# NACD
## Pollinator Field Day Curriculum Guide

National Association of Conservation Districts

POLLINATOR PARTNERSHIP

DAVID ROCKEFELLER FUND

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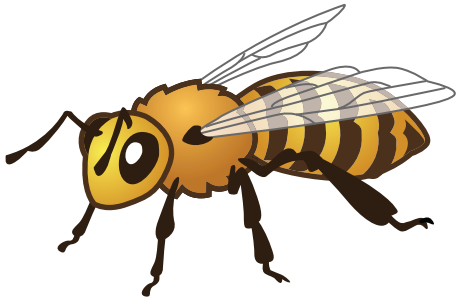
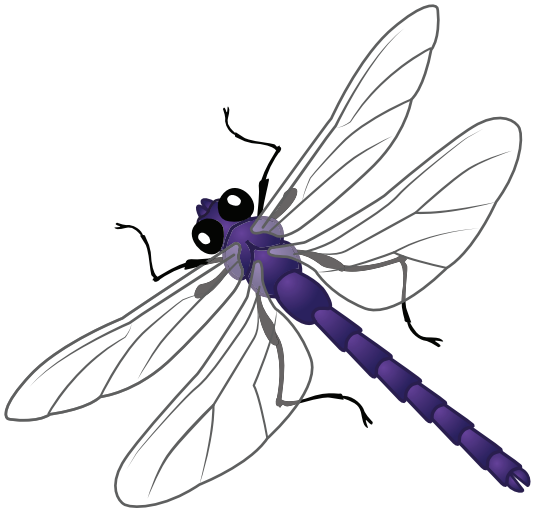
## WELCOME!

### NACD Pollinator Field Day Curriculum Guide







# WHAT IS A POLLINATOR FIELD DAY?

**Hosting a Pollinator Field Day is a wonderful way to connect your school or organization to the natural world.**

From the flowers that make our world brighter to the food we eat daily, pollinators play a special role in the environment. Pollination is the transfer of pollen from plant to plant that allows them to reproduce. While some plants may be pollinated by the wind, 80 percent of plants rely on animals like bees and bats for this process.

Imagine a world without any pollinators! No bumblebees or hummingbirds or even wasps to carry pollen from one plant to the next. While we would certainly miss looking at flowers and plants, we would definitely miss the more than 150 crops in the United States that depend on pollinators to grow. These vital creatures play an important role in our day-to-day lives. While we may not notice their hard work, we would certainly notice it if they were gone.

Hosting a Pollinator Field Day highlights these incredible animals and plants that we rely on and illustrates our connections to the environment in a fun and hands-on way. This guide will outline how to set-up and host a Pollinator Field Day and includes a variety of activities for formal and informal learning environments.

In addition to providing more connections to nature, hosting a Pollinator Field Day is a great way to build connections in the community with natural resource professionals, local colleges and universities and your local conservation district.

# WHAT IS A CONSERVATION DISTRICT?

Conservation districts are local units of government established under state law to carry out natural resource management programs at the local level. Districts work with millions of cooperating landowners and operators to help them manage and protect land and water resources on private and public lands in the United States. Districts also provide outreach to all ages, including youth, on natural resources topics.

*Find your district through this interactive map!*

# WHO IS NACD?

The National Association of Conservation Districts (NACD) is the nonprofit organization that represents America's 3,000 conservation districts and the 17,000 men and women who serve on their governing boards. NACD's mission is to promote the wise and responsible use of natural resources for all lands by representing locally-led conservation districts and their associations through grassroots advocacy, education and partnerships.

The association was founded on the philosophy that conservation decisions should be made at the local level with technical and funding assistance from federal, state and local governments and the private sector. As the national voice for all conservation districts, NACD supports voluntary, incentive-driven natural resource conservation programs that benefit all citizens.

NACD maintains relationships with organizations and government agencies; publishes information about districts; works with leaders in agriculture, conservation, environment, education, industry and other fields; and provides services to its districts. The association's programs and activities aim to advance conservation led by local districts and the millions of cooperating landowners and land managers they serve.

# HOW TO USE THIS GUIDE

**This guide to a Pollinator Field Day contains more than just instructions for hosting a great event. It's a complete guide, including pre- and post-activities, strategies for evaluation, and resources. Here's what you'll find inside:**

### Lesson Plans & Ideas

Included in the guide are pre- and post-Pollinator Field Day activities for grades K-8. The activities can be used in the classroom or informal learning settings. To make them easy to use in the classroom, each activity highlights alignment to the Next Generation Science Standards. Activities include background information, time involved and materials. Additionally, each activity includes evaluation and extension ideas.

### Pollinator Field Day Stations & Implementation

Instructions for planning and implementing a Pollinator Field Day, including information on how to contact local professionals, station activities for a variety of ages, guidelines for implementation and more.

### Extensions

If you enjoy your Pollinator Field Day experience, there are many ways to extend the fun! Learn about how to plant a pollinator garden, participate in citizen or community science efforts and more.

### Supplementary Content

Student worksheets, including crossword puzzles and word searches, as well as additional content for parents and guardians to share information about the Pollinator Field Day and email templates for outreach.

### A Note on Environmental Education

Hosting a Pollinator Field Day is a great way to incorporate environmental education into your school day, or educational program. "Environmental education is a process that allows individuals to explore environmental issues, engage in problem solving, and take action to improve the environment. As a result, individuals develop a deeper understanding of environmental issues and have the skills to make informed and responsible decisions." *(Quote Source)*

Central to environmental education are hands-on experiences for discovery. The activities in this guide are designed to be inquiry-based, offering plenty of time for questioning and exploration. During the Pollinator Field Day, we encourage you to invite guests who will engage your students.

# CORRELATIONS TO EDUCATION STANDARDS

**The activities in this guide are meant to be used in both formal (classroom) settings, as well as informal (museums, zoos, scout groups) settings.**

For ease of use in a formal setting, all activities have been correlated to the Next Generation Science Standards and the Common Core for ease of use. A Pollinator Field Day lends itself to exploring science, technology, engineering and math (STEM) concepts and has many connections to English language arts, reading and local history and geography.

## PRE-EVENT PLANNING

**Planning and hosting a Pollinator Field Day can feel like a big task. However, there are likely professionals in your area who are willing to contribute their expertise to make this day a success.**

The station activities listed in this guide can be used in an 'a la carte' manner - pick and choose the ones that will work best for the youth who will participate in the Pollinator Field Day. There is no correct number of stations to include, but note that each activity works best for a small group of up to 8-10 students.

## CONSERVATION PARTNERSHIPS

**Bringing in community partners is a great way to add additional content to your Pollinator Field Day and to introduce youth to natural resource professionals. Here are a few ideas for agencies that you can reach out to where you live.**

### Conservation District

Every state has conservation districts. Depending on your state, they may be called a soil and water conservation district, soil conservation district, resource conservation district or something similar. No matter the name, each district coordinates assistance from all available sources - public, private, local, state and federal - to develop locally-driven solutions to natural resources concerns. The National Association of Conservation Districts is the nonprofit organization that represents these districts.

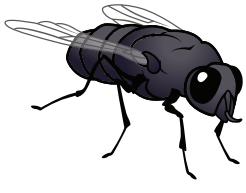
To find your local conservation district, visit:
*https://www.nacdnet.org/general-resources/conservation-district-directory/*

### State Natural Resource Agency

Another great community connection is your state natural resource agency or department. These governmental agencies manage and protect the state's natural resources. Working with your state's natural resource agency is a great way to introduce youth to careers and individuals working in natural resources.

### USDA: Natural Resources Conservation Service

Through the United States Department of Agriculture, the Natural Resources Conservation Service (NRCS) helps farmers, ranchers and forest landowners conserve the nation's soil, water, air and other natural resources. With NRCS staff across the United States, the agency fulfills its mission through offering conservation planning, technical assistance and financial assistance to landowners.



For more information, visit:
*https://www.nrcs.usda.gov/wps/portal/nrcs/main/national/about/*

### Additional Partners

There are many other organizations that may be willing to partner with you on your Pollinator Field Day. Consider reaching out to local community garden organizations, natural history museums, zoos and aquariums, colleges and universities, and local nonprofits that have conservation in their mission.

# ORGANIZATION AND SET-UP

## Logistics & Location

A Pollinator Field Day can be hosted outdoors or indoors with adequate space, like a gymnasium.

Each station requires the materials listed and a surface for the activity. This can be a 6' x 3' rectangular table or an 8' round table, or whatever is handy at your school or organization. There should be enough space for up to 8-10 students to engage in an activity comfortably. Depending on the location of your Pollinator Field Day, activities can occur in a large room, seperate rooms, or outdoors!

Station activities are approximately 10-15 minutes in length. While you are planning the schedule for the day, ensure that students have enough time to rotate between stations. This time will depend on the setting for your event. In a gymnasium or outdoor space, this may be 1-2 minutes, with a longer break halfway through the event, or up to 5 minutes if students need to move between rooms.

Ensure that all participant groups and station facilitators know the schedule for the day and which groups to expect at what time. This will ensure that your Pollinator Field Day runs smoothly and that all students have the time they need at each station.

## Building Community Relationships

Reaching out to community members, including individuals from conservation districts, state agencies and local farmers and ranchers as you are developing your Pollinator Field Day will make your event a collaborative and meaningful experience. You will likely find that many community members enjoy sharing their expertise with youth. Additionally, this highlights the variety of natural resource careers available where you live.

In the Appendices, you will find a sample letter to help you reach out to community members to ask them to be involved in your Pollinator Field Day. Ensure that you are reaching out to community members at least two months in advance of your Pollinator Field Day to give individuals and organizations enough time to get involved.

Another benefit of collaborating with community members on your Pollinator Field Day is the possibility of a continuing relationship. For example, if you decide to take your event further by doing a project at your school or organization, like planting a pollinator garden, many of these community members may be able to assist you with these efforts.

## Facilitator Training

In addition to working with community members who are natural resource professionals, you may want to work with volunteers who are interested in youth education or environmental education, or who are simply just interested in increasing awareness about pollinators. The involvement of other educators and parents who are involved at your school or organization will also help to make your Pollinator Field Day a success.

You will likely be working with a variety of individuals. It's a good idea to offer a short (around one hour) training ahead of your Pollinator Field Day so that all involved will understand the schedule for the day and what is expected of them at their station. If you are unable to offer a training in person, don't fret! Send information regarding the schedule and expectations well in advance of your Pollinator Field Day so all volunteers and station facilitators are prepared and know what to expect.

## DAY OF EVENT

**Your Pollinator Field Day is here! Here are a few tips and pointers to help ensure your event runs smoothly.**

Ensure that all facilitators and individuals working with student groups have the schedule of their rotations.

If your event is outdoors, you may want to ensure that each table is under a canopy or pop-up tent. You can ask community members and organizations to bring their own. You will also want to remind facilitators, volunteers and students to bring sunscreen, hats and water or a jacket, depending on the time of year you are hosting your Pollinator Field Day.

Have participants group up ahead of the event. A fun way to keep groups together is by giving them a pollinator as a name or mascot.

Make sure that groups are small in size (no more than 8-10) to ensure all students get to engage in the activity. If possible, groups should be comprised of students of similar ages or grade levels.

Ensure that you have enough materials and supplies for each station. You may want to have a few extra of each, just in case.

Plan ahead to have extra supplies like water, sunscreen and snacks.

Set expectations for students during the event before it begins. Some of these expectations may be site-specific but could include behavioral expectations like making sure that they are walking from station to station and are staying together, or content-specific, like making sure they engage fully at stations and learn 3 to 5 new things about pollinators based on their prior knowledge.

If facilitators are guiding students through an activity, ensure they have had time to practice the activity ahead of the event, either at a facilitator training or before the Pollinator Field Day begins.

Let all facilitators know the locations of bathrooms, first aid kits and where they can find an event coordinator if they are in need of assistance during the event.

Remind facilitators of the time they have to facilitate their activity during the event. If you're able, ask volunteers or adults paired with groups to help keep time. Let the facilitator know when they have five, three and one minute(s) left.

If you are allowing facilitators to take photos during the event, ensure all students have signed a photo release or that facilitators are taking photos in such a way to ensure the privacy of young students.

After the event, send thank you notes and/or follow up with event facilitators via email to show your appreciation and share outcomes. Some community partners will need to keep track of the number of students they reached for outreach or may want to share images with their supporters.

## BACK-UP PLANNING

**At an event like a Pollinator Field Day, it's a good idea to expect the unexpected! Here are a few scenarios that you may run into and a few ways to solve them**

**Inclement weather** • If you are planning on hosting your Pollinator Field Day outdoors, keep your eye on the weather and have a back-up location planned. All of the Pollinator Field Day activities can be held indoors and outdoors. If you don't want to worry about relocating due to the weather, you can always plan for your event to occur indoors.

