

Honey Bees & Pollination Lesson

Cathie Wood, Bath School District, Michigan

“What’s the Buzz?”

2-LS-2-1 Events have causes that generate observable patterns.

2-LS4-1. Make observations of plants and animals to compare the diversity of life in different habitats.

2-LS2-2 Develop a simple model that mimics the function of an animal in dispersing seeds or pollinating plants.

LS2.A: Interdependent Relationships in Ecosystems; Plants depend on animals for pollination or to move their seeds around.

3-LS1-1 Develop models that describe that organisms have unique and diverse life cycles but all have in common birth, growth, reproduction, and death.

3-LS4-2. Use evidence to construct an explanation for how the variations in characteristics among individuals of the same species may provide advantages in surviving, finding mates, and reproducing.

4-LS1-1 Construct an argument that plants and animals have internal and external structures that function to support survival, growth, behavior, and reproduction.

MS-LS1-4 Use argument based on empirical evidence and scientific reasoning to support an explanation for how characteristic animal behaviors and specialized plant structures affect the probability of successful reproduction of animals and plants respectively.

I CAN STATEMENT

- I can develop a model that mimics how a honey bee pollinates plants.

OBJECTIVES

Students will understand the following:

- Bees use the pollen from flowers as food.
- When they land on flowers to collect pollen, they spread pollen from one flower to another flower. (They stay with the same species until they return to the hive)
- Many plants cannot grow unless they are cross-pollinated by insects such as bees.
- Because bees cross-pollinate so many fruit and vegetable plants, they play a vital role in food production all over the world.

SUPPLIES

- Large index card or $\frac{1}{4}$ sheet of construction paper
- Markers
- Double sided tape
- Cotton balls

LESSON OPENER AND DISCUSSION QUESTIONS FOR STUDENTS:

What is a pollinator?

A pollinator is an animal that causes plants to make fruit or seeds. They do this by moving pollen from one part of the flower of a plant to another part. This pollen then fertilizes the plant. Only fertilized plants can make fruit and/or seeds, and without them, the plants cannot reproduce.

What are examples of pollinators?

Pollinators are animals of all types that visit flowers and take away their pollen. Pollen is a sex cell of plants. Insects - such as honey bees, bumblebees and wasps - and other animals - such as birds, rodents, monkeys, butterflies, and even humans - are all examples of pollinators.

Why is pollination important?

Pollination is important because it leads to the production of fruits we can eat, and seeds that will create more plants. Pollination begins with flowers. Flowers have male parts that produce very small grains called pollen. Pollination is the transfer of pollen grains from one flower to another.

What would happen to our planet if we didn't have animals to pollinate flowers?

We wouldn't have food! In fact, one third of our global food supply is pollinated by bees. Simply put, bees keep plants and crops alive. Without bees, humans wouldn't have very much to eat. ... If bees do not have enough to eat, we won't have enough to eat.

What would happen if the bees die out?

They are critical pollinators: they pollinate 70 of the around 100 crop species that feed 90% of the world. Honey bees are responsible for \$30 billion a year in crops. That's only the start. We may lose all the plants that bees pollinate, all of the animals that eat those plants and so on up the food chain.

Honey Bee Facts

Honey bees are social insects and live in large groups called colonies. There are three types, or castes, of honey bees—queen, worker, and drone. Honey bees have four distinct life stages—egg, larva, pupa, and adult.

Complete metamorphosis takes between 16 and 24 days.

Queen = 16 days Worker = 21 days Drone = 24 days

The queen lays each egg into a different cell of the honeycomb. It is her job to determine whether the egg will grow into a male or female bee. Fertilized eggs will become female workers, and unfertilized eggs will become male drones. After three days, the egg hatches and a worm-like creature, called larva, is unveiled. Worker bees feed the larva royal jelly—a milky, yellow syrup secreted from a gland in the worker bee's head. As it grows, the larva sheds its skin four to five times. On about day nine, the larva spins itself a cocoon. A worker bee seals the cocoon into the cell with wax.

