Bringing Wetlands to Market Part 1 Exercise 3
Wetlands and their ecological services

Focus questions
What are some types of wetlands and what do they have in common?
What important ecological services do wetlands provide?
Where are wetlands in the region near your school?

Performance tasks
Students will be able to distinguish among at least four types of wetlands.
Students will be able to explain four ecosystem services of wetlands.
Students will identify one or more wetland areas in the local area.

Overview
In this exercise, students will learn about the different types of wetlands and their ecological roles, and students will identify one or more local wetlands.

Time required
One 45 minute class period for each section

Background (adapted from *Our Wetlands, Our World*)
Wetlands have many names, including swamps, marshes, mudflats, sloughs, and estuaries. Many wetlands are transition ecosystems between land and water. Each type is unique: some are regularly covered with water, others are dry most of the year; some have saltwater, others fresh water, others a mixture of both; some are full of shrubs and trees, others appear barren; some are swimming pool sized, others stretch across thousands of acres.

A few generalizations can be made about wetlands. All wetlands have water present at least part of the year. Some wetlands are only damp, and some are wet only below the surface. But the presence of water leads to the two other defining characteristics of wetlands: hydric (saturated) soil and hydrophytic (water tolerant) plants.

Besides their usefulness in taking up and storing carbon dioxide, wetlands and coastal seagrass communities provide many important services for their ecosystems and for people. These include:

- Erosion control
- Flood protection
- Clean water
- Healthy fisheries
- Habitats
- Resting and feeding areas for migrating waterfowl
- Biodiversity protection
- Aesthetics and recreation
- Carbon sequestration (storage)

Egrets in a Massachusetts marsh Photo by Jim Fenton

Materials

Student reading and images of wetland types

or Powerpoint file of wetland types

Student reading on ecosystem services of wetlands

Internet access

Maps of your local region (see procedure)

Procedure

1. Introducing wetlands

a. Ask students to name as many types of wetlands as they can, and record the suggestions on the board. What do all the wetlands have in common?
Answers will vary; all wetlands have fresh or salt water as a major factor.

b. Have students refer to "Descriptions of Major Wetland Types." Ask students to add to their displayed list of wetland types so that major types are represented. There are many types of wetlands, so students may suggest some that are not introduced in the reading. The resources at the end of the reading can supply more information.

c. You may wish to present the Powerpoint file of wetland types to help students become familiar with the main types of wetlands.

d. For an interesting literature connection, ask students to suggest some stories that involve wetlands. For example, Tolkien's *Lord of the Rings* includes several scenes set in swamps. Ask students to discuss why people might have been fearful of swamps in the past.

A swamp in Bridgewater, MA Photo by Jim Fenton

Osprey nest in a Massachusetts salt marsh Photo by Ken Morton.

Wetlands and coastal ecosystems provide important services for wildlife and people

2. Wetland services

You may wish to introduce or review this topic using the wetlands metaphor activity developed by Project WET (https://sites.duke.edu/bayougrace/smithridge-curriculum-summer-2012/week-2-rivers-and-estuaries/348-2/). In this activity, wetland ecological roles are related to analogous human needs, such as the need for nurseries, shelter, and a resting place during travel.

a. Have students read the basic background information about wetland services and ecological roles "*Ecosystem Services of Wetlands."*

b. Ask students to suggest as many services as possible that are provided by wetlands and coastal ecosystems, and list them on the board, noting whether they are most helpful for plants and wildlife, the physical environment, or human activities and property. Have students record this list for use with stewardship and outreach projects.

3. Identifying local wetlands

In this section, you will ask students to locate as many of the wetland types as possible in your region. Students should work in small groups, and you may want to assign a different part of your geographic area to each group.

