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Phenology of Flowering and Fruiting in Plant Communities of Everglades NP and Biscayne NM, Florida

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PHENOLOGY OF FLOWERING AND FRUITING IN PLANT COMMUNITIES OF EVERGLADES NATIONAL PARK AND BISCAYNE NATIONAL MONUMENT, FLORIDA

Report T-593

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Phenology of Flowering and Fruiting in Plant Communities of Everglades National Park and Biscayne National Monument, Florida

Lloyd L. Loope

INTRODUCTION

This study was initiated in January 1978 as an attempt to document the timing throughout a single year of flowering and fruiting of plant species representative of the major plant communities of Everglades National Park and Biscayne National Monument. It is intended as a first effort at gaining an understanding of the phenology of plants in South Florida ecosystems--how flowering, fruiting, leaf fall, and vegetative growth are related to the changing seasons and to year-to-year fluctuations in rainfall, water levels, temperature, fire, and other environmental factors. Such investigations contribute to the larger objective of gaining the ability to predict the consequences of man-caused environmental perturbations upon the natural plant communities within national parks of South Florida.

ACKNOWLEDGEMENTS

The success of this study has been entirely dependent upon the following individuals, who recorded phenological observations at the field locations indicated: George Avery (Mahogany Hammock, West Lake boardwalk, Bear Lake Trail, Elliott Key); Pamela Krauss (successional stands on abandoned framland); Nancy Urban (Taylor Slough, Paradise Key); Richard Rintz (Taylor Slough); and Ingrid Olmsted (Paradise Key). Special thanks are due to Dale Taylor and Alan Herndon for providing data from Long Pine Key pineland vegetation and to Nancy Urban for preparing graphs. I thank Peter Rosendahl and Paul Rose for supplying data for water levels for 1978. Ingrid Olmsted searched the literature for relevant references. I thank Dottie Anderson for her skill and patience in typing this and other manuscripts.

METHODS

At the outset, the decision was made to conduct an extensive survey of flowering and fruiting involving many communities and species rather than an intensive study involving highly quantitative data collection from marked individuals. In order to allow recording of some measure of the intensity of flowering and fruiting for each species, a simple rating system from 0-5 was devised, as follows:

0 = no flowers or fruits

1 = 2% of apparent flowering or fruiting potential being realized

2 = 2-10% of apparent flowering or fruiting potential reached

3 = 11-50% of apparent flowering or fruiting potential reached

4 = 51-90% of apparent flowering or fruiting potential reached

5 = 91-100% of apparent flowering or fruiting potential reached

The rating system was applied to selected plant species representative of the areas sampled. Each species was evaluated over a comparable area on each sampling date and the rating was made for the area as a whole (not for a single individual).

The sampling sites were selected with the goal of sampling representative examples of the major plant communities of Everglades National Park and Biscayne National Monument. Accessibility was a major consideration in selection, since each site was to be sampled 12 times during the year. The following communities and locations were chosen:

1. Tropical Hardwood Hammock

   a - Elliott Key near Marina (Biscayne National Monument)
   b - Bear Lake Trail
   c - Mahogany Hammock
   d - Paradise Key (Gumbo-Limbo Trail)

2. Pineland: Long Pine Key

   a - Site near Redd Hammock burned one year previous to monitoring

3. Freshwater Marsh: Taylor Slough near bridge on Fla. #27

   a - *Muhlenbergia* prairie
   b - *Cladium* prairie
   c - *Eleocharis* marsh
   d - *Salix* head

4. Mangrove and other communities of saline soils

   a - West Lake Boardwalk
   b - Bear Lake Trail
   c - Elliott Key near Marina (Biscayne National Monument)

5. Secondary Succession: "Hole-in-the-Donut"

   a - Rockplowed former pineland, farmed and abandoned 3 years
   b - 30 year old stand on farmed former marl prairie

Figure 1 shows the location of the sampling sites.

The size of the sites sampled was quite variable between sites, but remained constant at a single site for the 12 monthly sampling visits. Most sites were along trails or boardwalks to allow easy access.

Sites were sampled at monthly intervals as near as possible to the 15th of each month. In practice, the sampling was always done between the 13th and 20th. Sampling commenced on January 16, 1978 and ended on December 18, 1978. Each sampling date required approximately four person-days of sampling effort.

For purposes of this report, the raw data (consisting of 0-5 ratings for flowering and fruiting of each species for each month) were simplified for ease of

interpretation. In constructing the tables (Tables 4-17) the 0-5 phenology ratings were used to determine the month in which a peak, if any, of flowering or fruiting occurs. Totals presented graphically were determined by community for the total number of species flowering or fruiting in each month and for the total number of species with a peak of flowering or fruiting in that month.

Nomenclature for plant species follows Avery and Loope (1980), which corresponds with Long and Lakela (1976) for over 90% of the species.

CLIMATE AND WATER LEVELS FOR 1978

1978 data for monthly precipitation and mean temperature in relation to mean values for the period of record for the three long-established stations nearest to the phenology sampling sites are given in Tables 1-3. Water level data from three nearby sites are given in Figure 2.

The most notable departure of 1978 climatological and hydrological conditions from the norm is the cool and moist January-March period when precipitation and water levels were considerably above normal for all stations. Water levels continued high through April and May and then closely approximated normal levels for the rest of the year. Although the data from stations shown in Tables 1 and 2 show near normal precipitation, Royal Palm Ranger Station, located near Taylor Slough and Paradise Key, recorded 75.12 inches for the year, 21.07 inches above normal. No freezing temperatures were recorded at the three stations during 1978. The lowest temperature, 33°F, was recorded at Flamingo on February 23.

RESULTS

Results are given in the following tables:

Tables 4-7	Tropical Hardwood Hammocks
Table 8	Pineland
Tables 9-12	Freshwater Marsh Communities
Tables 13-15	Mangrove and Other Saline Communities
Tables 16-17	Secondary Succession
Figures 3-16	Results Summarized Graphically

DISCUSSION

The Need and Mechanisms for Synchronization of Reproductive Activity

The importance of synchronization of flowering among individuals of a single species within a single locality is obvious. If haphazard flowering were to occur, cross-pollination, the process which ensures exchange and recombination of the genetic material of the species (thereby allowing evolutionary adaptation to changing environments), would be very inefficient. Outcrossing apparently has such an important long-term evolutionary value that vascular plants have evolved elaborate mechanisms to ensure that it takes place (Stebbins, 1950; Davis and

Haywood, 1963; Tomlinson, 1974). Recent studies investigating resource allocation (Gadjil and Solbrig, 1972; Abrahamson, 1979) provide data on the high energetic cost of flowering and fruiting for some species.

Many factors other than synchronization of flowering within a single species are important in the evolution of seasonal rhythms in plant communities. For example, Levin and Anderson (1970) point out that because of competition for the service of pollinators, selection favoring separation of flowering times will be operating on species which rely on the same pollinators. Favorable status of food reserves is a prerequisite for reproductive activity in most species. Natural selection can be expected to favor occurrence of flowering and fruiting at the time during the seasonal cycle which is most favorable for long-term success of the species--balancing chance for reproductive success (presence of pollinators, seed predators, germination requirements met, favorable conditions for seedling survival, etc.) vs. minimizing risk (especially through lost competitive advantage) from diversion of carbohydrate from vegetative to reproductive growth at that particular season.

The environmental influences and physiological mechanisms which trigger flowering and fruiting are far from being completely understood for any system, but are better understood for temperate zone systems than for tropical systems. Standard plant physiology textbooks (e.g., Salisbury and Ross, 1969) give an account of environmental factors influencing the reproductive cycle of plants of the temperate zone. Flower initiation is typically triggered by lengthening (or sometimes shortening) photoperiod, a period of exposure to cold or "vernalization" is required to break dormancy, and full flower development occurs with the advent of warm spring temperatures. No "textbook" pattern is currently available for tropical systems (Opler et al., 1976) and a wide variety of mechanisms are believed to be operating. Plant species of South Florida, in an intermediate environment with characteristics of both temperate and tropical systems, might be expected to have a complex pattern of mechanisms ensuring synchronization of flowering and fruiting.

