The Pollinators' Journey

Summary

Students perform a short play about threatened migratory pollinators.

Grade Level: K-4; 5-8

Time: 2 to 3 class periods (90 minutes or more)

Subjects: Science, Language Arts, Art, Social Studies

Skills: Evaluation, observation

Learning Objectives:
Students will be able to:

- List four animals that pollinate flowers
- Describe the the relationship between pollinators and the plants they pollinate
- Name three environmental threats facing pollinators today
- State one way that people can help protect pollinators

Materials:
- Video: Pollinators in Peril (Produced by NWF; to order a loaner copy, call 703-438-6001).
- Flower anatomy reference sheet
- Pollinator's Journey work sheets
- Paper
- Pencils
- Pipe Cleaners
- Paper plates
- String
- Glue
- Markers or crayons
- A fresh flower
- Pictures of a monarch butterfly, lesser long-nosed bat, organ pipe cactus and milkweed
- Maps of Southern Arizona, the Sonoran Desert and Mexico
- Books on pollination, flowers, monarch butterflies and nectar-feeding bats

Background

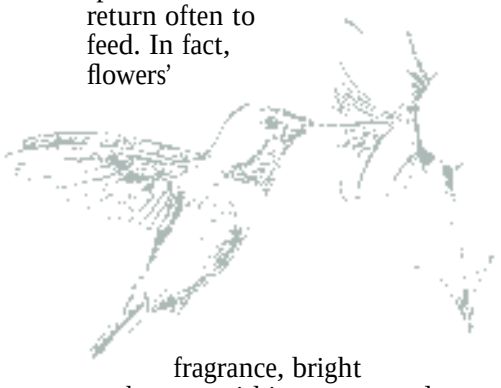
Flowering plants are much more common than non-flowering plants. Many people believe that the success of flowering plants is due in large part to the flower's close relationship with animals in the process called pollination.

Many flowering plants depend on animals to reproduce. Bees, butterflies, hummingbirds, bats, ants, moths, beetles and others visit flowers in search of food. In the process, animals pollinate the flowers, bringing their reproductive cells from one plant to another of the same species. Pollination leads to fertilization, the development of new seeds and, in some plants, fruit. The young seeds (either in fruit or not) may be carried by wind, water or animals to new locations where, if all goes well, they will grow into new plants.

How does the process of pollination work? Flowers contain a plant's reproductive parts, including the male anther and the female pistil. (See page 48 for a diagram). The structure of the flower forces the male anther, holding pollen grains, to brush up against the pollinating species while it is looking for its food, the nectar. The female pistil includes the stamen, which is sticky and collects pollen from the bodies of animal visitors, and the egg, called an ova. When pollen grains fertilize an ova, a new seed begins to develop.

Plants, rooted in one place, must face the challenge of transferring pollen to another flower of the same species. Some flowers rely on wind to carry pollen grains, while others use water. Animal pollinators, however, give plants an advantage as they deliver pollen directly to the flower. While collecting nectar from the base of a flower, pollinators like bees brush against pollen from the flower's anther. The bee ends up carrying a load of pollen on its body. At the next flower the bee visits, some of that pollen reaches the female reproductive parts while the bee feeds. For other animals, the exact way they collect and deliver the pollen is different (hummingbirds sometimes collect pollen on their heads!), but the function is the same. The pollination relationship is mutually beneficial to flower and animal – one gets food while the other receives help reproducing.

Over time, flowers have developed adaptations to ensure that the best pollinator for their species will visit and return often to feed. In fact, flowers'

