

Will the bees like it here?

Measuring habitat quality for wild pollinators



Grade Level: K-12

(This lesson can be adapted for multiple grade levels. Please adapt the lesson plan to meet the needs of your students)

Duration:

Prep time: 15 minutes

Activity duration: 60-90 minutes

PA Standards:

- 4.5.3.D. Identify Organisms that are dependent on one another in a given ecosystem.
- 4.5.7.D. Explain how biological diversity relates to the viability of ecosystems.
- 4.5.10.D. Research practices that impact biodiversity in specific ecosystems.
- 4.1.12.A. Analyze the significance of biological diversity in an ecosystem.

NGSS Practices

The bolded practices below are included in these lessons:

1. Asking questions
2. Developing and using models
3. Planning and carrying out investigations
- 4. Analyzing and interpreting data**
5. Using mathematics and computational thinking
- 6. Constructing explanations**
7. Engaging in argument from evidence
- 8. Obtaining, evaluating, and communicating information**

OBJECTIVES

Students will be able to evaluate two habitats for nesting and floral resources for wild bees and compare their evaluations to observed pollinator activity.

Students will be able to hypothesize habitat quality based upon the number of pollinators and pollinator diversity.

Students will be able to make observations and accurately record data.

Students will be able to summarize results of investigation and communicate this information to peers

Students will be able to synthesize information from all teams to explain observed patterns.

MATERIALS

4 potted flowering plants

Clipboards

Pollinator observation
datasheet

Habitat assessment
datasheet

Laptop and projector

BACKGROUND

Wild bees are crucial for plant reproduction in natural and agricultural systems, and even in the presence of honey bees (*Apis mellifera* L.), wild bees visit many crops in high numbers and increase fruit set (Garibaldi et al. 2013). Seventy eight percent of temperate plant species and 94% of tropical plant species require insect pollination for reproductive success and persistence (Ollerton, Winfree, and Tarrant 2011). Pollinator conservation is crucial for biodiversity conservation as pollinators represent several extremely diverse taxa and have a vital co-evolved role in supporting and selecting for diverse plant communities.

The first step to conserving wild bees in a specific location is documenting the floral and nesting resources already present. Diverse plant communities with varying bloom phenology provide wild bees with nectar and pollen throughout their flight season. Practices to add resources, like planting wildflowers, are more effective when the diversity or timing of resources they provide contrasts existing plant communities (Scheper et al. 2015, 2013). Similarly, artificial nesting sites (bee boxes/hotels) may be poorly colonized in habitats that already have ample natural nesting material.

In this lesson, students will evaluate two habitats for nesting and floral resources for wild bees and compare their evaluations to observed pollinator activity.

PROCEDURES

Before class

1. Select two habitats for evaluation (for example, pollinator garden and edge of woods next to school)
2. Place two potted plants in each habitat, 5-10m apart from each other. Try to choose similar locations within the habitat (similar number and type of plants around your potted plant)

Modification: This activity could be simplified by observing bees on any flowering plants present in each habitat rather than a specific potted plant. The main disadvantage of observing existing plants is that the number of bee visits per observation period is not directly comparable between habitats because the observed flowers are different. The number of visits could vary in response to specific plant traits like flower size, color, pollen and nectar quality making it a biased indicator of habitat quality. To overcome this limitation, student observations and discussion could focus on the diversity of pollinators observed in each habitat.

During class

1. Using discussion with the class, form hypotheses about the quality of each habitat for pollinators.
 - Which habitat do you think will have the most pollinators? Highest diversity of different types of pollinators?
2. Split class into 6 teams.
3. Assign 4 teams to perform pollinator observations (one for each plant) and two teams to do the habitat quality survey.
4. Pollinator observation procedure- Watch your potted plant for 5 minutes and count any pollinators that visit it. Make a tick mark on the pollinator observation sheet for each visitor to your plant on the appropriate line. Count the number of insects, not the number of visits (aka one bumblebee visiting 3 flowers still counts as 1 visitor). Stand at least 0.5m away from the plant so you don't scare away visitors.
5. Habitat assessment procedure- Fill out the habitat assessment survey (attached) for each habitat type considering the area immediately surrounding your potted plants (about ~50m or extent of habitat patch)
6. Reassemble the teams. Assign each team 2 questions to discuss and report back to the class
 - Pollinator observation possible questions-
 1. Which type of pollinator was your most common visitor?
 2. What does this insect collect while visiting your flower?
 3. Did you notice that pollinators were visiting multiple flowers on your plant?
 4. Why (or why not) would an insect visit multiple flowers on the same plant?
 5. Do pollinators that make visit multiple flowers benefit the plant?
 - Possible habitat assessment questions-
 1. Which pollinator resources (flowers, nest sites, water) are present in your habitat?

2. If you were trying to improve this habitat for pollinators, what would you add? Why?
9. Overall group discussion (looking at summarized visitation data, ideally projected so everyone can see)
- Where did we see the highest number of pollinator visits?
 - Does our data support our hypothesis?
 - If we were repeating this experiment, what could we change to be more certain of our results? (Why did we conduct observation on more than one plant in each habitat?)
 - Are pollinators using both of these habitats? Or neither?
 1. How could you figure this out?
10. Brief discussion of how relative area of different habitats adds up to larger scale landscape effects on bees
- Demonstration of beescape.org to show variation in landscape quality for bees

REFERENCES

Garibaldi, Lucas A., Ingolf Steffan-Dewenter, Rachael Winfree, Marcelo A. Aizen, Riccardo Bommarco, Saul A. Cunningham, Claire Kremen, et al. 2013. "Wild Pollinators Enhance Fruit Set of Crops Regardless of Honey Bee Abundance." *Science* 339 (6127): 1608–11.

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APPENDIX

Habitat Assessment