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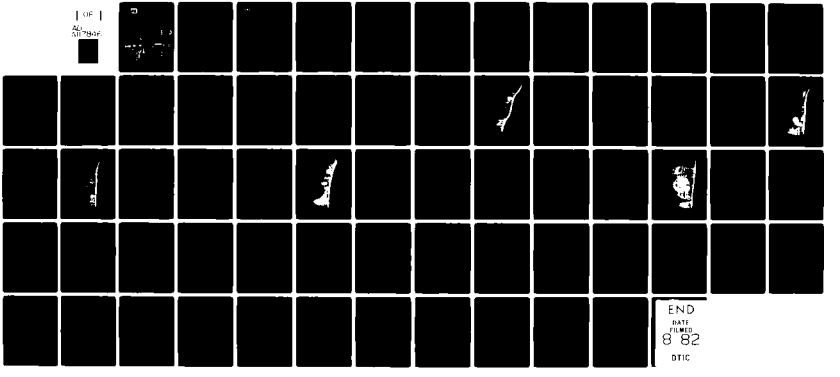

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TECHNICAL REPORT Y-78-7

PRELIMINARY GUIDE TO THE ONSITE IDENTIFICATION AND DELINEATION OF THE WETLANDS OF THE SOUTH ATLANTIC UNITED STATES

by

Robert T. Huffman, Gary E. Tucker, Jean W. Wooten,
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James S. Wilson

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

May 1982

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

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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
Y-78-7	South Atlantic States
Y-78-8	North Atlantic States
Y-78-9	Alaska

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VICKSBURG, MISSISSIPPI 39180

IN REPLY REFER TO:

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1 June 1982

SUBJECT: Transmittal of Technical Report Y-78-7

TO: All Report Recipients

The report transmitted herewith provides preliminary technical guidance on the onsite identification and delineation of wetlands to Corps of Engineers personnel responsible for the implementation of Section 404 of the Clean Water Act in the South Atlantic United States. This guide, sponsored by the Office, Chief of Engineers, represents one of a series of eight guides to the wetlands of the United States. Other guides include Alaska, peninsular Florida, Puerto Rico, West Coast States, Gulf Coastal Plain, Interior, and North Atlantic States.

TILFORD C. CREEL
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-78-7	2. GOVT ACCESSION NO.: AD-A117 846
3. RECIPIENT'S CATALOG NUMBER	
4. TITLE *(and Subtitle)*: PRELIMINARY GUIDE TO THE ONSITE IDENTIFICATION AND DELINEATION OF THE WETLANDS OF THE SOUTH ATLANTIC UNITED STATES	5. TYPE OF REPORT & PERIOD COVERED: Final report
	6. PERFORMING ORG. REPORT NUMBER
7. AUTHOR(s): Robert T. Huffman, Gary E. Tucker, Jean W. Wooten, Charles V. Klimas, Mike W. Freel, Stephen W. Forsythe, James S. Wilson	8. CONTRACT OR GRANT NUMBER(s)
9. PERFORMING ORGANIZATION NAME AND ADDRESS: U. S. Army Engineer Waterways Experiment Station, Environmental Laboratory, P. O. Box 631, Vicksburg, Miss. 39180	10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS: Dredging Operations Technical Support Program
11. CONTROLLING OFFICE NAME AND ADDRESS: Office, Chief of Engineers, U. S. Army, Washington, D. C. 20314	12. REPORT DATE: May 1982
	13. NUMBER OF PAGES: 59
14. MONITORING AGENCY NAME & ADDRESS*(If different from Controlling Office)*	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)*

18. SUPPLEMENTARY NOTES

Available from National Technical Information Service, 5285 Port Royal Road, Springfield, Va. 22151.

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

Community	South Atlantic states
Flooding	Wetlands
Hydrology	Wetlands soils
Plant community	Wetland vegetation

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 the South Atlantic region of the United States is one of a series of eight such guides, each prepared by a specialist or specialists familar 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 the onsite technical identification and delineation of wetland boundaries. The

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Unclassified

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20. ABSTRACT (Continued).

classification system in this guide is adapted from that utilized by the National Wetland Inventory (NWI) Project of the U. S. Fish and Wildlife Service, but frequently departs from NWI's system to describe common and/or distinct wetland communities or associations.

SUMMARY

This report represents one of a series of eight preliminary guides to the dominant plant associations and communities found in the major wetlands of the United States. The purpose of this guidebook is to aid Regulatory personnel with the onsite technical recognition and geographic delineation of wetland boundaries. This guidebook is designed to be self-contained and consists of three parts. An introduction covers the objectives and use of the guidebook as well as general information about wetlands. The second part, entitled "Wetlands of the South Atlantic United States," consists of five major sections: Regional Environment, Values, Wetland Vegetation, Wetland Soils, and Wetland Hydrology. The third part describes the Regional Wetland Types.

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PREFACE

At the request of the Office, Chief of Engineers, the Environmental Laboratory (EL) of the U. S. Army Engineer Waterways Experiment Station (WES) initiated production of a series of regional guidebooks designed to aid Regulatory personnel with the onsite technical recognition and geographic delineation of wetland boundaries. This report, which pertains to wetlands of the South Atlantic United States, is, therefore, one of a series of eight preliminary guidebooks to the country's wetlands. Other reports in the series apply to Alaska, Puerto Rico, West Coast, Interior, Gulf Coast, North Atlantic, and peninsular Florida. The reports are listed on the inside of the front cover.

Initial efforts to develop this preliminary guide were made under Purchase Order No. DACW39-77-M-1215, whereby Dr. Gene Silberhorn, Virginia Institute of Marine Sciences, Gloucester Point, Va., developed a report that provided an initial technical data base to be used for the preparation of this report. This effort was under the technical supervision of Dr. Luther F. Holloway, EL. Development of this report was under the technical direction of Dr. Robert Terry Huffman, EL. Other EL personnel, Dr. Gary E. Tucker, Dr. Jean Wooten, Dr. James S. Wilson, Mr. Charles V. Klimas, Mr. Mike Freel, Mr. Stephen W. Forsythe, and Ms. Linda Brown, together with Dr. Huffman, were instrumental in the final writing, critical review, and preparation of this report for publication.

The guide project was under the general supervision of Dr. Hanley K. Smith, Environmental Resources Division (ERD), EL; Dr. Conrad J. Kirby, Chief, ERD; Mr. Charles C. Calhoun, Program Manager, Dredging Operations Technical Support Program, EL; and Dr. John Harrison, Chief, EL.

The Commanders and Directors of WES during the study were COL George H. Hilt, CE, COL John L. Cannon, CE, and COL Nelson P. Conover, CE. Technical Director was Mr. Fred R. Brown.

This report should be cited as follows:

> Huffman, R. T. et al. 1982. "Preliminary Guide to the Onsite Identification and Delineation of the Wetlands of the South Atlantic United States," Technical Report Y-78-7, U. S. Army Engineer Waterways Experiment Station, CE, Vicksburg, Miss.

CONTENTS

LIST OF FIGURES

PRELIMINARY GUIDE TO THE ONSITE IDENTIFICATION AND DELINEATION OF THE WETLANDS OF THE SOUTH ATLANTIC UNITED STATES

PART I: INTRODUCTION

Background

1. Under the various 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 more traditional roles in flood control, hydropower production, navigation, water supply storage, and recreation, the Corps has regulatory authority for the control of the discharge of dredged or fill material into waters of the United States. The primary legislative basis for the Corps' regulatory authority and subsequent program is the Clean Water Act. Section 404 of the Clean Water 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.

2. The objective of the above-described legislation is to maintain and restore the biological, physical, and chemical integrity of the Nation's water quality through regulation of the discharge of dredged and fill material into "Waters of the United States." "Waters of the United States" has broad meaning and incorporates both aquatic and wetland ecosystems, and includes the following (Federal Register 1977):

a. The territorial seas with respect to the discharge of fill material.

b. Coastal and inland waters, lakes, rivers, and streams that are navigable waters of the United States, including their adjacent wetlands.

c. Tributaries to navigable waters of the United States, including adjacent wetlands.

d. Interstate waters and their tributaries, including adjacent wetlands.

e. All other waters of the United States not identified above, such as isolated wetlands and lakes, intermittent streams,

prairie potholes, and other waters that are not a part of a tributary system to interstate waters or navigable waters of the United States, the degradation or destruction of which could affect interstate commerce.

3. The Federal Register (1977) defines wetland ecosystems as:

> Those areas that are inundated or saturated by surface or groundwater 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. Wetlands generally include swamps, marshes, bogs, and similar areas.

Objective

4. The objective of this report is to present information that can assist Regulatory personnel with the onsite technical identification and geographic delineation of wetland boundaries in the South Atlantic states. The approach is, therefore, to describe the diagnostic environmental characteristics of wetland ecosystems and provide the user with a general description of the common wetland types of the South Atlantic region of the United States.

Wetland Identification and Boundary Determinations

5. Definition of jurisdictional limits is of obvious importance to any regulatory program. However, legislation authorizing the Corps' Section 404 Regulatory Program provided little guidance, except in a broad context, regarding the technical identification and geographic delineation of areas subject to jurisdiction. This is especially true in determining the landward extent of wetland areas.

6. Presently, the delineation of landward jurisdictional authority lies in the technical identification of ecosystems that have two key environmental characteristics:

a. Inundated or saturated soil conditions that are the result of periodic or permanent inundation by groundwater or surface water.

b. A prevalence of vegetation typically adapted for life in inundated or saturated soil conditions.

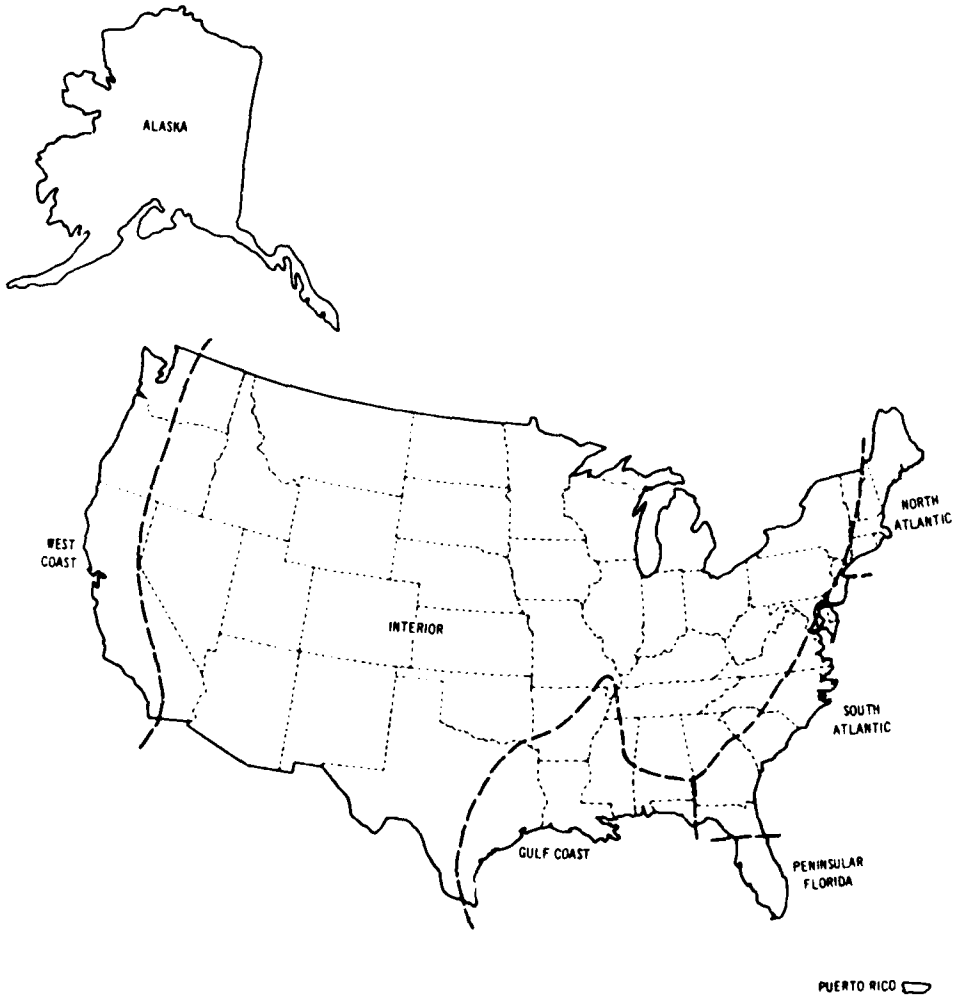
Often these characteristics can be readily identified in the field; however, field personnel are cautioned not to rely solely on vegetation, but to look for indicators of wetland soil and hydrology conditions such as those outlined by paragraphs 14 and 16. Evidence of one or more indicators of wetlands soil and hydrologic conditions will demonstrate a logical, as well as easily defensible, technical tie to why the vegetation is considered to be characteristic of wetland ecosystems for the particular situation of concern. Many wetland species can be found growing successfully in both wetland and nonwetland habitats. Combined use of wetland vegetation, soil, and hydrologic indicators can, therefore, greatly enhance the technical accuracy, consistency, and credibility of wetland determinations, particularly within the transition zone between wetland and nonwetland ecosystems.

