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Ag in the Classroom
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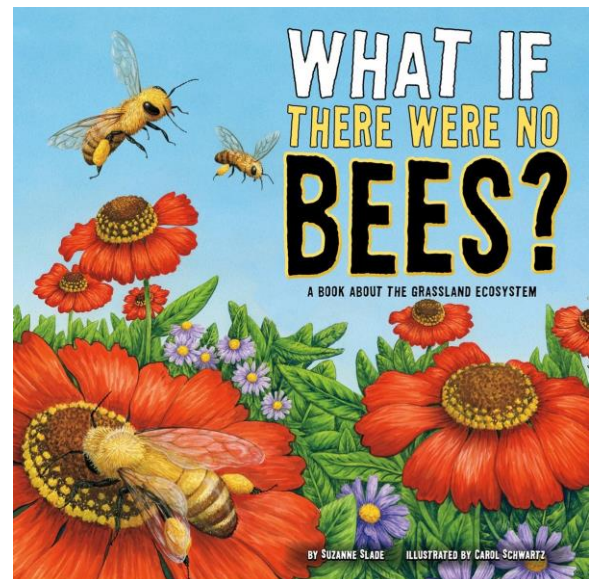
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What If There Were No Bees? A Book About the Grassland Ecosystem

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Grassland ecosystems can be found on nearly every continent. Countless animals and plants live in them. So what difference could the loss of one animal species make? Follow the chain reaction, and discover how important honey bees are. ¹



Did You Know? (Ag Facts) ²

- Honey bees can fly approximately 15 mph!
- The queen honey bee lays between 1,000-3,000 eggs per day. She can lay over one million eggs in her lifetime!
- Apples, watermelon, squash, and strawberries are among the SC food crops that depend on bee pollination.
- Bees pollinate 95 different crops, helping to create nearly one-third of the world's food supply.

Discussion Questions

- Why are honey bees important?
- What do you know about honey bees?

Grade Level(s): K-5

Purpose: Students will the parts of the honey bee, the stages of its life cycle, and its role in pollination.

Vocabulary:

- **brood**: the offspring produced by the colony (eggs and larvae)
- **cell**: a hexagonal chamber built of beeswax for brood rearing and storage of honey and pollen
- **crop**: spherically shaped organ in the abdomen of a honey bee that serves as a site for food storage, as a storage place for nectar bees collect from flowers, or as an initial site for the digestion of food; also known as the honey stomach
- **egg**: laid by a queen bee, this is the first stage in the life of a honeybee
- **enzyme**: a substance produced by a living organism which acts as a catalyst to bring about a specific biochemical reaction
- **evaporate**: turn from liquid to vapor
- **forage**: search widely for food
- **hive**: a container for housing honeybees; a colony of bees
- **nectar**: a sweet liquid secreted by flowers of various plants
- **pollen**: the fine, powder-like material produced by the anthers of flowering plants
- **pollination**: the transfer of pollen from the anther to the stigma of a plant
- **pollinator**: an animal that moves pollen from the anther to the stigma of a plant
- **proboscis**: straw-like tongue used by honey bees to suck nectar or honey
- **regurgitate**: bring swallowed food up again to the mouth

Background Agricultural Connections ²

Honey bees are extremely important to humans. Bees are pollinators. They collect pollen and nectar from flowering trees and plants and transfer pollen from flower to flower. 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.

Honey bees are an important insect that are familiar to many elementary students. Honey bees like to live in dark, enclosed places. In the wild, they can be found in tree limbs and trunks. Beekeepers care for honey bees in wooden **hives**.

Honey bees live in large groups called colonies. There are three types, or castes, of honey bees—queen, worker, and drone.

- **Queen** - One female who lays all of the **eggs**. She has a long, thin body and is the largest bee. Queen bees live from 3-5 years and can lay up to 2,000 eggs each day.
- **Drones** - Drones are male bees. Their job is to mate with the queen so she can lay eggs. Each colony in the hive has about 100 drone bees.

- **Workers** - Worker bees are all females. There are usually hundreds of worker bees in a hive. They are the smallest bees, but they have many important jobs. These jobs include grooming the queen, nursing the **brood** (young bees), creating wax, building the honeycomb, guarding the hive, **foraging** for **nectar** and water, and making honey.

