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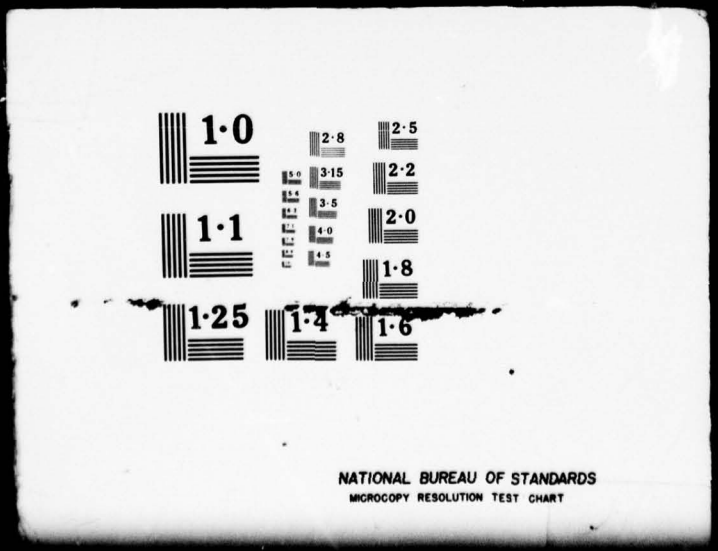








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TECHNICAL REPORT Y-78-2

PRELIMINARY GUIDE TO WETLANDS OF PENINSULAR FLORIDA

Major Associations and Communities Identified

Environmental Effects Laboratory
U. S. Army Engineer Waterways Experiment Station
P. O. Box 631, Vicksburg, Miss. 39180

February 1978
Final Report

Approved For Public Release; Distribution Unlimited

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Prepared for Office, Chief of Engineers, U. S. Army
Washington, D. C. 20314

PRELIMINARY GUIDE TO WETLANDS

Major Associations and Communities Identified

Technical Report No.	Region
Y-78-2	Peninsular Florida
Y-78-3	Puerto Rico
Y-78-4	West Coast States
Y-78-5	Gulf Coastal Plain
Y-78-6	Interior-Great Lakes
Y-78-7	South Atlantic States
Y-78-8	North Atlantic States
Y-78-9	Alaska

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P. O. BOX 631
VICKSBURG, MISSISSIPPI 39180

IN REPLY REFER TO: WESYV

31 March 1978

SUBJECT: Transmittal of Technical Report Y-78-2

TO: All Report Recipients

1. The report transmitted herewith provides preliminary guidance on wetland determination to Corps of Engineers personnel responsible for the implementation of Section 404 of the Federal Water Pollution Control Act Amendments of 1972 (PL 92-500) in peninsular Florida. This guide, sponsored by the Office, Chief of Engineers, represents one of a series of eight guides to the major wetland associations of the United States. Other guides include Puerto Rico, Alaska, South Atlantic States, Gulf Coastal Plain, North Atlantic States, Interior-Great Lakes, and West Coast States.

2. The guide is intended to assist in the field recognition of major wetland communities as they relate to the determination of jurisdictional boundaries in the implementation of the Section 404 permit program. It is neither a regional flora manual nor a general classification system. Several manuals that identify the flora of Florida are referenced in this document and personnel requiring species identification are referred to those works. Personnel requiring a detailed wetland classification system may wish to consult "Classification of Wetland and Deep-Water Habitats of the United States (an operational draft)," prepared by the National Wetland Inventory Project of 1975-79 of the U. S. Fish and Wildlife Service.

JOHN L. CANNON
Colonel, Corps of Engineers
Commander and Director

Unclassified

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

REPORT DOCUMENTATION PAGE

READ INSTRUCTIONS BEFORE COMPLETING FORM

1. REPORT NUMBER: Technical Report Y-78-2
2. GOVT ACCESSION NO.:
3. RECIPIENT'S CATALOG NUMBER:

4. TITLE (and Subtitle): PRELIMINARY GUIDE TO WETLANDS OF PENINSULAR FLORIDA, Major Associations and Communities Identified
5. TYPE OF REPORT & PERIOD COVERED: Final report.
6. PERFORMING ORG. REPORT NUMBER:

7. AUTHOR(s): Environmental Effects Laboratory
8. CONTRACT OR GRANT NUMBER(s):

9. PERFORMING ORGANIZATION NAME AND ADDRESS: U. S. Army Engineer Waterways Experiment Station, Environmental Effects Laboratory, P. O. Box 631, Vicksburg, Miss. 39180
10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS:

11. CONTROLLING OFFICE NAME AND ADDRESS: Office, Chief of Engineers, U. S. Army, Washington, D. C. 20314
12. REPORT DATE: February 1978
13. NUMBER OF PAGES: 92

14. MONITORING AGENCY NAME & ADDRESS (if different from Controlling Office): WES-TR-Y-78-2
15. SECURITY CLASS. (of this report): Unclassified
15a. DECLASSIFICATION/DOWNGRADING SCHEDULE:

16. DISTRIBUTION STATEMENT (of this Report)

Approved for public release; distribution unlimited.

17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)

DDC PROCESSED MAY 24 1978 F

18. SUPPLEMENTARY NOTES

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

Community — Plant community
Florida — Wetlands

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

This guide to the major plant associations and communities found in wetlands within peninsular Florida is one of a series of eight such guides, each prepared by a specialist or specialists familiar with the wetlands in the region covered by the guide. The guides are intended for distribution to the various U. S. Army Engineer Districts for use in wetland identification in the implementation of Section 404 of the Federal Water Pollution Control Act Amendments of 1972. The classification system in the guide is intended solely for use in the Section 404 permit program and is not considered a classification system for other purposes.

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SUMMARY

This report represents the first of a series of eight preliminary guides to the dominant plant associations and communities found in the major wetlands of the United States. The primary purpose of the guidebook is to aid regulatory functions personnel in recognizing and delineating wetlands subject to permit regulation under Section 404 of Public Law 92-500 (Federal Water Pollution Control Act Amendments of 1972).

The guidebook is designed to be self-contained and consists of three parts. An introduction covers the purpose and use of the guidebook as well as general information about Section 404 wetlands. The second part, entitled "Wetlands by Region," consists of three major sections: Regional Environment, Regional Botanical References, and Wetland Types. The section on regional environment is brief and provides a broad context for the more detailed descriptions of the dominant plant associations and communities found in the major wetlands of the region. Because of synonymy of many scientific names, the nomenclature standard used for the guide is presented in the section on regional botanical references. Detailed description of wetland vegetation is based upon data in the literature and information from scientists having familiarity with the region. The goal of this section is to provide a description sufficiently detailed for field use but not to report minor variations of each wetland. Thus, the descriptions are a compromise between site-specific reports and extremely general discussions. Part III contains appendices and references to pertinent publications and is specific to the region; a glossary that is common to all guides in the series has been added to aid in the user's clarity of understanding.

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PREFACE

At the request of the Office, Chief of Engineers (OCE), the Environmental Effects Laboratory (EEL) of the Waterways Experiment Station (WES) initiated production of this report, the first of a series of eight preliminary guides to the dominant plant associations and communities found in the country's major wetlands. Other reports in the series apply to Alaska, West Coast, Interior, Gulf Coast, North Atlantic, South Atlantic, and Puerto Rico. The reports are listed on the inside of the front cover. Funding was provided by OCE.

Dr. Howard J. Teas, Professor of Botany, University of Miami, provided a manuscript for initial construction of the draft guide under Purchase Order No. DACW39-76-M-2471. Mr. Richard H. Daley, Ecologist, Missouri Botanical Gardens, St. Louis, provided major review and rewriting of the draft copy under Purchase Order DACW39-76-M-5173. Preparation of the guide was initiated by Dr. Luther F. Holloway, Research Botanist, EEL. Dr. Gary E. Tucker, Research Botanist, EEL, directed the production of the guide with the assistance of Dr. Robert Terry Huffman, Research Botanist, EEL. Ms. Dorothy P. Booth, EEL, served as technical editor. The illustration used on the covers of this series of reports was drawn by Ms. Jane Barnes, Russellville, Arkansas.

The guide project was under the general supervision of Dr. H. K. Smith, Project Manager, Habitat Development Project; Dr. C. J. Kirby, Chief, Environmental Resources Division; Dr. Roger T. Saucier, Special Assistant, Dredged Material Research Program; and Dr. John Harrison, Chief, EEL.

The Commanders and Directors of WES during the study were COL G. H. Hilt, CE, and COL J. L. Cannon, CE. Technical Director was Mr. F. R. Brown.

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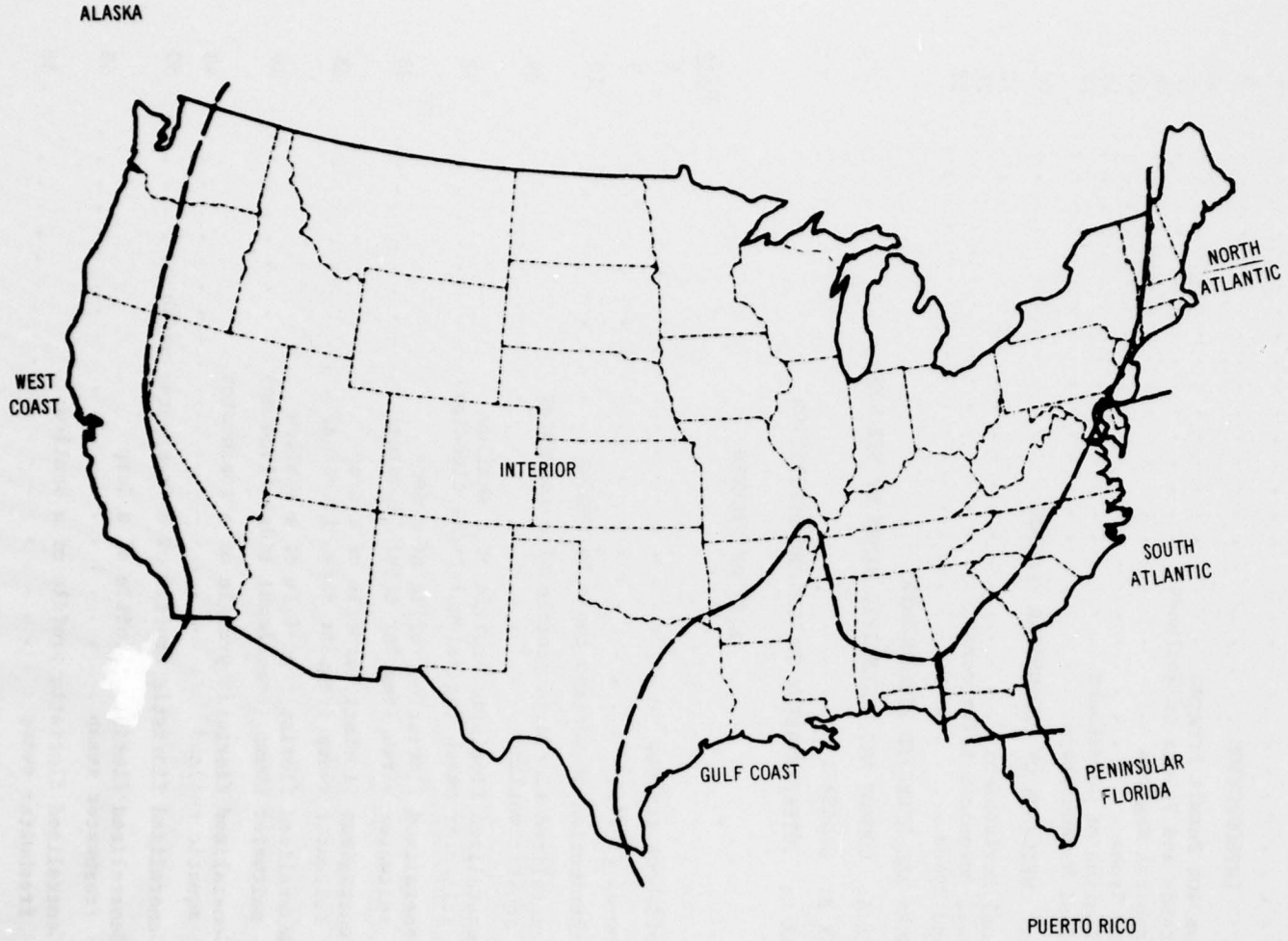


Figure 1. Eight geographical regions defined for the wetland guidebook series

PRELIMINARY GUIDE TO THE WETLANDS OF PENINSULAR FLORIDA
Major Associations and Communities Identified

PART I: INTRODUCTION

1. This guide to the major plant communities and associations found in wetlands within peninsular Florida is one of a series of eight such regional guides, each prepared by a specialist or specialists familiar with the wetlands in the region covered by the guide. Other regional guides include Alaska, West Coast, Interior, Gulf Coast, North Atlantic, South Atlantic, and Puerto Rico (Figure 1). The guides are intended for distribution to the various U. S. Army Engineer District regulatory functions personnel for use in identification of wetlands for the implementation of Section 404 of the Federal Water Pollution Control Act Amendments of 1972. The information provided is intended solely for use in the Section 404 permit program and is not considered a definitive classification system for other purposes.

2. Field personnel having need of a more detailed and definitive system of classification per se should consult one of the several wetland classification systems currently in use in the United States and Canada. The well-known Circular 39 (Shaw and Fredine, 1956) of the U. S. Fish and Wildlife Service has met with widespread use nationally despite its well-documented shortcomings. A recently published operational draft by the Fish and Wildlife Service (Cowardin et al., 1977) represents the most recent product of the National Wetland Inventory Project of 1975-79, an intensive effort that will result ultimately in the publication of a detailed and refined classification system to the wetlands of the entire nation. Numerous regional systems of classification also are available. Among the more significant regional classification systems are those of Golet and Larson (1974), Millar (1976), Odum et al. (1974), Penfound (1952), Stewart and Kantrud (1971), and Zoltai et al. (1975).

Section 404 Permit Program

Authority

3. Under the laws of the United States, Congress has assigned a number of nonmilitary functions to the U. S. Army Corps of Engineers. In addition to the well-known and more traditional roles in flood control, hydropower production, navigation, water supply storage, and recreation, the Corps has responsibility for some activities that are not so well known. Congress has given the Corps of Engineers regulatory responsibility to protect navigation channels and harbors against encroachments and also to preserve and restore water quality by regulating the discharge of dredged or fill material into waterways and wetlands.

4. The primary legislative basis for the Corps' regulatory authority for the disposal of dredged or fill material is the Federal Water Pollution Control Act Amendments of 1972. Section 404 of that Act gives authority to the Secretary of the Army, acting through the Chief of Engineers, to regulate the discharge of dredged or fill material in the waters of the United States.

5. Regulatory authority under Section 404 was initially considered limited to waters that are used presently, were used in the past, or could be used through reasonable improvements to transport interstate commerce. Limitation of the Corps' regulatory authority under Section 404 to navigable waters of the United States was successfully challenged in the District Court for the District of Columbia. On 27 March 1975, the Court ordered the Corps to extend its jurisdictional responsibility for the discharge of dredged or fill material under Section 404 to all waters of the United States (including the territorial seas) and adjacent wetlands and to revise its regulations accordingly.

6. In accordance with the Court's 1975 directive, the Corps of Engineers published an interim regulation in the Federal Register on 25 July 1975. The final set of permit regulations, considerably revised and reorganized, was published in the Federal Register on 19 July 1977.

Scope

7. The Corps of Engineers permit program under Section 404 is extended to many areas that have never been regulated before. In

addition to the navigable waters of tradition, the Corps has been given jurisdictional authority over tributaries to navigable waters, including adjacent wetlands; interstate waters and their tributaries, including adjacent wetlands; and all other waters of the United States, such as lakes and rivers and streams that are not interstate waters or part of a tributary system to navigable waters of the United States; impoundments; perched wetlands; intermittent streams; and prairie potholes, the degradation or destruction of which could affect interstate commerce. In the absence of adjacent wetlands that are a part of the waters described previously, the landward limit of jurisdiction in tidal waters shall be the high tide line and the shoreward limit of jurisdiction in all other waters shall be the ordinary high water mark.

8. The term "wetlands" is a very crucial part of Section 404 and refers to those areas that are inundated or saturated by ground or surface water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions (Appendix C).

Purpose

9. The purpose of the Section 404 program, which is a part of the Corps of Engineers' overall regulatory authority, is to ensure that the chemical and biological integrity of waters of the United States is protected from unregulated discharges of dredged or fill material that could permanently alter or destroy the character of these invaluable natural resources.

Importance and Values of Wetlands

10. Wetlands are valuable and productive natural resources of national significance, and some of their major functions include the following:

a. The provision of feeding, cover, and reproduction habitat for a great diversity of species, including endangered and threatened species.

b. The provision of educational, study, refuge and sanctuary, and recreational areas.

c. The maintenance of drainage, salinity, sedimentation, flushing, and current patterns.

d. Cycling of nutrients.

e. Reduction of contaminant loading.

f. Protection from erosion and storm damage.

Geographical Regions

11. Eight geographical regions have been defined for the wetlands guidebook series: Alaska, West Coast, Interior, Gulf Coast, North Atlantic, South Atlantic, Peninsular Florida, and Puerto Rico. The geographical regions are based on both physiographic and pragmatic considerations; the boundaries were influenced significantly by the works of Fenneman (1931, 1938). The use of natural units rather than artificial ones, such as political boundaries, minimizes the number of wetland types described in each guidebook. Several states are covered by a combination of two guidebooks, and a very few are covered by three guidebooks. Physiographic parameters were used where possible, since both hydrologic and biotic patterns are related closely to landscape features. Each of the regions will be covered in a separate guidebook. Geographic descriptions for the guides are as follows:

a. Alaska. The state of Alaska is the sole subject of an entire guide. Particular emphasis is placed on coastal wetlands; much of the interior region is "wet," but further study is needed to determine exact jurisdictional limits of Section 404.

b. West Coast. This region includes most of California (exclusive of the southeastern part), western Oregon, and western Washington.

c. Interior. The area covered by this region consists of the vast interior of the United States, including much of the Southwest, the Rockies and some of the intermontane region, the Central Plains, and the Midwest. States contained within the region are numerous.

d. Gulf Coast. The Gulf Coast region extends from the coastal plain of Texas to western Georgia. Inland, the coastal plain extends to southern Missouri in the Mississippi embayment; other states included in the region

are all or parts of Oklahoma, Arkansas, Louisiana, Mississippi, Alabama, Florida, and Tennessee.

e. North Atlantic. This region extends north from Sandy Hook, New Jersey, to the Canadian border and west to the Appalachian highlands. Included within the region is northern New Jersey, New York, and New England.

f. South Atlantic. Included within this region is everything north from peninsular Florida to Sandy Hook, New Jersey, and west to the Appalachian highlands. The separation of this region from the North Atlantic region is based largely on substrate features; the exposures of bedrock throughout the North Atlantic region are strikingly different from the thick mantle of Coastal Plain sediments predominating in most of the South Atlantic region. Additionally, most of the species of the "southern" swamp forest are restricted to the South Atlantic region as defined here.

g. Peninsular Florida. There is no clear physiographic distinction between peninsular Florida and the Gulf Coast and Atlantic Coast regions, but the vegetation of peninsular Florida has strong enough tropical affinities to warrant separate treatment. The peninsular region has been delineated by an arbitrary boundary extending from Jacksonville west to Steinhatchee, with all of Florida south of the boundary included in the region (Figure 2).

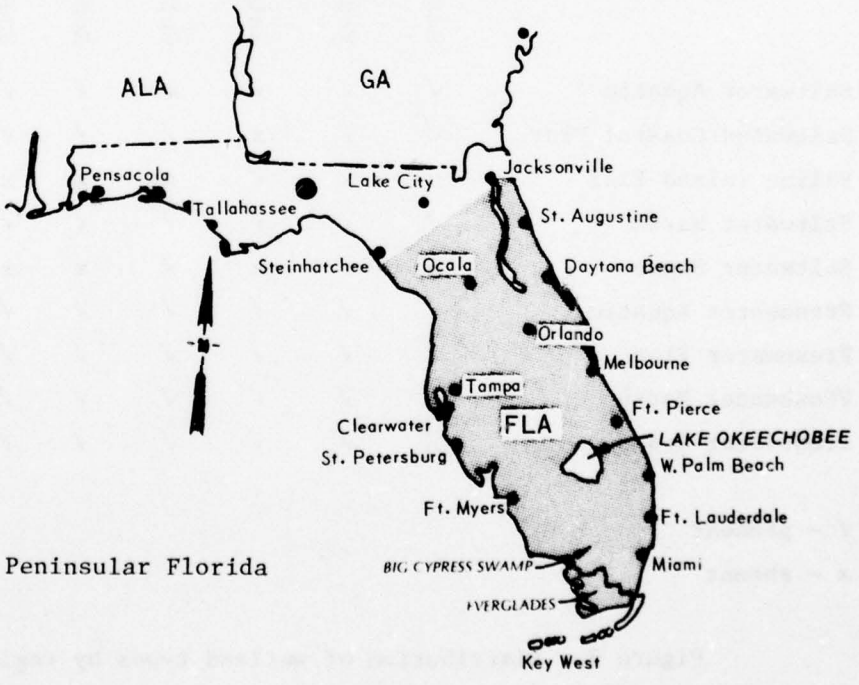


Figure 2. Peninsular Florida

"Subtropical Florida" as defined by Fenneman (1931) and Braun (1964) is essentially conspecific with this region.

h. Puerto Rico. The guidebook is intended for use in Puerto Rico; however, its utility may extend to the U. S. Virgin Islands because the vegetation of the two regions has many similarities.

