Water Resources Report No. 39

MISSOURI WETLANDS:
A Vanishing Resource

by
Jane E. Epperson

Missouri Department of Natural Resources
Division of Geology and Land Survey

Cover illustration by Debbie Kelly

COVER: 1) Common Cottonwood (Populus *deltoides*), 2) Red-Shouldered Hawk (Buteo *lineatus*), 3) Black Willow (Salix *nigra*), 4) Sedge (Carex *spp.*), 5) Mink den, 6) Crawfish chimneys, 7) King Rail (Rallus *elegans*), 8) Broad-Leaved Cattail (Typha *latifolia*), 9) Marsh Wren (Cistothorus *palustris*), 10) Spikerush (Eleocharis *spp.*), 11) Fat Mucket Mussel (Lampsilis *radiata*), 12) Bulrush (Scirpus *spp.*), 13) Blue Flag Iris (Iris *virginica*), 14) Burreed (Sparganium *eurycarpum*), 15) Snapping turtle (Chelydra *serpentina*), 16) Arrowhead (Sagittaria *latifolia*), 17) American Lotus (Nelumbo *lutea*), 18) Large-Mouthed Bass (Micropterus *salmoides*), 19) Green frog (Rana *clamitans*), 20) Green Darner Dragonfly (Anax *junius*), 21) Great Blue Heron (Ardea *herodias*).

Wetland Goals and Recommendations for the State of Missouri

MISSOURI DEPARTMENT OF NATURAL RESOURCES
Division of Geology and Land Survey

The following short and long term wetland conservation goals and recommendations were developed by the Missouri Department of Natural Resources in Cooperation with the Missouri Wetland Advisory Council. While unamimous approval was strived for by the Wetland Advisory Council, it was not attained in every case.

Short Term Goal

ACHIEVE NO OVERALL NET LOSS OF THE STATE'S REMAINING WETLAND RESOURCE BASE BY THE YEAR 1995.

No overall net loss means that the loss of Missouri wetlands will not exceed the gains, considering acreage, functions and values. Common sense dictates that this goal does not imply that individual wetland will, in every instance, be untouchable or that the no net loss standard should be applied on an individual basis. Rather, that the state's wetland resource base reach equilibrium, in the short term, between losses and gains. Achieving this short term goal will require a reduction in the rate at which existing wetlands are being lost and an increase in efforts to restore and create wetlands. These efforts must come from all levels of government and all sectors of the population. The public must share with the private sector the costs of restoring and creating wetlands to achieve this goal.

Recommendations - Short Term Goal

1. Establish a statewide planning committee through which options for implementation of the short term goal may be discussed. Planning for the future of the state's wetland resource should be through a forum process, not by any one agency or interest group. A consensus about the future of the state's wetland resource will be sought.

2. Research, evaluate, and report on the status of the wetland resource base. Information necessary to formulate responsible resource policy includes: past and current extent of the resource, causes of historic wetland losses, current threats faced by the resource, rationale for protecting the remaining resource, and the effectiveness of the existing private and government programs in protecting the resource.

3. Develop and implement a statewide wetland education program. The short term goal cannot be achieved without public and private participation. Public awareness of the importance of achieving the no overall net loss goal is critical in eliciting action from the public and private sector.

4. Establish a wetland information clearing house for the purpose of providing Missouri citizens with a single point of contact for up-to-date, accurate information on wetlands.

5. Create new incentives as appropriate, publicize and support existing incentives such as the Wetland Reserve Program, which encourage local governments, industry, and private wetland owners, to protect their wetland resources.

6. Integrate wetland protection into existing state programs to reduce wetland loss resulting from state government activities that either affect wetlands directly or that encourage private landowners to alter them. State agencies should avoid activities that would alter a wetland. If the activity must be located in a wetland, action should be taken to minimize the effects of the activity on the wetland. The state

agency should compensate for any wetlands altered by the unavoidable impacts.

7. Develop a system and begin recording the gains and losses of wetlands due to state agency activities or due to activities which were facilitated through agency funding.

8. Establish a cooperative public-private Wetland Federation for the purposes of: a) establishing a funding mechanism for wetland acquisition, and b) creating new, and promoting existing, opportunities for wetland restoration and creation.

9. Through rule making, improve the state's ability to protect wetlands through Section 401 of the Clean Water Act.

10. Establish special focus wetland mitigation banks, such as a highway department bank, which would serve as the first step toward the long term goal of a State Wetland Mitigation Bank.

11. Establish a state inter-agency wetland committee to discuss and coordinate ways state agencies can reduce wetland losses through cooperative measures. This committee would differ from the existing Missouri Wetland Advisory Council in that it would be a smaller working group composed of those state agencies directly involved with wetland issues.

12. Provide public assistance in the form of detailed advice, assessment, and design technical assistance to 404 permittees and others who are required to restore or create wetlands.

13. Establish and coordinate a network of volunteers, organizations, and professionals who can advise, design and build wetland restoration and creation projects.

Long Term Goal

INCREASE THE QUANTITY AND QUALITY OF MISSOURI'S WETLAND RESOURCE BASE CONSIDERING ACREAGE, FUNCTIONS AND VALUES BY THE YEAR 2000.

Recommendations - Long Term Goal

1. Complete a state wetland inventory which, at a minimum, incorporates data from the National Wetland Inventory, the USDA Soil Conservation Service, the Natural Heritage Inventory, and any other data on rare and endangered species.

2. Have in place alternatives which eliminate state funded private activities that may alter wetlands.

3. Establish a State Wetland Mitigation Bank.

4. Evaluate the implementation status of the short term wetland conservation goals. Continue and expand successfull efforts begun as short term wetland conservation goals.

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MISSOURI WETLAND
Information List

Prepared by the
Missouri Department of Natural Resources
Division of Geology and Land Survey

KEY TO SOURCE (cont'd.)

MDC	Missouri Department of Conservation P.O. Box 180 Jefferson City, MO 65102 314-751-4115
NGA	National Governors Association Public Affairs Department 444 North Capitol Street NW Suite 267 Washington, DC 20001 202-624-5330
NPS	National Parks Service P.O. Box 490 Van Buren, MO 63965 314-323-4236
NWF	National Wildlife Federation 1400 16th Street, NW Washington, DC 20036-2266 202-797-6800
SCS	Soil Conservation Service (USDA) 601 Business Loop 70 West Suite 250 Columbia, MO 65203 314-876-0912
USDA	U.S. Department of Agriculture Parkade Center, Suite 250 601 Business Loop 70 W Columbia, MO 65203 314-876-0911
WEF	Water Environment Federation Public Education Program 601 Wythe Street Alexandria, VA 22314-1994 703-684-2400 or 1-800-666-0206
WWF	World Wildlife Fund P.O. Box 4866, Hampden Post Office Baltimore, MD 21211 202-778-9575 or 410-516-6951

MISSOURI WETLANDS INFORMATION LIST
(Updated January, 1994)

INFORMATION CATEGORIES

About Wetlands...(general information)

Federal Wetland Protection Programs

Agriculture and Wetlands

Educator's Guide

Citizen's Guide to Action

KEY TO FORMAT

FS = Fact Sheet (single page, 8 1/2 by 11)

P = Pamphlet (single page of variable size, folded into less than 8 1/2 by 11)

B = Brochure (multiple-page document, less than 8 1/2 by 11)

D = Document (multiple-page document, 8 1/2 by 11)

V = Video (video cassette tape, VHS format)

PO = Poster

SOURCE = Address and/or telephone number where the information material may be obtained.

FEDERAL WETLAND PROTECTION PROGRAMS

TITLE	FORMAT	LENGTH	SOURCE	COST
Wetland Protection Hotline - 1/800/832-7828			EPA	
Stormwater Control Benefits of Managed Floodplains & Wetlands	B	3p	EPA	Free
Uses of Wetlands in Stormwater Management	B	3p	EPA	Free
Planning for the Future - Wetlands on Federal Lands	V	27 min	EPA	Free on loan

AGRICULTURE AND WETLANDS

TITLE	FORMAT	LENGTH	SOURCE	COST
Farming with Wetlands: How to Turn These Nuisance Areas into Profit for Farmers While Improving the Environment	V	9 min	EPA	Free on loan
Streamside Woodlands	V	8 min	EPA	Free on loan
The Wealth in Wetlands	V	23 min	EPA	Free on loan
Wetlands and Restoration	V	13 min	EPA	Free on loan
Wetlands in the Farmlands	V	12 min	EPA	Free on loan
Economic and Legal Incentives for Waterfowl Management on Private Lands (Leaflet 13.4.2)	L	5p	FWS	Free

AGRICULTURE AND WETLANDS

TITLE	FORMAT	LENGTH	SOURCE	COST
A Dozen Reasons to Restore Wetlands/U.S. Dept. of Agriculture Programs that Aid Wetlands	FS	2p	USDA	Free
Agriculture and Wetlands: Opening Communications and Finding Answers	FS	2p	EPA	Free
Agriculture and Wetlands: Section 404 and Swampbuster	FS	2p	EPA	Free
Clean Water Act Section 404(f) Exemptions	FS(#20)	1p	EPA	Free
Agriculture and Wetlands: The Federal Manual For Identifying and Delineating Jurisdictional Wetlands	FS	2p	EPA	Free
Agriculture and Wetlands: The Roles and Responsibilities of Federal Agencies in Protecting and Managing Wetlands	FS	2p	EPA	Free
Agriculture and Wetlands: Finding Common Ground	FS	2p	EPA	Free
Agriculture and Wetlands: Studies and Research to Improve Our Knowledge	FS	2p	EPA	Free
Attention Missouri Landowners, If You Have Wetlands on Land You Own or Manage, There are Things You Should Know...	FS	2p	SCS	Free
Entering Land Into the Wetlands Reserve Program	FS	3p	USDA	Free

ABOUT WETLANDS...

TITLE	FORMAT	LENGTH	SOURCE	COST
Wetlands Status and Trends in the Conterminous United States, Mid-1970's to Mid-1980's	D	22p	FWS	$ 2.25
Wetland Goals and Recommendations for the State of Missouri	D	4p	DNR	Free on loan
Crane River	V	58 min	EPA	Free on loan
Fabulous Wetlands	V	7 min	EPA	Free on loan
The Wealth in Wetlands	V	23 min	EPA	Free on loan
The Wetlands - Conserving America Series	V	58 min	NWF	Free on loan
Wetlands Nightmare - Solution for Local Governments	V	21 min	EPA	Free on loan
Exploring Missouri Wetlands	V	30 min	DNR	Free on loan
Threatened and Endangered Species of Wetlands and Waterways in IA, KS, MO and NE	D	103p + appendices	EPA	Free
Restoring and Creating Wetlands: A Planning Guide for the Central States Region: IA, KS, MO and NE	D	24p	EPA	Free

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FOREWORD

Wetlands were once a substantial component of Missouri's original landscape. In simple terms, wetlands are areas where the presence of water results in distinctive soil development and unique plant assemblages. The subject of wetlands, however, has never been a simple one. While the state has no wetland protection law, more than one federal program has authority with regard to wetlands. The federal protection afforded to wetlands, however, is piecemeal at best. A good deal of confusion and frustration exists as a result of sometimes conflicting and ever changing federal wetland policies.

The political debate over wetlands at the federal level may be expected to continue into the future. The best hope for timely, substantive progress in wetland protection lies at the state level. Individual states are in an ideal position to implement wetland education, protection, and management activities. States can employ detailed local knowledge of their specific wetland types and the particular characteristics of their economy or geography leading to wetland loss.

Addressing the causes of and possible solutions to wetland losses will require efforts from all levels of government and all sectors of the population. The challenge lies in bringing these parties together to confront the problem in a coherent and coordinated way. For this reason, the Department of Natural Resources brought together what is now the Missouri Wetlands Advisory Council. The council is composed of representatives from business, agriculture, environment, and conservation organizations as well as state and federal agencies. With the help of this statewide planning group, the department has and will continue to play a key role in developing statewide wetland strategies to provide focus and consistency for all wetland protection and management efforts.

I invite and encourage you to examine the information contained in this document, and to formulate informed opinions and suggestions on how the state of Missouri should proceed in the task of halting the trend in wetland loss.

G. Tracy Mehan, III
Director
Missouri Department of Natural Resources

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INTRODUCTION

Early American travelers had an impressive diversity of natural communities to explore and eventually settle. Missouri was a state of forests, savannas, prairies, and wetlands. Wetlands once covered approximately 4.8 million acres of Missouri's total land area, and thus were a major component of the historic landscape.

Since that time, Missouri's natural communities have been dramatically altered by activities such as logging, agricultural production, mining, draining, filling, the construction of more than a dozen major dams and reservoirs, and the channelization of the Missouri River.

Consequently, Missouri's wetland resource has diminished to approximately 10 percent of its original extent. This trend of wetland loss is not unique to Missouri. The nation as a whole has lost over one-half of its original wetlands. In response to this dramatic decline, President Bush, the National Governors Association, and a number of states have adopted a no-net-loss wetlands policy. Leadership at the state level is imperative if the national trend of wetland loss is to be slowed, stopped or reversed.

Missouri Governor John Ashcroft called for "the enhancement of Missouri's wetlands and the implementation of a common-sense no net loss policy" as one of his natural resource goals for the 1990s. As the state's natural resource agency, the Department of Natural Resources (DNR) is planning for the future of the remaining wetland resource. Formal wetland conservation planning began in 1990 and is continuing with financial assistance from the Environmental Protection Agency's (EPA) State Wetland Protection Development Grant Program.

The Department of Natural Resources established a statewide planning team, the Missouri Wetlands Advisory Council, to participate in the development of the Missouri Wetland Conservation Plan. The council plays an active role in determining the content, structure, and policy recommendations of the plan. The council is composed of representatives from approximately forty public and private organizations and state and federal agencies (Appendix 1). The Department of Natural Resources benefits from the diversity of roles, backgrounds, knowledge, and perspectives represented by the council. Although members often have diverging viewpoints, through the consensus process common goals and basic components of the plan have been identified. A formal coordination process was initiated (Appendix 2) whereby the department presents, at by-monthly council meetings, each draft component for review and revision.

This report is the result of that coordination, and meets the need for up-to-date, accurate information regarding the status of the wetland resource, as well as the programs and activities currently affecting it. This information will be the basis for the specific policy and action recommendations to follow.

ACKNOWLEDGMENTS

There can be no full accounting of my debt to the many people who have contributed to this publication. My thanks to all the people whom I called upon to solicit an opinion, to review a particular section, or to verify information.

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Coalition for the Environment
College of Agriculture, University of Missouri - Columbia
Ducks Unlimited
Federal Highway Administration
League of Women Voters
Missouri - AG Industries Council
Missouri Association of Counties
Missouri Department of Health
Missouri Department of Public Safety
Southeast Missouri Irrigators Association
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Susan Hazelwood, Audubon Society
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HOW MANY WETLANDS HAVE BEEN LOST?

Introduction

During the past half century, attitudes toward wetlands have changed dramatically. Prior to 1950, wetlands were considered of little value until they had been diked, drained, or filled to render them more adaptable to farming, grazing, or real estate development. Wetlands are now recognized as one of the most productive ecosystems in the world, deserving of protection for their multiple benefits. This chapter describes the historic and current extent of the wetland resource and explores the major causes of their decline.

National wetland losses

There were 221 million acres of wetlands in the lower 48 states when the nation was settled (Dahl, 1990). The national rate of wetland losses from the mid-1950s to the mid-1970s was estimated by Tiner to be 458,000 acres per year (Tiner, 1984). Tiner also reported that 97 percent of the total losses occurred in inland freshwater wetlands, 87 percent resulting from draining, clearing, leveeing and diverting of surface water for agricultural purposes. Urban and other types of development caused 8 and 5 percent of the losses, respectively (Figure 1). The rate of wetland loss has decreased to an estimated 290,000 acres per year in the mid-1970s to the mid-1980s (Dahl and Johnson, 1991). As of 1980, 104 million acres (47 percent) of the nation's original wetland resource remains intact (Dahl, 1990). The total remaining wetland resource accounts for only 5 percent of the nation's land surface. Of the lower 48 states, California has lost the largest percentage of wetlands (91 percent), while Florida has lost the most acreage (9.3 million) (Dahl, 1990). The four states with the greatest remaining wetland acreages within the lower 48 states are Florida, Louisiana, Minnesota, and Texas.

Missouri wetland losses

The amount of wetland loss in Missouri has exceeded the national average; 87 percent of Missouri's original 4.8 million acres of wetlands have been lost (Dahl, 1990). Wetlands were a substantial and diverse component of Missouri's original landscape, covering almost 11 percent of its surface area. Approximately one-half of Missouri's original wetlands were located in the southeast part of the state, in an area known as the Bootheel. The area was dominated by

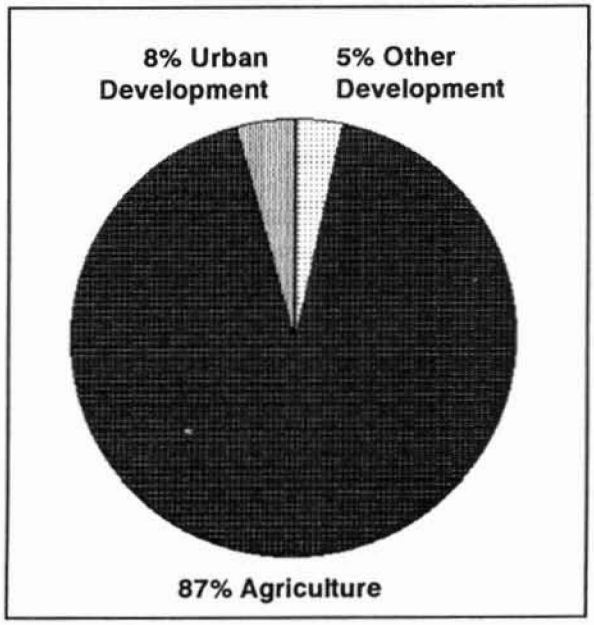

Figure 1. Causes of recent wetland losses (Frayer et.al., 1983).

forested swamps subject to frequent inundation from the Mississippi and other rivers. The hardwood swamps were so extensive that the Bootheel area was nicknamed "swampeast" Missouri. Of the original 2.4 million acres of forested wetlands in southeast Missouri, less than 60,000 acres or 2 percent remain intact (Vaught & Bowmaster, 1983). Statewide, 13 percent of the original wetland resource remains (Dahl, 1990). These remaining wetlands account for 1.4 percent of the land surface.

Wetlands, historically referred to as swamp and overflow lands, presented a physical challenge to the early settlers. Other than being useful for the hunting and trapping trade, these lands were regarded as a burden to their owners. Early settlers were interested in building towns and cultivating crops. In order to make use of the land for these purposes, the landscape had to be drastically altered by draining the water from the land or elevating the land surface.

In the mid-1800s, Congress made the draining and filling of wetlands a national policy. In 1850, Congress passed The Swamp Act, granting nearly 64 million acres of wetlands to 15 states with the condition that the states use the proceeds from the sale of the lands to increase their development or agricultural potential. Missouri received 4.8 million acres of these lands (Nolen, 1913). Less than six months later, the state of Missouri gave approximately one-half of the land to the counties in which they were situated, thus passing the responsibility of reclamation on to the counties. The bill specified that the county courts were "authorized and required, as soon as practicable, to have said overflowed and swamp lands drained and reclaimed." The courts would then be allowed to sell the lands at sheriffs' sales.

By 1852, the remaining wetlands located in southeast Missouri were also donated to their respective counties; however, no effort was made by the counties to carry out the provisions of the statute. Reclamation was an expensive proposition. Realizing that, if left up to the counties, this land would never be reclaimed, the legislature, in 1855, authorized the county courts to sell the lands without requiring prior reclamation. As a result, many large tracts of land were sold at public auction for next to nothing. For example, an 80,000-acre parcel in Stoddard County was sold in 1868 for $663, which is 8/10 cent per acre (Nolen, 1913).

During the mid to late 1800s, much of the land was purchased by the railroad and timber industries who were more interested in harvesting timber than in drainage. With abundant water and relatively warm growing seasons, cypress, oak, gum, and tupelo trees thrived and grew to enormous sizes. Based on census data, forested wetlands in southeast Missouri decreased by 257,000 acres during the period 1870 to 1890 (Korte and Fredrickson, 1977). From 1900 to 1920, forested wetlands in southeast Missouri decreased by 595,000 acres (Korte and Fredrickson, 1977).

