



Activity 3: Mystery Plant Adaptation

In this activity, students pick up where they left off at the end of Activity 2. They return to the Virtual Greenhouse to examine the variation in offspring of another Mystery Plant. Again, students move plants to flower boxes that match their needs, but this time, they start with a different type of plant. Finally, students plant one plant type in the Virtual Field and observe how populations of plants can adapt to new environments over many, many generations due to inherent variations.

Learning Goals

Big Idea 3: Organisms and Their Environment

- An organism thrives in specific environments that match its specific needs.
- Selection based on water or sunlight would lead a population (not an individual) of plants to migrate from one area to another.

Big Idea 7: Intraspecific Differences

- Individuals of the same species may differ.
- Not all offspring from the same parents look alike, even with respect to inherited traits.

Big Idea 8: Adaptation/Evolution

- Species are adapted to their environments and species adapt to changes in their environment. If the environment changes only certain species survive.
- Organisms with traits best suited to their environment have better chances of survival.

Big Idea 9: Heritability of Traits

- Offspring inherit some, but not all, of their traits from their parents.
- There are differences between traits that are inherited and traits that are not.

Big Idea 10: Reproduction

- Organisms have offspring.
- Without reproduction, a plant or animal species cannot continue.

Big Idea 11: Descent with modification

- Species evolve from common ancestors.
- Different species could arise from one species if different groups had different selection pressures.

The Models

In this activity, your students will use a model of the “Virtual Greenhouse” (page 2) that is nearly identical to the one at the end of Activity 2. In this case, the first parent plant is Leaf Size 2, with Leaf Sizes 1 and 3 as variations.

The flowers in this model produce offspring that vary from the parents. This means that offspring may not all be suited to the flower box they are found in. Make sure your students observe the differences by clicking on the Information Tool and then clicking on each of the plants.



Students can click the Carry button and then click on any plant in the model to carry it to a new location. Have students hold the mouse down as they drag the plant to a different flower box (the roots will be visible now!). When they let go of the mouse, the plant will be planted in a new location.



Figure 1. Flower box model.

On page 5 (Figure 2) of the activity there is a model that is similar, but not identical to the first “Virtual Field” model of Activity 2. The plants in the field now produce seeds with variations. The goal of this model is to have your students plant seeds of only one variety of plants and observe the change in plant population over time. There is only one seed packet button. Also notice the speed slider above the model, which speeds up the model. Be sure to point this out to students after they have had a chance to observe the model for a few generations.



The graph is key to understanding how the population is changing. When students start the model there will only be one line on the graph, but as the model runs there will be more and more varieties of plants. Spend time as a class interpreting the graph. Use the Information Tool to click on plants to determine which size leaves they have and map those to the graph.

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.

