Chapter III Wetland Functions

In the 1970's, the Corps of Engineers decided to preserve approximately 8,500 acres of wetlands in the Charles River Basin of Massachusetts instead of building expensive dams or dikes to control flooding. The Corps concluded that wetlands protection was the least costly solution to future flooding problems. The loss of these wetlands would have resulted in an annual cost of $17 million from flooding.

Wetlands have traditionally received "a bad rap" – they've been thought of as wastelands, as buggy, mucky places suitable only for murder mysteries. But as you'll soon discover in this chapter, wetlands perform a number of critical functions. They moderate impacts from flooding, control erosion, purify water, and provide habitat for fish and wildlife. They also provide a unique natural environment for people to enjoy outdoor recreation activities. Refer to the following information on wetlands functions to help you teach these concepts to your students.

Flood & Erosion Control

Flooding

Wetlands located along the shores of oceans, lakes, rivers, and streams protect surrounding properties from flooding by acting as a "sponge," temporarily storing flood water and slowly releasing it back into the system. As storm water enters a wetland from surface runoff or adjacent water bodies, it is slowed down by trees, shrubs, reeds, rushes, and other wetland plants. Slowing the flow of water allows more time for it to percolate through the soil rather than continue downstream. Wetlands with a large surface area also act as a large sink, diffusing large flows over a greater land area and slowing the momentum of rushing water. In this way, wetlands help protect adjacent and downstream property from flood damage. In 1975 alone, property damage from flooding cost the U.S. an estimated $3.4 billion! (See Activity 1: *Flood Storage*)

The floods of 1993: *If wetlands along the Missouri, Iowa, and Mississippi Rivers hadn't been destroyed for agriculture and urban development, some of the floodwater may have had someplace to go other than people's homes.*

Erosion

During a storm, the effects of rushing water can be very destructive. Fast-flowing water can carry a large load of soil particles from the land which are then washed into lakes, rivers, and streams. Excessive sediment in water is considered both a chemical and physical pollutant; it can carry bacteria and toxic particles and can alter the habitat of the receiving water for plants and animals. Wetland vegetation reduces the erosive effect of rushing water by slowing the velocity of floodwaters, binding the soil with its roots, and causing suspended soil particles to settle

The forested wetlands along the Alcovy River in Georgia significantly improve stream water quality affected by wastes discharged upstream. An equivalent amount of pollution removal in a sewage treatment plant would cost $1 million each year.

Innovative sewage treatment facilities utilizing wetland plants for waste processing have been successfully piloted in Harwich, MA and Providence, RI by Ecological Engineering Associates of Marion, MA.

out before they reach open waters. Coastal wetlands also protect shorelines from erosion by dissipating the energy from waves and currents.

Water Purification

Wetlands are particularly good water filters because of their location between land and open water. This allows them to intercept and assimilate many pollutants before they enter rivers, streams, or lakes. Rainwater that runs off buildings and streets in agricultural, residential and industrial areas picks up sediments, nutrients, toxic materials, and other wastes. If that rainwater flows through a wetland before it enters a river or stream, some of these pollutants are filtered by the soil and plants which protect the ecosystems downstream. However, wetlands alone can't solve our pollution problems since every wetland has a limited capacity to absorb nutrients, metals, sediments, etc. Overloading a wetland with pollution reduces its ability to serve this function.

Sediment Trapping

Water flowing into wetlands slows down dramatically as it comes into contact with wetland vegetation. Suspended soil particles or sediments will *settle out* of the water and bind to the stems and roots of plants. The role wetlands play in trapping excess sediments and preventing them from entering river and lake systems is important for a number of reasons:

1) sediments accumulating at the bottom of streams and lakes can smother fish spawning areas and bottom-dwelling aquatic life;
2) wetland filtering reduces siltation of ports, harbors, rivers, and reservoirs, saving a lot of money that would have to be spent on dredging or removing the sediment;
3) sediment particles are often vehicles for transporting pollutants such as nutrients, pesticides, and heavy metals.

