

TEACHER'S GUIDE

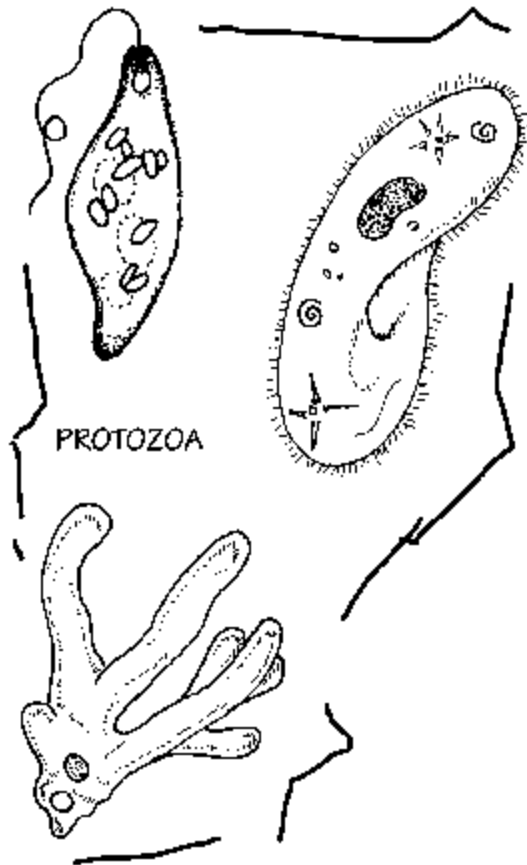
Unit 3, Lesson 1

WATERSHEDS AND WATER QUALITY

This lesson and its corresponding activities are targeted to grades 5-9 and subject areas English language arts, science and social science. Most of the activities and the following background information may be adapted to other grade levels.

What is a Watershed?

A watershed is a land area that delivers runoff water, sediment and other dissolved substances to a stream channel, lake, reservoir, major river and its tributaries or other bodies of water. It includes atmospheric, surface and



subsurface water and the pathways that water follows. A watershed impacts lives on a daily basis. A watershed defines geographic, political, social and cultural boundaries by connecting and/or dividing. Many different relationships ensue within a watershed--biological, ecological and hydrological as well as human patterns including travel,

exploration, commerce and communication. A watershed shapes and is shaped by the land, and humans play a large role in changes made to a watershed. Commercial or private developments can drastically change the appearance and the essential functions of a watershed in a particular area.

Everyone is responsible for the health of a watershed and the water systems within a drainage basin. Individual actions, both positive and negative, add up. Watershed investigations are conducted for many reasons but monitoring pollution is high on the priority list. For more information on your watershed, visit the "Surf Your Watershed" Web site at <http://www.epa.gov/surf>.

Pollution

Various forms of pollution can contaminate water quality. Chemical pollution is the introduction of toxic substances into an ecosystem. Examples include acid rain or contamination of water supplies by pesticides. Thermal pollution is the variance of temperatures above or below the normal condition of the water. This can occur in water located next to power plants or industrial complexes. Organic pollution is the process of oversupplying an ecosystem with nutrients. This can occur when an influx of fertilizers enters a water system. Ecological pollution includes the stresses ordinarily created by natural processes. Examples of ecological pollution include adding a substance that is not a naturally occurring substance in the ecosystem or increasing the amount or intensity of a naturally occurring substance or altering the level or concentration of biological or physical components of an ecosystem. Wherever water is located, it may be contaminated by thousands of different substances and conditions. Most of the time, this contamination alters the water in such ways that it becomes hazardous to wildlife, wildlife habitat and humans, sometimes directly, other times indirectly.

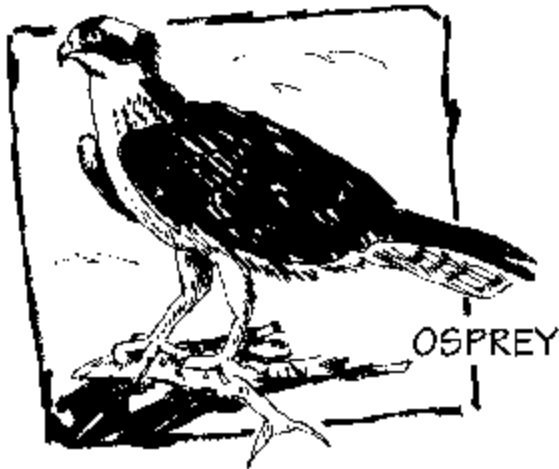
Gulf of Mexico

An example is the Gulf of Mexico watershed. The principal areas contributing nutrients to the Mississippi River and ultimately the Gulf of Mexico are streams draining the corn belt states, particularly Iowa, Illinois, Indiana, Ohio and southern Minnesota. While storm runoff carries natural nutrient loads and a mix of nonpoint source loads, it is generally agreed that agricultural sources are significant contributors. The largest influx of nutrients to the Gulf typically occurs each year during the spring and early summer when streamflow and nutrients such as nitrates are

