Montana
Wetland Resources

Wetlands cover only a small part of Montana, but their ecological and economic importance far outweighs their relative size. Wetlands provide stopover feeding areas and breeding grounds for migratory waterfowl (fig. 1). The Nation's most valuable waterfowl production area, the prairie pothole region of the northern Great Plains, includes wetlands of north-central and northeastern Montana. Wetlands are highly productive and provide food for both aquatic and terrestrial animals. Several threatened or endangered species depend on Montana wetlands, including the whooping crane, least tern, bald eagle, piping plover, grizzly bear, and peregrine falcon. Many freshwater fish and upland game birds are wetland dependent, as are antelope, white-tailed and mule deer, elk, moose, and bear, as well as other nongame mammals.

Wetlands stabilize or improve environmental quality by trapping sediments, producing oxygen, recycling nutrients, absorbing chemicals and other pollutants, moderating water temperature, and storing carbon (Tiner, 1984). Many small cities and towns in Montana use sewage lagoons, which are constructed wetlands, for municipal wastewater treatment.

Socioeconomic benefits of Montana wetlands are well documented. Wetland vegetation stabilizes streambanks, reduces erosion and flooding, and provides windbreaks for crops and farmsteads. In some areas, wetlands augment streamflow, whereas in other areas they capture overland runoff and slowly release it to underlying aquifers. Because of their high level of productivity, wetlands are excellent providers of renewable resources, including timber, hay, and livestock water. Montana natives and pioneers highly regarded wetland plants such as cattails, willows, and black cottonwood for food, fuel, insulation, basket-making materials, and construction materials, and their use continues to some extent today (Hansen and others, 1991; R.M. Hazelwood, U.S. Fish and Wildlife Service, oral commun., 1993).

Finally, wetlands are valued for recreation, education, and esthetics. As Montana's tourism industry becomes increasingly important, so do wetlands for the extensive opportunities they provide for fishing, hunting, camping, and observing wildlife.

Figure 1. Freezout Lake Wildlife Management Area in west-central Montana. Wetlands associated with this natural lake receive irrigation return flow, furnish habitat for numerous waterfowl species, and provide a variety of recreational opportunities. *(Photograph by John H. Lambing, U.S. Geological Survey.)*

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

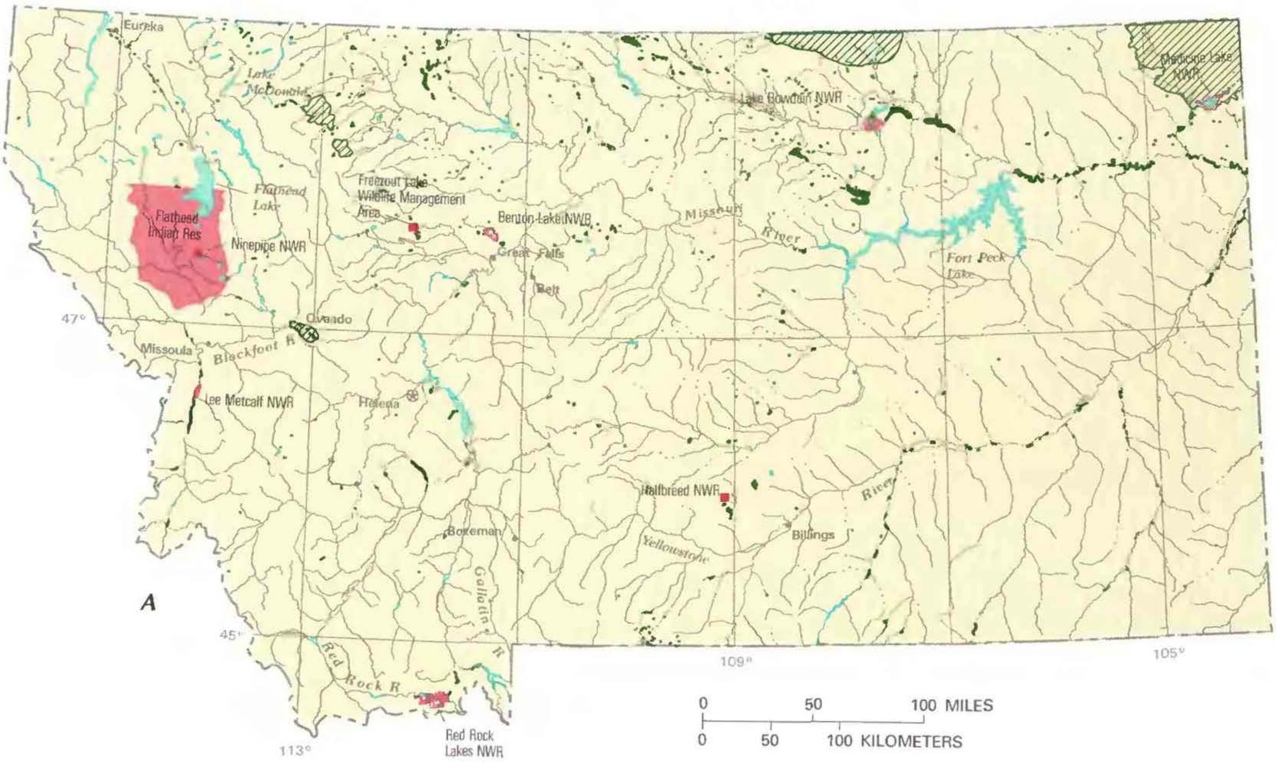
Wetlands can be vegetated or nonvegetated and are classified on the basis of their hydrology, vegetation, and substrate. In this summary, wetlands are classified according to the system proposed by Cowardin and others (1979), which is used by the U.S. Fish and Wildlife Service (FWS) to map and inventory 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 Montana 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.

