



PROTECT THE POLLINATORS

LESSON PACKET

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LESSON ONE

1 | INTRODUCTION TO POLLINATION



National Learning Standards:

MIDDLE SCHOOL

- CCSS.ELA-LITERACY.RST.6-8.2: Determine the central ideas or conclusions of a text; provide an accurate summary of the text distinct from prior knowledge or opinions.
- NGSS.MS-LS1-4: Use argument based on empirical evidence and scientific reasoning to support an explanation for how characteristic animal behaviors and specialized plant structures affect the probability of successful reproduction of animals and plants respectively.

HIGH SCHOOL

- CCSS.ELA-LITERACY.RST.11-12.4: Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 11-12 texts and topics.
- CCSS.ELA-LITERACY.RST.11-12.5: Analyze how the text structures information or ideas into categories or hierarchies, demonstrating understanding of the information or ideas.
- NGSS.HS-LS2-1 1 Use mathematical and/or computational representations to support explanations of factors that affect carrying capacity of ecosystems at different scales.

LEARNING OBJECTIVES:

1. Students will be able to define pollination.
2. Students will be able to identify basic flower anatomy.
3. Students will be able to construct a model of a flower.

KEY TERMS:

Pollination Pollinator Perfect Flower Imperfect Flower Nectar Pollen Pedicel
Sepal Receptacle Ovary Style Stigma Pistil Petal Filament Anther
Stamen

Background Information:

- National Cattlemen’s Beef Association’s interactive map, “The Beef Lifecycle” at <https://www.kidsgardening.org>¹

Materials:

- Craft materials such as pipe cleaners, Q-tips, feathers, pompoms, glitter, etc.
- Tape, glue, crayons, scissors, paper
- Flashcards
- Parts of a flower handout (1 copy per student)

INTRODUCTION TO POLLINATION

1 | INTRODUCTION (ANTICIPATORY SET)



1. Write “pollination” on the board. Direct students to turn to a partner and discuss what they know about pollination.
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2 | INPUT MODELING



1. Show students the trailer for “The Beauty of Pollination”: <https://video.disney.com/watch/the-beauty-of-pollination-wings-of-life-4da84833e06fd54fff590f49>
2. Ask students to reflect on the video and answer the following questions.
 - a. What is pollination? (Pollination is a necessary step in the reproduction of flowering plants; the process by which pollen is transferred from the male stamen to the female stigma, thereby enabling fertilization and sexual reproduction)
 - b. What is a pollinator? (An animal [e.g., insect, bat] that involuntarily transfers a flower’s pollen from male reproductive organs to female reproductive organs)
 - c. What types of pollinators were in the video? (bats, butterflies, bees, hummingbirds, etc.)
 - d. Why is pollination important? (provides food and promotes plant health)
 - e. Was there anything that surprised you in the video? (Answers may vary)
3. Preview: Today we will be learning about the importance of pollinators and factors that are negatively affecting their well-being.

INTRODUCTION TO POLLINATION

1 | CHECKING UNDERSTANDING & GUIDED PRACTICE



Give each student a copy of the flower anatomy handout. Walk through the parts of a flower and define each term. Have students copy down the terms and definitions.²

