# Arkansas
## Wetland Resources

Wetlands occupy about 8 percent of the land surface in Arkansas (Dahl, 1990) and are an important but threatened resource. Historically, wetlands occupied a much larger area of the State and greatly influenced early economic development. At the time the first Europeans settled in the area, wetlands occupied about 28 percent of what is now Arkansas. These wetlands consisted largely of vast bottom-land forests and swamps bordering the Mississippi River and other rivers and streams. The forested wetlands contained abundant bottom-land trees such as cypress, tupelo gum, sycamore, birch, cottonwood, and several species of oak that provided a source of timber for domestic and economic development. As the forests were cleared and the wetlands were drained, the fertile bottom land was opened up to agriculture, which eventually became the mainstay of the local economy. The loss of wetlands to agriculture and urbanization and the associated loss of wildlife habitat have slowed but continue to be a major concern (Arkansas Department of Pollution Control and Ecology, 1992).

Wetlands provide critical habitat for many important plants and animals in Arkansas. Seven endangered species and three threatened species of plants and animals inhabit wetlands in the State (Curtis James, U.S. Fish and Wildlife Service, written commun., 1993). Some of the endangered or threatened species of animals and plants in Arkansas that rely on wetlands sometime during their lives include the bald eagle, the red-cockaded woodpecker, the grey bat, the pink mucket pearly mussel, the fat pocketbook pearly mussel, and the pondberry.

Arkansas bottom-land forested wetlands provide important habitats for many species of fish. Seasonal flooding of river flood plains provides access to new or expanded food supplies during periods of increased energy needs of fish at critical stages in their reproductive and growth cycles (Jack Kilgore, John Baker, and R.D. Smith, U.S. Army Corps of Engineers, unpub. data, 1993).

Wetlands in Arkansas, especially those in the Mississippi River Valley, are a critical component of the series of wetland habitats along the Mississippi Flyway, which is used by millions of migratory birds each year. The management board of the Lower Mississippi Valley Joint Venture for the restoration of Mississippi Flyway waterfowl populations considers the protection and preservation of wetlands in Arkansas to be a key to the success of their program (Lower Mississippi Valley Joint Venture Management Board, 1990). Wetlands in the Cache–Lower White River system (fig. 1) in the Mississippi Flyway have been designated as one of nine "Wetlands of International Importance" in the United States under provisions of the Convention on Wetlands of International Importance Especially as Wildlife Habitat (Arkansas Department of Pollution Control and Ecology, 1992), which is known informally as the Ramsar Convention after Ramsar, Iran, where the convention was held in 1971.

Wetlands modify the water quality and hydrology of conterminous water bodies by serving as nutrient, sediment, and sediment-related toxic-materials traps. For example, Kleiss (1993), in a study on the Cache River in eastern Arkansas, found that there was a substantial decrease in suspended sediment and nitrate loads in the river after it passed through a wetland. Wetlands also mitigate the severity of floods and droughts by serving as floodways and reservoirs for surface waters and recharge-discharge areas for ground water (Mitsch and Gosselink, 1993). Wetlands in Arkansas also provide recreational opportunities for hunting, fishing, bird watching, and boating to thousands of people each year.

## TYPES AND DISTRIBUTION

Wetlands are lands transitional between terrestrial and deepwater habitats where the water table usually is at or near the land surface or the land is covered by shallow water (Cowardin and others, 1979). The distribution of wetlands and deepwater habitats in Arkansas is shown in figure 2*A*; only wetlands are discussed herein.

Wetlands can be vegetated or nonvegetated and are classified on the basis of their hydrology, vegetation, and substrate. In this summary, wetlands are classified according to the system proposed by Cowardin and others (1979), which is used by the U.S. Fish and Wildlife Service (FWS) to map and inventory the Nation's wetlands. At the most general level of the classification system, wetlands are grouped into five ecological systems: Palustrine, Lacustrine, Riverine, Estuarine, and Marine. The Palustrine System includes only wetlands, whereas the other systems comprise wetlands and deepwater habitats. Wetlands of the systems that occur in Arkansas are described below.