Dahl (1990), on the basis of unpublished data from the FWS, estimated that 840,300 acres, or 0.9 percent of the State, contained wetlands. However, the total wetland area of Montana has not yet been systematically inventoried. Since 1974, the FWS has been conducting a thorough inventory of the Nation's wetlands. That inventory will enable a more accurate estimate of Montana's wetland acreage.

Other investigators have made estimates of wetland acreage for various specific purposes. These estimates did not include all of the State's wetlands. On the basis of an inventory of 15 counties in northern Montana, the FWS (1954) concluded that 187,400 acres of wetlands statewide provide valuable waterfowl breeding habitat. R.J. King (U.S. Fish and and Wildlife Service, unpub. data, 1975) identified 159,608 wetland acres with significant waterfowl production capability (exclusive of constructed reservoirs and stock ponds) in 40 of Montana's 56 counties.The Water Quality Bureau of the Montana Department of Health and Environmental Sciences (1992) estimated that riparian areas comprise about 1,860,000 acres. Riparian areas include both wetlands and uplands.

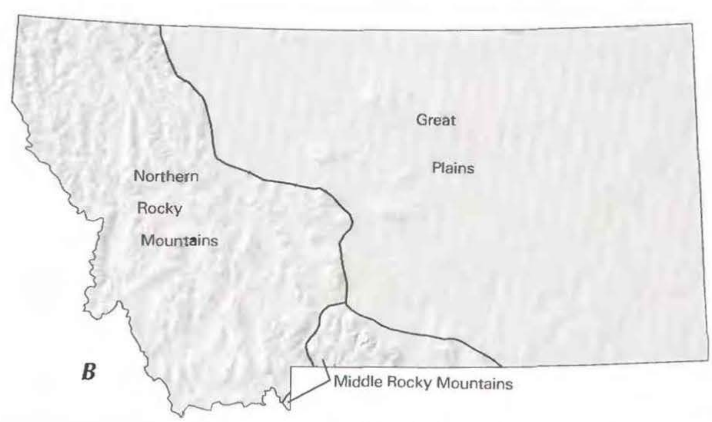
Most Montana wetlands are palustrine. These include forested wetlands adjacent to rivers statewide; scrub-shrub wetlands such as willow carrs (thickets) in western Montana and greasewood



