

Student Exploration: 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 population sizes of each species?

Hawks: _____ Snakes: _____ Rabbits: _____ Grass: _____

2. Select the BAR CHART tab, and click **Play** (▶). Allow the simulation to run for 24 months and watch the numbers closely. What do you notice about each population as time goes by?

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

3. Compare the equilibrium populations of the four organisms. Why do you think populations decrease at higher levels of the food chain? _____

<p>Activity A: Predator-prey relationships</p>	<p><u>Get the Gizmo ready:</u></p> <ul style="list-style-type: none"> Click 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. 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.**

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

2. 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.



A. How did doubling the rabbit population affect the grass, snakes, and hawks **at first**?

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

3. **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.

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

4. **Test:** Click **Reset**. Try each experiment with the Gizmo. Record each result after one month.

A. How did increasing the snakes affect the rabbits? _____


Explain why: _____

B. How did decreasing the snakes affect the hawks? _____

Explain why: _____

5. **Draw conclusions:** In general, what effect did removing prey have on predators? _____

What effect did removing predators have on prey? _____

Activity B: Long-term changes	<u>Get the Gizmo ready:</u> <ul style="list-style-type: none">• Click Reset.• Select the GRAPH tab.	
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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?


2. **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.

3. Summarize: Give at least one example of each of the following:

A. A major disturbance that the ecosystem was able to completely recover from.

B. A major disturbance that caused the ecosystem to stabilize at a new equilibrium.

C. A major disturbance that caused the ecosystem to completely collapse.

Activity C: Energy Pyramids	<u>Get the Gizmo ready:</u> <ul style="list-style-type: none">• Click Reset (↺).• Check that the BAR CHART tab is selected.	
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1. Observe: Look at the original population numbers in the food chain. To compare each population size, divide the higher trophic level by the lower trophic level, and multiply by 100 to find the percentage:

$$\text{Higher trophic level population} \div \text{Lower trophic level population} \times 100$$

A. How many rabbits are there compared to grass? _____%

i. *Hint: Number of rabbits \div number of grass \times 100*

B. How many snakes are there compared to rabbits? _____%

C. How many hawks are there compared to snakes? _____%

2. Summarize: Based on your data, about how much energy is passed “up” from one trophic level to the next at each energy transfer?

3. Apply: Based on this information, why do most food chains only contain four or at most five trophic levels?
