Kentucky
Wetland Resources

Wetlands compose less than 2.5 percent of the surface area of Kentucky, but these fragile and finite ecosystems have considerable environmental, socioeconomic, and esthetic value. Axe Lake Swamp (fig. 1) is an example of a scenic wetland in the western part of the State.

Wetlands contribute to the maintenance of good water quality and can improve degraded waters by reducing suspended-sediment concentrations, removing nutrients, and processing various organic and inorganic compounds (Tiner, 1984). A wetland can attenuate flood peaks and then release the stored water slowly, reducing the environmental impacts of floods and, in some parts of the State, increasing ground-water recharge. Wetlands are among the world's most productive ecosystems, efficiently converting solar energy and inorganic nutrients to biomass that supports many terrestrial and aquatic food webs. Wetlands in Kentucky support a diverse community of aquatic plants (Beal and Thieret, 1986), including rare and endangered species that do not exist elsewhere. Wetlands are vital habitat for many species of waterfowl and other migratory birds and are spawning and nursery grounds for many species of game and nongame fishes. Wetlands are home for many amphibian and reptile species, as well as for several game and nongame mammals.

Recreational opportunities such as hunting, fishing, hiking, nature observation and photography, camping, and canoeing abound in Kentucky wetlands, affording enjoyment to State residents and visitors. Recent research on the ecological function of wetlands has led to several innovative programs in the State for the use of constructed wetlands to treat residential, agricultural, and acidic mine wastewaters.

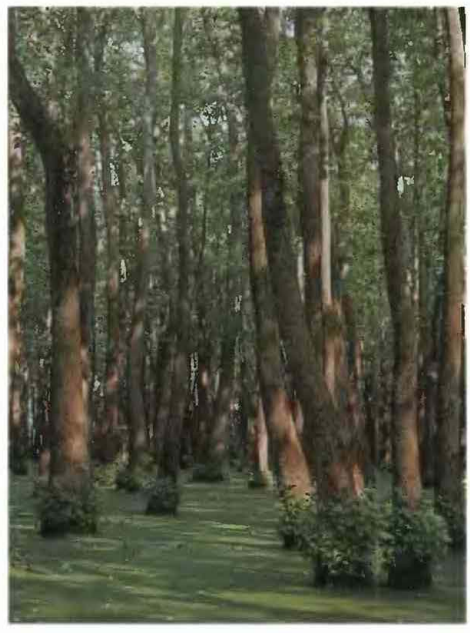

Figure 1. Axe Lake Swamp, a forested wetland in western Kentucky. *(Photograph courtesy of the Kentucky State Nature Preserves Commission.)*

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 Kentucky 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 Kentucky 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 Kentucky wetlands are palustrine and include areas lying shoreward of rivers and lakes, such as bald cypress swamps, bottom-land hardwood forests, emergent wetlands, and small ponds. The alluvial flood plains of the Ohio and Mississippi Rivers and their tributaries in the Western Kentucky Coal Field and Mississippi Embayment physiographic regions (fig. 2*B*) contain most of the State's wetlands. Wetland vegetation in those regions is mostly bottom-land hardwood forest associated with scrub-shrub and emergent species. Lacustrine wetlands in Kentucky are limited to reservoirs and a few small natural lakes such as Metropolis Lake and Swan Lake and are the least abundant type in the State. Riverine wetlands also are not abundant in Kentucky, but they are particularly important in the eastern part of the State, where they provide habitat for rare and endangered species, protect against shoreline erosion, and convey floodwaters (Kentucky Division of Water, 1990).

