New Mexico
Wetland Resources

Wetlands cover about 482,000 acres (0.6 percent) of New Mexico, a reduction of about 33 percent from the wetland acreage that existed about 200 years ago (Dahl, 1990). New Mexico's wetland acreage places the State 34th in total wetland acreage among the 48 conterminous States.

Wetlands are ecologically important and economically valuable to the State. Wetlands provide important wildlife habitat. For example, in the Rio Grande Valley, wetlands provide habitat for 246 species of birds, 10 species of amphibians, 38 species of reptiles, and 60 species of mammals (U.S. Fish and Wildlife Service, 1990). Wetlands also provide stopover, feeding, and breeding grounds for migratory waterfowl (fig. 1).

Riparian (streamside) wetlands along perennial streams are important as migration corridors for a variety of waterfowl and other wildlife. The playa lakes in eastern New Mexico are vital links in a chain of wetlands along the Central Flyway, which extends from central Canada to the coast of Texas. Areas of springs and marshes provide essential habitat for many rare and endangered species and for indigenous fish and wildlife in the western part of the State.

Wetlands contribute to flood attenuation, bank stabilization, and improved water quality. New Mexico's tourist industry benefits from the beauty of the State's diverse wetlands. These wetlands provide opportunities for recreational activities that include fishing, hunting, bird watching, nature photography, camping, and hiking.

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 New Mexico 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 New Mexico are described below.

Figure 1. Bosque del Apache National Wildlife Refuge. These riparian wetlands provide habitat for migratory and resident waterfowl, fish, and other wildlife. *(Photograph by Lisa Carter, U.S. Geological Survey.)*

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.

Although wetlands occur in all areas of New Mexico, they are most numerous in the eastern and northern areas of the State (fig. 2*A*). In the Southern Rocky Mountains (fig. 2*B*), wetlands are mostly in high mountain valleys and intermountain basins. In the Great Plains, wetlands occur along the flood plains of the Canadian and Pecos Rivers and in association with playa lakes. In the Colorado Plateaus and Basin and Range, wetlands are sparsely distributed, with the exception of wetlands associated with the San Juan, San Francisco, and Gila Rivers.

Palustrine wetlands are distributed statewide. In New Mexico, palustrine wetlands include forested wetlands in river flood plains and near springs and seeps; scrub-shrub wetlands such as bottomland shrubland; emergent wetlands, such as marshes, fens, alpine snow glades, and wet and salt meadows; aquatic bed wetlands in shallow ponds and small lakes; and sparsely or nonvegetated wetlands such as playa lakes. Palustrine wetlands along rivers, streams, springs, lakes, and ponds are called riparian wetlands. Riparian wetlands along the State's major rivers provide habitat for fish, wildlife, and diverse plant life. They also provide habitat for migrating, overwintering, and nesting waterfowl. One of the more notable riparian wetlands in New Mexico is in the Bosque del Apache National Wildlife Refuge. The 57,191-acre refuge lies along 9 miles of the Rio Grande in south-central New Mexico. Marshes within the refuge are ideal winter habitat for migratory birds, including ducks, geese, sandhill cranes, and whooping cranes. Efforts are being made to maintain and restore native riparian cottonwood habitat in the refuge for a variety of birds and other wildlife. Many western species of riparian trees and shrubs, such as willows and cottonwoods, have been lost because of nonnatural streamflow regimes (Howe and Knopf, 1991). The nonnatural flows followed the completion of water projects in the first half of the 20th century, resulting in rapid colonization and expansion of the exotic Russian-olive and salt cedar.

The playa lakes of eastern New Mexico provide habitat for migrating, overwintering, and nesting waterfowl in the Central Flyway (U.S. Fish and Wildlife Service, 1990). The estimated number of playa lakes in the State is 1,700, and they range in area from less than 1 acre to more than 600 acres (Nelson and others, 1983). The

playa lakes range in wetness from dry lake bed to shallow lake and can be fresh or saline. The freshwater playas are numerous, small to medium in size, and serve as zones of recharge to the underlying aquifer (Osterkamp and Wood, 1987). The saline playas are larger and fewer than the freshwater playas and are areas of discharge from the underlying aquifer. Most playa lakes in New Mexico are palustrine. However, playa lakes larger than 20 acres are classified as lacustrine wetlands, as are the shallow areas of large reservoirs.

Riverine wetlands occur in the shallow river channels of perennial streams. There are about 3,500 miles of streams in New Mexico (Ong and others, 1993).

HYDROLOGIC SETTING

Wetlands form where a persistent water supply is at or near the land surface. The location and persistence of the supply of water is a function of precipitation and runoff patterns, evaporation potential, topography, and the presence of a shallow water table.