Studies have shown that as much as 80-90% of sediments in the water column may be removed as they move through wetlands! (See Activity 3: *Runoff Race*)

Chemical and Organic Waste Processing

Water flowing through urban areas often contains heavy metals including cadmium, chromium, copper, lead, and nickel. Most of these substances are usually bound to sediments entering the wetland system. Wetland plants can trap heavy metals and pathogens (such as bacteria and viruses) from runoff waters and fix them temporarily in plant tissues. Thick, organic, wetland soils can trap pollutants and keep them out of adjacent water bodies. Accumulation of these pollutants, however, can harm wildlife as they are passed up the food chain.

Certain wetland plants can alter and render harmless viruses, coliform bacteria, and suspended solids after initial sewage treatment, serving as nature's treatment facilities for domestic wastes.

On the Atlantic and Gulf coasts, 66% to 90% of the commercially important fish and shellfish species depend on coastal marshes or estuaries for at least part of their lifecycle.

- The annual U.S. fish harvest is valued at more than $10 billion. In the Southeast, for example, 96% of the commercial catch are fish and shellfish that depend on estuarine-coastal wetlands.
- In 1976, $35.5 million worth of furs from beaver, muskrat and other wildlife were harvested from wetlands nationally.
- In Rhode Island, the 1985 commercial harvest of wetland-dependent coastal fishes (e.g., flounder, striped bass, shad, and white perch) had a value of $3.25 million, while the hard-shell clam or quahog harvest alone was valued at more than $14 million.

Nutrient removal

Elements such as phosphorus and nitrogen are essential ingredients of life for plants and animals, and are therefore considered nutrients; however, too much of a good thing can cause problems. An excess of nutrients carried into surface waters can result in *eutrophication* – an exponential growth or bloom of algae covering the water surface. The rapid growth of algae significantly reduces the amount of oxygen available to other aquatic life, potentially suffocating many of them. Because phosphorus and nitrogen are present in all human wastes, getting the nutrients out of wastewater is a large and expensive challenge.

Wetlands are effective in removing and storing nutrients such as nitrogen and phosphorus from waters flowing through them. Some wetlands are capable of removing 85-90% of phosphorus and nitrogen from runoff water. Microorganisms and wetland plants absorb these nutrients, release some of the nitrogen as gas, and store the remainder in the soil. Algae and some vascular plants can also convert nitrates and phosphates to usable by-products, thereby removing them from the system. Many towns are beginning to experiment with wetlands as effective alternatives to costly sewage treatment plants. (See Activity 2: *Treatment Plants*)

Groundwater Discharge and Recharge

Wetlands with a hydrological connection to groundwater can play a role in maintaining water supplies by:

1) *recharging* groundwater supplies: water stored in wetlands will slowly percolate into the underlying aquifer, and
2) *discharging* groundwater: water flows from the groundwater system to surface water bodies, sometimes maintaining a minimum amount of flow for rivers and streams during dry periods. Not all wetlands perform both of these functions; some wetlands primarily recharge groundwater while others mostly discharge groundwater.

Fish and Wildlife Habitat & Food Webs

Habitat

Though wetlands are most often associated with waterfowl, they provide essential habitat for a wide variety of species – birds, mammals, reptiles, amphibians, fish, and insects – up to 45% of which are rare and endangered. The high rate of wetland loss has contributed to the endangered status of many species. Some species, such as the wood duck and muskrat, spend most of their life within wetlands, while others – striped bass, peregrine falcon and deer – occasionally visit wetlands for food, water, or shelter. Those species that require wetland habitat to complete at least a portion of their life cycle are called *obligate* species.

