Photo courtesy of Wilfredo R. Rodriguez H.

Can Nutrients in Water Cause Harm?

The Science of Water: Activity 10

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BioEd Online

Can Nutrients in Water Cause Harm?*

**Previously entitled, "Make a Muddled Marsh."*

This activity's objectives are aligned with the National Science Education Standards, specifically those related to Science as Inquiry, Life Science and Environmental Science. Students create pond water cultures and investigate how the addition of fertilizers or natural nutrients affects their "pond."

Concepts

•Many different kinds of organisms live in water.

•Excess nutrients will cause over-abundant growth of some organisms living in water.

•Non-point source pollution is a major threat to water supplies in the United States.

Reference

Moreno N., and B. Tharp. (2011). *The Science of Water Teacher's Guide.* Third edition. Baylor College of Medicine. ISBN: 978-1-888997-61-3. Development of this student activity was supported, in part, by grant numbers R25 ES06932 and R2510698 from the National Institute of Environmental Health Sciences of the National Institutes of Health to Baylor College of Medicine.

Image Reference

Photo of eutrification in the waters of Lake Maracaibo, Venezuela, courtesy of Wilfredo R. Rodriguez H., released into the public domain.
http://commons.wikimedia.org/wiki/File:Aguas_del_lago_de_Maracaibo_contaminadas_por_Lemna_03.JPG

Key Words
lesson, experiment, water, pollution, fertilizer, overgrowth, water pollution, marsh, pond water, hay infusion, ecosystem,

Materials

Materials

Conduct this activity as a class demonstration.

Teacher Materials

- 2 oz hay or dried grass
- Small container of fish food
- Small container of liquid fertilizer
- 1 gallon of spring water (or de-chlorinated tap water)
- 1 1/2-gallon aquarium with lid
- 3 clear, soft drink bottles, 2-liter size

Materials per student

•Pen or pencil

•Copy of student sheet

Setup

1.You will need a hay infusion kit or pond water to conduct this demonstration activity. To start a hay infusion, set up a culture in a small aquarium about a week before beginning the activity. Add hay to one gallon of spring water or de-chlorinated tap water. (Chlorine is added to

tap water to kill microorganisms, so water straight out of the tap will not be effective in making "pond water.") *If you use tap water*, it is very important to let it rest uncovered for 24 hours, so the chlorine will have time to evaporate. An added light source will encourage growth within your hay infusion, and also will help to limit the foul smell.

2. As an alternative to making your own hay infusion "pond water," you can use water that you and/or your students collect from a pond, ditch or stream. If you are collecting your own water, try to find a source in which green algae is floating.

3.In addition to "pond water," you will need 3 clear, 2-liter plastic soft drink bottles. Cut off the tops of the bottles and make cylindrical containers from the bottle bottoms.

