

**Erratum to Activity: Impact of Climate Change on Bees in Eastern Forests:
Pollination in Action**

Under "Extensions":

First bullet, correct URL is: <http://www.livescience.com/14886-marla-spivak-bee-health-bts.html>

Impact of Climate Change on Bees in Eastern Forests: Pollination in Action

Region: Eastern Forests and Woodlands

Grade Level(s): 5-8

Time Required: 1 class period

Focus Question(s):

- What is the bee's role in the forest ecosystem?
- What will happen to the ecosystem when pesticides are used to control the spread of insects?

Learning Objectives:

- Students will develop an understanding of the pollination process and the relationship between pollinator and flowering plant.
- Students will model a scenario depicting the impact of climate change on pollination.

Materials:

- Carpenters' Straight-line Chalk, (powdered colored chalk for a straight-line tool.) Available in orange, red, blue and other colors.
- A few hundred Q-tips or cotton applicators.
- Spray bottle with water
- ABC Brainstorming Worksheet (See attached)

Background (Optional):

- Lindsey, Rebecca. 2007. Buzzing About Climate Change. NASA's Earth Observatory. <http://earthobservatory.nasa.gov/Study/Bees/printall.php>

Procedures/Instructional Strategies:

1. Review the concept of pollination with students. Explain that pollination is the process of moving pollen from one plant to another. It is through this process that plant reproduction happens. Briefly discuss the importance of plant reproduction to all living things.
2. Review the ways in which bees and butterflies pollinate plants as they get food for themselves. Bees, while sipping nectar from flowers, get pollen stuck on various parts of their bodies. This pollen then rubs off on certain parts of the next flower that they fly to. Bees are the most important pollinators in nature.
3. Take the class outside to an open area where they can run safely. Separate the students into groups of orange trees, apple trees and bees. Give the "trees" colored chalk to hold. The orange trees hold the orange chalk, the apple trees hold red chalk. Explain to the students that their chalk represents the tree's flowers.
4. Keep the supply of Q-tips a distance away at the "hive".

5. The bees take the clean Q-tips to the “trees’ flowers” to collect chalk and return the stained Q-tips to a basket near the hive. (Note: the chalk will not stain clothing)
6. When they deposit the stained Q-tip they take another clean one to find another tree.
7. Have the students rotate and change roles so that everyone gets a turn in each. Continue until all have had a turn and you have collected a considerable number of pollinated Q-tips at the hive.
8. Now create a new scenario and provide the background. The earth is getting warmer and this has caused the bees to come out of dormancy before the tree flowers are blooming. Take away most of the “tree flowers” (chalk) from the trees. Have farmers spray pesticides. (Have a student with spray bottle go around and spray, if it touches a bee the bee dies and end of game.)
9. Run the game again with these obstacles to pollination.
10. Have students discuss the game and their results.
11. Have students create an ABC Brainstorming Worksheet (See attached) on the topic of pollination. Tell students that the purpose of ABC Brainstorming is to think about what they already know and generate a list of ideas that might be connected to the topic of Pollination. Ask: What is pollination? What does it involve? As they brainstorm, ideas should be placed on the handout according to the letter of the alphabet with which they begin. Student volunteers can type the ideas onto the form. More than one idea can be placed into a letter category. An example of what a portion of the form might look like is included below. If students are having trouble getting started, fill in a few of the boxes with ideas of your own. Think out loud to show students how you come up with ideas for the form. For example: “When I think of pollination I’m reminded of bees and butterflies. I know that animals like birds can also help to pollinate flowers. Some pollinators are attracted to colorful flowers...etc.” Not all letters need to be used.

ABCs of Pollination (Example)

A (possible answers include: animal	N (night time blooms
B (bee, butterfly, birds, bats	O (organic, orange
C (color of flower, climate,	P (Pollen, pesticides
.....

Extensions:

- Have students read “Mysterious Bee Deaths Linked to Pesticides”. Have students write new scenarios based on what they have just read and their activity.
http://www.livescience.com/animals/070615_ap_bee_trouble.html
- Have the students write about anything the activity has inspired. Open their imagination by attributing human characteristics to the trees and bees. How does the world look to a bee that zooms around? What does a bee think when it is all the way inside a big

flower? Do the trees want to be visited? What happens to the blossom after a bee has visited?

- Probe for questions and inquiry.

Outcome/Assessment (Optional):

- Have students create a food or community web based on the activity.
- Have students create a Pollination ABC Worksheet (See attached).

National Science Education Standards Addressed:

Life Science:

- Reproduction is a characteristic of all living systems; because no individual organism lives forever, reproduction is essential to the continuation of every species. Some organisms reproduce asexually. Other organisms reproduce sexually.
- The number of organisms an ecosystem can support depends on the resources available and abiotic factors, such as quantity of light and water, range of temperatures, and soil composition. Given adequate biotic and abiotic resources and no disease or predators, populations (including humans) increase at rapid rates. Lack of resources and other factors, such as predation and climate, limit the growth of populations in specific niches in the ecosystem.

ABC Brainstorming Topic: Pollination Ecology

A	N
B	O
C	P
D	Q
E	R
F	S
G	T
H	U
I	V
J	W
K	X
L	Y
M	Z