



The Friends of Flight 93 National Memorial is the official 501(C)3 non-profit that represents Flight 93 National Memorial in partnership with the National Park Service. The lessons and activities below were created for teachers and/or parents to teach children (or themselves!) about the role pollinators play in the world and about the pollinators themselves.

To help cultivate the living memorial landscape that honors the 40 passengers and crew member of Flight 93 every day, the Friends of Flight 93 have partnered with Powdermill Nature Reserve in setting up and maintaining 8 bee hives here at Flight 93 National Memorial. These 8 hives are home to over 500,000 bees. According to surveys done at the memorial in both 2016 and 2017, Flight 93 National Memorial is home to at least 63 different species of bees!

Bees play an extremely important role in balancing natural biodiversity. The symbiotic relationship between bees and all flowering plants is what balances our ecosystems. Flight 93 National memorial is a former surface coal mine. The bees help to restore the memorial grounds and the crash site to its natural state. When Flight 93 crashed on September 11, 2001, it burned nearly 40 acres of ground and trees. This area is now considered sacred ground and the final resting place of the 40 passengers and crew members. The Pollinator Project will help ensure that the natural habitat and ecosystems of the memorial are environmentally restored and will help create a living memorial landscape that will continue telling the story of Flight 93 for generations to come.

Several [passengers and crew members](#) on United Flight 93 were passionate about the environment and a handful were traveling for personal trips that involved the outdoors. Alan Beaven was an ardent environmental litigator who prosecuted Clean Water Act violators. Richard Guadagno spent 17 years in environmental protection as a member of the U.S. Fish & Wildlife Service. Christine Snyder was an arborist and worked for The Outdoor Circle, Hawaii's oldest nonprofit environmental group. Four passengers were traveling to Yosemite National Park (William Cashman, Patrick Driscoll, Donald & Jean Peterman) to hike and enjoy the beauty. Donald Greene was headed to Lake Tahoe for the same reasons. As the living memorial landscape at Flight 93 National Memorial is restored, we honor all 40 passengers and crew members. The Friends of Flight 93 National Memorial website provides a wealth of additional information, about the events on 9/11, the story of Flight 93, and Flight 93 National Memorial. We encourage you to explore this online learning tool for further education resources at <https://www.flight93friends.org/>.



Age Range: Grades 3-5

How Social is that Bee?

An excellent lesson that highlights the difference between social and solitary bees! This complete lesson guide includes background knowledge, supply lists, time frames, etc. Available here:

https://dnr.maryland.gov/wildlife/Documents/Bee-at-Home_LessonPlan.pdf

Additional resource for this lesson:

Solitary vs. Honey Bees:

