THE BUZZ ABOUT BEES
MIDDLE SCHOOL

Life Science TEKS	
Sixth Grade:	6.12E, 6.12F
Seventh Grade:	7.11A, 7.11B, 7.11C, 7.12A, 7.13A
Eighth Grade:	8.11A, 8.11B, 8.11C

Life Science Vocabulary

abiotic, adaptations, balance, biotic, competition, environmental changes, external stimuli, food web, genetic traits, heredity, introduced species, organisms, populations, predator, prey, reproduction

Pre-Show Activity

Pre-Show Lesson: The Buzz About Bees

Materials: Signs that say “Agree”, “Disagree”, Strongly Agree” and “Strongly Disagree”; Article from Appendix A-1; Claim-Evidence-Reasoning chart in Appendix A-2

The teacher will need to tape up the signs before class - one in each corner of the classroom.

Procedure:

1. Show students the following statement: “Honeybees and other types of bees are vital to our survival.” Give students a few minutes to write their thoughts about this statement on a sticky note. Tell students to move to the corner that reflects how they feel about this statement: agree, strongly agree, disagree or strongly disagree. Students should bring their writing with them. When students get to their corner, they should share their thinking with others in their corner. Create a class bar graph with the sticky notes on the board or wall to illustrate the number of students who agree, strongly agree, disagree, and strongly disagree. Have students place their sticky note on the bar that represents their thinking.

2. Bring the class back together. Lead a discussion on the niche of bees in our world.

- What niche do different species of bees play in the ecosystem?

- Is their job important? Why or why not?
- Do they have any special characteristics that help them do their job well?
- Do bees help us?
- What are the biotic and abiotic factors of an ecosystem that impact bees?
- What would happen if we didn't have bees?
- Are bees in a food chain? If so, can you describe it?
- If there were no more bees, would it affect the ecosystem? How?
- In what type of ecosystems do you find bees? Why do you think that?
- How do you think humans affect bees?

3. Students will work with a partner to make a T-chart. One column should say "Importance of Bees" and the other column should say "Issues with Bees". Each student should make their own chart and be prepared to share. They can use the article in Appendix 1-A to help them. Once students are done with their chart, they should draw a line across the bottom to show where they ended.

4. Students will share their findings using the 1 Stay-3 Stray Strategy:

- Assign each person in the group a number 1-4.
- Those assigned with number one will be the presenter and stay where they are. All of the number twos will rotate one group to the right. All of the number threes will rotate two groups to the right. All of the number fours will rotate three groups to the right. The purpose is to mix the groups so that all students are with a new group.
- Once students are in their new groups, the ones will share first, then the twos, etc. Students can add comments from other classmates under the line that they drew.

5. Students will return to their original partner and share notes. Partners will make a claim to state their belief about the importance of bees and give evidence and reasoning to support it. See Appendix A-2 for a Claim-Evidence-Reasoning chart.

Post-Show Enrichment Activities

Activity One: Chain Notes

Have students write the question, “What do I know about bees?” at the top of a piece of paper. Working in groups of four, have students circulate the papers around the group, adding something new to each list. Students will continue passing the papers a couple of times around until they get back to the original writer. Using their original papers, students will write a 10 word sentence to summarize the importance of bees.

Activity Two: Dichotomous Key

Teach students how to make a dichotomous key using four or five different types of candy that can be easily identified (gummy bears, gum ball, peppermint, lollipops, tootsie roll). Discuss the features of each type of candy with students: colorful, soft, hard, has a stick, chocolate, round, cylindrical shape, etc. Lead them through making a dichotomous key using the example in Appendix A-3 as a guide. Another option would be to allow them to use an online dichotomous key for practice.

Once students understand how a dichotomous key works, have them work in partners to create their own dichotomous key to differentiate between bee species. They can use the information in Appendix A-4 for this or find a website with information about different bees. Partners can exchange keys to get feedback.

Activity Three: Public Service Announcement

There is a lot of misinformation in the public about bees, especially “killer bees”. Providing the public with the facts about these bees will help protect both the bees and humans. Students will create a public service announcement to educate the public about bees. They can use the information provided in Appendix A-5 to help them. The public service announcement should include:

- Information about how bees got to the United States
- The genetic make-up of Africanized bees versus American honey bees
- The importance of bees
- The precautions the public needs to take
- A final reassuring statement to ease the public’s fear of bees

Activity Four: Response to External Stimulus

Students will create a chart showing how Africanized bees respond to external stimuli and why they respond in that manner. They can use the article in Appendix A-5 to help them. See Appendix A-6 for the chart and sample answers.