Technological advances, such as the dipper dredge, made large scale drainage of wetlands feasible and accelerated the development of these areas during the early 1900s. People formed drainage districts to take advantage of the rich agricultural potential of southeast Missouri. The progressive loss of Missouri's southestern forested wetlands from 1650 to 1975 is depicted in Figure 2.

The Little River Drainage District, incorporated in 1907, is an example of a large drainage district project. The primary objective of the project was to make the Little River Swamp, among others, suitable for agriculture. The district was 90 miles long, from 4 to 30 miles wide, and contained approximately 500,000 acres of rich alluvial bottomland (Nolen, 1913).

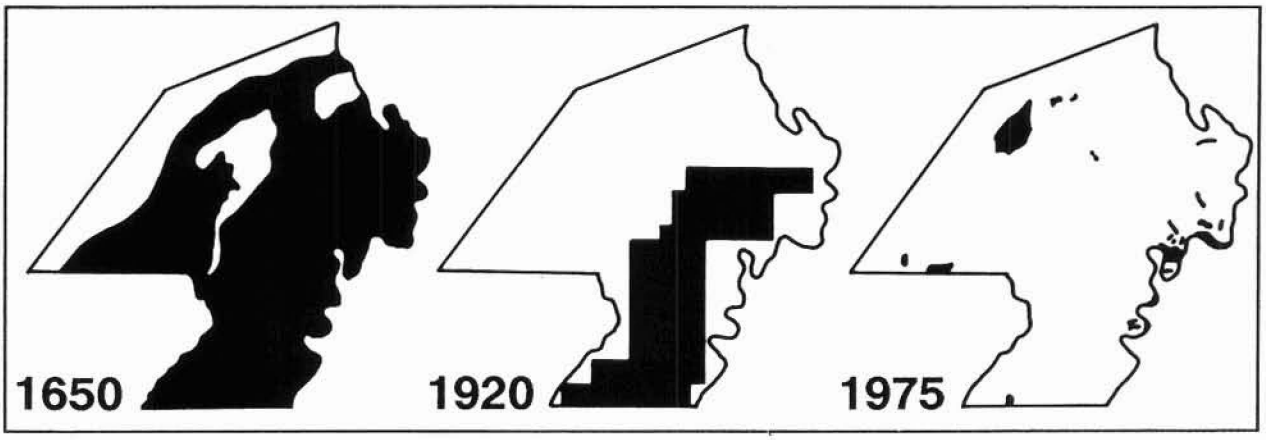

Figure 2. Loss of lowland hardwood forests in southeast Missouri, 1650-1975 (adapted from Korte, Fredrickson, 1977).

The district provided drainage outlets for an additional 614,000 acres of non-wetland and a system for diverting runoff from another 750,000 acres of Ozark highlands. Construction lasted from 1914-1929. Approximately $11 million were spent moving almost 88 million cubic yards of earth used in construction of the channels and levees (Nolen, 1913).

The Headwater Diversion Channel diverted the Castor and Whitewater Rivers directly into the Mississippi River south of Cape Girardeau. This diversion, along with other projects, eliminated inflow to the Bootheel (DNR, 1986). Appendix 3 depicts the drainage systems of southeast Missouri as of 1974. By 1912, approximately 3.5 million acres of wetlands had been targeted for drainage by the 191 drainage districts that had formed throughout the State (Nolen, 1913). This extensive alteration of the natural ecosystem, through the removal of water from the land, resulted in the successful creation of highly productive cropland.

Chapters 244 and 245 of the Revised Statutes of Missouri (1986) define current private drainage rights and the authority of levee districts. The owner of any swamp and overflowed land in Missouri has the right to construct any ditch, tile system or levee necessary to drain his/her land. In doing so, the land owner also has the right to go through or across any tract of land between his/her land and the outlet for the drainage waters.

Chapter 245 of the Revised Statutes defines the power of the board of supervisors once a levee district has been established. "The owners of a majority of the acreage in any contiguous body of swamp, wet or overflowed land...may form a levee district for the purpose of having such land and other property reclaimed and protected from the effects of overflow and other water, for sanitary or agricultural purposes."

The elected board of supervisors is authorized and empowered to "straighten, widen, change the course and line of any levee in or out of said district; to fill up any creek, drain, channel, river, watercourse or natural stream; and to divert or divide the flow of water in or out of said district;...to construct any and all of said works over any public highway, railroad right of way, track, easement, railroad or other right of way...." "The board shall levy a uniform tax...within such district...for the purpose of paying expenses incurred or to be incurred in organizing the said district,..." as well as "levy an annual benefit fee on improvements on certain tracts of real estate in said district."

Another major cause of wetland losses in Missouri was the channelization of the Missouri and Mississippi rivers by the United States Army Corps of Engineers (COE). Initiated in 1912, the Missouri River Bank Stabilization and Navigation Project was authorized to construct and maintain a 9-foot deep by 300-foot wide navigation channel and bank stabilization works on the Missouri River from Sioux City, Iowa to the mouth. Dikes and revetments were constructed that induced deposition behind the structures until the land elevation was high enough to warrant clearing for agriculture or other uses.

The U.S. Army Corps of Engineers' Missouri River Bank Stabilization and Navigation Project Final Feasibility Report and Final Environmental Impact Statement for the Fish and Wildlife Mitigation Plan (1981) estimated the environmental impacts of the project through the year 2003. Prior to the first authorization of the project in 1912, the Missouri River, from Sioux City, Iowa, to St. Louis, Missouri, was a wide, meandering river and host to a diversity of aquatic and terrestrial habitats. The natural components of a river flood-plain are illustrated in Figure 3. Direct losses of approximately 100,200 acres of primarily shallow water aquatic habitat have occurred or will occur within the 300,000 acres formerly covered by the natural channel area of the river (COE, 1981). In addition, approximately 85 percent or 309,000 of the 365,000 acres of riparian timber, sandbars, wetlands, and other habitat types will be destroyed within the active erosion belt. Upon completion of the project, 148,000 acres of agricultural land will have been created (COE, 1981). Appendix 4 shows the progressive changes that occurred as a result of the Missouri River Bank Stabilization and Navigation Project.

In addition to the Missouri and Mississippi rivers, many other streams and rivers in the state have been channelized or dammed. Missouri ranked fourth in the nation for total number of dams, with an inventory of 3,600 dams that met the criteria of 25 feet in height or 50 acre-feet (COE, 1982). In 1979, the Missouri Department of Conservation conducted a survey of stream alterations and found that Missouri had lost 3,997 miles of stream from channelization and impoundments (Fajen, 1979). This number represents second through eighth order streams; first order, the smallest tributary streams, are not included. Tally results may be correlated to the direct loss of wetlands hydrologically connected to the natural stream system. The alteration of the natural hydrology either drowns

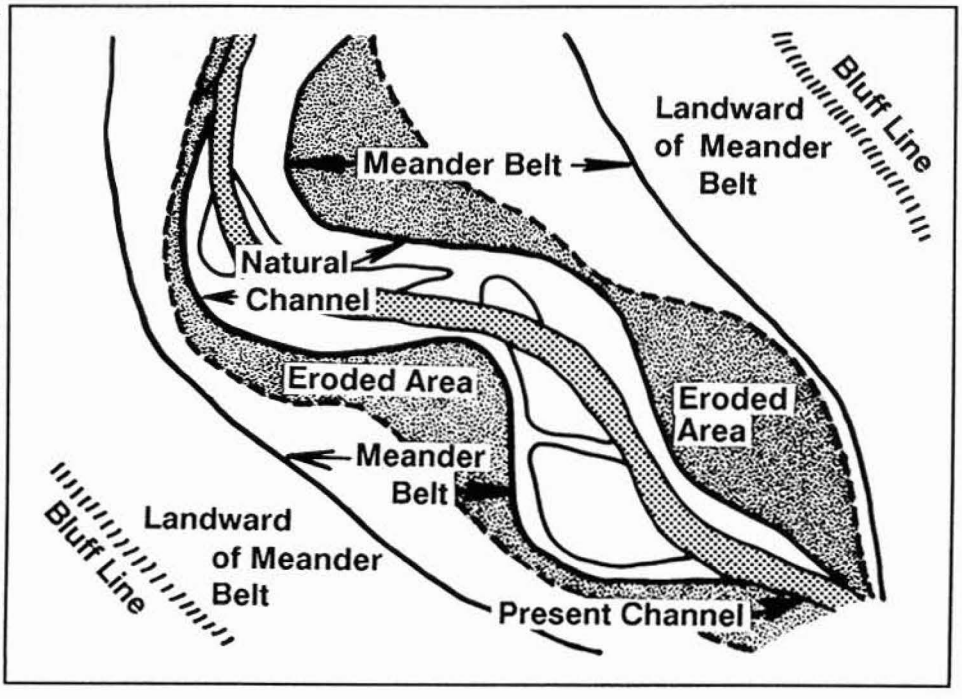

Figure 3. Natural components of a river flood-plain (U.S. Corps of Engineers, 1981).

(result of damming) or starves (result of channelization) the wetland of water, resulting in degradation or elimination of the wetland.

Summary

Wetlands, along with upland forests, savannas, and prairies were once substantial and diverse components of Missouri's original landscape. In the past, wetlands were considered worthless. Within two years after receiving the federally donated 4.8 million acres of swamp and overflowed lands, Missouri had transferred title to the counties, which in turn had sold it to the public, thus passing on the reclamation responsibility Congress had originally assigned to the state.

The logging industry was first to gain economically from this "worthless land" by harvesting the enormous cypress, tupelo, gum and oak trees that grew in the lowland swamps.

Paralleling the national trend, the majority of wetland conversions were made possible by draining or diverting water to facilitate agricultural production. Southeast Missouri was home to about one-half of the state's original wetlands. Only 2 percent of its original wetlands remain.

Large-scale, and widespread channelization and damming have also caused the degradation or elimination a significant number of wetlands.

As a state, we are now faced with the fact that less than 13 percent of our original wetland resource remains. Wetland losses continue to occur in Missouri. Missouri must strive toward meeting the challenge of identifying and reconciling physical and environmental limits with the development of its natural resources. Wetlands now account for only 1.4 percent of the state's surface area.

HOW DO WETLANDS FUNCTION?

Introduction

Considerable literature exists on the subject of wetland functions and values, not all of which is in agreement. Wetland hydrology is most often discussed in terms of the timing, frequency, duration of inundation or saturation and water depth. Because the study of wetlands is a relatively new science, the many complexities of wetland functions are not fully understood. The technical nature of evaluating wetland functions, and the interactions between functions, make a simple explanation difficult. Not every wetland performs all functions, nor can one function be explained in isolation from another. The following discussion has been kept general and is not inclusive.

Functions

Functions are the physical, biological, and chemical interactions of a wetland with its surroundings. Like any natural system, wetland processes are interconnected within and outside of the wetland boundary. Changes in a watershed, which alter the hydrology, will affect how a wetland functions. Similarly, changes to a wetland can affect other areas of the watershed.

The presence of water in a wetland, and the nutrients dissolved in that water, facilitate high plant productivity. Freshwater wetlands are comparable to tropical rain forests in terms of natural productivity, as illustrated in Figure 4. The diverse vegetation found in wetlands is the

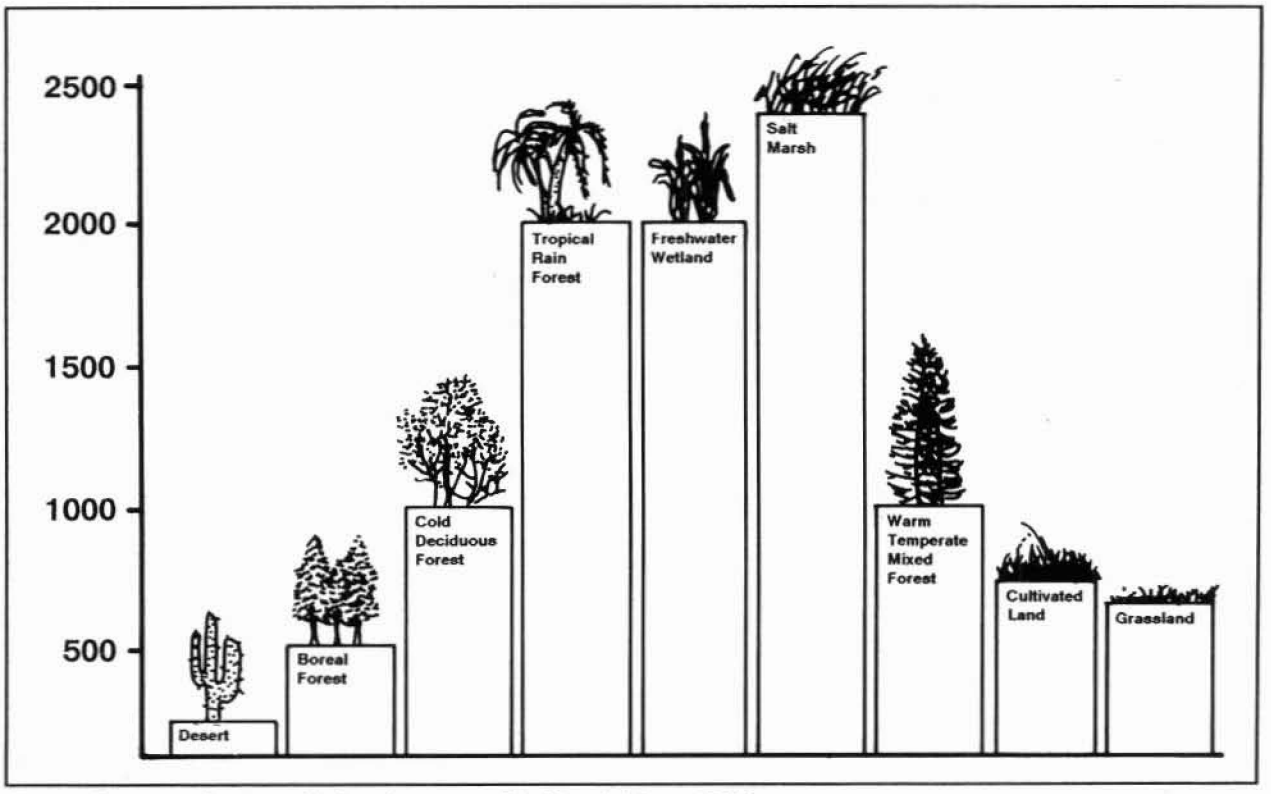

Figure 4. Net productivity of selected ecosystems [g/m²/year] (Tiner, 1984).

basis for the food chain and attracts invertebrates, amphibians, reptiles, mammals, resident and migratory waterfowl, shore birds, and songbirds. Besides providing food, the prolific and diverse vegetation also provides breeding and nesting habitat as well as cover from predators. Wetlands are also principal spawning, nursing, feeding, and staging areas for many lake, stream, and river fish species. Many species of fish and wildlife are dependent upon wetlands for some part of their life cycle.

This diversity and abundance of organisms is directly linked to the presence of water and its unique chemical make-up. Timing, depth, frequency, and duration of the water present are factors in water availability. Water chemistry and availability are products of the watershed in which the wetland is situated. Sources of water in a particular watershed include runoff from adjacent upland area, and from discrete sources such as streams or rivers. Consequently, wetlands are very vulnerable to land use changes in surrounding nonwetland areas.

In addition to the influences of the surrounding watershed, many factors within the wetland affect the productivity and diversity of life forms. For example, slight variations in ground elevation within a wetland create small but significant variations in frequency, depth, and duration of saturation or inundation by water. These elevational differences result in a diversity of biological communities within a single wetland system.

A stream or river that has a visible amount of suspended particles is said to have a high sediment content, and is often referred to as "muddy" or "dirty." Many wetlands have the ability to remove these sediments from inflowing water. The speed of moving water determines its ability

to carry sediment; the faster the water, the more sediment it can carry. When moving water slows down abruptly, it is no longer capable of carrying the load, and the sediment "drops out" of the water to the bottom of the wetland. Water velocity is decreased in a wetland for or of two reasons. First, most wetlands are relatively flat, offering very little incentive for water to go anywhere very quickly. Second, water is slowed by "bumping" into the dense vegetation typically found in wetlands.

While nutrients are a necessary component of any natural ecosystem, overloading of nutrients may result in a number of problems. A familiar example is algal blooms, which create toxic conditions and cause fish kills. Microorganisms living in the water and in association with wetland vegetation can reduce excess nutrients and some pollutants by chemically breaking them down into less harmful, less mobile forms. As part of their normal growth, some wetland plants metabolize common pollutants such as phosphorus and nitrogen. Wetland plants may also break down or absorb toxic substances, including some heavy metals and pesticides.

The hydrologic cycle is a concept which describes the physical movement of water through the natural environment. Figure 5 illustrates this concept and shows how wetlands are linked to it. During rainfall events, the typically abundant vegetation in wetlands intercepts the rain, temporarily delaying it from reaching the ground. Once the rain does hit the ground, wetland vegetation retards its flow. These physical functions reduce runoff. High runoff is often associated with soil erosion and flood damages. Missouri ranks fourth in the nation for soil erosion (U.S. Department of Agriculture, Soil Conservation Service (SCS), 1989). Missouri also rates high nationally in flood damages. An extreme example of a high runoff situation is in urban settings, where natural vegetation has been replaced by pavement. In this situation, cities must design and construct stormwater drainage systems to deal with the extra water. By

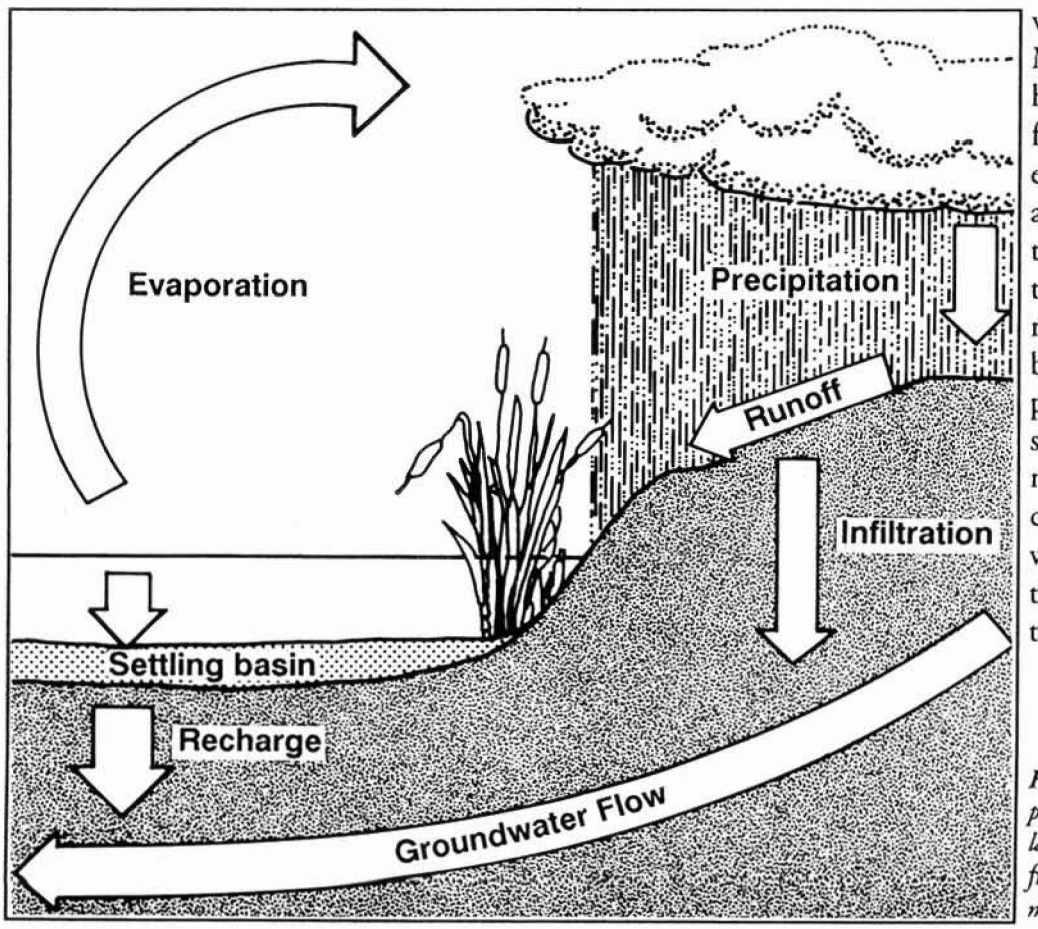

Figure 5. Hydrologic processes affecting wetland creation (adapted from Vaught and Bowmaster, 1983).

