# Pollination: Why Do We Need Bees?

Grades 4-5

**UCCE Master Gardener Program of Riverside County**

***Vetted by Riverside County Office of Education-STEM***

# Why Is This Important?

- Pollinators, including honey bees and wild bees, add up to $200 billion annually in ecological services.
- These include their vital role in producing food for wildlife, maintaining soil health, and keeping water clean, in addition to their role in pollinating agricultural products.

-USA Facts

# Learning Goal

Students will learn why we need bees. They will learn about the critical role bees have in pollinating plants which result in the production of fruits and vegetables.

# Anchor Phenomena: Bee Pollination


bees in slow motion pollinating apple blossoms

# Develop a Model To Describe the Phenomena

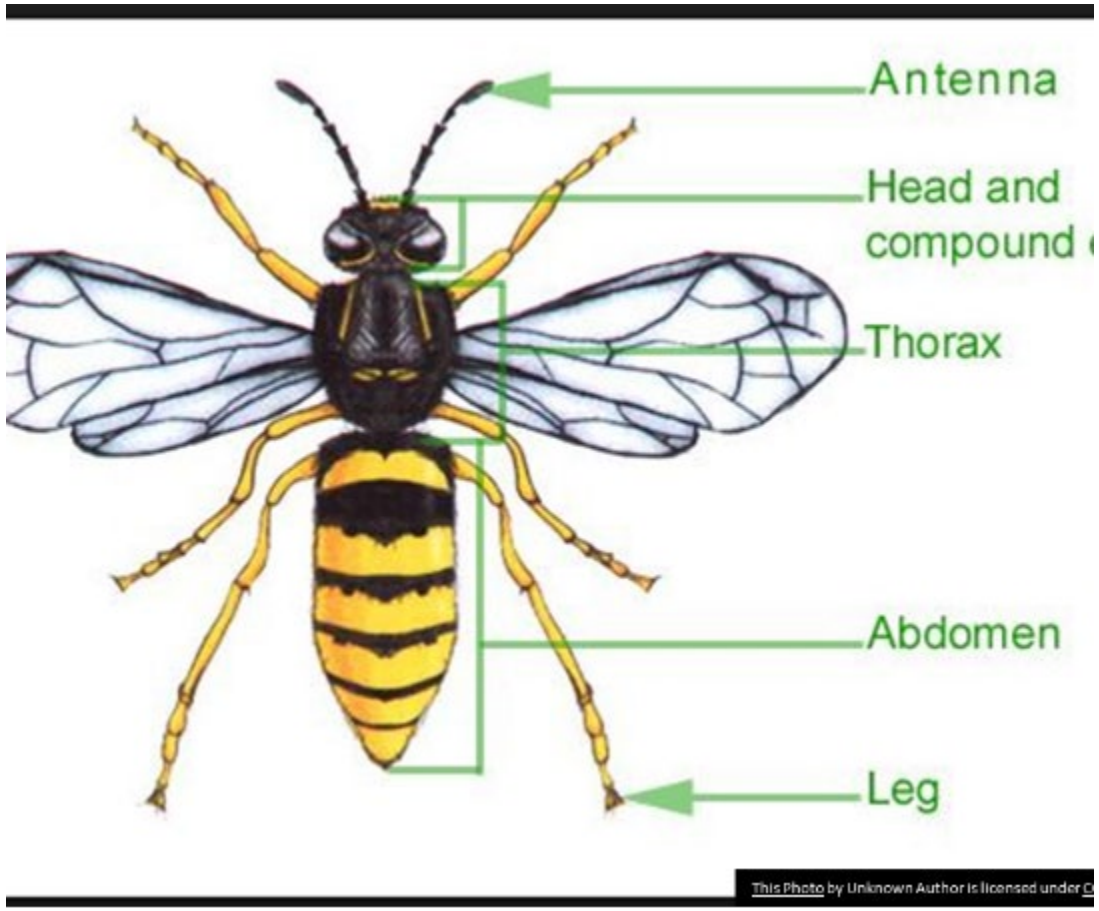
**Draw a diagram demonstrating the phenomena of pollination by bees including both observable and unobservable details.**

- Label all important parts of the diagram.
- Use arrows to show how all parts interact.
- Write an explanation describing the process of bee pollination.