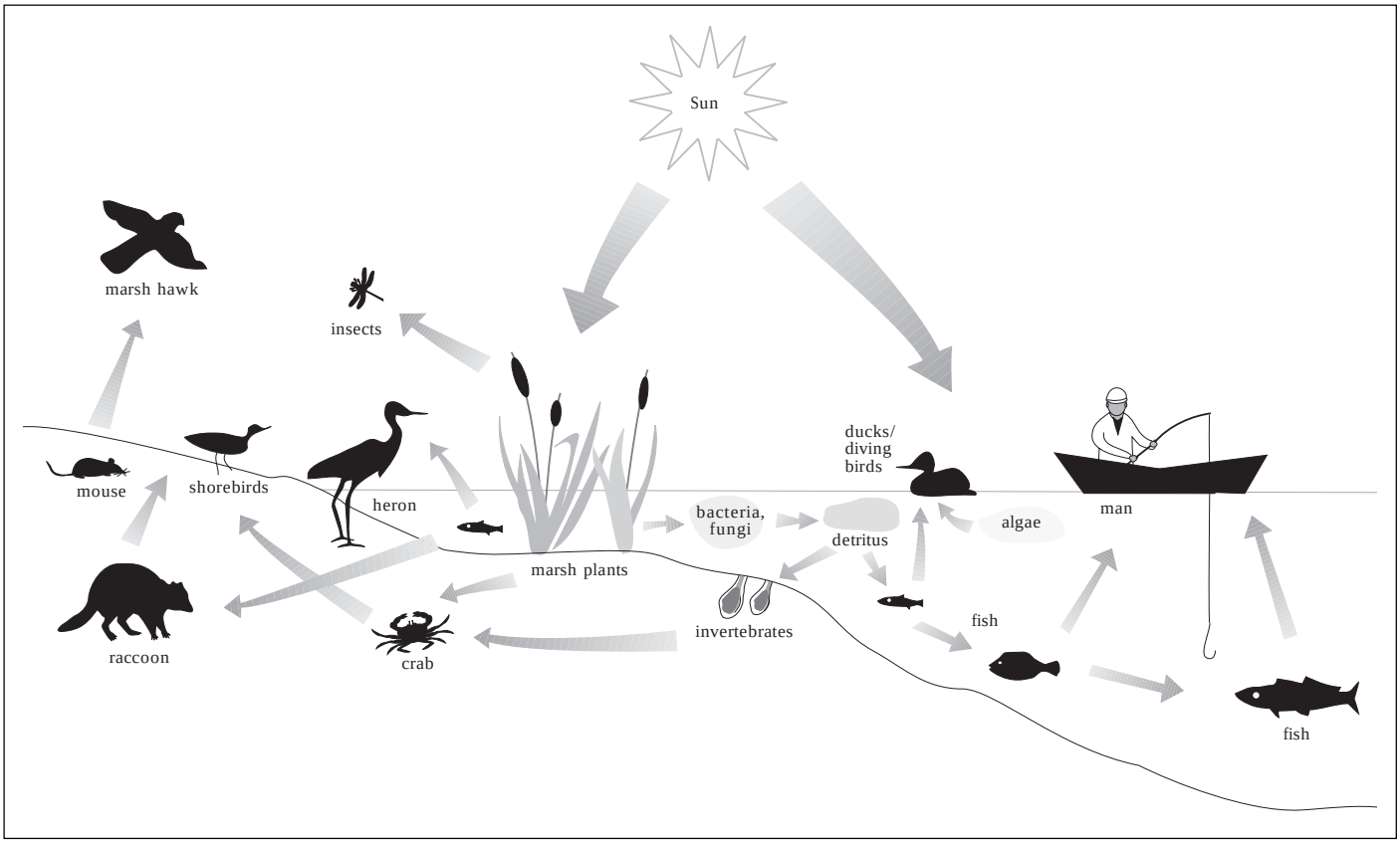
Why are wetlands favored by so many species? They attract wildlife for a number of reasons:

1) their vegetative cover provides shelter from predators;
2) they provide ideal nesting conditions for many waterfowl;
3) they provide migratory birds with a safe "stop over" location to rest during long migrations;
4) they provide essential spawning and nursery habitat for commercially important fish and shellfish;
5) many have an extensive, complex food chain that supports numerous species, including man.

