I
17. Lantana involucrata		290			290	II
18. Metopium toxiferum	145	290	145	1089	1669	IV
19. Mimusops emarginata			145		145	I
20. Mosiera longipes			218		218	I
21. Pithecolobium guadalupense			508		508	III
22. Randia aculeata	944	3920	290		5154	III
23. Rapanea guayanensis		73			73	I
24. Reynosia septentrionalis	290	944	508		1742	II
25. Rhacoma crossopetalum		73			73	I
26. Thrinax microcarpa		218	72		290	III
27. Torrubia longifolia			73	72	145	II
28. Ximinea americana		73	72		145	II
TOTAL	6680	14740	10233	2684	34337	

TABLE 22.

DENSITY PER ACRE OF TREE AND SHRUB SPECIES BY FOUR SIZE CLASSES IN HAMMOCK COMMUNITY OF RAMROD KEY (Based on 6 quadrats of 3 x 50 feet.) Per cent of cover is also shown by 6 classes: I—covering less than 1% of ground, II—1 to 5%, III—5 to 25%, IV—25 to 50%, V—50 to 75%, and VI—75 to 100%

Species	Under 1′	Over 1′ to 4′	Over 4′ to 12′	Over 12′ to 55′	Total	Cover
1. Amyris elimifera			48		48	I
2. Bumelia angustifolia	48	97	290		435	II
3. Byrsonima cuneata		97	48		145	II
4. Coccolobis laurifolia	48	48	290		386	III
5. Coccolobis uvifera		145			145	I
6. Conocarpus erecta	48			48	96	II
7. Elaphrium simaruba	97			97	194	II
8. Erithalis fruticosa		532	2178		2710	III
9. Eugenia axillaris	1162	1258	2081		4501	III
10. Eugenia buxifolia	1646	436	822	97	3001	III
11. Exostema caribaeum			242		242	II
12. Ficus aurea		48			48	I
13. Guettarda scabra		48			48	I
14. Gyminda latifolia			97		97	II
15. Icacorea paniculata	97	145	242	48	532	II
16. Ichthyomethia piscipula		48		48	96	II
17. Metopium toxiferum	6050	629	726	242	7647	III
18. Mimusops emarginata	145	97	339		581	III
19. Mosiera longipes	48	436	339		823	II
20. Myrica cerifera		97			97	I
21. Pithecolobium guadalupense	48	290	581		919	II
22. Randia aculeata	436	1839	97		2372	II
23. Rapanea guayanensis	290	387	97		774	I
24. Reynosia septentrionalis		339	581		920	II
25. Rhacoma crossopetalum		48	48		96	I
26. Savia bahamensis	14520	3436	4695		22651	IV
27. Sophora tomentosa	48				48	I
28. Thrinax microcarpa		290	48		338	II
29. Torrubia longifolia			194		194	II
TOTAL	24722	10700	14983	580	50184	

TABLE 23.

DENSITY PER ACRE FOR TREE AND SHRUB SPECIES FOR THE HAMMOCK COMMUNITY OF THE ENTIRE AREA
(Based on the 35 3 x 50 feet quadrats made on the 8 keys studied). Cover and frequency per cent are also shown. The cover is shown by 6 classes: I—covering less than 1% of ground, II—1 to 5%, III—5 to 25%, IV—25 to 50%, V—50 to 75%, and VI—75 to 100%

Species	Under 1′	Over 1′ to 4′	Over 4′ to 12′	Over 12′ to 55′	Total	Cover	Frequency
1. Amyris elimifera	17	265	116	8	406	II	22.86
2. Bourreria ovata		75	141	8	224	II	5.71
3. Bumelia angustifolia	66	240	224	25	555	II	40.00
4. Byrsonima cuneata	8	33	33	25	99	II	22.86
5. Capparis flexosa		17			17	I	5.71
6. Casasia clusiifolia		8	8		16	I	2.86
7. Chiococca alba			8		8	I	2.86
8. Coccolobis laurifolia	41	224	547	50	862	III	45.71
9. Coccolobis uvifera	8	58	17		83	I	14.29
10. Coccothrinax argentea	17	33	33		83	I	8.57
11. Conocarpus erecta	25	83	141	108	357	III	42.86
12. Dipholis salicifolia		8	17		25	I	2.86
13. Drypetes diversifolia		8	8		16	I	5.71
14. Elaphrium simaruba	332	25	58	107	522	III	45.71
15. Erithalis fruticosa	83	207	589		879	II	31.43
16. Eugenia axillaris	638	721	663	8	2030	II	45.71
17. Eugenia buxifolia	2462	4336	6723	232	13753	IV	94.29
18. Exostema caribaeum			41		41	I	2.86
19. Exothea paniculata	25		8		33	I	2.86
20. Ficus aurea		8			8	I	2.86
21. Ficus brevifolia				8	8	I	2.86
22. Guettarda scabra	8	33	17		58	I	8.57
23. Gyminda latifolia			58	41	99	II	11.43
24. Gymnanthes lucida		41	83		124	I	2.86
25. Hippomane mancinella	41		8		49	II	5.71

TABLE 23 (Continued).

DENSITY PER ACRE FOR TREE AND SHRUB SPECIES FOR THE HAMMOCK COMMUNITY OF THE ENTIRE AREA
(Based on the 35 3 x 50 feet quadrats made on the 8 keys studied). Cover and frequency per cent are also shown. The cover is shown by 6 classes: I—covering less than 1% of ground, II—1 to 5%, III—5 to 25%, IV—25 to 50%, V—50 to 75%, and VI—75 to 100%

Species	Under 1′	Over 1′ to 4′	Over 4′ to 12′	Over 12′ to 55′	Total	Cover	Frequency
26. Icacorea paniculata	17	49	83	8	157	I	17.14
27. Ichthyomethia piscipula	8	8	50	174	240	III	40.00
28. Jacquinnia keyensis	17	8	33		58	I	11.43
29. Krugiodendron ferreum	17				17	I	2.86
30. Lantana involucrata		33			33	I	2.86
31. Metopium toxiferum	1575	406	323	398	2702	III	80.00
32. Mimusops emarginata	33	17	133	8	191	II	31.43
33. Mosiera longipes	25	182	232		439	II	22.86
34. Myrica cerifera		25			25	I	5.71
35. Pithecolobium guadalupense	224	763	1169	58	2214	III	54.57
36. Psychotria nervosa	33	8			41	I	2.86
37. Randia aculeata	547	1874	323		2744	II	85.71
38. Rapanea guayanensis	58	207	50	8	323	II	28.57
39. Reynosia septentrionalis	265	398	1011	8	1682	III	74.29
40. Rhacoma crossopetalum		17	17		34	I	8.57
41. Sabal palmetto		17	33		50	II	5.71
42. Savia bahamensis	5944	713	912	50	7619	III	17.14
43. Serenoa repens		8			8	I	2.86
44. Solanum bahamense		8	8		16	I	5.71
45. Sophora tomentosa	8	8			16	I	5.71
46. Thrinax microcarpa	91	249	149		489	III	60.00
47. Torrubia longifolia		8	323	99	430	II	40.00
48. Ximinea americana	8	25	50	8	91	II	8.57
TOTAL	12641	11454	14440	1439	39974		

TABLE 24.

PER CENT OF FREQUENCY FOR THE TREE AND SHRUB SPECIES OF THE HAMMOCK COMMUNITY OF THE AREA

(Based on the eight keys studied). The number in parenthesis indicates the total number of quadrats run for the key

Species	Big Pine (6)	Little Pine (4)	Big Torch (5)	Little Torch (4)	Ramrod (6)	No Name (4)	Howe (3)	Cudjoe (3)
1. Amyris elimifera			40	50	16.6	50	33.3	
2. Bourreria ovata						50		
3. Bumelia angustifolia	50	75	20	50	16.6	25	66.6	33.3
4. Byrsonima cuneata		25		50	33.3	25	33.3	33.3
5. Capparis flexosa	33.3							
6. Casasia clusiifolia			20					
7. Chiococca alba	16.6							
8. Coccolobis laurifolia	33.3	100	40	50	50	50		33.3
9. Coccolobis uvifera	50				16.6	25		
10. Coccothrinax argentea	16.6	25						33.3
11. Conocarpus erecta	50	25	40	50	16.6	25	66.6	100
12. Dipholis salicifolia				25				
13. Drypetes diversifolia			40					
14. Elaphrium simaruba	50	75	40	25	33.3	75	66.6	
15. Erithalis fruticosa	16.6		20	75	83.3		33.3	
16. Eugenia axillaris	33.3		40	75	50	75	100	
17. Eugenia buxifolia	100	100	100	100	66.6	100	100	100
18. Exostema caribaeum					16.6			
19. Exothea paniculata						25		
20. Ficus aurea					16.6			
21. Ficus brevifolia							33.3	
22. Guettarda scabra				25	16.6	25		
23. Gyminda latifolia					33.3	50		
24. Gymnanthes lucida			20					

TABLE 24 (Continued).

PER CENT OF FREQUENCY FOR THE TREE AND SHRUB SPECIES OF THE HAMMOCK COMMUNITY OF THE AREA (Based on the eight keys studied). The number in parenthesis indicates the total number of quadrats run for the key

Species	Big Pine (6)	Little Pine (4)	Big Torch (5)	Little Torch (4)	Ramrod (6)	No Name (4)	Howe (3)	Cudjoe (3)
25. Hippomane mancinella							66.6	
26. Icacorea paniculata		25			50	50		
27. Ichthyomethia piscipula	33.3	25	40	50	33.3	75	66.6	
28. Jacquinnia keyensis	50							33.3
29. Krugiodendron ferreum						25		
30. Lantana involucrata						25		
31. Metopium toxiferum	100	50	60	100	83.3	100	66.6	66.6
32. Mimusops emarginata	33.3	25	20	25	33.3	50	33.3	33.3
33. Mosiera longipes				50	50	25		66.6
34. Myrica cerifera				25	16.6			
35. Pithecolobium guadalupense	83.3	100	60		16.6	50	66.6	66.6
36. Psychotria nervosa	16.6							
37. Randia aculeata	83.3	100	80	100	50	100	100	100
38. Rapanea guayanensis	33.3		20	75	33.3	25		33.3
39. Reynosia septentrionalis	66.6	100	60	75	50	100	100	66.6
40. Rhacoma crossopetalum	16.6				16.6	25		
41. Sabal palmetto								66.6
42. Savia bahamensis				25	83.3			
43. Serenoa repens	16.6							
44. Solanum bahamense			40					
45. Sophora tomentosa					16.6			33.3
46. Thrinax microcarpa	83.3	100	40		66.6	75	66.6	33.3
47. Torrubia longifolia	66.6	50	20		33.3	50		100
48. Ximinea americana	16.6	25				25		

TABLE 25.

PER CENT OF FREQUENCY, DENSITY, AND COVER FOR THE HAMMOCK UNDERSTORY (PARTLY WOODY OR HERBACEOUS PLANTS) BY KEYS, FOR EIGHT KEYS STUDIED, SHOWING NUMBER OF 3 X 3 FEET QUADRATS

Cover classes are shown by six classes: I—covering less than 1% of ground, II—1 to 5%, III—5 to 25%, IV—25 to 50%, V—50 to 75%, and VI—75 to 100%

Species	Per Cent Frequency	Density	Cover
BIG PINE KEY (12 quadrats)			
1. Borrichia frutescens	8.3	.17	I
2. Chiococca pinetorum	8.3	.08	I
3. Mariscus jamaicensis	8.3	.08	II
4. Morinda roioc	25.0	.25	I
5. Toxicodendron toxicodendron	8.3	.08	II
6. Rinina humilis	17.0	.17	II
7. Smilax havanensis	17.0	.25	I
8. Grass (unidentified)	8.3	.33	I
LITTLE PINE KEY (8 quadrats)			
1. Morinda roioc	50	.63	III
2. Smilax havanensis	12.5	.13	I
BIG TORCH KEY (10 quadrats)			
1. Abilgaardia monostachya	10	.3	I
2. Borrichia frutescens	10	.2	II
3. Chamaesyce scoparia	10	.1	I
4. Chiococca pinetorum	20	.2	II
5. Echites echites	10	.1	I
6. Eustoma exaltatum	10	.1	I
7. Morinda roioc	30	.9	II
8. Sideranthes megacephalus	10	.4	II
9. Sporobolis virginicus	20	6.0	III
10. Grass (unidentified)	10	.1	I
LITTLE TORCH KEY (8 quadrats)			
1. Chamaesyce scoparia	25	.38	I
2. Chiococca pinetorum	37.5	.38	III
3. Ernodea angusta	25	.88	II
4. Mariscus jamaicensis	12.5	.75	II
5. Morinda roioc	75	1.50	II
6. Sporobolis virginicus	25	1.38	I
7. Grass (unidentified)	25	.13	I
RAMROD KEY (12 quadrats)			
1. Chiococca pinetorum	16.6	.16	III
2. Ernodea angusta	25	.75	II
3. Morinda roioc	16.6	.16	I
4. Tillandsia aloifolia	8.3	.08	I
5. Tillandsia balbiciana	8.3	.08	I
6. Urechites lutea	8.3	.08	I

TABLE 25 (Continued).

PER CENT OF FREQUENCY, DENSITY, AND COVER FOR THE HAMMOCK UNDERSTORY (PARTLY WOODY OR HERBACEOUS PLANTS) BY KEYS, FOR EIGHT KEYS STUDIED, SHOWING NUMBER OF 3 X 3 FEET QUADRATS

Cover classes are shown by six classes: I—covering less than 1% of ground, II—1 to 5%, III—5 to 25%, IV—25 to 50%, V—50 to 75%, and VI—75 to 100%

Species	Per Cent Frequency	Density	Cover
NO NAME KEY (8 quadrats)			
1. Chiococca pinetorum	12.5	.13	I
2. Morinda roioc	12.5	.13	I
3. Urechites lutea	12.5	.13	II
HOWE KEY (6 quadrats)			
1. Chiococca pinetorum	16.6	1.35	II
2. Morinda roioc	50	.60	I
3. Grass (unidentified)	16.6	.50	I
CUDJOE KEY (6 quadrats)			
1. Chiococca pinetorum	33.3	1.66	III
2. Morinda roioc	16.6	.16	I
3. Tillandsia utriculata	16.6	.16	I

For the hammock community understory only 19 species in all were recorded with the most species for any individual key hammock community being 10 (see Table 25). As can be seen from the data, these plants are widely scattered and afford little cover. The total of 19 species for the hammock community understory compares with 52 species for that of the pineland community (Table 14).

In addition to the above studies, hammock quadrat data were obtained for Annette Key. Three 3 x 50 feet quadrats were used for the tree and shrub species and 9—3 x 3 feet quadrats for the understory. These data are shown in Tables 26 and 27. The following more or less important species did not show up in the Annette quadrats:

Amyris elmifera	*Mosiera longipes*
Byrsonima cuneata	*Rapanea guayanensis*
Erithalis fruticosa	*Savia bahamensis*
Icacorea paniculata	*Thrinax microcarpa*
Mimusops emarginata	*Torrubia longifolia*

Of the above species *Amyris, Erithalis, Icacorea, Mosiera, Rapanea* and *Savia* were never recorded for the key by the writer (Appendix I).

Other important differences include the abundance of *Gymnanthese lucida, Solanum blodgettii,* and *Thrinax parviflora.* None of these latter species showed up in the figures for the typical hammock. The understory contained only a few species.

3. **The Southeast Point Hammock of Big Pine Key.** Because the many cacti found in this hammock of Big Pine Key make it somewhat different from hammocks of the rest of the key and of the other keys studied, it has been treated separately. Three quadrats were run in it so that it could be compared with other hammocks in the area. Part of the difference may be accounted for by its being underlain by Key Largo limestone instead of Miami oolite which makes up the rock formation of the rest of the key and keys in the key deer range (Figure 9). Small (1933) states that this is the meeting place of two definite geologically distributed species of tree cacti: "*Cephalocereus deeringii* inhabits the Key Largo limestone, *C. keyensis,* the Key West oolite*".

The abundance of *Acanthocereus floridanus* (Figure 15) can readily be seen from the densisty per acre tabulation shown in Table 28. The prominence of this species in the Southeast Point hammock and its absence in the other hammocks forms the outstanding difference (Tables 15-24). Most of the species found in the typical hammock are present in the Southeast Point hammock but here they are evidently more widely scattered and thus many of them did not show up in the few quadrats run. The *Acanthocereus* growing along the edges of the hammock is much larger in size – growing up to six feet or better and climbing in the trees (Figure 15). Also found along the edges and more open spots are many *Opuntias*: *O. keyensis* and *O. dillenii,* and a number of *O. abjecta.* Some *Harrisia simpsonii* may be found in certain spots in this hammock. The Southeast Hammock was the only place on Big Pine Key where *Pithecolobium unguis-cati* was found as well as *Vallesia glabra, Hibiscus pilosus, Varronia globosa* and several other plants.