Appendix

A-1

The Importance of Honeybees
Just how important are honeybees to the human diet and all life on Earth?

By: Maria Boland, MNN State Reports
Monday, May 03, 2010 at 11:26 AM

Just how important are honeybees to the human diet? Typically, according to the U.S. Department of Agriculture, these under-appreciated workers pollinate 80 percent of our flowering crops which constitute 1/3 of everything we eat. Losing them could affect not only dietary staples such as apples, broccoli, strawberries, nuts, asparagus, blueberries and cucumbers, but may threaten our beef and dairy industries if alfalfa is not available for feed. One Cornell University study estimated that honeybees annually pollinate $14 billion worth of seeds and crops in the U.S. Essentially, if honeybees disappear, they could take most of our insect pollinated plants with them, potentially reducing mankind to little more than a water diet.

Bees are of inestimable value as agents of cross-pollination, and many plants are entirely dependent on particular kinds of bees for their reproduction (such as red clover, which is pollinated by the bumblebee, and many orchids). In many cases the use of insecticides for agricultural pest control has created the unwelcome side effect of killing the bees necessary for maintaining the crop. Such environmental stresses plus several species of parasitic mites devastated honeybee populations in the United States beginning in the 1980s, making it necessary for farmers to rent bees from keepers in order to get their crops pollinated and greatly affecting the pollination of plants in the wild. In recent years commercial honeybee hives have suffered from colony collapse disorder, which, for unknown reasons, left many bee boxes empty of bees after overwintering. Bee venom has also been found to have medicinal properties, used for treating arthritis, multiple sclerosis and even fibromyalgia, and more recently to treat sexual dysfunction, cancer, epilepsy and depression.

Pollination is transfer of pollen from the anther (the male part of the flower) to the stigma (the female part of the flower). Some plants can pollinate themselves: in this case, the pollen passes from the anther to the stigma inside the same flower, and this is called self-pollination. Other plants need pollen to be transferred between different flowers or different individuals of the plant. This is cross-pollination. Many plants can be pollinated both ways. Plants can be pollinated by wind or animals.

Flowers pollinated by bees most often bloom in daytime, and can be different colors (though seldom red). The scent of daytime, bee-pollinated flowers tends to be less strong than that of night-pollinated flowers, often pollinated by bats or moths.

Honeybee pollinated flowers have nectar tubes no more than two centimeters long. They have nectar guides (patterns to direct the bee towards the nectar) and often a landing place for bees. Bees are especially attracted to white, blue and yellow flowers. Plants pollinated by insects are called “entomophilous”, and insects are generally the most important pollinators. Usually a honeybee can visit between 50-1000 flowers in one trip, which takes between 30 minutes to four hours. Without pollen, the young nurse bees cannot produce bee milk or royal jelly to feed the queen and colony. If no pollen is available to the colony, egg laying by the queen will stop.

Humans' intense agricultural practices have greatly affected the pollination practices of bees within the United States. The increased use of pesticides, the reduction in the number of wild colonies and the increased value of both bees and pollinated crops have all added to the importance of protecting bees from pesticides. Furthermore, many homeowners believe dandelions and clover are weeds, that lawns should be only grass to be mowed down regularly, and that everything but the grass should be highly treated with pesticides. This makes a hostile environment for bees, butterflies and other pollinators. Many bee poisoning problems could be prevented by better communication and cooperation among the grower, pesticide applicator and the beekeeper.

A-2

Claim-Evidence-Reasoning

Question: Are honeybees vital to our survival?

Claim: Answer using a complete sentence.

Evidence: State facts about honeybees to support your claim.

Reasoning: Connect your facts to the scientific principles about honeybees and survival. Why is your evidence important?

A-3

Candy Dichotomous Key

Directions: Using the candy that you were presented with, respond to the questions below.

