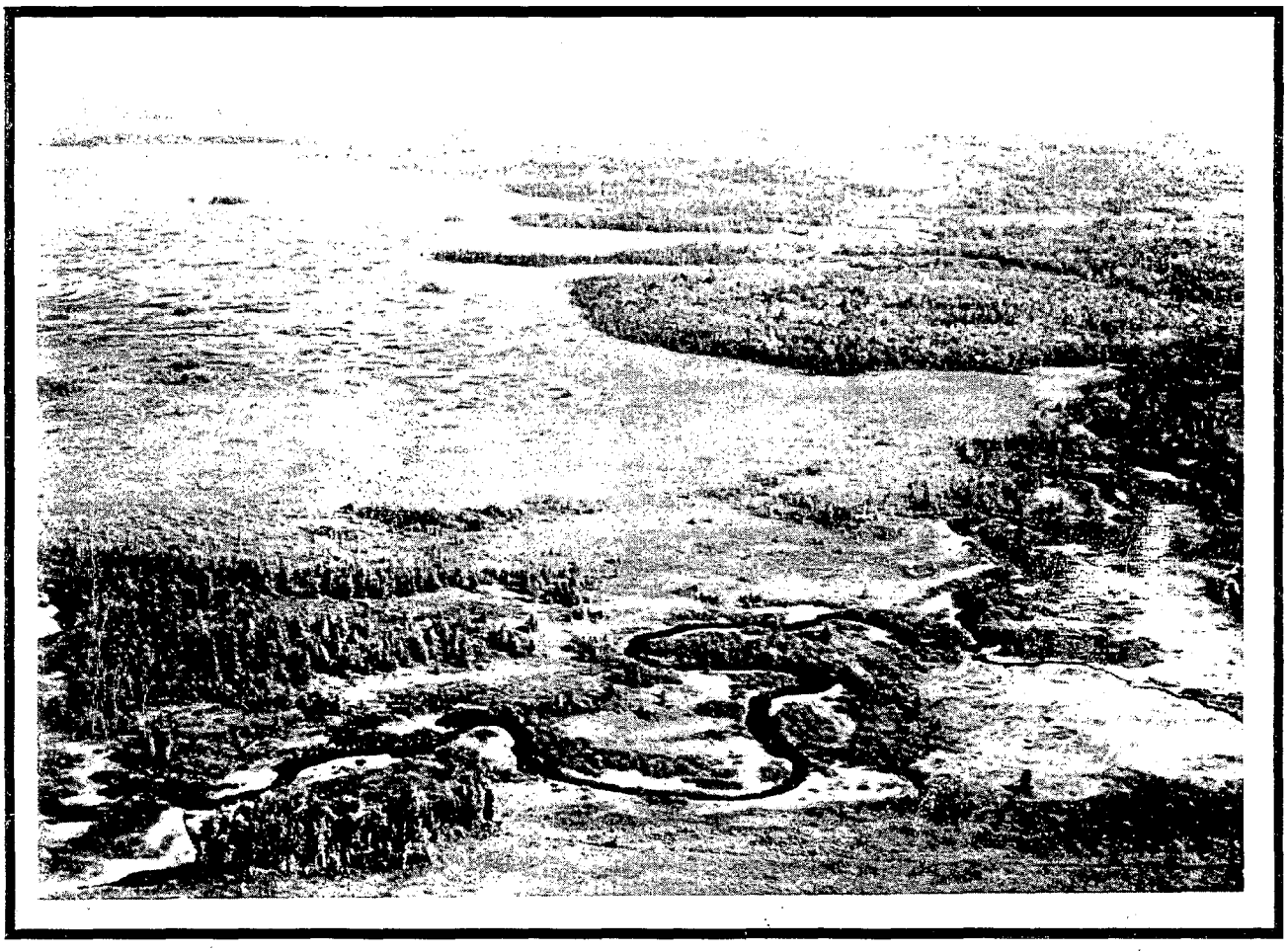
MAINE WETLANDS CONSERVATION PRIORITY PLAN



JREAU OF PARKS AND RECREATION
ATE PLANNING OFFICE
S SUBCOMMITTEE, LAND AND WATER RESOURCES COUNCIL

Widoff, Lissa.

MAINE WETLANDS CONSERVATION PRIORITY PLAN

AN ADDENDUM TO THE STATE COMPPREHENSIVE OUTDOOR RECREATION PLAN (SCORP)

Lissa Widoff

July, 1988

Maine Bureau of Parks and Recreation
Maine State Planning Office
Wetlands Subcommittee, Land and Water Resources Council

The preparation of this plan was financed in part through a planning grant from the National Park Service, Department of the Interior, under the provisions of the Land and Water Conservation Fund Act of 1965 (Public Law 88-578). The plan was also funded in part by a general appropriation to the Bureau of Parks and Recreation.

Acknowledgements

Many people contributed to various aspects of this report. The members of the Wetlands Subcommittee of the Land and Water Resources Council contributed their expertise and carefully reviewed this report. Others were contacted for assistance with information on historic losses of wetlands, as well as current losses and threats. The staff people of several state and federal agencies amicably tolerated my questioning and data gathering, and joined in the support of this report.

Specific thanks go to Ken Anderson and Gary Donovan of Maine Department of Inland Fisheries and Wildlife, Duane Scott and Bill Reid of Maine Department of Transportation, Bob Wengrzynek of the U.S. Department of Agriculture Soil Conservation Service, and Edward Zip Kellogg of the University of Southern Maine Library. Finally, thanks go to Tom Cieslinski, Cindy Bastey and Herb Hartman of the Bureau of Parks and Recreation who developed the work plan for this project, and to Jim Bernard of the Maine State Planning Office who oversaw its progress and completion and provided steady support in concept, content and editing.

Credit is due to Hank Tyler for use of the cover photo of the Great Heath in Cherryfield, Maine, one of the state's largest wetlands.

Executive Summary

Maine is 25% wetland. More than 5,000,000 acres of freshwater wetlands and approximately 160,000 acres of tidal wetlands are currently estimated to occur in Maine. The diversity of climatic and physiographic conditions in Maine accounts for the diversity of wetland types and their extent in Maine. Forested and shrub swamps are most abundant, while tidal marshes and beach systems are least abundant. Each have important natural values and the latter are crucial for the survival of many species of migratory birds. Other wetland types in Maine include mudflats and rocky shores, freshwater marshes, bogs and fens, floodplain wetlands and other seasonally flooded flats or basins with wetland vegetation and/or soils, according to the U.S. Fish and Wildlife Service definition of wetland.

Wetlands have many natural and cultural values and provide many important functions such as fish, wildlife and endangered species habitat; flood control, nutrient retention and sediment trapping; production of timber and other natural resources; and recreation, education and research, and use as natural areas. The "critical edge" or wetland-upland transition zone is extremely important for wildlife, providing a buffer protecting the wetland from indirect or secondary impacts, such as pollution.

Existing wetland inventories give only a partial indication of the extent and type of wetlands in Maine. Inventories have used different wetland definitions and classifications, size criteria for inclusion and inventory methodologies. Though a number of wetland inventories exist in Maine, there is a critical lack of a single comprehensive wetland mapping system that could be used for regulatory, planning and management purposes. The absence of a complete mapping or inventory system not only precludes the determination of current extent and location of wetlands, it makes wetland losses and other trends impossible to monitor.

Historically, 1-2% of Maine's original **vegetated** wetland acreage has been lost or converted to other uses. There has also been a net gain in open water wetland areas, although extent of this is not well recorded. Some restoration and mitigation projects have resulted in the creation of some vegetated coastal and inland wetland areas, but their replacement value for wildlife or other functions is not well known.

When wetlands are altered or destroyed for various kinds of development, maintenance and operating costs are generally higher than wisely developed upland sites. There are more environmental and socioeconomic costs associated with wetland alterations that must be considered, since these costs will inevitably be passed on to the consumer.

Alterations which result in outright wetland loss include filling, dredging and draining. Losses of wetland function and value are far more difficult to measure, but are just as serious and in fact more widespread. Important here is the loss of riparian or buffer areas adjacent to wetlands which are crucial for preserving the integrity of wetland functions and values. The conversion of land use around a wetland can also alter or destroy the natural values or integrity of a wetland.

The filling of wetlands has occurred throughout Maine's history of settlement as these "wastelands" were "improved" for residential and commercial development. Agricultural activities have converted vegetation types and when located in or near floodplains may have reduced some natural flood control features. Other wetland values have been lost or reduced, even thought the area may still be classified as wetland. Dam construction has created open water habitats while often flooding vegetated wetland types.

Currently, wetland losses are greatest in smaller wetlands in rapidly developing areas of the state, e.g. southern York County, south coastal areas and other high-growth urban centers. Coastal salt marshes are experiencing the greatest threats from fringing development, whereas inland

wetlands, especially smaller ones, are being filled. While the values of individual small wetlands may not be great, they are extremely important within a larger landscape context. The cumulative loss of many small wetlands via development activities may be just as severe as the loss of a smaller number of large wetlands when habitat and cultural values are considered.

Inconsistency between state and federal wetland laws, in terms of differing definitions, size of wetland regulated and exemptions, has complicated matters for developers and regulators alike. Within Maine, different agencies of state government have different mandates, (e.g. DEP regulates activities in wetlands to preserve their functions and MDOT is required to build safe roads for the public, which may include filling wetlands). Nationally, there are similar conflicting mandates, but these are being merged into a more unified policy in favor of stronger wetland protection.

Enforcement and implementation of regulatory wetland protection programs varies at all levels - federal, state and local - and are generally outpaced by the current rate of wetland alterations. Many wetland alterations are inadequately regulated, especially developments on smaller wetlands and the cumulative impacts on specific wetlands or wetland complexes. Regulation is ineffective in evaluating how seriously or permanently an alteration impairs wetland functions. It is unknown to what extent certain wetland functions are being lost by what degree of alteration.

Many losses of wetland function and value are attributed to activities in upland areas immediately adjacent to wetlands, (e.g. housing and industrial development, landfills). Most regulatory programs deal with the wetland itself and not specific activities on adjacent lands that could adversely affect the wetland indirectly. Regulation may not stop development from occurring near wetlands; however, non-regulatory initiatives (designation, registry, easements, etc.) may provide important opportunities to address problems created by adjacent and upland developments that affect wetlands.

Acquisition is often the only means to ensure the long-term protection of certain high-value wetlands and their component species. Permanent protection is also required for buffer areas around these high priority wetlands, to avert the potential for secondary impacts upon protected wetlands. Although the state and private entities have already protected some important wetlands, there are still acquisition needs which have not been met. There is agreement within the conservation community, wildlife biologists and natural area managers, that wetland acquisition is a high priority for Maine. The potential for wetlands as educational resources has scarcely been developed in the state, and may be contributing to any lack of understanding of the biological and cultural importance of these ecosystems.

TABLE OF CONTENTS

LIST OF TABLES

```
  OCLC:  23464398          Rec stat:    n
  Entered:    19890324     Replaced:    19950602     Used:    19910412
$ Type: a        Bib lvl: m        Source:          Lang:  eng
  Repr:          Enc lvl:          Conf pub: 0      Ctry:  meu
  Indx: 0        Mod rec:          Govt pub: s      Cont:  b
  Desc: a        Int lvl:          Festschr: 0      Illus: a
                 F/B:     0        Dat tp:   s      Dates: 1988,     %
$   1  010     89-620337 %
$   2  040     DLC 'c DLC %
$   3  043     n-us-me %
$   4  050 00  QH76.5.M2 'b W5 1988 %
$   5  082 00  333.91/816/09741 '2 20 %
$   6  090     'b  %
$   7  049     NOQM %
$   8  100 1   Widoff, Lissa. %
$   9  245 10  Maine wetlands conservation priority plan : 'b an addendum to
the state comprehensive outdoor recreation plan (SCORP) / 'c Lissa Widoff. %
$  10  260     [Augusta] : 'b Maine Bureau of Parks and Recreation, Maine State
Planning Office, Wetlands Subcommittee, Land and Water Resources Council, 'c
[1988] %
$  11  300     91, 26 p. : 'b ill. ; 'c 28 cm. %
$  12  500     "July 1988." %
$  13  504     Includes bibliographical references. %
$  14  650  0  Wetland conservation 'z Maine. %
$  15  650  0  Wetlands 'z Maine. %
$  16  710 2   Maine Land and Water Resources Council. %
```

1994

LIST OF FIGURES

CHAPTER 1 - INTRODUCTION AND SCOPE

The **Emergency Wetlands Resources Act of 1986 (Appendix I)** was enacted by the U.S. Congress to promote wetland conservation in order to maintain the public benefits they provide, as well as help fulfill international obligations contained in various migratory bird treaties and conventions. A broad variety of measures are specifically outlined in the Act to protect wetlands and curb wetland losses. **The Act amends the Land and Water Conservation Fund (LWCF) Act to:**

(1) Eliminate the restriction on acquiring migratory waterfowl areas;

(2) Require that State Comprehensive Outdoor Recreation Plans (SCORPs) specifically address wetlands as important outdoor recreation resources; and

(3) Qualify wetlands as suitable replacement lands for LWCF lands converted to other uses.

In addition, the Act requires the Department of the Interior to establish a **National Wetlands Priority Conservation Plan** (NWPCP) specifying the types of and interests in wetlands, to be given priority for federal and state acquisition. The NWPCP provides the basic policy framework for the various wetland protection efforts underway by different federal agencies.

The **Maine Wetlands Conservation Priority Plan** is an addendum to the Maine SCORP, satisfying the requirement for a wetlands component as outlined in (2) above. This Plan addresses the types and distribution of wetlands in Maine based on available data from existing inventories and assessments. No new data was collected. Estimates of historic wetland losses and analysis of future threats have been addressed. Existing wetland protection programs were evaluated including regulatory, acquisition and registration/designation programs administered at the state and federal levels. The natural functions and values of wetlands in Maine are outlined with special reference to impending threats and losses in quality and function. These considerations have been coalesced into recommendations for wetland acquisition priorities for the state. A set of criteria has been developed in consultation with various state agencies and experts that will provide a framework for wetlands later proposed for acquisition.

This report will serve a dual function by fulfilling the state requirement to the National Park Service and a background document to coordinate future state wetland policy development. The Land and Water Resources Council approved the broad approach to be taken in the preparation of this report. The recommendations proposed at the end of the report include some which are applicable to in-state interests only.

The U.S. Fish and Wildlife Service is simultaneously developing a State Wetlands Concept Plan which will be consistent with this wetland component of SCORP and outline site-specific wetland acquisition priorities for the Service. The State Concept Plan is produced by the U.S. Fish and Wildlife Service in Concord, New Hampshire and will drive their protection efforts.

The net result of these different programs is that for many federally funded land acquisition programs, states must fully and cooperatively address the diverse interests in wetlands protection before they can remain eligible for these funds. Similarly, the U.S. Fish and Wildlife Service must demonstrate consistency with state wetland protection priorities.

In Maine, a subcommittee of the Land and Water Resources Council was established to provide guidance and oversight of this effort to articulate a unified interest in a coordinated wetlands protection effort. Many unresolved issues remain, yet the unequivocal importance of wetlands in the Maine landscape, both culturally and biologically, was supported by all participants.

The members of the Wetlands Subcommittee of the Land and Water Resources Council are:

James Bernard	State Planning Office
Ken Anderson	Department of Inland Fisheries and Wildlife
Gary Donovan	Department of Inland Fisheries and Wildlife
John Williams	Maine Geological Survey
Tom Cieslinski	Bureau of Parks and Recreation
Hollis Tedford	Bureau of Public Lands
Walter Foster	Department of Marine Resources
Frank Ricker	Department of Agriculture, Food and Rural Resources
Duane Scott	Department of Transportation
William Reid	Department of Transportation
Judy Dorsey	Maine Audubon Society
Bob Wengrzynek	U. S. D. A. Soil Conservation Service
Don Witherill	Department of Environmental Protection
John Albright	The Nature Conservancy
Dr. Ronald Davis	University of Maine

CHAPTER 2 - ROLES AND RESPONSIBILITIES

Many state agencies and departments retain some control or interest in activities relating to the use and protection of Maine's wetlands resources. Responsibilities include the mapping of resources, the regulation of development activities, management of wildlife habitat, the designation of wetlands as natural areas, wetlands as recreation resources, and even wetlands as economic resources. The involvement of each of the state agencies in wetlands will be described in later chapters as appropriate and is summarized here.

Maine Department of Conservation

Maine Geological Survey - Responsible for mapping efforts including wetlands, distribution and sale of wetland maps, identification of peat resources and other wetland inventory efforts both geological and ecological.

Maine Bureau of Parks and Recreation - Owns and manages over 2000 acres of wetland habitats.

Maine Bureau of Public Lands - Owns and manages over 14,000 acres of wetland habitats.

Maine Land Use Regulation Commission - Responsible for regulation and monitoring land use activities in the unorganized territories of Maine.

Maine Department of Environmental Protection

Bureau of Land Quality Control - Regulates several land use laws that pertain to wetlands both directly and indirectly. Laws include Site Location of Development Law, Natural Resources Protection Act (coastal wetlands, freshwater wetlands, streamside and lakeside wetlands) and the Rivers Act.

Bureau of Water Quality Control - Regulates activities resulting in the discharge of pollutants into water bodies and wetlands.

Bureau of Oil and Hazardous Materials - Regulates and monitors the disposal of hazardous materials into the environment, including the remediation of unauthorized activities. Responsible for the identification of hazardous waste sites, some of which include wetlands.

Maine Department of Marine Resources - Responsible for the management and protection of commercial marine resources including fish and shellfish habitats, and intertidal areas.

Maine Department of Inland Fisheries and Wildlife - The Department's mandate is to preserve, protect and enhance the inland fisheries and wildlife resources of the state; to encourage the wise use of these resources; to ensure coordinated planning for the future use and preservation of these resources; and to provide for effective management of these resources. The Department currently manages over 16,000 acres of wetlands, and has programs in place to purchase additional areas.

Maine State Planning Office - Responsible for coordinating policy and planning efforts of natural resources agencies through the Land and Water Resources Council and through special projects.

CHAPTER 3 - THE DISTRIBUTION OF WETLANDS IN MAINE

Maine, with its variegated coastline and topography shaped by glaciation, has been endowed with a diversity of wetlands unmatched in the northeast exclusive of Canada. Maine has four times the wetland area of all New England states combined based on state and national wetland inventories, and 63% of the wetland area of New England based on hydric soil types (Tiner and Venneman, 1987). In most cases, hydric soils harbor wetland vegetation and communities. The wetland area of Maine is nearly equivalent in area to the state of Massachusetts. Maine also has the greatest percentage of its land area in wetland compared to other New England States.

Table 3.1. Estimated wetland area of New England

a) Based on national and state wetland inventories.

STATE	Wetland Area	Percent of State's Land Area
Maine	5,160,000	25
New Hampshire	95,000	2
Vermont	220,000	4
Massachusetts	587,000	10
Rhode Island	65,000	10
Connecticut	418,000	14
TOTAL	6,545,000	

b) Based on extent of hydric soils (Tiner and Venneman, 1987)

STATE	Area of Hydric Soil	Percent of State's Land Area
Maine	6,460,000	32.6
New Hampshire	983,000	17.2
Vermont	1,395,000	24.7
Massachusetts	818,000	16.5
Rhode Island	112,000	16.6
Connecticut	438,000	14.1
TOTAL	10,206,000	

The diversity of wetland types found in Maine is a result of many physical, climatic, and biological factors. The maritime influence of a cooler climate, glaciated landscapes and poor soil drainage conditions have contributed to the extent and character of Maine's wetlands. The salt marsh systems of the southern Maine coast and inland bogs, marshes and swamps are some of the general types of wetlands found in Maine.

THE ORIGIN OF WETLANDS IN MAINE

To aid in understanding the diversity of wetland types in Maine, the conditions of wetland formation are discussed here. The glaciers which covered Maine until approximately 13,000 years ago left a cool, moist and saturated landscape as they retreated. The weight of the ice and the volume of melting water caused the sea to inundate coastal Maine and inland areas along some of the major river valleys (Stuiver and Borns, 1975). Water filled depressions lined with impermeable marine clays left by the transgressing sea. Other areas remained saturated. These poorly drained areas gave rise to the extensive wetland areas seen in Maine today. In other cases, wetlands formed where a flooding regime was established, or where drainage along a slope favored wetland vegetation.

The cool climate also favored the growth of many wetland plants. Shallow ponds gradually filled with the remains of plant materials and gave rise to a succession of plant communities that continued to thrive and maintain the waterlogged conditions in which they grew. Peatlands (bogs and fens) are widespread in Maine, and contain deposits of undecomposed plant material known as peat, often several meters thick (Cameron et al., 1984; Davis et al., 1983; Tolonen et al., in press). In areas with better, but slow drainage patterns, shallower peat deposits formed. Peat deposits generally accumulate vertically because organic matter is deposited in a confined area. In many cases, however, peatland has been shown to spread laterally over adjacent mineral soils under suitable climatic conditions (Davis et al., in prep; Sorenson, 1986).

Salt marshes are similar to peatlands in that they are aggrading environments, (i.e. ones which accumulate sediment and continue to "grow" over time). As Maine's coastline moved seaward, salt marsh communities followed, retaining their proximity to the tidal influence on which they depend. Hence, in contrast to peat deposits, salt marsh sediment accumulation (which also contains substantial amounts of peat) tends to occur along a diagonal slope below ground.

Where ponds and lakes formed that were fed by groundwater or surface runoff, wetland vegetation became established along the edges or in calm coves. The rate of renewal of the volume of water in the basin and the configuration of the shoreline are two possible determinants of whether wetland vegetation invades and to what degree.

In general, natural wetlands exist because of saturated soil conditions, a regular flooding regime, impoundment, or seepage, and these conditions have their origin in Maine's glacial history. Even areas that were not covered by ice received meltwater or prolonged flooding or saturation during post-glacial periods. The diversity of wetland types found in Maine reflects the composite assemblage of plants and animals which have adapted to a given set of conditions over millennia.

MAJOR WETLAND TYPES

The wetland types which will be discussed throughout this report fall into a few broad categories. Freshwater wetlands include marshes, swamps and peatlands (bogs and fens). These may be isolated wetlands or associated with water bodies such as streams, lakes or ponds. Coastal wetlands include salt marshes, intertidal flats, rocky shores and other tidal marshes with varying salinity (brackish, fresh/brackish, etc.).

In the Emergency Wetlands Resources Act, "wetland" means land that has a predominance of hydric soils and that is inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances does support, a prevalence of hydrophytic vegetation typically adapted for life in saturated soil conditions. It is implied here that an area must have <u>all</u> these characteristics to be considered a wetland, and is consistent with the

Army Corps of Engineers wetland definition (33 CFR 328.3(b)) employed in the regulation of the discharge of dredged or fill material into wetlands under the Section 404 Program of the Clean Water Act.

The U.S. Fish and Wildlife Service defines wetlands for their classification system as:

> "lands transitional between terrestrial and aquatic systems where the water table is usually at or near the surface or the land is covered by shallow water. Wetlands must have one or more of the following three attributes: (1) at least periodically, the land supports predominantly hydrophytes, (2) the substrate is predominantly undrained hydric soil, and (3) the substrate is non-soil and is saturated with water at some time during the growing season of the year.
>
> The term wetland includes a variety of areas that fall into one of five categories: (1) areas with hydrophytes and hydric soils, such as those commonly known as marshes, swamps and bogs; (2) area without hydrophytes but with hydric soils-for example, flats where drastic fluctuations in water level, wave action, turbidity, or high concentration of salts may prevent the growth of hydrophytes; (3) areas with hydrophytes but nonhydric soils, such as margins of impoundments or excavations where hydrophytes have become established but hydric soils have not yet developed; (4) areas without soils but with hydrophytes such as the seaweed-covered portions of rocky shores; and (5) wetlands without soil and without hydrophytes, such as gravel beaches or rocky shores without vegetation." (Cowardin et al., 1979).

In the U.S. Fish and Wildlife classification, deepwater (or aquatic) habitats are those permanently flooded lands lying below the deepwater boundary of wetlands and are classified separately from wetlands as described above. Wetlands and deepwater habitats may be within each of the five major Systems defined in the classification: Marine, Estuarine, Riverine, Lacustrine, and Palustrine. The Palustrine by definition includes all freshwater wetlands. Wetlands are associated at the margins of deepwater habitats of all other systems.

For the purposes of this report, it is the U.S. Fish and Wildlife Service definition of wetlands that is used in discussions of wetlands. Although deepwater habitats are classified in most wetland inventories, later discussions on extent, distribution and threats and losses will not include these. Furthermore, this definition of wetland is a biological one and not limited to legal definition of wetlands which are included in particular laws or programs. The wetland classification system used by the Maine Wetland Inventory is given in **Appendix II** and that used by the U.S. Fish and Wildlife Service is given in **Appendix III**.

Each of the wetland types found in Maine is represented by a variety of plant associations or natural communities and is affected by several variables such as geographic location (or location within an "ecoregion"), proximity to the coast, bedrock and surficial geology, drainage, flood regime, etc. These variables will be briefly described here.

