SCIENCE FAIR CENTRAL

Maker Corner Activity

PROTECTING OUR POLLINATORS!

Grade Level: High School

MAKE. CREATE. EXPLORE.

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Humans depend on pollinators for the food we eat.

Overview

In this lesson, students will learn about the ecological importance of species that pollinate flowers, such as birds and insects. They will understand that humans are dependent on these pollinators for the food that we eat, and that losing these species would mean a lack of fruits and vegetables that we eat every day. Student will work in groups to design a unique habitat that would attract these pollinators based on their specific needs. They will also build a product for their habitat that would fit into their design to help pollinators survive and thrive!

Have you ever wondered . . .

What would happen if we didn't have pollinators?

Is the relationship between plants and their pollinators a one-way street, providing a snack for animals like insects and birds? The answer is no! Just as the pollinators use plants and flowers

as an important food source, the plants depend on the pollinators for their successful reproduction. This mutual relationship between plants and their pollinators keeps a balance in ecosystems and provides important foods for many species, including us!

This activity focuses on the **Defining the Problem**, **Designing Solutions** and **Creating or Prototyping** stages of the Engineering Design Cycle.

Engineering Design Cycle

- **Defining the Problem**
- **Designing Solutions**
- **Creating or Prototyping**
- Refine or Improve
- Communicating Results

Objectives

Students will be able to:

Identify the importance of pollinators, such as birds, bees, and butterflies to ecosystems and to our food supply

Research what types of habitats meet the needs of pollinators in their area

Design and **create** a habitat plan and accompanying product that would help to attract pollinators to their backyard or school yard

Plants have amazing ways to attract pollinators.

How you can attract pollinators to visit and make a home in your backyard?

If you look at the world of plants, there are many amazing ways that they attract their pollinators. This includes colors and scents, and some wonderful and weird shapes and characteristics. By learning about the pollinators that live in your area and the things that they are attracted to and need, you can create a habitat that will encourage pollinators to spend more time in your backyard!

Materials

Butterfly House

- ¼" thick plywood *(pre-cut into desired size for house)*
- Wood glue
- Hammer and nails
- Drill with drill bits
- Small hinges
- Spray paint *(various bright colors)*
- Paint sticks *(to make shingles for the roof)*
- Craft wood stick pieces
- Sheet moss
- 4' wooden dowel *(optional, if mounting in the ground)*

Hummingbird Feeder

- Glass bottle with a screw-on cap
- Scissors
- 2 aluminum cans
- Spray paint *(red and yellow)*
- Screwdriver
- Medium-sized nail
- Quick-set epoxy
- ruler or tape measure
- wire
- hot glue gun and hot glue

Bug Hotel

- *½" thick cedar or other rot-resistant wood
- bamboo stakes
- Hand saw
- Sheet moss
- Drill or electric screwdriver with various size drill bits
- 4x4" x 6' post *(pre-cut into 4" long pieces)*
- Brick edger with holes
- duct tape
- 4" terra cotta clay pots
- 11/2" Weather resistant screws
- Various sticks, leaves, logs gathered from outdoors
- Poultry netting
- Staple gun

***Cedar should be pre-cut to the following specifications:**

Top: 5 1/2"(h) x 5 1/2"(w) . **Bottom:** 5 1/2"(h) x 5 1/2"(w) . **Back panel:** 12"(h) x 5 1/2"(w) . **Left panel:** 12"(h) x 4 3/4"(w) . **Right panel:** 12"(h) x 4 3/4"(w)

Make connections!

How does this connect to students?

Many times, students don't think about where the food they eat comes from. By learning about the importance of pollinators in ecosystems, and their link to the foods we buy at the grocery and at farmers markets, it will encourage students to think twice before swatting away a bee and appreciate a butterfly in a new and more personal way.

How does this connect to careers?

Entomologists—study insects' habitats and how insects evolve. They also develop ways to control harmful insects. They research and control insect-borne diseases and discover and study new species of insects. They also teach students about insects and create public awareness about insects in general.

Ecologists—perform research and field studies to assess environmental concerns. For example, ecologists consider how human activity (e.g. a construction project) will affect the environment. They determine how an activity would affect individual species of trees, plants, fish and wildlife, as well as how the change would affect the ecosystem as a whole.

Landscape architects—design parks and the outdoor spaces of campuses, recreational facilities, businesses, private homes, and other open spaces. This includes preparing graphic representations of plans using computer-aided design and drafting (CADD) software and selecting appropriate landscaping materials.

How does this connect to our world?

