Activity 6: The Virtual Ecosystem

Animals are introduced to the Evolution Readiness activities as part of a "Virtual Ecosystem." In this activity, students try to keep a rabbit alive in a field with plants. Then they must keep one rabbit alive in that field with a population of other rabbits. Since the plants are food for the rabbits, students begin to understand a simple ecosystem and see that changes in one population affect changes in another dependent population. Students also learn about competition for resources since there is a limited amount of plants and multiple rabbits are trying to eat to survive.

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

Learning Goals

Learning goals highlighted in blue may be new to students as they have not been covered in prior computer activities.

Big Idea 1: Basic Needs of Organisms

- Plants and animals need air and water; plants also need light and nutrients; animals also need food and shelter.

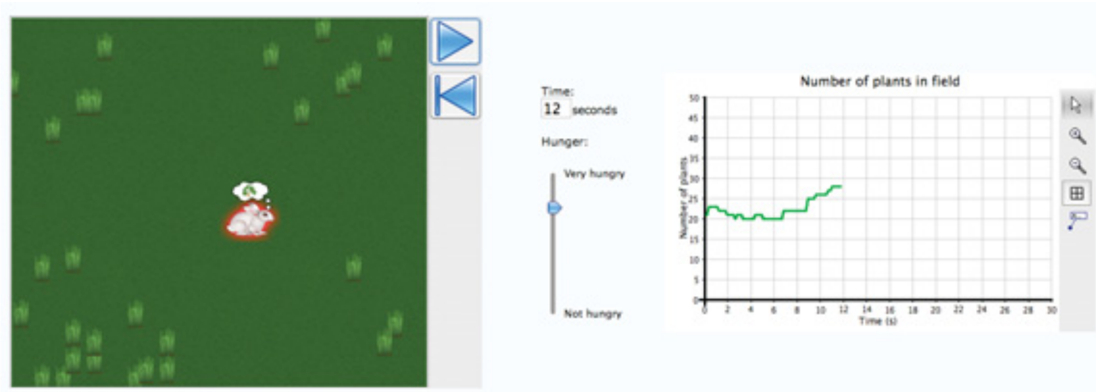
Big Idea 6: Interactions Between Species

- Organisms with similar needs compete with one another for resources.
- Animals obtain energy and resources by eating other animals and plants (food web).
- An ecosystem is a collection of interacting organisms, as well as their physical environment.

Model: Virtual Ecosystem

In this activity, your students will use the "Virtual Ecosystem" model (found on pages 2 and 4 of the activity).

First, students control a rabbit, moving it with keys on their keyboard to "eat" plants in the field. The goal of the model is to keep the rabbit alive for 30 seconds. (If the rabbit gets too hungry, it will die of starvation.)



In the first model (above, on page 2 of the activity), the student controls the rabbit using the arrows on the computer keyboard (up, down, left, and right). The goal is to keep the rabbit alive for 30 seconds by moving it over plants, which it eats to stay healthy. A hunger gauge keeps track of how hungry the rabbit is. Notice that a “thought bubble” appears over the user-controlled rabbit when it is very hungry (see hunger scale).

A graph shows the number of plants over time. Plants grow and are eaten by the rabbit, and the graph records these fluctuations.

 In the plant activities, data about plant growth was recorded in bar charts. In this activity, students are introduced to a new type of graph – a line graph. Be sure students are comfortable using line graphs. This line graph shows the number of plants in the field. As the rabbit eats more plants, the line will show the decrease in the number of plants.

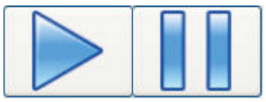
Note that a rabbit may “die” before the student has learned how to control the rabbit’s movement, allowing it to find food. If this happens, a message pops up, telling students, “The bunny died because it was not able to find enough food to live. Click Reset and try again!”

In the second model (above, on page 4 of the activity), the user-controlled rabbit is joined by other rabbits in the field. All rabbits need to eat plants to survive, which means they are all competing for the same resource. The computer-controlled rabbits eat before they get too hungry. The goal of this model is to keep the user-controlled rabbit alive for 100 seconds. Students will quickly discover that it is more difficult to find enough food when they are competing with other rabbits.