The geographic location of a wetland will influence its species composition. Wetlands in northern Maine share a closer affinity in species composition with Canadian, or boreal systems. For example, fens in northernmost and northwestern Maine have vegetation and surface features that classify them as "ribbed fens" or "string bogs", such as those in adjacent Canada. Bogs are abundant throughout Maine, with different types characteristic of different parts of the state with

overlap between them (Davis et al., in prep.). Coastal plateau bogs are restricted to the extreme eastern portion of the Maine coast in Washington and Hancock Counties (Worley, 1980, Damman, 1979). Distinctly "domed" bogs are apparently only found in central and eastern Maine, whereas other types, such as kettlehole bogs are found throughout the state.

Conversely, wetlands in southern Maine may contain species which are more common further south and reach the northern limit of their distribution in Maine. One example is Atlantic White Cedar (Chamaecyparis thyoides) which occurs in southern Maine swamps and peatlands, occasionally with tupelo (Nyssa sylvatica), another species of southern affinity. Along with these rare occurrences of plant species, associated organisms may likewise be found and similarly uncommon. One example is the butterfly Hessel's hairstreak (Mitoura hesseli) which is associated with Atlantic White Cedar wetlands to the south, and recently discovered for the first time in Saco Heath, a raised bog with Atlantic White Cedar in southern Maine (Maine Natural Heritage Data Base, 1987).

The proximity to the coast and tidal influence is another distinguishing factor for many wetlands, especially marshes. Saline or salt marshes are those regularly flooded by the tides. Other tidal marshes are also associated with freshwater systems, such as rivers, and the mixing of saline and fresh water in wetland systems will affect species composition. Saltwater influence diminishes inland from the coast, with a corresponding change in vegetation. Exposed flats are also affected by differing salinity in terms of species composition. The flora of brackish and fresh/brackish intertidal mudflats include several species which are considered rare in Maine. In addition, brackish wetlands associated with water bodies near the coast, such as Merrymeeting Bay, are also important for nesting and feeding waterfowl.

The chemical nature of the bedrock or surficial deposits associated with wetlands may affect the water chemistry and hence the vegetation composition of the wetland. Since most of the subsurface geology in Maine is acidic in nature, there are often similar species between similar wetland types. However, in a few areas in Maine, water passing through calcareous (lime-rich) sediments may enrich a wetland and encourage the growth of a number of lime-loving plants considered rare in Maine, primarily due to the scarcity of these environmental conditions. This condition is found in several "calcareous fens", i.e. shallow groundwater-fed peatlands, primarily restricted to a small region in northeastern Aroostook County. Elsewhere, calcareous sediments along rivershores, such as the St. John River, harbor a unique association of plants, including the federally endangered St. John River endemic, Furbish's Lousewort (Pedicularis furbishiae).

The kind of drainage in a wetland is another determinant of the type of wetland or the vegetation composition. Most wetlands are in low-lying areas, and are often catch basins for the associated watershed. Some wetlands may be in a stagnant basin with no outflow. Water levels may fluctuate with spring runoff and ensuing evapotranspiration, yet may stay saturated all year and be inhabited by a suite of species adapted to these conditions. Wetlands may also be in seepage areas, where water moves through the system at a regular rate, providing a steady influx of water, oxygen and nutrients and a natural flushing away of biological waste products. Seepage wetlands may also remain saturated all year, but do not become stagnant.

Finally, the vegetation structure imparts a primary distinguishing factor between wetlands. Wetlands may be forested or shrub-dominated (swamp), grass or sedge-dominated (marsh), heath shrub- and moss-dominated (bog) or non-vegetated (mudflat), or a combination of these. It is the vegetation structure as well as composition which has a bearing on the presence of particular animal species at a wetland. Diversity of species and structure contributes to the diversity of animal communities present.

The water regime or flood regime is an important factor in the distribution of wetlands in the state. Many wetlands are associated with water bodies which flood seasonally, or at least periodically. Inundation of the wetland provides the enrichment necessary for plant growth. In Maine, floodplain wetlands are most common along broad and flat river and stream valley systems. Floodplain vegetation may vary regionally or locally from silver maple floodplain forests to alder-lined stream banks, to sparsely vegetated cobble shores to sedge and rush-dominated marshes along slow moving streams. Physical and topographical conditions influence the vegetation structure and composition, forming many different kinds of floodplain plant communities. Historically, floodplain soils with higher mineral soil content have been more vulnerable to development.

WETLAND INVENTORIES

Overview

A number of different wetland inventories have been conducted in Maine, each with its own purpose, using different wetland definitions, classification, and methodology. None of these are comprehensive for all wetland types on a statewide basis, except for the Maine Wetlands Inventory (MWI) of the Maine Department of Inland Fisheries and Wildlife (MDIFW), which provides a usable classification scheme and a statewide approach for use as baseline for comparison of wetlands data in the state.

All existing wetland inventories have been evaluated for their usefulness to SCORP, particularly as they may provide accurate acreage estimates for wetland types statewide and regionally. A comparison of different wetland inventories is given in **Table 3.2.** Since most inventories focus on one region or group of wetland types, different sources may be used for the best estimates of each type. As justification for this approach, a chronology of wetland inventories is presented here.

The Maine Wetland Inventory (MWI)

In 1954, the U.S. Fish and Wildlife Service (USFWS), through its Office of River Basin Studies, conducted the first inventory of wetlands in Maine (USDI, 1954). At that time there was the first inkling of nationwide recognition of wetlands as important resources, particularly for their value as waterfowl habitat. To avert potential losses, selected wetlands >40 acres in size were selected by MDIFW staff and typed by the USFWS using aerial photo analysis. These were then surveyed on the ground and rated for their value to waterfowl (high-medium-low).

The study results have shown that Maine wetlands were not seriously threatened at that time, although wetland "development" to enhance waterfowl productivity was encouraged. Although 2/3 of the wetlands inventoried occurred in inland Maine, it was recognized then as now, that the coastal region contains the highest proportion of high value wetlands, especially true because of the tidal mudflats and marshes which host migratory and wintering shorebirds and waterfowl and sustain commercial shellfish production.

A companion study to this followed in 1959, in which permanent water areas in Maine >10 acres were surveyed. This study found a greater abundance of coastal saline areas than inland fresh areas that were significant to migratory waterfowl (USFWS, 1959). Then in the 1960's, MDIFW, also recognizing the importance of various wetland habitats to waterfowl, began the Maine Wetland Inventory (MWI). The purpose of the inventory was to locate and evaluate existing and potential wetlands in the state, especially those suitable as habitat for breeding waterfowl (McCall, 1972). For approximately ten years (1963-1973) data was collected on wetlands at least ten acres in size and entered into the MWI computerized data base. Information such as type, location, habitat value, etc. is computerized for each wetland entry, allowing the data base to still serve as a primary management tool for the Department. Wetlands were also identified by major and minor watershed. Thirteen major river drainage systems comprising 129 minor watersheds form the basic unit of organization of the maps and data base.

Table 3.2. Comparison of Wetland Inventories in Maine

PARAMETERS	SMI	PRI	FWI	NWI	MCI	MWI(1972)	MWI(1954)
Date completed	1987	1984	1983	1980	1977	1972	1954
Duration	1 yr.	5 yrs.	6 mo.	5 yrs.	5 yrs.	10 yrs	
Lead Agency	UMO/MGS	MGS	MGS/DEP	USFWS	SPO	MDIFW	USFWS
Base Map Scale	1:24,000	1:24,000 (in prep.)	1:50,000	1:24,000, 1:64,000, 1:100,000	1:48,000	1: 125,000 1:62,500	1: 125,000
Minimum wetland Size	150m2	80 ac.	10 ac.	3-5 ac.	5 ac./20 ac.	10 ac.	40 ac.
Classification System	Timson, 1977	Cameron, 1984	none	Cowardin et al., 1979	general	Martin et al., 1953	Martin et al., 1953
Number of Types Identified	1 (salt marsh)	1 (Bogs)	-	several	-	14	14
Methods	planimetry	aerial photo	aerial photo	aerial photo	aerial photo,1966	A.P. and Field Chk.	A.P. and F.C.
Photo Scale	-	1:20,000	1:40,000	1:80,000		1:1320	
Regional Coverage	coastal	statewide	organized towns	coastal	coastal	statewide	statewide
Acreage Data	Yes	Yes	Yes (partial)	Yes	No	Yes	Yes
Useful for SCORP	Yes	No	Yes	Yes	No	Yes	No

KEY: SMI=Salt Marsh Inventory (Jacbson et al., 1987); PRI=Maine Peat Resource Inventory (Cameron et al., 1984); FWI=Maine Freshwater Wetland Inventory (MGS,1985); NWI=National Wetland Inventory (USFWS,1980); MCI=Maine Coastal Inventory; MWI= Maine Wetland Inventory (MDIFW).

Although all wetland types were documented in the inventory (including open water wetlands), only their suitability or potential as waterfowl breeding habitat was evaluated. Today, MDIFW ground surveys are reviewing more than just waterfowl habitat, recognizing that all wetland types have various wildlife values (G. Donovan, K. Anderson, pers. communication; Jones et al., 1988). At present, **nearly 1.8 million** acres of wetland comprise the MWI database, and updates are incorporated incidental to ongoing work (**Table 3.3**). The distribution of wetland types included in the current Maine Wetland Inventory is illustrated in **Figures 3.1, 3.2** and **3.3**.

Table 3.3 TOTAL MAINE WETLAND INVENTORY COVERAGE BY TYPE:

TYPE	# ACRES	# WETLANDS
Flat/Basin	10,249	126
Fresh Meadow	58,772	1295
Fresh Marsh	57,602	9431
Open Fresh Water	**913,003**	**4224**
Shrub Swamp	208,342	5559
Wooded Swamp	279,599	5239
Bog	168,895	2265
Coastal Fresh Marsh	11,399	27
Coastal Open Fresh Water	1,462	5
Salt Marsh	16,917	140
Sound or Bay (mudflat)	56,689	not determined
Unknown	1,853	15
TOTALS	**1,781,798**	**19,848**

The MWI is the only statewide inventory which has catalogued acreage of individual wetlands by type and county, and is therefore a useful frame of reference with other inventories (**Table 3.4**). **Figure 3.4** illustrates the extent of wetland in each county as a percent of the total area in the county, based on MWI data. **Figure 3.5** portrays the proportion of the total state wetland area found in each county. While Penobscot, Hancock and Washington Counties all have higher percentages of their county area in wetland, nearly half of the state's wetland area is found in Aroostook, Piscataquis and Penobscot Counties combined.

The classification system used by the MWI (Martin et. al., 1953) was a widely used system, and is a precursor to the current USFWS Classification of Wetlands and Deepwater Habitats of the United States in **Appendix III** (Cowardin et al., 1979). **Appendix IV** provides a direct comparison between these two systems.

Other wetland inventories and researchers have used segments of the MWI data base to review distribution of a particular wetland type, correlate data or determine ownership or land use patterns (Davis et al., 1983; Reed and D'Andrea, 1973).

Figure 3.1. Distribution of Inland Wetland Types in Maine by County According to Maine Wetland Inventory Data

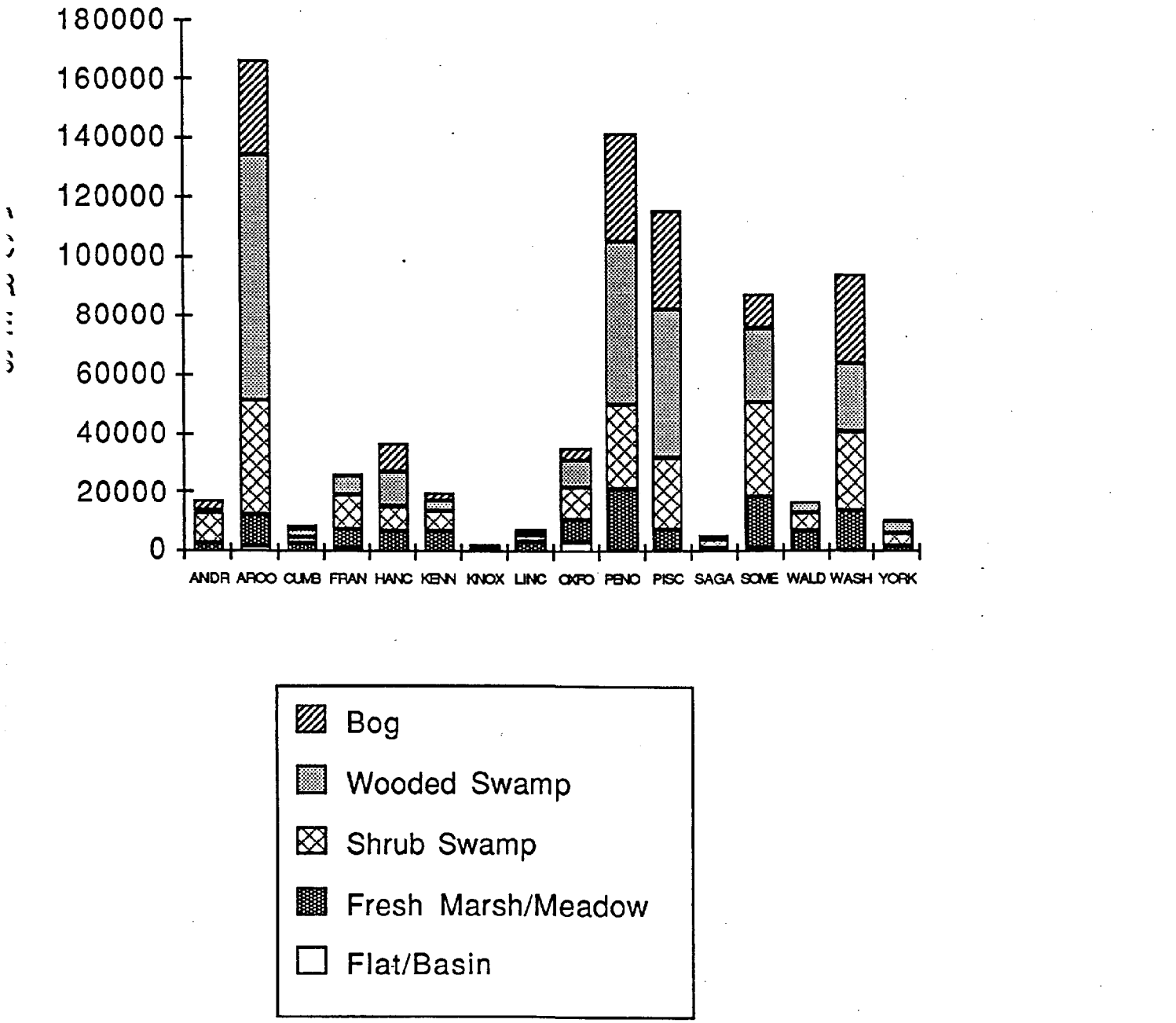


Figure 3.2. Distribution of Open Fresh Water Wetlands in Maine By County According to Maine Wetland Inventory Data

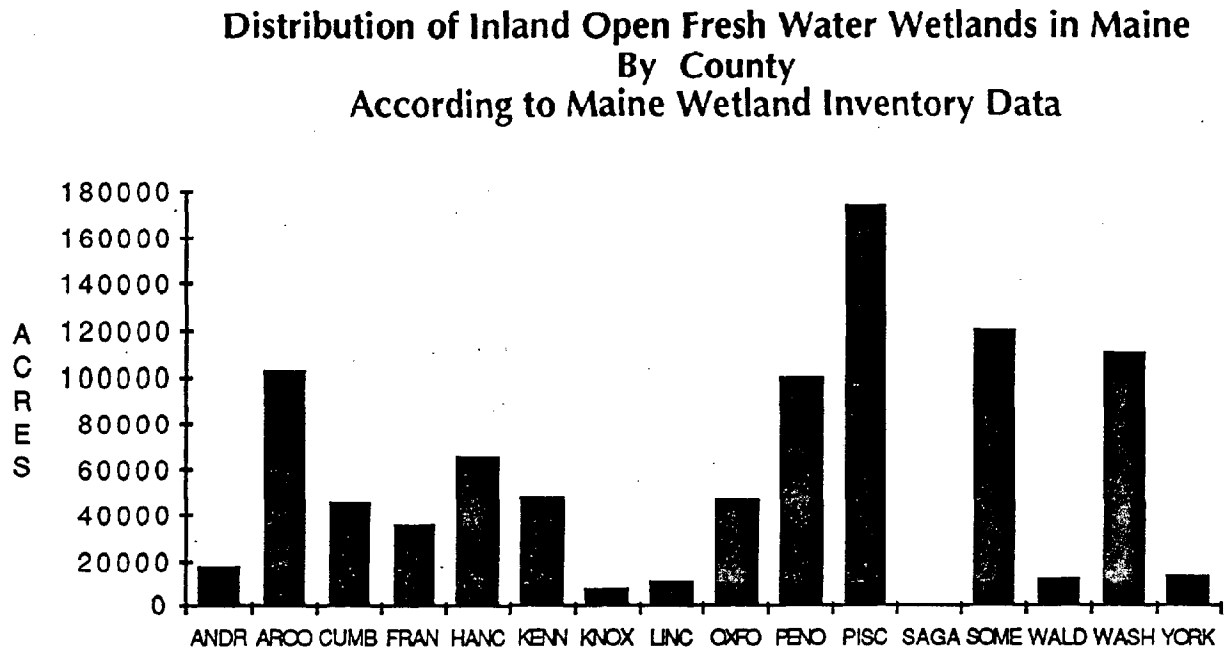


Figure 3.3. Distribution of Coastal Wetland Types in Maine by County According to Maine Wetland Inventory Data (excluding mudflats)

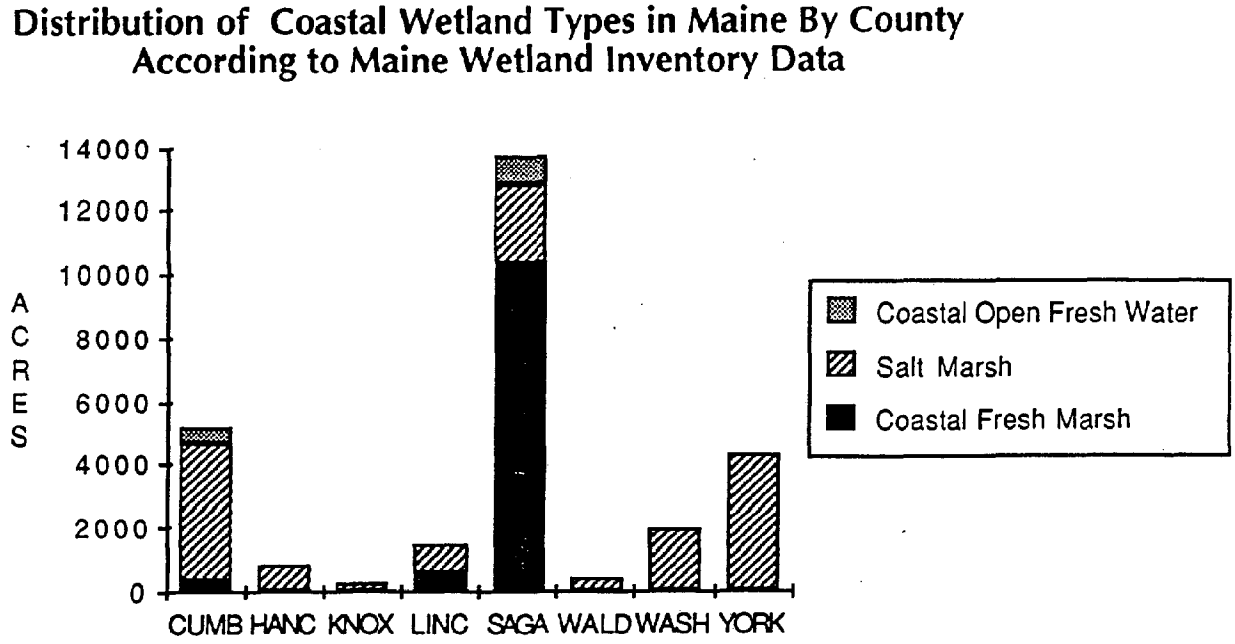


Table 3.4. Maine Wetland Inventory Coverage in Acres by Type and County

COUNTY	Flat/ Basin	Fresh Meadow	Fresh Marsh	Open Fresh Water
ANDROSCOGGIN	0	2782	1060	17310
AROOSTOOK	1901	3483	6907	102469
CUMBERLAND	59	1622	903	45349
FRANKLIN	1574	3878	1921	36011
HANCOCK	53	2961	3658	65505
KENNEBEC	0	602	6385	48281
KNOX	0	401	660	7445
LINCOLN	0	2202	1332	10918
OXFORD	3387	2910	4416	47349
PENOBSCOT	673	16003	4799	100702
PISCATAQUIS	967	2012	4548	173980
SAGADAHOC	0	1025	152	817
SOMERSET	1320	7953	9141	120866
WALDO	0	2648	4077	11665
WASHINGTON	315	7455	6003	110784
YORK	0	835	1140	13552
Total	10249	58772	57602	913003

COUNTY	Shrub Swamp	Wooded Swamp	Bog
ANDROSCOGGIN	1038	463	3382
AROOSTOOK	39005	83096	31815
CUMBERLAND	2214	2939	1527
FRANKLIN	12324	6109	782
HANCOCK	8626	11675	9965
KENNEBEC	6638	3845	2499
KNOX	721	465	783
LINCOLN	1738	1760	266
OXFORD	11521	9015	4073
PENOBSCOT	28539	55413	36644
PISCATAQUIS	24099	50742	33058
SAGADAHOC	2774	1494	157
SOMERSET	31843	24991	12040
WALDO	6080	3462	655
WASHINGTON	26836	22956	30953
YORK	4346	4174	296
Total	208342	279599	168,895

COUNTY	Coastal Fr. Marsh	Coastal Open Fr.Water	Salt Marsh	Sounds/ Bays
CUMBERLAND	348	454	4367	
HANCOCK	56	0	751	
KNOX	0	0	273	
LINCOLN	586	0	931	
SAGADAHOC	10365	958	2482	
WALDO	0	0	435	
WASHINGTON	0	0	1953	
YORK	44	50	4254	
Total	11399	1462	16,917	56,689

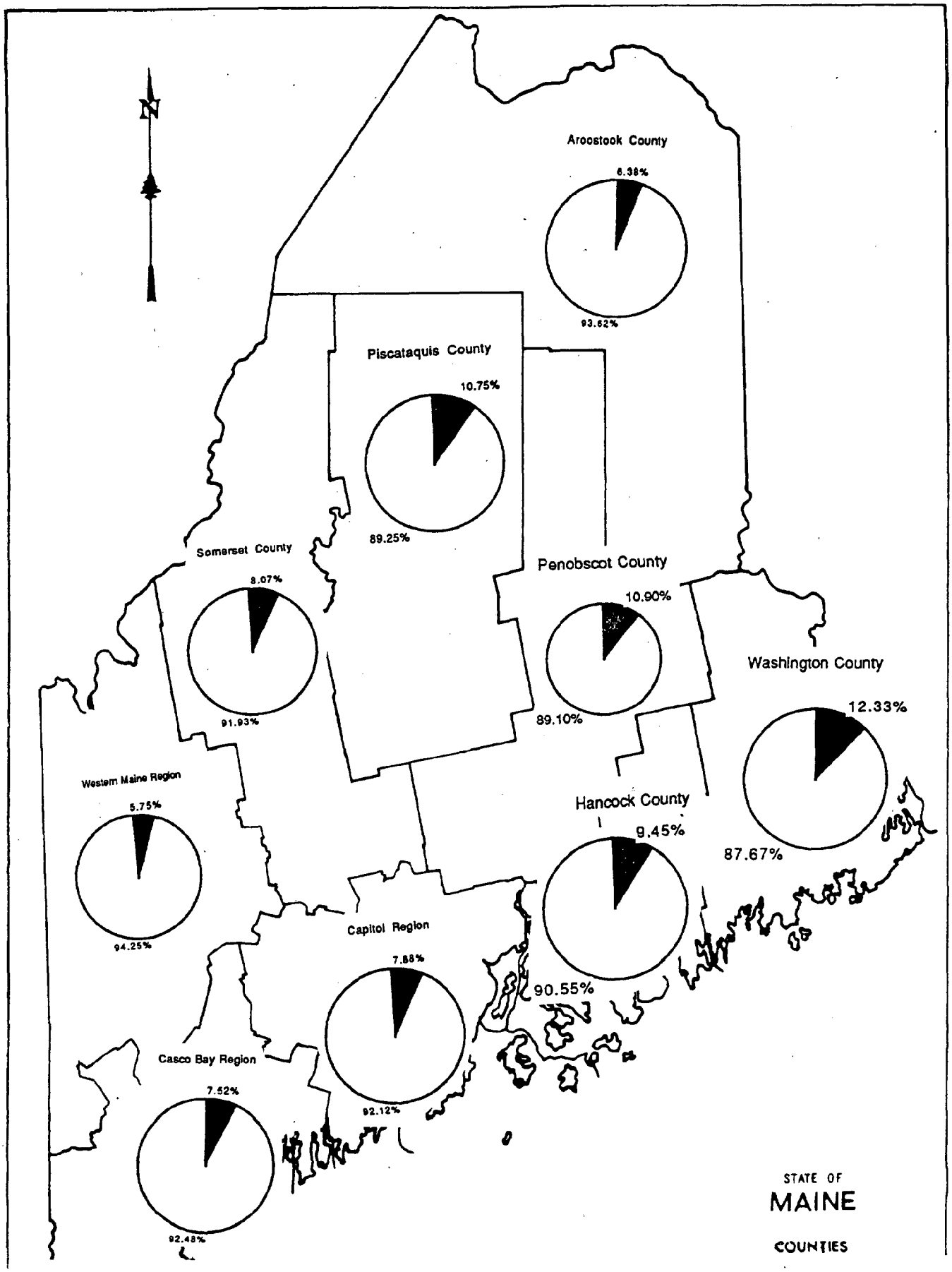
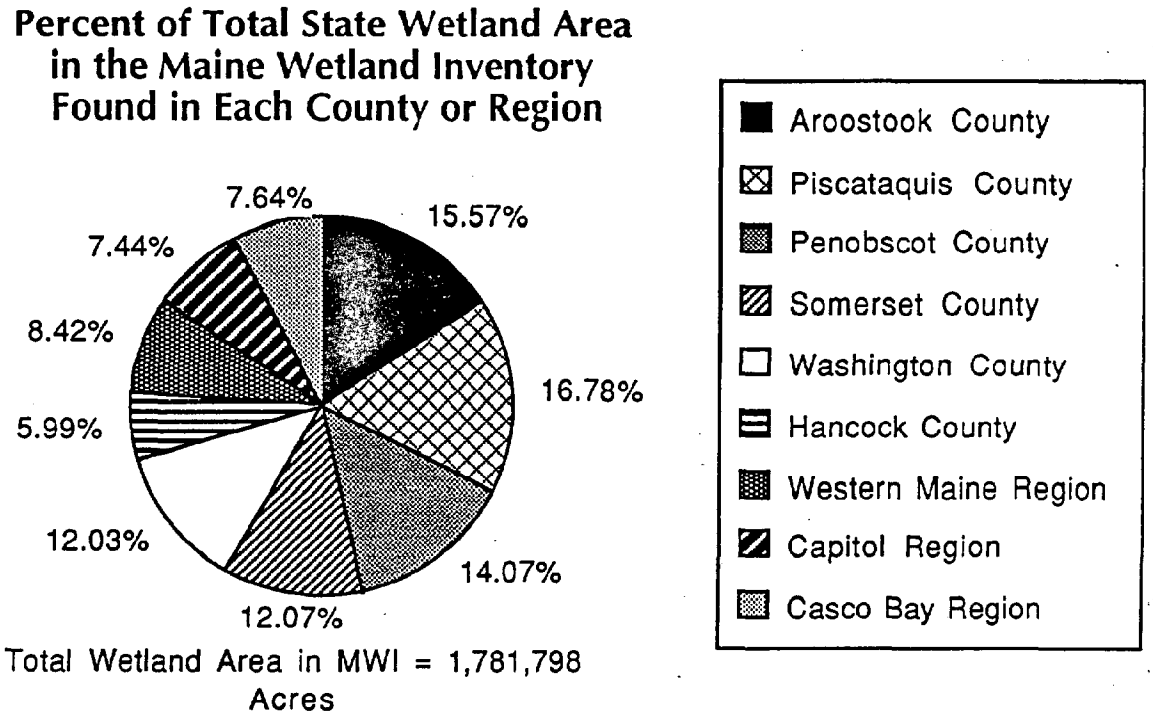


Figure 3.4. Percent of county land area classified as wetland by the Maine Wetland Inventory.