| System | Wetland description |
|---|---|
| Palustrine | Wetlands in which vegetation is predominantly trees (forested wetlands); shrubs (scrub-shrub wetlands); persistent or nonpersistent emergent, erect, rooted, herbaceous plants (persistent- and nonpersistent-emergent wetlands); or submersed and (or) floating plants (aquatic beds). Also, intermittently to permanently flooded open-water bodies of less than 20 acres in which water is less than 6.6 feet deep. |
| Lacustrine | Wetlands within an intermittently to permanently flooded lake or reservoir. Vegetation, when present, is predominantly nonpersistent emergent plants (nonpersistent-emergent wetlands), or submersed and (or) floating plants (aquatic beds), or both. |
| Riverine | Wetlands within a channel. Vegetation, when present, is same as in the Lacustrine System. |

Most of the wetlands in Arkansas are palustrine forested, scrub-shrub, and nonvegetated wetlands (Arkansas Department of Pollution Control and Ecology, 1992; U.S. Fish and Wildlife Service, 1992). The most extensive areas of wetlands in the State lie along the major rivers, such as the lower Mississippi, Arkansas, Red, White, and Little Rivers and their principal tributaries in the Mis-

**Figure 1.** Black Swamp, a wetland along the Cache River. The Cache–Lower White River wetlands have been designated "Wetlands of International Importance" under the provisions of the 1971 Ramsar Convention. *(Photograph by Ed Morris, U.S. Geological Survey.)*

sissippi Alluvial Plain, South Central Plains, and Arkansas Valley Ecoregions (fig. 2*A* and 2*B*). Other wetlands are scattered throughout the State and are associated with springs and seeps in the Ouachita Mountains and Ozark Highlands. Arkansas has 7 National Wildlife Refuges, 1 National Scenic River System, 1 National Forest, 17 State wildlife management areas, and 6 State parks that contain significant wetland areas.

The larger wetlands in Arkansas generally are forested wetlands associated with the flood plains of rivers such as the Saline, Ouachita, and Little Rivers and Bayou Dorcheat. Mixed forested and scrub-shrub wetlands border the Cache, Black, and St. Francis Rivers and Taylor Bay. Little Bayou Meto is lined by an example of a mixed forested and emergent wetland, which is uncommon in Arkansas. Smaller wetlands with unique features include Centerville Pondberry and Coffee Prairie. These two wetlands contain plant species of special concern to the State. Coffee Prairie has been identified by The Nature Conservancy and the Natural Heritage Commission as deserving of priority protection (U.S. Fish and Wildlife Service, 1992).

## HYDROLOGIC SETTING

The existence of wetlands depends on geologic and hydrologic conditions that favor the retention of water and on hydrologic processes that allow the water to accumulate (Winter and Woo, 1990). Wetland hydrology involves complex water-flow patterns that are affected by regional and local geology, topography, soil characteristics, and climate. Water in small wetlands can be supplied by local shallow ground-water flow systems, surface waters, or precipitation. In the mountainous areas of northern and western Arkansas, wetlands typically are small and associated with springs. Larger wetlands in southern and eastern Arkansas commonly receive water from local and regional ground-water flow systems and surface water. Surface water collects in topographic lows, and ground water commonly discharges in these areas. The rate at which water percolates downward from these wetlands to ground-water systems or upward from ground-water systems to the wetlands is a function of local hydraulic conditions and geologic characteristics.