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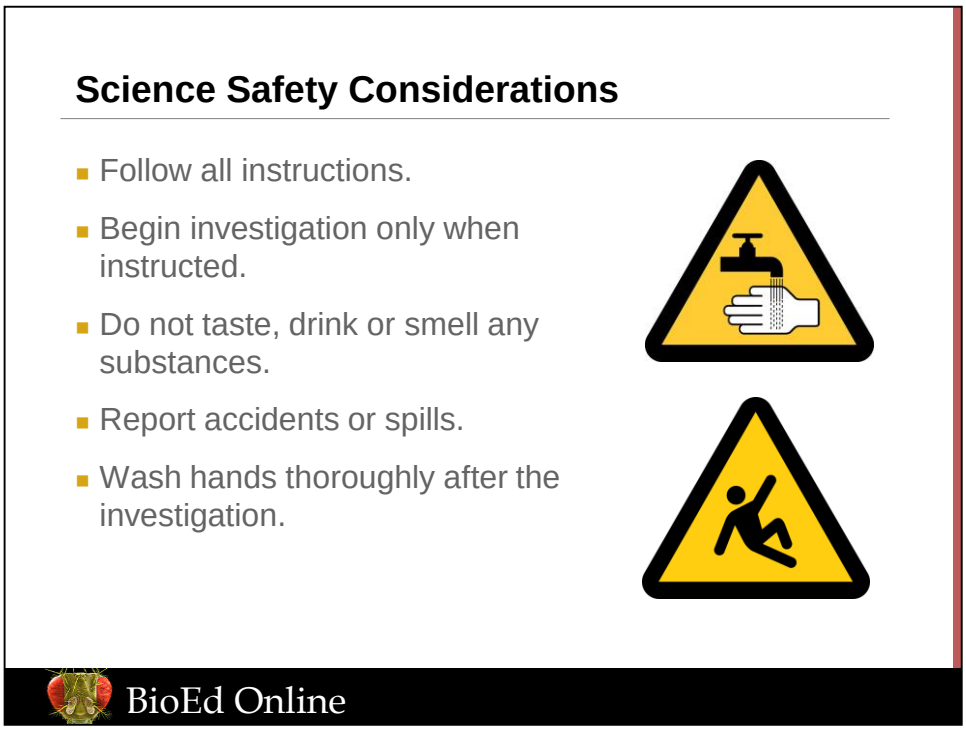
Image Reference

Photo by JP Denk © Baylor College of Medicine.

Key Words

materials list, materials needed,



Science Safety Considerations

Students always must think about safety when conducting science investigations. This slide may be used to review safety with your class prior to beginning the activity.

Safety first!

•Always school district and school science laboratory safety guidelines.

•Have a clear understanding of the investigation in advance.

•Practice any investigation with which you are not familiar before conducting it with the class.

•Make sure appropriate safety equipment, such as safety goggles, is available.

•Continually monitor the area where the investigation is being conducted.

References

1.Dean R., M. Dean, and L. Motz. (2003). *Safety in the Elementary Science Classroom*. National Science Teachers Association.

2.Moreno N., and B. Tharp. (2011). *The Science of Water Teacher's Guide.* Third edition. Baylor College of Medicine. ISBN: 978-1-888997-61-3.

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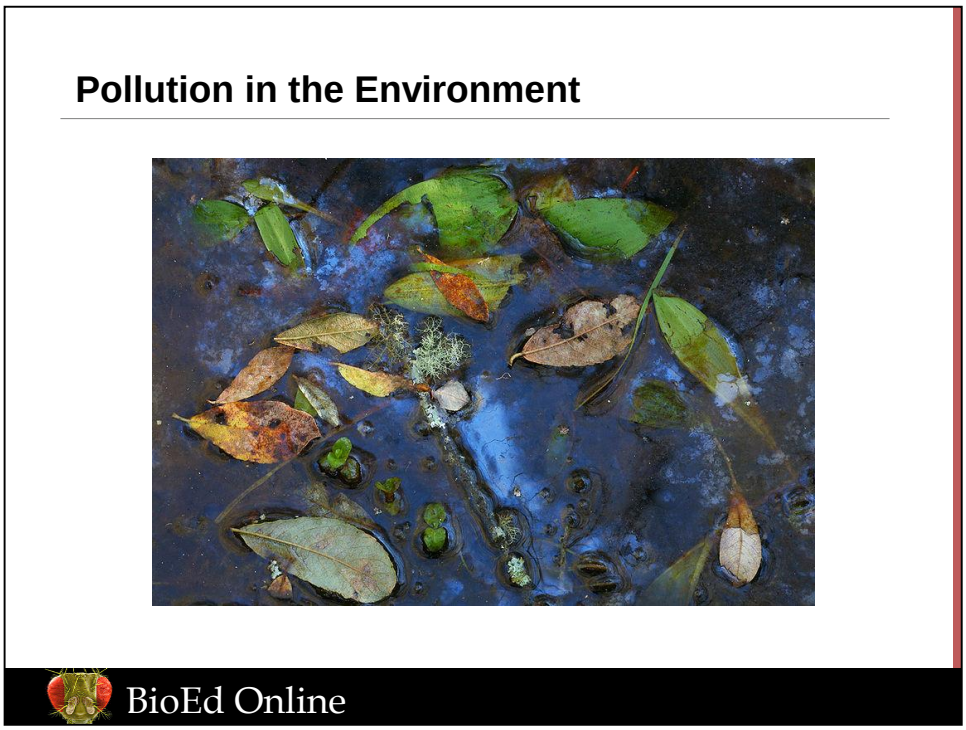
Key Words