- Perfect flower: A flower with a pistil and stamen.
- Imperfect flower: A flower with either a pistil or stamen, not both.
- Nectar: A sweet liquid secreted by flowers as an attractant and reward for pollinators.
- Pollen: A powder-like substance in a flower (or cone) that is made up of grains. Each grain functions as a capsule for carrying the male gametes (sperm cells) of the plant.
- Pedicel: The footstalk supporting a single flower in an inflorescence.
- Sepal: A division or lobe of the calyx or outer perianth of a flower. Sepals are often green, and/or reduced in size, but they can be colorful and petal-like as well.
- Receptacle: The generally enlarged top of the footstalk, which supports the other parts of the flower. Some “fruits” are enlarged receptacles rather than ovaries.
- Ovary: The part of the pistil that encloses the unfertilized seeds or ovules, and that typically develops into a dry or fleshy fruit once pollination takes place. Not all “fruits” are mature ovaries; some form from supporting parts of the flower, for example, strawberries develop from the receptacle - the enlarged top of the flower stalk.
- Style: The usually elongated part of the pistil that connects the ovary to the stigma.
- Stigma: The upper part of the pistil which receives the pollen. The stigma is often sticky, or covered with fine hairs or grooves, or other anatomical features that help the pollen to adhere. It may be cleft into several parts.
- Pistil: The seed-bearing or “female” reproductive part of a flower. The pistil is composed of the ovary, the style, and the stigma. The ovary contains the developing seeds, and is connected to the pollen-receiving stigma by the style. Flowers often contain a single pistil, but may contain several. Staminate or “male” flowers contain only stamens and lack pistils entirely.
- Petal: A division or lobe of the corolla or inner perianth of a flower.
- Filament: The usually narrow and often threadlike part of the stamen which supports the pollen-bearing anther.
- Anther: The pollen-bearing body of the stamen, usually relatively compact, and supported at the end of the narrow filament. Under a lens, anthers exhibit a wide variety of forms and means of attachment. These characteristics are often important in technical keys for flower identification.
- Stamen: The pollen-bearing or “male” reproductive part of a flower. The pollen is borne on a more or less compact body termed the anther, which is supported by the filament. A flower may have hundreds of stamens, or only a few. Pistillate or “female” flowers have pistils but no stamens.

INTRODUCTION TO POLLINATION

1 | INDEPENDENT PRACTICE



1. Students will use craft materials to create a model flower. The flower must contain the same parts of the illustration but does not have to look exactly like it. Students must be able to identify parts of the flower and students need to name their flower and describe how it is pollinated.
2. Students will present their flower to the rest of the class. Presenters will name their flower and how it is pollinated. At random, ask the presenter to identify the part of the flower.

INTRODUCTION TO POLLINATION

1 | WRAP-UP (REVIEW, ASSESS, CHALLENGE):



