Grades 4-6, 9-12

Helping Hands

Restoring Great Lakes Habitat

Connecting students with scientific principles through local sediment and habitat projects

ALIGNED TO NGSS, NSES, AND STATE STANDARDS

Authors:

Caitie Nigrelli, Environmental Social Scientist, Illinois-Indiana Sea Grant
Nishaat Yunus, USEPA Research Fellow, Oak Ridge Institute for Science and Education
Kirsten Hope Walker, Education Specialist, Illinois-Indiana Sea Grant

Editor:

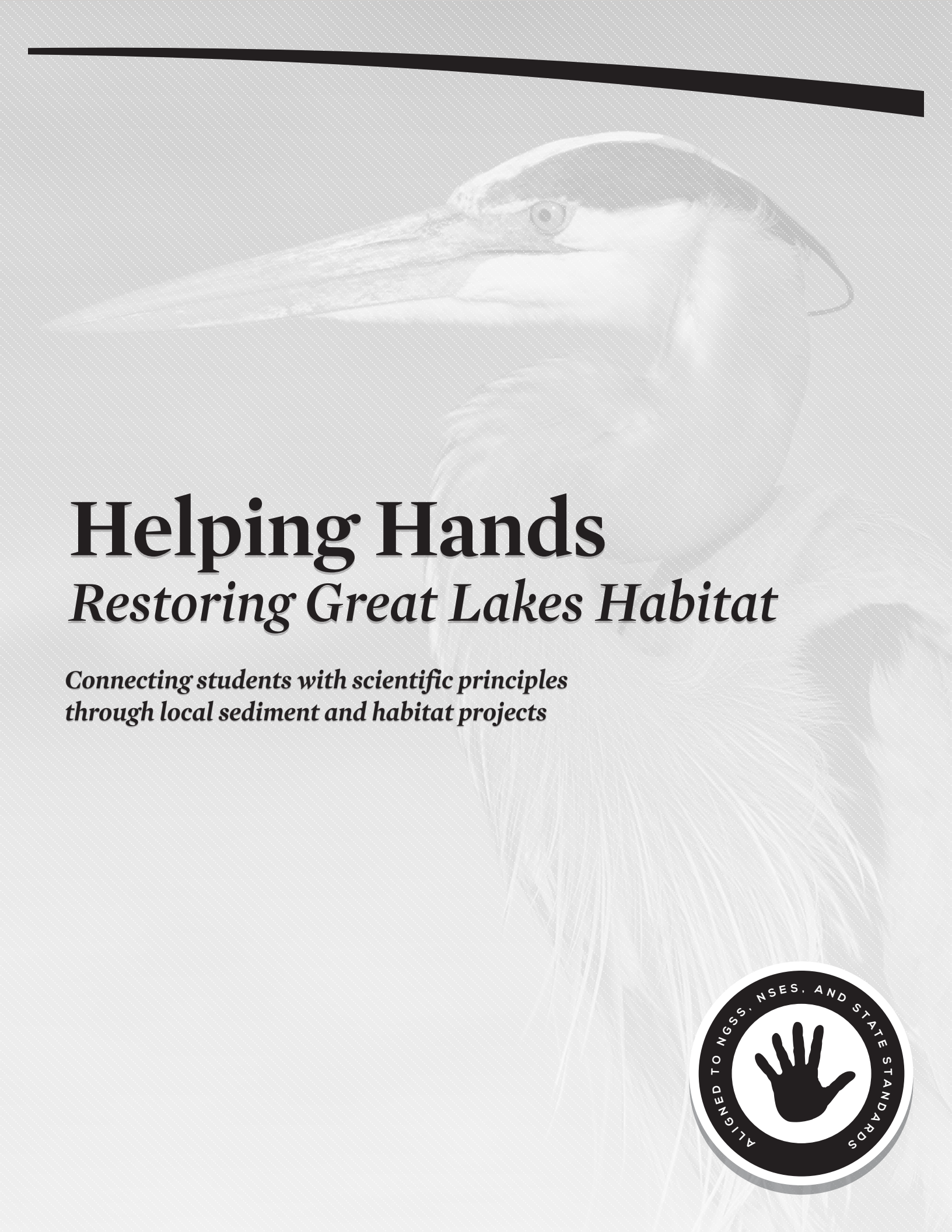
Terri Hallesy, Education Specialist, Illinois-Indiana Sea Grant

Graphic Design:

(V2.0) Joel Davenport, Communications Specialist, Illinois-Indiana Sea Grant
(V1.0) Susan White, Graphic Designer, Illinois-Indiana Sea Grant

UNIVERSITY OF ILLINOIS
EXTENSION

IISG-16-011



Helping Hands

Restoring Great Lakes Habitat

Connecting students with scientific principles through local sediment and habitat projects

ALIGNED TO NGSS, NSES, AND STATE STANDARDS

Table of Contents:

Introduction:

