Wyoming
Wetland Resources

Wetlands cover approximately 1.25 million acres of Wyoming according to estimates made in the 1980's (Dahl, 1990; University of Wyoming, 1990). Although wetlands comprise only about 2 percent of the State's area (Dahl, 1990), their ecologic and economic value is greater than their surface area might indicate. Wetlands are the most diverse ecosystems in Wyoming's semiarid environment. About 90 percent of the State's wildlife use wetlands daily (University of Wyoming, 1990). Wyoming wetlands support large numbers of breeding birds and many species of spring and fall migrants (fig. 1). Some waterfowl species, such as Canada geese, mallards, redheads, and the interior populations of trumpeter swans, use open water in the wetlands during the winter. Wetlands are the focus of varied recreational and tourist activities such as hunting, fishing, bird watching, camping, and hiking. Water and forage for Wyoming's livestock are provided by wetland areas.

Wetlands function as water reservoirs, linking surface and ground water, and as modulators of water quality (Odum, 1979). Their hydrologic functions include flood attenuation, water-quality improvement, water storage, and aquifer recharge and discharge. In the spring, wetlands usually receive flood waters, thereby attenuating flood peaks and reducing erosion. Wetlands can modulate water quality (Odum, 1979); water is stored in the wetlands, sediment settles out, and nutrients and heavy metals can be removed through biological and chemical processes. Depending on hydrologic conditions, aquifers may be recharged from wetland areas. Some wetlands slowly release water, augmenting streamflow and extending the period of flow later into the summer and fall.

Figure 1. American avocet at the Laramie Plain Lakes wetland complex. *(Photograph by LuRae Parker, Wyoming Game and Fish Department.)*

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 Wyoming 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 Wyoming 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.

There is no recent estimate for Wyoming of statewide wetland acreage in each of the three ecological systems; however, the FWS National Wetlands Inventory Program currently (1993) is mapping the State at a 1:24,000 scale. As of April 1993, only Yellowstone National Park (about 4 percent of the State) remained unmapped. Inventories of wetlands and permanent water areas significant to waterfowl were conducted in the 1950's by the FWS (U.S. Fish and Wildlife Service, 1955a,b). Those studies found 26 percent of Wyoming's wetlands to be palustrine, 35 percent mixed palustrine and lacustrine, 9 percent lacustrine, and 30 percent riverine. The inventories did not include many shallow plains basins and high mountain wetlands (C.R. Elliott, written commun., 1993); thus, it is not known if the percentages approximate the overall distribution of Wyoming's wetlands.

Wetlands are distributed throughout Wyoming (U.S. Fish and Wildlife Service, 1955a,b). Palustrine wetlands occur throughout Wyoming and include emergent wetlands such as seasonally flooded basins or flats, fresh marshes, fresh meadows, saline marshes, and playas; forested wetlands such as swamps; scrub-shrub wetlands such as shrub swamps and bogs; unconsolidated shore wetlands such as saline flats; and unconsolidated bottom wetlands such as small stock ponds. Freshwater wetlands are more concentrated in the mountainous areas, whereas the saline wetlands and stock ponds occur in greater density in the basins and plains (fig. 2*A*). Lacustrine wetlands discussed herein are limited to the shallows of reservoirs and naturally occurring lakes. Riverine wetlands associated with high-gradient streams are concentrated in the mountainous areas, whereas wetlands associated with low-gradient

streams and intermittent streams are more prevalent in basins and plains.

Wetlands also are distributed throughout the State in areas not delineated in figure 2*A*. On a map of the scale of figure 2*A*, many of the smaller wetlands do not appear because of their size. However, these small wetlands are ecologically significant because they sometimes are the only source of water and specialized habitat in a large area. Ratti and Kadlec (1992) noted that wetlands, as all resources, gain value from scarcity. The presence of wetlands allows much broader use of the upland areas in arid or semiarid climates. Ratti and Kadlec (1992) stated that wetlands in arid and semiarid areas are used far more extensively than wetlands in humid regions, where wetlands are more abundant. An example of the distribution of these small wetlands is shown in figure 2*B*, an area near Ocean Lake.