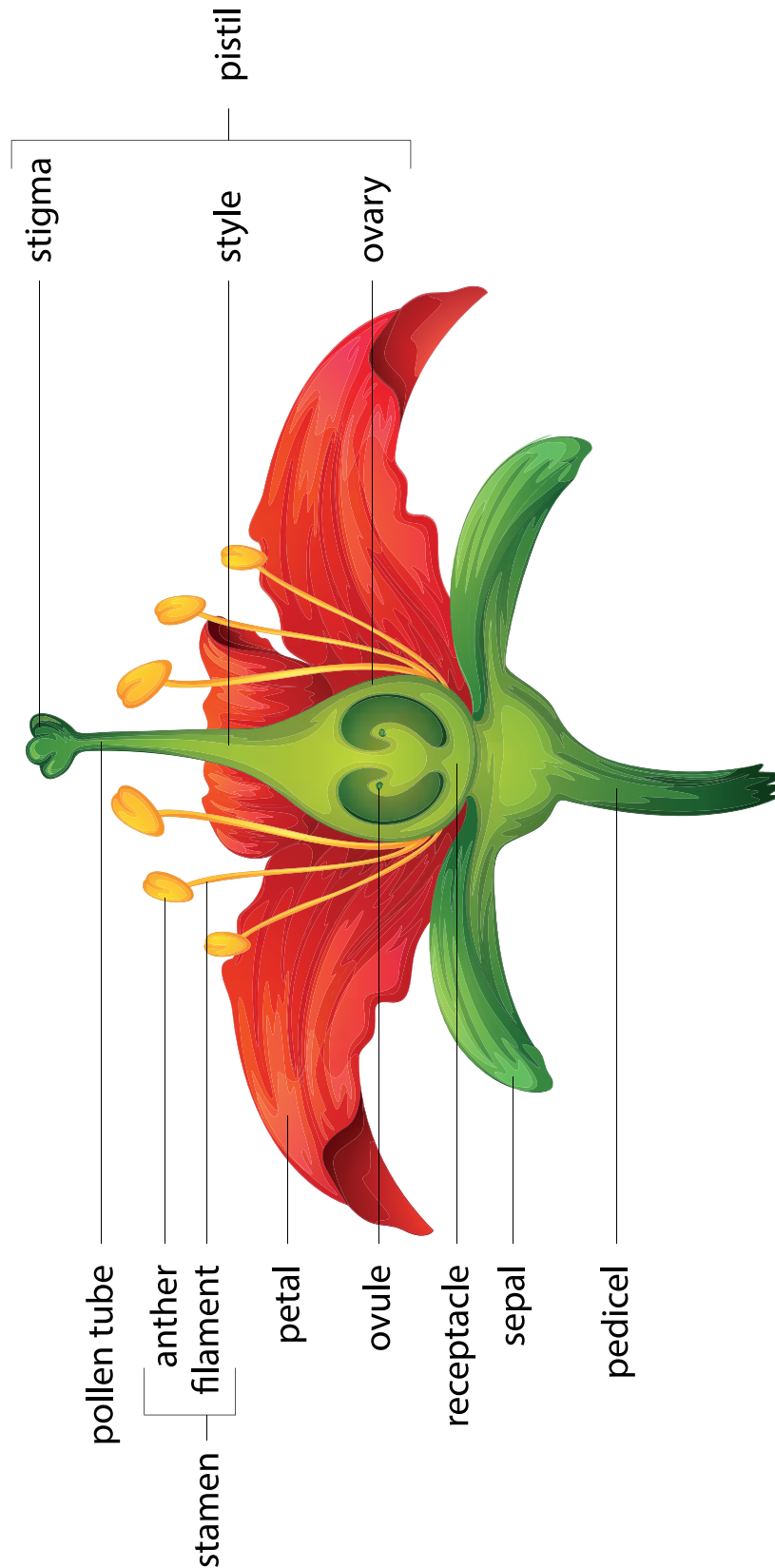
1. Divide the class into groups of three. Hand out 17 flashcards to each group. Instruct the groups to write down the 17 terms and definitions, with the term listed on one side and the definition written on the other.
2. Provide instructions for how the activity will work.
 - a. There are three roles each person will rotate through - clue giver, guesser, and card holder. The clue giver and the guesser will both sit down facing each other, while the card holder stands behind the guesser. When I say “go”, the card holder will hold a card above the guesser’s head with the term-side facing the clue-giver. The clue-giver will describe the term and the guesser will try to guess. Rotate positions after the guesser has guessed all 17 terms correctly. Questions? You’ll have 8 minutes.
 - b. When the activity is over, direct students to go back to their desks.
3. Thank students for their effort and answer any remaining questions.

INTRODUCTION TO POLLINATION

1 | ACTIVITY SHEET 1



Parts of a Flower



INTRODUCTION TO POLLINATION

2 | RESOURCES



¹ KidsGardening.org. (2017). Pollinator activity and lesson plan kit. Retrieved from <https://kidsgardening.org/lesson-plan-pollinator-lesson-plans/>

² University of Rochester. (2012). The description of flowers. Retrieved from <https://www.cs.rochester.edu/u/nelson/wildflowers/index.html>

LESSON TWO

2 | WHAT'S THE BUZZ?



National Learning Standards:

MIDDLE SCHOOL

- NGSS.MS-LS2-1 1 Analyze and interpret data to provide evidence for the effects of resource availability on organisms and populations of organisms in an ecosystem.
- NGSS.MS-LS2-5 Evaluate competing design solutions for maintaining biodiversity and ecosystem services.

HIGH SCHOOL

- NGSS.HS-LS2-6 Evaluate claims, evidence, and reasoning that the complex interactions in ecosystems maintain relatively consistent numbers and types of organisms in stable conditions, but changing conditions may result in a new ecosystem.
- NGSS.HS-LS2-7 7. Design, evaluate, and refine a solution for reducing the impacts of human activities on the environment and biodiversity.*

LEARNING OBJECTIVES:

1. Students will be able to understand the impact of pollinators on the world food supply.
2. Students will be able to describe pollinator stressors contributing to the decline of pollinators.

