



Loss of Wetlands in the Southwestern United States

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The following is abstracted primarily from the U.S. Geological Survey Water-Supply Paper 2425, [National Water Summary on Wetland Resources](#), 1996. The reader is urged to refer to the full paper for more detailed information.

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What are Wetlands?

Wetlands are areas where water covers the soil, or is present either at or near the surface of the soil all year or for varying periods of time during the year, including during the growing season. Wetlands have numerous definitions and classifications in the U.S. as a result of their diversity, the need for their inventory, and the regulation of their uses. They also vary widely because of regional and local differences in soils,

topography, climate, hydrology, water chemistry, vegetation, and other factors, such as human disturbance. The variety of common names for wetlands--marshes, swamps, potholes, bogs, fens, and pocosins--attest to the diversity of wetland types. Indeed, wetlands are found on every continent except Antarctica and fall into two general categories: coastal (tidal); and inland (non-tidal) (Tiner, 1996; and Carter, 1996).

Coastal wetlands are closely linked with estuaries, where sea water and fresh water mix. Because of the salt water and the fluctuating water levels caused by the tides, this is a difficult environment for most plants. However, mangrove swamps are examples of species that have adapted to tropical, saltwater environments.

Bottomland Hardwood Swamp

Todd Votteler



Bottomland Hardwood Swamp

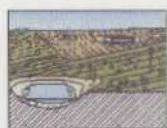
Inland Marsh

Todd Votteler



Inland Marsh

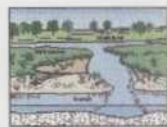
Inland wetlands are commonly found on river floodplains (riparian zones), in isolated depressions (playas, basins, and "potholes"), along margins of lakes and ponds, and other low-lying areas where groundwater intercepts the soil surface, or precipitation allows for soil saturation ([vernal pools](#) and bogs).



Isolated depression (playa)



Swampy area with springs



River floodplain



Basin with stream



Flood plain



Bog in basin and wet region



Vernal pool in divide



Open water body with floating mats and submerged beds

Water saturation is the dominant factor determining the nature of the soil and types of plant and animal communities living in the soil and on its surface. All areas considered to be wetlands must have enough water during some part of the year to stress plants and animals that are not adapted to life in water or saturated soils. The U.S. Fish and Wildlife Service (FWS) developed a non-regulatory, technical definition of wetlands that emphasize these concepts via the following three points: (1) hydrology--the degree of flooding or soil saturation is such that at some time during the growing season, the substrate is saturated or covered by shallow water; (2) vegetation--plants adapted to grow in water or in a soil or substrate that is occasionally oxygen deficient due to water saturation (hydrophytes) are found; and (3) soils--those saturated long enough during the growing season to produce oxygen-deficient conditions in the upper part of the soil, which commonly includes the majority of the root zone of plants, predominate (i.e., hydric soils) (Cowardin and others, 1979; Tiner, 1991).

containing pictures

Figure 14. Cross sections of selected wetland landscapes showing typical positions of wetlands relative to topographic features.

Typical positions of wetlands relative to topographic features.

Wetlands throughout History

Percentage of Wetlands Acreage Lost, 1780's-1980's



Twenty-two states have lost at least 50 percent of their original wetlands. Seven states—Indiana, Illinois, Missouri, Kentucky, Iowa, California, and Ohio—have lost over 80 percent of their original wetlands. Since the 1970's, the most extensive losses of wetlands have been in Louisiana, Mississippi, Arkansas, Florida, South Carolina, and North Carolina.

Source: Mitch and Gosselink. *Wetlands*. 2nd Edition, Van Nostrand Reinhold, 1993

Wetlands have often been regarded as wastelands—sources of mosquitoes, flies, unpleasant odors, and disease. People thought of wetlands as places to avoid or even eliminate. Largely because of this view, more than one half of America's original wetlands have been destroyed via a myriad of means such as infilling for housing developments and industrial facilities, being drained and converted to farmlands, and even as places to dispose of household and industrial wastes.

