

WETLANDS VALUES AND LOSSES
IN THE UNITED STATES

By

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PREFACE

This study came from an acknowledged need for detailed information on the values and losses of wetlands in the United States. Information from a six-month search is combined here and organized into national, regional, and state facts on wetlands to provide a source of information for those wishing to urge wetlands protection. The organization of this report allows its use for general and/or specific information on the wetlands of this nation.

I would like to thank my major adviser, Dr. Rudolph J. Miller, for his extensive advice, guidance, and support throughout my entire Master's degree program. Dr. Miller has been a professor, an adviser, and a friend. I would also like to thank other committee members, Dr. Helen Carter Miller and Dr. Marlan Nelson, for their enthusiasm, inspiration, and support throughout my program.

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CHAPTER I

INTRODUCTION

The need to recognize the values and losses of wetlands in our country has never been more urgent. The little protection for wetlands that exists is currently threatened by bills introduced in Congress proposing a weakened Clean Water Act, particularly in the area of wetlands. These bills have been under review since mid-1982, and will continue to be considered well into 1983.

Information on wetlands is scattered and, at times, difficult to locate. Individual state agencies have studies and information which are available to the public, but not often requested. Public concern for wetlands is just beginning to surface. Conservationists and wetlands ecologists must be prepared to present solid data on wetlands to state and national legislators in order to solicit support for their protection.

Legislators made aware of national wetlands values and losses may be affected or impressed if they are familiar with wetlands in their state. However, representatives disinterested in figures on national wetlands may be enlightened if information is presented which summarizes wetlands facts regarding their particular state. For this reason, it was

necessary to compile facts on wetlands on a state-by-state basis, as well as on a national and regional basis. This information can be a highly useful tool when discussing wetlands protection with legislators on a national or state level.

A search of literature and current studies provided the information in this report. All statements have been verified by appropriate state water-quality, wildlife-biology, flood-management, and wetlands specialists. This report first presents general information on wetlands types, values, and losses throughout the nation. This is to acquaint the reader with the variety of wetlands and their many functions. Second, regional information pertinent to areas of the nation with similar wetlands types is provided. Finally, information is provided on state wetlands (in alphabetical order).

CHAPTER II
UNITED STATES WETLANDS TYPES,
VALUES AND LOSSES

The wetlands of this nation represent a tremendous variety of ecosystems, supporting a wide array of plants, animals, and functions. They are generally described as lands where water is the dominant factor determining the nature of soil development and the types of plant and animal communities living in the soil and on its surface (1). Wetlands, both freshwater and coastal, include estuaries, potholes, marshes, playa lakes, bottomland hardwoods, and many other ecologically diverse areas.

Coastal estuaries provide the basis for ocean food webs, starting with microscopic plants and animals that provide food for marine fish and shellfish. In addition, estuaries provide essential habitat for breeding, spawning, and larval development of many fish. From 66-90% of the fish and shellfish harvested off the Atlantic and Gulf Coasts are estuarine-dependent, as are 50% of those harvested off the Pacific Coast (2).

Salt marshes are found almost continuously along the Atlantic and Gulf Coasts, and in isolated areas along the Pacific Coast. These areas have evolved as unique ecological

areas that buffer the effects of the tide. Salt marshes are also found inland, in Utah and the Dakotas, where the native soils have a high salt content.

The Florida Everglades have received national attention as important wetlands areas which have been severely affected by man. These freshwater wetlands provide many services and support many endangered species, including Everglade kites, peregrine falcons, American crocodiles and bald eagles.

Freshwater marshes occur throughout the United States, primarily in the southeast and north central states. They generally are found in areas of depressed land, where they fill with water from rain, runoff, or groundwater supplies. The plants of these marshes are submergent, emergent, and floating, and maintain the marshes by supplying both food and oxygen. The prairie potholes of Montana, Minnesota, Iowa, and the Dakotas are freshwater marshes that provide essential habitat for hundreds of waterfowl each year.

Bogs are found in some areas along the Atlantic and Gulf Coasts, and near the Great Lakes. They are characterized by dense layers of dead organic matter, known as peat. The inflow and outflow of water in bogs is limited, yet the supply of fresh water is adequate to support a variety of unique plants, such as Venus flytraps.

Swamps of the southeastern and north central states have large water supplies in winter and little water in the spring, and contain many trees and woody plants.

The bottomland hardwoods of the south and along many of our eastern rivers are wetlands that serve vital roles in control of erosion and flood-water damage. Bottomland hardwoods are made up of gum-tupelo, bald cypress, and water elm forests or oak, water hickory, elm, ash, hackberry, sweetgum, and black-gum trees.

Riparian areas are found along our rivers, lakes, and ponds. They are essential to many species of wildlife and also provide erosion control and flood damage control.

The playa lakes in the south central states are depressions that are filled after heavy rains and provide wildlife and livestock with precious water, otherwise scarce in the area.

Wetlands areas vary considerably in size, shape, locations, and ecological diversity, but have many things in common. First, they provide many services and values to man, wildlife, livestock, and the land. Second, their values are not easily recognized and often overlooked. Third, their values are not easily assessed in economic terms. And fourth, we are just learning of their many values--just as we are also recognizing the tremendous impact of loss and alteration of wetlands throughout the nation. Our wetlands provide, to society as a whole and to individuals, flood damage protection, water-quality control, pollution filtering, and jobs. They also support fish and wildlife species which are enjoyed by many Americans for aesthetic reasons, hunting, or scientific endeavors.

Wetlands are the sites of the beginnings for many food webs. They provide food for and produce many microscopic aquatic organisms that are consumed by larger fish, shellfish, and other animals. These animals are eaten by others, which include, the fishes of our oceans and the birds and mammals of our lands. Without this base, the entire food web would diminish. Wetlands are the most biologically productive areas we have, surpassing both prime grazing lands and agricultural fields (3, 4).

Wetlands also provide spawning, nesting, breeding, and resting habitat for an uncounted number of wildlife species. Many of these animals are hunted and fished for as a livelihood by people living in Alaska and along the Atlantic, Gulf, Pacific, and Great Lakes Coasts. Others are enjoyed by recreational hunters and fishermen--millions annually in the United States. In 1980, 17.4 million hunters hunted in the U.S., spending \$5.593 billion on supplies and related activities. Of these, 5.3 million were waterfowl hunters, spending \$638 million. Waterfowl are entirely dependent on wetlands, most of them utilizing the Prairie Pothole region of central U.S. and south central Canada (known as the "duck factory") for habitat. Furbearers, including muskrats, otters, beavers, and nutria, are also wetlands-dependent.

Other than game species, a tremendous variety of birds, mammals, fish, reptiles, and amphibians utilize wetlands for some part of their life history. These animals are enjoyed by birdwatchers, nature enthusiasts, artists, photographers,

and biologists. At least 80 federally endangered or threatened species and subspecies of wildlife are found in riparian wetlands (6).

One of the greatest values provided by wetlands is the filtration of pollutants and sediments from our waters. As runoff water from agricultural activities, forestry practices, urban areas, and industry flows towards rivers, lakes, and the oceans, it often passes through natural wetlands areas. This water contains a high level of pollutants, particularly excess nitrogen and phosphorus. The plants of the wetlands take up and hold these pollutants, utilizing them as nutrients. Later, as the plants die and decay, the nutrients are released into the waters, providing valuable nourishment for other plants and animals. In some cases, the emergent vegetation acts as a pump, translocating nutrients from buried decaying plants to the open water (7). These nutrients, recycled by the wetlands, would otherwise be lost to the rivers and oceans. The wetlands are comparable to man-made sewage treatment facilities, but provide a great advantage in their recycling ability. Sewage treatment plants remove pollutants, but cannot recycle them, and a location for their disposal must be found. In some cases, wetlands remove heavy metals, such as mercury, and man-made chemicals that could pollute water supplies. Some cities and industries utilize natural and man-made wetlands to treat sewage.

As a sediment accumulator, wetlands prevent eutrophication of our lakes. Nutrients and sediments are normally

collected by lakes and used to support plant species. However, if the incoming load of nutrients and sediments is increased beyond the lakes' ability to use it, eutrophication increases, causing a choking of the lake. Turbidity increases, algal blooms occur, oxygen supplies are diminished, and fish begin to die. Wetlands slow the flow of water, and sediments settle out. This keeps the water clear for photosynthesis and a healthy lake. The plants of the wetlands store the excess nutrients, keeping them unavailable for algal blooms, and release the nutrients slowly later.

For both pollution filtering and sediment control, wetlands function best if left in their natural state. Alteration of wetlands leads to a loss of these valuable services. An overload of pollution or sediments can be too much for a wetlands area to handle--their processes are effective, but cannot be rushed or overused.

Another economically-important value of wetlands is for reduction of flood damage. Floods and excess rainwater are slowed by wetlands in two ways. First, since wetlands are already saturated when the floodwaters hit, they do not absorb much of the water, but decrease the velocity of the flow. Second, the vegetation of the wetlands causes the water to weave in and out, slowing it down. This effect is obvious when compared to water flowing down a street or other urban areas. Man-made surfaces actually cause flood waters to concentrate and flow quickly. Some wetlands do absorb flood waters, and release them slowly. The effects of

wetlands on floodwaters save untold millions of dollars as they retain water, decrease flood peaks, and lessen or eliminate the destruction of human structures and property.

Wetlands also control erosion along our oceans, lakes, rivers, and streams. The dense vegetation of wetlands trap and hold topsoil and sediment, reducing erosion and preventing downstream sediment loading. The soils of our farm lands, logged areas, grazed areas, construction sites, and hillsides erode away at an alarming rate. Wetlands slow this erosion process, saving millions spent on both erosion control and dredging of silt-clogged areas.

Wetlands recharge groundwater supplies in some areas. Where wetlands occur as depressions below the water table, they serve as water accumulators for groundwater. In some areas where they are above the water table, water from wetlands seeps through to the groundwater supply. In this way, they also filter pollutants from the water supply. When compared to the cost of supplying water through ground-fed wells, groundwater supplies are much less expensive and deserve careful attention.

Wetlands provide many other important values: subjects for birdwatchers, artists, photographers, and nature enthusiasts; classrooms for teachers and outdoor groups; food and pleasure for hunters and fishermen; medicine for researchers; and research areas for scientists. All these values and more are difficult to evaluate. This fact, and the historic

perception of wetlands as wastelands, has made preservation of wetlands difficult in the United States.

In the history of the U.S., wetlands traditionally have served as sites of alteration for man's uses. Filling, draining, dumping, and burning have occurred in wetlands throughout the U.S. Nearly 50% of this nation's wetlands have been lost (8). Along the coast, the primary wetlands destruction has been dumping and filling for development. One million acres of coastal marsh have been lost in just the last 20 years. Inland wetlands have been drained primarily for agricultural purposes.

Other losses of wetlands across the U.S. include 80% of the bottomland hardwoods along the lower Mississippi River (9), 71% of the Great Lakes marshes (10), 70-90% of all original riparian habitat (6), and 50% of our prairie potholes (11). We are currently losing 458,000 acres of wetlands each year (12).

Our knowledge of wetlands values is just beginning. We do know that all the waters of the U.S. are hydrologically and ecologically related. Any destruction or degradation of this nation's wetlands will affect all the waters of the U.S.

We are aware of the losses. We realize some of the values. The next step is protection of these areas, more valuable in many ways than some of the best cultured land in the United States.

CHAPTER III

WETLANDS VALUES AND LOSSES BY REGION

Prairie Pothole Region: Montana, North
Dakota, South Dakota, Minnesota, Iowa

1. While comprising only 10% of the waterfowl breeding habitat in North America, prairie potholes provide 60-70% of the total continental duck production in an average year (11).

2. Fifty percent of the prairie potholes of the U.S. were drained by 1950 (11).

3. One-half of the prairie potholes of the upper Midwest had been lost by 1950, and about 48,000 acres of prairie wetlands are now lost annually (11).

4. Prairie pothole drainage is occurring at a rate of 20,000 acres per year in North Dakota (11).

5. The new nationwide permits for categories of waters allow any activity in isolated lakes and wetlands and leave unprotected over 700,000 additional acres of prairie potholes in North Dakota, South Dakota, Minnesota, Montana, and Iowa (13).

6. From 1964-1968, an estimated 125,000 acres of prairie potholes, which were prime duck nesting wetlands, were drained in Minnesota and North and South Dakota.

7. In the 1950s, 64,000 potholes covering 188,000 acres of wetlands were converted to farmland (15).

Bottomland Hardwoods and Lower Mississippi

River: Missouri, Arkansas, Louisiana,

Kentucky, Tennessee, Mississippi,

Alabama, Georgia

1. Eighty-one percent of the wetland habitat used by migrating and wintering waterfowl along the Mississippi Delta has been lost (16).

2. Forest wetlands in the Lower Mississippi River Valley are being drained and cleared at the rate of about 300,000 acres per year. These bottomland-hardwood wetlands are considered one of the most biologically-productive habitat types in North America (17).

3. Only about 20% of the bottomland-hardwood habitats along the lower Mississippi River remains today. These habitats have been altered at a rate averaging more than 200 square miles per year (9).

4. The bottomland-hardwood wetlands overwinter 2.5 million of the 3 million mallards in the Mississippi Flyway. Nearly 100% of the 4 million wood ducks of the Mississippi Flyway overwinter in bottomland hardwoods (9).

5. The bottomland-forest wetlands of the South can retain up to 16 times their biotic weight in floodwaters (18).

6. Originally, most of the 24-million-acre Mississippi Delta was forested; however, in 1937 there were only 11.8

million acres, and in 1977 only 5.2 million acres remained. If the present trend continues, there will be only 4.6 million acres left in 1985 and 3.9 million in 1995 (19).

7. Nationally, 80% of America's breeding waterfowl population requires bottomland hardwoods for survival (6).

8. Construction of dams on tributaries of the Mississippi River during the past 35 years has caused a significant reduction in the amount of sediment brought down the river that otherwise would be used for marsh maintenance or building. Navigation projects, levees, upstream diversions, and flood control reservoirs constructed on the Mississippi River since 1927 have virtually eliminated overbank marshes with nutrients and riverborne sediments, and thereby accelerated land loss (11).

9. Bottomland hardwoods support deer, squirrel, raccoon, mink, beaver, fox, rabbit, numerous local and migratory species of waterfowl, and other birds. This wildlife is utilized and appreciated by thousands of hunters, fishermen, birdwatchers, photographers, and vacationers annually (20).

10. Seventy to ninety percent of all original riparian habitat in the United States has been destroyed (6).

Great Lakes Region: Minnesota, Wisconsin,
Michigan, Illinois, Indiana, Ohio,
Pennsylvania, New York

1. Great Lakes marshes have decreased by 71% (10).

2. Great Lakes wetlands annually produce 32,000 ducks and geese and more than 1.8 million pounds of fish. Furriers obtain close to 400,000 muskrat and raccoon pelts a year from Great Lakes wetlands (21).

3. Coastal wetlands along the Great Lakes, USA only, amount to 191,733 acres--11.3% of the total U.S. shoreline length. (22).

4. Every year in the Great Lakes region, an estimated 20,000 acres of valuable wetlands are filled, drained, or developed (23).

5. Great Lakes wetlands purify surface and groundwater, control flooding, prevent shoreline erosion, provide recreational areas, replenish groundwater supplies, and support a variety of wildlife species (23).

6. One-half of Ohio's wetlands are in the Great Lakes basin (23).

7. Michigan has 106,000 acres of wetlands in association with the Great Lakes (24).

8. Michigan's acreage constitutes one-half of all Great Lakes wetlands (23).

9. One-third of Indiana's wetlands are in the Great Lakes Basin (23).

10. Approximately 3 million waterfowl annually utilize the Great Lakes shorelines during fall and spring migration for resting and feeding (25).

11. The value of the 1980 fishery harvest from Lake Ontario was \$1,147,000. In 1981, the harvest was worth

\$1,929,000 (a 68% increase), and totaled 2,636,000 pounds of fish. Yellow perch and the American eel accounted for 82% of the total cash value in 1981 (26).

12. Lake Ontario has 726 miles of total shoreline length. The major fish species of the lake are yellow perch, sunfish, bullhead, and smelt (26).

13. The 1977 commercial fishing harvest from Lake Huron was valued at \$3.5 million. Many species of fish are dependent on wetlands for some stages in their life history (27).

14. Lake Huron has 3,180 miles of shorelines, including islands (27).

Gulf Coast Region: Texas, Louisiana,
Mississippi, Alabama, Florida

1. Both the commercial and recreational fishing industries of the Gulf of Mexico are overwhelmingly dependent upon estuaries. About 90% of the commercial catch and 70% of the recreational catch are made up of species that are estuarine-dependent (28).

2. Two-thirds of the cash value of species harvested off the Gulf Coast are estuarine-dependent (2).

3. A volume of 1,757 million pounds of fish and shellfish with a value of \$390 million was harvested from the Gulf of Mexico and northern Gulf estuaries in 1976. Of these totals, about 89% of the volume and 92% of the value consisted of estuarine-dependent species.

4. The National Marine Fisheries Service estimates that coastal wetlands are valued at \$2,000 per acre.

5. There is growing evidence that the amount of marshland is the most important factor influencing estuarine-dependent fish and shellfish production. Recent research has revealed that shrimp catches around the world are related directly to the area of marsh in the shrimp nursery grounds. A similar correlation has been established for menhaden (30).

