Kansas
Wetland Resources

Kansas once was covered by an estimated 841,000 acres of wetlands; of that area about 435,400 acres, or 0.8 percent of the State's area, remain (Dahl, 1990). Wetlands in Kansas represent some of the last aquatic areas available for wildlife and plants. Wetlands provide habitat for many species of birds, fish, mammals, reptiles, and invertebrates. Kansas wetlands are particularly important to migratory waterfowl and shorebirds, which depend on the few remaining wetlands in the Central Flyway for food, water, and cover during their seasonal migrations. Cheyenne Bottoms (fig. 1), a large freshwater marsh in central Kansas, is considered the most important migration staging point for shorebirds in North America (Wentz, 1988). Cheyenne Bottoms also provides habitat for five nationally threatened or endangered species—bald eagle, peregrine falcon, least tern, piping plover, and whooping crane (Kansas Biological Survey and Kansas Geological Survey, 1987).

Kansas wetlands are valuable for their hydrologic functions. By attenuating flood peaks and storing floodwaters, wetlands can protect adjacent and downstream property from flood damage and help control erosion. Wetlands also have important water-quality functions, including silt removal, mineral uptake, and nutrient transformation. Kansas wetlands also are important for recreation, tourism, and esthetic and educational benefits.

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 Kansas is shown in figure 2*A*; only wetlands are discussed herein.

Figure 1. Blue-winged teal at Cheyenne Bottoms in central Kansas. *(Photograph by Mike Blair, Kansas Department of Wildlife and Parks.)*

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 Kansas 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.

Palustrine wetlands in Kansas include ephemeral wetlands; marshes; emergent wetlands in ground-water seeps, prairies, and oxbows; and forested wetlands in riparian areas. Ephemeral wetlands typically are flooded only seasonally; examples are sandhill pools located in the Arkansas River Valley in south-central Kansas and playa lakes scattered throughout the southwestern part of the State. Marshes occur in low-lying areas associated with river systems, terraces, and valley basins. Examples of fresh marshes are the Marais des Cygnes Wildlife Area in east-central Kansas, Jamestown Wildlife Area in north-central Kansas, and Cheyenne Bottoms. Salt marshes generally are limited to central Kansas. The largest salt marsh in the State is Quivira National Wildlife Refuge, which is located along Rattlesnake Creek. Areas saturated by fresh ground-water seepage are discontinuously distributed throughout the State. An example of an emergent wetland in a ground-water seep is the 11-acre Muscotah Marsh in northeastern Kansas. Prairie wetlands occur on nearly level soils on flood plains along rivers, streams, and creeks throughout most of the State. The Ninnescah River Basin wetlands, associated with the North and South Forks Ninnescah Rivers in south-central Kansas, include examples of prairie wetlands as well as riparian woodlands. Forested wetlands are located within riparian woodlands and forests along major rivers in both the eastern and western parts of the State (Lauver, 1989; Monda, 1992a).

Lacustrine wetlands in Kansas are primarily in impoundments. The Flint Hills National Wildlife Refuge at John Redmond Reservoir and Kirwin National Wildlife Refuge at Kirwin Reservoir are wetlands that have developed around lake headwater areas. These areas include both lacustrine wetlands and palustrine wetlands (persistent emergent, scrub-shrub, and forested wetlands along the shore or in backwater areas).

Riverine wetlands are most common in the eastern and central parts of the State. They include the beds of shallow, intermittent streams and areas less than 6.6 feet deep in perennial streams.

