SOCIAL & BENEFICIAL INSECTS

GOING BUGGY

GOALS FOR THIS STATION

- Understand the cooperative nature and roles of social insects.
- Understand the benefits of both social and solitary insects to nature and humans.
- Emphasize native bees (mason bees' life history and benefits).
- Construct native bee nest.

WHAT IS A SOCIAL INSECT?

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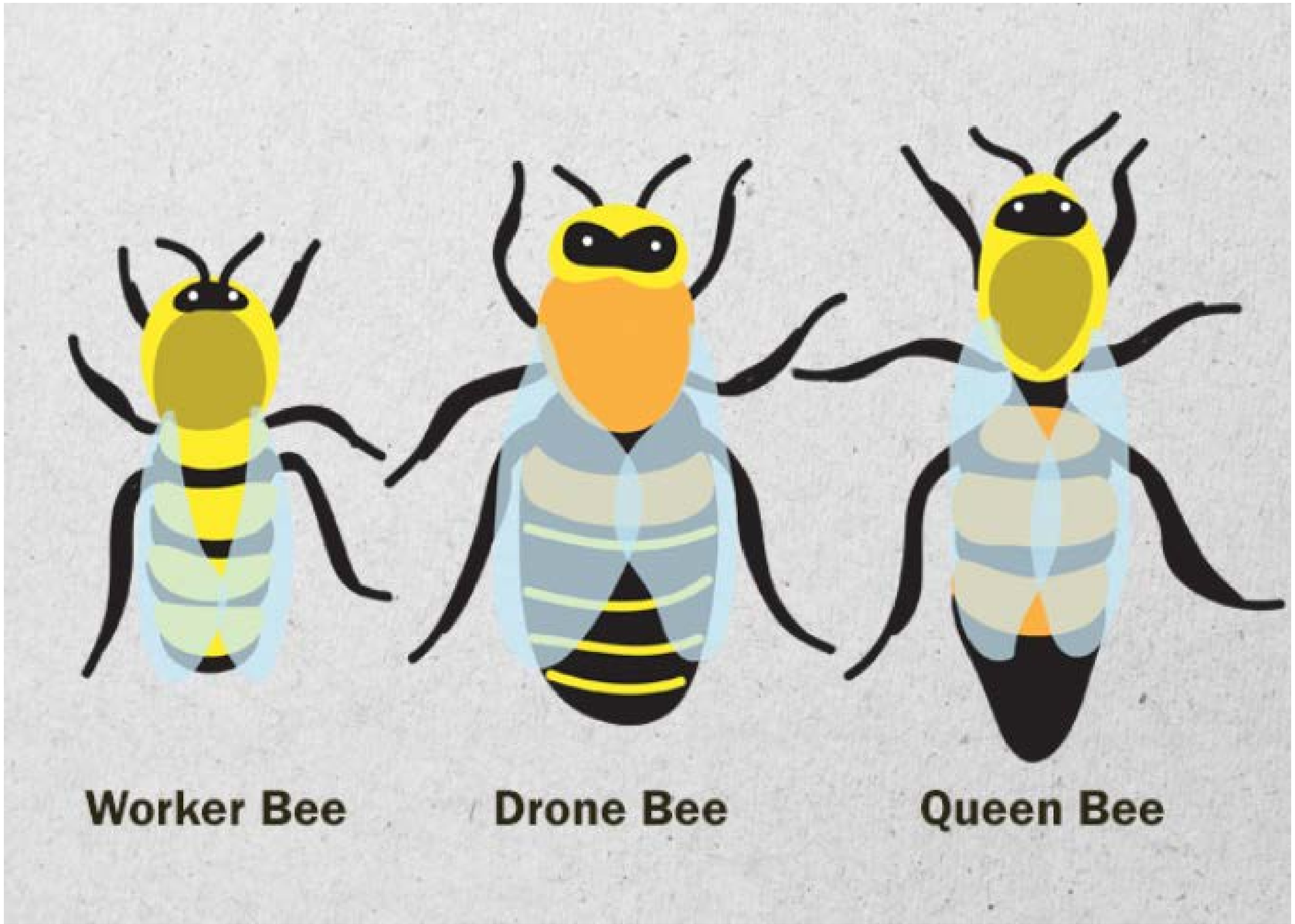
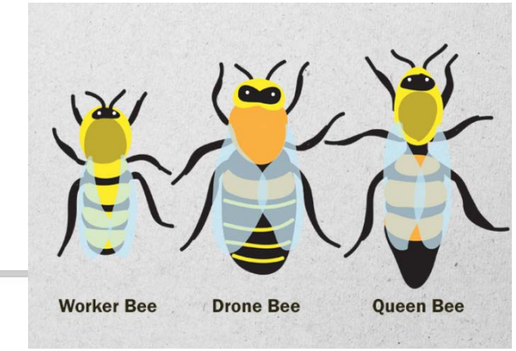
- Ask the students what the notice about the two picture (i.e., young and old termites are together, they all seem to be taking care of the smaller ones, some look different.)
- True social insects have 3 common characteristics:
  - Overlapping generations live together
  - The entire community cares for the young
  - Division of labor