6. Fisheries of the Gulf of Mexico increased in value from 10 to 85 million dollars and in weight from 250 to 700 million pounds from 1940 to 1960. Estuarine-dependent species such as shrimp, menhaden, and oysters dominate these fisheries and account for 90% of the landed value.

7. Dredging and filling accounted for the loss of 138,000 acres of wetlands in the Gulf of Mexico by 1977.

8. In 1976, a volume of about 1,757 million pounds of fish and shellfish with a value of nearly \$390 million was taken from the Gulf of Mexico and northern Gulf estuaries. Of these totals, 89% of the volume and 92% of the value consisted of species dependent upon estuaries (28).

9. The South Atlantic and Gulf Coasts alone produced 2.6 billion pounds of fish worth more than \$2.6 billion, retail, in 1980. Of these, 88% was comprised of estuarine-dependent species (11).

10. The Gulf of Mexico is bounded by five states which produce fishery products worth about 86.4 billion per year (32).

Atlantic Coast Region: Maine, New
Hampshire, Massachusetts, Rhode
Island, Connecticut, New York,
New Jersey, Delaware, Maryland,
Virginia, North Carolina,
South Carolina, Georgia,
Florida

1. Two-thirds of the cash value of fish and shellfish species harvested off the Atlantic Coast are estuarine-dependent (2).

2. Nationwide, in 1979, the commercial marine fishing harvest was 9.9 billion pounds of seafood with a total retail value of \$7.8 billion (33).

3. Nutrient removal by coastal wetlands has been estimated to be worth \$280,000 an acre. This estimate includes the cost to construct physical-chemical treatment facilities that would be capable of removing the same proportions of nutrients.

4. The National Marine Fisheries Service estimates annual United States coastal wetlands losses at 103,800 acres from 1954 to 1978. This represents an annual loss of \$207.6 million in fisheries byproducts (29).

5. Two-thirds of the cash value of species harvested off the Atlantic and Gulf Coasts are estuarine-dependent (2).

6. The National Marine Fisheries Service estimates that coastal wetlands are valued at \$2,000 per acre (29).

7. The South Atlantic and Gulf Coasts alone produced 2.6 billion pounds of fish worth more than \$2.6 billion, retail, in 1980. Of this, 88% was comprised of estuarine-dependent species (11).

8. The coastal waters of the United States hold great potential for aquaculture, which uses the coastal marshes as self-sustaining renewable resources. The annual return for oyster culture development could place the value of an acre of marsh-estuary at \$12,600 (34).

9. The National Estuary Study in 1970 provided commercial fishery estimates which indicated the value of commercial fish landed was about \$475 million (\$300 million estuary-connected) for about 4 billion pounds of fish. The full retail value of these fish was estimated to be about \$1.5 billion, of which \$1.1 billion was estuary-connected (35,36).

Flyways of the United States

"Flyway" is a useful geographic term that conveniently designates four regions of the United States utilized by migrating waterfowl. The flyways are useful political units in that they group together states with common borders whose waterfowl problems are similar. Waterfowl, too, show a greater affinity to a particular flyway than to the country as a whole (37).

The Atlantic Flyway

From the mid-1950s to the mid-1970s, the states of the Atlantic Flyway lost:

1. Over 15,000 acres of estuarine subtidal deep-water habitats to urban development. Of this, Florida lost 11,000 acres.

2. Over 9,000 acres of estuarine nonvegetated wetlands to urban development in Florida alone. This is over one-third of the national loss.

3. Over one-third of the national loss of estuarine vegetated wetlands (lost to urban development) occurred in Florida (43,000 acres).

4. The largest loss of palustrine vegetated wetlands within the Atlantic Flyway occurred in Florida.

States within the Atlantic Flyway which experienced the greatest losses of palustrine forested wetlands were Florida and North Carolina.

States within the Atlantic Flyway which experienced the greatest losses of wetlands were Florida, North Carolina, Georgia, South Carolina, Maryland, New Jersey, and Delaware.

The Mississippi Flyway

From the mid-1950s to the mid-1970s, the states of the Mississippi Flyway lost:

1. One-third of the national total loss of estuarine subtidal deepwater habitat to urban development. This loss, a total of 10,000 acres occurred in Louisiana.

2. Approximately 34,000 acres of estuarine vegetated wetlands, again all occurring in Louisiana. The national loss of this type of wetland was 106,000 acres.

3. Four and one-half million acres of palustrine forested wetlands, mostly to agriculture. The vast majority of these losses occurred along the Lower Mississippi River in Louisiana, Mississippi, and Arkansas.

4. Large acreages of palustrine vegetated wetlands in Louisiana, Michigan, and Minnesota were lost to urban development.

States within the Mississippi Flyway experiencing the greatest losses of wetlands were Louisiana, Mississippi, Arkansas, Minnesota, Michigan, Wisconsin, Illinois, and Alabama.

The Central Flyway

From the mid-1950s to the mid-1970s, the states of the Central Flyway lost:

1. Nearly one-half the national total loss of estuarine nonvegetated wetlands lost to urban development. This loss of 10,000 acres occurred in Texas.

2. Large losses of palustrine vegetated wetlands in South Dakota, North Dakota, Nebraska, and Texas.

States within the Central Flyway experiencing the greatest losses of wetlands were South Dakota, North Dakota, Nebraska, and Texas.

The Pacific Flyway

The state within the Pacific Flyway experiencing the greatest loss of wetlands from the mid-1950s to the mid-1970s was California (12).

CHAPTER IV

WETLANDS VALUES AND LOSSES BY STATE

Wetlands in Alabama

1. Alabama has 121,603 acres of coastal wetlands, which serve as either critical habitat, a base for food chains, storm force buffers, flood-water storage areas, or erosion deterrents (38).

2. Alabama's wetlands support a highly productive fisheries industry: In 1981, the commercial fishing harvest in Alabama totaled 33,677,000 pounds of fish and shellfish worth \$44,148,000. Of this, 66 to 90% of the species caught depend on coastal marshes or estuaries for at least part of their life cycle (33,39).

3. Alabama's wetlands provide recreational fishing: In 1979, over 200,000 people participated in marine recreational fishing in Alabama, catching over 3 million fish (40).

4. Alabama's wetlands provide waterfowl habitat: Annually, between 3 and 6 million waterfowl use wetlands in the lower Mississippi Flyway, which includes the state of Alabama (16).

Wetlands in Alaska

1. There are 131 to 300 million acres of wetlands within

Alaska. It has been estimated that 55% of the state of Alaska is wetlands (41, 42).

2. Forty-one percent of the wetlands in Anchorage are considered critical wetlands and are preserved by the local government (43).

3. Wetlands in Alaska support the economy and provide jobs: Wetlands in Alaska indirectly provide jobs for 25% of the work force (24,000 people), employed in the salmon fishing industry. Salmon require pristine streams and wetlands for spawning and survival of young. Sport fishing for salmon contributes millions of dollars to the local economy. The dockside value of fish harvested in Alaska in 1980 was \$560,600,000 (34, 44).

4. The wetlands of Alaska are in need of protection: Indications are that loss of wetlands and riparian habitat in Alaska is occurring at a rate far beyond the national average, especially near urban centers. Timber harvesting, mining, dredging, dam and housing construction, gas and oil exploration, and agricultural activities have increased dramatically throughout the state, especially within or proximate to wetlands and flood plains (45).

5. Alaska's wetlands support abundant marine fisheries: Coastal wetlands provide one of the most productive of all aquatic environments. Estuarine and marine fishes feed and find shelter in coastal wetlands. Juvenile pink and chum salmon rear in estuarine wetlands prior to their seaward migration. Organic nutrients generated by high volumes of

plant production are exported from coastal wetlands seaward to provide the critical nutrient refueling of Alaska's abundant marine fisheries. These wetlands-dependent fish and wildlife populations provide Alaskans with some of the world's best hunting and fishing (46).

6. Alaska's North Slope wetlands are valuable to wildlife: Fifty to seventy-five percent of the Arctic Coastal Plain along Alaska's North Slope is classified as wetlands. This area serves as important habitat for resident and migratory wildlife, especially birds. In 1979, from 4.9 to 5.4 million birds used the Alaskan Coastal Plain. Ninety-seven species of birds breed in Alaska's North Slope, and of these, 44 breed in the coastal zone. The area is also utilized by the two largest caribou herds in North America, estimated at 300,000 animals (46, 47, 48).

7. Alaska's wetlands provide critical alternative breeding grounds for uncounted millions of migrating birds: In the spring and fall, uncounted millions of ducks, geese, swans, cranes, terns, shorebirds, and gulls move northward in a vast migration, feeding in Alaska's productive wetlands as they go. Many of Alaska's wetlands are free from drought, and provide critical nesting habitat for many species of waterfowl and shorebirds and alternative breeding grounds for birds displaced from Canadian and Lower Forty Eight breeding habitat as a result of drought or loss of habitat to drainage, development, and other kinds of destruction (46).

8. The wetlands of Alaska's North Slope are being destroyed: Virtually all of the current oil and gas development activity takes place in wetlands. Once these wetland areas are destroyed, they cannot be replaced by any currently-known revegetation techniques (46).

9. The dominant physical feature of the Arctic Coastal Plain on Alaska's North Slope is surface water in the form of extensive wet meadows, ponds, lakes, and fluvial systems. The North Slope is characterized by low evaporation and transpiration rates, and drainage is retarded because of the presence of continuous permafrost. The size and stability of the wetlands within the tundra region provide a consistent habitat comprised of a stable water regime that is not subject to periodic drought as is the case in the Prairie Pothole region.

10. Alaska's wetlands need protection: On Alaska's North Slope, a wetland area of approximately 2,000 square kilometers centered on Teshekpuk Lake is critical to waterfowl from Canada and the Soviet Union, providing habitat for approximately 50,000 geese, roughly 20 percent of the world's black brant population (46).

11. Alaska's wetlands support the state's fishery industries: Vast stretches of Alaska's wetlands habitat lie adjacent to major rivers and their tributaries and form the headwaters of those systems. These river-, lake-, and stream-associated wetlands represent the hydrological cornerstone of the state's abundant anadromous and freshwater fisheries. These stream-associated wetlands provide rearing habitat for

juvenile salmonids in spring, summer, and fall. In winter they supply a continuous flow of water to adjacent stream systems enabling salmonid eggs and fry and freshwater fish to overwinter. Without the gradual release of water from stream-associated wetlands, eggs, fry, and mature fish would freeze or die from lack of oxygen. Alterations of river-, lake-, and stream-associated wetlands would eliminate salmonid-rearing habitat, thereby reducing salmon survival rates and returning salmon runs; it would also disturb the quality, quantity, and rate of release of water entering our major fish-producing river systems, ultimately reducing the productivity of Alaska's fisheries (46).

12. Alaska's wetlands provide a livelihood for the citizens of the state: Many of Alaska's rural villages are located in wetland areas. This is not a coincidence; rather, harvest of the productive wetlands for fish and wildlife has been a traditional way of life for many native people in Alaska and will continue to be as long as the fish and wildlife remain. The future of the state's commercial fisheries is equally dependent upon maintaining healthy fish stocks, and the fish stocks, in turn, are dependent upon their environment--the cornerstone of which is the state's stream-associated wetlands and coastal estuaries. Wetlands are no less important to Alaska's large sport hunting and fishing industry. Without the productive wetland fish and wildlife habitats this state would not be the sportsman's mecca that

it is. Indeed, without the abundant fish and wildlife resources Alaska would be economically the poorer.

Wetlands in Arizona

1. Less than 10% of the original riparian habitat along the Colorado River remains. New riparian habitat has been created from dam construction along the Colorado River, resulting in a change in species diversity. Native fish, including squawfish, bonytail chub, and razorback suckers, have suffered population declines due to habitat alteration (6, 50).

2. Only 5% of the original riparian habitat persists in the lower Gila Valley in Arizona (51).

3. In only 25 years, 50% of the riparian habitat in the San Pedro Valley was destroyed (51).

3. Arizona's wetlands are necessary for migrating birds: A 1977 study showed that, in Arizona, riparian study areas contained up to 10.6 times as many spring migrant birds per hectare as found on adjacent, non-riparian habitats (52).

4. Arizona's wetlands support a diversity of fish and wildlife: In Arizona and New Mexico, riparian habitats are capable of supporting very diverse fish and wildlife populations: 41-43% of the mammal species of North America, 38% of the bird species, 30-35% of the reptiles, and 13-14% of the amphibians are found in these areas.

5. Arizona's wetlands are essential to wildlife: Forty percent of the state's wildlife species depend on riparian

habitat for survival.

6. Arizona's wetlands provide bird habitat: For the 225-mile stretch of the Colorado River between Lees Ferry and Diamond Creek, 27 of 41 species of breeding birds utilize the riparian vegetation as nesting habitat (54).

7. Arizona's wetlands are preferred by birds: A study of riparian habitat in Arizona showed 80 pairs of birds per 100 acres of partially-cleared riparian areas, but 1,322 pairs per 100 acres of uncleared areas (55).

8. Arizona's wetlands are disappearing: Originally, riparian forests occupied most of the major drainages in the Southwest from the Mohave and Sonoran Deserts through Arizona, northeastern Sonoran, southern New Mexico, northern and eastern Chihuahua to the Rio Grande and its tributaries in southwest Texas. Today, only a few drainage systems, such as the undammed Rio Magdalena in Sonora and the San Pedro River in Arizona, represent riparian forest development (56).

9. Arizona's wetlands are an unique environment: Riparian areas in Arizona provide nationally unique habitat for wildlife species. Several species of wildlife that are totally or largely dependent upon Arizona's riparian habitat include Arizona grey squirrels, otters, zone-tailed hawks, black hawks, water ouzels or dippers, grey hawks, Bell's vireos, sulphur-bellied flycatchers, coppery-tailed trogons, Bullock orioles, yellow warblers, bald eagles, canyon tree frogs, and black bears. Species that use riparian areas in Arizona for some part of their life history include Arizona

alligator lizards, Sonoran mud turtles, white-tailed deer, turkeys, and a myriad of nesting and migratory raptors and songbirds (50, 53).

10. Arizona's wetlands have been altered: Diversion, interruption, and elimination of streamflows in Arizona during the past 200 years have greatly diminished the associated forest and woodland wetlands. Cottonwood-willow forests in Arizona are extremely important to breeding birds--more species are recorded nesting in this vegetation than in any other (53).

11. Arizona's wetlands are diminishing: Arizona's marshlands--both fresh and brackish water--are disappearing rapidly, affected by water diversions and other water projects. The few riparian marshland communities that remain are habitats for a number of species of Arizona's rare and vanishing wildlife, such as the yuma clapper rail, black rail, bitterns, and Mexican duck. Numerous other rails, shorebirds, and waterfowl are highly dependent on these diverse environments during both nesting and migration (56, 57).

Wetlands in Arkansas

1. Arkansas has lost half its original wetlands (8).
2. Arkansas has nearly 317,500 acres of wetlands.
3. In the Southeast, where bottomland hardwoods and wildlife were once so productive, there was a 53% loss of riparian habitat in Arkansas from 1945-1970 (59).

4. Alteration and destruction of wetlands in Arkansas is due primarily to crop production, improper timber harvesting practices, property taxes (which discourage owners from keeping wetlands in a natural state), and heavy equipment usage (which compacts soils, destroys vegetation, and increases runoff) (58).

5. Arkansas' wetlands support a highly productive fisheries industry: In 1981, the commercial fishing harvest in Arkansas totaled 19,060,000 pounds of fish worth \$6,306,000 (30).

6. Arkansas' wetlands provide waterfowl habitat: Annually, between 3 and 6 million waterfowl use wetlands in the lower Mississippi Flyway, which includes the state of Arkansas. In Arkansas alone, 1.1 million mallards utilized hardwood wetlands for winter habitat (16).

7. Loss of Arkansas's wetlands reduces waterfowl populations: Habitat losses and degradation in Arkansas have resulted in a decline in waterfowl use by one-third or more. There were 250,000 waterfowl using Arkansas' Cache River in 1945, and only 175,000 waterfowl in 1980 (16).

8. Arkansas' wetlands provide wildlife habitat: Arkansas wetlands are well-known nationally as resting, feeding, and roosting areas for millions of mallards and other ducks and geese each fall, winter, and spring. They also provide habitat for resident wood ducks, beavers, muskrats, mink, nutria, raccoons, herons, egrets, swamp rabbits, woodcocks,

rails, snipes, and a myriad of other aquatic-oriented birds, mammals, reptiles, and amphibians (58).

9. Alteration of Arkansas' wetlands results in loss of land: Construction of dams on tributaries of the Mississippi River during the past 35 years has caused a significant reduction in the amount of sediment brought down the river that otherwise would be used for marsh maintenance or building. Navigation projects, levees, upstream diversions, and flood control reservoirs constructed on the Mississippi River since 1927 have virtually eliminated overbank flooding, preventing nourishment of adjacent marshes with nutrients and river-borne sediments, and thereby accelerated land loss (11).

Wetlands in California

1. California has less than 450,000 acres of its original 3.5 million acres of wetlands left (9).

2. In California, 276,000 acres of wetlands have been filled, diked, or developed since the 1950s (60).

3. Wetlands restoration in California costs from \$1,300 to \$11,000 per acre, providing even greater incentive for preservation of wetlands (60).