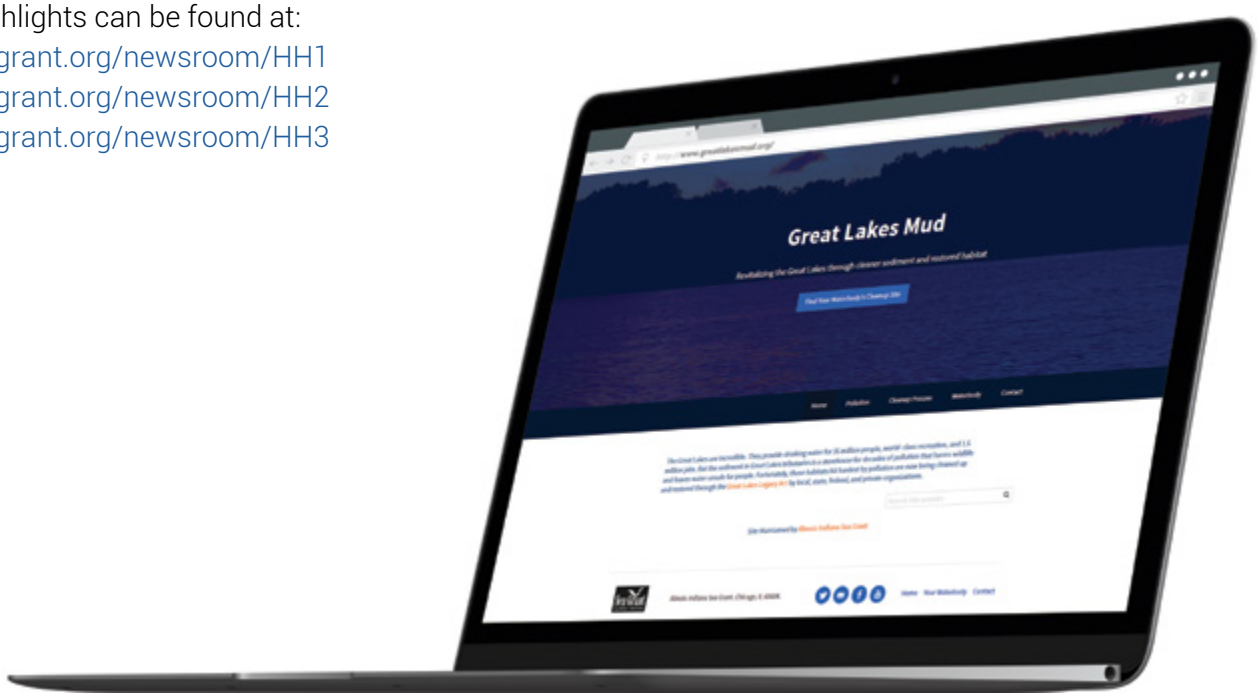
This curriculum project provides an opportunity to engage upper elementary and high school students in Great Lakes environmental stewardship. The lessons and hands-on activities apply to schools located in Great Lakes communities where large scale environmental cleanup and restoration projects are taking place. These places are called Areas of Concern due to years of degradation and pollution.

Through participation in the curriculum, students will be connected with local aquatic habitats and improve scientific and Great Lakes literacy. Students will learn ecological concepts such as water quality, pollution, and habitat restoration, while gaining an understanding about significant environmental cleanups happening near their school.

The curriculum is available online, along with additional resources to carry out lessons, such as PowerPoint files and alignment to standards. Specifically, each lesson has been aligned with National Science Education Standards, Next Generation Science Standards, and Great Lakes Literacy Principles: www.greatlakesmud.org/education.html.

Teachers interested in learning more about implementing this curriculum in their classrooms can contact Illinois-Indiana Sea Grant. This curriculum was initially implemented with schools in the Grand Calumet River Area of Concern in northwest Indiana by Caitie Nigrelli: www.iiseagrant.org/staff/nigrelli.php.

Project highlights can be found at:
www.iiseagrant.org/newsroom/HH1
www.iiseagrant.org/newsroom/HH2
www.iiseagrant.org/newsroom/HH3



Grade School Curriculum

Grades 4-6

Lesson 1:

What Makes Up My Ecosystem?
Get Down and Dirty

Grade Level: 4-6

Time: 75 Minutes

Vocabulary:
Habitat, native, invasive, shelter, migration, pollution, government, industry, U.S. Environmental Protection Agency, common names for local species.

Great Lakes Literacy Principles:

Principle 5
Concepts A, B, E, G, H

Principle 6
Concepts A, B, C

Summary:
Students learn about an environmental cleanup happening in their very own neighborhood. Students create a story and PowerPoint about their Area of Concern. They pot native seeds that they will grow in their classroom. They can then take the plants to the cleanup site to help restore the environment or plant them in a school garden.

Objectives:
- Describe the effect of historical pollution on today's environment.
- Describe the role of the U.S. Environmental Protection Agency (EPA).
- Relate EPA's role in the environmental cleanup in the students' neighborhood.

Materials:
Native seeds, flats filled with potting soil, species stickers, and spray bottles. An example PowerPoint (editable .ppt file) and seed planting instructions can be found on www.greatlakesmud.org/education.html.

