


## Student Exploration: Rabbit Population by Season

### Gizmo Warm-up

A **population** is a group of individuals of the same species that live in the same area. The size of a population is determined by many factors. In the *Rabbit Population by Season* Gizmo™, you will see how different factors influence how a rabbit population grows and changes.




- Select the BAR CHART tab. What is the size of the initial rabbit population? \_\_\_\_\_
- Select the TABLE tab. Click **Play** (▶), and allow the simulation to run for one year.
  - In which season did the rabbit population increase the most? \_\_\_\_\_
  - In which season did the rabbit population increase the least? \_\_\_\_\_

|                          |   |  |
|--------------------------|---|--|
| <b>Activity A:</b>       | <u>Get the Gizmo ready:</u>   |  |
| <b>Carrying capacity</b> | <ul style="list-style-type: none"> <li>Click <b>Reset</b> (↺).</li> </ul> |  |

### Question: What determines how large a population can grow?

- Think about it: A **limiting factor** is any factor that controls the growth of a population. What do you think are some of the **limiting factors** for the rabbit population? \_\_\_\_\_  
\_\_\_\_\_
- Run Gizmo: Select the DESCRIPTION tab. Set the **Simulation speed** to **Fast**. Select the GRAPH tab. Click **Play**, and allow the simulation to run for at least 10 years. (Note: You can use the zoom controls on the right to see the whole graph.)
  - Describe how the rabbit population changed over the course of 10 years.  
\_\_\_\_\_
  - What pattern did you see repeated every year? \_\_\_\_\_  
\_\_\_\_\_
  - How could you explain this pattern? \_\_\_\_\_  
\_\_\_\_\_


3. **Analyze:** The **carrying capacity** is the maximum number of individuals of a particular species that an environment can support. All environments have carrying capacities.
- A. What is this environment's approximate carrying capacity for rabbits? (Note: Average the summer and winter carrying capacities.) \_\_\_\_\_
- B. When did the rabbit population reach carrying capacity? Explain how you know.  
\_\_\_\_\_

|  |   |   |
|--|---|---|
| <p><b>Activity B:</b></p> <p><b>Density-dependent limiting factors</b></p> | <p><u>Get the Gizmo ready:</u></p> <ul style="list-style-type: none"> <li>• Click <b>Reset</b>.</li> <li>• On the SIMULATION pane, make sure <b>Ample</b> is selected for the amount of <b>LAND</b> available.</li> </ul> |  |
|--|---|---|

**Introduction:** **Population density** is the number of individuals in a population per unit of area. Some limiting factors only affect a population when its density reaches a certain level. These limiting factors are known as **density-dependent limiting factors**.

**Question: How does a density-dependent limiting factor affect carrying capacity?**

1. Think about it: What do you think some **density-dependent limiting factors** might be?  
\_\_\_\_\_
2. Predict: Suppose a shopping mall is built near a rabbit warren, leaving less land available for rabbits. How will this affect the environment's carrying capacity?  
\_\_\_\_\_
3. Experiment: Use the Gizmo to find the carrying capacity with **Ample**, **Moderate**, and **Little** land. List the carrying capacities below.
- Ample: \_\_\_\_\_ Moderate: \_\_\_\_\_ Little: \_\_\_\_\_
4. Analyze: How did the amount of space available to the rabbits affect their carrying capacity?  
\_\_\_\_\_
5. Challenge yourself: Other than space, what might be other density-dependent limiting factors? \_\_\_\_\_

|   |   |  |
|---|---|--|
| <b>Activity C:</b><br><b>Density-independent limiting factors</b> | <u>Get the Gizmo ready:</u> <ul style="list-style-type: none"> <li>• Click <b>Reset</b>.</li> <li>• On the SIMULATION pane, select <b>Ample</b> for the amount of <b>LAND</b> available.</li> </ul> |  |
|---|---|--|

**Introduction:** Not all limiting factors are related to a population's density. **Density-independent limiting factors** affect a population regardless of its size and density.

**Question: How do density-independent limiting factors affect how a population grows?**

1. Think about it: What do you think some **density-independent limiting factors** might be?

---

2. Gather data: Click **Play**. Allow the population to reach carrying capacity. Click **Pause** (||). Select the GRAPH tab

3. Predict: How do you think a period of harsh winters will affect the rabbit population?

---

4. Investigate: Click **Reset**. Select **Harsh winter** from the **CONDITIONS** listed on the SIMULATION pane. Click **Play**, and observe the how the population changes over five years.

A. How does the Harsh Winter graph differ from the Normal Weather graph? \_\_\_\_\_

---

B. What do you think most likely caused the differences seen in the two graphs?

---

5. Predict: How do you think a period of hot summers will affect the rabbit population?

---

6. Investigate: Deselect **Harsh winter**. Select **Hot summer**. Click **Play**, and observe the how the population changes over a period of five years.

A. How does the Hot Summer graph differ from the Normal Weather graph? \_\_\_\_\_

---

B. What do you think most likely caused the differences seen in the two graphs?

---

7. Think and discuss: Other than unusual weather, what might be another density-independent limiting factor that could affect the rabbit population?

---