Photoperiod has been demonstrated to be a controlling factor in initiating the flowering process for a wide variety of plants from both temperate areas and the tropics (Salisbury, 1963). Njoku (1958) demonstrated that diel photoperiods differing no more than 15 minutes could induce flowering of "short-day" tropical plants in Nigeria. All tropical plants subjected to study have been shown to be either "short-day" or "day-neutral" with regard to photoperiodic induction of the flowering process (Opler et al., 1976), whereas most temperate plants are "long-day" plants.

Following induction of flowering, many species, both temperate and tropical, undergo some form of dormancy which requires some stimulus to break it. In temperate areas, warm temperatures following winter cold may suffice as a stimulus, as pointed out above. In tropical areas, little seasonal variation in temperature may occur and differences between daily temperature extremes may exceed those between extreme mean monthly values.

Opler et al. (1976) categorize the major explanations which have been put forward to explain the break of dormancy which leads to anthesis of tropical plants as follows: reduction of water stress; lowering of temperature; increasing photoperiod; and drought conditions. They put forward convincing evidence that certain Costa Rican trees and shrubs can be triggered to flower by late dry season/early wet season rains of as little as 250 mm.

Tropical Hardwood Forest

Four tropical hardwood forest ("hammock") areas were sampled for flowering and fruiting phenology. Coastal (Elliott Key, Bear Lake Trail), inland (Paradise Key), and intermediate (Mahogany Hammock) types were included. All four sites exhibited similar patterns with most species flowering in the March-June period (especially April-May) and most species fruiting in the June-September period.

These findings are consistent with an accumulating number of studies in various parts of the world--Sri Lanka (Koelmeyer, 1959), Panama (Croat, 1969), Costa Rica (Frankie et al., 1974) and Southern Brazil (Jackson, 1978)--which suggest that seasonal tropical forests receiving over a meter of rain annually typically have the peak of flowering in the dry season. Medaway (1972), working in a Malayan rain forest, found that larger numbers of flowers and fruits were produced in years in which the dry season was most pronounced.

Janzen (1967) proposes that the peak in flowering and fruiting of tree species in the lowlands of Central America is the result of selection for sexual reproduction at the most opportune time in the year, rather than as the result of immutable physiological processes which can only occur at that time of the year. Janzen believes the primary advantage of dry season flowering and fruiting is "the lack of interference with vegetative processes, which in turn allows full competitive activity during the rainy season between adjacent plants and hence species, and the maximization of the use of pollinators and dispersal agents."

Freshwater Wetlands

The four freshwater wetland communities sampled, located in Taylor Slough in eastern Everglades National Park, are inundated for only part of the year. Hydroperiods are as follows (Olmsted, Loope, and Rintz, 1980): Muhlenbergia prairie, 2-4 months; Cladium prairie, 3-8 months; Eleocharis marsh, 9 months or more; and Salix head, 3-10 months. The period of lowest water levels is typically March-May. The overwhelming phenological pattern of the freshwater wetland communities sampled in this survey is one of peak flowering and fruiting at the end of the dry season. A tentative hypothesis to explain this pattern is that the wet season, from June through October, is a period of relative metabolic stress for most species in these communities. Although solar radiation and temperature may be quite favorable for growth and carbohydrate accumulation, nutrient uptake by the roots is probably slowed severely by the anaerobic conditions caused by inundation.

Environments subject to flooding place insurmountable stress upon vascular plant species without adaptations for coping with the problem of very low soil oxygen levels. Many aquatic vascular plants incorporate networks of cells with large air spaces (aerenchyma) to conduct oxygen to the roots through the shoots. Keeley (1979) provides a good brief review of the current state of knowledge of physiological mechanisms for coping with the problem of anaerobic conditions in the roots due to flooding.

As water levels fall and the soil ceases to be saturated, conditions favoring growth and carbohydrate accumulation return. Only during severe drought conditions is low soil moisture likely to slow growth in these communities. By late in the dry season most species can best afford to divert carbohydrate reserves from vegetative growth to reproductive growth. Seeds of most species may remain dormant

during the wet season and germinate early in the dry season when growth conditions would perhaps be most favorable.

Muhlenbergia filipes, one of the most successful species of freshwater wetlands with a short hydroperiod has a strikingly different pattern of flowering and fruiting from most of its associates. It flowers and fruits in October and November, at the end of the wet season.

Mangrove Vegetation

Phenology was monitored at three sites in mangrove vegetation - Elliott Key Marina, Bear Lake Trail, and West Lake. Results were fairly consistent among the three sites with flowering peaking in the June-September period and fruiting peaking in September and October. Each of four mangrove species falls into this pattern with Rhizophora mangle (red mangrove) flowering in June-October and fruiting in August-October; Avicennia germinans (black mangrove) flowering in May-July and fruiting in August-November; Laguncularia racemosa (white mangrove) flowering in May-August and fruiting in July-October; and Conocarpus erectus (buttonwood) flowering in May-October and fruiting all year, but especially in September and October.

There is little information on mangrove phenology of flowering and fruiting in the extensive mangrove literature. Gill and Tomlinson (1971) studied Rhizophora mangle in considerable detail in South Florida and found that although flowers may be found at any time of the year, the time of most abundant flowering is July-September. They found that fruits mature in 4-7 months. They and several other researchers (e.g., Heald, 1971) found that leaf production was highest in summer and attributed these patterns to response to higher solar radiation and temperature in summer. Lear and Turner (1977) state that, in most of the 29 species of Australian mangroves, maximum flowering and fruiting coincides with the summer months (December-March), which is also the wet season.

Mangroves and other plant species occupying saline environments are able to do so through exclusion and excretion of salt, processes which presumably require substantial amounts of energy. Few if any obligate halophytes exist. It seems likely that the low salinity conditions of the estuarine zone which occur in the June-October period in South Florida and throughout most of the American tropics north of the equator allow a substantially higher percentage of photosynthate to be diverted to growth and reproduction rather than maintenance of a favorable salt balance. This may be a major reason for the existing rhythms of flowering and fruiting in the four South Florida mangrove species.

Another important selective advantage for mangrove species of fruiting in the August-October period in South Florida is the ability to colonize bare substrates left by severe hurricanes. Craighead and Gilbert (1962) called attention to this phenomenon following the hurricane of 1960.

Successional Vegetation on Abandoned Farmland

Both successional stands sampled exhibited flattened curves showing continued activity of flowering and fruiting throughout the year and little indication of peaks in these phenomena.

In the 3-year successional stand, 14 of 30 species (47%) for which phenology was recorded were flowering (and fruiting as well, in 13 cases) in at least 10 months of the year. In all other communities sampled, this was true for less than 20% of the species. Baker (1965) drew up a list of a dozen characteristics that might be expected in "the ideal weed." One of these characteristics is "continuous seed production for as long as growing conditions permit." With the continually favorable growing conditions of Everglades National Park in 1978, 9 of 30 species (30%) were found in flower in all 12 months of the survey.

The 30-year old successional stand did not have a particularly high number of species with sustained periods of flowering. The flattening of the curve in this instance, with no pronounced peak of flowering or fruiting, seems to be due to the mixture of species with diverse flowering and fruiting times.

Miami Rock Ridge Pineland

Only one pineland site was monitored. This site had burned in March 1977, 10-21 months prior to sampling for phenology. No clear pattern is apparent from the limited data from pineland, except that flowering and fruiting are distributed throughout the year with only slight peaks.

Preliminary data (D. L. Taylor, personal communication) shows that most pineland species recover rapidly from fire and attain flowering within 4-16 weeks after above-ground parts have been killed by fire. Sufficient material is stored underground to allow rapid regrowth after fire. Fire stimulates flowering in at least some species. Studies of the interaction between fire and seasonal influences on flowering and fruiting phenology may shed valuable light on the timing of fires under natural conditions.