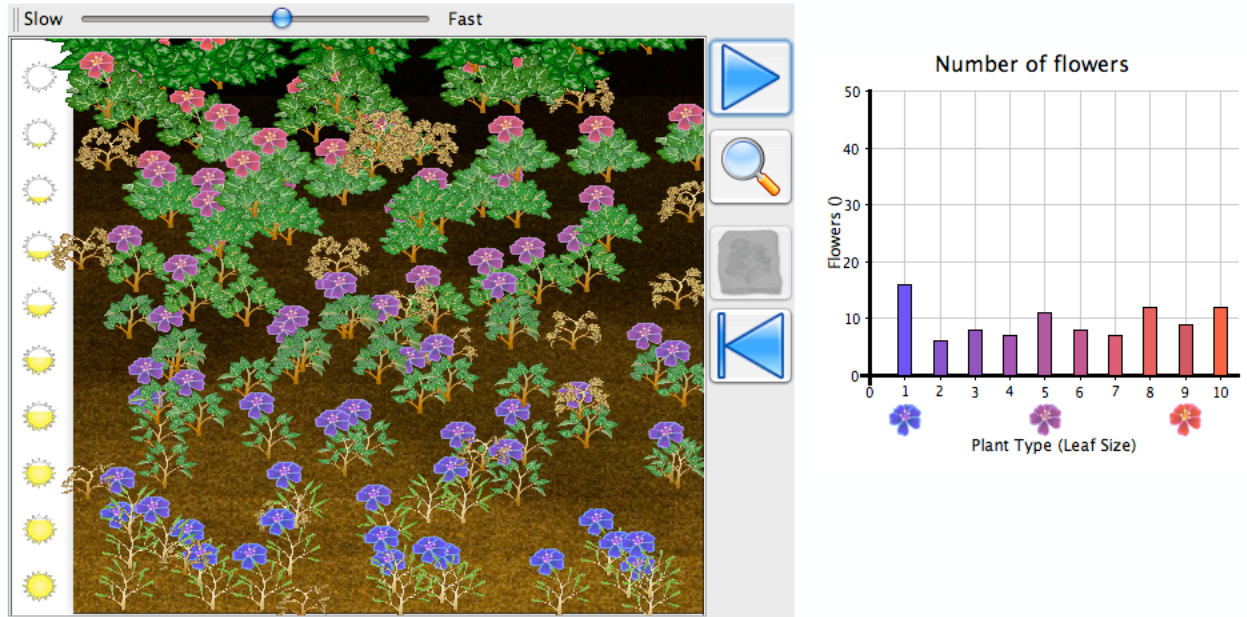


Figure 2. Virtual Field model with plants throughout the field and corresponding graph, showing healthy (flowering) plants.



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



Click the Information Tool and then click on a plant in the model for information about the plant.



Click a seed packet icon and then click in the field to plant a seed of that variety. Each seed packet contains 20 seeds. (Click the Play button to start the model and the plants will grow. The bushy plants will only grow and flower in the least amount of light. The thin plants will grow best with the most sunlight. The medium plants will grow best with a medium amount of sunlight.)

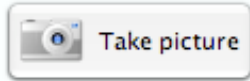
Note: When students use all the seeds in a packet, the icon will grey out. Students can get more seeds by Resetting the model.



The Carry button allows students to pick up a plant and move it to a different location. Students should notice the root size and shape for each plant when they move plants from one box to another. Note: if students drop a plant outside of a flower box, the plant dies.



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



Click the Take picture button to take a picture of the model. (Note: when you take a picture, the model pauses. You must click Play to restart it.) You can annotate your picture.



The Lab Book holds all pictures.



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)

Have students think about the Mystery Plants in Activity 2.

- How were some of the offspring Mystery Plants different than their parents? Make sure that students understand that all plants and animal babies have variation, not just certain Mystery Plants.

3. Guided inquiry (Explore)

As students run the activity you may want them to think about the following discovery questions:

- Describe variation.
- How might differences in the offspring be related to its chances of survival in the same environment? In a different environment?

4. Discuss the activity (Explain)

After your students run this activity, discuss what students concluded from the activity (answers to questions in the activity are included below). In particular, it is important to discuss the following with your students:

- 1) Variation
- 2) How is variation related to the adaptations of organisms to the environment?

Below are suggestions for discussion questions:

Variations in plants and animals

How does the plant model show that baby plants are different from their parents? How are the plants in the Virtual Greenhouse model different from the ones in Activity 2? (Answer: These are Leaf Size 2 plants and in Activity 2, students planted Leaf Size 5 plants. The point in repeating the model is to show students that all plants have variation, not just Leaf Size 5!)

Adaptation

How do these differences in the plants affect where they can grow? (Answer: Differences in leaf size allow different plants to thrive under different levels of sunlight.)

What caused the plants to spread across the field? (Answer: Variation in the plant offspring enabled some babies to live in different parts of the field. Variation in subsequent generations of offspring allowed the plant population to spread across the entire field.)

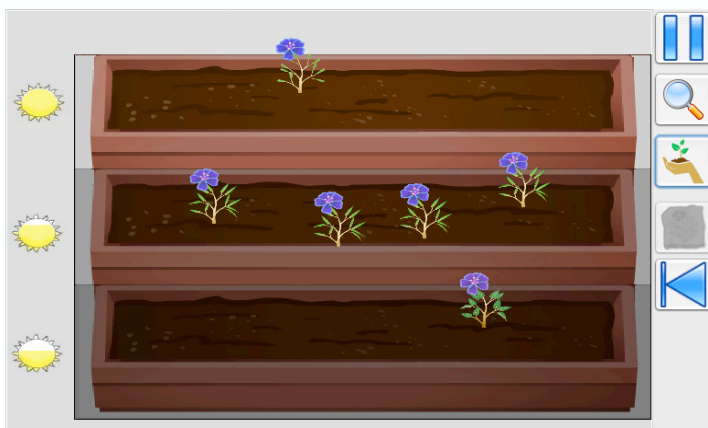
What are some other real-world examples where adaptation might help plants or animals survive in their environment?

Answers to Questions

Page 1

No questions.

Page 2



Student pictures should show a total of six flowering plants – four in the middle flower box and one each on the top and bottom flower boxes.

Page 3

No questions.