# What is a Bee?

**A bee is an insect; it has 3 body parts, six legs, wings and antennas.**

- Body Parts
  - Head (has antennas for smell)
  - Thorax
    - Movement (legs and wings)
  - Abdomen
  - Not all bees have stingers
- Bees are cold-blooded; they are more active in warm weather.
- They can be observed flying to and landing on flowers.



# What is the Relationship Between Bees and Flowers?

Bees feed on and need both nectar and pollen produced by flowers.

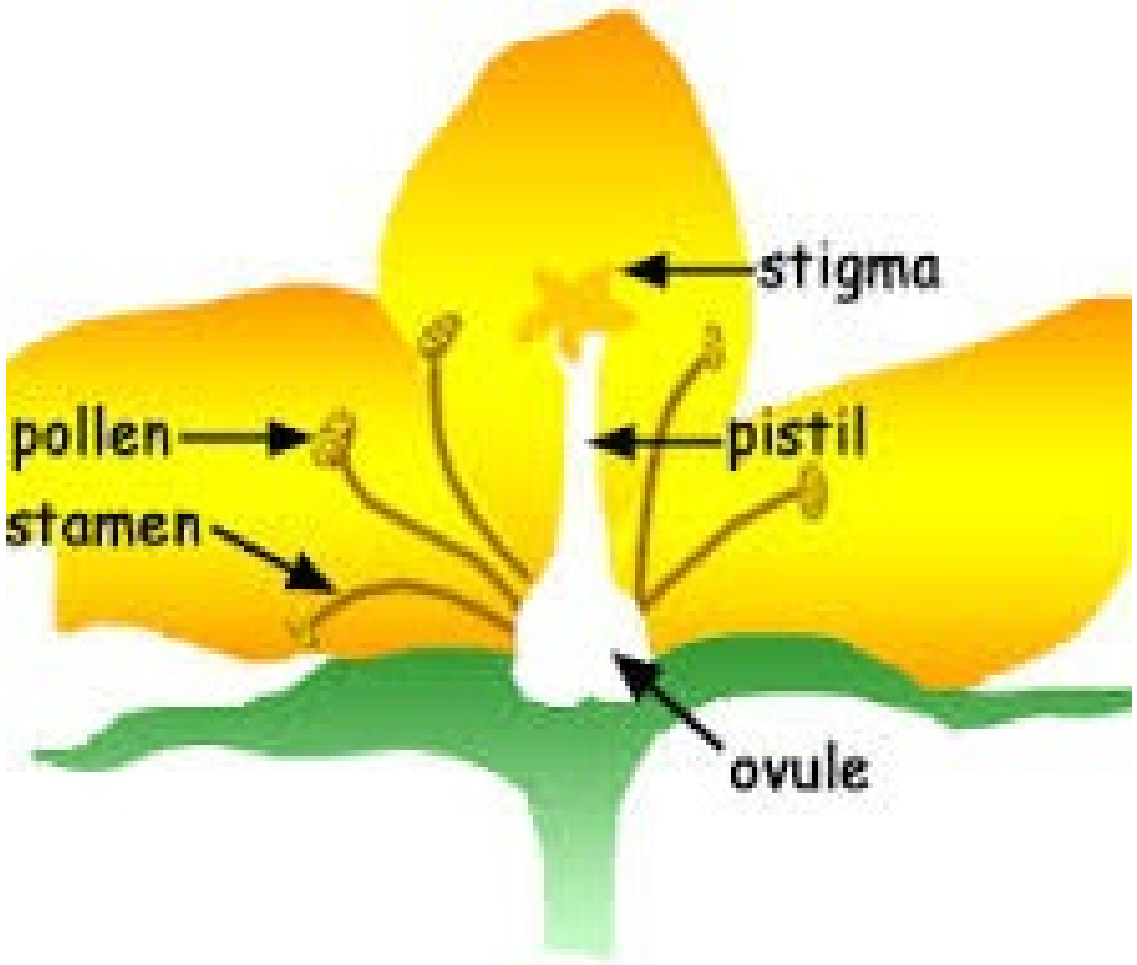
- The flower's nectar is used as an energy source to fly to and from their home.
- The flower's pollen provides protein and other nutrients. It is used by bees as larvae food.
- Bees transfer pollen from plant-to-plant, providing the pollination services needed by plants.