Precipitation and runoff rates differ annually and with location and season. Average annual precipitation in New Mexico (fig. 2*C*) ranges from about 8 inches in the northwestern corner of the State and in the southern Rio Grande Valley to 24 inches in the mountains of the northern and southern parts of the State. Runoff (fig. 2*D*) is greatest in the northern mountains and smallest in the desert areas of the southern and eastern parts of the State. Much of the runoff from the mountains occurs during concurrent snowmelt and rainfall in the spring and summer.

Average annual pan evaporation varies across the State and ranges from about 40 to 112 inches per year (Nelson and others, 1983). Most evaporation occurs from March through September and decreases with increasing altitude. Because annual evaporation exceeds annual rainfall, most of the State has a net annual moisture deficit. The moisture deficit is a limiting factor in the formation of wetlands and to the continued existence of some of the more fragile wetlands. Even those areas of the State having the highest precipitation and lowest evaporation (high mountain regions) can be unfavorable for development of wetlands because of steep topography, shifting stream channels, and unfavorable soil conditions (Cooper, 1986).

Shallow water tables and groundwater discharge into topographic depressions, streams, and springs maintain wetlands in many areas of New Mexico. These wetlands can be along small streams that have perennial flow in only short reaches or along larger, perennial streams. In intermountain basins, wetlands are maintained by a shallow water table and springs whose source is recharge from precipitation and runoff that occur during spring and summer.

Climatic, topographic, and hydrologic characteristics differ among and sometimes within the physiographic provinces. New Mexico's diverse physiography, climate, and topography result in diverse hydrologic settings for wetland formation.

In the Colorado Plateaus and Basin and Range Provinces (fig. 2*B*), wetlands occur in springs and seeps, around oxbow lakes, along streams and rivers, around reservoirs, and in other areas where the water table is near the land surface. The arid climate of this region results in a low density and acreage of wetlands. Wetlands, although few in number, are vital to wildlife of these physiographic provinces.

In the Great Plains, wetlands occur in riparian zones along perennial streams, around oxbow lakes, in isolated natural depressions with permanent or seasonal water supply, in playa lakes, and in association with other lakes, reservoirs, channelized streams, rivers, and irrigation ditches. Playa lakes make up the largest area of wetlands in this province.

The area of playa lakes has topography classified as either smooth plains, irregular plains, or tablelands (Nelson and others, 1983). Smooth plains are largely on upland terrain, and irregular plains and tablelands are mostly on lowland terrain. Because of the flatness of the terrain, there is generally little stream drainage, and playa lakes collect most of the surface runoff. The playa lakes are

Figure 2. Wetland distribution in New Mexico and physical and climatological features that control 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.)*

usually shallow depressions that have large surface area relative to the total volume of water contained in them. Consequently, most playa lakes have small storage capacities.

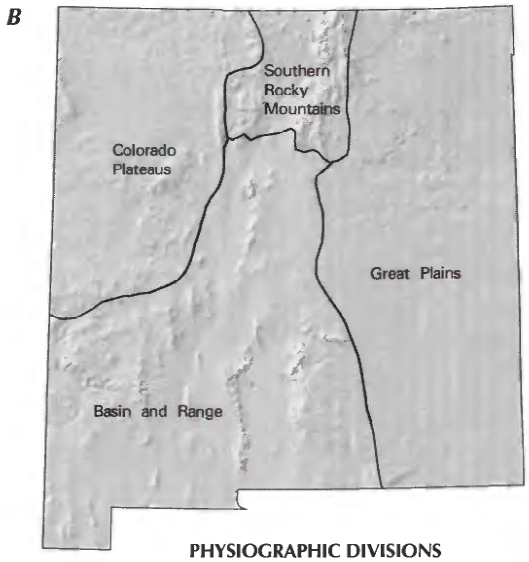
Studies by Osterkamp and Wood (1987) indicate that freshwater playa lakes in the Great Plains of New Mexico originate wherever surface depressions collect precipitation runoff. The lakes enlarge as a result of dissolution of carbonates by water infiltrating the unsaturated zone above the underlying aquifer and subsequent subsidence of the lake bed. Over time, the older central lake acquires a layer of clay-rich deposits that largely restricts water movement from the playa lake to the underlying aquifer. Water probably is removed from freshwater playa lakes primarily by recharge to the underlying aquifer from the areas around the lake where lake-bed sediments have not yet accumulated (Osterkamp and Wood, 1987) and by evaporation that in some years ranges as high as 96 to 112 inches per year (Nelson and others, 1983). There is no general agreement on the origin of saline playa lakes; however, Wood and Jones (1990) propose that the source of the salinity is from the concentration by evaporation of runoff and shallow, fresh ground water that discharges from the underlying aquifer.