Figure 3.5. Percent of total state wetland area in the Maine Wetland Inventory found in each county or region.



Maine Coastal Inventory (MCI)

In the mid-1970's, the Maine State Planning Office began the Maine Coastal Inventory (MCI) "to collect and display social, economic and natural resource information for the whole coast" (SPO, 1977). The inventory consists of both mapped and statistical information. The coast was divided into 29 mapping units, each containing a group of towns. A variety of maps were produced for each of the 29 units and included one each of Topography, Slopes, Watersheds and Water Classification, Soils, Fish and Wildlife (two maps), Land Cover Types and Recreation Facilities. In most cases the minimum resolution for land types or wetlands was five acres. The Land Cover Type map and the Fish and Wildlife maps contain wetland location information. The Land Cover Type maps identify wetlands as a land type, including those which are periodically or permanently flooded, such as beaver flowages, bogs, hardwood swamps, tidal flats, salt marshes and shrub swamps. Different wetland types are not distinguished. The Fish and Wildlife maps identify wetlands with important fish and wildlife values such as wetlands important to waterfowl, shellfish beds (e.g. clam flats), tidal flats and other wetlands as identified by air photo interpretation, the MWI, the Department of Marine Resources (DMR) and other sources.

The MCI maps provide locational data only, and are based on pre-1977 data. The base maps are 1:48,000 and could still provide some use to coastal towns for planning purposes, but present knowledge suggests that these are not widely used.

An Ecological Characterization of Coastal Maine (ECCM) and The National Wetland Inventory (NWI)

The most comprehensive broad ecological survey of the Maine coast is depicted in the 1980 U.S. Fish and Wildlife Service report "An Ecological Characterization of Coastal Maine" (Fefer and Shettig, eds., 1980). When the USFWS Office of Biological Sciences (OBS) was established in the early 1970's, the proposals for offshore energy development led to the selection of four major coastal ecosystems for characterization including the Maine coast. Cape Elizabeth to Calais was divided into six regions (**Figure 3.6**) and the biology and ecology of the natural wetland, aquatic and terrestrial systems of the landscape were described.

Wetlands and deepwater habitats were described using Cowardin's 1979 classification system (**Appendix III**). Detailed floral and faunal characterizations of the different systems were provided by experts in these fields in Maine and compiled into the five primary volumes of the report. Marine, Estuarine, Palustrine, Riverine, Lacustrine and Terrestrial Systems were described in depth and are further broken down according to vegetation structure and/or substrate. System "Classes" include: Emergent Wetland, Aquatic Bed, Flat, Reef, Rocky Shore, as appropriate to each system. Acreage data for wetlands in Marine and Estuarine intertidal areas, and all Palustrine areas are used for comparison and evaluation for SCORP purposes (**Table 3.5**). These data are not digitized as they have been in other states with operational geographic information systems (Tiner, 1985a,b).

The Ecological Characterization of Coastal Maine was one of the first major efforts of the National Wetlands Inventory (NWI) team of the USFWS. Their methodology and resolution has dramatically improved in the ten years since the report was first prepared. At that time, 1:80,000 scale black-and-white aerial photos were used to delineate wetlands at least 3-5 acres in size. Now, with color infra-red aerial photography at 1:58,000 scale, wetland units of 1 acre are distinguished (Ralph Tiner, pers. communication).

The NWI was completed for the entire Maine coast and maps are presently available through the Maine Geological Survey (MGS). Areas are mapped at 1:62,500 (15') or 1:24,000 (7.5') but not both. Some areas are available in 1:100,000. Although debate currently exists over the usefulness of NWI maps to Maine, a recent study in Massachusetts of the accuracy of NWI maps found >95%-

accuracy in wetland vs. upland delineation, and >85% accuracy in wetland type classification (Startwout et al., 1982). In Maine, the Soil Conservation Service field-tested the accuracy of selected areas in the NWI mapping project, and found nearly 87% correlation between their respective wetland delineations.

More recent inventories have focused on a particular wetland type, a particular resource value or a given geographic region. The vastness of the state's wetland resources has necessitated a narrower approach in these instances. The results are uneven, yet these efforts have shed light on previously unknown aspects of the state's wetlands in terms of distribution of types and their functions and values (Worley, 1982; Sorenson, 1986; Davis et al., in prep.).

Figure 3.6. The Six Regions of the Maine Coast Characterization Area, From an Ecological Characterization of Coastal Maine (Shettig and Fefer, 1980)

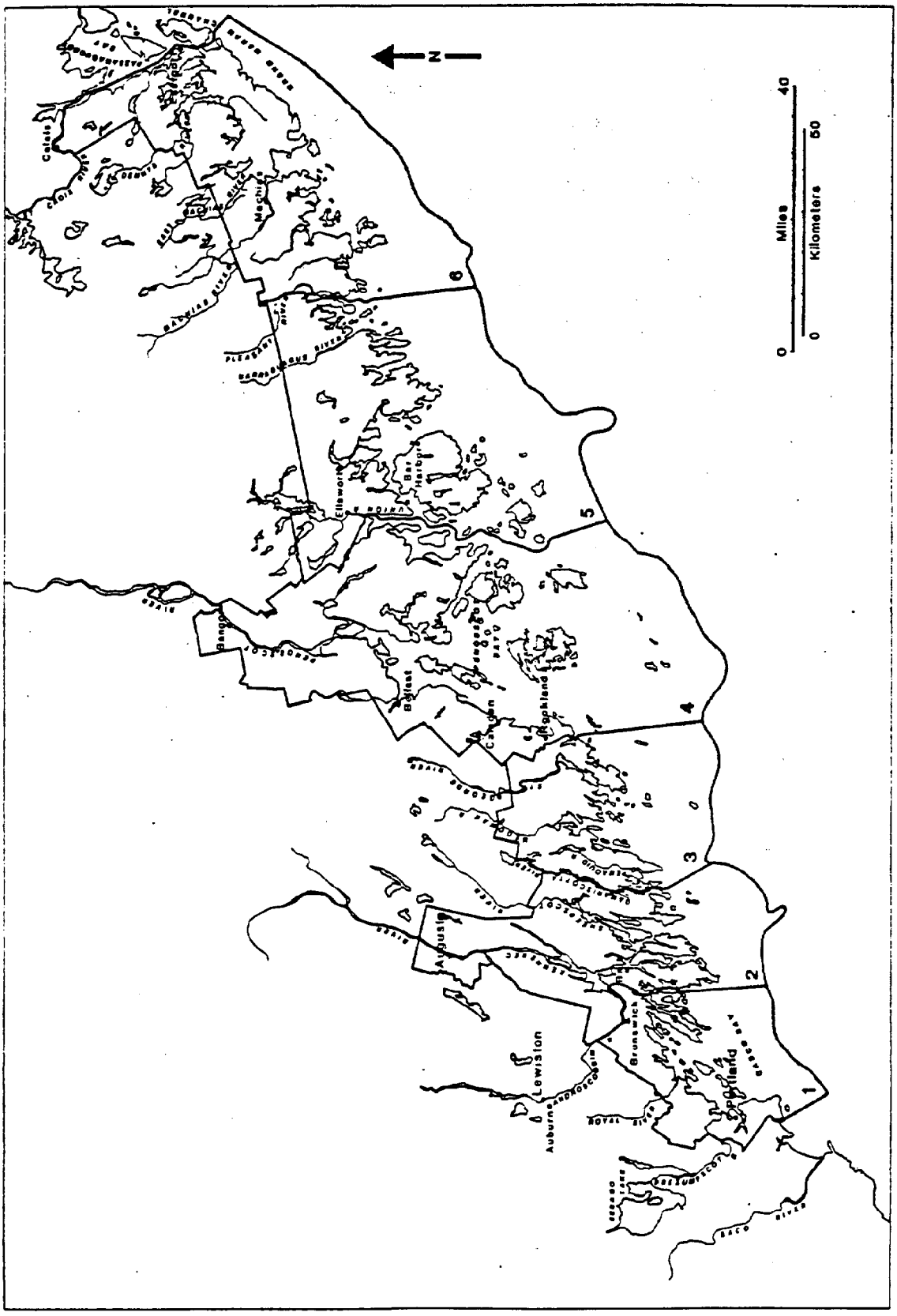


Table 3.5. Total State Wetland Acreage in the Coastal Zone, by System Type, from an Ecological Characterization of Coastal Maine (Fefer and Shettig, 1980)

WETLANDS IN MARINE AND ESTUARINE INTERTIDAL SUBSYSTEMS

CLASS	MARINE INTERTIDAL	Regions of Abundance	ESTUARINE INTERTIDAL	Regions of Abundance
Non-Vegetated				
Beach/Bar	2897	6,4	1089	4,6
Flat	28,827	6,5,4,1	41,650	2,6
Reef	108	5	138	3
Rocky Shore	21,521	4,6,5,1	2911	6
Vegetated				
Aquatic Bed	6202	1,6	2729	4,5,6
Emergent	0		13,802	2,6
Emergent/OW	0		499	1
Emergent/UB	0		406	5
Flat/Emergent	0		5	1
Flat/ Scrub-shrub	0		47	1
Scrub-shrub	0		66	6
TOT. INTERTIDAL	59,566		63,382	
TOT. SUBTIDAL	113,139		66,693	
SYSTEM TOTAL	172,705		130,075	

WETLANDS IN PALUSTRINE SYSTEM

CLASS	Acres	Regions of Abundance	#s	Regions of Abundance
Non-vegetated				
Open Water (OW)	3449	4	1251	4
Unconsol. bottom	52	4	1	4
Vegetated[1]				
Forested	106,810	6	5775	6,4,5
Forested/Shrub	13,728	5	1086	5,4
Scrub-shrub	47,307	6	3759	6
Emergent	9097	2	1222	4
Shrub/Emergent	8771	5	484	5
Forested/Emergent	633	5	81	5
Aquatic bed	57	4	1	4
TOTAL ACRES	189,702		13,650	

[1] The occurrence of a wetland class in combination with open water generally occurs on <1% of wetland area for each type and is therefore combined into the dominant vegetation class.

Maine Peat Resource Inventory (PRI)

In the late 1970's, the Maine Peat Resource Inventory (PRI) began. Under the direction of the U.S. Department of Energy (DOE), several states including Maine started peat resource inventories. The oil and energy crisis of the mid-seventies precipitated DOE encouragement of research on alternative energy sources, such as peat.

The Maine Peat Resource Program was administered by the Maine Office of Energy Resources (OER) and conducted by the MGS and Cornelia Cameron, peat resource specialist of the U.S. Geologic Survey in Reston, Virginia. Peat depth, quality and extent was determined for **233** peat deposits throughout the state, totalling **72,957** acres (**Table 3.6**). The actual acreage of peatland ecosystems (domed bogs, coastal plateau bogs, ribbed fens, etc.) is far greater since the inventory only included acres of commercial peat and peat deposits of at least 80 acres, with a minimum average thickness of five feet and an ash content of < 25%. General estimates of total peatland acreage are approximately 700,000 acres.

The results of the survey were published in a series of MGS Bulletins (Cameron et al., 1984) recording the commercial qualities and extent of each of the 233 deposits, as well as classification of the geological setting in which the peatland formed. A new series of MGS Surficial Geology maps will incorporate the results from the peatland inventory and the freshwater wetland maps, giving more detail to the kind of wetland habitats that are mapped on the 1:24,000 scale surficial geology maps.

Table 3.6. Results of the Maine Peat Resource Evaluation Program (Cameron et al., 1984)

COUNTY	NUMBER OF DEPOSITS SURVEYED	ACREAGE	ESTIMATED RESOURCES (Short Tons)
Androscoggin	4	1,160	2,383,000
Aroostook	43	11,498	18,851,400
Cumberland	1	200	400,000
Franklin	3	1,185	2,414,000
Hancock	5	1,338	2,559,200
Kennebec	8	2,010	4,260,000
Knox	2	227	447,000
Lincoln	4	402	776,200
Oxford	5	563	932,000
Penobscot	47	21,666	40,923,000
Piscataquis	29	5,896	8,311,200
Sagadahoc	0	0	0
Somerset	20	7,056	14,371,800
Waldo	8	2,893	4,835,800
York	6	1,875	2,923,000
TOTALS	223	72,957	136,502,400

Freshwater Wetland Inventory (FWI)

In 1982, the State Legislature ordered a freshwater wetland mapping project for the organized towns which led to the identification of many wetlands which were unregulated by existing laws. This mapping project, undertaken by the MGS for DEP, formed the basis of the 1985 Freshwater Wetlands Act, where wetland was defined as non-forested vegetated wetlands >10 acres on very poorly drained soils. The newly enacted Natural Resources Protection Act of 1988 broadens the Freshwater Wetlands Act definition to include forested wetlands and deletes the soils criteria.

The maps served primarily to locate and identify freshwater wetlands which were unregulated, with the maps providing a "red flag" for potential development activities. Of the **8,245** freshwater wetlands mapped, acreage calculations were completed only for the **1674** freshwater wetlands mapped in coastal towns and comprising **70,000** acres (M.Mullen, unpublished data). The exclusion of wetlands less than ten acres in size has led to an underestimate of wetlands in this inventory as well. Maps are available from MGS. With the recent changes in freshwater wetland definition to include forested types, these are incomplete in terms of their identification of the regulatory status of mapped wetlands.

Salt Marsh Inventory (SMI)

The most recent inventory of Maine's salt marshes uses MGS Coastal Geology maps by Barry Timson (1977), where several coastal environments are quite finely delineated. Researchers at the University of Maine, Orono (UMO) and MGS determined the areal extent of salt marsh in Maine by planimetric measurement of Barry Timson's 1977 coastal geology maps (Jacobson et al., 1987). The minimum size mapped is $150m^2$ and all such units were measured. This inventory provides the most accurate acreage calculations of salt marsh in Maine. The total acreage calculated was 18,960 acres (79 km^2) with most of the acreage in a few larger systems in the southern half of the coast, namely the Wells Embayment, Saco Bay and the Kennebec River Estuary. Numerous salt marshes even smaller than the minimum size mapped occur along the coast and would increase this estimate.

The same methodology for salt marsh acreage calculation could be applied to other coastal environments using Timson's maps. The contribution of organic matter by tidal marshes, flats and other coastal wetlands to the Gulf of Maine, suggests the importance of accurate documentation of the extent of coastal ecosystems.

National Cooperative Soil Survey (NCSS)

The National Cooperative Soil Survey of the USDA Soil Conservation Service (SCS) has been mapping the soils of Maine since the 1950's. Several county surveys are now complete in the southern and coastal portions of the state. Northern and inland Maine is still largely unmapped. The soil survey reports provide locational information mapping the occurrence of different soil types across the landscape. From a classification of soil types, wetland soils are a reasonable predictor of wetland community occurrence. Since many wetland types or size classes have been excluded from other inventories, these documents provide a baseline for comparison where the inventory is complete.

Based on soils types (i.e. hydric soils)[2], it is estimated that 30% of the cover of Maine, or 6 million acres is in wetland soils, with the greatest proportion of this found as forested and shrub wetlands including bottomlands, floodplains and swamps. About one million acres of this is in small lakes and ponds and their associated wetlands (B. Wengrzynek, pers. communication). The favorable correlation between wetland soils delineation and NWI maps supports the use of Soil Survey results as the best available wetland maps for the state, using the USFWS wetland definition. However, acreage is not specifically calculated here either.

Other Wetland Inventories/Data

Other specific wetland inventories include research at universities and surveys by state agencies or private organizations. A peatland data base is being created by Dr. Ronald Davis at the University of Maine at Orono, cataloguing ecological characteristics of all types of peatlands in Maine. The Critical Areas Program has supported surveys of a number of more unusual peatland types including coastal plateau bogs, ribbed fens and eccentric raised bogs. The Nongame Program of MDIFW is maintaining information on habitats important to rare, threatened and endangered animal species, and often includes data on wetlands.

The Maine Natural Heritage Program of The Nature Conservancy maintains an up-to-date computerized and mapped data base documenting the occurrences of rare, threatened and endangered plants, animals and natural communities, the latter including a range of wetland types classified on the basis of species assemblages and hydrologic conditions. The Natural Heritage Program classification of wetland types and their biotic features will be discussed later.

The Land Use Regulation Commission (LURC) provides no wetland acreage calculations, although it maps wetland protection zones (P-WL) on its planning maps, However, wetland acreage in P-WL in LURC territories is estimated to be 3% of the total jurisdiction or about 310,000 acres (Fred Todd, pers. comm.) .

Problems and Deficiencies

Despite the range of inventories and mapping projects conducted in Maine to date, no single inventory can provide an accurate estimate of acres or numbers of wetlands in Maine by type or by county. By evaluating each inventory and focusing on its strongest aspect, acreage figures can be extracted from different sources for use in describing the types and distribution of wetlands in Maine. However there are many inherent differences between the inventories that make comparisons difficult (**Table 3.2**). These basic problems and deficiencies are summarized below.

1. Inventory purpose - Inventories were undertaken for different purposes and with different goals in mind. This may bias or restrict the type of data collected in each. The Salt Marsh Inventory had the primary purpose of determining extent or acreage, the Maine Wetland Inventory evaluated wetlands for their value as waterfowl habitat and others have been used in land use planning, resource management, regulation or ecological characterization. This in turn determines the classification system used, the methodology, approach, map scales and final products.

2. Wetland classification and definition - Comparison of data becomes difficult when the classification of wetlands types and their respective definitions differ. Wetland definition is closely related to the purpose of the inventory. This problem is compounded when an inventory was

---

[2] Lists of the hydric soils of Maine are available from SCS for the state and by county where soil surveys are complete.

conducted using a legal definition of wetland rather than an ecological one. The Freshwater Wetlands Inventory is a case in point. The FWI defined wetlands by size class, > 10 acres, which already excludes a large number of small wetlands which are under the greatest threat of loss. The inclusion of wetlands only containing very poorly drained soils excludes another large set of wetlands found on poorly drained or periodically flooded soils which also harbor wetland vegetation and communities. The earlier definition of freshwater wetlands excluded forested wetlands, which according to soils and NWI data and maps comprise about 80% of all wetlands in Maine (Bob Wengrzynek, pers. comm.). All wetland inventories, except perhaps the NWI, have greatly underestimated the acreage and extent of forested wetlands, primarily due to differences in definition of what constitutes a forested wetland.

3. Geographic coverage and distribution of types - Inventories covered different geographic regions (e.g. coastal vs. statewide, etc.) or different types. Most inventories encompassed the coastal zone, resulting in an absence of usable inland wetland data. Most inventories are not comprehensive on a statewide basis nor in coverage of the full range of wetland types. Even detailed regional surveys pose some problems. For example, of the several inventories including Maine's coast, all define the coastal zone differently: The MCI divides the whole coast into 29 regions, comprising 141 towns and The Ecological Characterization divides the coast from Cape Elizabeth to Calais into 6 regions consisting of 131 towns.

4. Map scales - Map scales used in final map products differed among inventories.

5. Acreage data - Most inventories do not include the calculation of acreage data. Available data tends to underestimate actual wetland acreage in the state.

6. Date of inventory data - Most inventory data or maps of significant wetland areas are several years old. New information has rendered some of this data unreliable, by not their omission of recent land use changes or changes in wetland values. Inventories were often based on older aerial photos for interpretation.

7. Tracking/Monitoring - None of the inventories except the MWI has a mechanism for updating data. There appears to be no system which has the capacity to track changes in particular wetland features or parameters, or their ecological or legal status.

8. Biotic Diversity - Most inventories fail to reflect the natural biological diversity of wetlands. Many endangered and threatened species reside in specific wetland types, often with specific plant associations. Inventories or mapping projects need to refine their scale of resolution to capture this important component of wetlands.

Discussion

The current U.S. Fish and Wildlife Service classification (Cowardin et al., 1979) is the most widely used classification system for wetland inventories nationally. Using this system,the National Wetlands Inventory Team has completed wetland inventories for all states in USFWS Region 5 (Northeastern U.S.) except New York and Maine (R. Tiner, pers. communication). To compare data, one must first align or "crosswalk" similar wetland types between classifications, and then decide which has the best estimate for each type.

The classification used by the MWI was an earlier USFWS classification and has been crosswalked with Cowardin's (**Appendix IV**) indicating some compatibility of definition. Certain types will not readily correspond. For example, the MWI uses the terms "shrub swamp" and "bog" to represent separate wetland types. The NWI uses scrub-shrub to represent all units dominated by

shrubs or stunted woody vegetation and can therefore be found in either of the MWI types. Taken out of the context of a single wetland system or occurrence (e.g. floodplain, bog, marsh, etc.), the NWI figures can be somewhat misleading. The NWI does, however, provide the best available resolution and classification for delineation of wetland vegetation types in the areas it has mapped.

One problem with this fine degree of resolution is that since a single wetland may contain several vegetation classes (emergent wetland, open water, forested wetland, etc.) the unity of the single wetland system as a separate entity may be lost. However, the degree of refinement of these maps allows them to be used in several arenas - planning, regulation, management and research. When these maps are part of a computerized GIS, trends of wetland loss or changes in wetland character (e.g. flooding by beaver activity) can be accurately delineated and recorded over time (Tiner, 1984; Tiner, 1985a,b).

Published NWI findings are limited to the 6 regions of the coastal zone as defined in the Ecological Characterization of Coastal Maine from Cape Elizabeth to Calais (Fefer and Shettig, eds., 1980) and provides the best available acreage data for wetlands in the coastal zone. This was compared with MWI data sorted for the same towns and regions and unpublished acreage data for MGS-mapped freshwater wetlands in the coastal zone. Comparison of the palustrine wetland data from these three inventories of the coastal zone are used to give an indication of their relative accuracy and comprehensive coverage in the coastal zone (**Table 3.7**).