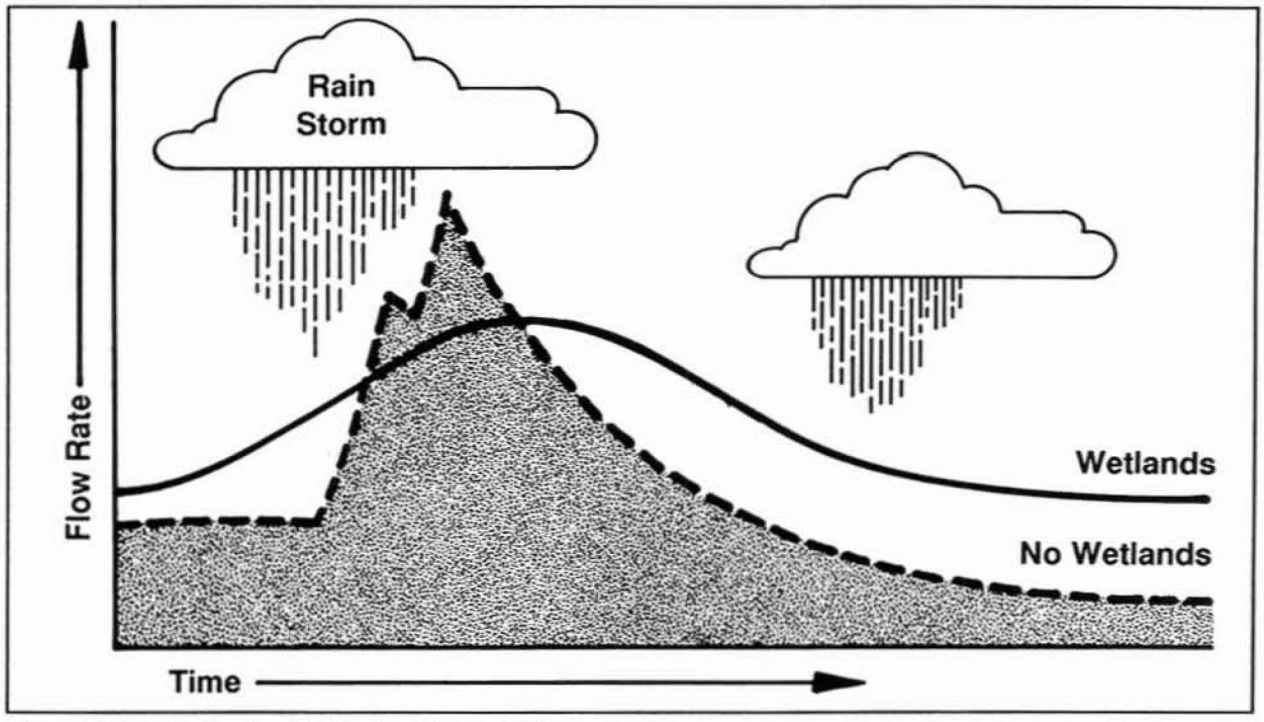

Figure 6. Wetlands reduce flood peaks (Kusler, 1983).

reducing runoff, wetland plants also give water a chance to soak into the soil where it can be utilized.

Wetland depressions and the organic material in them, such as logs, twigs and leaves, temporarily hold water from a storm or flood event. Just as a dry sponge can soak up more water than a wet one, the storage potential of a wetland is greatest after periods of low rainfall. This temporary storage of water is another way wetlands function to reduce storm runoff and associated negative impacts. In a similar fashion, wetlands may also act as overflow areas during a flood event. When a stream or river tops its banks, flood-waters spread across the flood-plain reducing water velocities and flood peaks. The stabilizing effect of wetlands on peak flood flows is depicted in Figure 6. Through their moderating influence, wetlands behave like natural reservoirs, holding flood waters then releasing them slowly. The water may be released by seeping into the subsurface where it may serve as a source of recharge to an underlying aquifer, or it may be released downstream, through base-flow, long after the rain has stopped. Maintaining overflow areas by leaving them in a natural state, helps reduce flood heights and damage downstream.

Summary

Although the various and interconnected functions performed by wetlands are difficult to quantify, we know that, depending on site specific conditions, wetlands reduce flood heights, improve water quality, reduce runoff and erosion, provide an environment for a diversity of plant and animal life, and help sustain base flow of adjacent streams or rivers during drought conditions.

Because Missouri's wetland resource has decreased so drastically, the overall ability of the remaining wetlands to perform the same function has been greatly reduced. Many fragmented and degraded wetlands no longer function as natural wetlands once did. Wetlands function most effectively in complexes and act as buffer

zones between upland and aquatic ecosystems. In manny instances, natural wetland hydrology has virtually been eliminated by widespread channelization, dams, drainage and levee systems, real estate development, and unwise land-use management. Degradation of the remaining wetlands is occurring due to alteration of the natural hydrology, overloading of nutrients, pollutants, and sedimentation.

WHY SHOULD WE PROTECT OUR WETLANDS?

Introduction

Wetland values may be defined as the economic or environmental benefits that humans receive from them. Environmental benefits tend to be intangible, cumulative, and long term, therefore making them difficult to measure in dollars. This is unfortunate in a society that often defines value by short term, economic gain. For this reason, and when possible, economic statistics relevant to Missouri are included in the following discussion of wetland values.

Water Quality Improvement

Wetlands are important to maintaining water quality because they remove sediment and excess nutrients and pollutants from the water that flows through them. Wetlands are the kidneys of the land, naturally filtering non-point source pollutants. This process is especially important around lakes where excess phosphorus and nitrogen from residential development may cause algal blooms and associated fish kills. Wetlands also help reduce soil erosion. Missouri ranks fourth in the nation for soil erosion (SCS, 1989). Wetlands remove the eroded soil which would otherwise enter our streams, rivers, lakes, and reservoirs. In addition, wetland vegetation stabilizes stream beds and shorelines. However, the seven tons of topsoil lost per acre per year from non-federal cropland (SCS, 1989) is too much for wetlands to assimilate, and they slowly or quickly fill in. Unretarded, increased sedimentation may reduce the life span of our reservoir systems and cause increases in the maintenance costs of our industrial and municipal water intake facilities.

Flood Damage Reduction

With two major rivers and approximately 4,000 other streams and rivers in the state, flood damage reduction is extremely important to Missourians. Many of Missouri's remaining wetlands occur in river flood-plains. These riparian wetlands have the natural ability to moderate the effects of a flood event (Figure 6). Reductions in the height and volume of flood peaks result in a decrease in damage to life and property. Channelization of Missouri's rivers and streams has caused the elimination of riparian wetlands, exacerbated flood conditions, and created the need for structural solutions. For example, many of the dams in Missouri were built for the dual purpose of flood control and recreation. The extensive network of levees throughout the state is another structural attempt to control the effects of flooding.

Government payments for flood-related disaster assistance total millions of dollars annually, and several billion more have been invested in structural measures to control floods. Missouri is ranked, by the National Flood Insurance Program, near the top of the list in flood damages

compared to other states. From 1978 through the end of 1990, the National Flood Insurance Program paid almost $117 million in flood insurance claims in Missouri (Federal Insurance Administration, 1991). These figures cover flood insurance and do not include other costs associated with flood damages. The National Flood Insurance Program provides reduced flood insurance premiums to citizens living in communities that implement flood reduction programs; maintaining or creating wetlands is recognized in this program.

There are both safety and economic considerations in maintaining wetlands in the flood plains, as recognized by the Federal and State Emergency Management Agencies. The once-vast network of wetlands associated with our streams and rivers provided the natural flood protection that we are paying for now.

Open Space and Passive Recreation

Open space generally refers to natural, undeveloped areas in an urban setting. These open spaces, because of their location, can be utilized and appreciated by a great number of people. Because of the popularity of these areas, many city administrators are incorporating open space into their city development plans. Many people value undeveloped areas around their homes. Consequently, many commercial and residential real estate developers are getting a higher profit return on land adjacent to natural areas.

Passive recreation, which includes activities such as nature study, bird watching, hiking, and nature photography, is not limited to urban centers. Because there are few open space opportunities in cities, passive recreation tends to occur more in rural or smaller city areas. In 1989, more than 453,000 people visited Big Lake, Big Oak Tree, and Pershing State Parks where wetlands are featured. A study of Missourians' outdoor recreational behavior showed that 68 percent of all Missourian's participated in hiking, 15 percent in nature photography, and 22 percent in bird watching or nature study (DNR, undated). These open spaces and recreational areas benefit the state economically through associated expenditures for identification books, camera equipment, hiking and camping gear, binoculars, and travel expenses.

Fish and Wildlife

As one of the most productive ecosystems in the world, wetlands are the life support system for an incredible diversity of plant and animal species. The food, breeding, nesting, spawning, and predator escape habitat provided by wetlands are to a great extent responsible for the recreational opportunities Missourians receive. Recreation and tourism are closely tied to fish and wildlife resources which are in turn tied to wetlands. In 1990, tourists spent approximately $6.1 billion in Missouri (Missouri Department of Economic Development, 1991). During that same year, the Missouri Department of Conservation (MDC) licensed almost one million fisherman, with almost 250,000 of those holding combination fishing and small-game hunting permits (MDC, unpublished). In 1989, MDC licensed 21,967 duck and 27,473 waterfowl hunters (MDC, unpublished). A statewide survey of waterfowl hunters in 1988 indicated an average annual expenditure of $8.6 million (Humburg, 1990). The importance of wetlands to fish, waterfowl, and certain game species has long been recognized, due to the popularity of hunting and fishing. Wetlands are similarly important to much of Missouri's other native wildlife.

Missouri's Rare and Endangered Species

The feeding, breeding, nesting, spawning, and cover habitat provided by wetlands is even

more critical for rare and endangered plants, fish and wildlife species. Almost 35 percent of the nation's rare and endangered wildlife species are either located in wetland areas or are dependent upon them (National Wetlands Policy Forum, 1988). The "Rare and Endangered Species of Missouri Checklist" provides the following statistics on Missouri's rare and endangered species which depend on wetlands for survival: 100 percent of the fish species, 68 percent of the bird species, 27 percent of the mammals, and 43 percent of the flowering plants (MDC, 1991).

Water Supply Stabilization

Some wetlands help to stabilize surface and ground water supplies by promoting infiltration and aquifer recharge. Recharge to economically and ecologically important aquifers is more likely following a major storm or flood event in which the water was retained in the wetland for more than a brief period of time. The likelihood of infiltration is also greater in the upstream reaches of the watershed. Wetlands also help sustain base flow conditions in streams and rivers by slowly releasing water long after the rain has stopped. This is particularly valuable during periods of drought. The gradual release of stored water is usually more beneficial to fish and wildlife downstream than sudden peak flows, although peak flows may be necessary for dispersal and germination of some wildlife plant foods and the upstream migration of fish.

Maintaining Missouri's Biodiversity

Biological diversity may be defined as the variety of life. Biodiversity is often described at three fundamental levels: 1) species diversity; 2) genetic diversity; and 3) community or ecosystem diversity. Biodiversity occurs on many scales, from local, through regional, to global. It is also dynamic or changing through time. Biodiversity is often used as an indicator of the relative health of a particular ecosystem or of the total environment. A lack of biodiversity is an indication of natural imbalance. Species or populations do not exist in isolation, rather they coexist with other species sharing the same environment. A business analogy for the elimination of biodiversity would be the monopolization of a world market, which eliminates competition, raises prices, and threatens world economy.

Wetlands play a critical role in preserving the great variety and abundance of the world's life forms. In Missouri alone, nearly one-quarter of the state's native plant species and their diverse genetic varieties rely directly on wetlands. Society benefits from maintaining biodiversity through wetland preservation because current and future generations depend on the long-term health and viability of our environment.

Education and Research Opportunities

Because Missouri has lost approximately 90 percent of its original wetland resource (SCS, 1985), remaining wetlands have become increasingly important for educational and research purposes.

Because of their general accessibility in both urban and rural settings, wetlands offer great opportunities for education. The highly diverse nature of wetlands challenges students, teachers, and research scientists to integrate the disciplines of zoology, botany, hydrology, agronomy and ecology.

Only in the past few decades have we begun to realize the many functions and values of wetlands. Our knowledge about different wetland types is for the most part isolated in separate literatures and scientific circles. Research is needed to understand the complex natural hydrology of wetland systems in order to effectively manage and restore degraded wetlands. Research is also necessary to understand the needs of the rare and endangered species dependent on wetlands.

The natural ability of wetlands to improve water quality has created a surge of new research into the utilization of man-made wetlands for treating municipal, agricultural, livestock, and mining waste-water. While constructed wetlands for waste-water treatment do not function as natural wetlands, knowledge of natural wetland functions is necessary for their development.

Summary

Value is a subjective concept. What is valuable to one individual, may be worthless to another. One way of defining value is an equivalent in money, goods, or services for something exchanged. How much and who pays for the results of a wetland being exchanged for another land use? The answer to "how much" is difficult and sometimes impossible to determine. The answer to "who pays" is everyone. We pay our city and state governments to maintain a supply of clean water, dispose of our waste, and manage stormwater runoff. Missourians paid over $4 million in annual flood insurance premiums in 1990 (Federal Insurance Administration, 1991). We also pay for hunting and fishing privileges and for the dams and levees that provide structural flood control. Preserving the remaining wetlands will not eliminate these costs, but "trading off wetlands" has certainly contributed to them.

These questions illustrate the difficulty in assigning a monetary value to wetlands. Often times we do not have the technology to determine the dollar value of wetlands. This does not make their value zero by default.

WHAT TYPES OF WETLANDS ARE IN MISSOURI?

Introduction

Just as the earth's rivers and streams can be likened to the arteries and veins of the human body, so can wetlands be compared to our kidneys. Wetlands share a number of similarities with the human body. Both "bodies" outwardly appear quite simple when in fact they are incredibly complex chemical, physical, and biological systems. Wetland scientists, like medical doctors, pursue years of education and training all the while making new discoveries. However, this knowledge needs to be conveyed in terms that can be understood by others. What exactly is a wetland? Is it the same thing as a swamp? What makes wetlands distinguishable from other types of natural systems? These are all good questions. Mitsch and Gosselink (1986) listed the following characteristics:

1) Wetlands are distinguished by the presence of water.
2) Wetlands have unique soils that differ from adjacent uplands.
3) Wetlands support vegetation adapted to wet conditions, and conversely are characterized by an absence of flood-intolerant vegetation.

In addition to the presence of water, unique soils, and vegetation adapted to wet conditions, wetlands have a number of other characteristics that distinguish them from other ecosystems yet make them more difficult to define:

4) Although water is present for at least part of the time, the timing, frequency, and duration of flooding or soil saturation varies

considerably from wetland to wetland.

5) Wetlands are often found at margins between deep water and terrestrial uplands and are influenced by both systems.
6) Wetlands vary widely in size, ranging from less than an acre to hundreds of acres.
7) Wetland location can vary greatly from rural to urban regions.
8) Wetland conditions, or the degree to which the wetland is influenced by humans, varies greatly from region to region and from wetland to wetland.

A commonly held misconception is that wetlands are under water 100 percent of the time. A soil that is saturated in the root zone, saturated to the surface, or inundated, yields the same result--anaerobic conditions. Wetlands undergo wet and dry cycles that are essential to their ecology. They rely on constantly fluctuating water levels to maintain productivity. Not only are plant establishment and growth controlled by water, but pulsations within the system make food supplies available for a diversity of animals. Wetland hydrology is often described in terms of timing (what time of the year water is present), water depth, frequency (how often is water present) and duration (how long is the water present). The combinations of timing, frequency, water depth or soil saturation, and duration vary from season to season and year to year for most wetlands.

It is important to note that wetlands are not deep-water habitats. Deep-water habitats are open water areas that generally have a mean annual water depth greater than 2 meters, lack true soil, and are either unvegetated or support only floating or submerged macrophytes. Light does not usually penetrate beyond 2 meters in depth, thus eliminating the plant's ability to photosynthesize. A body of water whose depth precludes the growth of emergent vegetation, and whose substrate is nonsoil, does not meet the criteria of a wetland. Wetlands are usually found at the interface between true terrestrial ecosystems, such as upland forests and grasslands, and true aquatic systems, such as deep lakes and oceans.

NATURAL WETLAND TYPES

The following categories of Missouri wetlands describe naturally occurring ecosystems that have not been disturbed by man's activities. Each wetland type is described in terms of its undisturbed soil, hydrology, and vegetation, as well as where in Missouri it may be found.

SWAMP

Swamps are forested areas where surface water is present for most of the year, including significant portions of the growing season. Their soils are very poorly drained, and include thick layers of peat or muck. Swamps are dominated by bald cypress and water tupelo, with understories open or filled with plants such as buttonbush, water elm and swamp privet. Although this type of wetland is considered to be the "wettest," even swamps undergo draw-down periods that are essential for the reproductive cycle of the trees adapted to survive in them.

Swamps are limited to Missouri's southeast lowlands, but may also be found in sinkhole ponds and depressions in uplands or river terraces within the southeast Ozarks region. The geographic limitation of swamps is the result of the extent that cypress and water tupelo's may be found to naturally exist (Figure 7).

SHRUB SWAMP

Shrub swamps are non-forested wetlands, dominated by woody vegetation that is flooded or contains water all or most of the year, including significant portions of the growing season. The hydrology of shrub swamps is essentially the same as that of the swamp, the difference being that shrub swamps are found above the latitude that swamp vegetation naturally exists. Soils are

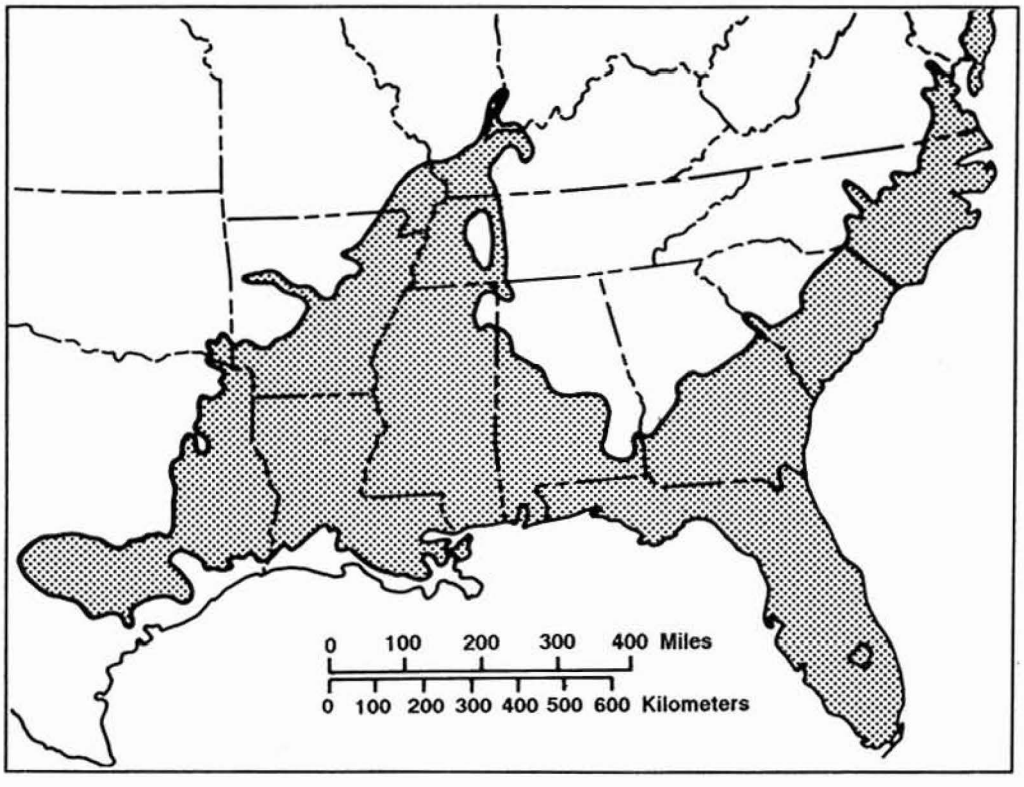

Figure 7. Distribution of bald cypress in the southeastern United States (adapted from Mitsch, Gosselink, 1986, after Little, 1971).

deep and very poorly drained, consisting of peat or muck over alluvial deposits. Shrub swamps are dominated by buttonbush in either scattered clumps or dense thickets, in association with scattered herbaceous emergents or free-floating aquatic plants.