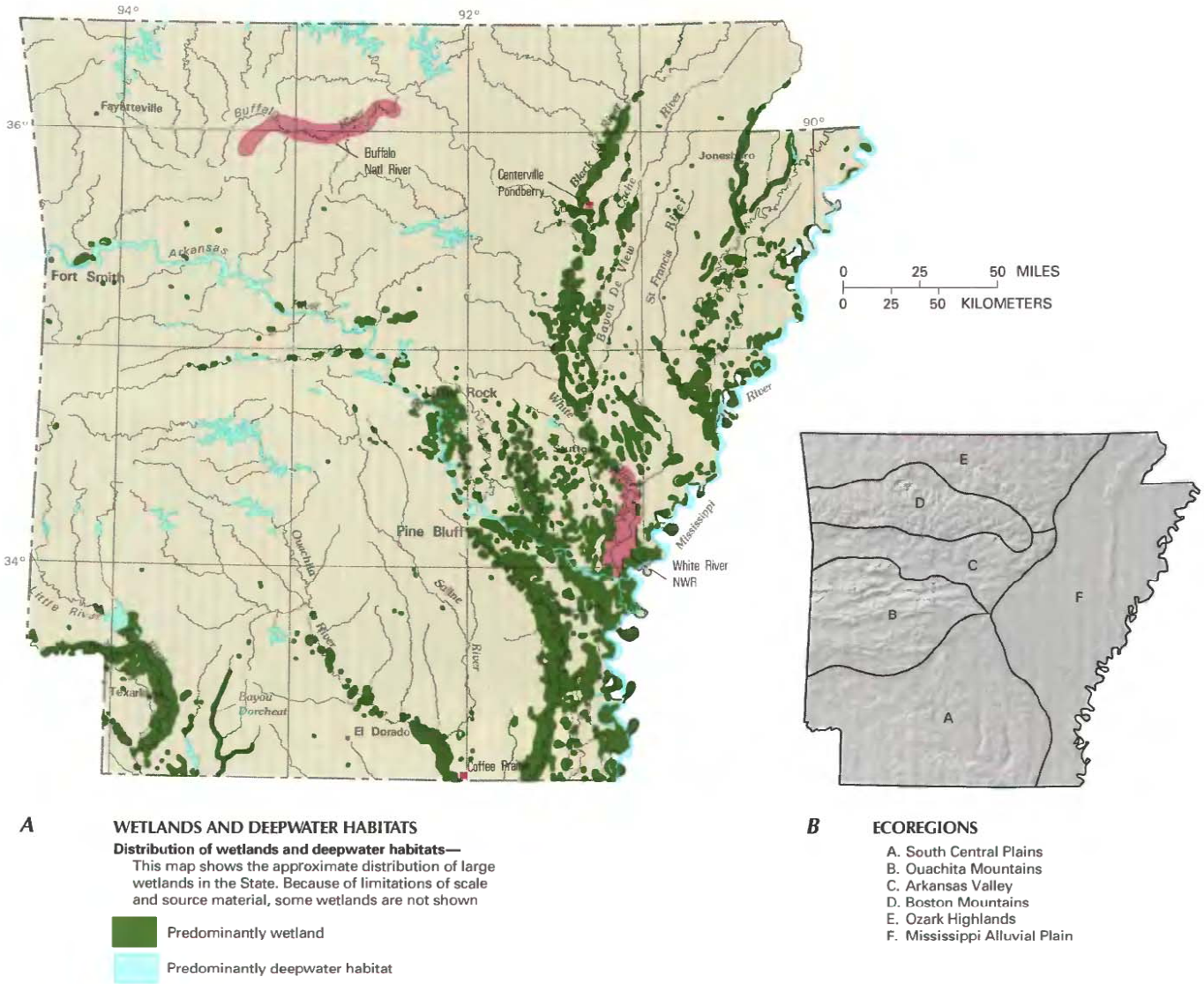


**Figure 2.** Wetland distribution in Arkansas and ecoregions of the State. ***A***, Distribution of wetlands and deepwater habitats. ***B***, Ecoregions. *(Sources: A, T.E. Dahl, U.S. Fish and Wildlife Service, unpub. data, 1991. B, Ecoregions from Omernik, 1987; landforms data from EROS Data Center.)*

In some parts of the State, seasonal fluctuations in precipitation result in seasonal differences in the flooded area of wetlands. However, precipitation in the State is abundant and averages from 40 to 56 inches per year. No season is without at least moderate amounts of precipitation (Freiwald, 1985); therefore, seasonal variations in the water content of most wetlands in the State are small.

Major wetlands in Arkansas are closely associated with the State's large river flood plains, and most are influenced by the Mississippi River. In the northeastern and eastern parts of the State, many streams flow through channels cut into alluvium—sands, silts, and clays—deposited by the Mississippi River. These streams include the Black, White, St. Francis, and Cache Rivers and Bayou Deview (Arkansas Department of Pollution Control and Ecology, 1992).

The flood plain of the Mississippi River is an area of little topographic relief that has been subjected to frequent flooding. This frequent flooding has resulted in the establishment of large stands of water-tolerant bottom-land trees and the development of backwater swamps associated with such hydrologic conditions (fig. 3*A*, 3*B*, and 3*C*). The continued survival of these forested and scrub-shrub wetlands depends on continued seasonal flooding and dewatering cycles. Disruption of the flooding and dewatering cycle can adversely affect plant and animal communities in wetlands and alter the size and type of the wetlands. When the flooding cycle is prevented, such as when wetland areas are leveed or ditched and drained, the water-tolerant plant species commonly are replaced by less water-tolerant trees and shrubs. Once the threat of flooding is reduced, these areas often are cleared for agriculture. When wetlands are drained or cleared, they can no longer trap sediments and sediment-bound contaminants, remove nutrients from flood waters, or provide off-channel storage to lessen the severity of floods. Also, nursery habitat for certain species of fish and invertebrates is greatly restricted when wetlands are drained. This can result in lower fish and invertebrate populations. Conversely, in forested wetlands subjected to permanent flooding, such as occurs when a river is dammed, the establishment of new trees will cease and the existing trees will die. Eventually, the forested wetland will be replaced by open water.