The lower 48 states contained an estimated 103.3 million acres of wetlands in the mid-1980s (an area about the size of California) (Dahl and Johnson, 1991). This compares to 220 million acres found in the same area in the 1600s. Thus, over half of our country's original wetlands have been converted. Six states lost 85 percent or more of their original wetland acreage, and 22 lost 50 percent or more (Dahl, 1990). Major loss of wetland habitat occurred during the mid-1950s to mid-1970s, but since then, the rate of loss has decreased to 70,000 to 90,000 acres annually. In addition to the wetlands that have been completely lost, others have just been degraded by chemical contamination and excessive nutrients, fertilizers, and sediments flowing into them. The increase in flood damages, drought damages, and the declining bird populations are, in part, the result of wetland degradation and destruction.

Wetlands loss did not happen all at once. Events in history, technological innovations, and society's values all contributed to the destruction or preservation of this habitat throughout time.

Early 1600s to 1800--Colonial Settlement

Wetland destruction began with permanent settlement of Colonial America. Though wetland drainage was widespread prior to 1785, few complete records exist before the Land Ordinance Act established the Public Land Survey that year, requiring the surveying and partitioning of land prior to settlement. Wetlands were regarded as swampy lands that were unhealthy and stood in the way of agricultural uses of the land.

1800 to 1860--Westward Expansion

Draining Wetlands for Irrigation



Dick Gersib

This was a period of numerous large land acquisitions (the Louisiana Purchase, annexation of Texas, lands ceded from Mexico, etc.). With increases in land came increases in population (from 7.2 million in 1810 to 12.8 million in 1830 (U.S. Bureau of the Census, 1832)). This, combined with technological advances, greatly facilitated loss of wetland habitat. Large-scale conversion of wetlands to farmlands began to have an impact on the distribution and abundance of wetlands around the country. Congress aided and promoted

wetland drainage, as well, with the Swamp Land Acts which granted all swamp and overflow lands to individual states for reclamation.

1860 to 1900--Agriculture Moves West

The American Civil War (1861-65) focused attention on developing routes around, through, and over water bodies and wetlands that stood as logistical barriers to the movement of men and heavy equipment. Because accurate maps were critical to war efforts, an early glimpse of some of the Nation's wetlands was finally gained. After the war, attention was focused on westward expansion and settlement. Railroads became an enemy of wetland habitat through both developing and draining these lands and as direct consumers of wetland forest products needed for railroad ties and fuel.

Agricultural demands for large tracts of land caused increasing drainage of the abundant wetlands in the mid-continent, including prairie potholes in the North Central U.S., bottom lands of the lower Mississippi River's alluvial plains, and the Gulf plains of Texas. The Central Valley of California was also targeted during this time.





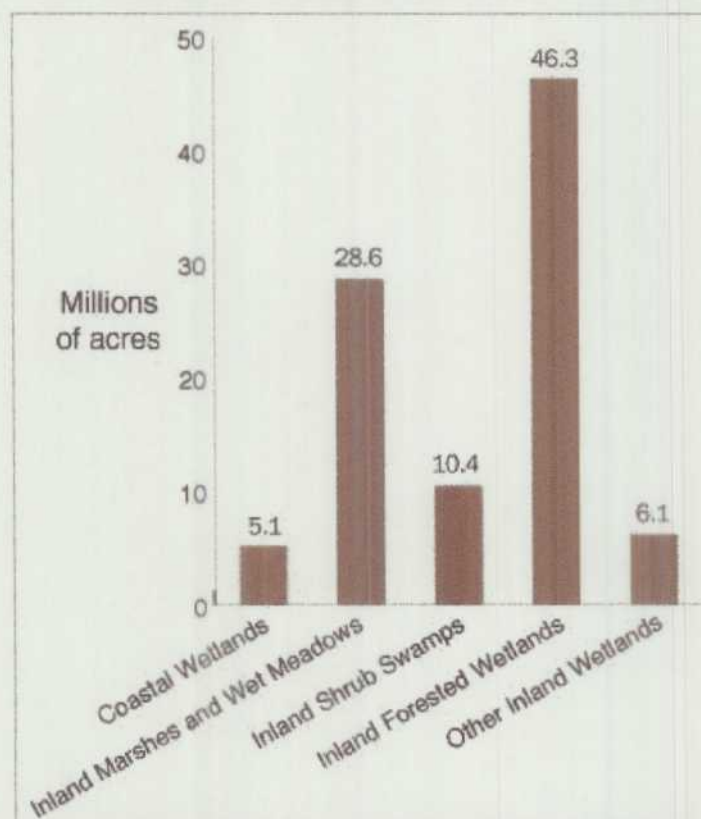
Figure 10. States with notable wetland loss, 1860 to 1900.