HYDROLOGIC SETTING

The availability of water to sustain wetlands depends on climatic, hydrologic, and physiographic factors as well as historic and present land use. Moisture is unevenly distributed across the State. Average annual precipitation in Kansas ranges from less than 16 inches in the west to more than 40 inches in the southeast (Jordan, 1986). In contrast, average annual evaporation potential increases

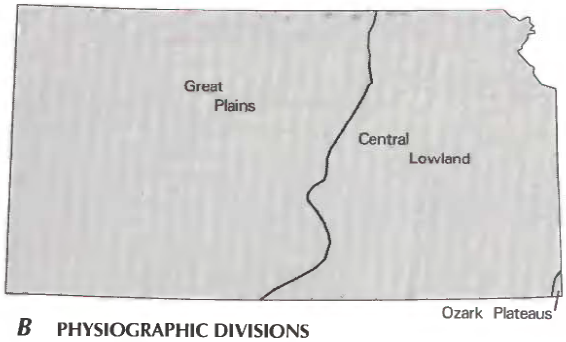
from east to west, ranging from less than 44 inches in the northeast to more than 68 inches in the southwest (Farnsworth and others, 1982). Runoff is poorly sustained in the western and central parts of Kansas because of sparse precipitation, conservation practices, and withdrawals of water from streams and associated alluvial aquifers, primarily for irrigation. As a result, water deficits can occur during many seasons and years in these parts of the State.

Differences in topography and geology separate Kansas into broad physiographic divisions (fig. 2*B*). In the Great Plains of western Kansas, surface-water resources are scarce. Wetlands in these areas depend on water from precipitation and, in some areas, streamflow or shallow ground water. In the Central Lowland of eastern Kansas, surface water is more dependable. Water in streams, flood plains, and alluvial aquifers sustains many prairie wetlands and riparian woodlands and forests. In the Ozark Plateaus, one of the wettest and most densely forested areas in Kansas, the abundant rainfall and high humidity create conditions favorable to wetlands (Spanbauer, 1988).

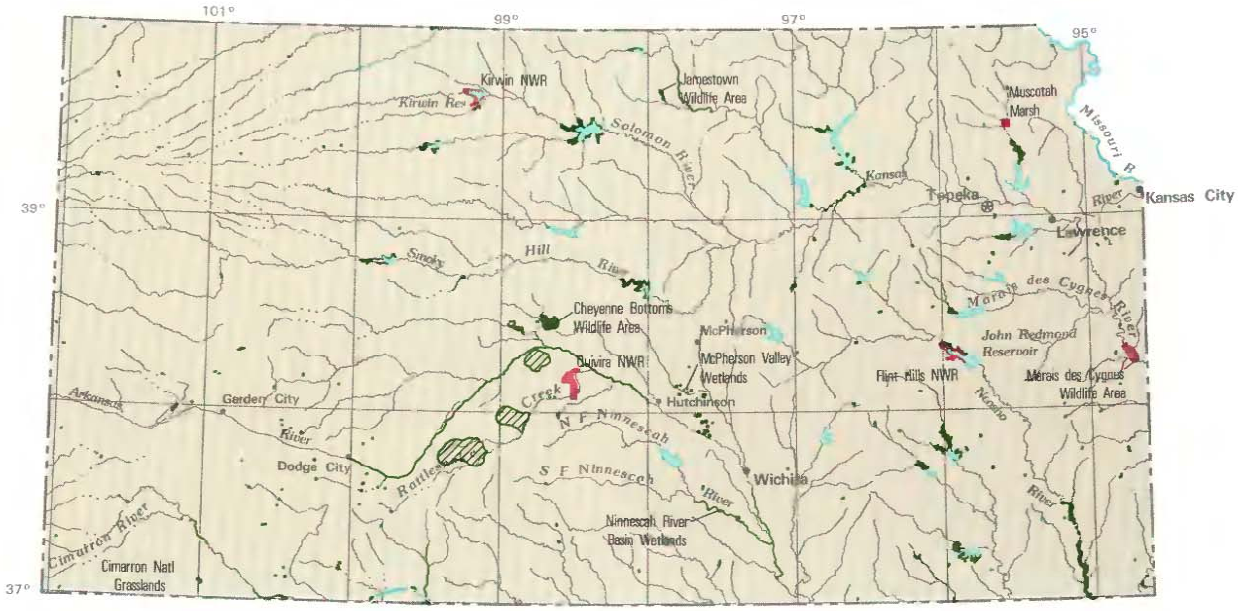
Wetlands in Kansas are temporarily, seasonally, semipermanently, or permanently flooded, depending on moisture availability. The playa lakes in southwestern Kansas are among the most temporary of palustrine wetlands, occurring in areas of low precipitation and high evaporation. Playas are sustained entirely by precipitation and surface drainage. These shallow basins drain areas as large as 2,000 acres but are flooded only after heavy rainfall or snowmelt in the spring. The clay soils of the playas tend to prevent seepage losses; most water loss is due to evaporation.