Food Webs

The vast amount of organic matter that accumulates in wetlands is the beginning of food webs for thousands of aquatic plants and animals. Because of their nutrient-rich waters, coastal marshes are among the most productive ecosystems in the world. When salt marsh plants die, their tissues are broken down by bacteria and fungi into *detritus,* nutrient-rich fragments that are flushed out with the tides and made available to fish, shellfish, and invertebrates. These organisms in turn are preyed upon by larger wetland inhabitants – raccoons, otters, herons, and other shorebirds.

Salt Marsh Food Web



WETLANDS SUPERMARKET

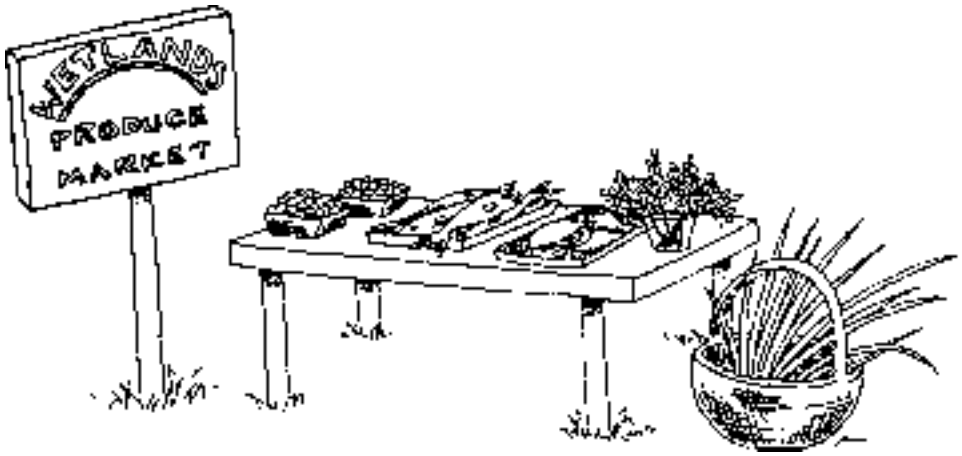
Wetlands are also valuable for the variety of commercial products harvested from them:

Food

- Wild rice, cranberries, blueberries, mint
- Salmon, alewife and other major commercial fish species
- Shrimp, blue crab

Other products

- Marsh grasses for baskets and chair caning
- Peat and sphagnum moss for landscaping
- Reeds for bedding and thatch
- Timber such as northern white cedar, tupelo, and bald cypress
- Beaver, muskrat, nutria, mink, and otter furs



Getting Your Students Involved:

Ask the students to take out their lunches or use the menu from the school cafeteria and trace each item to its original ingredients. Try to locate where each of the ingredients would have originated by geographical location and habitat. Identify the foods that might come from a wetland area. Which would have affected the job of a member of their family?

Finally, have the students create their own wetland food webs in the form of drawings, paintings, or mobiles from the wetland wildlife guide in Chapter II or other reference texts.

Recreation & Aesthetics

Even though wetland acreage in the U.S. is diminishing, recreational use remains brisk, particularly for hunting and fishing. In 1980, 5.3 million people spent $638 million on hunting waterfowl and other migratory birds. In 1975, fishing enthusiasts spent $13.1 billion to catch wetland-dependent fish. Hiking, canoeing, and photography are among the many activities that draw people to wetlands. Some of the most-often visited national parks and wildlife refuges in the nation are well-known for their wetlands, including the Florida Everglades, Cape Cod & Assateague Island National Seashores, Chincoteague & Parker River National Wildlife Refuges, and Acadia National Park.

Research & Education

The diversity and natural beauty of wetlands provide a living, hands-on classroom for education and scientific research, as this guidebook demonstrates.

Getting Your Students Involved:

Ask the students to describe their impressions of wetlands and the different ways they are described by our culture. How are bogs, swamps and marshes most often referred to in literature, folk tales, and local mythology? Have students ask their parents how they feel about wetlands. What words do parents use to describe them?

Have the students talk about their outdoor activities. Which of these activities use a wetland area or are affected by a wetland?