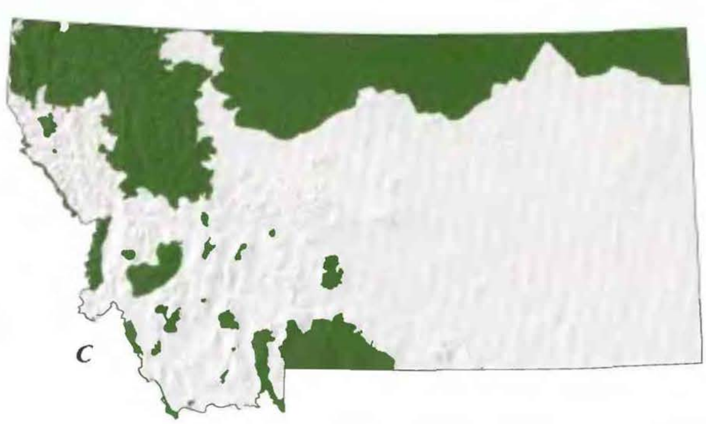
WETLANDS AND DEEPWATER HABITATS

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



PHYSIOGRAPHIC DIVISIONS



GLACIATION

- Glacial extent during most recent glacial maximum

Figure 2. Wetland distribution in Montana and physical features that control wetland distribution in the State. ***A***, Distribution of wetlands and deepwater habitats. ***B***, Physiography. ***C***, Extent of most recent glaciation. *(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. C, Alden, 1932, 1953.)*

scrubland adjacent to rivers in eastern and southwestern Montana; persistent-emergent wetlands such as marshes, fens and wet meadows in western Montana, and fresh and saline marshes in eastern Montana; and aquatic-bed wetlands such as water-lily ponds in northwestern Montana (Tiner, 1984; Hansen and others, 1991; Windell and others, 1986). Palustrine wetlands also are associated with artificial lakes and ponds throughout the State.

The distribution of the different types of wetlands in Montana correlates with the State's physiography (fig. 2*B*). In glaciated areas of the Great Plains (fig. 2*C*), wetlands are primarily in topographic depressions commonly referred to as prairie potholes. In the Northern and Middle Rocky Mountains, wetlands are primarily in potholes of glaciated intermontane basins, in the flood plains of streams in unglaciated intermontane basins, and in high mountain valleys. In unglaciated areas of the Great Plains, wetlands occur in flood plains of streams in the Missouri and Yellowstone River basins and also are commonly associated with constructed livestock ponds.

HYDROLOGIC SETTING

Wetlands form where the soil or substrate is saturated with or covered by water for extended periods. The location and persistence of water are a function of interdependent climatic, topographic, hydrologic, and geologic factors. In Montana, except in the high mountains, annual potential evaporation exceeds precipitation, resulting in a moisture deficit that inhibits wetland formation. Therefore, topographic, hydrologic, and geologic factors are as important as climatic factors in creating and maintaining most Montana wetlands.

Glaciation in the northern Great Plains (fig. 2*C*) blanketed the landscape with dense, clayey glacial till (sediment) (Alden, 1932). As the overlying glacial ice melted, potholes (kettle lakes) remained where ice blocks had previously been embedded in the till. These potholes range in area from less than 1 acre to several square miles. The nearly impermeable till inhibits direct infiltration of snowmelt into the soil. Instead, meltwater flows overland into prairie potholes. Even though potential evaporation exceeds precipitation in this region, the high moisture-retention capacity of the clayey soil allows lush, diverse wetland vegetation to develop wherever water accumulates, resulting in highly productive wetlands (Winter, 1989). In terms of waterfowl production, the seven most productive counties in Montana are located in the prairie pothole region (R.J. King, U.S. Fish and Wildlife Service, unpub. data, 1975).

The hydrology and water quality of prairie pothole wetlands can vary over time. In some areas, ground-water flow reverses direction because of changing water levels in adjacent potholes. Prairie pothole wetlands can recharge ground-water aquifers in spring until evaporation and water uptake by plants cause the water level in the wetland to drop below the local water table. At that time, ground water begins to flow back into the wetland (Winter, 1989). Wetland salinity commonly increases as evaporation concentrates dissolved minerals in the water through the summer and freezing concentrates them through the winter (LaBaugh, 1989). In spring, snowmelt dilutes the salinity.