PART II: WETLANDS OF THE SOUTH ATLANTIC STATES

Regional Environment

7. For the purpose of this guide, the South Atlantic Region covers the so-called Middle Atlantic United States (Figure 1). This

Figure 1. Guidebook Regions



includes Delaware, parts of New Jersey, Maryland, Virginia, North Carolina, South Carolina, Georgia, and northern Florida. The geographic area covered is large but the wetlands throughout the region show many similarities in species composition and structure. The vast majority

of these are found within, or along the edge of, the Atlantic Coastal Plain; for this reason, the emphasis in this guide is on wetlands of the coastal plain. Small, restricted wetlands, such as wet savannahs (grass-sedge bogs), that are found in the Piedmont and the Southern Blue Ridge plateaus, are included in freshwater marshes.

8. The entire South Atlantic Coastal Plain has a similar geologic history. Though unglaciated, the region received repeated marine submergence during the interglacial period of the past 50,000 years. Rolling hills and the Fall Line define its western edge. Elevations range from about 183 m above sea level to several meters below. Although the soils are composed mostly of sedimentary deposits, they are quite variable and range from deep and well drained to thin and continuously waterlogged.

9. The climate of the region is quite variable. The precipitation averages approximately 127 cm per year, but many areas experience serious moisture deficiencies in the summer months. The average frost-free period ranges from less than 200 days in the north to over 320 days in the southern part of the region.

10. Vegetatively, the South Atlantic Coastal Plain is represented by two forest types. Most of it is classified by Braun (1964) as belonging to the Southeastern Evergreen Forest region of the Deciduous Forest Formation; the northernmost part of the Atlantic Slope Section is the Oak-Pine Forest Region. Fire, commonly a factor in determining forest types and wetlands of the area, recently has been used for pest control, forage improvement, and timber management. In addition, in recent decades vast amounts of the region's wetlands have been drained for agricultural and silvicultural practices. This trend, however, has slowed in some areas, as people have become more aware of the value of wetlands.

Values

11. The wetlands of the South Atlantic United States often have certain useful attributes that make them valuable and productive

resources of local, regional, or national significance. The following is a list of values that are of notable importance:

a. Wetlands often serve as key areas for biotic productivity and cycling of nutrients associated with the formation and maintenance of food chains.

b. Wetlands provide food, cover, rest, reproduction, and nursery habitat for associated biota.

c. Wetlands typically have a major influence on drainage, salinities, flushing characteristics, current, and sedimentation patterns.

d. Certain wetlands influence surface water and groundwater recharge.

e. Many wetlands provide physical protection against erosion and storm damage.

f. Many wetlands serve as storage areas for storm and floodwaters.

g. Wetlands affect water quality variables such as dissolved oxygen, temperature, turbidity, and nutrient load.

h. Wetlands provide opportunities for recreation, education, and research.

Wetland Vegetation

12. Wetland plant species are organisms that, because of morphological adaptation(s), physiological adaptation(s), and/or reproductive strategies have the ability to perform certain requisite life functions that enable the species to achieve maturity in an environment where the soils within the root zone become inundated or saturated permanently or periodically. The determination of whether a particular plant species can be found in wetlands is made by evidence provided by any one of the indicators given below:

a. Visual observation is made of survival of plant species in habitat conditions exhibiting any one of the wetland hydrology/soil-moisture regimes described in the following sections on wetland soils and wetland hydrology.

b. The technical literature indicates that the plant is associated with habitat conditions exhibiting any one of wetland hydrology/soil-moisture regimes described in the following sections on wetland soils and wetland hydrology.

c. The presence of morphological or physiological adaptations or reproductive strategies for survival in aquatic or wetland habitats is indicated in technical literature.

Wetland Soils

13. Wetland soils are those that become saturated permanently or periodically within the root zone during the growing season of the prevalent vegetation.

14. The determination of whether a particular soil is indicative of a wetland ecosystem can be made by finding evidence of any one of the indicators listed below:

a. There is mottling with a chroma (brightness) of 2 or less within a major part of the root zone.

b. There is a gleyed soil horizon within the root zone.

c. If there is no mottling or if mottles present have a chroma greater than 2, the soil below 25 cm has a chroma of 1 or less.

d. The soil examined has hydric soil characteristics other than a, b, or c above.

e. Presence of free water within the root zone.

f. Visual observation of soil saturation.

Wetland Hydrology

15. Wetland hydrology connotes the inundation or saturation of areas by surface water or groundwater either permanently or periodically during the growing season of the prevalent vegetation.

16. The determination of hydrologic conditions indicative of wetlands can be made by finding evidence of any one of the indicators listed below:

a. Drainage pattern.

b. Drift lines.

c. Silt deposition on vegetation.

d. Water marks.

e. Active water table within a major portion of the root zone.

f. Stream gage data and flood predictions.

g. Historic records.

h. Visual observation of inundation.

PART III: REGIONAL WETLAND TYPES

17. The wetland classes and definitions that follow are taken or adapted from "Classification of Wetland and Deepwater Habitats of the United States" (Cowardin et al. 1979), which was prepared for the National Wetland Inventory (NWI) Project of the U. S. Fish and Wildlife Service. The NWI classes are a secondary level of five major systems: Marine, Estuarine, Riverine, Lacustrine, and Palustrine; and eight subsystems. For purposes of this discussion, the systems and subsystems are omitted. Below the class level, this guide will frequently depart from NWI's hierarchical classification system and describe common wetland plant communities or associations. These communities or associations are included to assist in the field identification and delineation of wetlands and do not preclude the use of NWI classification, though each of these plant communities or associations could be easily classified under this system.*

* See Appendix A for lists of common and scientific names used in this guide.

AQUATIC BED WETLANDS

DEFINITION: The Aquatic Bed Wetlands class includes areas having a prevalence of vegetation that grows principally on or below the surface of the water for most of the growing season in most years. Aquatic beds existing beyond a depth of 2 m (6.6 ft) are classified as deepwater habitats and, therefore, will not be considered in this guide.

18. By the hierarchical classification system of NWI, the Aquatic Bed Wetlands class can be categorized under each of the five major systems (Marine, Estuarine, Riverine, Lacustrine, and Palustrine). The class itself includes four subclasses: (a) Algal, (b) Aquatic Moss, (c) Rooted Vascular, and (d) Floating Vascular. To assist in field recognition, however, this guide will discuss Haline* Aquatic Bed Wetlands (Marine and Estuarine Systems) and Freshwater Aquatic Bed Wetlands (Riverine, Lacustrine, and Palustrine Systems). Use of recognized subclasses will be retained where applicable.

Aquatic Bed Wetlands (Haline)

19. The haline community is widely distributed along the Atlantic coast. These areas occur mostly below the intertidal zone and are commonly called "seagrass beds." The seaward limit of rooted or attached plant growth may extend to a depth of several meters. Aquatic beds existing beyond a depth of 2 m are considered deepwater habitats and not discussed in this guide. The shoreward limit is approximately at the elevation of the lower mean tide level. Consequently, these plants are submersed, except during exceptionally low tides.

Vegetation

20. Growth form and physiognomy. This area is characterized by the presence of submersed, narrow-leaved herbs, and macroscopic algae,

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* Haline - a term used to indicate a dominance of ocean salt.

that, under favorable conditions, comprise extensive communities.

21. Species composition of the Aquatic Bed Wetlands (Haline). Prevalent species include:

a. Subclass: Algal.

Marine algae representing numerous genera

b. Subclass: Rooted Vascular.

Cymodocea filiformis (Manatee-grass)
Halodule beaudettei (Shoal-grass)
Halophila engelmannii (Gulf seagrass)
Potamogeton pectinatus (Sago pondweed)
Ruppia maritima (Widgeon-grass)
Thallassia testudinum (Turtle-grass)
Zannichellia palustris (Horned pondweed)
Zostera marina (Eelgrass)

22. Species associations. The large offshore seagrass beds are primarily composed of eelgrass; the other species listed above (with the exception of shoal-grass) are common in many brackish habitats. Along the gulf coast, Gulf seagrass is commonly associated with the dominants.

Environmental conditions

23. Conditions in the Haline Aquatic Bed Wetland community are often quite variable. Substrates vary from sandy to muddy, water movement from slow to moderately fast, and salinity, often the most important limiting factor in this environment, from moderate to high. The zone of rooted or attached vegetation is limited only by the depth of effective light penetration. The most common inhabitants here are eelgrass and shoal-grass.

Aquatic Bed Wetlands (Freshwater)

24. The freshwater community is common in many areas in the South Atlantic Region. It occurs in streams, rivers, canals, ponds, lakes, sloughs, backwater areas, and reservoirs. Many of these are often completely covered with vegetation, but often this community forms a narrow band of vegetation that parallels the shorelines.

25. Under certain conditions, many aquatic plants are considered problem weeds. They reduce the recreational value of lakes and waterways, clog irrigation canals and drainage ditches, and cover water surfaces. Many of these troublesome species are exotic "aquarium-trade escapees," which thrive in the absence of natural predators or competitors. Their luxuriant growth is usually a response to the nutrient enrichment of the water by man's activities. Some of the least desirable exotics are hydrilla (*Hydrilla verticillata*), waterhyacinth (*Eichhornia crassipes*), elodea (*Egeria densa*), and watermilfoil (*Myriophyllum spicatum*).

Vegetation

26. Growth forms and physiognomy. The growth form is characterized by free-floating (attached, supported, and bouyed by the water), floating-leaved, and submersed herbs (Figure 2).

> The reader is cautioned that the generalized floristic profiles contained within this guide are diagrammatic and are not necessarily representative of many sites that will be found in the field. Wetland systems are dynamic, and many variations will be found.