Table 29 shows the frequency, density, and cover for the understory species.

4. **Regrowth of Vegetation in Burned Pineland.** Regrowth of vegetation in a burned area east of the Big Pine Inn was checked monthly for four months after the occurrence of fire, May 4, 1952. Except for pines and palms (*Thrinax, Coccothrinax,* and *Serenoa*) which are fire resistant, the ground was bare. Four 3 x 50 feet quadrats

*Key West oolite is synonymous with Miami oolite (Cooke, 1939).

TABLE 26.

DENSITY PER ACRE FOR TREE AND SHRUB SPECIES OF ANNETTE KEY HAMMOCK

(Based on three 3 x 50 feet quadrats). Cover and frequency per cent are also shown. The cover is shown by 6 classes: I—covering less than 1% of the ground, II—1 to 5%, III—5 to 25%, IV—25 to 50%, V—50 to 75%, and VI—75 to 100%

Species	Under 1′	Over 1′ to 4′	Over 4′ to 12′	Over 12′ to 55′	Total	Cover	Frequency
1. Bumelia angustifolia		97			97	I	33.3
2. Canella winteriana			97		97	II	33.3
3. Coccolobis uvifera		97	96		193	III	33.3
4. Conocarpus erecta			97	387	484	III	33.3
5. Elaphrium simaruba		97			97	I	33.3
6. Eugenia axillaris			97		97	I	33.3
7. Eugenia buxifolia	290	678	193	581	1742	III	100.0
8. Gymnanthes lucida		2033	4936		6969	III	33.3
9. Ichthyomethia piscipula			97	96	193	II	33.3
10. Metopium toxiferum	194		290	484	968	IV	100.0
11. Opuntia keyenis	97				97	I	33.3
12. Pithecolobium guadalupense		774	290		1064	III	100.0
13. Randia aculeata	97	1645	484		2226	II	66.6
14. Reynosia septentrionalis				194	194	III	33.3
15. Sebesten sebestena			97		97	II	33.3
16. Solanum blodgetti	97	1839	581		2517	II	100.0
17. Thrinax parviflora	774	871	1162	97	2904	IV	100.0
TOTAL	1549	8131	8517	1839	20036		

of trees and shrubs were made. Table 30 shows the density and cover for these species the fourth month after the fire, while Table 31 shows the density and frequency by months for the four months. Table 32 shows the density and frequency for the understory species in 13—3 x 3 feet quadrats monthly for four months and the cover class for the fourth month. The figures in these three tables give an idea of the rate of regrowth of the vegetation. Although at the end of the fourth month the tree and shrub species formed only about 30 per cent cover and the understory less than 22 per cent, these plants were making a good come-back. At this time most of the species were only a few inches high and were shoots coming from old underground roots and stems. The gain in abundance of new shoots can readily be seen in Table 31 for *Pithecolobium* and *Randia*. It can be seen from the figures shown in Table 32 that the understory species were rather widely scattered but were showing an increase in numbers. Twenty-five species are listed in Table 32 and of these, excluding the grasses, seven are not listed in the pineland understory quadrats for Big Pine Key (Table 14). These are: *Acalypha, Pityopsis, Evolvolus alsinoides, Bradburya, Hypoxis, Liatris* and *Piriqueta*. *Hypoxis* shows the greatest density. Small (1933) mentions this species as being one of the first plants to show up after fire.

From the studies conducted in the burn area it can be seen that even though fire may lay the ground bare except for the fire resistant species (pines and palms) it does not kill the underground portions of the broad-leaf forms which shortly send up many adventitious shoots to replace those upper parts destroyed by fire. Seeds of herbaceous forms are soon scattered throughout the burn by wind and birds. Many seeds probably survived the fire by being on or in the ground. Thus it

TABLE 27.

FREQUENCY, DENSITY, AND COVER FOR SPECIES FORMING UNDERSTORY OF ANNETTE KEY HAMMOCK

(Based on nine quadrats 3 x 3 feet). Cover is shown by six classes: I—covering less than 1% of ground, II—1 to 5%, III—5 to 25%, IV—25 to 50%, V—50 to 75%, and VI—75 to 100%

Species	Frequency	Density	Cover
1. Grass	11.11	.11	II
2. Heliotropium parviflorum	11.11	.11	II
3. Ipomoea cathartica	11.11	.11	I
4. Morinda roioc	22.22	.22	II
5. Sporobolis virginicus	22.22	.44	I

Figure 13. Pineland of No Name Key. The pineland vegetation here is more open than that of Cudjoe or Little Pine Keys. The writer was about 75 feet from the camera.

Figure 14. Pineland of Cudjoe Key. The writer can be seen at the edge of the clearing. Vegetation in the uncleared areas of pineland is thick but the succession has not advanced quite as far as that found on Little Pine Key.

TABLE 28.

DENSITY PER ACRE FOR TREE AND SHRUB SPECIES OF THE SOUTHEAST POINT HAMMOCK, BIG PINE KEY

(Based on three 3 x 50 feet quadrats). Cover and frequency per cent are also shown. The cover is shown by 6 classes: I—covering less than 1% of ground, II—1 to 5%, III—5 to 25%, IV—25 to 50%, V—50 to 75%, and VI—75 to 100%

Species	Under 1′	Over 1′ to 4′	Over 4′ to 12′	Over 12′ to 55′	Total	Cover	Frequency
1. Acanthocereus floridanus	108,416	10,261	580		119,257	IV	100
2. Amyris elimifera		580	581		1,161	III	100
3. Bourreria ovata			97		97	I	33.3
4. Bumelia angustifolia		1,355	871		2,226	III	100
5. Capparis cynophallophora	96	97			193	II	33.3
6. Capparis flexosa	96	194	194		484	I	100
7. Chiococca alba		581	96		677	II	100
8. Cephalocereus keyensis	484	968	1,258		2,710	II	33.3
9. Coccolobis laurifolia			97		97	III	33.3
10. Drypetes diversifolia		193	97		290	II	33.3
11. Eugenia buxifolia	968	2,904	774		4,646	III	100
12. Exostema caribaeum			194		194	I	66.6
13. Guettarda elliptica		97			97	I	33.3
14. Ichthyomethia piscipula				97	97	III	33.3
15. Krugiodendron ferreum	97	193		387	677	III	100
16. Mimusops emarginata			97		97	I	33.3
17. Pithecolobium guadalupense			387		387	III	33.3
18. Randia aculeata		387	290		677	II	66.6
19. Reynosia septentrionalis		581	387		968	III	100
20. Torrubia longifolia		97	97		194	I	33.3
21. Vallesia glabra			194		194	II	33.3
22. Xanthoxylum fagara		97			97	I	33.3
TOTAL	110,157	18,585	6,291	484	135,517		

is only a short time before the pineland assumes the appearance that it previously had.

5. **Land previously cultivated.** Much of the land (other than areas of marl) which has previously been cultivated is overgrown with very thick stands of *Pteris caudata.* Some of these are almost solid stands up to six feet in height. Such an area is shown in Figure 16. Scattered here and there through the *Pteris* in the less dense or more open spots may be found: *Ernodea, Eugenia axillaris, Lantana, Guettarda,* or *Rapanea.* Other openings and areas around the edges of the stand may yield to a number of species all mixed together: *Andropogon glomeratus, A. gracillus, Chloris petroea, Chiococca pinetorum, Agalinis keyensis, Myrica, Cirsium, Savia, Pithecolobium guadalupense, Mosiera, Torrubia longifolia* and *Flaveria linearis.* There was deer sign throughout these areas.

6. **Grass prairie at Northern End of Big Pine Key.** Data collected from the quadrat studies of this prairie are shown in Table 33. Twenty-eight species were listed (counting some of the grasses collectively). The prairie is covered by a blue-grey marl and the vegetation is very low making driving an automobile almost anywhere over it easy and practicable (Figure 4). Along the borders of the prairie are thick hammocks inland and a thick growth of mangrove toward the eastern shore. The area is reported to have been farmed in the past (the appearance of the vegetation gives the impression that it has) and it has also reportedly been burned.

TABLE 29.

FREQUENCY, DENSITY, AND COVER FOR SPECIES FORMING THE SOUTHEAST POINT HAMMOCK UNDERSTORY

(Based on six quadrats 3 x 3 feet). Cover is shown by 6 classes: I—covering less than 1% of ground, II—1 to 5%, III—5 to 25%, IV—25 to 50%, V—50 to 75%, and VI—75 to 100%

Species	Frequency	Density	Cover
1. Achyranthes ramosissima	16.66	0.16	II
2. Lasciasus divaricata	16.66	0.16	II
3. Morinda roioc	66.66	0.83	II
4. Myriopus volubis	16.66	0.16	II
5. Rivina humilis	50.00	0.83	II
6. Tillandsia circinata	16.66	0.16	I
7. Tillandsia usneoides	16.66	0.16	II

TABLE 30.

DENSITY OF TREE AND SHRUB SPECIES IN PINELAND BY FOUR SIZE CLASSES, FOURTH MONTH AFTER FIRE, BIG PINE KEY

Cover is shown by six size classes: I—covering less than 1% of ground, II—1 to 5%, III—5 to 25%, IV—25 to 50%, V—50 to 75%, and VI—75 to 100% (Based on four 3 x 50′ quadrats)

Species	Under 1′	Over 1′ to 4′	Over 4′ to 12′	Over 12′ to 55′	Total	Cover
1. Coccothrinax argentea	6.00	.75	.50		7.25	II
2. Elaphrium simaruba	.25				.25	I
3. Mosiera longipes	.50				.50	II
4. Pinus caribaea			.25	.75	1.00	III
5. Pisonia rotundata	1.25	.50			1.75	I
6. Pithecolobium guadalupense	31.75				31.75	I
7. Randia aculeata	22.50				22.50	I
8. Serenoa repens		.50			.50	I
9. Thrinax microcarpa	1.75	.25	1.00		3.00	III
10. Torrubia longifolia	.75	.50			1.25	I
11. Vachellia peninsularis	.25	.25			.50	I
12. Palm—unidentified seedlings	.50				.50	I
Total	65.50	2.75	1.75	.75	70.75	

TABLE 31.

DENSITY AND FREQUENCY FOR TREE AND SHRUB SPECIES IN BURNED PINELAND QUADRATS ON BIG PINE KEY BY MONTHS – FOR FOUR MONTHS BEGINNING MAY 26, 1952

(Based on 4 quadrats 3 x 50′)

Species	1st Month		2nd Month		3rd Month		4th Month	
	Density	Frequency %	Density	Frequency %	Density	Frequency %	Density	Frequency %
1. Coccothrinax argentea	1.00	75	4.25	100	4.25	100	7.25	100
2. Elaphrium simaruba	.00	0	.00	0	.25	25	.25	25
3. Mosiera longipes	.25	25	.50	50	.50	50	.50	50
4. Pinus caribaea	1.00	50	1.00	50	1.00	50	1.00	50
5. Pisonia rotundata	.25	25	1.50	50	1.75	50	1.75	50
6. Pithecolobium guadalupense	.50	25	5.25	100	22.50	100	31.75	100
7. Randia aculeata	.75	50	11.00	50	13.25	50	22.50	50
8. Serenoa repens	.50	25	.50	25	.50	25	.50	25
9. Thrinax microcarpa	2.75	50	2.75	50	2.75	50	3.00	50
10. Torrubia longifolia	.00	0	.00	0	1.75	25	1.25	25
11. Vachellia peninsularis	.25	25	.25	25	.50	25	.50	25
12. Palm–unidentified seedling	.00	0	.25	25	.50	25	.50	25

TABLE 32.

DENSITY AND FREQUENCY FOR UNDERSTORY SPECIES IN 13 BURNED PINELAND QUADRATS ON BIG PINE KEY BY MONTH—FOR FOUR MONTHS BEGINNING MAY 26, 1952.

(Quadrats 3 x 3 feet). Cover by six classes: I—covering less than 1% of ground, II—1 to 5%, III—5 to 25%, IV—25 to 50%, V—50 to 75%, and VI—75 to 100%

Species	1st Month Density	1st Month Freq. %	2nd Month Density	2nd Month Freq. %	3rd Month Density	3rd Month Freq. %	4th Month Density	4th Month Freq. %	4th Month Cover
1. Acalypha chamaedrifolia	.00	0.0	.00	0.0	.08	8.0	.08	8.0	I
2. Andropogen gracille	.15	15.0	.31	15.0	.40	15.0	.40	15.0	I
3. Aristida purpurascens	.08	8.0	.08	8.0	.08	8.0	.15	15.0	I
4. Bradburya virginiana	.00	0.0	.00	0.0	.00	0.0	.08	8.0	I
5. Chamaecrista keyensis	.00	0.0	.61	15.0	.70	15.0	1.08	15.0	II
6. Chamaesyce scoparia	.00	0.0	.08	8.0	.08	8.0	.08	8.0	I
7. Cirsium horridulum	.08	8.0	.00	0.0	.00	0.0	.00	0.0	
8. Croton linearis	.80	23.0	.46	40.0	.80	30.0	1.30	46.0	II
9. Dichromena colorata	.00	0.0	.00	0.0	.00	0.0	.08	8.0	I
10. Dyschoriste angusta	.08	8.0	.23	23.0	.23	23.0	.15	15.0	I
11. Evolvolus alsinoides	.15	15.0	.08	8.0	.08	8.0	.15	15.0	I
12. Flaveria linearis	.00	0.0	.08	8.0	.00	0.0	.00	0.0	
13. Galactia parviflora	.15	15.0	.46	31.0	.46	23.0	.61	31.0	I
14. Hypoxis wrightii	2.08	15.0	2.40	15.0	2.31	15.0	2.23	15.0	I
15. Liatris tenuifolia	.00	0.0	.08	8.0	.08	8.0	.15	15.0	I
16. Morinda roioc	.00	0.0	.00	0.0	.31	8.0	.31	8.0	I
17. Panicum sp.	.08	8.0	.00	0.0	.00	0.0	.00	0.0	
18. Physalis angustifolia	.31	8.0	.54	15.0	.54	15.0	.54	15.0	I
19. Phyllanthes pentaphyllus	.00	0.0	.08	8.0	.08	8.0	.08	8.0	I
20. Piriqueta tomentosa	.08	8.0	.08	8.0	.08	8.0	.31	23.0	I
21. Pityopsis graminifolia	.00	0.0	.08	8.0	.08	8.0	.08	8.0	I
22. Rhynchosia sp.	.00	0.0	.00	0.0	.15	8.0	.15	8.0	I
23. Ruellia hybrida	.54	15.0	.61	23.0	.54	15.0	.54	15.0	I
24. Smilax havanensis	.08	8.0	.46	31.0	1.15	40.0	1.15	46.0	II
25. Grass (unidentified)	.61	40.0	1.00	40.0	1.00	31.0	1.15	31.0	II

From the figures shown in Table 33 it can be seen that most of the species individually furnish little cover and are widely scattered. Grasses predominate and are found in all the quadrats. Most of the species are herbaceous types.

7. **Transition Zones.** These zones occur between the mangroves and hammocks or between the pineland and the mangroves. The zone is very irregular. Usually where hammock changes to mangrove there is a thinning out of the hammock species while *Conocarpus* becomes more numerous and usually grasses as *Panicum virgatum* or *Sporobolis virginicus* comprise much of the understory. This vegetation in turn

TABLE 33.