1. Is the candy hard? (If yes, go to question 2. If no, go to question 3.)
2. Is the candy shaped like a sphere? (If yes, go to question 4. If no, go to question 7.)
3. Does the candy have a chocolate flavor? (If yes, go to number 10. If no, go to number 6.)
4. Does the candy have a stick? (If yes, go to number 8. If no, go to number 5.)
5. Is the candy meant for chewing? (If yes, go to number 9. If no, go to number 7.)
6. Does your candy come in different flavors? (If yes, go to number 11. If no, go to number 1.)
7. Does your candy freshen breath? (If yes, go to number 12. If no, go to number 1.)
8. Your candy is a lollipop.
9. Your candy is a gum ball.
10. Your candy is a Tootsie Roll.
11. Your candy is a gummy bear.
12. Your candy is a peppermint.

A-4

Create a Bee Dichotomous Key

The following information was copied from
http://www.entomology.umn.edu/cues/pollinators/species.html

Types of Bees

Red-Tailed Bumble Bee (*Bombus ternarius*)
Rob Routledge, Sault College, Bugwood.org

Bumble Bees (*Bombus* species; Family Apidae, Subfamily Apinae)

These large (10 to 23 mm), hairy bees are the only truly social bees native to the United States. Overwintering queens form new colonies in the spring and nest in the ground. Bumble bees are used commercially to pollinate crops such as tomato. Pollen is carried on the hind legs on corbiculae (enlarged areas surrounded by stiff hairs). A few species invade the nests of other bumble bees; these social parasites do not carry pollen.

Honey Bee (*Apis mellifera*)
David Cappaert, Michigan State University, Bugwood.org

Honey Bees (*Apis mellifera*; Family Apidae, Subfamily Apinae)

Honey bees are an introduced European species and are used commercially for honey, beeswax, and propolis production, as well as for pollination. They are 10 to 15 mm in length and possess corbiculae. Unlike other bees, honey bees live through the winter (but in the absence of the males or drones). Feral honey bees nest in trees or other cavities. Most honey bees are relatively docile; but an African subspecies (*Apis mellifera scutellata*), which escaped into the southern United States, is highly aggressive.

Digger Bee (*Anthophora terminalis*)
Laura Gooch, http://www.flickr.com/photos/lgooch/7705996856/, Creative Commons Copyright

Long-Horned Bee (*Melissodes bimaculata*)
Johnny N. Dell, Bugwood.org

Digger and Long-Horned Bees

(Family Apidae, Subfamily Apinae)

Digger bees are sometimes classified in the family Anthophoridae along with the carpenter bees. These hairy bees range from 5 to 25 mm in length and, like other members of this family, the females use scopae (stiff hairs) to carry pollen.

Most species nest in the ground or in vertical banks, often in sandy soil. Some species waterproof their brood cells with secreted waxy or oily material. Most are solitary; however, some species may aggregate or share common entrances to nesting areas. Each female cares for her own brood.

Males of *Anthophora*, *Eucera*, and *Melissodes* may sleep in groups while clinging to plant material with their mandibles. One species, *Habropoda laboriosa*, is an important blueberry pollinator.

Small Carpenter Bee (*Ceratina* species)

Steve Nanz, University of Minnesota Extension Gardening Info

Carpenter Bees (Family Apidae, Subfamily Xylocopinae)

Large carpenter bees (*Xylocopa* species) are 13 to 30 mm in length and small carpenter bees (*Ceratina*) are 3 to 15 mm. Females use scopae to carry pollen.

Xylocopa species chew nests in wood (including buildings!) and stems of plants. *Ceratina* species have smaller jaws; therefore, they utilize softer material, such as dead wood, in which to nest. Most carpenter bees are solitary, but a few species are semisocial (mothers and daughters share nests).

Mining Bee

David Cappaert, Michigan State University, Bugwood.org

Mining Bees (Family Andrenidae)

These mostly solitary bees can be as small as 2 mm or as large as 25 mm. All species nest in the ground, especially on slopes, where large numbers of bees may aggregate. They are common in the early spring. Some species are important apple pollinators and can move more pollen than honey bees can!

Leafcutter Bee (*Megachile* species)
Whitney Cranshaw, Colorado State University, Bugwood.org

Blue Orchard Bee (*Osmia lignaria*)
Scott Bauer, USDA Agricultural Research Service, Bugwood.org

Leafcutter and Mason Bees (Family Megachilidae)

This is a diverse family of 3 to 20 mm solitary bees that usually nest in cavities (beetle tunnels in dead trees, crevices, etc.). However, cuckoo bees in the genera *Stelis* and *Coelioxys* are cleptoparasites (nest in other bee's nests) and may even kill the host bees' larvae.

