Buddy System

In this chapter, four lesson plans illustrate various ways people work together to solve environmental problems.

Restoration Nation

OBJECTIVES: Students will be able to:

- describe three different stream restoration techniques
- explain three different steps taken in a stream restoration project
- relate that preventing stream degradation is easier than trying to re-create a complex ecosystem

METHOD: Students will work in small teams to develop a restoration plan for Gilbert Creek using questions for direction. They will present their results to the class.

MATERIALS: Optional: This lesson provides a great opportunity to have a classroom visit from a guest speaker who is familiar with local restoration efforts.

SETTING: Indoors or outdoors

DURATION: One or two 45-minute sessions

VOCABULARY: Restore, stakeholders, fragmented

STANDARDS:
Science: B 8.6; C 8.4, 8.11, 12.1; F 8.9, 8.10, 12.8; G 8.5; H 8.2, 12.1, 12.3, 12.4, 12.7.
Environmental Education: B 8.5, 8.10, 8.15, 8.17, 8.18, 8.22, 8.23, 12.3, 12.5, 12.6, 12.8, 12.12, 12.19; D 8.1, 8.5, 8.8, 12.1, 12.7.
Social Studies: A 8.11, 12.11, 12.12.

BACKGROUND: Land management has been, and continues to be, a learning experience for humans. Ecosystem restoration, or the repair of ecosystems, is now a multi-billion-dollar industry in the United States. Generally, the goals of restoration on a waterbody are to improve water quality, enhance aquatic habitat, and reduce erosion. In streams, restorationists often have the added goal of trying to improve fish passage so that spawning is possible. Managers have to be very cautious in trying to restore a natural system—if they don't understand and work with the natural system, they could end up creating new challenges. Consultation with a variety of experts is important, as is monitoring and testing to make sure that the stream is responding as intended. If done well, ecological restoration can have dramatic and inspiring effects.

In Wisconsin, many aquatic restoration efforts are focused on making streams habitable by trout. Trout require cold water, plenty of oxygen, sheltered places to hide and rest, and abundant supplies of insects and forage fish. Trout streams must offer gravel beds for spawning and water swift enough to sweep silt off developing eggs. If a few of these necessities are missing, the trout go missing as well.

Not all Wisconsin streams are capable of supporting trout; some never were. However, some trout streams were and continue to be impaired by beaver dams, human-made dams, grazing cattle, highway construction, runoff pollution, flooding, soil erosion, and other sources. Gilbert Creek, the focus of this activity, was affected by soil erosion.

Streams are not the only waterbodies affected by land use decisions. Lakes and wetlands can also change as a result of land management decisions and, as a result, present their own restoration challenges. A lake's often-large watershed can cover more area and involve more stakeholders than a small stream's. Large watersheds may even cross state or country borders, making cooperation between different political organizations an important part of large waterbody restoration.

Perhaps the most challenging waterbodies that Wisconsin is trying to restore are lakes Michigan and Superior. These Great Lakes are examples of an extreme in ecosystem restoration. The watersheds for these lakes cross many state borders and Lake Superior's crosses our international border with Canada. Maintaining a fishery, reducing pollution, and regulating how Great Lakes water is used involves cooperation between many different governments. The International Joint Commission, a group of Canadian and American citizens, uses science to make restoration and management recommendations to all Great Lakes governments. The Great Lakes Compact is an agreement among Great

Lakes states on how the Great Lakes should be managed and maintained.

OPENING: Ask students to read **Restoration Nation** up to the Gilbert Creek Case Study. Have students define "restoration" and provide some examples as to why it is necessary. Encourage students to think back to Chapter 3 to come up with reasons why soil erosion or highway construction would affect fish habitat, particularly trout habitat.

MAIN ACTIVITY: Divide students into groups of three and have them read through the Gilbert Creek Case Study together. Give them time to answer the questions asked in their booklets and to develop a restoration plan for the creek. This may take the remainder of the class period, especially if they are being thoughtful. You may need to assist them in synthesizing their knowledge of trout needs and restoration possibilities.

Once the students have had time to develop their plan, have them share the plans with each other. Keep a running tally on the chalkboard or white board of the stakeholders students identify, their project goals, constraints, some measures they took, and some of their monitoring ideas.