The greatest areal extent of wetlands of all types in Kentucky is in the Western Kentucky Coal Field. The Clear Creek wetlands, located in the Tradewater River Basin, are the largest in this area and are the most disturbed by human activities. Clear Creek forms intermittent channels through marshes of cattail and other emergent plants, bottom-land hardwood forests, bald cypress swamps, and scattered dead forests. Submersed peat-moss mats can be found in

the deeper waters (Hill, 1983). The Clear Creek Basin also contains the only vegetated riverine wetlands in the Western Kentucky Coal Field, including both aquatic-bed and nonpersistent-emergent wetlands. Pondweed, coontail, and water milfoil grow on or below the water surface, along with emergent species such as lizard's tail and smartweed (Mitsch and others, 1983). The extensive wetlands of Cypress Creek, which are adjacent to the creek channel, are composed of well-developed stands of bald cypress, bottom-land hardwood forests, and cattail communities (Taylor, 1985). The area supports a diverse plant and animal community, including waterfowl and many nongame species such as the bald eagle. The Pond Creek–Henderson Sloughs wetland system lies in the northern part of the Western Kentucky Coal Field and has been adversely affected by oil-well brines. This area is characterized by a mosaic of bald cypress swamps and bottom-land hardwood forests, scrub-shrub vegetation, and open-water emergent vegetation. Wetlands in this area lie within the Mississippi flyway and provide valuable habitat and feeding grounds for migratory waterfowl.

In the Mississippi Embayment, there are extensive areas of wetlands dominated by bald cypress swamps or bottom-land hardwood forests. Terrapin Creek State Nature Preserve is a temporarily to permanently flooded cypress swamp that contains several perennial springs. The area supports a number of fish species found nowhere else in the State. Axe Lake Swamp State Nature Preserve consists of a bald cypress swamp and bottom-land hardwood forest within the Ohio River flood plain and constitutes a part of the largest contiguous swamp in Kentucky. The swamp supports eight plant and animal species that are rare in the State and provides wintering habitat for thousands of waterfowl. Also located in the Mississippi Embayment are Metropolis Lake, Murphy's Pond, and Swan Lake, three wetlands that are classified as "Outstanding Resource Waters" by the Kentucky Natural Resources and Environmental Protection Cabinet.

Wetlands in the central and eastern parts of the State are sparse and scattered. Swamp forests occur on poorly drained flats and in shallow depressions in the upper Green River Basin in the Mississippian Plateaus. Vegetation includes swamp white oak, buttonbush, lizard's tail, and sedges (Hoagland and Jones, 1992). At least a dozen swamps associated with abandoned river channels or sinking creeks (creeks that disappear through a "swallow hole" into solution channels in the underground limestone bedrock) are located in the Inner and Outer Bluegrass regions and the Knobs (Bryant, 1978; Meijer and others, 1981). This type of forested wetland, which occurs on moderately wet upland flats, is now rare in the Bluegrass and the Knobs. Another example of Bluegrass-region wetlands is in the Sinking Creek Basin (Meijer, 1976). Vegetation includes stands of bald cypress, swamp white oak, sedges, and rushes. The karst area near Mammoth Cave in the Mississippian Plateaus has depressional wetlands on sandstone ridges that contain water for 9 to 10 months during most years. There are also scattered emergent wetlands with organic soils in the Cumberland Plateau. Sphagnum moss is present at many of these sites in dense mats as much as a foot thick, in association with shrubs, sedges, and ferns (Mark Evans, Kentucky State Nature Preserves Commission, oral commun., 1992). Common or characteristic plant species include spicebush, common alder, cinnamon fern, and net-veined chain-fern.