For this project, students should use different types of maps, both paper and on-line, if possible. Sources of local maps include:

- ☐ Your local conservation commission
- ☐ USGS topographic maps: order paper copies or download free at the USGS store
- ☐ Google Earth
- ☐ Free digital topo maps web site

Massachusetts, like many states, has a free online viewer with wetlands identified by type. Wetland maps for Massachusetts are accessible at the state GIS web site
On this site, click "legend" in the key to see a display of the categories and abbreviations.

Image of "Bringing Wetlands to Market" study area from MA wetlands viewer

Try checking on line to see if your state has a wetland mapping tool. The maps may be slow to load because of the large size of the image files.

NOAA Coastal Services Center has an online interactive application that provides access to detailed land cover classification maps for coastal areas around the US; this site also has land use change images and data for many areas.

4. When students have located some examples of local wetland areas, post a map of your area in the classroom and have students indicate the locations of various wetlands on it. Discuss as a class the clearest way to present this information visually, and have the students agree on a standard format.

5. Discuss with students the possibility of adopting a local wetland to study and as a focal point for communicating about the value of wetlands to the community. See Part 4 and the Adopt-a-Wetland Field Study sections for more guidance on Stewardship and field studies.

Descriptions of Major Wetland Types (adapted from *Our Wetlands, Our World*)

Swamp — a wetland dominated by trees. A swamp is like a wetland within a forest, and may have near-surface water. Typically about 30 percent of the area must be dominated by trees or woody vegetation to be considered a swamp. Reeds and grasses may grow along the edge of the swamp. Swamps are found in many different climates (ranging from Florida to Maine and west). pH levels are 5 to 8. Groundwater levels are high. Dissolved oxygen levels typically vary from 2 ppm to 9 ppm. Temperature is variable, based on location.

Freshwater marsh — a continually or frequently inundated wetland that is dominated by emergent, herbaceous (non-woody) vegetation. Marshes typically are shallow with few floating plants. Marshes may form near surface water, such as a stream. They are transition areas between land and water. pH levels are 5 to 8. Groundwater levels are high. Dissolved oxygen levels typically vary from 3 ppm to 10 ppm. Temperature is variable, based on location.

Bog — a peat-accumulating wetland with no significant inflow or outflow of water. Precipitation is the main water source. Groundwater level is high. Soil and water have low mineral content. High level of organic material. Highly acidic (low pH). Thick masses of sphagnum moss may be present. Dissolved oxygen levels typically vary from ND (nondetectable) to 6 ppm. Temperature is variable, based on location.

Fen — a peat-accumulating wetland with drainage or connections to groundwater. Supports marshlike vegetation. Mineral content in water and soil that feeds the fen is high. Groundwater level is high, and a fen occupies a low point of relief. Rich in Ca, Mg, Ma, K. Low acidity (high pH). Dissolved oxygen levels typically vary

from 2 ppm to 8 ppm. Temperature ranges from 50 degrees F to 57 degrees F because of groundwater contact.

Tidal marsh or salt marsh— a continually or frequently inundated salt water wetland that is dominated by emergent, herbaceous vegetation. Tidal marshes are typically shallow and form in transition areas between land and water, surrounding salt water bays, mouths of rivers, tidal pool areas. pH levels are 6 to 8. Groundwater levels are high. Dissolved oxygen levels typically vary from 3 ppm to 10 ppm. Temperature is variable based on location.

Prairie potholes — shallow marshlike ponds formed in glacial depressions, such as kettles and depressions near glacial moraines. Range from New York to Montana. Groundwater levels are high. Dissolved oxygen levels typically vary from 3 ppm to 7 ppm. Temperature ranges from 50 degrees F to 57 degrees F if fed by groundwater.

More information about wetland types

"A World in Our Back Yard" excellent wetlands curriculum from EPA that includes field studies and stewardship activities; scroll down on this page to find pdfs of each chapter for free download.