Read students the events that actually took place in Gilbert Creek: The DNR, Trout Unlimited (a nonprofit group that does stream restoration), and Dunn County Fish and Game Club volunteers came together with the goal of improving trout habitat to make a sustainable fishery. Project managers spoke to local school groups, university classes, farmers, and other local citizens to broaden interest in trout habitat. During the summers of 2003, 2004, and 2005, every Tuesday night became a volunteer work party along the creek. The volunteers put LUNKERS structures in place to stabilize the streambanks and used logs and boulders to make pools. Volunteers removed over two miles of invasive trees and reseeded the land with native grasses. Gilbert Creek is now a much more attractive trout habitat: temperatures have dropped and macroinvertebrates have increased in numbers and diversity. There is less erosion and a more stable channel.

The threat of erosion from farmland and new construction projects remains a concern at Gilbert Creek. The health and stability of the hills around Gilbert Creek are just as important as the land immediately surrounding the stream. Trout Unlimited, the DNR, and others are keeping a close eye on the stream to see if new projects are needed.

CLOSING: Have students think about why restoring a lake or a large river would be more difficult than restoring a stream. Who would be the stakeholders in a restoration of Lake Michigan or Lake Superior? If you have invited a restoration ecologist, fisheries biologist, or other local expert in to talk about the mix of science and society, this would be an excellent time to have him or her describe a local restoration project.

ASSESSMENT QUESTION: Name three habitat problems a fisheries biologist may find in a degraded trout stream and one way of addressing each problem.

ANSWERS: *Lack of shelter: sink LUNKERS and logs. Lack of sunlight: plant native shrubs and vegetation, remove non-native trees. Bank erosion: plant vegetation, grade bank, remove livestock, put stabilization structures in place. Water too warm or slow: create log jams, narrow stream with gravel.*

EXTENSIONS:

In Depth: Have students read articles about and evaluate a local restoration project.

Field: Visit a local stream that has been restored and one that has not needed restoration. Can students find differences between the two? Can they see evidence of any of the restoration techniques described in their booklets?

Service Learning: Team up with a local fishing or conservation club to help with stream habitat restoration projects.

If you have downloaded this booklet, please see the appendix that follows for additional materials.

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Buddy System

Making sure that there is a healthy and sustained fishery for all to enjoy requires resource managers. Managing waterbodies for fish means creating, maintaining, and improving environments favorable to all stages of a fish's life cycle. We all play a role in managing Wisconsin's fisheries, because we all live in watersheds that support fish. Keeping fish in mind when making decisions about when and where we apply fertilizer, how we dispose of hazardous waste, or where we place cattle fences makes us all fish managers. The primary agency for managing fish in Wisconsin is the Department of Natural Resources (DNR). The DNR manages habitat improvement projects; studies, protects and restores fish populations; monitors fish health; staffs hatcheries; stocks fish; and enforces fishing regulations on Wisconsin waters, all of which are public.

Musky

Make sure students understand that ALL NAVIGABLE WATERS in Wisconsin are constitutionally protected as PUBLIC property. As long as the waterway is navigable for one period during the year, even if it is in flood, it is considered public property and they may enjoy it!

Restoration Nation

The Wisconsin DNR Bureau of Fisheries Management protects, maintains, and improves fish habitat. One of the jobs fisheries staff have is to partner with other DNR bureaus and concerned groups, like angler clubs, to improve fish habitat through restoring our streams, lakes, and wetlands.

The Route to Trout: Stream Restoration

Early 20th century farming practices harmed local watersheds in western Wisconsin's Driftless Area, where clean, cold creeks wind through valleys flanked by steep hills. When farmers removed trees and native grasses to plant crops, loose soil flowed downhill, depositing as much as 12 to 15 feet of soil in some creeks over the years. Water quality worsened, stream temperatures increased, and flooding became more frequent and severe.

Gilbert Creek Case Study

One hundred years after farming began in the Driftless Area, a local stream, Gilbert Creek (located twelve miles west of Menomonie), remained choked with silt. Its water was murky and warm, and invasive tree species lined its banks rather than the deep-rooted prairie grasses that once anchored soil in place.