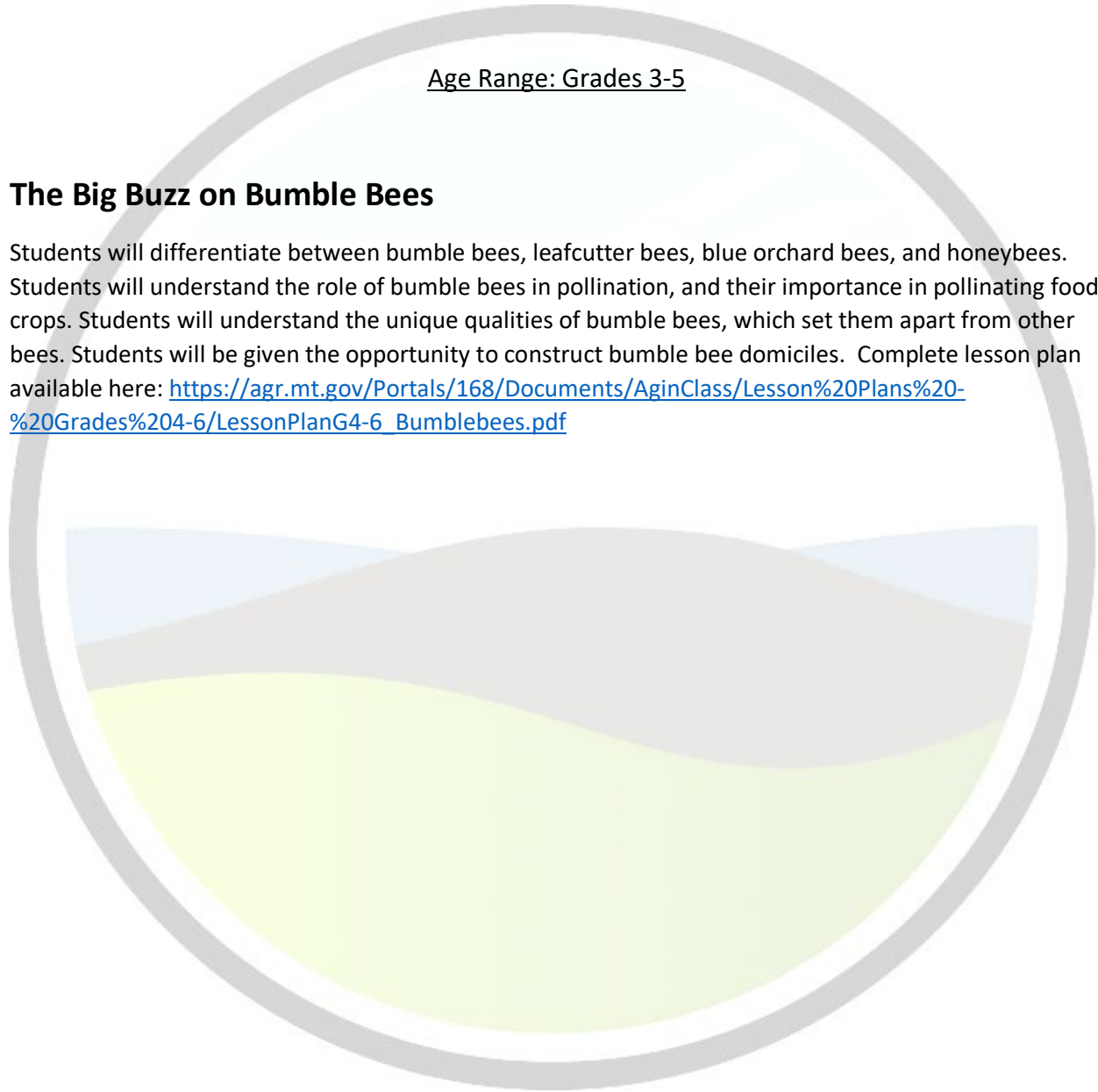
https://masonbeesforsale.com/pages/honey-bees-versus-solitary-bees?gclid=Cj0KCQjwuJz3BRDTARIsAMg-HxVaX2AQTCKfhz5vMIU1QcQojG1nBhkJXlIXafVCg0FWI6yGt7yw4xYaAhgxEALw_wcB



Age Range: Grades 3-5

The Big Buzz on Bumble Bees

Students will differentiate between bumble bees, leafcutter bees, blue orchard bees, and honeybees. Students will understand the role of bumble bees in pollination, and their importance in pollinating food crops. Students will understand the unique qualities of bumble bees, which set them apart from other bees. Students will be given the opportunity to construct bumble bee domiciles. Complete lesson plan available here: https://agr.mt.gov/Portals/168/Documents/AginClass/Lesson%20Plans%20-%20Grades%204-6/LessonPlanG4-6_Bumblebees.pdf





Age Range: Grades 3-5

Welcome to the Mason Bee Motel

Different species of bees build different nests. Open your own Mason Bee Motel and invite your winged guests!

Description of tunnel nests available here: https://xerces.org/sites/default/files/2018-05/13-054_02_XercesSoc_Tunnel-Nests-for-Native-Bees_web.pdf

Directions for building a tunnel nest available here: <https://www.turningclockback.com/diy-mason-bee-house/> (these are student-friendly directions!) or here: <https://www.naturalbeachliving.com/mason-bee-habitat/> (this set of instructions INCLUDES a video)

How-to video: <https://youtu.be/3zaQzJxSheQ>



Age Range: Grades 3-5

Seed Bombs!

Goal: The seed bomb is cheap compared to buying transplants, is natural and organic, easy to make, pocket sized, and you can easily cover a large area with seed bombs in a very short time. Students will make at least one bomb each. These can then be used at a location at the school to plant or students may take them home to use.

Instructions and supply lists are available for free online. This one (<https://www.instructables.com/id/How-to-Make-a-Seed-Bomb/>) includes pictures of each step!