## TRENDS

The area that is now Arkansas began losing wetlands shortly after the arrival of European settlers and has lost more wetland acres than any inland State in the Nation (Scott Yaich, U.S. Fish and Wildlife Service, written commun., 1993). Wetland loss in Arkansas from the 1780's to the 1980's was about 72 percent (Dahl, 1990), and many remaining wetlands have been altered from their natural state. Arkansas originally contained about 9,848,600 acres of wetlands before the arrival of European settlers. By 1937, wetland area in the State had decreased to about 4,900,000 acres (U.S. Fish and Wildlife Service, 1992). The rate of wetland loss increased after World War II owing to the increased availability of mechanized equipment. Wetland loss was about 36 percent of the remaining wetland area from 1957 to 1967 but decreased to about 14 percent from 1977 to 1985 (Arkansas Department of Pollution Control and Ecology, 1992). Holder (1969) estimated that 90 percent of the wetland loss in the last 40 years was due to the expansion of soybean production. By 1993, more than 90 percent of Arkansas' original bottom-land forested wetlands had been converted to upland or other types of wetlands (Scott Yaich, U.S. Fish and Wildlife Service, written commun., 1993). The 72-percent wetland loss reported by Dahl (1990) represents total wetland loss in the State but does not account for conversion of natural wetlands to some other type of wetland or the creation of artificial wetlands. For example, some of the State's remaining wetland acreage includes small farm ponds, which are not high-quality wetland habitat (Scott Yaich, U.S. Fish and Wildlife Service, written commun., 1993).

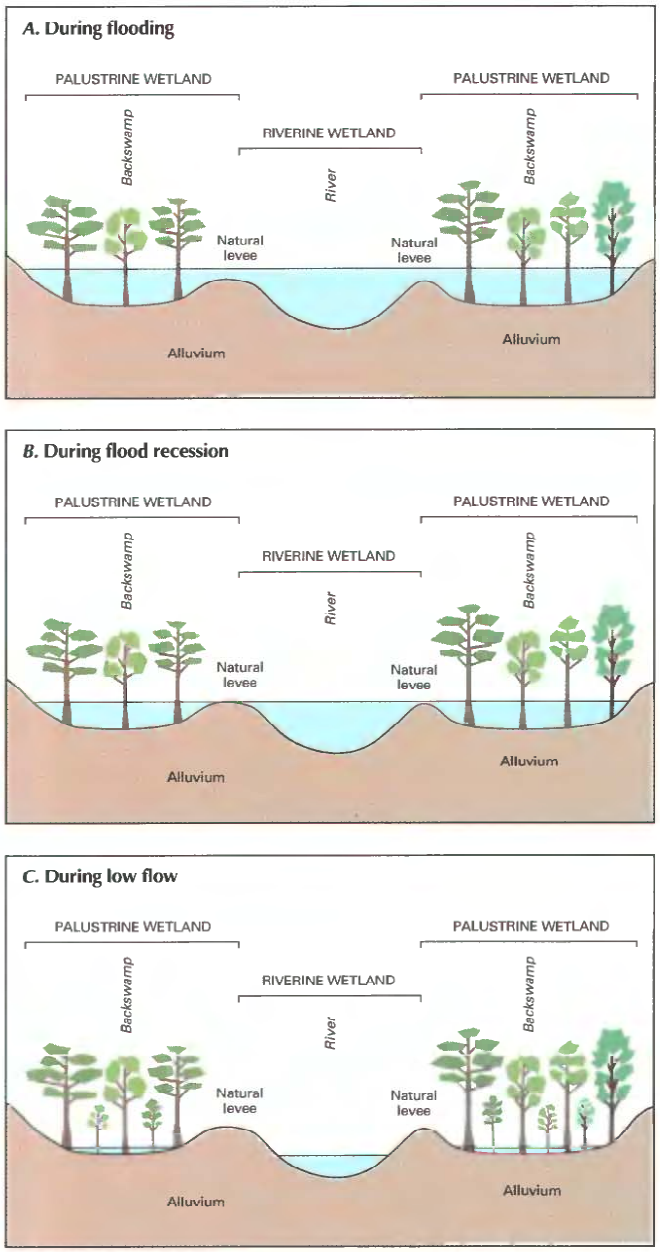


**Figure 3.** Surface hydrologic interaction between a river and forested wetlands in the flood plain. ***A***, During flooding. ***B***, During flood recession. ***C***, During low flow; note establishment of new trees.