4. California's wetlands support a highly productive fisheries industry: In 1980, the commercial fishing harvest in California totaled 804,276,000 pounds of fish and shellfish worth \$323,393,000. In addition, the California Department of Fish and Game has documented that 60 percent of the

common marine inshore species use bays and harbors during a portion of their life history (36, 61).

5. California is losing its wetlands: As a result of extensive diking and filling, San Francisco Bay has been reduced to one-third the size it was at the time of the Gold Rush. During the period when the San Francisco Bay area population grew from less than 25,000 (1849) to over 5 million (1979), 313 square miles of wetlands were reduced to 59 square miles (62, 63, 64).

6. California's wetlands provide educational and research facilities: Upper Newport Bay's interpretive facility in California attracts 50,000 visitors each year. A sanctuary and interpretive facility has been proposed for the Tijuana River National Estuary, with an estimated initial visitation of 3,000 persons per year (60, 65).

7. California's wetlands are important to endangered species: Approximately 20 percent of the nation's endangered species which occur in estuarine environments inhabit wetlands in California. Of the 12 birds, reptiles, and mammals listed as endangered in the state of California, nine species are either residents of or associated with coastal wetlands. Also, six species of endangered animals and two species of endangered plants occur in San Francisco Bay wetlands (60).

8. California's wetlands provide essential wildlife habitat: Due to the relatively large expanse of unbroken native habitat and diverse vegetative and aquatic conditions, California's Suisun Marsh provides approximately 85,000

acres of wintering habitat for the waterfowl of the Pacific Flyway (66).

Wetlands in Colorado

1. Less than 10% of the original riparian habitat persists along the Colorado River. New riparian habitat has been created from dam construction along the Colorado River, resulting in a change in species diversity (67).

2. Colorado's wetlands are essential to wildlife: In Colorado, 90% of the state's 800 species of fish and wildlife depend on riparian habitat, which accounts for less than 1 1/2% of the state's habitat. Also, along the South Platte River, 147 of the 151 wildlife species found there make at least seasonal use of the riparian and aquatic habitats (6, 68).

3. Colorado's wetlands and riparian habitat support wildlife: Approximately 3% of the land in the Rocky-Mountain West is considered to be representative of the cottonwood-willow riparian ecosystem. This portion of land is providing habitat for at least 40% of the vertebrate species encountered in the region. Riparian habitat sites are a critical source of diversity in the northern Great Plains. They provide a large number of vertical and horizontal strata, habitat "edge," and, where they follow streams or rivers, connecting travel lanes between habitat types for daily movement and seasonal migration of wildlife (69, 70).

4. Loss of Colorado's wetlands has affected waterfowl: The San Luis Valley in south central Colorado was once the state's major duck production area. Gradual changes in irrigation practices since the early 1970s have reduced the effective wetland acreage by at least 40-50% by drying up or drastically altering high-quality wetlands (71).

5. Colorado's wetlands sustain high breeding bird populations: Cottonwood groves, found in association with riparian areas, are believed to be the most productive bird habitat in northern Colorado. These cottonwoods are removed for dams, ditches, and reservoirs, eliminating the unique ecology of the area (72).

6. Colorado's wetlands sustain high breeding bird populations: Playa lakes found in Colorado provide necessary cover, nesting opportunities, and food for a wide variety of wildlife. Playas also provide watering areas for livestock and holding ponds for crop irrigation (73).

7. Colorado's wetlands are disappearing: The major rivers in Colorado's lower Gunnison River Basin have lost about 33 percent of their historical wetlands (74).

8. Colorado's wetlands are being altered: Colorado has 8,700 miles of trout waters, and of these, 3,000 miles have been altered by channelization since 1950. These alterations affect the wetlands, waters, fish, and wildlife interrelated with the changed waterways (75).

9. Colorado's wetlands supply recreational fishing: In 1980, 654,806 people participated in recreational fishing in

Colorado for a total of 10,062,568 angler-days. These fishermen spent \$117,686,000 on fishing equipment and related activities in the state of Colorado (76).

10. Colorado's wetlands supply aesthetic benefits: The Green, Elk, Cache La Poudre, Big Thompson, Gunnison, Los Pinos, Conejos, Delores, and Colorado Rivers in Colorado are all under study for inclusion in the National Wild and Scenic Rivers System. The rivers and their bordering wetlands provide many people with outdoor recreational activities (77).

11. Colorado's wetlands support a high species diversity: Biological inventories along the lower Gunnison River Basin in Colorado show a high species diversity. The plants and animals of the area are dependent upon available wetlands for survival (74).

Wetlands in Connecticut

1. Connecticut is losing its wetlands:
 - a. Connecticut has lost 50% of its coastal wetlands (78).
 - b. At the current rate of loss, only 14% of those marshes present in Connecticut in 1914 will remain in the year 2000 (9).
 - c. In the early 1960s, Connecticut was losing its tidal marshes at the rate of one acre per day. By this time, the state had lost one-half of these wetlands to dredging and filling, and only 15,000 acres remained (79).

2. Connecticut's wetlands support a highly productive fisheries industry: In 1980, the commercial fishing harvest in Connecticut totaled 5,198,000 pounds of fish and shellfish worth \$4,675,000. Of this, 66 to 90 percent of the species caught depend on coastal marshes or estuaries for at least part of their life cycle (33, 39).

3. Connecticut's wetlands provide recreational fishing: In 1979, over 375,000 people participated in marine recreational fishing in Connecticut, catching over 7,750,000 fish (40).

4. Alteration of Connecticut's wetlands has had many adverse effects: A major utility in southwest Connecticut deposited several hundred thousand tons of fly ash (a waste product associated with a coal-burning power plant) in the Hunt's Brook watershed in Montville, Connecticut. Following the introduction of the ash, the brook trout downstream disappeared. Another swamp filled with the ash resulted in a loss of animal life, an outbreak of skin rashes on swimmers at a downstream children's camp, and a threat to the use of the watershed as part of the water supply for the nearby Waterfore-New London area (79).

5. Connecticut's wetlands filter pollution: Wetlands near Groton, Connecticut, have acted as a pollution filter, including cleanup of an oil spill, since the 1972 construction of a housing subdivision nearby (79).

6. Connecticut's wetlands support a productive scallops harvest: In Connecticut's marshy Niantic River, the annual

scallop harvest is 15,000 bushels, amounting to 300 pounds per acre per year, which exceeds the beef yield on excellent grazing grounds (3).

7. Connecticut's wetlands provide food or habitat for a variety of birds, including Canada geese, black ducks, peregrine falcons and bald eagles (80).

Wetlands in Delaware

1. The principal type of wetlands in Delaware are tidal marshes. Approximately 8% of Delaware, or 106,000 acres, is wetlands, with about 88% of these wetlands consisting of tidal marshes (81).

2. Over the past 30 years, at least 7,550 acres of Delaware's coastal wetlands have been lost to residential and commercial development (81).

3. In 1973, the State Wetlands Act was passed, giving the state authority to regulate tidal wetlands. However, there are no state laws regulating inland freshwater wetlands. According to the Delaware Code, wetlands are

those lands above the mean low water elevation including any bank, marsh, meadow, flat, or other low land subject to tidal action. . .which may grow or is capable of growing a wide variety of wetlands plants (81, p. 1).

More simply, wetlands are any area of land where the presence of water determines the nature of the site and its vegetation (81).

4. Delaware's wetlands support a highly productive fisheries industry: In 1980, the commercial fishing harvest in Delaware totaled 4,074,000 pounds of fish and shellfish worth \$1,969,000. Of this, 66 to 90 percent of the species caught depend on coastal marshes or estuaries for at least part of their life cycle (39).

5. Delaware's wetlands provide recreational fishing: In 1979, over 120,000 people participated in marine recreational fishing in Delaware, catching over 3 million fish (40).

6. Delaware's wetlands provide wildlife habitat: In Delaware, wetlands provide essential habitat for Canada geese, black ducks, muskrats, deer, mallards, blue herons, rails, painted turtles, and numerous other wildlife species (81).

7. Delaware's wetlands treat pollution: High marsh areas of Delaware retain valuable nutrients during summer months and the pond-like areas of the marsh play a similar role in the winter. Also, freshwater tidal marshes are capable of performing tertiary treatment.

Wetlands in Florida

1. Florida lost 15,000 acres of coastal salt marshes from the mid-1950s to the mid-1970s (12).

2. By 1973, 40% of the wetlands of south Florida had been lost. As water levels have been lowered by the drainage of interior wetlands and consumption of fresh water, south Florida has suffered progressive salt-water intrusion (83).

3. The U.S. Fish and Wildlife Service estimates that in the mid-1970s, Florida had between 10.3 and 12.3 million acres of wetlands (84).

4. Florida's wetlands support a highly productive fisheries industry: In 1981, the commercial fishing harvest in Florida totaled 215,281,000 pounds of fish and shellfish worth \$172,726,000. Of this, 66 to 90 percent of the species caught depend on coastal marshes or estuaries for at least part of their life cycle (39).

5. Florida's wetlands provide recreational fishing: In 1979, over 1,750,000 people participated in marine recreational fishing in Florida, catching over 39.5 million fish (40).

6. Florida's wetlands are disappearing: Dredging and filling for residential real estate in Boca Ciega Bay, Florida, resulted in the immediate loss of an estimated 1,100 tons of seagrass, 1,800 tons of invertebrates, and 73 tons of fishery products. The loss of commercial sport fisheries, based on a 1968 dollar value, was estimated at \$1.4 million annually. Also, Tampa Bay, a Florida estuary, had lost 44% of its original wetlands by 1976. As a result, the commercial harvests of marine finfish and shellfish in this area declined by 20% (85, 86).

7. Loss of Florida's wetlands has had devastating effects: Drainage of the Everglades in the early 1900s led to tragedy in 1926 and 1928. Floods struck, causing extensive property damage and loss of life. Twelve feet of hurricane-

driven water overlapped the Okeechobee dikes in 1928 and killed more than 2,000 people (83).

8. Florida's wetlands treat pollution--without charge:

- a. In Sumpter County, Florida, a 500-acre cypress-gum swamp has been used for 19 years as Wildwood's (population 2,500) sewage treatment facility. Tertiary treatment benefits were estimated at \$80,000 per year in 1974 (87).
- b. The Kissimmee River canal has been cited as a major factor in the accelerated eutrophication of Lake Okeechobee, a major source of water for southern Florida. The original Kissimmee River flowed 100 miles through 45,000 acres of wetlands, acting as a pollution filter for the lake (88).

9. Florida wetlands need protection: The superintendent of the Florida Everglades National Park recently declared the park "one of the most seriously endangered parks in the System" (89).

10. Development in and around the city of Sanibel, Florida, since 1944 has destroyed over 1,000 acres of interior wetlands. The ecological health of the remaining 2,400 acres has been drastically impaired by drainage for mosquito control, by other excavations, and by the introduction of exotic plants. The wetlands system is also endangered by sewage, pesticides, and other water pollutants (90).

Wetlands in Georgia

1. Georgia's wetlands support a highly productive fisheries industry: In 1980, the commercial fishing harvest in Georgia totaled 19,427,000 pounds of fish and shellfish worth \$20,061,000. Of this, 66 to 90 percent of the species caught depend on coastal marshes or estuaries for at least part of their life cycle (39).

2. Georgia's wetlands provide recreational fishing: In 1979, over 100,000 people participated in marine recreational fishing in Georgia, catching over 1,500,000 fish (40).

3. Georgia's wetlands provide jobs: There are more than 95,000 acres of estuarine area within Glynn County, Georgia that are important nursery grounds and habitats for shellfish, which provide an annual catch of 100 million pounds. The local seafood processing industry employs one-third of the manufacturing workers in the area (91).

4. Georgia's wetlands are productive: Studies of Georgia's salt marshes show production of 10 tons of organic material per acre per year--a figure that exceeds that of most fertile hayfields or other agricultural fields (4).

5. Georgia's wetlands control pollution: Mountain Creek, a tributary of the Alcovy River in Georgia, was polluted with human sewage and chicken offal. After traveling 2.75 miles through the Neary River Swamp, the water was designated as clean by the Water Quality Control Board. After seven miles, the water quality was termed excellent. The

value of the 2,300-acre Alcovy River Swamp is estimated at \$1 million per year for water pollution control (92).

6. Georgia's wetlands are economically valuable: Georgia's tidal salt marshes are valued at \$2,500 to \$4,000 per acre per year for fishery production, oyster aquaculture, waste assimilation, and ecological life-support (34).

7. Georgia's wetlands control sediment loss: The economic value of Georgia's Alcovy River Swamp for accumulation of sediments is estimated at more than \$3,000 annually. This value would be wiped out by channelization, a threat to river-side wetlands in every part of the country (92).

8. Georgia's wetlands provide wildlife habitat: The Lewis Island Tract, acquired by the State of Georgia in 1972, consists of 6,000 acres of river swamp forest in the Altamaha River Delta of McIntosh County. This tract contains the last remnants of virgin cypress-gum forests in the state. It is also habitat for a number of rare animals, including limpkins (a rail-like bird), swallow-tail kites and Mississippi kites (93).

Wetlands in Hawaii

1. Hawaii's wetlands support a highly productive fisheries industry: In FY 1981, the commercial fishing harvest in Hawaii totaled 10,903,283 pounds of fish and shellfish worth \$11,841,164. Of this, 50 percent of the species caught depend on coastal marshes or estuaries for at least part of their life cycles (2, 94).

2. Hawaii's wetlands are essential to endangered species: Many of the Hawaiian wetlands are of critical importance to the survival of four endangered waterbird species: Hawaiian stilts, Hawaiian coots, Hawaiian gallinules, and the Hawaiian ducks (95).

3. Hawaii's wetlands losses have resulted in wildlife losses: Excessive stream diversion in west Maui resulted in the loss of 80 km of wetlands habitat and severe depletion of fauna. Native aquatic animal species on Maui (excluding insects) may have experienced population declines (95).

4. Hawaii's wetlands have been altered: Because many of Hawaii's 366 streams have been diverted to some extent, many acres of wetlands have been changed or eliminated (96).

5. Hawaii's wetlands offer unique habitat with historical significance: The Kawainui Marsh of Oahu, Hawaii, is the state's largest freshwater marsh, covering 800 acres. The marsh is possibly the earliest settlement site in Hawaii, dating back to the landings of Polynesians in 200-300 A.D. . . . Kawainui Marsh today is vital for flood control on Oahu, and its vegetation provides food and habitat for Hawaii's four endangered bird species (97).

6. Hawaii's wetlands provide a vital environment for species endemic to Hawaii alone: The Alakai Swamp of the Island of Kauai and its dense canopy support bird species found only on Kauai, including honeycreepers, flycatchers, the two endangered thrush species endemic to Kauai, Kauai 'O'os, Kauai Nukupu'us, and 'O'us (94, 98).

7. Hawaii's wetlands have been recognized for their vital role: Hawaii has recently established national wildlife refuges containing small wetlands to support populations of 1,000 Hawaiian stilts, 1,200 Hawaiian coots, and 750 Hawaiian gallinules. The refuge acquisitions took place on Kauai, Oahu, and Molokai. Although these important areas have been acquired, the remaining Hawaiian wetlands continue to decline as the human population increases (99).

Wetlands in Idaho

1. Idaho's wetlands support a productive fisheries industry: In 1981, the commercial fishing harvest in Idaho totaled 496,000 pounds of fish worth \$28,000 (39).

2. Idaho's wetlands provide wildlife habitat: Approximately 3% of the land in the Rocky Mountains is considered to be representative of the cottonwood-willow riparian ecosystem. This portion of land is providing habitat for at least 40% of the vertebrate species encountered in the region (69).

3. Idaho's wetlands support wildlife: The wetlands of the lower Snake River in Idaho provide essential habitat for mule deer, beavers, muskrats, mink, raccoons, skunks, weasels, bobcats, river otters, badgers, coyotes, California quail, Chuckar partridge, Hungarian partridge, ring-necked pheasants, mourning doves, many species of ducks and geese, flathead catfish, rainbow trout, crappie, and large mouth bass (100, 101).

4. Idaho's wetlands support sport fishing: Annually up to 3,500 fall chinook, 52,755 spring and summer chinook, and

76,000 steelhead trout migrate into Idaho's Snake River. In addition, important species of resident fish, including small-mouth bass, channel catfish, sturgeon, and whitefish, support an intensive sport fishery that provides 250,000 angler-days annually. These fish are dependent upon wetlands for varying stages in their life histories (100, 101).

5. Idaho's wetlands support pheasant: Patches of riparian and cattail habitat along the Snake River in Idaho provide critical wintering habitat for ring-necked pheasants. Idaho has the third largest population of pheasants in the nation (101).

6. Idaho's wetlands attract tourists: The state of Idaho has many "Blue Ribbon Trout Streams" that attract many fishermen each year. Tourism is the third largest industry in Idaho (101).

Wetlands in Illinois

1. Illinois' wetlands are disappearing:
 - a. Ninety-nine percent of Illinois' original wetlands have been destroyed (102).
 - b. Of the 1.5 million acres of wetlands in Illinois in 1800, only 13,000 acres remain undisturbed (102, 103).
 - c. Fifty percent of the original 400,000 acres of wetlands along the Illinois River have been lost (102).

- d. Seventy percent (185,000 acres) of the original wetlands along the Mississippi River in western Illinois has been lost (102).