Age Range: Grades 3-5

Bee-Based Food Chains

Goal: Students will be able to construct a food chain showing how bee-pollinated fruits and vegetables benefit humans. This may be used as a small lesson, a stand-alone activity, or a center.

Supplies:

1. Small toy farm animals (chickens, cows, sheep, goats, pigs)
2. Collection of plastic bee-pollinated foods (many lists are available online; for example: <https://honeylove.org/list-of-food/>)
3. Collection of cloth, cardstock, or paper arrows

Extension Questions:

1. What is your favorite food from the list?
2. How do the farm animals that eat some of these foods help people?
3. Let's find a recipe that uses your favorite food from the list to try at home!



Age Range: Grades 3-5

Honey Bee Life Cycle

Goal: Students will be able to describe the life cycle of a honey bee using the appropriate vocabulary.

Supplies:

1. Honey Bee Life Cycle packet (1 per student) – available: <https://www.livinglifeandlearning.com/honey-bee-life-cycle-worksheets.html>
2. Scissors
3. Glue stick
4. Crayons
5. Technology for watching video – available: <https://www.youtube.com/watch?v=xD5tdykIJB>

Steps:

1. Watch the video “Life Cycle of a Honey Bee” (<https://www.youtube.com/watch?v=xD5tdykIJB>).
2. Using the “Bee Life Cycle” page from the packet, allow students time to cut out the images and names.
3. Replay the video as needed for students to place images in the correct order. Or teacher may utilize the site <https://bees.techno-science.ca/english/bees/life-in-a-hive/stages.php?image=image4> to go through the stages one at a time to assist students.
4. Students use glue sticks to attach images.

Extension:

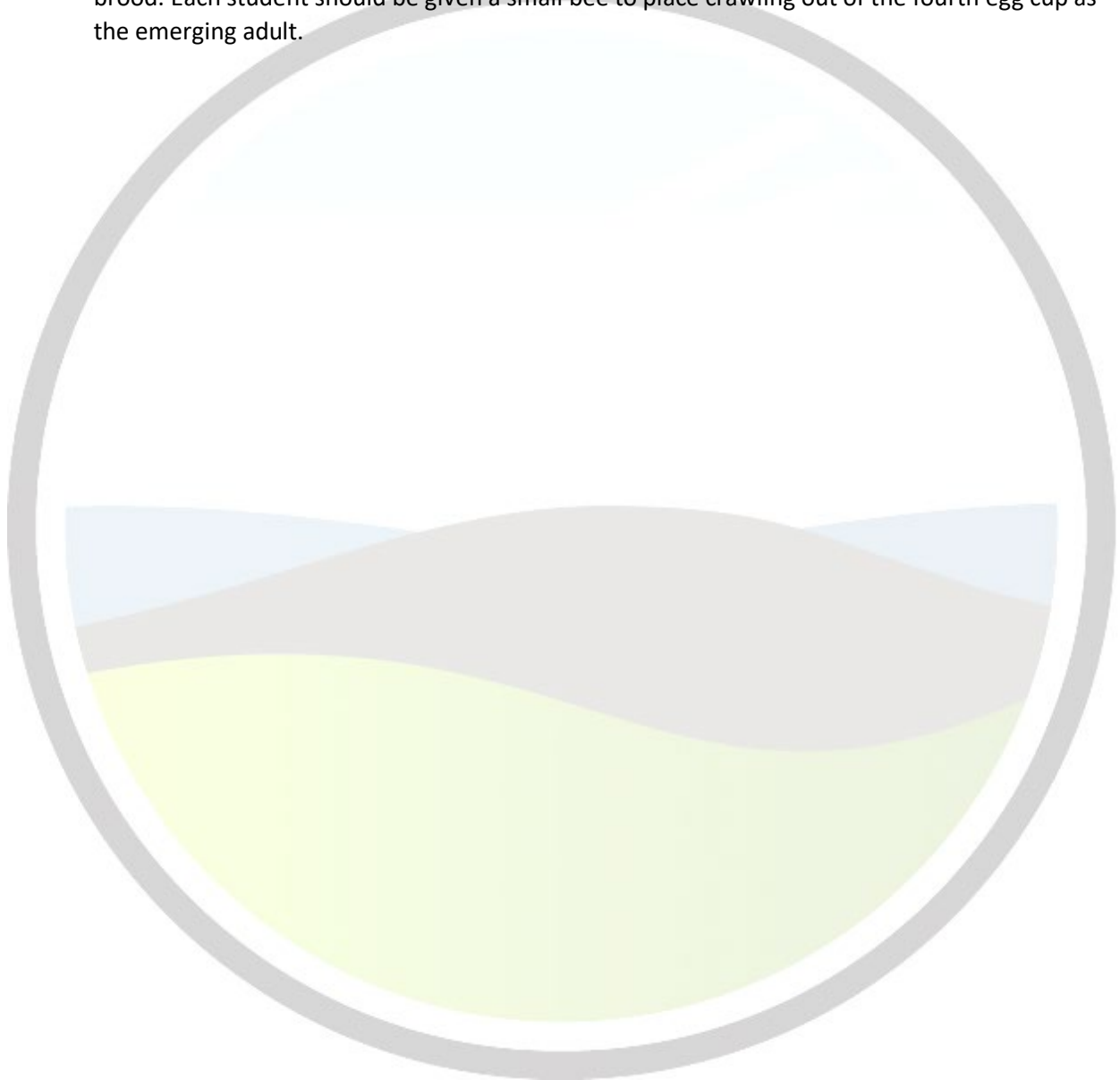
Using egg cartons cut into sections of 4 cups, students will build a model of the honey bee life cycle.