Sinks and shallow basins are other types of temporarily flooded wetlands in Kansas; they are mostly in the Great Plains region. The McPherson Valley Wetlands, a series of shallow lakes that historically covered a 126-square-mile area south of McPherson, are sinks caused by dissolution of underlying salt formations. The McPherson Valley Wetlands originally included several large, and many small, shallow marshes and two natural lakes (Wilson, 1992). Only one permanently flooded lake remains, along with a few shallow pools and marshes that were not drained. These areas are important for migratory waterfowl. Ongoing restoration of the McPherson Valley Wetlands is intended to reestablish and protect the seasonally and permanently flooded pools (Wilson, 1992).

Sandhill pools — depressions between the low dunes along the Arkansas River northeast of Hutchinson — become filled with water during the rainy season (Schoewe, 1949). Sandhill pools are poorly drained because of their nearly impervious subsoil. These wetlands can remain flooded, given a seasonally high water table, or can vanish during years of low precipitation (Lauver, 1989).



B **PHYSIOGRAPHIC DIVISIONS**



A **WETLANDS AND DEEPWATER HABITATS**

Distribution of wetlands and deepwater habitats— This map shows the approximate distribution of large wetlands in the State. Because of limitations of scale and source material, some wetlands are not shown

Predominantly wetland

Predominantly deepwater habitat

Area typified by a high density of small wetlands

0 25 50 MILES

0 25 50 KILOMETERS

Figure 2. Wetland distribution in Kansas and physiography of the State. ***A***, Distribution of wetlands and deepwater habitats. ***B***, Physiography. *(Sources: A, T.E. Dahl, U.S. Fish and Wildlife Service, unpub. data, 1991. B, Physiographic divisions from Fenneman, 1946; landforms data from EROS Data Center.)*

Wetlands associated with riparian woodlands and forests can be flooded temporarily or seasonally, depending on the characteristics of streams with which they are associated. Riparian forested wetlands are located primarily along the Missouri, Kansas, Marais des Cygnes, and Neosho Rivers in the Central Lowland, where precipitation and runoff are sufficient to sustain streamflows and evaporation rates are relatively low. In prairie wetlands, drainage is poor, and the deep, alluvial soils remain saturated for most of the growing season (Monda, 1992a). In some years, prairie wetlands along flood plains in eastern Kansas may be inundated for several days at a time (Lauver, 1989).

Salt flats are seasonally inundated wetlands occurring on nearly level ground or within slight depressions. Salinity is high because of saline ground-water discharge or concentration of dissolved constituents by evaporation. Salt flats are located in central Kansas, where naturally saline ground water discharges to surface streams and pools. Soils in salt flats are saturated but contain standing water only after heavy precipitation (Monda, 1992a).

Fresh and salt marshes form in low-lying areas that have deep, poorly drained soils. Marshes range from semipermanently to permanently flooded (Monda, 1992a). Salt marshes are restricted to salty seepage areas that often contain brackish or stagnant water (Lauver, 1989). Quivira National Wildlife Refuge is sustained by water from Rattlesnake Creek. Downstream reaches of the stream and the marsh itself are natural ground-water discharge areas for underlying saltwater-bearing formations (Sophocleous, 1992).