Wetland Types

General information

12. Nine basic wetland types are recognized in the United States (Figure 3). An interpretation of the definition of wetlands is given in Appendix C. The number of wetland types in each guidebook region, however, is either seven or eight, since no region has all possible types. The nine basic wetland types have been distinguished by a combination of differences in physiognomy (e.g., marsh versus swamp),

	Alaska	West Coast	Interior	Gulf Coast	North Atlantic	South Atlantic	Peninsular Florida	Puerto Rico
Saltwater Aquatic	✓	✓	✓	✓	✓	✓	✓	✓
Saltwater Coastal Flat	✓	✓	x	✓	✓	✓	✓	✓
Saline Inland Flat	x	x	✓	x	x	x	x	x
Saltwater Marsh	✓	✓	✓	✓	✓	✓	✓	✓
Saltwater Swamp	x	✓	x	✓	x	x	✓	✓
Freshwater Aquatic	✓	✓	✓	✓	✓	✓	✓	✓
Freshwater Flat	✓	✓	✓	✓	✓	✓	✓	✓
Freshwater Marsh	✓	✓	✓	✓	✓	✓	✓	✓
Freshwater Swamp	✓	✓	✓	✓	✓	✓	✓	✓

✓ - present

x - absent

Figure 3. Distribution of wetland types by region

growth form (e.g., herbaceous plants versus trees), and environmental factors (such as degree of salinity in soil and water) Terms used on a regional basis in the description and definition of wetlands, such as bog and pocosin, are discussed in the text at appropriate points.

Identification

13. The approach to the identification of wetlands in this guidebook series is to provide general classifications for each region of the country. For purposes of this series, the country has been divided into six large regions plus Alaska and Puerto Rico (as described earlier). Within each regional guide, a key (Table 1) is provided for classification of any site in question. The reader is then referred to a brief description of the type (Wetland Types, next section) for a preliminary check to see if the site was properly classified. Finally, the reader is referred to the text for a more complete description of the communities and associations in the wetland and a pictorial profile illustrating its dominant species. The description of each wetland association is concluded with a section entitled "Field Identification," which briefly explains how to distinguish the wetland from other wetland types and from adjacent uplands. The entire description of a wetland should be studied prior to using the field identification section, however, to familiarize the user with its major variations. Wherever feasible, characteristics of growth forms are highlighted for identification, but if classification of an area is questionable, final determination must be based upon species composition.

14. If a site "fits" the description reasonably well, then the decision is clear that the area should be classified as a wetland of that particular type. The converse is not true, however. (If the site does not closely match one of the descriptions, it cannot be concluded unequivocally that the area is not a wetland.) This text is written from a regional perspective and consequently cannot be comprehensive and describe all variations within each wetland type. If a site does not fit any of the descriptions yet is still suspected to be a wetland, a quantitative survey of the vegetation of the area will be necessary. Especially in cases where the natural vegetation cannot be ascertained,

Table 1

Key to Wetland Types

A. Aquatic vegetation predominant (dominant plants free-floating or attached and having poorly developed tissues of structural support, supported and buoyed up by the water); flooded usually for long periods or permanently	
B. Coastal; below the intertidal zone; seaward to limits of vascular plant growth; permanently flooded	SALTWATER AQUATIC
B. Inland; flooded permanently or semipermanently by fresh water	FRESHWATER AQUATIC
A. Terrestrial vegetation predominant (dominant plants rooted and with well-developed tissues of structural support) or sometimes barren of vegetation; flooded at least occasionally, often for prolonged periods	
C. 25 percent or less vegetative cover	
D. Subject to saltwater influence	
E. Coastal, tidal	SALTWATER COASTAL FLAT
E. Inland, nontidal	SALINE INLAND FLAT*
D. Fresh water	FRESHWATER FLAT
C. More than 25 percent vegetative cover	
F. Nonsaline soils	
G. 40 percent or less cover by woody plants	FRESHWATER MARSH
G. More than 40 percent cover by woody plants	FRESHWATER SWAMP
F. Saline (including brackish) soils	
H. 40 percent or less cover by woody plants	SALTWATER MARSH
H. More than 40 percent cover by woody plants	SALTWATER SWAMP

* The saline inland flat does not occur in peninsular Florida.

Table 1 (Continued)

How to use the key: A key is an artificial device constructed for the purpose of identifying an unknown object. Keys traditionally have been used in the field of biology for the identification of unidentified plant and animal species, but in this guidebook the key will be used for the identification of unidentified wetland types.

The key to wetland types consists of a series of contrasting statements or descriptions, and the user of the key is required to make decisions based on the comparison of statements in the key as related to observations on the unidentified wetland type. The user must work carefully through the key from its beginning until a wetland type has been selected for the area in question.

The key is constructed around a series of pairs of leads. The second lead of a pair usually repeats the data given in the first lead but in a negative sense. Let us assume that you, the user of the guidebook, have located a grass-dominated area that obviously is "wet" during the better part of the year and obviously under the jurisdiction of the Section 404 program. Proper use of the key should enable you to determine just what type of wetland is involved.

In order to begin use of the key, you must start with the first pair of lead sentences, in this case labelled "A." Read each lead carefully, weighing one against the other with relation to your grass-dominated area. Grasses normally do not grow as free-floating organisms nor do they depend on water to buoy them upright, since they normally have sufficient supporting tissues to grow erect; in this case, then, the second lead of the pair of choices is better descriptive of the grass-dominated area with which you are concerned. You are now ready to consider a second pair of leads. This time you will consider the leads labelled "C" (of course, if your habitat were dominated by aquatic vegetation rather than terrestrial grasses, you would be considering the choices labelled "B"). Read the two "C" leads carefully, look at your grassy area, and try to determine how much of the ground surface is covered by vegetation. If less than 25 percent of the ground surface is covered by vegetation and more than 75 percent of the area is bare ground, you will select the first "C" as indicated; if vegetative cover accounts for more than 25 percent cover, you will take the second choice labelled "C." Let us assume that your area has only 10 percent cover. You will select the first "C" and then proceed to the "D" possibilities. Is the area in question flooded by fresh water or salt water? Let us make the assumption that you are in a freshwater area; look at the key carefully and note that the second "D" lead has a series of dotted lines leading to the phrase "Freshwater Flat." After the process of first rejecting and then accepting leads, you finally have arrived at an identification of your wetland type.

Table 1 (Concluded)

After determining the wetland type of an area in question, the user should turn to the detailed description of that particular type in the guidebook. In our hypothetical case the user would turn to page 47, FRESHWATER FLAT, and carefully read the descriptive material.

The use of the key may not be as simple and easy as it may seem. After you have followed the key through until coming to an identification of the wetland type, it may appear that the wetland description does not seem to fit the site. In that case it always pays to go back to the key and make sure an error has not been made through haste or misunderstanding of terms used. Occasionally an area may be found that cannot be identified with the aid of the key; the entire guidebook is written from a regional perspective and does not cover all variations of each wetland type. If a site does not fit any of the wetland types as described but yet is suspected of being a wetland under Section 404, a professional ecologist or botanist may be required for a quantitative study of the vegetation at the site.

hydrologic and soil information will be required to determine whether or not a site is a wetland. The nine basic wetland types are defined as follows:

a. Saltwater aquatic. Wetlands that are dominated by free-floating, rooted, or otherwise attached herbaceous plants (including macroscopic marine algae) and that are permanently flooded by saline or brackish water (e.g., sea grass beds).

b. Saltwater coastal flat. Wetlands that have 25 percent or less vegetative cover and are occasionally (shallow flat) or regularly (deep flat) flooded by saline water of tidal origin (e.g., nonvegetated intertidal zone).

c. Saline inland flat. Wetlands that have 25 percent or less vegetative cover and are occasionally or regularly flooded by saline water of nontidal origin (e.g., inland salt flat).

d. Saltwater marsh. Wetlands that have more than 25 percent vegetative cover of herbaceous plants but 40 percent* or less cover by woody plants and that are occasionally (high marsh) or regularly (low marsh) flooded by brackish or saline water (e.g., Smooth cordgrass marshes).

e. Saltwater swamp. Wetlands that have more than 40 percent cover of woody plants and are occasionally or regularly flooded by brackish or saline water (e.g., mangrove swamps).

f. Freshwater aquatic. Wetlands that are usually dominated by free-floating or rooted aquatic herbs and are semipermanently or permanently flooded by fresh water (e.g., floating duckweed mats).

g. Freshwater flat. Wetlands that have 25 percent or less vegetative cover and are occasionally or regularly flooded by fresh water (e.g., mudflats).

h. Freshwater marsh. Wetlands that have more than 25 percent vegetative cover of herbaceous plants but 40 percent or less cover by woody plants that are occasionally or regularly flooded by fresh water (e.g., cattail marsh).

i. Freshwater swamp. Wetlands that have more than 40 percent cover by woody plants and are occasionally or regularly flooded by fresh water (e.g., cypress swamps).

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* The use of 40 percent as the division for woody plant cover is convenient for field work because when the tree cover is 40 percent, the distance between tree crowns equals the mean radius of a tree crown (UNESCO, 1973).

Organization of Guidebooks

15. Each guidebook is designed to be self-contained. Although this necessitates repetition of general information in the introductory part, the advantages in utility outweigh the duplication. The second part of each guidebook, entitled "Wetlands by Region," is the only one of the three parts unique with each guide. Part III, containing appendixes and references to pertinent publications, is largely specific for each region, except for a glossary that is common to the entire group of regional guides.

16. Three major sections are found in Part II: Regional Environment, Regional Botanical References, and Wetland Types. The section on regional environment is brief and provides a broad context for the more detailed descriptions of wetland types in each region. Because of the synonymy of many scientific names, the standard used for the guide is given in the section on regional botanical references.

17. Description of each wetland type is based upon data in the literature and from discussions with scientists having familiarity with the area. The goal is to provide a sufficiently detailed description for use in the field but not to report every possible variation of each wetland type. Thus, the descriptions are a comparison between site-specific reports and extremely general discussions.

18. The description of vegetation in each wetland type is divided into the following four parts:

a. Growth form. Growth form, such as deciduous (e.g., Ash, Bald cypress) or evergreen (e.g., pine, Southern magnolia) trees, is a concise description based upon the physiognomy of the vegetation. This should be particularly helpful to those not familiar with the species in the area.

b. Species composition. Discussion of species composition in each case includes listings in alphabetical order (by scientific name) of the dominant plants and the most commonly associated species. Because of local variation within any wetland type, an alphabetical listing is preferred over an attempt at listing species by importance value. The choice of associated species listed sometimes is arbitrary but, in the absence of complete species

lists for each type, is inescapable. Profiles are provided for most wetland types. These diagrammatic depictions of vegetation structure are meant only to reinforce the textual material. The section on transition zones outlines the plants or plant communities characteristically found between adjacent wetland types or between wetlands and uplands. Such transitions may be abrupt but more often they are gradual. The generalized structure of each wetland type and its relationship to transition zones is indicated by a pictorial vegetation profile.

c. Physical environments. The environmental conditions, the characteristic water regimes, and soils of each wetland type, are described where available. The discussions are limited to aspects of the physical environment most often affecting the vegetation and are not intended to fully describe the environment.

d. Field identification. The section on field identification gives the characteristics that distinguish the wetland type from other wetland types and from adjacent uplands.

19. In most cases some attempt to discuss successional relationships of wetland communities is made. In many cases, however, the successional relationships of wetlands vegetation are too poorly understood for meaningful generalizations.

20. The primary purpose of the guidebook series is to aid regulatory functions personnel in identifying wetland types. For that reason a well-organized but general approach has been attempted. The classification system in the guides is intended solely for implementation in the Section 404 permit program and is not considered a definitive classification system for other purposes.

Botanical Nomenclature

Common names

21. Common names, while admittedly convenient, often vary from place to place. One species may have several names in different geographic regions, or the same name may be applied to unrelated species in different areas. Yet other species lack a common name. In the guidebook series, the common name used for a plant is the one, in the opinion of the author, most often used locally within the region. A single

common name is used even though several names may be in use within the region. Those species not known to have a common name are referred to by their scientific name. Specific common names are here capitalized.

22. To assist in utility of the guides, an attempt has been made to provide a common name at each point where a scientific name appears. In a few cases, however, this has not been practical or has been considered superfluous; for that reason, in cases where assurance of communication seemed evident, a single name was employed.

Scientific names

23. Botanists, ecologists, and other scientists use scientific names in their technical publications and discussions. The Latin form of scientific names is definitive and uniformly adhered to by botanists around the world under the International Code of Botanical Nomenclature. Thus, the Latin name of a plant species is understood by the scientific community throughout the world, regardless of the prevailing language in a country.

24. Scientific names used in this guidebook series consist of two words. The first word of the scientific name is that of the genus to which a plant belongs, and it is always capitalized. The second word of the scientific name is referred to as the specific epithet, and it is printed here in lower case even though it may be derived from a geographical name or the name of a person. Both words are italicized or underlined. Following the scientific name it is customary, at least in checklists, to give the name of the author or person who originally described the plant to science; the name of the author is referred to as the authority. The authority for plants in these guides is given in Appendix A and in most cases the authority is abbreviated.

25. The following example illustrates the function and meaning of a typical scientific name. The genus *Typha* was first described by the Swedish botanist Linnaeus, as was the Common cattail, which occurs over most of the United States. Its name, therefore, is written *Typha latifolia* L., indicating that this species was described by Linnaeus. The scientific name *latifolia* indicates that the plant has broad leaves, in this case an accurate description.

26. Occasionally, there is need to refer to an unidentified species of a particular genus; an unidentified species of *Potamogeton*, for example, would be referred to in the text as *Potamogeton* sp. Similarly, it is sometimes convenient to refer to a group of species of a particular genus without giving the complete scientific name of each. A group of species of the genus *Potamogeton* would be given as *Potamogeton* spp.

27. Within the text of a paragraph or more of material, it is considered redundant to repeat the complete scientific name repetitively after its initial use. The species *Potamogeton amplifolius* would be given in full where first mentioned but at later times might be referred to in the text as *P. amplifolius*, the *P.* being an abbreviated form of *Potamogeton*. In situations where confusion with other species might result, however, the scientific name is given in full.

Synonymy of scientific names

28. Many plant species have been given more than one scientific name in the course of botanical history. A species may have been described and named independently by different botanists, or two species may have been considered one and the same following a period of study. In addition, there are differences of opinion among professional botanists as to whether a variation merits recognition as a variety or as a separate species or perhaps needs no additional name.

29. Because of differences of interpretation, one will often find a particular plant referred to by different scientific names in two or more separate publications. For this reason each of the guidebooks in this series has been compiled with the use of a particular publication as a standard for botanical nomenclature. In each case the standard for botanical nomenclature is a well-known regional manual of plant identification. The standard for each guidebook is identified in the section entitled Regional Botanical References.

PART II: WETLANDS OF PENINSULAR FLORIDA

Regional Environment

30. Peninsular Florida is the only area of the continental United States where biota has strong affinities with the tropics of the Caribbean region; consequently this area is treated as a separate region in this guidebook series. Peninsular Florida extends from approximately latitude 24°30' N at Key West to nearly 30° N between St. Augustine and Jacksonville. The climate is subtropical with 60 to 70 in. of annual precipitation in the south and 40 to 50 in. in the north. The rainfall is highly seasonal: the wet season extends from May through October and the dry season from November through April. Temperature seasonality, however, is small. Freezing temperatures are occasional in the north, rare as far south as Miami, and nonexistent in the southernmost keys. Thunderstorms and hurricanes are most frequent along the southeastern coast but are not restricted to that area.

31. Barrier islands are found on the Atlantic Coast continuously north from St. Lucie Inlet (about 40 miles north of West Palm Beach) to St. Augustine. They are much less frequent on the Gulf Coast, but large numbers of the islands do occur along the west coast of Florida.

32. Peninsular Florida is relatively level but is dotted with karst sinkholes south of Lake Okeechobee. Because the water table is high, most of these sinkholes hold permanent water. South of Lake Okeechobee, the land surface is nearly level and is interrupted only by a north-south oriented limestone ridge along the eastern coast stretching from the St. Lucie River south to Delray. Throughout Florida, differences in elevation of as little as 4 to 8 in. result in dramatic changes in the physiognomy (forest or grassland, for example) and in the species composition of the plant communities because of the changes in soil moisture between lower and higher sites. The importance of small topographic changes on the vegetation is illustrated by noting that the average elevation in south Florida is only about 15 ft; surface elevation of Lake Okeechobee is also about 15 ft as is the average

elevation in Big Cypress Swamp. Small stands of trees growing in a matrix of grasses and sedges are called "tree islands" or "hammocks" and are characterized by broad-leaved trees and palms.

33. Sandy soils predominate in peninsular Florida, but peats, mucks, and marls are extensive in the Everglades and in Big Cypress Swamp. The sands are ancient ocean terraces and form the "uplands" or high ground; the peats, mucks, and marls are found in low basins and depressions.

34. The vegetation of peninsular Florida is usually considered part of the Tropical Evergreen Forest Formation, not a part of the Deciduous Forest Formation, because many tropical plant species reach their northern range limit here (Braun, 1964). Most of the dominant species of southern Florida such as the pines, Sawgrass, and Bald cypress, though, are found in other parts of the southeastern United States.

35. The high sandy ground north of Lake Okeechobee dominated by pines, sometimes mixed with hardwoods and intermixed with stands of prairie, is referred to as the "pine flatlands." South of Lake Okeechobee lie the Everglades dominated by Sawgrass with scattered hammocks; west of the Everglades lies Big Cypress Swamp where Bald cypress is most important. The vegetation along the coast varies from mangrove swamp, to salt marsh, to strand vegetation where there are only a few scattered herbs and low shrubs. The single most important environmental factor affecting this variation of coastal vegetation is possibly exposure to winds and waves.

Regional Botanical References

36. The standard for botanical nomenclature in this guide is by Long and Lakela (1971). This is to say all scientific names employed in this guide are used in the sense of that publication. Choice of common names is based on general usage with the region.

37. Another technical work of much value in peninsular Florida is that of Small (1972, Parts I and II). The 1972 edition of Small is a

reprint of the 1933 edition; for this reason the nomenclature is out of date, but the work has long been a standard for the region.

38. Nontechnical works pertaining to the region are numerous and are best used for the identification of showy, large-flowered plants. They generally are not useful for the identification of the numerous graminoids that are so important in most wetlands. Included here are the works of Fleming et al. (1976) and Rickett (1967).

Wetland Types

List of wetland* types in peninsular Florida

39. Of the nine possible wetland types, peninsular Florida possesses eight. A brief definition of each type follows:

a. Saltwater aquatic. Wetlands that are dominated by free-floating, rooted, or otherwise attached herbaceous plants (including macroscopic marine algae) and are permanently flooded by saline or brackish water (e.g., sea grass beds).

b. Saltwater coastal flat. Wetlands that have 25 percent or less vegetative cover and are occasionally (shallow flat) or regularly (deep flat) flooded by saline water of tidal origin (e.g., nonvegetated intertidal zone).

c. Saltwater marsh. Wetlands that have more than 25 percent vegetative cover of herbaceous plants but 40 percent or less cover by woody plants and are occasionally or regularly flooded by brackish or saline water (e.g., smooth cordgrass marshes).

d. Saltwater swamp. Wetlands that have more than 40 percent cover of woody plants and are occasionally or regularly flooded by brackish or saline water (e.g., mangrove swamps).

e. Freshwater aquatic. Wetlands that are usually dominated by free-floating or rooted aquatic herbs and are semi-permanently or permanently flooded by fresh water (e.g., floating duckweed mats).

f. Freshwater flat. Wetlands that have 25 percent or less vegetative cover and are occasionally or regularly flooded by fresh water (e.g., mudflats).