Supplies:

1. Egg carton 4 cup (1 per student)
2. White polymer clay
3. Black polymer clay
4. White rice
5. Press N’ Seal
6. Small bee (1 per student) (example available: <https://www.amazon.com/slp/tiny-bees/5abmeur2eq2h3o7>)

Steps:

Using the completed life cycle diagram, students will create an example of each stage to place in the egg carton. The white rice represents the egg and is glued to the bottom of the first egg cup. The larva is made from white polymer clay and is glued to the second egg cup. The pupa is made of white polymer clay and black polymer clay for the eyes. After placing the pupa in the third egg cup, the student should use a piece of Press N' Seal to cover the cup to represent the capped brood. Each student should be given a small bee to place crawling out of the fourth egg cup as the emerging adult.





Age Range: Grades 3-5

Which Way to the Flower?

Goal: Students will learn how bees communicate without words and the difference between the waggle dance and the round dance.

Supplies:

1. Digital device per student
2. Video: <https://youtu.be/zc9DtMtHeSk>
3. Website: <https://askabiologist.asu.edu/bee-dance-game/>
4. Website: <https://askabiologist.asu.edu/sites/default/files/virtual-reality/Beehive-VR-360/>

Steps:

1. Students will watch "Earth to Luna!" episode about honey bee communication.
2. Teacher will review information about the dances, using the website <https://askabiologist.asu.edu/bee-dance-game/introduction.html>
3. Teacher will review how to play the Bee Dance Game: <https://askabiologist.asu.edu/bee-dance-game/how-to-play.html>
4. Teacher will demonstrate playing the Bee Dance Game: <https://askabiologist.asu.edu/bee-dance-game/play.html>
5. Students will play game themselves, utilizing what they have learned to earn higher scores.
6. As students master the game, have them open the Virtual Bee Hive Tour <https://askabiologist.asu.edu/sites/default/files/virtual-reality/Beehive-VR-360/> for the chance to be the bee!



Age Range: Grades 3-5

Honey Bee Careers

Goal: Students will learn about the three types of bees in a honey bee hive (worker bee, drone, queen) and what each of their “careers” consist of. They will also learn the life expectancy for each type.

- <https://bees.techno-science.ca/english/bees/life-in-a-hive/stages.php>
 - <https://www.nationalgeographic.com/animals/2019/03/honey-bee-job-queen-hive-animals/>
- Each colony has only one queen bee, a few drones (males), and the rest worker bees (females). The queen is the only one to reproduce. All the other bees in the colony are her offspring.
 - The queen lives three or four years. She leaves the colony one time to mate with drones from other colonies. Then she spends the rest of her life laying eggs for new bees.
 - The drones live just long enough to go out and mate with a queen from a different colony.
 - The worker bees live a few weeks to a few months. They have lots of jobs.
 - The worker bees feed and tend the eggs. Depending on her age, here are the jobs of a worker bee:

Days 1-3	Cleaning cells of the comb and keeping new eggs warm.
Day 6-10	Feeding younger larvae
Day 8-16	Receiving honey and pollen from field bees
Day 12-18	Making wax and building new cells in the comb.
Day 14 & onwards	Guarding the hive entrance, foraging for nectar and pollen.