Ask students to describe plant adaptations. Students might describe the long taproots that help desert plants get water from deep below the ground or they might describe leaf size on real plants or the Mystery Plants that help the plant get sunlight.

Page 4

Q1. Which adaptations help the Mystery Plants survive?

A. Size of leaves

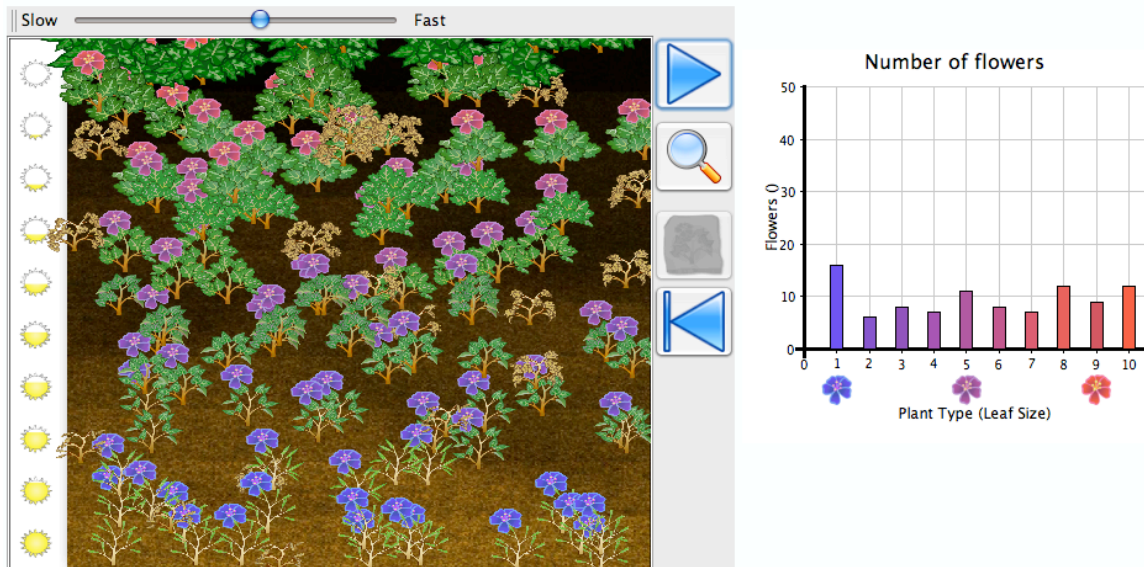
Q2. Cactus plants have spines. In addition to preventing water loss, what else do you think this adaptation is good for?

A. To keep away predators

Page 5

Q3. What do you think will happen to the offspring?

A. Student answers will vary. Students should describe the parent plant of Leaf Size 5 having some offspring that are a little different. Those different offspring will need different amounts of sunlight, so if the seeds fall in the row with the right amount of sunlight, they will grow and produce flowers, then seeds. Some of those seeds will be a little different than the parent.



Student pictures should have plants growing throughout the field, as above.

Page 6

Q4. In this graph, how many types of plants have flowers?

A. 1 type of plant

Q5. When was the picture of this graph taken?

A. After one season. [Some students may respond, "After a few seasons." This is correct if the student had planted one or only a few seeds in the correct row corresponding to the right sunlight level for the Leaf Size 5 plant.]

Q6. In this graph, how many types of plants have flowers?

A. 10 types of plants

Q7. When was the picture of this graph taken?

A. After many, many seasons.

Q8. You only planted one type of flowering plant. How did so many types of plants grow?

A. Student answers will vary. Sample responses include the following:

"The ones that survived and would be healthy would have seeds and if they were adapted, they would grow."

"Sometimes the 5's have baby 5's and sometimes there are some 4's and some 6's and if those land in the 4 or 6 zone, they would live and be healthy and flower and have seeds and it would go on, and those 4's would have some 3's and some 5's, and so on!"

"The plants did it. They kept making babies. The babies started changing. Seeds got scattered. So the plants that got planted in the sunny spot gave birth to plants that needed lots of sun."*

* **Note:** there may be a possible misconception here. Plants that are healthy in sunny spots will tend to produce baby plants like themselves—that is, that also grow best in lots of sun. Those plants will also produce babies with variations, however, so these plants may produce a seed that would grow best in a different amount of sun. If that seed happened to fall in the horizontal strip of field with the right conditions, it would grow to be healthy and produce seeds.

Page 7

No questions.



Students may have heard of Charles Darwin and his finches. Lead a short discussion on bird beaks and adaptations. Ask students what it means that the variations in the population helped some birds to survive.

Page 8

No questions.