Nutrient Pollution Lab

Explore the effects of excess nutrients on aquatic ecosystem

Overview: Students will study the factors affecting eutrophication in stream water when plant fertilizer is added. This lab is an introduction to basic experimental design and the scientific process.

Lesson Characteristics:
Use the table below for lesson planning purposes:

Grade	6-12
Time Required	1 hour *(If doing experiment): 3 hours*
Key Science Practices	Observation Engaging in Argument from Evidence
Key Concepts/Terms	Cultural Eutrophication Nutrient Pollution Experimental Design Statement of hypothesis
Setting	Inside or Outside
Materials	Lesson video *(If doing experiment): (5) 1 liter beakers, (3) liters river water, (1) liter distilled water, paper bag, 70 mg fertilizer*

Next Generation Science Standards:

Science and Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts
Planning and Carrying Out Investigations **Constructing Explanations** Analyzing and Interpreting Data	**MS-ESS3.C: Human Impacts on Earth Systems**	**Cause and Effect**

Other Standards

MS-ESS3-4: Construct an argument supported by evidence for how increases in human population and per-capita consumption of natural resources impact Earth's systems.

Learning Objectives

Students will... conduct an experiment to measure the effects of nutrients on stream water.

Preparation:

- Follow the procedure document instructions if you would like to conduct the experiment in class.

Background Information:

Vocabulary:

Term	**Definition**
Algae	A simple, nonflowering, and typically aquatic plant of a large group that includes the seaweeds and many single-celled forms. Algae contain chlorophyll but lack true stems, roots, leaves, and vascular tissue.
Control	In an experiment, controls help you interpret the results by giving you standards to compare against.
Cultural eutrophication	When a flux of excess nutrients from human activity are added into a local run-off which in turns speeds up the growth of algae.
Nutrient	A nutrient is any substance considered food for an organism. Phosphates and nitrates are the two main nutrients that cause cultural eutrophication as they enrich the water allowing for aquatic plants such as algae to grow rapidly.
Observation	The action or process of obtaining information about something or someone by carefully watching or examining it.
Variable	The things that are changing in an experiment are called variables. A variable is any factor, trait, or condition that can exist in differing amounts or types. An experiment usually has three kinds of variables: independent, dependent, and controlled.
Watershed	A watershed describes an area of land that contains a common set of streams and rivers that all drain into a single larger body of water, such as a larger river, a lake or an ocean.

Procedure:

Follow the steps in the table below to conduct the activity.

Sentences in bold are suggestions for what an educator might say to students.

Items in italics are possible student answers to questions.

Step	Action
	5E's: Engage Learning Cycle: Invitation
1	**Why do people use fertilizer on lawns and agricultural crops?** *People use fertilizers to help plants grow better.* **Fertilizers contain nutrients like nitrates and phosphates to help plants grow. How do nutrients in fertilizers that are put onto the ground get into rivers or streams?** *Rainfall and runoff.*
	5 E's: Explore Learning Cycle: Exploration
2	**If nutrients in an aquatic ecosystem suddenly increases what might be the result? Consider what happens in other ecosystems when there is suddenly a lot of food available.** *More individuals can survive, so the population grows.* Explain the process of eutrophication. **Why is too much algae a problem for water quality?** *It blocks light to aquatic plants and decreases oxygen available to aquatic life.*
	5 E's: Explain Learning Cycle: Concept Invention
3	Watch the video. Write a hypothesis to describe what you think will happen in each container on your data sheet. Write Day 1 observations on your data sheet.
	5 E's: Elaborate Learning Cycle: Application
4	Write Day 10 observations on your data sheet. Fill out summary of changes table on data sheet.

	Answer discussion questions.
5 E's: Evaluate	Learning Cycle: Reflection
5	Have students research scientific articles outlining the solutions that are being proposed to deal with the Chesapeake Bay dead zone. Have students write a brief essay on fertilizer best practices and riparian buffer zones. Have students attend a field study and test nitrates and phosphates at a local park.