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

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

Big Idea 3: Organisms and Their Environment

- Selection based on water or sunlight would lead a population (not an individual) of plants to migrate from one area to another.

Big Idea 4: Classification of Organisms

- Plants and animals can be classified into species and other types of groups based on the characteristics they share.

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.

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. Note: students must wait several seconds after the first flowering plant drops its seeds before the new generation of plants begins to grow. Pop-up messages tell students what to notice and to do.

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. It will take some time for the plants to spread through the field.

The graph is key to understanding how the population is changing. When students start the model there will only be one bar 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.

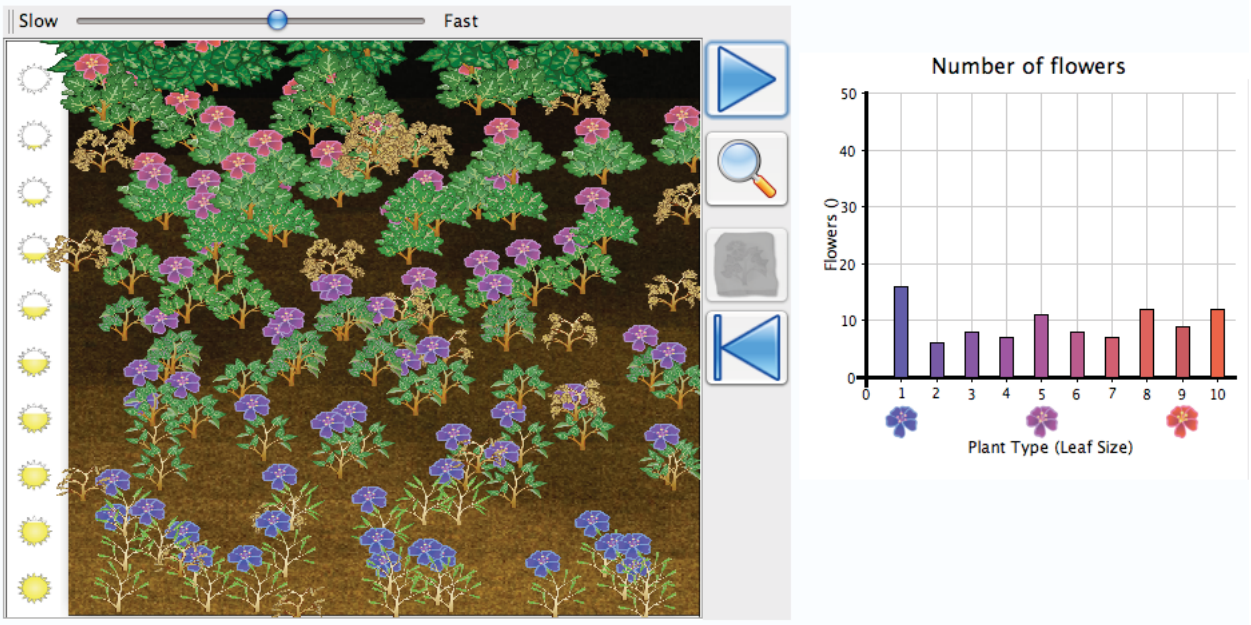


Figure 2. Virtual Field model with plants throughout the field and corresponding graph, showing healthy (flowering) plants.

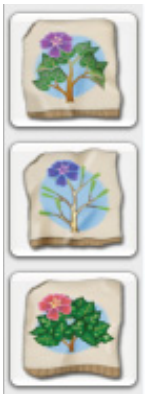
Model buttons

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

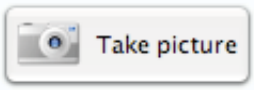


Click a seed packet icon and then click in the field to plant a seed of that variety. Each seed packet contains 20 seeds. (Click the Play button to start the model and the plants will grow. The bushy plants will only grow and flower in the least amount of light. The thin plants will grow best with the 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, it will go back to its original location.

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)

Lead a brief class discussion before running the activity.

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.

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 do variations in a species help a population adapt to a new 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

Q1. This is a Leaf Size 2 plant. Will all its offspring plants have the same size leaves?
A. No.

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

Q2. If all the seeds from the parent plant blew away in the wind and landed in a shadier spot, do you think any of the offspring would grow? Why or why not?
A. Student answers will vary. Because there is variation in offspring seeds, some seeds will require less light and be able to grow in a shadier location. (Some seeds may require more light; they would not grow in a shadier spot.)

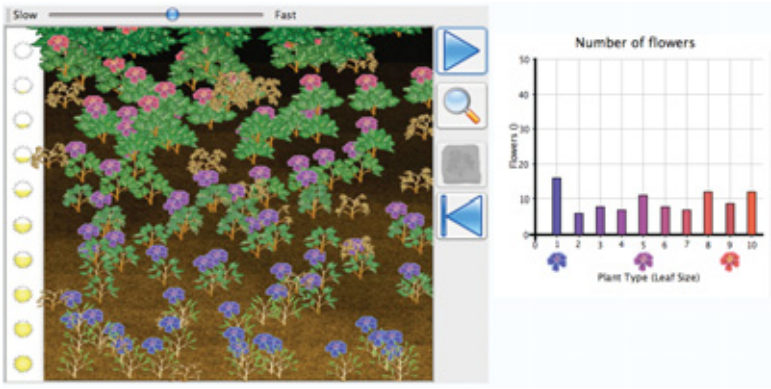
Page 4

Q3. 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

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 5

Q4. Make a prediction. How many different kinds of plants will be growing in the field after many seasons?
A. Many types of plants. [Note: this is a prediction question, so there is no automatic feedback.]



Student pictures should have plants growing throughout the field, as above. Make sure students run the model long enough to allow the plants to spread.

Page 6

Q5. In this graph, how many types of plants have flowers?
A. 1 type of plant

Q6. When was the picture of this graph taken?
A. After one season.

Q7. In this graph, how many types of plants have flowers?
A. 10 types of plants

Q8. When was the picture of this graph taken?
A. After many seasons.

Q9. You only planted one type of flowering plant. How did so many types of plants grow?
A. Student answers will vary. Students should understand that plant seeds scatter and seeds may land in an adjacent environment. If these seeds grow into plants with slightly different leaf sizes than the parents, they may thrive in the new environment and produce seeds of their own.

Sample student 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!"

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.

Wrap up the activity with the discussion below.

4. Discuss the activity (Explain)

After your students run this activity, discuss what students concluded from the activity. In particular, it is important to discuss the discovery question with your students:

> *How do variations in a species help a population adapt to a new environment?*

Below are suggestions to help guide the discussion for the two parts of this question (variations and adaptations):

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: Each healthy plant releases seeds and these seeds have variation. Most will grow into the same type of plant, but some will grow into a plant with a slightly different leaf size if planted in the right environment. If one of these different seeds landed in an adjacent environment, this variation enabled the offspring to live. Variation in subsequent generations of offspring allowed the plant population to spread across the entire field.)

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