Almost all of the cleared lands in the major wetland areas of the State were being farmed in the 1990's, although many of these areas are considered marginal for crop production because of the flooding hazard (U.S. Fish and Wildlife Service, 1992). Some of these marginal farmlands reverted to scrub-shrub wetlands when farming operations were discontinued.

Even though the rate of wetland loss has declined in recent years, Arkansas continues to lose wetlands. Continuing threats to the remaining, primarily forested wetlands of the State as identified by FWS (1992) include (1) drainage and flood protection, (2) dredging and stream channelization, (3) conversion of forested wetland to scrub-shrub, emergent, or open-water wetlands, (4) alteration of drainage patterns, (5) construction of dikes and levees, and (6) discharge of pollutants.

Much of the historical wetland loss within Arkansas has been a result of Federal legislation. In 1850, the U.S. Congress passed the Swamp Land Act, which granted to Arkansas 7,686,575 acres of swamp and overflow lands considered unfit for cultivation. The objective of the act was to help control floods in the Mississippi River Valley and encourage the drainage and clearing of these "sub marginal" lands for agriculture by allowing sale of these lands to private individuals for development (Shaw and Fredine, 1971). Congress passed the Flood Control Act of 1928 in response to the disastrous 1927 floods in the Mississippi Valley. This act removed the requirement for local interests to pay one-half of the cost of levee construction on the Mississippi River. The passage of this bill resulted in the accelerated construction of a vast network of levees along the Mississippi River and its tributaries. The net effect of this and other flood-control acts was the conversion of thousands of acres of wetlands to agriculture due to the removal of the threat of frequent flooding (Arkansas Department of Pollution Control and Ecology, 1992).

## CONSERVATION

Many government agencies and private organizations participate in wetland conservation in Arkansas. The most active agencies and organizations and some of their activities are listed in table 1.

*Federal wetland activities.*—Development activities in Arkansas wetlands are regulated by several Federal statutory prohibitions and incentives that are intended to slow wetland losses. Some of the more important of these are contained in the 1899 Rivers and Harbors Act; the 1972 Clean Water Act and amendments; the 1985 Food Security Act; the 1990 Food, Agriculture, Conservation, and Trade Act; and the 1986 Emergency Wetlands Resources Act.

Section 10 of the Rivers and Harbors Act gives the U.S. Army Corps of Engineers (Corps) authority to regulate certain activities in navigable waters. Regulated activities include diking, deepening, filling, excavating, and placing of structures. The related section 404 of the Clean Water Act is the most often-used Federal legislation protecting wetlands. Under section 404 provisions, the Corps issues permits regulating the discharge of dredged or fill material into wetlands. Permits are subject to review and possible veto by the U.S. Environmental Protection Agency, and the FWS has review and advisory roles. Section 401 of the Clean Water Act grants to States and eligible Indian Tribes the authority to approve, apply conditions to, or deny section 404 permit applications on the basis of a proposed activity's probable effects on the water quality of a wetland.

Most farming, ranching, and silviculture activities are not subject to section 404 regulation. However, the "Swampbuster" provision of the 1985 Food Security Act and amendments in the 1990 Food, Agriculture, Conservation, and Trade Act discourage (through financial disincentives) the draining, filling, or other alteration of wetlands for agricultural use. The law allows exemptions from penalties in some cases, especially if the farmer agrees to restore the altered wetland or other wetlands that have been converted to agricultural use. The Wetlands Reserve Program of the 1990 Food, Agriculture, Conservation, and Trade Act authorizes the Federal Government to purchase conservation easements from landowners who agree to protect or restore wetlands. The Consolidated Farm Service Agency (formerly the Agricultural Stabilization and Conservation Service) administers the Swampbuster provisions and Wetlands Reserve Program. The Natural Resources Conservation Service (formerly the Soil Conservation Service) determines compliance with Swampbuster provisions and assists farmers in the identification of wetlands and in the development of wetland protection, restoration, or creation plans.