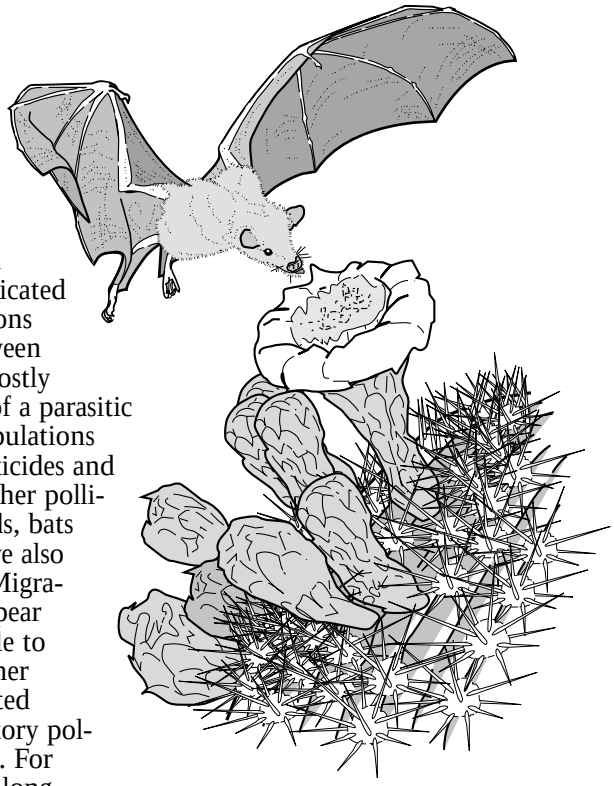


fragrance, bright colors, nourishing nectar and varied shapes are considered adaptations to attract certain pollinators. For example, the bright colors of flower petals are thought to help flowers stand out against a green background. Many flowers, such as a black-eyed susan, have a bull's-eye pattern of color to focus animal attention on the part of the flower with pollen and nectar. Violets have both a weak bull's-eye pattern as well as "nectar guides" – a pattern that radiates out from the nectar cup and leads animals to the part

of the flower where the nectar, anther and stamen are found. Many flowers have nectar guides, which aren't always visible to the human eye.

Birds and bees find different flowers attractive, largely due to differences in the animal senses. Birds have a poor sense of smell, but keen color vision. Bees use both color and odors to find a suitable flower. The shape of the flower also plays a role in determining the kind of pollinator who can feed from the flower. Butterflies must have a perch to land on while feeding. Hummingbirds can hover in front of the flower and so don't need a place to land. Pollinators have also adapted to ensure that they will have access to flower nectar. Animal adaptations include sense of smell, color preferences, beak shape (especially noticeable in hummingbirds) and tongue length.

Pollinators have a critical role in both agricultural and natural ecosystems. Crop plants depend on pollination to produce much of the food we eat – from wheat and oats to corn and tomatoes. In fact, scientists estimate that every third bite of food humans eat is made possible by the act of pollination. Pollinators are also key to maintaining the health and biodiversity of wildlife habitat. Many flowering plants will not produce seeds for the next generation, such as new oak trees or milkweed plants, without the aid of animal pollinators. A habitat that doesn't have young to replace the old of all species will eventually become less diverse – a few types of plants may become dominant, and in turn, the habitat will be able to support fewer animal species.



In this decade, conservation biologists discovered a disturbing trend. Pollinator populations have declined drastically. Domesticated honeybee populations dropped 25% between 1990 and 1998, mostly due to the spread of a parasitic mite. Wild bee populations face risks from pesticides and habitat loss, and other pollinators, such as birds, bats and butterflies, have also suffered declines. Migratory pollinators appear especially vulnerable to habitat loss and other threats. In the United States many migratory pollinators are in peril. For example, the lesser long-nosed bat pollinates cacti such as the organ pipe and saguaro common to the Sonoran desert landscape. The bat, along with migratory pollinators such as the rufous hummingbird, white-winged doves and monarch butterflies, must move from bloom to bloom to take in enough energy on its 2,000 mile or more journey to Mexico to survive. Along this nectar corridor, human development, extensive planting of non-native species (that pollinators can't feed on) and the destruction of "stop-over" areas by pesticides and human alterations work together to reduce the number of these migrants. For instance, monarch butterflies depend on the milkweed plant for food and a place to raise young. The milkweed is often a target of large-scale herbicide spraying along roads and on farms.