Reading: Ecosystem Services of Wetlands (adapted from *Our Wetlands, Our World*)

Water Filtration

Wetlands act as filters to improve water quality. The water that flows through the watershed into wetlands contains sediment and pollutants—fertilizers, soaps, pesticides, and lawn clippings, to name a few. As water enters a wetland, it slows, which causes sediment in the water to settle out, trapping the pollutants before they reach the ocean.

Wetlands handle the pollutants in several ways. Some are buried in layers of wetland soil. Others are absorbed by plants. Within the plants and soil, biological processes can break down and convert pollutants into less harmful substances. Without the wetland, the sediment and pollutants would drain directly into the ocean. Ocean pollution as a result of runoff from land is a major environmental problem, threatening marine wildlife and human health.

Habitat

Acre for acre, there is more life in a healthy wetland than there is in almost any other kind of ecosystem, even matching the high productivity of rainforests and coral reefs. Wetlands support a tremendous variety of fish, birds, amphibians, mammals, reptiles, insects, and other animals—providing food and shelter for them all.

Wetland waters are nutrient-rich with phytoplankton, zooplankton, and the organic debris of decaying plants. Many species of juvenile and small fish, as well as insects and small crustaceans, feed on these nutrients. In turn, larger fish, mammals, birds, reptiles, and amphibians have a plentiful food supply. In the rich mud of a mudflat, many small animals—shrimp, crabs, snails, clams, and worms—live in a submerged city of tunnels and burrows.

Resting and feeding sites for migratory birds

Wetlands are havens for birds. They wade among the grasses, probing the mud for food. They swim in the open waters, scooping up fish. They soar overhead, searching the land and water for their next meal. It is estimated that 75 percent of all North American birds depend on wetlands. Migratory birds from around the world stop at wetlands to feed and breed.

Nurseries and fish production

Many animal species use wetlands as nurseries. Commercially important fish and shellfish such as halibut, croaker, white seabass, scallops, oysters, and shrimp live in or return to wetlands annually to spawn. Larval and juvenile fish develop in the wetlands until they grow strong enough to venture out into the ocean. Many birds build their nests among marsh plants, and in the wetlands chicks learn to fly and to forage for food. The thick vegetation and shallow water found in wetlands provide good places to hide from predators, and the rich sources of food provide energy for young animals to grow.

Many species that depend on wetlands to survive have suffered great losses over the years as wetlands have disappeared. More than one-third of endangered and threatened species in the U.S. spend at least a portion of their lives in a wetland ecosystem.

Flood control

Like sponges, wetlands absorb, store, and release water. They provide a buffer against flooding by absorbing and retaining high water levels. Besides acting as a buffer system against flooding, wetlands regulate water flows through watershed systems. During storm events, wetlands can desynchronize the timing with which surges from a storm event enter a main stem from different tributaries. Water stored in wetlands help maintain base streamflow during dry periods and also release water to the groundwater system, facilitating recharge.

Erosion control

Storage and filtration of water by wetlands reduces downstream erosion and sedimentation, protecting both the natural and man-made environment. Wetlands also absorb the destructive force of waves and currents, protecting coastal and riparian areas. The roots of wetland plants stabilize soil and keep it from being washing away.

Biological Productivity and Diversity

Like coral reefs and rainforests, wetlands are efficient natural factories that turn sunlight into biomass at a rapid rate. This biological productivity provides the base for complex food chains and habitats, and accounts for the great diversity of life in wetlands. This abundance of life helps the wetland reduce erosion, feed wildlife, and fill our plates.

Recreation

Wetlands aren't beneficial just for wildlife. These areas provide wonderful recreational opportunities. People come to wetlands to:

- bird watch
- photograph wildlife
- draw or paint
- walk or bike
- kayak or canoe
- fish

Besides providing a site for such activities, wetlands are available to anyone who simply wants to enjoy the wonders of nature.

More information about wetland ecosystem services

EPA has an extensive series of information sheets about wetlands here

See Bringing Wetlands to Market "Adopt a Wetland" section for ideas and instructions for a variety of field studies students can carry out in a local wetland.