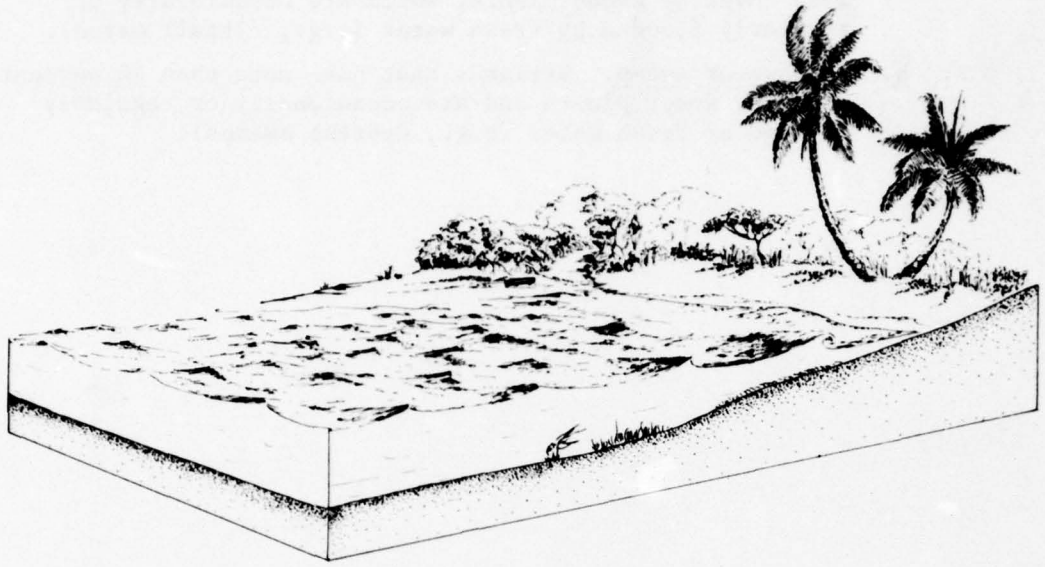
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* See Appendix C for an interpretation of the definition of wetlands.

g. Freshwater marsh. Wetlands that have more than 25 percent vegetative cover of herbaceous plants but 40 percent or less cover by woody plants, which are occasionally or regularly flooded by fresh water (e.g., cattail marsh).

h. Freshwater swamp. Wetlands that have more than 40 percent cover by woody plants and are occasionally or regularly flooded by fresh water (e.g., cypress swamps).

SALTWATER AQUATIC WETLANDS



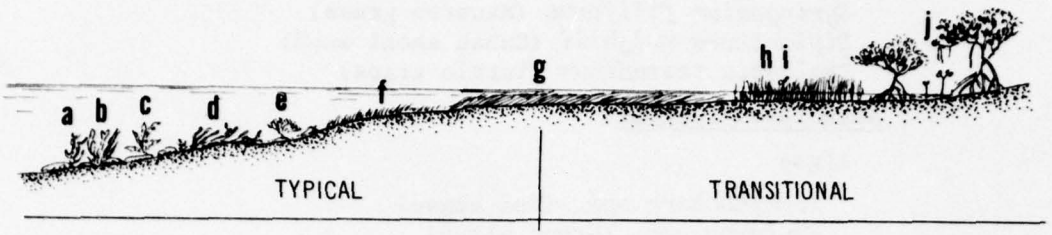
Definition: Wetlands that are dominated by free-floating, rooted, or otherwise attached aquatic herbs and are permanently flooded by brackish or saline water

40. The saltwater aquatic wetland is distributed along the entire coast of peninsular Florida below the intertidal zone. These areas are commonly called "seagrass beds." The shoreward limit is apparently the elevation of the lower mean tide, and the seaward boundary is the limit of rooted plant growth; consequently, the plants are exposed above the water surface only during exceptionally low tides. These areas are heavily used by numerous sport and commercial fish and shellfish species and numerous wading birds and shorebirds. The saltwater aquatic wetland is also of major importance in the detrital food chain and in nutrient cycling of the shallow coastal area.

VEGETATION

41. Growth forms and physiognomy: submerged, narrow-leaved herbs, such as turtle grass, and algae; frequently in dense, scattered, or extensive stands.

42. Species composition of the saltwater aquatic wetland:



Typical Species

a-e algae
f *Diplanthera wrightii* (Cuban shoal weed)
g *Thalassia testudinum* (Turtle grass)

Transitional Species

h *Spartina alterniflora* (Smooth cordgrass)
i *Rhizophora mangle* (Red mangrove) (seedlings)
j *Rhizophora mangle* (Red mangrove) (mature)

Figure 4. Generalized floristic profile of a saltwater aquatic wetland

The reader is cautioned that the generalized floristic profiles contained within this guide are oversimplified and are not representative of many sites that will be found in the field. Wetland systems are dynamic, and many variations will be found. Species listed as "typical" on the profiles are those that generally occur as dominants in the particular wetland types. Those listed as "transitional" are those that regularly are associated with the transition zones at the margins of the individual wetland types. Associated species are those that are of common occurrence in a particular wetland type but generally are not sufficiently abundant to be dominants.

Dominant species:

Syringodium filiforme (Manatee grass)
Diplanthera wrightii (Cuban shoal weed)
Thalassia testudinum (Turtle grass)

Associated species:

Algae

Acanthophora spp. (Red algae)
Caulerpa spp. (Green algae)
Dictyota spp. (Brown algae)
Halimeda spp. (Green algae)
Penicillus spp. (Green algae)

Vascular plants

Halophila baillonis (Carribbean halophila)
Halophila engelmannii (Gulf halophila)
Ruppia maritima (Widgeon grass)

Transitional species:

Rhizophora mangle (Red mangrove) (seedlings)
Ruppia maritima (Widgeon grass)
Spartina alterniflora (Smooth cordgrass)
Thalassia testudinum (Turtle grass)

Dominant and associated species. Turtle grass (*Thalassia testudinum*) grows in shallow areas, often in very dense circular stands. Turtle grass beds are important as nurseries for many marine animal species as well as providing shelter and food for invertebrates and immature fish. These stands are commonly in pockets once vegetated by mangroves but inundated by the postglacial rise in sea level. Turtle grass is replaced by Caribbean or Gulf halophila (*Halophila* spp.) of soft marl soils in deeper areas and in areas of reduced transparency. Where the water is shallow and receives freshwater runoff, Turtle grass is mixed with or replaced by Cuban shoal weed (*Diplanthera*). Widgeon grass (*Ruppia*) also frequently grows in shallow areas, particularly in river mouths and estuaries. Several species of macroscopic marine algae grow on and among the stands of Turtle grass including: red algae in the genera *Acanthophora* and *Laurencia*, brown algae of the genus *Dictyota*, and green algae of the genera *Caulerpa*, *Penicillus*, and *Halimeda*. Hard rock bottoms are vegetated almost exclusively by algae.

Successional patterns in the saltwater community are poorly known. Apparently Cuban shoal weed (*Diplanthera*) is the usual pioneer of sites after disturbances such as dredging or filling. Invasion may require 10 months or more. Except in shallow areas, Turtle grass (*Thalassia*) replaces Cuban shoal weed after about 10 years.

Transitional species. The saltwater community almost always borders other wetland types and rarely adjoins natural upland communities. The seaward limit of rooted plant growth is the outer boundary of the saltwater community; the lower limit of the intertidal zone is the shoreward boundary. Widgeon grass (*Ruppia*) can grow both above and below the lower intertidal boundary, though the upper area is also often nonvegetated and is a coastal flat wetland. Above this, the area may be a saltwater marsh or swamp.

ENVIRONMENTAL CONDITIONS

43. The substrate of the saltwater community varies from mud, usually dominated by Turtle grass (*Thalassia*), to hard rock where only algae occur. Turtle grass can grow in water up to 100 ft deep, although this is exceptional; Turtle grass often is regressive in shallow water if the salinity is reduced. Both Turtle grass and Cuban shoal weed (*Diplanthera*) can withstand the fluctuations in salinity found in estuaries, and they can survive brief periods of exposure to the air such as occur in shallow stands during exceptionally low tides.

FIELD IDENTIFICATION

44. The saltwater community can be identified by its landscape position below the intertidal zone and by the dominance of submerged aquatic herbs.

SALTWATER COASTAL FLAT

Definition: Wetlands that have 25 percent or less vegetative cover and are occasionally or regularly flooded by saline water of tidal origin

45. Coastal flats primarily include nonvegetated or sparsely vegetated intertidal areas. They include hypersaline areas above the mean high tide that are inundated during storm tides and are sparsely vegetated. Some coastal flats are slight depressions, flooded only at high tides, in which the water evaporates leaving the soils hypersaline; few plants can withstand these conditions. In peninsular Florida, coastal flats are found intermittently along the entire coast.

VEGETATION

46. Growth forms and physiognomy: The deep saltwater coastal flat (with frequent tidal inundation) is either nonvegetated or has scattered seagrasses tolerant of exposure on low tides and various floating and/or attached marine algae; seagrasses, if present, are frequently very short and rarely exhibit the luxuriant growth forms found in the saltwater aquatic wetland. The shallow saltwater coastal flat (with infrequent tidal inundation) is either nonvegetated or has scattered succulent forbs, often Glassworts (*Salicornia* spp.); usually less than 2 ft tall.

47. Species composition of the saltwater coastal flat wetland:

a. Flats with frequent tidal inundation (deep flat):

Dominant species

Diplanthera wrightii (Cuban shoal weed)
Ruppia maritima (Widgeon grass)
Ulva lactuca (Green algae)

Associated species

Acanthophora spp. (Red algae)
Enteromorpha spp. (Green algae)
Gracilaria spp. (Red algae)
Hypnea spp. (Red algae)

b. Flats with infrequent tidal inundation (shallow flat):

Dominant species

Batis maritima (Saltwort)
Salicornia perennis (Glasswort)

Associated species

Acnida cannabina (Water hemp)
Fimbristylis cellulosa (Sedge)
Philoxerus vermicularis (Beach carpet)
Sesuvium portulacastrum (Sea purslane)
Spartina spartinae (Prickly cordgrass)
Suaeda linearis (Sea blite)

Dominant and associated species. Two forms of the saltwater coastal flat occur in Florida. A mud or sand flat, subject to frequent tidal inundation, occurs in front of salt marshes or mangrove swamps; this type may be referred to as a deep saltwater coastal flat. Areas behind these same marshes and swamps are subject to infrequent tidal inundation and usually are marked by hypersaline soils; these areas, known locally as salinas, salt flats, or salt barrens, are referred to here as shallow saltwater coastal flats. Coastal flats in the intertidal zone commonly have few or no plants present. In depressions where storm tides are captured, the plant cover may be somewhat higher. When present, typical plant species that vegetate coastal flats include Glasswort (*Salicornia* spp.) and seasonal growth of Sea blite (*Suaeda linearis*) and Sea purslane (*Sesuvium portulacastrum*). Associated plants that may grow on coastal flats are Water hemp (*Acnida cannabina*), Beach carpet (*Philoxerus vermicularis*), and Saltwort (*Batis maritima*). These species are largely succulent and associated primarily with the soils having high salinities, especially in the areas behind saltwater marshes and swamps.

The deep saltwater flats in front of marshes and mangrove swamps often support scattered seagrasses and marine algae. The seagrasses, when present, usually are stunted and lacking the luxuriant growth forms associated with the saltwater aquatic wetland communities.

Transitional species. Coastal flats may be found adjacent to the ocean or the saltwater community or may be surrounded by salt marsh vegetation. In either case, the border is usually very distinct. Where coastal flats are adjacent to the ocean at their lower edge, the upper edge may be strand vegetation, saltwater marsh, or saltwater swamp.

ENVIRONMENTAL CONDITIONS

48. Soils of coastal flats are usually sandy; they are saline or more rarely hypersaline with salinity as high as 120 to 130 ppt (12 to

13 percent). The hypersaline conditions result from evaporation of storm tidewater.

FIELD IDENTIFICATION

49. Coastal flats are marked by their low cover value. Saltwater marshes and shallow coastal flats are best distinguished by their differences in cover value, because many species are common to both wetland types. The deep coastal flat shares many species with the saltwater aquatic community, but the flat is identified by its sparse and/or stunted vegetation. The coastal flat is distinguished from the saltwater swamp by the absence of high cover value by woody plants in the flat.

SALTWATER MARSH



Definition: Wetlands that have more than 25 percent vegetative cover of herbaceous plants but 40 percent or less cover by woody plants and that are occasionally or regularly flooded by brackish or saline water

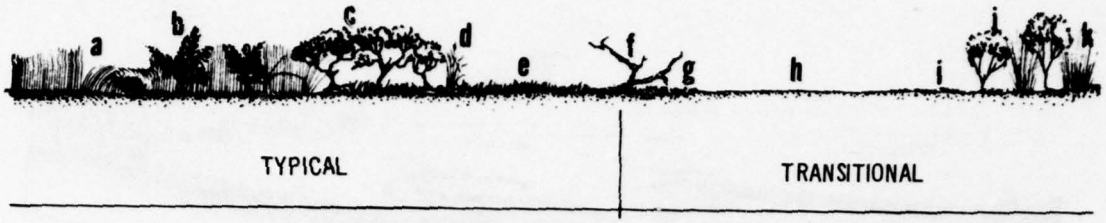
50. Salt marsh communities occur in coastal areas of low energy and gentle slope that are regularly flooded by the tides. Marshes also can be found landward of natural sandy berms or mangroves that absorb the energies of wind and waves.

51. Salt marshes are found along most of the Florida coast. Sometimes they are narrow bands but most often they are wider and may extend several miles inland. Like saltwater communities, marshes are highly productive. Many sport and commercial fish and shellfish utilize salt marshes, making marshes important for both recreational and commercial uses.

VEGETATION

52. Growth forms and physiognomy: dense stands of graminoids, expecially cordgrasses (*Spartina* spp.) and rushes (*Juncus roemerianus)*; with scattered succulent plants such as Saltwort (*Batis maritima*).

53. Species composition of the saltwater marsh:



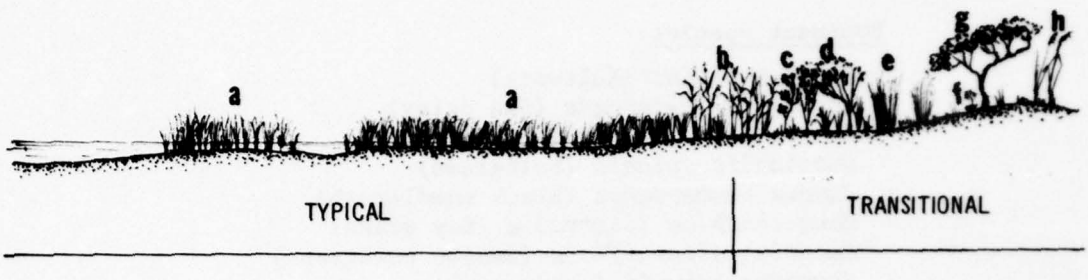
Typical Species

a *Juncus roemerianus* (Black needlerush)
b *Acrostichum aureum* (Leather fern)
c *Conocarpus erecta* (Buttonwood)
d *Spartina cynosuroides* (Big cordgrass)
e *Batis maritima* (Saltwort)
Distichlis spicata (Salt grass)
Sporobolus virginicus (Coastal dropseed)

Transitional and Associated Species

f *Conocarpus erecta* (Buttonwood) (stressed)
g *Salicornia virginica* (Glasswort)
h Bare sand or mud with algae (may be COASTAL FLAT)
hypersaline zone: *Salicornia perennis* (Glasswort)
Salicornia virginica (Glasswort)
Sesuvium portulacastrum (Sea purslane)
Suaeda linearis (Sea blite)
Suaeda maritima (Sea blite)
i *Philoxerus vermicularis* (Beach carpet)
j *Baccharis halimifolia* (Groundsel)
k *Aster tenuifolius* (Aster)
Borrichia arborescens (Sea daisy)
Borrichia frutescens (Sea daisy)
Distichlis spicata (Salt grass)
Eleocharis cellulosa (Spike rush)
Fimbristylis castanea (Saltmarsh fimbristylis)
Monanthochloe littoralis (Key grass)
Sesuvium portulacastrum (Sea purslane)
Spartina bakerii (Cordgrass)
Spartina spartinae (Prickly cordgrass)

Figure 5. Generalized floristic profile of a shallow saltwater marsh (occasional tidal flooding)



Typical Species

a *Spartina alterniflora* (Smooth cordgrass)
b *Fimbristylis castanea* (Saltmarsh fimbristylis)
Juncus roemerianus (Black needlerush)
Spartina cynosuroides (Big cordgrass)

Transitional and Associated Species

c *Iva frutescens* (Marsh elder)
d *Baccharis halimifolia* (Groundsel)
e *Spartina bakeri* (Cordgrass)
f *Limonium carolinianum* (Sea lavender)
g *Coccoloba uvifera* (Sea grape)
h *Acrostichum aureum* (Leather fern)
Borrichia arborescens (Sea daisy)
Borrichia frutescens (Sea daisy)
Cakile edentula (Sea rocket)
Distichlis spicata (Salt grass)
Heliotropium curassavicum (Seaside heliotrope)
Hymenocallis spp. (Spider lily)
Ipomoea pes-caprae (Railroad vine)
Paspalum vaginatum (Silt grass)
Philoxerus vermicularis (Beach carpet)
Salicornia virginica (Glasswort)
Sesuvium portulacastrum (Sea purslane)
Spartina patens (Marsh hay cordgrass)
Suaeda linearis (Sea blite)
Suaeda maritima (Sea blite)
Uniola paniculata (Sea oat)

Figure 6. Generalized floristic profile of a deep saltwater marsh (regular tidal flooding)

Dominant species:

Batis maritima (Saltwort)
Borrichia frutescens (Sea daisy)
Borrichia arborescens (Sea daisy)
Distichlis spicata (Saltgrass)
Juncus roemerianus (Black needlerush)
Monanthochloe littoralis (Key grass)
Spartina alterniflora (Smooth cordgrass)
Spartina bakerii (Cordgrass)
Spartina patens (Marsh hay cordgrass)
Spartina spartinae (Prickly cordgrass)

Associated species:

Acnida cannabina (Water hemp)
Avicennia germinans (Black mangrove)
Eleocharis cellulosa (Spike rush)
Fimbristylis castanea (Saltmarsh fimbristylis)
Laguncularia racemosa (White mangrove)
Philoxerus vermicularis (Beach carpet)
Rhizophora mangle (Red mangrove)
Salicornia virginica (Glasswort)
Salicornia bigelovii (Bigelow's Glasswort)
Sesuvium portulacastrum (Sea purslane)
Spartina cynosuroides (Big cordgrass)
Suaeda linearis (Sea blight)

Transitional species:

Baccharis halimifolia (Groundsel)
Batis maritima (Saltwort)
Coccoloba uvifera (Sea grape)
Iva frutescens (Marsh elder)
Limonium carolinianum (Marsh rosemary)
Sabal palmetto (Cabbage palm)
Spartina bakerii (Cordgrass)
Uniola paniculata (Sea oats)

Dominant and associated species. The deep saltwater marsh, which is inundated regularly by tides, is composed typically of nearly pure stands of Smooth cordgrass (*Spartina alterniflora*). Black needlerush (*Juncus roemerianus*) dominates on slightly higher, less frequently flooded land and often covers extensive areas extending several miles inland. In southern Florida the sedge *Fimbristylis castanea* sometimes shares dominance with Black needlerush and may contribute as much as 40 percent of the total cover. Scattered mangroves may be the most conspicuous species; if their cover is less than 40 percent, the site should be considered a salt marsh, otherwise it would be a saltwater swamp. Mangroves in these marshes usually are shrubs and rarely reach tree size.

The species composition of shallow saltwater marshes is more variable on the higher sites where tidal flooding is irregular than in the deeper and lower areas. In northern Florida, Marsh hay cordgrass or Saltgrass often dominates. In southern Florida highly saline sites often are dominated by Saltwort (*Batis*), but Glasswort (*Salicornia*), Sea purslane (*Sesuvium*), Sea blite (*Suaeda*), Water hemp (*Acnida*), and Beach carpet (*Philoxerus*) may be locally dominant. In moderately saline areas (approximately 20 ppt) adjacent to the Saltwort zone, Saltgrass (*Distichlis spicata*) or Key grass (*Monanthocloe littoralis*) are the most important species. Glassworts, Sea purslane, Sea blite, Water hemp, Beach carpet, Prickly cordgrass, and *Fimbristylis castanea* also are found in this zone. The least saline zone (approximately 5 ppt) characteristically supports either Prickly cordgrass (*Spartina spartinae*) or Sea daisy (*Borrichia* spp.) communities. These communities may form nearly pure stands covering up to several hundred acres. Saltgrass, Spike rush (*Eleocharis cellulosa*), and Sea purslane are scattered in these stands.

Transitional species. Salt marshes, especially those dominated by such highly salt-tolerant species as Saltwort, often form narrow bands between salt swamps, which are dominated by mangroves, and freshwater marshes. In some areas, salt marshes extend to the lower limit of the intertidal zone. The higher, irregularly flooded salt marshes often border salt barrens, while salt marshes border freshwater marshes in estuaries. Where no streams are present, they often border nonwetlands, especially pine flatlands, sometimes with Cabbage palm (*Sabal palmetto*) at the boundary.