**Station Facilitator Cancellation** • If a station facilitator has to cancel, try to ensure that you have an additional staff member on hand to facilitate the activity. If you can't do this, don't worry! If you need to remove the activity, see if you can adjust the schedule to accommodate a short break or game.

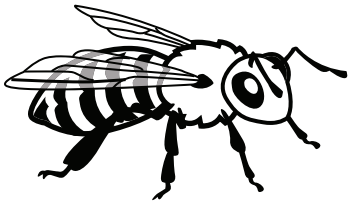
**Community Partner Cancellation** • If a community partner is bringing their own activity and needs to cancel, see if you can add an additional activity station facilitated by a volunteer. If you are unable to, again, don't worry! See if you can adjust the schedule to accommodate a short break or game.

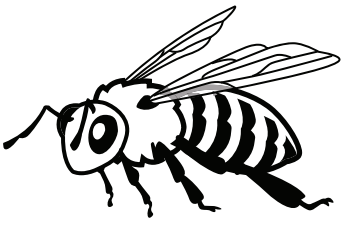
**Volunteer Cancellation** • All participant groups should have at least one adult to help guide and move groups from station to station. If you are relying on volunteers to help, you may want to schedule an extra volunteer or two to help with this task in case of a cancellation.

**Supplies and Materials** • If you are starting to run low on supplies or materials for a station or were short to begin with, have students collaborate so everyone has a similar experience.

**Station Goes Over Time** • If a station goes over time, make sure that the group quickly rotates to the next station. Any station that begins late will need to wrap up at the time indicated on their schedule. Ensure this is communicated to all facilitators, volunteers and adults with groups of students. For example, if a 15-minute station goes over by five minutes, the arriving group and the group that arrives late to their next station will only have 10 minutes to complete the activity. This will keep the rest of the event on time.

**Extra Time** • Provide a few ideas for a quick game (it doesn't necessarily need to be related to pollinators) to your facilitators and volunteers.





## CONSIDERATIONS

**The Pre-Pollinator Field Day Lessons are designed to provide background information on pollinators and activities for a variety of grade levels. While a grade level is indicated for each activity, they can be adapted for use with a variety of ages and settings.**

Components that you will find in each lesson include: Next Generation Science Standards alignment (however, lessons can be used in informal settings), time to complete, materials needed, background information and the lesson itself. Lessons utilize the 5 E model (engage, explore, elaborate, extend, evaluate) and include ideas for lesson extensions, and student pages.

You can find more information on the 5 E model here:
*http://cbm.msoe.edu/teacherWorkshops/mspResources/documents/day1/5eSummary.pdf*

### General Pre-Evaluation

Prior to these lessons and your Pollinator Field Day, take a few moments to find out what students know about pollinators by asking the following questions. You can record responses to reflect on the knowledge you gained after the lesson and your Pollinator Field Day.

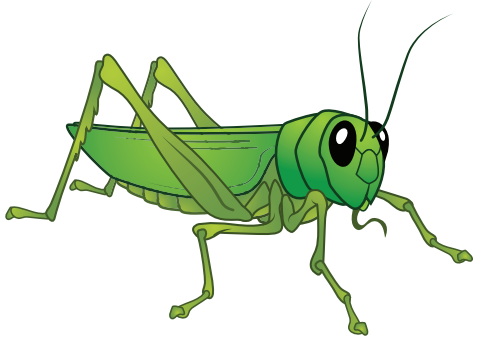
- What do you know about bees?
- What do you know about pollinators?
- How do you feel about bees and other pollinators?
- What do you know about flowers and plants?
- Do you know where your food comes from?
- What do you think would happen if the Earth's pollinators disappeared?
- Is there anything that people can do to help pollinators?
- Is there anything you'd like to learn about pollinators?

## K-2 Lesson : The Buzz About Bees

**LS1.A:** All organisms have external parts that they use to perform daily functions.

**LS1.C:** Animals obtain food they need from plants or other animals. Plants need water and light.

**LS2.A:** Plant depend on water and light to grow, and also depend on animals for pollination or to move their seeds around.



# CONSIDERATIONS

### K-2 Lessons Continued

### Time: 1 hour (can be divided into two 30-minute sessions)

**Materials**
- Pipe cleaners
- Masking tape
- Paper cups in a variety of sizes, holes should be poked in the bottom of each cup prior to the activity
- Scissors
- A few tablespoons of colored powder, like Jell-O or colored sugar

### Background Information

Honeybees and native bees are small insects, but they have a big impact on our environment and on humans. Bees are pollinators, meaning as they travel from plant to plant, they move pollen around on their bodies. Some of this pollen is used by the bees as a food source, and some of it is transferred from plant to plant. By transferring the pollen, bees (and other pollinators) help plants reproduce. The result of this process is seed development and the many fruits and vegetables that animals and humans rely on.

While many of us are familiar with bees as pollinators, there are many other animals that assist in the pollination of plants, including wasps, hummingbirds and bats, just to name a few. This lesson will focus on bees, but additional information about other pollinators can be found in extensions for this lesson and in other activities.

Honeybees were brought to North America in the 1600s by European settlers. Honeybees live in a large group called a colony or a hive. As their name suggests, these bees make honey, which many people enjoy! There are about 4,000 other species of native bees in North America. While these bees don't make honey, they still play an important role in the environment by helping to spread pollen from plant to plant.

Like other plants and animals, bees have special adaptations that help them collect and transfer pollen. Bees will store pollen on their hairs or in cavities on their body.

Bees will communicate the location of nectar and pollen with with other members of their colony through a special dance called a "waggle dance." This dance lets other bees know where a food source is by communicating both direction and distance.

### Students Will...

- Explain and describe that bees rely on pollen produced by flowers
- Explain and describe the different body parts and adaptations of bees
- Create a model to explain the process of pollination

# LESSON

## Engage

Ask students what they know about bees. Record this information on a white board or on a large sheet of paper to refer to during this lesson. If time permits, record what questions students may have about bees. You can also ask about observable phenomena: Have students ever seen bees on flowers in their yards or neighborhoods before? What did they think the bees were doing?

Explain that bees are pollinators, they move pollen from plant to plant. This helps plants to create seeds, which are important in reproduction. While some plants can self-pollinate or their pollen can be transferred by wind or water, many plants rely on animals like bees to spread pollen around. This relationship is important to the plants, bees and even to humans.

If time permits, have students observe some real flowers or images of flowers and bees. Ask what they notice and see if any other questions are generated.

## Explore

Tell students that they are going to practice pollination by making their own "bees" out of pipe cleaners. They will observe and investigate how this process works. Depending on the age of the students, the model flowers may need to be made ahead of time.

## Making the Flower

- Create an L-shape out of another pipe cleaner.
- Stick the long side of the pipe cleaner through the hole; stop when the short side rests against the bottom of the cup.
- Tape the short end of the pipe cleaner to the bottom of the cup using masking tape.
- Once students make their cups, an adult should add some of the colored powder, making sure that it doesn't land on the pipe cleaner in the "flower".
- Ask students if they know what the colored powder is modeling. Let them know that this is going to be the pollen that they talked about earlier.

## Making a Bee

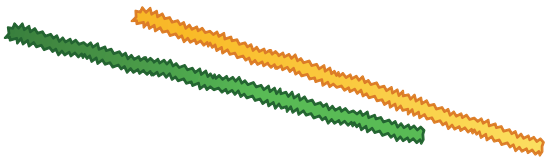
Model making a bee out of the pipe cleaners for the students, but note that they can create whatever bee or insect-like shape they want, as long as it can fit inside and touch the bottom of the cup. An easy way to make a bee is by taking a pipe cleaner and bending it into a U or V-shape.

- Wrap another pipe cleaner around the middle of it to create wings or a handle.
- If everyone makes a different shape, ask students to observe the variety of shapes of insects that the other students created.

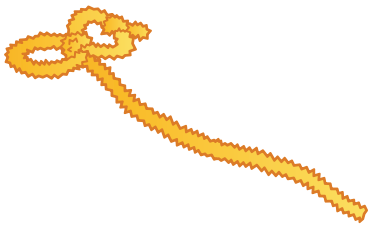
Once students have materials, ask them to generate a few ideas about what may happen based on the bees they created and the model flowers that are available.

Let students put their insects inside of a flower, move it around and take it out - what did they notice?
Allow students to let their bee visit other flowers and make observations. During the activity, the student-made bees should collect "pollen" and transfer it from flower to flower.

pipe cleaners

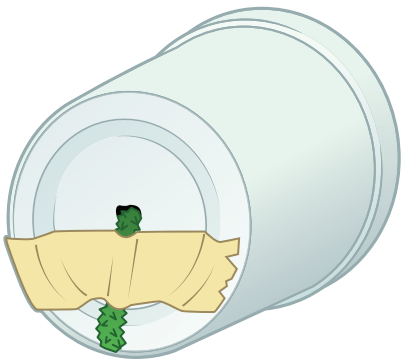


pipe cleaner bee



pipe cleaner flower-top

pipe cleaner flower-bottom



## LESSON

### Explain

**After the activity, bring students back and ask them what they observed. Questions may include:**

- What did you observe happening to your bee during the activity?
- What about the flower?
- Did anything happen to the pollen?
- Were any insects better than others at transferring pollen? Why do you think that is?
- Were any of the flowers easier to pollinate?
- Do you think this is a good model for how bees really pollinate flowers?

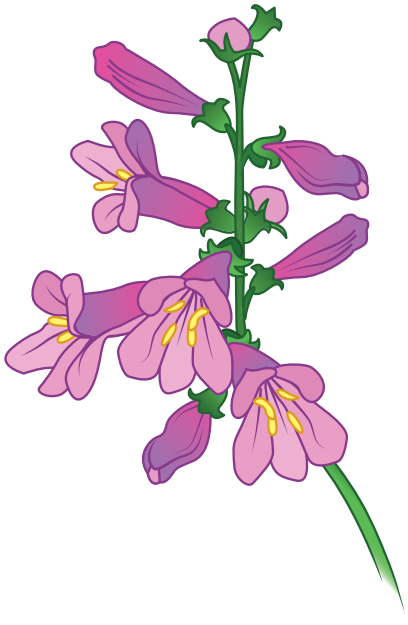
Show students images of bees and flowers. Explain that their fuzzy, pipe cleaner bee does share some similarities with real bees. Where appropriate, cover anatomical terms. When bees visit flowers, pollen will stick to them, and it will be transferred as they fly from flower to flower.

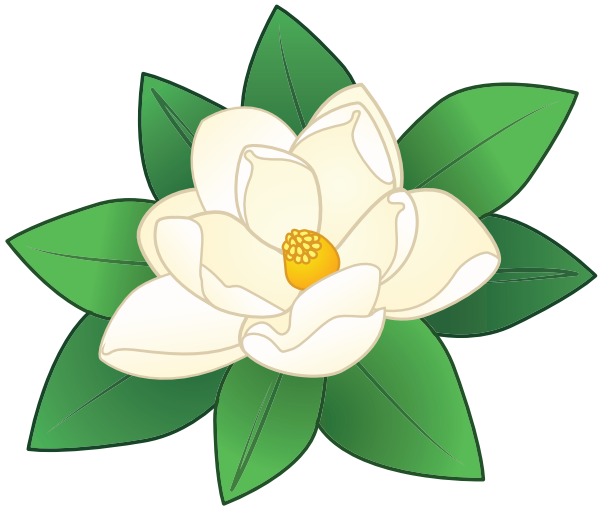
Review the parts of a flower. Where appropriate, explain that flowers have female and male parts. The female parts of the flower are the pistil, comprised of the stigma, style, ovule and ovary, which is usually located in the center of the flower. The male parts of the flower are the stamen, which is made up of the anther and the filament. The anther produces the pollen.

During pollination, pollen is transferred to the stigma, where it moves toward and joins the ovule. This fertilized ovule becomes the seed, and the ovary becomes the fruit.

Ask students what they think would happen if we didn't have flowers. Bees wouldn't have the pollen they need to survive! Follow up by asking what they think would happen if we didn't have bees or other pollinators. Not only do many plants rely on these animals for reproduction, but humans and other animals rely on them for the fruit they help to create.

Using the Student Page, have students draw what happens during pollination.





# DAY OF EVENT

## Extend

**Let students investigate other types of pollinators.**

- What adaptations do they have in common with bees?
- What makes them different?

