LONGWOOD GARDENS

Operation Pollination Program

Pre- and Post-Activities

BACKGROUND FOR TEACHER

Students will have an opportunity to investigate how flowering plants have developed with their pollinator partners and learn about the importance of pollination. While visiting the display Garden, students will get a close look at the parts of the plant that make pollination possible**.**

Pollination is the act of transferring pollen grains from the male anther of a flower to the female stigma. The goal of every living organism, including plants, is to create offspring for the next generation. One of the ways that plants can produce offspring is by making seeds. Seeds contain the genetic information to produce a new plant. Flowers are the tools that plants use to make their seeds. Seeds can only be produced when pollen is transferred between flowers of the same **species**.

Flowers must rely on vectors to move pollen from one flower to another. These vectors can include wind, water, birds, insects, butterflies, and other animals that visit flowers. We call animals or insects that transfer pollen from plant to plant **"pollinators"**. Approximately 80% of all plants are pollinated by pollinators. Pollination can occur during the day or at night. Bats and moths are two types of night pollinators, each having a unique flower preference.

The vital connection between plants and animals is evident in Longwood's 86 acre Meadow Garden. Pollinators benefit from the large block of diverse habitat which supports both native plants and pollinators, including the Monarch and Eastern Swallowtail butterflies.

VOCABULARY

Anther	Honey Bee	Pollination
Flower	Nectar	Seed
Fruit	Pollen	Stigma

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NEXT GENERATION SCIENCE STANDARDS FOR OPERATION POLLINATION

Standard: K-8-LS1. From Molecules to Organisms: Structures and Processes
Performance Expectations

3-LS1-1	Develop models to describe that organisms have unique and diverse life cycles but all have in common birth, growth, reproduction, and death.
4-LS1-1	Construct an argument that plants and animals have internal and external structures that function to support survival, growth, behavior, and reproduction.
5-LS1-1	Support and argument that plants get the materials they need for growth chiefly from air and water.

PRE- AND POST-ACTIVITIES

Pollination Tag (K-5)
Curriculum Connections: Science
Materials: Paper, crayons, markers, two-sided tape, cotton balls

1. Give each student paper, markers, and crayons.
2. Ask students to think about and draw their favorite fruit on a piece of paper.
3. Instruct students to flip the paper over and draw a large flower in any shape or color.
4. Give each student a cotton ball. Using a colored marker, have students color the cotton ball.
5. Use a small piece of two-sided tape to attach the colored cotton ball to the center of the flower. The colored cotton ball will be the “pollen” of the flower. (It is a good idea to have a few extra flowers made with cotton ball centers to ensure that all flowers get pollinated in this activity.)
6. Students will place the colored flower on their desk.
7. Depending on class size, pick 2 to 4 students at a time to be “pollinators”. These students can pretend to be bees, butterflies, birds, or any other pollinator. (Keep in mind that the first 2-4 pollinators will end up with two cotton balls.)
8. The pollinators will seek food from one attractive flower in the room.
    a. The pollinators will walk around the room and will take the cotton ball from one flower.
    b. The pollinators will then walk back to their own desk and rub the colored cotton ball on top of their flower.
    c. Next the pollinators will flip the flower to the fruit side, showing pollination occurred.
    d. Now the student with the missing cotton ball will become the pollinator. The new pollinator will fly to a new flower, take a cotton ball, and pollinate his/her own flower.
    e. Once pollinated, the paper is flipped to reveal the fruit.
    f. The game continues in this fashion until all flowers are pollinated and turned into fruits.

Extension/Modification Activity: Students can do this activity outdoors.

No-Bee Barbeque (6-8)
Curriculum Connections: Science, language arts
Materials: Paper, pens/pencils, photo of a bee

1. Begin this activity by showing a photo of a bee and talking about these beneficial insects. How much do the students know about bees? Do the students like bees? Encourage students to share some experiences they have had with bees.
2. Ask the students what it would be like to live in a world without bees. Discuss.
3. Tell the students to imagine being invited to a barbeque. What type of food would be there? What type of desserts would you like to have?
4. Give each student a paper and a pencil to list all the foods that will be at the barbeque. Share ideas.
5. Now tell the students that this barbeque will be taking place in a world with no bees. There will be no bees to sting you and no bees to land on the food. How does that sound? How will having no bees affect the barbeque?
6. Have students think about the list created. Which of the foods require bees for pollination? Have students cross off all foods on the list that came from the ground or were made with something that came from the ground. This includes all fruits or vegetables. Continue thinking about the origin of each item on the list.
7. After some time, discuss how many of the barbeque foods were crossed off the list.
8. What type of barbeque meal did this turn out to be? What surprised you about this activity?

Extension/Modification Activity: Invite students to come up with a plan to increase the number of bees by planting pollinator gardens at home and in the community.