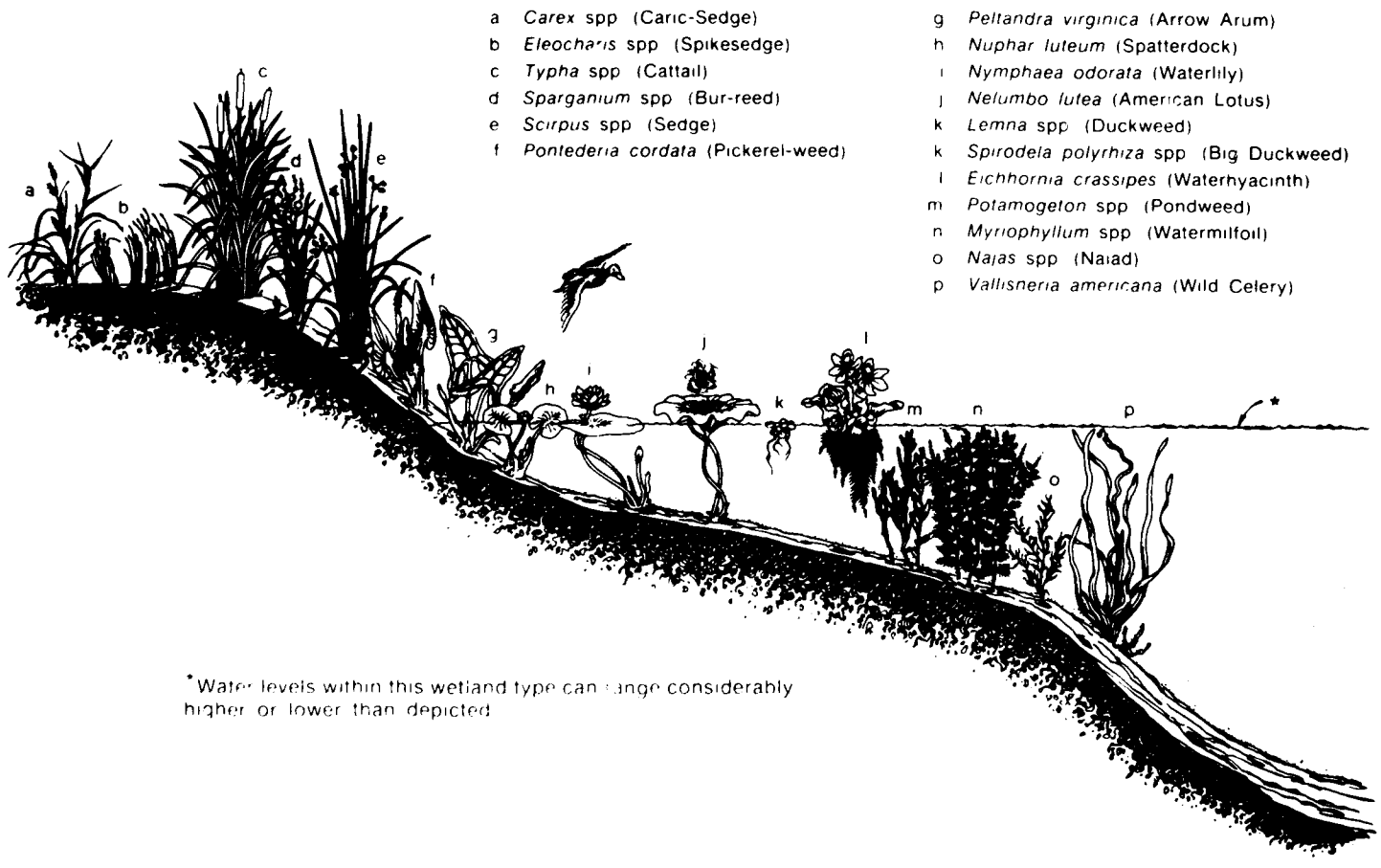
27. Species composition of the Aquatic Bed Wetlands (Freshwater). The two subclasses of vascular species are as follows:

a. Subclass: Rooted Vascular.

Prevalent species

Brasenia schreberi (Water-shield)
Ceratophyllum demersum (Coontail)
Myriophyllum spp. (Watermilfoil)
Nelumbo lutea (American lotus)
Nuphar luteum (Spatterdock)
Nymphaea odorata (Waterlily)
Potamogeton spp. (Pondweed)
Utricularia spp. (Bladderwort)
Vallisneria americana (Wild celery)

Figure 2. Generalized Profile of a Freshwater Aquatic Zone (Including Aquatic Bed Wetlands)



*Water levels within this wetland type can change considerably higher or lower than depicted

Common associated species

Heteranthera reniformis (Mud plantain)

Isoetes spp. (Quillwort)

Najas spp. (Naiad)

b. Subclass: Floating Vascular.

Prevalent species

Eichhornia crassipes (Waterhyacinth)

Lemna spp. (Duckweed)

Spirodela polyrhiza (Big duckweed)

Wolffia spp. (Watermeal)

Wolffiella gladiata (Watermeal)

28. Species associations. Freshwater communities are typically dominated by assemblages of aquatic plants that usually display a distinct water-depth-dependent zonation. Deep-water areas of ponds and lakes usually are covered with free-floating plants such as water-hyacinth, duckweed, and bladderwort. In areas where the water is not more than 2 m in depth, there will be rooted submergents such as wild celery, quillwort, and naiad. (These rooted submergents will often grow beyond a depth of 2 m in clear waters; however, such areas are considered deep-water habitats and will not be considered in this guide.) In shallower areas, floating-leaved plants such as waterlilies and spatterdock are dominant.

Environmental conditions

29. Most Freshwater Aquatic Bed Wetlands are inundated permanently except during extreme drought periods. Even in those ponds and lakes that experience significant water loss in dry years, the soils seldom dry completely since the water table is at or near the surface.

EMERGENT WETLANDS

DEFINITION: The Emergent Wetlands class includes areas dominated by erect, rooted, herbaceous hydrophytes, excluding mosses and lichens. This vegetation is present for most of the growing season in most years. These wetlands are usually dominated by perennial plants.

30. Within the Emergent Wetlands class, NWI includes two subclasses: (a) Persistent, and (b) Nonpersistent. These are based on the duration of the standing vegetation through the nongrowing season. Due to the large number of wetlands encompassed by the Emergent Wetlands class in the South Atlantic United States and the variance of persistence/nonpersistence from one geographic area to another, this guide will describe four common plant communities to assist in field recognition: (a) Haline Coastal Flats, (b) Haline Marshes, (c) Freshwater Flats, and (d) Freshwater Marshes (including tidal and interior freshwater marsh, wet savannahs, and fern bogs).

Haline Coastal Flats

31. Coastal flats primarily include sparsely vegetated intertidal areas, as well as hyperhaline flats above mean high tide (the latter being inundated during severe storms). Some flats are slight depressions, flooded only at high tides, in which the water eventually evaporates leaving the soils hyperhaline; few plants can survive here. Flats are intermittently found along the entire coast.

Vegetation

32. Growth forms and physiognomy. This area is characterized by the presence of scattered, moderate-sized, halophytic, and succulent forbs.

33. Species composition of the Haline Coastal Flats. Prevalent species include:

Batis maritima (Saltwort)

Salicornia spp. (Glasswort)

Sesuvium maritimum (Sea purslane)

Sesuvium portulacastrum (Sea purslane)

Suaeda linearis (Sea blite)

Common associated species include:

Atriplex arenaria (Sea beach orach)

Distichlis spicata (Saltgrass)

Spartina patens (Saltmeadow cordgrass)

34. Species associations. Coastal flats in the intertidal zone are usually sparsely populated. The more haline areas here commonly support halophytic succulents. Common dominants include saltwort and glasswort.

Environmental conditions

35. The soil of coastal flats is usually saline and sandy. Salinities may reach as high as 130 ppt,* particularly in the higher areas that are inundated by storm-tidal waters; subsequent evaporation creates a high saline environment.

Haline Marshes

36. The Haline Marshes of the South Atlantic region are extensive and can be divided into three major systems. The first, typical of the more northern portion of the region, is the Chesapeake Bay area, which includes a large number of broad estuaries. These were formed by tidal drowning of the lower courses of the Delaware, Susquehanna, and certain other rivers. The second occurs south of Chesapeake Bay to Myrtle Beach, S. C. These marshes are usually associated with large sounds, separated from the ocean by long, narrow, relatively straight barrier islands or bars ("banks," the "Outer Banks" of North Carolina). Here the tidal amplitude is rather low, seldom exceeding 1 m. The third major saltmarsh system, characteristic of the southern part of the region, extends from Myrtle Beach, S. C., to the northern border of Florida. Here, barrier islands are broader and not nearly as long as

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* Parts per thousand.

the more northern islands. Extensive saltmarshes occur along and behind the islands. These marshes are permeated with numerous, meandering streamlets and tidal channels.

37. Despite the basic physiographic differences that occur along this extensive coastline, the species composition of the Haline Marshes remains remarkably similar. The dominants are usually similar, although species variations and relative dominance are evident geographically. Many coastal haline marshes occur in close proximity to freshwater systems. Here hyperhaline and euhaline marshes (salinity greater than 30 ppt) grade uninterrupted into mixohaline (brackish) ones (0.5-30 ppt), and these into freshwater ones (less than 0.5 ppt). Low salinity Emergent Wetlands are also found at the upper end of tidal creeks, estuaries, and in depressions behind coastal dunes. Because the haline and brackish marshes are quite similar, they are treated as one type within this section. Where differences in vegetation occur, they are discussed.

Vegetation

38. Growth forms and physiognomy. This area is characterized by the presence of dense stands of graminoids with infrequent populations of shrubs and forbs.

39. Species composition of the Haline Marshes.

a. High salinity marshes (Figure 3).

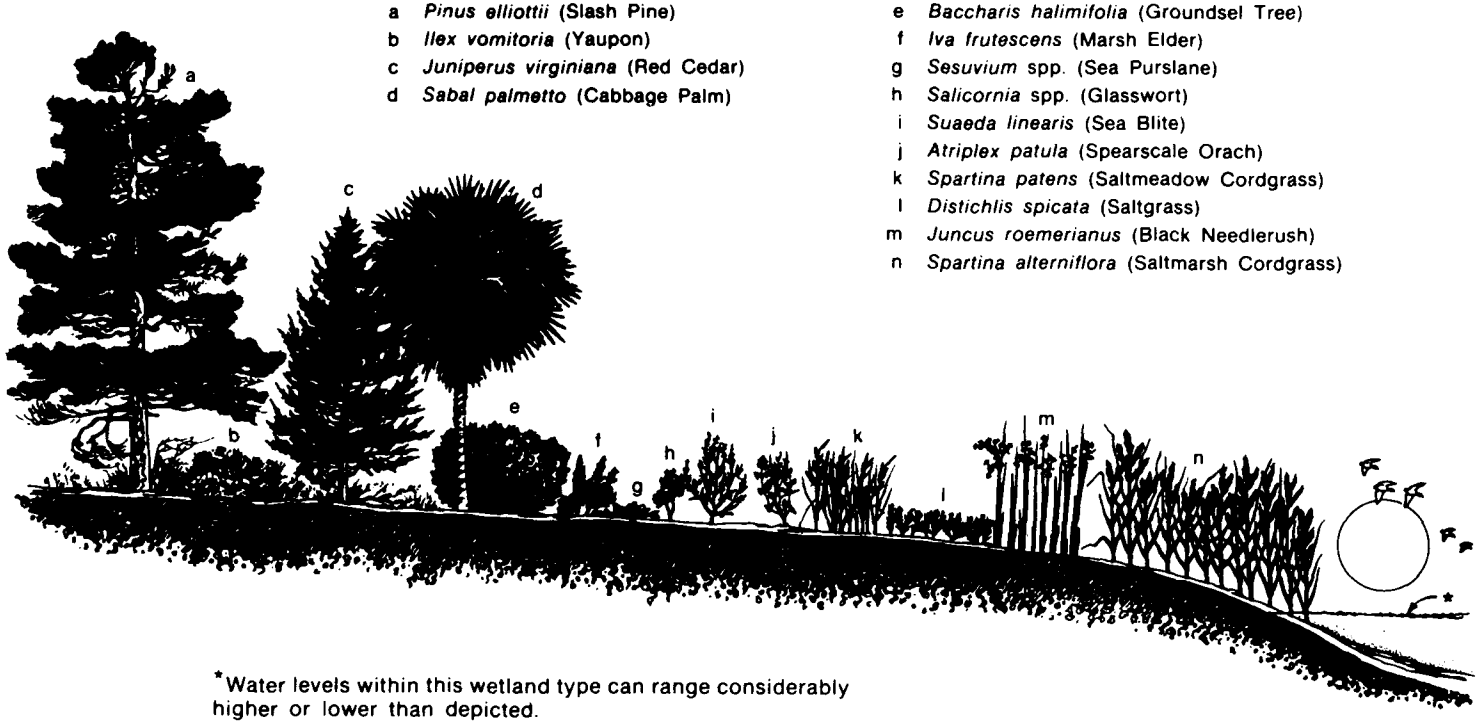
Prevalent species

Distichlis spicata (Saltgrass)
Juncus roemerianus (Black needlerush)
Spartina alterniflora (Saltmarsh cordgrass)
Spartina patens (Saltmeadow cordgrass)

Common associated species

Aster tenuifolius (Saltmarsh aster)
Atriplex patula (Spearscale orach)
Fimbristylis spadicea (Saltmarsh fimbristylis)
Limonium carolinianum (Sea lavender)
Panicum virgatum (Switchgrass)
Salicornia spp. (Glasswort)
Sesuvium maritimum (Sea purslane)

Figure 3. Generalized Profile of a High Salinity Saltmarsh and Coastal Flat



*Water levels within this wetland type can range considerably higher or lower than depicted.