ENVIRONMENTAL CONDITIONS

54. The most seaward salt marshes are inundated by all high tides while the most landward stands may be flooded only during storms. During the wet season, these higher sites may receive freshwater drainage from interior wetlands or uplands, but the soils are sufficiently saline that the vegetation is dominated by halophytes (salt-tolerant plants).

55. Soil salinity in the deeper areas approximates that of sea water, but ranges from hypersaline, as high as 12 to 13 percent (120 to 130 ppt), to brackish in shallow areas. Hypersaline conditions occur where only storm tides flood an area and salts accumulate in the soil as flood waters evaporate, and generally support a saltwater coastal flat community.

FIELD IDENTIFICATION

56. The dominance of Smooth cordgrass, Marsh hay cordgrass, or Black needlerush is frequently an easy way to identify salt marshes. This distinguishes them from freshwater marshes with which they would be confused most readily. Some brackish marshes are dominated by one of the cordgrasses, *Spartina bakerii*, which also dominates some freshwater marshes. In this case, separation of salt from freshwater marshes must be based on associated species. Where Saltwort and other highly salt-tolerant species are found surrounded by typical marsh vegetation, separation of the salt marsh from coastal flats is based upon total vegetative cover--salt marshes have more than 25 percent total cover.

57. Salt marshes usually can be distinguished from adjacent uplands based upon physiognomy. Salt marshes must have 40 percent or less cover by woody species (and mangroves are the only tall shrubs or trees) whereas most of the adjacent uplands are forested.

SALTWATER SWAMP



Definition: Wetlands that have more than 40 percent cover by woody plants and are occasionally or regularly flooded by brackish or saline water

58. Mangroves dominate all the saltwater swamps in peninsular Florida. On the eastern coast, saltwater swamps extend north to the vicinity of St. Augustine in St. John's County, the northeastern range limit of Black mangrove; south of there, mangroves are found intermittently along the coast around the southern tip of Florida and on many of the keys. On the west coast of Florida, saltwater swamps extend to the northern limit of Red mangrove in Levy County. Black mangroves are scattered along the entire Gulf coast to Mexico.

59. Saltwater swamps occur along protected coasts, tidal rivers, and creeks, and in bays and estuaries of much of peninsular Florida. There are approximately 350,000 acres of saltwater swamp in this region. These swamps are particularly valuable as spawning habitat for fish.

VEGETATION

60. Growth forms and physiognomy: Moderate to very dense growth of low to medium-tall broadleaf evergreen shrubs and trees (Mangroves), which often have aerial prop roots (Red mangroves) and sometimes exten-

sive pneumatophores (Black mangroves); dwarf shrubs and herbaceous plants are rare to occasional.

61. Species composition of the saltwater swamp wetland:



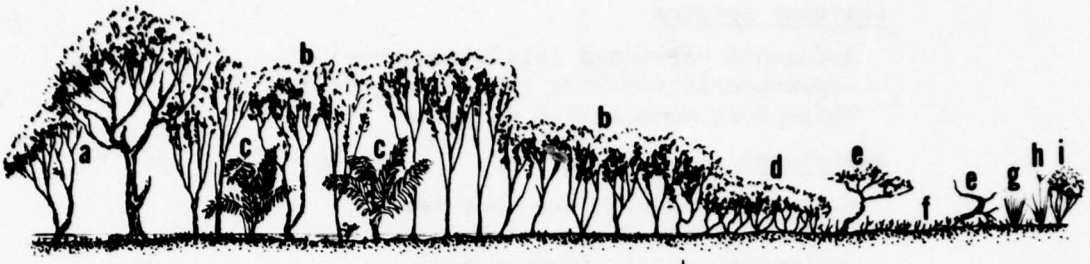
Typical Species

a *Rhizophora mangle* (Red mangrove) (mature)
b *Rhizophora mangle* (Red mangrove) (seedlings)
c *Avicennia germinans* (Black mangrove)
d *Laguncularia racemosa* (White mangrove)

Transitional and Associated Species

e *Rhizophora mangle* (Red mangrove) (stunted forms)
f *Avicennia germinans* (Black mangrove)
g *Conocarpus erecta* (Buttonwood)
h *Salicornia virginica* (Glasswort)
i *Spartina patens* (Cordgrass)
j *Baccharis halimifolia* (Groundsel)
Acrostichum aureum (Leather fern)
Batis maritima (Saltwort)
Borrichia arborescens (Sea daisy)
Borrichia frutescens (Sea daisy)
Cakile edentula (Sea rocket)
k *Casuarina equisetifolia* (Australian pine)
Dalbergia ecastophyllum (Dalbergia)
Ipomoea pes-caprae (Railroad vine)
Limonium carolinianum (Sea lavender)
Philoxerus vermicularis (Beach carpet)
Rhabdadenia biflora (Rubber vine)
Ruppia martima (Widgeon grass)
Sesuvium portulacastrum (Sea purslane)
Spartina alterniflora (Smooth cordgrass)
Spartina cynosuroides (Big cordgrass)
Sporobolus virginicus (Coastal dropseed)
Suaeda linearis (Sea blite)

Figure 7. Generalized floristic profile of a deep saltwater swamp (regular tidal flooding)



Typical Species

a *Avicennia germinans* (Black mangrove)
b *Laguncularia racemosa* (White mangrove)
c *Acrostichum aureum* (Leather fern)
Batis maritima (Saltwort)
Dalbergia ecastophyllum (Dalbergia)
Rhabdadenia biflora (Rubber vine)
Spartina cynosuroides (Big cordgrass)

Transitional and Associated Species

d *Laguncularia racemosa* (White mangrove) (stunted forms)
e *Conocarpus erecta* (Buttonwood)
f *Distichlis spicata* (Salt grass)
g *Spartina patens* (Marsh hay cordgrass)
h *Cyperus* spp. (Sedge)
i *Baccharis halimifolia* (Groundsel)
Borrichia arborescens (Sea daisy)
Borrichia frutescens (Sea daisy)
Cakile edentula (Sea rocket)
Heliotropium curassavicum (Seaside heliotrope)
Limonium carolinianum (Sea lavender)
Monanthochloe littoralis (Key grass)
Paspalum vaginatum (Silt grass)
Philoxerus vermicularis (Beach carpet)
Salicornia virginica (Glasswort)
Sesuvium portulacastrum (Sea purslane)
Sporobolus virginicus (Coastal dropseed)
Suaeda linearis (Sea blite)
Suaeda maritima (Sea blite)

Figure 8. Generalized floristic profile of a shallow saltwater swamp (occasional tidal flooding)

Dominant species

Avicennia germinans (Black mangrove)
Laguncularia racemosa (White mangrove)
Rhizophora mangle (Red mangrove)

Associated species

Acrostichum aureum (Leather fern)
Batis maritima (Saltwort)
Conocarpus erecta (Buttonwood)
Dalbergia ecastophyllum (Dalbergia)
Rhabdadenia biflora (Rubber vine)
Salicornia perennis (Glasswort)
Spartina alterniflora (Smooth cordgrass)

Transitional species

Avicennia germinans (Black mangrove)
Baccharis halimifolia (Groundsel)
Casuarina equisetifolia (Australian pine)
Conocarpus erecta (Buttonwood)
Distichlis spicata (Salt grass)
Juncus roemerianus (Black needlerush)
Laguncularia racemosa (White mangrove)
Rhizophora mangle (Red mangrove)
Salicornia virginica (Glasswort)
Spartina patens (Cordgrass)

Dominant and associated species. Red mangroves dominate the deepest swamps, while Black mangroves become increasingly important in shallower waters especially in areas inundated only at high tides. White mangrove is mixed with Red and Black mangrove, except in the deepest areas, but is more abundant inland of Black mangrove stands. Shrubs, vines, and herbs, such as Leather fern (*Acrostichum*), Dalbergia (*Dalbergia*), and Rubber vine (*Rhabdadenia*), which are uncommon or absent in the deeper portions of saltwater swamps, are more common in shallow areas.

Mangroves reduce the flow of water sufficiently to cause sediment deposition, and in the absence of disturbance, more xeric (dryland) communities dominated by Buttonwood probably slowly replace mangrove stands. Hurricanes destroy large tracts of mangroves, remove the accumulated sediments, and reverse successional trends. These disturbed areas eventually are reinvaded by mangroves. Hurricane Donna in September 1960 was the most destructive in recent history, and large dead mangrove trunks can still be seen in large sections of the coastal Everglades as a result of this storm.

Succession in the area north of St. Lucie inlet on the east coast and north of Tampa Bay on the west is probably from Smooth cordgrass marshes to Red mangrove swamps.

Transitional species. Buttonwood, stunted White mangroves, Salt grass (*Distichlis spicata*), and Black needlerush (*Juncus roemerianus*) often occur between salt swamps and salt marshes. Occasionally the swamps open directly onto marsh communities comprised of Saltwort, Bigelow's glasswort (*Salicornia bigelovii*), Sea blite (*Suaeda linearis*), and Sea purslane (*Sesuvium portulacastrum*). Infrequently, swamps border stands of more upland, salt-tolerant herbs such as sea daisies (*Borrichia frutescens* and *B. arborescens*), Prickly pear (*Opuntia* spp.), Marsh elder (*Iva frutescens*), and Bay cedar (*Suriana maritima*). Red and White mangroves extend upstream in some rivers to where the water is fresh. Consequently, these areas are actually freshwater, not saltwater, swamps, but the two types blend with little change in the vegetation and salinity measurements are necessary to separate them. In the Florida Keys, the mangroves are sometimes backed directly by hardwood hammocks with Poisonwood (*Metopium toxiferium*), Mahogany (*Swietenia mahagoni*), Stoppers (*Eugenia* spp.), Live oak (*Quercus virginiana*), and Gumbo-limbo (*Bursera simaruba*).

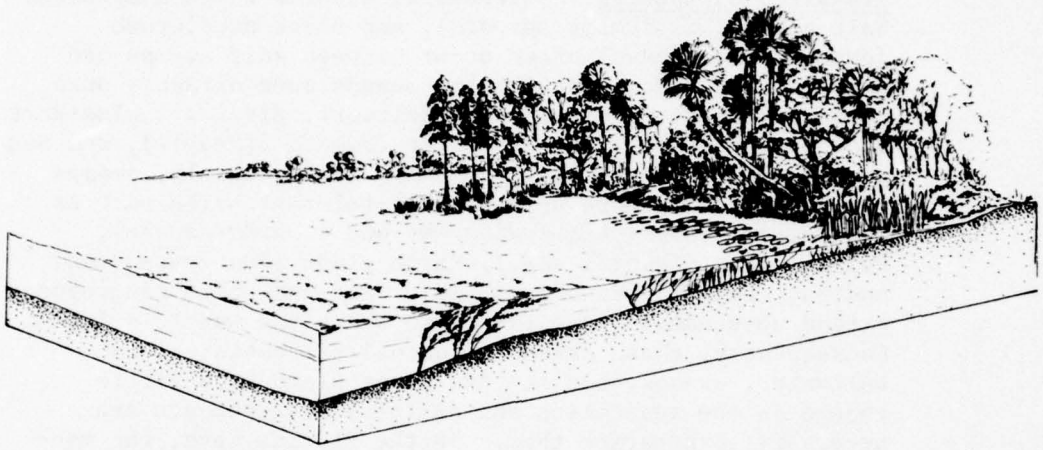
ENVIRONMENTAL CONDITIONS

62. Salt swamps are found from below the lowest tide levels to the limit of storm tides but are most common in the intertidal zone. Although the water is usually brackish or saline, the community may be found in fresh water along rivers. Mangrove stands often trap sediment and build the land surface.

FIELD IDENTIFICATION

63. Salt swamps have more than 40 percent cover by woody plants, which distinguishes them from both the saltwater community and salt marshes. In some areas, Red mangroves grow below the intertidal zone where the saltwater community is usually found; these wetlands should be considered part of the saltwater swamp type and not part of the saltwater community, since the vegetation is more similar to that of swamps of slightly higher ground than to that of the saltwater community.

FRESHWATER AQUATIC WETLANDS



Definition: Wetlands that are usually dominated by free-floating or rooted aquatic herbs and are semipermanently or permanently flooded by fresh water

64. This community occurs in streams, rivers, canals, ponds, lakes, and reservoirs throughout peninsular Florida. Often it is a narrow bank of vegetation that parallels shorelines, but many ponds, lakes, and canals are covered completely with vegetation.

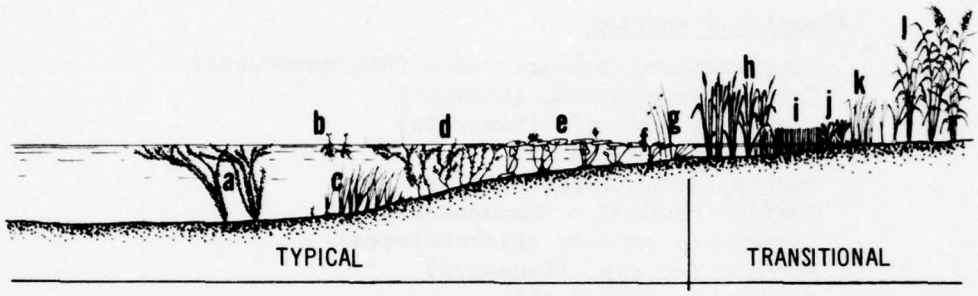
65. Various aquatic plants are considered obnoxious weeds, reducing the recreational value of lakes and waterways, clogging irrigation canals and drainage ditches, and covering the water surface. Many of these aquatic weeds are aquarium-trade escapees and are not native to Florida but thrive as if they were. The luxuriant growth of some of the aquatic plants is a response to the nutrient enrichment of the water by man's activities.

66. Some aquatic submerged plants form thick growths in lakes and ponds. These plants often interfere with the passage of boats and hinder swimming and fishing. Among the most important are the following introduced aquatics: Water hyacinth (*Eichhornia crassipes*), Elodea (*Elodea densa*), and Parrotfeather (*Myriophyllum brasiliense*).

VEGETATION

67. Growth forms and physiognomy: Free-floating herbs, such as Water hyacinth, and rooted aquatic herbs, such as Water lily; in dense, sometimes scattered, stands; often with abundant masses of filamentous algae attached to vegetation or in detached floating clumps.

68. Species composition of the freshwater aquatic wetland:



Typical Species

a *Elodea densa* (Elodea)
Hydrilla verticillata (Hydrilla)
b *Utricularia* spp. (Bladderwort) (floating)
c *Vallisneria neotropicalis* (Tape grass)
d *Myriophyllum* spp. (Water milfoil)
e *Nymphaea* spp. (Water lily)
f *Potamogeton* spp. (Pondweed)
g *Scirpus validus* (Giant bulrush)
Alternanthera philoxeroides (Alligatorweed)
Azolla caroliniana (Mosquito fern)
Brasenia schreberi (Water shield)
Ceratophyllum demersum (Coontail)
Eichhornia crassipes (Water hyacinth)
Lemna spp. (Duckweed)
Limnobium spongia (Frogbit)
Najas spp. (Naiad)
Nelumbo lutea (Lotus)
Nuphar luteum (Spatterdock)
Nymphaea spp. (Water lily)
Pistia stratiotes (Water lettuce)
Salvinia rotundifolia (Water fern)
Scirpus spp. (Bulrush)
Spirodela sp. (Giant duckweed)
Wolffiella floridana (Wolffiella)

Transitional and Associated Species

h *Typha* spp. (Cattail)
i *Eleocharis cellulosa* (Spike rush)
j *Pontederia lanceolata* (Pickerelweed)
k *Rhynchospora tracyi* (Beak rush)
l *Phragmites australis* (Giant reed)
Acrostichum danaeaefolium (Leather fern)
Cephalanthus occidentalis (Buttonbush)
Cladium jamaicense (Sawgrass)
Juncus effusus (Soft rush)
Ludwigia peruviana (Primrose willow)
Orontium aquaticum (Golden club)
Panicum hemitomon (Maidencane)
Panicum repens (Torpedo grass)
Panicum virgatum (Switch grass)
Sagittaria spp. (Arrowhead)
Salix caroliniana (Common willow)
Taxodium ascendens (Pond cypress)
Taxodium distichum (Bald cypress)
Thalia geniculata (Arrowroot)
Utricularia spp. (Bladderwort) (rooted)

Figure 9. Generalized floristic profile of a freshwater aquatic wetland

Dominant species

Eichhornia crassipes (Water hyacinth)
Elodea densa (Elodea)
Hydrilla verticillata (Hydrilla)
Myriophyllum brasiliense (Parrotfeather)
Myriophyllum spicatum (Eurasian watermilfoil)
Nelumbo spp. (Lotus)
Nymphaea spp. (Water lily)
Pistia stratiotes (Water lettuce)

Associated species

Alternanthera philoxeroides (Alligatorweed)
Cabomba caroliniana (Fanwort)
Cladium jamaicense (Sawgrass)
Lemna spp. (Duckweed)
Nuphar luteum (Spatterdock)
Panicum hemitomon (Maidencane)
Pontederia cordata (Pickerelweed)
Potamogeton spp. (Pondweed)
Typha spp. (Cat-tail)
Utricularia spp. (Floating bladderwort)
Vallisneria neotropicalis (Tape grass)

Transitional species

Acrostichum danaeaefolium (Leather fern)
Cladium jamaicense (Sawgrass)
Eleocharis cellulosa (Spikerush)
Phragmites australis (Common reed)
Rhynochospora tracyi (Beak rush)
Scirpus validus (Bulrush)

Dominant and associated species. Ponds and lakes typically are dominated by plants with different growth forms at different depths: free-floating plants such as Water hyacinth (*Eichhornia*) and Duckweeds (*Lemna, Spirodela, Wolffiella*) in the deepest parts; submerged, rooted plants such as *Elodea* and Watermilfoil or Parrotfeather (*Myriophyllum* spp.) in water less than 10 ft deep; and emersed graminoids and forbs such as Sawgrass, American lotus (*Nelumbo lutea*), Water lily (*Nymphaea*), and Spatterdock (*Nuphar luteum*) in areas less than 3 ft deep.

This wetland type is the pioneer stage in the succession of lakes and ponds to uplands that is a result of sedimentation. Wax myrtle (*Myrica cerifera*), Brazilian pepper (*Schinus terebinthifolia*), Australian pine (*Casuarina equisetifolia*), and Punk tree (*Melaleuca quinquenervia*) will replace the aquatic plants as the site becomes drier. The speed of succession is related directly to the rate of sedimentation of the particular water body. In flowing waters, the freshwater community is successionally stable.

Transitional species. The freshwater community is bordered by the open water at its outer edge, while shoreward it usually is bordered by a dense community of terrestrial plants--either swamps or marshes. Thus, freshwater communities usually adjoin other wetlands. Some aquatic communities, especially ponds, may be bordered directly by freshwater swamps with Bald or Pond cypress (*Taxodium distichum, T. ascendens*), Willow (*Salix caroliniana*), Primrose willow (*Ludwigia peruviana*), and Buttonrush (*Cephalanthus occidentalis*). Common reed (*Phragmites australis*) is often at the interface of a freshwater marsh with a freshwater community.

ENVIRONMENTAL CONDITIONS

69. Freshwater communities are inundated permanently except in drought years. Seasonally wet areas of herbaceous vegetation are classified as marshes since their vegetation is not dominated by floating or submerged aquatic plants; such areas often have less vegetative cover than more typical marshes.

70. The environmental conditions of open water, often occurring in large portions of the aquatic freshwater system, refers simply to the water quality. Often the extent of the algal cover (that is, the surface mat of macroscopic algae, if any) is dependent on the nutrient levels in the water with heavy nutrient loads, especially of some forms of nitrogen and phosphorus. High levels of nutrients and organic material favor growth of surface algal mats as well as phytoplankton (small free-floating algae) and periphyton (algae attached to rocks and vegetable matter), but these effects are less conspicuous than the growth of algal mats on the surface. When these mats are formed, the algae of lower levels die, and the process of decomposition removes oxygen from the water. The results can be anoxic conditions, resulting in the death of fish and other aquatic animals.

FIELD IDENTIFICATION

71. The freshwater community is dominated by herbaceous species, which distinguish it from freshwater swamp; it is dominated by rooted and usually free-floating aquatic plants, which separate it from freshwater marshes having terrestrial species such as Sawgrass, Cordgrass, and Cattail. Boundaries of this type may change rapidly as sediment

accumulates, in which case the species composition changes, usually to a freshwater marsh. Simultaneously the outer limit, which is usually open water, may be extended as sediment accumulates and submerged plants invade this recently deposited soil.

72. Areas of open water in the freshwater aquatic system are easily recognized by the relative lack of vascular plants. The water may be nearly clear or may have dense algal mats.