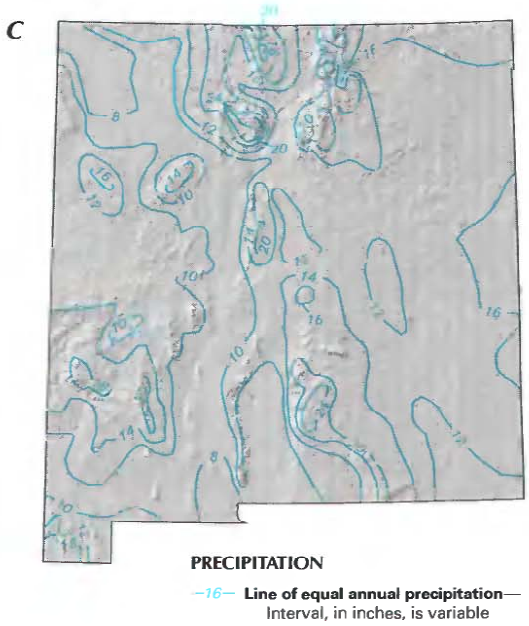
In the Southern Rocky Mountains, wetlands occur in two physiographically and climatically distinct settings, mountain valleys and intermountain basins. Generally, mountain valleys are geologically young and therefore steep. The valleys have been shaped over time either by running water throughout their entire length or by glaciers at higher altitudes and running water at lower altitudes. At high altitudes in some mountain valleys, glaciation formed large cirque basins in which remnant glaciers or late-melting snow maintains spring, seep, and snow-bed wetlands. Also, at these high altitudes, ponds form in depressions behind slumping saturated soils or in depressions caused by the weight of accumulated snow. Below the cirque basins, wetlands occur in the glaciated, U-shaped valleys, on saturated cliff faces, at the sloping floor near the sides of the valley, in glacial kettle ponds, in oxbow lakes, in depressions on glacial moraines, in lakes created by terminal or lateral moraines, in landslide-formed lakes, in seeps and springs, and in beaver ponds. In steep, V-shaped, nonglaciated areas of mountain valleys, wetlands occur as narrow riparian wetlands, near seeps and springs, and in beaver ponds (Windell and others, 1986).

Intermountain basins were filled by sediments derived from erosion of the surrounding mountains. The large, flat valleys are drained by low-gradient meandering streams and rivers. Intermountain-basin wetlands occur along these streams and rivers, in constructed and natural impoundments, around oxbow lakes, and in other areas where the water table is near the land surface. The shallow water table is maintained by underlying aquifers, impermeable substrates, or annual floods (Windell and others, 1986).

TRENDS

The FWS has estimated that from the 1780's to the 1980's, wetland acreage in New Mexico decreased by 33 percent—from about 720,000 to 482,000 acres (Dahl, 1990). Much of the decrease is attributable to the loss of native vegetation along streams because





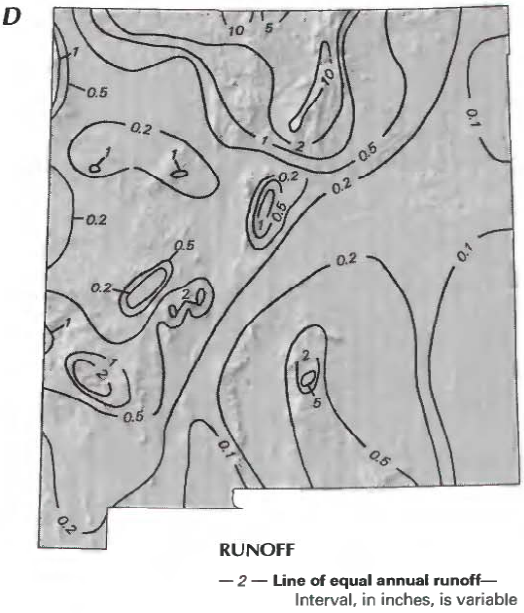


Figure 2. Continued. Wetland distribution in New Mexico and physical and climatological features that control wetland distribution in the State. ***B***, Physiography. ***C***, Average annual precipitation. ***D***, Average annual runoff. *(Sources: B, Physiographic divisions from Fenneman, 1946; landforms data from EROS Data Center. C and D, Gold and Denis, 1986.)*

of a change in streamflow resulting from reservoir construction or agricultural water diversions. The loss of native vegetation along streams alters riparian-wetland functions and allows the proliferation of nonnative vegetation (Howe and Knopf, 1991).

Wetland losses in rural areas can be attributed to conversion to cropland, dewatering or diverting water for irrigation, and overgrazing by livestock. Development of urban areas has caused wetland loss or degradation owing to encroachment of residential and commercial construction, dewatering for municipal and industrial water supply, channelization, and contamination from inadequately treated sewage and industrial waste. Other causes of wetland loss or degradation are clear cutting, burning, hard-rock mining and related activities that produce toxic acidic or alkaline runoff, placer mining, erosion and sedimentation, sand and gravel mining, road and railroad construction, and dam and reservoir construction in wetland areas (Windell and others, 1986).

