EPA United States Environmental Protection Agency

Wetlands: Protecting Life and Property from Flooding

Wetland Hydrology and Flood Control

Wetlands are transition zones between uplands and deeper water, unique ecosystems characterized by their hydrology, soils and vegetation. They function like natural tubs, storing flood waters that overflow riverbanks and surface water that collects in depressional areas. In this way, wetlands can help protect adjacent and downstream property from flood damage.

The Federal Emergency Management Agency (FEMA) states that floods are the most common and widespread of all natural disasters—except fire. Most communities in the United States have experienced some kind of flooding. FEMA encourages the use of wetlands for stormwater detention in lieu of, or in conjunction with, traditional structural flood control measures. (Source: FEMA)

How Do Wetlands Help Reduce Flooding?

The effectiveness of wetlands for flood abatement may vary, depending on the size of the area, type and condition of vegetation, slope, location of the wetland in the flood path and the saturation of wetland soils before flooding. A one-acre wetland can typically store about three-acre feet of water, or one million gallons. An acre-foot is one acre of land, about three-quarters the size of a football field, covered one foot deep in water. Three acre-feet describes the same area of land covered by three feet of water. Trees and other wetland vegetation help slow the speed of flood waters. This action, combined with water storage, can actually lower flood heights and reduce the water's destructive potential. (Source: EPA)

The Wetlands Initiative completed an 18-month study, "Flood Damage Reduction in the Upper Mississippi River Basin: An Ecological Means." The study revealed that restoring the 100-year flood zone of the Upper Mississippi five-state watershed could store 39 million acre-feet of floodwater, the volume that caused the Great Flood of 1993, and save over $16 billion in projected flood damage costs.

In Minnesota, an additional study by The Wetlands Initiative noted that flood peaks and damage costs would be decreased by restoring the natural hydrology of the floodplain. The cost of replacing the flood control function of the 5,000 acres of wetlands drained each year in Minnesota alone would be $1.5 million, compared to the potentially millions of dollars lost to flooding. Preserving wetlands in the first place and restoring some of those that have been drained could help reduce future flood losses. (Source: The Wetlands Initiative)

Preserving and protecting coastal wetlands can help reduce storm damage. St. Stanislaus was a boy's Catholic Boarding School over a hundred years old in Bay St. Louis, MS. Located on the beach overlooking the Gulf, it was destroyed by Hurricane Katrina. This picture was taken before the building disintegrated.

Where Wetland

Where Wetlands are Helping

These studies and others indicate that wetlands may play a part in flood abatement. The following examples illustrate how communities across the country are restoring wetlands in order to reduce the threat and costs of flood damage.

Charles River, Massachusetts

Along the Charles River in Massachusetts, the U.S. Army Corps of Engineers (the Corps) has acted to utilize wetlands in preventing flood damage. It was calculated that loss of all wetlands in the Charles River watershed would have caused an average annual flood damage cost of $17 million. The Corps concluded that conserving wetlands was a natural, less expensive solution to controlling flooding than the construction of dikes and dams alone, and they proceeded to acquire 8,103 acres of wetlands in the Charles River basin for flood protection. (Source: U.S. Army Corps of Engineers – Charles River Natural Valley Storage Area)

Horseshoe Park, Colorado

In 1982, an earthen dam on Lawn Lake in Rocky Mountain National Park collapsed, suddenly releasing almost 700 acre-feet of water into the Roaring River. A wall of water 25 to 30 feet high moving at 9 miles per hour rushed downstream and entered Fall River at Horseshoe Park. The Park contained wetlands adjacent to the river, with meadow grasses, reed and dense willow stands. Here the flood wave spread across the broad, flat valley and was slowed by wetland vegetation. The height of the wall of water was reduced to about 10 feet, and the water spread out over the meadow to a width of 1,300 feet. The flood was finally contained by Olympus Dam on Lake Estes, but it had claimed 4 lives and caused $31 million in damage. If not for the wetlands and meadows at Horseshoe Park, the damage would have been much worse. The height and speed of flood waters were reduced by the wetland vegetation, and the damaging flood peak was greatly reduced. (Source: Jarrett and Costa 1984)

Paul McIver

In 1982 these meadows and wetlands at Horseshoe Park in Colorado were hit by a 25 to 30 foot wall of water. The height and speed of the flood waters were reduced by the wetland vegetation, and the damaging flood peak was greatly reduced.