Ground-water discharge is a vital source of moisture for some wetlands in Kansas. Localized artesian conditions cause soils in the Muscotah Marsh to be saturated by ground-water seepage. Within the Cimarron National Grasslands in southwestern Kansas, a riparian wetland on the flood plain of the Cimarron River is sustained by moisture from ground-water storage when the river is not flowing. The Cimarron River rarely flows, but when floods occur, the riparian areas are recharged and support new growth of woody vegetation. Controlled grazing on the Cimarron National Grasslands, which is managed by the U.S. Forest Service, ensures that some trees will remain among the sagebrush and grasses.

The disappearance of nearly one-half of the State's wetlands has increased the importance of those that remain. Migratory birds formerly had access to many wetlands as well as to shallow, braided river channels throughout central Kansas for foraging and resting. Draining of these wetlands and the depletion of streamflows in major streams such as the Arkansas River have left only Cheyenne Bottoms and Quivira National Wildlife Refuge as major stopover places in Kansas. Keeping those areas viable requires manipulation of the hydrologic system to ensure a consistent water supply.

The Kansas Department of Wildlife and Parks manages the 19,857-acre Cheyenne Bottoms Wildlife Area (fig. 3). Several adverse hydrologic conditions have had to be overcome to maintain shallow water in Cheyenne Bottoms—inadequate precipitation, declining flows in streams flowing into the area, periodic flooding, and high evaporation and transpiration losses. Evaporation and transpiration account for about 95 percent of the water lost from the wetland (Kansas Biological Survey and Kansas Geological Survey, 1987). In some years, losses can exceed the amount of water entering the basin and result in an overall deficit and increased salinity (Zimmerman, 1990).

The management strategy addressing these problems has focused on water storage, supplementation, and drainage. In the 1950's, diked pools were constructed to enhance storage, and dams

