Eutrophication: pulse and press

How do environmental and human factors influence eutrophication?

Background

Have you ever encountered a body of water that was overwhelmed by a thick green coating? If you have, you may have observed an algal bloom. Algal blooms are the result of Eutrophication. Eutrophication may occur when there is an overabundance of nutrients, especially phosphorus and nitrogen in the water. The word "Eutrophication" originates from two Latin words meaning "good" and "food". When normal amounts of algae receive "too much" good food (i.e. phosphorus, P, and nitrogen, N), the algae may multiply prolifically. Eutrophication happens naturally over time. However, it can accelerate growth when excess nutrients enter a waterway. These nutrients can enter waterways through runoff from agricultural, urban or suburban areas. This is known as "cultural eutrophication". Common factors in cultural eutrophication include sewage, animal waste and fertilizers.

Algal blooms produce thick, green algae, smell and produce toxins that are harmful to other organisms. They can also cause a sudden drop in the amount of dissolved oxygen in the water, which can result in the death of fish and other water-organisms.

In this lab, you will examine the effects of adding excess fertilizer to "mini-ecosystems" in two different ways: by a singular influx, called a **pulse**, or by repeated release over time, called a **press**. A pulse could represent a one-time event such as a large storm causing agricultural runoff. A press could represent a long term event such as continual leaching of fertilizer from municipal water treatment systems.

Materials

- 3 quart-sized mason jars per lab group of students
- Pond or lake water (collected from the same source, at the same time)
- Graduated cylinder
- Microscope
- Pipet
- Fertilizer source such as Miracle-Gro, etc.
- Microscope well slides
- Sheet of white paper
- Water quality test kit (pH, nitrogen, and phosphorous tests)

Instructions

1. Fill 3 quart jars with 600ml of naturally sourced water.
2. Carefully stir the water in the jar; collect a drop of the water using the pipette. Examine the water under the microscope. Count the number of algae cells you see. Record this number.
3. Examine the color of the water while holding the jar against a white sheet of paper. Record this observation.
4. Jar 1 represents the control group; no fertilizer will be added to this jar. Jar 2 represents the "pulse" scenario. Jar 3 represents the "press" scenario.
5. Determine how much fertilizer you will use. The total amount of fertilizer used should remain equal for the pulse and press treatments. The pulse treatment should be given only once. Decide how often to give the "press" treatments. (Remember the cumulative amount of fertilizer given during the press treatments should equal the total amount of the pulse treatment).

- Pulse treatment _____ × 1 treatment
- Press treatments × _____ (number of treatments)
- Total amount of fertilizer per jar: _____

6. Determine how long you will run your experiment and how often you will check the algae count:

_____

7. Place the jars in a location with moderate daylight. Carry out your experimental design. Record your data and graph the algae growth from each jar below.

Data table

Jar	Treatment	Number of algae cells	Color of the water	pH	N	P
1	Control					
2	Pulse					
3	Press					

Reflection

1. Did the addition of N and P affect your ecosystems? Explain how.
2. Compare and contrast the effects of the pulse and press treatments on your ecosystem. Which had a greater impact? Why? What were the results of other groups that used greater or lesser amounts of fertilizer? Did they mirror your results? Explain.
3. Create a graph that displays the algae growth or decline in each jar during the course of your experiment.

Graph