# What is Pollen?

**Pollen** is the fine yellow grain found on the anther of a flower's stamen.

- Pollen helps the plant make seeds so new plants can grow and fruit can develop.
- Seeds develop in the ovule after fertilization with pollen.

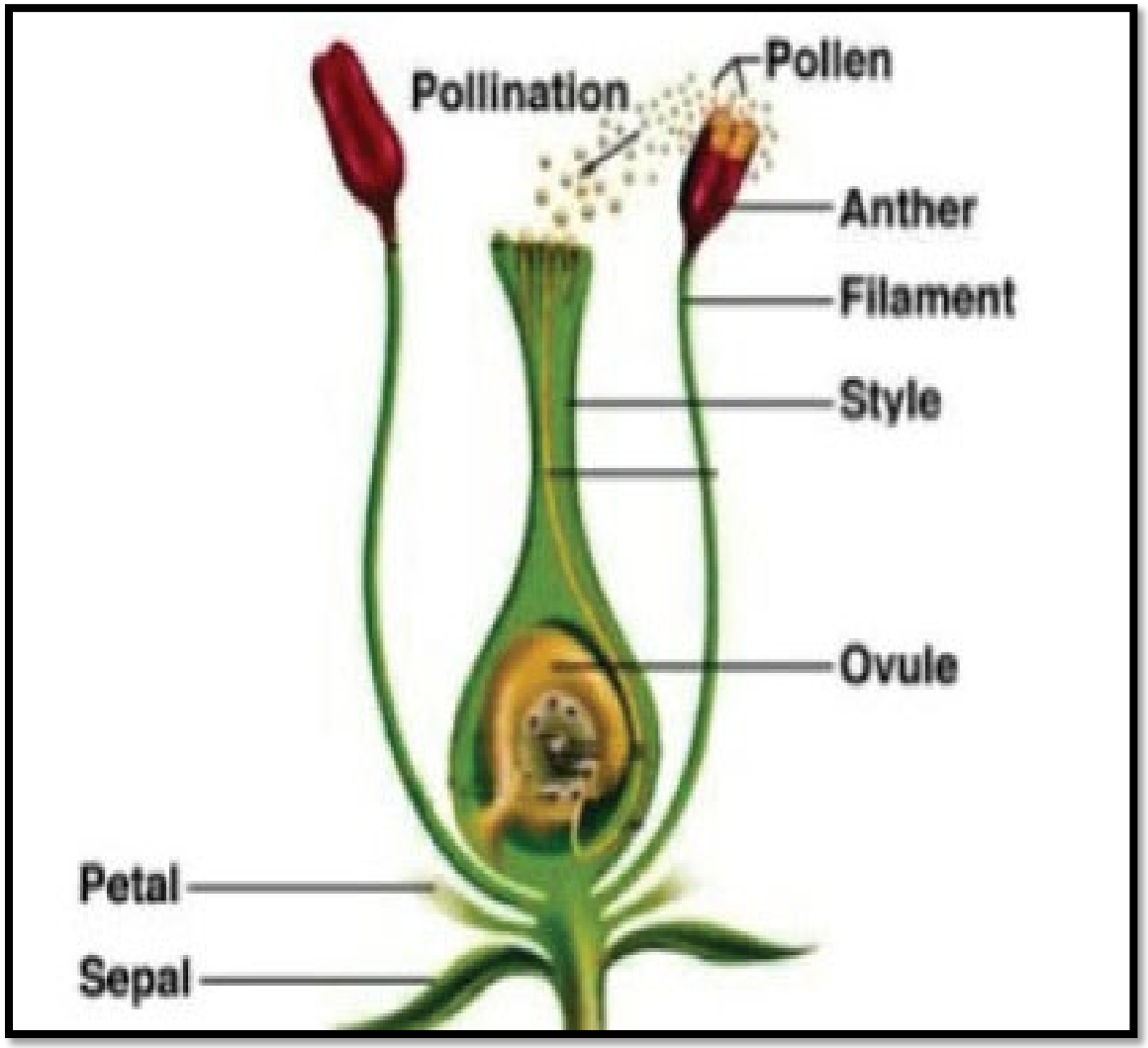
.



# What is Pollination?

Pollination is the transfer of pollen from the  anther to the surface of the stigma of the same or another flower.

- Pollination results in a fertilized ovule which goes on to form a seed.
- The ovary develops into a fruit to protect the seed.