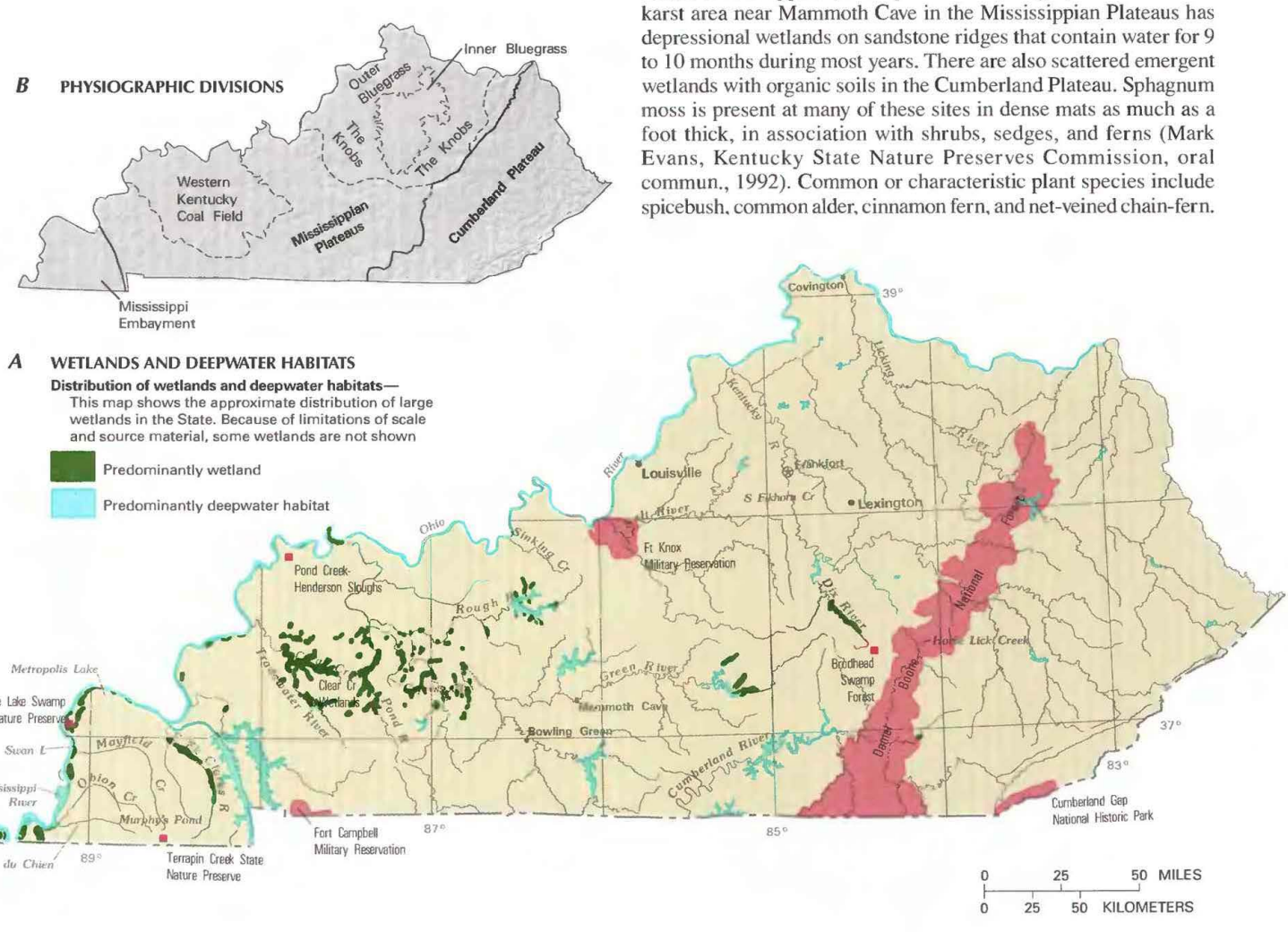

Figure 2. Wetland distribution in Kentucky and physiography of the State. ***A***, Distribution of wetlands and deepwater habitats. ***B***, Physiography. *(Sources: A, T.E. Dahl, U.S. Fish and Wildlife Service, unpub. data, 1991. B, Physiographic divisions modified from McDowell, 1986; landforms data from EROS Data Center.)*

HYDROLOGIC SETTING

The types and distribution of wetlands in Kentucky are determined principally by factors that include climate, topography, hydrology, geology, and soil type. Wetlands occur most commonly in areas where precipitation exceeds evapotranspiration and runoff or where there are perennial sources of ground water. Seasonally, precipitation is least from August through October; during these months, ground-water inflows help to maintain saturation in wetland soils.