Grand Kankakee Marsh, Indiana

In 1900, the Kankakee Marsh was one of the largest, most ecologically diverse wetlands in the United States. During the 20th century much of the marsh was drained and converted to agricultural use. Channelization of the Kankakee River, which fed the marsh, reduced its length from 250 to 90 miles. As a result, water quality was degraded and flooding increased. An ambitious project was undertaken to address these concerns. The project, featuring diverse partners from all levels of government, private conservation groups and business, was designed to restore over 25,000 acres of wetlands. With a grant from the North America Wetlands Conservation Act and donations of cash and land, 3,000 acres of wetlands have already been restored. Waterfowl populations have increased, water quality is improving and flooding has decreased. (Source: National Park Service, "Floods, Floodplains and Folks", 1996, U.S. Fish and Wildlife Service, Private Lands Office)

Mayview Wetland Project, Pennsylvania

The Pennsylvania Department of Transportation (DOT) completed a wetland restoration project to offset impacts to 32 acres of wetlands that were filled during the construction of Interstate 279 through Southwestern Pennsylvania and the Southern Expressway. The site of the wetland restoration is Mayview, a 65-acre piece of land, flanking Chartiers Creek, a major stream. The creek was subject to frequent, high velocity flooding and constructing wetlands there is helping control these floods. The new wetlands provide flood storage capacity for 63 million gallons of water and serve as an outdoor classroom for nearby schools. The Department of Transportation is seeking funding to restore additional acreage. (Source: National Park Service, "Floods, Floodplains and Folks", 1996)

Prairie Wolf Slough, Illinois

The Middle Fork of the North Branch of the Chicago River flows through an abandoned farm field in the suburbs. The area was identified as the future location for a trail, part of the North

Branch of the Chicago River Open Space Plan designed by the Friends of the Chicago River and Lake County Stormwater Management Commission, a regional open space advocacy organization. By restoring wetlands hydrology, clearing non-native vegetation and planting wetland, prairie and savanna vegetation, the functions and values of the wetlands have been restored. Structures used to drain the area for farming were removed, and a new water control structure was constructed to decrease sedimentation of the river. The result was moderation of stormwater flows which provided the area with flood protection, as well as permanent open space and new environmental education opportunities. (Source: National Park Service, "Floods, Floodplains and Folks", 1996, Friends of the Chicago River)

Vermillion River, South Dakota

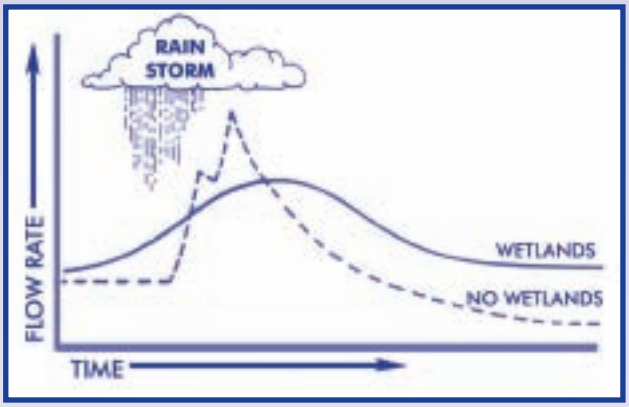
The Vermillion River has always flooded. It has a narrow channel and flows slowly, making it "flood prone." Thousands of years ago, this part of South Dakota was scoured by glaciers that carved out shallow depressions which remain today and seasonally fill with water. These "prairie potholes" are intermittent, seasonal wetlands which dot the landscape. They quickly thaw in spring and provide habitat for a multitude of migratory birds and other water fowl.

For hundreds of years, the rain and snow melt in the watershed were held in these wetlands, and runoff across the prairie was slowed. As South Dakota became populated, many prairie potholes were filled to facilitate farming. While these wetlands are small, they are numerous and can hold a significant amount of flood water. As more wetlands were filled, flooding increased.