In 2002, brook trout laid eggs in the North Branch of Gilbert Creek, but fish survey crews did not find any newly-hatched trout in 2003. The eggs were likely smothered by silt or killed by high water temperatures. If fishing were to continue in Gilbert Creek, something had to be done. Work with your team to develop a plan to restore trout habitat to Gilbert Creek, using the following questions for direction.

1) Who are the **stakeholders** in the Gilbert Creek restoration, and what do they want?

Students should consider at least some of the following: the property owners along the creek, the local angler club, individual anglers, local government, community businesses, recreationists, environmental advocacy groups, and perhaps others. Most would probably want to improve the creek's fish habitat and restore it to a healthier condition. Businesses and governments would both benefit from an increase in anglers and other recreationists to the area. Landowners and environmental advocacy groups may be concerned about how the team will go about doing the restoration. Will they cause property or ecosystem damage during the process?

INSTRUCTORS:
Underlined content is not provided in student manual.

2) Considering the needs of the stakeholders, what are your goals for the project?

The actual goal was to improve trout habitat for a sustainable fishery.

3) What are the constraints?

Government permits might be needed. Even though your goal is a good one, these permits might take years to obtain. Resistant stakeholders might not allow you to cut down invasive species on their property. You may not be able to find adequate funding, time, volunteers, or leaders. Ask students how they might overcome these constraints.

4) Using the stream improvement techniques on the next page and your own inspiration, decide some of the measures you will take to restore the stream.

Read the case resolution to see what actually took place. There are many possible ways to restore a stream. Teams should mention consulting with local experts like hydrologists, aquatic ecologists, fish biologists, engineers, or botanists to make sure they are taking reasonable steps.

5) How will you know if the steps you have taken succeeded in meeting your goals? What might you continue to monitor after your project is done?

Success will be proven when trout naturally reproduce in a stream. It would be wise to continue to monitor temperature, dissolved oxygen, and turbidity to make sure the project is working and to identify new hazards before they harm the stream.

INSTRUCTORS: Underlined content is not provided in student manual.

No matter what actions your restoration team takes, it is important that your team understands both the habitat needs of a fish during all phases of its life and the root causes of the habitat loss. If your team restores a stream, but does not address the cause of the erosion, for example, the stream will just need to be restored again later.

Lessons Learned

Wisconsin has over 2,700 trout streams with some natural reproduction. The DNR wants to improve and sustain these populations, believing the thrill and challenge wild trout offer will always be valued by anglers.

Protecting natural spawning areas is today's biggest challenge for Wisconsin habitat improvement. The ultimate goal of habitat improvement is a completely self-sufficient stream with large populations of wild trout maintaining themselves.

Perhaps the best lesson to learn from all of our restoration work is that it is much easier to prevent habitat loss by making thoughtful land use decisions than it is to restore degraded habitats. We have also learned that it is better to use natural structures and processes to restore streams, lakes, and rivers than it is to install artificial habitat structures. We may never be able to recreate the full complexity of a natural system after it has been altered.

Stream Improvement Techniques

When seeking to improve a trout stream, fishery biologists focus on making habitat meet the needs of the trout. Areas for them to address might include the following: lack of shelter (cover) or living space for fish, lack of sunlight due to overgrowth of vegetation, siltation due to erosion of streambanks, water that is too warm because a stream is too shallow. Fishery experts have developed many solutions to such concerns.

PROBLEM	TECHNIQUE
Bank Erosion	Plant vegetation on bank and buffer. Exclude or modify livestock grazing. Put stabilizing structures in place. Re-grade the slope of the bank.
Lack of Sunlight	Plant native shrubs and grasses. Remove non-native trees and plants.
Over-widened/ Shallow Streams	Use log jams to deepen pools. Use gravel to narrow a stream channel.
No Shelter	Place materials like wood and boulders. Install LUNKERS.

Installing a LUNKERS.

LUNKERS!

Little Underwater Neighborhood Keepers Encompassing Rheotactic Salmonids are crib-like wooden structures that imitate an undercut bank. LUNKERS provide shelter for fish while stabilizing the streambank. They were developed in Wisconsin by DNR trout stream biologist David Vetrano and work well for restoring fish habitat in Midwestern streams.