Procedure:
Find a well-lit space in the classroom for the seeds to grow in flats. Contact Illinois-Indiana Sea Grant for help obtaining native seeds. Administer the Cleanup Pretest prior to the first lesson. Instruct students to complete the "Our Area of Concern" activities, including story and PowerPoint creation. Set up the materials for planting seeds in an outdoor location at the school. Deliver the story about the local ecosystem and review the plant guide PowerPoint and seed planting instructions with the students. Then take the students outside and pot the seeds. After planting, let the plants drain for an hour, then bring them inside.

Assessment:
Conduct the cleanup pretest prior to the first lesson. Have the students write reflections about their experience planting and learning about the species (*See Example Student Reflections*).

Name _____ **Date** ____/____/____

Part I: Multiple choice
Read each question carefully and circle the correct answer.

1) A(n) _____ is a group of individuals of one species that lives together in an area. It does not include other species or non-living things.
a. ecosystem
b. population
c. community
d. organism

2) Bioaccumulation is when_____.
a. pollution is stored in the body of an animal and increases over time
b. prey is able to successfully hide from its predator
c. sediment at the bottom of a river attaches to chemical pollution
d. a channel of water flows toward another body of water

3) Which of the following is NOT a component of a species' natural habitat?
a. Shelter
b. Space
c. Food
d. Invasive species

4) _____ ecosystems include rivers, wetlands, and marshes.
a. Terrestrial
b. Aquatic
c. Arid

5) In the ecosystem, which of the following food chains is in the correct order? Note: the bottom of the food chain is listed first.
a. Fish, benthos, bird of prey, bird
b. Bird of prey, bird, benthos, fish
c. Bird of prey, fish, benthos, bird
d. Benthos, fish, bird, bird of prey

6) The _____ in the water body is/are being cleaned up this year because the pollution is harming the _____ that live(s) there.
a. fish, air
b. air, fish
c. sediment, benthos
d. benthos, sediment

7) Many environmental laws in the 1970s made it illegal for industries to pollute.
a. True
b. False

8) Scientists make _____ using their senses (smell, sight, etc.) to understand and make hypotheses about the world.

a. observations
b. guesses
c. science

Part II: Fill in the Blank

Read each statement carefully and fill in the blank with the correct answer.

9) A(n) _____ species is supposed to live in the local ecosystem. It belongs there.

10) A(n) _____ species does not belong in the local ecosystem. It harms the species that belong in the ecosystem.

11) _____ is the wet, squishy mud found at the bottom of a river or lake.

Part III: Short Answer

Read each question carefully and provide an answer using a complete sentence.

12) What are two environmental problems that make the Area of Concern an unsuitable habitat for native animals?

13) Why is it important for scientists and engineers to work as a team to clean up a water body?

Our Area of Concern: Our Story

Introduction:
Every place has a story. From historical developments to personal stories from people who have seen the area change, it's all an important part of the story. When students construct a story that includes facts and personal viewpoints it helps to develop a sense of place and ownership.

Teacher instructions:
For this activity we are going to combine historical facts about your Area of Concern with personal stories from those who have been in the area for a long time (if available) as well as your connection to the area and what you hope to see once the remediation project is complete.

1. Just the facts:

a. Where is the area located?
b. What is the acreage?
c. Who manages the area?
d. What history is associated with the area?
e. What pollutants have been found?
f. What are possible sources?

2. Stories from long-term residents (optional): Ask parents, grandparents, neighbors or anyone that has lived in the area for many years about how they have seen the area change. Ask questions like:

a. How long have you lived here?
b. Why did you move here?
c. What do you like about living here?
d. What do you know about problems associated with the [Area of Concern]?
e. What changes would you like to see in this area?

3. Your Story: Now tell us your story about living in the area. Here are a few starting questions, but feel free to add more information. Use complete sentences for your story.

a. How long have you lived here?
b. Were you born here or did you move here?
c. What do you like about living here?
d. What would you change about living here?
e. Do you have a favorite place to hang out?
f. What animals do you see living here?
g. Do you feel connected to where you live?
h. How long do you see yourself living here?

4. Construct a classroom story about your Area of Concern. Use the information to construct several paragraphs using items that the class has gathered and is willing to share. Keep in mind that not all of the information will be used, but together the class should be able to create a well-rounded and well represented story.

Sources for historical information:

- GreatLakesMud.org > Waterbody > Your Neighborhood Cleanup Site
- EPA Great Lakes Areas of Concern (www.epa.gov/great-lakes-aocs)
- Internet Search > [Area of Concern] history
- Look for your state's Area of Concern website
- Look for information from local municipalities and NGOs
- Local museums or libraries

Once you have completed your story, share it with others including Illinois-Indiana Sea Grant.