science, classroom, safety, lab, laboratory, rules, safety signs,



Pollution in the Environment

In *Mystery of the Muddled Marsh,* the story that accompanies this unit, runoff from a new park development introduces soil and fertilizers into a marsh and stream ecosystem. These pollutants cause the water of Marigold Marsh to turn murky, and lead to an excessive growth of plants, green algae and some microorganisms. These changes threaten marsh animals and their habitat until Riff and Rosie (characters in the story) are able to solve the mystery.

In this activity, students will see first-hand what happened to Marigold Marsh by observing the changes that occur over time when fertilizers are introduced to solutions of pond water.

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Image Reference

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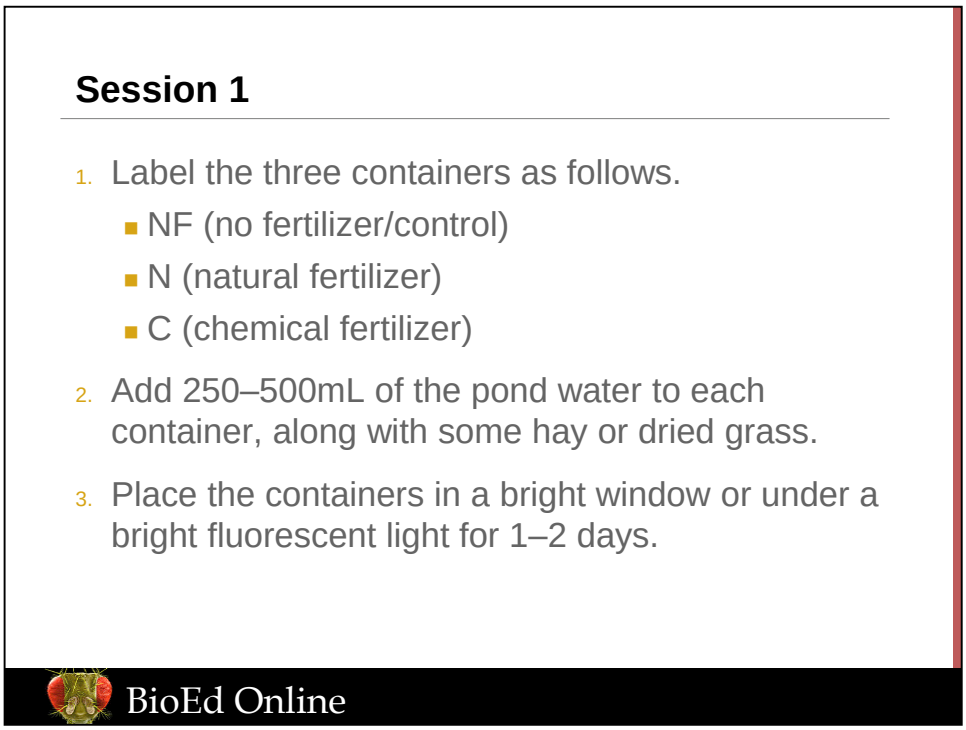

Session 1

Ask the students if they remember what happened to Marigold Marsh in the story, *Mystery of the Muddled Marsh*. Allow everyone to share his or her ideas. Tell students they will investigate what happens when fertilizer is added to a water ecosystem, and that they will be able to see some of the tiny plants and animals that lived in the muddled marsh.