Certain species of pollinators, such as many species of bees, are currently in the midst of a drastic population decline. Understanding the importance of pollination for plant and food growth is key as we look for ways to protect and give space to the many species of pollinators that we too often take for granted.

Blueprint for Discovery

Whole Group Activity - 10 minutes

1. Show a portion or all of the following video clip to students to begin: https://www.youtube.com/watch?v=_uHJGdTgtXE

Ask students to get out a piece of paper to informally write down their ideas about the following questions as they watch the clip:

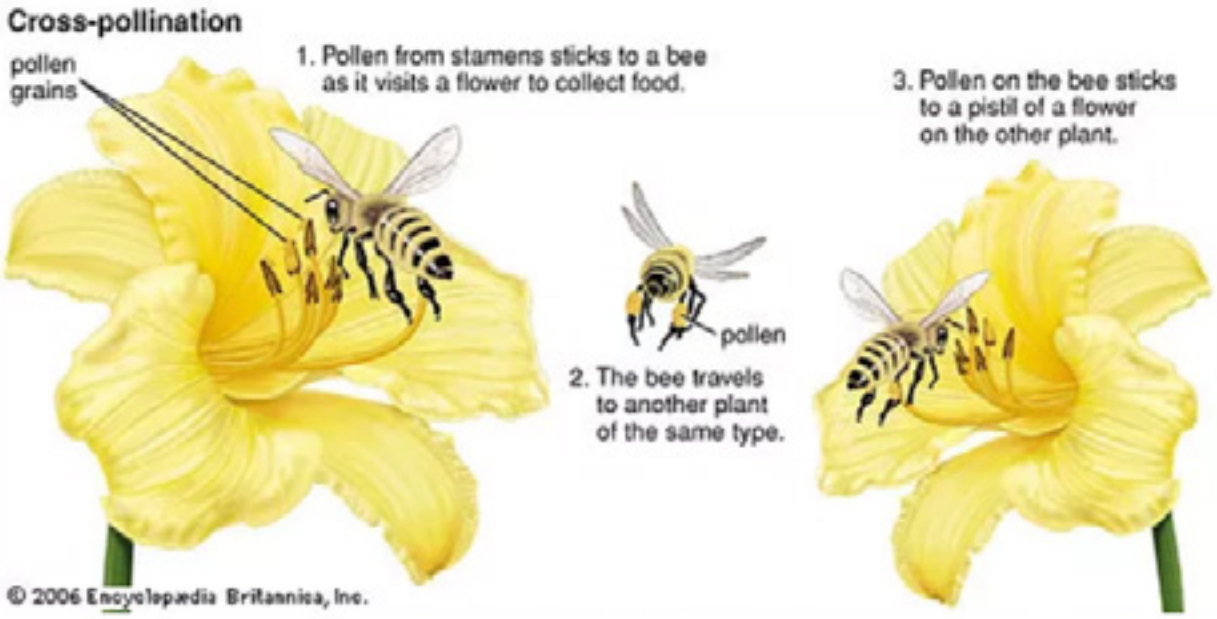
- What is the relationship between the orchid and the bee in this video?
- Why is this relationship important in an ecosystem?
- What would be the consequence if these relationships suddenly ended?

2. Ask students to share their answers to these questions with the class. Students should understand that the relationship they were watching between the bee and orchid is a complex and amazing example of **pollination**.

Explain that pollination occurs when the pollen that carries a plant's sperm is transferred to female parts of the same or another plant, which are called the pistil and ovary. This allows fertilization to occur in the plant, resulting in the formation of a seed. Seeds are protected by a fruit in flowering plants - something that we humans enjoy on a daily basis!

While there are plants are able to do this without help from something else, there are also many plants that depend on another species for pollination to be completed. It is mostly insects, birds, and bats that help move their pollen in exchange for a tasty treat - nectar.

Pollination Diagram



Without pollinators, plants would not be able to reproduce as successfully as they do and this would have a major negative impact not only on the delicate balance in ecosystems, but also on our global food supply.

3. Show students the following pictures on the front overhead screen. Explain that the pictures show what our supermarkets would look like with and without important pollinators, such as bees:

Not only would produce be affected by the loss of pollinators, but our dairy production would be greatly reduced as well...take a look:

4. Ask students for their reactions to the photos. Are they surprised? Explain to students that as they can see, it is important to protect and provide places for pollinators in the places that we live, not only for us but also for many other species that depend on flowering plants for food.

Small Group Activity - 40-45 minutes

1. Ask students to get into groups of 3-4. Explain to them that each group will be assigned one group of pollinators - insects, butterflies, and hummingbirds - to focus on for this lesson. Their task is to design a habitat plan and sketch, and a create a product that will help to attract their assigned pollinator to their backyard, garden, or school yard.