Sesuvium portulacastrum (Sea purslane)

Sporobolus virginicus (Saltmarsh dropseed)

Suaeda linearis (Sea blite)

b. Low salinity marshes (brackish) (Figure 4).

Prevalent species

Juncus roemerianus (Black needlerush)

Scirpus americanus (Chairmaker's rush or Three-square bulrush)

Scirpus olneyi (Olney threesquare)

Scirpus robustus (Saltmarsh bulrush)

Spartina cynosuroides (Big cordgrass)

Typha spp. (Cattail)

Common associated species

Aster spp. (Aster)

Cladium jamaicense (Sawgrass)

Eleocharis spp. (Spikerush)

Fimbristylis spadicea (Saltmarsh fimbristylis)

Hibiscus moscheutos (Rose mallow)

Kosteletzkya virginica (Seashore mallow)

Paspalum spp. (Joint-grass)

Phragmites australis (Common reed)

Pluchea purpurascens (Camphorweed)

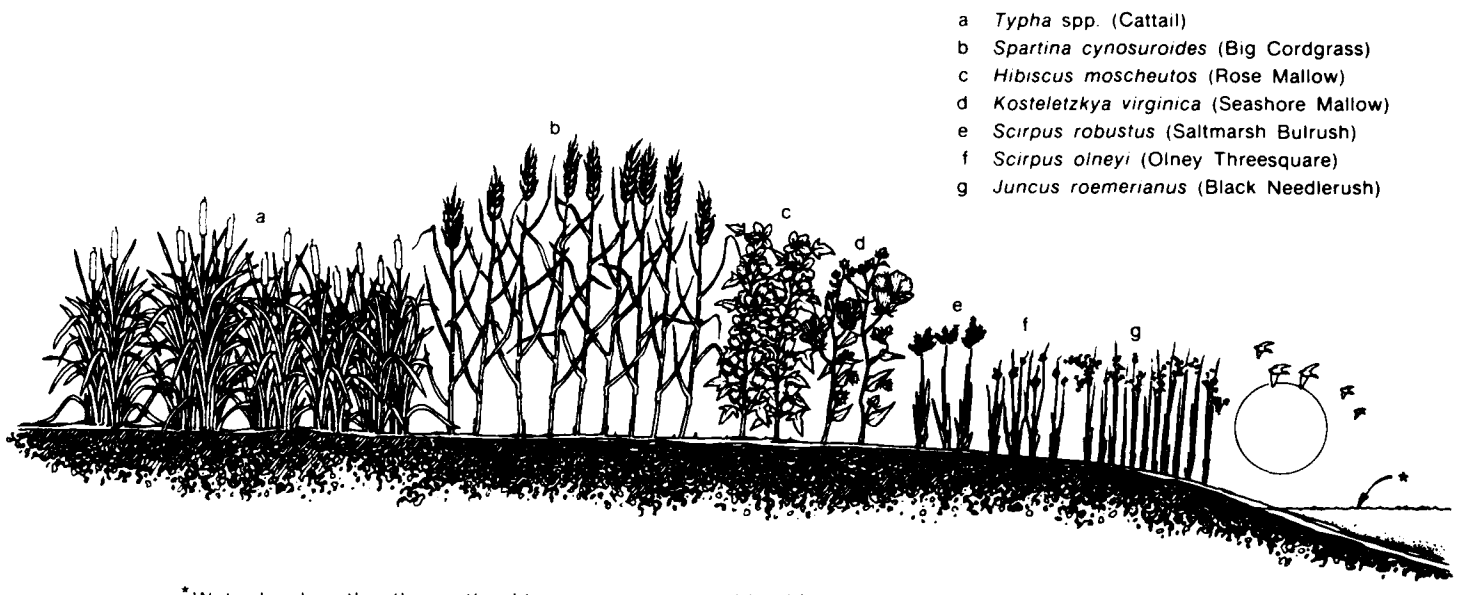
Polygonum spp. (Tearthrumb and Smartweed)

Sabatia spp. (Sea pinks)

Setaria magna (Giant foxtailgrass)

40. Species associations. Haline marshes of the South Atlantic coast are dominated by saltmarsh cordgrass in most intertidal zone environments. Black needlerush is locally abundant, especially on sandy substrates. The irregularly flooded areas of haline marshes are characterized by saltmeadow cordgrass, saltgrass, saltmarsh aster, and saltmarsh fimbristylis. In the northern one third of this region, these wetlands commonly contain saltmarsh dropseed, spearscale orach, and sea blite. The upper black needlerush-saltgrass-saltmeadow cordgrass communities of the haline marshes often give way in the less saline

Figure 4. Generalized Profile of a Low Salinity Marsh



a *Typha* spp. (Cattail)
b *Spartina cynosuroides* (Big Cordgrass)
c *Hibiscus moscheutos* (Rose Mallow)
d *Kosteletzkya virginica* (Seashore Mallow)
e *Scirpus robustus* (Saltmarsh Bulrush)
f *Scirpus olneyi* (Olney Threesquare)
g *Juncus roemerianus* (Black Needlerush)

*Water levels within this wetland type can range considerably higher or lower than depicted.

areas to stands of narrow-leaved cattail (*Typha angustifolia*) and big cordgrass. Compositional changes such as these generally indicate a lowering in salinity, usually due to influence of a nearby freshwater source. These low salinity marshes are often quite extensive, and can be found along the shores of long meandering tidal rivers many miles from the coast.

Environmental conditions

41. Species distributions in haline marshes are determined largely by inundation and salinity. The distinct restriction of saltmarsh cordgrass to the intertidal zone in most areas, followed by the less frequently flooded saltgrass-saltmeadow cordgrass zone, demonstrates the effect of flooding on haline marsh vegetation. Changes along the salinity gradient are more difficult to delineate since the degree of salinity in brackish marshes is quite variable (from season to season and even from day to day). Certain plants are more common in low salinity marshes, including big cordgrass, several species of *Scirpus*, and a variety of broad-leaved herbs.

Freshwater Flats

42. Freshwater Flats are frequent in areas of fluctuating water levels and are scattered throughout the region along reservoirs and certain streams and rivers.

Vegetation

43. Growth forms and physiognomy. These areas are characterized by scattered communities of rooted, emersed herbs and sparsely scattered shrubs and trees.*

44. Species composition of the Freshwater Flats. Prevalent species include:

Carex albolutescens (Caric-sedge)

Carex stricta (Tussock sedge)

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* Freshwater flats supporting shrubs or trees (i.e., *Cephalanthus occidentalis*, *Salix* spp.) as the dominant species are more properly classified as Scrub-Shrub Wetland.

Cephalanthus occidentalis (Buttonbush)
Cladium jamaicense (Sawgrass)
Cyperus strigosus (Redroot cyperus)
Echinochloa walteri (Walter's millet)
Eleocharis obtusa (Spikerush)
Eleocharis quadrangulata (Spikerush)
Leersia spp. (Cutgrass)
Panicum hemitomon (Maidencane)
Phragmites australis (Common reed)
Scirpus validus (Soft-stem bulrush)
Spartina cynosuroides (Big cordgrass)
Typha spp. (Cattail)
Zizania aquatica (Northern wild rice)
Zizaniopsis miliacea (Southern wild rice)

Common associated species include:

Acer saccharinum (Silver maple)
Betula nigra (River birch)
Carex spp. (Sedge)
Cyperus spp. (Sedge)
Hibiscus moscheutos (Rose mallow)
Juncus spp. (Rush)
Panicum spp. (Panicgrass)
Peltandra virginica (Arrow arum)
Polygonum spp. (Tearthumb and Smartweed)
Pontederia cordata (Pickerel-weed)
Sagittaria spp. (Arrowhead)
Scirpus spp. (Sedge)

45. Species associations. Species diversity on flats is often high even though the areas are sparsely vegetated. Substrate type and shade particularly affect diversity. The southern part of the region is usually more complex than its northern counterpart.

Environmental conditions

46. Freshwater flats usually occur as a result of prolonged periods of alternating flooding and exposure. They are found on many soil types,

ranging from silt to clay and sand to gravel. When the period of exposure for one or more years increases significantly during the growing season, the vegetative cover often increases sufficiently and forms a freshwater marsh. These marshes are usually only temporary, prolonged flooding recurs, the vegetation is destroyed, and the flat reforms.

Freshwater Marshes

47. Coastal Freshwater Marshes of this region may be confined to tidal rivers often extending several kilometres inland from the coast. In addition, many small freshwater marshes are found in depressions behind the dune systems. These typically are more diverse than salt or brackish marshes; consequently, it is not uncommon to find as many as 30 or more species occurring in a small area. Also included here are "wet meadows." These occur on the wet peaty substrates within the coastal plain, often resulting from fire or removal of timber from another class of wetland community.

48. Two other plant communities, the wet savannahs and the fern bogs, are included here as marsh types. The savannahs (grass-sedge bogs) are found on the flat coastal plain uplands and the fern bogs in central and south Georgia. They are discussed separately here since they fit within the broad category of freshwater marsh, but differ substantially in vegetation from the more common freshwater marshes.

Vegetation

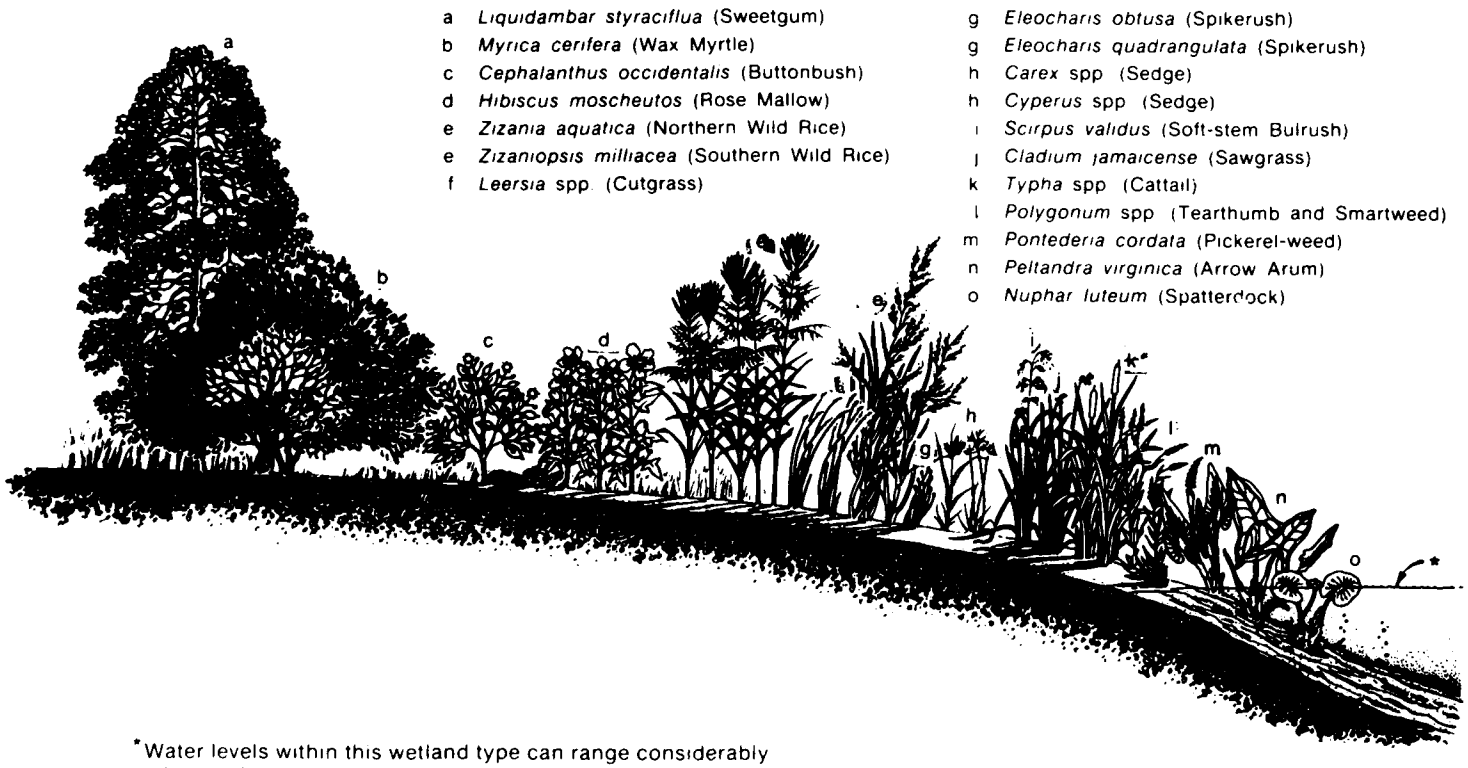
49. Growth forms and physiognomy. These areas are characterized by dense stands of graminoids, intermixed with occasional forbs (Figure 5). In some bogs, the graminoids are less common, and forbs more prevalent.