Preparation

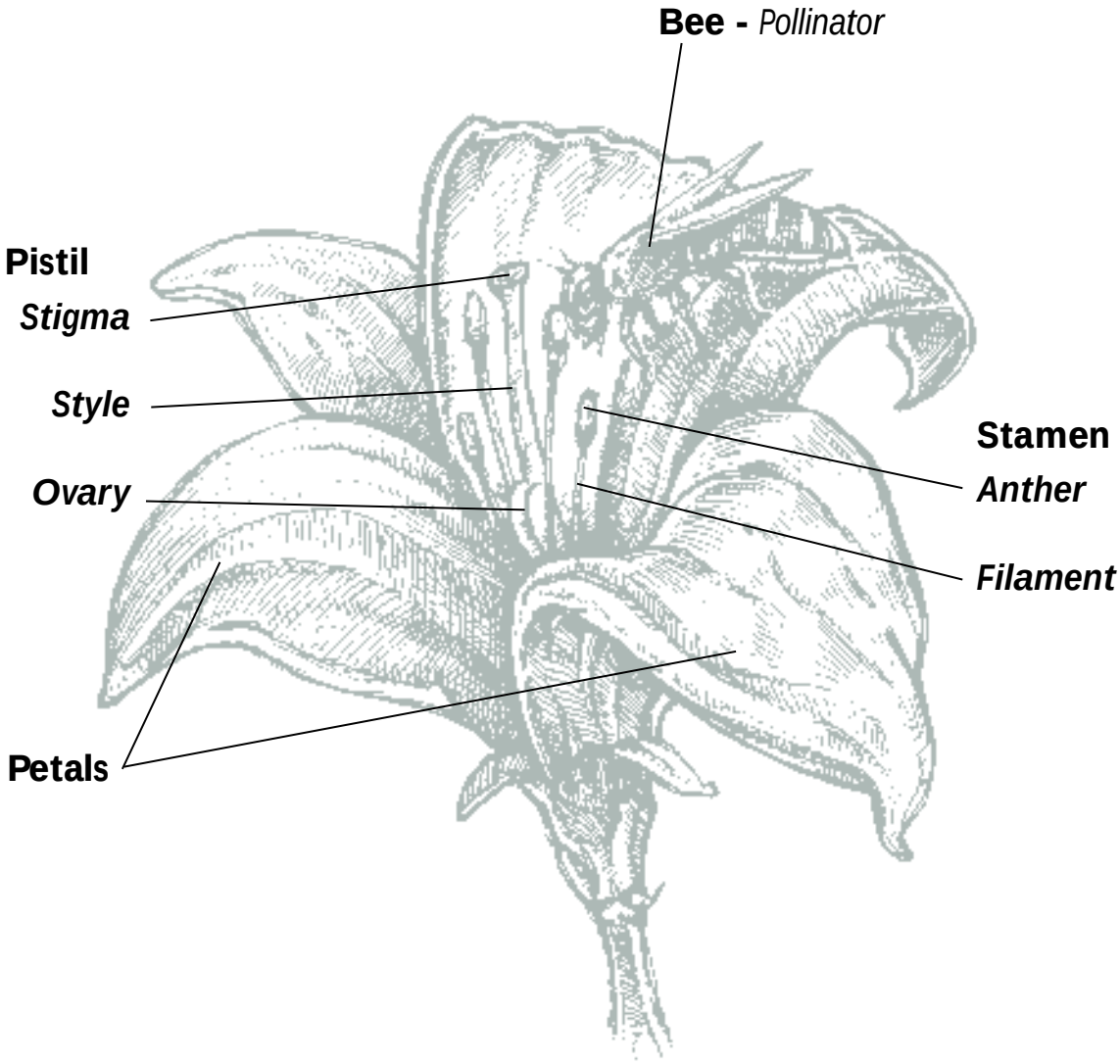
1. Write the characters for the play – long-nose bats, monarch butterflies, organ pipe cacti, milkweed plants and humans – on paper scraps. Student groups will pick a character out of a bowl for the play.

Procedure

1. Introduce the main ideas of pollination – flowering plants and their pollinators have adapted to each other to the point that one may have trouble surviving without the other. Show a diagram of a flower's parts and pictures of different pollinators interacting with flowers. Ask students to give examples of pollinators, such as bees, butterflies, birds, bats and others. Outline the role that pollinators play in maintaining the health of an ecosystem and its biodiversity.

2. Explain that some key pollinators (from honeybees to hummingbirds) are now threatened due to parasites, habitat

WORKSHEET



The **Stamen** *is the male part of the flower that produce the pollen.*
Each stamen has 2 parts:
The **Anther**, *which produces the pollen, and*
the **Filament**, *which provides support for the anther.*

The **Pistil** *is the female part of the flower that produces the seeds.*
The pistil has 3 parts:
The sticky **Stigma** *receives pollen during pollination,*
the **Ovary** *produces seeds,*
and the **Style** *connects the stigman to the ovary.*

Petals *surround and protect these parts of the flower.*

loss, pesticides and introduced species. The effects of a major loss of pollinators could be dramatic. Ecosystems could change their character, as trees and plants once common, begin to disappear. Agriculture could also suffer huge losses, which might lead to less food being produced. Create a chart showing what students know and what they want to know about pollination.

3. If you have it available, watch the NWF video *Pollinators in Peril* for further background for the students. After the video, further complete the chart to survey what students learned from the video.

4. After the video, ask students for ideas on how people can help pollinators. One idea is to plant native plants in the area to help local and migrant pollinators survive.