- **Pollinator #1** - **Hummingbirds**, groups will build a hummingbird feeder
- **Pollinator #2** - **Butterflies**, groups will build a butterfly house
- **Pollinator #3** - **Insects** (excluding butterflies), groups will build a bug hotel

2. It is suggested that for a class size around 32, students are divided into 8 groups, including 3 butterfly groups, 2 insect groups, and 3 hummingbird groups. While one group is at the "Building Station" building their habitat product, the other group should be at the "Habitat Planning Station" working on research and designing their habitat plan and sketch. This will enable the teacher to work with limited supplies and rotate groups through building stages. Students will use the directions at each station to complete their product. Groups should switch after 20-25 minutes at their station.

3. After students have finished their habitat plan and product, they will need to decide what steps they will take next! Where could they implement their habitat - at their home? at school? at a local park?

Take Action

As an extension to this activity, student groups with the same pollinator type could present and evaluate each other's habitat plans and give ideas for refinement or additions. Groups could create a presentation for the class that includes their habitat plan and showcases their product and how it would be implemented in their plan.

Students could also research the decline of pollinators and the reasons why scientists believe this is happening using the following links:

- http://greatpollinatorproject.org/conservation/major-threats-to-pollinators
- https://www.nytimes.com/2016/02/27/science/decline-of-species-that-pollinate-poses-a-threat-to-global-food-supply-report-warns.html
- https://www.esa.org/ecoservices/poll/body.poll.scie.decl.html

National Standards

Science

Next Generation Science Standards

HS-LS2-8
Ecosystems: Interactions, Energy, and Dynamics Evaluate the evidence for the role of group behavior on individual and species' chances to survive and reproduce.

HS-ESS3-4
Earth and Human Activity Evaluate or refine a technological solution that reduces impacts of human activities on natural systems.

Sources

- https://xerces.org/pollinator-conservation/agriculture/pollinator-habitat-installation-guides/
- https://www-tc.pbs.org/wgbh/nova/assets/swf/1/pollination-game/pollination-game.swf
- https://www.huffingtonpost.com/2014/06/17/store-without-bees_n_5500380.html

Student Groups: Habitat Plan Sheet

Use your student device to do some research on what species of pollinators live in your area and what you can do to attract them to your habitat!

Pollinator Focus Group (Hummingbirds, Butterflies, Insects):

1. What are some common species that live in your area that are important and beneficial pollinators?

2. Are any of these species threatened or endangered? Are there any species of special interest?

3. What types of things is your pollinator attracted to in a plant? Color? Smell?

4. What are some of the plants that these species depend on that you could plant in your habitat? Are these native plants to your area?

5. Describe the mutual relationship between your pollinator and the plants that it has a relationship with (be specific).