highest. During the Great Flood of 1993, abnormally large amounts of nitrates and other nutrients were transported to the Gulf. This means that as water from these states drains into the Mississippi River watershed, farmers are fertilizing not only their own crops but also the vegetation growing in the Gulf of Mexico which can lead to a serious problem. When nutrients fertilize algae massive algal blooms may develop. When these algae die and sink, decomposers use up all of the oxygen in a certain area trying to eliminate the dead material. This problem has turned parts of the Gulf of Mexico along the coast from Louisiana to Texas into what experts refer to as the "Dead Zone." No plants or fishes can survive in this zone because of the complete absence of oxygen in the water.

Monitoring

The quality of most Illinois bodies of water is monitored by



the Illinois Environmental Protection Agency (IEPA). The agency targets watersheds where pollution poses the greatest risk to human health, ecological resources or desirable use of the water.

IEPA found that river and stream quality has improved considerably since the early 1970s. Forty-eight percent of monitored stream miles were rated as "good" while 50 percent were rated as "fair" and 1.2 percent were rated as "poor." Increased species diversity in the Illinois, Rock and Mississippi rivers is evidence of improvement. One problem to watch, however, is the increasing amount of nutrients including phosphorus and nitrite/nitrate identified in some river basins. Streams are usually impacted by several sources. The major sources of pollution for Illinois rivers and streams today are agriculture, point sources, habitat modification, urban runoff and resource extraction. The three leading causes of water quality problems are nutrients, siltation and habitat alteration.

Inland lakes are another vital resource. Thirty percent of lake acreage monitored was rated as having "good" overall resource quality while 60.7 percent was rated as "fair" and 8.5 percent was classified as "poor." The balance of Illinois lakes had stable conditions. Major causes of pollution impacting Illinois lakes included suspended solids, siltation, organic enrichment and nutrients. Prevalent sources of lake pollution included agriculture, contaminated sediments and hydrologic/habitat modifications.

Lake Michigan has 63 shoreline miles and is protected to a greater degree than other Illinois lakes by higher water quality standards. All 63 shoreline miles were rated as having "good" overall resource quality. Major sources threatening the water quality of Lake Michigan include atmospheric deposition and contaminated sediments. For more information on the quality of Illinois waters, visit the Illinois Environmental Protection Agency's Web site at <http://www.epa.state.il.us/org/bow/water-quality/>.

WAYS TO HELP THE WATERSHED

- C Turn off water when you are not using it. Don't let it run while you are brushing your teeth or washing your hands. When shampooing, turn off water while lathering hair.
- C If your home has a dripping faucet, you may be losing more than 20 gallons of water per day. Replace worn-out washers to stop faucet leaks.
- C If your toilet "runs" between flushes, you are losing water. Normally, you can't hear a leaky toilet valve unless you are losing more than 250 gallons of water a day. Repair the toilet to save water.
- C Install water-saving devices. Take shorter showers. Don't let water run down the drain while waiting for it to get hot (for baths).
- C Wait until you have a full load before washing your dishes or clothes. Use the water or energy-saving cycle whenever you can.
- C Keep gutters and storm drains free of litter, pet waste, leaves and other debris.
- C Apply lawn and garden chemicals sparingly. Try biological insecticides instead of synthetic ones. Use the most pest resistant plants. Plant native species. Use pest traps or barriers.
- C Utilize plants for ground cover to control soil erosion in lawns.

- C Maintain your septic system.
- C Water gardens and lawns only in the evening or early morning. Irrigate slowly, deeply and infrequently. Reduce evaporation by using organic mulches or plastic ground covers.
- C Never dispose of used motor oil, paints or household chemicals into a storm sewer or down a drain.