In a honey bee colony with a population of 50,000-60,000 workers, nearly 20,000 of those workers are forager bees bringing in nectar and pollen to feed the colony. Honey bees are extremely important to humans. Bees are pollinators. They collect pollen (protein) and nectar (carbohydrate) from flowering trees and plants and transfer pollen from flower to flower. The pollen sticks to their hairy hind legs in a pollen basket. When the pollen basket is full, the bees return to the hive. Worker bees also suck up nectar with their lapping mouthparts. The proboscis is like a long tongue with a spoon at the end. They take the nectar back to the hive where they store it in a cell. Once the cell is full and has 18% moisture, the bees cap the cell with wax. That's the honey we eat! Bees pollinate 95 different crops, helping to create nearly one-third of the world's food supply. Honey bees use the nectar they gather from flowers to make honey, which is the only commercial food produced by insects that is eaten by humans on a wide scale. Honey bees also produce beeswax, which is used to make candles, artists' materials, lubricants, polishes, and cosmetics. Bee venom, pollen, royal jelly, and propolis are other bee-made products used in manufacturing, and for nutritional and medical purposes.

Ask students, "Why are honey bees important to humans?"

EXPLORATION/ACTIVITY/GAME – Pollination Tag

1. Start by telling students to draw their favorite fruit on a piece of paper.
2. On the other side of the paper, tell students to draw a large flower.
3. In the center of their flower, place a piece of double-sided tape, and attach a cotton ball to the flower. This is the pollen! Students may choose to color the cotton ball with marker to distinguish their pollen from the other flower's in the class.
4. Next, choose three students to be pollinators. The pollinators will now chase the flowers in a game of tag (you may want to implement some rules for safety).
5. When a flower is tagged, it must give its pollen to the pollinator. If the pollinator is already carrying a cotton ball, he/she hands the pollen to the flower to pollinate it. When this happens, the flower turns over his/her piece of paper to show that he/she turned into a fruit.
6. This player then comes out of the game to sit down.
7. The game ends when most of the flowers have been pollinated and turned into fruits!

<https://gardenatschool.wordpress.com/2012/06/16/pollination-games/>

8. Ask the following questions to students:
 - a. Do we need honey bees to pollinate orchards, fields, gardens, etc.
 - b. What would happen if the bees did not pollinate the apple orchards, peach trees, blueberry bushes, gardens, etc.
 - c. What can we do to help honey bees? *Plant native flowers and trees. Trees provide the earliest and most abundant pollen and nectar sources for bees. Redbud provides a nice balanced diet. Sugar Maple, Pussywillows, Tulip Poplar, Autumn Olive (invasive, but abundant along roadsides), and Basswood are good early sources of food for bees.*
9. **DEBRIEFING** -- Have students document what they observe or notice from the investigation in their journals. Students should be able to write their observations down and begin to understand the concept of making a claim and be able to back up their thinking. Ask "What did you notice (their claim) and what is the evidence?"
10. **DEBRIEFING: -- Circle. Square. Triangle.**
After being presented with new content, ask students to jot down three things in their journals or on an index card:
 - a. **Circle:** What's still going around in your head? What do you still not understand?
 - b. **Square:** What's squared away? What do you really understand?
 - c. **Triangle:** What three things could you do with your new learning? What will you do to make a change? How will you help the bees?

[Dirksen, D. "Hitting the Reset Button: Using Formative Assessment to Guide Instruction," *Phi Delta Kappan*. April 2011]

Fun Bee and Honey Facts

- A honey bee can fly up to 15 miles per hour.
- A honey bee worker only makes an average of 1/12 of a teaspoon in her lifetime.
- One ounce of honey would fuel a bees flight around the world.
- A pound of honey is made by 2 million flower visits. The bees fly 55,000 miles back and forth to bring that honey.
- A honey bee visits 50-100 flowers in one trip.
- Honey comb is hexagon (six-sided) shaped. The wall of comb is 2/1000 inch thick, but can support 25 times their own weight.
- Honey bees beat their wings 11,400 times per minute. This beating of wings makes the buzzing noise.
- Honey bees never sleep.
- An average hive has 50,000 to 60,000 worker bees.
- The honey bee is the only insect that produces food for humans.
- Honey keeps very well. A pot of honey was found in good condition in King Tut's tomb.
- Honey is full of a variety of vitamins and essential minerals, antioxidants, and amino acids.
- Eating honey is a natural way to get an energy boost. It is a mixture of simple sugars--glucose and fructose. Studies have shown that this works best in preventing fatigue and enhancing athletes' performance.
- Honey is an antimicrobial agent and can be used effectively on minor burns or scrapes. It has been shown to speed the healing of wounds.