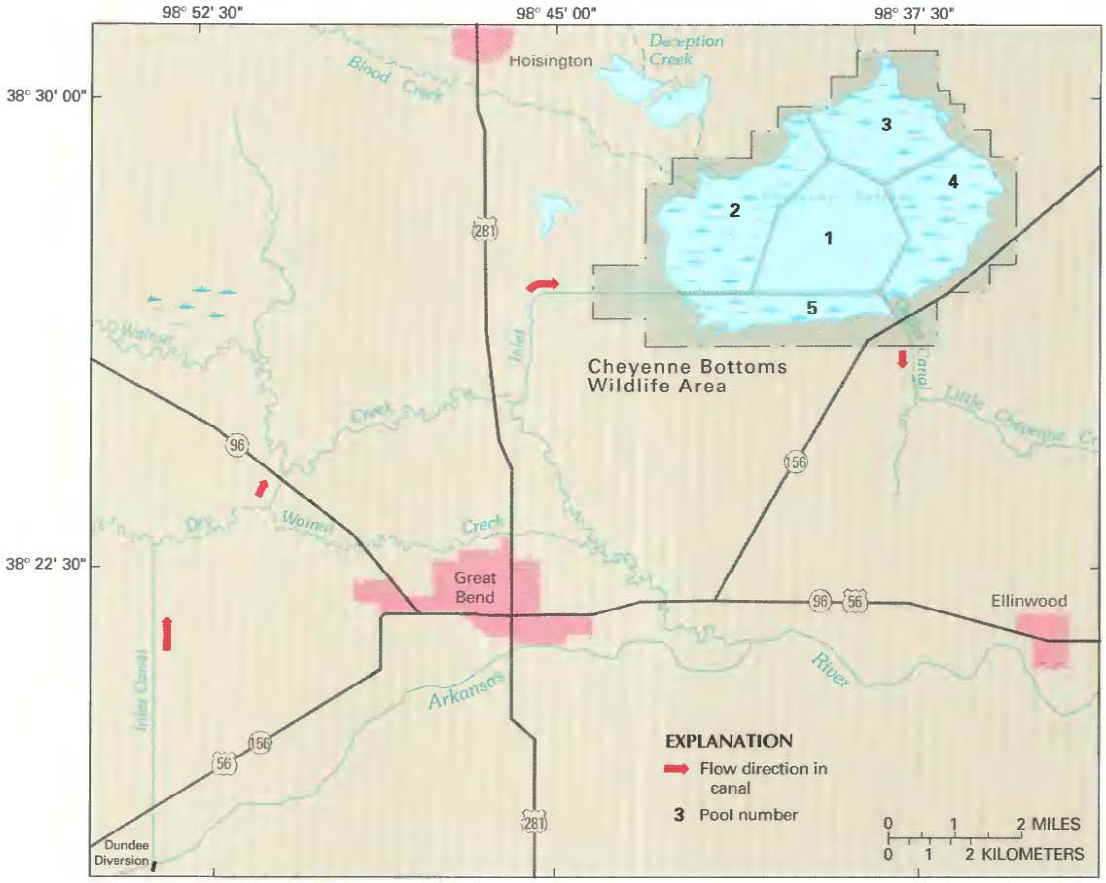


Figure 3. Hydrologic features of Cheyenne Bottoms. *(Source: Laurel Yasui, Kansas Department of Wildlife and Parks, written commun., 1992.)*

and ditches were built to divert water from the Arkansas River through Dry Walnut and Walnut Creeks to supplement natural flows from Blood and Deception Creeks. Ongoing activities at Cheyenne Bottoms include construction of additional dikes in pool 1 to create a deeper pool that will decrease evaporation relative to the volume of water stored; installation of pumping stations to facilitate water transfer among pools; level ditches dug through dense stands of cattails in silted areas of pool 4 to decrease water depth, provide varied habitat, and allow access to inner waters; and improvements to the canal from the Arkansas River to the marsh to reduce evaporation and seepage losses (Grover, 1992).

The Kansas Department of Wildlife and Parks holds water rights for 20,000 acre-feet per year from Walnut Creek and 30,000 acre-feet per year from the Arkansas River, but by the 1980's less than 20 percent of the legally protected amount of water was available (Karl Grover, Kansas Department of Wildlife and Parks, written commun., 1993). Declining flows in the Arkansas River and Walnut Creek have resulted from lower water tables caused primarily by ground-water withdrawals for irrigation, and from decreased runoff due to soil and water conservation practices such as terracing, construction of water impoundments, and conservation tillage (Kansas Biological Survey and Kansas Geological Survey, 1987; Zimmerman, 1990).

Recognition of the dependence of Cheyenne Bottoms on a managed hydrologic system resulted in legal action to protect the senior water right on Walnut Creek. In 1992, the Chief Engineer of the State Division of Water Resources established an Intensive Groundwater Use Control Area in the Walnut Creek Basin, thus limiting water withdrawals by all irrigators, municipalities, and industries therein. The intent of the restrictions is to restore aquifer recharge and base flow to Walnut Creek.

Table 1. Selected wetland-related activities of government agencies and private organizations in Kansas, 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	•	•	•	...	•	•
Military reservations	•	...	...	...	...	...
Department of the Interior						
Bureau of Land Management	•	...	...	...	...	•
Fish and Wildlife Service	•	...	•	•	•	•
Geological Survey	...	...	...	...	•	...
National Biological Service	...	...	...	...	•	...
Environmental Protection Agency	...	•	...	...	•	•
STATE						
Biological Survey	...	...	...	...	•	•
Conservation Commission	...	•	...	...	...	...
Corporation Commission	...	•	...	...	...	...
Department of Agriculture						
Division of Water Resources	...	•	...	...	...	...
Department of Health and Environment	...	•	...	...	•	•
Department of Wildlife and Parks	•	•	•	•	•	•
Geological Survey	...	...	...	...	•	...
Water Office	•	•	...	...	...	...
PRIVATE						
Baker University	•	...	•	•	•	...
Ducks Unlimited	•	...	•	•	...	...
Kansas Wildscape Federation	...	...	...	...	•	...
Kansas Wildlife Foundation	•	...	•	•	...	...
National Audubon Society	...	...	...	...	•	...
Sierra Club	...	...	...	...	•	...
The Nature Conservancy	•	...	•	•	•	...