KEY TERMS:

- Animal welfare: The well-being of animals.
- Conservation: The preservation, protection, or restoration of the natural environment, natural ecosystems, vegetation, and wildlife.
- Beef sustainability: The production of safe, nutritious beef while balancing environmental stewardship, social responsibility, and economic viability.

Background Information:

- Xerces Society, Farming with Pollinators:
https://xerces.org/sites/default/files/2018-05/08-006_01_XercesSoc_Farming-for-Pollinators-brochure.pdf
- The Pennsylvania State University Extension, Pollination and Pollinators:
<https://extension.psu.edu/pollination-and-pollinators>

Materials:

- Computers with access to internet
- Sticky notes

WHAT'S THE BUZZ?

2 | INTRODUCTION (ANTICIPATORY SET):



1. Write the below numbers on the board.³ Take a moment to think about what these numbers represent. Turn to a partner and discuss your thoughts. Elicit responses. Share answers:
 - 75% (75% of all flowering plant species need the help of animals to move their heavy pollen grains from plant to plant for fertilization).
 - 1/3 (1/3 of all foods and beverages is made possible by pollinators).
 - \$20 billion (In the U.S., pollination produces nearly \$20 billion worth of products annually).
2. What can you interpret from these data? (Pollinators are important to agriculture and food production).
3. Preview: Today we will be learning about the importance of pollinators and factors that are negatively affecting their well-being.

2 | INPUT AND MODELING:



Share the “pollinator stressors” with students. Draw the diagram on the board.⁴



WHAT'S THE BUZZ?

2 | CHECKING UNDERSTANDING & GUIDED PRACTICE:



1. Break students evenly into five groups: Poor nutrition, pathogens, habitat loss, weather and climate, and pesticides. (Assign a place for them to go).
 2. Stand up and move next to your group.
 3. Your task is to become experts on your “pollinator stressor.” Grab four sticky notes, go online and research the “stressor” you’ve been assigned. Find the four facts below related to your “stressor.” Capture the fact and source down on the sticky note. When you’re done, circle up with your groups and share your facts. Discuss any common themes that arise.
 - Fact 1: The importance of pollinators.
 - Fact 2: The decline in pollinators.
 - Fact 3: The cause of the decline related to your stressor.
 - Fact 4: Recommendation for reducing decline.
 4. Number students off 1-5 (continuously) until all students have been assigned a number. Direct students to group up according to number (1’s with 1’s) and share the themes identified from your “pollinator stressor” area. There should be a person from each “pollinator stressor” in their new group. If there isn’t, help backfill any necessary information.
 5. Ask for big takeaways from each stressor area. Direct students to post their sticky notes on the board.
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2 | INDEPENDENT PRACTICE:



Use the next 20 minutes to write a 300-word “Letter to the Editor” for your school newspaper/magazine using the information you’ve just learned. Questions? Go for it!

WHAT'S THE BUZZ?

2 | WRAP-UP (REVIEW, ASSESS, CHALLENGE):



Use the next 20 minutes to write a 300-word “Letter to the Editor” for your school newspaper/magazine using the information you’ve just learned. Questions? Go for it!

WHAT'S THE BUZZ?

2 | RESOURCES



³ Pollinator Partnership (2011). Pollination fast facts. Retrieved from [https://pollinator.org/PDFs/NPW/Pollination%20Fast%20Facts%20\(3\).pdf](https://pollinator.org/PDFs/NPW/Pollination%20Fast%20Facts%20(3).pdf)

⁴ The Pennsylvania State University Extension. (2018, April 26). Pollination and pollinators. Retrieved from <https://extension.psu.edu/pollination-and-pollinators>

LESSON THREE

3 | PLANTS AND POLLINATORS



National Learning Standards:

MIDDLE SCHOOL

- NGSS.MS-LS2-1 1 Analyze and interpret data to provide evidence for the effects of resource availability on organisms and populations of organisms in an ecosystem.
- NGSS.MS-LS2-5 Evaluate competing design solutions for maintaining biodiversity and ecosystem services.