Shrub swamps are found statewide in inundated depressions of oxbow ponds and sloughs of stream and river flood-plains, as well as in the basins of sinkholes or other depressions in upland settings.

Forested Wetland

Forested wetlands, sometimes referred to as flood-plain or riparian wetlands, are forested areas that periodically flood or contain standing water or saturated soils for short to prolonged periods during the dormant season. Forested wetlands remain dry for the greatest portion of the growing season. These wetlands are characterized by a combination of high species diversity, density, and high productivity. Examples of forested wetland tree species include black willow, pin oak, sycamore, American elm, green ash, silver maple, pecan, and river birch. Vegetation on the forest floor varies from abundant and diverse during drier periods to scarce during the wettest periods.

Forested wetlands are typically adjacent to, and influenced by, streams and rivers statewide, with their character, species composition, and structure varying according to their location within the landscape and the hydrology of the site.

Marsh

Marshes are a diverse group, unified by the fact that they are deep-soil wetlands dominated by herbaceous emergent plants that are primarily grasses and sedges. They contain standing water,

or saturated soils, for prolonged periods of the growing season. Dominant plant species include reed canary grass, cattail, bullrush, spike rush, arrowhead, smartweed, and sedges.

Most marshes are found along flood-plains of larger streams and rivers, but they may also be found along the borders of natural ponds and lakes, sinkhole ponds, and other upland depressions.

Wet Meadow

Wet meadows typically have deep, moist-to-saturated soils, and standing or flowing water is present for only brief to moderate periods during the growing season. Vegetation is dominated by a variety of sedges and rushes, forbs, and grasses, mostly prairie in nature.

Wet meadows are found along river and stream flood-plains, along the narrow draws and headwaters of small streams, and in upland depressions throughout Missouri, but less commonly in the Ozark regions.

Fens and Seeps

While fens and seeps are two distinct types of wetlands, they are described together because of their common water source and their relative scarcity in Missouri. Fens and seeps are distinctive from the other wetland types described herein. Their formation and existence is driven by groundwater, not surface water. Consequently, fens and seeps are characteristically saturated (not inundated) throughout the growing season of most years. Groundwater provides oxygenated, mineral-rich water to fens and seeps that is generally not available to the other wetland types. Water chemistry may vary from alkaline to acidic, depending on the geology of the area. Fens and seeps are covered by grasses, sedges, or reeds, but may occasionally be forested. Because of these diverse and unique conditions, fens and seeps are home to a number of the state's rare and endangered plant species like the snake-mouth orchid and the queen of the prairie. Both fens and seeps are generally small, mostly one-half to ten acres in size, with variable soil depths.

Fens and seeps are scattered throughout the Ozark region of Missouri, along stream terraces and at the base of slopes.

Pond and Lake Borders

Ponds are characterized by shallow (less than 2 meters) water and rooted vegetation. Most ponds are wetlands. The center of a lake, on the other hand, is characterized by deep (greater than 2 meters) water and a lack of vegetation. Deep permanent water does not constitute a wetland. The borders of lakes, however, are often vegetated by submerged, aquatic, floating vascular plants, algae, and perennial vegetation characteristic of wetlands. Examples of possible vegetation include lotus, arrowhead, rose mallow, pickerelweed, and a variety of sedges and rushes. The water in these wetlands occasionally draws down during the growing season, creating mud flats that support herbaceous, annual flowering plants, and seedlings of perennial herbs, shrubs, and trees.

Natural ponds and lakes form when a stream or river changes its course, leaving a natural depression which contains water. They are found in flood-plains of larger rivers and streams throughout Missouri. This category also includes sinkhole ponds of karst regions in the Missouri Ozarks.

Stream Beds

Wetlands may also exist within the channels of Missouri's streams and rivers where frequent flooding constantly scours and redeposits substrates of mud, silt, sand, gravel, or boulders. Streambed wetland vegetation ranges from a wide variety of pioneering annuals, perennials, and tree seedlings that establish on muds, silts, and sands between flood events, to the more permanent shrub and young tree communities

that form on gravel washes of Ozark streams. Examples of vegetation might include willow, cottonwood and sycamore saplings, smartweed, and water willow.

Summary

The characteristics that distinguish wetlands from other ecosystems make a clear definition of their boundaries difficult. This section has presented a general description of the water regime, soil character, vegetation, and possible landscape positions associated with eight types of natural Missouri wetlands: swamp, shrub swamp, forested wetland, marsh, wet meadow, fens and seeps, pond and lake borders, and stream beds. The wetland types described in this publication have been correlated with existing wetland classification systems as shown in Appendix 5. Classification systems correlated include: Cowardin et al., Circular 39 (FWS), SCS wetland classification system, and The Natural Terrestrial Communities System (Nelson, 1985).

The singular purpose of this section is to describe the variety of natural wetland types found in Missouri. The wetland descriptions presented assume that the wetlands have not been disturbed by human activity. The many terms used to describe the present day status of wetlands parallel the different purposes they are being used for. The definitions found in Appendix 6 are presented to describe the current condition of the wetland and the nature of the influences upon it. Most wetlands require more than one term to describe their status. For example, a created wetland could have been degraded and is now being restored and managed as a duck club.

Each of the eight wetland types described in this section can still be found in Missouri. Some are more abundant than others, but all are substantially diminished in terms of their original extent. Swamps are the hardest hit wetland type in terms of wetland loss. There are still a few significant tracts of marsh, forested wetland, and wet meadow left in Missouri.

It is important to realize that wetlands do not exist in isolation. They interact with the myriad of other wetland and nonwetland ecosystems within the watershed. These interactions influence wetland formation and continued viability. Because of the variety of land-use management practices in the state, the sustainability of the remaining wetlands is threatened by a number of factors, including channelization, levee development, sedimentation, overloading of nutrients, chemical runoff, and bank erosion.

WHAT IS THE OFFICIAL DEFINITION OF A WETLAND?

Introduction

The previous section describes Missouri wetland types, and correlates those types to the other existing wetland classification systems. How can such a diversity of wetland types be encompassed in a single definition? The very characteristics that distinguish wetlands from other ecosystems make them difficult to define. Missouri has no official wetland definition. This section presents federal wetland definitions that have been established to implement specific federal regulations and programs.

WETLAND DEFINITIONS BY SOURCE

U.S. Army Corps of Engineers, U.S. Environmental Protection Agency

> "Those areas that are inundated or saturated by surface or groundwater at a frequency and duration to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas."

This wetland definition is used to administer Section 404 of the Clean Water Act, 1977. Wetlands are just one of the "waters of the United States" that are regulated under the Act.

U.S. Department of Agriculture, Soil Conservation Service

> "Wetlands are defined as areas that have a predominance of hydric soil and that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and under normal circumstances[1] do support, a prevalence of hydrophytic vegetation typically adapted for life in saturated soil conditions, except lands in Alaska identified as having a high potential for agricultural development and a predominance of permafrost soils."

This wetland definition is used to identify and map wetlands specifically on agricultural lands to assess farmers' eligibility for benefits under the Food Security Act of 1985, and its 1990 amendment, the Food, Agriculture, Conservation, and Trade Act.

U.S. Department of the Interior, Fish and Wildlife Service

> "Wetlands are lands transitional between terrestrial and aquatic systems where the water table is usually at or near the surface or the land is covered by shallow water. For purposes of this classification, wetlands must have one or more of the following three attributes: (1) at least periodically, the land supports predominantly hydrophytes, (2) the substrate is predominantly undrained hydric soil, and (3) the substrate is nonsoil and is saturated with water or covered by shallow water at some time during the growing season of each year."

This wetland definition is being used to produce National Wetland Inventory maps. The definition includes vegetated and nonvegetated wetlands, recognizing that some types of wetlands lack vegetation, for example, mud flats, sand flats, and rocky shores.

Federal Interagency Committee for Wetland Delineation (1989)

All three of the federal definitions explained above are conceptually the same in that they all address three basic elements: hydrology, vegetation, and soils.

The four federal agencies (COE, SCS, EPA, FWS) cooperatively produced a manual to eliminate the confusion of state and local governments, property owners, and developers who were being held to different wetland definitions by separate federal agencies.

[1]Under normal circumstances refers to situations in which the vegetation has not been substantially altered by human activities.

Produced in January of 1989, the Federal Manual for Identifying and Delineating Jurisdictional Wetlands is a technical document which does not offer a single wetland definition but rather, defines the specific criteria necessary to identify a wetland in the field. Three technical criteria must be met for an area to be identified as a wetland: (1) hydrophytic vegetation, (2) hydric soils, and (3) wetland hydrology, which is the driving force behind all wetlands. The manual's purpose is not to classify a wetland, only to determine if one is present or not, and to delineate its boundaries.

Discussion

The 1989 Federal Manual For Identifying and Delineating Jurisdictional Wetlands was scheduled for review and refinement after its first year of use in the field. Proposed revisions to the 1989 manual were published in the federal register August 14, 1991, and open to public comment. The revisions were produced by the federal agencies rather than the Federal Interagency Committee for Wetland Delineation (FICWD), which wrote the manual. The proposed changes have set off a flurry of controversy from a wide variety of interests. Proponents of the proposed revisions advocate that the 1989 manual significantly expanded the areas previously classified as wetlands. Opponents of the proposed revision advocate that the changes are politically, not scientifically based, and are technically invalid.

The proposed revisions to the interagency manual have had a direct impact on COE and SCS activities. Until the revisions are finalized, the COE has been mandated by Congress to use the 1987 COE Wetland Delineation Manual to administer the Section 404 Program. Similarly, the SCS has been directed to stop sending wetland determinations to individuals until the revisions are official.

Summary

Missouri does not have an official definition of a wetland. While each of the three federal wetland definitions differ in the choice and arrangement of words, each is based on the three elements of a wetland--hydrology, hydric soil, and hydrophytic vegetation. Each definition presented originated at the federal level to fulfill a different and specific purpose.

IS THERE A MAP WHICH SHOWS THE LOCATION OF MISSOURI'S WETLANDS?

Introduction

Missouri has no single, comprehensive wetland inventory. Missouri wetlands are currently being mapped by the U.S. Fish and Wildlife Service and by the U.S. Soil Conservation Service. Some identification and delineation of wetlands is also being done by the Missouri Department of Conservation, the U.S. Army Corps of Engineers and the U.S. Environmental Protection Agency. This chapter describes the methods and status of wetland inventory mapping efforts underway.

WETLAND INVENTORY BY AGENCY

U.S. Department of the Interior, Fish and Wildlife Service

The Fish and Wildlife Service began its National Wetlands Inventory (NWI) in 1974. The purpose of the Inventory is to collect scientific information on the characteristics and extent of the nation's wetlands and to produce detailed maps depicting that information. Due to their biological and economic significance, coastal wetlands and wetlands along major river systems, such as the Missouri and Mississippi Rivers, were the first to be inventoried. The Emergency Wetlands Resources Act of 1986 recognized the importance of the National Wetlands Inventory and mandated completion of the mapping by 1998 as well as a "status and trends" report every five years.

The NWI maps are based on information obtained from analysis of aerial photographs. Wetlands are identified by one or more of the following attributes:

1. At least periodically, the area supports predominantly hydrophytes;
2. The substrate is predominantly undrained hydric soil; and
3. The substrate is nonsoil and is saturated with water or covered by shallow water at some time during the growing season of each year.

These wetlands are then classified according to an ecological system devised by Lewis M. Cowardin et al. (1979) in Classification of Wetlands and Deepwater Habitats of the United States. The classification hierarchy of wetlands and deepwater habitats, showing Systems, Subsystems, and Classes is diagrammed in Appendix 7. The five systems include Marine (open ocean); Estuarine (tidal wetlands with ocean-derived salts); Riverine (rivers or channels); Lacustrine (lakes), and Palustrine (shallow freshwater, usually vegetated). Only the last three systems are relevant in Missouri.

The status of the National Wetlands Inventory for the state of Missouri as of April 1990 is shown in Appendix 8. The Missouri NWI is expected to be completed by late 1994, however, most of the state will be mapped in some form by the end of 1992. Available formats include lines delineating wetland boundaries on topographic maps, plastic overlays, or aerial photographs.

An example of a National Wetlands Inventory map completed for a Missouri 7.5' quadrangle is shown in Appendix 9. NWI maps are available at a scale of 1:24,000 and can be obtained from the U.S. Fish and Wildlife Service by calling 1-800-USA-MAPS.

U.S. Department of Agriculture
Soil Conservation Service (SCS)

In 1989, the Soil Conservation Service launched an intensive wetland inventory program for use in implementing the Food Security Act of 1985. The SCS classifies wetlands on farms where the owner is receiving USDA benefits. The Swampbuster provisions of the Act specify that a landowner who converts and plants a wetland to an agricultural commodity crop between December 23, 1985, and November 28, 1990, may lose any USDA program benefits being received. After November 28, 1990, conversion alone of the wetlands will make a person ineligible for USDA program benefits.

For 75 counties in Missouri, the SCS will be completing a wetland inventory on all farms. The inventory includes those that are receiving USDA benefits as well as those that do not. For counties in the Ozark region of Missouri where few wetlands exist, mapping is only being done on lands of USDA program participants.

The SCS wetland maps are based on information taken from U.S. Geologic Survey topo-

graphic sheets, NWI maps, soil maps, and USDA Agricultural Stabilization and Conservation Service (ASCS) color slides. In addition, the SCS developed 7 and 15-day, 50 percent chance, water surface elevation profiles for most rivers and streams in Missouri. This flood information is added to 7.5' topographic maps and used as another reference for making wetland delineations. This information is compiled and mapped onto ASCS 1:12,000 black-and-white aerial photographs.

The wetland classification system used by SCS reflects its specific role in administering the Food Security Act. In this system, wetlands are classified into one of five categories:

1. Converted Wetland (CW), or one that has been drained, cleared, dredged, filled, leveled, or otherwise manipulated to produce an agricultural commodity after December 23, 1985.

2. Prior Converted Cropland (PC), or a wetland that was converted to cropland and planted prior to December 23, 1985,

3. Farmed Wetland (FW), or a wetland that has been partially converted, but still exhibits wetland characteristics such as flooding or ponding for an extended period of time. The area has been used to produce an agricultural commodity prior to December 23, 1985,

4. Wetland (W), or one that has not been altered in any way and has a predominance of hydric soils and under normal circumstances supports a prevalence of hydrophytic vegetation. In Missouri, this category may possess a qualifier which reflects the wetland's dominant vegetation, that is wooded (Ww), shrub (Ws), pasture (Wp), emergent (We), or open water (Wo),

5. Artificial Wetland (AW), or a wetland that was constructed in an area that was not wetland at the time of construction or disturbance.

Part of an SCS map completed for Missouri is shown in Appendix 10. The status of the SCS mapping effort in Missouri as of January 1991, is shown in Appendix 11. The U.S. Department of Agriculture program participants are mailed copies of wetland maps pertaining to their property. The wetland maps are stored at individual county ASCS offices on 1":1000' scale aerial photographs. See Appendix 12 for the ASCS county office locations in Missouri.

Missouri Department of Conservation

The Missouri Department of Conservation's Natural Heritage Database is an inventory of wetlands and other natural features owned or managed by their department, as well as other high-quality wetlands (MDC, undated). The database is the state's clearinghouse for information about our natural heritage; for example, sitings of rare or endangered plants and animals or the location of a fen. This inventory may be most useful in cataloging high quality, natural wetland communities and sites with rare and endangered species.

U.S. Army Corps of Engineers and U.S. Environmental Protection Agency

The U.S. Army Corps of Engineers and the United States Environmental Protection Agency, though not officially conducting wetland inventories, have made wetland delineations that have been used in making jurisdictional determinations of wetlands regulated under Section 404 of the Clean Water Act. These databases are limited.

Interagency Inventory Effort

Recently, the Missouri Departments of Natural Resources and Conservation, and the U.S. Soil Conservation Service and U.S. Fish and Wildlife Service have been working towards a common wetland database for use by these agencies.

A Memorandum of Agreement has been signed to develop a coordinated, interagency effort to complete and digitize a Missouri wetland database. In 1991, DNR requested funding from the General Assembly for the automation of wetland inventories in the department's Geographic Information System, but funding has not yet been received.

The Departments of Natural Resources and Conservation have developed a pilot project, funded by the Corps of Engineers, to identify the problems and differences associated with combining and automating the SCS inventory and the F&WS's National Wetland Inventory. The pilot area is along the Missouri River in Boone County and includes the MDC Eagle Bluff Wildlife Area. This project is scheduled to be completed by the Corps of Engineers by September 1992.

SUMMARY

The U.S. Fish and Wildlife Service is responsible for completing the National Wetland Inventory, which scientifically identifies the type and extent of wetland in the United States. The U.S. Department of Agriculture's Soil Conservation Service is producing maps only of those wetlands found on farmed land. The U.S. Army Corps of Engineers and the U.S. Environmental Protection agency have made limited and unofficial wetland inventories associated with the administration of the Section 404 Program. The Missouri Department of Conservation has inventoried only those wetlands owned or managed by them. A cooperative effort is underway to develop a common wetland database to be used by all agencies involved.

WHAT REGULATORY PROGRAMS AFFECT MISSOURI WETLANDS?

INTRODUCTION

Two federal programs and one state program address Missouri's wetlands from a regulatory perspective. None of the three programs were created for the specific purpose of protecting wetlands; rather, wetland protection has been added to their respective purviews. These regulatory programs protect Missouri wetlands in a very limited way and are discussed below under their title and statute.

FEDERAL REGULATORY PROGRAMS

SECTION 404 PROGRAM, CLEAN WATER ACT (AS AMENDED BY THE WATER QUALITY ACT OF 1987)

LEAD AGENCY: UNITED STATES ARMY CORPS OF ENGINEERS

LAW:

Under Section 404(a) of the Clean Water Act, a permit is required from the Corps of Engineers for the discharge of dredged or fill material into any "water of the United States." Waters of the United States are defined by the Corps as navigable waters; tributaries to navigable waters; waterbodies adjacent to these waters; wetlands; and isolated waterbodies. Under this law, wetlands are also considered "special aquatic sites" because of their significant ecological characteristics.

REGULATED ACTIVITIES:

Examples of activities covered under Section 404 include channelization, if the dredged material is deposited in any water of the United States; clearing of vegetation in a wetland when performed by heavy equipment, such as a bulldozer; placement of rip-rap or other structures to

stabilize erosion; and the filling of a wetland for residential, commercial, or other development. Farmed wetlands are defined in a Corps of Engineers Regulatory Guidance Letter dated September 26, 1990, as farm lands that have been manipulated and cropped before December 23, 1985, that are inundated 15 or more days during the growing season, or contain potholes or playas, are considered (Farmed Wetlands are also subject to 404 jurisdiction).

UNREGULATED ACTIVITIES:

Activities currently not regulated[1] under Section 404, which could degrade or eliminate wetlands include draining, if the excavation of a new ditch or clearing of an existing ditch does not involve deposition of materials in waters of the United States; clearing of vegetation or excavation, if not done by heavy machinery and dredged material is disposed of in upland areas; lowering of groundwater levels; flooding; and any upland activity even though the activity may affect a neighboring wetland.

EXEMPTIONS:

Agricultural exemptions exist for normal farming practices such as plowing, cultivating, minor drainage, and harvesting for the production of food, fiber, and forest products. Previously, a farmer who converted a wetland before December 23, 1985, and therefore exempt under the USDA farm bill, still might have to obtain a Section 404 permit from the Corps of Engineers. This inconsistency between the two federal programs had a resounding affect on Missouri farmers since the vast majority of wetland conversion occurred long before the December 23, 1985, date. As of September, 1990, the Corps of Engineers has determined that all "prior converted cropland" (see page 23 for definition) is generally exempt from Section 404 regulation.