TRENDS

According to FWS estimates, Kansas lost 405,600 acres, or 48 percent, of its wetlands between the 1780's and 1980's (Dahl, 1990). In 1890, the State sold 12 major salt marshes in central Kansas, some more than 1,000 acres in size. Many of these wetlands were drained and converted to agricultural uses shortly thereafter (Monda, 1992b). Draining and conversion to cropland have caused most of the wetland losses in Kansas; 40 percent of the losses occurred between 1955 and 1978 (Tiner, 1984). Most areas drained were shallow, palustrine wetlands such as the McPherson Valley Wetlands and the playa lakes. Only about 500 acres remain of the original 9,000-plus acres in the McPherson Valley Wetlands (Wilson, 1992), and about 70 percent of the original playa lakes are gone (Kansas Department of Wildlife and Parks, 1992a). Remaining wetlands, despite regulations protecting them, continue to be adversely affected by agricultural runoff of chemicals and sediment from surrounding croplands (Kansas Department of Wildlife and Parks, 1991). Other causes of wetland loss include depletion of surface and ground water, primarily as a result of irrigation withdrawals. Construction of flood-control structures and modifications to stream channels can result in drainage of wetlands or alteration of streamflows entering wetlands. Urban, industrial, and transportation-system development also can be detrimental to wetlands (Kansas Department of Wildlife and Parks, 1991).

CONSERVATION

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

Federal wetland activities.—Development activities in Kansas 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 (EPA), 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 discourages (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) (CFSA) administers the Swampbuster provisions and Wetlands Reserve Program. The Natural Resources Conservation Service (formerly the Soil Conservation Service) (NRCS) determines compliance with Swamp-buster 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 provides guidance to States in developing the wetland component of their plans.

Several Federal agencies provide technical and financial assistance for efforts to restore, enhance, or create wetlands and to educate the public about wetlands. The CFSA, through the Wetland Reserve Program, pays for easements on land where the owners are restoring and protecting wetlands. The Corps provides assistance for infrastructure restoration that affects wetlands and for some fish and wildlife habitat-restoration activities. The Corps also supports educational efforts through its interpretive programs and video library. The EPA provides financial and technical assistance for development of wetland inventories, project consultation, and public education. The EPA also oversees the development and implementation of State water-quality regulations that apply to surface waters, including wetlands. The FWS, through the Partners for Wildlife Program, offers technical advice and partial compensation to landowners who restore, enhance, or create wetlands.

State wetland activities.—State wetlands programs are distributed among many agencies. The Wetland and Riparian Areas Project is a cooperative effort that coordinates State programs for wetland and riparian areas, assists land managers, and promotes public awareness of wetland vaues and functions (Monda, 1992b). The project is coordinated through the Kansas Water Office as a multiagency effort with grant funding from the EPA.

The Department of Wildlife and Parks manages most of the 22,265 acres of State-owned wetlands in Kansas. The agency has acquired, by purchase or lease, additional acreage in the playa-lakes region and the McPherson Valley Wetlands through Federal funding from FWS and, as part of the five-State Playa Lakes Joint Venture, from the North American Waterfowl Management Plan (Kansas Department of Wildlife and Parks, 1992b). The North American Waterfowl Management Plan is a multinational program for restoring waterfowl breeding populations by habitat acquisition and enhancement. Through its Wildlife Habitat Improvement Program, the Department of Wildlife and Parks provides financial and technical assistance to landowners who improve or develop wildlife habitat on private lands.

The Kansas Department of Health and Environment addresses wetland protection through its nonpoint-source pollution-control programs, Clean Lakes projects, and Lake and Wetland Monitoring Program. Water-quality regulations for wetlands are included within antidegradation policies and are used to protect wetlands through Clean Water Act section 401 water-quality certification and section 404 permit review (Kansas Department of Health and Environment, 1992). Any action involving a discharge of dredged or fill material into a wetland in Kansas must receive a section 401 water-quality certification from the Department of Health and Environment as well as a section 404 permit from the Corps. The Department may approve, make its approval conditional, or deny certification on the basis of water-quality criteria.