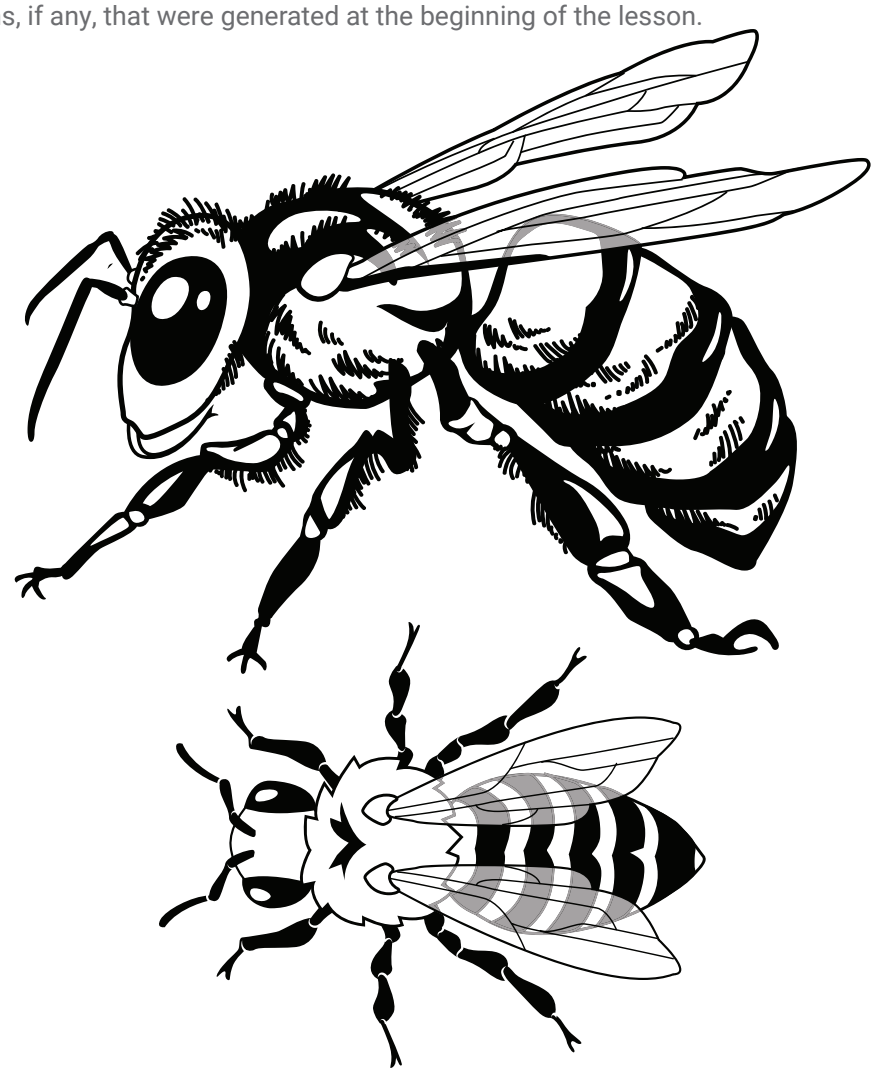
**Let students investigate other types of pollinators local to their region.**

- What are the types of pollinators found where you live?
- What are some of the adaptations that these pollinators have?

**Let students investigate some of the foods we eat that are pollinated by insects. If possible, reach out to a local farmer to see if they would be willing to come and speak to your students or allow you to visit for a field trip.**

## Evaluate

- Students should be able to draw a model of pollination, including a bee (or other pollinator) and a flower.
- Students should be able to describe the process of pollination.
- Revisit questions, if any, that were generated at the beginning of the lesson.



## The Buzz About Bees: How Pollination Happens

**How does pollination happen? Illustrate what you learned. Be sure to include a pollinator like a bee or other insect, and a flower.**

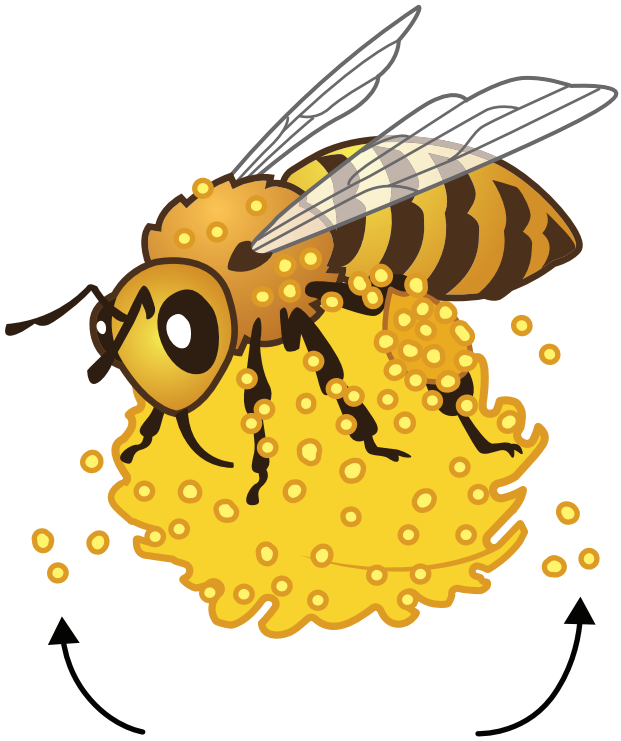
## 3-5 LESSON : ITS TOUGH TO BE A POLLINATOR!

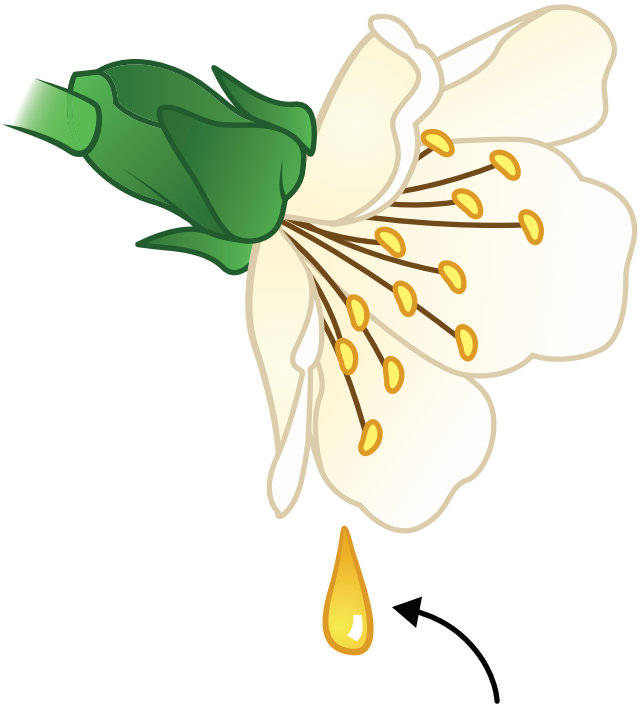
**Alignment to NGSS**
**LS2.D** • Being part of a group helps animals obtain food, defend themselves, and cope with changes.

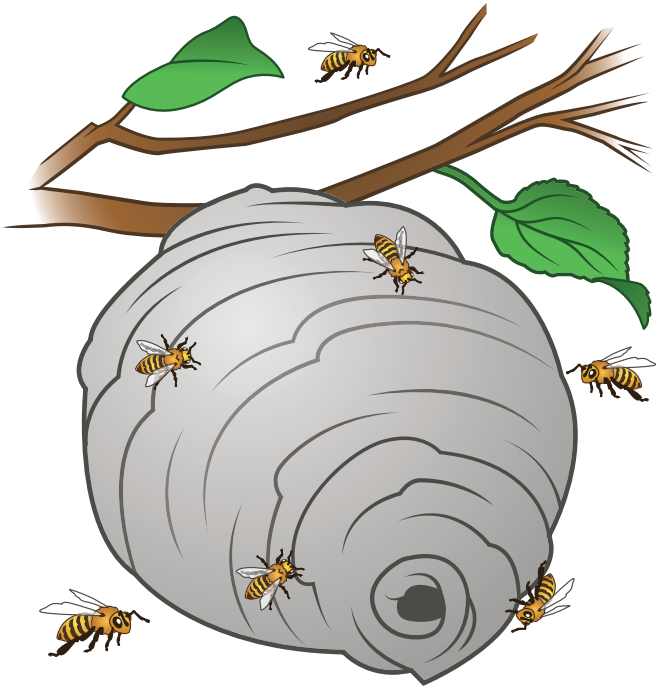
**LS1.C** • Food provides animals with the materials and energy they need for body repair, growth, warmth, and motion.

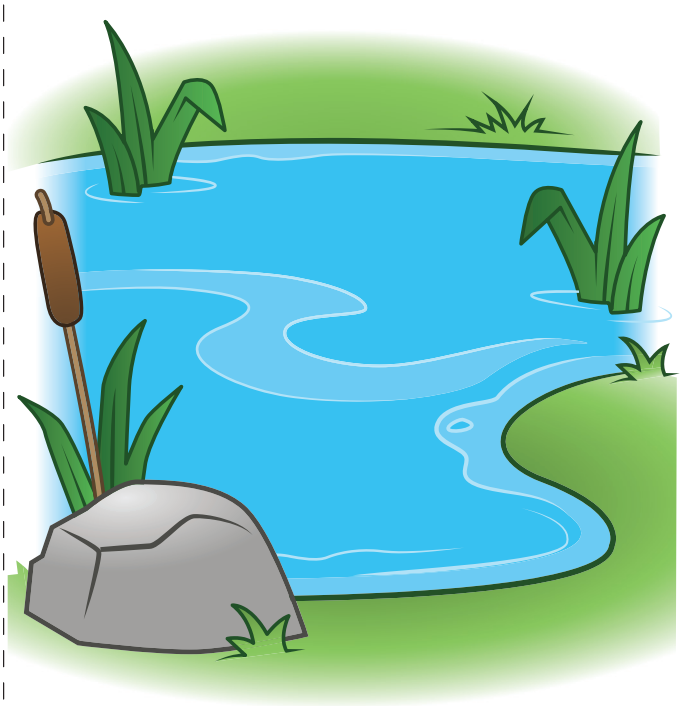
**Time: 1 hour (can be divided into two 30-minute sessions)**

**Materials**
Cards for pollinator survival game (if you are unable to print out cards, colored index cards or index cards with the words pollen, nectar, shelter, water, invasive species and disease written on them will work.)









### NECTAR

A sugary liquid produced by plants, a food source for many pollinators.

### POLLEN

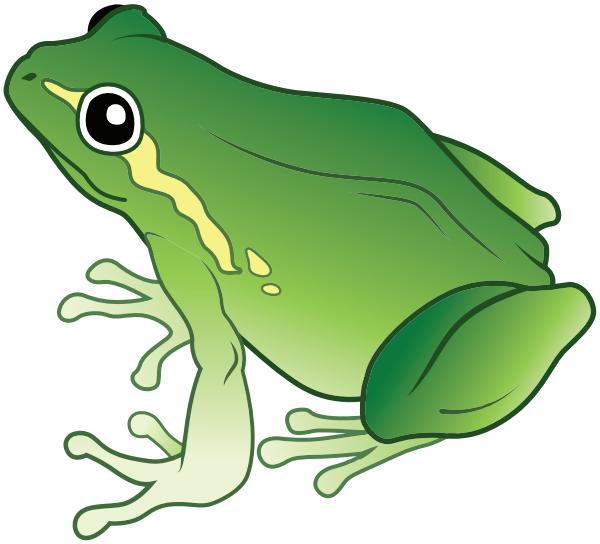
Formed in the male parts of a flower, need to be transferred to a female for pollination to occur. Pollinators help make this happen!

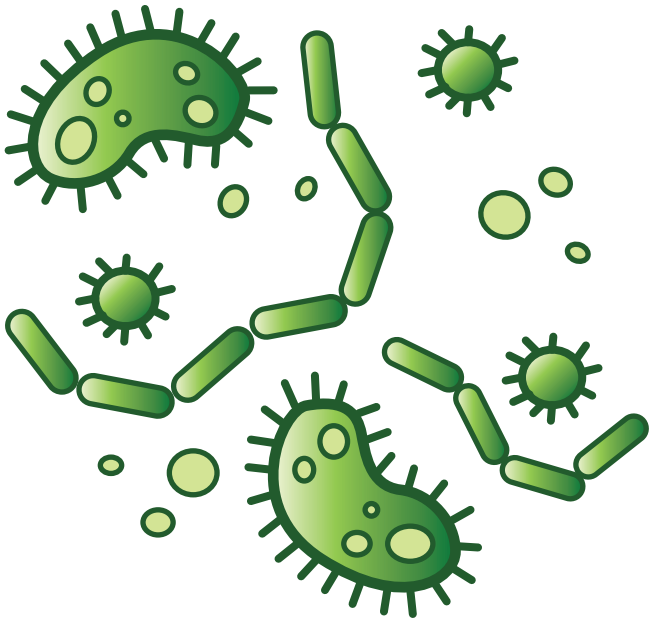
### WATER

Necessary for all living things to survive. Pollinators may find water in ponds, rivers, lakes and puddles.

### SHELTER

A safe place for living things. Pollinators may rely on shelter for safety or a place to raise their offspring.





### DISEASE

Something that makes a plant or animal sick. A disease may temporarily hurt a living thing or may even kill them.

### INVASIVE SPECIES

A living organism that is not native to an ecosystem that causes harm. For example, an invasive species may eat all the food in an ecosystem that an animal relies on.