Water quality can differ between temporary and permanent prairie pothole wetlands, even within the same area. Some prairie pothole wetlands are sustained by ground-water inflow, which provides a constant, but commonly mineralized or saline, source of water. Other prairie pothole wetlands are sustained only by runoff and receive no ground-water inflow. In wet years, these wetlands generally have freshwater, but during most years the combination of evaporation and infiltration causes them to go dry. Still other prairie pothole wetlands have brackish (slightly to moderately salty) water resulting from a combination of ground-water and surface-water inflow (Winter, 1989).

The glaciated areas of the Great Plains typically have a small regional topographic gradient, no integrated drainage system, and soils that have low permeability. Consequently, the region is highly susceptible to flooding. The large storage capacity of prairie potholes makes them instrumental in controlling seasonal flooding and thus in protecting productive cropland and rural communities from damage. Furthermore, the slow infiltration afforded by compact, clayey soils allows the potholes to slowly augment ground-water supplies with water that otherwise would leave the area as overland flow.

Glaciation in the Northern Rocky Mountains (fig. 2*C*) also covered some intermontane basins with glacial till, allowing the formation of pothole wetlands such as the complexes near Ovando and the Ninepipe National Wildlife Refuge. Dams formed by glacial debris created other productive wetland areas, including those associated with Flathead Lake and Lake McDonald. Geologic characteristics play an important role in the water quality of these wetlands. The mountain ground water that interacts with intermontane wetlands generally is less mineralized than prairie ground water, so the water is fresher in intermontane wetlands than in prairie pothole wetlands. However, some intermontane pothole wetlands near Eureka are biologically sterile because slime deposits from glacial rock flour inhibit growth (Reichmuth, 1986).

Intermontane basins are drained by low-gradient, meandering streams and rivers that develop riparian (streamside) wetlands in slackwater deposits behind natural levees, in oxbow lakes formed by meander cutoffs, on islands, below diversions, along shorelines, and on deltas and fans (Reichmuth, 1986). Riparian wetlands are dependent on seasonal flooding for moisture. The frequency and duration of flooding depend on climate, flood-plain elevation, drainage area, channel slope, and soils. The magnitude of flooding and the resultant ground-water levels in the alluvium affect the type and productivity of vegetation in riparian areas. Floodwaters also deposit nutrient-rich sediments and promote anaerobic (oxygen-poor) conditions that make the nutrients available to plants.

Intermontane basins, particularly those in southwestern Montana, are seismically active. For example, regional northwest tilting elevated the northern Gallatin River above the streambeds of its western tributaries, and wetlands have developed in resulting areas of shallow ground water. Another example is a geologically recent uplift that reversed the direction of flow in the upper Red Rock River. The uplift occurred so rapidly that streams have not had sufficient time to cut and deepen channels in response to the new regional gradient. The lack of an integrated drainage system has created large waterlogged areas (Reichmuth, 1986). These areas receive additional inflow from geologic faults, which allow warm ground water to flow toward the land surface, providing excellent wetland habitat for waterfowl. Fault-controlled ground-water flow also is a primary moisture source for wetlands in other intermontane basins.

High-mountain wetlands form in response to geologic, climatic, and even biological forces. In alpine and subalpine zones, where precipitation exceeds evaporation, wetlands persist wherever natural impoundments prevent surface runoff. For example, alpine lakes fill cirques, which are scour holes that glaciers carved below mountain peaks. Below the subalpine zone, sinuous, low-velocity streams drain broad, U-shaped glaciated mountain valleys. Seasonal flooding and high water tables sustain wetlands behind glacial moraines and beaver dams and within low-lying depressions such as oxbow and kettle lakes. Downstream from glaciated valleys, running water has eroded steep, V-shaped valleys that have wetlands along streams and springs and within impoundments created by landslides and beaver dams (Windell and others, 1986).