FRESHWATER FLAT

Definition: Wetlands that have 25 percent or less vegetative cover and are occasionally or regularly flooded by freshwater

73. Freshwater flats are most common surrounding areas of fluctuating water levels such as around reservoirs or adjacent to streams and rivers. Such areas are found throughout peninsular Florida. These freshwater flats are heavily utilized by many species of shore birds.

VEGETATION

74. Growth forms and physiognomy: Unvegetated or vegetated with open stands of terrestrial herbs, shrubs, and trees (generally willows).

75. Species composition of the freshwater flat wetland:

Dominant species

Baccharis halimifolia (Groundsel), invasive in dry years
Salix spp. (Willow)
Schinus terebinthifolius (Brazilian pepper)

Transitional species

Data not available.

76. Freshwater flats may adjoin open water, freshwater marshes, or freshwater swamps. Gravel bars may be completely surrounded by open water, but shorelines usually meet open water or the freshwater community on their lower edges and marshes or swamps on the higher edge. The transition to either open water or freshwater community is marked by changes in growth form--terrestrial versus aquatic herbs or algae--where plants are present. There is no necessary change in species composition from the freshwater flat to the marsh or swamp but simply a change in the percent cover of plants.

ENVIRONMENTAL CONDITIONS

77. Freshwater flats occur on a wide variety of soil types ranging from silty or even clayey to sandy and gravelly. Freshwater flats, however, are a result of fluctuating water levels. Even at times in which the fluctuations are reduced for a year or more, enough plants may invade a former flat and cover enough of the area that it would be classified a marsh until the next flooding occurred.

FIELD IDENTIFICATION

78. Freshwater flats are easily distinguished by the lack of vegetative cover in an area surrounded by wetlands. Where the soils are saline, these flats are classified as coastal flats.

FRESHWATER MARSH



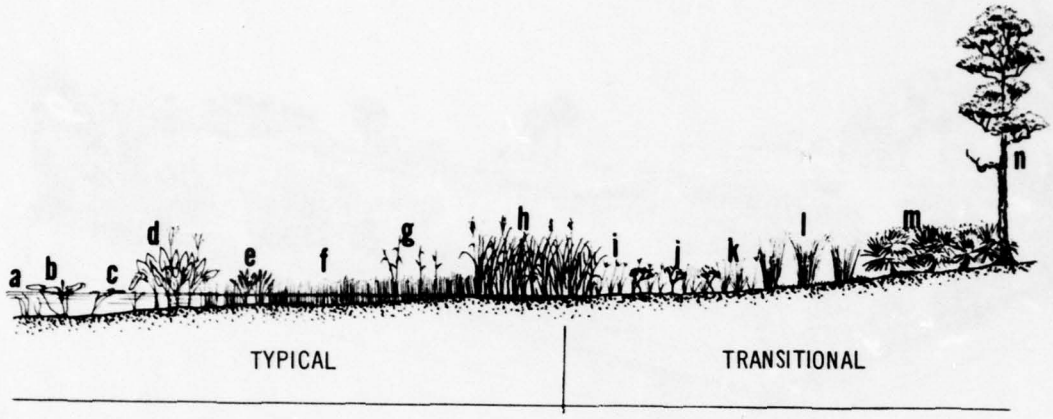
Definition: Wetlands that have more than 25 percent vegetative cover of herbaceous plants but 40 percent or less cover by woody plants that are occasionally or regularly flooded by fresh water

79. Freshwater marshes are scattered throughout inland Florida; the Everglades south of Lake Okeechobee are by far the largest area. Freshwater marshes are also found around ponds, canals, and sloughs. The Everglades alone cover over 2.5 million acres. This wetland often exhibits the highest plant diversity of all wetland types.

VEGETATION

80. Growth forms and physiognomy: Dense stands of graminoids, particularly Sawgrass, with forbs, such as Water lily, either scattered or in small, dense stands.

81. Species composition of the freshwater marsh:



Typical Species

a *Vallisneria* spp. (Tape grass)
b *Nymphaea* spp. (Water lily)
c *Potamogeton* spp. (Pond weed)
d *Thalia geniculata* (Arrowroot)
e *Pontederia lanceolata* (Pickerelweed)
f *Eleocharis cellulosa* (Spike rush)
g *Panicum lacustre* (Panic grass)
h *Cladium jamaicense* (Sawgrass)
Alternanthera philoxeroides (Alligatorweed)
Bacopa caroliniana (Water hyssop)
Bidens mitis (Beggar-tick)
Brasenia schreberi (Water shield)
Ceratophyllum demersum (Coontail)
Crinum americanum (Swamp lily)
Fuirena scirpoidea (Umbrella grass)
Hydrocotyle umbellata (Marsh pennywort)
Iris spp. (Iris)
Lemna spp. (Duckweed)
Lymnobium spongia (Frogbit)
Orontium aquaticum (Golden club)
Najas spp. (Naiad)
Panicum hemitomon (Maidencane)
Paspalidium geminatum (Water grass)
Rhynchospora tracyi (Beak rush)
Sagittaria spp. (Arrowhead)
Salvinia rotundifolia (Water fern)
Scirpus spp. (Bulrush)
Spartina bakerii (Cordgrass)
Stillingia aquatica (Queen's delight)
Typha spp. (Cattail)
Utricularia spp. (Bladderwort) (rooted)

Transitional and Associated Species

i *Cyperus* spp. (Sedge)
j *Hypericum fasciculatum* (St. John's wort)
k *Xyris elliottii* (Yellow eye grass)
l *Spartina bakerii* (Cordgrass)
m *Serenoa repens* (Saw palmetto)
n *Pinus elliottii* (Slash pine)
Asclepias curassavica (Scarlet milkweed)
Baccharis halimifolia (Groundsel)
Cephalanthus occidentalis (Button bush)
Eriocaulon spp. (Hat pins)
Fraxinus caroliniana (Pop ash)
Hymenocallis spp. (Spider lily)
Ilex cassine (Dahoon holly)
Juncus effusus (Soft rush)
Lachnanthes tinctoria (Red root)
Ludwigia peruviana (Primrose willow)
Lycopodium spp. (Club moss)
Myrica cerifera (Wax myrtle)
Oxypolis filiformis (Water dropwort)
Panicum virgatum (Switch grass)
Polygonum spp. (Smartweed)
Sambucus simpsonii (Southern elder)
Woodwardia virginica (Chain fern)

Figure 10. Generalized floristic profile of a freshwater marsh

Dominant species

Brasenia schreberi (Water shield)
Cladium jamaicense (Sawgrass)
Eleocharis spp. (Spike rush)
Panicum hemitomon (Maiden cane)
Phragmites australis (Common reed)
Spartina bakerii (Cordgrass)
Thalia geniculata (Arrowroot)
Typha spp. (Cattail)

Associated species

Amphicarpum muhlenbergianum (Blue maiden cane)
Centella asiatica (Coinwort)
Cyperus spp. (Flat sedge)
Eleocharis cellulosa (Spike rush)
Erigeron vernus (Fleabane)
Eriocaulon spp. (Hat pins)
Hydrocotyle spp. (Pennywort)
Hypericum spp. (St. John's wort)
Juncus repens (Black rush)
Limnobium spongia (Frogbit)
Nelumbo lutea (American lotus)
Nuphar luteum (Spatterdock)
Nymphaea elegans (Blue water lily)
Nymphaea odorata (White water lily)
Nymphoides aquatica (Floating heart)
Pontederia cordata (Pickerelweed)
Potamogeton spp. (Pond weed)
Peltandra virginica (Arrow arum)
Sabal palmetto (Cabbage palm)
Sagittaria lancifolia (Arrowhead)
Scirpus spp. (Bulrush)
Rhexia spp. (Meadow beauty)
Vallisneria spp. (Tape grass)

Transitional species

Baccharis halimifolia (Groundsel)
Cephalanthus occidentalis (Buttonbush)
Cyperus spp. (Flat sedge)
Hypericum fasiculatum (St. John's wort)
Ilex cassine (Dahoon holly)
Myrica cerifera (Wax myrtle)
Pinus elliottii (Slash pine)
Serenoa repens (Saw palmetto)
Spartina bakerii (Cordgrass)
Xyris elliottii (Yellow eye grass)

Dominant and associated species. Many freshwater marshes are dominated strongly by a single species and only scattered individuals of other species occur; others have

small stands of single species scattered in a larger area dominated by one or a few species. The strong dominance by single species results from vegetative reproduction by rhizomes (underground stems) of many of the dominant species. Changes in microtopography probably explain the patchy patterns of isolated stands of species in an area dominated by another.

Emersed graminoids, particularly Cattails (*Typha* spp.) dominate many deep marshes. These deep areas often include members of the freshwater aquatic community, such as the aquatics Arrowhead (*Sagittaria*) and Water lily (*Nymphaea*). When these aquatic species become dominant, the site is an aquatic wetland rather than a marsh.

Shallow marshes are almost always dominated by graminoids; Sawgrass (*Cladium jamaicense*) is estimated to cover as much as 75 percent of the Everglades marshes. Other locally common graminoids of shallow freshwater marshes (which include the "wet-prairies" of some other classifications) are Reed (*Phragmites*), Maidencane (*Panicum hemitomon*), Spike rush (*Eleocharis* spp.), and Cordgrass (*Spartina bakerii*). Shallow depressions occupying less than one to several acres in inland areas dominated by pines (the "pine flatwoods") typically support St. John's wort (*Hypericum* spp.) Coinwort (*Centella*), Spike rush (*Eleocharis*), Fleabane (*Erigeron*), Black rush (*Juncus repens*), and Cordgrass.

Transitional species. Although the transition may be the result of minor changes in elevations, the boundary between freshwater marshes and more upland communities is often well defined and marked commonly by woody species including: Slash pine (*Pinus elliottii*), Saw palmetto (*Serenoa repens*), Buttonbush (*Cephalanthus occidentalis*), Groundsel (*Baccharis halimifolia*), Wax myrtle (*Myrica cerifera*), Dahoon holly (*Ilex cassine*), and sometimes Cabbage palm (*Sabal palmetto*). The existence of some of these species may be indicative of some more mesic communities adjacent to this wetland type.

ENVIRONMENTAL CONDITIONS

82. Freshwater marshes may be semipermanently inundated with up to 8 ft of water, or they may be only seasonally flooded. Water level fluctuations range from slight to large even in semipermanently flooded areas. The dominant growth form is related to the depth and duration of inundation with forbs dominating permanently wet areas and graminoids dominating seasonally wet sites. This distinction does not always hold true. Cattails, for example, is generally considered a graminoid in ecological sampling but usually occurs in permanently wet areas.

83. Seasonally wet marshes, notably the Everglades, are subject to frequent fires, which may account for the strong dominance of Sawgrass. The dominance also may be a result of the ability of Sawgrass to thrive under low nutrient conditions; phosphorus levels, in particular, are quite low in the Everglades.

FIELD IDENTIFICATION

84. The freshwater marsh is distinguished from the adjacent freshwater aquatic community by the change from rooted and free-floating aquatic plants such as Pickerelweed (*Pontederia*) and Water lily (*Nymphaea*) to nonaquatic ones. Separation from salt marshes must be based on quantitative studies of species composition. Several of the dominant freshwater marsh species, notably Sawgrass (*Cladium*), Cattails (*Typha*), and the Cordgrass (*Spartina bakerii*), tolerate brackish water, making the boundary between these two wetland types difficult to ascertain. Use of quantitative sampling techniques to examine the total species composition often will be required to establish this boundary.

FRESHWATER SWAMP



Definition: Wetlands that have more than 40 percent cover woody plants and are occasionally or regularly flooded by fresh water. Freshwater swamps may be a mixed hardwood swamp, a bayhead tree swamp, a willow head swamp, or a cypress swamp.

85. Freshwater swamps are scattered throughout peninsular Florida wherever ponds, lakes, rivers, sloughs, or shallow wet depressions occur. They commonly occur in bands along rivers; they also often form circular-shaped stands in depressions.

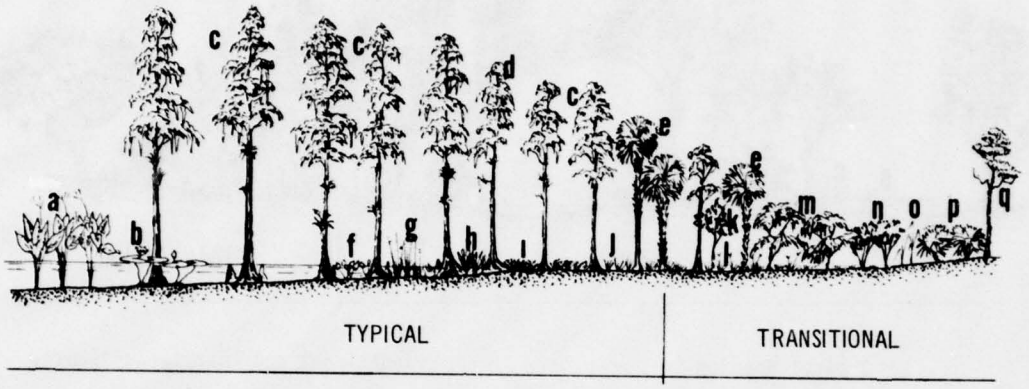
86. There are five major plant communities included in the freshwater swamp type: cypress swamps, mixed hardwoods, bayheads, willow heads, and banana holes. In general, these types share many species but differ from each other in their combination of dominants. The mixed hardwood type is found in river bottoms, while the other types are usually found in depressions.

VEGETATION

87. Growth forms and physiognomy: Medium to dense stands of tall deciduous needleleaf shrubs or trees, Cypress with epiphytic herbs ("air plants") such as Spanish moss, or dense stands of low to tall

broadleaf evergreens such as Red bay, or deciduous trees such as Red maple, often with deciduous shrubs and herbs present and sometimes with epiphytic herbs.

88. Species composition of the freshwater swamp wetland:



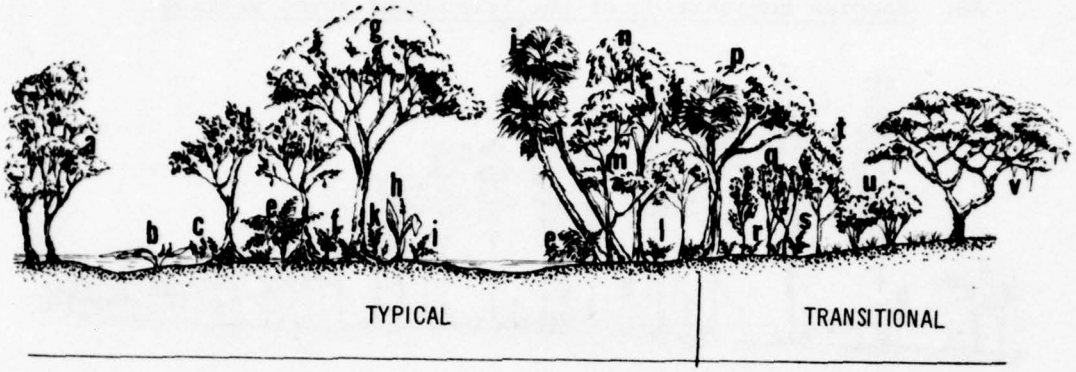
Typical Species

a *Thalia geniculata* (Arrowroot)
b *Nymphaea* spp. (Water lily)
c *Taxodium distichum* (Bald cypress)
d *Taxodium ascendens* (Pond cypress)
e *Sabal palmetto* (Cabbage palm)
f *Sagittaria* spp. (Arrowhead)
g *Scirpus validus* (Giant bulrush)
h *Crinum americanum* (Swamp lily)
i *Bacopa caroliniana* (Water hyssop)
j *Eriocaulon decangulare* (Hat pins)
Brasenia schreberi (Water shield)
Centella asiatica (Coinwort)
Cephalanthus occidentalis (Buttonbush)
Ceratophyllum demersum (Coontail)
Eichhornia crassipes (Water hyacinth)
Hydrocotyle umbellata (Marsh pennywort)
Justicia ovata (Water willow)
Lemna spp. (Duckweed)
Najas spp. (Naiad)
Nuphar luteum (Spatterdock)
Orontium aquaticum (Golden club)
Salvinia rotundifolia (Water fern)
Utricularia spp. (Bladderwort) (floating)
Vallisneria spp. (Tape grass)

Transitional and Associated Species

e *Sabal palmetto* (Cabbage palm)
k *Myrsine guianensis* (Myrsine)
l *Cyperus* spp. (Sedge)
m *Salix caroliniana* (Common willow)
n *Myrica cerifera* (Wax myrtle)
o *Panicum virgatum* (Switch grass)
p *Serenoa repens* (Saw palmetto)
Acrostichum danaeaefolium (Leather fern)
Fraxinus caroliniana (Pop ash)
Ilex cassine (Dahoon holly)
Ludwigia peruviana (Primrose willow)
Osmunda regalis (Royal fern)
Pinus elliottii (Slash pine)
Pinus serotina (Pond pine)

Figure 11. Generalized floristic profile of a deep freshwater swamp



Typical Species

a *Nyssa aquatica* (Water tupelo)
b *Orontium aquaticum* (Golden club)
c *Blechnum serrulatum* (Swamp fern)
d *Annona glabra* (Pond apple)
e *Acrostichum danaeaefolium* (Leather fern)
f *Osmunda regalis* (Royal fern)
g *Acer rubrum* (Red maple)
h *Eulophia alata* (Wild coco)
i *Thelypteris* spp. (Fern)
j *Sabal palmetto* (Cabbage palm)
k *Sabatia* spp. (Marsh pink)
l *Rubus betulifolius* (Swamp blackberry)
m *Fraxinus caroliniana* (Pop ash)
n *Magnolia virginiana* (Sweet bay)
o *Cornus stricta* (Swamp dogwood)
p *Ficus aurea* (Strangler fig)
Bacopa caroliniana (Water hyssop)
Carya aquatica (Water hickory)
Cephalanthus occidentalis (Buttonbush)
Crinum americanum (Swamp lily)
Justicia ovata (Water willow)
Nyssa ogeche (Ogeeche tupelo)
Nyssa sylvatica var. *biflora* (Swamp tupelo)
Peltandra virginica (Arrow arum)
Sagittaria spp. (Arrowhead)
Salvinia rotundifolia (Water fern)
Taxodium ascendens (Pond cypress)
Taxodium distichum (Bald cypress)
Thalia geniculata (Arrowroot)
Utricularia spp. (Bladderwort) (rooted)

Transitional and Associated Species

q *Myrsine guianensis* (Myrsine)
r *Thelypteris palustris* (Fern)
s *Woodwardia virginica* (Chain fern)
t *Ilex cassine* (Dahoon molly)
u *Myrica cerifera* (Wax myrtle)
v *Quercus virginiana* (Live oak)
Eulophia alta (Wild coco)
Gordonia lasianthus (Loblolly bay)
Ilex glabra (Gallberry)
Phragmites australis (Reed)
Psidium guajava (Guava)
Salix caroliniana (Common willow)
Sambucus simpsonii (Southern elder)
Serenoa repens (Saw palmetto)

Figure 12. Generalized floristic profile of a shallow freshwater swamp

Dominant species

Acer rubrum (Red maple)
Fraxinus caroliniana (Water ash)
Gordonia lasianthus (Loblolly bay)
Liquidambar styraciflua (Sweet gum)
Magnolia virginiana (Sweet bay)
Nyssa biflora (Swamp tupelo)
Persea borbonia (Red bay)
Sabal palmetto (Cabbage palm)
Salix caroliniana (Willow)
Salix nigra (Black willow)
Serenoa repens (Saw palmetto)
Taxodium ascendens (Pond cypress)
Taxodium distichum (Bald cypress)
Ulmus floridana (Florida elm)

Associated species

Annona glabra (Pond apple)
Acrostichum spp (Leather ferns)
Bacopa caroliniana (Water hyssop)
Blechnum spp. (Swamp fern)
Carpinus caroliniana (Hornbeam)
Carya aquatica (Water hickory)
Celtis laevigata (Sugarberry)
Cephalanthus occidentalis (Buttonbush)
Chrysobalanus icaco (Cocoplum)
Chrysobalanus interior (Small-fruited cocoplum)
Cladium jamaicense (Sawgrass)
Conocarpus erecta (Buttonwood)
Crinum americanum (Swamp lily)
Decumaria barbara (Wood vamp)
Dryopteris spp. (Woods fern)
Fraxinus caroliniana (Water ash)
Eriocaulon decangulare (Hat pins)
Gleditsia aquatica (Water locust)
Hydrocotyle spp. (Pennywort)
Ilex cassine (Dahoon holly)
Ilex glabra (Galberry)
Lachnanthes caroliniana (Red root)
Lyonia lucida (Shiny lyonia)
Metopium toxifera (Poison wood)
Myrica cerifera (Wax myrtle)
Myrsine guianensis (Myrsine)
Osmunda spp. (Cinnamon fern)
Pinus elliotii (Slash pine)
Pinus serotina (Pond pine)
Pinus taeda (Loblolly pine)
Quercus laurifolia (Laurel oak)
Quercus nigra (Water oak)
Sagittaria spp. (Arrowhead)

Salix floridana (Willow)
Saururus cernuus (Lizard's tail)
Tillandsia usneoides (Spanish moss)
Scirpus validus (Bulrush)
Toxicodendron radicans (Poison ivy)
Woodwardia virginica (Virginia chain fern)

Transitional species

Cyperus spp. (Flat sedge)
Myrica cerifera (Wax myrtle)
Myrsine quianensis (Myrsine)
Nymphaea spp. (Water lily)
Panicum virgatum (Switch grass)
Sabal palmetto (Cabbage palm)
Salix caroliniana (Willow)
Serenoa repens (Saw palmetto)
Thalia geniculata (Arrowroot)

Cypress swamps. Bald and Pond cypress are dominant in cypress swamps; these two species may occur together, but more frequently they are found in separate stands. Bald cypress is more common along lake margins and on floodplains while Pond cypress usually occurs on higher, poorly drained sites such as around ponds, as the name implies. Epiphytic orchids, ferns, and bromeliads, especially Spanish moss, are often the only plants besides Bald cypress present in semi-permanently flooded swamps. Big Cypress Swamp, west of the Everglades, is probably the most extensive cypress swamp in the world; all but a few of the giant cypress trees have been logged, however, and most of the trees are less than 10 in. in diameter (dbh).