PERMITS:

Section 404 authorizes the Corps of Engineers to issue two types of permits: 1) general, and 2) individual.

General permits may be issued on a nationwide, regional, or state basis. They cover certain activities that are similar in nature and have minimal individual or cumulative environmental impact. There are 40 general permits in effect nationwide, covering such activities as the placement of navigational aids and scientific testing or recording devices. One of the most controversial nationwide permits (Number 26) allows discharge into isolated wetlands if the Corps of Engineers is notified. There are certain criteria that activities must meet to fall under the purview of nationwide permits.

In addition to the 40 nationwide permits, Missouri also has 12 statewide general permits in effect. These additional general permits cover activities such as the construction of small bridges, irrigation structures, and utility lines. Although an individual permit may not be required if the activity falls within the criteria of a general permit category, the Corps of Engineers encourages individuals to contact them before undertaking any activities in waters of the United States.

Individual permits require an application which is subject to a public interest review that includes an evaluation of the environmental impacts of the project. Environmental criteria are designed to protect the chemical, physical, and biological integrity of a water body. Section 325.3(c)(1) of the Clean Water Act contains a list of factors commonly used for evaluating an application, but it should be noted that the regulations state, "All factors which may be relevant to the pro-

[1]March 2, 1991, the parties in North Carolina Wildlife Federation v. Suerman agreed to settle the lawsuit on the basis that EPA and COE would clarify the discharge of dredged material to include certain activities that have the effect of destroying or degrading any area of waters of the United States, which include wetlands. Regulations implementing this agreement are expected to be published for public coment in the Federal Register in June 1993.

posal will be considered including the cumulative effects thereof; among those are conservation, economics, aesthetics, general environmental concerns, wetlands, historic properties, fish and wildlife values, flood hazards, flood plain values, land use, navigation, shoreline erosion and accretion, recreation, water supply and conservation, water quality, energy needs, safety, food and fiber production, mineral needs, considerations of property ownership and in general, the needs and welfare of the people." The Section 404 (b)(1) guidelines state that the discharge should not be allowed if there is a "practicable alternative" that would accomplish the project purpose and have a less adverse impact on the aquatic environment. For non-water-dependent projects in wetlands, such an alternative is presumed to exist, and the burden is on the applicant to clearly demonstrate otherwise to the district engineer.

Mitigation for adverse impacts may also be required as a condition of issuance of either a general or individual permit. A memorandum of agreement between the Corps of Engineers and the EPA (February 7, 1990) concerning the determination of mitigation, states that an individual permit applicant should: 1) avoid impacts, 2) minimize, rectify, or reduce impacts over time, and 3) compensate for unavoidable impacts.

ENFORCEMENT:

The Corps of Engineers and EPA have enforcement authority under the Clean Water Act. The Corps of Engineers' main responsibility is for permit compliance. Once a permit has been issued, the Corps is responsible for ensuring that the terms of the permit are met. The Corps can also forward to EPA cases that involve flagrant or repeat violations, or where the Corps of Engineers recommends that a penalty be assessed. The main enforcement responsibility of the EPA involves violations by parties who never obtained a permit.

OTHER AGENCY INVOLVEMENT

U.S. ENVIRONMENTAL PROTECTION AGENCY:

Pursuant to Section 404, EPA and the Corps co-developed guidelines (Section 404 (b)(1) Guidelines) to specify disposal sites for dredged or fill material. These guidelines are used during permit review. The EPA has the authority to: 1) establish the jurisdictional scope of waters of the United States, 2) interpret Section 404(f) on exemptions, 3) review projects for environmental impacts, 4) oversee state assumption of the 404 program, and 5) pursue enforcement actions on unpermitted activities.

Under Section 404(c) of the statute, EPA has final veto power over a Corps permit, and can designate where fill is prohibited due to adverse impacts. This veto power has never been exercised in Missouri.

U.S. FISH AND WILDLIFE SERVICE:

The U.S. Fish and Wildlife Service has Section 404 responsibilities under the Fish and Wildlife Coordination Act of 1934, National Environmental Policy Act of 1969, and the Endangered Species Act of 1973. The FWS provides advisory comments and recommendations to the Corps of Engineers on the potential impacts on fish, wildlife and related environmental resources.

The Corps of Engineers must ensure that the proposed permit action does not jeopardize the continued existence of federally-listed or proposed threatened or endangered species, or destroy or adversely modify listed or proposed designated critical habitat. The Fish and Wildlife Service assists in evaluating impacts of rare and endangered species.

STATE AGENCIES:

Comments from state agencies are considered in the Corps of Engineers', Section 404 decisions. Under Section 401 of the Clean Water Act, DNR must certify that the proposed activity

will not violate state water quality standards. If Section 401 water quality certification is denied, the Corps must deny the 404 permit application.

PUBLIC:

Section 404 of the Water Quality Act requires the Corps to notify the public of any permit application. Upon the request of any citizen, a public hearing must be held, unless the District Engineer determines and documents in writing that the issues raised in the request are insubstantial or that a public hearing would serve no valid interest. The boundaries of the U.S. Army Corps of Engineers' Districts in Missouri, and contact information for each, is provided in Appendix 13. Appendix 14 correlates the county names with the code numbers used to identify them.

RIVERS AND HARBORS ACT OF 1899, SECTION 10

LEAD AGENCY: UNITED STATES ARMY CORPS OF ENGINEERS

LAW:

Section 10 of the Rivers and Harbors Act requires a permit for construction or excavation in, over, or under "navigable waters" of the United States. Navigable waters include those historically used for navigation, as well as those which may be developed for navigation in the future. In the latter case, the Corps determines if a water body is navigable or not. Jurisdiction for Section 10 in Missouri extends only to the ordinary high water (OHW) of the freshwater body. Most wetlands are above the OHW mark. In Missouri, the Lake of the Ozarks, the Osage, Mississippi, and Missouri rivers are the major navigable waters. Lower reaches of the rivers are also considered navigable. (Big Blue, Gasconade, Grand, and Lamine).

REGULATED ACTIVITIES:

The Rivers and Harbors Act regulates a broader array of activities than does Section 404, but over a much more limited area. For example, in a navigable waterway, the following activities would require a Section 10 permit but may not require a Section 404 permit: channel clean-out, vegetative clearing, marina expansion which requires no fill, and dredging where the spoil is deposited in an upland area. Conversely, if a project involving filling in a waterway or wetland is not on a navigable river, only a Section 404 permit is required. In 1968, the Corps of Engineers was required to consider public interest concerns in their review of Section 10 permits. Ecological effects are part of that review.

EXEMPTIONS:

No exemptions are allowed.

OTHER AGENCY INVOLVEMENT:

As with 404 permits, the U.S. Fish and Wildlife Service and other federal and state agencies may comment on Corps of Engineers public notices.

STATE REGULATORY PROGRAM

SECTION 401 PROGRAM, CLEAN WATER ACT, (AS AMENDED BY THE WATER QUALITY ACT OF 1987) AND CHAPTER 644, MISSOURI CLEAN WATER LAW OF 1973 (AND SUBSEQUENT MODIFICATIONS).

LEAD AGENCY: MISSOURI DEPARTMENT OF NATURAL RESOURCES, WATER POLLUTION CONTROL PROGRAM

LAW:

The intent of Section 401 of the Clean Water Act was to uphold state water quality standards and to avoid pollution resulting from activities allowed by a federal license or permit. Federal permits or licenses which could impact a wetland include Section 404, EPA issued National Pollution Discharge Elimination System (NPDES), and the Federal Energy Regulatory Commission (FERC). Under Section 401, state certification is required from all states with water quality standards, before issuing a federal permit. Mis-

souri adopted water quality standards in Chapter 644 of the Missouri Clean Water Law of 1973, and consequently all waters of the state, including wetlands, are protected at least by general narrative criteria. Recent revisions to the standards now specify that wetlands adjacent to streams shall be protected by the same criteria as established for the stream.

REGULATED ACTIVITIES:

Examples of activities that may be covered under Section 401 include: channel maintenance dredging on large rivers such as the Mississippi and Missouri, small hydropower projects, construction of retaining walls, sand and gravel dredging, bridge construction, and fill in wetlands.

UNREGULATED ACTIVITIES:

Currently, any activity which does not require a federal license or permit, also does not require Section 401 certification[1]. Such activities that could negatively impact wetlands include draining, some clearing of vegetation, excavation, lowering of ground water levels, flooding, and any upland activities.

EXEMPTIONS:

There are no exemptions. The scope of the review can include all activities of the permit and their potential impacts.

ENFORCEMENT:

Enforcement of Section 401 is the responsibility of the Department of Natural Resources. Denial of Section 401 certification results in the mandatory denial of the federal permit or license in question. In Missouri, a decision to deny 401 certification is subject to administrative appeal to the Clean Water Commission.

SUMMARY

The main regulatory tool used to protect wetlands in Missouri is Section 404 of the Clean Water Act. Under this act, the Corps of Engineers regulate only the discharge of material into waters of the United States, which include wetlands. Section 404 permit issuance is dependent upon the Department of Natural Resources certification that the proposed activity will not violate Missouri water quality standards.

WHAT NON REGULATORY PROGRAMS AFFECT MISSOURI WETLANDS?

INTRODUCTION

There are many nonregulatory programs that directly or indirectly affect Missouri wetlands. It should be noted that many private philanthropic organizations do a great deal of wetland protection through land acquisition and lobbying activities. This discussion, however, has been limited to state and federal agency programs and activities. Specifics are discussed under the subheadings of the appropriate agency or organization.

[1]March 2, 1991, the parties in North Carolina Wildlife Federation v. Suerman agreed to settle the lawsuit on the basis that EPA and COE would clarify the discharge of dredged material to include certain activities that have the effect of destroying or degrading any area of waters of the United States, which include wetlands. Regulations implementing this agreement are expected to be published for public coment in the Federal Register in June 1993.

FEDERAL AGENCY PROGRAMS AND ACTIVITIES, BY AGENCY

United States Department of Agriculture

Farmers who receive benefits from one or more USDA programs must comply with the swampbuster provisions of the 1985 Food Security Act, also known as the Farm Bill. Participation in USDA programs, including crop insurance, disaster payments, and price support programs is voluntary. A complete listing of USDA programs subject to the swampbuster provisions is provided in Appendix 15.

The 1985 Food Security Act was amended in 1990 by the Food, Agriculture, Conservation, and Trade Act. The 1990 amendments contain several new provisions that pertain to wetlands. The conservation provisions of the Act are administered by the USDA's Agricultural Stabilization and Conservation Service (ASCS) and the Soil Conservation Service (SCS). The SCS is responsible for mapping wetlands (see page 22), and the ASCS administers and enforces compliance. One of the several goals of the 1990 Act is to protect from degradation land with highly erodible soil and wetland areas.

The Swampbuster provision of the 1990 Act states that if a wetland was converted after November 28, 1990, to make production of an agricultural commodity possible, the farmer becomes ineligible for USDA Department of Agriculture benefits. This includes conversion to forage production. Wetland conversion between December 23, 1985, and November 28, 1990, did not cause an individual to be out of compliance with USDA programs. During that time period, the planting of an agriculture commodity triggered the swampbuster penalties on these converted wetlands. The landowner now must restore the converted wetland before reenrolling for benefits. However, if the conversion is deemed to have a "minimal effect" on wetland values, restoration may not be required. The minimal effect exemption also allows for mitigation of wetland values lost in the conversion of certain wetlands. Under the 1990 Farm Bill, graduated penalties exist in cases of "good faith" conversion. "Good faith" refers to a wetland conversion or the planting of an agricultural commodity on a converted wetland without an intent to violate the swampbuster provision. A good faith exemption requires restoration of the converted wetland.

The 1990 Act also contains the Environmental Conservation Acreage Reserve Program, which consists of two components--the Conservation Reserve Program (CRP); and the Wetland Reserve Program (WRP).

CRP, initiated in 1985, now provides for 10-15 year contracts with landowners to remove highly erodible land or other land of environmental concern from production. Under CRP, the landowner receives payment from the U.S. Department of Agriculture in the form of rent or as "payment in kind," in which federally-owned grain was given in the amount equal to what the land would produce if farmed. Wetlands, as delineated by the SCS, were eligible for CRP in the last two out of nine sign-up periods under the 1985 Farm Bill.

The Wetland Reserve Program encourages wetland restoration and protection. In 1992, Missouri was chosen as one of nine states funded to implement the WRP on a pilot basis. Other states chosen include Minnesota, Iowa, Mississippi, Louisiana, California, New York, Wisconisn, and North Carolina. The purpose of the Wetlands Reserve Program is to restore and protect wetlands on private lands. Under this program, the USDA will purchase easements from private landowners and provide a cost share of up to 75 percent to restore wetlands. Wetlands identified as farmed or prior-converted, as well as functionally-dependent adjacent lands, are eligible for WRP.

U.S. Department of the Interior, Fish and Wildlife Service

Under the Emergency Wetlands Resources Act of 1986, the U.S. Fish and Wildlife Service was called upon to establish national as well as regional "Wetlands Priority Conservation Plans." A Region III (MO, IL, IN, IA, MI, MN, OH, WI) Wetland Concept Plan has been developed to identify types and locations of wetlands that should be given priority for federal and state acquisition and restoration. The Emergency Wetlands Resources Act also provides for the protection of wetlands by increasing cooperative efforts in the management and conservation of wetlands and by increasing acquisition through purchase or easements.

The 1985 Farm Bill requires the USDA agencies to consult with the U.S. Fish and Wildlife Service on all swampbuster activities. The FWS is also provided with the opportunity to propose and accept conservation easements placed on Farmers Home Administration program lands (i.e., inventory properties, loan applications/ debt restructuring). The FWS has reviewed over 600 FmHA inventory tracts in Missouri and recommended placement of wetland conservation easements or fee title transfers on approximately 160 tracts. Wetlands and bottomland hardwoods will be restored on the majority of these tracts. In addition, the FWS provides landowners with financial and technical assistance to restore wetlands enrolled in the Conservation Reserve Program.

The FWS acquires lands and interests in lands, such as easements or leases, for the conservation of fish and wildlife and to provide wildlife-oriented public use for education and recreation. Included in these lands is the National Wildlife Refuge System, consisting of over 400 areas nationwide. Missouri has four National Wildlife Refuges--Mingo, Squaw Creek, Swan Lake, and Mark Twain. They are managed primarily for migratory birds and federally-listed threatened and endangered species.

Studies are currently underway to assess the potential for establishing two new national wildlife refuges in Missouri, one near New Madrid and the other along the Missouri River. Funding for FWS acquisitions comes from the sale of federal Duck Stamps, entrance fees to some national wildlife refuges, import taxes on arms and ammunition, donations, and from appropriations under the Land and Water Conservation Fund Act and the Migratory Bird Hunting Stamp Act.

Under the authority of the Endangered Species Act, the FWS protects wetlands upon which listed species depend, and through "Recovery Plan", enhance, restore, and protect such wetland habitats.

Historically, the FWS has researched and reported on the status of the nation's fish and wildlife resources. The national wetlands trends analysis examined wetland losses and gains from the mid-1950s to the mid-1980s. Under the Emergency Wetlands Resources Act, the U.S. Fish and Wildlife Service is responsible for completing the National Wetlands Inventory before 1998. The National Wetland Inventory uses the Cowardin, et al., (1979) classification system. Missouri's inventory is expected to be complete in 1993. In addition, the FWS must prepare the wetlands status and trends report, which is due to Congress every five years.

U.S. Army Corps of Engineers

The U.S. Army Corps of Engineers is in charge of the Upper Mississippi River Basin Environmental Management Plan, the purpose

of which is to protect and rehabilitate the environmental resources of the Upper Mississippi River and to guide future river management decisions. In Missouri, the program covers the section of the Mississippi River north of the mouth of the Ohio River. Federal funds are appropriated annually to support the program. The Environmental Management Plan funds habitat improvement projects to restore and preserve fish and wildlife habitat. Several projects are underway in Missouri. Resource monitoring and analysis, recreation, and river traffic monitoring are other Environmental Management Plan program activities.

The Corps of Engineers also coordinates activities with the U.S. Fish and Wildlife Service, the Upper Mississippi River Basin Association, and the five states that border the upper Mississippi River.

The Missouri River Fish and Wildlife Mitigation Plan is a cooperative effort between the Corps of Engineers and the states of Missouri, Nebraska, Iowa, and Kansas, to restore fish and wildlife habitat lost on the Missouri River. The mitigation plan was required after the Corps of Engineers determined that modifications made to the Missouri River for navigational purposes were not completely finished in 1958, and, therefore, subject to the Fish and Wildlife Coordination Act. The Fish and Wildlife Coordination Act states that fish and wildlife should be given equal consideration with other project features.

The Fish and Wildlife Service's 1980 "Fish and Wildlife Coordination Act Report" was the catalyst for the authorization of the Mitigation Plan. Planning objectives for the Missouri River include increasing acres of habitat (particularly flood-plain habitat), habitat quality, wildlife populations, and human use of these resources.

NATIONAL PARK SERVICE, U.S. DEPARTMENT OF THE INTERIOR

The National Park Service manages more than 80 million acres of lands and waters across the United States and Trust Territories. It is the responsibility of the National Park Service to conserve, protect and manage a wide variety of unique natural, scenic, recreational and cultural resources. Included in the 354 units of the National Park System are a diversity of wetland types, ranging from the sawgrass marshes of the Florida Everglades to the tundra of Denali National Park in Alaska.

In Missouri, the National Park Service manages the Ozark National Scenic Riverways, which includes 134 miles of the Current and Jack Fork rivers. Within the Ozark National Scenic Riverways, natural wetland communities are quite common in the transitional areas between the terrestrial and aquatic systems along the riparian corridor of the rivers and their tributaries. They may be periodically or permanently covered by water from ponding, flooding, and groundwater sources characteristic of the karst terrain in this region. Wetland types include forested wetlands, marshes, fens and seeps.

The National Park Service manages the Land and Water Conservation Fund, which provides money for the acquisition and development of open spaces and other recreational facilities. In Missouri, local governments may apply to the Missouri Department of Natural Resources for use of these funds. The Emergency Wetlands Resources Act of 1986 amended the Land and Water Conservation Fund, requiring that each Statewide Comprehensive Outdoor Recreation Plan (SCORP) specifically address wetlands. In Missouri, the SCORP is prepared by the DNR and will be discussed further under the state activities heading.

United States Environmental Protection Agency

The EPA Office of Wetlands, Oceans and Watersheds, provides guidance, technical assistance, and financial support to state governments involved in the development of state wetlands protection programs. The financial support to state governments is provided through the State Wetland Protection Grant Program. Region VII of the EPA, which includes Missouri, is providing funding for the development of the Missouri State Wetland Conservation Plan.

Other program activities of the EPA include the funding of wetland research projects. Recent studies explored the alternative economic uses of wetlands, and threatened and endangered species inhabiting Missouri wetlands.

The EPA has also provided funding to the U.S. Fish and Wildlife Service for its National Wetland Inventory mapping efforts in Missouri.

The EPA supports advanced planning projects to inform the public of the locations and value of wetlands in specific areas.

The EPA sponsors and helps teach classes on the use of the Federal Manual for Identifying and Delineating Jurisdictional Wetlands. The EPA has also established a toll-free Wetlands Information Hotline (1-800-832-7828) to answer questions about wetland regulations and programs.

The agency is also working with various sectors of the private community, including schools and the agricultural sector, to increase public awareness about the importance of wetlands. In this regard, the EPA, upon request, lends videos, films, and slide shows, and distributes other information on wetlands to governmental agencies, private organizations, and individuals.

STATE AGENCY PROGRAMS AND ACTIVITIES, BY AGENCY

The Missouri Department of Conservation (MDC)

The Missouri Department of Conservation, in its role as the state's fish and wildlife agency, has developed a Wetland Management Plan to guide MDC's efforts in the restoration and management of wetlands in Missouri until the year 2000 (MDC, 1989). The wetland related activities of the Department of Conservation, Wildlife, Fisheries, Forestry, Planning, and Natural History divisions are coordinated through this plan. The key elements of the Wetland Management Plan are

1. The protection, restoration, and improvement of wetland habitat. MDC conducted an inventory of publicly-owned wetlands in Missouri to provide a base of information for this segment of the plan. The inventory identifies future wetland sites to be purchased, management strategies for existing public wetlands, and cooperative ventures with other agencies and private wetland owners to improve protection on these areas. MDC has initiated an expanded private wetlands program in cooperation with the U.S. Fish and Wildlife Service.