5. Today students will focus on pollinators that migrate between the U.S. Sonoran Desert and tropical Mexico. Scientists are especially concerned about migratory pollinators, such as the ones in the Sonoran Desert. Use a map to point out the Sonoran Desert as well as Mexico.

These pollinators get food along their journey from flowers along what's called a "nectar corridor." Along the nectar corridor, the pollinators move north or south from one area to the next at the same time that flowers on which they feed are blooming. That means they always have something to eat on their long journey. However, these corridors are suffering. Introduced (non-native) plants are outcompeting some of the plants the pollinators rely on for food. Much of the land along the corridor has been built on or converted to roads or farms. People have used pesticides in some areas that kill the plants relied upon by migrants. Not having enough plants to feed on during the journey reduces the number of pollinators that can survive.

6. Tell students that they will now act out a short play about the problems faced by a special group of pollinators, the migratory pollinators in the Southwestern United States. Divide class into 5 groups, which will each pick one character from a bowl. All of the group members will act as the character during the play. Characters will include two pollinators (the long-nose bats and monarch butterflies), two flowering plants (the organ pipe cacti that bats feed on and the milkweed plants visited by butterflies) and humans. (The human role could also be played by the teacher.)

7. Optional: If there's time, provide art supplies for students to create paper-plate masks to wear during the play. Butterfly masks should include a curled, long proboscis (use pipe cleaners) and antenna. Students may also wish to make wings. Long-nosed bat masks should include a long nose and a long tongue (use pink construction paper) and may also fashion wings. Cacti can color their masks green and cut pipe cleaners in to 1/2 to 1 inch pieces to represent cactus spines. Have them glue the "spines" onto the paper plate as well as a "flower". Milkweed plants may want to draw or cut and paste green leaves and milkweed flowers onto the mask.

8. Read the following story to students once out loud. Then, have them rehearse the four scenes while you remind them of the story, with the educator giving stage directions. Encourage students to expand on the story during rehearsal if they wish.

Modifications for Older Students

1. Follow procedure outlined above through #5. Tell students that they will now work in groups to write scenes about the threats facing migratory pollinators today.

2. Then, hand out copies of the Pollinator's Journey story above. Instead of acting out this story, however, the older students will write their own play based on this story. (Alternatively, have the class pick one example they learned about in the video and set up their own story plot, divided into scenes (keep it to 5 or fewer scenes.) Divide the class into 5 groups. Each group will be responsible for writing

one of the scenes outlined in the story. (If students write a new story, divide the class into as many groups as there are scenes, or assign more than one scene to groups.) They should add dialogue, name characters and make

other changes as necessary. If they have additional questions they should do research to find the answers. Students should agree on how they will work together to write the scene. One idea is to improvise within the group, and have one member responsible for recording what is said. Then, the recorder can write the scene based on that. The group and the educator should review and suggest changes on the script before it's shared with the rest of the class.

3. Once all the groups are finished, each group will perform the scene they wrote for the rest of the class. (If they need more actors for the scene, they will need to ask for help from the other groups.) Have them accept comments from others and ask how well all the scenes flowed together. Making some small changes in the scripts may help the scenes work together better. Ask students if they want the same actors to play the parts all through the play, or if each group will perform its scene. They should also consider whether they want costumes, props or a simple set, and how they would go about creating these.

4. Have students perform the final version of the play. Consider inviting a class of younger students (or parents and family members) to come watch the final performance. The student performers may want to have a question and answer session with the younger students about pollination, flowers and the threats facing pollinators today. (This can serve as a built-in assessment.)

Extensions

✔ The loss of domesticated honeybees would heavily impact humans. Research honeybee pollination of crops. ***Which crops rely on bee pollination? How many bees have been lost in recent years? Why? What are farmers doing in response?*** There is more information on this in NWF's Pollinators in Peril video (see Web site).

✔ Go out to your schoolyard and look for pollinators during different seasons of the year. ***What pollinators can the students find? What can they do to support them?*** Have them investigate the habitat requirements of these local pollinators and plant species that they need to survive.

✔ Have students investigate the travels of hummingbirds and monarchs by observing and sharing data online. Visit Journey North (www.learner.org/jnorth/) for more information.

Assessment

✔ Have students draw a short cartoon (using words and pictures) to illustrate the story of the play. Students should include at least three of the human threats facing pollinators today, how human activities harm the pollinators, the consequences of losing pollinators and a way that people can help pollinators. For older students, read the written version of play.

