

**How can farming hurt wetlands, and how can we tell if a wetland is healthy?**

## **MY OWN FOOD CHAIN PROGRAM (K-2)**

### **Water Quality** **(ILS 12A, 12B, 12E)**

#### **Overview**

This curriculum explores the relationship between people and the food they eat. It aims to give children in grades K-2 a basic understanding of the flow of energy through the food chain, and the place of people in the food chain. If teachers complete the entire curriculum, their classes will explore food chains in nature, focusing in on its individual links and looking at the flow of energy as a whole. Students will then look at the place of people in the food chain, and discover how people have appropriated nature's systems in agricultural practices – making the food chain our own. Classes will compare traditional and sustainable agricultural practices.

Sustainable Agriculture, for the purpose of this curriculum, shall be defined as "a system of food production, supported by consumers, where farming operations, practices and technologies work in harmony with the natural systems that sustain life on earth."

#### **Suggested Grade Level**

This curriculum is designed for kindergarten through second grade levels. The topics covered can be built upon in complexity throughout that age range.

#### **Approximate Time**

45 minutes for session one, not including tray set-up; one hour for session two. This lesson should be completed during early fall or late spring, when water is warm enough for critters to be active.

#### **Objectives**

1. The students will use their erosion tables to observe the link between farming practices and water quality.
2. The students will test a local water body to see if it is healthy.
3. The students will understand the idea of using living things as a measure of water quality (biotic index).

#### **Activity Abstract**

In this lesson, students relate their soil trays to water quality by looking at the buckets left from the erosion lesson. They will catch aquatic critters and use them to determine if the health of local waterways have been compromised.

## **Background Information**

Having high quality water is important to farmers (and everyone else). However, the use of agricultural chemicals, such as pesticides, has been one cause for declining water quality in surface and groundwater, (Iowa Geological Survey). These chemicals get into water sources via runoff (as demonstrated in the erosion lesson) and they have detrimental effects on the organisms that live in the water, from fish and frogs to microbacteria and algae.

A biotic index -- using the amount and type of living creatures as a measure -- is one simple way that scientists judge the health of a body of water. Generally, scientists look for macroinvertebrates such as insect larva, crayfish, worms, etc. They are relatively abundant and easy to catch, compared to fish and frogs. In addition, they can be categorized into tolerant of pollution, semi-tolerant, semi-sensitive and sensitive to pollution. By comparing the numbers of species found in each category, people can judge the health of water, (UW Extension, 2003). Children can use a simpler version of a biotic index – if there are a lot of living things in a body of water, it is relatively healthy, compared to a body of water with few living things.

## **Materials**

- Buckets with dirty water from erosion lesson (you can stir them up if the dirt has all settled).
- Clear bowls/containers for the water from the buckets. (optional)
- One soil tray from erosion lesson (you may need to replenish the soil)
- Full container of food coloring (red is best) with the words “Bug Killer (Insecticide)” written on it.
- Watering can (from erosion lesson)
- Aquatic nets (1 per pair or more)
- Bins for viewing aquatic creatures (1 per five students)
- Hand lenses/ bug boxes (optional)
- Grubby clothes/mud boots for kids
- Children’s field guides to pond life (1 per five students)
- Clipboards, paper and pencils (1 per five students)
- Extra adults for a 1:4 or 1:5 ratio

## **Set-up**

Session two of this lesson requires extra adults, who should be given advanced instructions or furnished with the lesson plan.

## **Procedure (Session 1)**

1. **Tap prior knowledge.** Look into the buckets that caught the runoff from the soil lesson. If you have the clear containers, pour the water into them so it is easier for the whole class to see at the same time. Have students generate describing words (adjectives) for the water in each of the two buckets.) If desired, keep two lists of words on the board that can then be used to compare the water samples.
2. Ask students, if the trays had been real fields, there wouldn’t have been buckets to catch water. Where would it go? (Lakes, rivers, streams, possibly via other fields and ditches)

3. Through a guided imagery, ask children to imagine that they are fish swimming in a pond. They breathe air (through gills) from the pond's water. They see through the pond's water to catch their food – little bugs that swim in the water -- and avoid being someone else's dinner. They swim contentedly until one rainy day, water comes pouring in that isn't as crystal clear as the water they're used to. It has pieces of dirt all over it. They can't see! Or breath as well! What will happen to them?
4. Discuss what happens to the fish. List some other plants and animals that live in ponds. What would happen to them?
5. **Introduce scientific principle.** Tell the kids that the soil isn't even the worst part. Turn their attention to the soil tray from the erosion lesson. Explain that a lot of times, farmers try to kill bugs or weeds using chemicals called insecticides or herbicides.
6. Pull out the food coloring. Explain that you are going to sprinkle bug killer, or insecticide, all over your field so when you plant seeds the plants won't get eaten by bugs.
7. Liberally sprinkle food coloring over the soil in the tray. The more the merrier!
8. Ask the students to predict what is going to happen the next time there is a rainy day.
9. See if they're right! Make sure the bucket is in place, and pour water for 20 seconds (as in erosion lesson).
10. See if the kids were right! (A lot of food coloring will run off with the water; however, the soil may make it too murky to tell. Wait a short while for it to settle and you'll see the food coloring clearly.)
11. Discuss results. Return to the fish image. Ask the students to remember what the fish ate. (bugs) And what did the red stuff kill? (Bugs). What will happen to the fish? (Hmmm.) Is it good for the fish to breathe in the red stuff?