SUMMARY

This report provides a record of the timing of flowering and fruiting for plant species occurring in major plant communities of Everglades National Park and Biscayne National Monument, during 1978, a year of above-normal precipitation in late-winter. Phenological patterns differ strikingly between major groups of plant communities, but generally are very similar for similar communities. Tropical hardwood hammocks and seasonally inundated wetlands have strong flowering peaks at the end of the dry season in April and May. Mangroves flower in the summer and fruit mainly in the early fall. Flower and fruit production in early successional vegetation is rather constant throughout the year. Insufficient data is presented to characterize pinelands, in which phenology may be strongly influenced by recent fire history.

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Table 1. Climatic data for Homestead Experiment Station near Homestead, Florida, 1978. Source: National Oceanic and Atmospheric Administration (1978).

Homestead Experiment Station 1978

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
Average Maximum Temperature (°F)	71.7	71.3	77.8	82.9	87.0	89.7	90.2	90.1	89.5		83.7	81.2	
Average Minimum Temperature (°F)	51.8	50.0	56.8	61.8	69.7	72.9	72.8	72.5	71.4		64.7	62.9	
Average Temperature (°F)	61.8	60.7	67.3	72.4	78.4	81.3	81.5	81.3	80.5	78.0	74.2	72.1	74.1
Departure from normal (°F)	-3.5	-5.4	-2.1	.7	2.5	2.1	1.0	.3	.3	1.7	3.8	5.7	.4
Rainfall (in.)	2.19	5.12	3.11	2.96	7.06	10.24	5.61	9.18	8.96	6.77	1.82	1.75	64.77
Departure from normal (in.)	.35	3.34	.79	-.15	1.01	-.11	-2.58	1.60	-1.11	-1.65	-.30	.59	1.78

Table 2. Climatic data for Tamiami Trail at 40-Mile Bend, 1978. Source: National Oceanic and Atmospheric Administration (1978).

Tamiami Trail at 40-Mile Bend 1978

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
Average Maximum Temperature (°F)	72.4	70.8	78.3	84.0	89.0	91.1	91.4	91.4	91.1		84.4	83.0	
Average Minimum Temperature (°F)	52.1	50.5	58.3	63.5	70.8	74.4	75.1	75.3	75.1		65.9	62.7	
Average Temperature (°F)	62.3	60.7	68.3	73.8	79.9	82.8	83.3	83.4	83.1	78.9	75.2	72.9	75.4
Departure from normal (°F)	-4.9	-7.2	-2.3	.1	3.0	2.2	.9	.2	.7	.5	2.4	4.5	.0
Rainfall (in.)	2.23	3.16	3.53	1.93	3.52	10.60	14.59	3.46	5.73	4.00	1.79	1.47	56.01
Departure from normal (in.)	.69	1.58	1.31	-.75	-2.41	.78	6.41	-4.01	-3.60	-2.23	.29	.44	1.50

Table 3. Climatic data for Flamingo, Everglades National Park, 1978. Source: National Oceanic and Atmospheric Administration (1978).

Flamingo 1978

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
Average Maximum Temperature (°F)	72.2	71.2	77.1	81.9	85.7	88.5	89.6	89.5	89.3		82.8	81.6	
Average Minimum Temperature (°F)	50.4	51.0	57.8	63.6	71.0	74.4	74.9	73.7	72.7		65.5	62.0	
Average Temperature (°F)	61.3	61.1	67.5	72.8	78.4	81.5	82.3	81.6	81.0	78.4	74.2	71.8	74.3
Departure from normal (°F)	---	---	---	---	---	---	---	---	---	---	---	---	---
Rainfall (in.)	2.00	2.44	2.88	3.52	4.95	7.47	1.69	6.40	5.31	4.90	2.35	1.78	45.69
Departure from normal (in.)	---	---	---	---	---	---	---	---	---	---	---	---	---

Legend for Tables 4-17, flowering and fruiting phenology of selected plant communities of Everglades National Park and Biscayne National Monument for 1978.

+ = Species was observed to have individuals in flower in the month indicated.

++ = Species reached its maximum intensity of flowering for 1978 in the month indicated.

* = Species was observed to have individuals in fruit in the month indicated.

** = Species reached its maximum intensity of fruiting for 1978 in the month indicated.

(+) or (*) = Species not actually observed to be in flower or fruit at the sampling site, but inferred to be in flower or fruit in that general area from other information (not counted in summary figures, except for Royal Palm hammock, for which data was particularly sparse because of the scarcity of flowering or fruiting in the shaded sampling location).

Table 4. Flowering and fruiting phenology, tropical hardwood hammock, area of Elliott Key Marina, Biscayne National Monument, 1978

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Amyris elemifera											++	
Ardisia escallonioides									++	+	+	
	*	*	*	*						**	*	*
Ateramnus lucidus					++							
						**						
Bourreria ovata						+	++	+		+		
							**	*	*	*	*	
Bumelia celastrina	+	+	++									
Bumelia salicifolia		+	+	+	++	+						
							**					
Bursera simaruba					++							
						**						
Calyptranthes pallens					+	++						
							*	**	*			
Capparis flexuosa						++						
								**				
Casasia clusiifolia					++	+						
	*	*	*	*	*	*	*	*	*	**	*	*
Chiococca alba						+	+	+	+	++	+	
	**	*	*	*						*	*	*
Chrysophyllum oliviforme						+	+	+	++	+	+	
		*									*	**
Coccoloba diversifolia			+	+	++	+	+				+	
	**	*	*	*	*	*	*	*	*	*	*	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Drypetes diversifolia									+			
						*	*	*	*	*	*	*
Eugenia axillaris	*	*	*	**	*	*	*	*				
Eugenia foetida	*	**	*	*	*		*					
Exostema caribaeum							+	+			+	+
	*	*	*	*	*	*		*	*			
Exothea paniculata		+	++	+								
				*	**	*						
Ficus aurea			*	*	**	*	*	*	*		*	*
Ficus citrifolia	*	*		**			*	*	*	*	*	*
Guapira discolor				+	+	++	+	+	+	+		
						*	*	*	*	*	*	
Guettarda elliptica						++						
							*	*	**	*		
Krugiodendron ferreum			+	++	+	+	+	+	+			
	*	*						*	*	**	*	
Lysiloma latisiliquum				++	+			+		+		
	*	*	*			*	*	*	*	*	*	*
Mastichodendron	+					+				++		
foetidissimum	*	**	*			*					*	
Metopium toxiferum			+	++	+	+						
	*				*	*	**	*	*	*		*
Morinda royoc	+	+	+	+	++	+	+			+		+
	*	*				*	*		**	*		
Piscidia piscipula						++						
						**						

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Pisonia aculeata	+	+	++	+								
		*	**	*								
Pithecellobium guadalupense	+		+	+					+		++	
	**	*	*		*	*						*
Pithecellobium unguis-cati	++			+					+		+	
	*			*			*		*	*	*	**
Psychotria nervosa					++							
		**									*	*
Randia aculeata									++			
	*	*	*	*								
Reynosia septentrionalis			+	++								+
				*	**	*	*					*
Sapindus saponaria										+	++	
	*	*	*	*	*	*	*	*	*			**
Schinus terenbinthifolius											++	
											*	**
Simarouba glauca			++									
				++	+							
Swietenia mahagoni					+	++						
	*	*	*	*				*	*	*	*	*
Thrinax morrisii					+	++						
	*	*		*			*	*	*	*	*	*
Vitis rotundifolia					++	+						
						*	*	**	*	*		
Ximenia americana				++	+							
						**						
Zanthoxylum fagara	+	+	+	+	+	+	+	+				
	**	*										

Table 5. Flowering and fruiting phenology, tropical hardwood hammock, Bear Lake Trail, Everglades National Park (ENP), 1978

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Acacia farnesiana											++	
		*	**	*						*	*	
Ardisia escallonioides									++	+	+	+
	*	*	*	*	*	*	*	*	*	*	*	*
Bursera simaruba					++							
	*	**	*	*								
Canella winterana						++	+	+				
	*	*	*	*	*							
Capparis flexuosa						++						
Cereus pentagonus							++					
								*		**		
Cereus gracilis				+	++	+						
							**	*				
Chiococca alba							++	+				
									*	**	*	*
Chrysophyllum oliviforme						+	+	++	+			
		*										
Coccoloba diversifolia					+			+				
					*		*		*			
Colubrina arborescens	+								++	+		
	*	*	*								*	**
Cordia globosa						++	+	+	+	+		
											*	**
Dalbergia ecastophyllum						++						
								*				