HYDROLOGIC SETTING

Wetlands form where there is a water supply at or near the land surface. The location and persistence of the supply is a function of interdependent climatic, physiographic, and hydrologic factors including precipitation and runoff patterns, evaporation potential, topography, and ground-water discharge. There have been few, if any, studies that examine the influence of those factors on the distribution of wetlands in Wyoming. However, published reports indicate that combinations of those factors create conditions that support wetlands in Wyoming in four settings: mountain ranges, river drainages, closed basins, and areas of human activity.

Wetlands exist in all the major mountain ranges in Wyoming. The Wyoming Basin separates the Middle Rocky Mountains from the Southern Rocky Mountains, which reach into southeastern Wyoming, and the Great Plains extend to the east (fig. 2*C*). The mountain ranges force air masses to rise to higher altitudes, where cooling causes increased precipitation (fig. 2*D*). The average annual precipitation ranges from more than 60 inches in mountainous areas to less than 6 inches in the Wyoming Basin (Martner, 1986). High precipitation and runoff in the mountains, coupled with low evaporation, create a net moisture surplus that allows wetlands to form. Ground-water storage at higher altitude, due to such factors as frequent storms, bedrock depressions, and shallow soils, keeps the water table close to land surface and enhances the development of the mountain wetlands (Skinner, 1986).

Semipermanently and permanently flooded palustrine and riverine wetlands are associated with river drainages throughout Wyoming. Many of these wetlands exist because water storage in moun-