In NWI, 63% of all palustrine wetland acres mapped are forested and forested/shrub, 25% are scrub-shrub wetlands. 5% are emergent wetland, another 5% are shrub/emergent and 2% are open water. The breakdown of wetland units mapped is 77% forested, forested/shrub and scrub-shrub, 9% emergent, 4% shrub/emergent and 9% open water. Since a single wetland mapped by NWI may have more than one mapped unit, the acreage figures are a more accurate basis for comparison.

The FWI included 33% of the number of freshwater wetlands mapped by the NWI. Of the wetlands mapped by the FWI in the coastal zone, 96% were also mapped by NWI, whereas only 39% were mapped by the MWI.

According to the NWI, 35% of the Marine System and 49% of the Estuarine System are intertidal wetlands comprising 122,948 acres. Marine and Estuarine intertidal flats occupy the largest area of any single intertidal class, comprising 48% of Marine Intertidal and 66% of Estuarine Intertidal subsystems. Intertidal rocky shores are a close second, occupying 36% of Marine intertidal areas. Emergent Estuarine marshes (salt marshes), comprise 22% of Estuarine intertidal areas, and 11% of the entire Estuarine System. Acres given by NWI (**Table 3.5**) for Marine and Estuarine Systems can be considered reliable for these wetland types.

More than half the acreage mapped by the MWI is in Open Fresh Water which is the equivalent of Great Ponds and is the most common type by acres in every county except Sagadahoc, where Coastal Fresh Marsh is most abundant. However, Open Fresh Water habitats comprise 21% of the numbers of wetlands mapped. The next most abundant wetland types in acres as well as numbers are wooded and shrub swamps, but their extent in relation to Open Fresh Water may be underestimated. In the NWI, most open water habitats are classified not as wetlands per se but as deepwater habitats. In NWI, only 2% of Palustrine wetlands mapped are in the open water class.

Based on the best available data, minimum existing acreage is suggested for each type in the state (**Table 3.8, Figure 3.7**) and is explained as follows:

a) Estimates for Marine (saline) and Estuarine (brackish) wetlands are determined from NWI acreage plus additional estimated acreage for areas not included in the ECCM. Salt marsh acreage was taken directly from the recent results of Jacobsons' 1987 salt marsh inventory.

b) In general, the MWI mapped 37% of the wetland acreage mapped in the NWI regions. Therefore, for all Palustrine wetland types, MWI data were extrapolated proportionally. However, for shrub swamps and wooded swamps, where the relative coverage of MWI to NWI wetland inventory acres in the coastal zone regions was 20% and 6% respectively, a severe underestimate for these types is likely with the given extrapolation. SCS Soil Survey Mapping results are given for these two types as the best known estimate for their actual extent in Maine (B. Wengrzynek, pers. comm.)

c) Open water wetlands which are also great ponds (> ten acres in size) are excluded from these wetland estimates, however lakeshore and pondshore emergent wetlands and shallow aquatic beds are included.

Table 3.7. Inland Freshwater Wetlands along the Maine Coast, Cape Elizabeth to Calais. A comparison of Wetland Inventory Results in Acres (and Number of wetland units).

ECCM Region	NWI All WLs	NWI Non-For. WLs	FWI* All WLs	MWI** All WLs	MWI** Non-For.WL
1	7096 (758)	3185 (454)	1302 (53)	10739	10461
2	24134 (2424)	11872 (1401)	8722 (265)	25265	22107
3	19349 (1848)	6359 (902)	8249 (247)	3604	3217
4	40303 (3323)	13522 (1715)	14877 (468)	8958	6827
5	40989 (2584)	16036 (1110)	13662 (373)	10017	9380
6	57831 (2713)	18292 (1230)	15002 (268)	12300	12110
TOTAL	189,702	69,266	61,814	70,883	64,102
WL UNITS	(13,650)	(1230)	(1674)		

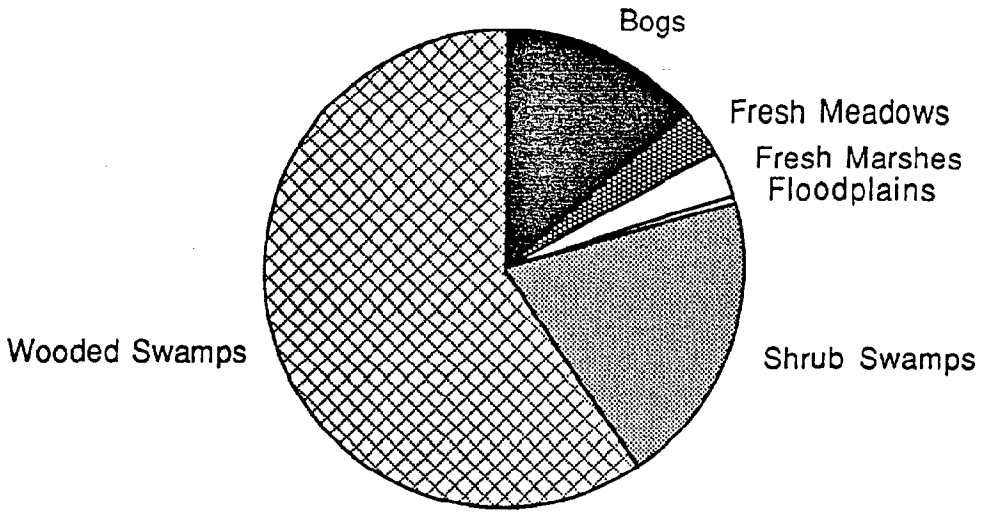
Key:
ECCM = Ecological Characterization of Coastal Maine
NWI = National Wetland Inventory
MWI = Maine Wetland Inventory
FWI = Freshwater Wetland Inventory
WL = Wetland
WL Units = Mapped units; wetland classes in NWI, MWI wetland types.
Non-For. WL = Non-forested wetlands
* = includes all wetlands on maps, both forested and non-forested
** = includes all wetland types in MWI data base except Open Fresh Water; Regions 1-6 =60,859 acres of open freshwater wetlands or 46% of wetlands delineated by MWI.

Table 3.8. Acres of Wetlands By Type in Maine

WETLAND TYPES	ACRES	SOURCE	STATE ESTIMATE
SALINE WETLANDS			
Tidal Flat	28,837	NWI	35,000
Rocky Shore	21,521	NWI	2,000
Beach/Bar	2,897	NWI	4,000
Reef	108	NWI	500
Aquatic Bed	6,202	NWI	7,000
Salt Marsh	18,960	SMI	19,000
TOTAL			87,500
BRACKISH WETLANDS			
Tidal Flat	41,700	NWI	45,000
Rocky Shore	2,911	NWI	3,000
Beach/Bar	1,089	NWI	2,500
Reef	138	NWI	500
Aquatic Bed	2,729	NWI	4,000
Fresh/Brackish Marsh	12,861	NWI	15,000
TOTAL			70,000
PALUSTRINE WETLANDS			
Floodplains/Flats	10,249	MWI	27,700
Inland Fresh Meadow	58,772	MWI	158,843
Inland Fresh Marsh	57,602	MWI	155,140
Shrub Swamp		SCS	1,000,000
Wooded Swamp		SCS	3,000,000
Bog	700,000	OER/DEP	700,000
			5,041,683
TOTAL ESTIMATED WETLANDS			
SALINE			87,500
BRACKISH			70,000
PALUSTRINE			5,041,683
TOTAL			5,199,183

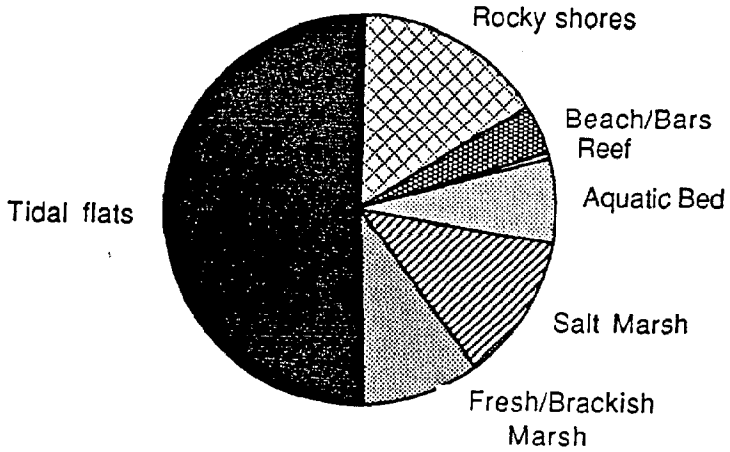
Figure 3.7 **Freshwater and Tidal Wetlands in Maine, 1988 Estimates (Based on Table 3.8)**

Freshwater Wetlands in Maine



Total Freshwater Wetlands = 5,041,683 Acres

Tidal Wetlands in Maine (Saline and Brackish Wetlands)



Total Tidal Wetlands = 157,500 Acres

CHAPTER 4 - WETLAND FUNCTIONS AND VALUES

INTRINSIC VALUES OF WETLANDS

Wetlands, as unspoiled natural ecosystems have certain values which contribute to their aesthetic appeal and the desire to preserve them. While many wetlands have been impacted by development, they still may retain important natural values for wildlife, recreation, education, etc. Many of these same functions and values may be found in upland habitats, but only wetlands will be treated here. The following discussion describes some of the more commonly recognized intrinsic values of wetlands, although many of these do not lend themselves to measurable study or quantification (Odum, 1978).

Wetlands as Natural Areas

Wetlands are often the last areas in a region to be developed. As such, they have a high wilderness value, the last enclave of a sense of remoteness and solitude. Quite often, there are associated aesthetic qualities which rank high in comparison with other landscape types. The interface between land and water, edges and other contrasts add to the scenic qualities of wetlands. Small wetlands may contribute to local landscape variety and interest, whereas larger wetlands may have diversity and variety within a site providing different visual impressions (Smardon, 1973, Adamus,1983). The unique flora and fauna of some wetlands are attractive to viewers and enhance their appreciation of these areas.

Now, however, due to changing aesthetic values in society, development in or near wetlands is desirable. Wetlands are being altered, converted or filled to provide residential proximity to wetlands. Adjacent development is now a serious external threat to wetland ecosystems.

Wetlands for Recreation and Education

In Maine, both tidal and inland wetlands are areas of great diversity and beauty, and provide open space for recreational and visual enjoyment. Recreation in wetlands is usually of a passive nature and dispersed. Hiking, boating, fishing, hunting and wildlife observation are typical uses of wetlands by the general public. Quite often, it is these activities which contribute an economic value to wetlands. National Wildlife Refuges which comprise large areas of wetland were originally created to protect migratory waterfowl habitat. These areas receive heavy visitor use and attest to the importance of wetlands from a cultural or humanistic viewpoint.

In Maine, an estimated 20,000 visitors hike the trails at the Rachel Carson National Wildlife Refuge and thousands more birdwatch and explore the marsh on the many roads that cross it (A. French, pers. comm.). Although there may be some negative aspects of visitation, there is still a need to enhance public access to wetlands for recreation, education, and research.

Wetlands associated with open water bodies tend to have a higher recreational value. The naturalness and general environmental quality of a site may be coupled with other values of cultural significance such as historic or archaeological values, thereby increasing the recreational value. Again, the proximity of NWRs to highly populated areas has contributed to their recreational and perceived values.

While recreational use can be a favored attribute of wetlands, careful management guidelines are necessary to prevent unwanted negative impacts associated with human use. Certain wildlife species (herons, loons, eagles, etc.) are vulnerable to human disturbance as are rare plant habitats and natural communities.

The potential of wetlands for general public education and scientific research may vary from interest in botany and ornithology to demonstrating basic ecological principles and concepts of energy flow, biotic change and recycling in natural systems. Wetlands are living classrooms and their value for education has become more important in recent years as outdoor and environmental awareness have increased (Wengrzynek, unpublished). Since the Wells unit of the Rachel Carson NWR has been recognized as part of a National Estuarine Reserve, fundamental kinds of research have begun there and include studies on salt marsh productivity, hydraulic and sediment transport in the Webhannet and Little River estuaries, critical habitats and species biology.

Potential Resource Values

By preserving a natural system and all the "parts" within it, species and resource values currently unknown may be preserved and eventually discovered. Species may hold medicinal or commercial values that would otherwise be unknown to us if they had not been preserved and available for research. Natural areas also provide baseline conditions which can be models for restoration of degraded habitats.

Other potential resource values of wetlands include their importance in public water supplies, both for ground water and surface waters. Wetlands may help protect the water quality of public water supplies and other surface water bodies. Wetlands may indicate areas of groundwater discharge and may warrant protection to preserve water quality of an aquifer.

The high natural productivity of wetlands have unrealized food production potential for marsh vegetation, aquaculture and game animal species. Minnesota has been harvesting wild rice commercially for many years. In Maine, the cultivation of cranberries is being contemplated, and natural wetlands containing cranberries may provide essential information on their growth, habitat requirements and insect pests. Natural wetland areas also contribute to the feeding and breeding requirements of many game and non-game species and, if conserved could ensure maintenance of strong populations for public use and enjoyment.

Under appropriate management schemes, forested wetlands can provide an important source of timber, despite the physical restraints of harvesting in wetlands. Several wetland tree species such as red maple, northern white cedar, black ash and others provide important wood products.

ECOLOGICAL VALUES OF WETLANDS

Wetlands provide certain services or natural functions that are beneficial to society. These services include reducing floodpeaks of high water periods; retaining, recycling and filtering nutrients; trapping harmful materials and providing natural habitats for fish and wildlife species, and endangered or threatened plants, animals and natural communities. The ecological services or resource values provided by wetlands in general and in Maine are described below, recognizing that some of these functions are performed by upland habitats as well.

Hydrological Functions

1) Flood Conveyance and Flood Storage

Topography generally determines the ability of a wetland to store and convey floodwater. Riverine wetlands and floodplains usually form natural pathways for the conveyance of floodwater from upstream to downstream points. Inland wetlands may store water during floods and release it slowly to downstream areas, lowering floodpeaks. The vegetation itself may reduce the flow velocity of river floodwater by friction. The amount of friction depends on the type and amount

of vegetative cover, but is significant in comparison to river channels without wetlands. Studies are still underway to predict the magnitude of the water storage capacity of wetlands, and the importance of such variables as wetland area, downstream location, magnitude of flooding and degree of encroachment on the wetland (OTA, 1984).

Lower floodpeaks are generally found in watersheds with a large percentage of wetland, yet total streamflow in the spring was found to be higher in basins with large lake and wetland areas (Novitski,1979). Analysis of flood hydrographs (displays of amounts of water released over time) reveal that certain wetland types, especially peatlands with perched (raised) water tables temporarily store and then slowly release storm waters (Boelter and Verry, 1977). Evapotranspiration rates and other factors contribute to flood storage capacity. Saturated wetlands may be unable to moderate floodwater as well as uplands because they may discharge water more rapidly under these conditions. Flood height may not be reduced, but water flow may be slowed somewhat. Certain undeveloped terrestrial environments may have greater flood storage value (Adamus and Stockwell, 1983), however the importance of wetlands for these functions on a local level cannot be understated. A study of the wetland and peatland systems in Washington County, Maine confirms these concepts (B. Nichols, U.S. Geological Survey, pers. comm.) Very few studies have measured inflow and outflow in wetlands to calculate the amount of floodwater stored in particular wetlands.

The role of vegetation in flooding depends on the degree to which certain vegetation types may actually decrease floodflow velocity. The filling and development of wetlands is apt to alter this ability. In water storage capacity models generated by the Army Corps of Engineers for the Charles River watershed in Massachusetts, a reduction in wetland area would result in a proportional increase in floodpeak and flood height, with the potential for millions of dollars in flood damage. Filling simply reduces the storage capacity of wetlands. If a wetland is filled above the natural floodplain level, the ability of the floodplain to convey or carry and distribute floodwater is lost, further contributing to increased flood hazard. The Charles River Plan therefore calls for the acquisition and protection of large areas of wetlands in the floodplain to serve as natural storage areas. The economic value of this service is valued at over $1 million (1978 dollars) which is "the difference between annual flood losses based on present land use and conditions" (CEQ, 1978).

Draining floodplains (e.g. by ditching or diking) may also increase floodpeaks by speeding runoff and reducing potential storage. However, some argue that drainage may actually reduce floodpeaks by draining away heavy rains that would otherwise saturate wetlands leaving them unable to further capture snowmelt or floodwater in spring (OTA,1984). In developed landscapes, wetlands are more effective than terrestrial environments for flood storage and desynchronization, i.e. offsetting the intensity of peak flows over time (Adamus, 1986).

2) Groundwater Recharge and Discharge

Groundwater recharge refers to the ability of a wetland to supplement groundwater through infiltration of surface water to the saturated zone. Given the low permeability of organic soils and the relatively impermeable clay layers, the probability that particular wetlands will have this function is low (Adamus, 1986). Hence, uplands may provide a greater recharge function than wetlands. A study in Minnesota found greater recharge in upland sands and the lowest recharge ability found in wetland peats (Verry and Boelter, 1979). Since water quality and quantity of recharge varies, the usefulness of this function in public drinking water or other uses cannot be presumed without careful site-specific study.

Strong evidence exists that wetlands more commonly act as water discharge areas, specific areas of groundwater contribution to surface waters. Groundwater discharge supplies water to many wetlands and these areas may be the only surface water outflow from an aquifer. Filling, sedimentation or impoundment may affect the quantity or quality of water discharge, possibly affecting downstream wetlands.

Shoreline Erosion Control

This function is important in wetlands associated with open water bodies such as lakes, rivers and along the coast. Natural river currents, tidal wave currents and waves generated by wind along lakeshores, estuaries and barrier islands all may contribute to shoreline erosion, as do the wakes from boat traffic. Vegetation may reduce erosion because the low-gradient shore and the plants themselves absorb and dissipate wave energy. The binding root structure and peat development in wetlands further stabilize the shore. The dense growth of wetland plants then encourages the deposition of suspended sediment (OTA,1984).

Wetland vegetation does not usually establish itself in high-energy environments susceptible to erosion, but where established, it does control erosion, stabilize soil, encourage sediment deposition and dampen wave energy. Generally, vegetated wetlands experience less erosion (or shoreline retreat) than non-vegetated wetlands. Studies have been undertaken to measure the ability of wetlands to control erosion, including the creation or establishment of vegetated wetlands (e.g. marshes) in highly erodible (disturbed/developed) areas, but success of marsh creation is strongly correlated with lower wave-energy environments. Even small, fringe wetlands along rivers and lakes may be important for shoreline stability/anchoring.

The potential economic importance of shoreline erosion control is a major concern in many coastal areas nationwide and as well as in Maine. The loss of public and private property and its associated taxable income, sedimentation of waterways and water bodies, increased turbidity of waters, siltation of fish and wildlife habitat and loss of beaches are a few of the potential impacts. The ability of coastal or other wetlands to moderate storm surges is related to the degree of water saturation of the wetland at the time of the flood or storm event. If the wetland is already saturated by high tide or a previous flood event, its capacity to temper storm water is limited.

The dredging of coastal harbors and waterways has historically resulted in the disposal of dredged material onto marshland. Although current laws and practices forbid the disposal of dredge spoils in wetlands, the removal of sand or other mineral sediments may reduce the rate of accretion of these sediments into salt marsh systems, which is necessary for their maintenance relative to rates of sea level rise (Hackney and Cleary, 1987). Dredging activities may also contribute to increased erosion of marsh habitats by increasing rates and volume of water flow through tidal channels and a resultant increase in erosive wave action. This trend has been suggested in Wells, Maine (Almquist, in prep.) and Scarborough Marsh (J. Kelley, pers. comm.).

Water Quality Improvement

The quality (i.e. the chemical, physical and biological condition) of water flowing over and through wetlands may be improved by the wetlands ability to retain pollutants and nutrients albeit temporarily. The potential for water quality improvement by a wetland depends on the effect of such storage on an adjacent or connected body of water, and the timing of nutrient retention and release. Materials captured by wetlands via natural processes include suspended sediments, excess nutrients, toxic chemicals, heavy metals, disease-causing microorganisms and dissolved nutrients such as nitrogen and phosphorous.

1) Sediment Trapping

The ability of wetlands to trap suspended sediment is largely a function of wetland vegetation which reduces flow velocity and captures sediment loads. This function is particularly important in marine or estuarine environments, such as salt marshes, where nutrient accumulation (accretion) takes place. Wetlands may trap sediments for as long as they are inundated by sediment-laden waters or until they silt up completely. Floodplain wetlands provide a similar function.
Upstream alteration or destruction of wetlands can create problems downstream by accelerating sedimentation of wetlands.

The absence of this function would result in increased erosion and turbid waters which interferes with fishing, swimming, aesthetic appeal of water, aquatic vegetation growth and bottom-dwelling fauna (invertebrates and spawning fish). High content of organic materials in sediments may result in a high biological oxygen demand to break it down in water, thereby reducing oxygen availability to aquatic life. Increased development activity in southern Maine has resulted in increased sediment loads into wetlands, causing some deterioration and potential loss of water quality (Adamus, 1986).

2) Filtration

Suspended organic and inorganic materials tend to absorb other pollutants (e.g. nutrients, toxics, pathogens) which are then deposited with the sediment in the wetland. The "fate" of these pollutants greatly depends on this trapping and filtering function of wetlands and their ability to further degrade or retain harmful materials.

Persistent harmful materials such as heavy metals and chlorinated or petroleum hydrocarbons may be trapped in wetlands either temporarily or permanently. For example, heavy metals remain bound in the oxygenated zone of sediment surfaces, whereas they are mobilized under anaerobic conditions. Organic compounds such as pesticides which degrade in soil may be trapped by wetland soils, efficiently removing them from the aquatic system, and improving water quality. It is unknown to what degree wetlands can remove toxic substances from water over the long-term.

One negative effect of the use of wetlands to filter toxic materials is the transfer of these materials through the food chain, as may occur with some metals such as mercury (but not in other metals like lead). Food chain effects of synthetic materials are becoming better known, but experience with persistent organic chemicals like DDT and dioxin warn of the potential dangers. Although wetlands may remove toxics from water, this removal may eventually contaminate higher trophic levels by food chain transport, unless the affected vegetation is removed from the system. Disposal of such removed vegetation can pose difficulties.

3) Nutrient Retention/Removal

Excess amounts of the nutrients nitrogen and phosphorous can cause proliferation of algal growth (algal bloom), which can degrade water quality and impinge upon recreational and other uses. Ensuing decomposition can then reduce available dissolved oxygen to dangerously low levels. Wetlands may trap and assimilate excess nutrients, which may then be recycled as detritus into the aquatic system.

Ducks Unlimited of Canada has experimented with the use of wetlands to treat agricultural and domestic waste using cattails and bulrushes. These species were found to secrete an antibody

that kills fecal bacteria. Other researchers estimate the value of phosphorus removal by wetlands to be $480-1420. per acre annually.

Determination of the aggregate effects of nutrient input vs. output on water quality, and the behavior of wetlands as nutrient sinks is thus far inconclusive, given the variable methodology of existing studies and the many interactive processes. The primary consideration of this function may be site-specific where high nutrient loading to aquatic systems can be moderated by the preservation of certain wetlands. Timing of nutrient inputs and outputs is also important, with some studies indicating much of the nutrient load being retained by wetlands during flood periods (Mitsch, 1977).

In Maine, hydrological studies on the Great Heath in Washington County indicate that nutrient retention in the surface peat depends upon the retention time of the water and the water source. The small amount of nutrients in precipitation coupled with active surface water flow contributes to the low nutrient levels in these upper peat layers. Nutrients do accumulate at the lower depths by the partial decay of plant materials in situ.

In southern Maine, Adamus (1986) found that septic leakage was the largest potential source of nutrients into wetlands he sampled in York County (31%). Highway runoff was the next most serious source (21%) with lesser but identifiable threats also from pesticides (5%), sewage (4%), dumps (3%) and industrial outfalls (2%). There has been direct evidence of increases in nutrients at the outlets of forested watersheds even with housing densities as low as one per acre.

Non-point source pollution is a serious threat to the water quality of water bodies and wetlands alike. Runoff from pastureland or sewage effluent may carry disease-causing microorganisms such as viruses and bacteria which can contaminate drinking water, recreational water and commercial fisheries. Such harmful organisms may also be bound in sediment loads trapped in wetlands and either die off or remain viable (OTA, 1984). Very little data are available on the fate of pathogens in wetland systems.

Fish and Wildlife Values

Wetlands are important to many fish and wildlife species for food, habitat and support of the food chain. Because of their value for food and habitat, wetlands often become a focal point for varied wildlife populations within a particular region. This is illustrated in the National Wildlife Refuge System where nationwide, 40% of the NWR System is wetland while only 5% of the land area of the coterminous states is wetland. Certain species are "wetland specialists" such as waterfowl, freshwater game fish, some endangered species, etc. Losses of wetlands will cause significant and adverse impacts on these indigenous populations.

