Activity 7: Variations and Adaptations

In Activity 6, students learned that ecosystems include both living and nonliving components. Living parts include plants and animals. Nonliving parts include sunlight, land, and water. In this activity, students experiment with how the weather affects plant growth. They are reminded that there is variety in both plants and animals and that different variations are adapted to live best under certain conditions. Students first investigate the affect of rainfall on grass plants. Can certain types of grass live in drought conditions? Then, they experiment to see which type of grass each variety of rabbit prefers to eat.

Although they do not test the direct relationship between rainfall amount and the rabbit population's ability to survive, students are encouraged to make this connection by thinking first about rainfall and plants, then about plants and rabbits. Students should be able to infer that when certain plants cannot grow and reproduce, the rabbits that eat those plants will not have enough food to survive. In this way, students are introduced to the concept of interdependence in an ecosystem.

To prepare for the activity, please read this guide carefully and run the activity before you run it with students.

Learning Goals

Big Idea 3: Organisms and Their Environment

- An organism thrives in specific environments that match its specific needs.

Big Idea 6: Interactions Between Species

- An ecosystem is a collection of interacting organisms, as well as their physical environment.
- Other plants and animals, as well as the environment, can affect the survivability of plants and animals.
- Animals obtain energy and resources by eating other animals and plants (food web).

Big Idea 7: Intra-specific differences

- Individuals of the same species may differ.

Model: Rainfall and Plant Growth Experiment

In this activity, your students will first run the "Rainfall and Plant Growth Experiment" (page 3).

Students select a level of rainfall, then add plants to the Virtual Ecosystem. They watch the model for 20 seconds to see which plants grow at that rainfall amount. At that time, a dialog box pops up, directing students to look at the graph.

The graph is a moving bar graph showing the amounts of each variety of the grass population over time. It stops at 20 seconds. Students do not need to look at exact numbers of plants, but instead they are instructed to think about a threshold level. Which types of grass grow to have more than 50 in their population in a specific level of rainfall?

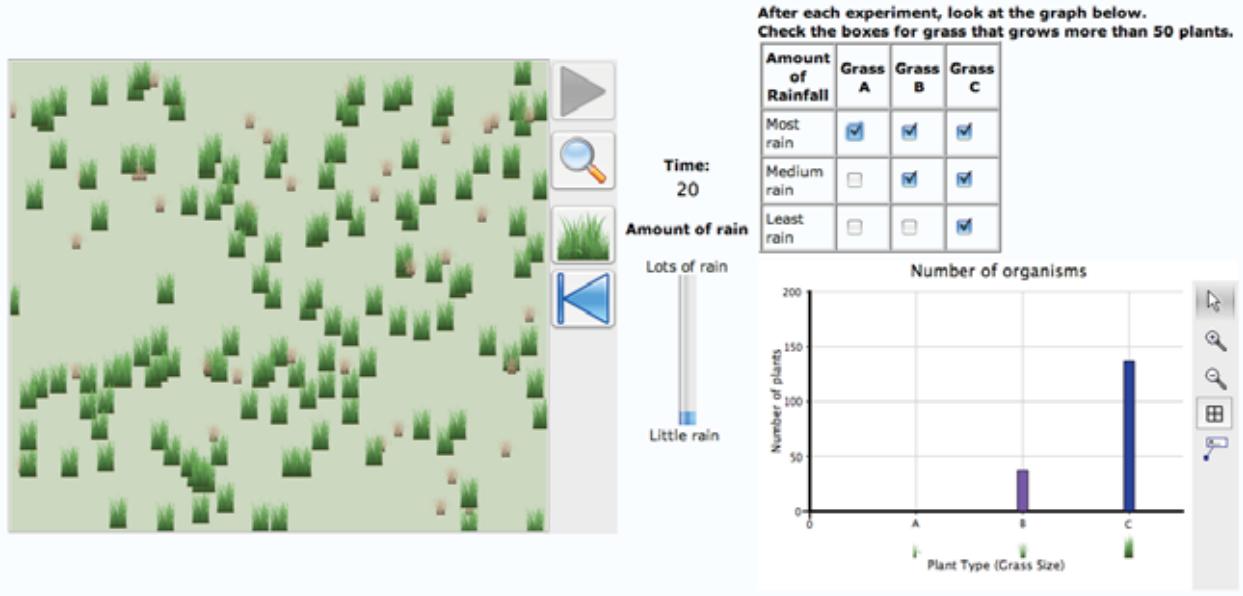
Students run this experiment **three times,** testing each level of rainfall (most rain, medium rain, least rain).

Their completed data table should look like this:

After each experiment, look at the graph below.
Check the boxes for grass that grows more than 50 plants.