A recent study of peat-fen (wetlands that have organic soils) hydrology in the headwaters of the Blackfoot River reveals the complexity of water flow through a mountain wetland. Not only does the flow velocity range markedly, from 1.8 to 880 feet per day, but ground water flows both into and out of the wetland. The large range of flow velocities was explained by the extreme variability of peat permeability (Morton and others, 1989).

Some eastern States have taken advantage of the natural filtering capacity of wetlands to mitigate acidic mine drainage. In an attempt to duplicate their success, three artificial wetlands have been constructed to treat acidic mine drainage from abandoned coal mines near Belt, Mont. The artificial wetlands have decreased the concentrations of toxic metals somewhat, but the concentrations still exceed State and Federal water-quality standards, and the discharge remains acidic. These shortcomings are attributable to mechanical problems, freezing in the winter, and, most significantly, extremely acidic, highly mineralized mine discharge that exceeds the treatment capacity of the wetlands. Therefore, wetlands might not provide a viable solution to acidic mine drainage problems in Montana (J.N. Koerth, Montana Department of State Lands, oral commun., 1992.)

TRENDS

Although wetland deterioration can be physical, chemical, or biological, the major concern in Montana is physical loss of wetlands (Montana Department of Health and Environmental Sciences, 1982, 1988, 1992). In its biennial report to the U.S. Environmental Protection Agency (EPA), the Water Quality Bureau stated that, "Precious little is known about Montana wetlands except that they are disappearing" (Montana Department of Health and Environmental Sciences, 1982, p. 3). The Montana Department of Fish, Wildlife and Parks (1992, p. 2) concurs, forecasting that "***a continuing general decline in the wetland base in the State appears most probable." The acreage of wetlands that have been lost is not precisely known, but one estimate is that only 73 percent of the State's predevelopment wetlands remain (Dahl, 1990).

Table 1. Selected wetland-related activities of government agencies and private organizations in Montana, 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	•		•	•	•	•
Bureau of Reclamation			•		•	
Fish and Wildlife Service	•		•	•	•	•
Geological Survey					•	
National Biological Service					•	
National Park Service	•		•	•	•	•
Environmental Protection Agency		•			•	
TRIBAL						
Confederated Salish and Kootenai Tribes	•	•	•	•	•	•
STATE						
Department of Fish, Wildlife and Parks	•	•	•	•		
Department of Environmental Quality						
Reclamation Division		•	•		•	•
Water Quality Division	•	•			•	•
Department of Natural Resources and Conservation						
Forestry Division		•				
Trust Land Management Division	•	•		•		•
Department of Transportation	•		•			•
Montana Bureau of Mines and Geology					•	
Montana Riparian Association			•		•	•
Natural Resource Information System						•
LOCAL ORGANIZATIONS						
Conservation Districts		•				
PRIVATE ORGANIZATIONS						
Ducks Unlimited			•		•	
The Nature Conservancy	•			•		•

Most losses have been due to conversion of wetlands to croplands, particularly in the prairie pothole region. As of the mid-1980's, about 20,000 acres of prairie in eastern Montana had been artificially drained for agricultural production (Dahl, 1990). Significant losses of wetlands are also attributable to the construction of highways, railroads, dams, large reservoirs, and irrigation systems; soil erosion and siltation; urbanization; recreational development; channelization; mining; logging; oil and gas production; and intensive grazing (Hansen and others, 1988; Montana Department of Fish, Wildlife and Parks, 1992; Windell and others, 1986). Montana wetland losses will become more critical as wetland habitat for breeding and migrating waterfowl diminishes in neighboring States.

Although the decline of wetland acreage continues, the national rate of wetland loss has slowed since protective legislation and educational programs were implemented in the mid-1980's (Dahl and others, 1991). Under that legislation, private organizations and government agencies have created, restored, and protected wetlands throughout Montana. In addition, the construction of reservoirs used for livestock watering, especially in eastern Montana, has improved waterfowl production and has contributed significantly to the wetland base (Montana Department of Fish, Wildlife and Parks, 1992).