50. Species composition of the Freshwater Marshes. Prevalent species for the three types are listed below:

a. Tidal and Interior Freshwater Marsh.

Carex albolutescens (Caric-sedge)
Carex stricta (Tussock sedge)
Cladium jamaicense (Sawgrass)
Cyperus strigosus (Redroot cyperus)

Figure 5. Generalized Profile of a Freshwater Marsh



a *Liquidambar styraciflua* (Sweetgum)
b *Myrica cerifera* (Wax Myrtle)
c *Cephalanthus occidentalis* (Buttonbush)
d *Hibiscus moscheutos* (Rose Mallow)
e *Zizania aquatica* (Northern Wild Rice)
e *Zizaniopsis milliacea* (Southern Wild Rice)
f *Leersia* spp. (Cutgrass)
g *Eleocharis obtusa* (Spikerush)
g *Eleocharis quadrangulata* (Spikerush)
h *Carex* spp. (Sedge)
h *Cyperus* spp. (Sedge)
i *Scirpus validus* (Soft-stem Bulrush)
j *Cladium jamaicense* (Sawgrass)
k *Typha* spp. (Cattail)
l *Polygonum* spp. (Tearthumb and Smartweed)
m *Pontederia cordata* (Pickerel-weed)
n *Peltandra virginica* (Arrow Arum)
o *Nuphar luteum* (Spatterdock)

*Water levels within this wetland type can range considerably higher or lower than depicted.

Echinochloa walteri (Walter's millet)

Eleocharis obtusa (Spikerush)

Eleocharis quadrangulata (Spikerush)

Leersis spp. (Cutgrass)

Panicum hemitomon (Maidencane)

Phragmites australis (Common reed)

Scirpus americanus (Chairmaker's rush or three-square bulrush)

Scirpus validus (Soft-stem bulrush)

Spartina cynosuroides (Big cordgrass)

Typha spp. (Cattail)

Zizania aquatica (Northern wild rice)

Zizaniopsis miliacea (Southern wild rice)

b. Wet Savannahs.

Ctenium aromaticum (Toothachegrass)

Panicum ensifolium (Panicgrass)

Panicum longiligulatum (Panicgrass)

Panicum wrightianum (Panicgrass)

Pinus serotina (Pond pine)

Rhynchospora chapmanii (Beak sedge)

c. Fern Bogs.

Sphagnum spp. (Sphagnum moss)

Woodwardia virginica (Virginia chain fern)

Common associated species of the three types are listed below:

a. Tidal and Interior Freshwater Marsh.

Carex spp. (Sedge)

Cyperus spp. (Sedge)

Hibiscus moscheutos (Rose mallow)

Juncus spp. (Rush)

Panicum spp. (Panicgrass)

Peltandra virginica (Arrow arum)

Polygonum spp. (Tearthumb and Smartweed)

Pontederia cordata (Pickerel-weed)

Sagitarria spp. (Arrowhead)

Scirpus spp. (Sedge)

b. Wet Savannahs.

Aletris farinosa (Stargrass)
Ilex glabra (Inkberry)
Myrica cerifera (Wax myrtle)
Pinus taeda (Loblolly pine)
Pinus palustris (Longleaf pine)
Quercus pumila (Running oak)
Sarracenia flava (Pitcher plant)
Solidago stricta (Goldenrod)
Xyris spp. (Yellow-eyed grass)

c. Ferr Bogs.

Ilex glabra (Inkberry)
Itea virginica (Virginia willow)
Leucothoe racemosa (Fetterbush)
Pinus elliottii (Slash pine)

51. Species associations of Tidal and Interior Freshwater Marsh. Many freshwater marshes are dominated by a single species. Most of these are strong rhizome producers (as are many marsh plants). This type of vegetative reproduction allows a population to quickly colonize an area and subsequently produce uniform mats of vegetation. Clumps of other species are frequently found within this community; therefore, differences in water levels and vegetative reproduction rates probably explain the patchy patterns of isolated stands of species in an area dominated by another plant species.

52. In many marshes where waters are often too deep for graminoids, emergent plants such as cattail are dominant. These areas often include members of the Freshwater Aquatic Bed Wetlands class, such as waterlilies (*Nymphaea* spp.) and spatterdock (*Nuphar luteum*). When these aquatic species become dominant, the site is considered an Aquatic Bed Wetland.

53. Tidal and inland freshwater marshes are usually characterized by different species. The tidal ones are commonly dominated by northern wild rice, southern wild rice, big cordgrass, and common reed. Inland

freshwater marshes, which have fewer of these species, are usually dominated by maidencane and soft-stem bulrush.

54. Species associations of Wet Savannahs. Wet savannahs or "grass-sedge bogs" are common in the sand-peat soils. These are usually dominated by grasses such as toothachegrass, panicgrass (*Panicum wrightianum*, *P. longiligulatum*, *P. ensifolium*) and beak sedge. Since many of these areas regularly burn, they seldom develop into a wooded wetland.

55. Species associations of Fern Bogs. Open fern bogs are best developed and most common on peaty substrates, such as in the Okefenokee Swamp. The dominant ground cover, Sphagnum moss, often has large colonies of Virginia chain fern scattered in it. Other common species here are slash pine, Virginia willow, fetterbush, and inkberry. When the woody cover becomes dominant, as it often does in the Okefenokee area, these areas are then considered as Scrub-Shrub Wetlands or Forested Wetlands.

Environmental conditions

56. Freshwater marshes may be seasonally or permanently inundated. Water level fluctuations range from very little to nearly 3 m, and the dominant growth forms are usually related to timing, depth, and duration of inundation. Forbs usually dominate the permanently wet sites and graminoids the seasonally wet ones. Fire is an important factor in the elimination of woody or herbaceous invader species in certain areas. Many seasonally flooded marshes, wet meadows, and grass-sedge bogs would probably be succeeded by woody plants (Scrub-Shrub Wetlands or Forested Wetlands) if it were not for the regular occurrence of fires within these areas.

57. Substrates are often nutrient or pH limiting in grass-sedge and fern bogs. Peaty soils often exclude all but the most acid-tolerant plants. In addition, the wet savannah, which is wet much of the time, is quite species limiting since it is usually underlain by an impermeable layer of clay hardpan or ironstone; this usually results in a perched water table and poor drainage.

SCRUB-SHRUB WETLANDS AND FORESTED WETLANDS

DEFINITIONS: a. The Scrub-Shrub Wetlands class includes areas dominated by woody vegetation less than 6 m (20 ft) in height. The species include true shrubs and trees or shrubs that are small or stunted because of environmental conditions. Scrub-Shrub Wetlands include many of the young tree and shrub species found within Forested Wetlands.

b. The Forested Wetlands class includes areas dominated by woody vegetation equal to or greater than 6 m in height.

58. Within the Forested Wetlands class, NWI includes five subclasses: (a) Broad-leaved Deciduous, (b) Needle-leaved Deciduous, (c) Broad-leaved Evergreen, (d) Needle-leaved Evergreen, and (e) Dead. (For a more detailed description of these subclasses and specific dominance types, the reader is urged to consult Cowardin et al. (1979).) To assist in the field recognition of wetlands, however, this guide will deviate from the NWI classification system and describe four distinct wooded wetland associations: (a) Cypress-Tupelo Swamp (dominated by *Taxodium* and *Nyssa* spp.), (b) Southern Overflow Forest (bottomland hardwoods), (c) Atlantic White Cedar Bog (dominated by *Chamaecyparis*), and (d) Pocosin-Bay Forest (upland bogs in pine Savannahs). These plant communities are included for identification purposes and do not preclude the use of NWI classification, though each of these plant associations could be easily classified under this system.

Wooded Wetlands

59. Wooded Wetlands are extensive in the region. They commonly occur along sluggish, meandering streams, on floodplains of major rivers, along shallow lakes, and on flats with restricted drainage. The substrate may be mucky, alluvial, or peaty and frequently remains saturated for much of the year.

Vegetation

60. Growth forms and physiognomy. These areas are characterized by medium to dense stands of shrubs and/or broadleaf or deciduous, often buttress-based, trees (Figure 6).

61. Species composition of the Wooded Wetlands. Prevalent species of the four types include:

a. Cypress-Tupelo Swamp.

Nyssa aquatica (Tupelo gum)
Nyssa sylvatica var. *biflora* (Swamp black gum)
Taxodium ascendens (Pond cypress)
Taxodium distichum (Bald cypress)

b. Southern Overflow Forest.

Acer rubrum (Red maple)
Carya aquatica (Water hickory)
Celtis laevigata (Sugarberry)
Forestiera acuminata (Swamp privet)
Planera aquatica (Water elm)
Populus heterophylla (Swamp cottonwood)
Quercus laurifolia (Laurel oak)
Quercus lyrata (Overcup oak)
Quercus palustris (Pin oak)
Quercus phellos (Willow oak)
Ulmus americana (American elm)
Ulmus rubra (Slippery elm)

c. Atlantic White Cedar Bog.

Chamaecyparis thyoides (Atlantic white cedar)

d. Pocosin-Bay Forest.

Acer rubrum (Red maple)
Chamaecyparis thyoides (Atlantic white cedar)
Clethra alnifolia (White alder)
Cyrilla racemiflora (Titi)
Gordonia lasianthus (Loblolly bay)
Ilex coriacea (Gallberry)

Figure 6. Generalized Profile of a Swamp

a *Pinus serotina* (Pond Pine)
b *Osmunda cinnamomea* (Cinnamon Fern)
b *Thelypteris palustris* (Marsh Fern)
b *Woodwardia areolata* (Netted Chain-fern)
c *Cyrilla racemiflora* (Titi)
d *Magnolia virginiana* (Sweet Bay)
e *Saururus cernuus* (Lizard's Tail)
f *Acer rubrum* (Red Maple)
f *Carya aquatica* (Water Hickory)
g *Nyssa aquatica* (Tupelo Gum)
g *Nyssa sylvatica* var *biflora* (Swamp Black Gum)
h *Taxodium ascendens* (Pond Cypress)
h *Taxodium distichum* (Bald Cypress)
i *Peltandra virginica* (Arrow Arum)
j *Nymphaea odorata* (Waterlily)

*Water levels within this wetland type can range considerably higher or lower than depicted

Lyonia ligustrina (Male-berry)
Lyonia mariana (Stagger-bush)
Magnolia virginiana (Sweet bay)
Myrica cerifera (Wax myrtle)
Nyssa sylvatica var. *biflora* (Swamp black gum)
Persea borbonia (Red bay)
Pinus serotina (Pond pine)
Smilax laurifolia (Bamboo vine)
Sphagnum spp. (Sphagnum moss)
Taxodium ascendens (Pond cypress)
Zenobia pulverulenta (Zenobia)

Common associated species of the four types include:

a. Cypress-Tupelo Swamp.

Acer rubrum (Red maple)
Carya aquatica (Water hickory)
Forestiera acuminata (Swamp privet)
Fraxinus tomentosa (Pumpkin ash)
Liquidambar styraciflua (Sweetgum)
Planera aquatica (Water elm)
Quercus lyrata (Overcup oak)
Salix nigra (Black willow)
Ulmus americana (American elm)

b. Southern Overflow Forest.

Acer negundo (Box elder)
Asimina triloba (Pawpaw)
Carpinus caroliniana (Ironwood)
Fraxinus spp. (Ash)
Itea virginica (Virginia willow)
Lindera benzoin (Spicebush)
Quercus michauxii (Swamp chestnut oak)
Saururus cernuus (Lizard's tail)

c. Atlantic White Cedar Bog.