The greatest areal extent of wetlands in Kentucky is in the Western Kentucky Coal Field. The region grades from rolling hills in the south and east to flat flood plains in the northern areas near the Ohio River. Extensive bottom-land hardwood wetlands in this part of the State are the result of a shallow water table, poorly drained soils, and frequent overbank flooding following seasonal precipitation (Harker and others, 1981). Bottom-land hardwood forest, either seasonally flooded or temporarily flooded, is the major wetland type (Mitsch and others, 1983). Valleys of major streams and their tributaries are wide, flat, and filled with thick alluvium or glacial deposits (fig. 3*A*). The associated flood plains contain many riparian wetlands. Soils near the Green, Pond, Tradewater, and Rough Rivers are thick and not well drained. The gentle slope of the Tradewater River and many of its tributaries (less than 1 foot per mile) results in floods that peak and subside slowly, fostering storage in associated alluvial wetlands. Base flow in streams and water in wetlands commonly are sustained by discharge of ground water from permeable limestone (Quinones and others, 1983). Many areas within the Western Kentucky Coal Field have been altered by strip mining, which has changed drainage characteristics. Swamp forests are left as stands of dead timber following disruption of the natural hydrology. Many of these areas are in transition to persistent-emergent or aquatic-bed wetlands. Abandoned coal-mine strip benches typically contain topographic depressions in which small wetlands form, and seepage through mine-spoil piles commonly supports wetlands on or below the piles.

Far western Kentucky is in the Mississippi Embayment. The region has low relief and is characterized by gently rolling uplands and wide, shallow valleys. Extensive bottom-land hardwood forests are found along Mayfield and Obion Creeks and Bayou de Chien. Much of the flood plain of these streams is composed of unconsolidated alluvium underlain by saturated sand and gravel. Other areas within the Mississippi Embayment have extensive deposits of loess or glacially derived outwash. The water table generally is shallow, and the region has some of the most productive aquifers in the State (Davis and others, 1973). Much of western Kentucky is subject to flooding by the Mississippi and Ohio Rivers, sometimes for prolonged periods. This periodic inundation is a primary source of water for riparian wetlands.