The 1986 Emergency Wetlands Resources Act encourages wetland protection through funding incentives. The act requires States to address wetland protection in their Statewide Comprehensive Outdoor Recreation Plans to qualify for Federal funding for State recreational land; the National Park Service (NPS) provides guidance to States in developing the wetland component of their plans.

**Table 1.** Selected wetland-related activities of government agencies and private organizations in Arkansas, 1993

[Source: Classification of activities is generalized from information provided by agencies and organizations. •, agency or organization participates in wetland-related activity; ..., agency or organization does not participate in wetland-related activity. MAN, management; REG, regulation; R&C, restoration and creation; LAN, land acquisition; R&D, research and data collection; D&I, delineation and inventory]

| Agency or organization | MAN | REG | R&C | LAN | R&D | D&I |
|---|---|---|---|---|---|---|
| FEDERAL | | | | | | |
| Department of Agriculture | | | | | | |
| Consolidated Farm Service Agency | ... | • | ... | ... | ... | ... |
| Forest Service | • | ... | ... | • | ... | • |
| Natural Resources Conservation Service | ... | • | • | ... | ... | • |
| Department of Defense | | | | | | |
| Army Corps of Engineers | ... | • | ... | • | • | • |
| Department of the Interior | | | | | | |
| Fish and Wildlife Service | • | ... | • | • | • | • |
| Geological Survey | ... | ... | ... | ... | • | ... |
| National Biological Service | ... | ... | ... | ... | • | ... |
| National Park Service | • | ... | • | • | • | ... |
| Environmental Protection Agency | ... | • | ... | ... | • | ... |
| STATE | | | | | | |
| Department of Pollution Control and Ecology | • | • | ... | ... | • | ... |
| Forestry Commission | • | • | • | ... | • | • |
| Game and Fish Commission | • | • | • | • | • | • |
| Natural Heritage Commission | • | ... | ... | • | ... | • |
| Soil and Water Conservation Commission | • | • | • | ... | ... | • |
| PRIVATE | | | | | | |
| Ducks Unlimited | ... | ... | ... | • | ... | • |
| National Audubon Society | • | ... | ... | • | ... | • |
| The Nature Conservancy | • | ... | • | • | • | • |

The FWS administers seven National Wildlife Refuges, including the 154,000-acre White River National Wildlife Refuge located along the lower White River in Arkansas. The FWS also administers wetland-acquisition programs and advises Federal and State agencies responsible for wetland conservation. Other Federal agencies that have management or monitoring responsibilities for wetlands in Arkansas include the NPS, the U.S. Forest Service (FS), and the U.S. Geological Survey (USGS). The FS is responsible for the management of wetlands in the State's National Forests. Buffalo National River, a segment of the Buffalo River under the jurisdiction of the NPS, has some small wetland areas associated with the river. The USGS collects information on the quantity and quality of many of the Nation's water resources, including its wetlands.

*State wetland activities.*—Arkansas has a Natural and Scenic Rivers program and a Natural Heritage program. These two programs designate extraordinary and ecologically sensitive areas, including wetlands, within the State. A technical review committee made up of representatives from State agencies makes recommendations to the Governor on section 404 permits. The State has adopted a program administered by the Arkansas Department of Pollution Control and Ecology that applies an antidegradation policy to substantial alterations of a water body, including associated wetlands. In addition, the Arkansas Soil and Water Conservation Commission and the Arkansas Forestry Commission have extensive responsibilities concerning the management of the State's wetlands.

The Arkansas Game and Fish Commission, the State's lead wildlife agency, has a long-standing commitment to protect wetlands

within the Mississippi River Valley because of the area's importance to wildlife, particularly to migratory birds. The Arkansas Game and Fish Commission owns or controls more than 174,000 acres in 14 wildlife management areas within the Mississippi River Valley, much of which consists of wetlands. The Arkansas Game and Fish Commission and the Arkansas Natural Heritage Commission are committed to additional investment in the Mississippi River Valley and have begun developing comprehensive plans for these activities. The Game and Fish Commission has developed the Cache–Lower White Rivers Joint Venture under the North American Waterfowl Management Plan. The objective of this program is to protect bottom-land habitat in the Cache River and lower White River Basins, which constitute the second-largest area of contiguous bottom-land habitat in the Mississippi River Valley, second only to the Atchafalaya River Basin in Louisiana. In 1990, protected Federal and State lands in the Joint Venture were designated "Wetlands of International Significance" under the provisions of the 1971 Ramsar Convention, which produced an international agreement for cooperation in the conservation of wetland habitats.

