

Activity 2.2.1 Interdependent Organisms

Purpose

During *Natural Resources and Ecology*, you learned where living organisms fit into an ecosystem's trophic levels. Trophic levels represent a food web demonstrating the exchange of energy from one level to another. How else are living organisms dependent upon each other?

A biodiverse ecosystem includes multiple types of plants, animals, and microorganisms working together to function as a community. Functional diversity enables organisms to exchange ecosystem services, such as nutrients, oxygen, and carbon dioxide, needed to survive. Plants absorb sunlight and use solar energy to grow. Animals eat plants or other animals, while bacteria break dead plants and animals down, supplying nutrients to the ground. In turn, those nutrients support new plant life.

Carrying capacity is the maximum population of a given species that a habitat can support. The carrying capacity of an ecosystem is limited based upon services exchanged between its organisms. The services exchanged are limiting factors for a species population. If the service supply of oxygen, carbon dioxide, or nutrients decreases in an ecosystem, the ecosystem's health may decline and become unbalanced. Unbalanced ecosystems may cause the biodiversity of an ecosystem to decrease.

What services do organisms exchange in a balanced ecosystem?

Materials

Per pair of students:

- Computer with *Food Chain* software

Per student:

- Pen
- *ESI Notebook*
- *Laboratory Notebook*

Procedure

Explore the dependence of organisms in a lake ecosystem. Record all data, graphs, and answers to analysis questions in your *Laboratory Notebook*.

Part One – Independent Organisms

1. Open the **Master Food Chain** software according to your teacher's instructions.
2. Choose **Challenge 1**.
3. Read the challenge, "Identify two organisms that can survive by themselves for 90 days."
4. Click on **Develop Hypothesis**.

5. Click on each picture on the computer screen. Describe the role of each organism and ecosystem service in Table X on the student data sheet. The list at right provides organisms and ecological services to research.

Table 1. Research Suggestions

Organisms		Ecosystem Services
• Sunfish	• Fungi	• Carbon dioxide
• Shiner	• Green algae	• Oxygen
• Copepod	• Diatoms	• Nutrients
• Bacteria	• Daphnia	• Detritus

6. On the student data sheet, draw a food web, including the eight organisms listed in Table 1. Identify the trophic level of each organism and label each as a consumer, producer, or decomposer.

7. Circle the organisms on the food web that you believe can survive by themselves.
8. Select those organisms on the computer screen. Selected organisms will have a green dot below them.
9. Develop a hypothesis explaining why you chose the organisms and how they can survive by themselves. Record the hypothesis on the student data sheet.
10. Click on **Test Hypothesis**.
11. Click on **Run**.
12. Record the number of days the organisms survived in Table 3. If they do not survive 90 days, the program will hint at how to solve the challenge.
 - Each organism you chose will have a red or green dot beside it. Collect the following data for each organism you selected in Table 3.
 - Click on an organism with a green or red dot and copy the population graph.
 - Click on the second page of each graph to determine why the species did or did not survive. Record the cause of death or survival.
 - Click on **View Logic** and use the space bar to click through the relationships between organisms and carrying capacity indices. Explain how each organism is related to other organisms in the ecosystem.
 - The Carrying Capacity Indices represent the ecological services provided in the ecosystem. For the Carrying Capacity Indices, complete the following in Table 4.
 - Click on each and copy the graph of the index.
 - Click on the second page of the graph to see if and when the supply ran out.
 - Click on **View Logic** and use the space bar to click through the relationships between organisms and carrying capacity indices. Record why the index increased or decreased.
13. Click on **Develop Hypothesis** and repeat Steps 8–12 until you solve the challenge.
14. Exit the program by Clicking on **Exit this challenge, Main Menu, Quit**.
15. Answer Part One analysis questions.

Part Two – Dependent Organisms

1. On the computer desktop, click on **Master Food Chain**.
2. Choose **Challenge 2**.
3. Read the challenge, "Choose the smallest number of species that will enable sunfish to survive for 90 days."
4. Click on **Develop Hypothesis**.
5. Place a star by the organisms on your food web in Figure 1 that you believe will sustain a sunfish population in the lake.
6. Select those organisms on the computer screen. Selected organisms will have a green dot below them.
7. Develop and record a hypothesis explaining why you chose the organisms and how they will support the sunfish.
8. Click on **Test Hypothesis**.
9. Click on **Run**.
10. Record the number of days the sunfish survived. If the sunfish do not survive 90 days or if you choose too many organisms, the program will hint at how to solve the challenge.
 - Each organism you chose will have a red or green dot beside it. Collect the following data for each organism you selected in Table 5.
 - Click on an organism with a green or red dot and copy the population graph.

- Click on the second page of each graph to determine why the species did or did not survive. Record the cause of death or survival.
 - Click on **View Logic** and use the space bar to click through the relationships between organisms and carrying capacity indices. Explain how each organism is related to other organisms in the ecosystem.
 - The Carrying Capacity Indices represent the ecological services provided in the ecosystem. For the Carrying Capacity Indices, complete the following in Table 6.
 - Click on each and copy the graph of the index.
 - Click on the second page of the graph to see if and when the supply ran out.
 - Click on **View Logic** and use the space bar to click through the relationships between organisms and carrying capacity indices. Record why the index increased or decreased.
11. Click on **Develop Hypothesis** and repeat Steps 8–10 until you solve the challenge.
 12. Exit the program by clicking on **Exit this challenge, Main Menu, Quit**.
 13. Answer Part Two analysis questions.