2. Illinois' wetlands losses result in declines in waterfowl populations: Waterfowl population indices from Illinois suggest that habitat losses and degradation have resulted in a decline in waterfowl use by one-third or more. There were 3,000,000 waterfowl along the Illinois River in 1945, and only 1,000,000 in 1980. Ninety-two percent of the wetlands habitat used by migrating and wintering waterfowl along the Mississippi River in Illinois has been lost (16).

3. Illinois' wetlands are economically important: Operation and maintenance costs of structural flood control along the Illinois River are high, and have historically been subsidized by state and federal tax money. By 1966, 8,000 acres of floodplain wetlands have been returned to the river, because the cost of maintaining the wetlands in an artificial state at times exceeded the earning power of the land (102).

4. Illinois' wetlands act as reservoirs and control flooding:

- a. Heron Pond wetlands, annually flooded by Cache River, has retained up to 21 million gallons of flood water and slowly released it back to the river after removing silt and excess nutrients (102).
- b. It is estimated that the forested wetlands along the Cache River have stored up to

1.1 billion gallons of flood waters (102).

- c. A cypress swamp along the Cache River retains 10 times more phosphorus than it releases annually, and also holds back floodwaters. The value of this 75-acre swamp for these two functions is estimated at \$18,500 per year (104).

5. Illinois' wetlands are essential to endangered species: Forty percent of Illinois' endangered and threatened species survive in wetlands. Also, wetlands communities in northeastern Illinois contain the greatest number of endangered species of plants and animals in the state. This includes 19 endangered or threatened animals and 69 endangered or threatened plants. Modification or destruction from urban development threatens 62% of the high-quality wetlands in northeastern Illinois (102).

6. Illinois' wetlands support sport fishing. The 59 miles of the Kankakee River and associated wetlands in Illinois supplied 173,500 quality angling days in 1975, while tributary streams contributed another 36,000 angling days. Fish in the Kankakee River include largemouth bass, smallmouth black bass, walleye, northern pike, channel catfish, bluegill, rockbass, crappie, and carp (104).

7. Illinois' wetlands support a productive fisheries industry: In 1980, the commercial fishing harvest in Illinois totaled 4,587,000 pounds of fish worth \$1,103,000 (39).

8. Illinois' wetlands filter pollution: A nine-mile stretch of the Kankakee River in Illinois provides important filtering of pollutants. Known as the Momence Wetlands, this relatively undisturbed 1,900-acre floodplain forest taps sediment from adjacent and upstream farmlands. After slow-moving floodwaters recede from the broad floodplain, a thin layer of sediment remains as evidence (102).

- a. A range of \$250 to \$500 per acre per year of public services including fish productivity, flood control, drought prevention, sediment control, and water-quality enhancement is estimated to be provided by the Momence Wetlands. Their total economic value ranges from \$475,000 to \$950,000 per year (104).
- b. Flooding occurs along the Kankakee River almost every year for a period of 7 days or more. The adjoining Momence Wetlands hold back and then slowly release floodwaters, saving nearby areas from costly flood damage (104).

9. Illinois' wetlands supply water: Many of the wetlands west and northwest of the Chicago metropolitan area have been found to be valuable for local municipal water supplies (104).

10. Illinois wetlands provide food, cover, and habitat for a variety of wildlife: Southern flying squirrels,

meadow voles, eastern cottontails, white-tail deer, red foxes, great blue herons, black-crowned night herons, Canada geese, mallards, black ducks, wood ducks, shovelers, broad-winged hawks, marsh hawks, ring-necked pheasants, killdeer, sandpipers, plovers, black terns, chimney swifts, ruby-throated hummingbirds, belted kingfishers, red-bellied woodpeckers, wood peewees, crested flycatchers, eastern blue birds, cedar waxwings, warblers, and vireos all utilize the wetlands of Illinois (105).

11. Stream-straightening destroys wetlands by isolating the wetlands from the channel. A straightened stream cannot store flood waters because it has no wetlands. Unfortunately, by 1976, 3,500 miles or nearly one-third of Illinois' interior streams were straightened (102).

Wetlands in Indiana

1. The State of Indiana began a Wetlands Conservation Program in 1967. To date, there have been approximately 3,000 acres acquired under this program (106).

2. Indiana's wetlands are crucial to sport fish populations: The Kankakee River Basin in Indiana and Illinois is nearly 125 miles long, and the total watershed area is about 5,300 square miles. The Kankakee is favored for its diversity of sport fish, including largemouth bass, smallmouth black bass, walleye, northern pike, channel catfish, bluegill, rock bass, crappie and carp (104).

3. Indiana's wetlands serve as natural reservoirs: Flooding occurs along the Kankakee River almost every year for a period of 7 days or more. At one time, the adjoining wetlands helped prevent area flooding by acting as a reservoir and then releasing floodwaters slowly. Due to extensive drainage, few wetlands areas remain along the Kankakee. In 1982, unrestrained spring flood waters flooded areas up to eight miles wide along the Kankakee (104, 106).

4. Indiana's wetlands are disappearing: Channelization of the Kankakee River in Indiana in the early 1900s changed the winding river into a straight ditch. The original wet prairies and marshes were drained and converted to cropland (104).

5. Indiana's wetlands support a productive fisheries industry: In 1981, the commercial fishing harvest in Indiana totaled 185,000 pounds of fish worth \$129,000 (39).

Wetlands in Iowa

1. Iowa has lost close to 95% of its marshes, and 99% of its original glacial wetlands (10, 107).

2. Iowa once had 1,192,392 acres of wetlands granted to the state for reclamation. Less than 70,000 of these acres remain today (10).

3. The Iowa Legislature recently recognized the need for wetlands protection and enacted legislation to allow property tax exemptions on wetlands and other types of "conservation lands" (99).

4. Iowa's wetlands control flooding: A study in north central Iowa revealed that pothole depressions over an area of a few square miles have the ability to store more than one-half inch of surface water, or approximately 12,500 gallons per acre (108).

5. Iowa's wetlands losses cause declines in waterfowl numbers: Northwestern Iowa once included some of the most productive waterfowl habitat in North America, but intensive drainage of wetlands and cultivation of the uplands have modified the significance of these areas to waterfowl. In 1970, low water levels during critical phases of the breeding cycle appeared to have caused population declines of waterfowl and other marsh birds (109).

6. Iowa's wetlands support a highly productive fisheries industry: In 1981, the commercial fishing harvest in Iowa totaled 3,741,000 pounds of fish worth \$945,000 (39).

7. Bottomland hardwoods in Iowa support fish and wildlife: Eighty percent of America's breeding bird population requires bottomland hardwoods for survival. From 1937 to 1977, bottomland hardwoods in the U.S. declined from approximately 12 million to 5.2 million acres (6, 19).

8. Iowa's wetlands are being altered: Construction of dams on tributaries of the Mississippi River during the past 35 years has caused a significant reduction in the amount of sediment brought down the river that otherwise would be used for marsh maintenance or building. Navigation projects, levees, upstream diversions, and flood control reservoirs

constructed on the Mississippi River since 1927 have virtually eliminated overbank flooding, preventing nourishment of adjacent marshes with nutrients and river-borne sediments, and thereby accelerated wetland losses (11).

Wetlands in Kansas

1. Kansas' wetlands offer resources to man and wildlife: Approximately 2,000 playa lakes in Kansas provide cover, nesting opportunities, and food for a variety of wildlife. They also provide watering areas for livestock and holding ponds for crop irrigation (73).

2. Kansas' wetlands support a productive fisheries industry: In 1981, the commercial fishing harvest in Kansas totaled 170,000 pounds of fish from the Missouri River worth \$41,000 and 780,300 pounds from reservoirs in Kansas (39, 110).

3. Kansas' wetlands are utilized by a wide variety of wildlife: Many of Kansas' over 400 species of birds, 91 species of reptiles, and 78 species of mammals utilize the limited wetlands of Kansas (110).

4. Kansas' wetlands support recreational fishing: In 1980, 518,500 people participated in recreational fishing for a total of 7,861,000 angler-days. These fishermen spent \$65,558,000 on equipment and fishing-related activities in the state of Kansas (76, 110).

5. Kansas' wetlands are scarce and in need of protection: Riparian habitats account for only 1% of the land use

in the Northern Great Plains of the United States. This small amount of land area provides potential breeding habitat for 172 terrestrial vertebrate species and potential feeding habitat for at least 216 terrestrial vertebrate species. Forty-two percent of these species breed only in riparian or other wetlands sites. These riparian areas represent a critical source of diversity in this geographical region. They provide a large number of vertical and horizontal strata, habitat "edge," and, where they follow streams or rivers, connecting travel lanes between habitat types for daily movements and seasonal migrations of wildlife (70).

6. Kansas' wetlands support superior fishing quality and quantity: The Chikaskia River Basin in south central Kansas has been described as "the only wildlife habitat in a sea of wheat." The excellent water quality of the Chikaskia River, cleansed and filtered by bordering wetlands, supports sport fishing rarely surpassed in the state. The fish crop averages 116 pounds per acre-foot, and includes 35 species. Other rivers and streams having high-value fishery resources include Cedar Creek, Caney River, Deep Creek, Fall River, and Spring River. The Spring River contains 91 species of fish representing a blend of plains and Ozarkian fish fauna (110, 111).

7. Kansas' wetlands are essential to wildlife: The riparian habitat along Kansas' streams and rivers sustains populations of white-tail deer, Rio Grande turkeys, bobwhite

quail, mourning doves, fox squirrels, cottontails, raccoons, mink, red foxes, herons, and raptors (111).

Wetlands in Kentucky

1. Kentucky has 1.6 million acres of wet soils. Forty-two percent of these wet soils are located in the western Kentucky coal fields (112).

2. Soil erosion in western Kentucky is high--25-75% of the state's topsoil has been lost. Wetlands control soil erosion (113).

3. Wetlands losses in Kentucky affect fishing: Channelization in western Kentucky has caused wetlands destruction and a tremendous reduction in fish populations and the quality and quantity of sport and commercial fishing (114).

4. Wetlands in western Kentucky are being altered: The western coalfield of Kentucky is an extensive physiographic region with many wetlands. Wetlands in this area have been disturbed for an array of reasons (114):

- a. Clear Creek Swamp has been greatly influenced by surface mining for coal (114).
- b. Henderson Sloughs have been affected extensively by oil drilling operations (114).
- c. Cypress Creek wetlands have been altered by coal mining, drainage, impounding, and agriculture (114).

Wetlands in Louisiana

1. Louisiana's wetlands are disappearing:

- a. Louisiana lost 183,000 acres of coastal salt marshes from the mid-1950s to the mid-1970s (12).
- b. Eighty-one percent of the original 25 million acres of wetlands in the Mississippi Delta have been lost (19).

2. The rate of loss of Louisiana's coastal marshes has increased significantly: In 1973, Louisiana's rate of coastal marsh loss was 6.7 square miles per year; in 1974, it was 15.8 square miles; in 1977, 28.1 square miles; in 1980, 39.4 square miles; and today, the rate is 47 square miles per year.

3. Louisiana's wetlands support a highly productive fisheries industry: In 1981, the commercial fishing harvest in Louisiana totaled 1,168,597,000 pounds of fish and shellfish worth \$193,549,000. Of this, 66 to 90 percent of the species caught depend on coastal marshes or estuaries for at least part of their life cycle (33, 39).

4. Louisiana's wetlands provide recreational fishing: During 1975, sport fishing in Louisiana was valued at \$76 million, or over \$100 million in 1981 dollars. In 1979, over 550,000 people participated in marine recreational fishing in Louisiana, catching over 22,250,000 fish (11, 40).

5. Louisiana's coastal wetlands maintain a valuable fisheries harvest: The Vermillion Parish coastal wetlands of

Louisiana support an estimated annual harvest value of \$665,000 of shrimp, menhaden, and blue crab (116).

6. Louisiana's wetlands are economically important: Louisiana contains more than 40 percent of all wetlands in the coterminous United States. These wetlands support 70 percent of the Mississippi Flyway's wintering waterfowl and produce the largest fur harvest (\$10-15 million per year) in North America (117, 118).

7. Wetland losses affect the trapping industry. If the current trend of coastal wetlands loss in Louisiana continues, the state's fur harvest (40% of the nation's total) would decline by 35% by the year 2000 (11).

8. Wetlands losses affect Louisiana's fishing industry: An estimated \$2.1-4.3 million is lost annually in fisheries products due to previous wetlands destruction. In addition, for each dollar spent on fisheries directly, approximately \$3 are spent indirectly. This multiplier effect means that the cumulative economic impact of Louisiana's coastal wetlands losses on the fisheries industry is a minimum of \$8.5-17.1 million annually (119).

9. In recent years, shrimp and menhaden, both of which are wetlands-dependent, have accounted for more than 95% of the total poundage of commercial fish and shellfish landed in Louisiana (120).

10. The Louisiana Wildlife and Fisheries Commission estimates that there were about 675,000 days of waterfowl

hunting in the Louisiana coastal region during the 1976-77 season (11).

Wetlands in Maine

1. Maine's wetlands support a highly productive fisheries industry: In 1981, the commercial fishing harvest in Maine totaled 238,107,000 pounds of fish and shellfish worth \$103,945,000. Of this, 66 to 90 percent of the species caught depend on coastal marshes or estuaries for at least part of their life cycle (33, 39).

2. Maine's wetlands provide recreational fishing: In 1979, over 175,000 people participated in marine recreational fishing in Maine, catching over 1,500,000 fish (40).

3. Maine's wetlands are ecologically important: Wetland tidal flats represent 48% of the intertidal habitats of Maine. Fisheries of the tidal flats rely heavily on organic material from adjacent coastal, estuarine, riverine, and salt marsh habitats. Many of Maine's commercial fish species, including herring, mackerel, smelt, hake, scup, menhaden, flounder, cod, haddock, and perch are dependent upon wetlands for various stages in their life histories (80).

4. Maine's wetlands provide an array of services for humans: The wetlands in Maine store groundwater, stabilize surface water, reduce flood damage, help curb erosion by reducing runoff, serve as firebreaks, and produce wild and cultivated crops, including cranberries, wild rice, clams, and marine worms.

5. Maine's wetlands support a wide variety of bird species: The wetlands of Maine provide food, cover, and habitat for many bird species, including swallows, oystercatchers, plovers, ruddy turnstone, killdeer, willets, godwits, gulls, terns, loons, grebes, cormorants, mute swans, Canada geese, mallards, black ducks, gadwalls, canvasbacks, redheads, eiders, herons, hawks, belted kingfishers, peregrine falcons, osprey, and the American bald eagle (80).

6. Maine's wetlands support productive clam and marine worm harvests: In 1980, the landed value of soft-shelled clams harvested off Maine's coast was \$8.5 million. The landed value of marine worms in 1980 was \$2.5 million (122).

Wetlands in Maryland

1. Between 1908 and 1968, 200,000 acres of Maryland's wetlands were destroyed (123, 124).

2. Prior to 1970, an estimated 1,000 acres of wetlands were destroyed each year in Maryland. Since the inception of the wetlands protection program in 1970, the State's regulatory program has reduced that rate of loss by 50 times to approximately 20 acres annually. The State of Maryland's Water Resources Administration believes that a federal program based on Maryland's experience would strengthen both tidal and non-tidal protection (125, 126).

3. Maryland's wetlands support a highly productive fisheries industry: In 1981, the commercial fishing harvest in Maryland totaled 115,115,000 pounds of fish and shellfish

worth \$56,640,000. Of this, 66 to 90 percent of the species caught depend on coastal marshes or estuaries for at least part of their life cycles (33, 39).

4. Maryland's wetlands provide recreational fishing: In 1979, over 900,000 people participated in marine recreational fishing in Maryland, catching over 16 million fish (40).

5. Maryland's wetlands are ecologically diverse: The Cranesville Swamp in western Maryland has lost 200 of its original 500 acres to farming and logging practices. The remaining acreage is unique because it represents one of the few "northern bogs" situated south of the line of glaciation. Cranesville Swamp was formed 10,000-25,000 years ago and exhibits a boreal forest climate more typical to Canada and Alaska. A rare combination of wildlife inhabits the area, including salamanders, blue montane crayfish, bobcats, red foxes, white-tail deer, northern water shrews, and raccoons. Brook trout, wolves, and black bears were once found near Cranesville Swamp, but no longer remain. All of Maryland's remaining mountain peatlands are threatened with strip mining, except Cranesville Swamp and Finzel Swamp, both owned by The Nature Conservancy (98).

6. The aquatic vegetation of Maryland's wetlands is disappearing: The loss of aquatic plants in the wetlands of the Chesapeake Bay has caused much concern since 1970--waterfowl are moving out of the area in search of food, the overall "health" of the bay is declining, and there has been an

adverse effect on commercial fisheries. The grasses of the Chesapeake Bay estuaries provide estuarine-spawning fish (shad, herring, rockfish) and their offspring with protection from predators. The grasses also reduce wave action, reduce velocity of water flow and settle suspended sediments. Loss of these important estuarine grasses will increase turbidity. One example of grass loss occurred along the Rappahannock River, which experienced a decrease from 1,730 acres in 1971 to 10 acres in 1974 (127).

7. The Susquehanna Flats of the Chesapeake Bay were once one of the most important feeding grounds for migratory waterfowl. Each fall from 1958 to 1971, an average of 4,900 waterfowl were observed in this area. The average fall usage of the area by canvasbacks was estimated at 1.1 million bird-days. The vegetation in this area has been drastically reduced, resulting in a loss of waterfowl visiting the Susquehanna Flats (128).