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Erythrina herbacea	+	+	+	++							+	
Eugenia axillaris	*	*	*	*		+ *	++ *	+	**	*	*	
Eugenia foetida						++		**				
Exothea paniculata		+	++	+ **								
Ficus aurea		*	*	*	*	*	*	*	**	*	*	
Forestiera segregata	*	**	*					+			++	
Guettarda elliptica						++	+ *	*	*	**	*	*
Hamelia patens			+		+	+	+		++	+	+	+
Hippocratea volubilis			+	++								
Hippomane mancinella					++ *	*	**	*				
Krugiodendron ferreum				+	+	*	+ *	+		+ *		
Lasiacis divaricata	*		*					++ *	*	**	*	*
Mastichodendron foetidissimum					++	+						
Metopium toxiferum				++	**	*	*					
Nectandra coriacea	*	*		+	++	+	*	*	*	**	*	*

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Pisonia aculeata	+	+	++	+								
				**								
Pithecellobium guadalupense	+		+	+							++	+
	**											
Psychotria nervosa	*											**
Randia aculeata	+		++		+				+			
	**		*	*								*
Sabal palmetto					+	++	+					
Sapindus saponaria					+		+	+	++	+	+	
	*	*	*	*	*						*	**
Swietenia mahagoni						++						
	*	*									**	*
Tillandsia fasciculata				++	+							
				**	*		*				*	
Toxicodendron radicans	+	++	+									
			**		*	*	*					
Ximenia americana				++	+							
Zanthoxylum fagara		+	++	+	+							
					*							

Table 6. Flowering and fruiting phenology, tropical hardwood hammock, Mahogany Hammock, ENP, 1978.

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Acoelorrhaphe wrightii				+	++	+						
	*						*	*	**	*	*	*
Ardisia escallonioides									++			
	**											
Bumelia salicifolia				++								
						**						
Bursera simaruba					++							
							**					
Calyptranthes pallens					+	++						
							**	*	*	*		*
Calyptranthes zuzygium						++						
						**						
Chrysophyllum oliviforme						+	+	++	+			
	**	*	*									
Coccoloba diversifolia			+		++		+					
	*	*			*		**		*			
Encyclia tampense						+	++	+				
	**	*	*	*	*				*	*	*	*
Erythrina herbacea				++								
Eugenia axillaris		++										
Exothea paniculata		+	++	+								
				*	*	**						
Ficus aurea					**		*	*				
Ficus citrifolia							*	*	**	*		

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Hippocratea volubilis	+		++	+								
Ilex cassine				++								
					**	*	*	*	*	*	*	
Magnolia virginiana							*	**	*			
Metopium toxiferum				++	+							
					*	**	*	*				
Myrcianthes fragrans				++	+							
Nectandra coriacea				+	++							
					*					**	*	
Oplismenus setarius	*										**	*
Persea borbonia				++		+						
						*	*	*	*	**	*	
Psychotria nervosa					++							
							*		*	**	*	
Quercus virginiana			++									
Randia aculeata						**						
Sabal palmetto					+	++						
							*	*	*	**	*	*
Swietenia mahagoni						++						
	*	**	*	*					*	*	*	*
Toxicodendron radicans		+	++									
				*	*			*	*			

Table 7. Flowering and fruiting phenology, tropical hardwood hammock, Royal Palm hammock (Paradise Key), 1978

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Ardisia escallonioides		*	*	*	(*)	**	*	*		*	*	*
Bumelia salicifolia			+	+			**	*	*	*		
Bursera simaruba					(+)		**					
Calyptranthes pallens					(+)	(+)	(*)	(*)	(*)			
Celtis laevigata								**				
Chiococca alba								++ *	*	**		
Chrysophyllum oliviforme	(*)	(*)						(+)	(+)			(*)
Coccoloba diversifolia	*	*	(+) *	(+) *	(+)							
Erythrina herbacea		+	++	+								
Eugenia axillaris		**										
Exothea paniculata		+	++ **									
Ficus aurea											*	**
Hippocratea volubilis			(+)	(+)								
Mastichodendron foetidissimum					(+)	(+) **						

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Metopium toxiferum				++								
						**	*	*				
Morus rubra		++	+									
Myrsine floridana								**				
Nectandra coriacea	+	+	+	++	(+)	+	+					
	*		*		(*)	*	*	*	**	*	*	
Parthenocissus quinquefolia					(+)							
						**	*		*	*	*	
Pisonia aculeata		(+)	(+)									
				(*)								
Prunus myrtifolia	(+)											
	*	**	*	*								
Psychotria nervosa					(+)							
	*	*					**	*	*	*	*	*
Quercus virginiana			++									
								*	*	*	**	*
Schoepfia chrysophylloides	++											
	**											
Sapindus saponaria										++		
											**	
Simarouba glauca			(+)									
				(*)	(*)							
Tetrazygia bicolor					+	++	+					
							**	*	*			
Toxicodendron radicans		++										
	*		*	**	(*)	*						

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Vitis munsoniana				++		**	*	*	*	*		
Ximenia americana				(+)	(+)	(*)						
Zanthoxylum fagara			(+)	(+)	(*)							

Table 8. Flowering and fruiting phenology, pineland, Long Pine Key, ENP, 1978

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Andropogon cabanisii									+	+		
												*
Angadenia sagraei					+	(+)	++					
Ardisia escallonioides									+	+		
											*	
Aster adnatus										+	++	
										*	**	
Aster dumosus	+	+	+								++	+
	*	*	*								**	*
Borreria terminalis	++	+	+	+	+	+	+	+	+	+	+	+
	*	*	*	*	*	*		*		*	*	*
Byrsonima lucida				+	++							
					**	(*)	*					
Cassia chapmannii			+	++	+							
			*		**							
Cassia deeringiana			+	++	+	(+)	+	+				
				*	*	**	*					
Cassytha filiformis								+	+	++		
								*	*	**	(*)	*
Chiococca parvifolia									+	++		+
									*	**	*	*
Chamaesyce pinetorum	+	+	+	+	+	+	+	+	+		+	+
	*	*	*	*	*	*	*	*	*		*	*
Chamaesyce porteriana	+	+	+	+	+	+	+	+	+		+	+
	*	*	*	*	*	*	*	*	*		*	*

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Crotalaria pumila	+	++	+	+	+							+
	*	*	**	*	*	*						
Croton linearis	+	+	++	+	+		+	+		+	+	+
	*	*	*	*	*	*	*	*		*	*	*
Dichromena floridensis	+	+		+		+	+	+	+	+	+	+
				*		*	*	*	*	*	*	*
Dodonea viscosa		+									++	
		*	*								*	**
Dyschoriste oblongifolia				++	+	(+)	+	+				
				**	*	(*)	*	*				
Gerardia filifolia					+	(+)	+	++	+	+		
					*	(*)	*	**	*	*		
Guettarda elliptica						+	++	+				
							*	**	*	*	*	*
Guettarda scabra						+	++	+				
							*	**	*	*	*	*
Hedyotis nigricans	+	+	+	+	+	+	+	+	+	+	+	+
	*	*	*	*	*	*	*	*	*	*	*	*
Jacquemontia curtisii	+	+	+	+		+	+	+	+	+	+	+
	*	*	*	*	*		*				*	*
Metopium toxiferum				++								
						**	*	*				
Melanthera angustifolia					+	+	++	+	+	+	+	
					*		**	*	*	*	*	
Mikania scandens					+	+	++	+		+		
							*	**	*		*	
Morinda royoc	+	+	+	+	++	+		+		+		
		*	*	*	**	*	*	*	*	*		