Amount of Rainfall	Grass A	Grass B	Grass C
Most rain	☑	☑	☑
Medium rain	☐	☑	☑
Least rain	☐	☐	☑

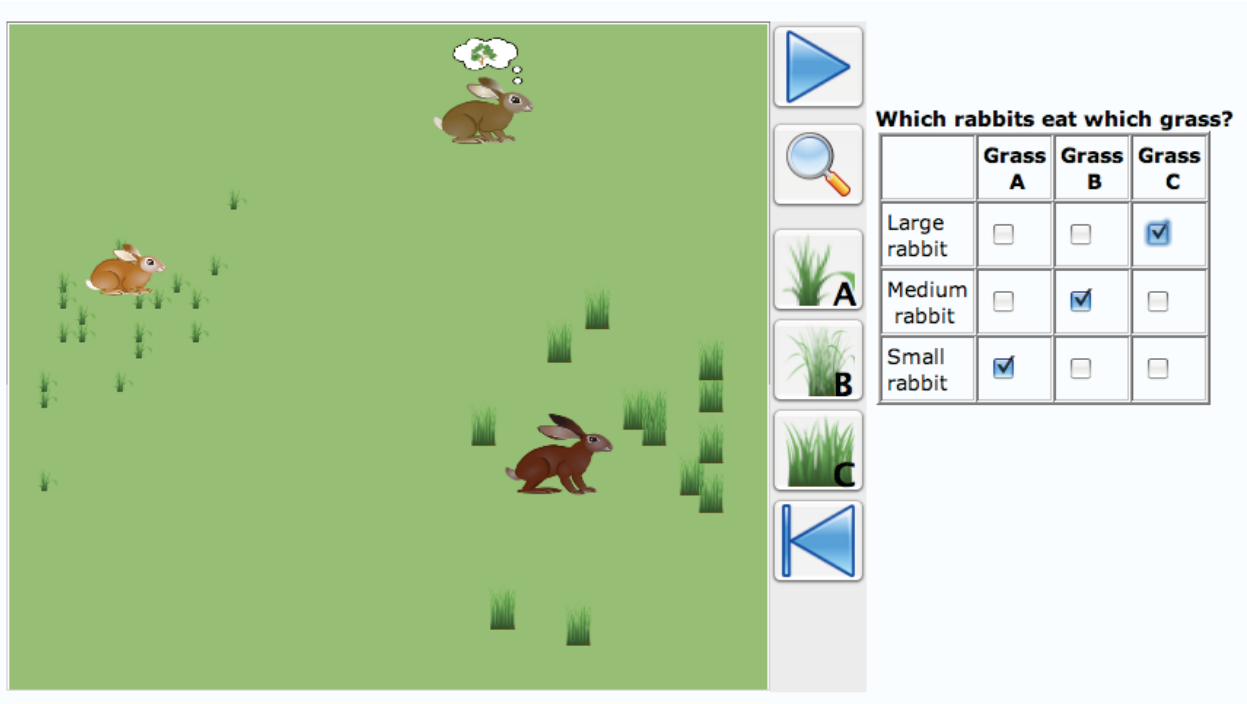
Note: In order to collect valid data for each level of rainfall, students should allow the model to run for 20 seconds (a pop-up message appears then, directing students to fill in the table and then try another rainfall level).



Model: Feeding Rabbits Experiment

In the "Feeding Rabbits Experiment" (page 6), students determine which grass each rabbit prefers to eat. They learn that small, medium, and large rabbits each eat a different type of grass. This simple experiment sets them up to make the connection between rainfall amount, plant growth of the different varieties of grass, and survival of different varieties of rabbits.

The small rabbit eats the shortest grass, Grass A. The medium rabbit eats the medium grass, Grass B. The large rabbit eats the tallest grass, Grass C. If students plant a lot of different grasses at one time, they may find it difficult to determine which rabbit eats which grass. Students can reset the model to clear the grass and try planting one type of grass at a time or planting the three types of grass in different parts of the field.



Note that in this model, the rabbits do *not* die of starvation. They do get a "hunger thought bubble" over their heads when they reach a certain hunger level.

Model buttons

Make sure you run the model before your students start this activity to ensure that you are familiar with the model and the control buttons. Below are descriptions of the control buttons.

Review the use of these buttons with your students before they run the activity.

Click the Play button to start the model. Use the Pause button to stop it.

Use the magnifying glass to get more information about a plant.

In the first model, click the grass button to add <u>all three types of grass</u> to the Virtual Field.

In the second model, click a plant variety, then <u>click inside the Virtual Field</u> to plant that type of grass.