SPECIES OF PLANTS FOUND IN GRASS PRAIRIE AT NORTHERN END OF BIG PINE KEY SHOWING DENSITY, FREQUENCY PER CENT AND COVER

Cover is shown by six classes: I—covering less than 1% of ground, II—1 to 5%, III—5 to 25%, IV—25 to 50%, V—50 to 75%, and VI—75 to 100%
(Based on 10 quadrats 3 x 10 feet)

Species	Density	Frequency	Cover
1. Agalinis maritima	1.9	40	II
2. Andropogen sp.	0.2	10	II
3. Borrichia frutescens	4.8	30	I
4. Bumelia angustifolia	1.1	10	II
5. Cassytha filiformis	0.4	40	I
6. Chaetochloa geniculata	0.8	20	II
7. Chamaesyce scoparia	13.1	90	II
8. Chloris petraea	0.9	40	II
9. Conocarpus erecta	0.2	20	II
10. Croton linearis	0.1	10	I
11. Evolvolus alsinoides	0.5	40	I
12. Flaveria linearis	1.8	70	II
13. Ichthyomethia piscipula	0.1	10	I
14. Metastelma blodgettii	0.3	20	I
15. Morinda roioc	3.3	70	II
16. Neptunia floridana	0.1	10	I
17. Passiflora pallida	0.1	10	I
18. Physalis angustifolia	0.6	30	I
19. Pithecolobium guadalupense	0.8	20	II
20. Portulaca phaeosperma	0.4	10	I
21. Randia aculeata	7.5	90	III
22. Sideranthus megacephalus	0.2	20	I
23. Solanum blodgettii	2.9	50	II
24. Sporobolis virginicus	—	100	IV
25. Vachellia peninsularis	0.6	20	III
26. Waltheria americana	7.6	60	II
27. Ximinea americana	0.1	10	II
28. Grass (unidentified)	6.9	80	III

may grade off in open exposed limestone rock with a laminated crust and scattered scrub mangrove (*Laguncularia, Avicennia, Rhizophora* and *Conocarpus*) (Figure 2). Around depressions in the limestone may be found large mangrove (mainly *Rhizophora*) in a thick almost impenetrable mass. In other cases the hammock may grade off into a grass prairie type such as the one on Big Torch Key and the north end of Big Pine Key (See Number 6 above and Figure 4). Pineland may grade off into hammock first or it may just suddenly end and a grass prairie begin. Some of these prairies are large and extensive, others are small in area and narrow. In other cases the pineland may be bordered by a *Conocarpus* type of vegetation. Sometimes this strip of buttonwood may be very narrow, other times very wide, before the vegetation changes to the red mangrove type found along the shore line. In low marshy areas close to shore but inside the very thick red mangrove there may be large patches of sprawling *Batis maritima,* a foot to foot and a half high completely covering the ground. Table 34 shows the species that may comprise the transition zone.

8. **Open Scrub Type of Mangrove-Prairie.** The open scrub type of mangrove-prairie is made up of very few species. Here are found the four mangroves (*Rhizophora, Avicennia, Conocarpus,* and *Laguncularia*) in scrub form and generally widely scattered making walking comparatively easy. These trees are mostly 2 to 4 feet in height. Many times the ground is covered solidly with *Monanthochloe* or *Sporobolis virginicus.* At other times the few other species may show up prominently. At times the mangroves may be growing from practically solid exposed rock at which time there is little if any other ground cover (Figure 2). Table 35 shows the species common to this type of habitat.

9. **Beach Dune Community.** There are certain plants which are very typical of this habitat and grow profusely here. Many of these are herbaceous forms. Among the common ones are: *Uniola* and *Ipomoea pes-caprae,* the pioneer plants; *Canavali, Cenchrus echinatus, Galactia spiciformis, Melanthera deltoidea, Schobera angiosperma, Brachyrhamphus Cakile, Mallotonia,* and *Casasia.* The latter plants grow higher up on the dune. In addition such hammock forms as *Ichthyomethia, Coccolobis uvifera, C. laurifolia,* and *Metopium* are common, and here, too, *Cocos nucifera* may usually be found. Figure 9 shows the Southeast Point beach dune.

Discussion

Much of the data of the preceding pages has been combined and is shown in tabular form in Table 36. This table shows the keys most

TABLE 34.

PLANTS OF THE TRANSITION ZONE BETWEEN HAMMOCK AND RED MANGROVE OR BETWEEN PINELAND AND RED MANGROVE

(Based on 1 line transect, three 3 x 100′ quadrats, and general observations)

Trees and Shrubs	
Borrichia arborescens	Pisonia rotundata
Bumelia angustifolia	Pithecolobium guadalupense
Byrsonima cuneata	Randia aculeata
Coccolobis uvifera	Rapanea guayanensis
Coccothrinax argentea	Reynosia septentrionalis
Conocarpus erecta	Rhacoma crossopetalum
Erithalis fruticosa	Rhizophora mangle
Eugenia buxifolia	Serenoa repens
Jacquinnia keyensis	Sophora tomentosa
Metopium toxiferum	Suriana maritima
Mimusops emarginata	Thrinax microcarpa
Mosiera longipes	Torrubia longifolia
Pinus caribaea	
Herbs	
Agalinis maritima	Mariscus jamaicensis
Aster braceii	Morinda roioc
Borrichia frutescens	Panicum virgatum
Cassytha filiformis	Rhacoma ilicifolia
Chiococca pinetorum	Smilax havanensis
Ernodea angusta	Sporobolis virginicus
Flaveria linearis	Tillandsia balbiciana
Grass (unidentified)	Tillandsia circinata

TABLE 35.

PLANTS OF OPEN SCRUB TYPE OF MANGROVE PRAIRIE

(Based on three 3 x 100 feet quadrats)

Trees and Shrubs	
Avicennia nitida	Lycium carolinianum
Conocarpus erecta	Rhizophora mangle
Laguncularia racemosa	
Herbs	
Borrichia frutescens	Salicornia ambigua
Dondia linearis	Salicornia bigelovii
Grass (unidentified)	Sporobolis virginicus
Monanthochloe littoralis	

used by the deer (based on deer sign and observations), the acreage of the key, the extent of the different vegetation types, whether fresh water is available, deer sign noted by the writer and that noted by others.

The two keys, Big Pine and No Name Key, are most intensively utilized. These keys are rather close together and have similar vegetational types, although Big Pine Key has more fresh water available and the pineland is more open.

Big Torch and Middle Torch Keys are the next most used and are similar except that they lack pineland.

Ramrod and Howe Key are moderately used. Howe Key is very close to the north end of Big Pine and at low tide can be waded. These, too, lack true pineland areas.

Among those keys showing little use are Sugarloaf and Cudjoe Keys which are more like Big Pine than the keys in the second and third category and formerly supported a number of deer.

The keys in the fifth category are for the most part not as high above sea level, lack fresh water, lack pineland, hammock growth is not extensive, and the keys are small in size.

Although Big Pine Key has more fresh water available than the other keys, fresh water cannot, in the writer's opinion, be the sole reason for deer preference of Big Pine Key. On Ramrod Key where a few deer were found good fresh water is available in the ditches along the old abandoned state highway which would furnish water for as many deer as the key could hold. Although good waterholes on the other keys may not be as numerous the deer certainly would have no trouble in finding them.

LIFE HISTORY

Size

The key deer is the smallest race of Virginia white-tailed deer found in the United States. There is a gradual diminution in average size from the northern *borealis* race to that found on the keys, *clavium*, a characteristic common to species of homoiothermic animals. This latter condition is in direct contrast to poikilothermic animals (such as reptiles) whose sizes increase toward the equator. Insular forms of mammals also tend to be dwarfed (Hesse, Allee, and Schmidt, 1951).

Romans (1775) always spoke of small deer on the keys (except for Biscayo). To show that he was familiar with both the mainland and key forms the following passage is quoted:

TABLE 36.

DEER USE OF KEYS IN KEY DEER RANGE BASED ON EVIDENCE OF SIGN DURING COURSE OF SURVEY

Extent of habitat type, acreage of key, availability of fresh water, deer sign noted by writer, and deer sign noted by others are shown. Use is shown by 4 categories: I—Intensively Used; II—Less Intensively Used; III—Moderately Used; IV—Little Used; V—Not Used

Key	Acreage	Preference	Hammock	Pineland	Scrub Mangrove	Open Prairie	Mature Mangrove	Dunes	Fresh Water	Deer Sign Writer	Deer Sign Others
Big Pine Key	6000	I	Extensive	38% of Key	Extensive	Extensive	Some	Some	Plenty	Numerous	Numerous
No Name Key	1000	I	Extensive	16% of Key	Extensive	Some	Some	Very Restricted	Some	Numerous	Numerous
Big Torch Key	1400	II	Extensive	None	Extensive	Some	Some	None	Some	Moderate	Moderate
Middle Torch Key	1000	II	Extensive	None	Extensive	Some	Some	None	Some	Moderate	--------
Ramrod Key	900	III	Extensive	None	Extensive	Extensive	Some	Some	Plenty	Moderate	Few
Howe Key	930	III	Extensive	None	Extensive	Some	Moderate	None	Some	Moderate	Some
Little Pine Key	600	IV	Extensive	19% of Key	Extensive	Extensive	Some	Very Restricted	Some	Few	Moderate
Little Torch Key	770	IV	Extensive	None	Extensive	Extensive	Some	Some	None	Few	Few
Johnson Keys	350	IV	Extensive	None	Some	Some	Moderate	None	None	Few	--------
Water Key (Off Little Pine)	100	IV	Some	None	Some	Some	Some	None	Some	Few	--------
Annette Key	390	IV	Restricted	None	Some	Extensive	Extensive	None	None	Few	--------
Cudjoe Key	3300	IV	Extensive	7% of Key	Extensive	Extensive	Some	Some	Some	Very little	Some
Summerland Key	1100	IV	Extensive	None	Extensive	Extensive	Some	None	Some	None	Some
Sugarloaf Key	Large	IV	Extensive	Some	Extensive	Extensive	Moderate	Some	Some	None	Some
Big Spanish Key	73	V	None	None	None	None	Extensive	None	None	None	None
Little Spanish Key	39	V	None	None	None	None	Extensive	Restricted	None	None	None
Mayo Key	65	V	None	None	Extensive	Some	Extensive	None	None	None	None
Porpoise Key	20	V	Restricted	None	None	Extensive	Extensive	Small	None	None	None
Water Key (Off Big Torch)	216	V	None	None	Extensive	Extensive	Extensive	None	None	None	None
Top Tree Hammock Key	140	V	Moderate	None	Extensive	Some	Some	None	None	None	None
Knock'emdown Key	1100	V	Extensive	None	Extensive	Extensive	Extensive	None	None	? None	None
New Found Harbor	142	V	Moderate	None	Some	Some	Moderate	Extensive	None	None	None
Spanish Harbor	73	V	Restricted	None	Some	Some	Some	Extensive	None	None	None
Cutoe Key	175	V	None	None	Some	Some	Extensive	None	None	None	None

"Matacombe yields a few deer of a small kind; but large deer, bear, and turkies are not to be had without going to the mainland for them. I was once in great want of provisions at Matacombe, and sent a hunter with a boy in a skiff to the westward, at Sandy-point or Cape Sable; whence he returned in a few days, with thirteen large and very fat deer, properly salted and cured, which were excellent provisions for us for several days."

Ellicott (1803) remarked that the deer "are less than our ordinary breed of goats."

On the other hand Maynard (1872) who came to Florida for three winters (1868-69, 1870-71, 1871-72) to study the birds, but who also gave considerable attention to the mammals writes:

"This animal (deer) is found in all sections, even on the Keys. They inhabit small islands where they can obtain little or no fresh water, yet deer from these localities are noticeably larger than those from the mainland. Of this fact I have been assured by Lord Parker, an English gentleman, who has spent several winters in Florida, and who has killed a large number of these animals in all sections of the state."

Figure 15. *Acanthocereus floridanus* **and** *Opuntia dillenii* **found in the Southeast Point Hammock of Big Pine Key. These spiny plants form impenetrable thickets throughout this area.**

The writer was unable to measure any live or freshly killed key deer during the course of this survey; however, approximate figures were obtained in the field. Jack Watson, Refuge Manager, USFWS, watched a six point buck at the north end of Big Torch Key, September 4, 1951, rubbing his antlers against a tree. Upon seeing Mr. Watson the surprised buck started off but in doing so caught one antler on a rotten limb and the antler was shed. There was a stub of a limb on the tree which was at the deer's shoulder height. This was measured and found to be 26 inches. Watson also obtained a good sight record of a doe on the Pine Channel Bridge April 13, 1952, before she jumped the railing and swam to shore. She measured approximately 27 inches. Dr. Albert Schwartz (Curator of Vertebrate Zoology, Charleston Museum) and Neil Bell (Department of Zoology, University of Miami) while collecting specimens on Big Pine Key during February, 1953, observed two bucks, one in the morning of the 6th and the other in the morning of the 7th. These deer appeared very tame and could be approached closely. One of these bucks, with only "buttons" showing (see frontispiece) measured in the above manner was 24 inches at the shoulder. The other with antlers approximately 2 inches long had a shoulder height of 26 inches.

Figure 16. *Pteris caudata* **area on No Name Key. Note the thickness of this fern.**

Many of the old time residents and hunters of the Lower Florida Keys to whom the writer talked also know the west coast of the mainland (Ten Thousand Islands area). They state that there is no noticeable difference in size between those deer of the keys and those of the latter area. There are others, though, who state that the key deer might be slightly smaller.

Mr. Henry Watkins, a hunter for many years in the Lower Keys, who collected some of the specimens for Barbour and Allen in 1922, says that fully mature deer will range in weight from 55 to about 110 pounds and that a four point buck would probably weigh 60-65 pounds. He says further, "I have also hunted the Ten-Thousand Island area. The key deer will average smaller."

Mr. Lain Dobbs, another hunter who has done considerable hunting on the keys and Ten Thousand Islands gave similar information regarding weights. He says "my recollection is that the mainland deer

Figure 17. Doe observed April 22, 1952, for a total of about 1½ hours. The writer checked her shoulder height against vegetation twice. Mr. and Mrs. A. L. Chase of Big Pine Key who were with the writer also checked her height independently. The result was a measurement of approximately 27-28 inches. It is highly probable that this doe was the same one seen by State Biologists Fred Stanberry and Louis Gainey, March 11, 1952, in the same area on Doctor's Arm, Big Pine Key. They obtained a measurement of 27½ inches.

are about 15 pounds heavier than the deer on the keys, but there was no difference in the height."

The writer also talked to a Key West police officer, Mr. S. M. Hernandez, who said he had hunted only a few times on the keys but that in 1937 he killed a doe which weighed 72 pounds.

Barbour and Allen (1922) state in their paper dealing with the key deer: "A full-sized doe is reliably stated to weigh approximately 65 pounds; the larger of the two immature males (MCZ #18497) was said to have weighed 80 pounds."

Of the key deer specimens in the collection of Museum of Comparative Zoology, Harvard College, Cambridge, Mass., there is only one in which the measurement was taken (other than skull) and this is specimen MCZ 18060 which was an immature buck standing 26 inches at the shoulder*. It is indeed unfortunate that Barbour and Allen did not obtain some of these other measurements when they collected their specimens.

An eight-point buck hit by an automobile in the latter part of 1950 and mounted in El Anon Ice Cream Parlor on Duval Street, Key West, Florida, is 28 inches high at the shoulder in the mounted condition.

Apparently there are only four specimens in the National Collections and these are in the U. S. Fish and Wildlife Service Collections, Section of Birds and Mammals, Branch of Wildlife Research. Of the four, measurements were taken on only three. These three were collected by Jack Watson on Big Pine Key**:

Specimen number	Sex	Approx. age	Date	Shoulder Ht.	Weight
285520-33971X	F	3 yrs.	8/12/50	21 inches	35 lbs.
285844-34349X	F	6 mos.	12/14/50	18 inches	25 lbs.
285845-34350X	M	1 yr.	11/29/50	20 inches	27.5 lbs.

An "old dead doe" which was said to have died from natural causes collected by Jack Watson was 26 inches at the shoulder and the weight was estimated at 40-50 pounds.***

A buck killed on the highway June 17, 1951, and collected by Jack Watson had a shoulder height of 24 inches and a weight of 35 pounds.

Data, too, are rather scarce on deer of the Cape Sable and Ten Thousand Islands region.

*Letter to the writer from Charles P. Lyman, Associate Curator of Mammals, MCZ, Harvard College. Cambridge, Mass., dated April 22, 1952.

**Letters to the writer from Viola S. Schantz, Zoologist, Section of Distribution of Birds and Mammals Branch of Wildlife Research, U. S. Fish and Wildlife Service, Washington 25, D. C., dated April 23, 1952, and February 26, 1953.

***U. S. Fish and Wildlife Service Narative Report for January 1, 1948-April 30, 1948.

Cory (1896) remarks that a Florida deer will often weigh not over 110 pounds but he has killed them considerably larger.

Barbour and Allen (1922) comparing the Florida deer with the *virginianus* and *clavium* race state:

> "The deer of the extreme southern tip of Florida on the other hand is very small indeed, with a small skull and small delicate antlers, yet with a tooth row very little reduced in absolute size from that found in typical *virginianus* . . . . . Finally, we are describing as a very distinct geographic race the small pallid deer with reduced tooth row that inhabits the southernmost keys of Florida."

After examining and comparing skulls of *clavium* with those of the mainland, the writer heartily agrees with Barbour and Allen (1922) that the individual teeth are obviously smaller and the tooth row shorter in the former race. Fourteen skulls and 10 skins of *O. v. clavium* were loaned to the University of Miami, Department of Zoology from MCZ, Harvard College. The writer was fortunate in having Dr. Albert Schwartz, a mammalogist as well as taxonomist, examine these skulls and compare them with data of his own on the *osceola* race. His measurements and conclusions are quoted below.