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Persea borbonia				++								
						**	*	*	*			
Phyllanthus pentaphyllus	+	+	+	+		+	+	+		+	+	+
	*	*	*	*		*	*	*	*	*	*	*
Physalis viscosa	+	+	+	+			+	+	+			+
	*	*	*	*			*					*
Randia aculeata					++							
					**	(*)	*	*				
Rhus copallina								++				
								*	**	*	*	
Ruellia caroliniensis	+		+	+	+		+	+	+		+	
				*	*			*	*		*	
Sabal palmetto				+	++	+						
					*	**	*	*	*	*		
Samolus ebracteatus		+	++	+								
		*	*	**	*							
Serenoa repens	+	+	+	++	+							
	*	*		*	**	*	*	*	*			
Smilax auriculata				++								
					*	**	*		*	*		*
Tetrazygia bicolor						++	+					
							**					

Table 9. Flowering and fruiting phenology, Muhlenbergia prairie, Taylor Slough, ENP, 1978

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Andropogon virginicus											++ **	
Asclepias lanceolata				+	++		+	**	+			
Aster dumosus	+ **	+ *	+ *	+ *	+ *							++
Aster tenuifolius											++	+
Centella asiatica				++ *	+ **							
Chloris glauca							**	*				
Cirsium horridulum			++ *	+ *	+ **							
Cladium jamaicense						++	**					
Dichromena colorata			+ *	++ *	+ **							
Gerardia harperi					+ *	+ *	++ **	+ *	+			
Hyptis alata							++					
Linum carteri var. smallii				++ *	+ **							
Lobelia glandulosa			+ *	++ *	+ **							
Melanthera parviflora			+ *	++ **	+ *							

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Muhlenbergia filipes										++	+	
	*										*	
Panicum portoricense			++	+	+							
	*	*	*	**	*				*			
Phyla nodiflora			+	++	+							
				**	*							
Polygonum baldwinii				++	+							
				**	*							
Rhynchospora microcarpa			+	++	+							
		*	*	*	**	*	*	*	*	*	*	*
Sabatia grandiflora			+	++	+			+				
			*	*	**							
Setaria geniculata				+	++							
				*	**							
Solidago stricta	+	+	+	+	+					+	++	+
	*	*	*	*	*						**	*
Teucrium canadense					++	+						
					**	*	*					

Table 10. Flowering and fruiting phenology, Cladium prairie, Taylor Slough, ENP, 1978

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Andropogon virginicus									+	++		
											*	**
Asclepias lanceolata				+	++	+	+					
Aster dumosus	+	+	+	++	+							
	*	**	*	*	*							
Aster tenuifolius	+	+	+	+	+					+	++	+
	*	*	*	*	*							**
Bacopa caroliniana					++							
Centella asiatica				++	+	+						
				*	**	*						
Chloris glauca						++						
								**				
Cladium jamaicense						++						
						**	*	*				
Cynoctonum mitreola				+	++	+	+					
					*	**	*	*				
Eupatorium coelestinum						++					+	
						**						
Eupatorium leptophyllum	++											
	**											
Helenium vernale	+	++	+	+								
		*	**	*								
Lobelia glandulosa	+	+	+	+					+	+	++	+
									*	**	*	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Ludwigia simpsonii									++ *	**	*	
Melanthera parvifolia				++ **	+ *							
Oxypolis filiformis	+	+	+					+	+ *	++ **	+ *	*
Panicum portoricense	*	*	+ *	++ **	+ *	+ *	*	*	*	*	*	*
Phyla nodiflora			+	++ **	+ *	*	*					
Pluchea rosea	+	+	+ *	+ *	++ *	+ *	+ **					
Polygala grandiflora	+		+	++ *	+ **	+ *	+	+	+			
Rhynchospora microcarpa			+	++ *	+ *	+ **	+ *	*	*	*		
Rhynchospora tracyi							++ *	+ *	**	*	+ *	+ *
Sabatia grandiflora				+ *	++ *	+ **	+ *					
Setaria geniculata	+	+	+	+ *	++ *	+ *	**					
Solidago stricta			+ *	+ *	+ *				++	+	+ *	**

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Stillingia aquatica	+	+	+	++	+							
	*	*	*	**	*							
Teucrium canadense				+	+	++	+					
					*	*	**					
Utricularia foliosa										++		
										**		

Table 11. Flowering and fruiting phenology, Eleocharis marsh, Taylor Slough, ENP, 1978

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Aster dumosus		+	+	++	+							
			*	**	*							
Aster tenuifolius											++	
Bacopa caroliniana					++							
Centella asiatica				++	+							
				*	**							
Crinum americanum	+		+		++	+						
					**	*						
Cynoctonum mitreola				+	++							
					**							
Eleocharis cellulosa									+			++
							**	*				
Gerardia harperi					++							
					**							
Hymenocallis palmeri				++	+	+						
					**							
Nymphoides aquatica					+	++	+	+				
					*	**						
Oxypolis filiformis								+	++	+	+	+
									*	**	*	*
Panicum hemitomon				++	+							
				**	*							
Paspalidium geminatum				++								
		**										

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Peltandra virginica			++	+	+ **		+					
Phragmites australis											++ *	+ **
Phyla nodiflora				+	++							
Polygonum hirsutum					++							
Pontedaria lanceolata				+	++ **	+ *	+ *			+		
Rhynchospora inundata				+	++ *	*	**	*				
Rhynchospora tracyi				++ *	+ *	*	**	*	*	*	*	*
Sagittaria lancifolia	+ *	+ *	+ *	++ **	+ *	+ *	+	+	+ *	+	++ **	+ *
Spiranthes vernalis	**	*									++	
Utricularia foliosa	+ *	+ *	+ *				+ *		++	+ *	+ **	+ *

Table 12. Flowering and fruiting phenology, Salix head, Taylor Slough, ENP, 1978

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Cephalanthus occidentalis					++ *	+ *	+ **	*				
Hymenocallis palmeri					++							
Ipomoea sagittata					++		+	+				
Mikania scandens									+	++ *	+ **	+ *
Nymphaea odorata	+ **	+	+	+	++	+						
Peltandra virginica	+ *	+	+ *	++ *	**	+ *		+	+			
Phragmites australis	*	*								++ *	+ **	*
Phyla stoechadifolia			++	+								
Polygonum hirsutum		+	+	+ *	+ *	+			+			+
Salix caroliniana	++ **	+ *	*									+
Sarcostemma clausa										++ **		

Table 13. Flowering and fruiting phenology, mangrove vegetation, Bear Lake Trail, ENP, 1978.

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Alternanthera ramosissima	+	+										+
	*	*										*
Atriplex arenaria	+					+	+	++	+	+	+	+
	*						*	*	**	*	*	*
Avicennia germinans					++	+	+					
								**	*			
Baccharis halimifolia								++	+			
										**		
Borrichia frutescens							++					
							*	**				
Conocarpus erectus						+	+	++	+			
									**			
Laguncularia racemosa						++						
							*	**	*			
Rhabdadenia biflora									++			+
Rhizophora mangle									++			
								*	**			

Table 14. Flowering and fruiting phenology, mangrove vegetation, Elliott Key Marina, Biscayne National Monument, 1978.

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Acrostichum aureum						*	**	*	*	*		
Acrostichum danaeifolium	*	**										
Alternanthera ramosissima	+ *	+ *	+ *	+ *	+ *	+ *	+ *	+ *	+ *	+ *	+ *	+ *
Atriplex arenaria						+	++	+	+ **	+ *	+ *	+ *
Avicennia germinans					+	++	+	*	**	*	*	
Baccharis halimifolia	*							+	++	+	**	*
Batis maritima					++	+	**					
Bidens alba	+ *	+ *	+ *	+ *	+ *	+ *		+ *	++ **	+ *	+ *	+ *
Borrichia arborescens		++	+	+			*					
Borrichia frutescens	*	+ *	+ *	+ *	++ *	+ **	+ *	+ *	+ *	+ *		
Conocarpus erectus	*	*	*		+ *	+	++ *	+	**	+ *	*	*
Echites umbellata										++		

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Laguncularia racemosa					+	+	++	+				
							*	**	*			
Lycium carolinianum					+				++		+	
												*
Urechites lutea						+	+	+	++			
	**	*	*	*						*		*

Table 15. Flowering and fruiting phenology, mangrove vegetation, West Lake, ENP, 1978.