Mixed hardwood swamps. Dominance in mixed hardwood stands usually is shared among several species, especially Red maple, Swamp tupelo, Sweet gum, Bald cypress, Water ash, Florida elm, and Cabbage palm. Water oak, Laurel Oak, Water hickory, Hackberry, Water locust, and Sweet bay are locally important in these stands. In the understory, species such as Buttonbush, Dahoon holly, Wax myrtle, and Lizard's tail are common in most freshwater swamps, including those of mixed hardwoods.

Bayheads. In bayheads, the most important trees are Sweet bay (*Magnolia virginiana*), Red bay (*Persea borbonia*), and in northern Florida also Loblolly bay (*Gordonia lasianthus*). Red maple, Swamp tupelo, and Sweet gum, which are dominants in mixed hardwood stands, are found in bayheads but are less important there. Most of the associated species of the mixed hardwoods are also found in bayheads.

Willow heads. Willow heads may consist of nearly pure stands of willow (*Salix caroliniana* and *S. nigra*), particu-

larly on wetter sites. In shallower areas, the communities often include other swamp species mixed with the dominant willows: Sweet bay, Wax myrtle, Bald and Pond cypress, Dahoon holly, Red bay, and Buttonbush. In addition, Coco plum, Poison wood, and Buttonwood are associated commonly with willow heads of southern Florida.

Banana holes. A relatively isolated variant of freshwater swamp is found between Miami and Homestead. These are the so-called "banana holes" that are small sinks in the limestone and derive their name from the common practice of raising bananas in them. Some have vertical walls; others are shallow and cup-shaped. The vegetation is highly variable, but often Cabbage palm, Pond apple, and Small-fruited coco plum are the most important species.

Bald cypress swamps are successionally stable in permanently wet areas, but where the maximum annual water depth is less than 3 ft and the soil surface is dry during the spring, they may be replaced by hardwoods. Moreover, cypress communities gradually accumulate organic materials, reducing the depth and duration of inundation. As the community becomes drier, the stand will become a mix hardwood bayhead or swamp.

Willow heads follow a similar successional pattern: as they accumulate organic material, the stands are replaced by bayhead swamps. As yet more peat is formed in the bayheads, they are in turn replaced by hardwood hammocks composed of species requiring less moist conditions, such as Magnolia (*Magnolia grandiflora*), Laurel oak, and American holly (*Ilex opaca*).

Transitional species. Cypress communities often border or encircle deeper waters that support freshwater communities. Towards drier sites, they are often adjacent to mixed hardwoods though the latter may border directly on aquatic communities or freshwater marshes. Mixed hardwoods grade into upland hammocks as described above. Similarly, bayheads often merge into upland communities such as pine flatwoods. Dense shrub thickets composed of species from both the bayhead and the pine flatland commonly separate those two communities.

ENVIRONMENTAL CONDITIONS

89. Cypress communities can withstand nearly permanent inundation but exposed saturated soils are necessary for seed germination. The pH of the soil and soil water appears to be the major factor separating the distribution of the two species of cypress. Pond cypress typically occurs in acidic soils where the pH ranges from 3.6 to 5.4. Bald cypress

communities usually occur in pH ranges from neutral to alkaline, although slightly acidic conditions may develop during the dry season. Bald cypress grows vigorously on deep mucks or brown peats, clays, or fine sands. Shallow marl soils overlying bedrock support marginal Bald cypress growth, exemplified by the dwarf Bald cypress stands of the Everglades. (Because of tree cover in these stands of less than 40 percent, these wetlands are classified as marshes.) Pond cypress typically is found on fine sandy soils underlaid by hardpan.

90. Mixed hardwoods often are associated with flowing water; consequently flooding usually is for short periods during the growing season. Wet hammocks occur in areas that are rarely flooded, but the soils are usually saturated.

91. Bayheads are found on infrequently to seasonally flooded sites where the maximum water depth is less than 3 ft, and consequently water level fluctuations are small. Bayheads may occur, for example, on the margins of pond cypress swamps.

92. Willow heads grow on frequently flooded sites with soils that are saturated most of the year. The water levels usually fluctuate less than 3 ft per year.

FIELD IDENTIFICATION

93. Freshwater swamps are distinguished from adjacent wetlands by the presence of trees. Aquatic communities frequently border them in areas either too deep for cypress or permanently flooded, which prevents germination of cypress seeds. The transition of freshwater swamps to uplands, particularly to pinelands, is frequently gradual and delineation of the boundary is difficult. Since several of the dominants of freshwater swamps occasionally occur in sites too dry to be considered wetlands, secondary species can be more effectively used to define the boundary. Saw palmetto in particular is an obligate upland species and frequently can be used to distinguish wetland from upland communities.

94. The separation of the five types of freshwater swamps from each other can be done on the basis of dominant species. Although most of these occur as secondary species in the other types, each is a dominant (or codominant) in only one type.

SELECTED REFERENCES AND BIBLIOGRAPHY

1. Alexander, T., 1971, Sawgrass biology related to the future of the Everglades ecosystem. Soil and Crop Sci. Soc. Fla. 31:72-74.

2. Alexander, T., and Crook, A., 1974. Recent vegetational changes in southern Florida. Pp. 61-72. in P. Gleason, ed. Environments of south Florida: Present and past. Miami Geol. Soc., Mem. 2.

3. Barbour, M. G., 1970. Is any angiosperm an obligate halophyte? Amer. Midl. Nat. 84:105-120.

4. Braun, E. L., 1964. Deciduous Forests of Eastern North America. Hafner Publishing Co., New York. 596 pp.

5. Burkhalter, A. P., Curtis, L. M., Lazor, R. L., Beach, M. L., and Hudson, J. C., undated. Aquatic weed identification and control manual. Bureau of Aquatic Plant Research and Control, Florida Dep. Nat. Res. 99 pp.

6. Carter, M. R., Burns, L. A., Carinder, T. R., Dugger, K. R., Fore, P. L., Hicks, D. B., Revells, H. L., and Schmidt, T. W., 1973. Ecosystems analysis of the Big Cypress Swamp and adjacent estuaries. U. S. Environmental Protection Agency, Atlanta, Georgia. 451 pp.

7. Cowardin, L. M., Carter, V., Golet, F. C., and LaRoe, E. T., 1977. Classification of wetlands and deep-water habitats of the United States (an operational draft). U. S. Fish and Wildlife Service, 100 pp.

8. Craighead, F. C., 1971. The trees of south Florida. Univ. Miami Press, Coral Gables, Florida. 212 pp.

9. Craighead, F. C., 1974. Hammocks of south Florida. in P. Gleason, ed. Environments of south Florida: Present and past. Miami Geol. Soc., Mem. 2. pp. 53-60.

10. Daley, Richard H., 1976. Guide to Wetlands of Peninsular Florida. Prepared under purchase order for the Environmental Effects Laboratory, U. S. Army Engineer Waterways Experiment Station, Vicksburg, Mississippi.

11. Davis, J. H., 1940. The ecology and geologic role of mangroves in Florida. Carnegie Inst. Wash. Publ. 517:303-412.

12. Davis, J. H., 1943. The natural features of Southern Florida, especially the vegetation and the Everglades. Fla. Geol. Survey Bull. 25. 311 pp.

13. Davis, J. H., 1946. The peat deposits of Florida. Florida Geol. Survey Bull. 30. 311 pp.

14. Demaree, D., 1932. Submerging experiments with Taxodium. Ecology. 13:258-262.

15. Dickson, R. E., and Broyer, T. C., 1972. Effects of aeration, water supply and nitrogen source on growth and development of tupelo gum and bald cypress. Ecology. 53(4):626-634.

16. Egler, F. E., 1952. Southeast saline Everglades vegetation, Florida, and its management. Vegetatio acta Geobotanica. 3:213-265.

17. Fenneman, N. M., 1931. Physiography of Western United States. McGraw-Hill, New York, 534 pp.

18. Fenneman, N. M., 1938. Physiography of Eastern United States. McGraw-Hill, New York, 497 pp.

19. *Fleming, G., Genelle, P., and Long, R., 1976. Wild flowers in Florida. Banyan Books, Miami.

20. Fowells, H. A., ed., 1965. Silvics of forest trees of the United States. U. S. Dept. Agr., Agr. Handb. 271. 762 pp.

21. Golet, F. C., and Larson, J. S., 1974. Classification of freshwater wetlands in the glaciated northeast. U. S. Fish and Wildlife Service. Resour. Publ. 16. 56 pp.

22. Goodrick, R. L., and Milleson, J. F., 1974. Studies of floodplain vegetation and water level fluctuation in the Kissimmee River Valley. Miami Geol. Soc. Tech. Pub. No. 74-2. 60 pp.

23. Hall, T. F., and Penfound, W. T., 1939a. A phytosociological study of a cypress-gum swamp in southeastern Louisiana. Amer. Midl. Natur. 21:378-395.

24. Hall, T. F., and Penfound, W. T., 1939b. A phytosociological study of a Nyssa biflora consocies in southeastern Louisiana. Amer. Midl. Natur. 22:369-375.

25. Hayden, B., and Dolan, R., 1975. Classification of coastal environments of the world, final report. Department of Environmental Sciences, University of Virginia, Charlottesville, Virginia. Prepared under Contract Nonr-N0014-69-A-0060-0006, Task No. NR 389-158 for Geography Programs, Office of Naval Research, Washington, DC.

* Nontechnical reference

26. Hofstetter, R., 1974. The effect of fire on the pineland and sawgrass communities of southern Florida. Pp. 201-212 in P. Gleason, ed. Environments of south Florida: Present and past. Miami Geol. Soc. Mem. 2.

27. Humm, H., 1973a. Salt Marshes. Pp.IIA-1-IIA-6. in J. Jones et al. A summary of knowledge of the eastern Gulf of Mexico. Martin-Marietta Aerospace, Orlando, Fla.

28. Humm, H., 1973b. Mangroves, Pp. IIID-1-IIID-6. in J. Jones et al. A summary of knowledge of the eastern Gulf of Mexico. Martin-Marietta Aerospace, Orlando, Fla.

29. Humm, H., 1973c. Benthic algae of the eastern Gulf of Mexico. Pp IIIB-1-IIIB-16. in Jones et al., eds. A summary of knowledge of the eastern Gulf of Mexico. Martin-Marietta Aerospace, Orlando, Fla.

30. Hunt, F. M., 1951. Effects of flooded soil on growth of pine seedlings. Plant Physiol. 26:363-368.

31. Klein, H., Schneider, W. J., McPherson, B. F., and Buchanan, T. J., 1970. Some hydrological and biological aspects of the Big Cypress Swamp drainage area, Southern Florida. U. S. Geol. Survey Open File Report 70003, Tallahassee, Fla. 94 pp.

32. Kurz, H., and Wagner, K., 1957. Tidal marshes of the Gulf and Atlantic coasts of northern Florida and Charleston, South Carolina. Fla. State Univ. Stud. 24:1-168 pp.

33. Laessle, A. M., 1942. The plant communities of the Welaka area. Univ. of Fla. Biol. Sci. Ser. 4(1):1-143.

34. Long, R. W., 1974. Origin of the vascular flora of southern Florida. Pp. 28-36. in P. Gleason, ed. Environments of south Florida: Present and past. Miami Geol. Soc., Mem. 2.

35. Long, R. W., and Lakela, O., 1971. A flora of tropical south Florida. Univ. of Miami Press, Coral Gables, Fla. 1962 pp.

36. Loveless, C. M., 1959. A study of the vegetation in the Florida Everglades. Ecology. 40:1-9.

37. Lugo, A., Ramsey, T., and Hoy, J., 1973. Chlorophyll studies in a southern hardwood forest in north central Florida. Florida Scientist 36(2-4): 146-153.

38. *Matoon, W. R., 1967. Common forest trees of Florida: How to know them. Florida Forest Service, 94 pp.

39. Menninger, E. A., 1964. Seaside plants of the world: A guide to planning, planting, and maintaining salt-resistant gardens. Hearthside Press, New York. 303 pp.

40. Millar, J. B., 1976. Wetland classification in western Canada: a guide to marshes and shallow open water wetlands in the grasslands and parklands of the Prairie Provinces. Can. Wildl. Serv. Rep. Ser. 37. 38 pp.

41. Monk, C. D., 1965. Southern mixed hardwood forests of north-central Florida. Ecolog. Monogr. 35(4):335-354.

42. Monk, C. D., 1966. An ecological study of hardwood swamps in north-central Florida. Ecology. 47(4):649-654.

43. Monk. C. D., and Brown, T. W., 1965. Ecological consideration of cypress heads in north central Florida. Amer. Midl. Nat. 74(1): 126-140.

44. *Morton, J. F., 1968. Wild plants for survival in south Florida. Second Edition. Hurricane House Publishers, Miami, Fla. 80 pp.

45. Odum, H. T., Copland, B. J., and McMahan, E. A., eds., 1974. Coastal ecological systems of the United States. The Conserv. Found., Washington, D. C. 4 vols.

46. Penfound, W. T., 1952. Southern swamps and marshes. Botan. Rev. 18:413-445.

47. Penfound, W. T., and Watkins, A. G., 1937. Phytosociological studies in the pinelands of southeastern Louisiana. Amer. Midl. Nat. 18:661-682.

48. Penfound, W. T., and Hathaway, E. S., 1938. Plant communities in the marshes of southeastern Louisiana. Ecol. Monogr. 8:1-56.

49. Phillips, R. C., 1960. Observations in the ecology and distribution of the Florida seagrasses. Fla. State Bd. Conserv. Marine Laboratory. Prof. Pap. ser. 2. 72 pp.

50. Reid, G. K., 1961. Ecology of inland waters and estuaries. Van Nostrand Co., New York, 375 pp.

51. Reimold, R. J., and Queen, W. H., ed. 1974. Ecology of halophytes. Academic Press. New York. 605 pp.

52. *Rickett, H. W., 1967. Wild flowers of the United States. Volume Two. The southeastern states. McGraw-Hill, New York.

53. Robas, A., 1970. South Florida's mangrove-bordered estuaries their

role in sport and commercial fish production. Univ. of Miami Sea Grant Publ. Coral Gables, Florida. 28 pp.

54. *Savage, T., 1972. Florida mangroves: a review. Fla. Dep. Nat. Res., Leaflet ser., Part 2. 16 pp.

55. Shaw, S. P., and Fredine, C. G., 1956. Wetlands of the United States. U. S. Fish and Wildlife Service Circ. 39. 67 pp.

56. Small, J. K., 1972. Manual of the southeastern flora. Part One. Hafner Publ. Co., New York. 774 pp.

57. Small, J. D., 1972. Manual of the southeastern flora. Part Two. Hafner Publ. Co., New York. 780 pp.

58. Simon, J., 1974. Tampa Bay estuarine system - a synopsis. Fla. Scientist 37(4):217-244.

59. *Stevenson, G. B., 1969. Trees of Everglades National Park and the Florida Keys. Everglades Nat. Hist. Assoc. 32 pp.

60. *Stevenson, G. B., 1958. Native trees of the Florida Keys. Privately published booklet. 32 pp.

61. Steward, K. K., 1974. Physiological, edaphic, and environmental characteristics of Everglades sawgrass communities. Pp 37-46. in P. J. Gleason, ed. Environment of south Florida: Past and present. Miami geol. Soc., Miami, Florida, Mem. 2.

62. Stewart, R. E., and Kantrud, H. A., 1971. Classification of natural ponds and lakes in the Glaciated Prairie Region. U. S. Bur. Sport Fish. Wildl. Resour. Publ. 92. 57 pp.

63. *Sturrock, D., 1968. Trees for southern Florida. Cent. and S. Fla. Flood Control Distr., West Palm Beach, Florida. 242 pp.

64. Taylor, J., 1974. The Charlotte Harbor estuarine system. Fla. Scientist 37(4):205-216.

65. Taylor, W. R., 1967. Marine algae of the eastern tropical and subtropical coasts of the Americas. University of Michigan Press, Ann Arbor. 870 pp.

66. *Teas, H. J., 1974. Mangroves of Biscayne Bay. Unpub. Rept. to Dade County Com. 107 pp.

67. Teas, H. J., 1976. A wetlands vegetation guide for peninsular Florida. Prepared under purchase order for the Environmental Effects Laboratory, U. S. Army Engineer Waterways Experiment Station, Vicksburg, Mississippi.

68. Teas, H. J., Wanless, H. A., and Chardon, R., 1976. Effects of man on vegetation of Biscayne Bay. Environments of Biscayne Bay: Past, present, and future. Univ. of Miami Sea Grant Publication (in press).

69. UNESCO. 1973. International classification and mapping of vegetation. Ecology and Conservation Series No. 6, 93 pp. and chart with map symbols.

70. Waisel, Y., 1972. Biology of halophytes. Academic Press, Inc., New York. 396 pp.

71. Ward, D. B., 1968. Checklist of the vascular flora of Florida. Agricultural Experiment Stations, Institute of Food and Agricultural Sciences, Bulletin 726 (Tech), Univ. of Florida, Gainesville. 72 pp.

72. *Weldon, L. W., Blackburn, R. D., and Harrison, D. S., 1969. Common aquatic weeds. Agriculture Handbook No. 352. U. S. Dept. of Agriculture, Washington, DC 43 pp.

73. West, E., and Arnold, L., 1946. The native trees of Florida. Univ. of Fla. Press, Gainesville, Florida, 212 pp.

74. Wright, A. A., and Wright, A. A., 1932. The habitats and composition of the vegetation of the Okefenokee Swamp. Georgia Ecol. Monogr. 2:109-232.

75. Zoltai, S. C., Pollett, F. C., Jeglum, J. K., and Adams, G. D., 1975. Developing a wetland classification for Canada. Proc. N. Am. Forest Soils Conf. 4:497-511.