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# TOUGH TO BE A POLLINATOR

## Background Information

All animals, including humans, need food, shelter and water to survive. Pollinators are no different! The food source for these animals can include pollen and nectar from flowers.

For shelter, many bees live in a colony or a nest. Many of us are familiar with the term “beehive” as a place where bees live. A beehive is a human-made structure that some species of honeybees use for shelter. A nest may be found in a natural or artificial cavity. An artificial cavity could be something human-made, like a building.

The inside of a bee nest is made of hexagonal-shaped cells made of beeswax. This is called a honeycomb. Here, bees can store pollen and raise their young.

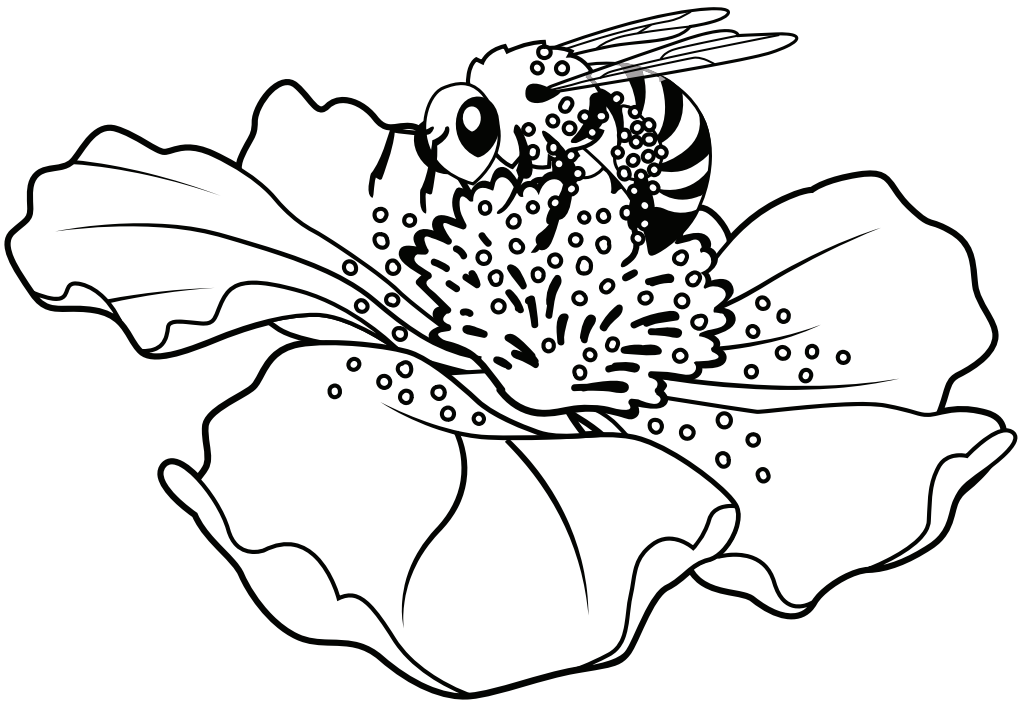
Living in a group has many benefits. Not only is there additional safety living in a group, but there is also the ability to share resources like food and shelter. Animals like bees also have specific functions in their hive or nest. However, there are some downsides. For example, disease can spread quickly through a group of animals.

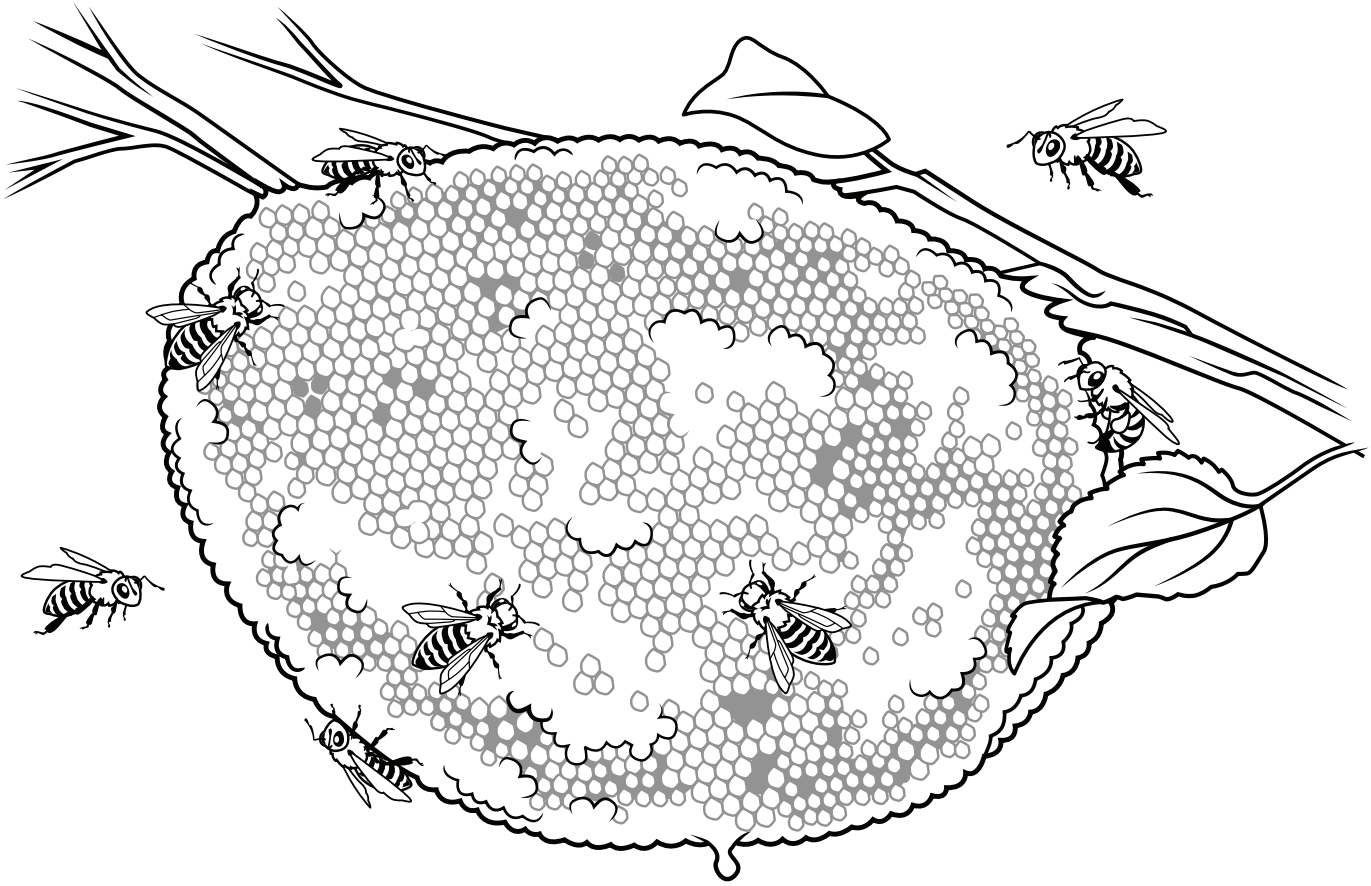
While shelter can provide safety, animals like bees have a number of adaptations that allow them to survive in their environment. Their most prominent defense mechanism is their stinger, which they will use to defend their colony. Also, only female bees are capable of stinging. This defense sometimes comes at a cost - when a honeybee stings, the stinger gets stuck and the bee will die.

This activity focuses on bees and their hives or nests; however, the context can be applied to many other types of pollinators.

## Students Will...

- Explain and describe what living things and bees need to survive
- Explain and describe the different body parts and adaptations of bees







## LESSON

### Engage

Ask students what living things need to survive. Answers may include food, shelter and water. Ask why these are important to animals and to people. Ask if there is anything that bees specifically need to survive, showing a picture of a flower with pollen to demonstrate if necessary. Record answers and any questions that may arise on a whiteboard or large sheet of paper.

Show students images of a bee nest in a tree or other cavity. What do they notice? Have students elaborate on what happens in a bee nest or hive. For example, bees will store food and raise their young.

Ask if there are some benefits to living in a large group like bees do. Are there any other adaptations they have that allow them to survive in their environment?

### Explore

To better understand how bees survive, students are going to become bees to play a game of survival. First, they will do it on their own as individual bees and then will form a colony.

# FIGHT FOR SURVIVAL GAME

## Game Instructions

For this game, you will need access to an outdoor area like a field or an indoor space like a gym.

Prior to the first round of the game, have the survival game cards spread out, omitting the disease and invasive species cards, with one set in hand so that you can share the instructions. It is recommended that there are at least two cards of each type per student.

Once you get to the game area, let students know that they are each going to be a bee and will work independently in this round. Establish rules for proper game play - you may walk quickly to pick up cards, you may not steal cards from other players, etc. Show the players each of the cards they are looking for. Their goal in this round is to collect as many of each card as possible until they are all gone. Let students collect cards until there are none left.

Bring students back together and form a circle. Have them compare their resource cards. Did anyone get one of each? Did anyone get only one or two of each? Did anybody not collect any? Ask if they think this is comparable to animals in the wild. Ask what they think would happen if they were working in groups - would it be easier to collect the resources they need?

Collect the cards from the students. This time, break them into small, evenly-sized groups. Explain that this time they will work in teams to gather the resources that they need. For example, if they are a group of 5, they will need to collect 5 pollen/nectar cards, 5 shelter cards and 5 water cards. If they collect 5 pollen/nectar, 6 shelter and 4 water, one of their team members would “die”. They will be able to communicate to each other, but they won’t be able to speak. Only one team member may be out collecting a card at a time. Once the rules are shared and the cards are spread back out, allow students to play this next round.

After this round, have students discuss the gameplay. Was it easier or harder in teams? Were they able to get the resources they needed to survive?

Play an additional round or two, adding in the disease or invasive species card. Any teams that pick up these cards would die, regardless of the other resources they acquire.

## Explain

**After the activity, bring students back together and ask them what they observed. Questions may include:**

- What were some of the differences between the individual round and the team rounds?
- Was it easier to survive as a team? Why or why not?
- What else besides disease or invasive species might impact bee survival?
- During some of the rounds, you weren’t able to speak to communicate.
- How do bees communicate with each other?
- Do you think this is a good model for how bees really live together in hives?

Show students images of beehives and bees.

Talk about the social structure of a beehive and how bees communicate the location of resources via a waggle dance.

Go over bee anatomy and discuss some additional bee adaptations and how these are also useful in bee survival.

# PRE-FIELD DAY LESSONS

## LESSON

### Extend

- Let students investigate the lifecycle of bees.
- Let students investigate the survival strategies of other pollinators.
- Let students investigate a beehive. If possible, reach out to a community member to see if they would be willing to come and speak to your students or allow you to visit for a field trip.

### Evaluate

- Students should be able to describe what living things need to survive and explain the specific needs of bees.
- Students should be able to describe the benefits of living in a group.
- Students should be able to name one thing that may affect bee populations and their survival.
- Students should be able to explain some of the physical adaptations of bees that contribute to their survival individually and as a group.
- Revisit questions, if any, that were generated at the beginning of the lesson.

## STUDENT PAGE

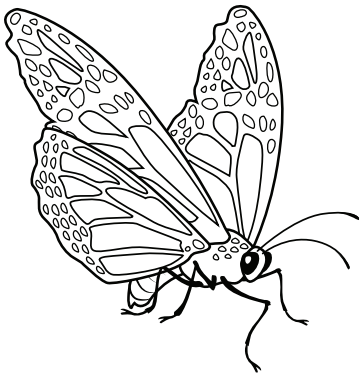
### On the student page, let students answer the following:

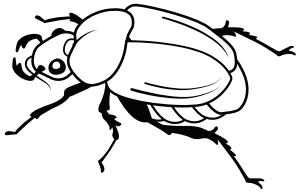
- Reflect on your experience playing the "Fight For Survival" Game.
- What were some of the challenges you faced as a pollinator?

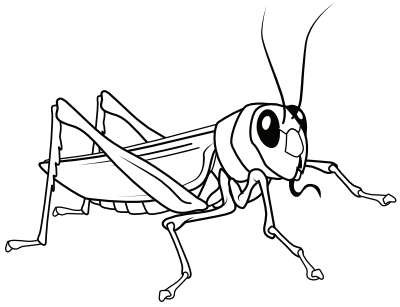
**Additional Resources**

**Major Threats To Pollinators** • http://greatpollinatorproject.org/conservation/major-threats-to-pollinators
**The Plight Of the Pollinator (U.S. National Park Service)** • https://www.nps.gov/articles/pollinator.htm
**Pollinators in Trouble** • https://www.nps.gov/subjects/pollinators/pollinators-in-trouble.htm

## WHAT ARE THE CHALLENGES POLLINATORS FACE?







# 6-8 LESSON : OUR CONNECTIONS TO POLLINATORS

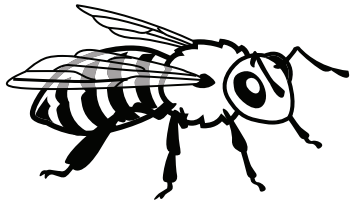
## Alignment to NGSS

**LS2.A** • Organisms and populations are dependent on their environmental interactions both with other living things and with nonliving factors, any of which can limit their growth. Competitive, predatory, and mutually beneficial interactions vary across ecosystems but the patterns are shared.