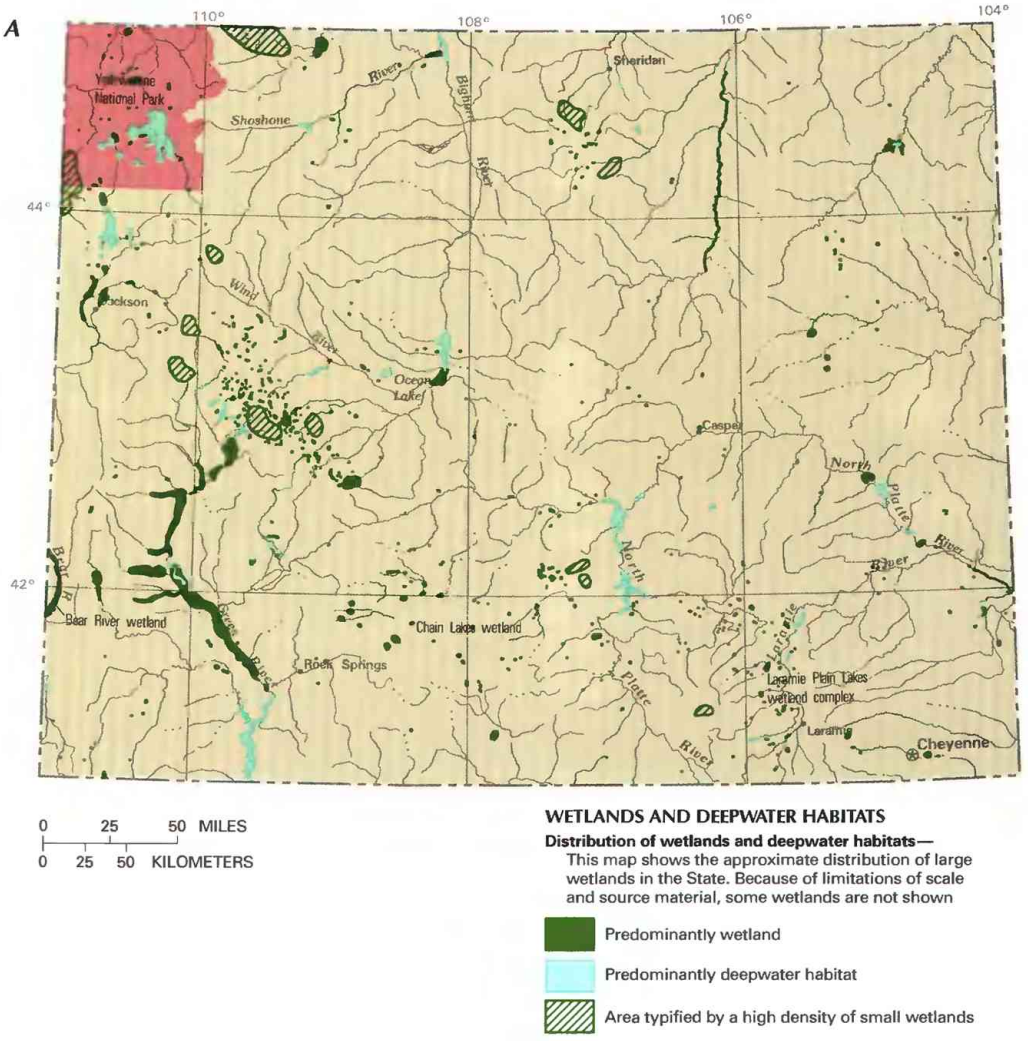

Figure 2. Wetland distribution in Wyoming and physical and climatic factors that influence wetland distribution in the State. ***A***, Distribution of wetlands and deepwater habitats. *(Sources: A, T.E. Dahl, U.S. Fish and Wildlife Service, unpub. data, 1991.)*

tainous areas, reservoirs, or aquifers extends the season of flow beyond the spring snowmelt period. In mountainous areas, water is stored in snowpack, lakes, bogs, riparian areas, and aquifers and then is gradually released from spring through fall. Runoff is higher in the mountains than in the basin and plains areas (fig. 2*E*). Several large reservoirs on the North Platte River, the Wind–Bighorn River system, and the Green River control streamflow by storing spring runoff and, later in the year, releasing the water to downstream users. The extended streamflow provides water to the associated wetlands over a longer period of time, but it limits overbank flooding, thus reducing spring flood moisture to riparian wetlands. Ground-water discharge supplies much of the base flow to rivers and wetlands on the plains of Wyoming. This base flow comes either from water stored in alluvial aquifers or discharged from deeper, bedrock aquifers. These different types of water storage provide the moisture necessary for the existence of wetlands along Wyoming's major drainages.

Playa wetlands exist in closed basins of various sizes throughout Wyoming. These wetlands may be saline or fresh, depending on local factors such as the hydrology and soils. Examples of saline playa wetlands can be found in the Chain Lakes of the Wyoming Basin. The Chain Lakes contain saline, shallow, palustrine emergent wetlands; palustrine and lacustrine unconsolidated shore wetlands; and seasonally flooded depressions. These wetlands lie within a salt-desert shrub- and sagebrush-covered basin that is one of the driest areas in Wyoming. Owing to the high evapotranspiration potential, the area has a net average annual water deficit of from 10 to 17 inches per year. The Chain Lakes wetlands are maintained by ground-water discharge where the land surface intersects with the water table, but their water level changes in response to precipitation and runoff (Charles Reed, Bureau of Land Management, oral commun., 1993). One attribute of such wetlands is their attenuation of the variability in the hydrologic cycle. In the arid and semiarid West, variability rather than stability may actually be the norm in the hydrologic cycle (Ratti and Kadlec, 1992). The cycle of wet and dry years causes constant fluctuations of water levels in lakes and streams. Playas that are dry in drought years take on special importance in wet years because many other wetlands are deeply

