

Instructions for
Lab Activity 5 – Ecosystems
NSCI 102

As mentioned at the end of Lab 04, you will need to plan ahead for this activity!

- For the first experiment, you will need a large pitcher, jug, or container that can hold at least 1 Liter of water. An empty and rinsed 2L soda bottle, half gallon milk container, etc. will work well.
- Experiment 2 must be started at least 5 days before you plan to submit the assignment.

In this activity, you will conduct two experiments to demonstrate biomagnification and energy transfer within ecosystems, as well as the effects of pollution on organisms within an ecosystem. We will be working through the information and experiments in Lab 4: Ecosystems within your eScience Lab Manual, or from the links posted in Canvas.

Work through each section, keeping track of your answers and observations. When you are finished with each section, complete the “Quiz” over that section before moving on.

Lab Activity 05 - Introduction

Read the Introduction to Lab 4. When you are able to answer the questions below, you may complete the "Quiz" for Part 1.

- 1. Identify five different ecosystems which exist on Earth. Then, assign one abiotic and one biotic factor to each ecosystem.**
- 2. What order heterotroph is an animal which consumes only plant matter for energy?**
- 3. Research one chemical that accumulates as a result of biomagnification. Explain why this chemical accumulates at higher levels.**

Lab Activity 05 – Experiment 1: Biomagnification

Carefully read through the Instructions for Lab 4 - Experiment 1 before you begin, then make sure you follow each step carefully. Items you will need are listed in the instructions. Many of those items will be in the packet labeled "Ecosystems"

- 1. Before you begin, create a hypothesis describing what you believe will happen when the oil and water are transferred into different containers. Will this affect biomagnification, and, if you believe so, how**

2. **Once your experiment is set up, take a photo that you will upload into the Canvas quiz.**
3. **Record your results in the table below.**

Clarification of formula in Step 6:

$$\% \text{ Concentration of Oil} = (\text{Volume of Oil} / \text{Total Volume}) \times 100$$

Table 1: Volume and Concentration Totals					
Trophic Level	Cylinder	Volume of H ₂ O	Volume of Oil	Total Volume	% Oil
1 st	1000 mL			1000 mL	
2 nd	100 mL			100 mL	
3 rd	10 mL			10 mL	

4. **Summarize how the concentration of oil changed from one trophic level to the next.**
5. **How does the change in concentration represent biomagnification?**
6. **How does this also illustrate the amount of energy transferred from one trophic level to the next within an ecosystem?**
7. **Imagine you are a scientist that suspects bioaccumulation of a dangerous chemical is occurring in an ecosystem. Develop a procedure to determine whether or not bioaccumulation is occurring.**

Lab Activity 05 - Experiment 2: Effect of pH on radish seed germination

Carefully read through the Instructions for Lab 4 - Experiment 2 before you begin, then make sure you follow each step carefully. Note that this activity needs to be set up at least 5 days before you plan to submit the assignment. Items you will need are listed in the instructions. Many of those items will be in the packet labeled "Ecosystems"

Once you have your experiment set up, take a photo and upload it into the Lab 05 Experiment 2 Assignment within Canvas to document that your experiment was set up on time.

1. Formulate a hypothesis predicting which environment will be the most suitable for radish seed germination and growth (water [neutral], vinegar [acidic], or sodium bicarbonate solution [alkaline]). Be sure to include why you believe the environment will be beneficial. Use scientific reasoning, if possible.
2. Record the initial pH, daily observations, and final lengths of the sprouts here.

Table 2: pH and Radish Seed Germination			
Stage/Day Observations	Acetic Acid	Sodium Bicarbonate	Water
Initial pH			
Day 1 (# of seeds germinated)			
Day 2 (# of seeds germinated)			
Day 3 (# of seeds germinated)			
Day 4 (# of seeds germinated)			
Day 5 (# of seeds germinated)			
Day 6 (# of seeds germinated)			
Day 7 (# of seeds germinated)			
Final Length of Sprouts			

3. What abiotic factor was tested in this experiment?
4. What biotic factor(s) played a part in this experiment?

5. **Construct a line graph using the data from Table 2. Plot the day on the x-axis, and the number of seeds germinated on the y-axis. Be sure to include a title, label the x- and y-axes, and provide a legend describing which line corresponds to each plate (e.g., blue = acetic acid, green = sodium bicarbonate, etc...). Take a photo of your graph and upload it in the Canvas quiz. You can simply draw the graph by hand and take a clear picture of it, or, if you are comfortable using Excel or other software to create graphs, you may do that instead.**
6. **Construct a bar graph based on the data from Table 2. Think about which pieces of the data should be displayed in the bar graph. Then, determine which variables should be placed on the x- and y-axes. Be sure to include a title, label the x and y axes, and provide a legend if needed. Take a photo of your graph and upload it in the Canvas quiz. You can simply draw the graph by hand and take a clear picture of it, or, if you are comfortable using Excel or other software to create graphs, you may do that instead.**
7. **Did pH have a noticeable effect on the germination rate of the radish seeds? Compare and contrast the growth rate for the control with the alkaline and acidic solutions.**
8. **According to your results, would you say that the radish has a broad pH tolerance? Why or why not? Use your data to support your answer.**
9. **Do you think all types of seeds would respond to this experiment in the same way? How could you test this?**
10. **Knowing that acid rain has a pH of 2-3 would you conclude that crop species with a narrow soil pH range are in trouble? Is acid rain a problem for plant species and crops?**
11. **Research and briefly describe a real world example about how acid rain affects plants. Be sure to demonstrate how pH contributes to the outcome, and proposed solutions (if any). Your description should be approximately 2 - 3 paragraphs. Include at least two reputable sources (use [APA formatting](#) and include the url for web links).**

Lab Activity 05: Feedback and Getting Ready for Next Week's Lab

For Lab 6, you will complete two experiments. Neither requires advance set-up, but you might choose to do them at two different times to break it up a bit.

Please answer the following questions to help improve this activity in the future.

- 1. Approximately how long did it take you to complete this lab activity?**
- 2. Did you find that this lab reinforced your understanding of ecosystem concepts? Why or why not?**
- 3. Did you experience any frustrations or difficulties while working on this activity? Please explain.**
- 4. What suggestions do you have for improving this activity in the future?**