DIVISION OF LABOR

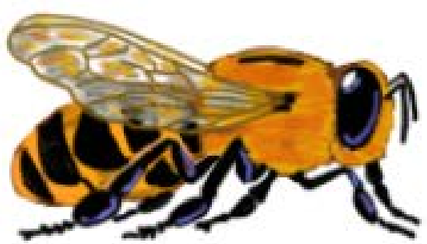


DIVISION OF LABOR



Queen

* fertile adult female;
* typically mates with 10 or more drones;
* ensures genetic heterogeneity in the hive;
* controls workers by pheromones which inhibit ovarian development of workers.



Drone

* fertile adult male;
* mates with queen from during her mating flight.

Worker

* unmated adult females;
* daughters of the queen.
* perform tasks necessary for colony to function.

ACTIVITY 1: ROLE PLAY LIFE OF THE HIVE

Role-Playing the Life of the Hive

- ***Set out the hive (bee box), and flowers along the trail. Have the coffee can of honeycomb ready to show the children.
- ***Use chart on honeybees to expand on the information that the children read from their cards.
- ***Choose students to role-play and have them read and act out their roles:
- 1 SCOUT (male) -- EATEN BY A BIRD and dies
- 2 SCOUT -- (male) FINDS THE NEW HIVE (BEE BOX)
- 3 DRONE --(male) MATES WITH THE QUEEN AND DIES
- 4 DRONE -- (male) MATES WITH THE QUEEN AND DIES
- 5 QUEEN -- (female) LAYS THE EGGS
- The queen is kept in the bottom box (the brooder) of the super (stack of bee boxes) by clipping her wings. Otherwise, she would lay her eggs where the honey is being made.
- 6 WORKERS-- (female) I FEED THE LARVAE (YOUNG). I feed the queen royal jelly all of her life (a secretion from the workers' glands) and feed the royal jelly to the larvae for the first two and a half days.
- WORKER – (female): I'm a field worker bee and I gather nectar and transfer it to the house worker bee by my tongue.
- WORKER – (female): I'm a house worker bee -- I form the cells of wax and I fill the nectar into the cells with my tongue.
- WORKER – (female): I gather nectar and transfer it to the house bee.
- WORKER – (female): I gather nectar and when the cell is filled. I seal the cell with beeswax.
- WORKER – (female): I gather the nectar and transfer it to the house bee.
- WORKER – (female): I seal the cell with a thin layer of wax.
- WORKER – (female): I defend the hive (ask who the predators of the hive might be)
- WORKER – (female): I cool the hive when it is hot (Ask why. To keep the wax from melting. The bees will also keep the hive warm in winter to keep themselves from freezing)