1900 to 1950--Changing Technology

This period in American history was a time of ambitious engineering and drainage operation, with two of the most notable projects being the lock and dam system developed on the Mississippi River and the continued modification of wetlands in California's Central Valley. Technology advanced rapidly, and by the 1930s, large-scale flood control projects, diversion dams and the like were being built on major river tributaries. Though the government continued to encourage the drainage of wetlands during this period of history, it also initiated the process of acquiring and restoring America's wetlands through the Migratory Bird Hunting Stamp Act.

1950 to Present--Changing Priorities and Values

Extent of Wetlands in the Lower 48 States



Source: Dahl and Johnson. 1991, *Wetlands Status and Trends in the Conterminous United States: 1970's-80's*. U.S. Fish and Wildlife Service

During the mid-1950s to the mid-1970s, an average of 550,000 acres of wetlands were lost each year (Office of Technology Assessment, 1984). Agriculture accounted for more than 80 percent of these losses (Frayer and others, 1983). Since the 1970s, though, there has been increasing scientific awareness that wetlands are valuable areas that provide important environmental functions. We now know that wetlands are some of the most productive ecosystems in the world, comparable to rain forests and coral reefs. Wetlands are critical to the ecology of watersheds because they help regulate water levels within the watersheds; improve water quality; reduce flood and storm damages; and provide important fish and wildlife habitat. Lately scientists have also realized that they serve as global reservoirs for carbon, preventing the release of carbon dioxide into the atmosphere and thus helping to moderate global climate conditions.

The effects of Federal policy reversal on the rate of wetland loss are not clear. From 1987 to the present, Federal efforts to restore wetlands has increased. The U.S. Fish and Wildlife Service estimated that between 1987

and 1990 approximately 90,000 acres were added to the Nation's wetland inventory. However, wetlands are still suffering losses, and more frequently, degradation. Manipulation of water levels in wetlands is the current trend. Partial drainage or lowering of water levels is becoming prevalent in some parts of the country. Effects of this type of management are uncertain.

Major Causes of Wetlands Loss and Degradation

Human Actions

- Drainage
- Dredging and stream channelization
- Deposition of fill material
- Diking and damming
- Tilling for crop production
- Levees
- Logging
- Mining
- Construction
- Runoff
- Air and water pollutants
- Changing nutrient levels
- Releasing toxic chemicals
- Introducing non-native species to the ecosystem
- Grazing by domestic animals

Great Blue Heron

U.S. FWS, Herb Stein



Natural Threats

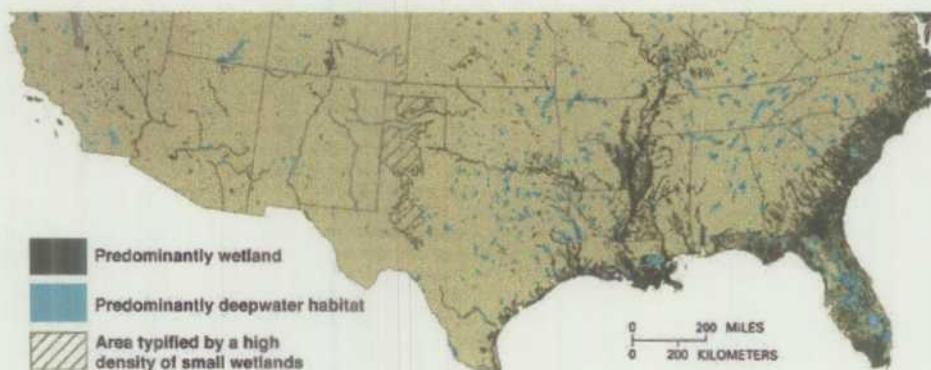
- Erosion
- Subsidence
- Sea level rise
- Droughts
- Hurricanes and other storms