Pollinator Garden Mural (K-5)
Curriculum Connections: Science, language arts
Materials: Large roll of paper, masking tape, colored pencils, markers, crayons, construction paper, glue sticks, *On Meadowview Street* by Henry Cole

1) Prior to beginning this activity, secure large roll paper to a wall or the floor using masking tape.
2) Begin this activity by reading the book *On Meadowview Street* by Henry Cole.
3) Discuss all the beneficial insects and creatures shown in the story. Discuss how the character Caroline made a difference.
4) As a group, create a scene similar to Caroline's yard at the beginning of the book.
5) Encourage students to use a variety of materials (colored pencils, markers, crayons, construction paper, etc.) to create the mural. This can be an ongoing project where students can add to the meadow mural each day. Be sure to reinforce the idea that the flowers will bring the pollinators and wildlife!

6) For example:
    a) Day one: students can “plant” their meadow by drawing, coloring, or creating flowers and trees on the mural.
    b) Day two: students can draw, color, or create bees, butterflies, birds, and other pollinators.
    c) Day three: students can add a pond, salamanders, frogs, fish, and dragonflies.
7) Display the mural in a location for all to see.

Extension/Modification Activity: Use the mural to generate discussion about creating habitat for wildlife and how students can do this at their homes and in local communities.

Feeding the Birds (K-5)
Curriculum Connections: Science
Materials: Pinecones, vegetable shortening (Crisco), popsicle sticks, birdseed, string, paper lunch bags

1. Prepare the materials by putting the vegetable shortening on a plate, the birdseed in a large bowl, and pinecones and string in the center of a table.
2. Discuss how some birds can act as pollinators. Explain that while birds are out seeking nectar or food from plants, they accidently get pollen on their wings or body and carry that pollen from flower to flower.
3. Ask each student to select a pinecone and a piece of string for the activity.
4. Have the students tie the string to the top of the pinecone for hanging.
5. Students can coat their pinecones with the vegetable shortening by rolling the pinecone in the shortening or by using a popsicle stick to apply the shortening.
6. Once the pinecone is coated, students can dip the pinecone in the bowl of birdseed or sprinkle the birdseed on top.
7. Place the coated pinecone in a paper lunch bag for easy transport.
8. Students can hang the birdfeeder from a tree at home or in the neighborhood.

Extension/Modification Activity: If trees are near, hang the pinecone birdfeeders outside the classroom windows. Students can observe the number and types of birds that frequent the feeder. Research can be done on the specific birds in the area.

The Perfect Flower (3-8)
Curriculum Connections: Science
Materials: Paper, pencils, markers, list of questions, large paper for a list

1. Divide students into groups of 2 and give each student a piece of paper and a pencil.
2. Have student 1 ask student 2 a series of questions listed below. Student 1 must record the answers to these questions.
    a. What is your favorite color?
    b. What is your favorite scent?

   c. What is your favorite food?
   d. What is your favorite dessert?
   e. Do you have a favorite shape?
3. Next, have student 2 ask student 1 the same questions and record the answers.
4. Once students have collected the list of favorites, they should return to their own seats.
5. Each student will need a new piece of paper and coloring tools. The goal is to draw a special flower using the partner's favorite preferences (color, shape, etc.).
6. Once all flowers are completed, they can be scattered around the room.
7. Each student will then pretend to be a pollinator in search of the perfect flower. The flower that attracts them will have the qualities shared earlier. Can the pollinator find a flower matching their favorite characteristics to pollinate?
8. Students can check the results with their partners to see how accurate the choices were.
9. Discuss how there are many pollinators in the real world that will only seek out specific flowers. There are many plants in the real world that can only be pollinated by one specific pollinator (i.e. the vanilla orchid).

Extension/Modification Activity: This activity can be developed further by having students draw a real pollinator on the paper that might actually be attracted to the flower drawn. Research can be done to extend this activity identifying other plants with unique pollinator partners.

WEB RESOURCES FOR TEACHERS

USDA Forest Service
http://www.fs.fed.us/wildflowers/pollinators/index.shtml

Kids Gardening
www.kidsgardening.com/

Discovery Education
http://www.discoveryeducation.com/teachers/

Pollinator Partnership
www.pollinator.org/usefulresources.htm

SUGGESTED PRINT RESOURCES FOR STUDENTS

Cole, Henry. *On Meadowview Street*. Greenwillow Books. 2007. Print.

Gray, Rita, and Kenard Pak. *Flowers Are Calling*. HMH for Young Readers, 2015. Print.

Hirsch, Odo. *Darius Bell and the Crystal Bees*. Crows Nest, N.S.W.: Allen & Unwin, 2011. Print.

Hoff, Mary King. *Pollination (World of Wonder).* Mankato, MN: Creative Education, 2004. Print.

Huber, Raymond, and Brian Lovelock. *Flight of the Honey Bee*. Candlewick, 2013. Print.

Loewer, H. Peter., and Jean Loewer. *The Moonflower*. Atlanta, GA: Peachtree, 1997. Print.

Sayre, April Pulley, and Patricia Wynne. *The Bumblebee Queen*. Watertown, MA: Charlesbridge, 2005. Print.