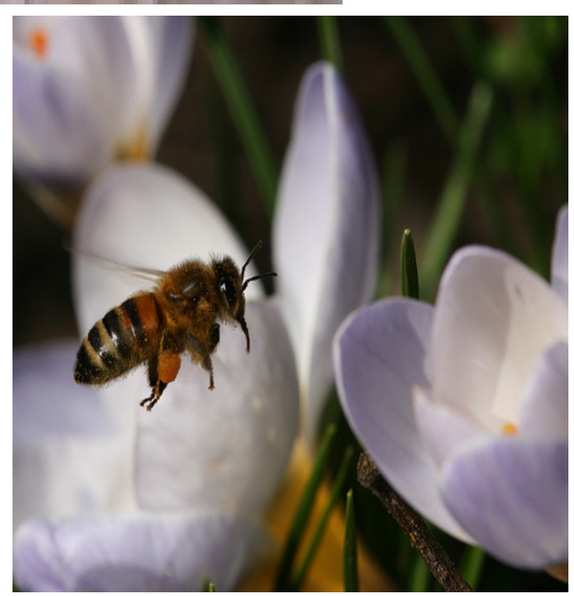
ROLES OF SOCIAL INSECTS

Ask students:

1. if they think insects are good or bad?
2. What are some of the ‘good’ roles insects play in ecosystems?

- Insects pollinate the flowers of plants.
- Insects recycle dead trees, plants, and animals by eating them.
- Insects limit mold and bacteria by eating other animal’s leftovers.
- Many animals eat insects, and some only eat insects.
- Insects feed on other insects that eat our crops.

ACTIVITY 1: ROLES OF SOCIAL INSECTS



ACTIVITY 2

- **Pictures to discuss (2-4 minutes)**
- **Show the following 6 photos and use the instructor material to discuss.**

PICTURE 1:
Fruits, Vegetables, Chocolate Bar, Coffee

- Insects pollinate the flowers of these plants and plant by-products. Without insects visiting the flowers of these plants, few plants would pollinate and few flowers would produce seeds. If they couldn't produce seeds, they would eventually die off and disappear from the planet. Flies do more pollinating than any other type of insect. Bees are next, and then butterflies. Chocolate is made from the seeds of a cocoa tree's fruit. Coffee is made from coffee beans.

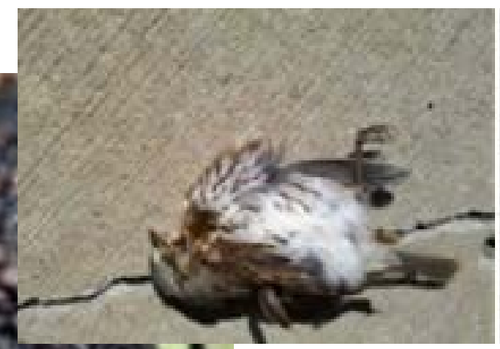
COFFEE

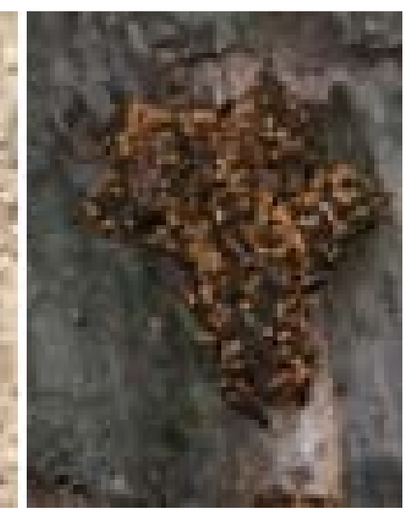
PICTURE 2:
Fallen Trees, Rotting Wood

- Insects recycle dead trees and plants by eating them. Plants, especially trees, consume a lot of the nutrients available in the soil and so lock up a lot of an ecosystem's nutrition. Subsequent generations of plants need these nutrients returned to the soil so that more plants can grow. Insects provide this service, particularly termites and beetles. Without insects, fungi and bacteria would decompose plant matter only very slowly. Dead plants and trees would pile up and it would be a very long time before they turned to dirt and provided room and nutrients for more plants to grow.

PICTURE 3:
Dead Bird, Raccoon Scat

- Insects recycle dead animals by eating them. Insects, especially flies, beetles and ants, very quickly consume dead animals. Although some birds and other animals are also scavengers, insects are the primary reason dead animals and dung don't pile up everywhere and make the world stink. Consider that the larvae that emerge from the eggs of a single fly can consume half a cow in just a few days. Here in Texas we have dung beetles that pat dung into little balls and then roll those balls off, where they bury the dung balls with their eggs. When the beetle eggs hatch, the beetle larvae eat the dung in the safety of an underground burrow.