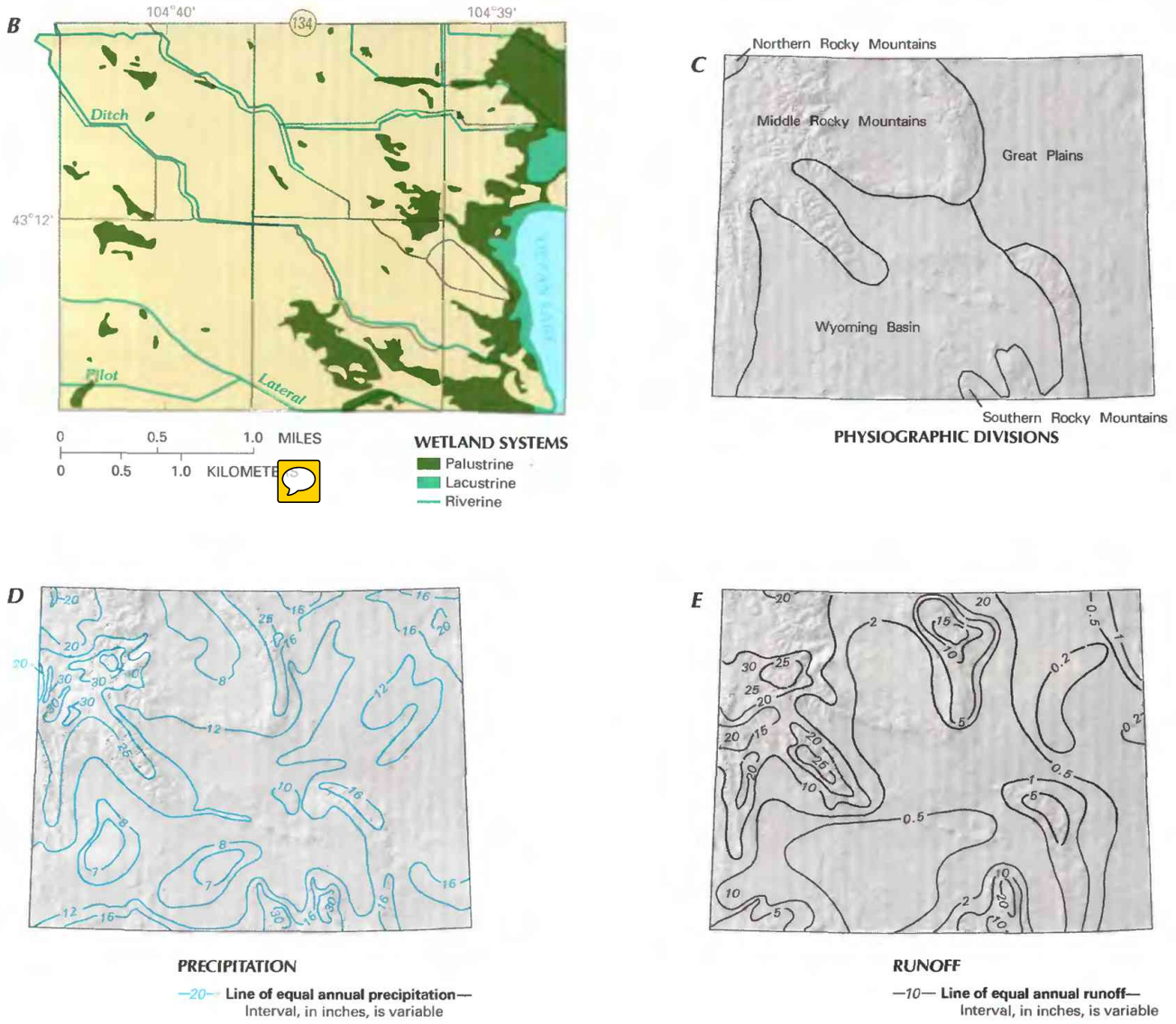

Figure 2. Continued Wetland distribution in Wyoming and physical and climatic factors that influence wetland distribution in the State. ***B***, Detail of wetlands west of Ocean Lake in the Wind River Basin. ***C***, Physiography. ***D***, Average annual precipitation. ***E***, Average annual runoff. *(Sources: B, Modified from U.S. Fish and Wildlife Service, 1987. C, Physiographic divisions from Fenneman, 1946; landforms data from EROS Data Center. D and E, Schuetz and others, 1986.*

flooded and their submersed vegetation is less available and productive. Ecologically, the fluctuation of water levels has interactive effects with the vegetation's germination, establishment, and competition, adding to the diversity or productivity of these sites (Ratti and Kadlec, 1992). Osterkamp and Wood (1987) found that water fluctuation also may aid in the development and enlargement of these playas through carbonate-rock dissolution, piping, and weathering.