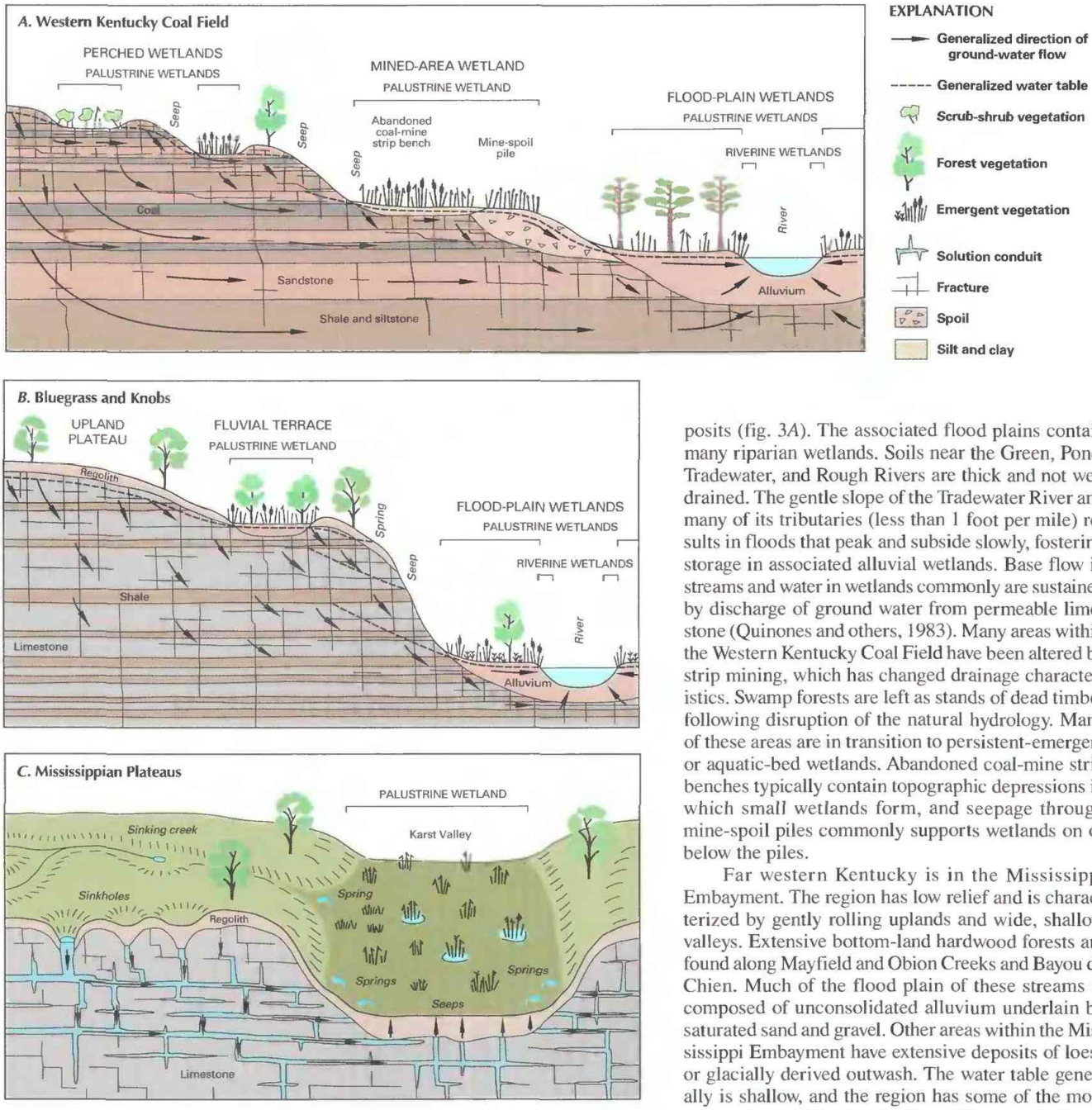

Figure 3. *Generalized geohydrologic setting of representative wetlands in* Kentucky. ***A,*** Western Kentucky Coal Field. ***B,*** Fractured bedrock and terrace deposits in the Inner and Outer Bluegrass regions and the Knobs. ***C,*** Karst terrane in the Mississippian Plateaus.

Wetlands in the central and eastern parts of the State generally are associated with karst terrane or are located on poorly drained flood plain or upland soils. Swamp forests in the Knobs and the Bluegrass region grow along the Green, Licking, Dix, and Kentucky Rivers and also occur on high-level terrace deposits at elevations of 600 to 1,000 feet (fig. 3*B*). Forested wetlands in the Knobs have formed on alluvium or low-permeability shale, whereas Bluegrass-region forested wetlands typically are in alluvium underlain by limestone and shale. Brodhead Swamp Forest, located in the Mississippian Plateaus, is in a sinkhole basin underlain by limestone and drained in the subsurface. The wetland is fed by several intermittent springs as well as by surface runoff (Hannan and Lassetter, 1982) and typically contains surface water for 11 months of the year. At other locations in the Mississippian Plateaus, wetlands form in sinkholes and karst valleys that are subject to flooding (fig. 3*C*). In the karst area surrounding Mammoth Cave, shallow depressional wetlands are sustained by the surficial aquifer on the tops of sandstone ridges. An underlying layer of compact, poorly permeable soil holds water in the soil at the surface. Scattered emergent wetlands with organic soils form at the base of gentle to steep slopes in valleys, ravines, and canyons in the southeastern Cumberland Plateau. These midelevation wetlands are fed by acidic ground-water seepage from stratified and fractured bedrock aquifers.