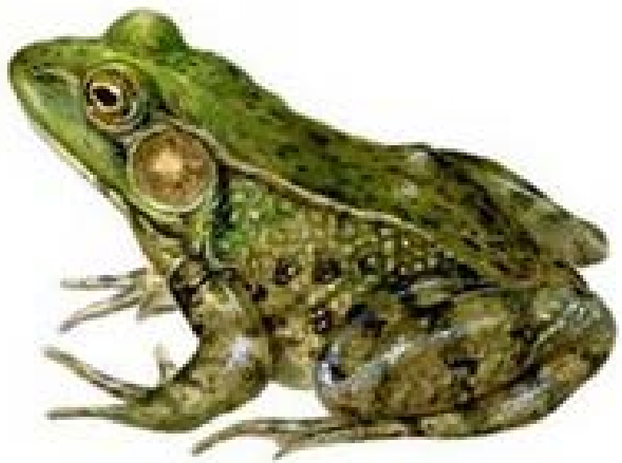


PICTURE 4:
Rotten Food in the House

- Insects limit mold and bacteria by eating other animal's leftovers. Ever wonder why old food left in the fridge only gets moldier and stinkier over time, while old food left outside usually disappears in a day or two? Although some animals will eat old food that's sitting outside, much of the food is eaten by insects like ants, flies, and beetles. The food hardly has time to get moldy and stinky. While mold can stink, bacteria are responsible for most of the stench. Mold and bacteria decompose organic matter much more slowly than insects recycle it.

PICTURE 5:
Golden Cheeked Warbler, Frog, Lizard

- Many animals eat insects, and some only eat insects. Without insects, most of these animals would die and never be seen by people again. The golden-cheeked warbler, an endangered bird (depicted), is one of these animals. One of Doeskin Ranch's primary purposes is to preserve golden-cheeked warbler habitat. The golden-cheeked warbler is an insectivore, meaning that it primarily eats insects. They prefer to feed their young soft-bodied prey, such as caterpillars and spiders, rather than hard-bodied prey such as beetles.



PICTURE 6:
Honey, Honey Jars

- Honeybees make honey by collecting nectar from flowers. Without honeybees, there would be no honey. The orchard Mason bee, a “solitary” bee, is very important for the pollinating of Texas' fruit.

HONEY

Honey

Beneficial Insects

- ANSWERS:
  - Pollination
  - Animal carrion clean up as decomposers
  - Yes, we are dependent on insects. (have them understand the importance of pollinating to the food that is on their table)
  - Shortage of food for consumption

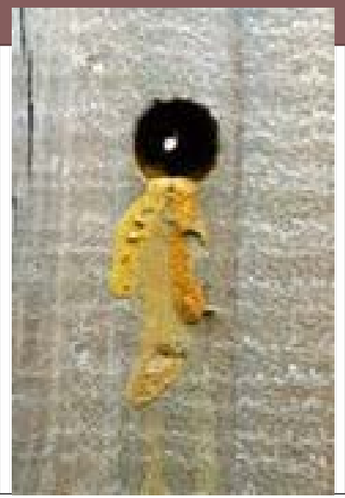
- ASK:
  - What benefits do humans see from insects in the ecosystem?
  - Are we dependent on insects?
  - What would happen if there were no insects?

Having established why/how insects are beneficial to mankind, the bulk of the station's time should be spent on bees (social and solitary). Insect pollination of plants is the obvious segue.