# Video: From Flower to Fruit

# How Are Bees Able to Pollinate Plants?

- Depending on the type of bee, pollen is collected between the spaces of the dense, branched hairs on their back legs called scopa or even on the abdomen.
- Some bees, including Honey Bees, have a pollen basket they use to harvest and carry pollen to their nest or hive.
- As the bee collects sugary nectar and pollen, some of the pollen collected on a bee lands on the flower's stigma.

# How Important are Bees to the Pollination Process?

Three-fourths of the world's flowering plants and about 35 percent of the world's food crops depend on animal pollinators, including bees, to reproduce.

*-United States Department of Agriculture*

# What Types of Food Crops are Pollinated by Bees?

- Apples
- Almonds
- Berries
- Cherries
- Melons
- Peaches and other stone fruits
- Squash and other vegetables
- Grapes


# Bees Also Make Things People Eat and Use

- Honey
  - Different flavors
  - Good on toast and sandwiches
- Wax
  - Candle wax
  - Paraffin
- Royal Jelly
  - Dietary supplement

# What are Some Bees that are Pollinators in North America?

- Honey Bees
- Bumble Bees
- Leafcutter Bees
- Alkali
- Mason Bees
- Carpenter Bees

# Are All Bees Native to North America?

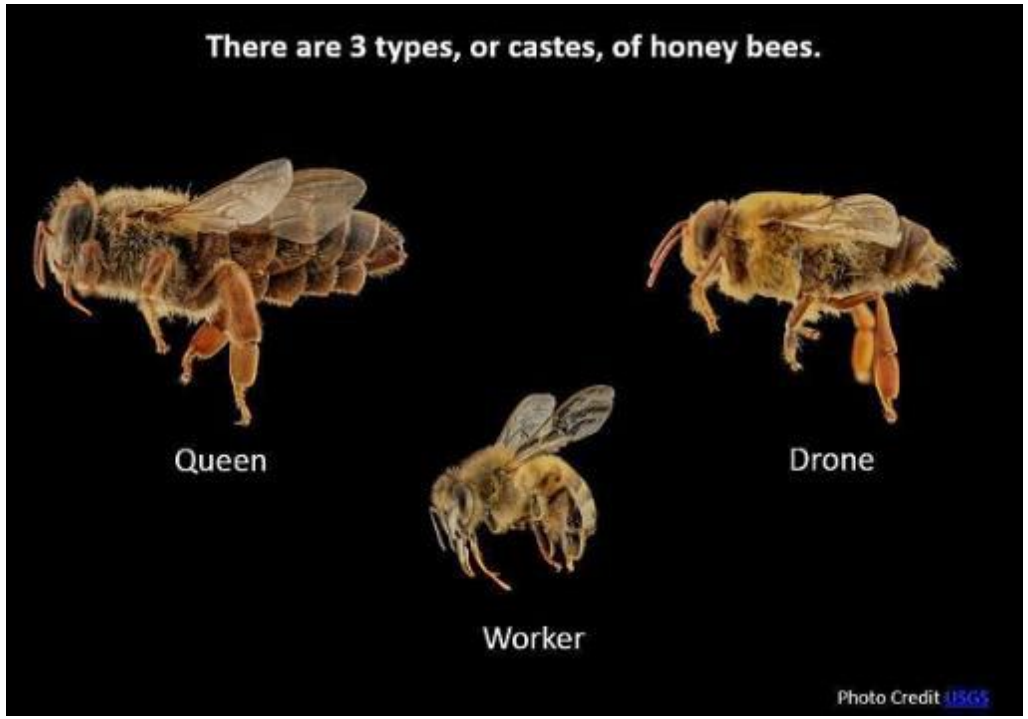
Not all bees are native; some were brought here from other areas of the world.

- Honey Bees were brought to the United States from Europe and are non-native.
- Honey Bees are social insects which means they work together in a colony.

# How Do Honey Bees Live and Work as a Colony?

Honey Bees live in a hive they construct or in man-made hives.

- Queen – Lays Eggs
- Worker Bees
  - Females
    - Collect nectar and pollen and bring it to the hive
    - Feed the Queen
- Drones
  - Males



# Why Are Honey Bees Important?

- Because they work in colonies and are easy to manage, farmers have depended on Honey Bees to pollinate their crops.
- Honey Bees are raised and maintained by beekeepers.
- However, in recent years, Honey Bee populations have been declining due to what scientists call *Colony Collapse Disorder.* This disorder makes Honey Bees sick and many die from it.