8. A freshwater tidal marsh in the upper Delaware River estuary receiving effluent from a secondary sewage treatment acts as a sink for nitrogen and phosphate during the summer, then releases the nutrients back into the marsh complex slowly during the autumn and winter. This marshland processes as much as 2 to 5 inches of wastewater per day, or about 1 to 2.5 million gallons per year per 18.4 acres (129).

9. Maryland's coastal wetlands provide food, cover, and habitat for a variety of wildlife: Fiddler crabs, marsh crabs, blue crabs, gulls, glossy ibises, black-crowned night

herons, brant geese, snow geese, sandpipers, clapper rails, black ducks, American widgeons, pintails, hooded mergansers, redheads, redwinged blackbirds, cottontails, gray foxes, red foxes, white-tail deer, skia deer, leopard frogs, painted turtles, and pickerel frogs all utilize the wetlands of Maryland (130).

10. Maryland's wetlands support rare plant and animal species: The Glades, located in Garrett County, consists of 600 acres of wetlands. The largest wetlands complex in western Maryland, this area serves as headwaters to Casselman River and Cherry Creek. Because The Glades is one of the largest undeveloped areas in Maryland, it has significant wildlife value. Bears and bobcats, both rare in the state, are known to frequent this area as well as many game animals such as white-tailed deer, wild turkeys, and ruffed grouse. Because of its unique ecological conditions, this wetland complex harbors at least 12 rare plant and animal species such as small cranberry, bog dubmoss, and nesting Nashville warblers (131).

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Wetlands in Massachusetts

1. Over one-half of all the natural wetlands in Massachusetts have been destroyed by dredging, filling, or draining.

2. Massachusetts' wetlands are scarce and in need of protection: Inland wetlands make up only 6% (304,413 acres) of Massachusetts' total land mass (133).

3. Wetlands supply Massachusetts with recreational revenue: Massachusetts' wetlands are valuable to fish and wildlife and the related hunters and fishermen. In 1966, the state fishing, hunting, and combination licenses totaled 275,276. In excess of \$100 million was spent by the sportsmen, helping make recreation the second largest industry in the state (134).

4. Massachusetts' wetlands support a highly productive fisheries industry: In 1980, the commercial fishing harvest in Massachusetts totaled 369,640,000 pounds of fish and shellfish worth \$196,854,000. Of this, 66 to 90 percent of the species caught depend on coastal marshes or estuaries for at least part of their life cycle (33, 39).

5. Massachusetts' wetlands provide recreational fishing: In 1979, over 750,000 people participated in marine recreational fishing in Massachusetts, catching over 22,500,000 fish (40).

6. Massachusetts' wetlands are of great economic importance: The value of the wetlands at the Charles River Basin for pollution reduction, recreation, preservation, and research was determined to be \$150,000 per acre if left undeveloped, and their market value for construction between \$200-500 per acre.

7. Massachusetts' wetlands prevent huge flood damage losses: The U.S. Army Corps of Engineers (1971) determined that the protected 8,422 acres of wetlands in the Charles River Basin near Boston prevented flood damages of at least

\$3,193,000 annually. The loss of the entire 8,422-acre wetland base would produce average annual flood damages of \$17,084,606. The present value of each acre of this area is estimated at \$33,370 (132, 135).

8. Massachusetts' wetlands are crucial for groundwater recharge: In eastern Massachusetts, groundwater recharge accounts for 93% of the total annual discharge from area wetlands. The resulting savings from this wetland recharge of well water is about \$16.50 per day, or \$6,044 per year. The present value of one acre of wetlands for groundwater recharge is \$100,730 (132, 136).

9. Massachusetts' wetlands prevent storm damage: The runoff from hurricane rains of August, 1955, was distributed over one month in the Charles River Basin with a drainage area of 477 km² and 3,400 hectares of wetlands. Runoff lasted only one week in the adjacent Blackstone River which has a drainage area of 360 km², but few wetlands in the basin. The Charles River Basin stored approximately 61,000 m³ of storm water, which is equivalent to the average capacity of a Corps of Engineers reservoir in New England (137).

10. Massachusetts' valuable wetlands are subject to destruction: The most valuable wetlands in Massachusetts occur in the eastern half of the state. While they are therefore more accessible to a greater number of people, they are also subject to a greater risk of destruction because of the growing pressures of urbanization, industrialization, and highway construction (134).

11. Massachusetts' wetlands are important for flood protection: Wetland losses of more than 2% in the Neponset and Charles Rivers in Massachusetts are likely to result in significant flood damage (138, 139).

12. The wetlands of Massachusetts support a diversity of wildlife: Deer, bullfrogs, muskrats, bitterns, redwinged blackbirds, long-billed marsh wrens, coots, pied-billed grebes, great blue herons, sora rails, short-eared owls, red shouldered hawks, osprey, black ducks, wood ducks, Canada geese, cottontails, hares, raccoons, grouse, woodcocks, beavers, pickerel, bass, panfish, and minnows all utilize the wetlands of Massachusetts (133).

Wetlands in Michigan

1. Michigan was losing 6,500 acres of marshland per year in 1978 (10).

2. Michigan's wetlands are disappearing:

a. During the mid-1800s over 11 million acres of wetlands existed in Michigan, covering approximately 30 percent of the state's land base. It is now estimated that there are only 3 to 5 million acres of wetlands remaining (a 70% loss) (140).

b. In Michigan, 70,125 acres of coastal wetlands once existed in Little Bay de Noc, the Les Cheneaus Island, Saginaw Bay, Lake St. Clair, and the Detroit River-Lake Erie

complex. Only 28,500 acres of those wetlands remain today (21).

3. Michigan's wetlands are important to recreational and commercial wildlife activities: Michigan has 105,855 acres of coastal wetlands, which represent only 3.5 percent of the state's total acreage. These coastal wetlands are the site for approximately 21% of the waterfowl harvest, 14% of the duck production, 11% of the muskrat take, 15% of the commercial fish landings, and a large portion of the sport fishing (24).

4. Michigan's wetlands support a highly productive fisheries industry: In 1981, the commercial fishing harvest in Michigan totaled 12,823,000 pounds of fish worth \$5,647,000 \$5,647,000 (39).

5. Michigan's wetlands are economically important: In terms of average economic value for fish, wildlife and recreation, Michigan's coastal wetlands contribute an estimated \$439.69 per wetland acre/year for a total of \$51.8 million. Inclusion of other values such as waste assimilation, filtering of suspended solids, use by endangered species and other ecological values, would increase the average annual economic return per acre to over \$3,000 (24).

6. Michigan's wetlands provide essential wildlife habitat: Deer in northern Michigan "yard" in cedar swamps during winter, and are dependent on wetlands for survival. Other wetland-dependent species include herons, shorebirds, and osprey (21).

Wetlands in Minnesota

1. Minnesota has lost 80% of its original prairie wetlands. There are approximately 1.4 million acres of wetlands remaining in the state's agricultural areas (141, 142).

2. Minnesota's wetlands are rapidly disappearing: Wetlands drainage is occurring at a rate of about 15,000 acres per year in Minnesota. Approximately 25% of the wetlands in the 19 western counties of Minnesota were lost between 1964 and 1974. Over 40% of the prairie potholes in western Minnesota were destroyed from 1964-1974 (11, 143).

3. Minnesota's wetlands support a highly productive fisheries industry: In 1980, the commercial fishing harvest and live bait industry in Minnesota totaled 10,317,000 pounds of fish and 250,000 gallons of live bait worth \$2,128,000 and \$30,000,000, respectively (39, 144).

4. Minnesota's wetlands control flooding: Wetlands in Minnesota significantly reduce flood levels in major metropolitan areas downstream. During the flood of 1979, the Thief Lake Wildlife Management area wetlands reduced flood peaks in Crookston, Minnesota, by 1.5 feet (145).

5. Minnesota's wetlands are economically important: In Minnesota, aquaculture yields of 700 lbs./acre of trout and 350 lbs./acre of sunfish and catfish have been achieved under moderate pond management. The gross value of these yields ranges from \$1,050-4,200 per acre (146).

6. Minnesota's urban wetlands have been shown to be of significant importance in pollution reduction: In the Seven

County Metropolitan Area, including Minneapolis-St. Paul and their outlying suburbs, a recent study found that particulate-associated and soluble pollutants were reduced substantially in watersheds where wetland occurrence was high (144).

7. Loss of Minnesota's wetlands is costly: The Clearwater River Restoration Project, started in 1980, involves the use of wetlands and the creation of wetlands to treat problems related to surface water runoff and wastewater treatment. As a result of this project, the State of Minnesota and the Federal Government will have to spend over \$2 million to replace wetlands that have been destroyed through development and agricultural usage (147).

8. Minnesota's wetlands provide essential waterfowl habitat: The Prairie Pothole wetlands of Minnesota are of great concern. The total Prairie Pothole region comprises only 10% of the waterfowl breeding habitat in North America, yet provides 60-70% of the total continental duck production in an average year (11).

Wetlands in Mississippi

1. Thirty-two percent of Mississippi's original riparian habitat was lost from 1945-1970 (59).

2. Mississippi's wetlands contain plant species of value to man: Three vascular plant species abundant in Mississippi tidal marshes have been shown by the National Cancer Institute to contain the tumor inhibitor, Jincusol (148).

3. Mississippi's wetlands support a highly productive fisheries industry: In 1981, the commercial fishing harvest in Mississippi totaled 264,891,000 pounds of fish and shellfish worth \$30,159,000 (39).

4. Mississippi's wetlands support waterfowl: Annually, between 3 and 6 million waterfowl use the wetlands in the lower Mississippi Flyway, which includes the state of Mississippi (16).

Wetlands in Missouri

1. Missouri's wetlands are disappearing:
 - a. Only one-tenth of Missouri's original wetlands remain (8).
 - b. Seventeen percent of the riparian habitat in Missouri was lost by 1880. Forty percent was lost by 1920, and by 1975, only 4% remained (149).
 - c. Missouri's southeastern wetlands covered 2.4 million acres when European settlers arrived in the 1780s. Land clearing for agriculture, timber, and railroads led to a decline of 0.9 million acres by 1920. By 1975, only 98,000 acres remained, much of it in blocks less than 1,000 acres. Today, only 60,000 acres remain (149).
 - d. Seventy percent of the original wetlands habitat along the Mississippi River in

eastern Missouri has been lost (102).

2. Missouri's wetlands support a productive fisheries industry: In 1981, the commercial fishing harvest in Missouri totaled 970,000 pounds of fish worth \$231,000 (39).

3. Missouri's wetlands losses affect fishing: In Missouri, loss of riparian habitat to channelization resulted in an 80% decline in fish harvest over 16 years (150).

4. Missouri's wetlands losses affect waterfowl: The loss of natural riparian vegetation, including habitat features such as tree cavities, has greatly reduced or eliminated the carrying capacity of Missouri's riparian corridors (16, 151).

Wetlands in Montana

1. Montana's wetlands provide essential habitat for migrating waterfowl: The wetlands of the Canyon Ferry Reservoir in Montana are a stopover point for 250,000 ducks, 7,000 snow geese, and 3,000 swans migrating through the Pacific Flyway each year. Other species utilizing these wetlands include gulls, osprey, black-necked stilts, black-bellied plovers, and snowy plovers (152).

2. The major impacts by man upon riparian and wetland habitats in Montana include:

- a. Impoundments, which alter native plant species,
- b. Channelization, which reduces floodplain habitat area, riparian plant community

- diversity, and causes major changes in the hydrologic geometry and sediment transport capability of the river channel,
- c. logging, which alters the seasonal runoff regime in the watershed and introduces dissolved and suspended sediment loads in the stream channel system,
 - d. livestock grazing, which leads to channel bank erosion, increased sedimentation, soil compaction, and decreases riparian and wetland community diversity, and
 - e. recreational activity, which disturbs vegetation, compacts soils, and accelerates bank erosion (153).

3. Montana's wetlands offer unique wildlife habitat: Riparian habitats account for only 1% of the total land use of the Northern Great Plains, including Montana. This small amount of land provides potential breeding habitat for 172 terrestrial vertebrate species and potential feeding habitat for at least 216 terrestrial vertebrate species. Forty-two percent of these species breed only in riparian or other wetlands sites. Riparian habitats are a critical source of diversity in this geographic region. They provide a large number of vertical and horizontal strata, habitat "edge," and, where they follow streams or rivers, connecting travel lanes between habitat types for daily movements and seasonal migrations of wildlife (70).

4. Montana's wetlands have aesthetic value: Portions of the Flathead and Missouri Rivers in Montana are included in the National Wild and Scenic Rivers System of the United States. These rivers and adjoining wetlands provide outdoor recreational activities for many of Montana's citizens and visitors (77).

5. Montana's wetlands provide recreational fishing: In 1980, 205,017 people participated in recreational fishing in Montana for a total of 3,457,456 angler-days. These fishermen spent \$45,767,000 on fishing equipment and related activities in the state of Montana (76).

Wetlands in Nebraska

1. Nebraska has lost 90% of its original wetlands (154).
2. The Rainwater Basins in south central Nebraska are rapidly disappearing:
 - a. Nebraska's Rainwater Basin region had lost 82% of its marshes by the 1960s (155, 156).
 - b. In the early 1900s, there were 4,000 marshes in the Rainwater Basin totaling 94,000 acres. By 1981, only 16,150 acres remained (156, 157).
3. Nebraska's wetlands may insure good water quality: The Sandhill wetlands of north central and northwestern Nebraska may protect water quality by keeping nutrients and other pollutants from entering ground and surface water (158).

4. Nebraska's wetlands provide habitat for waterfowl: An estimated 2.5 million ducks and geese migrate through Nebraska and utilize the state's wetlands. The Rainwater Basin wetlands of south central Nebraska provide habitat for millions of migratory birds, including mallards, blue-wing teal, pintails, shovelers, Canada geese, blue geese, snow geese, and white-fronted geese. Some 250,000-300,000 white-fronted geese, 90% of the mid-continental population, depend upon the Rainwater Basin and the central Platte River as a staging area during spring migration. In addition, sandhill and whooping cranes utilize habitat in Nebraska's Rainwater Basins (159, 160).

5. Loss of Nebraska's wetlands affects waterfowl: Loss of wetlands in Nebraska leads to overcrowding of waterfowl and thus increases their susceptibility to infectious diseases. In 1975, 25,000 white-fronted and Canada geese, pintails, mallards, and other ducks died of fowl cholera in the Rainwater Basin wetlands of Nebraska. In 1980, 72,000 to 80,000 ducks and geese died there--the second largest loss to fowl cholera ever reported in the U.S. (157).

6. Nebraska's wetlands supply sport hunting: Ballards Marsh, a 1,561-acre wetlands area in north central Nebraska, attracts waterfowl, grouse, pheasants, deer, doves, and many sport hunters each year. Waterfowl hunting in the state averages from 240,000 to 340,000 man-days each year (156, 161).

7. Nebraska's wetlands are essential to endangered species: In May, 1978, the U.S. Fish and Wildlife Service

designated a portion of the Platte River from Lexington to Denman, Nebraska, as critical habitat for the whooping crane, an endangered species (162).

8. Nebraska's wetlands support sport fishing: In 1975, there were over 5,100,000 man-days of fishing spent in the state of Nebraska (156).

9. Nebraska's wetlands support a productive trapping industry: In the 1981-82 furbearer season, 221,452 wetland-dependent furbearers, including muskrats, beavers, mink, and raccoons were harvested in Nebraska at a value of \$3,039,484 (156).

Wetlands in Nevada

1. Less than 10% of original riparian habitat persists along the Colorado River. New riparian habitat has been created from dam construction along the Colorado River, resulting in a change in species diversity. The Colorado River and its two small tributaries (Virgin and Muddy Rivers) represent the only perennial streams in Nevada (67, 163).

2. Nevada's wetlands support large bird populations: The highest densities of nesting birds for North America are found in the cottonwood riparian forests of Nevada, Arizona, and New Mexico. In Nevada, a minimum of 70 percent, or 281 individual bird species, are dependent on meadow wetlands and/or stream riparian habitats for survival during some phase of their life cycle (163, 164).

3. Nevada's wetlands provide habitat for a great diversity of birds: Of the 41 breeding bird species found using wetlands along the lower Colorado River in Nevada, 74% prefer riparian habitat (54).

4. Nevada's wetlands sustain endangered species: Bald eagles, brown pelicans, peregrine falcons, Colorado bonytails, pahrnagat roundtail chubs, Colorado squawfish, woundfins, cui-uis, and Lahontan cutthroat trout all depend on wetlands, lakes, and rivers in Nevada for survival (163, 165).

5. Nevada's wetlands support many species of birds: The wetlands of the Lower Colorado River provide food, cover, and habitat for grosbeaks, long-billed marsh werens, yellow-headed blackbirds, red-winged blackbirds, dickcissels, ash-throated flycatchers, western kingbirds, phoebes, cactus wrens, Northern orioles, yellow-breasted chats, summer tanagers, yellow-billed cuckoos, towhees, yellow-rumped warblers, quail, woodpeckers, and brown creepers (165).

6. Nevada's wetlands support recreational fishing: In 1980, 142,575 people participated in recreational fishing in Nevada for a total of 2,197,426 angler-days. These fishermen spent \$33,104,000 on equipment and fishing-related activities in the state of Nevada (76).

