NATURAL RESOURCE RESTORATION LESSON PLAN

Fix It!

Theme

Repairing Damaged Resources

Links to Overview Essays and Resources Needed for Student Research

http://oceanservice.noaa.gov/education/corals
http://oceanservice.noaa.gov/topics/coasts/restoration/
http://restoration.noaa.gov/pdfs/restoring.pdf
http://www.photolib.noaa.gov/habrest
http://restoration.noaa.gov
http://www.nmfs.noaa.gov/habitat/restoration
http://photos.orr.noaa.gov

Subject Area

Life Science

Grade Level

9-12

Focus Question

How can resource managers and concerned public groups repair coastal resources damaged by human activity or natural events?

Learning Objectives

- Students will be able to give at least three examples of natural events and human activities that injure coastal resources.

- Students will be able to describe at least three cases in which injured coastal resources have been restored by human activity.

- Students will be able to describe at least three ways that people have been able to contribute to coastal resource restoration.

Materials Needed

- (optional) Computers with internet access; if students do not have access to the internet, you can download reference materials for the case studies cited under "Learning Procedure" from *http://www.photolib.noaa.gov/habrest/index.html* and *http://restoration.noaa.gov*

Audio/Visual Materials Needed

None

Teaching Time

One or two 45-minute class periods, plus time for student research

Seating Arrangement

Groups of 2-3 students

Maximum Number of Students

40

Key Words

Restoration
Coral reefs
Ship groundings
Marshes
Coastal habitats
Fish habitats
Abandoned mines

Background Information

Coastal resources are under constant threat from natural processes and human activities. News media regularly feature stories of damage to coral reefs, estuaries, fisheries and other resources caused by storms, ship groundings, oil spills, chemical releases, and many other events. Modern coastal resource management includes using science and technology to protect and restore coastal resources affected by such events. These efforts can include removing pollutants and invasive species (species of plants or animals that are not native to the ecosystem and cause economic harm, environmental harm, or harm to human health), repairing damaged habitats, restoring natural ecosystem processes such as water flow, and re-introducing native organisms. In addition, restoration projects often include monitoring activities to evaluate long-term success. Such projects have been implemented in marshes, forested wetlands, oyster reefs, seagrass beds, beaches, tidal streams and riparian forests. The results include improved habitats for fish, birds and other wildlife, protection against flooding, better water quality, enhanced recreational opportunities, and increased economic opportunities through activities such as commercial fisheries and tourism.

The obvious first step for many restoration projects is to remove the cause of damage. In the case of resources damaged by pollution, the first step is to control the source of pollutants. There are three basic options for dealing with pollutants that have already entered an ecosystem. The first option is to do nothing and allow natural processes to make the pollutants harmless (some naturally occurring bacteria, for example, are capable of breaking down or changing toxic substances into nontoxic molecules). The second option is to isolate pollutants from the rest of the ecosystem by covering them with soil or other material, or by treating the pollutants with chemicals that bind to the pollutants and prevent them from interacting with living organisms. The third option is to remove the pollutants from the ecosystem; a task that is often extremely expensive or impractical. In the case of damage caused by ship groundings, removing the cause of damage has the potential to cause even more damage than the initial event. When coastal resources have been damaged by changes in the flow or circulation of a water body (such as changes caused by dams, canals, or severe storm damage), these changes must be corrected before the desired natural systems can be re-established.