Conclusion

1. Why are organisms dependent upon each other in an ecosystem?
2. What factors affect the health of an ecosystem?
3. How do ecological services affect the carrying capacity and biodiversity of an ecosystem?

Name _____

Activity 2.2.1 Student Data

Table 2. *Organism Research*

Organism	Role	Ecosystem Service(s)

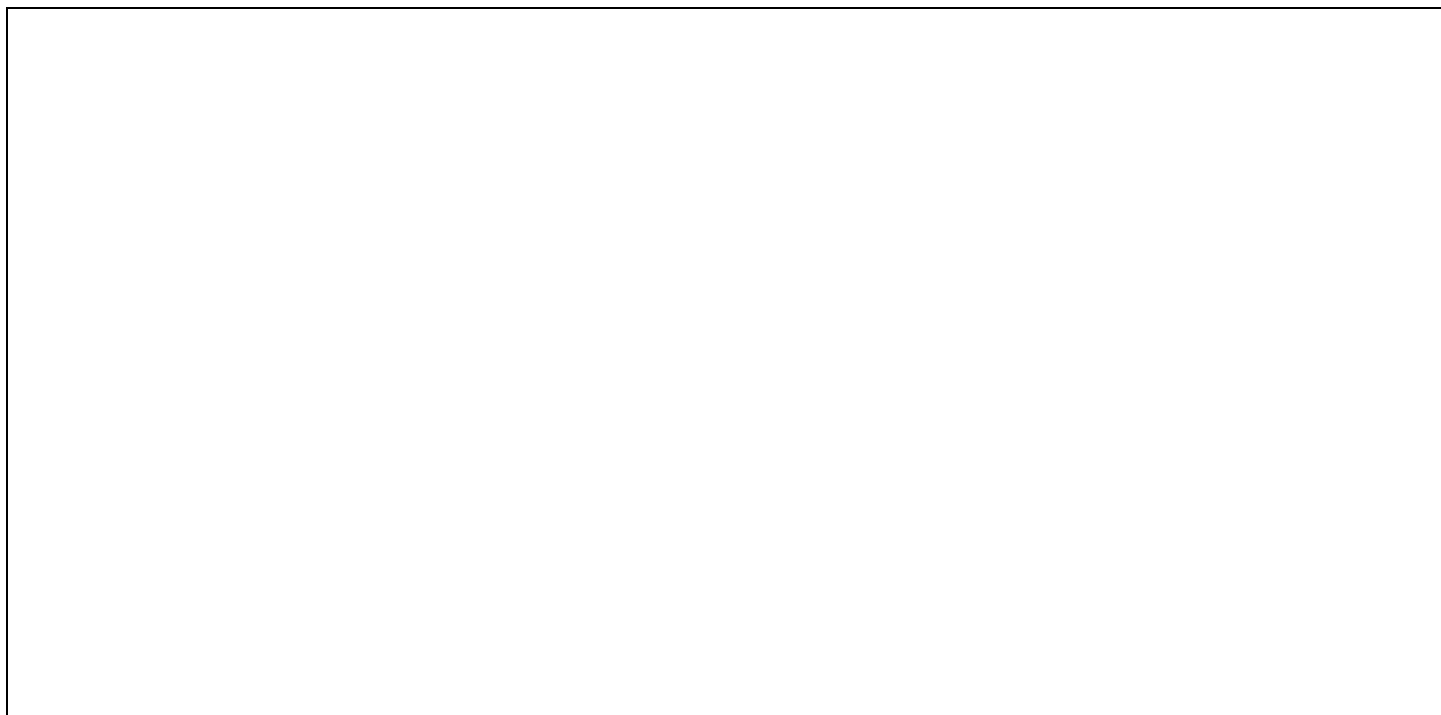


Figure 1. Food Web

Part One Hypothesis:

Table 3. *Organism Survival*

Organism	Days Survived	Population Graph	Cause of Death or Survival	Relationship to Other Organisms

Table 4. *Ecological Services*

Ecological Service	Index Graph	If / When Supply Ran Out	Reason for Increase or Decrease

Part One Analysis

q1 What are the characteristics of organisms that can survive on their own?

q2 What are the characteristics of organisms dependent upon other organisms?

Part Two Hypothesis:

Number of Days Survived:

Table 5. *Sunfish Survival*

Organism	Population Graph	Cause of Death or Survival	Relationship to Other Organisms

Table 6. *Ecological Services*

Ecological Service	Index Graph	If / When Supply Ran Out	Reason for Increase or Decrease

Part Two Analysis

q3 Why is a diverse ecosystem needed for all organisms to survive?

q4 What limits the population of a species in an ecosystem?

q5 How does the supply of ecological services limit the population of a species?