PICKING UP THE PIECES

OBJECTIVES

Students will be able to:

- describe the challenges of restoring an altered ecosystem.
- describe some of the human alterations to the Mississippi River

METHODS

Students simulate ecosystem restoration by putting a puzzle together.

BACKGROUND

Restoration of an ecosystem is much more complex than grabbing the keys to a bulldozer and starting to push things back into place. Habitat restoration requires careful planning and patience. In some respects, it is much like trying to figure out how to put a puzzle back together, only you don't necessarily have, or know, where all of the pieces are and where they go.

A basic step in developing a picture to use as a template is to determine what the unaltered ecosystem looked like by studying areas similar to what is being restored or researching historic records about the location being restored. Next, the impacts of human actions need to be identified. For the Mississippi River, this includes looking at how humans have altered the floodplain and some complex processes like sedimentation, hydrology (movement of water) and water quality. Managers must then identify the habitat needs of the plants and animals that will use the restored habitat. Meeting the habitat needs of a variety of species - their food, water, shelter and space – may require tradeoffs. All of this information is used to determine the best mix of management actions to be implemented at several different geographic scales. This is because some animals will spend their entire life in a square yard, while others need access to larger areas of different habitats to survive (i.e. migratory waterfowl and fish). Finally, society has to place enough value in restoring altered habitats to provide the necessary money to do the restoration.

Grade Level: 4 - 12

Subjects: Social Studies, Science, Ecology

Duration: 30

Group Size: Individual

Setting: Classroom

Key Vocabulary: ecosystem, restoration

Materials:

- *map handout, 1 per student*
- *2 flat surfaces formed by a book, folder, or pads of paper*
- *scissors to cut map into pieces*
- *envelopes for map pieces*

Mississippi River Habitat Restoration

Habitat on the Mississippi has changed over the last 150+ years. One of the greatest changes occurred when locks and dams were built in the late 1930's to provide a minimum 9-foot deep stairway of water from St. Paul to St. Louis for commercial navigation. For example, we know that in a 50 year period of time, over 80% of the islands in Pool 8 between Genoa and Stoddard, Wisconsin, have been lost due to erosion. During this same time period, some backwater lakes, the preferred home of bluegills, largemouth bass and waterfowl, have filled in at an average rate of an half inch per year.

Many other human alterations have affected the quality of habitat on the Mississippi River. These other impacts included cutting down of floodplain forests first as fuel for steamboats and later in preparation of the large bodies of water to be formed by the dams. Urban development and the construction of levees to protect farm fields and cities have had a big impact on the habitat in the Mississippi River floodplain from Rock Islands, Illinois to the Gulf of Mexico.

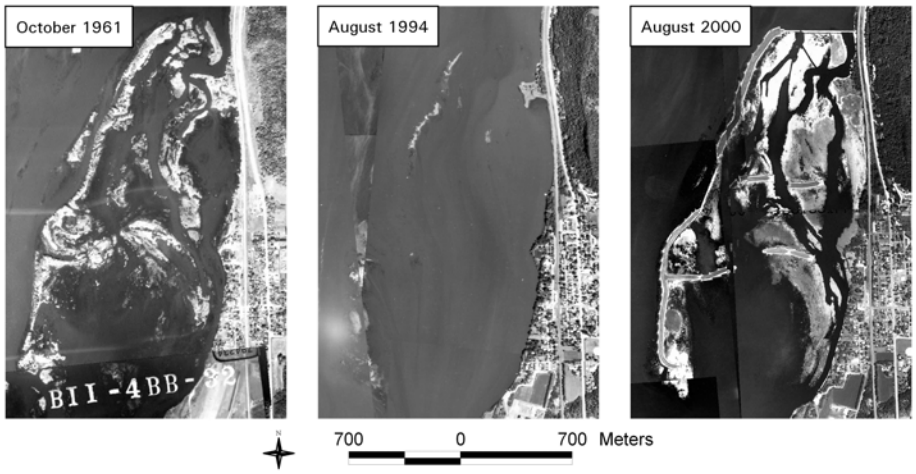
1939

1989

Island erosion in Mississippi River, Pool 8, near Stoddard WI.