Southwest States Wetland Resource Summaries

- [Arizona](#)
- [California](#)
- [Colorado](#)
- [Kansas](#)



- [Nebraska](#)
- [Nevada](#)
- [New Mexico](#)
- [Oklahoma](#)
- [Texas](#)
- [Utah](#)
- [Wyoming](#)



Current distribution of wetlands and deepwater habitats.

Arizona

Less than 1 percent of Arizona's landscape has wetlands. Since the late 1800's, streams and wetlands throughout Arizona have been modified or drained, resulting in the loss of more than one-third of the State's original wetlands. The most extensive Arizona wetlands are in riparian zones and include oxbow lakes, marshes, cienegas, and bosques. Nonriparian wetlands include tinajas, playas, and caldera lakes. Extreme aridity and seasonally varying precipitation are the climatic characteristics that most significantly influence wetland formation and distribution in Arizona. Recreational use of wetlands provides economic benefits to the State. [Back to list of Southwest States](#)

California

California's wetlands have significant economic and environmental value, providing benefits such as water-quality maintenance, flood and erosion attenuation, prevention of saltwater intrusion, and wildlife habitat. The Sacramento-San Joaquin Delta regularly harbors as much as 15 percent of the waterfowl on the Pacific Flyway. California has lost as much as 91 percent of its original wetlands, primarily because of conversion to agriculture. Flooded rice fields, which are converted wetlands, covered about 658,600 acres in the mid-1980's. Rice farmers, State and university researchers, and private organizations are cooperatively studying the feasibility of managing rice fields for migratory waterfowl habitat. Wetland protection is identified as a goal of The California Environmental Quality Act of 1970. [Back to list of Southwest States](#)

Colorado

Wetlands cover about 1 million acres of Colorado--1.5 percent of the State's area. Wetlands occur in all life and climatic zones, from the high mountains to the arid plains and plateaus. Wetland types in Colorado include forested wetlands, willow carrs, fens, marshes, alpine snow glades, and wet and salt meadows. Wetlands are vital to wildlife in the State, particularly in the arid regions. Colorado's wetland area has decreased by about one-half in the last two centuries, and losses are continuing due to a variety of land-development pressures; however, irrigation and changes in land-use practices have resulted in new wetlands, principally in the San Luis Valley and near Boulder. [Back to list of Southwest States](#)

Kansas

Kansas has about 435,000 acres of wetlands, which include sandhill pools along the Arkansas River, playa lakes in western Kansas, freshwater marshes such as those in Cheyenne Bottoms, and salt marshes such as those in Quivira National Wildlife Refuge. Kansas wetlands are important to migrating waterfowl and shorebirds, which depend on the few remaining wetlands in the Central Flyway. Kansas has lost about one-half its wetlands during the last 200 years, mostly due to conversion to cropland and depletion of surface and ground water due to irrigation withdrawals. Wetland preservation and restoration are being accomplished through cooperation among Federal and State agencies and private organizations. [Back to list of Southwest States](#)

Nebraska

Nebraska has three wetland complexes recognized as being of international importance as migrational and breeding habitat for waterfowl and nongame birds: the Rainwater Basin wetlands in south-central and southeastern Nebraska, the Big Bend reach of the Platte River (directly north of the Rainwater Basin), and the Sandhills wetlands in north-central and northwestern Nebraska. Nebraska has lost about 1 million acres of wetlands in the last 200 years--about 35 percent of the State's original wetland acreage. Conversion to agricultural use was the primary cause for most of the losses, but urbanization, reservoir construction, highway construction, and other activities also contributed. [Back to list of Southwest States](#)