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Acrostichum aureum	*	*	*	*	*	*	*	*	*	*	*	*
Alternanthera ramosissima	+ *	+ *	+ *	+ *	+ *	+ *	+ *	+ *	+ *	+ *	+ *	+ *
Avicennia germinans					++	+	+	 *	 **	 *		
Baccharis halimifolia								+	++	+ **	 *	
Batis maritima					++							
Borríchia frutescens				++	+ **	+						
Cladium jamaicense				++								
Conocarpus erectus							+	++	+ **	 *		
Hippocratea volubilis	+	+	++	+								
Laguncularia racemosa					+	++	+ *	+ **	 *	 *		
Lycium carolinianum								++	 **	 *		
Rhabdadenia biflora							+	+	+	+	++	+
Rhizophora mangle						+	++	+	+ **	+ *		
Sarcostemma clausum							+	++	+	 **		
Spartina spartinae								++	 **	 *		

Table 16. Flowering and fruiting phenology, successional vegetation (3-year old), "Hole-in-the-Donut," ENP, 1978

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Ambrosia artemisiifolia						+	++	+	+			
								*	**			
Andropogon glomeratus								+	++	+		
								*	**	*		
Baccharis halimifolia									+	++	+	
										*	**	
Bidens pilosa	+	+	+	+	+	+	+	+	+	+	+	+
	*	*	*	*	*	*	*	*	*	*	*	*
Blechnum brownei	*	*	*	*	*							*
Boehmeria cylindrica				+	+	++	+	+				
				*	*	*	*	**	*			
Borreria laevis	+	+	+	+	+	+	+	+	+	+	+	+
	*	*	*	*	*	*	*	*	*	*	*	*
Brachiaria mutica							+	+	+	+	+	
								*	*	*	*	
Chamaesyce hirta	+	+	+	+	+	+	+	+	+	+	+	+
	*	*	*	*	*	*	*	*	*	*	*	*
Chamaesyce hyssopifolia	+	+	+	+	+	+	+	+	+	+	+	+
	*	*	*	*	*	*	*	*	*	*	*	*
Cissus sicyoides	+			+	++	+	+	+	+	+	+	+
					*	*	**	*	*	*	*	
Commelina diffusa	+	+	+	+	+	+	+	+	+	+	+	+
	*	*	*	*	*	*	*	*	*	*	*	*
Corchorus siliquosus							++	+	+	+	+	+
	*	**	*	*	*	*	*	*	*	*	*	*

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Cyperus distinctus	++ **	+ *	+ *	+ *	+ *	+ *	+ *	+ *	+ *	+ *	+ *	+ *
Eupatorium capillifolium	+ *	 *								+ *	+ *	++ **
Lepidium virginicum			+ *	++ *	+ *	+ **						
Ludwigia octovalvis	+ *	+ *	+ *	+ *	+ *	+ *	+ *	+ *	+ *	+ *	+ *	+ *
Lythrum lineare							++ *	+ **	+ *	 *		
Melilotus alba		+ *	+ *	+ *	++ *	+ *	+ *	+ *				
Melothria pendula	+ *	+ *	+ *	+ *	+ *	+ *	+ *	+ *	+ *	+ *	+ *	+ *
Pectis leptocephala	+ *	 *	+ *	+ *	+ *	+ *	+ *	+ *	+ *	+ *	+ *	+ *
Phaseolus lathyroides	+ *	+ *	+ *	+ *	+ *	+ *	+ **	+ *	+ *	+ *	+ *	+ *
Rhynchosia minima	+ *	+ *	+ *	+ *	++ **	+ *	+ *	+ *	 *	+ *	+ *	+ *
Sarcostemma clausa						+	+ *	+ *	++ *	+ **	+ *	
Setaria geniculata	+ *	+ *	+ *	+ *	+ *	+ *	+ *	+ *	+ *	+ *	+ *	+ *
Sida acuta		+ *	+ *	+ *	+ *	+ *	+ *	+ *	+ *	+ *	+ *	+ *

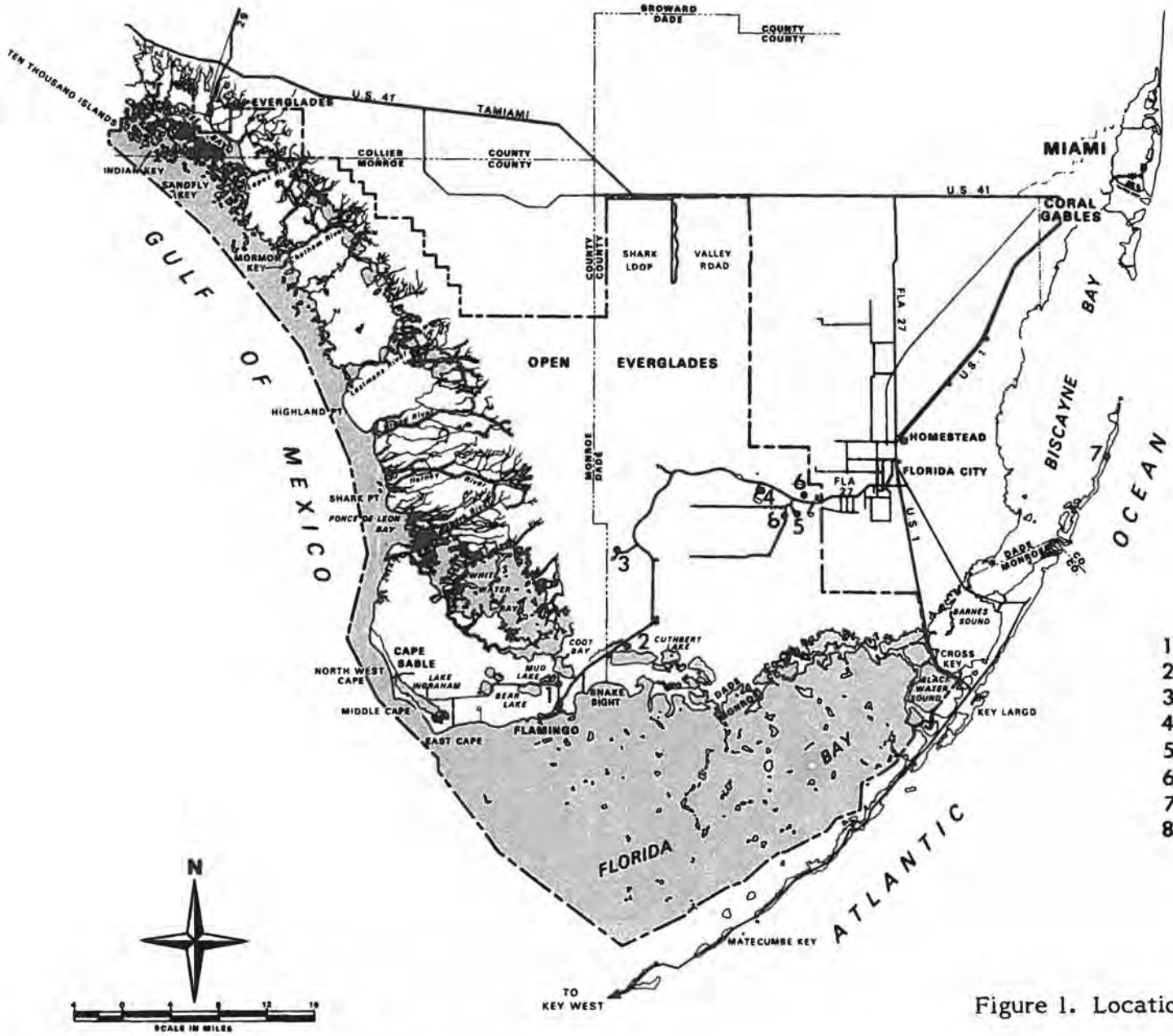
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Solanum americanum			++ *	+ **								
Solidago sp.									+	++ *	+ **	
Sonchus asper			++ *	+ **	*							
Toxicodendron radicans		+	++ *	+ *	+ *	+ *	+ *	+ *				

Table 17. Flowering and fruiting phenology, successional vegetation (5-30 year old), "Hole-in-the-Donut," ENP, 1978