REFERENCES

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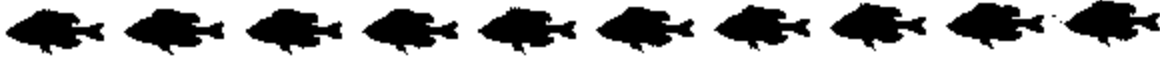
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See related CD-ROM components: *Illinois Rivers and Lakes Fact Sheets*; *Aquatic Illinois* video.



UNIT 3, LESSON 1

ACTIVITY 1

WHICH WATERSHED ARE YOU IN?

SUGGESTED GRADE LEVELS: 5-9

SUBJECTS: English language arts, science, social science

SKILLS: analysis, comparison and generalization, critical thinking, research, problem solving, interpretation

CORRELATION TO ILLINOIS LEARNING STANDARDS: English language arts 4A; science 12E, 13B; social science 17A, 17C

OBJECTIVES

Students will: 1) become familiar with watersheds and the importance of water quality; and 2) be able to determine which watershed they live in and what bodies of water originate or feed into that watershed.

METHOD

Students use a road map to mark the boundaries of their watershed and flow of water within and out of the watershed.

BACKGROUND

The U.S. Environmental Protection Agency defines a watershed as a “geographic area in which water, sediments and dissolved materials drain into a common outlet.” This area is also called the drainage basin, drainage area or catchment. Since water flows downhill, watersheds are defined by topography; to draw a watershed, you essentially connect high points and ridges on a topographic map. Finding out which watershed you live in involves in-depth local map interpretation.

MATERIALS

highway road maps (available free from Illinois Secretary of State’s offices); paper; markers

PROCEDURE

1. Have students locate their city on a highway road map.
2. Find the river or creek on the map which is closest to your city. Trace the flow of this river/creek downstream with a marker. Continue tracing as it joins other rivers. Stop when you reach Cairo (or in some cases, Lake Michigan). You may need to explain to students that not all cities have runoff that flows directly into a river. For most, it will be smaller streams which merge to larger streams. This step illustrates where runoff from your city may travel.
3. Next, go upstream from your city to the origin of the river or creek. Using a marker of a different color than that used in step 2, trace the course of this river/creek plus any streams that are shown entering it along the way. With a pencil, broadly circle the area around your marking, but do not cross any other streams. Don’t worry if your watershed boundaries are not exact. For classroom purposes, drawing dividing lines between stream systems will give students an idea of the size of the watershed they live in. NOTE: Students in northern Illinois may need a Wisconsin road map as well. Students along the eastern Illinois border may need an Indiana road map, too.

EXTENSIONS

1. Using a road map and a national map, have students trace the stream nearest them to its headwaters and then to its mouth until it reaches the Mississippi River and finally the Gulf of Mexico.
2. Take the class outdoors and investigate a nearby body of water. Identify what, if any, kinds of pollutants are present and discuss possible pollution sources. Reference Unit 2, Lesson 2 for information on how to collect samples and what to look for. Discuss the impact of these pollutants on the watershed.
3. Invite a government official or an employee of the local water treatment plant to speak to your class about local regulations that govern waste management and water treatment. How do these laws directly impact waterways in your area? Do these laws work? Why or why not?
4. Have students brainstorm how individual households can reduce pollution in the community. What can be done by just one person to help cleanup the environment?

5. Portions of Lake and Cook counties drain directly into Lake Michigan. Using a map of the eastern United States, have students trace the possible route of runoff from these counties (may reach the Atlantic Ocean).
6. Have students conduct a sunny day hike of the school grounds, making a map of its features. Include trees, buildings, parking lots and other natural and humanmade structures. Make a copy of the map. On one of the maps, have students draw arrows predicting the flow of water runoff. On the next rainy day, take students outside with the other copy of the map. Have them draw arrows showing the actual direction of water runoff. Compare the two maps. Were the predictions correct? What affected runoff? What types of materials from the school grounds could be carried into local bodies of water? How could the school grounds be improved?

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EVALUATIONS

1. After students trace their local stream to an Illinois border river or lake, have them name some of the cities located along that path. How did the river or lake contribute to the growth of these cities?
2. Students should be able to define a watershed and locate their watershed on a map.
3. Students should be able to name major streams within their watershed.
4. A toy boat is placed in a river near your city. What might be the route of its travels?
5. What we do in our backyard in Illinois may affect organisms in Louisiana. Do you agree or disagree?

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