The Great Flood of 1993 was devastating to the area. To combat future flooding, structural flood controls were put in place, but they were not sufficient. In response to this problem, the National Park Service and the Federal Emergency Management Agency formed a partnership with the South Dakota Division of Emergency Management and Turner-Lincoln-Clay Counties Water Project District. Working together, this coalition assessed the area and condition of the remaining network of potholes. They developed a plan to protect the remaining wetlands and restored some of those that had been filled.
(Source: National Park Service, "Floods, Floodplains and Folks", 1996, The Vermillion River: Managing the Watershed to Reduce Flooding, Federal Emergency Management Agency)

The Special Case of Coastal Wetlands

Wetlands in many locations play an important role in flood protection. Nowhere is this function more important than along coastal areas. Coastal areas are vulnerable to hurricanes and other powerful storms, and the flat coastal terrain means that land and property can be exposed to the full power of these storms. Preserving and reconstructing coastal marshes can help reduce storm damage. Coastal wetlands serve as storm surge protectors when hurricanes or tropical storms come ashore. in the Gulf coast area, barrier islands, shoals, marshes, forested wetlands and other features of the coastal landscape can provide a significant and potentially sustainable buffer from wind wave action and storm surge generated by tropical storms and hurricanes. (Source: Working Group for Post-Hurricane Planning for the Louisiana Coast)



This diagram indicates that wetlands reduce peak stormwater flows. (Source: Kusler 1983)

More Wetlands Mean Less Flooding

These examples illustrate how protecting and restoring wetlands can reduce the destructive potential of flooding. Wetland restoration and preservation is an important component of a comprehensive flood protection strategy. EPA, working with other federal agency partners, is a resource for state and local decision-makers, providing tools and limited funding for development of state wetland programs. Preserving wetlands, along with other flood control measures, can offer a degree of protection against flooding that is often more effective and costs less than a system of traditional dikes and levees. If more communities protect existing wetlands and increase the quantity of wetlands through restoration projects, we will be better protected against the consequences of floods.

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Wetland Resources

On the Internet:

Charles River Natural Valley Storage Area . . . . . www.nae.usace.army.mil/recreati/crn/crnhome.htm
Federal Emergency Management Agency . . . . . www.fema.gov
Friends of the Chicago River . . . . . www.chicagoriver.org
National Park Service . . . . . www.nps.gov
The Wetlands Initiative . . . . . www.wetlands-initiative.org
U.S. Army Corps of Engineers . . . . . www.usace.army.mil

In Print:

Floods, Floodplains and Folks. 1996. National Park Service. Rivers, Trails and Conservation Assistance Program.

Flood Damage Reduction in the Upper Mississippi River Basin—An Ecological Alternative. 2004. Donald L. Hey, et al. The Wetlands Initiative, Chicago, IL. Available at www.wetlands-initiative.org

Jarrett, R.D., and J.E.Costa. 1984. *Hydrology, geomorphology, and dam break modeling of the July 15, 1982 Lawn Lake Dam and Cascade Lake Dam Failures, Larimer County, Colorado: U.S. Geological Survey Professional Paper 1369.*

Johnson, Rex R. 1997. *The Vermillion River: Managing the Watershed to Reduce Flooding.* Clay County Conservation District, Vermillion, SD.

Additional Wetland Resources

For additional information, visit the U.S. EPA's website (www.epa.gov/owow/wetlands/), call the toll-free Wetlands Helpline at 1-800-832-7828 or refer to the sources below.

On the Internet:

"A New Framework for Planning the Future of Coastal Louisiana after the Hurricanes of 2005." January 26, 2006. Working Group for Post-Hurricane Planning for the Louisiana Coast . . . . . www.umces.edu/la-restore
Association of State Floodplain Managers . . . . . www.floods.org
Association of State Wetland Managers . . . . . www.aswm.org
"Reinventing a Flood Control Strategy." 1994. Donald L. Hey and Nancy S. Philippi. The Wetlands Initiative, Chicago, IL. . . . . www.wetlands-initiative.org
Society of Wetland Scientists . . . . . www.sws.org
U.S. National Weather Service . . . . . www.nws.noaa.gov
Wetlands Status and Trends . . . . . http://wetlandsfws.er.usgs.gov

In Print:

Bradley, A.A., K.W. Potter, T. Price, P. J. Cooper, J. Steffen and D. Francz. 1994. Dahl, T.E. 1990. "Wetland losses in the United States: 1780's to 1980's." Washington, DC. U.S. Department of Interior.

"Flood analysis in DuPage County using HSPF," *Proceedings of the Transportation Research Board (TRB) Annual Meeting*, Washington, DC.

Protecting Floodplain Resources, a Guidebook for Communities. June 1996. The Federal Interagency Floodplain Management Task Force.

Shabman, L. 1994. "Responding to the 1993 Flood: The Restoration Option," *Water Resources Update*, University Council on Water Resources, 95, 26-30.

U.S. National Weather Service, 1993, "Update on Midwestern floods, heat and drought in the East: Special Climate Summary," 93/2, Climate Analysis Center.