## Time: 1.5 - 2 hours, can be divided into two 45-minute or 1-hour segments

**Materials • A variety of fruits that depend on pollination. Examples include:**

- Almonds
- Apples
- Avocado
- Coffee
- Chocolate
- Pumpkin
- Strawberries
- Tomato
- If you are unable to find these items, illustrations are provided.
- Butcher paper or student page
- Markers or colored pencils
- Access to the internet via a computer or other device



## Background Information

Humans and pollinators are deeply connected. We are both a part of the same food web, with humans relying on pollinators to help many of the plants we eat reproduce and produce the food that we consume.

While some plants are able to self-reproduce, three-fourths of the world's flowering plants and about 35 percent of the world's food crops depend on animal pollinators to reproduce.

Think about the produce section of the grocery store. Pollinators make most of this selection possible. Without pollinators, not only would we not have fresh fruit, sugarcane, some spices, nuts and products like coffee and chocolate, but the farmers that grow these crops would also be affected. Pollinators tie us all together in ways that we may not have even thought of. Don't forget, pollinators impact approximately one in every three bites of food we eat!

When honeybee populations are impacted by disease or other external environmental factors, it has the possibility of creating a ripple effect throughout an entire system.

To analyze how we interact with pollinators, it is useful to look at or create a food web. More complex than a food chain, a food web illustrates the complex interactions in an ecosystem between organisms and their environment. Food webs can help us see how organisms interact both directly and indirectly, and what may happen in a system if an organism is removed.

## Students Will...

- Describe and explain how humans and pollinators are connected
- Create a model of a food web that includes pollinators
- Explain what would happen to the food web if pollinators were removed

# LESSON

## Engage

Place the food items where all students can see them, or show them  illustrations. Ask if they can think of what they all have in common. Field a few responses. If students are unable to come up with the answer, ask them how fruits are formed. Fruits are the ripened ovary of a flowering plant. And many plants, like the ones that these food items came from, depend on pollinators to reproduce and produce fruits.

Record any questions or ideas that may arise during this discussion on a whiteboard or large sheet of paper.

## Explore

Give students an example food web. Allow them to observe it independently for a few moments.
After reviewing, ask students.

- Which organisms are the producers (the ones forming the base of the food web)?
- Which organisms are consumers? Which are carnivores, omnivores or herbivores?
- What would happen if a producer was removed?
- What would happen if one of the other organisms was removed?

Tell students that they will create their own food web (or chains, based on time) that include at least one pollinator, one food item and humans. They may include up to five additional organisms. Students may work either individually or in small groups.

To create their food web, have students pick one of the food items and let them research which pollinator(s) it relies on to reproduce. Students should draw their food web or chain on a large sheet of butcher paper or the student page.

Allow students to share their food webs with the rest of their peers. If students worked individually, allow them to share in pairs. Smaller groups can share with the entire group.

## Explain

Bring students back together in a large group. Ask them if any patterns emerged.
Additional questions may include:

- What were some of the other organisms that you included based on your research? Did anything surprise you?
- What would happen to the food web if an organism, other than a pollinator, was removed due to disease or pollution?
- What would happen to the food web if the population of one of the organisms doubled?
- What do you think would happen if an invasive species was introduced?

Review the concept of a food web and a food chain. Ask students what does a food web illustrate that a food chain does not? Which one is more accurate and reflective of an actual ecosystem

## LESSON

### Elaborate

Let students keep a food journal and review it to see which items they eat rely on pollinators. Don't forget to read all the ingredients on processed or pre-packaged food.

Let students research their area to see if there are any farms that grow crops that rely on pollinators. If possible, reach out to a community member to see if they would be willing to come and speak to your students or allow you to visit for a field trip.

### Evaluate

- Students should be able to explain the relationship between humans and pollinators.
- Students should be able to create a model of a food web that includes pollinators, crops and humans.
- Students should be able to explain that pollinators impact many systems, including agriculture and the economy.
- Revisit questions, if any, that were generated at the beginning of the lesson.

## OUR CONNECTION TO POLLINATORS: FOOD WEB

**Create a Food Web that illustrates our connections to pollinators and many of the foods we eat.**

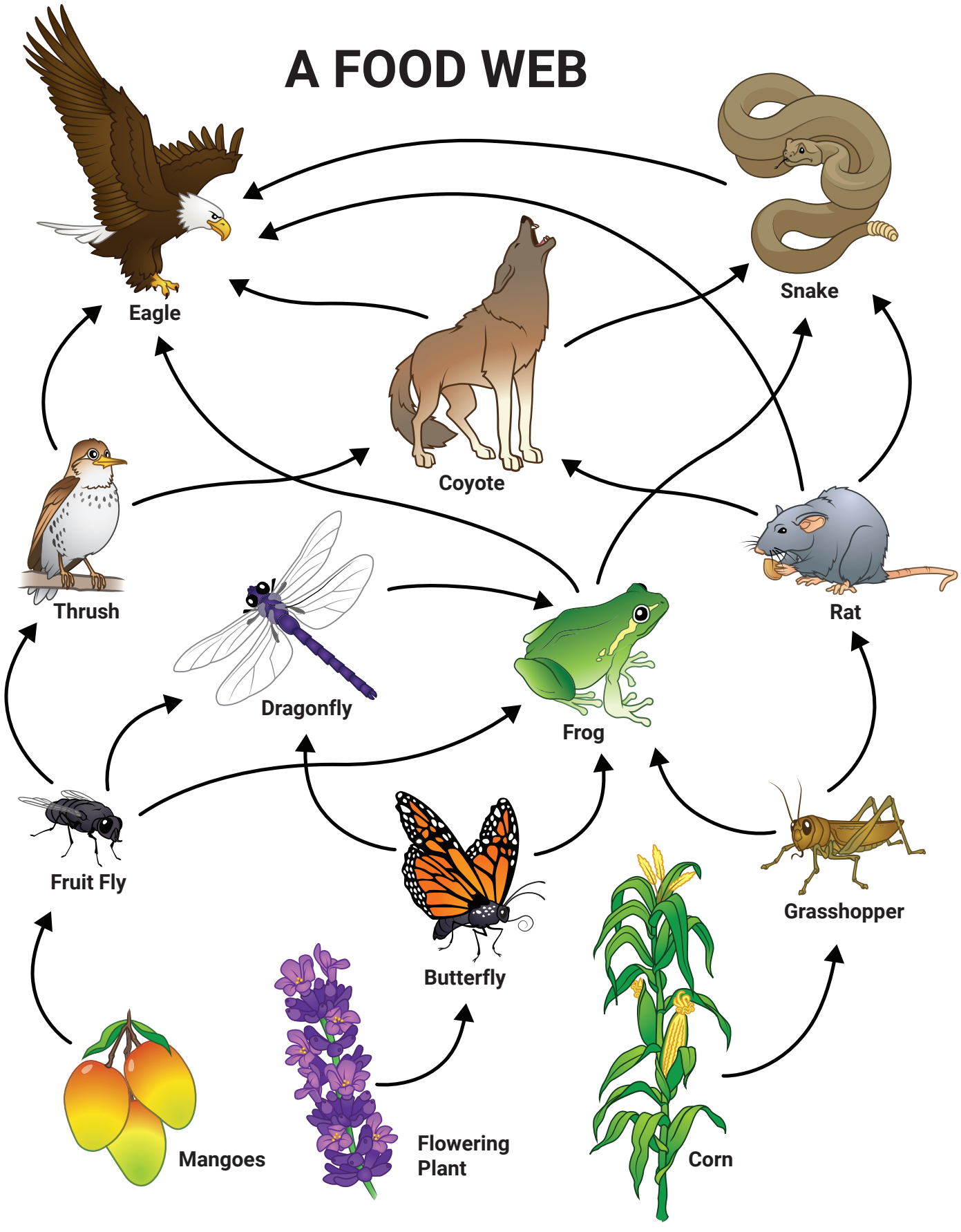
### Additional Resources

Complexity Explorer
*https://www.complexityexplorer.org/news/26-the-web-of-life-and-the-ecological-human-in-summary*

Food Chains and Food Webs: Examples Of Food Chains and Food Webs
*https://k8schoollessons.com/food-chains-food-webs/*

Food Web: Concept and Applications
*https://www.nature.com/scitable/knowledge/library/food-web-concept-and-applications-84077181/*

Insects & Pollinators | Nrcs
*https://www.nrcs.usda.gov/wps/portal/nrcs/main/national/plantsanimals/pollinate*


A FOOD WEB
Eagle
Snake
Coyote
Thrush
Rat
Dragonfly
Frog
Fruit Fly
Grasshopper
Butterfly
Mangoes
Flowering Plant
Corn

# GUIDE FOR STATION FACILITATORS

**Pollinator Field Day facilitators are crucial to the implementation of a successful Pollinator Field Day.**

More generally, facilitators should be focused on facilitating a fun and educational experience for all students. The activities are structured to have an emphasis on student engagement. Facilitators should do their best to guide students through their experience and share information where appropriate. If there are additional community members or organizations who will be facilitating or exhibiting their own activity, check in before the event to ensure the activity is hands-on and appropriate for the age level of the students participating in the event.

### Why are there no print materials for the field day?

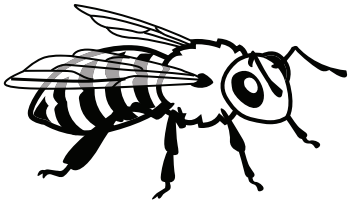
This Pollinator Field Day does not come with a print student field guide. Each of the stations include hands-on content and activities and an outline for facilitators to ask questions to gauge students' knowledge as they participate. Conducting a large event outdoors means that there are already many variables to consider and things to troubleshoot. Eliminating a print student field guide allows you to remove an item that may be costly and to create a more sustainable event.

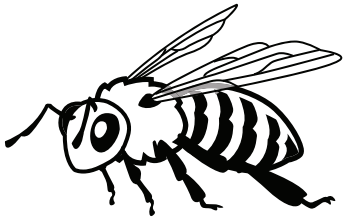
By not including a print field guide, we are hopeful that the emphasis of your Pollinator Field Day will be on student engagement in activities and the hands-on components at each station.

# POLLINATOR MATCH!

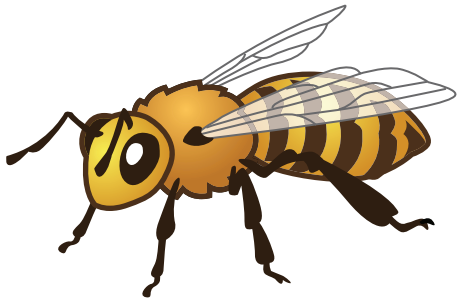
### Materials

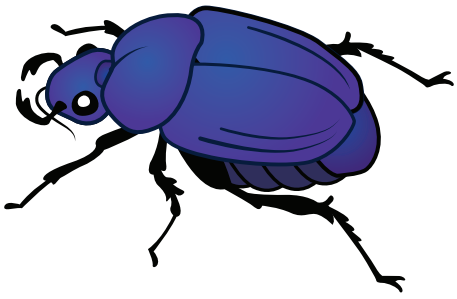
- Pollinator and flower cards





# POLLINATOR FIELD DAY STATIONS





# POLLINATOR FIELD DAY STATIONS

### BAT

Bats are attracted to flowers that are open at night, since that is when they are active. They prefer lighter colored flowers and a strong fragrance. Many of the flowers that attract bats also attract moths, which bats like to eat.

### HUMMINGBIRD

Hummingbirds aren't very picky, they will feed on any flower that produces a lot of nectar. Hummingbirds may be more attracted to red or orange flowers.

### BEE

Bees prefer purple, blue or yellow flowers. Bees are attracted to flowers with a sweet fragrance. Bees will eat pollen and nectar from flowers.

### BUTTERFLY

Butterflies prefer red, purple or yellow flowers. Like bees, they are attracted to flowers with a sweet fragrance. Butterflies seek out flowers with a platform or solid place to land.