# What About North America's Native Bees?

There are about 4,000 species of native bees in in North America. One example is the Digger Bee in this picture.

- Unlike the Honey Bee, 90% of native bees live **solitary lives** which means they do not form colonies.
- Most native bees nest in the ground or wood cavities

✓Some bees nest in the ground in abandoned cavities. Others dig or build their own nests.

✓Some shelter inside trees, others in rock walls or even abandoned snail shells.

# Why Are Native Bees Important?

Protecting native bees is an important way to help make-up for the loss of honey bees.

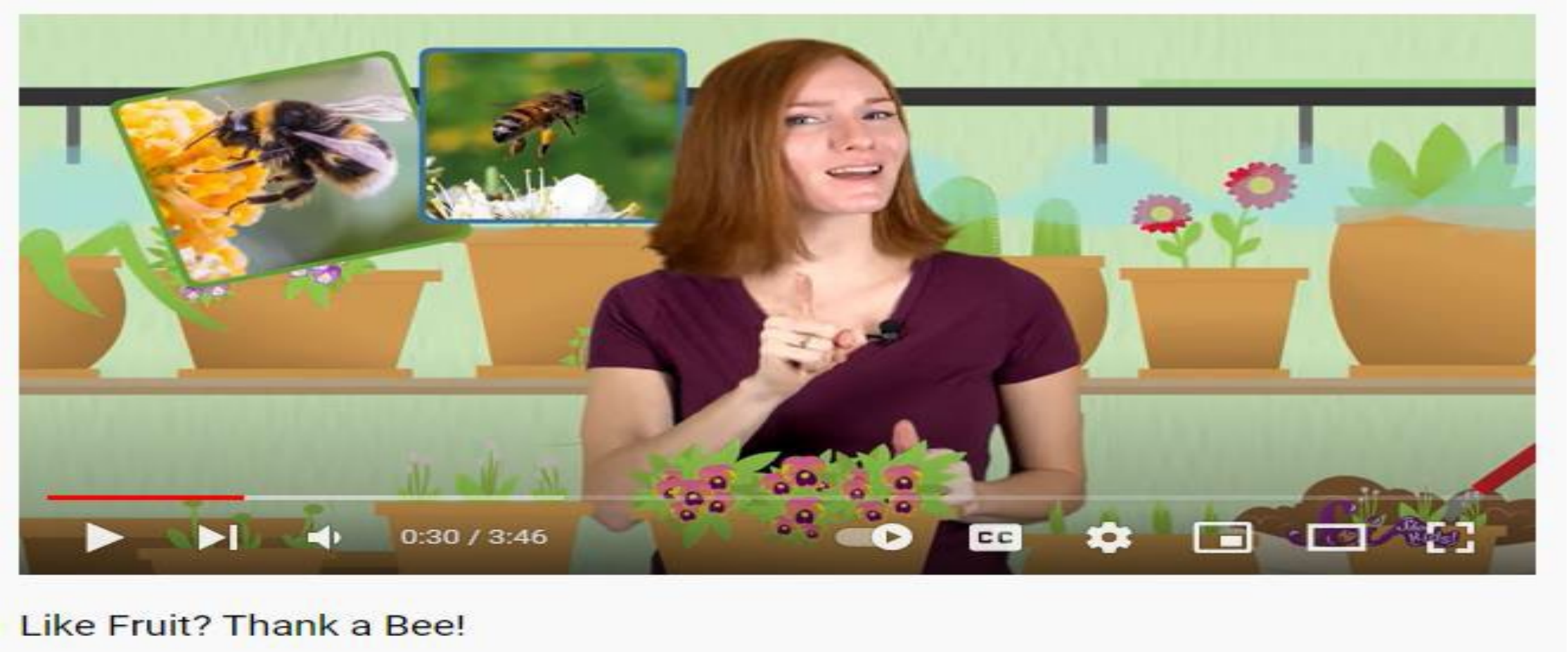
- Scientists found that agriculture close to native bee habitats such as woodlands and undisturbed vegetation received native bee pollination for crops.
- However, this was only true for organic forms of agriculture which did not use pesticides that can harm or kill insects.