Adapted from Better Lesson and California Ag in the Classroom

EXTENSIONS/ENRICHMENT

Have students write a paragraph describing why bees are important in the pollination of an apple tree blossom. Have them include one way the weather could hurt, slow or stop bees from pollination and one way the weather could help bees pollinate apple trees. Have them explain one other condition that could affect pollination (chemicals, humans, types of crops, predators, etc.)

If you have Chromebooks or Google Classroom, have them watch a YouTube video of honey bees in action.

<https://www.youtube.com/watch?v=IE-8QuBDkkw>

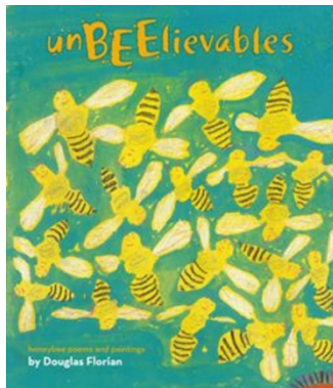
<https://www.youtube.com/watch?v=f6mJ7e5YmnE>

<https://www.youtube.com/watch?v=6-tqiaPoS2U>

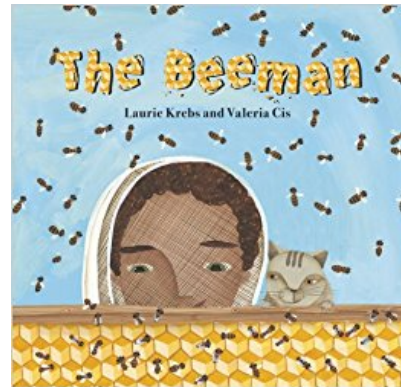
<https://www.youtube.com/watch?v=UIEZU5L-M0E>

LITERARY CONNECTIONS

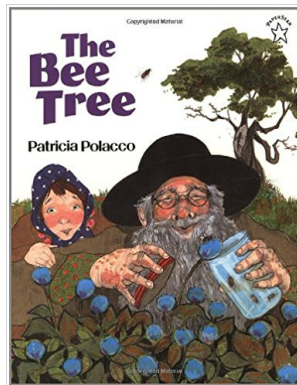
UnBEElievables
By Douglas Florian
Poems and Paintings



The Beeman
by Laurie Krebs



The Bee Tree
by Patricia Polacco



The Magic School Bus
Inside a Beehive



<http://www.politico.com/agenda/story/2017/09/13/food-nutrients-carbon-dioxide-000511>

This is a lengthy article, but explains the changes in plants due to the increased levels of carbon dioxide in the atmosphere. Below is an excerpt from the article:

Goldenrod, a wildflower many consider a weed, is extremely important to bees. It flowers late in the season, and its pollen provides an important source of protein for bees as they head into the harshness of winter. Since goldenrod is wild and humans haven't bred it into new strains, it hasn't changed over time as much as, say, corn or wheat. And the Smithsonian Institution also happens to have hundreds of samples of goldenrod, dating back to 1842, in its massive historical archive—which gave Ziska and his colleagues a chance to figure out how one plant has changed over time.

They found that the protein content of goldenrod pollen has declined by a third since the industrial revolution—and the change closely tracks with the rise in CO₂. Scientists have been trying to figure out why bee populations around the world have been in decline, which threatens many crops that rely on bees for pollination. Ziska's paper suggested that a decline in protein prior to winter could be an additional factor making it hard for bees to survive other stressors.

Ziska worries we're not studying all the ways CO₂ affects the plants we depend on with enough urgency, especially considering the fact that retooling crops takes a long time.