Bee’s Pollination Statistics

- According to the USDA, the % of crop plants pollinated by bees:
  - 100% Almond
  - 90% Apple
  - 90% Broccoli
  - 90% Blueberry
  - 90% Onion
  - 80% Cherry
  - 80% Celery
  - 65% Onion
  - 2% Peanut
  - 1% Grape

SOLITARY BEES



Solitary Bees

- The solitary bees we will talk about today are:
  - Miners
  - Mason
  - Leafcutter
  - Carpenter
- Commonalities among Solitary Bees:
- Most nests are –
  - Dug underground
  - In existing cavities and crevices
  - Excavated into soft wood or plant stems
- Do not live in colonies but can share nests

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Andrenid (mining) bees

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- Over 2000 species
- Solitary, females dig burrows in ground
- Lay egg on large ball of pollen at the end of tunnel

Mason Bees

- 300 species world wide, 140 in North America
- Make compartments of mud in their hollow nests
- Great spring pollinators, very efficient fruit tree pollinators
- Handle cold well.

Images: http://upload.wikimedia.org/wikipedia/commons/thumb/6/6c/Osmia_rufa_couple_%28aka%29.jpg/800px-Osmia_rufa_couple_%28aka%29.jpg
And

Mason Bees

http://1.bp.blogspot.com/_PM8we4QcI3w/S7ovOp-6WJI/AAAAAAAAAS0/jvp3aD8wAaI/s320/Mason-Bees1.jpg
And http://upload.wikimedia.org/wikipedia/commons/1/1f/Masonegg.jpg

Leaf Cutter bee

- Make small discs of leaves or petals

Leaf cutter bees

Leaf cutter bees (nests)

Images: http://completegarden.files.wordpress.com/2008/10/leaf-cutter-bee-bamboo-cut-open-chambers3.jpg
And
http://www.christinefarmer.com/home/wp-content/uploads/2009/06/leafcutter_bees_emerging_christine_farmer_web.jpg

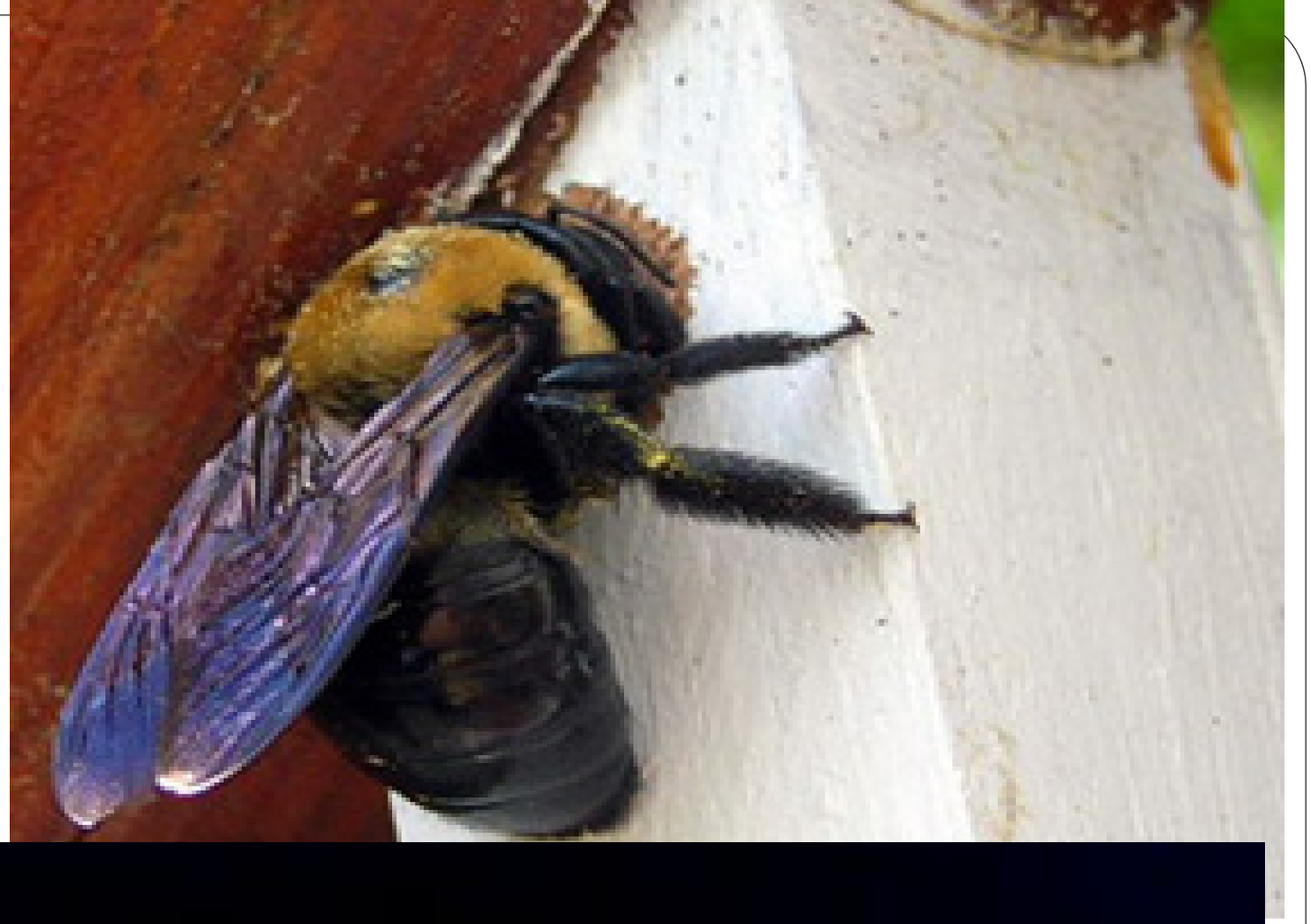
Leaf cutter bees (nests)