The Laramie Plain Lakes wetland complex (fig. 3) consists of 5,500 acres of riverine, palustrine, and lacustrine wetlands associated with the Laramie River and small, closed basins (University of Wyoming, 1990). Many of the closed basins containing playa lakes in this complex are the result of blowouts (Kolm, 1982) caused by high winds funneled across the more than 7,000-foot-high plain between mountain ranges. Some lakes are fresh and others are saline. In addition to being significant habitat for many bird species (fig. 1), this complex of wetlands provides habitat for the Wyoming toad, an endangered species (fig. 3). When the glaciers retreated about 17,000 years ago, a population of Wyoming toad was stranded in the basin, where it adapted to a grassier, less forested environment (Johnson, 1985).

Some small wetlands result from human activities. Irrigation of farm lands, mining, and stock ponds associated with ranching have changed or created wetlands. An example of the interactive effects of human activities and natural wetlands associated with a stream is the Bear River wetland, the most productive and diverse bird habitat in Wyoming. The area contains 23,000 acres of continuous wetlands; 97 percent are palustrine and 3 percent are riverine (D.C. Lockman and Leonard Serdiuk, Wyoming Game and Fish Department, written commun., 1984). These wetlands were enhanced by agricultural diversion of water during the spring high flows into the low-gradient flood-plain areas adjacent to the Bear River. The original purpose of the diversions was to flush salts and increase hay-meadow production. The complex hydrology of the Bear River system resulted in lengthening the wetland production period from the original spring runoff period of late May to mid-June to an extended period of late April to early July (D.C. Lockman and Leonard Serdiuk, written commun., 1984). The low gradient of the Bear River and the existence of old oxbows allowed a mosaic of marshes, other wet areas, and dry nesting areas to develop.

Wetlands have developed in stock ponds and in pits and depressions resulting from mining. Stock ponds generally receive only surface-water runoff and are concentrated in arid and semiarid basins. The wetlands associated with mining are scattered throughout the State and generally are the result of intersecting the water table during the excavation of the pit, although the wetlands can also