Antler measurements of five antlers picked up in the field by the writer are shown in Table 37. Only one of these was a recently shed antler. The largest of these, even with a part of the point of the main beam broken off measured 377 mm. along the outer curve. The measurement of antlers on the finest head of six adult deer from Chokoloskee (Barbour and Allen, 1922) was 375 mm.

Measurements and conclusions of Dr. Albert Schwartz in his examination of the 14 skulls of *Odocoileus virginianus clavium* from the Museum of Comparative Zoology, Harvard College.*

Measurement	*O. v. clavium (5 adult male)*	*O. v. osceola (4 adult male)*
Greatest length of skull	*248.7 (231 - 255)*	*266.8 (254.5 - 293.3)*
Condylobasal length	*221.6 (210 - 230)*	*255.5 (246.2 - 278.5)*
Greatest length of nasals	*79.1 (75.1 - 86.3)*	*89.9 (83.2 - 100.0)*
Least breadth of nasals	*16.8 (14.2 - 18.0)*	*17.1 (15.3 - 20.1)*
Width between paroccipital processes	*54.4 (50.8 - 60.1)*	*71.6 (62.2 - 86.7)*
Least interorbital width	*60.9 (55.0 - 65.5)*	*56.9 (55.0 - 68.2)*
Width across orbit at fronto-jugal suture	*109.1 (99.5 - 115.2)*	*102.4 (91.0 - 121.3)*
Palatal length	*150.8 (140.7 - 158.1)*	*166.8 (160.7 - 181.7)*
Least width of palate	*26.5 (22.9 - 28.5)*	*24.5 (23.9 - 26.0)*
Length of upper molariform tooth row	*63.5 (60.3 - 65.3)*	*74.7 (72.4 - 77.1)*

*Letter to writer dated July 15, 1952.

Conclusions:

Examination of 14 specimens of O. v. clavium from the MCZ, of which five may be considered full adult bucks gave the above measurements, in mm. Comparison of these data with measurements taken from four adult bucks of O. v. osceola, as this race is known to me and represented by specimens taken in the central plains region of Monroe County, Florida, shows the following:

O. v. clavium seems to be a distinctive form. Perhaps its best character is the small tooth row and correspondingly smaller individual teeth; this character is obvious merely by observation of the skull and comparison with the skulls of osceola. The table of measurements above show that the tooth row measurements of clavium and osceola not only average differently, but that there is no overlap in tooth row measurements. Another character is the width between the paraoccipital processes; the occipital region of the skull appears to be narrower in clavium than in osceola, and this narrowness is reflected in the measurements of the inter-paroccipital distance. Measurements of greatest length and condylobasal length show that clavium both averages and actually is smaller in these two measurements. Observations on the skulls indicate that clavium has a shorter and broader rostrum than does osceola, when skulls of two adult bucks of the same skull length are compared. The shorter palatal length of clavium also reflects the smaller skull of this form. For various reasons, the other measurements seem not to be significant.

The above notes indicate to me that the differences between clavium and osceola are such as we usually consider to be those between two subspecies of the same species. They certainly are not what I might consider specific differences, and are rather a question of degree of development. The isolation of clavium has led to the evolution of a slightly smaller form, but clavium, as I understand the form from a systematists viewpoint, is no diminutive or pygmy form. This is obvious from the original description."

After considering all the above data and observations of deer, the writer considers the key deer a small race. However, there is no extreme difference in size of this deer and the deer found on the southern tip of the mainland. There would naturally tend to be somewhat of an overlap, i.e. the larger key deer will overlap small mainland individuals. Unless one is thoroughly experienced, deer seen in the field in the keys will appear the same size as those found on the adjacent mainland. The only real means of comparing the two from such observations would be to have them side by side.

After examination of the skulls of key deer specimens in the MCZ collection the writer greatly doubts that any of the *virginianus* race were ever introduced into the area as rumor has it.

A number of deer seen by the writer in the field appeared to be about the size of the 28 inch mounted specimen in El Anon Ice Cream Parlor at Key West, however, some of these may have been slightly larger. Since in all other races of deer there is a great variation in size of mature animals it is likely that there is a similar variation in the size of individuals here also.

Food Habits

Food habit studies were made by direct observation of the deer, browse evidence, pellet analysis, and one stomach analysis. Table 38 lists species used by the deer and the method of determination. In addition to those listed, an old resident of the area reports that she has watched them feed on *Salicornia.* Nearly all the old timers mention having watched them browse on the mangroves and buttonwood.

Direct Observation. Observation of key deer feeding occurred only in rare instances. The writer was indeed fortunate, however, on June 10, 1952, when a small buck in the velvet was noted at 1:05 p.m. by Mr. and Mrs. A. L. Chase as he walked across their yard on Big Pine Key. They watched him for an hour while he browsed on *Vachellia peninsularis* and *Pithecolobium guadalupense* and at one time chewed or licked some rosin off a pine tree. Raccoons have been observed to eat this rosin so it may be that they get something of value from it. It was a hot afternoon and the buck was panting. He would bed down every now and then to chew his cud. Mr. Chase came and got the writer at 2:00 p.m. while his wife watched the

TABLE 37.

Measurements (in millimetres) of five key deer antlers found by the writer during the course of the study. Only one had been recently shed. Length of main beam measured along the outer curve.

Site	Date	No. of Points	Length of Main Beam	Length of Points 1	2	3	Basal circ.	Mid Beam circ.	Antler
Big Pine Key	4/4/52	4*	377	Broken	63	51	90	78	Left
Middle Torch Key	8/25/52	3	307	None	100	46	70	70	Left
Big Pine Key	3/8/52	2**	256	None	78	.....	59	59	Left
Big Torch Key	4/28/52	1	211	None	None	None	52	45	Right
Big Pine Key	2/8/52	4***	327	Missing	93	33	76	72	Right

*All points broken off or parts thereof – the remaining portion measured.
**Abnormal – flattened and fork-horned.
***Basal point missing, tip of point No. 2 missing.

deer. The writer was able to watch this buck until nearly 7:00 p.m. at which time he left the buck. The buck appeared very tame and could be approached to within 10 feet. Whenever he bedded down the writer would force him to move on so that browse plants could be noted. Seventeen of the 21 species of plants listed as direct observation in Table 38 were browsed on by this deer. Several times deer have been seen to feed on *Chamaesyce scoparia* and *Coccothrinax argentea* and in two instances on *Torrubia longifolia.* A buck on No Name Key has been observed by Mr. Thomas R. Mullen several times feeding on *Calonyction tuba.*

Browse Evidence. Browsed plants were not found often, probably because of scarcity of deer. However, there were certain places where it could easily be noted. One of these sites was a spot with about a 15 foot radius located in the open pineland of Big Pine Key about 300 feet from the highway behind the old location of the State Road Prison Camp (Figure 20). This site is in plain view from the highway. Beach (shell) sand had been dumped at this spot and now supported a type of vegetation commonly found on or near the beach (of Big Pine Key). The prominent plants were *Melanthera deltoidea, Solanum nigrum, Schobera angiosperma, Amaranthus hybridus* and *Portulaca oleacea.* Using a one-twentieth acre quadrat (46.5 x 46.5 feet) to cover this small patch and to include an outer margin, the plants that were noted are shown in Table 39. The patch was first noted December 19, 1951 at which time the vegetation was up to three or four feet high. On February 3, 1952, it was found to have been cut back. Closer examination revealed that deer had browsed here rather extensively and recently. At this time 15 pellet groups were found and removed. These contained many *Coccothrinax* seeds, *Vachellia peninsularis, Physalis, Smilax, Solanum nigrum, Thrinax* and material from *Rhizophora mangle.* Three plants extensively utilized were *M. deltoidea,* S. *nigrum* and *Schobera.* A few *Amaranthus* and possibly some *Portulaca* also showed browsing. The spot was again visited on February 11, at which time eleven more groups of pellets were collected, some of them just deposited. Analysis of the pellets revealed similar findings. On February 25, five more groups were collected here and five groups in a somewhat similar dune patch 150 feet away. This latter spot had been checked previously on February 11 at which time no droppings were found.

Deer browse has also occurred at the Southeast Point on *Amaranthus, Melanthera,* and *Brachyrhampus* several times. Browse on *Eri-*

TABLE 38.
DEER FOOD DETERMINED BY BROWSE EVIDENCE, DIRECT OBSERVATION, PELLET ANALYSIS, AND STOMACH ANALYSIS

Species	Browse	Observation	Pellet	Stomach
1. Agalinis maritima	x	x		
2. Agave sisalana	?			
3. Amaranthus hybridus	x		x	
4. Avicennia nitida		x		
5. Bidens pilosa	x			
6. Bourreria ovata	?			
7. Brachyrhamphus intybaceus	x			
8. Bumelia angustifolia		x	x	
9. Calonyction tuba	x	x		
10. Casasia clusiifolia			x	
11. Cassytha filiformis			x	
12. Chamaesyce buxifolia	x			
13. Chamaesyce hypercifolia	x	x		
14. Chamaesyce scoparia	x	x		
15. Coccolobis uvifera		x		
16. Coccothrinax argentea		x	x	x
17. Conocarpus erecta		x		
18. Crotalaria maritima			x	
19. Dolicholus minimus			x	
20. Echites echites	x	x		
21. Erithalis fruticosa	x		x	
22. Ficus brevifolia	?			
23. Galactia parvifolia			x	
24. Jacquinnia keyensis		x	x	
25. Laguncularia racemosa		x		
26. Lantana involucrata			x	
27. Malvastrum corchorifolium			x	
28. Meibomia purpurea			x	
29. Melanthera deltoidea	x			
30. Mimusops emarginata			x	
31. Monanthochloe littoralis		x		
32. Morinda roioc		x	x	
33. Neptunia floridana			x	
34. Physalis angustifolia			x	
35. Pinus caribaea			x	
36. Pithecolobium guadalupense		x		
37. Portulaca oleacea	?			
38. Randia aculeata			x	
39. Rhizophora mangle		x	x	
40. Ruellia hybrida		x		
41. Schobera angiosperma	x			
42. Smilax havanensis	x	x	x	
43. Solanum bahamense			x	
44. Solanum nigrum	x		x	
45. Tamarindus indica			x	
46. Thrinax microcarpa			x	
47. Tillandsia circinata		x	x } ?	
48. Tillandsia utriculata	x		x }	
49. Torrubia longifolia		x		
50. Typha domingensis		x		
51. Vachellis peninsularis		x	x	
52. Ximinea americana				x

thalis occurs regularly in a small isolated stand of pineland on the west side of Big Pine Key but in other areas such evidence is usually hard to find.

Agave sisalana at an old abandoned homestead at the north end of Big Torch Key where there is much deer sign appeared to have been browsed on by deer – especially the young terminal bud leaves. However, a patch of *Agave* on Big Pine Key where much deer sign has occurred showed no such usage.

A plant of *Bourreria ovata* and *Ficus brevifolia* gave the appearance of deer browse but it is possible the condition came about by other means.

Two gardens were planted on Big Pine Key the latter part of November, 1951, by the writer and were maintained for some time. These were placed in areas used by the deer to see what use, if any, the deer would make of them. Sweet potatoes, corn, collards, tomatoes and peas were planted. The corn and peas did not grow well, however. Although tracks were found nearby and even in the gardens several times, only once did deer make use of the plantings (leaves of sweet potatoes only). All the old homesteaders of the area claim that when

TABLE 39.

PLANTS OF THE SAND DUNE PATCH FOUND IN THE PINELAND OF BIG PINE KEY

The following symbols are used for degree of dominance:

P – prominent
M – moderate in number
F – few
R – rare

Species	Dominance	Species	Dominance
Amaranthus hybridus	P	Meibomia purpurea	F
Andropogon gracillus	R	Melanthera deltoidea	P
Bidens pilosa	M	Morinda roioc	F
Buchnera elongata	R	Paspalum blodgettii	R
Cakille fusiformis	F	Paspalum vaginatum	M
Capriola dactylon	F	Phyllanthes pentaphyllus	R
Chaetochloa geniculata	M	Pinus caribaea	F
Chamaecrista keyensis	F	Pisonia rotundata	R
Chamaesyce hypercifolia	F	Pityopsis graminifolia	F
Chloris petraea	M	Portulaca oleacea	P
Cirsium horridulum	F	Pterocaulon undulatum	F
Coccothrinax argentea	F	Rhynchosia cinerea	F
Croton linearis	F	Schobera angiosperma	P
Cyperus brunneus	F	Smilax havanensis	F
Flaveria trinerva	M	Solanum nigrum	P

deer were numerous the only way to keep them out of their gardens was to shoot them. They all mention that the deer are particularly fond of sweet potatoes. Mr. and Mrs. A. L. Chase have observed deer to walk through their garden without touching anything, passing on to *Chamaesyce hypercifolia* which was growing in their yard.

A number of feeding stations were set up from time to time during the course of the study using apples, mangos, dried corn, oats, rabbit feed (pellets and alfalfa), cigarettes, and lump sugar. These were placed among trails and in areas which showed deer use. In addition sweet potatoes planted in cans were used, setting them along trails. The apples were hung by string in an attempt to keep raccoons from reaching them. At no time did the deer make use of such food even though there might be fresh tracks all along the trail where such food was placed. Jack Watson, however, says that he has had deer take apples a number of times.

Pellet Analysis. Pellet material was analyzed in two ways. The first method was to crush the pellet and pick out the seeds, seed fragments, and other material which were checked against herbarium specimens. The other method was to examine a sample of the pellet group under the microscope, looking for characteristic cell structures, scales, and hairs which might be identified. The H-shaped idioblasts found in the cortex of the stems and twigs of *Rhizophora mangle* were easily identified in the droppings as well as the scales of the fruit and twigs of *Mimusops emarginata* and the scales of *Tillandsia.* Some of the scales of the different species of *Tillandsia* appeared identical to the writer so he did not pursue the issue any farther. The hairs on some of the other plants were also too much alike to arrive at a definite conclusion.

Of a total of 293 groups examined histologically, 63.48 per cent contained *Rhizophora* material and 6.83 per cent contained scales of *Tillandsia.*

The identification of seed and material (combined for the above two methods) revealed the percentages shown in Table 40 for the 293 groups examined.

Stomach Analysis. Only one stomach analysis was obtained. This was made on the remains of material from the stomach of a buck killed on the highway at Big Pine Key, June 17, 1951. The material was made up of *Coccothrinax* fruit, both immature and ripe, including peduncles and pedicels, and several seeds of *Ximinea americana.*

Discussion. Because of the sub-tropical climate of lower Florida, plants never cease growing, or do they even drop their leaves except in rare cases. Many of them flower and fruit several times a year and there is no time of the year when some of these fruits are not available. Since many of them grow around salt or brackish water their vegetative parts may be very succulent.

It is evident not only from the pellet analysis but also from reports of hunters and people living in the area that the mangroves make up a large bulk of the deer's diet. That at least the red mangrove (*Rhizophora mangle*) has some nutritional value has been shown by Boris Sokoloff, et al. (1949 1950). They found that mangrove leaf contains from 12.1 to 14.3 per cent protein. This compares with alfalfa meal which contains 16%, alfalfa leaf meal 20%, corn 9%, oats 12%, barley 13%, and wheat 12% protein. The amino acid composition was found to be similar to that of alfalfa leaf. The carotene content of mangrove leaf was found inferior to alfalfa leaf, but thiamin, riboflavin, folic acid and pantothenic acid contents approached that of alfalfa.

In a chick feeding trial of two lots of 100 chicks each – one lot was fed with a feed containing alfalfa meal and the other with mangrove meal, they found that the lot fed on the feed containing mangrove meal increased in weight as well if not better than those getting alfalfa. In tests on cattle using mangrove leaf meal, Eddy and Sokoloff (no date

TABLE 40.

LIST OF SPECIES FOUND IN 293 PELLET GROUPS SHOWING PER CENT OCCURRENCE. GROSS ANALYSIS AND HISTOLOGICAL METHODS WERE USED

Species	Per cent
Rhizophora mangle	63
Coccothrinax argentea	43
Vachellia peninsularis	26
Mimusops emarginata	21*
Physalis angustifolia	20
Thrinax microcarpa	20
Morinda roioc	13
Erithalis fruticosa	10
Smilax havanensis	7
Tillandsia spp.	7
Solanum nigrum	4
Casasia clusiifolia	3
Crotalaria maritima	2
Solanum bahamense	2
All others each less than	2

*Based on only 202 pellet groups.

of publication) found that the leaf meal produced by the dehydration of red mangrove leaves shows possible use up to at least 40% of the ration as an ingredient in the feed mixes of both dairy cattle and in the production of calf fattening rations.