Nevada

Wetlands cover less than 1 percent of Nevada but are some of the most economically and ecologically valuable lands in the State. Benefits of wetlands include flood attenuation, bank stabilization, water-quality improvement, and fish and wildlife habitat. Desert wetlands include marshes in playa lakes, nonvegetated playas, and riparian wetlands; mountain wetlands include fens and other wetlands that form in small glacial lakes. More than one-half of Nevada's original wetlands have been lost, primarily due to conversion of wetlands to cropland and diversion of water for agricultural and urban use; many others have been seriously degraded by human activities. Some wetlands have been created by mine dewatering and sewage treatment. [Back to list of Southwest States](#)

New Mexico

Wetlands cover about 482,000 acres (0.6 percent) of New Mexico; most are in the eastern and northern areas of the State. New Mexico's wetlands include forested wetlands, bottom-land shrublands, marshes, fens, alpine snow glades, wet and salt meadows, shallow ponds, and playa lakes. Riparian wetlands and playa lakes are especially valuable to migratory waterfowl and wading birds. New Mexico has lost about one-third of its wetlands, mostly due to agricultural conversion, diversion of water to irrigation, overgrazing, and urbanization. Other causes of loss or degradation have been mining, clear cutting, road construction, streamflow regulation, and invasion by nonnative plants. [Back to list of Southwest States](#)

Oklahoma

Wetlands cover about 950,000 acres (2 percent) of Oklahoma. Wetlands in Oklahoma include bottom-land hardwood forests and swamps; marshes and wet meadows; aquatic-bed wetlands characterized by submersed or floating plants in ponds, lakes, rivers, and sloughs; and sparsely vegetated wetlands such as intermittently flooded playa lakes. Most forested wetlands are in eastern Oklahoma, where

precipitation is highest and evaporation lowest. Riparian wetlands and playa lakes in drier western Oklahoma are especially valuable to wildlife. Nearly two-thirds of Oklahoma's original wetlands have been lost as a result of agricultural conversions, channelization, impoundment, streamflow regulation, and other causes. [Back to list of Southwest States](#)

Texas

Wetlands cover about 7.6 million acres of Texas, 4.4 percent of the State's area . The most extensive wetlands are the bottom-land hardwood forests and swamps of East Texas ; the marshes, swamps, and tidal flats of the coast; and the playa lakes of the High Plains. Wetlands provide flood attenuation, bank stabilization, water-quality maintenance, fish and wildlife habitat, and opportunities for hunting, fishing, and other recreational activities. Commercial fisheries benefit directly from coastal wetlands. Texas has lost about one-half of its original wetlands as a result of agricultural conversions, overgrazing, urbanization, channelization, water-table declines, construction of navigation canals, and other causes. [Back to list of Southwest States](#)

Utah

Wetlands cover only a small part of Utah but provide critical aquatic habitat in an arid environment as well as economic and other benefits. Utah wetlands include the shallows of small lakes, reservoirs, ponds, and streams; riparian wetlands; marshes and wet meadows; mud and salt flats; and playas. The largest wetlands in the State surround Great Salt Lake. Because of the importance of Great Salt Lake and its associated wetlands to migratory waterfowl and shorebirds, in 1991 the lake was designated a Hemispheric Reserve in the Western Hemisphere Shorebird Reserve Network. Streamflow regulation and agricultural, residential, industrial, and ski-area development have resulted in widespread wetland losses. [Back to list of Southwest States](#)

Wyoming

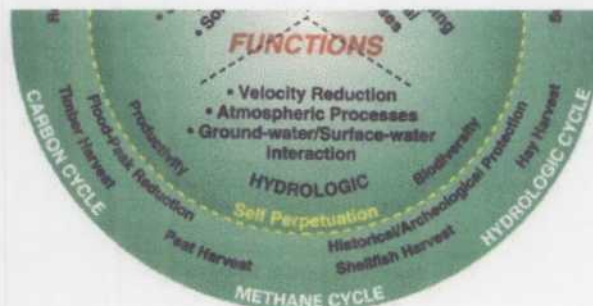
Wetlands cover about 1.25 million acres (2 percent) of Wyoming and are the most diverse ecosystems in the State's semiarid environment. The Laramie Plain Lakes wetland complex is home to the Wyoming toad, an endangered species. Trend information indicates that wetland acreage in Wyoming has decreased over time, primarily due to agricultural and urban development. However, agricultural diversions, whose original purpose was to flush salts and increase hay-meadow production, have enhanced wetlands along the Bear River; the Bear River wetland is one of the most productive and diverse bird habitats in Wyoming. The Wyoming Wetlands Act is the basis for wetland program development by the State. [Back to list of Southwest States](#)