✔ Research local pollinators, their habitat requirements, and threats that face them. Create a bulletin board with the facts students have discovered about the threats facing pollinators today. See if the class can post it in an area of the school where many students can see it.

The Pollinators' Journey

Narrator

It is early fall in the beautiful Sonoran Desert of Arizona. Long-nosed bats and monarch butterflies live here in the summer. Soon, they must start a long journey south where they live in the winter. The nights are starting to get cooler. The flowers that bats and butterflies feed on have begun to fade. It is time to begin their journey to Mexico.

Stage Directions

Bats pretend to fly while feeding on cacti. Butterflies will fly and land next to milkweed flowers to feed. When students hear the word "cooler" they should begin to shiver (although these animals do not shiver in reality, this is a good tool for conveying the idea of the changing season). As the bats and butterflies try to continue to feed, the cacti and milkweed flowers sit down and drop their heads. The butterflies and the bats all know it is time to begin the journey. They leave the scene. Suggestion: There is no role for humans in this scene. Perhaps have that group be wind or act as flowers just for this scene.

Narrator

Each year the pollinators follow the same route to Mexico, called a nectar corridor. They stop at the same places each year to rest and feed on flowers. But this year, one of the rest stops is missing! A new golf course stands where there were once hundreds of flowers to feed on and cover to hide in. A few flowers remain, but many of the pollinators have nothing to eat. Without food, some pollinators get very tired. They don't have the energy for the long trip. Some bats and butterflies die. Others move on.

Stage Directions

Have bats and butterflies start on one side of the room and move together across the room. The flowers stand facing each other, forming a corridor for the group of pollinators to move through (as the pollinators pass, the flowers should move to the front of the corridor line. The Humans group should form a football huddle to represent the new golf course, right in the nectar corridor. Flowers nearby have died during the construction and sit on the floor with their heads dropped. One cacti and one milkweed will remain standing. Bats and butterflies feed on the flower, but all of the pollinators are tired and moving slowly. One out of three of the pollinators should lay down on the floor to show they have died (they should act as humans in next scene). The other pollinators leave to continue the journey.

The Pollinators' Journey *continued*

Narrator

Arriving at their winter home, there are fewer bats and butterflies than usual. New buildings and highways have destroyed some of the usual rest stops along their journey. Herbicides sprayed along highways may poison butterflies. Breaking up habitat into smaller areas makes the journey harder, as cities, houses and highways fragment wild habitat into smaller pieces. But those that have made it can live in peace for awhile.

Stage Directions

The remaining bats and butterflies arrive at their winter home, where the flowers are all in bloom. As the teacher talks about the threats facing pollinators, the humans should act out the actions of: building, spraying herbicides and cutting down trees and shoveling over wild habitat.

Narrator

In spring, the weather warms. It's time for pollinators to begin their return journey to Arizona. The flowers have started to fade. The bats and butterflies depart.

Stage Directions

Bats and butterflies are feeding on flowers. Slowly, flowers begin to sit down and drop their heads to show they are not in bloom anymore. The bats and butterflies may use human cues to show they are getting hotter, such as wiping sweat from the brow or fanning themselves (like shivering, this is a human way to deal with heat, but will help get the ideas across). Humans sit out during this short scene.

The Pollinators' Journey *continued*

Narrator

Near the end of the journey, the bees and bats are very tired. While some stop-over spots are still rich with nectar, others have been destroyed. If only there were a flower-filled field over the next hill. Suddenly, they see flowers in bloom. It's a rest stop lost years ago to development and it looks inviting again. The flowers sit in a garden next to a large school building. Students have been working hard to create wildlife habitat on their schoolgrounds. They've selected the exact plants that they know these migrating pollinators are looking for, and they have added bat boxes to their habitat. Hungry, the pollinators fly down to the garden to feed on flowers. In the garden, they see children weeding around the cacti and milkweed and watering young plant seedlings. The pollinators all get enough to eat. They are ready for the final miles of their trip, well-fed and prepared to go on. Flapping their wings, the bats and butterflies fly away, leaving the children quiet with awe and happy that they have helped to make the pollinators journey a successful one.

Stage Directions

Humans and flowers should all be on one side of the classroom. Flowers are in bloom, while humans are tending to the Schoolyard Habitat. The bats and butterflies are flying, obviously tired and slow, toward the garden. They swoop down to the flowers and feed on the nectar. Once they have all had a chance to feed, they move much more quickly, and fly away with much more energy. The humans stare at them in awe and smile while the bats and butterflies leave the room/area.