In 1988, the Natural Heritage Commission, in cooperation with the Arkansas Chapter of The Nature Conservancy, began to develop the White River–Lower Arkansas River Megasite plan (Lynch and others, 1992). This plan presents a landscape-level design inventory of an ecologically intact, biologically diverse bottom-land system that includes more than 550,000 acres. More than 280,000 acres in this habitat system are public lands. The boundaries of this habitat system differ somewhat from those of the high-priority waterfowl habitat defined by the Cache–Lower White Rivers Joint Venture, although both are in the Mississippi River Valley.

*Regional and private wetland activities.*—The Arkansas Chapter of The Nature Conservancy is involved in an effort to protect and restore the forested wetlands of the Mississippi River Alluvial Plain in Arkansas as part of a coordinated effort to protect wetlands of that region in seven States. The National Audubon Society and Ducks Unlimited also are involved in the protection and restoration of wetlands and the critical wildlife habitats they contain.

More than 50 percent of the remaining bottom-land forests in the Mississippi River Valley are in private ownership and much of these forests are commercial timberlands owned by the forest-products industry. Most of these commercial timberlands are a critical part of the Lower White–Lower Arkansas River Megasite plan because they occupy key locations contiguous with and connecting public lands within the system.

## References Cited

Arkansas Department of Pollution Control and Ecology, 1992, Wetlands, Chapter 4 of water quality inventory report, 1992: Little Rock, Arkansas Department of Pollution Control and Ecology, p. 45–48.

Cowardin, L.M., Carter, Virginia, Golet, F.C., and LaRoe, E.T., 1979, Classification of wetlands and deepwater habitats of the United States: U.S. Fish and Wildlife Service Report FWS/OBS–79/31, 131 p.

Dahl, T.E., 1990, Wetlands—Losses in the United States, 1780's to 1980's: U.S. Fish and Wildlife Service Report to Congress, 13 p.

Freiwald, D.A., 1985, Average annual precipitation and runoff for Arkansas, 1951–80: U.S. Geological Survey Water-Resources Investigations Report 84–4363, scale 1:1,000,000.

Holder, Trusten, 1969, Disappearing wetlands in eastern Arkansas: Little Rock, Arkansas Planning Commission, 71 p.

Kleiss, B.A., 1993, An ecosystem study of bottom land hardwood wetlands associated with the Cache River, eastern Arkansas, *in* Landin, M.C., ed., Wetlands, Proceedings of the 13th Annual Conference Society of Wetland Scientists, New Orleans, La.: Utica, Miss., Society of Wetland Scientists, South Central Chapter, p. 31–37.

Lower Mississippi Valley Joint Venture Management Board, 1990, Conserving waterfowl and wetlands: Vicksburg, Miss., North American Waterfowl Management Plan, Lower Mississippi Valley Joint Venture, 32 p.

Lynch, J.M., Baker, W.W., Foti, Tom, and Peacock, Lance, 1992, The White River-lower Arkansas River megasite—A landscape conservation design project: Little Rock, Arkansas Natural Heritage Commission and the Arkansas Nature Conservancy, 81 p.

Mitsch, W.J., and Gosselink, J.G., 1993, Wetlands (2d ed.): New York, Van Nostrand Reinhold Company, 722 p.

Omernik, J. M., 1987, Ecoregions of the United States—Map supplement: Annals of the Association of American Geographers, v. 77, no. 1, scale 1:2,500,000.

Shaw, S.P., and Fredine, C.G., 1971, Wetlands of the United States—Their extent and their value to waterfowl and other wildlife: U.S. Fish and Wildlife Service Circular 39, 67 p.

U.S. Fish and Wildlife Service, 1992, Regional wetlands concept plan—Emergency wetlands resources act, southeast region: Atlanta, Ga., U.S. Fish and Wildlife Service, 259 p.

Winter, T.C., and Woo, Ming-Ko, 1990, Hydrology of lakes and wetlands: *in* Wolman, M.G., and Riggs, H.C., eds., Surface water hydrology: Boulder, Colo., Geological Society of America, The geology of North America, v. O–1, chap. 8, p. 159–187.

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