When worker bees are foraging, they collect nectar from flowers using their straw-like mouth part known as a **proboscis**. The nectar is stored in a special part of their body called the **crop**, or honey stomach. **Pollen** is collected on the legs and body of the forager bees. The pollen is transferred from flower to flower to **pollinate** the plants so seeds, fruits, and vegetables are produced. Over 1,000 different plants that are grown for food, beverages, fiber, species, and medicine need **pollinators** in order to produce the products we need and want.

When the forager worker bees have a full crop, they travel back to the hive. When they are back in the hive, the forager **regurgitates** the nectar and transfers it to a worker bee in the hive. **Enzymes** in the stomach of the bees convert the nectar into a thin, watery form of honey. This liquid is placed in a **cell** in the honeycomb. The bees use their wings to fan the liquid to **evaporate** the water until it thickens. Finally, the wax-making worker bees seal the honeycomb cell where the honey continues to ripen and develop flavor.

Why Are Bees Important?

Materials:

- *What If There Were No Bees?* Book

Procedures:

(Before Reading)

- Ask students why bees are important?
- Why do you think the author made the title a question? How does this get your attention as a reader?

(During Reading)

1. As a class, discuss answers to the comprehension questions:
 - What does it mean when it says “bees do the work of giants”? (pg. 2)
 - Looking at the food chain illustration, explain which animals are predators of the bee. How do you know? (pg. 3)
 - Turn and talk -- How do bees help the flowers? How do flowers help the bees? (pg. 6)
 - What is the main idea of these two pages? What are some details you heard? (pg. 8)
 - This page is mostly about the harmful effects of bee extinction. What are some details you heard to support that? (pg. 9)
 - Turn and talk – How would the absence of bees hurt animals? (pg. 16)
 - How would all of these changes affect us? (pg. 18)
 - What are some ways people are helping bees survive? (pg. 19)
 - What information does this map give you about bees? (pg. 20)

(After Reading)

- What is the main idea of this book? List details as a class.
- Students can write persuasive pieces on the importance of bees.

Pollination Stimulation ³

Materials:

- [Honey Bee PowerPoint](#)
- [Anatomy of Honey Bee sheet](#)
- 32 black chenille stems
- 8 containers of 100 mini (5mm) pompoms
- 8 small containers* of water
- 16 medium-sized (1") pompoms*
- 16 jewel bags (1.5" x 2") with yarn tied as a necklace*
- 16 drinking straws*
- Construction paper, 25 pieces

*These items are included in the [Pollination Stimulation Kit](#), which is available for purchase at agclassroomstore.com.

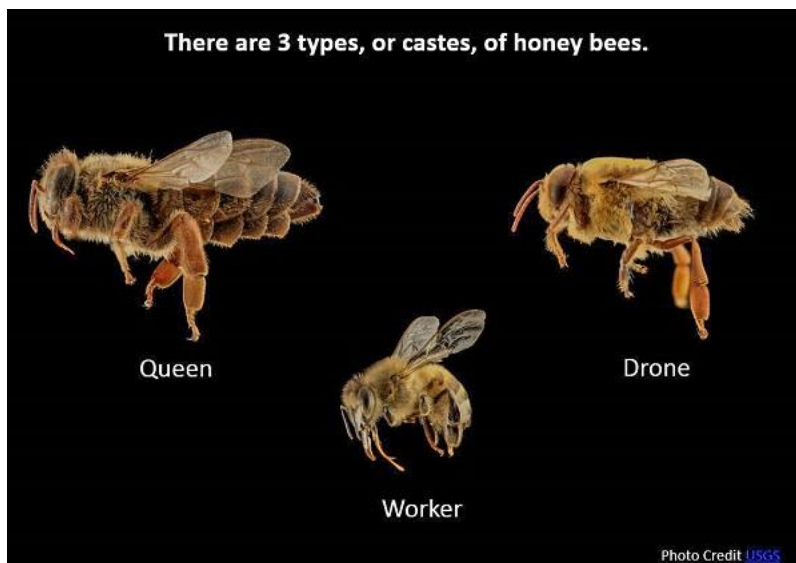
Procedures:

(Part One)

1. Explain to the students that honey bees have three main body regions— the head, thorax, and abdomen. Use the “*Honey Bee*” *PowerPoint* to discuss the main parts of a worker bee.
2. Ask students to label the parts of a worker bee on the “Anatomy of a Worker Bee” activity sheet.