Leaves of *Avicennia marina* are fed to camels about the Red Sea and Persian Gulf where fodder is a thing of much value (Burkill, 1935). Paranjpye (1920) says that branches of *Avicennia* (*A. officinalis*) are cut and fed to cattle in the Ratnagiri district of the west coast of India and Baker (1920) states that cattle eat the leaves of the Australian *Avicennia* or grey mangrove with great relish. Cattle in New Zealand also are known to feed on *A. officinalis* (Imperial Agricultural Bureaux, 1947).

Breeding Habits

Shedding and Regrowth of Antlers. A buck seen by Jack Watson April 27, 1952, was believed to have just shed antlers. On May 13, 1952, he observed an anterless buck and a doe. A six point buck was seen by Tony Stevens, Game Commission photographer March 20, 1952. Several other bucks with antlers were also noted during these months. An antler which appeared freshly shed was picked up by the writer April 28, 1952.

Bucks were seen in the velvet from May 28 to September 5, 1952. A buck observed by Jack Watson June 1, 1952 had 8 inch antlers. One observed by the writer May 28 had antlers 4 inches long. The small buck (Figure 17) seen June 10 had very short antlers but other bucks seen about that time had 2 or 3 tines per antler. A buck in the velvet observed September 3, 4, and 5, 1952, by Mr. and Mrs. A. L. Chase in their yard was again seen there by them September 7 and at this time appeared to have polished antlers.

On September 20 the writer found four *Avicennia* trees scarred and with many broken branches – in fact, one was so mangled that it appeared as if a bulldozer had run over it – evidence of bucks trying to get velvet off. At three of these trees droppings were found. Most of the leaves were brown but where the branches were still partially attached to the tree, some of the leaves were still green. The "horning" probably occurred during the previous week. According to Dixon (1934) and others, polishing of the antlers by "horning" may continue until the antlers are shed. On December 10, 1951, several buttonwood (*Conocarpus*) trees in the Watson Hammock area had broken, twisted and scarred branches from "horning" activities. The condition of the branches and leaves at that time indicated that this activity had taken

place within the previous two weeks. Some young shoots of an old *Avicennia* tree noted on December 11 on the beach also showed evidence of such usage. In this case the petioles of the broken twigs and limbs were still green. On December 15 broken branches and twigs of a buttonwood tree were found which did not yet show wilting. Further "horning" was noted up through the first half of February. Fresh or fairly fresh droppings were usually found around the "horned" trees.

A buck observed for about 10 minutes by the writer December 24, 1951, had well polished antlers. The antler obtained by Jack Watson September 4, 1951, (page 91) was polished. Of the other buck observations after September none were seen in the velvet.

From the above data it appears that shedding of antlers takes place during March and April. Regrowth begins about May and the velvet is shed around September. The case of the buck shedding an antler in September was probably abnormal.

Mainland bucks shed antlers usually in February and March according to Mr. Fred Fuchs of the Redland Section of Dade County, a hunter for many years in the Everglades region. Mr. Fuchs states that he once killed an old buck in December which had one antler – the other antler had recently been shed.

Rutting. At the sand dune patch in the pineland of Big Pine Key evidence on February 11, 1952, indicated that a buck fight had been staged. The ground at this time was torn up and fresh droppings were scattered around this spot. On February 25 the second dune patch also showed evidence of a recent scuffle. In February, 1953, Jack Watson found evidence of another fight in this latter patch. Again many droppings were noted. Bucks have been noted with does throughout the year. These data may indicate that the rut takes place about February.

Dropping of Fawns. Observations of spotted fawns have been made from August through June which substantiates Barbour and Allen's (1922) statement regarding the hunters' claim that there is no special breeding season for these deer. Jack Watson reported seeing two deer at 7:30 a.m. August 24, 1952: a doe and a last year's fawn. The doe appeared to be heavy through the belly. On July 26, 1952, Mrs. Chase noted a doe which came into her yard at 10:05 a.m. to feed on berries of *Coccothrinax*. She said the doe appeared to be heavy with fawn. Jack Watson on September 16, 1952, saw a doe and spotted fawn at 10:00 p.m. on Big Pine Key. Captain Ed Barry of Big Pine Key took a picture of a spotted fawn February 25, 1952. Three previous observations of spotted fawns have been recorded by Jack Watson:

August 15, 1950. Two spotted fawns seen by Joe Knight, Conservation agent.

December 13, 1950. Doe, buck and spotted fawn seen by toll gate keeper.

September 1948. Two spotted fawns seen by Myrtle and Wesley Gibson of Big Pine Key.

Watson also noted some very small pellets and tracks on the northwest side of Big Torch Key about August 1952. The writer observed a doe and fawn October 27, 1951, but was unable to determine whether the fawn was spotted. In the period from about April to June 1953, a number of spotted fawns have been observed: a driver for the Gulf Oil Company saw two together with a buck and doe in April; Mr. and Mrs. A. L. Chase saw one in April with a doe; and Tony Stevens noted a doe and small fawn June 8. Besides these specific observations for this latter period several other observations have been reported.

According to Mr. Fuchs the peak of the fawning season of the mainland deer is April but does may drop fawns anytime from March to September. Maynard (1872) wrote that Florida deer drop their fawns about March.

There have been several observations in recent years of twin fawns but Mr. Henry Watkins, after all the years he has hunted these deer states "I have seen only one fawn per doe although I heard of one case where there were two."

Regarding the number of fawns dropped by mainland deer Mr. Fuchs states that in certain years twin fawns are seen while in other years only single fawns are to be noted.

It would appear from the above data on the two forms that their breeding habits are similar.

Pelage. The winter coat of the key deer is darker than that of the summer appearing more bluish-grey, the summer coat being tawny. Deer in both light or dark coat have been noted by the writer in February and April, indicating the period of change from the winter dark to the lighter summer coat. Maynard (1872) states that the mainland form sheds early in February.

Population

A number of attempts were made to reach an accurate population figure of deer on the keys. The results were not very satisfactory other than indicating the scarcity of deer.

Deer Drive. A deer drive was conducted March 16, 1952, at the north end of Big Pine Key, beginning at a line one and one-eighth

miles south of the northern tip of the island. The drive line was approximately 3/4 miles long. The drive got under way about 10:30 a.m. with 65 drivers on the line. These drivers walked toward the northern tip of the key which narrows down to a small point. Observers and photographers in ten boats covered the shore line for one end of the drive line to the other around the point. A Game Commission plane flew overhead. Although the drivers may have missed some small areas because of the ruggedness of the terrain and vegetation, the area as a whole was fairly well covered and some areas were actually covered twice. One cannot appreciate how rugged and almost impenetrable some of the vegetation is in the area until one has seen it. No deer were seen by the drivers, indicating the real scarcity of these animals.

Aerial Census. A census from the air in a Navy blimp was also attempted. It was thought that a blimp flying at low altitude might be a means of counting the deer. The flight was made September 18, 1952, leaving the Boca Chica Naval Air Station about 9:00 a.m. The keys were combed back and forth, taking each key separately. From the air the vegetation as a whole appeared mostly very open so that deer not bedded down under some tree or shrub should have been easy to spot – at least if they were moving. However, in red mangrove areas and some of the hammocks, this was not the case as these areas were very dense. Big Pine Key was covered first, then No Name, Little Pine, Little Torch, Middle Torch, Big Torch, and Ramrod Keys were worked in the same manner. The flight was completed about noon.

Although several raccoons were seen running along the ground and many birds and butterflies could be seen moving about, only one deer was observed. This one was seen on Big Pine Key toward the north end at 10:45 a.m. by several members of the crew after the ship had passed over. Since no more deer were seen, the chances are that all were remaining "frozen" like the one above until the airship had passed over, or they were already under cover. However, members of the crew stated that elsewhere deer will flush when a low flying airship passes over. Here, though, the deer may have become accustomed to the many planes and blimps flying over the area at all times of the day. But even so, if there were many deer certainly some would have been in the open where they could easily have been seen.

Pellet Group Counts. Another type of census which was attempted but proved unsatisfactory for this area was that of counting

pellet groups. It has been shown by Bennett, et al (1940) that in certain areas where populations were known:

1 deer to 15	acres deposited	(summer)	33.4	groups per acre per month
		(winter)	28.5	groups per acre per month
1 deer to 50	acres deposited	(summer)	8.2	groups per acre per month
1 deer to 60	acres deposited	(summer)	6.48	groups per acre per month
1 deer to 6–14	acres deposited	(year round)	54	groups per acre per month
1 deer to 15	acres deposited	(year round)	24.9	
1 deer to 14–18	acres deposited	(year round)	26.4	
1 deer to 46–69	acres deposited	(year round)	18.7	
1 deer to 60–72	acres deposited	(year round)	11.7	

With this type of census in mind the project leader set up quadrats on Big Pine Key along the roadway every three-quarters of a mile. Using a compass, a course perpendicular to the road was taken out to the shore line. All pellet groups were picked up within five feet of either side of the line walked. These quadrats were not previously cleared of droppings and any found were thus picked up.

It should be mentioned that droppings found in this area have been noted to remain a year or more without deteriorating, once they have become dry, even though they are subsequently soaked with water. To test this quality several fresh dry pellets were placed in cans with marl. One can was exposed to the weather, one was kept dry, and one was partially filled with water part of the time. They were put in the cans in August, 1951, and were still in fairly good shape in August, 1952.

Table 41 shows the 16 quadrats run with a total of only five pellet groups collected. The total area sampled amounted to approximately 13.81 acres and covered a distance of approximately 11.41 miles. The distance was scaled from topographical charts. Every type of terrain was covered in these samples. Big Pine Key contains a total of approximately 6,000 acres of land. The southeastern peninsula, however, was not included in the sample.

If the sample is considered adequate and the droppings for a whole year were picked up on this survey then 0.03 dropping groups per month per acre were deposited. This figure is extremely small. Taking the one deer to 50 acres depositing 8.2 groups per acre per month, as a basis, then one deer to 5000 acres should deposit 0.82 groups per month. From these figures it is evident that this type of census cannot apply to this particular area. However, it should again at least indicate the scarcity of deer.

The areas where the droppings of the key deer were found were rather restricted. The deer tend to use the same spots to make their depositions. During the past year a total of about 366 collected and

uncollected groups have been noted. These have been found on a number of the keys, but mostly on Big Pine and Big Torch Keys. These pellet groups are practically all that have been noted by the project leader throughout the field work. A few of those on Big Torch Key were gathered collectively and thus the number of individual groups was estimated in these cases. Thus the finding of only 30.5 groups per month scattered over some 22,000 acres of key deer range would indicate very few deer. Table 42 shows the number of dropping groups found on the different keys.

Track Counts. The counting of tracks is usually considered an unreliable means of obtaining a population figure. If this method were to be of value in the lower keys area the count should be made after a heavy rain and all the keys should be worked at the same time. Tracks do not show up in the rocky pineland and much of the shoreline is rocky. In the marl prairies and marshy areas where the ground may remain damp tracks may appear fresh for a week or more. Another point against a track count census is that the keys are small comparatively and one deer may do a lot of running in a night, especially along shorelines. On the other hand deer are known to stay in certain areas, possibly within a quarter mile radius, for several days at a time.

TABLE 41.

NUMBER OF PELLET GROUPS FOUND IN SIXTEEN 10 FEET WIDE QUADRATS SPACED EVERY THREE-QUARTER MILE PERPENDICULAR TO THE ROAD AND EXTENDING TO THE SHORE

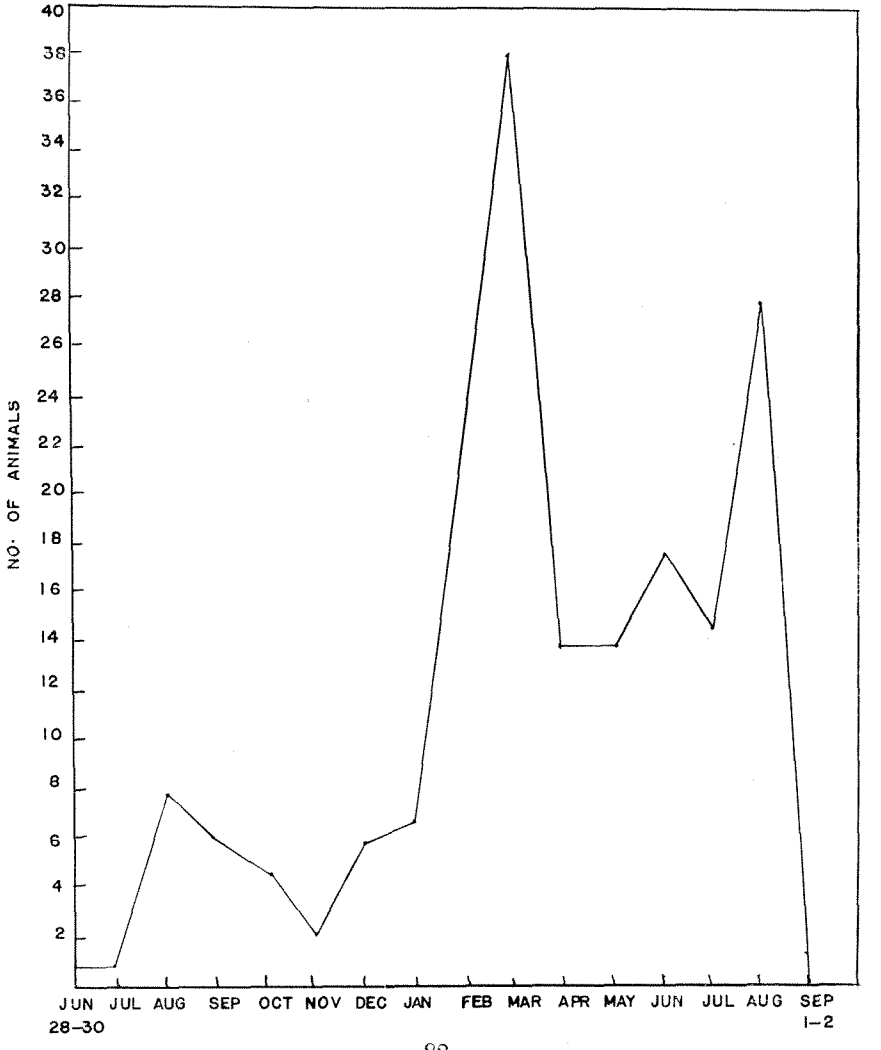
Length of quadrat (in feet) and acreage of quadrat are also shown

Quadrat Number	Number of Groups Found	Length of quadrat	Acres
1	0	4,166.68	0.96
2	0	3,750.01	0.86
3-4	0	9,583.36	2.20
5-6	0	7,500.02	1.72
7-8	0	6,866.68	1.57
9-10	0	6,866.68	1.57
11-12	1	9,733.35	2.23
13-14	1	5,200.01	1.19
15	0	4,333.34	0.99
16	3	2,266.67	0.52
TOTAL	5	60,266.80 or 11.41 miles	13.81

Deer Observations. A total of only 187 deer observations were recorded by the writer during the period June 28, 1951, through September 3, 1952. Of this number he himself made 40 and Jack Watson 59. Although the writer had searched for these deer at night along the roads and through the woods he never made any night observations until January 2, 1953. However, of the 187 observations 49 were at night and 35 of the 49 were Watson's.

Table 43 gives a breakdown of the observations as to bucks, does, and undetermined deer (including fawns and yearlings). The buck-

Figure 18. Observations of 187 deer by months, June 1951 through September 1952.

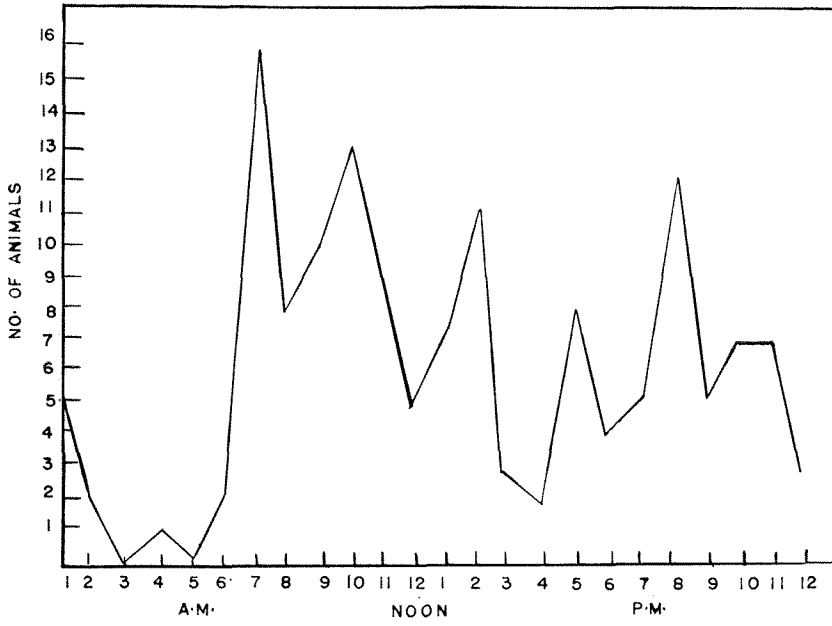


doe ratio from these figures is practically 1:1. Figure 22 shows the time of day for 145 of the observations. Most of the deer were seen in the early part of the morning around (7:00 a.m.), however a good number were noted during most of the daylight hours, and between 7-8 p.m. in the evening. The fewer deer seen at night can be accounted for by the lessened visibility and the fact that fewer people are around to do the observing.