- Nest in existing cavities like holes in wood, hollow plant stems, garden hoses
- Line nests and make cell walls with leaf fragments

Carpenter bees

- 500 species worldwide
- “semi-solitary”
- Males cannot sting, females can but generally don’t.
- Prefer open faced flowers

Image: J.K. Barnes. University of Arkansas.



Tips to encourage bees in your garden

- Plant a garden instead of a mowing a lawn!
- Replace parts of lawn with native flowers
- Try using non-hybridized flowers
- Plan for blossoms year round
- Set up native bee homes
- Give them some water!

Threats- loss of habitat

http://3.bp.blogspot.com/-3NQIpliSntM/T1K5B57ZdHI/AAAAAAAABRM/1PDPBN6VWI4/s1600/urban+sprawl.jpg

Habitat Loss, Degradation, and Fragmentation

- Much pollinator habitat has been lost to agriculture, resource extraction, and urban and suburban development. Although these land uses can provide floral resources and benefit some pollinators, many bees and butterflies are habitat-specific, and the loss of habitat that provides sites for overwintering, foraging for pollen and nectar, or nesting can be detrimental to these species.
- Habitat degradation, the decline in habitat quality, is another serious concern. For example, the loose, friable soil required by ground-nesting bees may be trampled by heavy foot traffic or the use of off-road vehicles. In cities, ground-nesting species may be particularly limited due to the large amount of landscape that has been covered with concrete or other impervious surface.
- Many pollinators are adversely affected when large, intact tracts of habitat are broken up into smaller, isolated patches by road construction, development, or agriculture. These habitat fragments may not be large enough to meet all pollinator needs by themselves. Establishing and maintaining connectivity—safe passage among patches—is key to pollinator persistence in these areas.

Non-native Species and Diseases

http://www.apicoltoreitaliano.it/image/apicoltuPeste_Americana.jpg

Non-native Species and Diseases

- Plants or animals brought here from other places can decrease the quality of pollinator habitat. When non-native shrubs such as autumn olive and multiflora rose take over open fields, they crowd out the wildflowers needed by certain butterfly and bee species for pollen, nectar, or larval food.
- Introduced parasites and diseases are still another threat to pollinators. Thus far, the effects of these parasites have been species-specific, including the mite and virus species that have severely compromised honey bee colonies.

ACTIVITY 3

- BUILD A SOLITARY BEE NEST

ACTIVITY 3

- Using paper cups and straws, tie some straws into a bundle with string and place inside the cup. Remind the students that the house must be closed on one end (the bottom) so the bee doesn't get confused.
- Pieces of paper towel can be place around the straws to hold them securely in the cup.
- Cup may then be placed on the ground between rocks or logs so they don't blow around, facing south or southeast (if paper is used, rather than plastic or milk carton, the house should be covered to protect it from wet weather).