TRENDS

Wetlands are sensitive to changes in normal patterns of water storage and movement (Mitsch and Gosselink, 1986). Changes in hydrologic conditions, such as those associated with resource development or other human activities, commonly result in wetland loss or degradation. On the basis of the distribution of hydric soils as described by the Kentucky Division of Conservation (1982), Kentucky once had more than 1.6 million acres of wetlands. By 1977, about 929,000 acres (58 percent) of the State's original wetlands had been lost, primarily through drainage and subsequent conversion to cropland and pastureland. Losses were greatest in western Kentucky, amounting to 52 percent of the State's bottom-land hardwood forests. By 1990, Kentucky's remaining wetland acreage was estimated to be between 387,000 acres (John Hefner, U.S. Fish and Wildlife Service, written commun., 1993) and 650,000 acres (Kentucky Division of Water, 1992), representing a total State loss of about 60 to 76 percent since predevelopment times.

Only 20 percent of the remaining naturally occurring wetlands in Kentucky are forested. In addition to losses from logging and conversion to agricultural land, the disproportionate loss of bottom-land hardwoods might have been due to stream channelization. As flood frequency and duration are reduced, long-term changes in species composition occur; typically, riparian species are lost.

The FWS estimated that, as of 1983, losses of wetlands in Kentucky were continuing at a rate of about 3,600 acres annually (Tiner, 1984). The primary cause of wetland loss in the State has been conversion of bottom-land hardwood forests for agricultural use. Although loss due to agricultural conversion continues, the rate has declined because of changes in government subsidy programs, declining agricultural-commodity prices, and the overall scarcity of remaining forested wetlands. Other hydrologic alterations, such as channelization for flood control, highway construction, and modifications associated with industrial and commercial development, continue to adversely affect wetland resources in Kentucky. However, the loss due to those causes also is declining in response to expansion and enforcement of regulations.

Surface coal mining disturbs as much as 4,000 acres per year of the more than 2.9 million acres of land in the Western Kentucky Coal Field region (Mitsch and others, 1983). More than 114,000 acres of wetlands, principally bottom-land hardwood forests, could eventually be affected. Owing to the economic importance of coal, conflicts of interest arise between advocates of wetland protection and advocates of resource development. In addition to loss, wetlands also can be degraded by water pollution. Acidic mine drainage from coal-mining activities is common in the Western Kentucky Coal Field region, and water having low pH and high sulphur or iron concentrations causes severe damage to plant and animal communities (U.S. Fish and Wildlife Service, 1992). In the Mississippi Embayment, nonpoint-source inputs of nutrients, pesticides, and sediments can exceed the capacity of wetlands to absorb, filter, and transform those pollutants to less harmful forms, resulting in degradation or loss of wetlands. Other pollutants such as industrial wastewater and pesticides have deleterious short-term and long-term effects on wetlands.

CONSERVATION

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

Federal wetland activities.—Development activities in Kentucky 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

Table 1. Selected wetland-related activities of government agencies and private organizations in Kentucky, 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						
Fish and Wildlife Service	•		•	•	•	•
Geological Survey					•	
National Biological Survey					•	...
National Park Service		...	...		•	•
Office of Surface Mining		•	•		•	•
Environmental Protection Agency	...	•	...		•	•
Tennessee Valley Authority	•		•		•	•
STATE						
Geological Survey					•	
Natural Resources and Environmental Protection Cabinet						
Division of Conservation		...			•	•
Division of Water		•			•	•
Surface Mining Reclamation and Enforcement	...	•	•	..	•	...
State Nature Preserves Commission	•		•	•	•	•
Tourism Cabinet						
Fish and Wildlife Resources	•	•	•	•	•	•
Transportation Cabinet	•		•	•	•	•
Water Resources Research Institute			•		•	
PRIVATE ORGANIZATIONS						
Ducks Unlimited	•		•		•	•
Kentucky Resources Council	..		...		•	..
The Nature Conservancy	•		•	•	•	•
Riverfields	•	...	•	•	•	•

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) 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.

The EPA Wetlands Planning Unit has initiated an Advance Identification project in the Western Kentucky Coal Field. The project is a joint initiative between the EPA, the Corps, and the State and includes wetlands in four counties. The goals of the project are to increase public and industry awareness of wetland values and to generate information on wetland resources for regulatory agencies making permit decisions. The EPA has also awarded the Kentucky Natural Resources and Environmental Protection Cabinet, Division of Water, a project funded by the EPA State/Tribal Wetland Development Grant Program. The goal of this project is to collect biological, chemical, and physical data from minimally degraded wetland sites to develop biological standards for the assessment of wetland health.