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Ampelopsis arborea									+	++	+	
									**	*	*	
Ardisia solanacea				+	+	++	+	+	+	+	+	
	*	*	*				*	*	**	*	*	*
Baccharis glomeruliflora									+	++	+	+
	*									*	**	*
Buchnera floridana			++	+	+	+	+	+	+	+	+	+
			*	*	*	**	*	*	*	*	*	*
Bumelia salicifolia			+	++	+	+						
				*		*	**	*				
Cirsium horridulum	++	+	+	+	+							
		*	**	*	*							
Cissus sicyoides	+			+	++	+	+	+	+	+	+	+
		*	*		*	*	*	*	**	*	*	
Erythrina herbacea	++	+	+								+	+
	*	**	*	*			*					
Hypericum hypericoides	++	+	+	+	+	+	+	+	+	+	+	+
	**	*	*	*	*		*	*	*	*	*	*
Metopium toxiferum				++								
				*	**	*	*	*	*	*		
Medicago lupulina		+	++	+	+	+						
		*	*	**	*	*						
Morinda royoc	+	+				+	++	+	+	+		
		*				*		**	*	*		

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Myrica cerifera	+										++	+
	**	*	*	*								*
Myrsine floridana					++							
		*	*			**	*	*				
Parthenocissus quinquefolia						+	++	+	+	+	+	
						*	**	*	*	*	*	
Persea borbonia			+	++	+	+						
					*	**	*	*				
Plantago virginica	+	+			+	+	++	+				
					*	*		**				
Psidium quajava					+	++	+	+				
	*		*		*	*	*	**	*	*		
Sabal palmetto				+	++	+	+					
	*					*	*	**	*	*	*	*
Salix caroliniana	++	+										+
		**	*									
Samolus ebracteatus		+	++			+	+	+			+	+
		*	**			*	*	*			*	*
Schinus terebinthifolius	+									++	+	
	*	*	*							*	*	**
Sesbania macrocarpa								++	+			
	*	*	*					*	**	*	*	*
Sisyrinchium miamiense	++	+	+	+	+					+	+	+
		*	**	*	*							*
Solidago leavenworthii								+	++	+		
									*	**	*	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Trema micranthum				+	+	++	+	+	+	+		
					*	*	*	**	*	*		
Vicia acutifolia		+	++	+	+							
			*	**	*							
Vigna luteola	++	+	+	+	+	+	+	+	+	+	+	+
	*	*	*	*	*	*	*	*	*	*	*	*
Vitis aestivalis				++								
Vitis munsoniana	+	+	+	+	+	+	++	+	+	+	+	
	*	*	*	*	*	*	*	**	*	*	*	*
Waltheria indica	+	+	++	+	+	+	+	+	+	+	+	+
	*	*	*	*	*	*	*	*	*	*	*	**



1 Bear Lake Trail
2 West Lake Boardwalk
3 Mahogany Hammock
4 Long Pine Key Pineland
5 Paradise Key (Royal Palm)
6 Taylor Slough near Bridge
7 Elliott Key Marina
8 Hole-in-the-Donut

Figure 1. Location of phenology sampling sites.

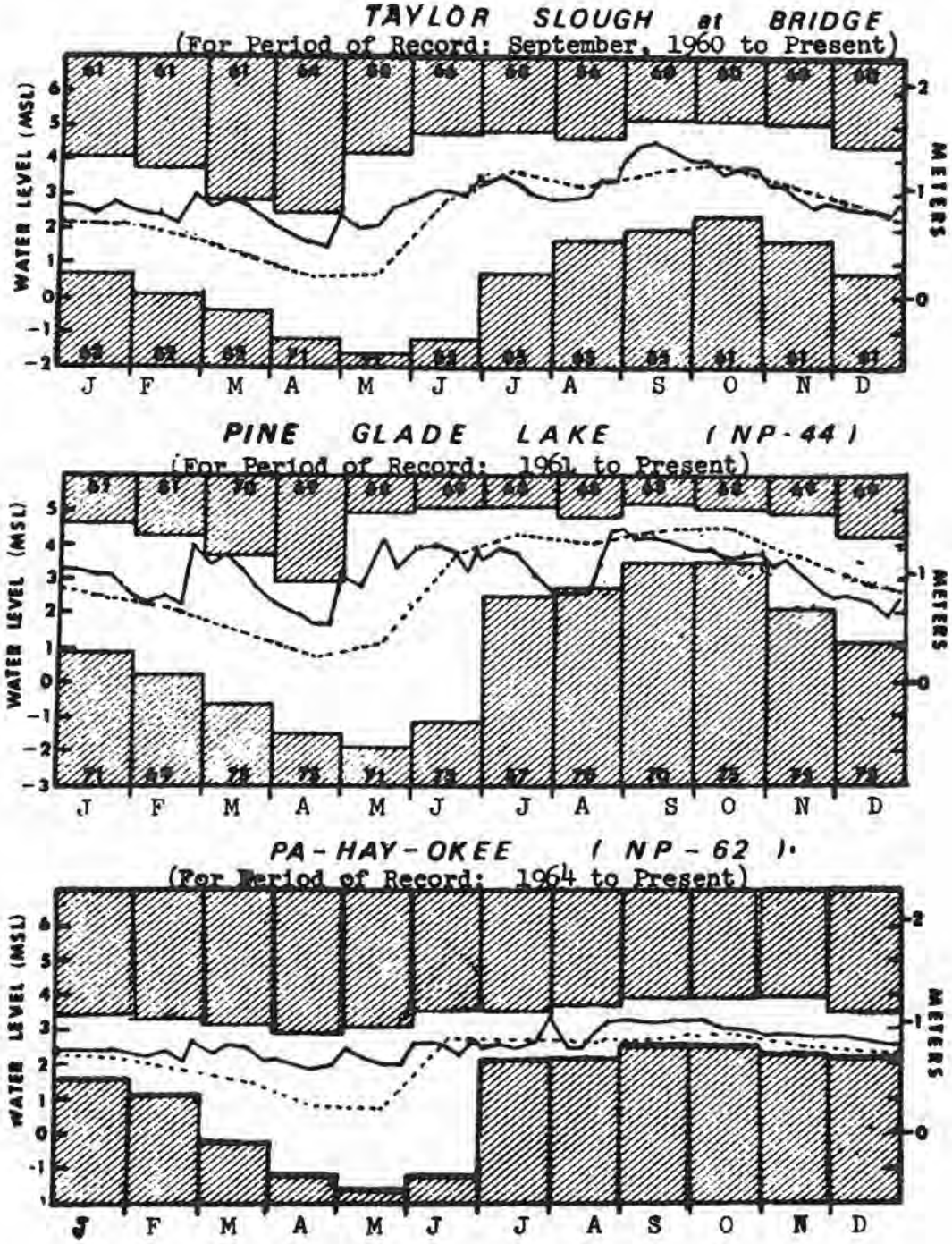


Figure 2. Water levels (———), taken weekly, for 1978 at three sites within Everglades National Park as compared with mean levels (-------) and maximum and minimum mean monthly levels for the period of record.

Figures 3-16. Flowering and fruiting phenology for selected sites in Everglades National Park and Biscayne National Monument, 1978.

Legend:

———	denotes number of species in flower
— — — —	denotes number of species in fruit
- - - - - - - -	denotes number of species at peak of flowering
.....	denotes number of species at peak of fruiting

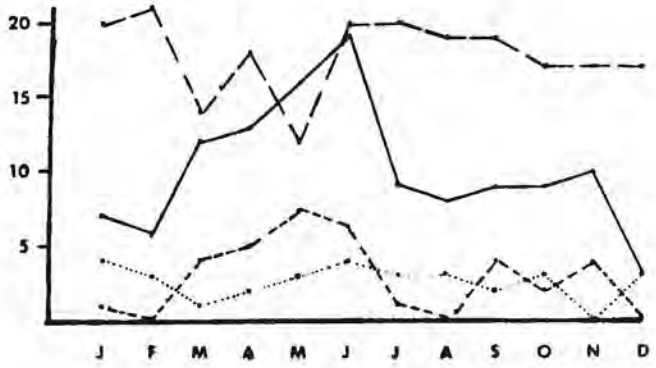


Figure 3. Hammock near Elliott Key Marina.