### Procedure (Session 2)

1. **Review Scientific Principle.** Review the water runoff demonstration from session 1.
2. Explain that because insecticides in the water kill animals that live there too, we can use the animals that live in our water to see if the wetland is healthy or in trouble. Today we're going to do just that! If there is a lot of poisons in the water, what do they expect to catch? (not much!) What if there aren't too many poisons? (lots of things; this may be a good time to review what we can realistically expect to catch; see appendix B for details!)
3. **Hands-on Activity.** Walk or drive to the local wetland. Bring nets, bins, guides, lenses, clipboards.
4. Split class into groups (as small as you have enough adults for) and assign each group to an adult. Go over the safety and procedural rules for catching critters in the pond. **See appendix B.**

**Teacher note!!!**  
**It is extremely important to be familiar with the guidelines for pond behavior and procedures for netting found in Appendix B!**

5. Have each group find a place by the edge and start catching!
6. Use the field guides to try to find what you caught. Have each group keep a tally of all the different types of critters they found.
7. Allow about 30 minutes for catching critters. (Give a five minute warning).
8. Have all groups meet with the critters they caught and share with the other groups so everyone can see everything.
9. Release critters where you found them.
10. Return to classroom.
11. Share tally numbers. Write them on the board.
12. **Relate Activity and Scientific Principle.** Discuss the health of the wetland. Did you find a lot of critters? Why or why not? Do you think there are some chemicals – like the red stuff – that kill animals in your pond? Where does it come from?
13. Explain that this way of determining water quality is very important to scientists.
14. **Conclusion.** Share a story that tells about a biotic index. For example, up in Canada, there were big problems with water quality several years ago. Scientists up north first started noticing these problems in lakes and rivers because of fish. They went out to catch them – just like the class went to catch bugs – every year. They noticed that they had less one year than the year before, and still less the year after. They weren't sure what was wrong, but the fish were the first thing that alerted them that something was wrong. Then they had to do other tests to figure out what was causing the lack of fish. (Turned out to be acid rain, but it could have been insecticides that farmers were putting on their fields.) Ecowatch is another example of biotic indices at work.  
(See <http://dnr.state.il.us/orep/ecowatch/> for more information.)

### **Extensions (optional)**

1. Compare 2 or more wetlands to see which is healthier in terms of how many critters you found.
2. Write a story about a water critter and what happens to it when soil and chemicals enter its pond.

### **References**

Biotic index. University of Wisconsin Extension, 2003. <http://clean-water.uwex.edu/wav/monitoring/biotic/>

CBC Archives: Dying Lakes, Dying Crops, 2004. [http://archives.cbc.ca/IDC-1-75-584-3177/science\\_technology/acid\\_rain/clip1](http://archives.cbc.ca/IDC-1-75-584-3177/science_technology/acid_rain/clip1)

Illinois DNR: Ecowatch, 2003. <http://dnr.state.il.us/orep/ecowatch/>

Iowa Geological Survey. <http://www.igsb.uiowa.edu/inforsch/waterag.htm>

USGS National Water Quality Assessment Program, 2002.  
<http://water.usgs.gov/nawqa/informing/agriculture.html>

## **Appendix A: More Background Information.**

“Acid rain in Canada was first discovered in Killarney, Ontario, on Lumsden Lake. Two scientists doing experiments with fish populations noticed the fish dying before their very eyes – for no apparent reason. Conferring with locals uncovered a trend: fish were slowly disappearing from lakes all over the Georgian Bay region. The region is close to Inco, the nickel smelting company that was found to be one of North America's worst contributors to acid rain.”

-- [http://archives.cbc.ca/IDC-1-75-584-3177/science\\_technology/acid\\_rain/clip1](http://archives.cbc.ca/IDC-1-75-584-3177/science_technology/acid_rain/clip1) see also [http://www.physics.ohio-state.edu/~kagan/phy367/P367\\_articles/AcidRain/effects-on-lakes.html](http://www.physics.ohio-state.edu/~kagan/phy367/P367_articles/AcidRain/effects-on-lakes.html) for more information.

“Iowa is a dominantly agricultural state, with 60% of the land area in row-crop production and receiving agricultural-chemical application. The routine use of agricultural chemicals has led to nitrate and pesticide contamination of surface water and groundwater from both nonpoint sources (such as routine use on crop fields or lawns) and point sources (such as chemical spills). Iowa's approach to addressing water quality concerns has been a coordinated education, demonstration, and research program to address the problems of water quality and agriculture. The Geological Survey Bureau has been involved in a myriad of water quality and agricultural studies of local, state, and regional importance.”

-- <http://www.igsb.uiowa.edu/inforsch/waterag.htm>

## Appendix B: Water guidelines and safety rules.

### Safety Rules for catching critters

1. Students must stay with adult supervisors.
2. Students should not get wet above their ankles – we're not swimming!
3. Nets are not swords or shovels or bats or anything that needs to be swung in the air or dragged in the dirt.

### Procedure for catching critters

1. Critters are an important part of the pond life. We are going to catch them and observe them and put them back in the pond where we got them without hurting them.
2. Fill bin with 2 inches (or so) of water from the pond. When you catch critters they will die if you don't put them in water, and these bins will allow us to see them. Creatures need the water they came from – faucet water may be the wrong temperature or have the wrong chemicals in it.
3. Use the net to catch critters. Most critters eat the plants/detritus on the bottom of the pond (or they eat the critters that eat those things) so that's where you'll catch them. Scoop the net back and forth through the plants or right atop the muck.
4. Look for critters. We are not looking for large things like fish and frogs; we are searching for insects that may be as small as 1/8 inch or less! Fish and frogs are probably in the water if there are insects, but they are too fast and deep for us to catch. A lot of the insects are small so you have to look very closely for anything that moves at all. If you have muck/leaves in the net you need to search carefully through them. **Students need to be made aware of the size of what you're looking for – possibly shown samples – or they will not even realize they have critters in their nets, and will complain that they don't catch anything!**
5. Put caught critters in the bin.
6. Repeat until finished!