Whereas the major wetland concern in Montana is the diminishing quantity, also important is the deteriorating quality of the wetlands that remain. Fertilizers, pesticides, sediments, and salts from farms and ranches, brine from oil-field activities, and saline seeps induced by agricultural practices adversely affect the quality of water in some Montana wetlands (Montana Department of Fish, Wildlife and Parks, 1992; Reiten, 1992; Miller and Bergantino, 1983). A recent drought in Montana also has adversely affected both the quantity and quality of the State's wetlands. Many wetlands have dried up, and evaporation has concentrated dissolved minerals in others.

CONSERVATION

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

Federal wetland activities.—Development activities in Montana 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 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 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 (CFSA) (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 provides guidance to States in developing the wetland component of their plans.

Federal agencies are responsible for the proper management of wetlands on public land under their jurisdiction. The Bureau of Land Management manages about 267,000 acres of wetlands and deepwater habitats in Montana, including 9,000 miles of streams (D.K. Hinckley, Bureau of Land Management, oral commun., 1992). The Corps manages the 408,591-acre Fort Peck Lake project area, which includes deepwater and upland habitats, palustrine and lacustrine wetlands, and 1,520 miles of shoreline (L.D. Krueger, U.S. Army Corps of Engineers, oral commun., 1992). The U.S. Forest Service manages 16,806,039 acres in 11 National Forests in Montana (U.S. Forest Service, 1991). The FWS manages 40,590 acres of waterfowl protection areas and 1,066,559 acres of National Wildlife Refuges in Montana, including major wetland complexes at Medicine Lake, Lake Bowdoin, Benton Lake, Lee Metcalf, Red Rock Lakes, Halfbreed, and Ninepipe National Wildlife Refuges. The FWS also holds perpetual easements on 32,100 acres of Montana wetlands. Finally, since 1988, the FWS has involved about 300 Montana landowners in the restoration, enhancement, and creation of about 7,500 wetland acres (J.W. Stutzman and P.H. Hartmann, U.S. Fish and Wildlife Service, oral commun., 1992, 1993). The CFSA administers a Water Bank program in which private landowners agree not to destroy wetlands in return for annual payments. In Montana, about 3,200 wetland acres are protected under this program (Montana Department of Health and Environmental Sciences, 1988).

Tribal wetland activities.—Indian tribes are becoming increasingly involved in wetland programs on reservation lands and ceded territories in Montana. For example, the Confederated Salish and Kootenai Tribes of the Flathead Indian Reservation in western Montana have enacted several ordinances directed at protecting and managing wetlands in their 1.2-million-acre reservation. These include a Tribal Water Quality Ordinance and Shoreline Protection and Aquatic Lands Conservation Ordinances, which enforce a "no net loss" policy. The tribes also have applied for treatment as a State under section 404 of the Clean Water Act and are awaiting action by EPA (S.K. Ball, Confederated Salish and Kootenai Tribes, written commun., 1993).

State wetland activities.—Four State interagency agreements pertain to wetland protection. The Montana Riparian Association is a statewide interagency cooperative that develops riparian ecological classifications to assist in the identification, description, and management of riparian communities, including wetlands (Hansen and others, 1991). The Montana Riparian Education Committee, which is composed of agricultural and conservation organizations and State and Federal agencies, informs private landowners of the economic benefits and resource values of riparian areas (J.F. Schumaker, Montana Department of Natural Resources and Conservation, written commun., 1992). The Montana Interagency Wetlands Group cooperates to avoid, minimize, or mitigate damage to wetlands that might result from State highway construction. If none of those alternatives is feasible, the group operates a wetland-banking system, which creates new wetlands to replace those that are lost (Montana Department of Fish, Wildlife and Parks, 1992). The North American Waterfowl Management Plan is an agreement between Canada and the United States to reverse recent declines in waterfowl populations. Under the plan, wetlands can be purchased, leased, or protected by easements. Landowners are offered economic incentives for using farming practices that are beneficial to waterfowl. Another component of the plan is the joint venture—a partnership of public and private organizations working toward the common goal of wetland preservation. The U.S. Prairie Pothole Joint Venture is a coalition of Federal and State agencies and private organizations that researches, protects, and enhances prairie wetland and upland habitat in northeastern Montana and four other States that have prairie potholes. Joint ventures are also being planned for the northern Great Plains and the intermontane basins of Montana (Montana Department of Fish, Wildlife and Parks, 1992).