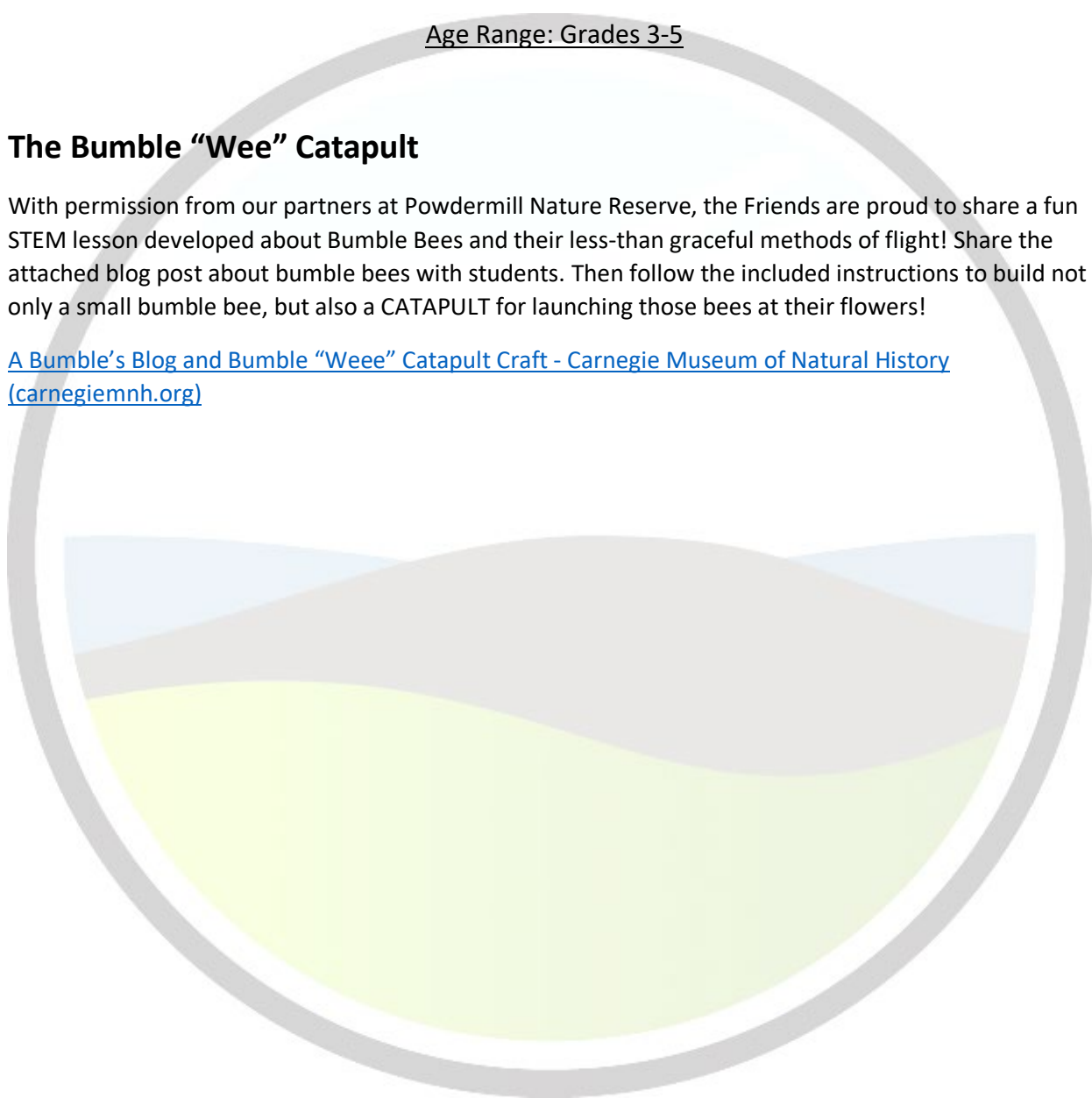


Age Range: Grades 3-5

The Bumble “Wee” Catapult

With permission from our partners at Powdermill Nature Reserve, the Friends are proud to share a fun STEM lesson developed about Bumble Bees and their less-than graceful methods of flight! Share the attached blog post about bumble bees with students. Then follow the included instructions to build not only a small bumble bee, but also a CATAPULT for launching those bees at their flowers!