Have one or two students label the three containers "NF" (no fertilizer/control), "N" (natural fertilizer), and "C" (chemical fertilizer). In bilingual classrooms, also label the containers: "SF" (sin fertilizante), "N" (fertilizante natural), and Q (fertilizante químico).

Show the students the prepared hay infusion culture or natural pond water. If possible, have students observe a few drops of the water under a microscope. Explain that they will be growing similar living things in the bottles. Add about 250–500mL of the prepared or natural pond water, along with some hay or dried grass, to each container.

Place the containers in a bright window or under a bright fluorescent light for 1–2 days to allow the culture to develop. Bright light is important. In low-light conditions, hay infusions tend to develop mold and/or foul-smelling bacteria within 2–3 days.

Note: If you are using pond water that already has plenty of green algae and other growth, the cultures do not need time to develop or "rest." In this case, proceed directly to the next step.

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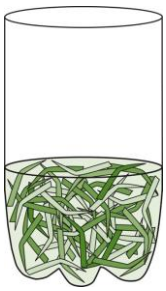
Session 2

1. Observe the three containers with a hand lens and record your observations.
2. Add 3 drops of liquid fertilizer to container “C” and a pinch of fish food to container “N.”
3. What do you think will happen?
4. Keep the containers in a well-lit area.



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Session 2

Have students observe the three containers and record their observations. Ask, *Do you notice any differences among the bottles? Why do you think this is so?* Let the students use hand lenses to observe the containers.

Explain that students will be observing what happens when fertilizer is added to an aquatic ecosystem. Most students will remember the word “fertilizer” from the story, *Mystery of the Muddled Marsh,* but make sure they understand that fertilizer has positive uses, and that it can be very important for food production.

Show the fertilizer and fish food to the class. Help students to understand that each substance will add nutrients to the water in the bottles.

Have a student add three drops of liquid fertilizer to the bottle labeled “C” and a large pinch of fish food to the bottle labeled “N.” Then have

students predict what they think will happen in each bottle over the course of the next week. The bottles should be kept in a bright window or under bright fluorescent lights. As mentioned earlier, low-light conditions often cause hay infusions to develop mold and/or foul-smelling bacteria within 2–3 days.

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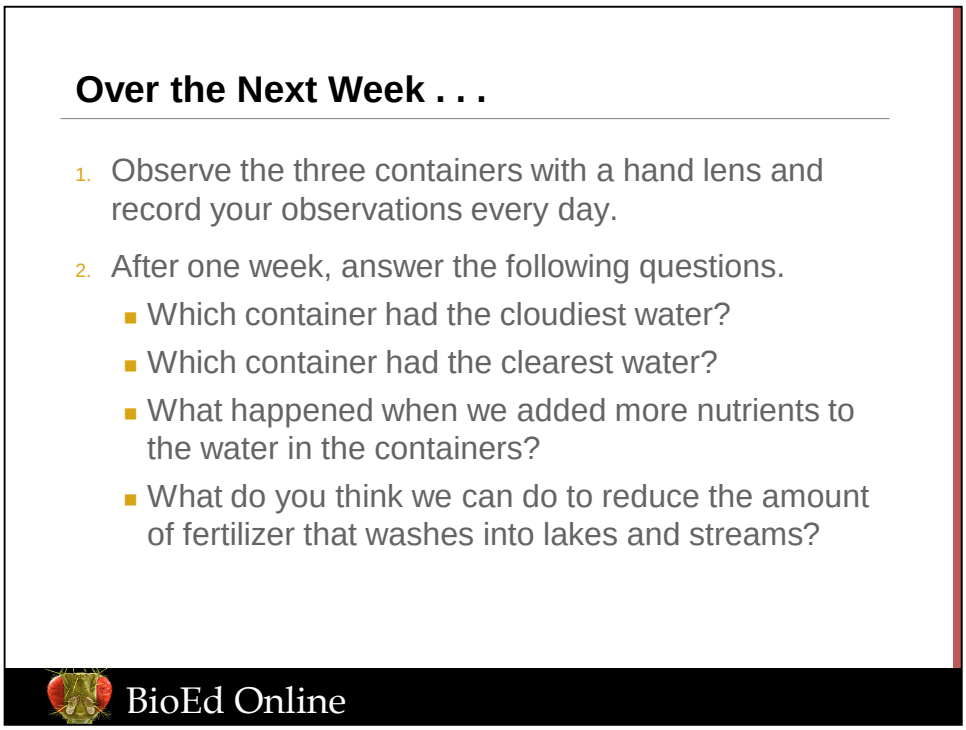