Our Area of Concern: Planting Renewal

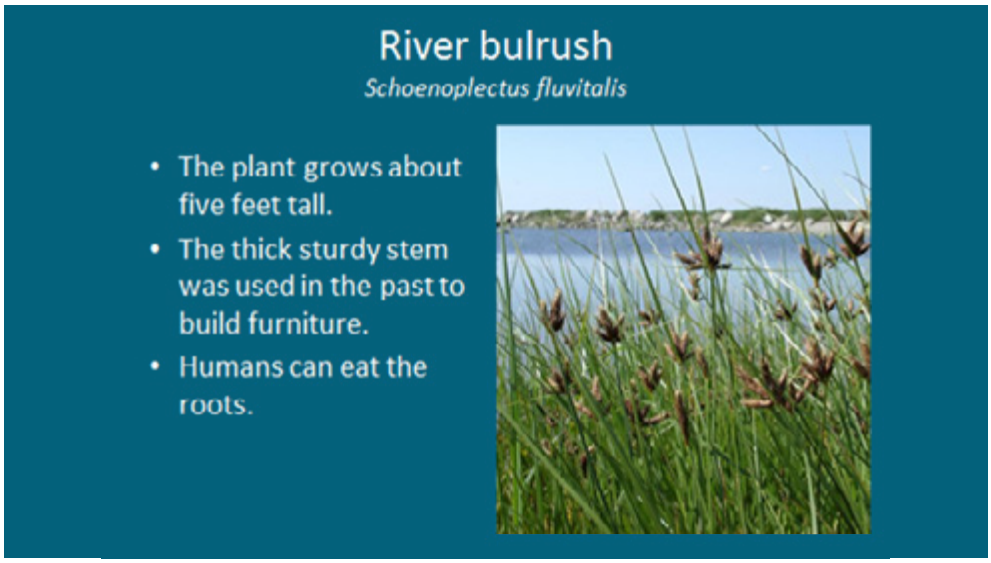
Introduction: Plants are part of what make an ecosystem viable, but some plants contribute more than others. Native plants typically provide shelter and are a food source for other native species. Invasive plant species, however, take over an area and do not support native organisms.

Teacher instructions: Students will create a PowerPoint slide about native and invasive plants in your Area of Concern. Depending on the number of species, this can be done by individual students, pairs, or small groups. Each slide will have key information about the plants:

1. The common and scientific name
2. A photo
3. 2-3 bullet point facts

When the slides are completed, compile them into one PowerPoint presentation, separating out the invasive from the native plants. Have the students present their plant to the class and encourage them to add one or two more verbal comments. The students might have a question about the plant that they couldn't find the answer to or an interesting fact about the plant. During the presentations, students should take notes on each plant. Encourage them to ask questions along the way.

Here is an **example** of a slide with speaking notes added at the bottom:



• It is threatened by nutrients like fertilizers or sewage, which increase the success of the non-native plants.
• It is native to all states except New Hampshire, where the population was introduced in a human-created wetland.

Resources for Area of Concern Research:

Since habitat restoration in your area is dependent on decisions made by local, state, and federal partners, the list of plants will vary. There are plants that are specific to the water body in your region or site. Contact Illinois-Indiana Sea Grant to learn more about native plants being considered for site restoration in your area, as well as the invasive species that pose a threat.

Sources for General Information:

Indiana:
• Aquatic Invasive Plant Species http://www.in.gov/dnr/6347.htm
• Common Native and Exotic Aquatic Plants of Indiana Waters bit.ly/22XUIVg

Minnesota:
• Invasive Aquatic Plants http://www.dnr.state.mn.us/invasives/aquaticplants/index.html
• Minnesota Aquatic Plant Guide http://dnr.state.mn.us/nr/plants/aquatic/index.html

Michigan:
• The Field Guide to Invasive Plants of Aquatic and Wetland Habitats for Michigan bit.ly/21RhRq7
• Common Aquatic Plants of Michigan Guide http://1.usa.gov/1VRy3rz

Ohio:
• List of Ohio's Aquatic Invasive Species http://ohiodnr.gov/ais
• Go Native! (Ohio Department of Natural Resources) http://ohiodnr.gov/gonative

New York:
• New York Invasive Species Information http://www.nyis.info/
• Aquatic Plants: The Good & The Bad (helpful for identifying invasive from native) bit.ly/1pHFLIf

Wisconsin:
• Common Wetland Invasive Plants in Wisconsin 1.usa.gov/1MPTKRJ
• Wetland Plants of Wisconsin http://bit.ly/1RNDvfu

Note: *As of 2016, all management actions for Areas of Concern in Illinois are complete, and all Areas of Concern in Pennsylvania have been delisted. If you are interested in the curriculum or possible projects in these states, contact Illinois-Indiana Sea Grant.*

Example Student Reflections from Different Sites

Tuesday me and my classmates helped plant seeds for the Buffalo River. My teacher taught us about the Buffalo River. She told us a story about what happened to the Buffalo River. We learned proper steps to planting seeds. There are different kinds of plants we planted.

In Buffalo River there are plants invading Buffalo River. In the 1970's the government made a lot of laws to protect our environment. Birds and other animals used to stop there and rest. Now the animals don't come because of the pollution.