Note: Planting the grass in different areas of the field may help students to figure out which type of rabbit eats which type of grass.

Click the Reset button to reset the model to its original condition.

The glossary contains definitions for the vocabulary words (in blue) used in this activity. Students can click on individual blue words for pop-up definitions or click the Glossary icon for the complete glossary.

Lesson Plan

1. Estimated time

This activity should take approximately 45 minutes.

2. Introduce the activity (Engage)

Students know that all animals need to eat to survive.

Ask: Why don't all animals live in all environments? Why don't you find polar bears in the desert and camels in the Arctic? Animals' bodies are adapted to live in certain places—polar bears would be super hot in the desert and camels would have a hard time walking on ice! These animals wouldn't be able to find the foods they need in these environments either. Polar bears won't find seals in the desert and a camel would be hard pressed to find dry grass growing on the ice.

The rabbits in the Virtual Ecosystem eat grass. They cannot live where there is no grass for them to eat. They need to live where their food grows.

Ask students to remember the plant activities. They learned that different varieties of plants live best under different conditions. What did the Mystery Plants need to survive? (Answer: Some need more or less sunlight, some need more or less water.) Tell students that in this activity, they will experiment with the grass living in the Virtual Ecosystem. They will find out what the grass needs to grow best. They will also find out if different types of rabbits like to eat the same type of grass.

As students run the activity you may want them to keep the following discovery question in their minds. Write this question on the board so that students can see it during the class period.

How does a change in the environment affect the different plants and animals living in that environment?

3. Guided inquiry (Explore)

Have students run the activity.

Refer to the stop sign symbols 

in the following section. Stop on those activity pages and lead a full-class discussion.

If students are working in pairs or small groups, explain to them that they should discuss their answers with classmates, and then type their answers directly into the computer.

Page 1
No questions.

Page 2
No questions.

Page 3
No questions.

Student data tables should look like this:

Record your data in the table below.

Amount of Rainfall	Grass A	Grass B	Grass C
Most rain	☑	☑	☑
Medium rain	☐	☑	☑
Least rain	☐	☐	☑

Make sure students understand that they check in the boxes for the grass only if it grew to more than 50 on the y-axis. Ask students: Why does a grass that can live in different levels of water have a better chance of surviving when the environment changes? Have a few students answer this question and point out that the tall grass has an advantage over the other two varieties.

Page 4

Q1. Which type of grass grew best in all levels of rainfall?
A. Grass C

Q2. Which grass is best adapted to live with the least amount of water?
A. Grass C

Q3. How do you think rainfall might affect rabbits living in the field?
A. Student answers will vary. The rainfall affects the plants and since the rabbits eat the plants, they will be affected. If there isn't enough rain, there won't be enough food for the rabbits. They will not be able to survive in the field.

Page 5
No questions.

Page 6
No questions.

Student data tables should look like this:

	Grass A	Grass B	Grass C
Large rabbit	☐	☐	☑
Medium rabbit	☐	☑	☐
Small rabbit	☑	☐	☐

Page 7

Q4. Look at the table above. Do all the rabbits like to eat the same type of grass?
A. No

Q5. What would happen to the rabbit population if Grass C were removed from the ecosystem?
A. The large rabbits would die.

Q6. What kind of changes in the environment might cause grass to die?
A. Student answers will vary. They should describe rainfall amount, though they may also think about global warming/temperature, or amount of sunlight.

Page 8
No questions.

Wrap up the activity with the discussion below.

4. Discuss the activity (Explain)

After your students run this activity you may want to discuss what students concluded from the activity. In addition, it is important to discuss the discovery question with your students.

> *How does a change in the environment affect the different plants and animals living in that environment?*

Environmental effects

Make sure students understand that a change in the rainfall affected not only the grass, but also the rabbits that rely on that grass for food. What other animals might be affected if there were a drought? Students may list other herbivores, such as squirrels and deer. Ask students how they think foxes or hawks might be affected. What do these predators eat? If there is no grass and no rabbits, would these predatory animals be able to survive? (Although this activity does not include predators, you may want to start to discuss more complete food chains and food webs.)

Here is a real-world example: The Earth's climate is getting warmer. Some people think that human activity and pollution is making the Earth heat up. Other people think that it is just a natural cycle in the

Earth's history—sometimes the Earth is warmer and sometimes it is cooler. Either way, when the environment changes, animal populations have to adapt to the new environment or they will go extinct.

Right now, animals like polar bears are having trouble living in a warmer climate. They use the frozen ice to hunt for their food. Since the ice where they live is melting, they are forced to swim greater distances for their food. Polar bears are good swimmers, but they certainly aren't fish. Over time, how might polar bears adapt to live in an environment with more water and less ice?