In New England, for example, damage to coastal marshes is often caused by dikes, levees, and poorly designed water-control structures that interfere with normal water movement by tides. In many cases, this interference results in reduced salinity. Coastal marshes are normally dominated by the marsh grass Spartina. When salinity is reduced, Spartina may be displaced by a naturally occurring reed known as Phragmites. This reed is more tolerant of lower salinity than Spartina, and a reduction in salinity often allows Phragmites to become invasive. Excessive growth of Phragmites tends to trap sediments and fragments of dead plants. As these materials accumulate, the elevation of the marsh increases and this causes even more interference to normal tidal flow. These changes reduce the production of fishery species, birds, and other wildlife that use marsh surface and tidal creek habitats. Restoration of intertidal wetlands first requires that normal tidal exchange be restored. In most cases, this is enough to reduce the vigor and growth of Phragmites so that the invasive species gradually declines. As this occurs, it is frequently necessary to revegetate the area with native, non-invasive plant species. Restoration projects concerned with other kinds of aquatic plants and wetlands also frequently use transplants to encourage natural recolonization in areas where water quality has been improved.

Many restoration projects have been initiated to improve fishery production. One of the most widespread activities is restoration of fish habitats degraded by dams placed in the path of fish runs. These dams are a serious obstacle to fish species that migrate upstream as part of their reproductive cycle. The obvious solution is to remove the dam, but this is not always feasible due to existing land uses, economic activities, and concerns regarding erosion and sedimentation that could result from increased stream flows. Fish ladders, or fishways are a commonly used strategy to bypass blockages. These devices consist of a series of gradually inclining steps with resting pools located at regular intervals. These provide the fish with a means for active migration that simulates natural river conditions. Other types of fishways have been designed for use with both small and large dams.

Restoring coastal resources is a NOAA priority. NOAA restores injured resources, and provides data, science and tools needed for restoration planning. When destructive events affect coastal resources over large areas, restoration often involves partnerships that include entire communities. In this activity, students will investigate a variety of case studies to learn how science, technology, and cooperative effort can be applied to restore coastal resources.

Learning Procedure

1. Briefly review the importance and inherently vulnerable nature of coastal resources. Ask students to list some of the benefits obtained from these resources and examples of events that can damage them. Be sure students include natural events as well as anthropogenic damage (damage caused by human activities).

2. Tell students that their assignment is to investigate what can be done to restore injured coastal resources. Assign one of the following case studies to each student group:
   - Apex Houston - Common Murre Restoration Project
   - Blackbird Mine Restoration Project
   - Columbus Iselin Coral Reef Restoration
   - Fortuna Reefer Coral Reef Restoration
   - Elpis Coral Reef Restoration
   - Maitland Coral Reef Restoration
   - Iron Mountain Mine Restoration Project
   - World Prodigy Restoration Projects
   - Adobe Creek Restoration Project
   - Barren Island Tidal Wetland Restoration
   - Elizabeth River Restoration Project
   - Finney Creek Restoration Project
   - Glade Bekken Stream Restoration Project
   - Parker River Fish Restoration Project
   - Pepper Buster and Johnny Mangrove Seed
   - Tampa Bay High School Wetland Nursery Project
   - Black Bayou Hydrologic Restoration Project
   - Lake Salvador Shoreline Protection Project
   - Point au Fer Hydrologic Restoration Project
   - Oculina Restoration in the Experimental Oculina Research Reserve

   Tell students that each group is to prepare a report on their assigned case study. These reports should include information on:
   - What caused damage to natural resources;
   - What economic and social consequences resulted from this damage;
   - What restoration activities were undertaken;

- Who undertook these activities; and
- What ecological, economic and social benefits have been achieved through restoration activities.

You may want to suggest that students include relevant photographs in their report. NOAA has images for most of these case studies at *http://www.photolib.noaa.gov/habrest* and *http://photos.orr.noaa.gov*. In addition, you should direct students to the NOAA Restoration Portal Web Site at *http://restoration.noaa.gov*, but be sure students also use a whole-web search engine to search for other articles about their case studies as well.

3.
Have each group summarize their case study orally, then lead a discussion about resource restoration. The following points should emerge during this discussion:

- **Specific restoration techniques vary widely, depending upon the resources of concern, cause of injury, and desired outcomes.** In the case of ship groundings, the overall objective is often to recreate the habitats that existed prior to a grounding event. But different activities are undertaken to achieve this objective in different locations, as illustrated by the Fortuna Reefer, Maitland, Elpis, and Columbus Iselin case studies.