6. How will you provide water for your pollinators in your habitat?

7. What types of shelter will your provide for pollinators?

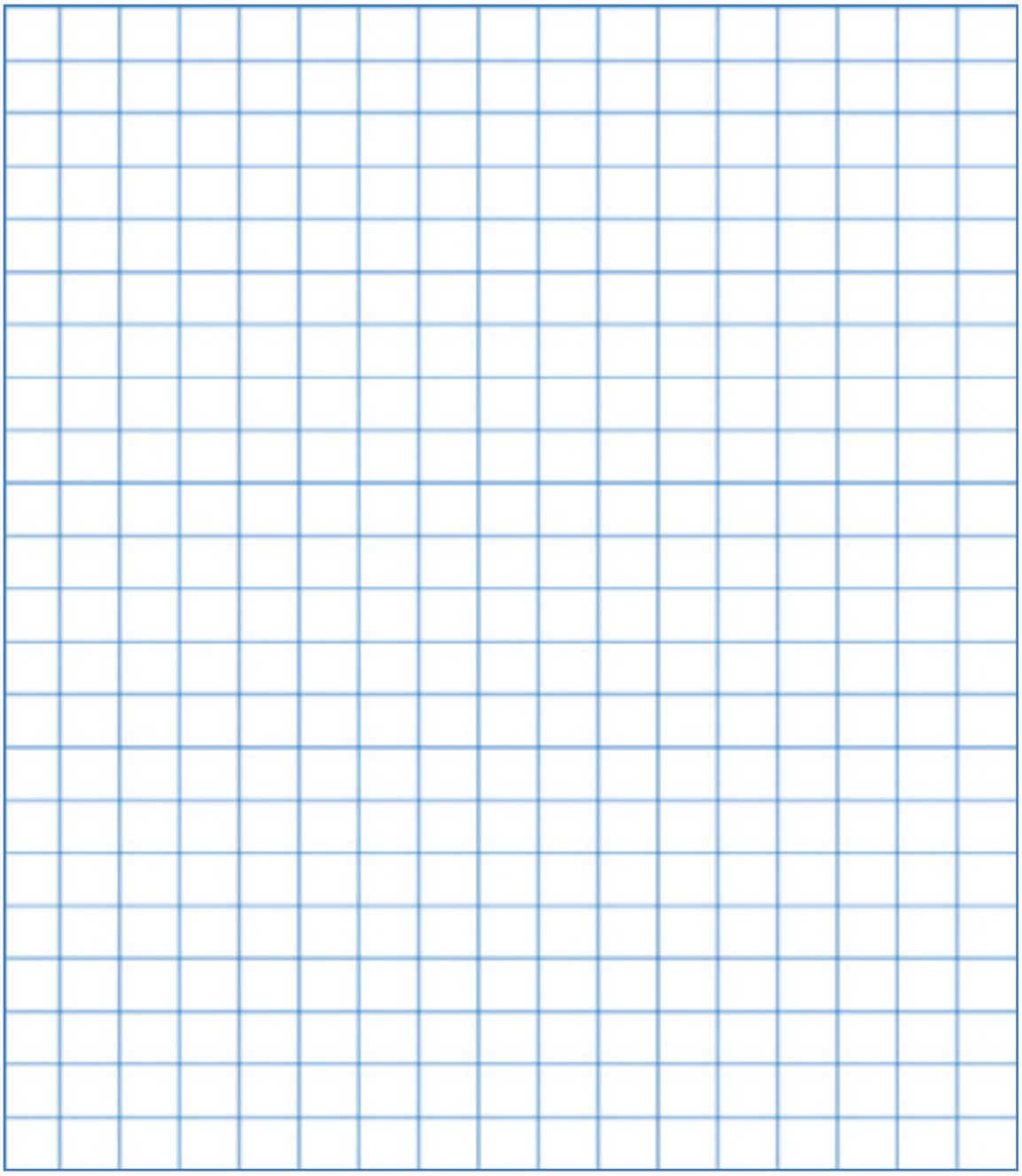
8. What are some of the predators of your pollinator and how will you protect them in your habitat?

9. What can you add to your habitat to educate people who visit it about why your pollinators are important to protect?

Student Groups: Habitat Sketch

Use a piece of graph paper to sketch what your habitat would look like if you were to build it.

Try to draw things to scale as much as possible and make sure to clearly label important parts and areas of your habitat (plant species, water and shelter sources, educational features). Be sure to include your POLLINATOR PRODUCT as a part of your sketch!



Student Groups: Butterfly House Building Instructions

Instructions

1. Gather the pieces of cedar that have been pre-cut for your butterfly house. This should include a base, two sides, a back panel, and one or two pieces for a roof.

2. Put the wood pieces together to create a square house without a front.

3. Use wood glue to put together the structure, then add nails using a nail gun or hammer to assure that it's in place.

4. Repeat #2-3 for the roof.

5. Use spray paint to paint the exterior a bright color to attract butterflies.

6. Cut the craft sticks to create a front door to your butterfly house with a few slots in it that are at least 3" long and 1" wide to allow butterflies to enter and exit (see picture below).

7. Use wood glue or a hot glue gun to attach the craft sticks to each other in the pattern you have designed.

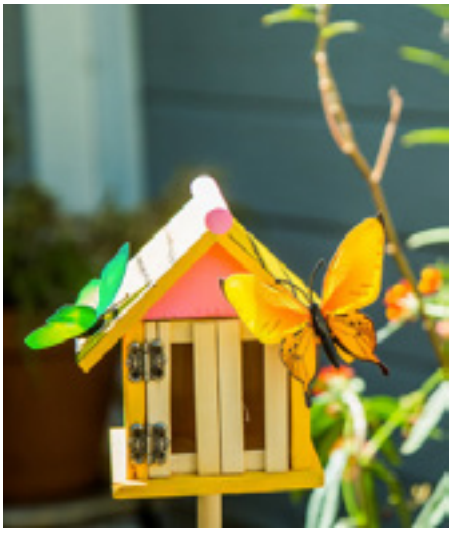
8. Use a drill or screwdriver to attach 1 or two small hinges to your front door to allow it open and close.

9. Using a hot glue gun, add some of the sheet moss to the inside back wall of your butterfly house to give butterflies something to cling to. You can also add sticks or twigs to the inside of the house as well.