Wetlands Protection and Restoration

The federal government protects wetlands through regulations, such as Section 404 of the Clean Water Act and "Swampbuster" provisions of the Food Security Act, economic incentives (tax deductions for selling or donating wetlands to a qualified organization), and acquisitions (i.e., establishing national wildlife refuges). Recently, partnerships have been developed among federal, state, tribal, and local



governments with the goal of protecting entire watersheds. However, approximately 75 percent of all wetlands are privately owned, so individual landowners are crucial to the preservation of this ecosystem.



Placing a value on wetlands facilitates decisions as to which sites should be developed and ensures that the most valuable wetlands are being preserved. The value of the wetland lies in the benefits that its habitat, water-quality, and hydrologic functions provide to the environment or to people. However, the true value of this habitat cannot be measured monetarily. Restoration and creation of new wetlands can help maintain the quality of wetlands and their surrounding ecosystems, while at the same time accommodating the human need for development. Although indications are that some replacement can be successful, full functional replacement has not yet been demonstrated. The more complex the hydrology and ecology of a system, the more difficult it is to restore. Complete restoration may indeed be impossible in some ecosystems, such as bogs and fens, due to their development over thousands of years (Kusler and Kentula, 1990). In general, restoration is more likely to be successful than creation. Chances are greater that a restored wetland will persist longer than one that was created, as well, due to the number of natural functions that must be manipulated in order to succeed.

References and Further Reading

Carter, V., 1996, in National Water Summary on Wetland Resources: Washington, D.C., U.S. Geological Survey Water-Supply Paper 2425, 431 pp.

Cowardin, L.M., Carter, V., 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 FSW/OBS-79/31, 131 pp.

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 pp.

Dahl, T.E., and Johnson, C.E., 1991, Wetlands--Status and trends in the conterminous United States, mid-1970s to mid-1980s: Washington, D.C., U.S. Fish and Wildlife Service, 22 pp.

Frazer, W.E., Monahan, T.J., Bowden, D.C., and Graybill, F.A., 1983, Status and trends of wetlands and deepwater habitats in the conterminous United States, 1950s to 1970s: Fort Collins, Colorado, Colorado State University, 31 pp.

Kusler, J.A., and Kentula, M.E., eds., 1990, Wetland creation and restoration--The status of the science: Washington, D.C., Island Press, 591 pp.

Office of Technology Assessment, 1984, Wetlands--Their use and regulation: Washington, D.C., U.S. Congress, OTA-0-206, 208 pp.

Tiner, R.W., 1984, Wetlands of the United States--Current status and recent trends: Washington, D.C., U.S. Fish and Wildlife Service Report, 59 pp.

Tiner, R.W., 1996, in National Water Summary on Wetland Resources: Washington, D.C., U.S. Geological Survey Water-Supply Paper 2425, 431 pp.

U.S. Bureau of the Census, 1832, Return of the whole number of persons within the several districts of the U.S., 1830: Washington, D.C.

Additional Web Links of Interest

- [Natural Resources Conservation Service Wetland Science Institute](#)
- [U.S. Bureau of Reclamation Riparian and Wetland Studies](#)
- [U.S. EPA Office of Wetlands, Oceans, and Watersheds](#)
- [U.S. EPA Wetlands Fact Sheets](#)
- [U.S. Fish and Wildlife Service National Wetlands Inventory](#)
- [U.S. Geological Survey National Water Summary of Wetland Resources](#)
- [U.S. Geological Survey National Wetlands Research Center](#)
- [California Wetlands Information System](#)
- [University of Arizona Water Resources Research Center](#)
- [Other State and Federal Agency Web Sites](#)

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