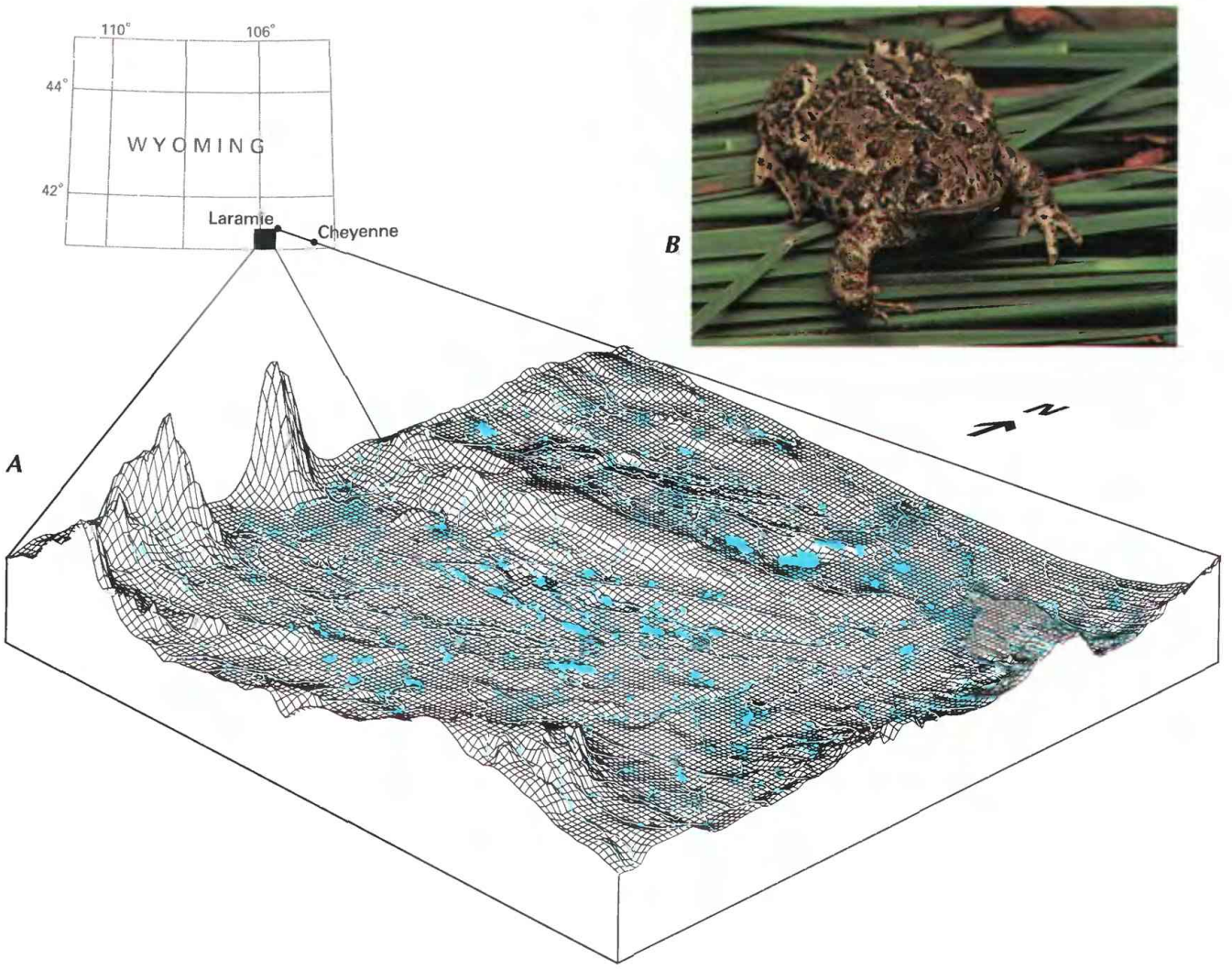

Figure 3. Laramie Plain Lakes wetland complex and the resident endangered Wyoming toad. ***A***, Laramie Plain Lakes wetland complex. ***B***, Wyoming toad. *(Sources: A, Compiled by C.A. Eshelman, U.S. Geological Survey. B, Photograph by LuRae Parker, Wyoming Game and Fish Department.)*

receive surface-water runoff. Wetlands created during reclamation of bentonite-mine pits in northeastern Wyoming were designed to reduce water turbidity from colloids by settlement of sediment and establishment of vegetation (P.R. Ogle, Mariah Associates, oral commun., 1993). Some studies have compared strip-mine and stock-pond wetlands. Olson (1979) found that the concentration of chemical constituents in the water was inversely related to water levels and that strip-mine ponds had different chemical concentrations than stock ponds. Wangsness (1977) discovered that dissolved-oxygen concentrations were smaller, major-ion concentrations were larger, biological communities were less diverse, and chemical fluctuations were more pronounced in strip-mine ponds than in natural ponds in northwestern Wyoming near Sheridan.

TRENDS

Trends in the acreage and types of wetlands in Wyoming are the subject of controversy. Dahl (1990) estimated that between the 1780's and 1980's Wyoming lost 38 percent (by area) of its wetlands. Skinner (1986), in an examination of historic journals of Lewis and Clark, Captain John C. Fremont, and Osborne Russell, cites observations of changing hydrologic and riparian conditions over the 1804–1986 period that indicate a change in the type of wetlands along some major streams but do not necessarily support reports of large losses in wetland acreage.

Palustrine wetlands, particularly those created and maintained by seasonal flooding, have decreased in area, owing to agricultural and urban activities, although the loss has not been quantified (U.S. Fish and Wildlife Service, 1990). Knight (1991) reported that, in the Bighorn River flood plain between 1938 and 1986, woodlands decreased, shrublands increased, the area of meadow and marshes fluctuated before 1961 but stabilized since that time, and salt cedar increased. Knight (1991) suggests that some of these changes might have been related to the construction of dams on the Bighorn River.

Approximately 230,000 acres of deepwater reservoir habitat have been created in Wyoming. The operation of reservoirs for irrigation and power production can cause downstream water-level fluctuations that are unfavorable to the regeneration of riparian and other wetland vegetation (U.S. Fish and Wildlife Service, 1990). Conversely, flood-irrigation systems have created wetlands as a result of canal and dam seepage. Urban development, especially in the Jackson area, has resulted in both direct wetland loss and decline in wetland quality (U.S. Fish and Wildlife Service, 1990). Shallow pond acreage, primarily stock ponds, has increased substantially in Wyoming.