2. MDC is actively pursuing the acquisition of four new wetland areas, expansion of seven existing areas, and development of other publicly-owned wetland areas, all of which complement the North American Waterfowl Management Plan. Missouri is participating in two high priority joint ventures in the Lower Mississippi Valley and the Upper Mississippi River-Great Lakes regions.

3. MDC has identified population goals and management strategies for various waterfowl, wildlife, furbearer, and fish species. One of MDC's goals is to maintain and increase popu-

lations of threatened, endangered and rare wetlands species. MDC has an ongoing program for restoration of species extirpated or rare in Missouri such as the bald eagle and river otter.

4. MDC's Wetland Management Plan addresses human use of wetland resources, such as the establishment of waterfowl hunting seasons, education and interpretation programs, trapping programs, and other hunting and fishing opportunities.

5. The MDC Plan also identifies future research needs in the areas of 1) response of wetland habitats and wildlife to management and recreational use, 2) relationships between wildlife and habitats, and 3) population dynamics and life-history research.

Missouri Department of Natural Resources (DNR)

The Department of Natural Resources, Division of Parks, Recreation, and Historic Preservation is responsible for preserving, restoring, and managing a diversity of natural wetland ecosystems through the state park system. These include wetland areas featured at Big Lake and Van Meter State Parks, and old growth bottomland forests and wet prairies found at Big Oak Tree and Pershing State Parks. All are being managed to preserve Missouri's native biodiversity. Missourians may learn about these ecosystems along boardwalks, at trailhead kiosks, in visitor centers, and in naturalist programs statewide.

Also under the Division of Parks, Recreation, and Historic Preservation, the Department of Natural Resources is responsible for developing the Statewide Comprehensive Outdoor Recreation Plan (SCORP). A Missouri Wetlands Priority Plan was added to the 1985-1990 SCORP, as required by the Emergency Wetland Resource Act of 1986. This plan includes a wetland resource assessment, a description of protection strategies, and recommendations for future planning.

The Missouri Department of Natural Resources, Division of Geology and Land Survey, Water Resources Program is developing a State Wetlands Conservation Plan. This publication is the first part of the plan. This background information will be used to develop short- and long-term wetland goals as well as specific recommendations for achievement of the goals. In addition, the results of a statewide telephone survey are being used to guide the content and format of a public wetland education strategy.

Summary

The most significant federal program, in terms of the number of people affected in Missouri, is the "swampbuster provisions" of the 1985 Food Security Act, commonly referred to as the Farm Bill. Under this act, farmers who receive USDA benefits and who convert a wetland after December 23, 1985, may get those benefits reduced or eliminated.

Other agencies engaged in various wetland programs and activities include the Fish and Wildlife Service, Corps of Engineers, National Park Service, Environmental Protection Agency, Missouri Department of Conservation and Missouri Department of Natural Resources.

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APPENDICES

APPENDIX 1

MISSOURI WETLANDS ADVISORY COUNCIL

STATE REPRESENTATION:
Department of Conservation
Department of Agriculture
Department of Highway and Transportation
Department of Natural Resources
Department of Economic Development
Department of Health
Department of Public Safety

FEDERAL REPRESENTATION:
USDA Soil Conservation Service
USDA Agricultural Stabilization and Conservation Service
U.S. Fish and Wildlife Service
U.S. Army Corps of Engineers - Kansas City, St. Louis, Memphis Districts
U.S. Environmental Protection Agency
U.S. Forest Service
Federal Highway Administration
National Park Service

LEGISLATIVE REPRESENTATION:
Jerry T. Howard, State Senator, District 25
Nolan G. McNeill, State Representative, District 131

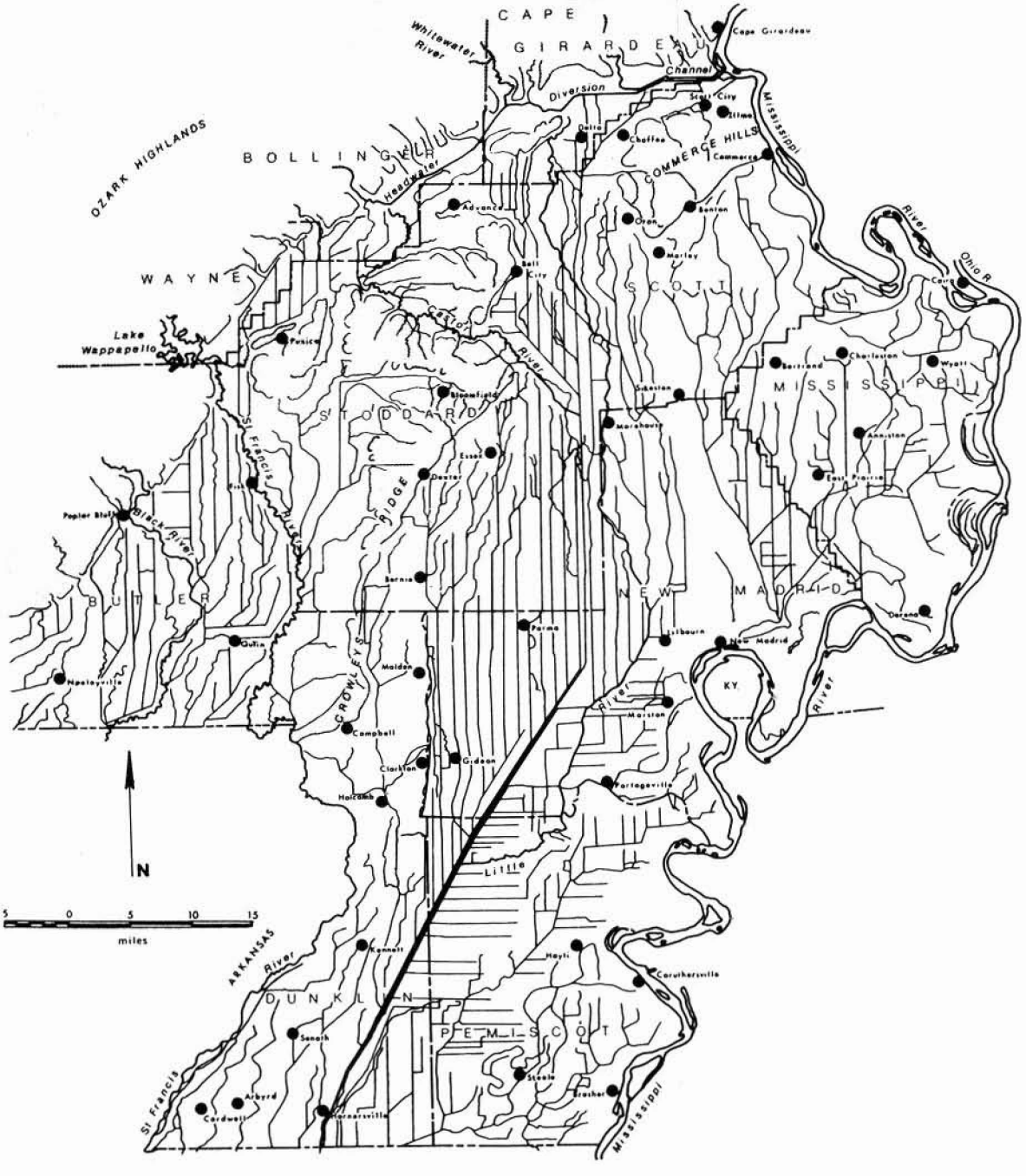
PUBLIC AND PRIVATE REPRESENTATION:
Private landowner and farmer
Missouri Farm Bureau Federation
Izaak Walton League of America
Home Builders Association
Associated Industries of Missouri
The Audubon Society
Delta Research Center
The Sierra Club
The Conservation Federation
Missouri Municipal League
Ducks Unlimited
Missouri Association of Counties
League of Women Voters
The Nature Conservancy
MO-AG Industries Council, Inc.
Coalition for the Environment
Water Pollution Control Committee
University of Missouri-Columbia, College of Agriculture
Soil and Water Conservation Society
Southeast Missouri Irrigators Association
Jeffrey L. Bruce and Company
American Society of Landscape Architects

APPENDIX 2

MISSOURI WETLAND ADVISORY COUNCIL COORDINATION PROCESS

APPENDIX 3

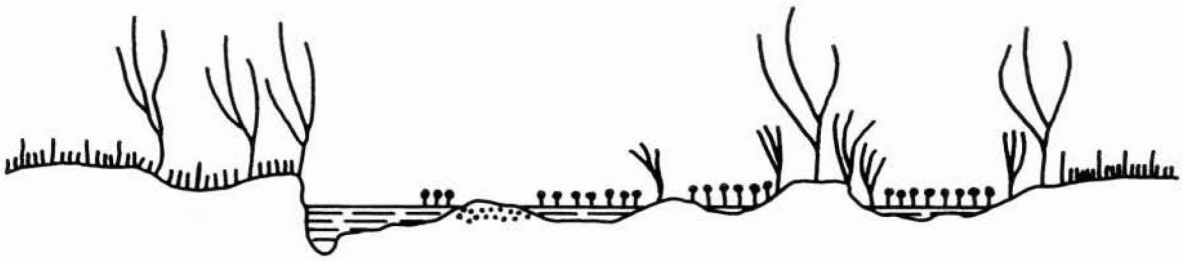
SOUTHEAST MISSOURI DRAINAGE
1974



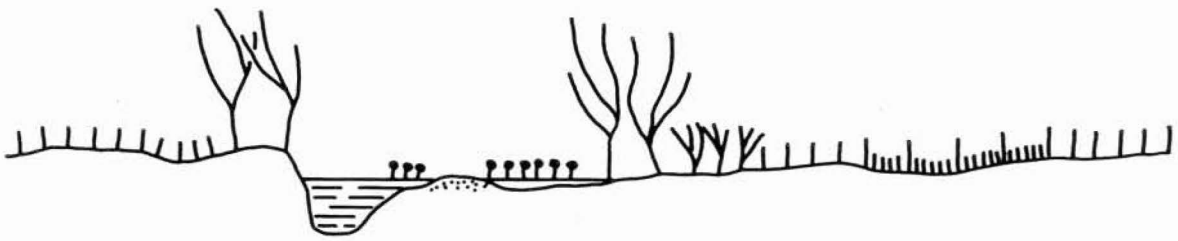
(Missouri Department of Natural Resources, 1986)

APPENDIX 4

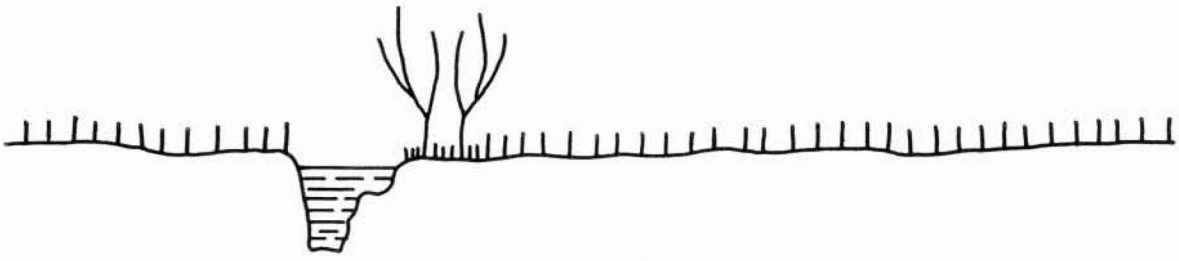
PROGRESSIVE EFFECTS OF THE MISSOURI RIVER BANK STABILIZATION AND NAVIGATION PROJECT



Without Bank Stabilization and Navigation Project

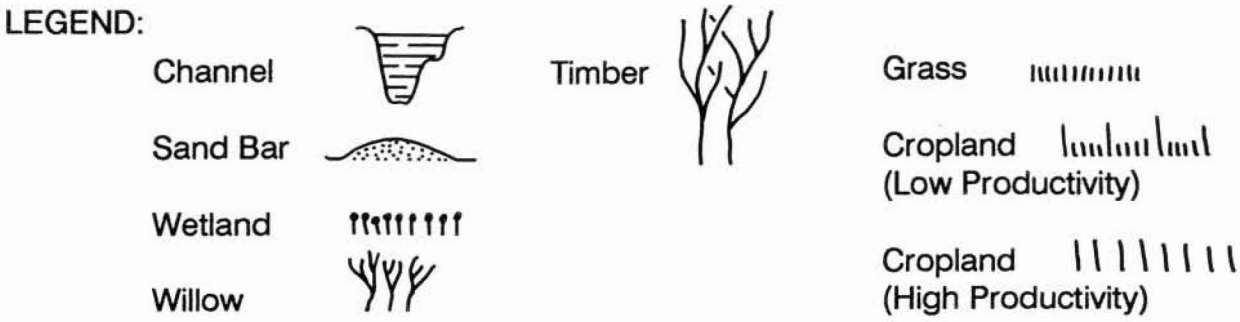


Midway through Construction of the Project



Ultimate Effect of the Project

LEGEND:



(Adapted from U.S. Army Corp of Engineers, 1981)

CROSS-REFERENCE OF CLASSIFICATION SYSTEMS

Missouri Wetland Types	F&WS Circular 39	SCS Food Security Act*	Missouri Natural Terrestrial Communities	Cowardin et al.
1. Swamp	Type 7, Wooded Swamp	Wetland (Wetland Wooded or Wetland Forested)	Swamp Ponded swamp	Palustrine Forested Wetland
2. Shrub Swamp	Type 6, Shrub Swamp	Wetland (Wetland Shrub)	Shrub swamp Pond Shrub Swamp	Palustrine Scrub-shrub Wetland
3. Forested Wetland	Type 7, Wooded Swamp	Wetland (Wetland Wooded or Wetland Forested)	Mesic bottomland forest (in part) Wet mesic bottomland forest Wet bottomland forest Flatwoods (in part) Wet-mesic savanna	Palustrine Forested Wetland
4. Marsh	Type 3, Inland Shallow Fresh Marsh and Type 4, Inland Deep Fresh Marsh	Wetland	Fresh water marsh Saline marsh Pond marsh	Palustrine Emergent Wetland Lacustrine Emergent Wetland Rivertine Emergent Wetland
5. Wet Meadow	Type 2, Inland Fresh Meadow	Wetland Wetland Pasture	Wet-mesic prairie Wet prairie	Palustrine Emergent Marsh
6. Fens and Seeps	N/A	Wetland	Fen Deep muck fen Prairie fen Forested fen Seep Acid seep Forested acid seep Saline seep	Palustrine Emergent Marsh

*Subdivisions in parenthesis

Missouri Wetland Types	F&WS Circular 39	SCS Food Security Act*	Missouri Natural Terrestrial Communities	Cowardin et al.
7. Natural Ponds and Lakes	Type 5, Inland Open Fresh Water	Wetland (Wetland Open Water) (Wetland Emergent)	N/A	Palustrine Open Water Wetland Palustrine Unconsolidated Bottom Wetland Palustrine Aquatic Bed Wetland Lacustrine Littoral Wetland
8. Streams	N/A	Wetland (open water)	Sand bar Gravel wash	Riverine Upper Perennial (Aquatic Bed, Unconsolidated Bottom, Emergent or rock bottom) Riverine Lower Perennial (Unconsolidated bottom, Emergent or rock bottom) Riverine Intermittent Stream Bed (Semi Permanent and Seasonal)

*Subdivisions in parenthesis

APPENDIX 6

SOME COMMON TERMS USED TO DESCRIBE THE STATUS OF A WETLAND

ALTERED - Wetland alteration is the act of transforming an area that was previously a wetland, or is presently a degraded wetland, into another wetland classification type and/or modified function.

CONSTRUCTED - Wetlands created for the purpose of treating wastewater.

CONVERTED - Wetland conversion is the act of transforming a wetland into another land use, such that the wetland is no longer present.

CREATED - Wetland creation is the intentional act of bringing a wetland into existence where one had not previously occurred. Creation techniques vary but usually entail excavation or the construction of berms, levees and water control structures which establish wetland hydrology. Once the hydrology has been introduced, wetland plants may grow naturally, or it may be necessary to transplant desired vegetation from other established wetlands. Even when wetland vegetation is established, it will take an indeterminate amount of time for hydric soils to develop. Thus, created wetlands, also called artificial wetlands, may not meet the criteria for a true wetland for years after its creation. These artificial wetlands may function to provide moist soil management, waterfowl and wildlife habitat, and sediment traps.

DISTURBED - Disturbed wetlands are former wetlands which have lost all or significant proportions of their natural wetland plant communities, but are still wet enough to function, or are caused to function as wetlands. Some examples of land use practices which may cause wetland disturbance are overgrazing in wetlands, clearing of wetland vegetation to produce grain crops, harvesting of forested wetlands along streams and rivers, real-estate development, and artificial flooding for green-tree reservoirs.

DEGRADED - Wetland degradation results from any development or naturally occurring condition which results in a decrease in the acreage and/or function of a wetland site or complex.

DEVELOPED - Wetland development constitutes any man-made change including, but not limited to, the construction of buildings or other structures, mining, dredging, filling, grading, paving, excavation, or drilling operations. Development results in wetland degradation or conversion.

ENHANCED - Wetland enhancement is the act of increasing the acreage and/or function of a degraded wetland, within the same wetland classification type.

INCIDENTAL - Incidental wetlands are those that are unintentionally formed as a result of human activity and often in locations which did not previously support wetlands. Depending on site specific conditions, vegetation may be typical of any of the natural wetland categories. Incidental wetlands are commonly associated with farm ponds, drainage ditches, man-made lakes, gravel and clay pits, abandoned quarries and mines, storm-water drainage systems, and highway or road construction.

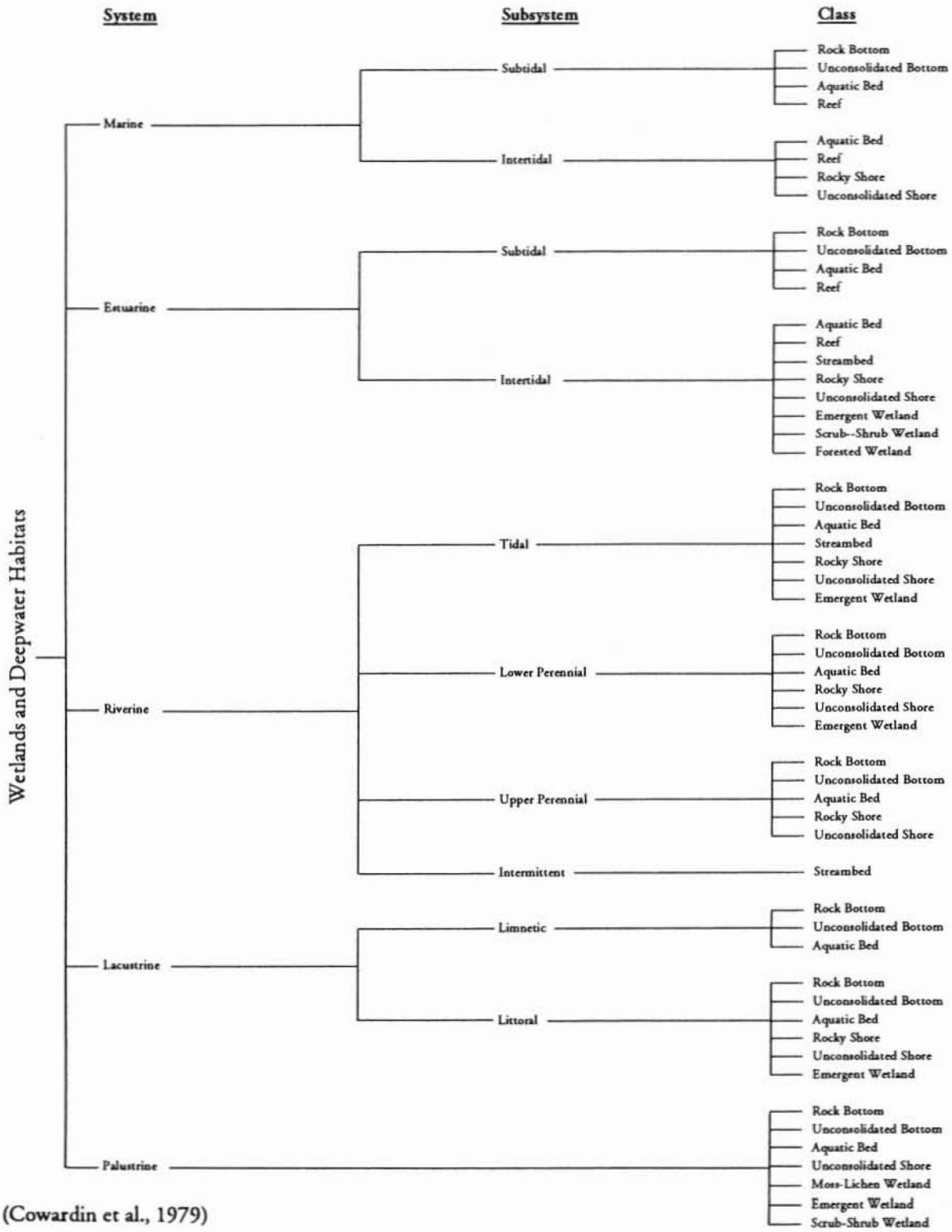
MANAGED - Managed wetlands are those in which the hydrology and or vegetation are actively manipulated to meet specific objectives.