# How Can We Help Bees?

People can plant habitat gardens that will attract bees and other pollinators. A habitat garden includes:

- Flowering plants, including native plants
- Water
- Shelter, including undisturbed ground areas for native bees

# Video: Thank a Bee!



# Check for Understanding

- What is a bee?
- What is nectar?
- What is pollen?
- Why do bees need nectar and pollen?
- What is pollination?
- Why do plants need bees?
- How are Honey Bees different from native bees?
- Why is pollination by bees so important?
- How can people help bees?

# Phenomena in the Garden Application Activity:
## *Create a Checklist*

- Based on what you have learned, develop a checklist of what a garden should include to support bees, including native bees.
- Take your checklist into a garden area and use it to identify if the garden provides what bees need.

# Develop a Model To Describe the Phenomena

**Revise or draw a new diagram demonstrating what you have learned about the phenomena of pollination by bees. Include both observable and unobservable details.**

- Label all important parts of the diagram.
- Use arrows to show how all parts interact.
- Write an explanation describing the process of bee pollination.

# Extend Activity

Research Colony Collapse Disorder.

- Determine if Native Bees can be affected by this disorder.
- Add what you have learned to your diagram.

# Next Generation Science Standards

**4th Grade**

- LS1.A: Structure and Function. Plants and animals have both internal and external structures that serve various functions in growth, survival, behavior, and reproduction. (4-LS1-1)

**5th Grade**

- LS2.A: Interdependent Relationships in Ecosystems. The food of almost any kind of animal can be traced back to plants. Organisms are related in food webs in which some animals eat plants for food and other animals eat the animals that eat plants. A healthy ecosystem is one in which multiple species of different types are each able to meet their needs in a relatively stable web of life. Newly introduced species can damage the balance of an ecosystem. (5-LS2-1)
- LS1.C: Organization for Matter and Energy Flow in Organisms. Food provides animals with the materials they need for body repair and growth and the energy they need to maintain body warmth and for motion. (secondary to 5-PS3-1)

# Next Generation Science Standards Continued

**Crosscutting Concepts**

A system can be described in terms of its components and their interactions. (4- LS1-1),(4-LS1-2); (5-LS2- 1)

**Science and Engineering Practices**

Modeling in 3–5 builds on K–2 experiences and progresses to building and revising simple models and using models to represent events and design solutions:

Use a model to test interactions concerning the functioning of a natural system. (4-LS1-2)

Develop a model to describe phenomena. (5-LS2-1)

# Resources

- Bay Nature: Are native bees suffering the same colony collapse disorder as the honeybee?; Michael Ellis;  October 2007
- California Native Plant Society
- Master Gardener Handbook, Second Edition, Dennis K. Pittenger Ed., 2015
- Honey Bee Suite: Honeybee or Honey Bee? Which is Correct?
- National Agriculture in the Classroom, https://agclassroom.org/matrix/lesson/84/
- Native Bee Series: Intro to California Native Bees, Plant Bee Foundation, www.plantbee.org/planet
- Utah State University Extension: Beginner's Guide to Common Native Bees

# Resources

- University of California; Agriculture and Natural Resources
- United States Department of Agriculture
- USA Facts: What is the Loss of Bees Costing Us?
- Xerces Society: Wild Bee Conservation
- Images: Creative Commons; kiddle.co; www.easysciencefforkids.com, Los Angeles County Beekeeper Association, Marin County Master Gardeners, UCCE Master Gardener Kay Force; Stock Images
- Image: www.baynature.org Rollin Coville
- Videos: SciShow Kids; Vidmen

# Master Gardeners

The University of California Cooperative Extension (UCCE) Master Gardener Program (MGP) is an educational program designed to teach and effectively extend information to address home gardening and non-commercial horticulture needs in California.

UCCE is the outreach arm of UC's division of Agriculture and Natural Resources (ANR). Master Gardener volunteers (MG volunteers) promote the application of basic environmentally appropriate horticultural practices through UCCE-organized educational programs that transfer research-based knowledge and information.

University of California
Agriculture and Natural Resources
UCCE Master Gardener Program

# Gardening Questions?

**Email the UCCE Master Gardeners of Riverside County**

- Email Helpline: anrmgriverside@ucanr.edu
- School Gardens: mgschoolgardens@gmail.com

**Website Resources**

- Riverside Master Gardeners Website

University of California
Agriculture and Natural Resources
UCCE Master Gardener Program