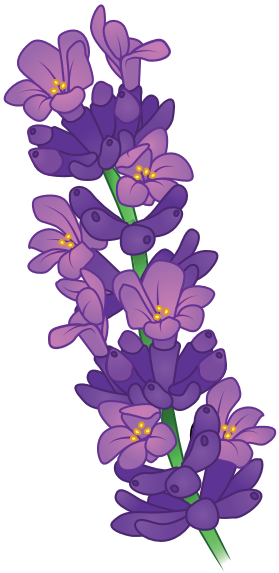
### MOTH

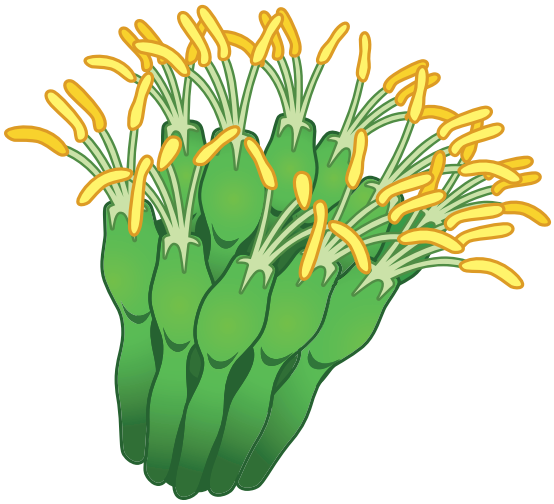
Moths prefer yellow or white flowers. Moths are attracted to flowers with a strong, sweet fragrance. You'll find moths attracted to flowers that open in the evening.

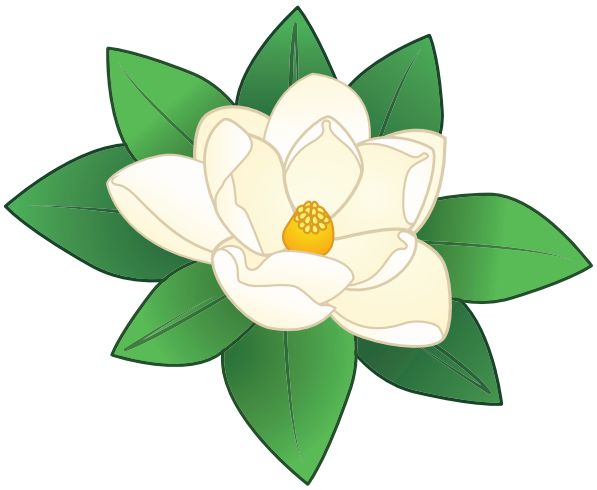
### BEATLE

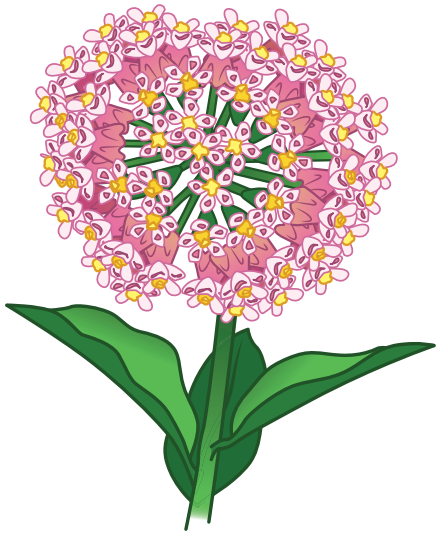
Beetles prefer green or white flowers. They like a flower that has a fruity smell. Beetles aren't very picky and will eat all parts of a flower.

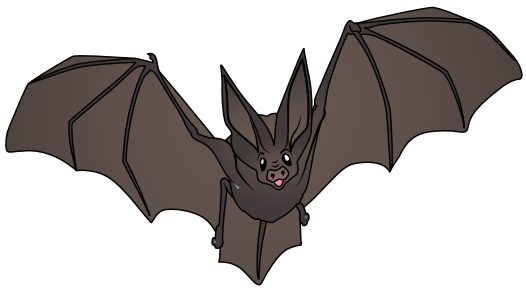
# POLLINATOR FIELD DAY STATIONS











# POLLINATOR FIELD DAY STATIONS

## EVENING PRIMROSE

Evening primrose has large, bright yellow petals. As their name indicates, these flowers tend to open in the evening or at night. Evening primrose has a sweet fragrance.

## LAVENDER

With purple flowers and abundant nectar and pollen, lavender is a favorite of many pollinators. This plant is also very fragrant and may bloom continuously.

## MAGNOLIA

Magnolias have large, white petals and are open during the day. They have a strong, fruity scent.

## PENSTEMON

Penstemon come in a variety of colors, including blue, purple, white, red or orange. Some penstemons have a landing surface for pollinators. Others will have flowers that are down-turned.

## MILKWEED

Milkweeds have purple, red or yellow flowers. These plants have a sturdy place for insects to land on when they feed on nectar.

# POLLINATOR MATCH

## Background Information

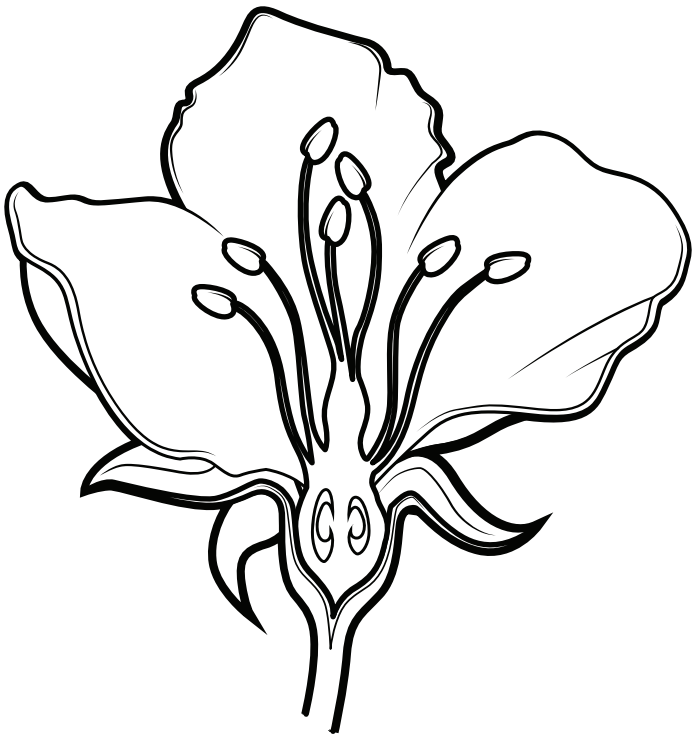
Pollinators help move pollen from plant to plant. But, different pollinators look for different plants. And some plants try to stand out to be more attractive to different pollinators! There are some plants that have adaptations that help them attract many different types of pollinators, but some may only attract one kind of insect.

## Station Instructions

- Ask students if they have a favorite food. Do they think that pollinators have a specific plant they like to visit for pollen or food?
- Ask students if they think that some flowers try to attract insects to come and visit them.
- Explain that yes, flowers try to attract pollinators and pollinators have specific flowers they like to visit. Tell the students that they will work together to match pollinators to the flowers that are their favorite.
- First, have students try to match the pollinator to the flower based on image alone. Let students try to figure it out on their own/with their chaperones without giving away too much information about the correct answer.
- Depending on the age of the students and the number of chaperones, read information about each pollinator and see if they can identify which flower they may visit. If necessary, read the information about each flower.
- If the activity ends early, share a fun fact about each of the pollinators or flowers and answer any student questions

## Evaluation

Students should be able to explain that pollinators and flowers have unique adaptations and that flowers try to attract different pollinators.



# BEE-ING A BEE!

## Bee costume components

- Wings (can be made of paper or cardboard)
- Stinger (can be made using cardboard and yarn)
- Antennae (can be made with pipe cleaners and a headband)
- Pollen sacs (can be made with paper bags and yarn)
- Pair of legs (can be made with cardboard)

Note: each of these components can easily be made with simple materials like cardboard and yarn, there is no need to purchase a costume.

## Background Information

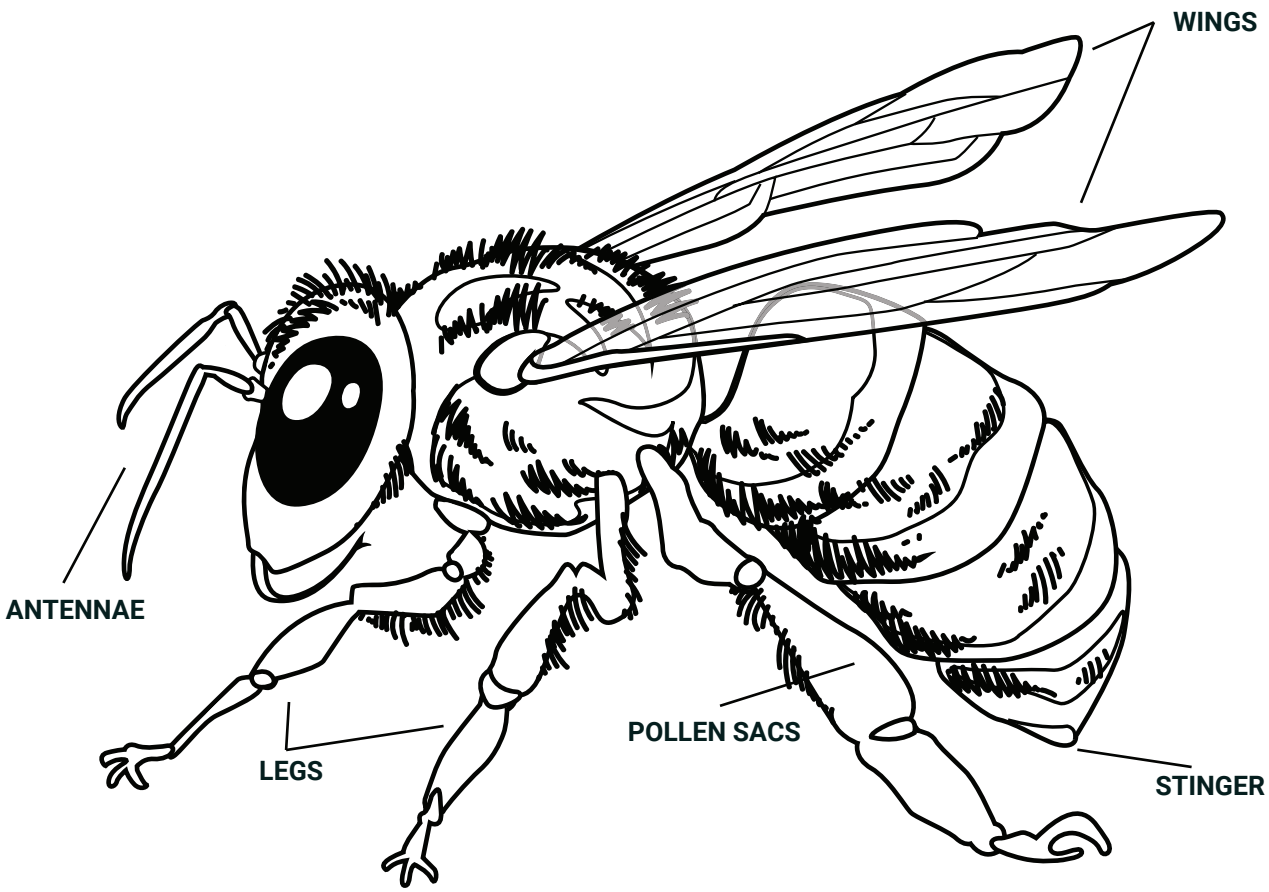
Review bee anatomy sheet and descriptions of bee anatomy

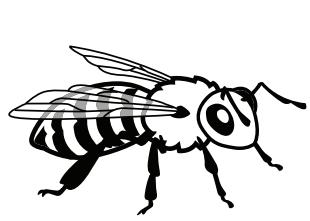
## Station Instructions

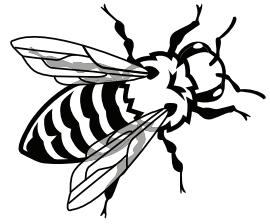
- Ask students if they can describe what a bee looks like.
- Ask them if bees have any special body parts that we don't have and if they have ever seen a bee up close
- Tell students that while we don't have any bees to look at today we are going to turn one of their peers into a bee! Alternately, you can have one student model each individual part of the bee.
- Ask for a volunteer and have other students gather around in a semicircle.
- If any of the bee parts were mentioned while you were asking what students knew about bees, pull these items out first and put them on the volunteer.
- With each item, first ask students what they think it helps the bee with, then explain its function.
- Once the student is all dressed up as a bee, ask them to buzz around and have their peers give them a round of applause.