PRESERVED - Wetland preservation is the maintenance of an area to meet the specific objective of securing the wetland site or complex for its inherent values. Wetland preservation is the active or passive perpetuation of a wetland's ecological functions and values.

RESTORED - Wetland restoration is the act of returning an area that was previously a wetland, or is presently a degraded wetland, back to a condition of equal or greater acreage and/or function within the same wetland classification type. In many cases, reestablishing the hydrology is sufficient to reactivate the seedbed that lies dormant in the wetland soil. For example, restoration of a drained wetland may be as simple as removing the drainage tiles or plugging up the drainage ditch that kept the water off the area.

APPENDIX 7

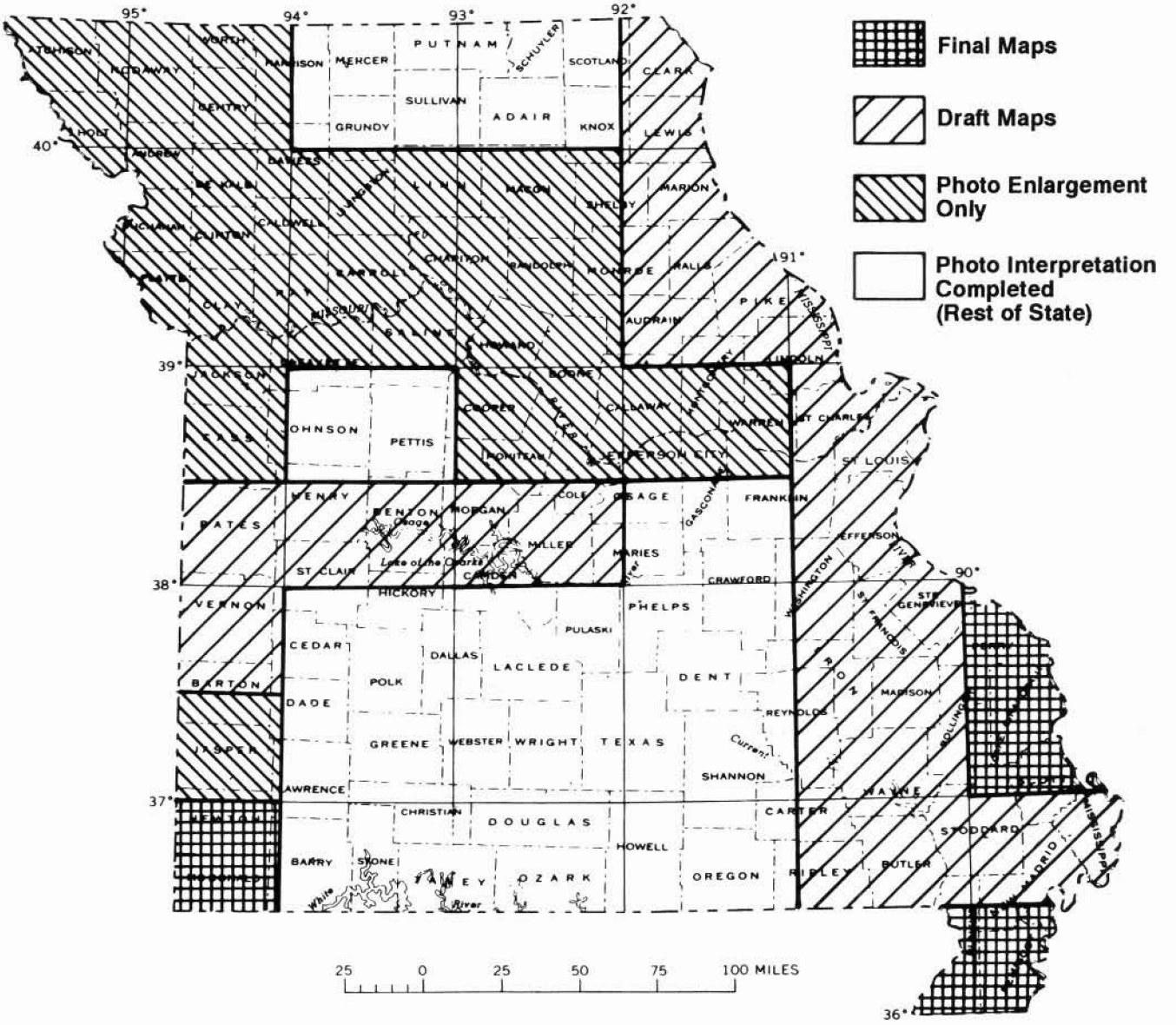
CLASSIFICATION HIERARCHY OF WETLANDS AND DEEPWATER HABITATS



(Cowardin et al., 1979)

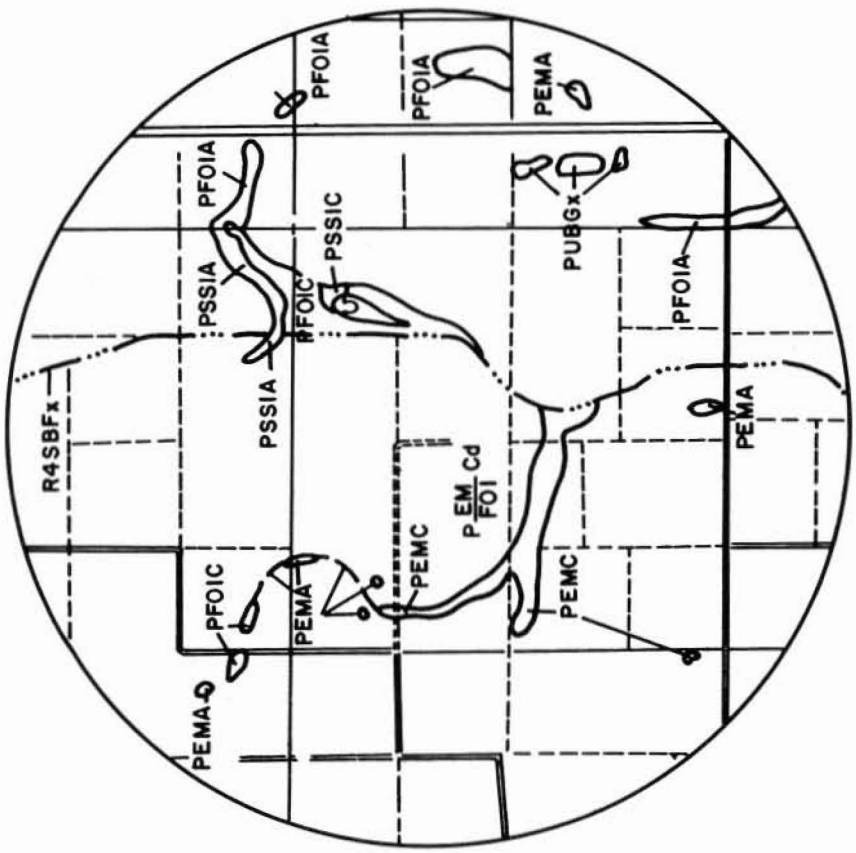
STATUS OF THE NATIONAL WETLANDS INVENTORY IN MISSOURI

AS OF APRIL 9, 1992



(Data Source: Ron Erickson, Regional Wetlands Coordinator, National Wetlands Inventory, U.S. Fish and Wildlife Service, Bloomington, MN)

EXAMPLE OF A NATIONAL WETLAND INVENTORY MAP[1]



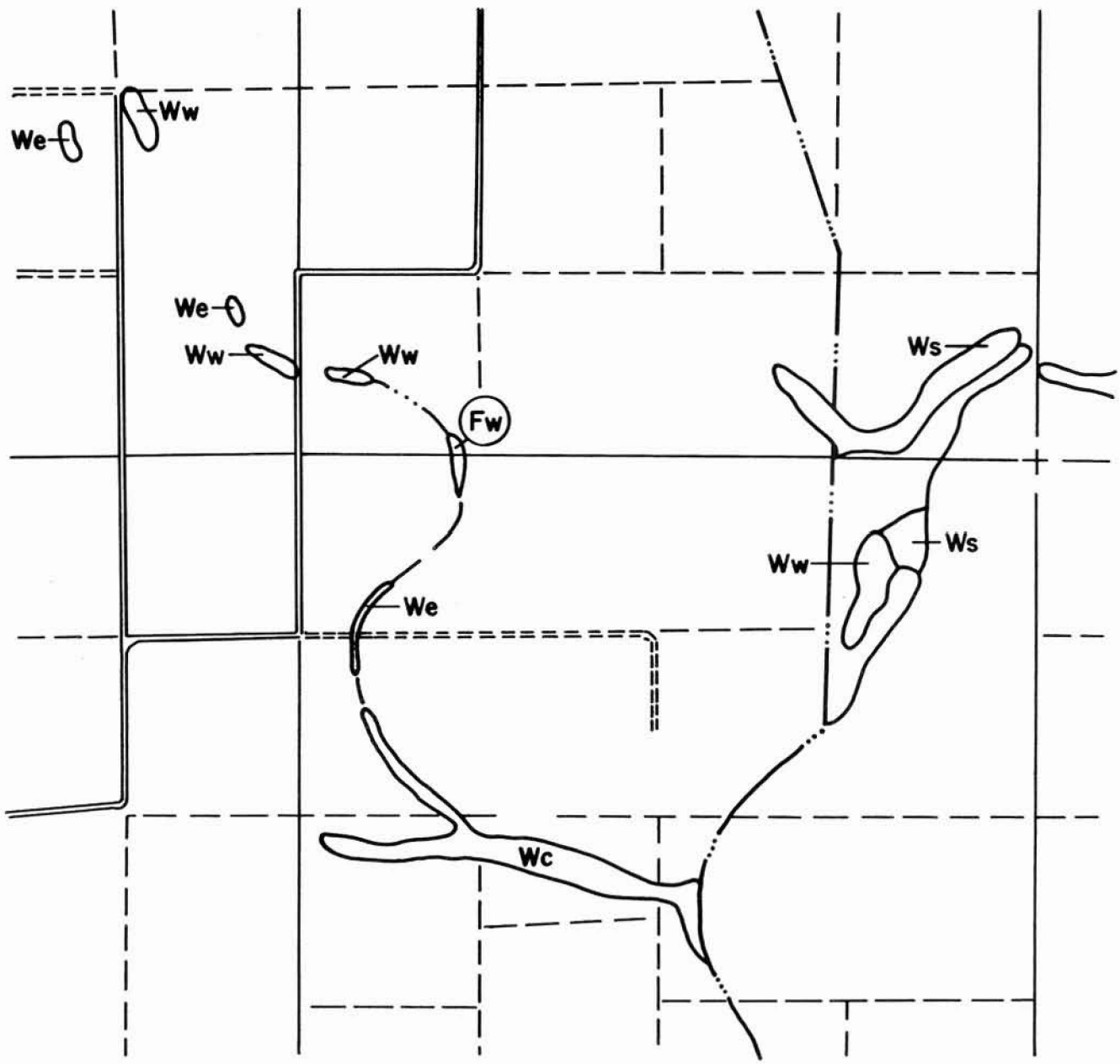
SYSTEM: P-PALUSTRINE

CLASS	Subclass													
RB-ROCK BOTTOM	1 Bedrock 2 Rubble	UB-UNCONSOLIDATED BOTTOM	1 Cobble-Gravel 2 Sand 3 Mud 4 Organic	AB-AQUATIC BED	1 Algal 2 Aquatic Moss 3 Rooted Vascular 4 Floating Vascular 5 *Unknown Submergent* 6 *Unknown Surface*	US-UNCONSOLIDATED SHORE	1 Cobble-Gravel 2 Sand 3 Mud 4 Organic 5 Vegetated	ML-MOSS-LICHEN	1 Moss 2 Lichen	EM-EMERGENT	1 Persistent 2 Nonpersistent	SS-SCRUB-SHRUB	1 Broad-Leaved Deciduous 2 Needle-Leaved Deciduous 3 Broad-Leaved Evergreen 4 Needle-Leaved Evergreen 5 Dead 6 *Deciduous* 7 *Evergreen*	FO-FORESTED	1 Broad-Leaved Deciduous 2 Needle-Leaved Deciduous 3 Broad-Leaved Evergreen 4 Needle-Leaved Evergreen 5 Dead 6 *Deciduous* 7 *Evergreen*	OW-OPEN WATER *Unknown Bottom*

[1]Appendices 9 and 10 depict the same area.

APPENDIX 10

EXAMPLE OF A USDA WETLANDS INVENTORY MAP[1]

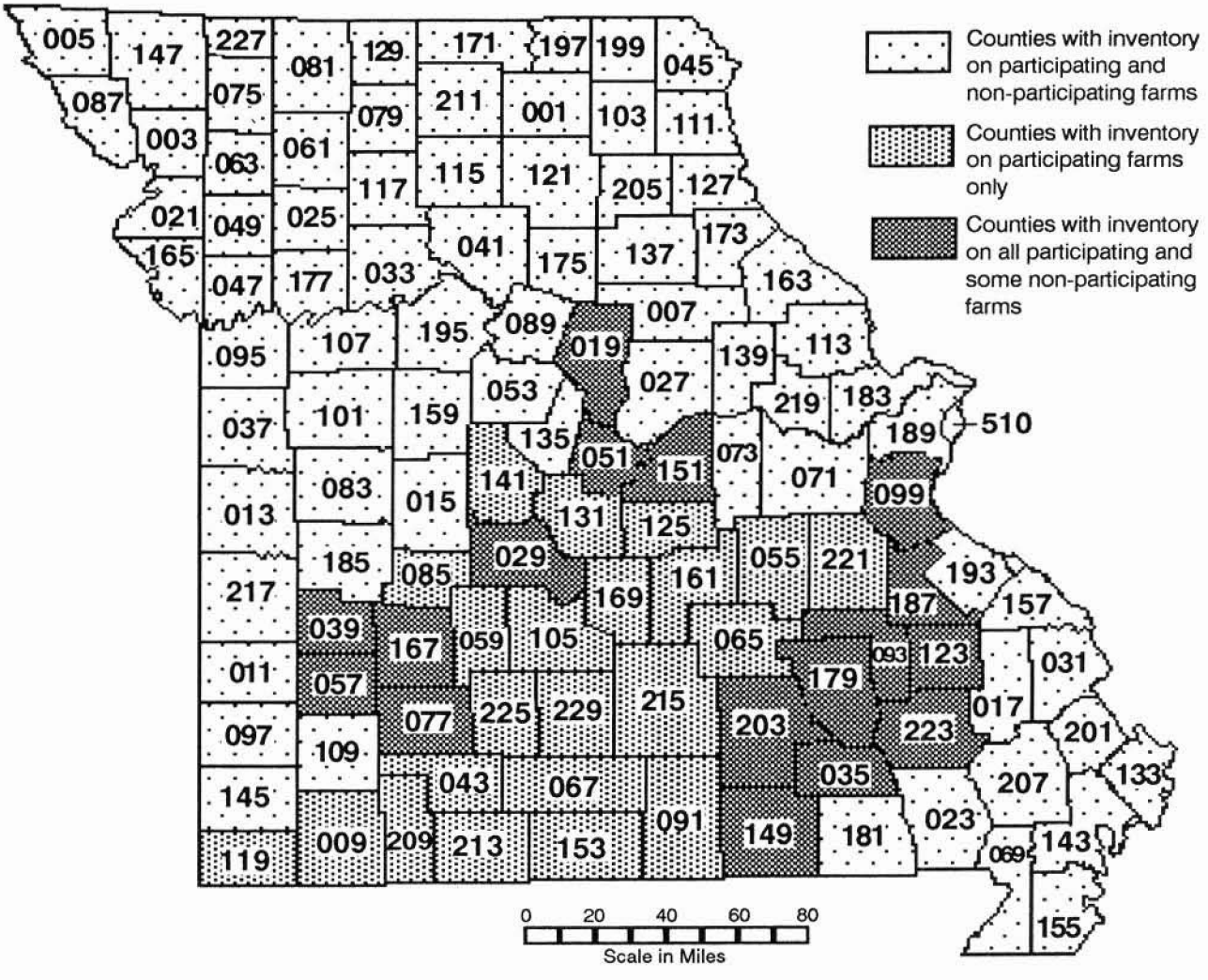


[1]Appendices 9 and 10 depict the same area.

APPENDIX 11

STATUS OF THE USDA WETLAND INVENTORY IN MISSOURI

AS OF JANUARY 1, 1992[1]



[1]See Appendix 14 for correlation of county numbers with county names.