Leafcutter bees (*Megachile* species) cut sections of leaves and flowers to wrap brood cells, while mason bees (*Osmia* species) use mud to divide brood cells. Other genera and species may use materials such as plant hairs, pebbles, wood.

Bees in this family collect pollen on hairs on the underside of the abdomen instead of on the legs. The blue orchard bee (*Osmia lignaria*) is an important pome fruit pollinator.

Green Sweat Bee (*Agapostemon* species)
David Cappaert, Michigan State University, Bugwood.org

Sweat Bees (Family Halictidae)

These small bees are sometimes brightly colored and may be 3 to 23 mm depending on species. Most are solitary and nest in the ground or in wood, but some *Lasioglossum* species exhibit social behavior. Some *Sphecodes* species are cleptoparasites (nest in other bees' nests).

Yellow-Faced Bee (*Hylaeus* species)
David Cappaert, Michigan State University, Bugwood.org

Polyester Bees (Family Colletidae)

These 5 to 15 mm solitary bees nest in the ground or in wood and line the insides of the cells with a substance that resembles cellophane. *Colletus* and *Hylaeus* are two common genera. Although solitary in nesting behavior, they may aggregate.

A-5

Introduced Species: Africanized Honey Bee

The information below was taken from the website:
http://www.columbia.edu/itc/cerc/
danoff-burg/invasion_bio/inv_spp_summ/Apis_mellifera_scutellata.htm

Common Name: Africanized Honey Bee (AHB), Africanized Bees, Killer Bees, Brazilian Bees

The Africanized Honey Bee is a hybrid of one of the several European Honey Bee subspecies and the African Honey Bee.

The Africanized Honey Bee, more popularly known as the "killer" bee, has the general appearance of the more temperamental European Honey Bee. However, they are slightly smaller, but only microscopic measurements in a laboratory would be able to distinguish between the two. They are robust, 3/4 of an inch in length, and are covered in fuzz. They are brownish in color with black stripes that aren't as distinct as those on wasps or hornets. They have four clear wings that are attached to the thorax, which is the middle section of the body. The six legs are also attached to the bottom of the thorax. The abdomen is larger than the thorax and ends in the stinger, and the head is smaller than both of the sections. The two compound eyes are large and bulbous and allow the Africanized Honey Bee to see ultraviolet rays, enabling them to fly at night. The queens are the largest bees in the social structure, followed by the drones and then the workers.

Africanized Honey Bees and European Honey Bees may be similar in appearance, but not in behavior. Africanized Honey Bees will attack when unprovoked, and they respond rapidly and in large numbers to disturbances that European Honey Bees would ignore. Like European Honey Bees, Africanized Honey Bees can sting only once; they deliver a venom identical to that of European Honey Bees. Both types of bee die shortly after leaving their stings and ends of their abdomen in their victim.

Africanized Honey Bees have gradually spread northward through South America, Central America, and eastern Mexico, progressing some 200 miles per year. In 1990, Africanized Honey Bees reached southern Texas, appeared in Arizona in 1993, and found their way to California in 1995.

Honey bees are not native to the Western Hemisphere. European settlers brought most honey bees to the Americas approximately 400 years ago. The honey bee colony's ability to survive the winter depends on their food stores. Keeping warm takes energy in the form of honey. If the colony runs short of honey, it will freeze to death before spring. The worker bees force the now useless drones from the hive, leaving them to starve. It's a harsh sentence, but one that's necessary for the colony's survival. Although able to survive harsh winters, European Honey Bees did not perform well in the tropical climate of South America. African Honey Bees were brought to the Western hemisphere in 1956, when the Brazilian government asked Dr. Warwick Kerr, a

geneticist, to create a bee that could survive Brazil's tropical climate. The European Honey Bee had not been able to successfully withstand heat and predation. It was hoped that African Honey Bees, having proved themselves successful for millions of years in the tropics, could bred with the European bee. The goal was to create a bee which was gentle, yet successful in the tropics. However, in 1957, some of them got loose and set up housekeeping in the tropics of Brazil. They've been spreading ever since.

Africanized colonies can increase their colony populations extremely quickly, but only in response to immediate availability of resources. The rapid expansion is obtained by high fecundity and shorter development times. These characteristics indicate that Africanized honeybees have evolved to survive and thrive in unpredictable conditions.