While it is impossible to reverse all of the habitat losses on the river, there is a federal program that has been around since 1986 charged with the responsibility of restoring and improving Mississippi River fish and wildlife habitat. The boundaries of this program include the Mississippi River from St. Paul, Minnesota, to Cairo, Illinois, and the Illinois River from Alton, Illinois to almost Chicago.

The Environmental Management Program (EMP) was first passed by Congress in 1986 and reauthorized in 1999 as a continuing program. This program established funding for Long Term Resource Monitoring of the Mississippi River and Illinois River's ecological health and Habitat Rehabilitation and Enhancement Projects on these rivers in Minnesota, Wisconsin, Iowa, Illinois and Missouri. Congress placed management responsibility for the EMP with the Corps of Engineers, but the program is implemented through an inter-agency/multi-state team approach. Monitoring and habitat projects are coordinated with the five upper Mississippi River states, U.S. Fish and Wildlife Service, U.S. Geological Survey and three Corps of Engineers districts. Additionally, public input plays a vital role in the planning and development of the habitat projects, with up to four public meetings held for a particular project.



Environmental Management Program Habitat Rehabilitation and Enhancement Projects have been successful at restoring habitat. Shown here is Pool 8 Islands Phase II (the Stoddard Islands) as they looked in 1961, 1994 and 2000. By 1994, almost all of the islands had eroded away. With them went the protection they provided to aquatic vegetation beds and fisheries habitat. The project was completed in the fall of 1999. Within one year (2000), much of the vegetation had returned and the area was similar to what it looked like in 1961.

MATERIALS

- for each student, make a copy of the air photo "Mississippi River near La Crosse, Wisconsin". Or, visit the following web site and choose a photo for them to create a puzzle from: http://www.umesc.usgs.gov
- scissors to cut map into pieces
- envelopes for map pieces
- 2 flat surfaces formed by a book, folder, or pads of paper
- a copy or overhead of the 1890/1989 Pool 8 handout to show students
- a copy or overhead of the Mississippi River near La Crosse
- 1 copy each of the Stoddard Islands area in 1961, 1994 and 2000

PROCEDURES

1. Prepare for the activity by cutting up an air photo of the Mississippi River near La Crosse Wisconsin for each student and placing the pieces into an envelope. Cut the air photos into different number of pieces to provide for different levels of difficulty when the students are working on putting them back together. Recommended are equal proportions of puzzles with the following number of square pieces: 4, 6, 8, 12, and 16.

2. Explain to the students that today they will be trying their skills at restoring an altered ecosystem. Pass out a packet of puzzle pieces to each student. Also, provide them with 2 sheets of paper (or 2 folders or 2 books).

3. Instruct the students to scatter the puzzle pieces on their desktop with the white side up so that they can not see the picture. Tell them that these pieces represent a portion of the Mississippi River ecosystem that has been altered by human actions.

   Have them assemble the puzzle without looking at the picture. Have them assemble the pieces on another piece of paper (or folder or book). Once they have assembled the puzzle, they should place another piece of paper (or folder, or book) on top of the puzzle. Then, carefully hold the two pieces of paper (or folders, or books) together with the puzzle in between and turn it over so the picture will be visible when they remove the top paper.

   Using an overhead of the air photo (or you can provide each of them a copy), ask: "How closely does your restoration look like the air photo? What would help you restore the ecosystem more accurately?"

   Some students with only a few puzzle pieces may have put the puzzle back together correctly. Tell them that it was just a matter of luck.

4. **Tell the students that putting the puzzle together without looking at the picture represents how difficult habitat restoration can be without any information on what the natural ecosystem looked like and what humans have done to alter the ecosystem**. Have them brainstorm and record types of information that might be helpful in developing a plan to restore an ecosystem.

   Some examples of items that may be on their list of information needs are:

Sedimentation	The habitat needs of plants and animals
Locks and Dams	Urban Development
Erosion	Data (and photos) of the natural ecosystem
Water quality	Where in the watershed it is located
Pollution	Visiting other restoration projects.