Pinus serotina (Pond pine)
Pinus taeda (Loblolly Pine)

Smilax spp. (Greenbrier)

d. Pocosin-Bay Forest.

Arundinaria gigantea (Cane)
Dionaea muscipula (Venus fly trap)
Drosera spp. (Sundew)
Gaylussacia frondosa (Dangleberry)
Kalmia angustifolia (Lambkill)
Leucothoe axillaris (Fetterbush)
Osmunda cinnamomea (Cinnamon fern)
Pinguicula spp. (Butterwort)
Sarracenia spp. (Pitcher plant)
Scutellaria integrifolia (Skullcap)
Sorbus arbutifolia (Red chokeberry)
Taxodium ascendens (Pond cypress)
Thelypteris palustris (Marsh fern)
Woodwardia areolata (Netted chain-fern)

62. Species associations of Cypress-Tupelo Swamps. The most common type of wooded wetland in the South Atlantic region is characterized by bald cypress, pond cypress, tupelo gum, and swamp black gum. Usually one species is dominant, but occasionally they occur in mixed populations. Bald cypress is often found in nearly pure stands, particularly where flooding occurs for several months at a time. Cypress-tupelo swamps are common except in the northern-most part of the South Atlantic area, and are best illustrated by the large, well-known Dismal Swamp of the Virginia-North Carolina border and the Okefenokee Swamp of southern Georgia and northern Florida. A wide variety of hardwoods, in association with the dominants, is found within these swamps. Common species include red maple, water hickory, overcup oak, black willow, American elm, and sweetgum. In less frequently flooded areas, it is not uncommon for these species to increase in importance as the numbers of cypress and gum trees decrease. These sites are often without inundation during parts of the growing season. The transition zones are often quite variable in this region. They may be quite abrupt or occur as wide "flats" between the deep-water swamps and nonwetlands. Here there

is usually an increase in the herbaceous understory as well as a marked change in the overstory composition. This zone often contains species from both communities.

63. Species associations of Southern Overflow Forest. These communities are characteristically found on poorly drained, periodically inundated flats along streams and rivers. Some of the more common overstory species include swamp cottonwood, sugarberry, overcup oak, willow oak, red maple, slippery elm, and water hickory. The understory vegetation is usually sparse; it commonly includes buttonbush (*Cephalanthus occidentalis*), spicebush, pawpaw, and Virginia willow. The shrub and perennial herb layer usually increases in density and complexity in the transition zones and in areas with higher elevation.

64. Species associations of Atlantic White Cedar Bogs. These bogs are usually found in the coastal areas of the region. They are dominated by Atlantic white cedar, a species which is limited in distribution to these shallow water swamps and bogs. These communities usually occur on peat underlain by sand. In some situations where dense stands occur, branches reach nearly to the ground and little herb or shrub understory vegetation is present. Buell and Cain (1943) found that Atlantic white cedar swamps require fire and a high water table for successful maturation of their seedlings; in the absence of fire, this community is commonly replaced by the evergreen shrub bog (pocosin) type community.

65. Species associations of Pocosin-Bay Forest. This community is usually found on acidic, saturated substrates in shallow depressions, ancient estuaries, and other poorly drained, upland areas of the coastal plain (particularly in North Carolina). This community often supports a series of intergrading plant communities that share numerous species. Scattered over this Sphagnum-dominated area are such broadleaf evergreen shrubs as gallberry, lambkill, and zenobia. Frequent trees here include pond pine and Atlantic white cedar. Near the edge of the pocosin, taller shrubs and trees characteristic of the bay portion of the forest are present, including red bay and wax myrtle. This bay forest usually has more flooding than the pocosin and is dominated by trees such as

sweet bay, swamp black gum, red maple, and pond cypress. Typical shrubs here include titi, white alder, and red chokeberry. Herbaceous species present commonly include skullcap, netted chain-fern, cinnamon fern, and marsh fern.

66. One group of herbs in these areas, the carnivorous plants, is of particular interest. A number of species of *Sarracenia* (pitcher plant), *Pinguicula* (butterwort), and *Drosera* (sundew) are common in the transition zones surrounding pocosins. *Dionaea* (Venus fly-trap) occurs in the transition zone of wet savannahs and is an associated species in pocosin-bay communities in southeastern North Carolina and a few coastal counties in South Carolina. Pocosins, bay forests, and wet savannahs generally have a great many species in common. The areas are quite variable and frequently intergrade with one another, the major differences among them being primarily due to such factors as water regime, substrate type, and fire.

Environmental conditions

67. Variations in Scrub-Shrub Wetlands and Forested Wetlands are primarily due to the water regime. Both the deep- and shallow-water systems are at least periodically flooded, and in many instances the substrate is saturated and anaerobic for much of the growing season. Soil acidity, particularly in the bogs, and fire frequency and intensity are other important limiting factors in these areas.

STREAMBED

DEFINITION: The Streambed class includes all wetlands restricted within a channel containing nontidal flowing water for only part of the year. When the water is not flowing, it may remain in isolated pools or surface water may be absent. This class also includes all channels of a river or estuary that are completely dewatered at low tide. Water regimes are restricted to irregularly exposed, regularly flooded, irregularly flooded, seasonally flooded, temporarily flooded, and intermittently exposed (Cowardin et al. 1979).

68. Within the Streambed class, NWI includes seven subclasses: (a) Bedrock, (b) Rubble, (c) Cobble-Gravel, (d) Sand, (e) Mud, (f) Organic, and (g) Vegetated. Only the last subclass will be considered in this guide.

Streambed (Vegetated)

69. The form and substrate of Streambed vary greatly depending upon the gradient of the channel, the velocity of the water, and the sediment load. Streambeds are usually not vegetated because of the scouring effect of moving water, but they may be colonized by annuals or perennials during periods of the low flow (Cowardin et al. 1979).

Vegetation

70. Species composition of Streambeds (Vegetated). Prevalent species include:

Panicum capillare (Old witchgrass)*

Environmental conditions

71. Vegetated streambeds are exposed long enough to be colonized

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* Cowardin et al. (1979). In addition to this species, those listed as dominants for the Unconsolidated Shores (Vegetated) subclass are also commonly found.

by herbaceous annuals or seedling herbaceous perennials (pioneer plants). This vegetation, unlike that of Emergent Wetlands, is usually killed by rising water levels or sudden flooding (Cowardin et al. 1979).

UNCONSOLIDATED SHORES

DEFINITION: The Unconsolidated Shores class includes all wetland habitats having the following characteristics: (1) unconsolidated substrates with less than 75 percent areal cover of stones, boulders, or bedrock; (2) less than 30 percent areal cover of vegetation other than pioneering plants; and (3) any of the following water regimes: irregularly exposed, regularly flooded, irregularly flooded, seasonally flooded, temporarily flooded, intermittently flooded, saturated, or artifically flooded (Cowardin et al. 1979).

72. Within the Unconsolidated Shores class, NWI includes five subclasses: (a) Cobble-Gravel, (b) Sand, (c) Mud, (d) Organic, and (e) Vegetated. Only the last subclass will be considered in this guide.

Unconsolidated Shores (Vegetated)

73. The substrates that characterize Unconsolidated Shores usually lack vegetation except for pioneering plants that become established during periods of favorable growth conditions. Unconsolidated Shores consist of landforms such as beaches, bars, and flats that are created by the erosion and deposition actions of waves and currents (Cowardin et al. 1979).

Vegetation

74. Species composition of Unconsolidated Shores (Vegetated). Prevalent species include:

Chenopodium rubrum (Goosefoot)
Echinochloa crusgalli (Barnyardgrass)
Kochia scoparia (Summer cypress)
Xanthium strumarium (Cocklebur)

Environmental conditions

75. Some unconsolidated shores are exposed for a sufficient period to be colonized by herbaceous annuals or seedling herbaceous

perennials (pioneer plants). This vegetation, unlike that of Emergent Wetlands, is usually killed by rising water levels and may be gone before the beginning of the next growing season. Many of the pioneer species are not hydrophytes but are weedy mesophytes that cannot tolerate wet soil or flooding (Cowardin et al. 1979).

REFERENCES AND BIBLIOGRAPHY

References

Braun, E. L. 1964. Deciduous Forests of Eastern North America (Reprint), Hafner, New York.

Buell, M. F. and Cain, R. L. 1943. "The Successional Role of Southern White Cedar, Chamaecyparis thyoides, in Southeastern North Carolina," Ecology, Vol 31, pp 567-586.

Cowardin, L. M. et al. 1979. "Classification of Wetlands and Deepwater Habitats of the U. S.," Publication FWS/OBS-79/31, U. S. Fish and Wildlife Service, Washington, D. C.

Federal Register. 1977. "Title 33 - Navigable Waters; Chapter II - Corps of Engineers, Department of the Army: Regulatory Programs of the Corps of Engineers," Vol 42, No. 138, Government Printing Office, Washington, D. C., pp 37122-37164.

Bibliography

Beal, E. O. 1977. "A Manual of Marsh and Aquatic Vascular Plants of North Carolina with Habitat Data," Technical Bulletin No. 247, North Carolina Agricultural Experiment Station, Raleigh, N. C.

Britton, N. L. and Brown, A. 1913. An Illustrated Flora of the Northern United States and Canada, 2d ed., Dover Publications, New York.

Brown, C. A. 1959. Vegetation of the Outer Banks of North Carolina, Coastal Studies Series No. 4, Louisiana State University Press, Baton Rouge.

Chapman, V. J. 1974. Salt Marshes and Salt Deserts of the World, 2d ed., Cramer, Lehre.

Coker, W. C. and Totten, H. R. 1944. Trees of the Southeastern States, University of North Carolina Press, Chapel Hill.

Cooper, A. W. 1974. "Saltmarshes," Coastal Ecological Systems of the U. S., H. T. Odum, B. J. Copeland, and E. A. McMahan, eds., Vol II, Conservation Foundation, Washington, D. C., pp 55-98.

Daiber, F. C. 1976. "Tidal Marsh Bibliography," A Delaware Sea Grant Technical Report, University of Delaware, Newark, Del.

Dawson, E. Y. 1956. How to Know the Algae, William Brown and Co., Dubuque, Iowa.

Elias, T. S. 1980. The Complete Trees of North America, Field Guide and Natural History, Van Nostrand, New York.

Eyles, D. E. and Robertson, J. L. 1944. "A Guide and Key to the Aquatic Plants of the Southeastern U. S.," Bulletin 286, U. S. Public Health Service, Washington, D. C.

Fasset, N. C. 1957. A Manual of Aquatic Plants, University of Wisconsin Press, Madison.

Fenneman, N. M. 1931. Physiography of the U. S., McGraw-Hill, New York.

_____. 1938. Physiography of the Eastern U. S., McGraw-Hill, New York.

Fernald, M. L. 1970. Gray's Manual of Botany, 8th ed., Van Nostrand, New York.

Gleason, H. A. 1952. New Britton and Brown Illustrated Flora, 3 Vols, Lancaster Press, Lancaster.

Godfrey, R. K. and Wooten, J. W. 1979. Aquatic and Wetland Plants of Southeastern States: Monocotyledons, University of Georgia Press, Athens.

_____. In Press. Aquatic and Wetland Plants of Southeastern States: Dicotyledons, University of Georgia Press, Athens.

Golet, F. C. and Larson, J. S. 1974. "Classification of Freshwater Wetlands in the Glaciated Northeast," Resourse Publication 116, U. S. Fish and Wildlife Service, Washington, D. C.

Goodwin, R. H. and Niering, W. A. 1974. "Inland Wetlands; Their Ecological Role and Environmental Status," Bulletin, Ecological Society of America, Vol 55, pp 2-6.

Hotchkiss, N. 1972. Common Marsh, Underwater, and Floating Leaved Plants of the United States and Canada, Dover Publications, New York.

Huffman, R. T. 1980. "The Relation of Flood Timing and Duration to Variation in Bottomland Hardwood Community Structure in the Ouachita River Basin of Southeastern Arkansas," Miscellaneous Paper E-80-4, U. S. Army Engineer Waterways Experiment Station, CE, Vicksburg, Miss.