Here are the steps we took to plant the seeds. First we labeled the pots with a species sticker. Then we sprinkled three seeds with a spoon because the seeds were tiny. After that we covered the seeds with soil. Last we watered the seeds. Finally we put then in the sun so they could get sunshine.

I'm helping the Buffalo River because I don't want the animals to suffer. And, because the invasive species are invading the other plants. I want the plants to grow big and wide. The reason why I want them to grow big and wide is because then the animals could have a big shelter to stay in. I can't wait to plant them in the Buffalo River!

On Tuesday a special visitor came. She came to talk to us about the Roxana Marsh. Then the lady had a paper she read to us a paper about Roxana Marsh. She told us that it is one plant that does not belong in Roxana Marsh. People were throwing trash in Roxana Marsh. Then it was the factory's fault because it was the factory that was killing the Roxana Marsh plants. No animal went to Roxana Marsh because of the pollution.

The project is that we have to plant seeds. The plants are being affected because of pollution. We are going to plant more seeds to help them. It was a plant that does not belong in Roxana Marsh. The invasive plant is called phragmites.

The first step was we had to put a name sticker on the cup. Then we filled the pot with planting soil. Next, do not push the pot down. After, tap the filled pot on the ground to help the soil. Settle in. Later, spoon sprinkle seeds into each. Sprinkle a small amount of soil over the top. Push the seeds into the soil. Finally slowly water the pot.

I am helping Roxana Marsh because I want all the animals to come back to Roxana Marsh. And because I love plants. And I love nature. I love helping people out with their problems. I hope Roxana Marsh native plants grow and animals.

Lesson 2:
Habitat Woes

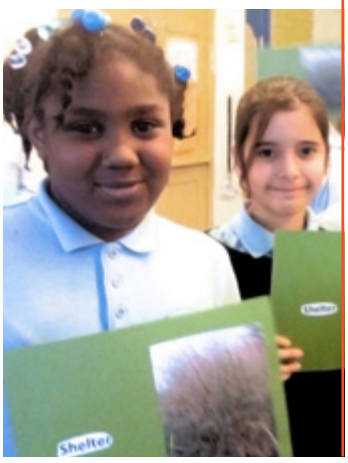
Grade Level: 4-6

Time: 75 Minutes

Vocabulary:
Habitat, wetland, river, sediment, native, invasive, organism, pollution, food web, ecosystem, community, population, aquatic, resources, shelter.

Great Lakes Literacy Principles:

Principle 6
Concepts D, E, F



Summary:
Students learn ecological terms and concepts. Students participate in a role-playing activity to understand the effects of pollution and invasive species on native species' habitat and the food web.

Objectives:
- Evaluate the importance of suitable habitat for wildlife.
- Recognize that degradation of resources from pollution and invasive species are reasons why the current habitat is unsuitable for the native species.
- Compare their own habitat to an aquatic organism's habitat.
- Describe the differences among organism, population, community, and ecosystem.

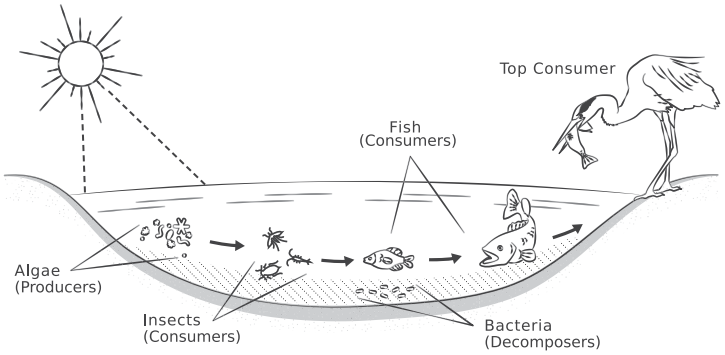
Materials:
Habitat PowerPoint, drawing paper and markers for Degraded Habitat Activity. An editable PowerPoint (.ppt) file can be found on www.greatlakesmud.org/education.html.

Procedure:
After recapping lesson one, present the Habitat PowerPoint, read the explanation of the aquatic food web, and facilitate the Degraded Habitat Activity.

Assessment:
Have students draw a food web that shows five relationships among six components of an aquatic food web as the explanation of the food web is read.

Our Area of Concern: Connecting Life

Food webs are an important way to understand how aquatic habitats function. It is also a great tool to show how each organism depends on others for survival. This basic diagram shows several biotic and abiotic factors that contribute to an aquatic food web. Make sure you use resources specific to your waterbody because not all species are found in every location.



The sun's energy, soil nutrients, and CO2 are captured by both plants (terrestrial and aquatic) and algae and converted into plant biomass that becomes the base of the food chain. Plants release O2 as a waste product (which is very important to animals). This represents the net primary productivity, which one way or another supports the rest of the ecosystem.

The next level in the food web is primary consumers. They specialize in eating both dead and living plant matter. Detritovores eat detritus (or rotting vegetation), while herbivores eat living plants.