The most deer that the writer has ever jumped in the field in any one day has been three. These three were jumped individually at the north end of Big Pine Key within about one and a half hours time on August 24, 1952. On August 22, 1952, two were jumped in the same area within an hour. On October 9, 1951, a doe and fawn were seen together as they ran across the shallow water of a slough on Big Pine Key. Other than these only one deer has been seen by him in any one day even though the whole day may have been spent in the field searching for them.

One of the residents of Big Pine Key in 1951 ran across six together on No Name Key. Another old timer of the area speaks of having seen as many as fifteen together in years past. On August 19, 1952, Jack Watson saw three small deer together at 8:30 p.m. and he states that these looked to be last year's fawns. On March 16, 1952, the day

Figure 19. Time of observations of 145 deer, June 1951 through September 1952.



of the deer drive, it was reported to the writer in April that four deer had been seen at the north end of Big Pine Key on that day.

Figure 19 shows the 187 deer observations by months graphically. The highest peak was in March, 1952, and the next highest was in August. The observations from February through August, though, were all high compared to previous months. Part of this may be caused by lack of reports during the first part of the work when the writer was new in the area. However, all reports of observations recorded by Jack Watson during this time have been included. Therefore, the total figure should yield correct results. The toll gate keepers and others claim that spring (March and April) is the time of the year when most deer are seen. Since all but 12 of the observations have been on Big Pine Key these data may indicate that some of the deer move to Big Pine Key during this part of the year. At the same time, however, tracks have always been found on the other keys which the deer inhabit.

TABLE 42.

TOTAL NUMBER OF PELLET GROUPS FOUND LISTED BY KEYS FROM JUNE, 1951, THROUGH SEPTEMBER, 1952

This number includes collected and uncollected groups

Key	Number of Groups
Big Pine Key	210
Big Torch Key	88
Little Pine Key	12
Ramrod Key	30
No Name Key	14
Cudjoe Key	1
Howe Key	6
Middle Torch Key	5
TOTAL	366

TABLE 43.

DEER OBSERVATIONS FROM JUNE 28, 1951, THROUGH SEPTEMBER 3, 1952

Showing bucks, does, undetermined and total number seen

Observed by	Bucks	Does	Undetermined	Total
Jack C. Watson, USFWS	23	13	23	59
Writer	12	13	15	40
Others	30	33	25	88
TOTAL	65	59	63	187

From the above population studies and observations the writer would judge that there are no fewer than twenty five or more than eighty deer in the area at present. From the number of young deer observed it would appear that the deer are probably on the increase.

The scarcity of deer at the present date is no doubt a result of hunting pressure. Fontaneda (1575) spoke of many deer in the area. Romans (1775) spoke of a few deer at Matacombe, plenty at Cayos Vacas and the pine islands, but regarding Key West: "On this key we find numbers of deer (of the small kind) . . . ." Describing a well of excellent fresh water at Key West he wrote:

> "the ground is trodden like a sheep crawl, occasioned by the deer who resort here to drink, of which a patient man may here shoot 5 or 6 in a day; they are very small . . . .'

Ellicott (1803) mentions getting four at Key Vacas in a few hours. Commodore David Porter in a letter dated December 29, 1829 (Browne 1912) described the woods at Key West "filled with deer and other game."

Nearly 50 years later the situation of deer on the keys had evidently changed for DePourtales (1877) wrote "the deer is probably destroyed at present, but the raccoon is still not uncommon . . . ."

Barbour and Allen writing in 1922 stated that deer were more numerous then than 12 to 15 years previous. The present day old time residents also state that deer were more numerous a number of years ago.

PREDATORS

There seem to be no deer predators in the present key deer range and apparently never have been. Mr. W. A. Parrish of Marathon states that in 1936 he saw one panther on Key Vaca and that in 1927 there was a pack of wild dogs on the island of which he finally killed 26. Old timers and hunters do not recall any predators. However, at the present time, there are rumors from time to time of panther or wildcat tracks. Such tracks are probably "wild" domesticated cats.

Fontaneda (1575) mentioned bear only on the upper keys. Romans (1775) said that they were sometimes to be had on Cayo Biscayo. DePourtales (1877) wrote: "the bear does not extend so far – I think only to Matacumbe – and is probably only a visitor at the time when the turtles lay their eggs . . . ."

MANAGEMENT RECOMMENDATIONS

Up to the present time (1952) the deer needed only protection from hunters. Man has kept the pineland and hammocks open to some extent – especially on Big Pine Key which carries more deer than any other key – by repetition of fires and clearing of land for development. However, the situation is changing rapidly. On Little Pine Key where no fires have occurred in recent years a thick growth of hammock climax vegetation has been produced in the pineland. Vegetation in the pineland of No Name and Cudjoe Keys is not so thick. On some of the keys where hammocks were opened up at one time for homesteads there still remain some small openings in the brush. Many such sites have been overgrown for years. The open scrub mangrove areas and grass-marl prairies which usually occur between the mangrove fringe and hammock or pineland are not likely to change for many years unless altered by man.

If the pineland on these keys is to be kept as such it will be necessary to practice controlled burning every two or three years. Where there are large areas of thick hammock a bulldozer could be used to keep selected sites open.

That the deer use the pineland rather extensively has been shown by the amount of palm and *Vachellia* seeds found in their droppings (Table 40).

Utilization of the open areas near thick growths of vegetation is supported by the fact that most of the dropping groups picked up by the writer were in such places. Deer seen in the field were usually near or in the margins of thick hammock or buttonwood stands. Deer trails within the mangrove fringe of the islands on scrub mangrove-prairie types, where tracks are easily made in the soft marl, are usually in places where walking is easy but close enough to brush into which the deer can escape in case of danger. Where a hammock area was opened up on Doctor's Arm, Big Pine Key in 1951-52, deer were seen regularly afterwards in the cleared fields – even when heavy machinery was being operated. Here they were seen to browse on a number of herbaceous plants that began to grow in such areas. During periods when no deer were actually observed, fresh tracks or browsed plants could still be noted.

It has been stated in the literature a number of times that deer come to green growth following fire. Many of the residents of the lower keys mention that deer hunters used to make a practice of burning portions of the keys in order to attract deer.

Biswell, et al (1952), have shown that opening of areas in chamise brushlands in California made for better deer habitat. They found that the average number of deer on the study areas in heavy brush ranged from 10 to 30 per square mile, in wildlife burns from 5 to 160, and in open brush 40 to 110. Where surrounding food conditions were poor, a wildfire burn of newly sprouting brush was found to attract large numbers of deer. The burned areas lose their attractiveness shortly as the sprouts grow and become less palatable.

Taber (1953) has shown that the fawn production by breeding does was as follows for the different habitat types: in heavy brush less than 84.3%; on wildfire burns, 115.6%; and in open brush 147%.

Biswell, et al (1952) further found that bucks from opened brush tended to be heavier in weight than those from heavy brush with the tendency being greater in young than in medium aged deer. Bucks from a recent wildfire burn had more massive antlers, but tended to be similar in weight to those of opened brush.

Does of opened brush tended to be in the best condition, those from wildfire burns intermediate, and those from heavy brush poorest. The difference was more distinct in yearling and very old does than in those of medium age.

Because of the extremely few deer found on the keys at the present time there seems little likelihood that deer suffer from lack of food since at any given time of the year some of the forage plants are growing and producing fruit. However, as the protected herd increases it will be necessary to open up areas of brush to provide succulent growth for the increased population when competition would come into play. When the herd does build up to the capacity of the range (the range capacity would have to be determined later with further study) it will become necessary to remove the excess deer.

Since the keys (especially those over which the highway crosses) are being developed by man rather rapidly and the rate will probably increase because electric power from Key West has now been installed (1953) to Big Pine Key, the range of these particular keys will be decreased. Big Pine Key is the most frequented by the deer. It is also the most valued by man and it will be developed most rapidly. Already (1952) a state road has been extended almost to the northend of the island. With development and additional settlement there will be an increase of dogs, which will be detrimental to the deer. During the period of the survey by the writer there were a number of dogs on the key (Big Pine) that spent much of their time running deer. Deer might eventually be driven to neighboring islands. Some of these

islands not connected by bridges would make a refuge for the deer, such as: Howe, No Name, Big Torch, Middle Torch, and Little Pine Keys. No Name Key will probably be reconnected by a bridge in the near future which would again encourage development of this key. Little Pine Key, if it could be made suitable for the deer so that they would be attracted to it, would probably make the best place of refuge since it is separated from the main range by more than a mile of water. It contains all the habitat types and fresh water. The pineland would have to be cleared to some extent. Burning, if done at the present time, would have to be done very carefully because of the thickness of the vegetation which might result in overburn. A bulldozer could be used to clear parts of the pineland for the first time. It could also be used to make clearings in the hammocks. Certain plants used by deer are apparently missing on Little Pine Key, but after opening up the pineland and hammock areas seeds of the missing plants could be sown if they do not come in naturally.

In view of the above discussion the writer recommends the following management procedures:

1. Continue protection of the deer throughout the present range.

2. Purchase or lease enough land in the present range to set up a reserve to which the deer could resort as the keys in the area are developed and settled. Perhaps the best method of providing this reserve would be to establish it on certain of the outlying keys. The deer would probably move off to these as settlement of those connected to the highway takes place. The deer could come and go as they pleased, thus increasing the range to a considerable extent for many years to come. Of course, this method would make protection more difficult, but it appears that most of the residents of the area favor having the deer around, and their cooperation could aid greatly in the protection of these animals. Too, this method would provide an attraction to the many people who come down to see these deer.

3. Keep open areas scattered throughout the pineland and hammocks. In the pineland this should be done by controlled burning every two or three years, however, a bulldozer should be used the first time in areas where thick vegetation occurs. Open areas in hammocks would be best maintained by the use of a bulldozer.

4. Determine the range capacity of the deer as the herd builds up and remove the excess deer.

5. If it is found necessary as settlement of the keys takes place restrict dogs so that they would not be allowed to roam loose in the area.

LITERATURE CITED

BAILEY, L. H., 1949. *Manual of Cultivated Plants.* Revised Ed. New York, The Macmillan Company.

BAKER, R. T., 1920. *Agric. J. India,* 15: 263 as quoted by I. H. Burkill, 1935. A Dictionary of the Economic Products of the Malay Peninsula. London, S.W. Governments of the Straits Settlements and Federated Malay States by the Crown Agents for the Colonies. I: 274-275.

BARBOUR, THOMAS, and ALLEN, GLOVER M., 1922. *The white-tailed deer of Eastern United States.* J. Mammology, III (2): 65-78.

BENNETT, L. J., ENGLISH, P. F., and MCCAIN, RANDALL, 1940. *A study of Deer populations by use of pellet group counts.* J. Wildlife Mgt. 4: 398-403.

BISWELL, H. H., TABER, R. D., HEDRICK, D. W., and SHULTZ, A. M. 1952. *Management of Chamise Brushlands for Game in the North Coast Region of California.* California Fish and Game, 38 (4): 443-484.

BROWNE, JEFFERSON B., 1912. *Key West, the Old and the New.* St. Augustine, The Record Company Printers and Publishers.

BURKILL, I. H., 1935. *A Dictionary of the Economic Products of the Malay Peninsula.* London, S.W. Governments of the Straits Settlements and Federated Malay States by the Crown Agents for the Colonies. 1:274.

COOKE, C. WYTHE, 1939. *Scenery of Florida.* Geological Bull. No. 17, State of Florida, Department of Conservation, Tallahassee.

COOKE, C. WYTHE, 1945. *Geology of Florida.* Geological Bull. No. 29, State of Florida, Department of Conservation, Tallahassee.

CORY, CHARLES B., 1896. *Hunting and Fishing in Florida.* Boston, Estes & Lauriat.

DE POURTALES, L. F., 1877. *Hints on the origin of the flora and fauna of the Florida keys.* American Naturalist 11: 137-144.

DIXON, JOSEPH S., 1934. *A study of the Life History and Food Habits of Mule Deer in California.* Cal. Fish and Game, 20 (3 and 4):1-146.

EDDY, WALTER H. and SOKOLOFF, BORIS. (No date of publication) *Mangrove meal as a cattle food ingredient.* So. Bio-Research Laboratory, Florida Southern College, Lakeland, Fla.

ELLICOTT, ANDREW, 1803. *The Journal of Andrew Ellicott, etc.,* Philadelphia, Thomas Dobson, as quoted in Catharine van Cortlandt Mathews, Andrew Ellicott, His Life and Letters, New York, The Grafton Press, 1908.

FONTANEDA, D° d'ESCALENTE, 1575. *Memoir of D° d'Escalente Fontaneda* respecting Florida, written in Spain about 1575, translated from Spanish by Buckingham Smith, Washington 1854. Reprinted with revisions Miami 1944.

HESSE, RICHARD, ALLEE, W. C., and SCHMIDT, KARL P., 1951. *Ecological Animal Geography.* New York, John Wiley & Sons, Inc.

HEYERDAHL, THOR, 1950. *Kon-Tiki across the Pacific by Raft,* translated by F. H. Lyon. New York, Rand, McNally and Co.

IMPERIAL AGRICULTURAL BUREAUX, 1947 (June). Joint Publication No. 10. *Use and Misuse of Shrubs and Trees as Fodder.* Aberystwyth, G. B. Imperial Bureau of Pastures and Field Crops. P. 42.

MAYNARD, C. J., 1872. *Catalogue of the mammals of Florida, with notes on their habits, distribution, etc.* Bulletin of the Essex Institute 4 (10): 135-150.

OOSTING, HENRY J., 1948. *The study of plant communities.* San Francisco, W. H. Freeman & Company.

PARANJPYE, 1920. Agric. J. India, 15:350 as quoted by I. H. Burkill, 1935. *A Dictionary of the Economic Products of the Malay Peninsula.* London, S.W. Governments of the Straits Settlements and Federated Malay States by the Crown Agents for the Colonies. 1:274.

ROMANS, BERNARD, 1775. *A concise natural history of East and West Florida.* New York. v 1.

SMALL, JOHN K., 1933. *Manual of Southeastern Flora.* New York, Pub. by Author.

SMALL, JOHN K., 1938. *Ferns of the Southeastern States.* Lancaster, Pa., The Science Press Printing Company.

SOKOLOFF, BORIS, REED, JAMES B., and DUTCHER, RAYMOND, 1949 (1950). *Nutritive Value of mangrove leaves (Rhizophora mangle L.).* Quart. Journ. Fla. Acad. Sci., 12(3):191-194.

TABER, RICHARD D., 1953. *Studies of Black-Tailed deer reproduction on three Chaparral Cover Types.* Calif. Fish and Game, 39:177-186.

APPENDIX

Appendix I. Check list of plant species in key deer range by keys for 15 keys. The first part of the list is made up of 390 species representing 98 families, all of which were found on Big Pine Key as well as the other keys noted in the list. The second part of the list is made up of 22 species (representing 19 families) which were found on keys other than Big Pine Key. A total of 415 species (ferns and higher plants), representing 102 families, is listed below. The list is compiled from field data collected during the study. The plant families are listed in the order of Small (1933) (Prantl-Engler system). The names also are those used by Small (1933, 1938), and are followed by synonyms in many cases. In a few cases where species were not found in Small's manual, the names used are those found in Bailey (1949). Both native and introduced forms are included in the list. For presence of species on the keys other than Big Pine Key, a number designating the key follows the species in the list. Numbers have been assigned to each key as follows:

Little Pine Key	1	Water Keys (off Big Torch)	8
No Name Key	2	Annette Key	9
Ramrod Key	3	Water Key (off Little Pine)	10
Cudjoe Key	4	Howe Key	11
Little Torch Key	5	Sugarloaf Key	12
Middle Torch Key	6	Spanish Harbor Key	13
Big Torch Key	7	New Found Harbor Keys	14

	Species Present On
I. PTERIDOPHYTA	
A. Filicineae	
1. Schizacceae	
(1) Anemia adiantifolia (L.) Sw.	1, 2, 3, 5
2. Polypodiaceae	
(1) Acrostichum daneaefolium Langsd. & Fisch. (A. excelsum Maxon)	3, 4, 5, 7, 10, 11
(2) Marginaria polypodioides (L.) Tidestrom. (Polypodium polypodioides Watt.)	
(3) Phlebodium aureum (L.) J. Smith	
(4) Pteris caudata L.	1, 2, 3, 4, 5, 6, 11, 12
(5) Pycnadoria bahamensis Ag. (Small) (P. Pinetorum Small)	2, 3, 4
(6) Sphenomeris clavata (L.) Maxon	
(7) Thelypteris normalis (C. Chr.) Moxley (Dryopteris normalis C. Chr.)	
(8) Vittaria lineata (L.) Smith	
II. SPERMATOPHYTA	
A. Gymnospermae	
1. Pinaceae	1, 2, 3, 4, 5, 6, 11, 12
(1) Pinus caribaea Morelet	
B. Angiospermae – Monocetyledonae	
1. Typhaceae	
(1) Typha angustifolia L. (T. domingensis Pers.)	3, 5
2. Zannichelliaceae	
(1) Ruppia maritima L.	1, 2, 3, 5
3. Alismaceae	
(1) Sagittaria sp.	

