

## **The Effects of Nutrients on a Mini-Pond Ecosystem**

Person, J. L. (1989). Environmental Science Investigations. J.M. LeBel Enterprises, Ltd., Ronkonkoma, NY. 131 pp.

**Goal: To observe the changes that occur in a mini-pond ecosystem as the amount of plant nutrients [fertilizer] is increased.**

### **Materials**

8-one gallon (4.5 liter) glass jugs  
glass containers  
4 funnels  
4 stirring rods  
tap water  
pond water  
bioscope

4-50 ml graduated cylinders  
4-100 ml graduated cylinders  
1-1000 ml graduated cylinder  
45 ml 8-24-8 garden fertilizer  
Water Test Kits: nitrate & phosphate

[The number of graduated cylinders necessary will depend upon the number of students involved in setting up the experiment.]

### **Procedure**

1. Fill the 4.5 liter glass jugs with 4 liters of tap water and place them in a sunny location for a few days to allow the chlorine to escape.

[It is important that the jugs be nearly identical so that water lost through evaporation will be nearly equal. These (4.5 L) jugs can probably be obtained from the chemistry department. If not, use gallon jugs from the cafeteria or milk jugs from home.]

2. At the same time fill another container with tap water and place it with the glass jugs.

[This will allow chlorine to escape, and insure supply a source of chlorine-free water for use in the experiment. Keeping the container with the jugs will assure that the water temperature will be the same as the temperature of the water in the jugs.]

3. Inoculate each of the 4.5 liter jugs with 150 ml of pond water which has been obtained from the water's edge. This creates several similar mini-ponds.

4. Choose an ordinary garden fertilizer such as 8-24-8. The fertilizer chosen should not contain any coloring agent. Make a fertilizer solution by adding 45 ml (3 tablespoons) of the fertilizer to four liters of water. *Do not use metal containers for mixing or storing the fertilizer solution.*

[This fertilizer solution will be referred to as the stock solution. A stock solution is the original solution from which other solutions can be made. A supply of stock solution should always be available for use in the experiment.]

5. Label each jug with a number; begin with number 1. Add increasing amounts of the stock solution to the mini-ponds as follows: #1 = 0 ml; #2 = 2 ml; #3 = 4 ml; #4 = 6 ml; #5 = 8 ml; #6 = 10 ml; #7 = 12 ml; #8 = 14 ml.

6. All jugs should have the same amount of liquid added. So that each mini-pond will receive a total of 14 ml of liquid, add the proper amount of chlorine-free water from the container set up in step 2. [#1 = 14 ml; #2 = 12 ml; #3 = 10 ml; #4 = 8 ml; #5 = 6 ml; #6 = 4 ml; #7 = 2 ml; #8 = 0 ml.]

7. The above amounts of stock solution and chlorine-free water will be added to the mini-ponds each week. To make this job easier, label each jug with the proper amounts of each liquid to be added. Then you need only refer to the "recipe" on the jug.

<b>Jug #</b>	<b>Stock Solution</b>	<b>+</b>	<b>Chlorine-free Water</b>	<b>= Total</b>
1	0 ml	+	14 ml	= 14 ml
2	2 ml	+	12 ml	= 14 ml
3	4 ml	+	10 ml	= 14 ml
4	6 ml	+	8 ml	= 14 ml
5	8 ml	+	6 ml	= 14 ml
6	10 ml	+	4 ml	= 14 ml
7	12 ml	+	2 ml	= 14 ml
8	14 ml	+	0 ml	= 14 ml

## Observations

On the same day of each week note these changes in the mini-ponds.

1. Look through each "pond" toward the light. Note the color observed.

Describe the color as:

<b>clear</b>	<b>green</b>	<b>gray</b>
<b>rust</b>	<b>brown</b>	<b>tan</b>
<b>yellow</b>	<b>blue</b>	<b>colorless with particles</b>

If two of the "ponds" are the same color but there is a difference in the intensity or depth of the color, record the lightest color with a + sign. Increase the number of + signs as the depth of the color increases.

For example:

light green = green +
darker green =green ++
darkest green =green +++

2. Place a printed card directly behind each "pond" and attempt to read the print. Record the turbidity [cloudiness] of each "pond" as follows:

CLEAR	print can be easily read
SLIGHTLY CLOUDY	print can be read, but appears fuzzy
CLOUDY	print can be seen, but not read
VERY CLOUDY	print can barely be seen
OPAQUE	print cannot be seen

**After definite changes in color and turbidity have been noted make the following observations:**

1. Use pipettes to take samples from each mini-pond. Use the nitrate and phosphate test kits to determine the amount of phosphates and nitrates in the water. Follow the directions in the lid of the kit.
2. Pour the mini-pond into a white-bottomed tray for study of the organisms. Use the bioscope and microscope as needed to aid in the identification of the organisms. Identify the type of organisms seen using the references available. Record the name of each type of organism observed. Record the number as indicated below:

**TMTC** too many to count  
**M** many

**S** several  
**F** see very few

After the Observations are completed and recorded. Complete the analysis of the results.

<b>DATE:</b>				<b><u>NUTRIENT</u></b>	<b>TESTS</b>
<b>JUG</b>	<b>COLOR</b>	<b>INTENSITY</b>	<b>TURBIDITY</b>	<b>PHOSPHATE</b>	<b>NITRATE</b>
		<b>(depth of color)</b>	<b>(cloudiness)</b>		
1					
2					
3					
4					
5					
6					
7					
8					

### ANALYSIS

1. In which jug was the color intensity the greatest?

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2. In which jug was the turbidity the greatest?

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3. Which jug had the greatest variety of organisms?

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4. How did the increase in nutrients affect the alga growth?

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5. How did the increase in nutrients affect the variety of organisms in the mini-pond?

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6. Which jug had the best nutrient level for a healthy ecosystem?

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7. Would you consider any of the mini-ponds polluted? If so, which one(s)?

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Explain why you would label these mini-ponds polluted.

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