The Montana Department of Fish, Wildlife and Parks has a supporting technical role in all four interagency agreements. As a regulatory agency, the Department administers the Montana Stream Protection Act of 1963, which regulates construction by government agencies along streams, and the U.S. Fish and Wildlife Coordination Act, which regulates Federal activities that might adversely affect wetlands. Also, the Department determines wetland designations for Swampbuster enforcement and assists the FWS with its ongoing wetland inventory. The State Waterfowl Stamp program, with matching funds from Ducks Unlimited, supports the Department efforts to protect, develop, and enhance wetlands and associated upland areas on public and private land. Forty-five State Wildlife Management Areas, including 19 that contain wetlands, also are administered by the Department (Montana Department of Health and Environmental Sciences, 1982).

The Montana Department of Environmental Quality (a new State agency formed July 1, 1995, and composed of parts of the former Departments of Health and Environmental Sciences, Natural Resources and Conservation, and State Lands), administers and enforces State water-quality standards. Although none of the existing standards apply directly to wetlands, the Department is developing enforceable water-quality and biological standards that will be specific to Montana wetlands. This effort, funded by EPA, also includes the development of a State wetlands data base, water-quality and biological monitoring, education, river-corridor management, support for the Montana Riparian Association and wetland banking, and a wetland-protection coordinator. The coordinator is working with other agencies and organizations to develop a State wetland-protection plan (Montana Department of Health and Environmental Sciences, 1992). Until the new standards are approved, section 404 of the Clean Water Act continues to provide the most explicit protection for Montana wetlands. The Department is the State agency that reviews section 404 permit applications and certifies compliance with State water-quality standards. As the permitting agency for hardrock and coal mines, the Department of Environmental Quality enforces compliance with section 404 and requires mitigation of wetland loss in mining areas (S.J. Olsen and B.K. Lovelace, Montana Department of State Lands, oral commun., 1992).

The Montana Department of Natural Resources and Conservation (reorganized July 1, 1995, to include parts of the former Department of Natural Resources and Conservation and the Department of State Lands) manages 5.2 million acres statewide in addition to all land below the low-water level of navigable lakes and streams. An estimate of wetland acreage under Department management is not available. The Department leases about 80,000 acres to the Department of Fish, Wildlife and Parks, the FWS, and The Nature Conservancy; most of the remaining area is leased to individuals and corporations for logging, grazing, and agricultural activities. The Streamside Management Zone Act, which the Department administers, prohibits certain forestry practices along streams, lakes, other water bodies, and adjacent wetlands.

County and local wetland activities.—County conservation districts administer the Natural Streambed and Land Preservation Act of 1975. Districts review applications and issue permits to individuals and other private entities planning activities that may physically alter or modify the bed or immediate banks of a perennial stream. By educating the public and enforcing permit conditions, the Districts minimize impacts to riparian wetlands (J.F. Schumaker, Montana Department of Natural Resources and Conservation, written commun., 1992).

Private wetland activities.—Ducks Unlimited provides funds for State agencies to restore, enhance, and create wetlands in Montana and supports university research of waterfowl ecology (P.M. Bultsma, Ducks Unlimited, oral commun., 1992). The Nature Conservancy manages habitat for the preservation of rare species and ecosystems. Working with private landowners, the Conservancy has established more than 152,000 acres of conservation easements and has acquired more than 15,000 acres of critical habitat statewide. In addition, the Conservancy cooperates with government agencies to assist them in acquiring land. To complement its conservation efforts, the Conservancy coordinates the Natural Heritage Program of the Natural Resource Information System, which maintains a computerized inventory of biological resources (H.S. Zackheim, The Nature Conservancy, oral commun., 1992).

References Cited

Alden, W.C., 1932, Physiography and glacial geology of eastern Montana and adjacent areas: U.S. Geological Survey Professional Paper 174, 133 p.