4. Poaceae

(1)	Andropogon glomeratus (Watt.) B.S.P.	1, 2, 3, 4, 5, 6, 7, 11, 12 2, 3, 4, 5, 6, 7, 11
(2)	Andropogon gracillus Spreng.	2, 3, 4, 5
(3)	Aristida purpurascens Poir.	1, 4, 5, 12
(4)	Capriola dactylon (L.) Kuntze (Cynodon dactylon Pers.)	2, 4, 5, 13, 14
(5)	Cenchrus echinatus L.	2, 3, 4, 5, 7, 9, 13
(6)	Cenchrus gracillimus Nash.	
(7)	Chaetochloa geniculata (Lam.) Millsp. & Chase (Setaria geniculata)	1, 2, 3, 4, 5, 7, 12, 13
(8)	Chloris petraea Swartz	1, 2, 3, 4, 5, 7, 9, 10, 12,13
(9)	Distichlis spicata (L.) Greene	1, 4, 6
(10)	Eleusine indica (L.) Gaertn.	
(11)	Eragrostis amabilis (L.) Wight & Arn.	
(12)	Eragrostis ciliaris (L.) R. Br.	
(13)	Eragrostis elliottii S. Wats.	2, 3, 4, 5
(14)	Lasiacis divaricata (L.) A. Hitchc.	1, 2, 14
(15)	Monanthochloe littoralis Engelm.	All
(16)	Muhlenbergia capillaris (Lam.) Trin.	2, 3, 4, 5, 7, 9, 11, 12
(17)	Panicum adspermum Trin.	3, 4, 5, 9, 13
(18)	Panicum bartowense Scribn. & Merr.	
(19)	Panicum fasiculatum Sw.	
(20)	Panicum sp.	4
(21)	Panicum virgatum L.	1, 4, 7, 12
(22)	Paspalum blodgettii Chapm.	1, 2, 3, 4, 5, 6, 7, 11, 12
(23)	Paspalum monostachyum Vasey	
(24)	Paspalum vaginatum Swartz	All except 10, 11, 12
(25)	Saccharum officinarum L.	
(26)	Setaria magna (Griseb.) Scribn.	13, 14
(27)	Sorghastrum secundum (Ell.) Nash	4
(28)	Spartina junciformis Engelm. & Gray	All except 11, 13
(29)	Sporobolis domingensis (Trin.) Kunth	1, 3, 5, 6, 7, 12, 13
(30)	Sporobolis virginious (L.) Kunth	All
(31)	Stenotaphrum secundatum (Watt.) Kuntze	5, 14
(32)	Syntherisma sanguinale (L.) Dulac.	
(33)	Uniola paniculata L.	14
(34)	Valota insularis (L.) Chase	14

5. Cyperaceae

(1)	Abilgaardia monostachya (L.) Vahl.	3, 4, 5, 6, 7, 11
(2)	Cyperus brunneus Sw.	1, 2, 3, 4, 7, 11, 12, 13, 14
(3)	Cyperus elegans L.	
(4)	Cyperus inflexus Muhl.	
(5)	Cyperus ligularis L.	1, 3, 6, 11
(6)	Dichromona colorata (L.) A. Hitchc.	1, 2, 3, 4, 11, 12

(7) Eleocharis atropurpurea (Reitz) Kunth	4
(8) Eleocharis cellulosa Torr.	4, 5
(9) Fimbristylis castanea (Michx.) Vahl.	All except 8, 13, 14
(10) Fimbristylis spathacea Roth.	4
(11) Mariscus jamaicensis (Crantz) Britton (Cladium effusum (Sw.) Torr.)	1, 2,3, 4, 5, 6, 7, 11, 12
(12) Rynchospora microcarpa Baldw.	
(13) Schoenus nigricans L.	
6. Arecaceae (Palmaceae)	
(1) Coccothrinax argentea (Lodd.) Sarg.	1, 2, 4, 5, 7, 12, 13, 14
(2) Cocos nucifera L.	All except 8, 9, 11
(3) Phoenix dactylifera L.	1, 2, 3, 4, 5, 6, 7, 14
(4) Sabal palmetto (Walt.) Todd*	1, 2, 4, 7, 12
(5) Serenoa repens (Batr.) Small	1,2,3, ,4, 5, 6, 7, 11,12
(6) Thrinax microcarpa Sarg.	All except 8, 13, 14
(7) Thrinax parviflora Sw.	1, 7, 8, 9, 10, 11, 13, 14
7. Bromeliaceae	
(1) Dendropogon usneoides (L.) Raf. (Tillandsia usneoides L.)	
(2) Tillandsia aloifolia Hook	1, 2, 3, 4, 5, 6, 7, 11, 12
(3) Tillandsia balbisiana Schult	1, 2, 3, 4, 5, 6, 10, 11
(4) Tillandsia circinata Schlect.	1, 2, 3, 4, 5, 6, 7, 10, 11
(5) Tillandsia fasiculata Sw.	2
(6) Tillandsia utriculata L.	1, 2, 3, 4, 5, 6, 7, 11
8. Juncaceae	
(1) Juncus romerianus Scheele	
9. Convallariaceae (liliaceae, Agavaceae)	
(1) Asparagus officinalis	
(2) Asparagus plumosus Baker	2
(3) Asparagus springeri Regel.	
(4) Cordyline guineensis (L.) Britton (Sansevieria guineensis Willd.)	2, 3, 4, 7, 13
10. Aloaceae (Liliaceae)	
(1) Aloe vera L.	2
11. Smilacaceae (Liliaceae)	
(1) Smilax havanensis Jacq.	1, 2, 4, 5, 10, 12
12. Leucojaceae (Amaryllidaceae, Agavaceae)	
(1) Agave decipiens Baker	1, 3, 5, 10, 14
(2) Agave sisalana Perrine	2, 3, 4, 7, 12
(3) Aletris bracteata Northrop.	
(4) Hymenocallis keyensis Small	All except 1, 9, 11
(5) Hypoxis wrightii (Baker) Brackett.	
13. Ixiaceae	
(1) Sisyrinchium sp.	
14. Musaceae	
(1) Musa sapientum L.	5
15. Orchidaceae	
(1) Bletia purpurea (Lam.) D. C.	

*Very numerous on Cudjoe and Sugarloaf Keys.

(2) Encyclia tampensis (Lindl.) Small (Epidendrum tampense Lindl.)	1, 2, 3, 4, 6, 11
(3) Habenaria quinqueseta (Michx.) Sw.	
(4) Vanilla eggersii Rolfe (V. barbellata Reichb.)	3, 11
Dicotyledonae	
1. Casuarinaceae	
(1) Casuarina equisetifolia Forst.	2, 3, 7
2. Myricaceae	
(1) Myrica cerifera L.	2, 3, 4, 5,6, 12
3. Urticaceae	
(1) Pilea herniarioides (Sw.) Lindl.	
(2) Pilea microphylla (L.) Liebm.	
4. Artocarpaceae (Moraceae)	
(1) Ficus aurea Nutt.	2, 3, 4, 5, 6, 7, 11, 14
(2) Ficus brevifolia Nutt.	All except 8, 10, 13, 14
5. Ulmaceae	
(1) Trema floridana Britton	2, 3, 5
6. Polygonaceae	
(1) Coccolobis laurifolia Jacq.	All except 8, 14
(2) Coccolobis uvifera (L.) Jacq.	All except 8
7. Chenopodiaceae	
(1) Atriplex arenaria Nutt.	2, 4, 5, 10, 11, 12, 13, 14
(2) Dondia linearis (Ell.) Millsp.	All keys
(3) Salicornia ambigua Michx.	All except 14
(4) Salicornia bigelovii Torr.	All except 8, 13
8. Amaranthaceae	
(1) Achyranthes ramosissima (Mart.) Standley	3, 10, 14
(2) Amaranthus hybridus L.	
(3) Amaranthus spinosus L.	
(4) Iresine paniculata (L.) Kuntze	
(5) Philoxerous vermicularis (L.) R. Br.	All keys
9. Phytolaccaceae	
(1) Rivina humilis L.	4, 12, 14
10. Batidaceae	
(1) Batis maritima L.	All keys
11. Allionaceae	
(1) Boehaavia erecta L.	
12. Pisoniaceae (Allioniaceae)	
(1) Pisonia aculeata L.	
(2) Pisonia rotundata Griseb.*	2, 3, 4, 6, 12
(3) Torrubia braceii Britton	1, 3, 4
(4) Torrubia longifolia (Heimer) Britton	All keys
13. Tetragoniaceae	
(1) Sesuvium maritimum (Walt.) B.S.P.	5
(2) Sesuvium portulacastrum L.	All keys
(3) Trianthema portulacastrum L.	
14. Portulacaceae	
(1) Portulaca oleacea L.	1, 2, 3, 4, 5, 7, 9

*Conspicuously absent on Little Pine Key.

(2) Portulaca phaeosperma Urban	1, 3, 4, 5, 7, 8, 11
15. Annonaceae	
(1) Annona glabra L.	5
16. Brassicaceae (Cruciferae)	
(1) Cakile fusiformis Greene	7
(2) Lepidum virginicum L.	
17. Capparidaceae	
(1) Capparis cynophallophora L.	3, 4, 5
(2) Capparis flexosa L.	7, 8, 11, 12, 13, 14
18. Sedaceae (Crassulaceae)	
(1) Kalanchloe verticillata Elliot	2, 3
19. Amygdalaceae	
(1) Chrysobalanus icaco L.*	
(2) Geobalanus oblongifolius (Michx) Small	
20. Mimosaceae	
(1) Acuan depressum (H.B.K.) Kuntze	1, 2, 3, 4, 5, 7, 8, 12
(2) Leucaena glauca (L.) Benth.	1, 3, 4, 7, 13
(3) Neptunia floridana Small	
(4) Pithecolobium guadalupense Chapm.	All keys
(5) Pithecolobium unguis-cati (L.) Benth.	
(6) Vachellia farnesiana (L.) Wight & Arn.	2, 4, 5, 7, 10
(7) Vachellia peninsularis Small**	2, 4, 5, 7, 9, 11, 12
21. Cassiaceae	
(1) Caesalpinia pauciflora (Griseb.) C. Wright	4
(2) Chamaecrista aspera (Muhl.) Greene	2, 3, 4, 5, 12, 13
(3) Chamaecrista keyensis Pennell	2, 4
(4) Delonix regia (Boj.) Raf.	5
(5) Guilandina crista (L.) Small	2, 3, 4, 13
(6) Parkinsonia aculeata L.	
(7) Peiranisia bahamensis (Mill.)	4
Britton and Rose	
(Cassia bahamensis)	1, 2, 3, 4, 5, 7, 11, 13
(8) Tamarindus indica L.	1, 2, 3, 5, 7
22. Fabaceae	
(1) Bradburya virginiana (L.) Kuntze	2, 3, 5
(2) Canavali lineata (Thunb.) D. C. (C. obtusifolia (Lam.) D. C.)	2, 3, 5, 14
(3) Crotalaria maritima Chapm. (and C. maritima liniaria)	
(4) Dolicholus minimum (L.) Medic. (Rhynchosia minima D. C.)	1, 2, 3, 4, 5, 6, 7, 8, 11
(5) Erythrina arborea (Chapm.) Small	
(6) Galactia parvifolia A. Rich	1, 2, 4
(7) Galactia spiciformis T. & G.	1, 2, 3, 5, 7, 8, 10, 12, 13
(8) Ichthyomethia piscipula (L.) A. Hitchc.	All keys

*Only one plant found.

**Conspicuously absent on Little Pine Key.

(9) Indigofera miniata Ortega	
(10) Indigofera tinctoria L.	4
(11) Leucopterum parvifolium (D.C.) Small (Rhynchosia parvifolius D.C.)	2, 3, 4, 12
(12) Maibomia cana (Gmel.) Blake (Desmodium incanum D.C.)	
(13) Meibomia purpurea (Mill.) Vail (Desmodium tortuosum (Sw.) D.C.)	2
(14) Phaseolus lathroides L.	5
(15) Rhynchosia cinerea Nash	
(16) Sesban sp. (Sesbania sp.)	4
(17) Sophora tomentosa L.	2, 3, 4, 5, 6, 7, 12
(18) Stylosanthes hamata (L.) Taub.	3
(19) Vigna repens (L.) Kuntze	
23. Linaceae	
(1) Cathartolinum arenicola Small	
24. Malphigiaceae	
(1) Byrsonima cuneata (Turcz.) P. Wilson (B. lucida (Sw.) D.C.)	All except 8, 14
25. Rutaceae	
(1) Amyris elimifera L.	2, 3, 4, 5, 7, 11
(2) Citrus aurantifolia (Christm.) Sw.	2, 5
(3) Zanthoxylum fagara (L.) Sarg.	11
26. Surianaceae	
(1) Suriana maritima L.	All except 8, 10
27. Simaroubaceae	
(1) Simarouba glauca D.C.	3, 5, 11
28. Burseraceae	
(1) Elaphrium simaruba (L.) Rose	All except 9
29. Polygalaceae	
(1) Asemeia leiodes (Blake) Small (Polygala leiodes Blake)	1, 2, 3, 4
(2) Pilostaxis carteri Small (Polygala carteri Small)	
(3) Polygala praetervisa Chodat.	2, 4, 12
30. Euphorbiaceae	
(1) Acalypha chamaedrifolia (Lam.) Muell Arg.	
(2) Bivonea stimulosa (Michx.) Raf. (Jatropha stimulosa Michx.)	
(3) Chamaesyce adenoptera (Bertol.) Small	2
(4) Chamaesyce blodgettii (Engelm.) Small	11
(5) Chamaesyce buxifolia (Lam.) Small	1, 2, 3, 4, 5, 13, 14
(6) Chamaesyce conferta Small	3, 4, 5
(7) Chamaesyce hirta (L.) Millsp.	3
(8) Chamaesyce hypercifolia (L.) Small	2, 3, 4, 5, 7, 13
(9) Chamaesyce scoparia Small	All except 13
(10) Chamaesyce serpyllum Small	

(11)	Croton berlandieri Torr.	
(12)	Croton linearis Jacq.	1, 2
(13)	Ditaxis blodgettii (Torr.) Pax.	4
(14)	Drypetes diversifolia Krug & Urban	1, 2, 3, 4, 5, 7, 11
(15)	Gymnanthese lucida Sw.	7, 9, 10
(16)	Hippomane mancinella L.	2, 3, 4, 5, 7, 11
(17)	Phyllanthes niruri L.	
(18)	Phyllanthes pentaphyllus C. Wright	2, 4, 12
(19)	Poinsettia heterophylla (L.) Small	2, 3, 4, 5, 7, 8, 13
(20)	Poinsettia pinetorum Small	3, 5, 14
(21)	Ricinus communis L.	4
(22)	Savia bahamensis Britton	2, 3, 5, 6, 11, 12
(23)	Tragia saxicola Small	
31.	Spondiaceae (Anacardiaceae)	
(1)	Metopium toxiferum (L.) Krug & Urban	All keys
(2)	Schinus terebinthifolius Raddi	
(3)	Toxicodendron toxicodendron (L.) Britton (Rhus toxicodendron L.)	1, 2, 3, 5, 7
32.	Celastraceae	
(1)	Gyminda latifolia (Sw.) Urban	2, 3, 11
(2)	Maytenus phyllanthoides Benth.	All except 12
(3)	Rhacoma crossopetalum L.	All except 8, 13, 14
(4)	Rhacoma illicifolia (Poir.) Trelease	2, 4, 6, 12
33.	Dodonaeaceae	
(1)	Dodonaea microcarpa Small	3, 5, 6, 11
34.	Sapindaceae	
(1)	Cupania glabra Sw.*	
(2)	Exothea paniculata (Juss.) Radlk.	2, 11
(3)	Hypelate trifoliata Sw.	
35.	Frangulaceae (Rhamnaceae)	
(1)	Colubrina asiatica (L.) Brongn.	
(2)	Krugiodendron ferreum (Vahl) Urban	2, 3, 4, 12, 13, 14
(3)	Reynosia septentrionalis Urban	All except 8
36.	Vitaceae	
(1)	Cissus trifoliata L.	
(2)	Parthenocissus quinquefolia (L.) Planch.	
37.	Malvaceae	
(1)	Abelmoschus esculentus (L.) Moench. (Hibiscus esculentus L.)	4
(2)	Abutilon permolle (Willd.) Sweet	3, 7
(3)	Gayoides crispum (L.) Small	All except 6
(4)	Gossypium hirsutum L.	8, 11
(5)	Hibiscus pilosus (Sw.) Fauc. & Randle.**	
(6)	Hibiscus rosa-sinensis L.	3, 4, 5, 6
(7)	Malvastrum corchorifolium (Desr.) Britton	3

*Restricted to Watson Hammock, *Big Pine Key*.