The suitability of wetlands as animal or fish habitat is often strongly correlated to the density and diversity of vegetation. Vegetation diversity is often a major determinant of wildlife diversity. Criteria which are important in such an evaluation are: diversity of wetland types present within a system; dominant wetland types (some types are more valuable to a diversity of species); habitat and physiognomic diversity (height and shape of vegetation); interspersion and contrasts between edges; vegetation cover types; location of wetland in landscape, i.e. whether wetland is associated with a water body; wetland size (small wetlands are important for individual breeding pairs while larger wetlands are important for statewide populations and flocks); naturalness of surrounding habitat types; proximity to other wetlands and water chemistry as it affects vegetation type and value as a food source to different species (Golet, 1973).

In wetlands with regular flood regimes, nutrient input during spring floods contributes to the higher plant productivity in wetlands resulting in their well-known high fertility. It is the periodic drying cycle that allows sediments and nutrients to change chemically and become available to plants. Coastal marshes receiving regular nutrient supply have some of the highest plant productivity rates of any natural ecosystem, in part due to the flowing or regularly fluctuating water levels. This high productivity is an important food chain link.The estimated 300-900 g dry wt /m^2/yr produced by Maine salt marshes (Jacobson et al., 1987) ends up as biomass entering the carbon cycle of the Gulf of Maine. Up to 20% of net primary productivity may be exported from wetland to open water areas, and mostly from areas closest to the water's edge, where detritus (organic debris) feeds filter feeders and other detritivores (Nixon, 1980; OTA, 1984).

The quantitative significance of wetland-derived detritus to estuarine food supplies relative to detritus from other terrestrial or open-water food sources is not generally known, but varies widely with both species and estuary. There is not yet sufficient evidence to conclude that coastal marshes play a significant role in supporting marine fish and shellfish productivity through export of detritus; phytoplankton is probably more important.

Both wetlands and their associated water bodies have multiple values for wildlife species, including those which aren't strictly wetland-dependent. Conversely, riparian zones (upland areas immediately adjacent to a water body or wetland) may be extremely important to wetland species by providing a buffer for maintenance of wetland environmental (e.g. water) quality, food resources, etc. Similarly, some species, including many furbearers, are quite often found in this interface between aquatic or wetland and upland habitats (Jones et al., 1988).

In coastal areas, wetlands and tidal flats provide valuable habitat for nesting and migratory shorebirds, wading birds, waterfowl, gulls, terns and raptors. Salt marshes are generally considered high value waterfowl habitat because of the large concentrations of breeding pairs and the use of the marshes as overwintering and stopover areas during biannual migrations. Wetland vegetation usually comprises a significant component of the diet of ducks, geese and swans. Some species prefer the submergent aquatic vegetation, while others, especially geese and swans, favor emergent vegetation.

Migratory shorebirds include sandpipers, plovers, turnstones, curlews, dowitchers, phalaropes and the endangered piping plover. These depend on just a few coastal habitats during their long migrations from the Arctic breeding grounds to the South American wintering areas. Most of these birds congregate in extensive mudflat areas, such as those between Lubec and Quoddy Head (Lubec Flats), where they build up their fat reserves before continuing their migrations. The piping plover (Charadrius melodius) nests on sand dunes which are highly susceptible to human disturbance.

Bald eagles, ospreys and wading birds (herons, etc.), typically nest near open water and feed on a variety of fresh and saltwater organisms. These species are especially sensitive to disturbance during their nesting periods and management recommendations for their protection in coastal areas in southern Maine have been recommended (Jones et al., 1988).

Salt marshes and tidal flats are also important for commercially sought fish species, worth millions of dollars annually to Maine fishermen. Many of these require wetlands at some stage of their life cycle. Juvenile marine fish also use coastal marshes, especially brackish marshes.

Mammals like furbearers (e.g. muskrats) live in wetlands banks in houses made of wetland vegetation. Many other wildlife species use wetlands although are not necessarily restricted to them. The use of different wetland types by different wildlife species is included in **Appendix II**.

About 30% of all plant and animal species found on the federal government's list of endangered and threatened species heavily depend on wetlands for food and or habitat, even though only 5% of the nation's area is wetland. In Maine 42% of the official state-listed endangered and threatened plants are found in wetland habitats, including one federally endangered species, Furbish's Lousewort. Of rare and endangered animal species in Maine, 30% are also found in wetlands during at least part of their life cycle or are known to feed or breed in wetlands. The Official List of Maine's Endangered and Threatened Plants is maintained by the Maine Critical Areas Program and state-listed animal species are monitored by the Non-game Program of the Department of Inland Fisheries and Wildlife. Lists can be obtained from these agencies.

Of all wetland functions, wildlife habitat may be the most sensitive to disruption. Increasing development has fragmented formerly continuous areas of habitat for wildlife species. Roads separate wetlands, decreasing their value and accessibility for some species, especially mammals and amphibians (Adamus, 1986). Impacts of development include increased pollution and sediment sources as well as human disturbance of wildlife areas. The loss of riparian habitat, upon which many wetlands and resident animal populations depend, is also of great importance.

The economic value of wetlands as wildlife habitat is difficult to determine, and cannot be computed simply by license sales or other user values. Economic values include non-consumptive uses such as photography, wildlife observation, etc. and expenses incurred by the user. Consumptive uses such as hunting and fishing, usually include expenses to the user for licenses, food, travel and equipment, which contribute to the value of the wildlife, but not necessarily the wetland itself (Boyle, 1987).

An estimated 81% of Maine's population older than 6 years old participate in non-consumptive uses of wildlife to some degree. The participation of non-residents brings revenue into the state, but has not been quantified.

General consumptive use values for wildlife (namely in hunting and fishing) have been preliminarily evaluated (Boyle, 1987). The total value of waterfowl hunting however is impossible to determine in the absence of accurate numbers of hunters. Furthermore, the value of hunting for different species has not been determined. However, the general increase in hunting and fishing licenses is countered by the general decline in duck hunting participation since 1981 (Boyle, 1987). This latter trend may be attributable to population declines in the more popular game ducks, such as the black duck, as well as increases in hunting costs (licenses and duck stamps).

Maine's fishery resources include some species which depend on or use wetland habitats for some part of their life cycle. In coastal areas this includes shellfish found in near shore waters which receive nutrients and detritus from adjacent salt marsh and wetland systems. Soft shell clams, bloodworms and sandworms are harvested commercially in intertidal areas.

Maine shellfish contribute the largest proportion of the landed value of Maine fisheries (**Figure 4.1**) especially due to their high value per pound (e.g. lobsters). In 1984, the total shellfish landing was valued at $ 76,476,000. The landed value of principal shellfish species has generally increased (**Figure 4.2**), even while the total catch in pounds of certain species fell (**Figure 4.3**).

Figure 4.1. The landed value of Maine fisheries from 1960 - 1984 (Colgan et al., 1986).

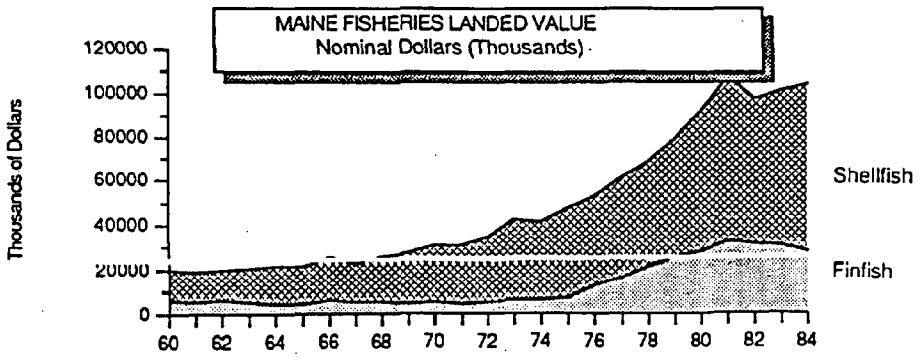


Figure 4.2. The landed value of lobsters, clams and scallops from 1960 - 1984 (Colgan et al., 1986).

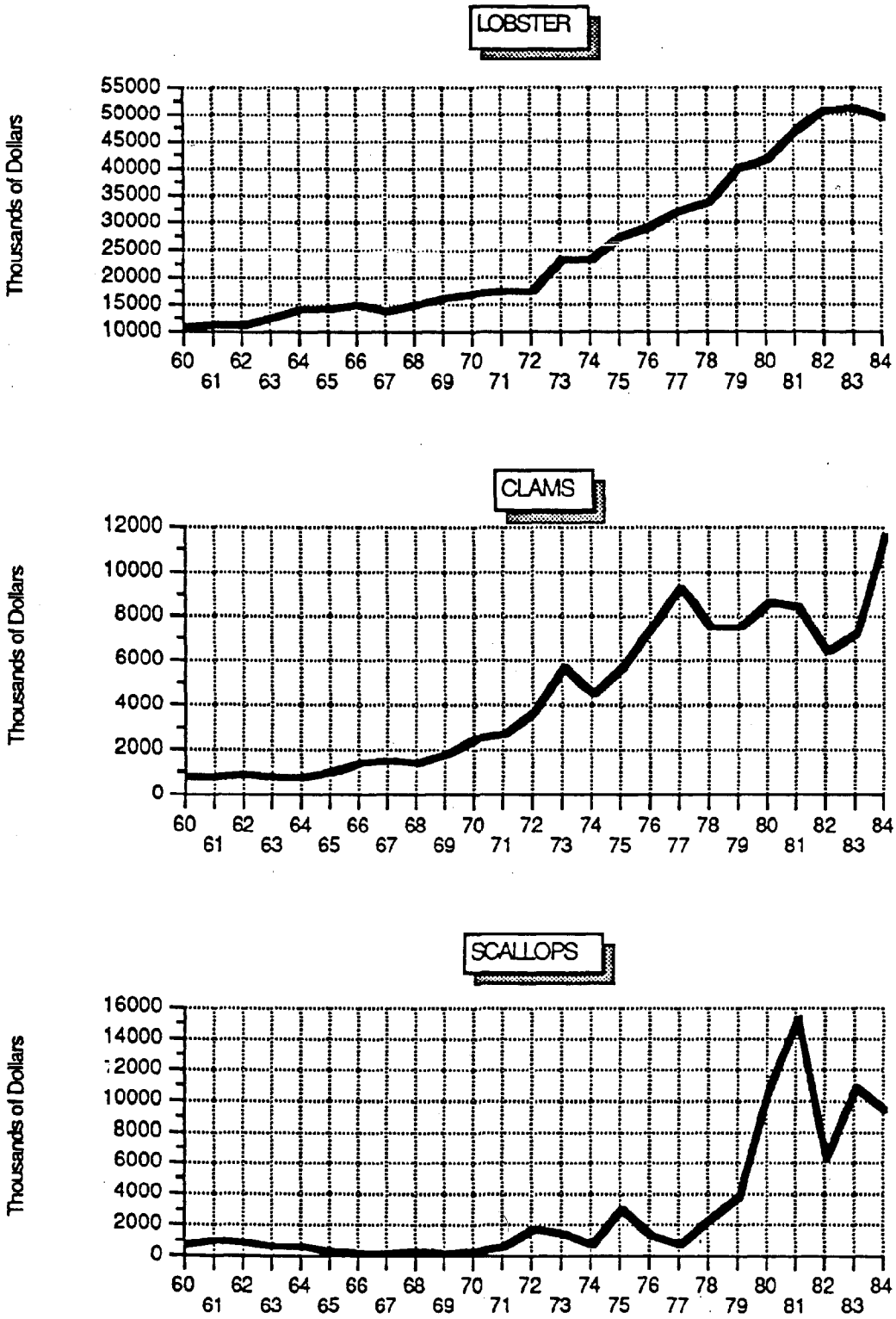
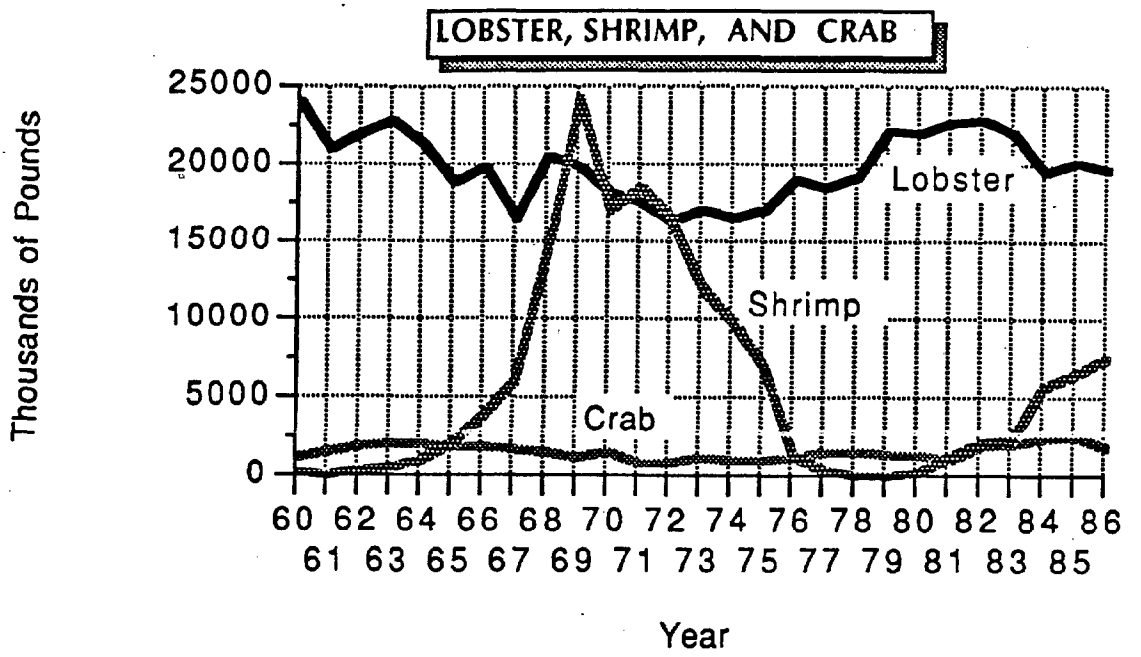
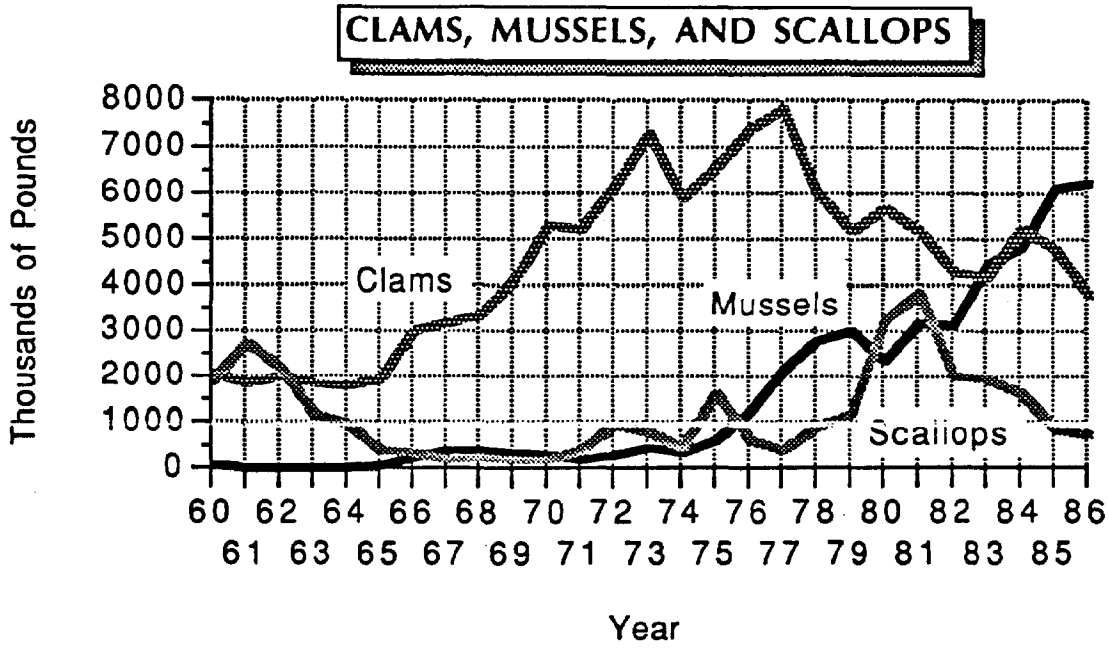


Figure 4.3. The total catch of principal shellfish species in pounds from 1960 - 1986 (Maine State Planning Office, 1988).

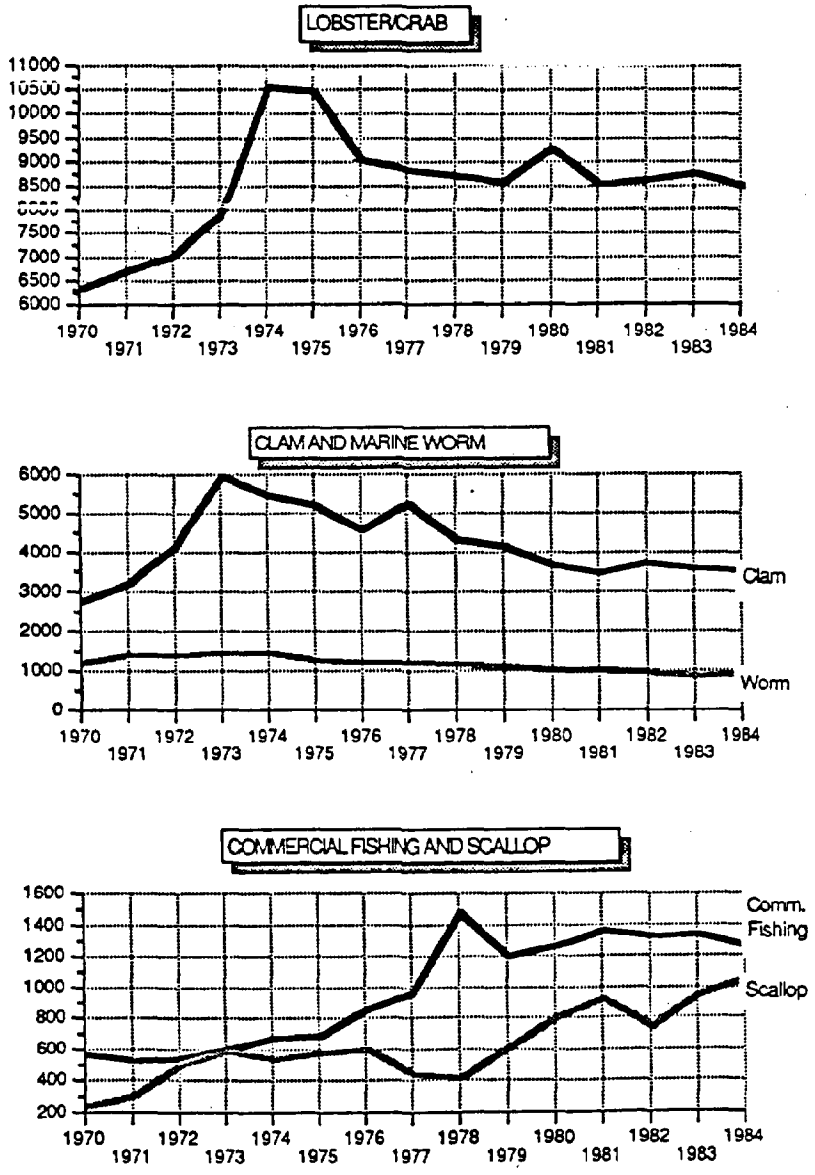




Shellfish species which are increasing in commercial importance are mussels and quahogs. One-third of the mussel catch in 1985 was cultivated, and quahogs have only recently gained economic importance. The number of harvesting licenses issued from 1970 - 1984 for shellfish, worms and commercial fishing is found in **Figure 4.4.**

Canned, fresh and frozen seafood processing of Maine's marine fisheries held a commercial value of nearly $70,000,000. and employed 1700 people in 1984. However, the proportion of this attributable to shellfish species is minor (Colgan et al., 1986).

Figure 4.4. Numbers of harvesting licenses for shellfish, worms and commercial fishing from 1970 - 1984 (Colgan et al., 1986).



Climatic and Atmospheric Functions

There has been little research on this topic, but several hypotheses have been suggested regarding the biospheric importance of wetlands.

There is growing evidence that wetlands help maintain global atmospheric stability. Terrestrial detritus is a large pool of carbon (e.g. peat) or highly organic wetland soils. Methane (a by-product of anaerobic decomposition) is thought to regulate the ozone layer. Wetland conversion results in accelerated oxidation of organic matter and release of CO2 instead of methane.

Large bodies of water are known to moderate local temperature and/or precipitation. Similar functions may be associated with wetlands and their associated water bodies or by the large quantities of water they contain and their contribution to local climatic conditions via evapotranspiration.

CHAPTER 5 - WETLAND ALTERATIONS: THREATS AND LOSSES

HISTORIC WETLAND LOSSES

Nationwide, wetland losses are great. It is estimated that 30-50% of original wetland acreage in the lower 48 states has been converted to other uses within the last 200 years. Between the 1950's and 1970's alone, eleven million acres were converted, at a rate of about 550,000 acres per year. With federal and state governmental regulations in effect, this rate of loss has slowed somewhat, to about 300,000 acres per year (OTA, 1984). Coastal wetlands, which experienced the greatest wetland losses during the early periods of settlement, seem reasonably well protected through state coastal zone management programs. However, development pressures are greater now than ever, resulting in serious degradation of remaining coastal wetlands. Inland freshwater wetlands have never been well protected and continue to face serious losses.

According to the EPA, New England wetlands are not disappearing as rapidly as other areas in the U.S., primarily because of stronger wetland protection laws, fewer remaining wetlands and a more environmentally aware population. (EPA, 1986). Historic losses have occurred mostly on coastal wetlands, although at present there is increasing development pressure on inland freshwater wetlands (OTA, 1984). Trends in Maine may be similar to the rest of New England. However, regulation of many freshwater wetlands is still inadequate and the large number of wetlands in Maine's natural landscape will result in more pressure to develop them as the population increases.

More importantly, the absence of statewide comprehensive wetland or land use maps make historic losses difficult to assess, future threats difficult to manage, and wetland trend studies impossible to produce. Wetland losses include both the physical loss of wetland acreage through a variety of manipulative or destructive alterations and loss of wetland function(s) by these same physical activities or by chemical or biological alterations. Nationally, the major types of wetland alterations are water diversions through activities such as road building; drainage and channelization for agricultural purposes; chemical and nutrient contamination from various development and agricultural activities; and the cumulative impacts of other activities conducted in areas adjacent to wetlands (OTA, 1984).

Historic wetland losses in Maine will be described in this section and reported by type of activity involved. Many of these activities continue to threaten wetlands while others have been curtailed by regulation. In some cases, wetlands have been created by human and non-human influences. The types of habitats lost or altered and regions of greatest loss by human activity is also given where known. In most cases, there is no definite acreage documentation of wetland losses overall, only the expert recollection of individuals, regulators, planners and field biologists in Maine, who supplied the bulk of the following information.

Land Use History

The history of European settlement in Maine and the ensuing patterns of land use give some indication of the historic impacts upon wetlands. The early settlements were restricted to coastal areas where fishing and farming was the mainstay of most communities. Salt marshes used for "salt hay" production and the productive fishery resources of offshore estuarine areas enabled a continuous history of habitation along the coast. Urban centers often grew from these coastal towns and later followed inland waterways up the major rivers such as the Kennebec and the Penobscot. As the timber industry grew, settlements spread further inland, yet maintained the critical connection with the sea.

The later expansion of urban areas was unconcerned with wetlands, and filling was common along coastal wetlands, adjacent spits, beaches, and along river floodplains. Many of Maine's major coastal towns and cities are situated at the mouths of such rivers, or in protected coves where salt marshes and other wetland communities are prevalent. Examples of wetlands situated on inland river floodplains include: Gardiner, Hallowell, and Augusta along the Kennebec River, and in Bangor along the Penobscot River. Adjacent, silt-laden soils of floodplains and river valleys were also converted to agricultural use, and many river valley farms remain highly productive farmland today.

Types of Wetland Alteration Contributing to Wetland Loss

There are many causes or motives for wetland alteration that result in wetland loss. Some alterations may result in the total loss of the wetland habitat and natural functions alike, or may slightly or partially impair one or more functions, leaving the wetland intact. Other activities may degrade the wetland more slowly, resulting in eventual loss of function and value.

Today most federal and state regulations focus on those activities which tend to destroy wetlands (i.e. filling and dredging). The placement of fill into a wetland terminates its water-holding capacity, diminishes its ability to sustain wetland vegetation and alters soil characteristics. When filled, wetlands become upland or dry sites and their development potential is much higher. However, the drainage problems associated with developing wetlands may be simply shifted to neighboring areas including residences.

Filling wetlands may be intentional as in the creation of residential development sites, or it may be incidental to other activities, such as dredging, where the dredged material is placed in a wetland. Dredging is often done to keep intertidal channels and subtidal areas clear and passable for navigation.

Drainage of wetlands has been less of an issue in Maine, where the pressure to develop wetland sites for agricultural purposes has not been as great as in the midwest. With farm abandonments on the rise, conversion of wetland soils becomes less attractive. Drainage of wetlands may become important when considered in the context of other development activities such as filling or peat mining.