In an aquatic habitat, an abundance of submerged vegetation and algae provides an available food source. Many types of aquatic invertebrates (benthic organisms and bugs) and small fish like minnows specialize in eating detritus and/or living plants. Plus, many types of aquatic insects (dragonfly larvae) eat other small benthic organisms, like fly or mosquito larvae. And some small fish eat only insects (i.e. bluegill species). Typically, large fish are piscivores, and they eat minnows, bluegill, and other fish. Large piscivores include largemouth bass and northern pike. Because of sediment contamination, there are limits to safe human consumption of certain fish species.

Kingfishers are an example of perching birds that eat small fish, while great blue herons are wading birds that will eat small-to-medium-sized fish. Only large raptors (eagles, osprey) and mammals (primarily humans) are capable of capturing and eating bigger fish like largemouth bass. Insectivorous songbirds such as swallows, red-winged blackbirds, and warblers are commonly found around aquatic habitats. They often feed on adult-staged, flying, benthic organisms like dragonflies, mayflies, and mosquitos.

Small mammals can also be found near the water's edge. In river areas, beavers are herbivores that feed mostly on vegetation from trees, while carnivorous mink feed on small fish, birds, frogs, and snakes. Omnivores eats vegetation, small fish, and frogs. Reptiles like water snakes (carnivorous) and turtles (omnivorous) are also found in aquatic ecosystems.

Nearshore shallow water is great habitat for mallards and coots and other dabbling ducks (tip up, with head underwater and tails in the air) and their ducklings. This is because of the abundance of plants growing there. The benthic community also thrives in shallower water because food is readily available. Environmental dredging can help remove contaminants and help the benthos flourish. Since benthos form the base of the food web, these cleanups can have a positive long-term impact on many organisms.

Degraded Habitat Activity

Summary:
Students simulate a process of historical pollution and invasive species introduction through a role-playing activity.

Materials:
Drawing paper, markers.

Procedure:
1. Review the meaning of habitat with the students and ask students to think about what makes up their own habitat. Have students make comparisons between key elements of a habitat (food, water, for native animals.)
2. Divide the students into six groups: bird, fish, water, shelter, pollution, and invasive species.
3. Using drawing paper and markers, have each student create a habitat component card for the group they are in. Each student writes their habitat component on the paper and decorates the card.
4. Establish a large area (either in the classroom with tables, chairs, and desks moved away or outside) that can be used to simulate the bird's habitat before contamination. The "pollution" stays on the sidelines at this time, simply observing the undeveloped land.
5. Ask the students representing shelter and clean water to arrange themselves in the habitat area. Then, have the fish stand next to the water and have the birds join and stand among their resources.
6. Once all the species are established in their habitats, it is time for the pollution to enter the picture. The students who are simulating pollution remove the clean water and fish and stand in their place. Clean water and fish leave the habitat area. Then, because the ecosystem is weak, the invasive species remove the shelter and stand in their place. The shelter leaves the habitat area.
7. Ask the class if the birds are happy, and why or why not. Have the birds leave the habitat area.
8. Then tell the pollution and the invasive species that the U.S. Environmental Protection Agency and its partners are coming to clean up the environment. Have the pollution and invasive species leave the bird's habitat area.
9. Tell the clean water, fish, and shelter that they can go back to their original habitat/location since the pollution and invasive species are now gone.
10. Tell the birds to go back among their resources. Ask them if they are happy, and why or why not.

Wrap-Up:
Engage all of the students in discussion of what happened in this Degraded Habitat Activity.
What actions took place? What were the consequences? Emphasize the resource needs of the bird and how these habitat requirements are being considered throughout the environmental cleanup design.

Lesson 3:
Knock Out Pollution

Grade Level: 4-6

Time: 75 Minutes

Vocabulary:
Pollution, habitat, sediment, predator, prey, food chain, benthos, bioaccumulation, biomagnification, observation.

Great Lakes Literacy Principles:

Principle 5
Concepts A, B, D, E, F, G, H, I

Principle 6
Concepts A, C, D, E, F

Summary:
Students learn ecological terms and discuss concepts. Students watch and reflect on a demonstration of bioaccumulation. Students practice scientific observation skills to identify types of pollution.

Objectives:
- Explain and diagram how pollution moves up the food chain from the sediment to the fish people eat using the terms benthos and bioaccumulate.
- Describe how pollution biomagnifies between species.
- Use observation skills to identify types of pollution.
- Describe the environmental and societal benefits of the cleanup.

Materials:
Pollution PowerPoint. See Bioaccumulation Demo and Pollution Activity for additional materials. An editable PowerPoint (.ppt) file can be found on www.greatlakesmud.org/education.html.

Procedure:
Set up the Pollution Activity. Perform a quick recap of lesson two and then present the Pollution PowerPoint. Midway through the PowerPoint, perform the bioaccumulation demo. Following the PowerPoint, facilitate the Pollution Activity.

Bioaccumulation and Biomagnification Demo

Adapted from University of Kentucky Cooperative Extension Service's Bioaccumulation Basics

Summary:
Students observe a demonstration on bioaccumulation and biomagnification that uses marbles and clear containers to illustrate the concept.

