

The Pond: Investigating Pollutants in the Ecosystem

Overview

There are several types of pollutants that may enter an ecosystem through soil and/or water. Sometimes we can trace the pollutants to a localized source and sometimes not. Testing samples of soil or water may help to determine which areas are affected by certain types of pollutants. Participants can test hypothetical samples of soil/water in order to identify sources of pollution and infer the potential effects of pollution on an ecosystem. This activity can be conducted with soil or water samples or simulated with color-coded paper.

Background

Pollutants may be introduced into an ecosystem (soils and/or waterways) from various sources. A point source pollution can be traced back to a specific industry, sewer system, pipe, structure, or localized spill. In many cases, pollution comes from several diffuse sources and travels through ecosystems as rainfall or melting snow picks up natural and man-made pollutants and distributes them far and wide. This type of pollution is called a nonpoint source that may end up in our rivers, lakes, and estuaries.

According to the EPA, in many states, nonpoint source pollution is the leading cause of water pollution issues and has harmful effects on our drinking water supplies, fisheries, recreation, and wildlife. Types of nonpoint source pollution which can include chemicals like herbicides/pesticides and manure nutrients as well as urban drainage, atmospheric deposition, and soil erosion.

In a nutshell, agriculture, urban runoff, and municipal point sources all play a role in contributing to the overall issue of nonpoint source pollution. The state and federal governments have created guidelines to control water quality by enforcing, regulating, and monitoring waterways. Locally, citizens are also stepping up to practice water conservation and participate in community cleanups.

Pollution can be categorized into basic types such as: ecological, thermal, organic, and chemical. Not surprisingly, pollution is caused most often by human actions. Water testing is an effective way to try to analyze samples in order to determine if there are issues and if so, what type of problem. Testing may detect pH levels, nitrates, phosphates, lead, hardness, microorganisms, and/or chlorine.

In this activity, we will focus on analyzing samples for phosphate contamination. The elemental form of phosphorus in nature is rare and most often found as a phosphate molecule (PO_4). Explain why someone would want to be able to test for phosphorus in their water source.

Objectives

Students will be able to:

Infer potential effects of pollutants on an ecosystem

Analyze data to determine sources of pollution

Identify sources of phosphates

Process Skills:

Predicting

Analyzing

Duration:

60 minutes

Extension (60 minutes)

Include what happens if there is not enough or too much phosphorus in a body of water.

Materials

Option 1:	Option 2:
The Pond Story Pollutant Handout 3 water samples Phosphate test Flasks Droppers Data Table	Flasks Beads of various colors (or tokens or color paper dots) Flasks Graph paper Pollutant Handout

Engage

Share an image of a body of water that has excess algae or eutrophication. Ask everyone to make observations about it.



Read the story, *The Pond*, and have participants take notes on key terms and important facts that may be useful during the water testing inquiry.

Explore

After reading the story, distribute the data table and the pollutant handout for the water testing inquiry. Explain that a local environmental group heard about Callie's illness and wanted to determine the source of the pollutants that could have contributed to the eutrophication of the pond. Using the data table, assist the scientists in testing and analyzing the water samples.

Test each of the 3 water samples and record the results on the data table.

Predict where each sample was taken within the story and why. What do you think the pH levels and phosphorus levels will be for each sample? Record answers.

Option 2:

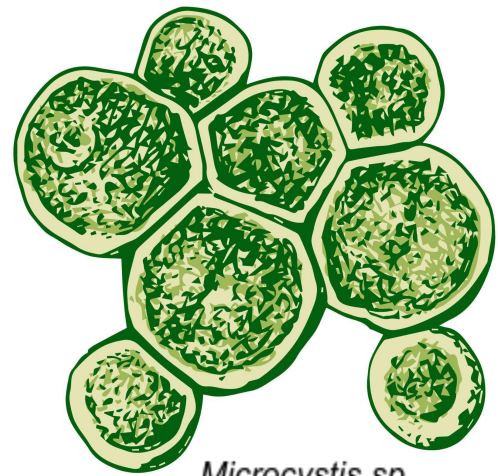
A local environmental group heard about Callie's illness and wanted to determine the source of the pollutants that could have contributed to the eutrophication of the pond. Using the data table, assist the scientists in testing and analyzing the water samples.

Using the color coded pollutant handout, analyze the three "simulated water samples." Tally the different colors of beads (representing different types of pollutants) and graph the results for each sample.

Analyze the results and provide an explanation/scenario of why the pond water made Callie sick.

Explain

Discuss the results of the inquiry and have participants share their findings and results. Use the pollutant handout to guide the learning conversation about types of water pollution and sources. Be sure to define the difference between point and nonpoint source pollution.



Microcystis sp.