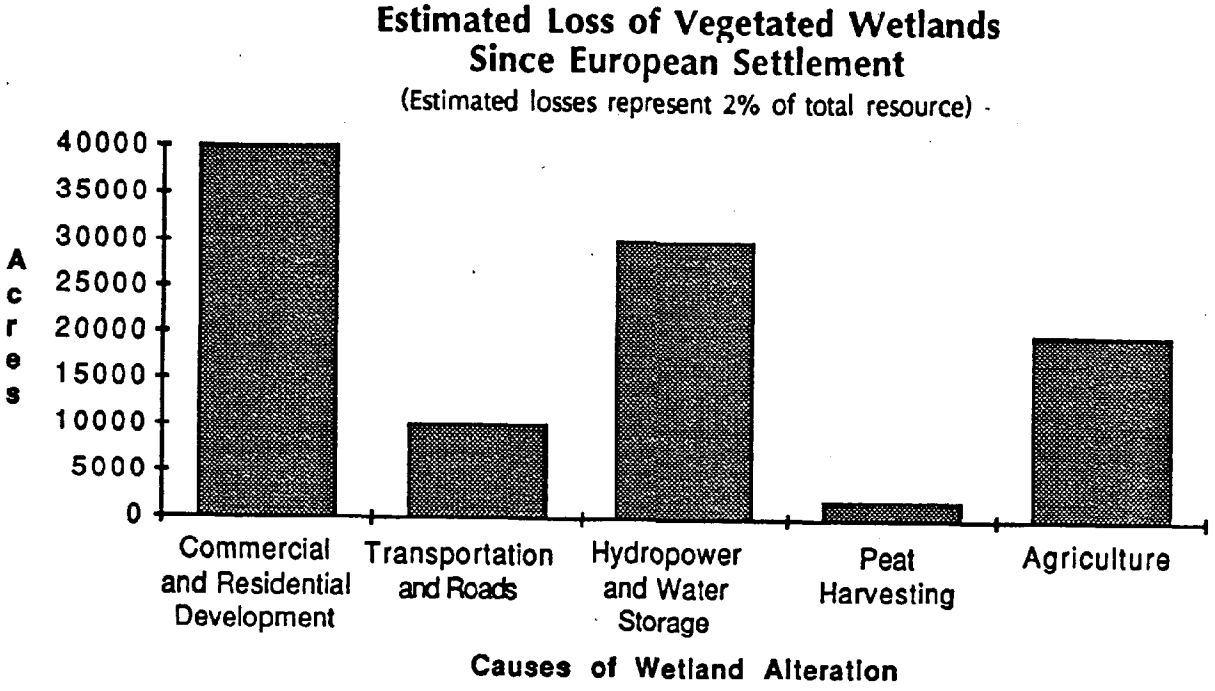
All of these activities can be described as conversion from one "land" type to another, generally from wet to dry. Other kinds of conversions may result in a net gain of wetland acreage, or no net change in acreage, but a change in wetland type. Fishery and wildlife management techniques often alter one characteristic of a wetland in favor of another. For example, water-level control structures may increase the area of permanent water and enhance the value of the wetland for waterfowl. Provided that management decisions consider the full range of values present at a given site before determining its appropriateness for change, such effects upon other natural wetland values may be small.

Other types of wetland alteration include the clearing of vegetation (by burning, digging, herbicide application, scraping, mowing, grazing or otherwise cutting); the diversion or impoundment of water flow through a wetland by dam construction, channelization, etc.; too much shading of vegetation; and activities on adjacent upland areas which directly or indirectly impact wetlands. The latter may include chemical changes induced by nutrient runoff or the introduction of toxic materials, or the reduction of populations of existing species and/or the introduction of exotic species.

Causes and Amounts of Wetland Loss

Many of the increased development pressures on wetlands relate directly to population growth. Increasing urbanization, residential and commercial development, increased roadways and use of wetland resources all result in direct and indirect adverse impacts on wetlands. The following factors and activities have been identified as contributors to historic wetland loss. The net effect of these activities on wetland loss is illustrated in **Figure 5.1.**

Figure 5.1 Estimated loss of vegetated wetlands in Maine since European settlement.



1. Commercial, Residential and Urban Development

Commercial and residential development has been and continues to be an important cause of wetland loss in Maine. Initially restricted to coastal areas and major waterways, inland freshwater wetlands are now subject to the same threats. Typical wetland development involves filling to provide a suitable substrate for construction. In addition to direct and secondary impacts of development on wetlands themselves, impacts from associated upland development is prevalent.

The early losses of coastal wetlands to urbanization are based on assumptions of which cities or towns may rest on former wetlands. One can suspect a similar trend is valid for all of New England, although greatest in southern New England. The urban and residential expansion of the 1950's and 1960's had the greatest affect on coastal wetlands as such growth outpaced protection.

The extent and nature of such wetland losses are not well documented. While certain wetlands may not have been lost or filled outright, many development activities have secondary impacts such as water quality deterioration (via stormwater runoff, sewage control, etc.), chemical pollution (industrial, agricultural, etc.) and habitat degradation. The loss of important wildlife habitat along wetland borders is often at least as important as the wetland itself to some species. Another secondary impact of population growth in and around coastal wetlands was the ditching and partial drainage of many salt marshes for mosquito abatement. These ditches are still visible on the ground and from aerial photos, although many have since filled in.

2. Transportation and Roads

Wetland losses associated with early periods of road building were not recorded, but may range in the hundreds of acres. Federal highway projects document more recent wetland losses and mitigation. Hundreds of acres of wetland are likely to have been filled by the Maine Department of Transportation (MDOT), the Maine Turnpike Authority (MTA) and by the construction of local, town or private roads. Historical record of wetland fills by roadbuilding is incomplete and archival in nature. Some estimates exist in environmental documentation ("categorical exclusions") for federally funded projects and federally (Corps) permitted activities, but they have not been tabulated for the hundreds of such cases.

Most of the road construction in Maine over the last 40-50 years has been through the upgrading of dirt roads. The rapid growth rates of the 1950's were accompanied by increased road and highway building. At the same time, wetlands were not an area of major concern and actual wetland losses were not recorded. Now, however, the Federal Highway Administration (FHWA) requires federally funded roadway projects consider ways to avoid or minimize wetland losses.

There are 22,000 miles of public roadways in Maine and MDOT is responsible for 8,700 miles. For FHWA projects, MDOT must explain why there are no practicable alternatives to impacting the wetlands and explain why the proposed action includes all practicable measures to minimize harm to wetlands. Currently, MDOT fills and alters about 10 acres per year, some of which is compensated by the creation and enhancement of wetland perhaps to different types.

The Maine Turnpike Authority was responsible for filling large areas of wetland during construction of the Maine Turnpike, possibly in the hundreds of acres. Open water wetland areas were created as well, as mitigation for some wetland losses, and inadvertently as construction altered drainage patterns. MDIFW coordinated closely with MTA during highway construction to avoid the crossing or disturbance of certain high value wetlands.

LITERATURE CITED

Adamus, P. R. and L. T. Stockwell. 1983. **A Method for Wetland Functional Assessment.** Vol. 1. FHWA-IP-82-24. U.S. Department of Transportation. Washington, D.C.

Adamus, P. R. 1983. **A Method for Wetland Functional Assessment.** Vol. 2. FHWA-IP-82-24. U.S. Department of Transportation, Washington, D.C.

Adamus, P.R. 1986. **The Cumulative Impacts of Development in Southern Maine: Wetlands: Their Locations, Functions and Value.** Maine State Planning Office. Augusta, ME 04333. 69 pp.

Arbuckle, J. and M. Lee. 1987. **The Cumulative Impacts of Development in Southern Maine: A study of habitat changes in 5 coastal towns.** Maine Audubon Society for the Maine State Planning Office. Maine State Planning Office. Augusta, Maine 04333. 50 pp. and Appendices.

Batie, S. S. and L. A. Shabman. 1982. **Estimating the Economic Value of Wetlands: Principles, Methods and Limitations.** Coastal Zone Management Journal 10(3): 255-278.

Boelter, D. H. and Verry, E. S. 1977. **Peatland and Water in the Northern Lake States.** U.S.D.A. Forest Service. General Technical Report NC-31, North-Central Forest Experiment Station, St. Paul, MN.

Boyle, K. J., V. A. Trefts, P. S. Hesketh. 1987. **A Preliminary Investigation of the Economic Value and Use of Maine's Inland Fish and Wildlife Resources.** A Report to the Maine Department of Inland Fisheries and Wildlife and the Maine Department of Conservation. 52 pp.

Cameron,C.C.; M.K. Mullen, C.A. Lepage and W.A. Anderson. 1984. **Peat Resources of Maine.** Maine Geological Survey, Department of Conservation, Augusta, Maine. MGS Bull. Nos. 28-32. 5 Vols.

Colgan, C.S., L.C. Irland, J. Benson. 1986. **The Natural Resource Industries of Maine. An Assessment and Statistical Report.** Maine State Planning Office and Finance Authority of Maine, Augusta, ME. 135 pp.

Cowardin, L.M.; V. Carter, F.C. Golet and E.T. LaRoe. 1979. **Classification of Wetlands and Deepwater Habitats of the United States.** U.S. Fish and Wildlife Service, Office of Biological Services. FWS/OBS-79/31. 131 pp.

Dahl, T. E. 1985. **Use of National Wetlands Inventory Data for Wetland assessment.** In: Proceedings: National Wetlands Assessment Symposium, June 17-20, 1985. Association of State Wetland Managers. pp. 146-150.

Damman, A. W. H. 1979. **Geographic patterns in peatland development in eastern North America.** In: Classification of Peat and Peatlands. Proc. of the International Symposium, Hyytiala, Finland, Sept. 17-21, 1979. International Peat Society. pp 42-57.

Davis, R.B. (in prep.) **Eccentric Raised Bogs in Maine.** Report to the Critical Areas Program.

Davis, R. B., A. Zlotsky, G. L. Jacobson, E. Sorenson and L. Widoff. (in prep.). **Maine's Freshwater Peatlands: Typology and Distribution.** Can. J. Botany.

Davis, R.B.; G.L. Jacobson, Jr., L.S. Widoff, A. Zlotsky. 1983. **Evaluation of Maine Peatlands For Their Unique and Exemplary Qualities.** Report prepared for Dept. of Conservation, Augusta, Maine. 186 pp.

Eckstorm, F. H. 1904. **Penobscot Man.** Juniper Press, 1978 (reprint). 362 pp.

Fefer, S.I. and P.A. Shettig (Principle Investigators). 1980. **An Ecological Characterization of Coastal Maine (North and East of Cape Elizabeth).** U.S. Department of the Interior, U.S. Fish and Wildlife Service. FWS/OBS-80/29. 6 volumes.

Giffen, R.A. 1988. **Filling Coastal Wetlands. A history of decisions under Maine's Alteration of Coastal Wetlands Act.** A report to the Maine Audubon Society. 12 pp.

Golet, F. C. 1973. **Wetlands and Wildlife.** In: A Guide to Important Characteristics and Values of Freshwater Wetlands in the Northeast. Publ. No. 31 Reprint, Water Resources Research Center, University of Mass, Amherst.

Golet, F. C. 1978. **Rating the Wildlife Value of Northeastern Freshwater Wetlands.** In: Wetland Functions and Values: The State of Our Understanding, P. E. Greeson, J. R. Clark and J. E. Clark (eds.) Proc. of the National Symposium on Wetlands, pp. 63-73.

Gutis, P.S. 1988. **Troubled Seas: Global Red Tides of Algae Bring New Fears.** The New York Times. May 3, 1988.

Hackney, C.T. and W.J. Cleary. 1987. **Salt marsh loss in Southeastern North Carolina lagoons: importance of sea level rise and inlet dredging.** Journal of Coastal Research, 3(1)93-97. Charlottesville, ISSN 0749-0208.

Haynes, G. H. 1889. Ellsworth, Maine. **The picturesque city of the east. Green Lake, the tourist's, angler's and hunter's paradise.** Journal Press, Lewiston, ME. obl. pp.24.

Horwitz, E. L. 1978. **Our Nation's Wetlands: An Interagency Task Force Report.** Council on Environmental Quality. 70 pp.

Jacobson, H.A.; G.L. Jacobson and J.T. Kelley. 1987. **Distribution and Abundance of Tidal Marshes Along the Coast of Maine.** Estuaries 10(2): 126-131.

Jones, J. J. 1986. **The Cumulative Impacts of Development in Southern Maine: Important Wildlife Habitats.** Maine State Planning Office, Augusta, Maine.

Jones, J. J., J. P. Lortie, U. D. Pierce, Jr. 1988. **The Identification and Management of Significant Fish and Wildlife Resources in Southern Coastal Maine.** Maine Department of Inland Fisheries and Wildlife, Augusta, Maine, 04333. 140 pp.

Maine Department of Conservation. 1982. **Maine Rivers Study.** Maine D.O.C. and U.S.D.I. National Park Service. 249 pp.

Maine Department of Inland Fisheries and Wildlife. 1988. **Maine Wetland Inventory Data Base.** Unpublished Data. Augusta, Maine. 04333.

Maine State Planning Office. 1986. **Coastal Program Core Laws and Their Administration.** Augusta, ME 04330.

Maine State Planning Office. (in prep.) **The State of the Environment.** Augusta, ME.

Martin, A. C., N. Hotchkiss, F. M. Uhler, and W. S. Bourn. 1953. **Classification of the Wetlands of the United States.** U.S. Fish and Wildlife Service, Spec. Sci. Rep. Wildl. 20. 14 pp.

McCall, C.A. 1972. **Manual for Maine Wetlands Inventory.** Maine Dept. of Inland Fisheries and Wildlife, Game Division. Augusta, Maine. 38 pp.

Mitsch, W. J., Dorge, C. L., and Weimhoff, J.R., 1977. **Forested Wetlands for Water Resource Management in Southern Illinois**, University of Illinois, Urbana-Champaign) Water Resources Center, Research Report No. 132, NTIS No. PS 276659.

Novitski, R. P. 1979. **The hydrologic characteristics of Wisconsin wetlands and their influence on Flood, Streamflow and sediment.** In: Wetland Functions and Values: The State of our Understanding, P. E. Greeson, J. R. Clark and J. E. Clark, (eds.). Proc. of the National Symposium on Wetlands. American Water Resources Association, Minneapolis, MN. pp.377-388.

Odum, E.P. 1978. **The Value of Wetlands: A Hierarchical Approach** In: Wetland Functions and Values: The State of our Understanding. E. P. Greeson, J.R. Clark and J.E. Clark (eds.). Proc. of the National Symposium on Wetlands. American Water Resources Assoc., Minneapolis, MN. pp 16-25.

Office of Technology Assessment (OTA). 1984. **Wetlands: Their Use and Regulation.** U. S. Congress, Washington, D. C. OTA-0-206. 208 pp.

Payson, H. III. 1982. **The economic impact of less dredging by the Army Corps of Engineers: Selected Maine ports through 1990.** For New England Governors Conference. Maine State Planning Office, Augusta, Maine.

Platt, R. H. 1987. **Coastal Wetland Management: The Advance Designation Approach.** Environment 29(9):16-43.

Platt, R. H. 1987. **Coastal Wetland Management: Strengthening EPA's Role.** Report prepared for the Office of Wetlands, E.P.A. Land and Water Policy Center, Univ. of Mass., Amherst. 46 pp plus Appendices.

Reed and D'Andrea. 1973. **The Tidal Wetlands Dilemma.** Conservation Priorities Plan. Land and Space Planning, South Gardiner, Maine.

Scheirer, B. 1982. **A Report on Unauthorized Wetland Filling in Wells, Maine.** U.S. Dept. of the Interior, U.S. Fish and Wildlife Service. Unpublished report. 8 pp.

Sewall Company, 1945. **Report on the Proposed Flowage Area Above Long Falls Dam in TWP 3 R 4, BKP, WKR, Carrying Place, Dead River, Flagstaff, Bigelow, Eustis and Coplin for Central Maine Power.** Old Town, Maine. 9 pp. and maps.

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

Smardon, R. C. 1973. **Visual-Cultural Values of Wetlands.** In: A Guide to Important Characteristics and Values of Freshwater Wetlands in the Northeast. (J. S. Larson, ed.) Publication #31 Reprint. Water Resources Research Center. University of Mass., Amherst. pp 9-12.

Sorenson, E. 1986. **The Ecology and Distribution of Ribbed Fens in Maine.** Critical Areas Program Planning Report No. 81. State Planning Office, Augusta, Maine 04333.

Spencer, H. E., Jr. 1963. **Man-made Marshes for Maine Waterfowl.** Game Div. Bull. No. 9, Dept. Inland Fisheries and Wildlife, Augusta, Maine, 04333. 79 pp.

Startwout, D.J. 1982. **An Evaluation of the National Wetlands Inventory in Massachusetts.** Proc. of **In-Place Resource Inventories Workshop**. University of Maine, Orono, Maine. pp 685-691.

State Planning Office. 1977. **Maine Coastal Inventory Handbook.** Coastal Planning Program. Land Use Information Series - IV. 31 pp.

Stockwell, S.S. and M. Hunter, Jr. 1983. **A Description of the Wildlife in 27 Maine Peatlands.** Report prepared for Maine Dept. Of Inland Fisheries and Wildlife. 144 pp.

Stuiver, M. and H. W. Borns. 1975. **Late Quaternary Marine Invasion in Maine. Its Chronology and Associated Coastal Movement.** Geol. Soc. Am. Bull. 86:99-104.

Tiner, R.W. 1984. **Wetlands of the United States: Current Status and Recent Trends**. U.S. Fish and Wildlife Service. National Wetlands Inventory, Newton, MA 59 pp.

Tiner, R.W., Jr. 1985a. **Wetlands of Delaware.** U.S. Fish and Wildlife Service, National Wetlands Inventory, Newton Corner, MA and Delaware Dept. of Natural Resources and Environmental Control, Wetlands Section, Dover, DE. Cooperative Publication. 77 pp.

Tiner, R.W. 1985b. **Wetlands of New Jersey.** U.S. Fish and Wildlife Service, National Wetlands Inventory, Newton Corner, MA. 117 pp.

Tiner, R.W. and B. Veneman. 1987. **The Hydric Soils of New England.** University of Mass. Cooerative Extension Bull. C-183, Amherst, MA. 27 pp.

Tolonen, K., R. B. Davis and L. Widoff. (In press). **Peat accumulation rates in selected Maine peatlands.** Maine Geological Survey, Augusta, Maine. Bulletin No. 33. 97 pp.

U.S. Department of the Interior. 1954. **Wetlands Inventory of Maine**. U.S. Fish and Wildlife Service, Office of River Basin Studies. Boston, MA. 30 pp + map.

U.S. Fish and Wildlife Service. 1959. **Inventory of Permanent Water Areas of Significant Value to Waterfowl in the State of Maine.** U.S. Dept. of the Interior. March, 1959.

U.S. Fish and Wildlife Service. 1965. **A Supplementary Report on the Coastal Wetlands Inventory of Maine.** U.S. Dept of the Interior. 11 pp.

U. S. Fish and Wildlife Service and Environment Canada. 1986. **North American Waterfowl Management Plan.** U. S. Dept. of the Interior and Canadian Wildlife Service. 33 pp.

Verry, E. S. and Boelter, D. 1979. **Peatland Hydrology.** In: Wetland Functions and Values: the State of Our Understanding, P. E. Greeson, J. R. Clark, and J.E. Clark (eds.). Proc. of the National Symposium on Wetlands. American Water Resources Association, Minneapolis, MN. pp. 389-402.

Worley, I. A. 1980. **Botanical and Ecological Aspects of Coastal Raised Peatlands in Maine.** Maine

State Planning Office, Critical Areas Program, Augusta, Maine. Planning Report No. 69. 175 pp.
Worley, I. 1982. **Botanical and Ecological Aspects of Coastal Raised Peatlands in Maine.** Critical Areas Program Planning Report No. 69. State Planning Office, Augusta, Maine 04333.

Public Law 99-645
99th Congress

An Act

Nov. 10, 1986
[S. 740]

To promote the conservation of migratory waterfowl and to offset or prevent the serious loss of wetlands by the acquisition of wetlands and other essential habitat, and for other purposes.

Emergency Wetlands Resources Act of 1986.
16 USC 3901 note.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled,

SECTION 1. SHORT TITLE.

This Act may be cited as the "Emergency Wetlands Resources Act of 1986".

16 USC 3901.

SEC. 2. FINDINGS AND STATEMENT OF PURPOSE.

(a) FINDINGS.—The Congress finds that—

(1) wetlands play an integral role in maintaining the quality of life through material contributions to our national economy, food supply, water supply and quality, flood control, and fish, wildlife, and plant resources, and thus to the health, safety, recreation, and economic well-being of all our citizens of the Nation;

(2) wetlands provide habitat essential for the breeding, spawning, nesting, migration, wintering and ultimate survival of a major portion of the migratory and resident fish and wildlife of the Nation; including migratory birds, endangered species, commercially and recreationally important finfish, shellfish and other aquatic organisms, and contain many unique species and communities of wild plants;

(3) the migratory bird treaty obligations of the Nation with Canada, Mexico, Japan, the Union of Soviet Socialist Republics, and with various countries in the Western Hemisphere require Federal protection of wetlands that are used by migratory birds for breeding, wintering or migration and needed to achieve and to maintain optimum population levels, distributions, and patterns of migration;

(4) wetlands, and the fish, wildlife, and plants dependent on wetlands, provide significant recreational and commercial benefits, including—

(A) contributions to a commercial marine harvest valued at over $10,000,000,000 annually;

(B) support for a major portion of the Nation's multimillion dollar annual fur and hide harvest; and

(C) fishing, hunting, birdwatching, nature observation and other wetland-related recreational activities that generate billions of dollars annually;

(5) wetlands enhance the water quality and water supply of the Nation by serving as groundwater recharge areas, nutrient traps, and chemical sinks;

(6) wetlands provide a natural means of flood and erosion control by retaining water during periods of high runoff, thereby protecting against loss of life and property;

(7) wetlands constitute only a small percentage of the land area of the United States, are estimated to have been reduced by half in the contiguous States since the founding of our Nation, and continue to disappear by hundreds of thousands of acres each year;

(8) certain activities of the Federal Government have inappropriately altered or assisted in the alteration of wetlands, thereby unnecessarily stimulating and accelerating the loss of these valuable resources and the environmental and economic benefits that they provide; and

(9) the existing Federal, State, and private cooperation in wetlands conservation should be strengthened in order to minimize further losses of these valuable areas and to assure their management in the public interest for this and future generations.

(b) PURPOSE.—It is the purpose of this Act to promote, in concert with other Federal and State statutes and programs, the conservation of the wetlands of the Nation in order to maintain the public benefits they provide and to help fulfill international obligations contained in various migratory bird treaties and conventions with Canada, Mexico, Japan, the Union of Soviet Socialist Republics, and with various countries in the Western Hemisphere by—

(1) intensifying cooperative efforts among private interests and local, State, and Federal governments for the management and conservation of wetlands; and

(2) intensifying efforts to protect the wetlands of the Nation through acquisition in fee, easements or other interests and methods by local, State, and Federal governments and the private sector.

SEC. 3. DEFINITIONS.

For the purpose of this Act:

(1) The term "Committees" means the Committee on Merchant Marine and Fisheries and the Committee on Interior and Insular Affairs of the House of Representatives and the Committee on Environment and Public Works and the Committee on Energy and Natural Resources of the Senate.

(2) The term "designated unit" means a unit of the National Wildlife Refuge System designated by the Secretary under section 201(a)(2).

(3) The term "hydric soil" means soil that, in its undrained condition, is saturated, flooded, or ponded long enough during a growing season to develop an anaerobic condition that supports the growth and regeneration of hydrophytic vegetation.

(4) The term "hydrophytic vegetation" means a plant growing in—

(A) water; or

(B) a substrate that is at least periodically deficient in oxygen during a growing season as a result of excessive water content.

(5) The term "wetland" means land that has a predominance of hydric soils and that is inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances does support, a prevalence of hydrophytic vegetation typically adapted for life in saturated soil conditions.

TITLE I—EXTENSION OF WETLANDS LOAN ACT

SEC. 101. EXTENSION OF WETLANDS LOAN ACT.

(a) AVAILABILITY OF APPROPRIATIONS.—The first section of the Act entitled "An Act to promote the conservation of migratory waterfowl by the acquisition of wetlands, and for other essential waterfowl habitat, and for other purposes", approved October 4, 1961 (16 U.S.C. 715k-3), is amended by striking out "September 30, 1986" and inserting in lieu thereof "September 30, 1988".

(b) REPAYMENT PROVISIONS.—Section 3 of such Act (16 U.S.C. 715k-5) is amended by striking out the first three sentences.

TITLE II—REVENUES FOR REFUGE OPERATIONS AND THE MIGRATORY BIRD CONSERVATION FUND

National Wildlife Refuge System.

16 USC 3911.

SEC. 201. SALE OF ADMISSION PERMIT AT CERTAIN REFUGE UNITS.