7. Nevada's wetlands are important to recreational hunting: The Nevada Department of Wildlife, through lease or ownership, controls 344,000 acres of wetlands that support between 75,000 and 130,000 hunter use-days between August 15 and January 15 (163).

Wetlands in New Hampshire

1. New Hampshire's wetlands support a highly productive fisheries industry: In 1980, the commercial fishing harvest in New Hampshire totaled 19,050,000 pounds of fish and shellfish worth \$5,182,000. Of this, 66 to 90 percent of the species caught depend on coastal marshes or estuaries for at least part of their life cycle (33, 39).

2. New Hampshire's wetlands provide recreational fishing: In 1979, over 200,000 marine recreational fishing trips took place in New Hampshire, resulting in a total catch of over one and one quarter million fish (40).

3. New Hampshire's wetlands are threatened: The ratio of people to wetlands is higher in the New England states than anywhere else in the U.S. (80).

4. New Hampshire's wetlands support a diverse fishing industry: Most species of commercial fish and shellfish harvested off New Hampshire's coast are dependent on wetlands for survival. This includes striped bass, menhaden, flounder, cod, salmon, clams, scallops, smelt, and lobster (80).

5. New Hampshire's wetlands provide habitat for a variety of birds: The wetlands of New Hampshire offer food, cover, and habitat for swallows, oystercatchers, black-bellied plovers, ruddy turnstone, killdeer, willets, dowitchers, lesser yellowlegs, eight species of sandpipers, godwits, gulls, terns, loons, grebes, cormorants, Canada geese, mallards, black ducks, gadwalls, canvasbacks, eiders,

herons, egrets, belted kingfishers, peregrine falcons, osprey, hawks, and American bald eagles (80).

Wetlands in New Jersey

1. New Jersey lost 10-25% of its marshland to commercial development prior to 1971 (34, 166).

2. In 1981, there were only 243,136 acres of wetlands remaining in New Jersey (167).

3. The New Jersey Wetlands Act of 1970 protects coastal wetlands, but there is no state protection given to freshwater wetlands (168).

4. New Jersey's wetlands control flooding: New Jersey's Great Swamp retains water and acts as a detention basin during floods, preventing harmful downstream effects on the Passaic River (169).

5. New Jersey's wetlands provide a variety of services: The Atlantic White-Cedar forests of New Jersey's wetlands are commercially important for wood, provide excellent deer wintering areas, and serve as habitat for a number of rare and endangered wildlife species including Pine Barrens tree frogs, Hessel's hairstreaks (a butterfly), southern bog lemmings, and bog turtles. White-Cedar swamps provide valuable services to humans by impeding storm water runoff and serving as firebreaks (168, 170).

6. New Jersey's wetlands support rare plant species: There are 90 species of rare plants found in the wetlands of New Jersey (168).

7. New Jersey's wetlands support a highly productive fisheries industry: In 1980, the commercial fishing harvest in New Jersey totaled 200,634,000 pounds of fish worth \$49,879,000. And in 1981, over 47 million pounds of shellfish were landed in New Jersey with a dockside value of over \$30 million. The same year, over 140 million pounds of fish were landed with a dockside value of nearly \$18 million. Of this, 66 to 90 percent of the species caught depend on coastal marshes or estuaries for at least part of their life cycle. This includes bluefish, striped bass, weakfish, mackerel, blue crabs, menhaden, clams, alewife, flounder, and oysters (29, 33, 39).

8. New Jersey's wetlands are essential to state trout fishing: Trout fishing generates about \$50 to \$75 million worth of business in New Jersey annually. Inland wetlands are essential to the environmental health of the trout resource and its users. Loss of some brook trout habitat in New Jersey streams has caused the species to be placed on the threatened species list (171).

9. New Jersey's wetlands provide recreational fishing: In 1979, over 950,000 people participated in marine recreational fishing in the state of New Jersey, catching over 17 million fish. Also in 1979, over \$151,000,000 was spent directly on marine recreational fishing in the state of New Jersey (40, 172).

10. New Jersey's wetlands produce organisms of medicinal value to humans: Monobactams, a new family of antibiotics introduced by E. R. Squibb and Sons, are derived from a swamp

microorganism found only in the pinelands wetlands of the Wading River in New Jersey. The first compound, "Azactam," is currently being tested in hospitals around the world to treat hospital-generated infections which have been resistant to more traditional drugs, such as penicillin and tetracycline. The existence of this microorganism, Chromobacterium violaceum, is attributed to the natural acidity of the wetlands soil, and the absence of pesticides in the area (173).

11. New Jersey's wetlands support a great diversity of wildlife: The Great Swamp of New Jersey covers 6,000 acres and provides habitat for more than 180 species of wildlife and 1,000 plant species. Birds found inhabiting the swamp include pintails, wood ducks, red-headed woodpeckers, pileated woodpeckers, barred owls, great horned owls, saw-whet owls, long-billed marsh wrens, American bitterns, herons, egrets, coots, and gallinules (98).

12. New Jersey's wetlands support a productive fur-bearer harvest: In the 1980-82 furbearer season, the harvest of muskrats, mink, beavers, and other furbearers in New Jersey was valued at \$2,433,670 (168).

13. New Jersey's wetlands provide recreation: In 1970, there were over 250,000 visitors to New Jersey's Great Swamp. In 1981, there were 200,000 visitors to Brigantine National Wildlife Refuge and 25,000 visitors to Barnegat National Wildlife Refuge (98, 168).

14. New Jersey's wetlands losses affect waterfowl: Near Manahawkin, New Jersey, development of coastal lagoon

communities for man has resulted in an almost complete loss of habitat for all species of waterfowl, except the mallard. And although the mallard adults have adapted well to nesting in suburban environments, their brood survival is very poor (174).

15. New Jersey's coastal wetlands provide the primary base for estuarine and marine food webs: The principal direct dietary beneficiaries of organic wetland materials are bacteria and protozoans, which are in turn fed upon by larger invertebrates. Important finfish, shellfish, waterfowl, and other resources feed upon these invertebrates. New Jersey's coastal wetlands are prime wintering habitat annually for hundreds of thousands of migratory waterfowl (175).

Wetlands in New Mexico

1. Forty percent of New Mexico's wildlife depends upon riparian habitat for survival (6).

2. New Mexico's playa lakes are important wetlands: Playa lakes in New Mexico, such as Burford Lake, McAlester Lake, and Wagon Mound Lake, supply cover, nesting opportunity, and food for wildlife, including birds, cottontail rabbits, raccoons, bobcats, badgers, coyotes, foxes, opossums, skunks, snakes, frogs, and turtles. Playas also provide man with watering areas for livestock and holding ponds for crop irrigation (73, 176).

3. New Mexico's wetlands are unique reservoirs of plant and animal life: The riparian areas of New Mexico offer

essential components of life to an array of wildlife. Breeding bird densities are high in cottonwood stands, with as many as 1,000 pairs or more per 100 acres (177).

4. New Mexico's wetlands support recreational fishing: In 1980, 217,722 people participated in recreational fishing in New Mexico, for a total of 3,531,133 angler-days. These fishermen spent \$53,726,000 on equipment and fishing-related activities in the state of New Mexico (76).

5. New Mexico's wetlands are scarce and need protection: Only 3% of the land in the Great Plains of the U.S., including New Mexico, is woodland, found along river valleys where subsoil moisture is available (178).

6. New Mexico's wetlands have been altered: At least 85% of the playas in New Mexico have experienced some type of alteration. These playas are considered "islands" of wildlife habitat in a highly altered plains ecosystem (179).

7. New Mexico's wetlands are essential to birds: The highest densities of nesting birds in North America have been reported in the Southwest cottonwood riparian forests of the United States. Also, of 166 bird species known to nest in New Mexico, 127 (77%) are dependent on wetlands habitat (164).

8. New Mexico's wetlands support a diversity of fish and wildlife: In Arizona and New Mexico, riparian habitats are capable of supporting very diverse fish and wildlife populations: 41-43% of the mammal species of North America, 38% of the bird species, 30-35% of the reptiles, and 13-14% of the amphibians are found in these areas (180).

9. New Mexico's wetlands support unique wildlife species: New Mexico is included in the historical range of the endangered whooping cranes (179).

Wetlands in New York

1. New York wetlands are disappearing:
 - a. There are an estimated 125,000 wetlands in New York state, covering a total area of approximately one million acres. A study of 27,000 of these wetlands showed that most have been affected by human influence, such as commercial and residential development, dirt trails, campgrounds, and industry (181, 182).
 - b. Land has been drained in the vicinity of 25% of 27,000 wetlands studied in New York, and streams in or near 15 percent of the wetlands have been channelized (181, 182).
 - c. Thirty-three percent of the salt meadows and marshes on Long Island were lost between 1954 and 1968 (123, 183).

2. New York's wetlands support a highly productive fisheries industry: In 1981, the commercial fishing harvest in New York totaled 36,522,000 pounds of fish and shellfish worth \$45,555,000. Of this, 66 to 90 percent of the species caught depend on coastal marshes or estuaries for at least part of their life cycle (33, 39).

3. New York's wetlands provide recreational fishing: In 1979, over 1,350,000 people participated in Marine recreational fishing in New York, catching over 33,500,000 fish (40).

4. New York's wetlands control water quality and supply groundwater: At the Brookhaven National Laboratory an artificial marsh-pond system is being used in an attempt to solve Long Island's two biggest problems--sewage disposal and water supply. The system treats 20,000 gallons of sewage daily from the town of Brookhaven. There is no problem of odor, and there is a notably thriving plant, fish, and shellfish population. After natural water filtration, the cleansed water can be used to recharge groundwater supplies (184).

Wetlands in North Carolina

1. The pocosin wetlands of North Carolina are disappearing:

- a. Nearly 33% of North Carolina's pocosin wetlands were totally converted to non-wetland uses between 1962 and 1979. Another 36% are "in transition," i.e., they have been drained, cleared, cut, or planned for development (185).
- b. Of the 2.24 million acres of pocosins still in a relatively unaltered state in 1962, 740,000 acres had been totally developed by

1979, representing a loss of nearly 33% of pocosins in North Carolina (186).

- c. Clearing of pocosins has been implicated in disturbance of organic soils, causing elevated levels of mercury and iron in waters draining from the cleared pocosins. In some cases, mercury levels reported were more than 20 times North Carolina's standards. A build-up of mercury in the aquatic system could cause a loss of millions of dollars to the commercial fishing industry (187).

2. The pocosins of North Carolina help control salinity: North Carolina's pocosins absorb and store freshwater from rainfall and release it gradually into the adjacent estuaries, thereby stabilizing salinity levels. Many estuarine-dependent fisheries species, especially in immature stages, are highly sensitive to changes in salinity, especially shrimp and flounder. Recent studies indicate a fourfold increase in the runoff rate from cleared pocosins (188, 189).

3. North Carolina's wetlands support a highly productive fisheries industry: In 1981, the commercial fishing harvest in North Carolina totaled 432,006,000 pounds of fish and shellfish worth \$57,520,000 at dockside. Processed value exceeded \$200 million. Ninety percent of this total consisted of species, including shrimp, blue crab, and flounder, which depend on coastal marshes or estuaries for at least part of their life cycle (39, 190).

4. North Carolina's wetlands provide recreational fishing: In 1979, over 3,500,000 people participated in marine recreational fishing in North Carolina, catching over 22 million fish. And wetland-associated freshwater fishing in eastern North Carolina totaled more than 1.5 million fishing days in 1981 (40, 191).

5. North Carolina's pocosins are essential to wildlife: Black bears, bobcats, otters, mink, muskrats, raccoons, and gray foxes need pocosin wetlands habitat to survive (188).

6. North Carolina's pocosin wetlands support sport hunting: The pocosins of North Carolina support a mixture of small and large game animals. In the 1977-78 season, nearly 100,000 trips were made to pocosin areas for recreational hunting (188).

7. The pocosin wetlands of North Carolina support endangered and threatened species: The bogs of North Carolina and surrounding land are habitat for American alligators, pine barrens tree frogs, red cockaded woodpeckers, and eastern cougars. Endangered plants, such as spring flowering golden rods, whitewicky kalmias, and rough-leaf loostrifes also occupy the pocosins (188).

8. Many genera of birds, including herons, egrets, ibises, yellowlegs, sandpipers, plovers, oystercatchers, terns, gulls, skimmers, pelicans, kingfishers, ducks, grebes, geese, loons, cormorants, ospreys, hawks, eagles, and owls utilize North Carolina's intertidal flats (192).

Wetlands in North Dakota

1. North Dakota's wetlands are disappearing: North Dakota has only 2.0-2.3 million acres of wetlands remaining of 4.0-4.5 million acres. Approximately 250,000 to 400,000 wetland acres have been lost in North Dakota since the mid-1960s, primarily due to agricultural drainage. By the year 2000, another 600,000-800,000 acres will have been drained (11, 193).

2. North Dakota's wetlands control flood damage:

a. The wetlands of the Red River Basin North Dakota significantly reduce flood levels in major metropolitan areas downstream.

Minnesota's Agassiz National Wildlife Refuge wetlands reduced flood peaks from a 1979 flood in Grand Forks, North Dakota by 0.5 feet (145).

b. Undrained wetlands in the Pembina River Basin in North Dakota stored 12 inches of water per surface acre of wetland. Since 1942, flood peaks in this area have increased due to increased drainage of wetlands (194).

c. In the Devil's Lake Basin of North Dakota, wetlands retain 50-79% of the total runoff from most storms (11).

3. Loss of North Dakota's wetlands increases flood peaks: A 1971 study of the flood plains of the Pembina

River at Neche, North Dakota, attributed significantly higher flood peaks in this area after 1942 to increased wetlands drainage (194).

4. North Dakota's wetlands are economically important: The gross business volume generated in North Dakota by resident hunting expenditures was \$54.3 million in 1973. The average annual expenditure for waterfowl, small game, and big game was \$7.6, \$8.5, and \$6.1 million, respectively. About 55 percent of the gross business volume generated by hunters is attributed to the existence of state wetlands (195).

Wetlands in Ohio

1. Ohio's wetlands are disappearing:

- a. Approximately 6.7 million acres of Ohio's original wet soils have been drained.
- b. Along the shoreline of Lake Erie, Ohio has lost 66% of its shallow marshes and 44% of its deep marshes since 1954 (197).

2. Ohio's wetlands support a highly productive fisheries industry: In 1980, the commercial fishing harvest in Ohio totaled 10,490,000 pounds of fish worth \$3,351,000 (39).

3. Loss of Ohio's wetlands affects wildlife: Wetlands losses in the past 20 years, due primarily to farming, in northwest and western Ohio have contributed to a reduction by 64% of meadowlark populations and by 95% of the ring-necked pheasant populations (198).

4. Ohio's wetlands perform many valuable services: Ohio's wetlands reduce flood peaks, increase groundwater recharge, provide fish spawning and nursery grounds, provide wildlife habitat, and reduce pollution. Sediment yields from eroding lands may be reduced as much as 90% by depressional wetlands (196, 198).

5. Ohio's wetlands are economically important: The current value for Ohio's marshes bordering Lake Erie for waterfowl hunting and muskrat production exceeds their economic value for any other purpose. Ohio is the number two fur harvest state in the nation (196, 199).

6. Ohio's wetlands provide goose habitat: The careful management of some of Ohio's wetlands has contributed to an increase in goose populations from 1,500 in 1958 to over 40,000 in the early 1970s (196).

7. No wetlands along the Teays River in southeastern Ohio exist in their natural state. Many have been subject to filling, drainage, and pollution, especially from acid mine drainage. Probably all have been logged (199, 200).

Wetlands in Oklahoma

1. Seventy percent of the original wetlands found in Oklahoma have been lost (201).

2. All of the original 726 hectares of natural wetlands on the floodplain of Wildhorse and Rush Creeks in south central Oklahoma have been destroyed (7).

3. Wetlands purify and replenish important groundwater supplies: Groundwater supplied 56% of the total reported water used in Oklahoma in 1975. Over 80% of the state's irrigation needs are satisfied by groundwater and approximately 300 towns and cities obtain their water supply from ground-fed wells and streams (202).

4. Oklahoma's wetlands are disappearing:

- a. Since 1870, 87% of the original riparian areas and 17% of the original channel lengths in south-central Oklahoma have been eliminated. All of the original 54 wetlands in the same area no longer exist (203).
- b. Most natural wetlands in Oklahoma are bottomland flood plain wetlands created and maintained by river overflow and saturated soils. Construction of large reservoirs since the mid-1900s and their inundation of over 232,875 hectares of bottomland hardwoods has probably been a major cause of wetlands destruction (202).
- c. Many of Oklahoma's remaining natural wetlands basins have been severely altered by soil erosion, siltation, reduced groundwater levels due to irrigation and channelization, chemical, and fertilizer runoff from crop and pasture land, livestock management, highway and power-line construction, industrial pollution, oil

and sludge pollution, and small flood control structures (202).

5. Oklahoma's wetlands are important resources: The 700 playa lakes in Oklahoma provide watering areas for livestock and holding ponds for crop irrigation. They also supply cover, nesting opportunity, and food for a wide variety of wildlife (73).

6. Oklahoma's wetlands need protection: Of the 53,000 acres of wetlands remaining in Oklahoma, most have been drastically altered by clearing for agricultural, residential, and industrial development or inundated by water development projects. Few tracts remain undisturbed, the most extensive of these lying in the floodplain of the Deep Fork River in Okmulgee, Creek, and Okfuskee Counties (202).