**Restricted to Southeast Point Hammock.

(8) Malvaviscus grandiflora Hort.	5
(9) Sida carpenifolia L.	2, 3, 4, 5, 13
(10) Sida ciliaris L.	3
(11) Sida elliottii T. & G.	
(12) Sida procumbens Sw.	3, 5
(13) Thespesia populnea (L.) Soland.	1, 3, 4, 13
38. Buettneriaceae (Sterculiaceae)	
(1) Waltheria americana L.	All except 6, 11
39. Canellaceae	
(1) Canella winteriana (L.) Gaertn.	2, 11
40. Turneraceae	
(1) Piriqueta tomentosa H.B.K.	
41. Papayaceae	
(1) Carica papaya L.	2, 4, 5, 7, 9, 12
42. Passifloraceae	
(1) Passiflora pallida L. (P. suberosa L.)	4, 5, 7, 9, 12, 13
43. Opuntiaceae (Cactaceae)	
(1) Acanthocereus floridanus Small	8, 13, 14
(2) Cephalocereus keyensis Britton & Rose*	
(3) Harrisia simpsonii Small	11
(4) Opuntia abjecta Small*	
(5) Opuntia dillenii (Ker.) Haw.	All except 6
(6) Opuntia impedita Small	4, 7
(7) Opuntia keyensis Britton	1, 2, 3, 4, 14
(8) Opuntia ochrocentra Small	
44. Lauraceae	
(1) Tamala bourbonia (L.) Raf.	
45. Cassythaceae	
(1) Cassytha filiformis L.	1, 2, 4, 5, 6, 11, 12
46. Lythraceae	
(1) Ammannia latifolia L.	
(2) Lythrum lineare L.	
47. Punicaceae	
(1) Punica granatum L.	
48. Terminaliaceae (Combretaceae)	
(1) Conocarpus erecta L.	All keys
(2) Laguncularia racemosa Gaertnf.	All keys
(3) Terminalia catappa L.	3, 4, 5
49. Myrtaceae	
(1) Calypthranthes pallens (Poir.) Griseb.	2, 3, 4, 5, 6, 7, 11
(2) Eugenia axillaris (Sw.) Willd.	All except 8, 10, 14
(3) Eugenia buxifolia (Sw.) Willd.	All except 8
(4) Mosiera longipes (Berg.) Small** (Eugenia longipes Berg.)	2, 3, 4, 5, 6, 7, 11, 12
(5) Psidium guajava Radd.	3, 4
50. Rhizophoraceae	
(1) Rhizophora mangle L.	All keys
51. Epilobiaceae (Onagraceae)	
(1) Gaura angustifolia Michx.	2, 13

*Restricted to Southeast Point Hammock.

**Conspicuously absent on Little Pine Key.

(2) Isnardia sp.	2
(3) Ludwigia microcarpa Michx.	
52. Ammiaceae	
(1) Centella repanda (Pers.) Small	
53. Armeriaceae	
(1) Limonium angustatum (A. Gray) Small	4, 5, 6, 7, 9, 11
(2) Limonium carolinianum (Walt.) Britton	1, 2, 3, 4, 7, 9, 10, 11
54. Primulaceae	
(1) Samodia ebracteata (H.B.K.) Baudo. (Samolus ebracteatus H.B.K.)	4, 7, 12
55. Theophrastaceae	
(1) Jacquinnia keyensis Mez.	1, 3, 4, 5, 6, 7, 9, 10, 11, 12, 13
56. Ardisiaceae (Myrsinaceae)	
(1) Icacorea paniculata (Nutt.) Sudw.	1, 2, 3, 11
(2) Rapanea guayanensis Aubl.	1, 2, 3, 4, 5, 6, 7, 11, 12
57. Ebenaceae	
(1) Diospyros virginiana L.	
58. Sapotaceae	
(1) Bumelia angustifolia Nutt.	All keys
(2) Chrysophyllum olivaeforme L.	2
(3) Dipholis salicifolia (L.) A.D.C.	2, 3, 4, 5, 6, 7, 11, 12
(4) Mimusops emarginata L.	All except 8
(5) Sapota achras Mill (Achras sapota L.)	1, 2, 3, 4, 5, 6, 7
59. Oleaceae	
(1) Forestieria pinetorum Small	
60. Spigeliaceae	
(1) Cynoctomum mitreola (L.) Britton	
(2) Cynoctomum sessilfolium (Watt.) J. F. Gmel.	
(3) Polypremum procumbens L.	
(4) Spigelia anthelmia L.	3
61. Gentianaceae	
(1) Eustoma exaltatum (L.) Griseb.	All except 8, 11, 14
(2) Sabattia campanulata (L.) Torr.	2, 3
62. Apocynaceae	
(1) Carissa grandiflora A. D. C.	
(2) Echites echites (L.) Britton (E. umbellata Jacq.)	1, 2, 3, 4, 5, 7, 12
(3) Nerium oleander L.	6, 14
(4) Rhabdadenia biflora (Jacq.) Muell. Arg.	3
(5) Rhabdadenia corallicola Small	3, 12
(6) Urechites lutea (L.) Britton	All except 8, 13, 14
(7) Vallesia glabra Cav.*	
(8) Vinca rosea L.	2, 3, 4, 5
63. Asclepiadaceae	
(1) Amphistelma scoparia (Nutt.) Small	
(2) Asclepiadora viridis (Walt.) A. Gray	

*Restricted to Southeast Point Hammock.

(3) Epicion northropiae (Schlect.) Small (Metastelma northropiae Schlect.)	1, 7, 9, 10, 14
(4) Funastrum clausum (Jacq.) Schlect. (Philibertia viminalis A. Gray)	3, 7, 8, 13
(5) Lyonia palustris (Pursh) Small	1, 2, 3, 4, 5, 7
(6) Metastelma blodgettii A. Gray	1, 2, 3, 4, 5, 7, 12
64. Convolvulaceae	
(1) Calonyction tuba (Schlect.) Colla.	All except 6, 7
(2) Evolvolus alsinoides L.	3, 4, 5, 7, 9
(3) Evolvolus glaber Spreng.	
(4) Evolvolus wrightii House	
(5) Ipomoea batatas (L.) Lam.	
(6) Ipomoea pes caprae (L.) Sweet	2, 4, 5, 12, 13, 14
(7) Ipomoea sagittata Cav.	4
(8) Ipomoea triloba L.	3, 4, 5
(9) Jacquemontia pentantha (Jacq.) G. Don.	1, 2, 11
(10) Pharbitis cathartica (Poir.) Choisy. (Ipomoea cathartica Poir.)	3, 5, 7, 8, 9, 12, 13, 14
65. Solanaceae	
(1) Capsicum annuum L.	
(2) Capsicum frutescens L.	
(3) Lycium carolinianum Walt.	All except 2, 4, 12
(4) Nicotiana tobacum L.	
(5) Physalis angustifolia Nutt.	1,2, 3, 4, 5, 7, 11
(6) Physalis barbadensis Jacq.	3, 4, 5, 12
(7) Solanum bahamense L.	1,3, 4, 5, 7, 12, 13, 14
(8) Solanum blodgettii Chapm.	All except 8, 11
(9) Solanum nigrum L.	4, 5
(10) Solanum verbascifolium L.	4, 5, 12
66. Ehretiaceae	
(1) Bourreria ovata Miers.	1, 2, 3, 5, 11
(2) Sebesten sebestena (L.) Britton (Cordia sebestena L.)	3, 8, 9, 10, 11, 13
(3) Varronia globosa Jacq.	
67. Heliotropiaceae (Boraginaceae)	
(1) Heliotropium curassavicum L.	2, 3, 4, 5, 12, 13
(2) Heliotropium leavenworthii Torr.	4, 12
(3) Mallotonia gnaphalodes (Jacq.) Britton (Tournefortia gnaphalodes (R.) Br.	4, 5, 13, 14
(4) Myriopus volubis (L.) Small (Tournefortia volubis R. & S.)	3, 12, 13
(5) Schobera angiosperma (Murr.) Britton (Heliotropium parviflorum L.)	All except 6, 7, 11
68. Verbenaceae	
(1) Citharexylum fruticosum L.	
(2) Lantana involucrata L.	1, 2, 3, 4, 5, 6, 7, 11, 12, 13
(3) Phyla nodiflora (L.) Greene	1, 3, 4, 5

(4) Valerianoides jamaicensis (L.) Kuntze	1, 3, 4, 5, 7, 10
69. Avicenniaceae (Verbenaceae)	
(1) Avicennia nitida Jacq.	All keys
70. Lamiaceae	
(1) Ocimum micranthum Willd.	12
71. Rhinanthaceae (Scrophulariaceae)	
(1) Agalinis keyensis Pennell (Gerardia keyensis Pennell)	
(2) Agalinis maritima Raf. (Gerardia maritima Raf.)	1, 2, 3, 4, 5, 7, 8, 9
(3) Agalinis purpurea (L.) Pennell (Gerardia purpurea L.)	2, 3, 4, 5, 6, 7, 11, 12
(4) Bramia monnieri (L.) Pennell	3
(5) Buchnera elongata Sw.	
(6) Capraria biflora L.	3, 4, 5, 7, 12, 13
72. Acanthaceae	
(1) Diapedium assurgens (L.) Kuntze	13
(2) Dyschoriste angusta (A. Gray) Small	
(3) Ruellia hybrida Pursh.	2, 4
73. Pinguiculaceae	
(1) Pinguicula pumila Michx.	
74. Olacaceae	
(1) Ximinea americana L.	1, 2, 3, 4, 5, 6, 7, 11, 13
75. Rubiaceae	
(1) Borreria ocimoides (Burm.) D.C.	
(2) Borreria terminalis Small	12
(3) Casasia clusiifolia (Jacq.) Urban	1, 3, 5, 7, 10, 11, 13, 14
(4) Catesbaea parviflora Sw.	
(5) Chiococca alba (L.) A. Hitchc.	2, 3
(6) Chiococca pinetorum Britton	1, 2, 3, 4, 5, 6, 7, 11, 12, 14
(7) Erithalis fruticosa L.*	All except 9, 11, 14
(8) Ernodea angusta Small	1, 2, 3, 4, 5, 6, 7, 11, 12
(9) Exostema caribaeum (Jacq.) R. & S.	3
(10) Galium bermudense L.	
(11) Guettarda eliptica Sw.	2, 3, 11
(12) Guettarda scabra Vent.	1, 2, 3, 4, 5, 11, 12
(13) Hamelia patens Jacq.	5
(14) Houstonia filifolia (A. Gray) Small	
(15) Morinda roioc L.	All except 14
(16) Psychotria nervosa Sw.	
(17) Randia aculeata L.	All except 13
(18) Spermacoce keyensis Small	
(19) Strumpfia maritima Jacq.	12
76. Cucurbitaceae	
(1) Momordica charantia L.	
77. Lobeliaceae	
(1) Lobelia glandulosa Walt.	
78. Ambrosiaceae (Compositae)	
(1) Ambrosia hispida Pursh.	2, 3, 4, 5
(2) Iva imbricata Walt.	2

*Only one plant found on Little Pine Key.

79. Carduaceae (Compositae)	
(1) Ageratum littorale A. Gray	4
(2) Aster adnatus Nutt.	
(3) Aster bracei Britton	1, 2, 3, 4, 5, 6, 7, 9, 12
(4) Baccharis angustifolia Michx.	2, 5
(5) Baccharis halimifolia L.	1, 3, 4, 5, 12
(6) Bidens pilosa L. (B. leucantha L.)	1, 2, 3, 4, 5, 7, 11, 12, 13
(7) Borrichia arborescens (L.) D. C.	All except 10, 14
(8) Borrichia frutescens (L.) D. C.	All keys
(9) Chaptalia dentata (L.) Cass.	
(10) Cirsium horridulum Michx.	1, 2, 3, 4, 5, 7
(11) Coreopsis leavenworthii T. & G.	
(12) Emilia coccinea (Sims) Sweet	
(13) Flaveria linearis Lag.	All except 6
(14) Flaveria latifolia (J. R. Johnston) Rydb.	2, 12
(15) Flaveria trinerva (Spreng.) C. Mohr.	2, 4
(16) Gaillardia picta Sweet	2, 3
(17) Leptilon canadense (L.) Britton	2, 4, 5, 7, 12
(18) Liatris tenuifolia (Nutt.) Kuntze	4
(19) Melanthera deltoidea Michx.	2, 3, 4, 5, 8, 9, 12, 13
(20) Melanthera parvifolia Small	
(21) Mikania batatifolia D.C.	1, 2, 3, 4, 5, 7, 12
(22) Pectis leptocephala (Cass.) Urban	3, 7
(23) Pityopsis graminifolia (Michx.) Nutt. (Chrysopsis graminifolia (Michx.) Nutt.)	2
(24) Pluchea foetida (L.) D.C.	3
(25) Pluchea purpurascens (Sw.) D.C.	2, 3, 5, 12
(26) Pterocaulon undulatum (Walt.) C. Mohr.	
(27) Sideranthus megacephalus (Nash) Small	2, 3, 5, 7, 9, 11
(28) Solidago petiolata Mill (S. angustifolia Ell.)	4, 12
(29) Tridax procumbens L.	
(30) Vernonia blodgettii Small	4
80. Cichoriaceae (Compositae)	
(1) Brachyrhamphus intybaceus (Jacq.) D.C. (Lactuca intybaceus Jacq.)	4, 5, 13
(2) Sonchos oleraceus L.	4, 12

SPECIES NOT FOUND ON BIG PINE KEY

A. Monocotyledonae	
1. Poaceae	
(1) Tricholaena rosea Nees	5
2. Arecaceae (Palmaceae)	
(1) Washingtonia robusta Wendl.	3, 7
3. Commelinaceae	
(1) Commelina elegans H.B.K.	14
4. Leucojaceae (Amaryllidaceae)	
(1) Crinum sp.	Little Knock'emdown Key

B. Dicotyledonae

1. Mimosaceae
   (1) Albizzia lebbek (Willd.) Benth. 4, 5
2. Fabaceae
   (1) Cajan cajan (L.) Millsp. 4
   (Cajanus indicus Spreng.)
   (12) Crotalaria incana L. 2
3. Zygophyllaceae
   (1) Tribulus cistoides L. 13
4. Meliaceae
   (1) Melia azedarach L. 4
5. Polygalaceae
   (1) Asemeia grandiflora (Walt.) Small 3, 5
   (Polygala grandiflora Walt.)
6. Euphorbiaceae
   (1) Chamaesyce cordifolia (Ell.) Small 2, 3, 4
   (2) Chamaesyce garberii Small 2
7. Spondiaceae (Anacardiaceae)
   (1) Rhus leucantha Jacq.* 1
8. Sapindaceae
   (1) Melicocca bijuga L. 4 & Little Knock'emdown Key
9. Frangulaceae (Rhamnaceae)
   (1) Colubrina colubrina (Jacq.) Millsp. 13
   (C. ferruginosa Jacq.)
10. Vitaceae
    (1) Muscadinia munsoniana (Simpson) Small 12
11. Clusiaceae
    (1) Clusia rosea L.* 5
12. Myrtaceae
    (1) Melaleuca leucadendra L. 5
13. Rubiaceae
    (1) Spermacoce tetraqueta a. Rich 4
14. Cucurbitaceae
    (1) Melothria crassifolia Small 5
15. Carduaceae (Compositae)
    (1) Eupatorium capillifolium (Lam.) Small 4, 5, 12
    (2) Helianthus annuus L. 4
    (3) Leptilon pusillum (Nutt.) Britton 13

*Only one plant found.