Kartesz, J. T. and Kartesz, R. 1980. A Synonymized Checklist of the Vascular Flora of the United States, Canada, and Greenland, Vol II, The Biota of North America, University of North Carolina Press, Chapel Hill.

Martin, A. C., Zim, H. S., and Nelson, A. L. 1955. American Wildlife and Plants, A Guide to Wildlife Food Habits, Dover Publications, New York.

Niering, W. A. 1979. The Audubon Society Field Guide to North American Wildflowers - Eastern Region, Knopf, New York.

Peterson, R. T. and McKenny, M. 1968. A Field Guide to Wildflowers of Northeastern and North-Central North America, Houghton Mifflin, Boston.

Petrides, G. A. 1958. A Field Guide to Trees and Shrubs, The Peterson Field Guide Series, Houghton Mifflin, Boston.

Phillips, E. A. 1959. Methods of Vegetation Study, Holt, Rinehart, and Winston, New York.

Preston, R. J., Jr. 1961. North American Trees, Massachusetts Institute of Technology Press, Cambridge.

Radford, A. E., Ahles, H. E., and Bell, C. R. 1968. Manual of the Vascular Flora of the Carolinas, University of North Carolina Press, Chapel Hill.

Radford, A. E. et al. 1974. Vascular Plant Systematics, Harper and Row, New York.

Rickett, H. W. 1965. Wildflowers of the United States: The Northeastern States, McGraw-Hill, New York.

_____. 1967. Wildflowers of the United States: The Southeastern States, McGraw-Hill, New York.

Shaw, S. P. and Fredine, G. G. 1965. "Wetlands of the United States - Their Extent and Their Value to Waterfowl and Other Wildlife," Circular 39, U. S. Fish and Wildlife Service, Washington, D. C.

Silberhorn, G. M., Dawes, G. M., and Barnard, T. A., Jr. 1974. "Coastal Wetland of Virginia - Guidelines for Activities Affecting Virginia Wetlands," Special Report No. 46, Virginia Institute of Marine Science, Gloucester Point, Va.

Silberhorn, G. M. 1976. "Tidal Wetland Plants of Virginia," Educational Series No. 19, Virginia Institute of Marine Science, Gloucester Point, Va.

Small, J. K. 1933. Manual of the Southeastern Flora, University of North Carolina Press, Chapel Hill.

Stewart, R. E. and Kantrud, H. A. 1971. "Vegetation of Prairie Potholes, North Dakota, in Relation to Quality of Water and Other Environmental Factors," Professional Paper 585-D, U. S. Geological Survey, Washington, D. C.

Teal, J. M. and Teal, M. 1969. Life and Death of the Saltmarsh, Little, Brown, and Co., Boston.

Teskey, R. O. and Hinkley, T. M. 1977a. "Impact of Water Level Changes on Woody Riparian and Wetland Communities, Vol I, Plant and Soil Responses," Publication FWS/OBS-77/58, U. S. Fish and Wildlife Service, Washington, D. C.

_____. 1977b. "Impact of Water Level Changes on Woody Riparian and Wetland Communities, Vol II, The Southern Forest Region," Publication FWS/OBS-78/59, U. S. Fish and Wildlife Service, Washington, D. C.

Uhler, F. M. and Hotchkiss, N. 1968. "Vegetation and Its Succession in Marshes and Estuaries Along the South Atlantic and Gulf Coasts," Proceedings, Marsh and Estuaries Management Symposium, J. D. Newson, ed., Louisiana State University, Baton Rouge, pp 27-32.

United Nations Educational, Scientific, and Cultural Organization. 1973. "International Classification and Mapping of Vegetation," Ecology and Conservation Series No. 6.

U. S. Army Corps of Engineers. 1979. "Wetland Plants of the Eastern United States," Supplement, U. S. Army Engineer Division, North Atlantic, New York, N. Y.

U. S. Department of the Interior. 1970. National Atlas of the United States, U. S. Geological Survey, Washington, D. C.

U. S. Soil Conservation Service, Soil Survey Staff. 1975. "Soil Taxonomy: A Basic System of Soil Classification for Making and Interpreting Soil Surveys," Agriculture Handbook 436, U. S. Soil Conservation Service, Washington, D. C.

Wells, B. W. 1928. "Plant - Communities of the Coastal Plain of North Carolina and Their Successional Relations," Ecology, Vol 9, pp 230-242.

Wells, K. A. 1962. "North Carolina Wetlands; Their Distribution and Management," North Carolina Wildlife Resources Commission, Raleigh, N. C.

Wenty, W. A., Smith, R. L., and Kadlec, J. A. 1974. "State-of-the-Art Survey and Evaluation of Marsh Plant Establishment Techniques: Induced and Natural: Vol II, A Selected Annotated Bibliography on Aquatic and Marsh Plants and Their Management," Contract Report D-74-9, U. S. Army Engineer Waterways Experiment Station, CE, Vicksburg, Miss.

Whitehead, D. 1972. "Developmental and Environmental History of the Dismal Swamp," Ecological Monographs, Vol 42, pp 301-315.

Whitlow, T. H. and Harris, R. W. 1979. "Flood Tolerance in Plants: A State-of-the-Art Review," Technical Report E-79-2, U. S. Army Engineer Waterways Experiment Station, CE, Vicksburg, Miss.

Wright, A. H. and Wright, A. A. 1932. "The Habitats and Composition of the Vegetation of Okefenokee Swamp, Georgia," Ecological Monographs, Vol 2, pp 190-232.

Zoltai, S. C. et al. 1975. "Developing a Wetland Classification for Canada," Proceedings, North American Forest Soils Conference, Vol 4, pp 497-511.

APPENDIX A: COMMON AND SCIENTIFIC NAMES OF PLANTS OF THE SOUTH ATLANTIC STATES

Common/Scientific Names*

American elm
Ulmus americana L.
American lotus
Nelumbo lutea (Willd.) Pers.
Arrow arum
Peltandra virginica (L.) Kunth
Arrowhead
Sagittaria spp.
Ash
Fraxinus spp.
Aster
Aster spp.
Atlantic white cedar
Chamaecyparis thyoides (L.) B. S. P.
Bald cypress
Taxodium distichum (L.) Richard
Bamboo vine
Smilax laurifolia L.
Barnyardgrass
Echinochloa crusgalli (L.) Veauv.
Bayberry
Myrica spp.
Beak sedge
Rhynchospora chapmanii M. A. Curtis
Big cordgrass
Spartina cynosuroides (L.) Roth
Big duckweed
Spirodela polyrhiza (L.) Schleid.
Black needlerush
Juncus roemerianus Scheele
Black willow
Salix nigra Marsh.
Bladderwort
Utricularia spp.
Box elder
Acer negundo L.
Bur-reed
Sparganium spp.
Butterwort
Pinguicula spp.

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* Species names are listed alphabetically by scientific name beginning on page A7.

Buttonbush
Cephalanthus occidentalis L.
Cabbage palm
Sabal palmetto (Walt.) Lodd. ex Schultes and Schultes
Camphorweed
Pluchea purpurascens (Swartz) DC.
Cane
Arundinaria gigantea (Walt.) Muhl.
Caric-sedge
Carex albolutescens Schweinitz
Caric-sedge
Carex spp.
Cattail
Typha spp.
Chairmaker's rush
Scirpus americanus Persoon
Cinnamon fern
Osmunda cinnamomea L.
Cocklebur
Xanthium strumarium L.
Common reed
Phragmites australis (Cav.) Trin.
Coontail
Ceratophyllum demersum L.
Cutgrass
Leersia spp.
Dangleberry
Gaylussacia frondosa (L.) T. and G.
Duckweed
Lemna spp.
Eelgrass
Zostera marina L.
Elodea
Egeria densa Planch.
Fetterbush
Leucothoe axillaris (Lam.) D. Don
Fetterbush
Leucothoe racemosa (L.) Gray
Gallberry
Ilex coriacea (Pursh) Chapman
Giant foxtailgrass
Setaria magna Griseb.
Glasswort
Salicornia spp.
Goldenrod
Solidago stricta Aiton
Goosefoot
Chenopodium rubrum L.
Greenbier
Smilax spp.

Groundsel tree
Baccharis halimifolia L.
Gulf seagrass
Halophila engelmannii Asch.
Horned pondweed
Zannichellia palustris L.
Hydrilla
Hydrilla verticillata (L.f.) Caspary
Inkberry
Ilex glabra (L.) Gray
Ironwood
Carpinus caroliniana Walt.
Joint-grass
Paspalum spp.
Lambkill
Kalmia angustifolia L.
Laurel oak
Quercus laurifolia Michx.
Lizard's tail
Saururus cernuus L.
Loblolly bay
Gordonia lasianthus (L.) Ellis
Loblolly pine
Pinus taeda L.
Longleaf pine
Pinus palustris Miller
Maidencane
Panicum hemitomon Schult.
Male-berry
Lyonia ligustrina (L.) DC.
Manatee-grass
Cymodocea filiformis (Kutz.) Correll
Marsh elder
Iva frutescens L.
Marsh fern
Thelypteris palustris Schott
Mud plantain
Heteranthera reniformis R. and P.
Naiad
Najas spp.
Netted chain-fern
Woodwardia areolata (L.) Moore
Northern wild rice
Zizania aquatica L.
Old witchgrass
Panicum capillare L.
Olney threesquare
Scirpus olneyi Gray
Overcup oak
Quercus lyrata Walter

Panicgrass
Panicum ensifolium Baldwin ex Ell.
Panicgrass
Panicum longiligulatum Nash
Panicgrass
Panicum spp.
Panicgrass
Panicum wrightianum Scribner
Pawpaw
Asimina triloba (L.) Dunal
Pickerel-weed
Pontederia cordata L.
Pin oak
Quercus palustris Muenchh.
Pitcher plant
Sarracenia flava L.
Pitcher plant
Sarracenia spp.
Pond cypress
Taxodium ascendens Brongn.
Pond pine
Pinus serotina Michx.
Pondweed
Potamogeton spp.
Pumpkin ash
Fraxinus tomentosa Michx. f.
Quillwort
Isoetes spp.
Red bay
Persea borbonia (L.) Spreng.
Red cedar
Juniperus virginia L.
Red chokeberry
Sorbus arbutifolia (L.) Heynhold
Red maple
Acer rubrum L.
Redroot cyperus
Cyperus strigosus L.
River birch
Betula nigra L.
Rose mallow
Hibiscus moscheutos L.
Running oak
Quercus pumila Walter
Rush
Juncus spp.
Sago pondweed
Potamogeton pectinatus L.
Saltgrass
Distichlis spicata (L.) Greene

Saltmarsh aster
Aster tenuifolius L.
Saltmarsh bulrush
Scirpus robustus Pursh
Saltmarsh cordgrass
Spartina alterniflora Loisl.
Saltmarsh dropseed
Sporobolus virginicus (L.) Kunth
Saltmarsh fimbristylis
Fimbristylis spadicea (L.) Vahl
Saltmeadow cordgrass
Spartina patens (Ait.) Muhl.
Saltwort
Batis maritima L.
Sawgrass
Cladium jamaicense Crantz
Sea beach orach
Atriplex arenaria Nuttall
Sea blite
Suaeda linearis (Ell.) Moq.
Sea lavendar
Limonium carolinianum (Walt.) Britt.
Sea pinks
Sabatia spp.
Sea purslane
Sesuvium portulacastrum L. (L.)
Sea purslane
Sesuvium maritimum (Walt.) B. S. P.
Seashore mallow
Kosteletzkya virginica (L.) Presl
Sedge
Cyperus spp.
Sedge
Scirpus spp.
Shoal grass
Halodule beaudettei (den Hartog) den Hartog
Silver maple
Acer saccharinum L.
Skullcap
Scutellaria integrifolia L.
Slash pine
Pinux elliottii Englelm.
Slippery elm
Ulmus rubra Muhl.
Smartweed
Polygonum spp.
Soft-stem bulrush
Scirpus validus Vahl
Southern wild rice
Zizaniopsis miliacea (Michx.) Doell. and Ascherson