(Part Two)

3. Using the background information as a guide, discuss the roles of each of the three castes of honey bees—the queen, workers, and drones.



4. Simulate the role worker bees play in pollination by conducting a pollination simulation. Choose 8 students to represent flowers, 16 students to represent worker bees, and 1 student to represent the queen bee. Numbers of flowers and worker bees may vary according to class sizes. Extra students can represent the worker bees and drones that remain in the hive.
5. Have students create construction paper headbands to differentiate flowers, worker bees, and the queen bee. Draw and cut out flowers to glue onto the flower headbands. Create antennae using chenille stems to staple onto the worker bee headbands. Cut out a crown-shaped headband for the queen bee.
6. Choose a large area, preferably outdoors, to serve as the “garden” and a smaller area to the side of the garden to serve as the “beehive.”
7. Each flower will hold one container of mini pompoms to represent pollen and one container of water to represent nectar. The flowers will choose a location inside the garden in which to stand.
8. Each worker bee will carry one medium-sized pompom to represent the bee’s hairy body, one jewel bag tied with yarn and worn as a necklace to represent the honey sac, and one straw to represent the proboscis.
9. The worker bees will begin at the beehive with the queen, drones, and other workers whose duties require them to work inside the hive. When the queen bee gives the command, the worker bees will leave the hive in search of nectar from flowers.
10. When a worker finds a flower, they will land their medium-sized pompom into the container of mini pompoms. The worker will then simulate gathering nectar with their proboscis by filling a straw with water using their finger to create a vacuum. The water will be deposited into the jewel bag. When the worker removes the medium-sized pompom from the container, the tiny pompoms will stick to the larger pompom much the same way pollen sticks to the hairs of a bee when it visits a flower.
11. After collecting nectar and pollen from the flower, the worker will find a new flower to visit. Here, the worker will brush off some of the pollen collected from the previous flower into the new flower’s container. They will then collect more nectar and pollen before visiting another flower.
12. Once the worker bee has filled their honey sac with nectar, they will return to the hive.
13. For the purpose of this simulation, the worker bee must collect nectar and pollen from each flower before visiting a flower for a second time, and only two bees may visit the same flower at once.
14. Trade roles and repeat the simulation as many times as desired.

A Life Without Bees⁴

Materials:

- [A Life Without Bees](#) image displayed
- Student writing journals

Procedures:

1. Explain to your class that most of the foods we eat (one out of every three bites) are the result of a pollination partnership. Add that different species of bees pollinate many of the plants that make up our food supply. Ask your students whether they like bees.

Naysayers will undoubtedly mention that bees sting or that they are allergic to bees. Tell your students that they are going to explore a world without bees and, in particular, what the food supply would be like if bees no longer existed.

2. Direct your students to “A Life Without Bees” image. Ask students to imagine a world without bee-pollinated plants: the “Bee-Free Zone.” Explain that they are going to attend a barbecue in the Bee-Free Zone and that hamburgers are on the menu. Have the students read the list of bee-pollinated plants that appears at the top of the page.

3. Tell your students that they have chosen a hamburger or hot dog from the grill. Explain that they can now choose what they will have with their hamburger or hot dog. Remind them that this is the bee-free barbecue and that the foods listed under “Plants Pollinated by Bees” won’t be available. These include tomatoes, onions, cucumbers, lettuce, oil for frying potatoes, oranges, lemons, limes, mustard seed, cacao bean used in making chocolate, vanilla, almonds, watermelon, and apples.

4. Have your students select the items on the checklist that they could not have at the bee-free barbecue. After they’ve eliminated the bee-pollinated items from the list, have them describe the meal that would remain.