Materials:
2 ½ cups of marbles or beads, six small half cup food storage containers labeled "benthic organisms,"

two medium 1-cup storage containers labeled "fish," one large 2-cup storage container labeled "bird."

Procedure:
1. Ask for three volunteers from the class, two to stand with you and one at the board. Explain that the marbles are a type of pollution called PCBs and that the storage containers represent different parts of the food chain. Tell the volunteer the total number of marbles and have the student write it down as total units of PCB pollution.

2. Ask the other two volunteers to fill the small containers (benthic organisms) with marbles (PCB pollution). Explain that benthic organisms live in the polluted sediment and absorb the PCB pollution. Count the number of marbles in each benthic organism container and have the board volunteer write it as units of PCB pollution.

3. Say that the fish are hungry and prey on polluted benthic organisms. Ask volunteers to evenly pour the PCB pollution from the small to the medium containers, explaining that the fish now have PCB pollution from the benthic organisms in their bodies. Count the number of marbles in each fish and have the volunteer write it down on the board. Explain that as fish prey on benthic organisms, they absorb the PCB pollution. Pollution accumulates as the fish eat more benthic organisms. This is called bioaccumulation.

4. Say that the bird is hungry and that it eats the polluted fish. Ask volunteers to pour the PCB pollution from the medium containers to the large container, explaining that the bird now has all the PCB pollution from the fish and the benthic organisms in its body. Count the number of marbles in the bird and have the volunteer write it on the board. Compare the number of marbles at each step in the food chain.

5. Ask the class which animal has the most pollution. Explain that the top predators will almost always be the animals that are most harmed by pollution because they get all the pollution that was in all of the other animals. The PCB pollution increases as it moves up the food chain, and this is called biomagnifcation. Explain that not all types of pollution bioaccumulate, but PCB is one that does.

Wrap-Up:
Engage all of the students in discussion of what happened. Which animal ended up being the most polluted? Why? Did the predators know their prey was polluted?

Pollution Activity

by Amy Mucha, U.S. EPA

Summary:
Students "pollute" a habitat and use observation skills to determine the type of pollution.

Materials:
Four quart-size food storage containers filled with water and soil, 12 (three for each group) travel-size, unlabeled bottles of safe liquids or powders with different smells, colors, and textures (mouthwash, Murphy's Oil Soap, conditioner, Kool-Aid, baking soda, and dish soap).

Procedure:

1. Break students into four teams. Explain that each team will be given a "habitat" (container filled with water and soil) and supplies.

2. Give each team 5 minutes to use their supplies to pollute their experimental "habitats." (We're using safe supplies.) Students choose which of the three bottles to empty into the container. Encourage students to try different amounts of each bottle and notice the result in the container as contents are added. For example, one team may decide to use half of bottle X and all of bottles Y and Z. Another team may decide to dump the contents of all their bottles in the "habitat" container all at once.

3. Have the teams trade stations and make observations to understand what "pollutants" are in the other team's "habitat."

    a. As the students are trying to figure out what the "pollutants" are, ask them which sense they are using. What do they see? What do they smell? What does the "pollution" feel like in their hands?

Wrap-Up:
Engage all of the students in a discussion of what happened. What "pollutants" did the students use in their "habitats?" Which senses did the students use to observe the "pollution?" Explain that scientists must also make observations to understand if a habitat is polluted, where the pollution is, and what the pollution is. Scientists use their senses to learn about habitats, just like the students did in the activity. However, if the habitat is polluted, scientists may have to use protective clothes and equipment to study the environment.

Lesson 4:

Design an Ideal Habitat—Think Like Engineers and Scientists

Grade Level: 4-6

Time: 75 Minutes

Vocabulary:
Restoration, scientist, engineer, pollution, habitat, ecosystem, food chain, shelter, resources.

Great Lakes Literacy Principles:

Principle 5
Concepts A, B, D, E, F, G, H, I

Principle 6
Concepts C, D, E

Summary:
Students learn how an engineer designs a large project like habitat restoration, working with a team of environmental professionals. Students create a mural of the ecosystem using the ecological knowledge they have accumulated throughout the educational program.

Objectives:

- Describe how an engineer designs a restoration project, including the importance of working on a team.
- Describe scientific relationships of organisms within the local ecosystem.

Materials:
See Mural Activity for additional materials. The Ecosystem Components PowerPoint and project figures and maps can be found on www.greatlakesmud.org/education.html and www.greatlakesmud.org, respectively.

Procedure:
Prior to the lesson, complete step one of the Mural Activity. Provide students a quick recap of the third lesson. Engage students in a discussion about project design concepts using the Project Design Discussion Questions and project figures and maps. Present the Ecosystem Components PowerPoint. Alternative to the discussion activity, contact Illinois-Indiana Sea Grant prior to the lesson to set up a videoconference with a project scientist. Have students complete the Ecosystem Design Components worksheet. Facilitate the Mural Activity. Administer the test on a later day.