- **Specific efforts may be needed to recruit desired species back to the area being restored.** Such efforts were part of the response to the Columbus Iselin grounding. The Apex Houston - Common Murre Restoration Project also shows that even if suitable habitat is available, additional actions may be needed to restore desirable populations of plants and animals. The World Prodigy restoration project is a case where multiple efforts were needed to restore a highly productive habitat that was associated with economically important resources. Similarly, once an historic oyster reef was reconstructed as part of the Elizabeth River Project, it was still necessary to seed the reef with hatchery-produced seed oysters.

- **Resource restoration projects often involve balancing multiple considerations,** including costs, anticipated benefits, and objectives of different resource users that may conflict with each other. Wetlands typically provide flood and erosion control, wildlife habitat, and recreational opportunities. Tampa Bay, Barren Island, Pepper Buster, Finney Creek, and Glade Bekken Stream restoration projects have undertaken activities to restore specific wetlands so that they can provide benefits desired by different groups of users.

- **Appropriate technology is a key issue for most restoration projects.** The Glade Bekken project used a special type of excavator to move heavy timbers across sensitive areas. The Finney Creek project solved a similar problem with simpler technology (using volunteers to move woody debris). The Parker River project improved a fishway for anadromous fishes with a more sophisticated Alaskan Steep Pass fish ladder. Some restoration projects, such as the Oculina and Lake Salvador projects, are intended to evaluate the effectiveness of alternative technologies.

- **Students can play an important part in resource restoration,** as illustrated by the Elizabeth River, Adobe Creek and Tampa Bay Wetland Nursery projects.

The Bridge Connection

www.vims.edu/bridge – Type "restoration" in the Search box to locate links to various restoration projects.

The Me Connection

Have students write a brief essay on how they could initiate or become involved in a project to restore natural resources, and how this effort could be of personal benefit.

Extensions

1.

Visit *http://www.response.restoration.noaa.gov/kids/kids.html#exper* for experiments, projects, and teaching resources related to oil spills, including a Sediment Penetration Exercise, Mearns Rock Graphing Project, and a project on Oil Spills at the Water Surface.

2.
Visit *http://www.response.restoration.noaa.gov/esi/exercise/index.html* for instructions and materials for an exercise in planning a protection strategy for a coastline threatened by an oil spill using environmental sensitivity index maps.

Resources

http://restoration.noaa.gov/ – The NOAA Restoration Portal Web Site provides centralized access to information about NOAA restoration programs, projects, and activities through a single point-of-entry. This site serves as a gateway to more detailed NOAA restoration publications, Web sites, audiovisual materials, and case studies.

http://www.response.restoration.noaa.gov/ – NOS Office of Response and Restoration website, with tools and information for emergency responders and planners, and others working to understand and mitigate the effects of oil and hazardous materials in our waters and along our coasts.

National Science Education Standards

Content Standard A: Science as Inquiry
- Abilities necessary to do scientific inquiry
- Understandings about scientific inquiry

Content Standard C: Life Science
- Interdependence of organisms

Content Standard E: Science and Technology
- Abilities of technological design
- Understandings about science and technology

Content Standard F: Science in Personal and Social Perspectives
- Personal and community health
- Natural resources
- Environmental quality
- Natural and human-induced hazards
- Science and technology in local, national, and global challenges

Links to AAAS "Oceans Map" (aka benchmarks)

5D/H1

Ecosystems can be reasonably stable over hundreds or thousands of years. As any population of organisms grows, it is held in check by one or more environmental factors: depletion of food or nesting sites, increased loss to increased numbers of predators, or parasites. If a disaster such as flood or fire occurs, the damaged ecosystem is likely to recover in stages that eventually result in a system similar to the original one.

5D/H3

Human beings are part of the earth's ecosystems. Human activities can, deliberately or inadvertently, alter the equilibrium in ecosystems.