APPENDIX A: SCIENTIFIC AND COMMON NAMES OF PLANTS OF PENINSULAR FLORIDA

Scientific/Common Names

Acanthophora spp.
Algae
Acer rubrum L.
Red maple
Acnida cannabina L.
Water hemp
Acrostichum aureum L.
Leather fern
Acrostichum danaeaefolium Langsd. & Fisch.
Leather fern
Alternanthera philoxeroides (Mart.) Griseb.
Alligatorweed
Amphicarpum muhlenbergianum (Schultes) Hitchc.
Blue maidencane
Andropogon glomeratus (Walt.) BSP.
Beard grass
Annona glabra L.
Pond apple
Aristida gyrans Chapman
Three awn grass
Asclepias curassavica L.
Scarlet milkweed
Aster tenuifolius L.
Aster
Avicennia germinans (L.) L.
Black mangrove
Azolla caroliniana Willd.
Mosquito fern
Baccharis halimifolia L.
Groundsel
Bacopa caroliniana (Walt.) Robins.
Water hyssop
Batis maritima L.
Saltwort
Bidens mitis (Michx.) Sherff
Beggar-tick
Blechnum serrulatum Richard
Swamp fern
Borrichia arborescens (L.) DC
Sea daisy
Borrichia frutescens (L.) DC
Sea daisy

Brasenia schreberi J. F. Gmel.
Water shield
Cabomba caroliniana Gray
Fanwort
Cakile edentula (Bigel.) Hook.
Sea rocket
Cakile harperi Small
Sea rocket
Callicarpa americana L.
Beauty berry
Carpinus caroliniana Walt.
Hornbeam
Carya aquatica (Michx. f.) Nutt.
Water hickory
Casuarina equisetifolia Forst.
Australian pine
Caulerpa spp.
Algae
Celtis laevigata Willd.
Sugarberry
Centella asiatica (L.) Urban
Coinwort
Cephalanthus occidentalis L.
Buttonbush
Ceratophyllum demersum L.
Coontail
Chrysobalanus icaco L.
Cocoplum
Cladium jamaicense Crantz
Sawgrass
Coccoloba uvifera (L.) L.
Sea grape
Conocarpus erecta L.
Buttonwood
Cornus florida L.
Dogwood
Cornus stricta Lam.
Swamp dogwood
Crinum americanum L.
Swamp lily
Cyperus pollardi Britt. ex Small
Flat-sedge
Cyperus spp.
Flat-sedge
Dalbergia ecastophyllum (L.) Benth.
Dalbergia
Decumaria barbara L.
Wood vamp
Dictyota spp.
Algae
Diplanthera wrightii (Aschers) Aschers.
Cuban shoalweed

Distichlis spicata (L.) Green
Salt grass
Echinochloa walteri (Pursh) Heller
Wild millet
Eichhornia crassipes (Mart.) Solms.
Water hyacinth
Eleocharis cellulosa Torr.
Spike rush
Elodea Canadensis Michx.
Elodea
Elodea densa (Planchon) Caspary
Elodea
Erigeron vernus (L.) T. & G.
Fleabane
Eriocaulon decangulare L.
Hat pins
Eriochloa michauxii (Poir.) Hitchc.
Cup grass
Eulophia alta (L.) Fawc. & Rendle
Wild coco
Ficus aurea Nutt
Strangler fig
Fimbristylis castanea (Michx.) Vahl.
Saltmarsh fimbristylis
Fraxinus caroliniana Mill.
Water ash
Fuirena scirpoidea Michx.
Umbrella grass
Gleditsia aquatica Marsh.
Water locust
Gordonia lasianthus (L.) Ellis
Loblolly bay
Habenaria repens Nutt.
Creeping orchid
Halimeda spp.
Algae
Halodule wrightii
Cuban shoalweed
Halophila baillonis Aschers.
Seagrass
Halophila engelmannii Aschers.
Seagrass
Heliotropium curassavicum L.
Seaside heliotrope
Hibuscus grandiflorus Michx.
Swamp hibiscus
Hydrilla verticillata Royle
Hydrilla
Hydrocotyle umbellata L.
Marsh pennywort

Hymenocallis spp.
Spider lily
Hypericum fasciculatum Lam.
St. John's wort
Ilex cassine L.
Dahoon holy
Ilex glabra (L.) Gray
Gallberry
Ilex opaca Ait.
American holly
Ipomoea pes-caprae (L.) Sweet
Railroad vine
Iris spp.
Iris
Iva frutescens L.
Marsh elder
Juncus effusus L.
Soft rush
Juncus repens Michx.
Black rush
Juncus roemerianus Scheele
Black needlerush
Justicia ovata (Walt.) Lindau
Water willow
Kosteletzkya virginica (L.) Presl
Fen rose
Lachnanthes caroliniana (Lam.) Dandy
Red root
Laguncularia racemosa Gaertn. f.
White mangrove
Laurencia spp.
Algae
Lemna spp.
Duckweed
Limnobium spongia (Bosc.) Stead.
Frogbit
Limonium carolinianum (Walt.) Britt.
Sea lavender
Liquidambar styraciflua L.
Sweet gum
Ludwigia peruviana (L.) Hara
Primrose willow
Lycopodium spp.
Club moss
Lyonia fruticosa (Michx.) G.S. Torr.
Staggerbush
Lyonia lucida (Lam.) K. Koch
Fetterbush
Magnolia virginiana L.
Sweet bay

Melaleuca quinquenervia (Cav.) Blake
Punk tree
Metopium toxiferum (L.) Krug & Urban
Poison wood
Monanthochloe littoralis Engelm.
Key grass
Myrica cerifera L.
Wax myrtle
Myriophyllum brasiliense Camb.
Parrot feather
Myriophyllum spicatum (Walt.) BSP.
Eurasian watermilfoil
Myrsine guianensis (Aubl.) Kuntze
Myrsine
Najas flexilis (Willd.) Rost & Schmidel
Naiad
Najas guadalupensis (Spreng.) Magnus
Naiad
Najas marina L.
Naiad
Nelumbo lutea (Willd.) Pers.
Lotus
Nuphar luteum (L.) Sibth. & Sm.
Spatterdock
Nymphaea spp.
Water lily
Nyssa aquatica L.
Water tupelo
Nyssa biflora Walt.
Swamp tupelo
Nyssa ogeche Bartr.
Ogeechee tupelo
Opuntia spp.
Prickly pear
Orontium aquaticum L.
Golden club
Osmanthus americana (L.) Gray
Devil wood
Osmunda cinnamomea L.
Cinnamon fern
Osmunda regalis L.
Royal fern
Ostrya virginiana (Mill.) K. Koch
Hop hornbeam
Oxypolis filiformis (Walt.) Britt.
Water dropwort
Panicum hemitomon Schult.
Maidencane
Panicum lacustre Hitchc. & Ekman
Panic grass

Panicum repens L.
Torpedo grass
Panicum virgatum L.
Switch grass
Paspalidium geminatum (Forsk.) Stapf.
Water grass
Paspalum giganteum Baldw. ex Vasey
Paspalum
Paspalum vaginatum Sw.
Silt grass
Peltandra virginica (L.) Kunth.
Arrow arum
Penicillus spp.
Algae
Persea borbonia (L.) Spreng.
Red bay
Philoxerus vermicularis (L.) R. Brown
Beach carpet
Phlebodium aureum (L.) Sm.
Golden polypody fern
Phragmites australis (Cav.) Trin. ex Streud
Reed
Pinus elliottii Engelm.
Slash pine
Pinus serotina Michx.
Pond pine
Pinus taeda L.
Loblolly pine
Pistia stratiotes L.
Water lettuce
Polygonum spp.
Smartweed
Pontederia lanceolata Nutt.
Pickerelweed
Potamogeton illinoensis Morong
Pondweed
Psidium guajava L.
Guava
Quercus laurifolia Michx.
Laurel oak
Quercus michauxii Nutt.
Swamp chestnut oak
Quercus nigra L.
Water oak
Quercus virginiana Mill.
Live oak
Rhabdadenia biflora (Jacq.) Muell.
Rubber vine
Rhexia spp.
Meadow beauty

Rhizophora mangle L.
Red mangrove
Rhynchospora tracyi Britt.
Beak rush
Rubus betulifolius Small
Swamp blackberry
Ruppia maritima L.
Widgeon grass
Sabal palmetto (Walt.) Todd. ex Schultes
Cabbage palm
Sabatia spp.
Marsh pink
Sagittaria spp.
Arrowhead
Salicornia bigelovii Torr.
Glasswort
Salicornia virginica L.
Glasswort
Salix caroliniana Michx.
Common willow
Salix floridana Chapman
Florida willow
Salix nigra Marsh
Black willow
Salvinia rotundifolia Willd.
Water fern
Sambucus simpsonii Rehder
Southern elder
Saururus cernuus L.
Lizard's tail
Schinus terebinthifolius Raddi
Brazilian pepper
Scirpus validus Vahl.
Giant bulrush
Serenoa repens (Bartr.) Small
Saw palmetto
Sesuvium portulacastrum L.
Sea purslane
Spartina alterniflora Loisl.
Smooth cordgrass
Spartina bakerii Merrill
Cordgrass
Spartina cynosuroides (L.) Roth
Big cordgrass
Spartina patens (Ait.) Muhl.
Marsh hay cordgrass
Spartina spartinae (Trin.) Hitchc.
Prickly cordgrass
Sporobolus virginicus (L.)Kunth.
Coastal dropseed

Stillingia aquatica Chapman
Queen's delight
Suaeda linearis (Ell.) Moq.
Sea blite
Suaeda maritima (L.) Dum.
Sea blite
Suriana maritima L.
Bay cedar
Syringodium filiformis Kuetz.
Manatee grass
Taxodium ascendens Brogn.
Pond cypress
Taxodium distichum (L.) Richard
Bald cypress
Thalassia testudinum Konig & Sims
Turtle grass
Thalia geniculata L.
Arrowroot
Thelypteris palustris Schott
Marsh fern
Thelypteris spp.
Woods fern
Toxicodendron radicans (L.) Kuntze
Poison ivy
Typha angustifolia L.
Cattail
Typha domingensis Pers.
Cattail
Typha latifolia L.
Cattail
Ulmus floridana Chapman
Florida elm
Uniola paniculata L.
Sea oats
Utricularia spp.
Bladderwort
Vaccinium arboreum L.
Sparkle berry
Vallisneria neotropicalis Marie-Victorin
Tape grass
Vittaria lineata (L.) Sm.
Shoestring fern
Wolffiella floridana (Sm.) Thompson
Wolffiella
Woodwardia virginica (L.) Sm
Chain fern
Xyris elliottii Chapman
Yellow eye grass

Common/Scientific Names

Algae
Acanthophora spp.
Algae
Caulerpa spp.
Algae
Dictyota spp.
Algae
Halimeda spp.
Algae
Laurencia spp.
Algae
Penicillus spp.
Alligatorweed
Alternanthera philoxeroides (Mart.) Griseb.
American holly
Ilex opaca Ait.
Arrow arum
Peltandra virginica (L.) Kunth.
Arrowhead
Sagittaria spp.
Arrowroot
Thalia geniculata L.
Aster
Aster tenuifolius L.
Australian pine
Casuarina equisetifolia Forst.
Bald cypress
Taxodium distichum (L.) Richard
Bay cedar
Suriana maritima L.
Beach carpet
Philoxerus vermicularis }L.) R. Brown
Beak rush
Rhynchospora tracyi Britt.
Beard grass
Andropogon glomeratus (Walt.) BSP.
Beauty berry
Callicarpa americana L.
Beggar-tick
Bidens mitis (Michx.) Sherff
Big cordgrass
Spartina cynosuroides (L.) Roth
Black mangrove
Avicennia germinans (L.) L.
Black needlerush
Juncus roemerianus Scheele
Black rush
Juncus repens Michx.

Black willow
Salix nigra Marsh
Bladderwort
Utricularia spp.
Blue maidencane
Amphicarpum muhlenbergianum (Schultes) Hitchc.
Brazilian pepper
Schinus terebinthifolius Raddi
Buttonbush
Cephalanthus occidentalis L.
Buttonwood
Conocarpus erecta L.
Cabbage palm
Sabal palmetto (Walt.) Todd. ex Schultes
Cattail
Typha angustifolia L.
Cattail
Typha domingensis Pers.
Cattail
Typha latifolia L.
Chain fern
Woodwardia virginica (L.) Sm.
Cinnamon fern
Osmunda cinnamomea L.
Club moss
Lycopodium spp.
Coastal dropseed
Sporobolus virginicus (L.)Kunth.
Cocoplum
Chrysobalanus icaco L.
Coinwort
Centella asiatica (L.) Urban
Common willow
Salix caroliniana Michx.
Coontail
Ceratophyllum demersum L.
Cordgrass
Spartina bakerii Merrill
Creeping orchid
Habenaria repens Nutt.
Cuban shoalweed
Diplanthera wrightii (Aschers) Aschers.
Cuban shoalweed
Halodule wrightii
Cup grass
Eriochloa michauxii (Poir.) Hitchc.
Dahoon holy
Ilex cassine L.
Dalbergia
Dalbergia ecastophyllum (L.) Benth.

Devil wood
Osmanthus americana (L.) Gray
Dogwood
Cornus florida L.
Duckweed
Lemna spp.
Elodea
Elodea Canadensis Michx.
Elodea
Elodea densa }Planchon) Caspary
Eurasian watermilfoil
Myriophyllum spicatum (Walt.) BSP.
Fanwort
Cabomba caroliniana Gray
Fen rose
Kosteletzkya virginica (L.) Presl
Fetterbush
Lyonia lucida (Lam.) K. Koch
Flat-sedge
Cyperus pollardi Britt. ex Small
Flat-sedge
Cyperus spp.
Fleabane
Erigeron vernus (L.) T. & G.
Florida elm
Ulmus floridana Chapman
Florida willow
Salix floridana Chapman
Frogbit
Limnobium spongia (Bosc.) Stead.
Gallberry
Ilex glabra (L.) Gray
Giant bulrush
Scirpus validus Vahl.
Glasswort
Salicornia bigelovii Torr.
Glasswort
Salicornia virginica L.
Golden club
Orontium aquaticum L.
Golden polypody fern
Phlebodium aureum (L.) Sm
Groundsel
Baccharis halimifolia L.
Guava
Psidium guajava L.
Hat pins
Eriocaulon decangulare L.
Hop hornbeam
Ostrya virginiana (Mill.) K. Koch

Hornbeam
Carpinus caroliniana Walt.
Hydrilla
Hydrilla verticillata Royle
Iris
Iris spp.
Key grass
Monanthochloe littoralis Engelm.
Laurel oak
Quercus laurifolia Michx.
Leather fern
Acrostichum aureum L.
Leather fern
Acrostichum danaeaefolium Langsd. & Fisch.
Live oak
Quercus virginiana Mill.
Lizard's tail
Saururus cernuus L.
Loblolly bay
Gordonia lasianthus (L.) Ellis
Loblolly pine
Pinus taeda L.
Lotus
Nelumbo lutea (Willd.) Pers.
Maidencane
Panicum hemitomon Schult.
Manatee grass
Syringodium filiformis Kuetz.
Marsh elder
Iva frutescens L.
Marsh fern
Thelypteris palustris Schott
Marsh hay cordgrass
Spartina patens (Ait.~ Muhl.
Marsh pennywort
Hydrocotyle umbellata L.
Marsh pink
Sabatia spp.
Meadow beauty
Rhexia spp.
Mosquito fern
Azolla caroliniana Willd.
Myrsine
Myrsine guianensis (Aubl.) Kuntze
Naiad
Najas flexilis (Willd.) Rost & Schmidel
Naiad
Najas guadalupensis (Spreng.) Magnus
Naiad
Najas marina L.

Ogeechee tupelo
Nyssa ogeche Bartr.
Panic grass
Panicum lacustre Hitchc. & Ekman
Parrot feather
Myriophyllum brasiliense Camb.
Paspalum
Paspalum giganteum Baldw. ex Vasey
Pickerelweed
Pontederia lanceolata Nutt.
Poison ivy
Toxicodendron radicans (L.) Kuntze
Poison wood
Metopium toxiferum (L.) Krug & Urban
Pond apple
Annona glabra L.
Pond cypress
Taxodium ascendens Brogn.
Pond pine
Pinus serotina Michx.
Pondweed
Potamogeton illinoensis Morong
Prickly cordgrass
Spartina spartinae (Trin.) Hitchc.
Prickly pear
Opuntia spp.
Primrose willow
Ludwigia peruviana (L.) Hara
Punk tree
Melaleuca quinquenervia (Cav.) Blake
Queen's delight
Stillingia aquatica Chapman
Railroad vine
Ipomoea pes-caprae (L.) Sweet
Red bay
Persea borbonia (L.) Spreng.
Red mangrove
Rhizophora mangle L.
Red maple
Acer rubrum L.
Red root
Lachnanthes caroliniana (Lam.) Dandy
Reed
Phragmites australis (Cav.) Trin. ex Streud
Royal fern
Osmunda regalis L.
Rubber vine
Rhabdadenia biflora (Jacq.) Muell.
Salt grass
Distichlis spicata (L.) Green

Saltmarsh fimbristylis
Fimbristylis castanea (Michx.) Vahl.
Saltwort
Batis maritima L.
Saw palmetto
Serenoa repens (Bartr.) Small
Sawgrass
Cladium jamaicense Crantz
Scarlet milkweed
Asclepias curassavica L.
Sea blite
Suaeda linearis (Ell.) Moq.
Sea blite
Suaeda maritima (L.) Dum.
Sea daisy
Borrichia arborescens (L.) DC
Sea daisy
Borrichia frutescens (L.) DC
Sea grape
Coccoloba uvifera (L.) L.
Sea lavender
Limonium carolinianum (Walt.) Britt.
Sea oats
Uniola paniculata L.
Sea purslane
Sesuvium portulacastrum L.
Sea rocket
Cakile edentula (Bigel.) Hook.
Sea rocket
Cakile harperi Small
Seagrass
Halophila baillonis Aschers.
Seagrass
Halophila engelmannii Aschers.
Seaside heliotrope
Heliotropium curassavicum L.
Shoestring fern
Vittaria lineata (L.) Sm.
Silt grass
Paspalum vaginatum Sw.
Slash pine
Pinus elliottii Engelm.
Smartweed
Polygonum spp.
Smooth cordgrass
Spartina alterniflora Loisl.
Soft rush
Juncus effusus L.
Southern elder
Sambucus simpsonii Rehder

Sparkle berry
Vaccinium arboreum L.
Spatterdock
Nuphar luteum (L.) Sibth. & Sm.
Spider lily
Hymenocallis spp.
Spike rush
Eleocharis cellulosa Torr.
St. John's wort
Hypericum fasciculatum Lam.
Staggerbush
Lyonia fruticosa (Michx.) G.S. Torr.
Strangler fig
Ficus aurea Nutt
Sugarberry
Celtis laevigata Willd.
Swamp blackberry
Rubus betulifolius Small
Swamp chestnut oak
Quercus michauxii Nutt.
Swamp dogwood
Cornus stricta Lam.
Swamp fern
Blechnum serrulatum Richard
Swamp hibiscus
Hibuscus grandiflorus Michx.
Swamp lily
Crinum americanum L.
Swamp tupelo
Nyssa biflora Walt.
Sweet bay
Magnolia virginiana L.
Sweet gum
Liquidambar styraciflua L.
Switch grass
Panicum virgatum L.
Tape grass
Vallisneria neotropicalis Marie-Victorin
Three awn grass
Aristida gyrans Chapman
Torpedo grass
Panicum repens L.
Turtle grass
Thalassia testudinum Konig & Sims
Umbrella grass
Fuirena scirpoidea Michx.
Water ash
Fraxinus caroliniana Mill.
Water dropwort
Oxypolis filiformis (Walt.) Britt.

Water fern
Salvinia rotundifolia Willd.
Water grass
Paspalidium geminatum (Forsk.) Stapf.
Water hemp
Acnida cannabina L.
Water hickory
Carya aquatica (Michx. f.) Nutt.
Water hyacinth
Eichhornia crassipes (Mart.) Solms.
Water hyssop
Bacopa caroliniana (Walt.) Robins.
Water lettuce
Pistia stratiotes L.
Water lily
Nymphaea spp.
Water locust
Gleditsia aquatica Marsh.
Water oak
Quercus nigra L.
Water shield
Brasenia schreberi J. F. Gmel.
Water tupelo
Nyssa aquatica L.
Water willow
Justicia ovata (Walt.) Lindau
Wax myrtle
Myrica cerifera L.
White mangrove
Laguncularia racemosa Gaertn. f.
Widgeon grass
Ruppia maritima L.
Wild coco
Eulophia alta (L.) Fawc. & Rendle
Wild millet
Echinochloa walteri (Pursh) Heller
Wolffiella
Wolffiella floridana (Sm.) Thompson
Wood vamp
Decumaria barbara L.
Woods fern
Thelypteris spp.
Yellow eye grass
Xyris elliottii Chapman

APPENDIX B: GLOSSARY

ABUNDANCE: a term used in quantitative vegetation sampling, referring to density of a given species per unit area; usually expressed as the total number of individual organisms in a unit area.

ACIDIC: having a pH value of less than 7, nonalkaline.

ALGAE: a nonvascular chlorophyll-bearing organism, common to various types of wetlands and very important in productivity.

ALKALINE: having a pH value greater than 7, nonacidic.

ANGIOSPERM: a plant characterized by flowers and seeds enclosed in fruits; e.g., orchids, palms, oaks, etc.

ANNUAL: a plant in which the entire life cycle is completed in a single growing season.

AQUATIC VEGETATION: a plant characteristically growing wholly or partly submerged in water.

AUTHORITY: the name of the person or persons who first described a particular plant to science, appearing in conjunction with a scientific name; e.g., Typha latifolia L. (the L. representing the botanist Linnaeus).

BACKWATER: an accumulation of usually quiet water, held back by a natural dike, high tides, or unusually high water levels in creeks, rivers, or lakes.

BANANA HOLE: type of freshwater swamp occurring in small sinkholes in Florida.

BARRIER ISLAND: an offshore island, similar to a bar, except with ridges, vegetation, and swampy tracts.

BAY: a body of water, smaller than a gulf, located in a recess in the shoreline.

BAYHEAD: a regional name applied to a type of freshwater swamp in Florida, dominated by a mixture of hardwood species.

BAYOU: a small, sluggish secondary stream or lake, often existing as an area of backwater in an abandoned channel.