7. Oklahoma's wetlands provide habitat for wildlife: The Chickaskia River Basin in north central Oklahoma is referred to as the only wildlife habitat in a "sea of wheat." The water quality of the Chickaskia River is excellent, and the surrounding wetlands support white-tail deer, Rio Grande turkeys, bobwhite quail, mourning doves, fox squirrels, cottontail rabbits, raccoons, mink, red foxes, herons, and raptors (111).

8. Oklahoma's wetlands provide brooding and rearing habitat for waterfowl: In 1978, the wetlands of Oklahoma provided brooding habitat for a production of 2,730 mallard, 1,412 pintail, and 7,132 wood duck ducklings (202).

9. The wetlands of Oklahoma provide wintering habitat for mallards, common merganzers, wigeons, gadwalls, pintails, green-winged teal, wood ducks, ring-necked ducks, common goldeneyes, hooded merganzers, shovelers, redheads, canvas-backs, and coots. In one study of dabbling ducks wintering in Oklahoma in 1978-1980, natural wetlands were more frequently utilized by the birds than manmade wetlands: 36-71% of the mallards, 50% of the pintails, 100% of the gadwalls, and 100% of the wood ducks wintered on natural wetlands (7).

Wetlands in Oregon

1. Oregon's wetlands support wildlife: More wildlife species in Oregon depend entirely on wetlands than any other habitat. Of the 373 terrestrial species known to occupy the Great Basin of southeastern Oregon, 288 are either directly dependent on riparian zones or utilize them more than other habitats (204).

2. Oregon's wetlands support a highly productive fisheries industry: In 1980, the commercial fishing harvest in Oregon totaled 126,316,000 pounds of fish and shellfish worth \$55,748,000. Of these, 50% of the species caught are dependent on wetlands for some part of their life cycle (2, 39).

3. Oregon's coastal wetlands are a valuable resource: Coastal wetlands are essential to the life cycle of most commercially important fish and shellfish. The 1979 U.S. commercial fishing harvest was 9.9 billion pounds of seafood with a total retail value of \$7.8 billion. Seventy to eighty

percent of that catch was composed of estuarine-dependent species (33).

4. Oregon's wetlands provide food, cover, and habitat for a variety of wildlife: The wetlands of Oregon sustain populations of mule deer, white-tail deer, mink, raccoons, bobcats, river otters, California quail, Chuckar partridges, Hungarian partridges, ring-neck pheasants, mourning doves, and an array of ducks and geese (100).

5. Loss of Oregon's wetlands affects recreational hunting: Projects along the Lower Snake River in 1945 altered 140 miles of riparian habitat in Oregon, Washington, and Idaho and caused a loss of 43,500 man-days of hunting and trapping (100).

Wetlands in Pennsylvania

1. Pennsylvania's wetlands control flood damage: In 1955 a severe flood in the Pocono Mountains of eastern Pennsylvania washed out hundreds of bridges across Monroe County. Bridges below the Cranberry Bog, a vast low-lying bog underlain with deep peat deposits, were intact after the disaster, due to the retention of floodwaters by the bog (205).

2. Pennsylvania's wetlands filter excess pollutants: The Tinicum Marsh near Philadelphia filters sewage effluent as it passes through the 512-acre marshland. The sewage effluent contains 63% fewer phosphates after two to five hours of filtration by the marsh (206).

3. Pennsylvania's wetlands support a highly productive fisheries industry: In 1980, the commercial fishing harvest in Pennsylvania totaled 347,000 pounds of fish and shellfish worth \$312,000 (39).

4. Pennsylvania's wetlands provide recreational fishing: In 1980, 459,291,000 people fished in Pennsylvania, spending over 31 million angler-days participating in this sport. They also spent nearly \$121 million on fishing equipment and related activities in Pennsylvania. The Pennsylvania Fish Commission cultures and stocks a substantial number of pickerel, pike, and muskellunge for sport fishing, all of which depend on wetlands for spawning areas (76).

Wetlands in Rhode Island

1. Ten percent of Rhode Island's coastal wetlands larger than 40 acres were filled between 1953-1964 (207).

2. Rhode Island wetlands store valuable nutrients: Salt marshes in Rhode Island have been shown to efficiently hold surface-applied nitrogen, phosphorus, cadmium, and zinc and release them to plants as needed (208).

3. Rhode Island wetlands are being altered: From 1939 to 1972, approximately 17% of the wetlands in South Kingston, Rhode Island, had changed sufficiently to warrant reclassification. Man's activities were influential in 41% of the changes, and 58% of these man-induced changes were retrogressive (209).

4. Loss of Rhode Island's wetlands has affected oyster production: In Upper Narragansett Bay, Rhode Island, oyster populations were once so abundant that they were used by New England colonists to fatten pigs. The upper bay supported a viable oyster industry for many years, but due to habitat alteration, no oysters have been harvested since 1957. Also, soft-shelled clam harvests have decreased from 600,000 pounds in 1949 to only 8,000 pounds in 1979 (210).

5. Rhode Island's wetlands support a highly productive fisheries industry: In 1981, the commercial fishing harvest in Rhode Island totaled 80,288,000 pounds of fish and shellfish worth \$48,761,000. Of this, 66 to 90 percent of the species caught depend on coastal marshes or estuaries for at least part of their life cycle. In 1979, Rhode Island's quahog fishery produced 2.2 million pounds of meat with a dockside value of \$6.3 million and provided full-time employment for approximately 1,300 people and part-time employment for an additional 2,300 people (33, 39, 207).

6. Rhode Island's wetlands provide recreational fishing: In 1979, over 425,000 people participated in marine recreational fishing in Rhode Island, catching over 6 million fish. In the same year, there were 33,000 recreational boats registered in Rhode Island (40, 207).

7. Rhode Island's wetlands are essential to winter flounder populations: In 1962, two small lagoons off the coast of Rhode Island having a surface area of only 3.18 square miles and an average depth of less than 3 meters,

produced 25 percent of the recruits to the offshore adult population of 6,870,000 winter flounders. If these estuarine breeding grounds were destroyed, the offshore fishery would be virtually eliminated (32, 211).

8. Rhode Island's wetlands have historical value: On Jamestown and Prudence Island, nearly 100% of the locations listed on the National Register of Historical Sites are located adjacent to freshwater wetlands. In the Arcadia Management Area, 80% of the historical sites are within 150 meters of freshwater wetlands. And the well-drained soils adjacent to wetlands contain some of the best examples of prehistoric archeological sites in the state (212).

9. Rhode Island's wetlands support sport hunting: Most wildlife species sought by hunters in Rhode Island, including beaver, deer, waterfowl, and upland game species are associated at some time during their life history with wetlands. In 1981, 10,723 hunting licenses were sold in Rhode Island, and approximately 3,135 Migratory Bird Stamps are sold annually in Rhode Island (213, 214, 215).

10. Rhode Island wetlands support a diversity of wildlife: Salamanders, bog turtles, brook lamprey, black-crowned night herons, yellow-crowned night herons, blue-winged teal, American bitterns, hooded mergansers, red-shouldered hawks, osprey, marsh hawks, king rails, soras, long-billed marsh wrens, short-billed marsh wrens, water shrews, and southern bog lemmings all utilize the wetlands of Rhode Island during some part of their life history (216).

Wetlands in South Carolina

1. South Carolina's wetlands store nutrients: The upper Santee Swamp in South Carolina withholds phosphorus and nitrates from the Wateree and Congaree Rivers, acting to trap and then slowly release these nutrients as needed by area plants (217).

2. South Carolina's wetlands filter and remove particulates: In Georgetown, South Carolina, dredge spoil flushed onto 20 hectares of wetlands was filtered by the wetlands, and the resulting effluent was as clean and free of sediment as the river system it was entering (218).

3. South Carolina's wetlands support a highly productive fisheries industry: In 1980, the commercial fishing harvest in South Carolina totaled 21,183,000 pounds of fish and shellfish worth \$20,448,000. Of this, 66 to 90 percent of the species caught depend on coastal marshes or estuaries for at least part of their life cycle (33, 39).

4. South Carolina's wetlands provide recreational fishing: In 1979, over 350,000 people participated in marine recreational fishing in South Carolina, catching over 2,250,000 fish (40).

Wetlands in South Dakota

1. An estimated 48,913 acres of wetlands were drained in South Dakota from 1964-1974 (219).

2. Wetland drainage is occurring at a rate of about 13,000 acres per year in South Dakota (11).

3. In 1975, there were approximately 1,332,562 acres of wetlands in South Dakota (219).

4. South Dakota's wetlands are important to waterfowl: In one study of 12 ponds in western South Dakota an average of 18 waterfowl young were produced per pond per year. These ponds averaged a use of 2,847 shorebird days and 32,018 waterfowl days annually (220).

5. South Dakota's wetlands support a highly productive fisheries industry: In 1981, the commercial fishing harvest in South Dakota totaled 2,259,000 pounds of fish worth \$357,000 (39).

6. South Dakota's wetlands are disappearing: Between 1940 and 1970, 7 million acres of wetlands were drained in Minnesota and the Dakotas. In one township in South Dakota, more than 60% of the wetlands were drained between 1954 and 1961 (154).

7. South Dakota's wetlands provide water: Lake Kampeska and its associated wetlands cover 4,800 acres and serve as a water source for the city of Watertown, South Dakota. Approximately 3.2 inches of water are pumped into Watertown annually from Lake Kampeska (221).

8. South Dakota's wetlands are economically valuable: Duck hunters in the U.S. spend \$87 million per year for hunting-related food, travel, and equipment. In South Dakota, waterfowl hunters spend \$10-15 million annually. Waterfowl production in South Dakota is largely dependent on natural wetlands (222, 223).

9. South Dakota's wetlands are essential to wildlife: Blue-winged teal, mallards, and pintails rank in the top five hunted birds in the Central Flyway, and all depend upon the prairie potholes for survival. Pheasants, Hungarian partridge, white-tail deer, rabbits, and foxes all utilize the wetlands of South Dakota (222).

Wetlands in Tennessee

1. Soil erosion is high in western Tennessee--75% of the topsoil has been lost. Wetlands control soil erosion (113).

2. Estimates indicate that by the year 2,000 there will be virtually no wetlands left in west Tennessee in private ownership, with the exception of minor pockets (224).

3. Tennessee's wetlands are economically valuable: Losses of wetlands in Tennessee's Obion-Forked Deer Basin due to a channelization project amounted to 9% of the aquatic habitat and 70% of the forested wetlands. The economic loss of fish, wildlife, and commercial timber totaled \$4,000,000 per year. Over 42,000,000 tons of soil are lost per year in the Obion-Forked Deer River Basin.

4. Losses of Tennessee's wetlands are costly: Channelization in Tennessee has affected 200,000 acres of floodplain wetlands and has resulted in fish and wildlife losses that exceed \$2 million per year (225).

5. Tennessee's wetlands losses affect fish: Channelization and wetland alteration in western Tennessee resulted

in a 90% reduction in fish populations over a 40-year period. Prior to channelization, annual sport and commercial fishing was valued at \$1.5 million. After channelization, fishing values totaled \$79,000 (113).

6. Tennessee's wetlands support hunting and fishing: In 1979, 200,000 ducks were harvested by 30,000 waterfowl hunters in the state of Tennessee. These hunters spent \$9 million on hunting supplies and transportation. Also in 1979, 200,000 furbearer pelts attributable to the presence of wetlands were sold in Tennessee at a value of \$2 million (224, 226).

Wetlands in Texas

1. Coastal Texas has lost over 600,000 acres of its original wetlands to dredge-and-fill activities (227).

2. Texas' wetlands support a highly productive fisheries industry: In 1981, the commercial fishing harvest in Texas totaled 113,108,000 pounds of fish and shellfish worth \$174,787,000. Of this, 66 to 90 percent of the species caught depend on coastal marshes or estuaries for at least part of their life cycle (33, 39).

3. Texas' wetlands provide recreational fishing: In 1979, over 1,000,000 people participated in marine recreational fishing in Texas, catching over 5,000,000 fish (40, 228).

4. Texas' playa lakes are an important resource:

- a. In the High Plains of Texas alone, approximately 20,000 playa lakes collect from 1 to 3 million acre-feet of water per year (73).
- b. Eighty to ninety percent of the wintering waterfowl population of the Texas Panhandle are found on playa lakes (73).
- c. A reduction of playa lakes affects waterfowl: In 1972, over 2 million birds were counted on Texas Panhandle playa lakes. During a drought in 1978, only 232,373 birds were counted (73).
- d. Playa lakes provide watering areas for livestock and holding ponds for irrigation (73).
- e. The playa lakes of the Southern Great Plains of Texas support a variety of wildlife, including pronghorn, ring-neck pheasants, cottontails, raccoons, long-billed curlews, American avocets, Wilson's phalaropes, sandhill cranes, marsh hawks, prairie falcons, and Mississippi kites (179).

5. Texas' wetlands are valuable to trappers. The 260,000 acres of coastal marshes in Texas produce up to 350,000 muskrat pelts annually (229).

6. Texas' coastal wetlands provide essential habitat: Peripheral marsh waters in a low-salinity area in Galveston Bay are much more productive for commercial crustaceans and fish than the bay's open waters. Also, the most important

commercial Texas shrimp species are estuarine-dependent for some stages of their life histories (230, 231).

7. Texas' wetlands support waterfowl: The Southern High Plains of Texas rank second only to the Texas Gulf Coast in importance as a wintering area for waterfowl in the Coastal Flyway. In peak years, more than 900,000 ducks have wintered at Buffalo Lake National Wildlife Refuge and more than 100,000 at Muleshoe National Wildlife Refuge. An average of 280,000 mallards were counted on the Southern High Plains during the mid-winter inventories between 1964 and 1970, along with another 376,000 ducks of other species (232, 233, 234).

Wetlands in Utah

1. Less than 10% of original riparian habitat persists along the Colorado River in Utah. New riparian habitat has been created from dam construction along the Colorado River, resulting in a change in species diversity (67).

2. Utah's wetlands within the Rocky Mountains need protection: Approximately 3% of the land in the Rocky Mountain West is considered to be representative of the cottonwood-willow riparian ecosystem. This portion of land is providing habitat for at least 40% of the vertebrate species encountered in the region (69).

3. Utah's wetlands provide recreation: More than 54,000 visitor-days annually are recorded on marshes managed by the Utah Division of Wildlife Resources. These visits are made by bird watchers, photographers, and nature

enthusiasts. Hunter use approximates an additional 200,000 days annually during which 300,000 or more waterfowl are harvested. Division-managed marshes support over one-quarter million recreation days each year (235).

4. Utah's wetlands are important to recreational stream fishing: Fish utilize wetlands for spawning and food supply. Utah has 3,034 miles of stream fisheries, including the Swift Creek and Lake Fork River. These two important streams are ranked by the Utah Division of Wildlife Resources as significantly important to Utah's stream fishery resource. Brook, rainbow, brown, and cutthroat trout are all popular sport fish. Lake Fork River averages 400 angler trips per mile each year (236).

5. Utah's wetlands support recreational fishing: In 1980, 280,049 people participated in recreational fishing in Utah for a total of 3,699,400 angler-days. These fishermen spent \$62,066,000 on equipment and fishing-related activities in the state (76).

6. Utah's wetlands support a variety of wildlife: The unique habitat of Utah's wetlands provide food and cover for mule deer, elk, moose, cougars, black bears, mourning doves, ruffed grouse, ring-neck pheasants, California quail, cottontails, snowshoe hares, bobcats, pikas, ground squirrels, chipmunks, red-shafted flickers, yellow warblers, golden eagles, prairie falcons, peregrine falcons, mallards, and American bald eagles (236).

7. Utah's wetlands provide habitat for a variety of birds: At least 130 species of birds utilize marshes managed by the Utah Division of Wildlife Resources, including 32 species of waterfowl, 5 species of game birds, 11 species of raptors, and 82 species of nongame shore and passerine birds. Forty-eight species are known to nest on the areas. Some species that utilize the areas include pelicans, cormorants, egrets, hawk sparrows, eagles, killdeer, dowitchers, avocets, snipes, gulls, doves, meadowlarks, and terns (235).

8. Utah's wetlands support waterfowl: Historically Utah's marshes, particularly those of the Great Salt Lake, have served as major stopover points for migrating birds and have been significant in avian production. In recent years, up to 200,000 ducks and 20,000 Canada geese have been produced annually on marshes operated by the Utah Division of Wildlife Resources. Migrant populations in the fall regularly exceed 1,000,000 ducks, 40,000 whistling swans, and 25,000 geese. Spring migration of waterfowl is generally less spectacular numerically, but is still important: These areas accommodate close to 50 million waterfowl use-days annually and several times that number of use-days by other nongame, shore, passerine, and raptorial species (235).

9. Utah's wetlands support a variety of plant life: At least 126 species of vegetation are found on the Salt Lake marshes, including 10 species of submerged aquatics, 5 species of free-floating aquatics, 14 species of emergent marsh

plants, 28 species of moist soil plants, 56 species of upland weeds and herbs and 13 species of brush and trees (235).

Wetlands in Vermont

1. Vermont is losing its wetlands:

- a. Out of 100 randomly selected wetlands studied in 1979, 73% had been impacted by changes to the wetlands or the adjacent upland.
- b. In a 1980 study of 246 Chittenden County wetlands greater than 4 hectares, 53% were shown to have been directly impacted.
- c. Development activities were present in 12 major Lake Champlain wetlands surveyed in 1977 (237, 238, 239).