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.

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)

Lead brief class discussion before running the activity.

All of the Evolution Readiness activities that students have done on the computer have focused on plants. Students will be excited to learn that they will now work with animals!

Students often instinctively know something about food webs. They know that some animals eat plants for food. These animals are called herbivores. Ask students about animals in your local ecosystem. What herbivores are they familiar with? For instance, what do squirrels eat? Or what do deer eat? What happens if there is not enough food for the animals living in an area? (Answer: They die of starvation or they move to a new area in search of food.)

If you have already completed the Clipbirds activity, you could also engage students in a conversation about competition for resources. What was it like to go after food while other students were also trying to get food? Was it difficult or easy? Did it make them try harder to find food?

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.

What does "competition for resources" mean?

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.

Review the line graph with students. Students will need to interpret a screenshot of a line graph on page 4, so this is a good opportunity to practice graph interpretation skills.

Page 3

Q1. Before you go to the next page, make a prediction. Do you think it will be easier or more difficult for your rabbit to survive when other rabbits are in the field?
A. It will be harder for my rabbit to survive.

Q2. Why do you think so?
A. Student answers will vary depending on their prediction above.

Note: Since this pair of questions is based on a prediction, students do not get immediate feedback (via a pop-up message) about their response to the multiple-choice question. Instead, they can test for themselves what will happen in the model on the following page.

Page 4
No questions.

- After students run the model, ask if any students were successful at keeping "their" rabbit alive for 100 seconds.
- Have them explain their strategy.
- Ask students what happened to the plants when more rabbits came into the field. Be sure students look at the graph of plants in the field.

Page 5

Q3. Look at the graph above. Between 0 and 10 seconds, what happened to the plant population?
A. The plant population stayed about the same.

Q4. Look at the graph above. Between 10 and 30 seconds, what happened to the plant population?
A. The plant population decreased.

Q5. What do you think would happen to the **rabbit** population after another 10 seconds?
A. The rabbit population will decrease.

Page 6

Q6. If there are the same number of plants in the field with groundhogs and rabbits, what do you think will happen?
A. Some of the animals will not get enough to eat and will starve.

Page 7

Q7. List two nonliving things in the ecosystem above.
A. Student answers will vary and may include air, water, or sand (soil/dirt).

Q8. List two living things in the ecosystem above.
A. Student answers will vary and may include zebra, giraffe, grass, or trees.

The scenic African photograph shows an ecosystem. At this point, you could show additional photographs of ecosystems (for instance, aquatic or prairie ecosystems, etc.). Ecosystems are very complex. In this activity, we are focusing on competition for resources. In other activities, we will look at changes in one population affecting changes in another population.

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. It is important to discuss the discovery question with your students:

What does "competition for resources" mean?

Competition for resources

What do animals living together in the same environment need to live? They need space, water, food, and a mate to have offspring. There is not an endless supply of any of these things, so animals must compete for these resources.

Competition for resources between the same species (like the rabbit population in the model on page 4 of the activity) is called intra-species competition. Each animal in a population needs to find enough food to eat and avoid predators. If some animals are better at finding food and running away from predators, they are more likely to live long enough to have babies. These animals will be more likely to pass on those traits to their children. Animals who were unable to find food or avoid predators will die before having offspring.

Competition for resources between different species (as described on page 7 of the activity, when a hypothetical population of groundhogs moves in) is called inter-species competition. Chipmunks, squirrels, groundhogs, and rabbits often compete for the same food in a field environment. There are just so many plants for them to eat. If there are too many animals living in one area, there may not be enough food for all the animals, which will force some members of the population to move elsewhere for food or they will die.

Students may have heard of invasive plants or animals. These are plants or animals that aren't native to an environment. One invasive plant, called Kudzu, was introduced to the United States in 1876. Kudzu was brought to the United States to help with soil erosion. In a little over 100 years, this plant beat out the native plants and tress in the southern forests and has taken over. Kudzu grows so well because of its unique adaptations like deep roots and its ability to grow over other plants. In the competition for resources (like light and nutrients), Kudzu won!

Kudzu vines completely cover trees in the forest above.