[A Bumble’s Blog and Bumble “Wee” Catapult Craft - Carnegie Museum of Natural History \(carnegiemnh.org\)](http://carnegiemnh.org)





Age Range: Grades 3-5

Bee Bodies – Honey Bee Anatomy

Most people can describe or draw a basic bee: black and yellow stripes, wings, a 3-part body. This lesson will take students beyond the basics by bringing the honey bee's amazing anatomy and structures alive. From the pollen basket to the hairy eyes, bees are creatures that inspire wonder and curiosity.

Although each of the 20,000 species of bees in the world has something in common with the next, this lesson focuses on honey bees: the only insects that produce food for humans. In order to survive, thrive, and perform their work in the world, honey bees have evolved with a fascinating anatomy and specific adaptations. This detailed, up-close look at both the structures and the functions of honey bee anatomy will help students understand the bee's place in the world.

Honey bees have many parts that are easily recognizable: a head, thorax, abdomen, legs, antennae, eyes, wings, etc. They also have a corbiculae (or pollen basket), tiny hairs on their eyes, a proboscis, and hooks (or hamuli) that hold their wings together in flight. Students will learn about and label these parts.

Download the ENTIRE lesson plan at the link below!

- http://sweetvirginia.org/wp-content/uploads/2017/04/HA_Lesson-Plan_Print_01.pdf



Age Range: Grades 3-5

Tiny Insect – HUGE Role

Honey bees are astoundingly good communicators. They need to coordinate their activities according to very specific needs and time-frames. In order to keep the hive functioning, they must all know whether the queen is healthy, what work needs to be done, and where to find sources of pollen and nectar. One of the ways they communicate critical information is through specialized, message-infused movements, commonly referred to as dances. There are three distinct dances, each with its own message. The waggle dance is performed in the hive, near the entrance/exit, by a bee that has discovered a good source of nectar a certain distance from the hive. The waggle dance has amazing mathematical detail, conveying the distance and direction of the source using precise angles related to the location of the sun.

Honey bees are not just honey producers, collecting nectar and pollen and converting it to sweet nourishment; honey bee activity is required for some types of pollination. Although some pollination occurs naturally via spores being carried from plant to plant on the wind, much of it occurs from bees accidentally moving pollen from plant to plant as they travel around collecting nectar. Bees are an essential part of the pollination process, significantly contributing to our food supply.

This lesson encourages a review of the food web and provides specific information about the pollination process. Students will learn about the basic structures of flowering plants and the methods by which pollinators play a role in their reproduction. Students will finish this lesson with a better understanding of the role of the honey bee—and the importance of pollination—in the food web we all dip into every day.

Download the ENTIRE lesson plan at the link below!

- http://sweetvirginia.org/wp-content/uploads/2017/04/HA_Lesson-Plan_Print_03.pdf



Age Range: Grades 3-5

Bee Week!

Five 45-minute lessons developed by Mary Klass in 2015 are available for download:

<https://www.nps.gov/subjects/pollinators/upload/FINALBee-Week.pdf>

Each lesson includes a focus question, warm-up, main lesson, and post lesson assessment! Use a single lesson or any combination to meet your class's instructional needs!

Lessons Include:

Day 1 Topic: External Observation of a Honey Bee

Focus Question: What adaptations do bees have to be effective pollinators and to survive?

Lesson: External Observation of a Honey Bee: Students will follow detailed directions on a lab sheet to complete an external observation of a honey bee, observing the different adaptations that help the bees be effective pollinators and survive.

Day 2 Topic: Flower Dissection / Insect Pollination

Focus Question: What adaptations do flowers have to ensure their pollination and survival?

Lesson: Flower Dissection

Day 3 Topic: The Importance of Pollinators

Focus Question: What is a pollinator?

Lesson: The Importance of

Day 4 Topic: Engineering A Bee

Focus Question: If you were an engineer, how would you create a "bee" to help pollinate plants?

Lesson: Engineering a Bee

Day 5 Topic: Pollinators in our World

Focus Question: What can you do to help pollinators?

Lesson: Build a "Bee Helper"