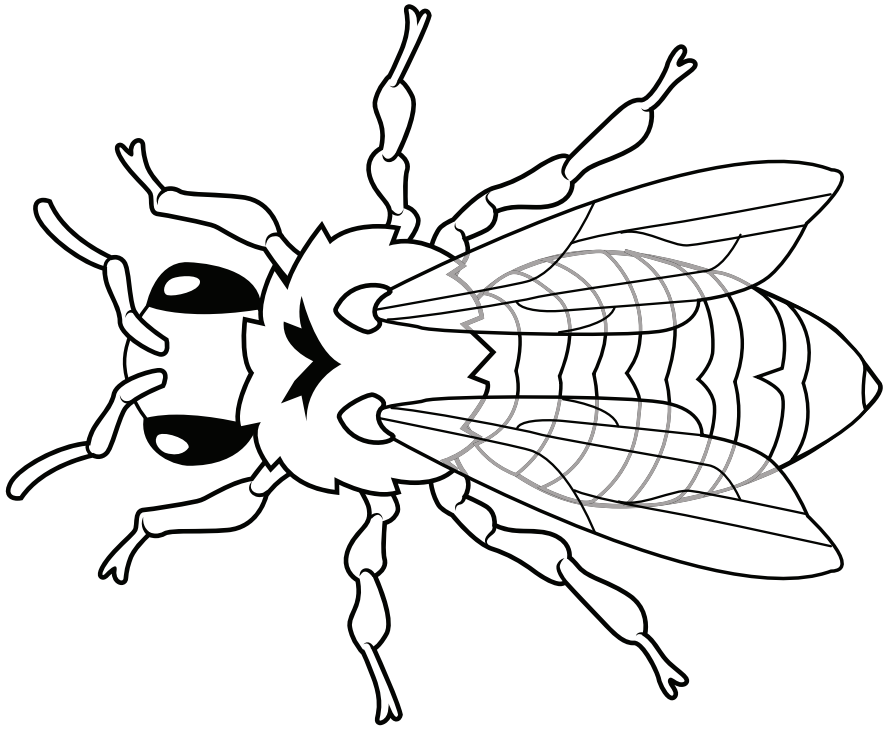
## Evaluation

Students should be able to explain that bees have unique body parts that help them survive in their environment.


WINGS
ANTENNAE
LEGS
POLLEN SACS
STINGER







# POLLINATING PROBOSCIS

## Materials

- Non-noisemaking party blowers, one per student
- Double-sided tape
- Paper cups
- Small ¼" pom poms
- Pictures of a butterfly or moth proboscis

## Background Information

There are many animals that act as pollinators. Many of us are most familiar with animals like bees. Moths and butterflies are also pollinators. When they visit flowers to feed on their nectar they will also spread their pollen around.

Moths and butterflies have a special adaptation to help them feed on the liquid nectar of flowers, a long tongue called a proboscis.

## Station Instructions

- Ask students if they can think of any other pollinators besides bees. Answers may include butterflies, bats, hummingbirds and moths.

- Tell students that butterflies and moths are two types of pollinators. One thing they share in common is a special adaptation called a proboscis. Show them the image of the butterfly or moth proboscis and ask them what they think it does.

- Explain that butterflies and moths use their proboscis to get nectar from flowers which is their food. This proboscis is a long tongue that they can use to reach into the flower to drink up the nectar. Some insects and flowers are very specialized, so not every pollinator can get nectar from every flower. If available, show different types of pollinator mouth parts and flowers so students can see this in action.

- Tell students that they are going to practice getting nectar out of a flower with a proboscis. Give each student a party blower.

- Have them affix a piece of double-sided tape to the end of their party blower; assist if necessary.

- Give each student a cup, which represents a flower, with a few pom poms in it to represent the nectar.

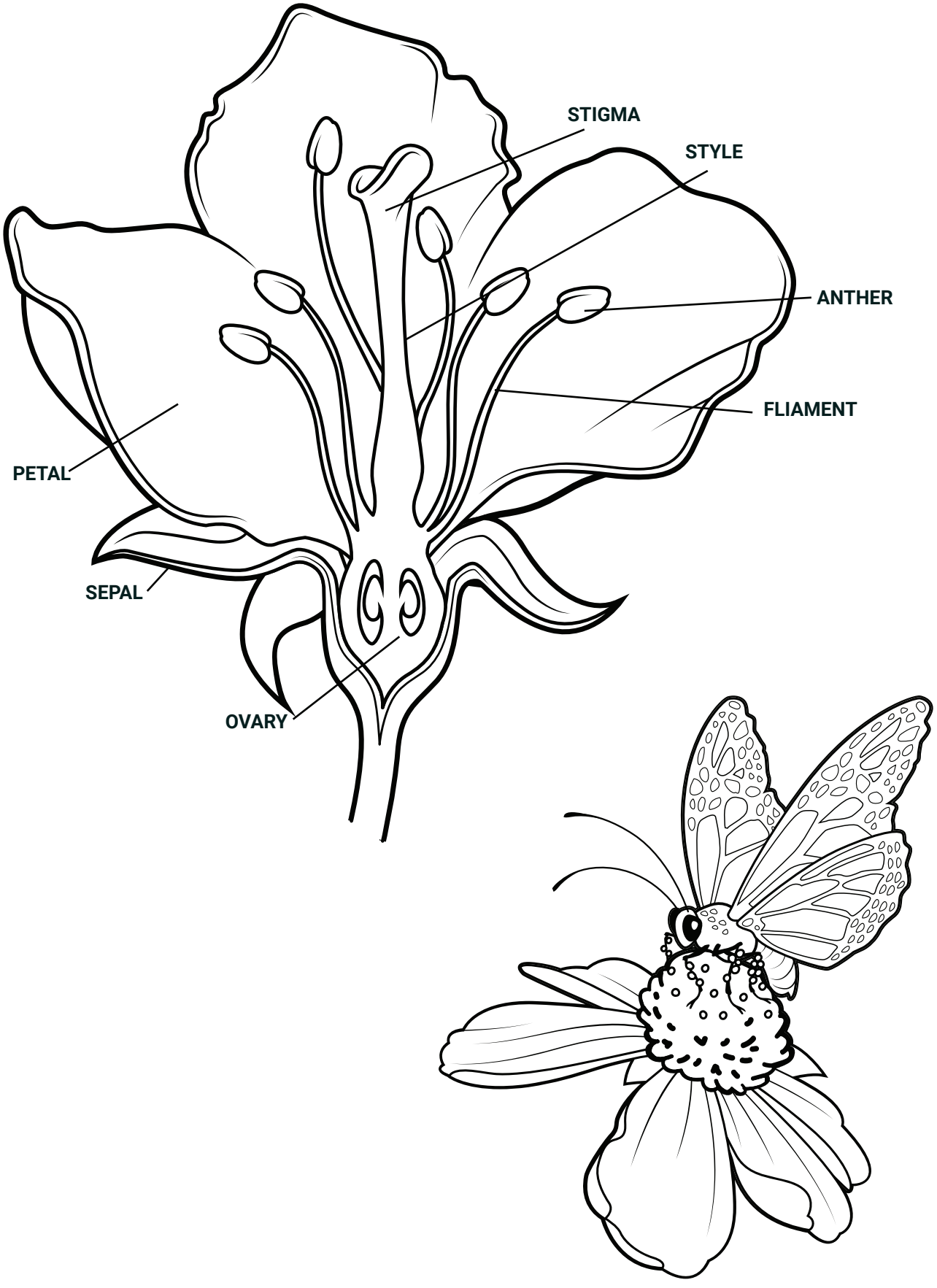
- Let students blow on their party blower to try to pick up the nectar from their cups.

- Before time is up, ask students how they did and if they thought their experience was similar to a butterfly or moth.

## Evaluation

Students should be able to explain that different pollinators have different types of adaptations to feed on flowers. Butterflies and moths have a specialized tongue called a proboscis, which they use to feed on nectar.

# POLLINATOR FIELD DAY STATIONS



# FLOWER DISSECTION

## Materials

- Flowers (1 per every 2-3 students, tulips and lilies work well)
- Scissors
- Magnifying glasses
- Diagram of a flower
- Newspaper or butcher paper to cover tables
- Bin for refuse during the event

## Background Information

Flowers are the reproductive parts of many plants and include both male and female parts necessary for reproduction. The process of pollination moves pollen from the stamen (male parts of the flower) to the pistil (female parts of the flower.) The pollen fertilizes ovules in the female part of the flower, forming seeds and fruit.

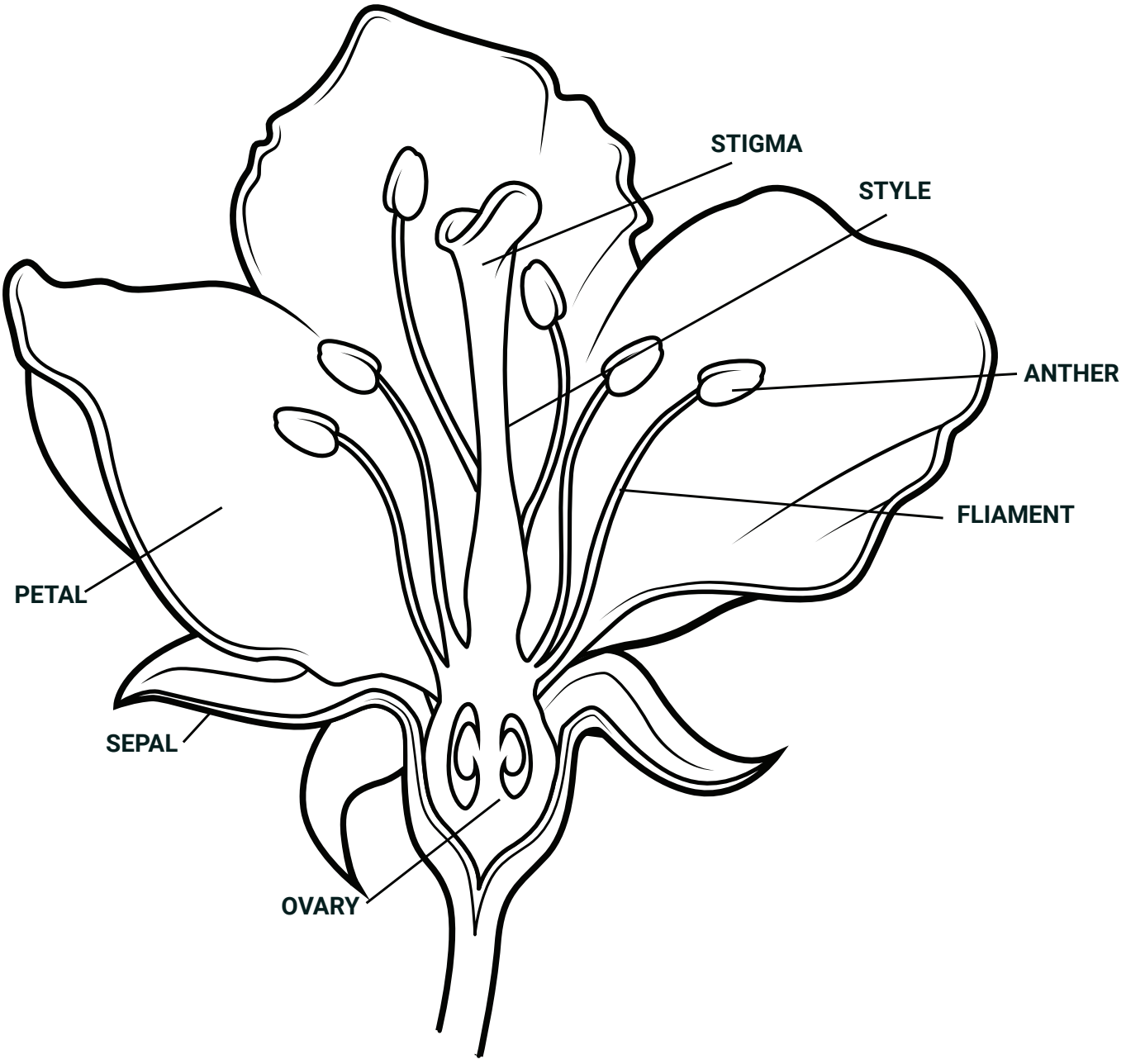
Some flowers can self-pollinate, but many rely on the help of pollinators like bees, butterflies, moths, bats, wasps and more. Some plants even have separate male and female flowers, and without the help of pollinators, they would not be able to produce fruit. The color and shape of the flower will attract different types of pollinators.

## Station Instructions

- Ask students what they know about flowers. Have they ever taken a close look inside of one?
- Explain that they are going to work in small groups to carefully dissect a flower and observe the different parts.
- Ask if they have any ideas about what they might see as they dissect the flower.
- Hand out flowers and a diagram of the flower. Before handing out scissors, tell students that they will need to find each of the parts listed on the diagram and that you will help to guide them through the flower dissection.
- Ask students what they observe when they look at the entire flower. How many petals does it have? Why do they think the petals might be brightly colored? Let students carefully remove some of the petals so they can see the reproductive organs.
- Find the stamen, the male part of the flower. What do they notice?
- Find the pistil, the female part of the flower. What do they notice?
- Carefully find and cut open the ovary of the flower. Ask what they notice inside.
- After dissecting, ask students if they have any new observations or if there was anything interesting that they noticed.

## Evaluation

Students should be able to identify the male and female parts of the flower and explain that pollinators aid in the process of plant reproduction.