BIENNIAL: a plant normally requiring two growing seasons to complete its life cycle; vegetative growth appears the first year and flowering and fruiting follow in the second year.

BOG: a vegetation type usually denoting an area of wet, acid peat.

BRACKISH: referring to water or soils having salinity contents of 0.5 to 30 ppt (o/oo).

BROADLEAF: having broad, flat leaves; usually referring to angiosperms (flowering plants) as contrasted with the needle-leaves of many gymnosperms.

CARR: a poorly defined regional wetland term, used primarily in parts of the Midwest; refers to a successional community (dominated by shrubs) that appears between marsh and swamp formation.

CLIMAX: the terminal community of a particular plant succession sequence, maintaining itself relatively unchanged unless the environment changes.

COASTAL FLAT: wetland type having 25 percent or less vegetative cover and that is occasionally or regularly flooded by saline water of tidal origin.

COLONY: a group of organisms of the same species growing in a localized area, often used to refer to a group of plants becoming established in a new situation.

COMMUNITY: a distinctive combination of two or more ecologically related species, living together and interacting with each other in a characteristic natural habitat.

CONIFER: a common term for any gymnosperm of the order Coniferales (the group containing those gymnosperms producing definite cones, as pine, spruce, etc.).

COVER: a term used in quantitative vegetation sampling, referring to the amount (percent) of ground with vegetation above it; estimated by vertically projecting the outline of the crown onto the ground.

dbh: diameter (of a tree) at breast height.

DECIDUOUS: shedding of leaves at end of growing season (or sometimes, in the Southwest, under periods of environmental stress before the end of the growing season); usually referring to broad-leaved woody angiosperms (flowering plants) but sometimes referring to gymnosperms (e.g., Bald cypress).

DEFLATION PLAIN BASIN: a basin formed in arid areas by removal of loose material from an area by wind.

DETRITAL: referring to dead organic tissues, decomposed material, and organisms in an ecosystem; usually including the live microorganisms involved in the decomposition of the material.

DISCLIMAX: a potentially long-persisting and self-reproducing vegetation type, maintaining its composition and structure only as a consequence of continuing disturbance (as by fire, grazing, etc.).

DOMINANT: a prevailing species of an area; a species that to a considerable extent controls the conditions for existence of its associates within an ecosystem.

DWARF SHRUB: woody plants characterized by numerous stems and rarely exceeding 50 cm in height.

ECOTONE: the transition zone between two or more adjacent plant communities, usually containing species from each of the adjacent vegetation types.

EMERSED: standing out above the water, as the leaves of certain hydrophytes.

EMERGENT: same as EMERSED.

EPIPHYTE: a plant that grows on another plant for support but is not parasitic on it.

ESTUARY: a basin in which river water mixes with and dilutes sea water.

EVERGREEN: a perennially green plant, never losing all its leaves at one time.

FEN: a poorly defined regional term for a type of marsh; usually said to be formed on peat that is circumneutral or alkaline in pH; vegetation marked by high species diversity; equivalent to the sedge-meadow of many authors.

FLOATING-LEAVED COMMUNITY: an aquatic assemblage dominated by species having leaves that float on the water surface, often floating by virtue of long flexuous petioles (such as most water lilies).

FLORA: the vegetation of an area; also used to denote a book for identification of plant species in an area.

FORBS: associated herbaceous species other than grasses; term used in ecological description of nonwoody vegetation.

FREQUENCY: a term used in quantitative vegetation sampling, relating to the number of times a species occurs in a given number of sample plots; expressed as a fraction of the total, usually in percent.

FRESH WATER: water containing less than 0.5 ppt (o/oo) salinity.

FRESHWATER AQUATIC COMMUNITY: a wetland dominated by free-floating or rooted aquatic herbs and that is semipermanently or permanently flooded by fresh water (e.g., a patch of water lilies).

FRESHWATER INLAND FLAT: a wetland having less than 25 percent vegetative cover and that is occasionally or regularly flooded by fresh water (e.g., mudflats).

FRESHWATER MARSH: a wetland having more than 25 percent vegetative cover by terrestrial herbs but 40 percent or less cover by woody plants, occasionally or regularly flooded by fresh water (e.g., sawgrass prairie).

FRESHWATER SWAMP: a wetland having more than 40 percent cover by woody plants and that is occasionally or regularly flooded by fresh water (e.g., cypress swamp).

GENUS (plural GENERA): a taxonomic category that represents a group of closely related species (e.g., all kinds of cat-tail are placed in the single genus Typha).

GRAMINOID: a term referring to grasses or grasslike plants (including the grasses, sedges, rushes, etc.).

GRASS-SEDGE BOG: a wet peatland dominated by grasses and sedges.

GROUND WATER: water contained in rocks below the water table.

GROWTH FORM: a descriptive concept of vegetation based on some particular characteristic, such as deciduous versus evergreen and broad-leaf versus needle-leaf.

GUT: a narrow inlet of water along a coastline.

GYMNOSPERM: any of a number of different kinds of woody seed-plants in which the seeds are not enclosed in a fruit (e.g., pine, cedar, etc.).

HALOPHYTE: any plant species capable of tolerating salinity levels of more than 0.5 ppt (o/oo).

HAMMOCK: a dense growth of broad-leaved trees on a slight elevation; not considered wet enough to be a swamp.

HARDPAN: a hard, impervious subsurface layer of clay soil, usually impervious to both water and root penetration.

HARDWOOD: a broad-leaved angiosperm (flowering plant) tree having wood characterized by the presence of specialized cells called vessels.

HERB: a nonwoody plant--annual, biennial, or perennial--whose aboveground parts are short lived (in temperate regions, only one growing season).

HERBACEOUS: the adjective used to describe plants that are herbs.

HYDRIC: aquatic.

HYDROPHYTE: a plant growing in water or in characteristically wet soil.

HYPERSALINE: soil or water with a high salt content.

IMPOUNDMENT: standing body of open water created by artifically blocking or restricting the flow of a river, stream, or tidal area.

INTERMITTENT STREAM: a stream receiving its water primarily from surface runoff.

INTERTIDAL ZONE: in coastal areas, the region between levels of high tide and low tide.

KARST TOPOGRAPHY: a topography formed over limestone, dolomite, or gypsum and characterized by sinkholes, caves, and underground drainage.

KELP: any of the various large, coarse brown seaweeds (brown algae) of marine waters.

LACUSTRINE: pertaining to a lake.

LAGOON: a shallow coastal body of water, partly separated from the sea by beaches or islands; usually a lagoon is elongate and parallel to the shoreline and characterized by higher salinity than found in an estuary.

LAKE: a natural depression fed by one or more streams and from which a stream may flow; occurs due to widening or natural blockage of a river or stream or occurs in an isolated natural depression that is not part of a surface river or stream; usually too deep to permit the growth of rooted plants from shore to shore.

LIANA: a woody or herbaceous climbing plant--a vine--with its roots in the soil.

LITTORAL: that portion of a body of water extending from shoreline toward the middle of the water to the limit of occupancy by rooted plants.

MANUAL: a handbook used in the taxonomic identification of plant species.

MARL: a deposit of crumbly, earthy material, usually composed of clay mixed with limestone or other carbonate.

MARSH: a wetland dominated by nonwoody vegetation; if woody plants are present, they account for less than 40 percent vegetative cover.

MESIC: pertaining to a habitat characterized by a medium amount of water, neither very wet nor very dry (much vegetation adjacent to wetlands is MESOPHYTIC in nature).

MUCK: a type of surface deposit in a poorly drained area, consisting of much dark, partially composed organic matter intermixed with mineral matter.

MUDFLATS: an area usually supporting only sparse vegetation or no vegetation at all, although algae may be numerous on such sites; mudflats may be intertidal in coastal areas or associated with areas of widely fluctuating water levels inland.

MUSKEG: a term used in several different ways but usually referring to bog (in itself a poorly defined term) habitats of the far north.

NEEDLE-LEAF: a descriptive term used in referring to the usually slender, often evergreen, leaves of many gymnosperms (e.g., pine).

NONVASCULAR PLANT: referring to the simple (and usually small and inconspicuous) plants characterized by a lack of specialized conducting and supporting tissues (e.g., algae).

NONWOODY: referring to a plant that does not form long-lived above ground structures; plants other than trees and shrubs.

OPEN WATER: areas that support very little vegetative cover (25 percent or less); such areas comprise the permanent or semipermanent interior portions of many ponds and lakes.

OXBOW: a shallow, crescent-shaped lake that results when loops of a meandering stream are cut off; oxbows are very common in deltaic regions.

PEAT: a dark-brown or black substrate produced by the partial decomposition and disintegration of mosses, sedges, trees, and other

plants growing in areas of its deposition; peat characteristically is deposited in certain wetland types.

PERCHED WETLANDS: wetlands located away from significant stream influence; perched wetlands include potholes and many so-called bogs, swamps, and similar areas vegetated by marsh or swamp plants.

PERENNIAL: a woody or herbaceous plant living from year to year, normally not dying after once flowering.

PERIPHYTON: algae growing attached to rocks and vegetation.

PERMANENT: used in reference to bodies of water that are long persistent and not subject to the normal processes of drying out by evaporative forces.

PHREATOPHYTE: a plant that has roots extending into the water table, thereby attaining a permanent water supply; of major concern in arid areas.

PHYSIOGNOMY: a descriptive concept based on the external appearance of vegetation (e.g., forest, prairie, marsh, etc.).

PHYTOPLANKTON: small, free-floating or weakly swimming algae, restricted to the very upper levels of bodies of water.

PLAYA LAKE: a slight depression in the plains of the Interior region, containing water after heavy rains but dry at other times, often supporting distinctive vegetation.

PNEUMATOPHORE: slender conical roots that grow vertically out of the mud, found in certain types of mangroves; used in conduction of oxygen to underground root systems.

POCOSIN: a regional term applied in the Carolinas to upland bogs found in undrained, shallow depressions in pine savannahs; pocosins are dominated by evergreen shrub species.

POND: a small, quiet body of standing water, usually sufficiently shallow to permit the potential growth of rooted plants from shore to shore.

POTHOLES: wetlands occupying basins formed by melting of isolated chunks of buried ice left behind by receding glaciers.

PRODUCTIVITY: the rate at which energy is stored in the form of organic substances, which can be used as food materials.

RESERVOIR: a pond or lake build for storage of water, usually by construction of a dam across a stream or river.

RHIZOME: an underground stem, growing horizontally, often thickened and containing accumulations of reserve food material; important structure for vegetative reproduction in many wetland plant species.

RIPARIAN: pertaining to vegetation of a riverbank or streamside.

SALINA: the term used for coastal flat (salt flat) in Puerto Rico.

SALINE: referring to water having too much salinity to be considered fresh water (in common usage the term is applied to water of high salinity, i.e., in excess of 30 ppt).

SALINE FLAT: wetlands having 25 percent or less vegetative cover that are occasionally or regularly flooded by saline water or nontidal origin (e.g., salt flats in interior of U. S.).

SALINE WATER: water containing greater than 30 ppt (o/oo) salinity.

SALINITY: pertaining to the percentage of salt found in saline water.

SALT FLAT: any area having high concentrations of soil salinity and supporting little or no vegetation, may be either coastal or inland.

SALT WATER: water containing high concentrations of salinity; normally the term is used to refer to sea water.

SALTWATER AQUATIC WETLAND: a wetland that is dominated by free-floating rooted, or otherwise attached herbaceous plants (including macroscopic marine algae) and that are permanently flooded by saline or brackish water (e.g., seagrass beds).

SALTWATER MARSH: a wetland having saline (including brackish) soils with 40 percent or less cover by woody plants and 25 percent or more cover by terrestrial herbs that is occasionally or regularly flooded by brackish or saline water (e.g., smooth cordgrass marshes).

SALTWATER SWAMP: a wetland having saline (including brackish) soils with 40 percent or more cover by woody plants and occasionally or regularly flooded by brackish or saline water (e.g., mangrove swamps).

SANDBAR: a bar or low ridge of sand bordering the shore or near the surface of the water, built up by currents or wave action.

SEAGRASS BEDS: usually areas of shallow water located along the coastline that support the underwater growth of seagrasses; of great value in providing cover for spawning fish and for their great productivity.

SEAWEED: any of the various macroscopic forms of marine algae (either Red algae, Brown algae, or Green algae).

SEDGE: any member of the plant family Cyperaceae; often used to refer to the specific genus Carex of the Cyperaceae.

SEMIPERMANENT: referring to a body of water that under normal circumstances is long-persisting but under certain conditions may dry up in response to the normal processes of evaporation.

SHALLOWS: wetlands that are not usually considered marsh; represented by shallow pools, salt pans that hold water, and shallow lakes in estuarine systems; they may be nonvegetated or vegetated with emergent or submergent vascular plants or algae.

SHRUB: a perennial woody plant of relatively low stature (usually considered less than 20 ft) with several to many stems from at or near the ground.

SHRUB BOG: any permanently waterlogged peatland dominated by shrubs.

SINKHOLE: a characteristic feature of karst topography in limestone areas; a depression or "sink" occurs when the underlying limestone is eroded through solution processes; the sinkhole may or may not hold water.

SLOUGH: a channel of slow-moving water in a region having little topographic relief.

SOUND: a wide channel or strait connecting two large bodies of water or separating an island from the mainland.

SPECIES: a taxonomic category below the rank of genus representing a group of closely-related individuals that actually or potentially interbreed (e.g., the genus Typha contains several species of Cattail: T. latifolia, T. angustifolia, and T. domingensis; the species are considered to be closely related and hybridization is common in Cattails).

SPECIFIC EPITHET: the term referring to the scientific name applied to each species within a genus (e.g., latifolia is the specific epithet of the species Typha latifolia).

STAND: a group of plants on a given sample area.

STRAND VEGETATION: a term defined in several different ways, usually referring to the vegetation at the very edge of the shore (exclusive of any adjacent areas, such as dunes).

STREAM: any mass of water with a unidirectional flow.

SUBMERGED: referring to a hydrophytic plant that grows characteristically completely under water.

SUBMERGENT: same as SUBMERGED.

SUBMERSED: same as SUBMERGED.

SUCCESSION: the gradual, usually orderly and sometimes predictable sequence of plant communities occupying a given area with the passage of time.

SUCCULENT: a plant having juicy and fleshy stems and leaves that are adapted for water storage.

SWAMP: a wetland in which the dominant vegetation consists of trees (greater than 40 percent cover), tidal or nontidal, saltwater or freshwater.

TIDAL: referring to the alternate rise and fall of waters along the coast or of those having coastal influence.

TIDAL CREEK: a wetland situated along channels where water flows in both directions due to tidal influence.

TRANSITION ZONE: also referred to as ECOTONE; the intermediate zone between two or more adjacent plant communities, usually containing species from each of the adjacent vegetation types.

TREE: a perennial woody plant usually having a single trunk or stem and usually more than 20 ft in height.

TUNDRA: a treeless plain, either wetland or "dry," found between the northern limits of trees and the region of perpetual ice and snow in the far north, or above treeline in the high mountains.

UPLANDS: areas that are not flooded on a regular basis and that do not support vegetation dominated by hydrophytes.

VASCULAR PLANT: referring to any of the many kinds of plants having specialized conducting and supporting tissue as well as differentiation into the structures known as roots, stems, and leaves (e.g., trees and shrubs of all kinds, grasses, etc.).

VEGETATIVE COVER: a term used in quantitative vegetation sampling, referring to the amount (percent) of ground with vegetation above it; estimated by vertically projecting the outline of leaves onto the ground.

VEGETATIVE REPRODUCTION: in seed plants, referring to reproduction by any of several means other than by seeds (e.g., underground rhizome systems, formation of roots on detached stems and leaves, etc.).

VERNAL POOL: a regional term applied to depressions in the grassland area of California; these pools, supporting a distinctive assemblage of plant species, fill with water in winter but dry up by summer.

WATER TABLE: the surface of the water-saturated zone of permeable rocks.

WETLANDS: those areas that are inundated or saturated by ground or surface water at a frequency and duration sufficient to support, and that under normal circumstances do support a prevalence of vegetation typically adapted for life in saturated soil conditions.

WET MEADOWS: graminoid-dominated marshes, often with a wide variety of associated species, often found along floodplains where freshwater swamps have been cleared.

WILLOW HEAD: willow-dominated freshwater swamp occurring in southern Florida.

XERIC: pertaining to an area or habitat having a very low or inadequate moisture supply; plants of such habitats are XEROPHYTIC.

APPENDIX C: INTERPRETATION OF WETLAND DEFINITION

1. An area of some concern with respect to policy in the interpretation of the wetland definition is inclusion of the littoral zone as a wetland. In bodies of fresh water, the littoral zone is that area extending from the shoreline into the water to the limits of occupancy by rooted plants. The littoral zone has been defined in several ways by various marine science disciplines but usually is used as more-or-less synonymous with the intertidal zone (that region between high and low tides). Most intertidal littoral habitats (such as marine seagrass beds, macrophytic algal beds, rocky shores, and flats; as well as freshwater habitats such as mud flats and submerged aquatic plant beds) were regulated prior to the Federal Water Pollution Control Act Amendments of 1972, in large part by Sections 9 and 10 of the River and Harbor Act of 1899.

2. The emphasis in this report is on plant communities and their transition zones, and, from a technical standpoint, it is unrealistic to exclude the littoral zone plant communities from technical consideration. The reason for this is that plant communities are dynamic entities that are subject to considerable variation with respect to their position along various environmental gradients, and thus cannot be delineated precisely by policy statements that fail to take field realities into account. Seagrass beds, for example, usually are considered permanently inundated habitats; den Hartog,* however, reports that of the 12 genera of seagrasses, only three (none of which occur in American waters) occur exclusively in permanently flooded habitats.

3. For technical purposes, therefore, a broad definition of wetland has been followed in this guidebook series; although, for purposes of practical delineation of wetlands from a standpoint of policy regulatory functions, personnel may find it necessary to follow a narrower definition.

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* C. den Hartog. 1977. Structure, function, and classification in seagrass communities. in C. McRoy and C. Helfferich, eds. Seagrass ecosystems. Marcel Dekker, Inc., New York.

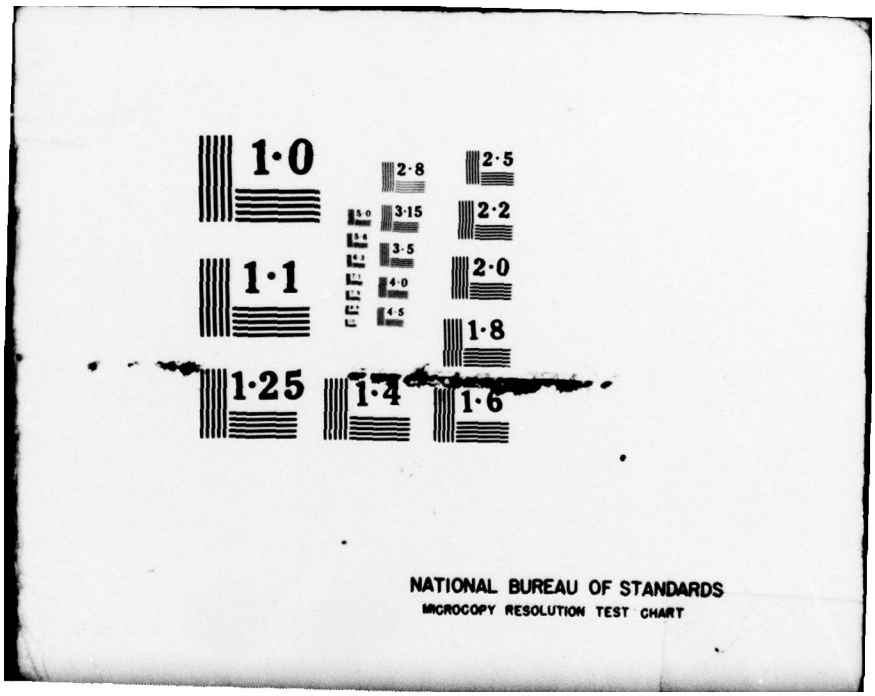
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United States. Waterways Experiment Station, Vicksburg, Miss.
Preliminary guide to wetlands of peninsular Florida; major associations and communities identified. Vicksburg, Miss. : Environmental Effects Laboratory, U. S. Army Engineer Waterways Experiment Station, 1978.
66, [26] p. : ill. ; 27 cm. (Technical report - U. S. Army Engineer Waterways Experiment Station ; Y-78-2)
Prepared for Office, Chief of Engineers, U. S. Army, Washington, D. C.
Selected references and bibliography: p. 61-66.

1. Community. 2. Florida. 3. Plant community. 4. Wetlands. I. United States. Army. Corps of Engineers. II. Series: United States. Waterways Experiment Station, Vicksburg, Miss. Technical report ; Y-78-2.
TA7.W34 no.Y-78-2