Several State agencies administer programs that affect wetlands through regulation of State waters. The Kansas Department of Agriculture's Division of Water Resources is responsible for review and approval of flood-plain zoning ordinances. The Division also regulates placement of fill and construction of levees within the 100-year flood plain, dam construction, stream obstruction, and channel modifications. The State Water Project's Environmental Coordination Act requires that various State agencies, including the Department of Wildlife and Parks, State and Extension Forestry, the Kansas Corporation Commission, and the State Historical Society, review applications to the Division of Water Resources for modification of streams and flood plains to determine potential adverse effects on wetlands, fish, and wildlife. These agencies may recommend acceptable alternatives to proposed modifications. The Kansas Water Office coordinates the manipulation of lake levels in Federal reservoirs through its Pool Level Management program, which can benefit waterfowl by controlling habitat access. The Kansas Water Office monitors minimum desirable streamflows established for 23 Kansas streams through the Minimum Desirable Streamflow program, thus protecting fish, wildlife, and water quality. The Kansas Water Office also oversees water-resource planning and management in Kansas through its administration of the State Water Plan. The Kansas Corporation Commission protects the State's fresh and other usable waters through regulation of drilling operations, surface-pond construction, and oil-and-gas spill cleanup.

The Kansas Biological Survey is involved in wetland activities through research on aquatic ecosystems, identification of Kansas Natural and Scientific areas, and development of models to evaluate the health of rivers, streams, and wetlands. The Kansas Geological Survey conducts geohydrologic studies related to wetlands in the State, such as the evaluation of the stream-aquifer system in the Rattlesnake Creek Basin, which includes Quivira National Wildlife Refuge.

The State Conservation Commission administers the Riparian and Wetland Protection Program, in which county conservation districts develop comprehensive plans to protect and restore riparian and wetland areas. Assistance from the Commission and the Department of Wildlife and Parks, along with funding from existing local, State, and Federal programs, is used to demonstrate the water-quality and flood-prevention benefits of riparian and wetland areas to landowners.

The Kansas State and Extension Forestry, through the Forestry Stewardship Program, provides technical assistance to landowners in proper management of riparian forests. Forest Stewardship Plans are developed by District Foresters, with participation by landowners, the Department of Wildlife and Parks, and the NRCS. Landowners who follow the plan are eligible for financial assistance through the Stewardship Incentive Program, which provides cost-share funding for riparian and wetland protection and improvements such as tree planting and maintenance, streambank stabilization, and preservation of fish and wildlife habitat.

Private wetland activities.—The Kansas chapter of Ducks Unlimited is involved in wetland-habitat conservation. Through its Matching Aid to Restore States Habitat program, Ducks Unlimited has provided the Department of Wildlife and Parks with matching funds that have been used, as of 1993, to purchase or lease 1,926 acres for wetland-habitat development. Another 916 acres of existing wetlands have benefited from additional development and restoration.

Baker University is involved in preservation and research at three natural areas in northeastern Kansas that contain wetland and riparian areas. The Nature Conservancy has cooperated with the FWS in the acquisition of 6,000 acres adjacent to the Marais des Cygnes Wildlife Area, and is building a 5,437-acre preserve near Cheyenne Bottoms.

Education and advocacy are as important to wetland protection as are regulation and land acquisition. The Kansas Wildlife Federation influences wetland activities in Kansas through education of its members and the public and lobbying of state legislators.

The Kansas Wildlife Federation was instrumental in securing funding for the Kansas Biological Survey and Kansas Geological Survey study of Cheyenne Bottoms and contributed financially to the lawsuit concerning enforcement of State water laws in the Walnut Creek Basin. The Kansas chapters of the Sierra Club and the National Audubon Society also are involved in education and advocacy regarding wetland issues.

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