CONSERVATION

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

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

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

Most farming, ranching, and silviculture activities are not subject to section 404 regulation. However, the "Swampbuster" provision of the 1985 Food Security Act and amendments in the 1990 Food, Agriculture, Conservation, and Trade Act discourage (through

Table 1. Selected wetland-related activities of government agencies and private organizations in Wyoming, 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 Commerce						
National Oceanic and Atmospheric Administration	...	...			•	...
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	...	•	...		...	•
NORTHERN ARAPAHO AND EASTERN SHOSHONE TRIBES	•	•	•	•	•	•
STATE						
Department of Agriculture			•	...	•	
Department of Commerce						
Economic and Community Development	•		•	•	•	•
Department of Environmental Quality						
Abandoned Mine Land Division		•	•	...	•	•
Industrial Siting		•	...	...	...	...
Land Quality Division		•	•		•	•
Solid and Hazardous Waste		•	•		•	•
Water Quality Division		•	•	...	•	•
Department of Transportation	•		•		•	•
Game and Fish Department	•	•	•	•	•	•
Geological Survey	...	...			•	...
Oil and Gas Commission	...	•			•	...
State Engineer's Office	...	•			•	...
State Land and Farm Loan Board	•				...	...
University of Wyoming	•	...	...	...	•	...
Water Development Commission	•	•	•	•	•	•
COUNTY AND LOCAL	•	•		•	...	•
PRIVATE ORGANIZATIONS						
Ducks Unlimited	•		•	•	•	•
Powder River Resource Council	...		...	...	•	...
The National Audubon Society	•	...	•	•	•	•
The Nature Conservancy	•	...	•	•	•	•
Pheasants Forever	•	•	•	•	•	•
Trout Unlimited	•		•	•	•	•
Wyoming Association of Conservation Districts	•		•	...	•	...
Wyoming Riparian Association	...		...	...	•	...
Wyoming Stockgrowers Association			...	...	•	...
Wyoming Wildlife Federation	...	.	•	...	•	...

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 provides guidance to States in developing the wetland component of their plans.

State wetland activities.—The Wyoming Wetlands Act is the basis for wetland program development by the State. The act designates the Wyoming Department of Environmental Quality's Water Quality Division as the lead agency for developing guidance for the evaluation of wetland ecological functions and values and for establishment of a statewide wetland-mitigation bank. Section 35–11–309(d) of Wyoming Statutes and the Legislative Policy and Intent of the Wyoming Wetlands Act differentiates between naturally occurring wetlands and wetlands resulting from human activities. As part of the Wyoming Wetlands Act, the State is considering the use of a wetland bank for tracking and mitigation of wetland disturbance and for creation management. Use of water, an essential part of any wetland, also is regulated by State laws, seven interstate compacts, and various U.S. Supreme Court decrees (Wolfe, 1986).

County and local wetland activities.—Wetland activities at county and local government levels differ throughout the State. Wetland considerations commonly are addressed as part of the county zoning or land-use plans in Wyoming's 23 counties. Conservation Districts often are active in implementing wetland projects.

Private wetland activities.—Ducks Unlimited and The Nature Conservancy are active in the acquisition and management of wetland areas. Other organizations participating in wetland-protection activities in Wyoming include Trout Unlimited, the National Audubon Society, the Powder River Resource Council, the Wyoming Wildlife Federation, the Wyoming Stockgrowers Association, the Wyoming Riparian Association, and the Sierra Club.

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FOR ADDITIONAL INFORMATION: District Chief, U.S. Geological Survey, 2617 East Lincolnway, Suite B, Cheyenne, WY 82001; Regional Wetland Coordinator, U.S. Fish and Wildlife Service, Fish and Wildlife Enhancement, P.O. Box 25486, Denver Federal Center, Denver, CO 80225

Prepared by
Kathy Muller Ogle,
U.S. Geological Survey