2. Vermont's wetlands have been altered: In a study of 100 sample wetlands in Vermont, it was determined that 27% of the wetlands had been modified by dredging and ditch digging by 1975--the largest source of wetlands change in the study. Also, 11% of the wetlands were filled with soil or solid waste. Filling has increased by 120 percent since the 1960s, resulting in an even greater wetlands loss (205).

3. Some of the impacted wetlands and lost values of Vermont wetlands include:

- a. Abbott's Marsh--lost fish and wildlife habitat and education and recreational value to sedimentation,

- b. Berlin Pond--lost wildlife habitat due to construction of a highway,
- c. Colchester Point--lost 90% of rare plant habitat due to housing development,
- d. Passumpsic River Floodplain Marshes--lost wildlife habitat and recreational value to landfills, and
- e. Pine Street Barge Canal Wetland--lost fish and wildlife habitat, educational, and recreational values, and clean water due to dumping of toxic materials (240).

4. Vermont wetlands support recreational fishing: In 1980, 103,966 people fished in the state of Vermont, for a total of 2,432,954 angler-days. They spent over \$15,000,000 on fishing equipment and activities in Vermont (76).

5. Vermont's wetlands filter excess nutrients and pollutants: The wetlands near Lake Champlain and Lake Bomoseen filter sewage effluent released in the area, protecting the two lakes from eutrophication. Too much pollution, however, will overload the wetlands and lead to the death of the lakes (205).

6. Vermont's wetlands control soil erosion: In a few hours, a severe storm can carry off several feet of topsoil. Wetlands hold back flood waters and sediment loss, which is extremely important to Vermont, where the topsoil is thin and the land is hilly (241).

7. Vermont's wetlands provide waterfowl habitat: In the the 1700s and early 1800s a large percentage of Vermont's forests, including swamps, were cut to satisfy a great demand for charcoal, potash, lumber, and firewood. Unable to nest, the wood duck came close to extinction in Vermont. A protection program, including erection of next boxes in swamps and marshes, brought the species back to stable numbers in Vermont. Also, Lake Champlain wetlands provide nesting and feeding areas for waterfowl migrating between Canada and the southern U.S. (205).

8. Vermont's wetlands provide wildlife habitat for clams, muskrats, woodchucks, otters, mink, crayfish, and frogs (205).

9. Vermont has many important swamps and marshes: Cornwall Swamp (1,250 acres), Bear Swamp (250 acres), and Scott's Brook Cedar Swamp (400 acres) all absorb excess water runoff and slowly release it in the dry summer months in Vermont. The marshes of Vermont include:

- a. Barton River Marsh--1,100 acres, a favorite of waterfowl hunters and fishermen,
- b. Dead Creek Marsh--the largest waterfowl management area in the state, with highly diverse plant and animal species,
- c. Little Otter Creek Marsh--1,000 acres,
- d. Missisquoi Marsh is a 5,561-acre federal wildlife refuge, supporting the largest

great blue heron colony in the northeastern U.S., and

- e. Stevens Marsh--250 acres, acts as a natural sewage treatment facility, filtering excess nutrients from overflow sewage effluent from the city of St. Albans. This treatment helps purify water en route to St. Albans Bay and Lake Champlain (205, 242).

10. Vermont's wetlands provide habitat for a wide variety of wildlife species: Wildlife inhabitants common in the wetlands of Vermont include 13 amphibians, 7 reptiles, 80 birds, 13 mammals, and 16 fish. These include spotted salamanders, painted turtles, warblers, grebes, heron, geese, ducks, owls, kingfishers, flycatchers, wrens, sandpipers, mink, river otters, foxes, white-tail deer, brook trout, bass, pickerel, pike, and perch (205).

11. Loss of Vermont wetlands affects many values: The Burlington Intervale originally consisted of over 400 acres of wetlands along the Winooski River. Today, roughly 150-200 acres of wetlands remain. As a consequence of alterations, many former uses and values have diminished. Recreational, educational, aesthetic, and scientific values have all decreased (240).

Wetlands in Virginia

1. Virginia's wetlands are disappearing:

- a. More than 4,026 acres of tidal wetlands were lost in Virginia from 1955-1969. Channelization accounted for 47% of the wetlands acreage lost (243).
- b. Twenty-three percent of the 1,660 acres of wetlands habitat of the Sandbridge Marsh, Virginia Beach, was destroyed from 1962-1969 (243).
- c. Prior to 1972, Virginia was losing 400-600 acres of wetlands each year (123).

2. Virginia's wetlands support a highly productive fisheries industry: In 1980, the commercial fishing harvest in Virginia totaled 637,515,000 pounds of fish and shellfish worth \$84,993,000. Of this, 66 to 90 percent of the species caught depend on coastal marshes or estuaries for at least part of their life cycle (33, 39).

3. Virginia's wetlands provide recreational fishing: In 1979, over 850,000 people participated in marine recreational fishing in Virginia, catching over 12 million fish (40).

4. Coastal wetlands of Virginia are important to the economy: Coastal wetlands occupy one percent of the total area of Virginia, yet 95% of the state's annual harvest of commercial and sport fish from tidal marshes are dependent on these coastal wetlands (244).

5. Virginia's wetlands are productive: Coastal wetlands productivity in Virginia is about 10 tons per acre in

some grass marshes (244).

6. Virginia's wetlands are important to the oyster industry: The total value of Chesapeake Bay oysters dependent on wetlands varied across counties in 1979 from \$57,578 to \$8,378,148 (245).

Wetlands in Washington

1. Washington is losing its wetlands: Of the nine major estuaries in Washington, the Duwamish and Puyallup have been extensively developed. Grays Harbor and the Snohomish are quickly approaching the same condition. Dredging, filling, domestic and industrial effluents, and improper land use are threatening all of Washington's estuaries (246).

2. Washington's wetlands are important to sport and commercial fishing: Every year, 37,700 fall chinook, 122,000 spring and summer chinook, and 55,067 steelhead trout move into the lower Snake River, using the area's wetlands for spawning. Also, resident fish, including smallmouth bass, channel catfish, sturgeons and whitefish, comprise an intensive sport fishery that provides 250,000 angler-days annually (100, 247).

3. Washington's wetlands support a highly productive fisheries industry: In 1981, the commercial fishing harvest in Washington totaled 184,593,000 pounds of fish and shellfish worth \$95,955,000. Of these, 50% of the species caught depend on wetlands for some part of their life cycle (2, 39).

4. Washington's wetlands provide essential habitat for many species of fish: Washington's estuaries are important in the life cycles of many fish. Steelhead trout and salmon use estuaries as a transition zone between freshwater spawning grounds and the ocean. Flounder spend much of their lives in estuaries. Salmon, steelhead, and cutthroat trout use estuaries as nursery grounds. Anchovies, herring, and smelt all spend a part of their lives in estuaries and are an important food source for larger fish and some birds and mammals. Various species of flatfish, rockfish, sea perch, cod, lingcod, halibut, oysters, clams, shrimp, crabs, dogfish sharks, skates, and rays are also found in estuarine waters of Washington (246).

5. Washington's wetlands are important to fish and wildlife: Puget Sound is comprised basically of two types of wetlands: salt marsh and estuarine. There are presently 61,632 acres of these wetlands. They are vital in providing nursery areas for sea-run cutthroat trout and steelhead trout. They support 900,000-1,100,000 wintering waterfowl per year and produce 200,000 to 300,000 waterfowl annually (247).

6. Washington's wetlands are essential to wildlife: The wetlands of Washington provide habitat, food, and cover for mule deer, white-tail deer, beavers, mink, raccoons, bobcats, river otters, California quail, Chuckar partridges, Hungarian partridges, ring-neck pheasants, mourning doves, and numerous ducks and geese (100).

7. Washington's wetlands are important to many bird species: Washington's estuaries support a variety of bird species, including ducks, geese, swans, plovers, sandpipers, loons, grebes, gulls, terns, herons, and cranes. As many as 40,000 snow geese have been counted at one time on the Skagit Flats of Washington. En route from Mexico wintering grounds to Alaska nesting grounds, black brant feed in eelgrass beds in Washington's estuarine waters. In April, Padilla Bay near Anacortes hosts almost one-half of the 125,000 brant of the Pacific Flyway. The Nisqually estuary serves as habitat for 165 species of waterfowl and other birds (246).

8. Washington's wetlands supply habitat: Approximately 3% of the land in the Rocky Mountain West, including Washington, is considered to be representative of the cottonwood/willow riparian ecosystem. This portion of land provides habitat for at least 40% of the vertebrate species encountered in the region (69).

Wetlands in West Virginia

1. West Virginia has 276 wetlands areas, totaling 17,238 acres. Of this, Canaan Valley has 6,764 acres of wetlands and Meadow River has 4,600 acres (248).

2. West Virginia's wetlands are a scarce national heritage: Less than 2% of West Virginia's landscape is covered by wetlands--these areas need protection (249, 250).

3. West Virginia's wetlands improve water quality: Tub Run Bog, a freshwater wetland in the Appalachian

Mountains of West Virginia, effectively improves the quality of acid mine drainage as it percolates through the wetlands. Concentrations of hydrogen and sulfate ions are significantly reduced, and water leaving Tub Run Bog has a chemistry similar to stream water draining other nearby watersheds, which show little influence of acid mine drainage (251).

4. West Virginia's Canaan Valley contains unique and important wetlands:

- a. The more than 6,000 acres of unimproved wetlands in the Canaan Valley represents 39% of West Virginia's wetland habitat.
- b. The Canaan Valley wetlands support over 590 different plant species--many of which are considered rare.
- c. Birdwatchers enjoy the more than 162 species of birds identified in the Canaan Valley. The Valley provides habitat for predators, mammals, and both song and game birds.
- d. Canaan Valley wetlands may hold floodwaters and slow runoff, thus saving costly flood damage.
- e. The streams of Canaan Valley support the only self-sustaining brown trout population in Tucker County.
- f. The Canaan Valley wetlands provide habitat for a large breeding population of woodcock, are the largest woodcock staging area in the

state, and support healthy populations of wild turkeys and ruffed grouse.

- g. The Canaan Valley wetlands are utilized by white-tail deer, black bears, snowshoe hares, red foxes, mink, muskrats, teal, Canada geese, black ducks, eagles, herons, hermit thrushes, finches, warblers, hawks, and owls (252).

Wetlands in Wisconsin

1. Wisconsin once had 7.5-10 million acres of wetlands. Today, only one-third of these original wetlands remain (253).

2. Southeastern Wisconsin lost 50% of its original 263,000 acres of wetlands from 1850-1980, and 61% of its marshes by 1968 (254).

3. Wisconsin's wetlands support a highly productive fisheries industry: In 1977, production of fish in the Wisconsin waters of Lake Michigan and Green Bay alone was 47,573,191 pounds of fish (39).

4. Percentages of wetlands lost in Wisconsin from the mid-1930s to the late 1950s:

Kenosha County	62.5%	Dodge County	29.8%
Green County	54.8%	Waukesha County	26.3%
Rock County	39.3%	Walworth County	24.5%
Dome County	33.7%	Marquette County	18.1%
Racine County	32.0%	Fond du Lac County	16.8%
Winnebago County	31.3%		

5. Wisconsin's wetlands treat wastewater: Effluent discharged from the Waupun City, Wisconsin, wastewater treatment

plant into Horicon Marsh for tertiary treatment saves an estimated \$1.8 million when compared to conventional treatment facilities (256).

6. Wisconsin's wetlands store valuable nutrients: The Nevin Wetlands near Madison, Wisconsin reduces 81% of the suspended solids, 21% of the nitrogen, and 7% of the phosphorus in water moving through the wetlands. Wetlands hold these nutrients for use by plants (257).

7. Wisconsin's wetlands recharge groundwater: Up to 55% of the groundwater supply near the Nevin Wetlands in Wisconsin is recharged by the wetlands (257).

8. Wisconsin's wetlands control flooding: In Wisconsin, flood flows are 80% lower and sediment yields are 90% lower in basins consisting of 40% lake and wetlands areas than in basins with no lakes or wetlands (257).

9. Wisconsin's wetlands supply water: The 5-square-mile Cedarburg Bog in southeastern Wisconsin contributes to the groundwater supply in a 165-square-mile growing suburban area (258).

10. Wisconsin's wetlands are vital to many rare and endangered plant and animal species: Prairie chickens (found in Buena Vista Marsh), harriers, red-shouldered hawks, osprey, upland plovers, ladyslipper orchids, and fringed gentians all utilize the wetlands of Wisconsin (259).

11. Some of the important wetlands areas in Wisconsin include: Chiwaukee Prairie, consisting of 80 acres of high-quality wet prairie; Bark Bay, 110 acres of one of the finest

estuaries on the Great Lakes shoreline in Wisconsin; Comstock Marsh, a 240-acre tract of open sedge and shrub bog; and Peat Lake, a shallow 150-acre pothole and cattail marsh (260).

12. The area of Wisconsin with wetlands of highest value to waterfowl--the Southeast--is also the area with the highest agricultural value and the most drainage activity (261).

13. The wetlands of Wisconsin support a diversity of wildlife: Great horned owls, gray squirrels, bobwhites, pheasants, red-winged blackbirds, common loons, goshawks, ruffed grouse, snowshoe hares, woodcocks, muskrats, sunfish, northern pike, walleye, and muskellunge all utilize the wetlands of Wisconsin (261).

Wetlands in Wyoming

1. Wyoming's wetlands are important to wildlife: Approximately 3% of the land in the Rocky Mountain West is considered to be representative of the cottonwood-willow riparian ecosystem. This portion of land is providing habitat for at least 40% of the vertebrate species encountered in the region (69).

2. Wyoming's wetlands are critical to endangered species: Endangered whooping cranes utilize wetlands found along the Green River in Wyoming. The trout streams in western Wyoming contain the rare Bonneville cutthroat trout, which use the streams and their wetlands for spawning areas (162, 262, 263).

3. Wyoming's wetlands support recreational fishing: In 1980, 293,636 people participated in recreational fishing in Wyoming for a total of 3,017,841 angler-days. These fishermen spent \$75,069,077 on equipment and fishing-related activities in the state of Wyoming (76, 263).

4. Wyoming's wetlands offer unique habitat: Riparian habitats account for only about 1% of the Northern Great Plains, which includes Wyoming. This small amount of land area provides potential breeding habitat for 172 terrestrial vertebrate species. Forty-two percent of these species breed only in riparian or other wetland sites. These riparian areas represent a critical source of diversity in this geographical region. They provide a large number of vertical and horizontal strata, habitat "edge," and, where they follow streams or rivers, connecting travel lanes between habitat types for daily movements and seasonal migrations of wildlife (70).

5. Wyoming's wetlands are found along many state creeks and rivers: The Platte River, Green River, Snake River, Tongue River, Powder River, Bighorn River, and Little Powder River all have adjoining wetlands which support cottonwood and willow groves and many species of wildlife (263, 264).

6. Wyoming's wetlands are important to the citizens of the state: In Wyoming, fishing is the top outdoor recreational activity. Many people also enjoy floating Wyoming's rivers--in 1978, 68,959 people floated the upper Snake River

in northwest Wyoming. Float fishing is popular in the Snake, Green, and North Platte Rivers in Wyoming (263, 265).

7. Wyoming's wetlands are aesthetically important: The Clarks Fork and Snake Rivers in Wyoming are under study for inclusion in the National Wild and Scenic Rivers System. These rivers and their wetlands offer many outdoor recreational activities to many people each year (77).

CHAPTER V

SUMMARY AND CONCLUSIONS

Since the founding of our country, wetlands have been viewed as economically worthless areas to be reclaimed or improved by filling, draining, dredging, or burning, making them available for agricultural, residential, or commercial development. Only within the last 30 years have the numerous values of wetlands come to public attention. Wetlands are essential to fish and wildlife as spawning, feeding, breeding, and resting habitat. They also provide vital services for humans by reducing flood volume and thus flood damage, controlling local storm runoff, recharging groundwater supplies, filtering pollutants and sediments from water, controlling erosion, increasing fisheries productivity, and providing recreational, educational, and scientific uses.

Concurrent with recent attention to the value of wetlands has come the realization of the impact of wetlands loss in the United States. Most recently, extensive flooding in Louisiana, causing millions of dollars in damages, has been attributed to the alteration and destruction of wetlands along the Mississippi River. In other states, declines in wildlife populations, erosion, and low groundwater supplies have been traceable to wetlands losses.

The current emphasis on the economy can be used to protect highly-valued wetlands. Wetlands in their natural state often provide a higher economic value, in terms of filtration, erosion control, and flood control, than they would if converted to commercial or residential use. The problem lies in past inabilities to evaluate wetlands services accurately. Economic figures are now available for some wetlands, and they need to be utilized to protect these areas.

Wetlands are most commonly found along coasts, estuaries, ponds, lakes, and rivers, where they have evolved as habitats adjacent to large bodies of water. They can also be found in areas where they provide the only source of water for livestock and wildlife species. Wherever they occur, they are hydrologically and ecologically related to all other waters. The effect of their destruction is detrimental to all water systems. Wetlands, once the least appreciated ecosystems, are now the subject of much attention. Their protection is limited, and needs to be strengthened. It is the hope of this author that this report will serve as a source of information in the protection of these valuable areas.

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