PPP Lesson Plan

↗ Module	Ecology

Lesson Information

Grade Level: High School

Overview: This lesson aims to teach all about the wonderful diversity of wild bees. Unlike honeybees, these bees form loose groups or are solitary and live in the ground or cavities instead of in distinct hives. Students will gain an understanding of the role that native bees play as pollinators and why they are necessary for a healthy environment.

Duration: 45 min – 1 hour

People to Plant Connection:

We aim to show which plants are most attractive and useful to bees, and encourage the cultivation of those, whether it be through planting or allowing certain weeds to flourish. Through careful observation of these busy bees, students should experience less fear and greater appreciation for their service to plants and the environment.

Learning Objectives:

By the end of this lesson, participants should be able to…

- **Differentiate** between bees and bee mimics using anatomical and behavioral characteristics.
- **Analyze** wild bee foraging behavior in relation to plant traits such as flower size, color, and structure.
- **Explain and evaluate** the ecological role of pollination and the consequences of pollinator loss within local and global ecosystems.
- **Apply standardized data collection methods** to gather, organize, and compare pollinator observations across sampling sites.
- **Interpret basic data visualizations** (Observation Data Sheet) to draw evidence-based conclusions about plant–pollinator interactions.

Materials:

- Outreach boxes of pinned specimens
- Hand lenses, magnifying glasses or dissecting/binocular microscopes (optional but recommended)

- Non-adhesive ribbon, thread or caution tape to demarcate sampling quadrat, along with stakes to hold them.
- Diagram of bee anatomy
- Bee Observation Data Sheet

Site specific Considerations:

- Some sites may not have many bee foragers depending on the type of flowers or weather conditions (bees do not forage in the rain or on windy days). In this case, you might want to swap to the indoor activities.

Lesson Plan

Warm-up Activity: Spot & Identify Pollinators in the Garden

Time Required: 5 min

Directions

ASK: What is a bee? What do bees do? Have you been stung by a bee? Are you afraid of bees?

- Introduce the idea of bees that do not make honey, and are more docile than honeybees
- Go over basic bee anatomy and compare against that of other pollinators

Introduction:

Time Required: 10 min

The bees you might think of at first mention of the word are black and yellow-orange striped, fuzzy, and make honey that we enjoy. The hard-working honeybee is just one species of bee out of over 100 that live in New York City alone, not to mention the hundreds of other bee-imitators that have evolved to resemble bees to stay safe from predation. Bees can come in many shapes and sizes, which we will share here, as well as some mimics to watch out for:

Bees: (in general, you'll see that they have 4 wings, 5 eyes, and pollen-collecting hairs)

- Honeybee – our domesticated livestock. Unlike all other bees, they collect nectar in their guts and regurgitate it later to make honey. If you look closely, you can see a ring of hair on their eyes, unique to the species!
- Bumblebee – these fat, hairy bees make small colonies in rat burrows or other open spaces underground. They have a divot in their hind legs (the corbicula) that makes it easy for them to pack in the pollen for their kids!

- Green Sweat Bees: These flashy, bright green bees are easy to spot, but might be mistaken for flies or beetles at first glance.
- Small carpenter bees/small sweat bees: Bees can be tiny, too! These bees are often non-striped and have dull metallic or black coloration.

Bee Lookalikes:

- Flies: these always have two wings! They also have short, straight antennae.
- Wasps: some of the smaller wasps can really resemble bees! They have less hair, and a thinner waist.

Directions

- Show off the practice kits and explain the difference between the bees and the non-bees.
- Allow the students to look at the kits and ask them to identify the insect as a bee or a bee lookalike (show of hands, maybe?)

Main Activity: Bee Observation In a Garden

Time Required:

Directions

Now that the students are acquainted with the diversity of bee species, they will head to the garden to test their skills! Set up quadrats near several pollinator-attracting plants, and assign small groups of students to observe the flowers for bees and bee-mimics for a small, set amount of time each, allowing them to tally up what they see using the included datasheet. In the end, ask all the students to tally up what they found together inside and have them enter this information into a spreadsheet (template provided). They can create pie or bar charts to compare what they saw with other groups. For a longer period and upperclassmen, consider each group as a replicate and have the class combine their data and determine statistical significance of difference in pollinator composition between plants species.

Show what you know:

Time Required: 10 min

Directions

Ask the students to draw conclusions about the flower-bee interactions based on the data they collected – do some bees prefer small flowers to larger ones? How about color?

How does the data collection help you understand the habits of the bees? What does the statistical significance tell you about how much this is relevant based on the data you collected?

Winding Down:

Time Required: ~5 min)

Directions

The class can talk about any particularly interesting visitors they found while collecting data. What kind of features did the insect have? Can they identify it as a bee or non-bee?

Rooted:

Time Required: 5 min

Directions

Measuring impact of the class – show of hands!

- Do you feel more comfortable around bees?
- Do you understand pollinator-plants interactions better?

Alternatives

Alternate Activity:

- Draft and draw different artificial habitat ideas for native bees (explain more about the habitats they live in here)
- Take a bee from the specimen kit and look at it in more detail – look at the body shape and details, and try to infer the function based on the shape (split hairs for collecting pollen, antennae for smelling)
- Review flower anatomy and compare how bees are well-suited to pollinate