5. Show them Figure 1, (1890 vs 1989 habitat in Pool 8 of the Mississippi River). Ask them to describe the differences they see. Discuss with them human impacts to the Mississippi River ecosystem and the ecological effects that these impacts had. (The Background information in this activity and the introduction found in the fish and wildlife habitat section, pages FW

1-4, may be helpful). Towards the end of the discussion, point out that box 1 is the area where the air photo they tried to put together was taken.

Ask if they have any additional information needs to add to their list.

6. Show them the first two time series (1961 and 1994) of the Stoddard Islands. Ask them to describe the differences they see and to hypothesize how wildlife and fisheries use may be different between the two photos. Tell them that in 1961, this area was a productive area for aquatic plants, wildlife and fish.
This area is in the lower section of Pool 8 (the boxed area in the 1890 vs. 1989 labeled "2" in Figure 1). Construction of the locks and dams caused water levels in the lower section of the pool to increase, flooding much of the land. This subjected the remaining land, now islands, to wave erosion caused by wind. After the islands had eroded away, the protection they provided to the aquatic habitat was lost. This resulted in the uprooting of aquatic plants in the area and introduction of river currents. Both of these impacts resulted in a loss of backwater fish and wildlife habitat.

   Ask them, "What would you do here to restore the 1994 habitat back to what it looked like in 1961?"

7. After they have given suggestions on what to do to restore the habitat, show them the 2000 air photo of the Stoddard Islands area. Describe to them the actions river managers decided to implement in the area to restore it.

   "River managers determined that the primary impacts to this area were: increased water levels, impacts of wind generated waves, island erosion, river currents too high to support a diverse fish community, lack of aquatic vegetation and sedimentation. The combination of features used to offset these impacts were island construction, protection of restored islands with a combination of rock and vegetation and dredging to increase water depths. The islands protect the area from wave action and current. Protection from wave action improved the light penetration in the water that allowed the plants to become reestablished. Reducing the water velocities, along with dredging out accumulated sediment, improved habitat conditions for over 45 species of fish"

   Point out that the islands were not built exactly where they were in 1961. This was one way to reduce the cost of the project while still meeting the project objectives. Restoration of habitat damaged by human actions is expensive. The Stoddard Islands project (Officially known as the "Pool 8 Islands, Phase II, Environmental Management Program, Habitat Rehabilitation and Enhancement Project") cost $2.9 million dollars, so if

money can be saved by not rebuilding exactly what was there, it can be used to do other restoration projects.

8. Tell students to again scatter the puzzle pieces on the desk, only this time, have the picture side up. Project a copy of the air photo up on a screen, or give them a copy of the air photo. **Tell them they can use the copy of the air photo as they assemble the puzzle. The completed air photo represents the research managers do to help determine what the impacts of humans were on a site and how different components of the ecosystem fit together.**

   Have each person raise their hand when they have completed their puzzle and record how much time it took to assemble and the number of pieces they had. When everyone has raised their hand, ask, **"Why did it take longer for some people to complete the puzzle?"** What they should observe is that it took longer for people with more pieces.

   Tell them, **"The number of pieces people had is a representation of how altered the ecosystem they were restoring was. Those with the most pieces had the most altered ecosystem. In the real world, it takes more time, information and planning to restore highly impacted and altered ecosystems."**

9. Have them look at their completed puzzle and discuss any observations they have. One observation should be that the pieces don't fit together perfectly. This is true even with the most successful ecosystem restoration projects because we do not know exactly how everything in nature fits together.

DURING ASSESSMENT

Monitor student involvement in the discussions and input to developing the list of information needs and human impacts.