Session 3

Each day, have students observe the containers and write or draw their observations on the "My Marsh Observations" sheets. After about one week, have the students discuss their results within small groups. They should compare the appearance of the three containers over time, answering questions such as, "Which container has the cloudiest water?" and "Which container has the clearest water?"

Students also may be able to observe differences in the color and/or quantity of organisms in the containers. Older students may want to use a microscope to compare the amount of organisms in a drop of water from each of the three containers. In general, expect the containers with chemical and natural fertilizers to produce the most algae and other microorganisms. Over time, these cultures may turn brown and develop a foul smell.

Discuss the results with the class. Ask, *What happened when we added more nutrients to the water in the containers? What do you think would happen if we continued to add nutrients to the water?*

Help students to make extensions to other situations by asking, *What do you think we can do to reduce the amount of fertilizer that washes into lakes and streams? What would happen if no one used fertilizers at all?* Finally, challenge them by asking, *Can you think of ways we can use the fertilizer needed to grow food without polluting our waterways?*

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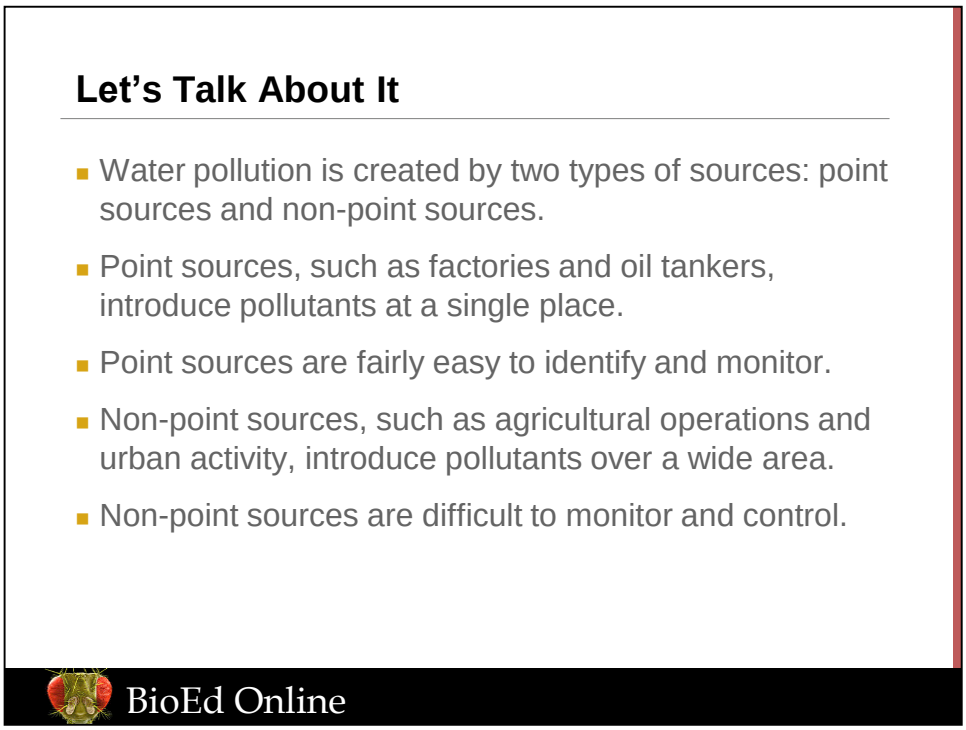

Let's Talk About It

In general, water pollution in the United States is caused by one of two sources. Point sources introduce pollutants into waterways at a single place. Factories, sewage treatment plants, abandoned mines and oil tankers are examples of point sources of water pollution. Although this type of pollution is not always significant in terms of volume, it is the primary point of entry for toxic chemicals into water supplies. In most cases, point sources of pollution can be identified and monitored by government agencies.