Because rainfall determines the availability and abundance of flora and food sources, the unpredictable rainfall in the tropics creates unpredictable availability of resources for bees. Therefore, Africanized bees' foraging stresses this unreliability and results in a more opportunistic bee. The bees forage, store their resources, and increase their chances of survival by collecting more pollen, committing more of their foraging cohort to pollen collecting, and swarming more often to areas of higher resources. Africanized bees might forage individually, shift their foraging from intensive and collective to gleaning, or searching of relevant resources individually, bit by bit.

Because of this adaptability to unpredictable resources, the Africanized honeybee discovers their habitat quickly, disperses readily to find other habitats if and/or when their current habitat has become inhabitable, uses resources quickly and efficiently, and reproduce rapidly.

Many other basic Africanized Honey Bees traits include:

- frequent swarming to establish new nests
- minimal hoarding of honey
- the ability to survive on sparse supplies of pollen and nectar
- moving their entire colony readily (abscond) if food is scarce
- exploiting new habitats very quickly and is not particular about its nesting site.
- a highly defensive nature
- responding more quickly and more bees sting
- sensing a threat from people or animals 50 feet or more from their nest
- sensing vibrations from power equipment 100 feet or more from nest
- pursuing a perceived enemy 1/4 mile or more

When Africanized Honey Bees compete with other species of honey bees for flowers, the Africanized bees may displace the other bees from the food sources. While over a short period of time, the abundance of other species of bee decreases and colony nectar and pollen harvest decreases, Africanized honeybees are negatively affected slightly over long periods. Competition

is considered among one of the factors that are responsible for differences in foraging behavior and specialization in bees.

Africanized Honey Bees have similar predators as all other bees. Their most destructive predators are humans. Africanized honeybees are preyed on by ants, anteaters, and armadillos. Honey badgers, safari ants, bee wolves, and bears are also major predators. Additionally, predation causes disturbances that could affect swarming and absconding. If a colony has just settled and predation causes a disturbance, the colony might be forced to relocate immediately, affecting colony size and growth rates. Bees defend their nests from predators by biting or stinging. Africanized bees pursue their predatory intruders for much longer distances than European honeybees.

Africanized honeybees in the tropics directly influence 25-30% of the reproductive success of the flora. The flora depends on the bees for pollination, and in turn, flora provide seeds and fruit for their own reproductive success and as food for other organisms.

Africanized Honey Bees are dangerous because they attack intruders in numbers much greater than European Honey Bees. Since their introduction into Brazil, they have killed some 1,000 humans, with victims receiving ten times as many stings than from the European strain. They react to disturbances ten times faster than European Honey Bees, and will chase a person a quarter of a mile.

Finally, the public should maintain a healthy respect for all bee colonies and swarms. Any wild swarms found near residences or close to domestic animals (horses, cows, poultry, hogs, and dogs) must be suspect and reported to pest control operators, police, fire departments, and/or beekeepers. In all cases, the people who received the multiple stings, survived. Since the bees are potentially dangerous, people need to be aware that they are out there. The public already is exposed to yellow jackets and small wasps that are just as defensive as the Africanized Honey Bee. Therefore, killer bees are not so scary. Just stay away from bee hives. The bees will "never go away" nor can they be completely exterminated. Bees are responsible for the life of our trees, flowers and the food we eat. At least one meal per person per day is possible because of the bee. Therefore, learning about the Africanized Honey Bees and taking certain precautions can lower the risk of being injured by this new insect in our environment.

A-6

Bee Responses to External Stimuli

External Stimulus	Response of Africanized Bee	Response of Honey Bee
Notices a person or animal		
Colony is disturbed by predators		
Sees a flower with pollen.		
Cold climate		

Possible Answers:

External Stimulus	Response of Africanized Bee	Response of Honey Bee
Notices a person or animal	Attacks without being provoked.	Ignores.
Colony is disturbed by predators	Colony has to relocate. Pursues the predator a long distance.	Colony has to relocate. May pursue predator, but for a short distance.
Sees a flower with pollen.	Goes to the flower to collect the pollen.	Goes to the flower to collect the pollen or flies back to hive to communicate findings with other bees.
Cold climate	They cannot survive a cold climate and will die.	They kick the drones out of the hive and survive on the existing honey.
This is left blank for the students to add an idea.		