Spatterdock
Nuphar luteum (L.) Sibthorp and Smith
Spearscale orach
Atriplex patula L.
Sphagnum moss
Sphagnum spp.
Spicebush
Lindera benzoin (L.) Blume
Spikerush
Eleocharis obtusa (Willd.) Schultes
Spikerush
Eleocharis quadrangulata (Michx.) R. and S.
Spikesedge
Eleocharis spp.
Stagger-bush
Lyonia mariana (L.) D. Don
Stargrass
Aletris farinosa L.
Sugarberry
Celtis laevigata Willd.
Summer cypress
Kochia scoparia (L.) Schrad.
Sundew
Drosera spp.
Swamp black gum
Nyssa sylvatica Marshall var. *biflora* (Walt.) Sargent
Swamp chestnut oak
Quercus michauxii Nutt.
Swamp cottonwood
Populus heterophylla L.
Swamp privet
Forestiera acuminata (Michx.) Poir.
Sweet bay
Magnolia virginiana L.
Sweet gum
Liquidambar styraciflua L.
Switchgrass
Panicum virgatum L.
Tearthumb
Polygonum spp.
Three-square bulrush
Scirpus americanus Persoon
Titi
Cyrilla racemiflora L.
Toothachegrass
Ctenium aromaticum (Walt.) Wood
Tupelo gum
Nyssa aquatica L.
Turtle-grass
Thallassia testudinum Koenig

Tussock sedge
Carex stricta Lam.
Venus fly-trap
Dionaea muscipula Ellis
Virginia willow
Itea virginica L.
Virginia chain fern
Woodwardia virginica (L.) Smith
Walter's millet
Echinochloa walteri (Pursh) Heller
Water elm
Planera aquatica Walt.
Water hickory
Carya aquatica (Michx. f.) Nutt.
Waterhyacinth
Eichhornia crassipes (Mart.) Solms.
Water-shield
Brasenia schreberi J. F. Gmel.
Waterlily
Nymphaea odorata Aiton
Watermeal
Wolffia spp.
Watermeal
Wolffiella gladiata (Hegelm.) Hegelm.
Watermilfoil
Myriophyllum spicatum L.
Watermilfoil
Myriophyllum spp.
Wax myrtle
Myrica cerifera L.
White alder
Clethra alnifolia L.
Widgeongrass
Ruppia maritima L.
Wild celery
Vallisneria americana Michx.
Willow oak
Quercus phellos L.
Yaupon
Ilex vomitoria Ait.
Yellow-eyed grass
Xyris spp.
Zenobia
Zenobia pulverulenta (Bartram) Pollard

Scientific/Common Names

Acer negundo L.
Box elder
Acer rubrum L.
Red maple
Acer saccharinum L.
Silver maple
Aletris farinosa L.
Stargrass
Arundinaria gigantea (Walt.) Muhl.
Cane
Asimina triloba (L.) Dunal
Pawpaw
Aster spp.
Aster
Aster tenuifolius L.
Saltmarsh aster
Atriplex arenaria Nuttall
Sea beach orach
Atriplex patula L.
Spearscale orach
Baccharis halimifolia L.
Groundsel tree
Batis maritima L.
Saltwort
Betula nigra L.
River birch
Brasenia schreberi J. F. Gmel.
Water-shield
Carex albolutescens Schweinitz
Caric-sedge
Carex spp.
Caric-sedge
Carex stricta Lam.
Tussock sedge
Carpinus caroliniana Walt.
Ironwood
Carya aquatica (Michx. f.) Nutt.
Water hickory
Celtis laevigata Willd.
Sugarberry
Cephalanthus occidentalis L.
Buttonbush
Ceratophyllum demersum L.
Coontail
Chamaecyparis thyoides (L.) B. S. P.
Atlantic white cedar
Chenopodium rubrum L.
Goosefoot

Cladium jamaicense Crantz
Sawgrass
Clethra alnifolia L.
White alder
Ctenium aromaticum (Walt.) Wood
Toothachegrass
Cymodocea filiformis (Kutz.) Correll
Manatee-grass
Cyperus spp.
Sedge
Cyperus strigosus L.
Redroot cyperus
Cyrilla racemiflora L.
Titi
Dionaea muscipula Ellis
Venus fly-trap
Distichlis spicata (L.) Greene
Saltgrass
Drosera spp.
Sundew
Echinochloa crusgalli (L.) Beauv.
Barnyardgrass
Echinochloa walteri (Pursh) Heller
Walter's millet
Eichhornia crassipes (Mart.) Solms.
Waterhyacinth
Egeria densa Planch.
Elodea
Eleocharis obtusa (Willd.) Schultes
Spikerush
Eleocharis quadrangulata (Michx.) R. and S.
Spikerush
Eleocharis spp.
Spikesedge
Fimbristylis spadicea (L.) Vahl
Saltmarsh fimbristylis
Forestiera acuminata (Michx.) Poir.
Swamp privet
Fraxinus spp.
Ash
Fraxinus tomentosa Michx. f.
Pumpkin ash
Gaylussacia frondosa (L.) T. and G.
Dangleberry
Gordonia lasianthus (L.) Ellis
Loblolly bay
Halodule beaudettei (den Hartog) den Hartog
Shoal grass
Halophila engelmannii Asch.
Gulf seagrass

Pinus taeda L.
  Loblolly pine
Planera aquatica Walt.
  Water elm
Pluchea purpurascens (Swartz) DC.
  Camphorweed
Polygonum spp.
  Tearthumb or Smartweed
Pontederia cordata L.
  Pickerel-weed
Populus heterophylla L.
  Swamp cottonwood
Potamogeton pectinatus L.
  Sago pondweed
Potamogeton spp.
  Pondweed
Quercus laurifolia Michx.
  Laurel oak
Quercus lyrata Walter
  Overcup oak
Quercus michauxii Nutt.
  Swamp chestnut oak
Quercus palustris Muenchh.
  Pin oak
Quercus phellos L.
  Willow oak
Quercus pumila Walter
  Running oak
Rhynchospora chapmanii M. A. Curtis
  Beak sedge
Ruppia maritima L.
  Widgeon-grass
Sabal palmetto (Walt.) Lodd. ex Schultes and Schultes
  Cabbage palm
Sabatia spp.
  Sea pinks
Sagittaria spp.
  Arrowhead
Salicornia spp.
  Glasswort
Salix nigra Marsh
  Black willow
Sarracenia flava L.
  Pitcher plant
Sarracenia spp.
  Pitcher plant
Saururus cernuus L.
  Lizard's tail
Scirpus americanus Persoon
  Chairmaker's rush or Three-square bulrush

Heteranthera reniformis R. and P.
Mud plantain
Hibiscus moscheutos L.
Rose mallow
Hydrilla verticillata (L.F.) Caspary
Hydrilla
Ilex coriacea (Pursh) Chapman
Gallberry
Ilex glabra (L.) Gray
Inkberry
Ilex vomitoria Ait.
Yaupon
Isoetes spp.
Quillwort
Itea virginica L.
Virginia willow
Juncus roemerianus Scheele
Black needlerush
Juncus spp.
Rush
Juniperus virginiana L.
Red cedar
Kalmia angustifolia L.
Lambkill
Kochia scoparia (L.) Schrad.
Summer cypress
Kosteletzkya virginica (L.) Presl
Seashore mallow
Leersia spp.
Cutgrass
Lemna spp.
Duckweed
Leucothoe axillaris (Lam.) D. Don
Fetterbush
Leucothoe racemosa (L.) Gray
Fetterbush
Limonium carolinianum (Walt.) Britt.
Sea lavendar
Lindera benzoin (L.) Blume
Spicebush
Liquidambar styraciflua L.
Sweetgum
Lyonia ligustrina (L.) DC.
Male-berry
Lyonia mariana (L.) D. Don
Stagger-bush
Magnolia virginiana L.
Sweet bay
Myrica cerifera L.
Wax myrtle

Myrica spp.
Bayberry
Myriophyllum spicatum L.
Watermilfoil
Myriophyllum spp.
Watermilfoil
Najas spp.
Naiad
Nelumbo lutea (Willd.) Pers.
American lotus
Nuphar luteum (L.) Sibth and Sm.
Spatterdock
Nymphaea odorata Aiton
Waterlily
Nyssa aquatica L.
Tupelo gum
Nyssa sylvatica Marshall var. *biflora* (Walt.) Sargent
Swamp black gum
Osmunda cinnamomea L.
Cinnamon fern
Panicum capillare L.
Old witchgrass
Panicum ensifolium Baldwin ex Ell.
Panicgrass
Panicum hemitomon Schult.
Maidencane
Panicum longiligulatum Nash
Panicgrass
Panicum spp.
Panicgrass
Panicum virgatum L.
Switchgrass
Panicum wrightianum Scribner
Panicgrass
Paspalum spp.
Joint-grass
Peltandra virginica (L.) Kunth
Arrow arum
Persea borbonia (L.) Spreng.
Red bay
Phragmites australis (Cav.) Trin.
Common reed
Pinguicula spp.
Butterwort
Pinus elliottii Englelm.
Slash pine
Pinus palustris Miller
Longleaf pine
Pinus serotina Michx.
Pond pine

Scirpus olneyi Gray
Olney threesquare
Scirpus robustus Pursh
Saltmarsh bulrush
Scirpus spp.
Sedge
Scirpus validus Vahl
Soft-stem bulrush
Scutellaria integrifolia L.
Skullcap
Sesuvium maritimum (Walt.) B. S. P.
Sea purslane
Sesuvium portulacastrum (L.) L.
Sea purslane
Setaria magna Griseb.
Giant foxtailgrass
Smilax laurifolia L.
Bamboo vine
Smilax spp.
Greenbrier
Solidago stricta Aiton
Goldenrod
Sorbus arbutifolia (L.) Heynhold
Red chokeberry
Sparganium spp.
Bur-reed
Spartina alterniflora Loisl.
Saltmarsh cordgrass
Spartina cynosuroides (L.) Roth
Big cordgrass
Spartina patens (Ait.) Muhl.
Saltmeadow cordgrass
Sphagnum spp.
Sphagnum moss
Spirodela polyrhiza (L.) Schleid.
Big duckweed
Sporobolus virginicus (L.) Kunth
Saltmarsh dropseed
Suaeda linearis (Ell.) Moq.
Sea blite
Taxodium ascendens Brongn.
Pond cypress
Taxodium distichum (L.) Richard
Bald cypress
Thallassia testudinum Koenig
Turtle-grass
Thelypteris palustris Schott
Marsh fern
Typha spp.
Cattail

Ulmus americana L.
American elm
Ulmus rubra Muhl.
Slippery elm
Utricularia spp.
Bladderwort
Vallisneria americana Michx.
Wild celery
Wolffia spp.
Watermeal
Wolffiella gladiata (Hegelm.) Hegelm.
Watermeal
Woodwardia areolata (L.) Moore
Netted chain-fern
Woodwardia virginica (L.) Sm.
Virginia chain fern
Xanthium strumarium L.
Cocklebur
Xyris spp.
Yellow-eyed grass
Zannichellia palustris L.
Horned pondweed
Zenobia pulverulenta (Bartram) Pollard
Zenobia
Zizania aquatica L.
Northern wild rice
Zizaniopsis miliacea (Michx.) Doell and Ascherson
Southern wild rice
Zostera marina L.
Eelgrass

In accordance with letter from DAEN-RDC, DAEN-ASI dated 22 July 1977, Subject: Facsimile Catalog Cards for Laboratory Technical Publications, a facsimile catalog card in Library of Congress MARC format is reproduced below.

Preliminary guide to the onsite identification and delineation of the wetlands of the South Atlantic United States / by Robert T. Huffman ... [et al]. (Environmental Laboratory, *U.S. Army Engineer Waterways* Experiment Station). -- Vicksburg, Miss. : The Station ; Springfield, Va. : available from NTIS, 1982.
45, 14 p. ; ill. ; 27 cm. -- (Technical report ; Y-78-7)
Cover title.
"May 1982."
Final report.
"Prepared for Office, Chief of Engineers, U.S. Army."
Bibliography: p. 42-45.

1. Floodplains. 2. Hydrology. 3. Plant communities. 4. Wetlands. I. Huffman, Robert T. II. United States. Army. Corps of Engineers. Office of the Chief of Engineers. III. U.S. Army Engineer Waterways Experiment Station. Environmental Laboratory. IV. Series: Technical report (U.S. Army Engineer Waterways Experiment Station) ; Y-78-7.
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