The FWS Regional Wetlands Concept Plan (U.S. Fish and Wildlife Service, 1992) identified areas of wetlands in Kentucky that warrant protection because of their resource value, vulnerability, and scarcity. Among them are approximately 6,000 acres in the Cypress Creek area of the Western Kentucky Coal Field. This tract is recognized as habitat for several State-listed threatened or endangered species, contains five archeological sites, and is recognized as an important wetland area by the Kentucky State Nature Preserves Commission.

Several other Federal agencies conduct wetland-related activities in the State. The Forest Service (FS) is inventorying wetlands in the Daniel Boone National Forest. The FS manages wetlands for waterfowl and has constructed approximately 100 acres of new wetlands as a part of their nationwide "Taking Wings Initiative." The Department of Defense has asked the FWS to identify all wetlands on Fort Knox and Fort Campbell Military Reservations and to conduct a survey of threatened and endangered species in wetlands on these properties. The NPS has inventoried wetlands in the four NPS properties in Kentucky. Cumberland Gap National Historic Park is working with the Kentucky State Nature Preserves Commission to study midelevation peatlands that are located within park boundaries. Fed by acidic seeps, these wetlands support a mixed community of shrub and emergent plants as well as scattered dense mats of sphagnum moss.

State wetland activities.—Kentucky has not adopted specific wetland regulations (Aldy, 1992). Wetlands are specifically defined in State water-quality standards and regulatory statutes. The State administers the Clean Water Act section 401 water-quality certification program, and wetlands are included in the definition of surface waters. The Kentucky Division of Water is the point of contact for administering the State water-quality certification review process of section 404 permit applications (Hannan and others, 1986). The Kentucky Natural Resources and Environmental Protection Cabinet has assembled an interagency working group to explore mitigation options to curtail the loss of Kentucky's bottom-land hardwood forests.

Although the FWS has not yet completed its inventory of Kentucky's wetlands, under a Memorandum of Agreement, the Kentucky Department of Fish and Wildlife Resources has provided funds to the Kentucky Division of Water to digitize all the FWS National Wetlands Inventory maps for Kentucky. The digitized information will become a part of the Kentucky Natural Resources and Environmental Protection Cabinet's geographic information system. In addition to having an active wetlands-acquisition program, the Kentucky Department of Fish and Wildlife Resources offers technical guidance in wetland identification and restoration to landowners and developers. The Department also participates in the New Madrid Wetlands Project, a four-State initiative to protect important waterfowl habitat in the lower Mississippi River valley. The proposal, developed to further the goals of the North American Waterfowl Management Plan, includes acquisition and management of 39,000 acres of wetlands in Kentucky.

The Kentucky State Nature Preserves Commission has recommended several wetlands for conservation and protection (Hannan and others, 1986). These areas were chosen on the basis of the presence of threatened or endangered species, the presence of critical habitat or an Outstanding Resource Water (as designated by the Kentucky Natural Resources and Environmental Protection Cabinet), and the imminence of destruction or alteration. They also manage a number of existing wetland preserves and foster the protection of other wetlands in the State through a system of registry and dedication agreements with private individuals.

Private wetland activities.—Most of Kentucky's wetlands are privately owned. The Nature Conservancy is active in land acquisition and stewardship of wetlands in Kentucky. The group also participates in joint management, along with various State agencies and private individuals, of several wetlands in the Mississippi Embayment as well as the Horse Lick Creek wetland system in the Knobs. The Kentucky Resources Council is an environmental advocacy organization that provides legal and technical support to local government and public interest groups to ensure the full and fair implementation of the Clean Water Act with respect to wetlands in the State. Riverfields is a group of concerned private citizens that owns and manages two wetland areas, including bottom-land hardwood forest in the alluvial flood plain of the Ohio River near Louisville. They strongly emphasize public education in their activities.

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