5. Conclude the lesson by reminding students of how important bees are to the production of many of our foods.

Enriching Activities

- [What if there were no bees? Writing/Illustration Activity](#)
- Use the following videos to further explore the world of honey bees.
 - In [Flight of the Honey Bee](#) (2:15) a commercial beekeeper illustrates how honey bees play an essential role in the crop production process. Give your students a close-up look at a honey bee covered in pollen and hives traveling across the country to pollinate different crops.
 - In order to collect pollen and nectar efficiently, honey bees tell each other where to look for the best flowers. Show your students a [Dancing Honeybee Using Vector Calculus to Communicate](#) (3:01).
- HONEY SNACK: Cut a banana in half and insert a popsicle stick in each half before drizzling the banana with honey and roll it in crushed graham cracker crumbs.

Suggested Companion Resources

- [The Life and Times of the Honeybee](#) (book)
- [Tops and Bottoms](#) (Book)
- [National Honey Board](#) (website)
- [The Bee Cause Project](#) (website)
- [NMSU Field Trip: Honey](#) (video)

Sources/Credits

1. Slade, S. (2011). *What If There Were No Bees? A Book About the Grassland Ecosystem*. North Mankato, MN: Capstone.
2. Minnesota Ag in the Classroom
3. Utah Ag in the Classroom
4. Smithsonian Education

Suggested SC Standards Met:

English/Language Arts -

- K.RI.5.1 With guidance and support, ask and answer who, what, when, where, why, and how questions about a text; refer to key details to make inferences and draw conclusions in texts heard or read.
- K.RI.5.2 With guidance and support, ask and answer questions to make predictions using prior knowledge, pictures, illustrations, title, and information about author and illustrator.
- K.RI.6.1 With guidance and support, retell the central idea and identify key details to summarize a text heard, read, or viewed.
- 1.RI.5.1 Ask and answer who, what, when, where, why, and how questions to demonstrate understanding of a text; use key details to make inferences and draw conclusions in texts heard or read.

- 1.RI.5.2 Make predictions using prior knowledge, pictures, illustrations, title, and information about author and illustrator.
- 1.RI.6.1 Retell the central idea and key details to summarize a text heard, read, or viewed.
- 2.RI.5.1 Ask and answer literal and inferential questions to demonstrate understanding of a text; use specific details to make inferences and draw conclusions in texts heard or read.
- 2.RI.5.2 Make predictions before and during reading; confirm or modify thinking.
- 2.RI.6.1 Retell the central idea and key details from multi-paragraph texts; summarize the text by stating the topic of each paragraph heard, read, or viewed.
- 2.RI.7.1 Compare and contrast topics, ideas, or concepts across texts in a thematic, author, or genre study heard, read, or viewed.
- 3.RI.5.1 Ask and answer literal and inferential questions to determine meaning; refer explicitly to the text to support inferences and conclusions.
- 3.RI.6.1 Summarize multi-paragraph texts using key details to support the central idea.
- 3.RI.7.1 Compare and contrast diverse texts on the same topic, idea, or concept.

Social Studies:

- 1.1 The student will demonstrate an understanding of how families interact with their environment both locally and globally.
- 2.1 The student will demonstrate an understanding of the local community as well as the fact that geography influences not only the development of communities but also the interactions between people and the environment
- 5.6.6 Identify issues related to the use of natural resources by the United States, including recycling, climate change, environmental hazards, and depletion that requires our reliance on foreign resources.

Science –

- K.L.2 The student will demonstrate an understanding of organisms found in the environment and how these organisms depend on the environment to meet those needs.
- 1.L.5 The student will demonstrate an understanding of how the structures of plants help them survive and grow in their environments.
- 2.L.5 The student will demonstrate an understanding of how the structures of animals help them survive and grow in their environments.
- 3.L.5 The student will demonstrate an understanding of how the characteristics and changes in environments and habitats affect the diversity of organisms.
- 4.L.5: The student will demonstrate an understanding of how the structural characteristics and traits of plants and animals allow them to survive, grow, and reproduce.
- 5.L.4 The student will demonstrate an understanding of relationships among biotic and abiotic factors within terrestrial and aquatic ecosystems.