APPENDIX 12

COUNTY ASCS OFFICE LOCATIONS IN MISSOURI
AS OF JULY 1992

County Name	Address	Phone
Adair	P.O. Box E Kirksville, MO 63501	(816)665-3274
Andrew	105 Hwy. 71 W. Savannah, MO 64485	(816)324-3196
Atchison	P.O. Box 128 Rock Port, MO 64482	(816)744-5328
Audrain	Highway 54 East Mexico, MO 65265	(314)581-1406
Barry	P.O. Box 397 Old Cassville, MO 65625	(417)847-2862
Barton	Box 47 Lamar, MO 64759	(417)682-3571
Bates	611 W. Mill Butler, MO 64730	(816)679-6112
Benton	Rt. 1, Box 338D Lincoln, MO 65338	(816)547-2351
Bollinger	P.O. Box 26 Marble Hill, MO 63764	(314)238-2671
Boone	1206 Bus Loop 70 W. Columbia, MO 65202	(314)443-8701
Buchanan	P.O. Box 8399 St. Joseph, MO 64508	(816)364-3927
Butler	313 South Broadway Poplar Bluff, MO 63901	(314)785-8416

COUNTY ASCS OFFICE LOCATIONS IN MISSOURI AS OF JULY 1992

Caldwell	Box 38 Kingston, MO 64650	(816)586-2711
Callaway	1201A South Highway 54 Fulton, MO 65251	(314)642-5557
Cape Girardeau	P.O. Box 69 Jackson, MO 63755	(314)243-1467
Carroll	RR 1 Box 211A Carrollton, MO 64633	(816)542-2681
Carter	Box 594 Van Buren, MO 63965	(314)663-7314
Cass	1300 A Locust Harrisonville, MO 64701	(816)884-4432
Cedar	Box J Stockton, MO 65785	(417)276-4712
Chariton	Bentley Bldg., Hwy. 24 Keytesville, MO 65261	(816)288-3729
Christian	429 East South St. Ozark, MO 65721	(417)485-2718
Clark	Route 1, Box 16A Kahoka, MO 63445	(816)727-3364
Clay	218 W. Mill St. Liberty, MO 64068	(816)781-5566
Clinton	Box 277 Plattsburg, MO 64477	(816)539-2136
Cole	206 Metro Jefferson City, MO 65101	(314)893-5196
Cooper	Rt. 1, Box 367 Boonville, MO 65233	(816)882-5647

COUNTY ASCS OFFICE LOCATIONS IN MISSOURI AS OF JULY 1992

Crawford	P.O. Box 280 Hwy. 8 East Steelville, MO 65565	(314)775-2312
Dade	P.O. Box 47 Greenfield, MO 65661	(417)637-5991
Dallas	Route 3, Box 80 Buffalo, MO 65622	(417)345-7721
Daviess	Hwy. 6 West Gallatin, MO 64640	(816)663-3703
Dekalb County	Box 338 Maysville, MO 64469	(816)449-2112
Dent	P.O. Box 39 Salem, MO 65560	(314)729-3512
Douglas	P.O. Box 488 Ava, MO 65608	(417)683-4212
Dunklin	Box 69 239 North Main Kennett, MO 63857	(314)888-2536
Franklin	409 E. State St. Suite 1 Union, MO 63084	(314)583-2303
Gasconade	316 Hwy. 19 South Owensville, MO 65066	(314)437-4131
Gentry	Box 190 Albany, MO 64402	(816)726-5525
Greene	3003 E Chestnut Expressway Springfield, MO 65802	(417)831-5246
Grundy	Box 49 1716 Lincoln St. Trenton, MO 64683	(816)359-2006

COUNTY ASCS OFFICE LOCATIONS IN MISSOURI AS OF JULY 1992

Harrison	100A Outer Road Bethany, MO 64424	(816)425-7635
Henry	303 C South Vansant Clinton, MO 64736	(816)885-5567
Hickory	Box 167 Hermitage, MO 65668	(417)745-6496
Holt	512 State Street Box 196 Mound City, MO 64470	(816)442-3134
Howard	Rt. 2, Box 61A Fayette, MO 65248	(816)248-3384
Howell	111 Walnut West Plains, MO 65775	(417)256-7117
Iron	P.O. Box 457 Pilot Knob, MO 63663	(314)546-7305
Jackson	1972 Copper Oaks Circle Blue Springs, MO 64015	(816)229-5113
Jasper	P.O. Box 734 Carthage, MO 64836	(417)358-8198
Jefferson	P.O. Box 67 Hillsboro, MO 63050	(314)789-2441
Johnson	P.O. Box 517 Warrensburg, MO 64093	(816)747-8400
Knox	R.R. 1, Box 64 Edina, MO 63537	(816)397-2222
Laclede	Box 209 Lebanon, MO 65536	(417)532-5741
Lafayette	P.O. Box 491 Higginsville, MO 64037	(816)584-7486

COUNTY ASCS OFFICE LOCATIONS IN MISSOURI AS OF JULY 1992

Lawrence	P.O. Box 417 Mount Vernon, MO 65712	(417)466-7107
Lewis	Box 98 Monticello, MO 63457	(314)767-5275
Lincoln	750 East Cherry Street Troy, MO 63379	(314)528-4113
Linn	Route 3, Box 229D, Pershing Road Brookfield, MO 64628	(816)258-7265
Livingston	708 South Washington Chillicothe, MO 64601	(816)646-6220
McDonald	P.O. Box L Anderson, MO 64831	(417)845-3514
Macon	Box 365 Macon, MO 63552	(816)385-2616
Madison	285 Jennifer Fredericktown, MO 63645	(314)783-3692
Maries	Box 205 Vienna, MO 65582	(314)897-2138
Marion	Box 391 Palmyra, MO 63461	(314)769-2235
Mercer	Box 287 Princeton, MO 64673	(816)748-4385
Miller	P.O. Box 10 Tuscumbia, MO 65082	(314)369-2324
Mississippi	P.O. Box 248 Charlestown, MO 63834	(314)683-6096
Moniteau	Hwy. 50 West California, MO 65018	(314)796-4691

COUNTY ASCS OFFICE LOCATIONS IN MISSOURI AS OF JULY 1992

Monroe	Route 2, Box 87A Paris, MO 65275	(816)327-4137
Montgomery	1013 South Sturgeon Montgomery City, MO 63361	(314)564-2262
Morgan	Box B 100 S. Burke Versailles, MO 65084	(314)378-4589
New Madrid	495 A, Hwy. 61 New Madrid, MO 63869	(314)748-2557
Newton	R.R. 6, Box 28A Neosho, MO 64850	(417)451-1007
Nodaway	Route 3, Box 16D Maryville, MO 64468	(816)582-7423
Oregon	Box 8 Alton, MO 65606	(417)778-7561
Osage	1016 A Main St., P.O. Box 50 Linn, MO 65051	(314)897-2138
Ozark	Box 501 Gainesville, MO 65655	(417)683-4212
Pemiscot	900 Truman Blvd. Caruthersville, MO 63830	(314)333-1923
Perry	Route 2, Box 8D Perryville, MO 63775	(314)547-2571
Pettis	319 S. Lamine Sedalia, MO 65301	(816)826-3339
Phelps	P.O. Box 608 Rolla, MO 65401	(314)364-2088
Pike	Route 3, Box 28 Bowling Green, MO 63334	(314)324-3313

COUNTY ASCS OFFICE LOCATIONS IN MISSOURI AS OF JULY 1992

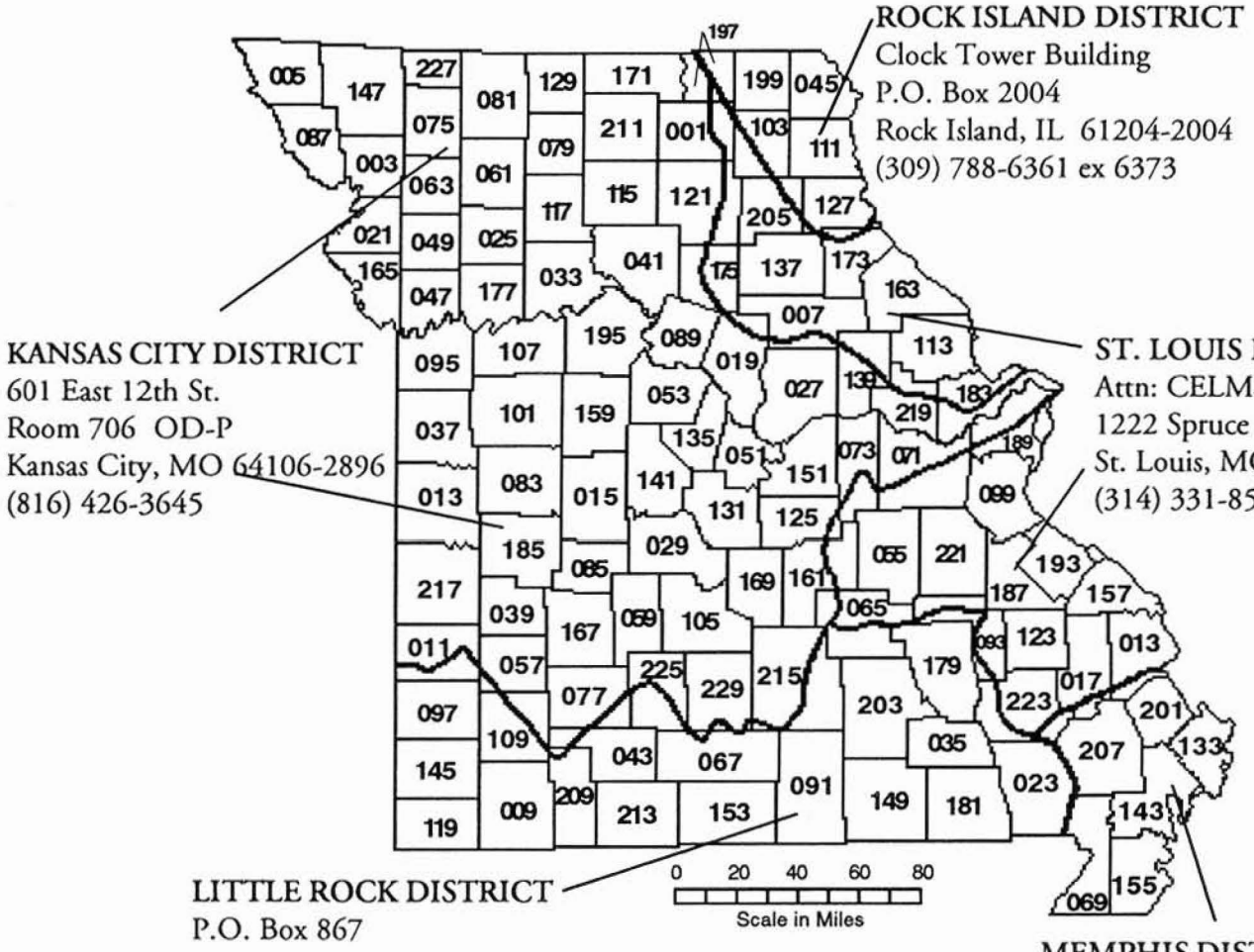
Platte	Box 1220 Platte City, MO 64079	(816)431-2101
Polk	1303 East Broadway Bolivar, MO 65613	(417)326-4823
Pulaski	106 S. Bates Waynesville, MO 65583	(314)369-2324
Putnam	P.O. Box 405 Unionville, MO 63565	(816)947-2439
Ralls	P.O. Box 510 New London, MO 63459	(314)985-8611
Randolph	2051 N. Morely Moberly, MO 65270	(816)263-1169
Ray	Box 159 Richmond, MO 64085	(816)776-5861
Reynolds	P.O. Box 129 Ellington, MO 63638	(314)663-7314
Ripley	209 Lafayette St. Doniphan, MO 63935	(314)996-3723
St. Charles	1 Westbury South Bldg. D St. Charles, MO 63301	(314)724-1264
St. Clair	R.R. 2, Box 1B Osceola, MO 64776	(417)646-8107
St. Francois	1109 Ste. Genevieve Avenue Farmington, MO 63640	(314)756-6488
St. Louis	234 Old Meramec Station Manchester, MO 63021	(314)394-5051
St. Genevieve	Rt. l, Box 1203 St. Genevieve, MO 63670	(314)883-2703

Saline	Box 518 Marshall, MO 65340	(816)886-7447
Schuyler	Monroe and Green, P.O. Box 249 Lancaster, MO 63548	(816)457-3715
Scotland	P.O. Box 336 Memphis, MO 63555	(816)465-8517
Scott	P.O. Box 248 Benton, MO 63736	(314)545-3593
Shannon	Box 157 Eminence, MO 65466	(314)226-3241
Shelby	Third St., Box 249 Shelbyville, MO 63469	(314)633-2440
Stoddard	P.O. Box 9 Bloomfield, MO 63825	(314)568-4512
Stone	P.O. Box 315 Galena, MO 65656	(417)357-6724
Sullivan	Route 1, Box 5A Milan, MO 63556	(816)265-3440
Taney	Route 1, Box 1405 Forsyth, MO 65653	(417)546-4742
Texas	P.O. Box 1 Hartville, MO 65667	(417)741-6195
Vernon	P.O. Box 268 Nevada, MO 64772	(417)667-8137
Warren	801 E. Old Hwy. 40 Warrenton, MO 63383	(314)456-3433
Washington	P.O. Box 267 Potosi, MO 63664	(314)789-2441

Wayne	P.O. Box 217 Greenville, MO 63944	(314)224-3410
Webster	Federal Bldg. Marshfield, MO 65706	(417)468-2088
Worth	Box 189 Grant City, MO 64456	(816)564-3614
Wright	Box 1 Hartville, MO 65667	(417)741-6194

APPENDIX 13

U.S. ARMY CORPS OF ENGINEER
DISTRICT REGULATORY BOUNDARIES AND OFFICES IN MISSOURI[1]



ROCK ISLAND DISTRICT
Clock Tower Building
P.O. Box 2004
Rock Island, IL 61204-2004
(309) 788-6361 ex 6373

KANSAS CITY DISTRICT
601 East 12th St.
Room 706 OD-P
Kansas City, MO 64106-2896
(816) 426-3645

ST. LOUIS DISTRICT
Attn: CELMS-RD
1222 Spruce St.
St. Louis, MO 63103-283
(314) 331-8575

LITTLE ROCK DISTRICT
P.O. Box 867
Little Rock, AR 72203
(501) 324-5295

MEMPHIS DISTRICT
C. Davis Fed. Bldg., B-202
167 N. Mid America Mall
Memphis, TN 38103-1894
(901) 544-3471

[1]See Appendix 14 for correlation of county numbers with county names.

APPENDIX 14

FEDERAL INFORMATION PROCESSING SYSTEM (FIPS) CODES FOR MISSOURI COUNTIES

Missouri's state code number--29

APPENDIX 15

USDA PROGRAMS EFFECTED BY 1985 FOOD SECURITY ACT AND ITS 1990 AMENDMENT

Non compliance with the 1985 Food Security Act and its 1990 amendment, the Food, Agriculture, Conservation and Trade Act, will result in the reduction or elimination of benefits received from the following USDA programs. These programs are listed in the catalog of Federal Domestic Assistance. Specific details on these programs are available from the administering agency.

1985 Food Security Act.

	Program	Administrating Agency
(1)	Federal Crop Insurance	FCIC
(2)	Conservation Reserve Program	ASCS
(3)	Commodity Loans and Purchases	ASCS
(4)	Cotton Production Stabilization	ASCS
(5)	Feed Grain Production Stabilization	ASCS
(6)	Storage Facilities Equipment Loans	ASCS
(7)	Wheat Production Stabilization	ASCS
(8)	National Wool Act Payment	ASCS
(9)	Beekeeper Indemnity Payments	ASCS
(10)	Rice Production Stabilization	ASCS
(11)	Soil and Water Loans	FmHA
(12)	Farm Operating Loans	FmHA
(13)	Farm Ownership Loans	FmHA
(14)	Emergency Loans	FmHA
(15)	Loans to Indian Tribes and Tribal Corporation	FmHA

1990 Food, Agriculture, Conservation and Trade Act.

All programs under the 1985 Act were retained and the nine programs listed below were added.

(16)	Watershed Protection and Flood Prevention Loans and Cost Share Payments	SCS
(17)	Great Plains Conservation Program cost-share payments	SCS
(18)	Emergency Conservation Program	ASCS
(19)	Agricultural Conservation Program cost-share payments	ASCS
(20)	Disaster Assistance Payments	ASCS
(21)	Agricultural Credits Act payments	ASCS
(22)	Agricultural Water Quality Incentives Program payments	ASCS
(23)	Environmental Easement Program payments	ASCS
(24)	Payments for storage of agricultural commodity acquired by the Commodity Credit Corporation under the Commodity	ASCS

GLOSSARY

GLOSSARY

ANAEROBIC: A condition in which molecular oxygen is absent from the environment.

ALLUVIAL: Derived from water borne sediment.

ALLUVIUM: Stream deposited sediment.

AQUIFER: A body of rock or soil that is sufficiently porous and permeable to be useful as a source of water.

BASE FLOW: The baseflow component of a stream represents the withdrawl of groundwater from storage. Baseflow typically occurs during low rainfall or drought conditions.

BIODIVERSITY: Abundance in number of species in a given location.

CLEAR-CUTTING: A method of harvesting timber in which all trees are removed from a given area of forest.

DETRITUS: Fresh to partly decomposed plant and animal material.

DIKE: A structure constructed perpendicular to a shoreline.

DOMINANT SPECIES: A plant species that exerts a controlling influence on or defines the character of a community.

DORMANT SEASON: That time of the year when plants are in a state of cessation of growth and suspended biological activity during which life is maintained.

DURATION (INUNDATION/SOIL SATURATION): The length of time during which water stands at or above the soil surface (inundation) or during which the soil is saturated.

ECOSYSTEM: A system made up of a group of living organisms and its physical environment, and the relationships between them.

EMERGENT VEGETATION: A rooted herbaceous plant species that has parts extending above a water surface.

ENDANGERED: Survival is in immediate jeopardy.

ENHANCED: Wetland enhancement is the act of increasing the acreage and/or function of a degraded wetland, within the same wetland classification type.

EVAPOTRANSPIRATION: The total water loss from soil by direct evaporation and plant surfaces that give off moisture. See transpiration.

EXTIRPATED: Formerly occurred as a regularly breeding species, but no longer reproduces in Missouri.

FEN: A type of wetland found in Missouri whose primary source of soil saturation is alkaline groundwater.

FOOD CHAIN: A succession of organisms in a community that constitute a feeding chain in which food nutrients and energy is transferred from one organism to another as each consumes

a lower member and, in turn, is preyed upon a higher member.

FLOODED: A condition in which the soil surface is temporarily covered with flowing water from any source, such as streams overflowing their banks or runoff from adjacent or surrounding slopes.

FLOOD-PLAIN: The area influenced by over bank flow from an adjacent river or stream.

FRESHWATER WETLAND: Wetlands formed and influenced by freshwater, e.g. non saline.

GEOMORPHIC: Surface land form.

GROUNDWATER: That portion of the water below the ground surface whose pressure is greater than atmospheric.

GROWING SEASON: The time of the year when plants increase in size and quantity by natural development through the assimilation of nutrients.

HABITAT: The immediate environment in which an organism lives; it includes such components as cover, food, shelter, water and breeding sites.

HERBACEOUS: Non-woody vegetation.

HYDRIC SOIL: A soil which is saturated, flooded or ponded long enough during the growing season to develop anaerobic conditions in the upper part.

HYDROLOGY: That discipline of science which deals with the properties, distribution and circulation of water.

HYDROPHYTE: Any plant growing in a soil or substrate that is at least periodically deficient in oxygen as a result of excessive water content.

HYDROPHYTIC VEGETATION: Plants that grow in water, soil, or on a substrate that is at least periodically deficient in oxygen as a result of excessive water content.

INCIDENTAL: Refer to Appendix 6.

INUNDATION: A condition in which water temporarily or permanently covers the land surface.

KARST: An area underlain by carbonate rock and characterized by solution features such as caves, sinkholes and underground streams.

MACROPHYTES: Any plant species that can be readily observed without the aid of optical magnification.

MANAGED: Refer to Appendix 6.

MUCK: Highly decomposed organic material in which the original plant parts are not recognizable.

NON-WETLAND: Any area that has a sufficiently dry condition that hydrophytic vegetation, hydric soils, or wetland hydrology are lacking.

NON-POINT SOURCE POLLUTION: Pollution caused by diffuse sources including but not limited to agricultural, silvicultural, urban runoff, and runoff from construction activities.

PEAT: Unconsolidated material consisting of undecomposed and slightly decomposed organic matter under conditions of excessive moisture.

PHOTOSYNTHESIS: The process occurring in green plants by which solar energy is used to convert carbon dioxide and water into sugar.

POINT-SOURCE POLLUTION: Pollution caused by a discernable, confined, discrete source including but not limited to any pipe, ditch, channel, tunnel, conduit, concentrated animal

feeding operation, or floating man-made craft from which pollutants may be discharged.

PONDED: A condition in which nonflowing water covers the soil surface; water is removed only by percolation, evaporation or transpiration.

PRESERVED: Refer to Appendix 6.

RARE: Present in small numbers. If environment worsens, status could deteriorate to Endangered.

RESTORED: Refer to Appendix 6.

REVETMENT: A blanket of rock or other material placed on a shoreline.

RIPARIAN: The area adjacent to a stream or river that is at least periodically influenced by flooding.

RIP-RAP: Angular stone used to armor a stream-bank or lake shore.

RUN-OFF: The water that flows over the land surface after rainfall and eventually flows into a stream, lake, or other body of water.

SATURATED: The zone of soil and rock in which pore spaces are completely filled with water.

SAVANNA: A natural terrestrial community composed of grassland interspersed with trees.

SEEP: A type of wetland found in Missouri whose primary source of soil saturation is neutral, acidic, or saline groundwater.

STAGING AREA: A traditional use-area for migratory birds, necessary for the completion of migration.

SUBSTRATE: Nonsoil; the bottom surface on which plants grow.

TRANSPIRATION: The process in plants by which water is released into the gaseous environment (atmosphere).

TYPICALLY ADAPTED: A term that refers to a species being suited to a given set of environmental conditions due to some feature of its morphology, physiology, or reproduction.

UNDERSTORY: Low growth (as of herbs and shrubs) on the floor of a forest.

WATERSHED: The total area drained by or contributing water to a stream, lake, or other body of water; may range from a few square miles, in case of a small stream, to thousands of square miles in the case of the Mississippi River.

WOODY VEGETATION: A seed plant that develops persistent, hard, fibrous tissues, e.g. trees and shrubs.