(a) SALE OF ADMISSION PERMITS.—(1) Notwithstanding the Land and Water Conservation Fund Act of 1965 (16 U.S.C. 460l-4 et seq.), in order to provide additional revenues for the conservation of wetland resources of the Nation and for the operation and maintenance of refuges—

(A) the Secretary of the Interior may, at units of the National Wildlife Refuge System designated by the Secretary under paragraph (2)—

(i) charge fees for admission permits;

(ii) sell Golden Eagle passports and Golden Age passports;

(iii) issue at no charge lifetime admission permits as authorized in section 4(a)(5) of the Land and Water Conservation Fund Act of 1965 (16 U.S.C. 460l-4—460l-11);

(B) the amounts collected by the Secretary as a result of the activities described in subparagraph (A) shall be distributed as provided in subsection (c).

(2) The Secretary shall designate a unit of the National Wildlife Refuge System for purposes of this Act if the Secretary determines, with respect to such unit, that—

(A) The level of visitation for recreational purposes is high enough to justify the collection of fees for admission permits for economic reasons.

(B) There is a practical mechanism in existence for implementing and operating a system of collecting fees for admission permits.

(C) Imposition of a fee for admission permits is not likely to result in undue economic hardship for a significant number of visitors to the unit.

(b) EXCEPTIONS.—(1) The Secretary may not require an admission permit under subsection (a)(1) for entry by a person into a designated unit if such person is the holder of—

(A) a valid migratory bird hunting and conservation stamp issued under section 2 of the Act of March 16, 1934 (16 U.S.C. 718b) (commonly known as the Duck Stamp Act);

(B) a valid Golden Eagle Passport issued under section 4(a)(1) of the Land and Water Conservation Fund Act of 1965 (16 U.S.C. 4601-6a(a)(1));

(C) a valid Golden Age Passport issued under section 4(a)(4) of such Act; or

(D) a valid lifetime admission permit as authorized in section 4(a)(5) of such Act.

(2) Permits for a single visit to any designated unit shall be made available by the Secretary of the Interior for a reasonable fee, but not to exceed $3 for individuals or $7.50 per vehicle. For purposes of this subsection, the term "single visit" means a more or less continuous stay within a designated unit by a person or group described in subsection (d). Payment of a single visit fee and issuance of a single visit permit shall authorize exits from and re-entries to a single designated unit for a period of from one to fifteen days. Such period shall be defined for each designated unit by the Secretary based upon a determination of the period of time reasonably and ordinarily necessary for such a single visit.

(3) Special admission permits for uses such as group activities may be issued in accordance with procedures and at fees established by the Secretary.

(4) A person may not be required to purchase an admission permit under subsection (a)(1) in order to travel by private noncommercial vehicle over any road or highway—

(A)(i) established as part of the National Federal Aid System (as defined in section 101 of title 23, United States Code); and

(ii) commonly used by the public as a means of travel between two places which are outside the designated unit; or

(B) to any land in which such person has a property interest if such land is within any designated unit.

(5) A person may not be required to purchase an admission permit under subsection (a)(1) for entrance or admission to a unit of the National Wildlife Refuge System created, expanded, or modified by Public Law 96-487.

16 USC 3l note.

(c) DISTRIBUTION OF AMOUNTS COLLECTED.—Amounts collected from the sale of admission permits under this section and from fees collected at any unit of the National Wildlife Refuge System under subsections (b) and (c) of section 4 of the Land and Water Conservation Fund Act of 1965 (16 U.S.C. 460l-6a (b), (c)) shall be distributed as follows:

(A) Thirty per centum shall be available to the Secretary of the Interior until expended. The Secretary shall use such amount—

(i) first, to defray the cost of collection;

(ii) next, for operation and maintenance of the collecting unit; and

(iii) next, for operation and maintenance of all units within the National Wildlife Refuge System, except those units created, expanded, or modified by Public Law 96-487.

(B) Seventy percent shall be deposited into the migratory bird conservation fund established under section 4 of the Act of March 16, 1934 (16 U.S.C. 718d).

(d) PERSONS ACCOMPANYING PERMITTEES.—A person who holds a stamp, passport, or permit described in subsection (b) shall be entitled to general entrance into any designated unit, along with—

(1) any persons accompanying such person in a single, private, noncommercial vehicle; or

(2) where entry to the area is by any means other than single, private, noncommercial vehicle, the person and any accompanying spouse, children, or parents.

(e) RESTRICTIONS.—A permit issued under this section is nontransferable. Such a permit may not authorize any uses for

which fees are charged under the Land and Water Conservation Fund Act of 1965 (16 U.S.C. 460l–4 et seq.).

(f) ESTABLISHMENT OF FEES; POSTING OF NOTICES.—(1) All fees established pursuant to this section shall be fair and equitable. In establishing such fees, the Secretary shall consider the following:

(A) The direct and indirect cost to the Government.

(B) The benefits to the permit holder.

(C) The public policy or interest served.

(D) The comparable fees charged by non-Federal public agencies.

(E) The economic and administrative feasibility of fee collection and other pertinent factors.

(2) The Secretary shall require that notice that a fee has been established under this section—

(A) be prominently posted at each designated unit and at appropriate locations in each such unit; and

(B) to the extent practicable, be included in publications distributed at such units.

(g) VOLUNTEERS.—The Director of the United States Fish and Wildlife Service may accept services of volunteers to sell admission permits under this section or to sell Golden Eagle and Golden Age Passports or Migratory Bird Hunting and Conservation Stamps. The Director may use funds appropriated or otherwise made available to the Service to cover the cost of any surety bond that may be required of a volunteer performing the services authorized under this subsection.

SEC. 202. PRICE OF MIGRATORY BIRD HUNTING AND CONSERVATION STAMP.

16 USC 718b. Section 2(b) of the Act of March 16, 1934 (16 U.S.C. 718(b)), is amended in the first sentence—

(1) by striking out "$7.50" and inserting in lieu thereof "$10.00";

(2) by striking out "any hunting year" and inserting in lieu thereof "hunting years 1987 and 1988, $12.50 for hunting years 1989 and 1990, and $15.00 for each hunting year thereafter,"; and

(3) by inserting "available for obligation and" before "attributable".

16 USC 3912. **SEC. 203. TRANSFERS TO MIGRATORY BIRD CONSERVATION FUND.**

Notwithstanding any other provision of law, an amount equal to the amount of all import duties collected on arms and ammunition, as specified in subpart A of part 5 of schedule 7 of the Tariff Schedules of the United States, shall, beginning with the next fiscal year quarter after the date of enactment of this Act, be paid quarterly into the migratory bird conservation fund established under section 4 of the Act of March 16, 1934 (16 U.S.C. 718d).

19 USC 1202.

TITLE III—STATE AND FEDERAL WETLAND ACQUISITION

16 USC 3921. State and local governments. **SEC. 301. NATIONAL WETLANDS PRIORITY CONSERVATION PLAN.**

(a) IN GENERAL.—The Secretary shall establish, and periodically review and revise, a national wetlands priority conservation plan which shall specify, on a region-by-region basis or other basis considered appropriate by the Secretary, the types of wetlands and interests in wetlands which should be given priority with respect to Federal and State acquisition.

(b) CONSULTATION.—The Secretary shall establish the plan required by subsection (a) after consultation with—

(1) the Administrator of the Environmental Protection Agency;

(2) the Secretary of Commerce;

(3) the Secretary of Agriculture; and

(4) (the chief executive officer of each State. State and local governments.

(c) FACTORS TO BE CONSIDERED.—The Secretary, in establishing the plan required by subsection (a), shall consider—

(1) the estimated proportion remaining of the respective types of wetlands which existed at the time of European settlement;

(2) the estimated current rate of loss and the threat of future losses of the respective types of wetlands; and

(3) the contributions of the respective types of wetlands to—

(A) wildlife, including endangered and threatened species, migratory birds, and resident species;

(B) commercial and sport fisheries; Fish and fish.

(C) surface and ground water quality and quantity, and flood control; Water. Flood control.

(D) outdoor recreation; and

(E) other areas or concerns the Secretary considers appropriate.

SEC. 302. REMOVAL OF RESTRICTION ON ACQUISITION.

Section 7(a)(1) of the Land and Water Conservation Fund Act of 1965 (16 U.S.C. 460l-9(a)(1)) is amended by striking out "national wildlife refuge areas under section 7(a)(5) of the Fish and Wildlife Act of 1956 (16 U.S.C. 742f(5)) except migratory waterfowl areas which are authorized to be acquired by the Migratory Bird Conservation Act of 1929, as amended (16 U.S.C. 715–715s)" and inserting in lieu thereof "national wildlife refuge areas under section 7(a)(4) of the Fish and Wildlife Act of 1956 (16 U.S.C. 742(f)(a)(4)) and wetlands acquired under section 304 of the Emergency Wetlands Resources Act of 1986".

SEC. 303. INCLUSION OF WETLANDS IN COMPREHENSIVE STATEWIDE OUTDOOR RECREATION PLANS.

Section 6 of the Land and Water Conservation Fund Act of 1965 (16 U.S.C. 460l-8) is amended—

(1) in subsection (d), by adding at the end thereof the following new paragraph:

"For fiscal year 1988 and thereafter each comprehensive statewide outdoor recreation plan shall specifically address wetlands within that State as an important outdoor recreation resource as a prerequisite to approval, except that a revised comprehensive statewide outdoor recreation plan shall not be required by the Secretary, if a State submits, and the Secretary, acting through the Director of the National Park Service, approves, as a part of and as an addendum to the existing comprehensive statewide outdoor recreation plan, a wetlands priority plan developed in consultation with the State agency with responsibility for fish and wildlife resources and consistent with the national wetlands priority conservation plan developed under section 301 of the Emergency Wetlands Resources Act or, if such national plan has not been completed, consistent with the provisions of that section";

A-3

(2) in subsection (e)(1), by inserting, in the first sentence thereof, after "For the acquisition of land, waters, or interests in land or waters" the following: ", or wetland areas and interests therein as identified in the wetlands provisions of the comprehensive plan"; and

(3) in subsection (f)(3), by adding at the end thereof the following: ": *Provided*, That wetland areas and interests therein as identified in the wetlands provisions of the comprehensive plan and proposed to be acquired as suitable replacement property within that same State that is otherwise acceptable to the Secretary, acting through the Director of the National Park Service, shall be considered to be of reasonably equivalent usefulness with the property proposed for conversion.".

SEC. 304. FEDERAL ACQUISITION.

3922. The Secretary is authorized to purchase wetlands or interests in wetlands, which are not acquired under the authority of the Migratory Bird Conservation Act of 1929 (16 U.S.C. 715-715s), consistent with the wetlands priority conservation plan established under section 301.

3923. id SEC. 305. RESTRICTION ON USE OF EMINENT DOMAIN IN ACQUISITIONS.

The powers of condemnation or eminent domain shall not be used in the acquisition of wetlands under any provision of this Act where such wetlands have been constructed for the purpose of farming or ranching, or result from conservation activities associated with farming or ranching.

A-4

TITLE IV—WETLANDS INVENTORY AND TREND ANALYSIS

SEC. 401. NATIONAL WETLANDS INVENTORY PROJECT.

3931. (a) IN GENERAL.—The Secretary, acting through the Director of the United States Fish and Wildlife Service, shall continue the National Wetlands Inventory Project and shall—

(1) produce, by September 30, 1988, National Wetlands Inventory maps for the areas that have been identified by the Service as top priorities for mapping, including—

(A) the entire coastal zone of the United States;

(B) floodplains of major rivers; and

(C) the Prairie Pothole region;

(2) produce, by September 30, 1998, National Wetlands Inventory maps for those portions of the contiguous United States for which final maps have not been produced earlier;

(3) produce, as soon as practicable, National Wetlands Inventory maps for Alaska and other noncontiguous portions of the United States; and

(4) produce, by September 30, 1990, and at ten-year intervals thereafter, reports to update and improve the information contained in the report dated September 1982 and entitled "Status and Trends of Wetlands and Deepwater Habitat in the Coterminous United States, 1950's to 1970's".

and local nments. (b) NOTICE.—The Secretary shall notify the appropriate State and local units of government at such time as he proposes to begin map preparation under subsection (a) in an area. Such notice shall include, but is not limited to, the identification of the area to be mapped, the proposed schedule for completion, and the identification of a source for further information.

SEC. 402. REPORTS TO CONGRESS. 16 USC 2

(a) IN GENERAL.—The Secretary, in consultation and cooperation with the Secretary of Agriculture, shall prepare and submit to the committees—

(1) by March 30, 1987, a report regarding the status, condition, and trends of wetlands in the lower Mississippi alluvial plain and the prairie pothole regions of the United States; and

(2) by September 30, 1987, a report regarding trends of wetlands in all other areas of the United States.

(b) CONTENTS OF REPORTS.—The reports required under subsection (a) shall contain—

(1) an analysis of the factors responsible for wetlands destruction, degradation, protection and enhancement;

(2) a compilation and analysis of Federal statutory and regulatory mechanisms, including expenditures, financial assistance, and tax provisions which— Taxes.

(A) induce wetlands destruction or degradation; or

(B) protect or enhance wetlands;

(3) a compilation and analysis of Federal expenditures resulting from wetlands destruction, degradation, protection or enhancement;

(4) an analysis of public and private patterns of ownership of wetlands;

(5) an analysis of the environmental and economic impact of eliminating or restricting future Federal expenditures and financial assistance, whether direct or indirect, which have the effect of encouraging the destruction, degradation, protection or enhancement of wetlands, including—

(A) public works expenditures;

(B) assistance programs such as price support programs, commodity loans and purchase programs and disaster assistance programs; Loans.

(C) soil conservation programs; and

(D) certain income tax provisions; Taxes.

(6) an analysis of the environmental and economic impact of failure to restrict future Federal expenditures, financial assistance, and tax provisions which have the effect of encouraging the destruction, degradation, protection or enhancement of wetlands, including— Taxes.

(A) assistance for normal silviculture activity (such as plowing, seeding, planting, cultivating, minor drainage, or harvesting for the production of fiber or forest products); Agricultu agricultu commodi

(B) Federal expenditures required incident to studies, evaluations, design, construction, operation, maintenance, or rehabilitation of Federal water resource development activities, including channel improvements; Forests a forest pro

(C) the commodity loans and purchases program and cotton, feed grain, wheat, and rice production stabilization programs administered by the Department of Agriculture; and Loans. Agricultu agricultu commodi

(D) Federal expenditures for the construction of publicly owned or publicly operated highways, roads, structures, or facilities that are essential links in a larger network or system; and Highways

(7) recommendations for the conservation of wetlands resources based on an evaluation and comparison of all manage- State and governme

ment alternatives, and combinations of management alternatives, such as State and local actions, Federal actions, and initiatives by private organizations and individuals.

TITLE V—MISCELLANEOUS PROVISIONS

16 USC 668dd note.

SEC. 501. MIGRATORY BIRD TREATY ACT.

Section 6(b) of the Act of July 3, 1918 (16 U.S.C. 707(b)) is amended by deleting "shall" the first place it appears therein and by inserting in lieu thereof "shall knowingly".

SEC. 502. BAYOU SAUVAGE URBAN NATIONAL WILDLIFE REFUGE.

(a) PURPOSES OF REFUGE.—The purposes of the Bayou Sauvage Urban National Wildlife Refuge are—

(1) to enhance the populations of migratory, shore, and wading birds within the refuge;

(2) to encourage natural diversity of fish and wildlife species within the refuge;

(3) to protect the endangered and threatened species and otherwise to provide for the conservation and management of fish and wildlife within the refuge;

(4) to fulfill the international treaty obligations of the United States respecting fish and wildlife;

(5) to protect the archeological resources of the refuge;

(6) to provide opportunities for scientific research and environmental education, with emphasis being given to the ecological and other values of wetlands; and

(7) to provide opportunities for fish and wildlife oriented public uses and recreation in an urban setting.

(b) ACQUISITION AND ESTABLISHMENT OF REFUGE.—

Louisiana.

(1) ACQUISITION.—Within four years after the effective date of this section the Secretary of the Interior (hereinafter in this Act referred to as the "Secretary") shall acquire the approximately nineteen thousand acres of lands and waters, and interests therein, located in Orleans Parish, Louisiana, that are depicted on the map entitled "Bayou Sauvage Urban National Wildlife Refuge", dated September 15, 1986, and on file at the United States Fish and Wildlife Service, Department of the Interior. The lands and waters, and interests therein, acquired under this paragraph comprise the Bayou Sauvage Urban National Wildlife Refuge. The acquisition shall be made through donation, purchase with donated or appropriated funds, or exchange, or through any combination of the foregoing.

Federal Register, publication.

(2) ESTABLISHMENT.—At such time as sufficient lands and waters, and interests therein, have been acquired under paragraph (1) to constitute an initial area that can be administered to carry out the purposes set forth in subsection (a), the Secretary shall establish the Bayou Sauvage Urban National Wildlife Refuge by publication of notice to that effect in the Federal Register.

(3) BOUNDARY ADJUSTMENTS.—The Secretary may make such adjustments with respect to the boundary of the Bayou Sauvage Urban National Wildlife Refuge as may be necessary to facilitate the acquisition of lands and waters, and interests therein, for the refuge and to facilitate the administration of the refuge.

(c) ADMINISTRATION OF REFUGE.—The Secretary shall administer all lands and waters, and interests therein, acquired under subsection (b) in accordance with the provisions of the National Wildlife Refuge System Administration Act of 1966 (16 U.S.C. 668dd–668ee) to carry out the purposes set forth in subsection (a). The Secretary may utilize such additional statutory authority as may be available to him for the conservation and development of wildlife and natural resources, the development of outdoor recreation opportunities, and interpretive environmental education as he considers appropriate to carry out such purposes. Within two years after the effective date of this section, the Secretary shall complete a master plan for the development of the Bayou Sauvage Urban National Wildlife Refuge.

(d) AUTHORIZATION OF APPROPRIATIONS.—There are authorized to be appropriated to the Department of the Interior—

(1) from funds not otherwise appropriated from the Land and Water Conservation Fund, such sums as may be necessary for the acquisition of lands and waters, and interests therein, for the Bayou Sauvage Urban National Wildlife Refuge; and

(2) $5,000,000 for the development of the refuge.

The moneys appropriated under subparagraphs (1) and (2) shall remain available until expended.

(e) EFFECTIVE DATE.—This section takes effect on the later of the date of enactment of this Act or October 1, 1986.

Approved November 10, 1986.

LEGISLATIVE HISTORY—S. 740 (H.R. 1203):

HOUSE REPORTS: No. 99-86, Pt. 1 accompanying H.R. 1203 (Comm. on Merchant Marine and Fisheries).
SENATE REPORTS: No. 99-445 (Comm. on Environment and Public Works).
CONGRESSIONAL RECORD, Vol. 132 (1986):
Oct. 3, considered and passed Senate.
Oct. 14, considered and passed House.

TYPE 1 - Seasonally Flooded Basins or Flats.

These flats occur in upland depressions, which may fill with water during periods of heavy rain or melting snow, and along river courses, where flooding ordinarily occurs in late fall, winter, or spring. The soil is covered with water or is waterlogged during variable seasonal periods, but is generally well-drained during the growing season. Where the water recedes early, smartweeds, fall panicum, chufa, wild millet, and cockleburs are likely to occur.* Areas that are only temporarily submerged rarely develop any wetland vegetation. Ducks often use flooded upland depressions when feeding - eating seeds that were present before flooding and invertebrates that developed wither before or after submergence.

TYPE 2 - Inland Fresh Meadow.

These meadows often fill shallow lake basins or potholes; they may also be found bordering the landward side of shallow marshes. The soil is waterlogged to within a few inches of the surface during the growing season. Vegetation characteristic of northern meadows includes cares, rushes, redtop, reed grasses, mannagrasses, prairie cordgrass, and mints. When associated with permanent water areas, fresh meadows are commonly used by nesting waterfowl. Deer and moose frequent them while resting and feeding.

TYPE 3 - Inland Shallow Fresh Marsh.

Shallow marshes may nearly fill shallow lake basis or potholes, or they may border the landward side of deep fresh marshes occupying such depressions. The soil, normally waterlogged during the growing season, may be flooded with as much as 6 inches of water. Common plant species found in northern regions are plume grass, rice cutgrass, carex, and giant burreed. Various other marsh plants (cattails, arrowheads, pickerel weed, smartweeds) may also be found. These marshes are used heavily by nesting and feeding waterfowl, and they are visited frequently by other birds, moose, deer, and various furbearers.

TYPE 4 - Inland Deep Fresh Marsh.

These marshes often occupy shallow lake basins and potholes, or they may border open water occurring in such areas. The soil is covered with 6 inches to 3 feet of water during the growing season. Shallow-water vegetation consists mainly of cattails, plume grass, spikerushes, and

*** The scientific names of all plants mentioned here and on the following pages are listed at the end of this Appendix.**

wild rice; pondweeds, duckweeds, coontail, spatterdock sometimes occur in the more open areas. These areas are important not only to nesting and feeding waterfowl, but also to numerous other wildlife species, such as herons and rails, muskrats, otters, and beavers, turtles, frogs, and fish.

TYPE 5 - Inland Open Fresh Water.

Open fresh water of variable depth occurs in artificial lakes, ponds, and reservoirs. It may also be found in shallow lake basins, potholes, or streambeds, and is commonly fringed with marsh vegetation. In shallow areas (less than six feet) vegetation may include pondweeds, wild celery, coontail, water milfoil, water lilies, and spatterdocks. These open water areas are useful to diving ducks, coots, and occasionally to geese. The bordering vegetation provides cover and the open surface areas are particularly good for brooding and resting.

TYPE 6 - Shrub Swamp.

Shrubby swamps occur primarily along sluggish streams. The soil is generally waterlogged but may be covered with a foot or more of water. Alder and dogwood predominate on the drier areas; willow, buttonbush, and sweet gale characterize the wetter sites. These swamps are used to varying degrees by ducks, moose, deer, woodcock, and raccoons.

TYPE 7 - Wooded Swamp.

These swamps occur along sluggish streams, on flat uplands, and in shallow lake basins or potholes. The soil is normally waterlogged but may be seasonally covered with as much as one foot or more of water. (When such areas are flooded for a period of one or more years, the trees die and the site reverts to a meadow for a period of one or more years, the trees die and the site reverts to a meadow association). Northern swamps are composed of tamarack, arborvitae, black spruce, balsam fir, red maple, and black ash. The coniferous swamps usually have a thick carpeting of mosses; deciduous swamps often support duckweeds, smartweeds, and other herbaceous vegetation. Wooded swamps are frequently used by hole-nesting ducks, feeding waterfowl, deer, moose, beaver, and numerous small birds and mammals.

TYPE 8 - Bog.

Bogs occur most often in shallow lake basins, and potholes, along sluggish streams, and on flat uplands. The soil is generally saturated and supports a spongy ground-cover of mosses or other plant material. Vegetation may be woody, herbaceous, or both. Northern representatives

include Labrador-tea, leather-leaf, cranberries, carex, cottongrass, sweet gale and sphagnum moss. Stunted black spruce and tamarack may also occur. In Maine, these bogs, especially those with an interspersion of open water, are of importance to some nesting waterfowl. Moose, deer, beaver, and hares also frequent these areas.

TYPE 12 - Coastal Shallow Fresh Marsh.

These marshes occur along tidal rivers and adjacent the landward side of deeper marshes. The soil is waterlogged and may be flooded with as much as 6 inches of water at high tide. Vegetation consists of various grasses and sedges, cattails, arrowheads, smartweeds, and arrow-arum. These marshes are highly important to feeding wildfowl and herons; they are of lesser importance to mink, raccoons, and snipe.

TYPE 13 - Coastal Deep Fresh Marsh.

These deep marshes occur primarily along tidal rivers. During the growing season the soil is covered with 6 inches to 3 feet of water at average high tide. Common plants found are cattails, wildrice, pickerel weed, and spatterdocks; pondweeds, widgteon grass, and other submerged species often occur in marsh openings. Where suitable vegetation dominates, these marshes are heavily used by feeding waterfowl, sora rails, and herons. Raccoons, mink, muskrats, and fish also utilize these areas.

TYPE 14 - Coastal Open Fresh Water.

These waters are of variable depth and occur in tidal rivers and sounds. Vegetation is generally found at depths less than six feet and consists of pondweeds, naiads, wild celery, coontail, water milfoils, and waterweeds. Such areas are heavily used by diving ducks and other water birds, and by fish.

TYPE 16 - Coastal Salt Meadow.

Salt meadows border the landward side of salt marshes, or open water. The soil is always saturated during the growing season but is rarely inundated by tidal water. Indigenous plant species are salt meadow cordgrass (Apartina patens) and black rush; common three-square occurs in fresher areas. Salt meadows are of great importance to resident and wintering waterfowl, particularly when well interspersed with potholes and ditches. Such areas support large populations of amphipods, clams, and snails, and afford wildfowl an ample source of food.

TYPE 18 - Regularly Flooded Salt Marshes.

Salt marshes occur most often along coastal bays. At

average high tide during the growing season, the soil is covered with six inches or more of water. The predominant plant species is saltmarsh cordgrass (Spartina alterniflora). Open water areas often support widgeon grass, eelgrass, and Sago pondweed. Feeding wildfowl use these wetlands heavily, as do herons, rails, other shore birds, fish, and shellfish.

TYPE 19 - Sounds and Bays.

This type consists primarily of mud flats laid bare at low tide and occurring along salt-water rivers, sounds, and bays. Vegetation, if present, may consist of eel-grass, widgeon grass, Sago pondweed, and muskgrasses. These tidal flats support large shellfish populations and are extremely important to wintering waterfowl populations.