Non-point sources of pollution include large areas of land that drain into underground and surface water sources. With non-point source pollution, water collects pollutants as it travels over land and through layers of soil. Major contributors to non-point source pollution include agricultural operations (which can add chemical fertilizers, pesticides, manure and soil to water), logging and other industries that leave the soil surface bare (thereby allowing soil to be washed into waterways), urban and suburban activities (where lawn chemicals, household chemicals, motor oil and gasoline can be washed into water supplies),

and septic systems (which can contaminate underground water supplies with disease-causing bacteria). Non-point sources of water pollution are difficult to monitor and control because they can be spread over many square miles.

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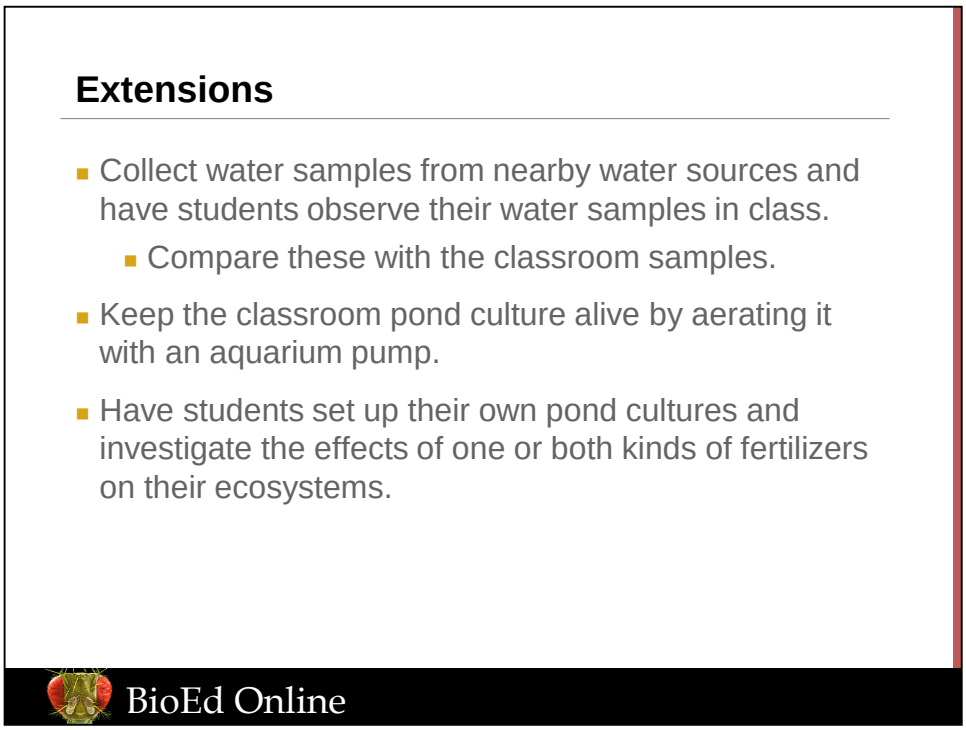

Extensions

Visit a nearby stream, marsh, pond, or ditch with standing water. and have students collect small samples of water. Students should observe their water samples in class using hand lenses or low-power microscopes and compare these samples to those in the containers used for the activity.

Keep one or more classroom cultures of pond water alive for an extended period by adding a simple aquarium pump and plastic tubing to aerate the water.

Have student groups set up their own cultures and investigate the effects of one or both kinds of fertilizers on their systems.

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