______1953, Physiography and glacial geology of western Montana and adjacent areas: U.S. Geological Survey Professional Paper 231, 200 p.

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: Washington, D.C., U.S. Fish and Wildlife Service Report to Congress, 13 p.

Dahl, T.E., Johnson, C.E., and Frayer, W.E., 1991, Wetlands—Status and trends in the conterminous United States, mid-1970's to mid-1980's: Washington, D.C., U.S. Fish and Wildlife Service Report to Congress, 22 p.

Fenneman, N.M., 1946, Physical divisions of the United States: Washington, D.C., U.S. Geological Survey special map, scale 1:7,000,000.

Hansen, P.L., Boggs, K.W., Pfister, R.D., and Joy, John, 1991, Classification and management of riparian and wetland sites in Montana, draft version 1: Missoula, Montana Riparian Association, Montana Forest and Conservation Experiment Station, School of Forestry, University of Montana, 478 p.

Hansen, P.L., Chadde, S.W., and Pfister, R.D., 1988, Riparian dominance types of Montana: University of Montana Miscellaneous Publication 49, p. 9–23.

LaBaugh, J.W., 1989, Chemical characteristics of water in northern prairie wetlands, *in* van der Valk, Arnold, ed., Northern prairie wetlands: Ames, Iowa State University Press, p. 56–91.

Miller, M.R., and Bergantino, R.N., 1983, Distribution of saline seeps in Montana: Montana Bureau of Mines and Geology Hydrogeologic Map 7, 7 p.

Montana Department of Fish, Wildlife and Parks, 1992, 1993 Montana statewide comprehensive outdoor recreation plan, draft section III, Montana wetlands: Helena, Montana Department of Fish, Wildlife and Parks, 8 p.

Montana Department of Health and Environmental Sciences, 1982, Montana water quality, 1982: Helena, Water Quality Bureau, Montana 305(b) Report, 116 p.

______1988, Montana water quality, 1988: Helena, Water Quality Bureau, Montana 305(b) Report, 80 p.

______1992, Montana water quality, 1992: Helena, Water Quality Bureau, Montana 305(b) Report, 42 p.

Morton, R.B., Goering, J.D., and Dollhopf, D.J., 1989, Hydrologic characteristics of a wetland using a bromide tracer, *in* Woessner, W.W., and Potts, D.F., eds., Proceedings of the Symposium on Headwaters Hydrology, Missoula, Mont.: American Water Resources Association Technical Publication Series TPS-89-1, p. 553–562.

Reichmuth, D.R., 1986, Fluvial systems in the wetland environment, *in* Sather, J.H., and Low, Jessop, eds., Proceedings of the Great Basin/Desert and Montane Regional Wetland Functions Workshop, Logan, Utah, February 27–28, 1986: University of Massachusetts at Amherst, The Environmental Institute Publication 90-4, p. 23–59.

Reiten, J.C., 1992, Water quality of selected lakes in eastern Sheridan County, Montana: Montana Bureau of Mines and Geology Open-File Report MBMG 244, 44 p.

Tiner, R.W., Jr., 1984, Wetlands of the United States—Current status and recent trends: Newton Corner, Mass., U.S. Fish and Wildlife Service, National Wetlands Inventory, 59 p.

U.S. Fish and Wildlife Service, 1954, Wetlands inventory of Montana: Billings, Mont., U.S. Fish and Wildlife Service, Office of River Basin Studies, p. 20.

U.S. Forest Service, 1991, Land areas of the national forest system as of September 30, 1991: U.S. Forest Service Report FS-383, p. 25.

Windell, J.T., Willard, B.E., Cooper, D.J., and others, 1986, An ecological characterization of Rocky Mountain montane and subalpine wetlands: U.S. Fish and Wildlife Service Biological Report 86(11), 298 p.

Winter, T.C., 1989, Hydrologic studies of wetlands in the northern prairie, *in* van der Valk, Arnold, ed., Northern prairie wetlands: Ames, Iowa State University Press, p. 16–55.

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