POST ASSESSMENT

1. Give examples of 4 pieces of information managers might need to know about a site to restore habitat.

2. Describe 2 impacts humans have had on the Mississippi River ecosystem.

3. Describe 2 actions people can take to restore Mississippi River habitat impacted by human actions.

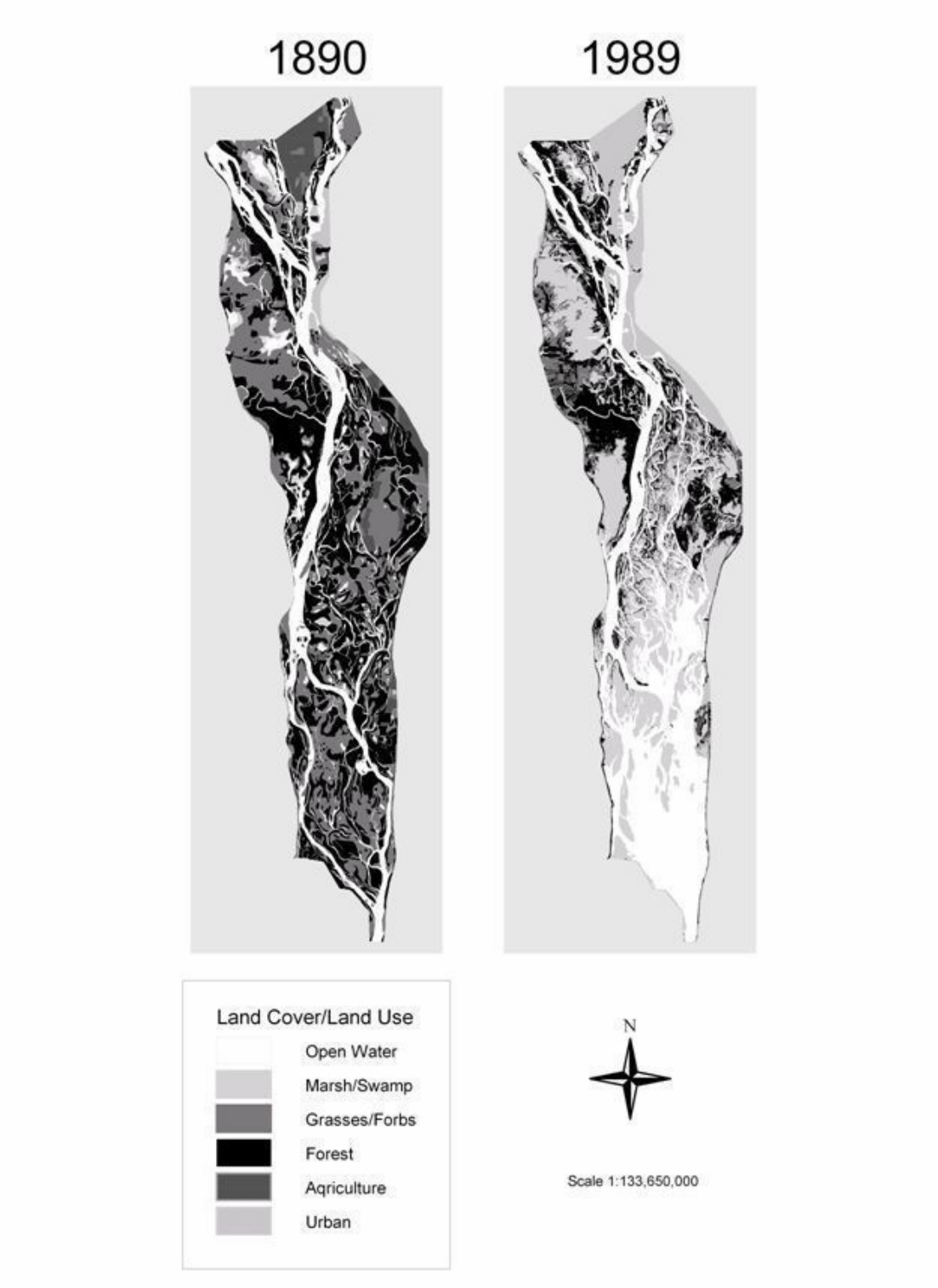
EXTENSIONS

Have student's research restoration projects in their local community or on the Mississippi River. The following website provides information on several Environmental Management Program Habitat Rehabilitation and Enhancement Projects:

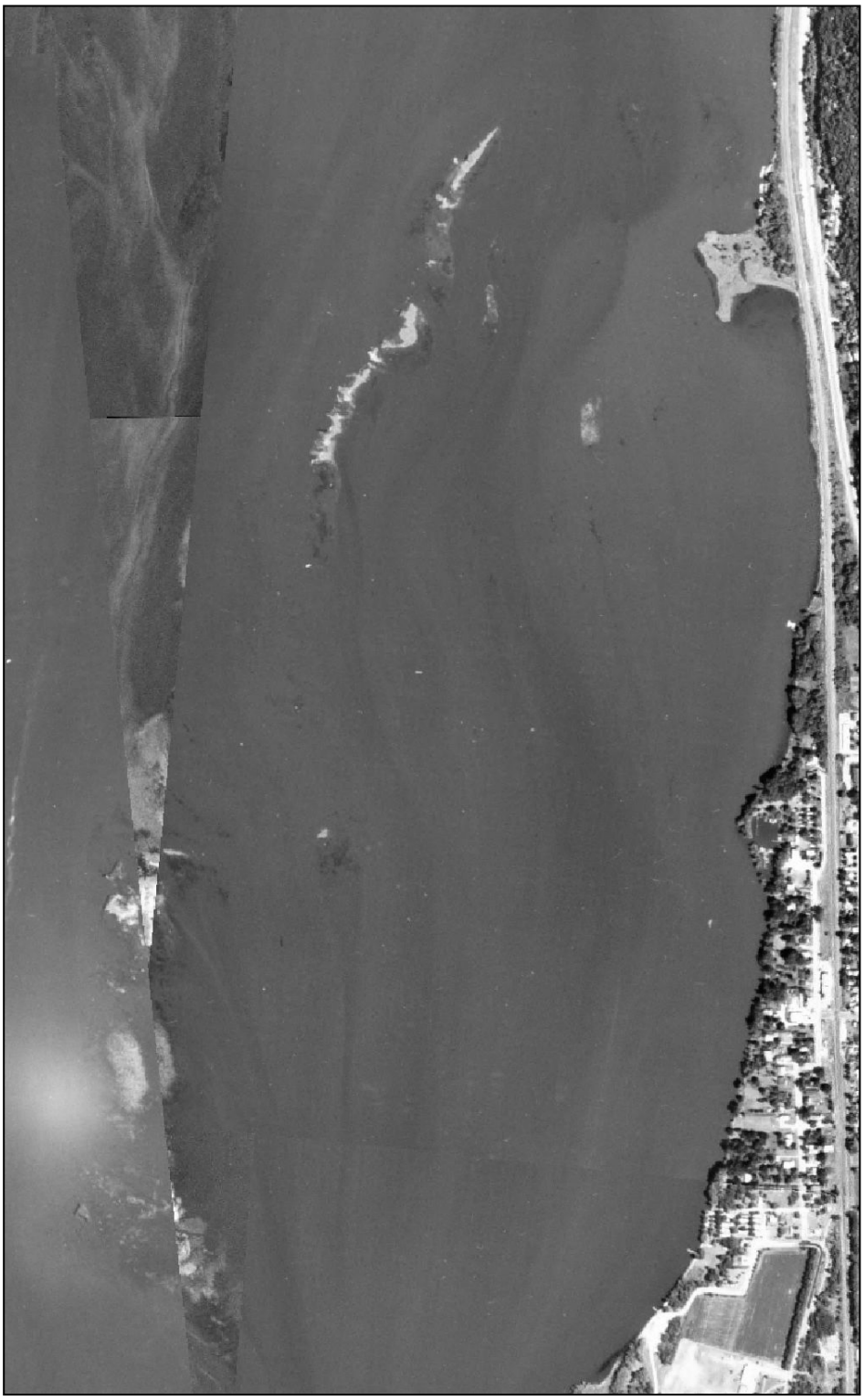
http://www.mvr.usace.army.mil/EMP/hrep.htm

Mississippi River backwater near La Crosse, Wisconsin.

Figure 1. Land cover comparison of 1890 and 1989 vegetation conditions in Pool 8 of the Upper Mississippi River.



Stoddard Islands, Pool 8, October 1961



Stoddard Islands, Pool 8, August 1994

Stoddard Islands, Pool 8, August 2000