Some human activities have helped to form wetlands or enlarge existing ones. The construction of reservoirs between 1916 and 1985, which provided for storage of more than 5.9 million acre-feet of surface water (Garrabrant and Garn, 1990), resulted in the formation of wetlands along the edge of those water bodies. However, such gains are at the expense of the original, natural riparian wetlands. Farm-pond construction also contributes to the formation of wetlands around the edge of the pond. More than one-half of the State's cropland is irrigated (Garrabrant and Garn, 1990), and leaking ditches and seeps and return flow associated with irrigation have contributed to the formation of wetlands.

CONSERVATION

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

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

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

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

Table 1. Selected wetland-related activities of government agencies and private organizations in New Mexico, 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	...	•	...	...	•	•
STATE						
Department of Game and Fish	•	•	•	•	•	•
Energy, Mineral, and Natural Resources Department	...	...	•	...	...	...
Environment Department	•	•	...	•	•	...
State Engineer Office	•	•	...	...	...	•
University of New Mexico						
Natural Heritage Program	...	...	...	...	•	•
COUNTY AND LOCAL GOVERNMENTS						
Albuquerque Open Space Division	•	...	•	•	•	•
Santa Fe County	...	...	...	...	•	•
PRIVATE ORGANIZATIONS						
National Audubon Society	...	...	•	...	...	...
Sierra Club	...	...	•	...	•	...
The Nature Conservancy	...	...	...	•	...	...

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.

The U.S. Forest Service (FS) manages five National Forests in New Mexico that contain diverse wetlands and riparian ecosystems. The FS also coordinates with State agencies and private landowners on wetland-conservation activities.

The FWS manages six National Wildlife Refuges in New Mexico that provide habitat for migrating birds, endangered species, and other wildlife and wildlife-oriented public recreation. Under the 1986 Emergency Wetlands Resources Act, the FWS evaluated eight priority wetland sites in the State for acquisition (U.S. Fish and Wildlife Service, 1990).

A goal of the Bureau of Land Management (BLM) is to restore, maintain, and improve riparian wetland area conditions on public land in New Mexico. The BLM is responsible for the management of 12.8 million acres of public land in the tristate area of New Mexico,

Oklahoma, and Kansas, which includes 27,600 acres of riparian wetland (Bureau of Land Management, 1990).

State wetland activities.—The principal State agencies in New Mexico that regulate or manage wetlands are the Department of Game and Fish, Environment Department, and the State Engineer Office. Also involved is the State Park and Recreation Division of the Energy, Mineral, and Natural Resources Department, which developed the New Mexico Wetlands Priority Conservation Plan (New Mexico Energy, Minerals, and Natural Resources Department, 1988). This plan is a component of the 1986 Statewide Comprehensive Outdoor Recreation Plan. The goals of agencies managing wetlands in New Mexico are to provide habitat for fish and wildlife and for diverse plant species, to maintain wetlands for erosion and flood control, and to enhance wetlands as agricultural, recreational, and scenic resources.

State management of wetlands in New Mexico began with an assessment of State wetlands by the State Park and Recreation Division (New Mexico Energy, Minerals, and Natural Resources Department, 1988). The steps in the assessment were to locate wetlands, determine their types, assess their quality, prioritize them according to their value and benefit, and rate the probable effect on them of each of the major causes of wetland losses. The Division considers the seven major causes of loss or degradation of wetlands in New Mexico to be (1) municipal water development, (2) natural water-table fluctuation, (3) development of land surfaces, (4) pollution, (5) erosion, tree cutting, or siltation, (6) invasion by nonnative plant species, and (7) poor management. The assessment of the quality of wetlands is based on habitat conditions, the dominance of native or rare species, the presence of terrestrial animals, and the uniqueness of the wetland in New Mexico. State government acquisition of wetlands will be based on whether the public values and benefits of wetlands can be maintained or realized under present ownership (New Mexico Energy, Minerals, and Natural Resources Department, 1988).

County and local wetland activities.—The Open Space Division of the city of Albuquerque acquires, manages, and restores wetlands. The Division also conducts feasibility studies and inventories wetlands in areas under its jurisdiction. The county of Santa Fe is involved in research and inventory of wetlands in the county.

Private wetland activities.—Private organizations involved in wetland management and conservation in New Mexico include the National Audubon Society, the Sierra Club, and The Nature Conservancy. A principal activity of the National Audubon Society and the Sierra Club is the restoration and creation of wetlands. The Sierra Club also conducts research in wetlands. The Nature Conservancy acquires wetlands and other ecologically valuable habitats for conservation. A major goal of these private organizations is to inform the public about the value of wetlands.

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