Assessment:
Post-test and answer key are provided in Lesson Plan 1 and cover concepts learned throughout the educational program.

Project Design Discussion Questions

In order to plan effective project designs for restoration, stakeholders need to discuss important components of the design. Discuss the following questions with your students and use the answers for guidance.

What kinds of plants belong in your ecosystem design?
Think native. Talk about what kinds of plants live there now compared to what kinds of plants are supposed to live there (plants they're growing in their classroom; plants discovered for the Habitat Components PowerPoint).

What kinds of animals belong in your ecosystem design?
Again, think native. Talk about the food chain. Talk about what kinds of animals live there now compared to what kinds of animals belong there. Discuss what animals students have seen in their yards and near the river.

Why are native species having a hard time living or thriving?
This is where it is important circle back to talk about the pollution in the sediment and in the food chain (bioaccumulation and biomagnification), as well as invasive species that are taking over.

How does a team of scientists and engineers decide what plants to plant?
Explain that the plants are chosen based on what native species were documented historically as well as what resources are important for the new habitat plan. Plants must have adequate light, water, and nutrients. However, they also must provide food and shelter resources for native animals. Highlight the species the students are growing in the classroom and the role of each one.

Why are certain plants planted in certain locations?
All plants need water, sun, and nutrients – but different plants need different amounts of these resources. That's why some plants can grow underwater, slightly underwater, on the shore, and up on dry ground. They provide shelter and food for different kinds of animals. Use specific examples, such as the plants they are growing in their classroom or species from the Ecosystem Components PowerPoint.

Name _____ **Date** ____/____/____

Ecosystem Design

Using the information you learned from the Ecosystem Components PowerPoint, list the plants, animals, and non-living things that belong to each component of your ecosystem design. Explain the role that each plant, animal, and non-living thing plays in supporting a healthy ecosystem. (Examples are provided below.)

Component	Name	Role / Importance
On Land or in Air (Nonliving)		
On Land or in Air (Living Plants)		
On Land or in Air (Living Animals)		
In the Water (Nonliving)		
In the Water (Living Plants)		
In the Water (Living Animals)	- Bluntnose Minnow	- Small Fish that eats plants and benthos

Mural Activity

Summary:
Students draw components of an ecosystem and put them together in a mural to demonstrate scientific relationships.

Materials:
Ecosystem Components PowerPoint and Ecosystem Component Printouts (printouts are created by printing out slides from the PowerPoint, one slide per page), 4'x3' light blue butcher paper, 4'x 2' green butcher paper, 1'x1' brown butcher paper, drawing paper, pencils, markers.

Procedure:
1. Instructions for preparing the ecosystem base with butcher paper are provided in Lesson Plan 4 procedure.

2. Break students into four teams. Explain that each team will draw one of the following ecosystem components:

    a) Above water: nonliving, living plants
    b) Above water: living animals
    c) In the water: nonliving, living plants
    d) In the water: living animals.

3. Give single-sided printouts of ecosystem components to each team, along with drawing paper, pencils, and markers. Turn on an automatic ecosystem component PowerPoint slideshow in the background.

4. Walk around as students draw ecosystem components, helping them with scale and important organism characteristics. Talk to students about species diversity and distribution and encourage them to draw a species that is different from others chosen at their table. Otherwise, the mural could end up having one songbird and five birds of prey based on species popularity with the students.

5. As students finish their ecosystem component, help them paste it on the mural. Ask the students where they think their component should go on the mural based on its needs and relationships to other species within the ecosystem.

Wrap-Up:
Engage students in a discussion about the mural. Ask them about species diversity and distribution. Relate the mural back to the second lesson, and ask them if they'd be happy organisms if they lived there. This mural can be displayed at the press event, described in Lesson Plan 5.

Lesson 5:
Press Event

Grade Level: 4-6

Time: 75 Minutes

Summary:

Contact Illinois-Indiana Sea Grant for information on press events related to the cleanup and to learn how to participate. Students who attend the press event will need to sign a photo release form, which can be obtained from Illinois-Indiana Sea Grant. Logistics and timing for the press event will be determined weeks in advance of the event. There are many options for involvement. Students may have the opportunity to listen to agency leaders speak about the cleanup, have photos taken with VIPs, display their mural, and/or plant natives near the water body. If students are planting, they will be directed to the planting area to receive directions on proper installation, and VIPs can be invited to help students install the plants.

Materials:

Dependent on participation (*e.g., trowels, murals, and/or plants from the students*).

Helping Hands
Restoring Great Lakes Habitat

Connecting students with scientific principles through local sediment and habitat projects

> *We will conserve only what we love. We will love only what we understand, and we will understand only what we are taught.*
>
> - Baba Dioum

FIND OUT MORE

GreatLakesMud.org
Visit our webiste for additional resources

cmccoy2@illinois.edu
Please send all questions and feedback
to Environmental Social Scientist Caitie Nigrelli

Sea Grant
ILLINOIS-INDIANA
IISG-16-011