**Student Exploration:** **Food Chain**

**Vocabulary:** consumer, ecosystem, energy pyramid, equilibrium, food chain, population, predator, prey, producer

**Prior Knowledge Questions** (Do these BEFORE using the Gizmo.)

The *Food Chain* Gizmo™ shows a **food chain** with hawks, snakes, rabbits, and grass. In this simulation, the hawks eat snakes, the snakes eat rabbits, and the rabbits eat grass.

1. **Producers** are organisms that do not need to eat other organisms to obtain energy.
	1. Which organism is a producer in this food chain? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
	2. Where does the producer get its energy? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
2. **Consumers** must eat other organisms for energy. Which organisms are consumers in this food chain? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_



**Gizmo Warm-up**

The SIMULATION pane of the Gizmo shows the current **population**, or number, of each organism in the food chain.

1. What are the current populations of each organism?

Hawks: \_\_\_\_\_ Snakes: \_\_\_\_\_ Rabbits: \_\_\_\_\_ Grass: \_\_\_\_\_

1. Select the BAR CHART tab, and click **Play** (). What do you notice about each population as time goes by?

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 If populations don’t change very much over time, the ecosystem is in **equilibrium**.

1. Notice the populations decrease as you go from the bottom of the food chain to the top. Why do you think this is so? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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This diagram, showing decreasing populations at each level, is called an **energy pyramid**.

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| **Activity A:** **Predator-prey relationships** | Get the Gizmo ready: * Click **Reset** (Reset).
* Check that the BAR CHART tab is selected.
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**Question: Predators are animals that hunt other animals, called prey. How do predator and prey populations affect one another?**

1. Observe: Run the Gizmo with several different starting conditions. You can use the **+** or **–** buttons to add or remove organisms, or you can choose **Diseased** from the dropdown lists.
2. Form hypothesis: How do you think predator and prey populations affect one another?

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1. Predict: Based on your hypothesis, predict how changing the rabbit population will affect the other organisms at first. Write “Increase” or “Decrease” next to each “Prediction” in the table.

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| **Change** | **Grass** | **Snakes** | **Hawks** |
| Doubling rabbit population | Prediction: | Prediction: | Prediction: |
| Result: | Result: | Result: |
| Halving rabbit population | Prediction: | Prediction: | Prediction: |
| Result: | Result: | Result: |

1. Test: Add rabbits until the population is about twice as large as it was (200% of balance). Click **Play**, and then **Pause** () after approximately ONE month. Next to each “Result” line in the table, write “Increase” or “Decrease.” Click **Reset** and then halve the rabbit population (50% of balance). Record the results for this experiment in the table as well.
	* 1. How did doubling the rabbit population affect the grass, snakes, and hawks at first?

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* + 1. How did halving the rabbit population affect the grass, snakes, and hawks at first?

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**(Activity A continued on next page)**

**Activity A (continued from previous page)**

1. Predict: Predict how changing the snake and hawk populations will affect the other organisms within the first month. In the tables below, write your predictions.

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| **Change** | **Grass** | **Rabbits** | **Hawks** |
| Doubling snake population | Prediction: | Prediction: | Prediction: |
| Result: | Result: | Result: |
| Halving snake population | Prediction: | Prediction: | Prediction: |
| Result: | Result: | Result: |

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| **Change** | **Grass** | **Rabbits** | **Snakes** |
| Doubling hawk population | Prediction: | Prediction: | Prediction: |
| Result: | Result: | Result: |
| Halving hawk population | Prediction: | Prediction: | Prediction: |
| Result: | Result: | Result: |

1. Test: Click **Reset**. Try each experiment with the Gizmo. Record each result after one month.
	* 1. How did increasing the snakes affect the grass? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Explain why: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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* + 1. How did increasing the hawks affect the rabbits? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Explain why: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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1. Draw conclusions: In general, what effect did removing prey have on predators? \_\_\_\_\_\_\_\_\_

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What effect did removing predators have on prey? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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Extend your thinking: In North America, many top predators, such as wolves, have been driven nearly to extinction. What effect do you think this has on their main prey, deer? Write your answer on a separate sheet, and/or discuss with your classmates and teacher.

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| **Activity B:** **Long-term changes** | Get the Gizmo ready: * Click **Reset**.
* Select the GRAPH tab.
 | Food Chain SE3 |

**Question: An ecosystem is a group of living things and their physical environment. How do ecosystems react to major disturbances?**

1. Observe: Kill off most of the hawks using the **–** button, and then click **Play**. Observe the GRAPH for about 12 months, and then click **Pause**. What happens?

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1. Analyze: Explain why you think the population of each organism changed the way it did. (Use extra paper if necessary.)

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1. Experiment: Click **Reset**. Try making other changes to the ecosystem. Use the **+** or **–** buttons, or choose **Diseased** from the dropdown lists. Click **Play** and observe for at least 12 months. Record what happens on another sheet of paper or in your notes.
2. Summarize: Give at least one example of each of the following:
	* 1. A major disturbance that the ecosystem was able to recover completely from.

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* + 1. A major disturbance that caused the ecosystem to stabilize at a new equilibrium.

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* + 1. A major disturbance that caused the ecosystem to completely collapse.

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* + 1. (Challenge) A major disturbance that *almost* caused a total collapse, but that the ecosystem was able to recover from eventually.

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