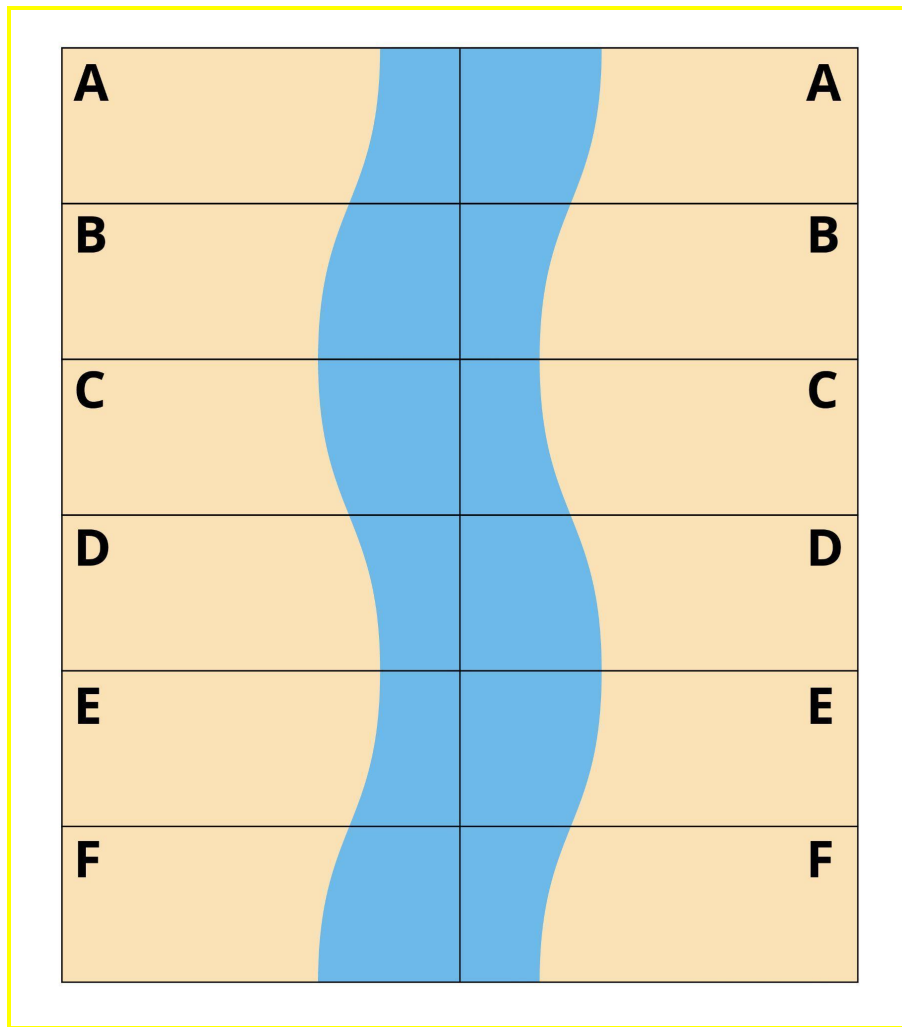
For more information about harmful algae blooms (HABs) check out the guidelines from the Center for Disease Control and Prevention:

<https://www.cdc.gov/habs/materials/factsheet-cyanobacterial-habs.html#:~:text=Treatment%20is%20mainly%20supportive%20and,needed%2C%20replenish%20fluids%20and%20electrolytes>

Extend

This extension activity demonstrates the process of nonpoint source pollution.

Recreate the grid on a large piece of paper or poster board. Cut the grid into separate pieces for distribution to groups.



Tell the participants that they just inherited two million dollars and a plot of land along the river. Explain that they get to “develop” their plot of land along the river any way they like- residential, agricultural, industrial, vacation properties, logging, mining, etc.

Allow groups to discuss how they want to use their money to develop the land and have them draw on their piece of poster. Once the drawings are complete, have each group share their developed plot and identify any sources of pollutants. For each pollutant, give the group a token (poker chip, marble, corn, etc.).

Instruct the participants to put the puzzle pieces together and discuss how each group affected the river. Beginning with the two letters “A”, as each group adds their plot of land to the puzzle, have them pass their tokens to the next group (Bs), and then Cs and so on and so forth. At the end, group F should have collected all of the tokens (representing various types of pollutants) demonstrating that all of the participants contributed to the pollution down river (non point pollution).

Evaluate

Discuss the results of the inquiry.

Ask your students to create an exit slip describing point vs. nonpoint pollution.

Teacher Key

[Suggested results for the 3 samples](#)

Student Data Sheets

The [Pond Inquiry Data Table](#)

References

United States Environmental Protection Agency. (n.d). *Basic Information about Nonpoint Source (NPS) Pollution*.

<https://www.epa.gov/nps/basic-information-about-nonpoint-source-nps-pollution>