HIGH SCHOOL

- NGSS.HS-LS2-6 Evaluate claims, evidence, and reasoning that the complex interactions in ecosystems maintain relatively consistent numbers and types of organisms in stable conditions, but changing conditions may result in a new ecosystem.
- NGSS.HS-LS2-7 7. Design, evaluate, and refine a solution for reducing the impacts of human activities on the environment and biodiversity.*

LEARNING OBJECTIVES:

1. Students will be able to determine 5 native plant species that can increase pollinator well-being.
2. Students will be able to diagram a model of a beneficial pollinator habitat.

Background Information:

Go online and find your region. Print the plant list associated with where you live.

Xerces Society – Pollinator-Friendly Plant List:

<https://xerces.org/pollinator-conservation/plant-lists/>

Materials:

- 8.5 x 11 piece of paper (1/person)
- Colored pencils/markers/crayons
- Access to the internet
- Sticky tear sheets labeled A-Z
- Printed plant list for your region (1 copy/person):
<https://xerces.org/pollinator-conservation/plant-lists/>

PLANTS AND POLLINATORS

3 | INTRODUCTION (ANTICIPATORY SET):



1. Ask students to brainstorm answers to the below questions. Elicit responses after they have had a few minutes to think.
 - a. What do pollinators need to survive? (food, water, shelter, places to raise young)
 - b. Which of these things do flowers provide? (food, shelter)
 - c. What parts of the flowers do pollinators eat? (drink the nectar and feed off the pollen)
 - d. What do flowers need to survive? (light, water, food)
 - e. What is the symbiotic relationship between the pollinator and flower? (a chance for flowers to reproduce)

3 | INPUT AND MODELING:



1. Introduce the concept of native plants. Native plants are adapted to the local climate and soil conditions where they naturally occur. These important plant species provide nectar, pollen, and seeds that serve as food for native butterflies, insects, birds and other animals. Unlike natives, common horticultural plants do not provide energetic rewards for their visitors and often require insect pest control to survive. Some of the benefits include:
 - a. Native plants do not require fertilizers and require fewer pesticides than lawns.
 - b. Native plants require less water than lawns and help prevent erosion.
 - c. Native plants help reduce air pollution.
 - d. Native plants provide shelter and food for wildlife.
 - e. Native plants promote biodiversity and stewardship of our natural heritage.
 - f. Native plants are beautiful and increase scenic value!

PLANTS AND POLLINATORS

3 | CHECKING UNDERSTANDING & GUIDED PRACTICE:



1. Set context that the students will be creating a profile for a pollinator-friendly plant. Their profiles should include the following:
 - a. Photo/drawing
 - b. Common name
 - c. Life cycle
 - d. Maximum height
 - e. Other notes/fun facts
2. Pass out the Pollinator-Friendly Plant List from the Xerces Society and assign each student a plant. Tell students they'll have 15 minutes.
3. As students finish, have them tape their profile up around the classroom.
4. Have students do a "gallery walk" around the classroom to learn about the different native plants in your region.

3 | INDEPENDENT PRACTICE:



1. Students will design a habitat that will draw pollinators to their area. They may use a piece of paper and colored pencils/markers/crayons for their design. The design must include the following:
 - At least 10 different species of native plants that have overlapping flowering.
 - Other beneficial considerations: Sunshine, a place to nest, and clean water. ⁴
2. After students have completed their habitats, direct students to turn to a partner and explain their habitat and why they chose to include those items.

PLANTS AND POLLINATORS

3 | WRAP UP (REVIEW, ASSESS, CHALLENGE):



1. Students will complete a “ticket out the door.” Have students think of the most interesting thing they learned today, write it down on a piece of paper and hand it in as they walk out.
2. If time, elicit responses from the group.
3. Thank students for their participation.

LAND MANAGEMENT PRACTICES

3 | RESOURCES



⁴ UC Master Gardener Program. (2015, June 17). Creating a pollinator garden. Retrieved from <https://ucanr.edu/blog/uc-master-gardener-program-statewide-blog/article/growing-more-food-pollinator-power-national>

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