It should be emphasized that each of these wetland types is generally found in conjunction with one ore more of the other types; very seldom will an area be found that is entirely fresh meadow or entirely deep fresh marsh. When classifying a wetland, select the type which most closely identifies the greater portion (50-75%) of the area as it is delineated on the map.

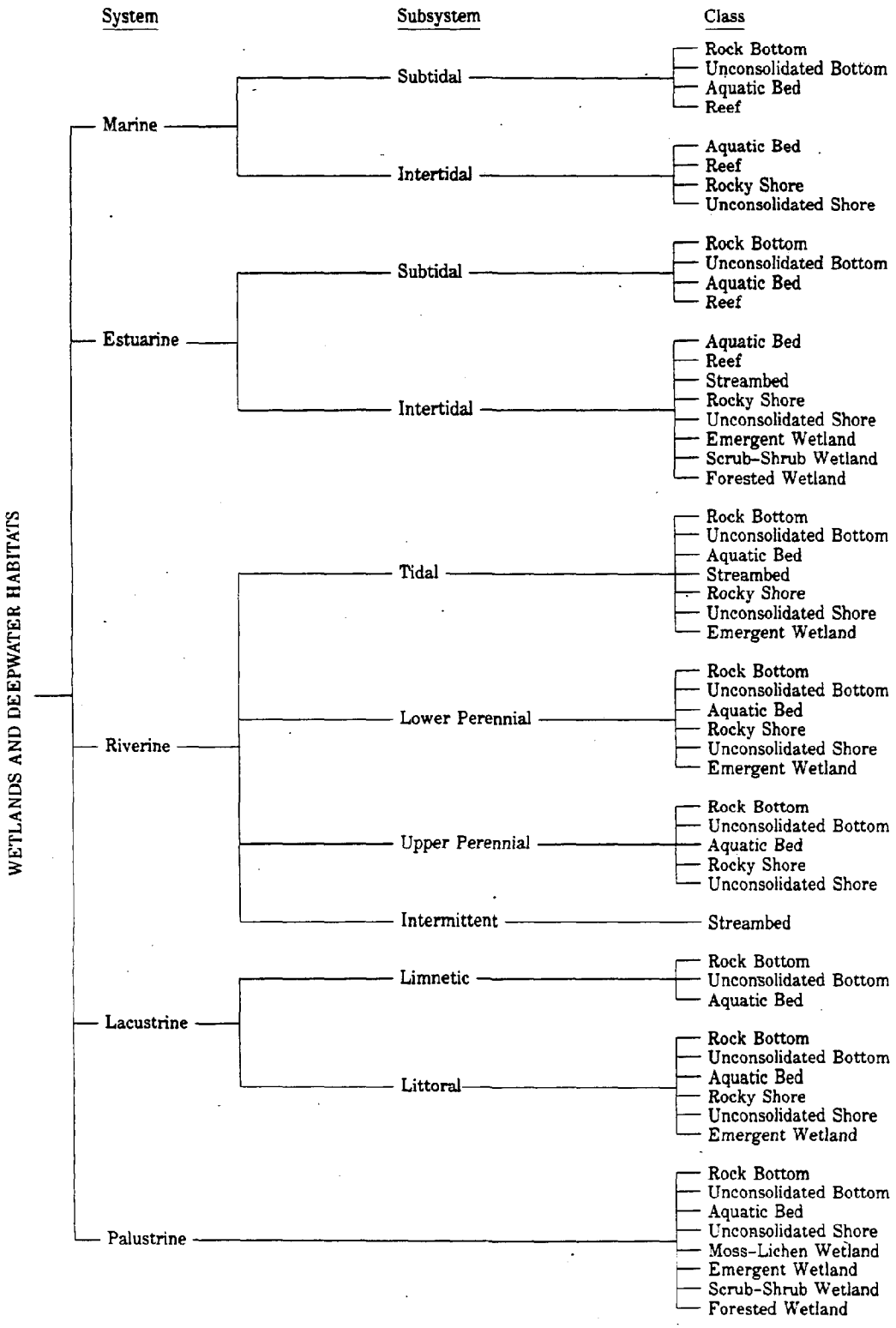
Glossary of Plant Names

These are the common and scientific names of plants referred to in this appendix (from Fernald, 1950 and Fassett, 1957).

Common Names	Scientific Names
Alders	Alnus spp.B.Ehrh.
Arborvitae	Thuja occidentalis L.
Arrow-arum	Peltandra virgnica (L.) Kunth.
Arrowheads	Sagittaria spp. L.
Balsam Fir	Abies balsamea (L.) Mill.
Black Ash	Fraxinus nigra Marsh.
Blackrush	Juncus gerardi Loisel.
Black spruce	Picea mariana (Mill.) BSP
Bulrushes	Scirpus spp. L.
Buttonbush	Cephalanthus occidentalis L.
Carex	Carex spp. L.
Cattails	Typha spp. L.
Chufa	Cyperus esculentus L.
Cockleburs	Xanthium spp. L.
Common three-square	Scirpus americanus Pers.
Coontail	Ceratophyllum demersum L.
Cottongrass	Eriophorum spp. L.
Cranberries	Vaccinium spp. L.
Dogwoods	Cornus spp. L.
Duckweeds	Lemnaceae
Eelgrass	Zostera marina L.
Fall panicum	Panicum dichotomiflorum Michx.
Giant burreed	Sparganium eurycarpum Engelm.
Grasses	Gramineae
Labrador-tea	Ledum groenlandicum Oeder.
Leatherleaf	Chamaedaphne calyculata (L.) Moench.
Mannagrasses	Glyceria spp. R. Br.
Mints	Labiatae
Muskgrasses	Chara spp. L.
Naiads	Najas spp. L.
Pickerel weed	Pontederia cordata L.
Plumegrass	Phragmites communis Trin.
Pondweeds	Potamogeton spp. L.
Prairie cordgrass	Spartina pectinata Link.
Red Maple	Acer rubrum L.
Redtop	Agrostis stolonifera L.
Reed grasses	Calamagrostis spp. Adams.
Rice cutgrass	Leersia oryzoides (L.) Swartz.
Rushes	Juncus spp. L.
Sago pondweed	Potamogeton pectinatus L.
Saltmarsh cordgrass	Spartina alterniflora Loisel.
Saltmeadow cordgrass	Spartina patens (Ait.) Muhl.
Sedges	Cyperaceae

Smartweeds	Polygonum spp. L.
Spatterdocks	Nuphas spp. Sm.
Sphagnum moss	Sphagnum spp.
Spikerushes	Eleocharis spp. R. Br.
Sweet gale	Myrica gale L.
Tamarack	Larix laricina (DuRoi) K. Koch
Water lilies	Nymphaea spp. L.
Water milfoils	Myriophyllus spp. L.
Waterweeds	Elodea spp. Mich.
Widgeon grass	Ruppia marinima L.
Wild celery	Vallisneria americana Michx.
Wild millet	Echinochloa spp. Beauv.
Wild rice	Zizania aquatica L.
Willow	Salix spp. L.

Appendix III U. S. Fish and Wildlife Service Classification of Wetlands and Deepwater Habitats of the United States (Cowardin et al., 1979).



APPENDIX IV

Comparison Between U.S. Fish and Wildlife Service Wetland Classification (Cowardin, 1979) and Classification of U.S. Fish and Wildlife Service Circular 39 (Martin et al., 1953).

Circular 39 type and references for examples of typical vegetation	Classification of wetlands and deepwater habitats		
	Classes	Water regimes	Water chemistry
Type 1—Seasonally flooded basins or flats Wet meadow (Dix and Smeins 1967; Stewart and Kantrud 1972) Bottomland hardwoods (Braun 1950) Shallow-freshwater swamps (Penfound 1952)	Emergent Wetland Forested Wetland	Temporarily Flooded Intermittently Flooded	Fresh Mixosaline
Type 2—Inland fresh meadows Fen (Heinselman 1963) Fen, northern sedge meadow (Curtis 1959)	Emergent Wetland	Saturated	Fresh Mixosaline
Type 3—Inland shallow fresh marshes Shallow marsh (Stewart and Kantrud 1972; Golet and Larson 1974)	Emergent Wetland	Semipermanently Flooded Seasonally Flooded	Fresh Mixosaline
Type 4—Inland deep fresh marshes Deep marsh (Stewart and Kantrud 1972; Golet and Larson 1974)	Emergent Wetland Aquatic Bed	Permanently Flooded Intermittently Exposed Semipermanently Flooded	Fresh Mixosaline
Type 5—Inland open fresh water Open water (Golet and Larson 1974) Submerged aquatic (Curtis 1959)	Aquatic Bed Unconsolidated Bottom	Permanently Flooded Intermittently Exposed	Fresh Mixosaline
Type 6—Shrub swamps Shrub swamp (Golet and Larson 1974) Shrub-carr, alder thicket (Curtis 1959)	Scrub-Shrub Wetland	All nontidal regimes except Permanently Flooded	Fresh
Type 7—Wooded swamps Wooded swamp (Golet and Larson 1974) Swamps (Penfound 1952; Heinselman 1963)	Forested Wetland	All nontidal regimes except Permanently Flooded	Fresh
Type 8—Bogs Bog (Dansereau and Segadas-vianna 1952; Heinselman 1963) Pocosin (Penfound 1952; Kologiski 1977)	Scrub-Shrub Wetland Forested Wetland Moss-Lichen Wetland	Saturated	Fresh (acid only)
Type 9—Inland saline flats Intermittent alkali zone (Stewart and Kantrud 1972)	Unconsolidated Shore	Seasonally Flooded Temporarily Flooded Intermittently Flooded	Eusaline Hypersaline
Type 10—Inland saline marshes Inland salt marshes (Ungar 1974)	Emergent Wetland	Semipermanently Flooded Seasonally Flooded	Eusaline
Type 11—Inland open saline water Inland saline lake community (Ungar 1974)	Unconsolidated Bottom	Permanently Flooded Intermittently Exposed	Eusaline
Type 12—Coastal shallow fresh marshes Marsh (Anderson et al. 1968) Estuarine bay marshes, estuarine river marshes (Stewart 1962) Fresh and intermediate marshes (Chabreck 1972)	Emergent Wetland	Regularly Flooded Irregularly Flooded Semipermanently Flooded-Tidal	Mixohaline Fresh

APPENDIX IV continued

Circular 39 type and references for examples of vegetation	Classification of wetlands and deepwater habitats		
	Classes	Water regimes	Water chemistry
Type 13—Coastal deep fresh marshes			
Marsh (Anderson et al. 1968)	Emergent Wetland	Regularly Flooded	Mixohaline
Estuarine bay marshes, estuarine river marshes (Stewart 1962)		Semipermanently Flooded-Tidal	Fresh
Fresh and intermediate marshes (Chabreck 1972)			
Type 14—Coastal open fresh water			
Estuarine bays (Stewart 1962)	Aquatic Bed Unconsolidated Bottom	Subtidal Permanently Flooded-Tidal	Mixohaline Fresh
Type 15—Coastal salt flats			
Panne, slough marsh (Redfield 1972)	Unconsolidated Shore	Regularly Flooded	Hyperhaline
Marsh pans (Pestrong 1965)		Irregularly Flooded	Euhaline
Type 16—Coastal salt meadows			
Salt marsh (Redfield 1972; Chapman 1974)	Emergent Wetland	Irregularly Flooded	Euhaline Mixohaline
Type 17—Irregularly flooded salt marshes			
Salt marsh (Chapman 1974)	Emergent Wetland	Irregularly Flooded	Euhaline
Saline, brackish, and intermediate marsh (Eleuterius 1972)			Mixohaline
Type 18—Regularly flooded salt marshes			
Salt marsh (Chapman 1974)	Emergent Wetland	Regularly Flooded	Euhaline Mixohaline
Type 19—Sounds and bays			
Kelp beds, temperate grass flats (Phillips 1974)	Unconsolidated Bottom	Subtidal	Euhaline
Tropical marine meadows (Odum 1974)		Irregularly Exposed	Mixohaline
Eelgrass beds (Akins and Jefferson 1973; Eleuterius 1973)	Aquatic Bed Unconsolidated Shore	Regularly Flooded Irregularly Flooded	
Type 20—Mangrove swamps			
Mangrove swamps (Walsh 1974)	Scrub-Shrub Wetland	Irregularly Exposed	Hyperhaline
Mangrove swamp systems (Kuenzler 1974)		Regularly Flooded	Euhaline
Mangrove (Chapman 1976)	Forested Wetland	Irregularly Flooded	Mixohaline Fresh

NATIONAL WETLANDS PRIORITY CONSERVATION PLAN

WETLANDS ASSESSMENT THRESHOLD CRITERIA

INSTRUCTIONS: Complete this page to determine whether a wetland site (refer to Wetlands Profile guidance) qualifies for acquisition consideration under the National Wetlands Priority Conservation Plan.

Use the attached guidance for estimating wetland losses, threats and functions and values thresholds. The guidance is organized in the same sequence as the threshold criteria and will direct the user to an appropriate conclusion. Complete all questions and statements.

1. WETLANDS PROFILE:

   a. Wetland Site Name:_____. File No:_____.
   b. USGS 1:24,000 Map Quadrangle Name:_____.
   c. Township:_____; Section:_____.
   d. Longitude:_____; Latitude:_____.
   e. City:_____; County:_____; State:_____.
   f. Ecoregion: __ __ __ __ __(refer to Cowardin, et al., 1979, p.27).
   g. Size: _____(acres). Date of wetlands assessment:_____.

2. WETLAND LOSS PRIORITY: (circle one) 1 2 3 4 5
   Must be priority level 1, 2 or 3 to meet threshold.

3. IS THE WETLAND SITE THREATENED (refer to the attached guidance under Wetland Threats)? Must be circled "yes" to meet threshold.

   YES NO

4. WETLAND FUNCTIONS AND VALUES
   Check all that apply. Must check at least two to meet threshold.

   ___ a. Wildlife
   ___ b. Fisheries
   ___ c. Water Supply/Quality, Flood and Erosion Protection
   ___ d. Outdoor Recreation
   ___ e. Other Areas or Concerns _____

5. CONCLUSION

   _____ Yes, wetland site meets all threshold criteria and qualifies for acquisition consideration under provisions of the National Wetlands Priority Conservation Plan.

   _____ No, wetland site does not meet all threshold criteria and therefore does not qualify for acquisition consideration under provisions of the National Wetlands Priority Conservation Plan.

GUIDANCE FOR ESTIMATING WETLAND LOSSES, THREATS AND VALUES THRESHOLDS

1. WETLANDS PROFILE

Complete items (a) through (g) to give a name and address to each wetland site.

For the purpose of the National Wetlands Priority Conservation Plan, a wetland site is an identifiable property, tract, area, or region containing wetlands or a complex (aggregation) of physically- or functionally-related wetlands. A wetland site may contain a variety of wetland types, interspersed habitat of other types and associated upland buffer areas. The boundary of the site should be specific and as geographically restricted as practical, determined by application of sound acquisition principles. In other words, regardless of size, a wetland site should be treated in terms of a unit which would generally fit the acquisition goals, process and needs of the user.

2. WETLAND LOSSES

Wetlands will be classified as follows: System, subsystem, class and water regime according to Cowardin et al., 1979 (refer to key on next page). Estimate percent of site for each type.

	TYPE				PERCENT OF SITE
	system	subsystem	class	water regime	
a.	___	___	___ ___	___	___ %
b.	___	___	___ ___	___	___ %
c.	___	___	___ ___	___	___ %
d.	___	___	___ ___	___	___ %
e.	___	___	___ ___	___	___ %
f.	___	___	___ ___	___	___ %
g.	___	___	___ ___	___	___ %
h.	___	___	___ ___	___	___ %
i.	___	___	___ ___	___	___ %
j.	___	___	___ ___	___	___ %
k.	Upland				___ %
				Total	100 %

Example:

E:2:E M:N

System:Estuarine
Subsystem:Intertidal
Class:Emergent
Water Regime:Regularly Flooded

National Wetlands Priority Conservation Plan - May 1988

Letter and number key for classification of wetlands to the level of water regime:

SYSTEMS AND SUBSYSTEMS

M	Marine	R	Riverine
	1 Subtidal		1 Tidal
	2 Intertidal		2 Lower Perennial
			3 Upper Perennial
			4 Intermittent
			5 Unknown Perennial
E	Estuarine	L	Lacustrine
	1 Subtidal		1 Limnetic
	2 Intertidal		2 Littoral
P	Palustrine		
	No Subsystem		Upland

Classes

AB	Aquatic Bed	RS	Rocky Shore
EM	Emergent	SB	Streambed
FO	Forested	SS	Scrub-Shrub
ML	Moss/Lichen	UB	Unconsolidated Bottom
RB	Rocky Bottom	US	Unconsolidated Shore
RF	Reef		

WATER REGIME MODIFIERS

A	Temporary	L	Subtidal
B	Saturated	M	Irregularly Exposed
C	Seasonal	N	Regularly Flooded
F	Semipermanent	P	Irregularly Flooded
G	Intermittently Exposed		
H	Permanent		
J	Intermittently Flooded		

Wetland losses by type. Determine whether the wetland types identified above are decreasing, stable or increasing. Apply to the formula and priority table on the next page.

If supportable information is available to substantiate trends for various wetland types other than that shown by the NWI trends study, this information may be used to support departures from the trends groupings presented above.

Explain:_____

In the absence of more reliable data, the following conclusions based on Frayer et al. (1983) may be used:

Decreasing:	Palustrine emergent
	Palustrine forested
	Palustrine scrub-shrub
	Estuarine intertidal emergent
	Estuarine intertidal forested
	Estuarine intertidal scrub-shrub
	Marine intertidal
Stable:	Estuarine intertidal non-vegetated
	Estuarine subtidal
	Lacustrine
Increasing:	Palustrine open water
	Palustrine unconsolidated shore
	Palustrine non-vegetated

Decreasing wetland types	___ ___ % OF SITE X 1=	____
Stable wetland types	___ ___ % OF SITE X 2=	____
Increasing wetland types	___ ___ % OF SITE X 3=	____
Uplands	___ ___ % OF SITE X 3=	____
	TOTAL	_____

a. Priority 1 (0-139)
b. Priority 2 (140-179)
c. Priority 3 (180-219) WETLAND LOSS PRIORITY = _____
d. Priority 4 (220-259)
e. Priority 5 (260-300)

3. WETLANDS THREATS

For the purpose of the National Wetlands Priority Conservation Plan, threat is defined as the likelihood that a wetland site, or portion thereof, will be destroyed or degraded, directly or indirectly, through human actions.

In establishing the threat threshold, a wetland site is considered to be threatened if an estimated $\geq$ 10 percent of the site's wetland functions and values are likely to be destroyed or adversely affected through direct, indirect, or cumulative impacts over the next ten years considering:

1. the array of potential wetland threats; and

2. the probable degree of protection provided by the various relevant laws, ordinances and regulations.

At a minimum, the following items should be considered when evaluating wetland threat (indicate activities that either destroy or degrade wetlands at the site):

a. ____Drainage or filling
b. ____Agricultural conversion or use
c. ____Livestock grazing
d. ____Groundwater withdrawal/depletion
e. ____Loss of instream flows
f. ____Residential or commercial development
g. ____Oil, gas, mineral development
h. ____Power plants
i. ____Transportation (roads and bridges)
j. ____Navigation project, port, marina or pier
k. ____Water development project(s)
l. ____Water pollution
m. ____Other, (e.g., timber or vegetation removal, mosquito control practices, diverse ownership with no individual commitment to protection):_____

Indicate all laws, ordinances or programs that have some degree of wetland protection potential for this site:

a. ____Clean Water Act (Corps section 404 regulatory program)
b. ____River and Harbor Act (Corps section 10 regulatory program)
c. ____Endangered Species Act
d. ____Water Resources Development Act of 1986
e. ____Food Security Act of 1985
f. ____Local zoning or ordinances (e.g., local wetland or floodplain zoning)
g. ____State ordinances or authorities (e.g., State wetland protection laws, State permit program for activities in wetlands)
h. ____Coastal Wetlands Protection Law
i. ____Inland Wetlands Protection Law
j. ____Owner(s) favors protection
k. ____Other: _____

Considering the relative effectiveness of the combination of the above factors to protect the public values and services of the wetlands, is the wetland site threatened using the definition of threat?

YES NO

If yes, explain type, degree and imminence of threat:_____

4. WETLAND FUNCTIONS AND VALUES

It is assumed that virtually all wetlands provide important public benefits in several functions and values categories. Many wetlands, however, have been recognized, identified and/or listed as having certain of these functions and values. In order to lead to greater objectivity and provide a technique for use by persons of many disciplines, this wetlands assessment method relies on documented data or information rather than allowing for interpretation by users across many disciplines.

Indicate all functions and values which can be attributed to the wetland site. If any of the statements within a category (wildlife, fisheries, water supply/quality, flood and erosion protection, outdoor recreation and other areas or concerns) is affirmative, check that category on the cover sheet, under item 4.

A. Wildlife (endangered and threatened species, migratory birds and resident species)

1. Y N Are Federal or State threatened or endangered plants or animals known to use the wetland site on a regular basis? If yes, list species names:_____

_____

2. Y N Have any wildlife resources of the wetland site been recognized, identified, or listed by a Federal or State agency, conservation organization, institution (educational or research) or private group due to specific legislation, designations or management or planning documents (e.g., high wildlife value, declining populations/numbers, edge of range, Audubon Blue List, list(s) or species of special concern or emphasis)? If yes,list recognition:_____

_____

3. Y N Has the wetland site been specially designated, or is it part of a region specially designated, by a Federal or State agency or private group as important for migratory birds or resident wildlife (e.g., referenced in the North American Waterfowl Management Plan or a State Waterfowl Concept Plan or on a list maintained by The Nature Conservancy? If yes, list designation:

_____

_____

_____

_____

B. Commercial and Sport Fisheries

1. Y N Does commercial fishing occur on the site? If so, name fishery:_____

2. Y N Does sport fishing occur on the site? If so, name fishery:_____

3. Y N Does the wetland site have fishery resource value(s) (e.g. anadromous fishery, spawning, nursery, juvenile or foraging habitat) that is recognized, identified or listed by a Federal or State agency, conservation organization, institution or private group due to specific legislation, designations, or management or planning documents? If so, name recognition:

C. Surface and Ground Water Quality and Quantity and Flood Control

1. Y N Are the groundwater recharge and/or discharge (water supply) functions of the wetland site recognized, identified or listed by a Federal, State, or local agency, conservation organization, institution or private group due to specific legislation, designations, or management or planning documents (e.g., sole source aquifer, municipal water supply)? If so, name recognition:

2. Y N Are the water quality functions (e.g., nutrient assimilation, sediment trapping, toxic substance uptake and transformation) of the wetland site recognized, identified or listed by a Federal, State, or local agency, conservation organization, institution or private group due to specific legislation, designations, or management or planning documents (e.g., presence of a downstream dredged channel or reservoir which requires periodic dredging, eutrophic waterbodies downstream, low dissolved oxygen problems, fishkills)? If so, name recognition:

3. Y N Are the flood control, erosion and/or shoreline damage reduction functions of the wetland site recognized, identified or listed by a Federal, State, or local agency, conservation organization, institution or private group due to specific legislation, designations, or management or planning documents (e.g., flood control project, wetland site within the 100-year floodplain, identified by a city as important for coastal shoreline protection)? If so, name recognition:

_____

_____

_____

D. Outdoor Recreation

1. Y N Is there a recognized or documented demand for the recreational opportunities available in the wetland site? If yes, explain:

_____

_____

2. Y N Is the wetland site within 50 miles of a Metropolitan Statistical Area or within 50 miles of a tourist area receiving more than 100,000 visitors per year? If yes, name location:

_____

_____

E. Other Areas or Concerns

1. Y N Does the wetland site have ecological or geological features consistently considered by regional scientists to be rare for wetlands in the region (e.g., fens in the midwest, cypress swamps in northern States, spring communities in various regions)? If yes, name the feature:

_____

_____

2. Y N Is the wetland site included in a national or statewide listing of historical or archaeological sites? If yes, name list:

_____

_____

3. Y N Is the wetland site being used, or could it be used, for educational or research purposes (e.g., used by a nature center, school, camp, or college, essential to an on-going environmental research or monitoring program)? If yes, name use:

_____

_____

4. Y N Does the wetland site have other public values of concern to the Secretary of the Interior? If yes, name and document:

_____

_____

_____

5. Conclusion

To qualify for acquisition consideration under the provisions of the National Wetlands Priority Conservation Plan, a wetland site must: 1) include predominantly (50 percent or greater) wetland types which are rare or declining in the ecoregion; 2) be threatened with loss and/or degradation; and 3) offer important values to society in two identifiable functional categories. References, literature citations, agency contacts and personal communications must be provided to support the assessment and conclusions made in this checklist.

6. Map of Wetland Site

Reproduce and submit a USGS quadrangle map, National Wetlands Inventory Map or other appropriate map delineating the wetland site, its principal features where appropriate (e.g., bald eagle nest sites) and other relevant features of the assessment area where appropriate (e.g., downstream municipal water supply or public access point).