10. Drill holes in the bottom for a post (optional).

Materials

- ¼" thick plywood *(pre-cut into desired size for house)*
- Wood glue
- Hammer and nails
- Drill with drill bits
- Small hinges
- Spray paint *(various bright colors)*
- Paint sticks *(to make shingles for the roof)*
- Craft wood stick pieces
- Sheet moss
- 4' wooden dowel *(optional, if mounting in the ground)*



Student Groups: Hummingbird Feeder Building Instructions

Instructions

1. Gather the pieces of cedar that have been pre-cut for Using a flat screwdriver and a hammer, poke a hole in the cap of the bottle you will be using.

2. Use the wedge shape of your scissors to enlarge the hole to roughly ⅜" or 1 cm.

3. Make a matching hole in the bottom center of one of the aluminum cans.

4. Use a ruler and marker to measure and mark each of the aluminum cans ⅜" or 1 cm from the bottom edge of the can.

5. Use scissors to cut the top off of each can.

6. Next, cut down the side of each can and around the line that you marked at ⅜" or 1 cm from the bottom of the can.

7. Take the end piece of the can with the hole and mark 3 equally spaced dots around the bottom edge of the can.

8. Make a single cut into the side of one end piece and fit the two end pieces together. This will be the base of your hummingbird feeder.

9. Spread a thin layer of epoxy around the outer layer of the two can ends of the base to ensure a water-tight seal.

10. Add epoxy to the flat side of the bottle cap and attach it to the base you just constructed, making sure to line-up the holes. Let the epoxy set for a few minutes.

11. Take a drill and using a ⅛" drill bit, or a hammer and similar-sized nail, and create the three holes that you marked earlier on the base.

12. Using a marker, draw and cut-out flower shapes from the leftover aluminum from the cans. They should be no more than 1 ½" in diameter.

Materials

- Glass bottle with a screw-on cap
- Scissors
- 2 aluminum cans
- Spray paint *(red and yellow)*
- Screwdriver
- Medium-sized nail
- Quick-set epoxy
- ruler or tape measure
- wire
- hot glue gun and hot glue

Instructions *(continued)*

13. Use the drill or a hammer and nail to create holes in the center of each flower.

14. Use brightly colored spray paint to color the base and the flowers to attract hummingbirds (reds and yellows work well).

15. Use the epoxy to attach the flowers to the base, making sure to line up the holes. Push toothpicks through the holes to ensure that no epoxy is plugging the holes.

16. Lightly bend the petals of your flowers to help them look more natural.

17. Screw the bottle back into the bottle cap base of your feeder.

18. Use and twist wire around the bottle to attach a hanger to your feeder.

Student Groups: Bug Hotel Building Instructions

Instructions

1. Take the pre-cut cedar wood piece and assemble them into the shape you want for your bug hotel. The front should be open, as this is where you will add in the hiding places for the insects.

2. Use a drill or electric screwdriver to assemble the piece together into the base for your bug hotel.

3. Take the bamboo steaks and carefully use the hand saw to cut pieces that are 31/2" to 4" long. You should cut anywhere from 10-20 pieces based on what you want your bug hotel design to be.

4. Gather the bamboo pieces together in one or two bundles and use duct tape around the bundle to secure them together.

5. Place the bamboo pieces with the openings facing out in your bug hotel.

Materials

- *½" thick cedar or other rot-resistant wood
- bamboo stakes
- Hand saw
- Sheet moss
- Drill or electric screwdriver with various size drill bits
- 4x4" x 6' post *(pre-cut into 4" long pieces)*
- Brick edger with holes
- duct tape
- 4" terra cotta clay pots
- 11/2" Weather resistant screws
- Various sticks, leaves, logs gathered from outdoors
- Poultry netting
- Staple gun

6. Next, use a drill and bits of various sizes to drill holes into the pieces of 4x4" post wood. These will provide hiding spots for insects.

7. Place the the 4x4" post pieces into your big hotel with the holes facing out.

8. Take a terra cotta clay pot and fill it loosely with sheet moss, you can use a hot glue gun to loosely attach the moss to the pot to create crevices for insects to crawl into. Add your clay pot to your bug hotel box. You may repeat with a second pot if you have room!

9. Next pack your bug hotel with outdoor debris, such as sticks, pinecones, twigs leaves, and additional sheet moss.

10. When you have finished filling your bug hotel, cut out a piece of poultry netting that will cover the front of your bug hotel. This will help to keep birds out of it and protect the insects inside.

11. Attach the poultry netting to the front of the bug hotel using a staple gun.