Figure 4. Bear Lake Trail, hammock.

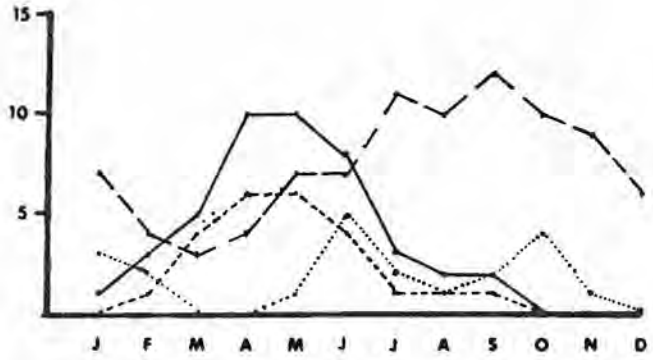


Figure 5. Mahogany Hammock.

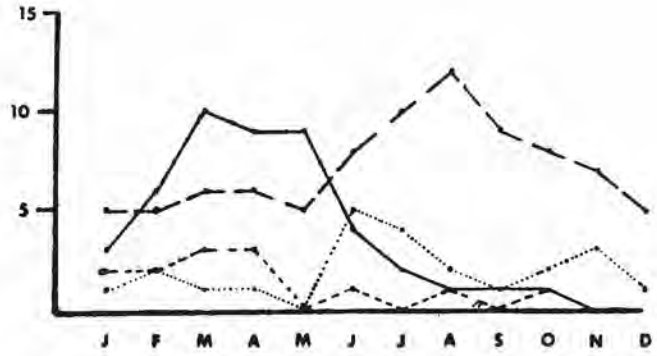


Figure 6. Royal Palm Hammock.

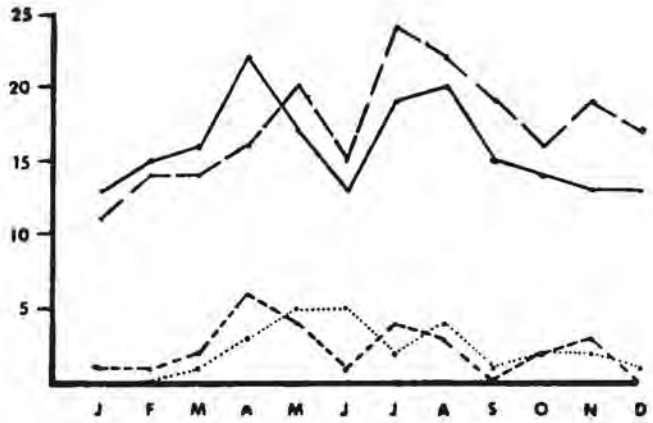


Figure 7. Pineland, Long Pine Key.

Figure 8. Muhlenbergia prairie, Taylor Slough.

Figure 9. Cladium prairie, Taylor Slough.

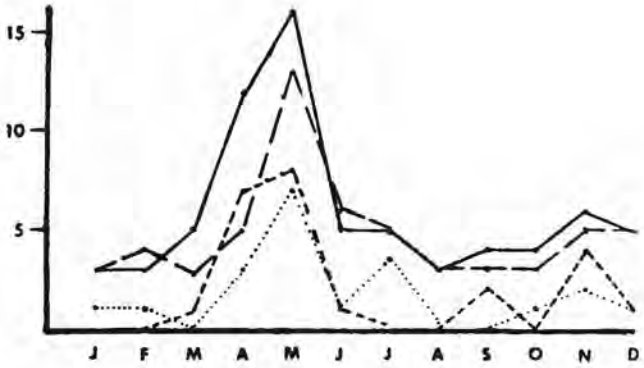


Figure 10. Eleocharis marsh, Taylor Slough

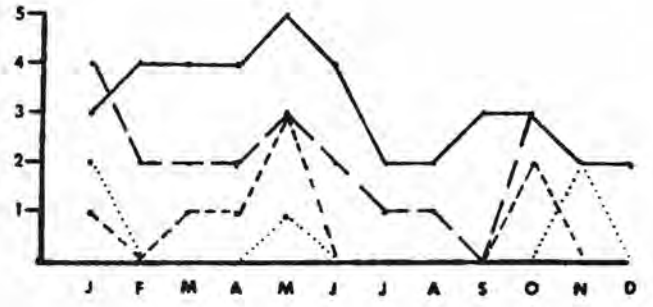


Figure 11. Salix head, Taylor Slough.

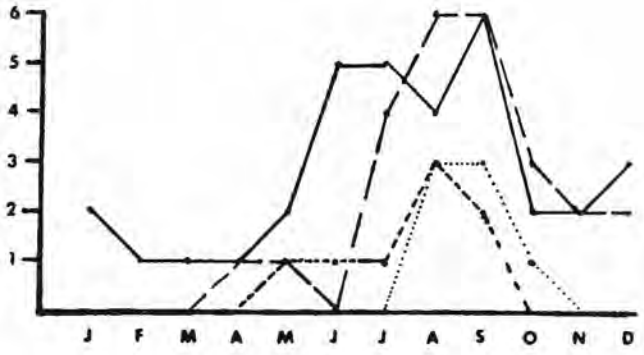


Figure 12. Mangrove vegetation, Bear Lake Trail.

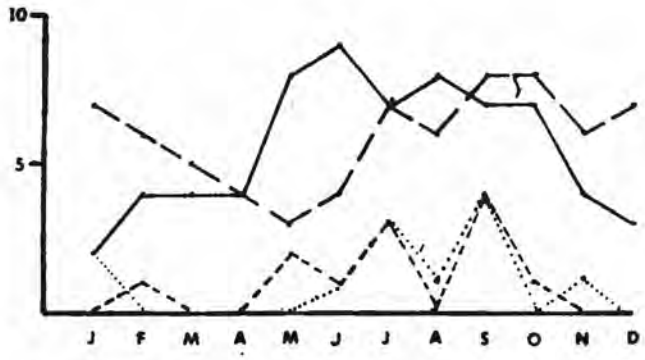


Figure 13. Mangrove vegetation near Elliott Key Marina.

Figure 14. Mangrove vegetation, West Lake.

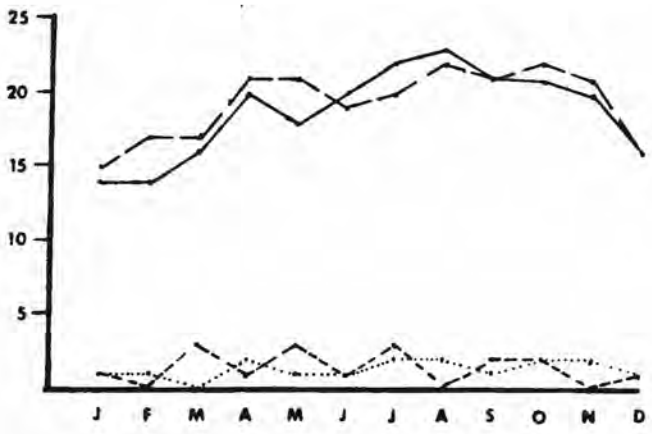


Figure 15. Successional vegetation, 3 years old, Hole-in-the-Donut.

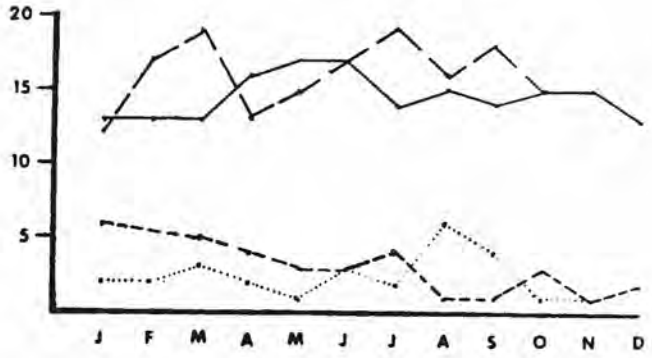


Figure 16. Successional vegetation, 5-30 years old, Hole-in-the Donut.