STIGMA
STYLE
ANTHER
FLIAMENT
PETAL
SEPAL
OVARY

# POLLINATOR PICNIC

## Materials

- Pictures of food items with pollination information

## Background Information

Most of the foods that we eat are the result of our relationship with pollinators. One in three bites of food that we eat include a bee-pollinated food item. While we could survive without bees, the foods that would be left would be less than exciting. Pollinators help to provide variety and contribute to the overall biodiversity of ecosystems.

Review the food item cards before the activity.

## Station Instructions

Ask students if they know how humans and pollinators are connected. If necessary, explain that many of the foods we eat require pollinators to grow and that one in three bites of food we eat include a bee-pollinated food item.

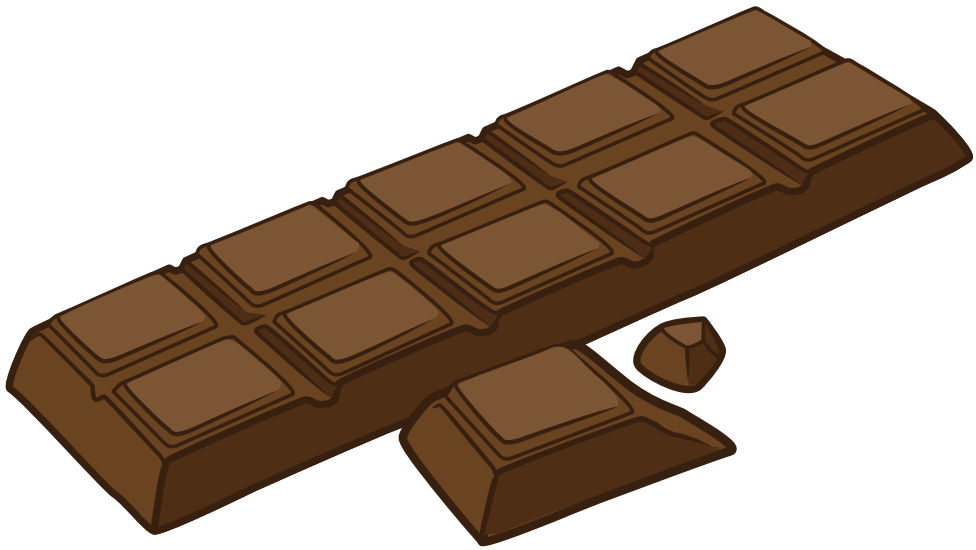
Tell students that they are going to put together a picnic, but they can only use foods that don't require pollination.

Give students the food item cards and ask them to put together a picnic that doesn't require pollination. If they need additional help, let them know that they can read the back of the card for more information.

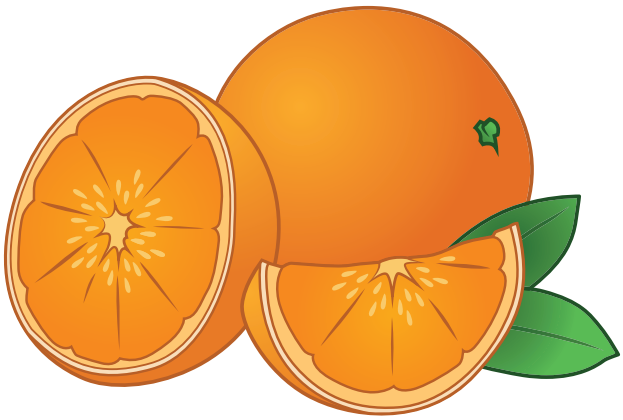
Ask students what they observed. Were they surprised about the items that were included or excluded? What do they think a world without pollinators would be like?

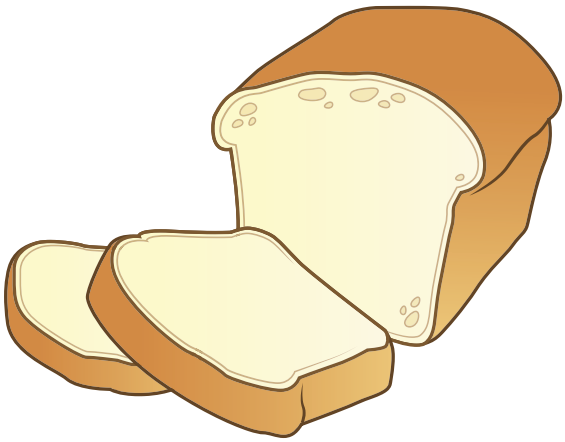
## Evaluation

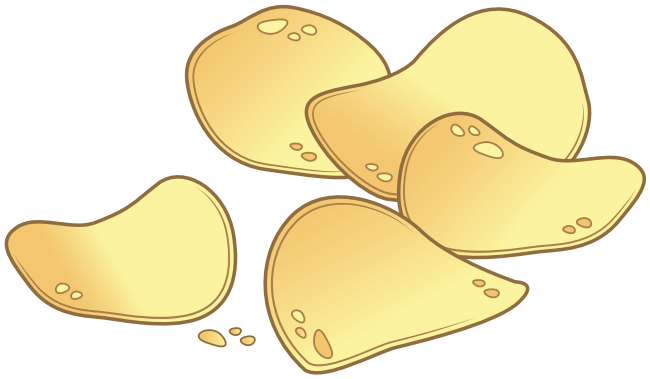
Students should be able to explain that many of the food items that we eat daily require pollinators. Humans and pollinators have a complex relationship that involves many systems.

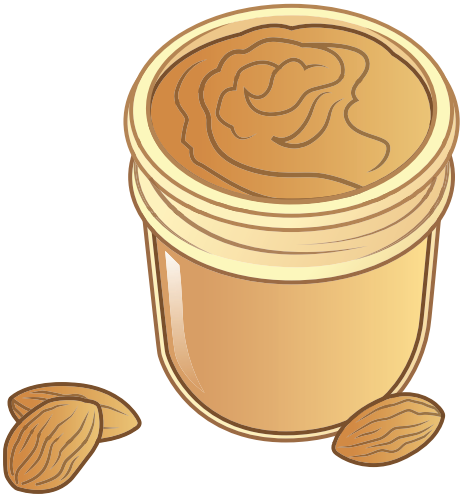


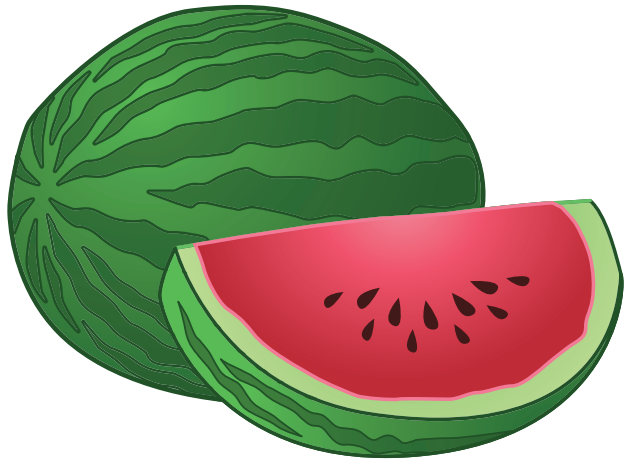
# POLLINATOR FIELD DAY STATIONS











# POLLINATOR FIELD DAY STATIONS

### RASPBERRY JAM

Raspberries are an animal-pollinated plant

### ORANGES

Oranges are an animal-pollinated plant

### POTATO CHIPS

The oil that potatoes are fried is comes from an animal-pollinated plant

### BREAD

Wheat is wind-pollinated

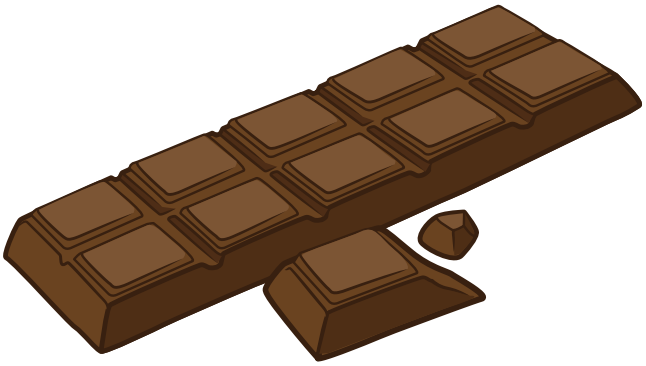
### WATERMELON

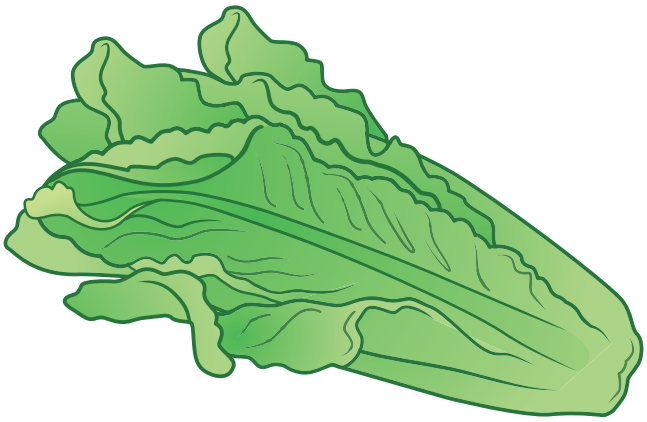
Watermelons are an animal-pollinated plant

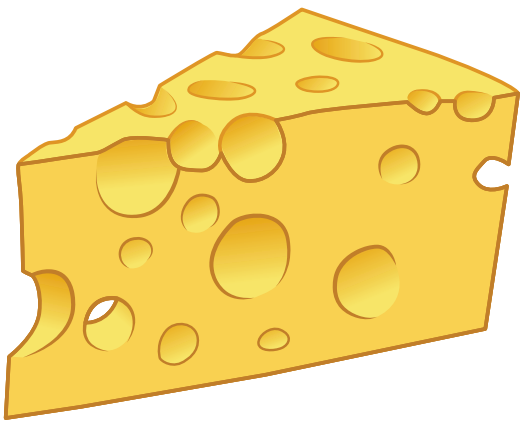
### ALMOND BUTTER

Almonds are an animal-pollinated plant

# POLLINATOR FIELD DAY STATIONS





# POLLINATOR FIELD DAY STATIONS

### LETTUCE

Lettuce is an animal-pollinated plant

### CHOCOLATE BAR

Cacao beans are an animal-pollinated plant

### MAYONNAISE

Ingredients in mayonnaise do not rely on pollination

### MUSTARD

Mustard seed is an animal-pollinated plant

### BANANAS

Bananas do not require pollination

### CHEESE

Cheese technically does not rely on pollination, but if the dairy cows were fed alfalfa, then pollination is involved

# DESIGN A FLOWER

## Materials

- Pipe cleaners
- Tissue paper
- Construction paper
- Pom poms
- Scissors
- Tape or glue dots
- Pollinator Information Cards (PAGE 31-34)

## Background Information

Flowers and pollinators have co-evolved and have a unique relationship. Many plants rely on pollinators, so they have developed ways to attract them using colors and shapes. Some plants are more general, attracting many different types of pollinators. Some are more specific, attracting one type of pollinator or even a specific species!

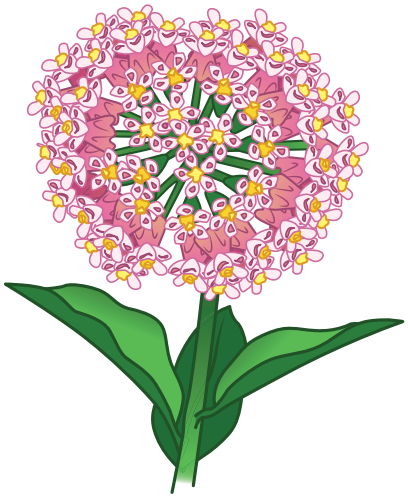
The special structures, colors and shapes on plants are adaptations that help them to attract pollinators and survive. Pollinators also have unique adaptations, like a proboscis, that allow them to feed off of certain plants.

## Station Instructions

- Ask students what they know about pollinators and flowers. Do some pollinators like specific types of flowers?
- Why or why not?
- Tell students that they are going to work in pairs or small groups to design a flower for a specific pollinator. Let them choose a pollinator card and read more about what the pollinator is looking for in a flower.
- Allow students to work with the art supplies provided to create a flower that will attract the pollinator from their card.
- Have students share their flowers and explain why their pollinator would be attracted to it.

## Evaluation

Students should be able to explain that plants have different adaptations to attract pollinators. This helps them to reproduce.



# BEE DANCE PARTY

## Materials

- Cards with images and descriptions of bee dances
- Items for students to find - can be something reusable or consumable
- This station will need additional open space for the activity

## Background Information

Honeybees need to communicate with each other so that they know the location of flowers where they can find nectar. Their dances can communicate information like distance, relation to the sun and hive, and even specific locations.

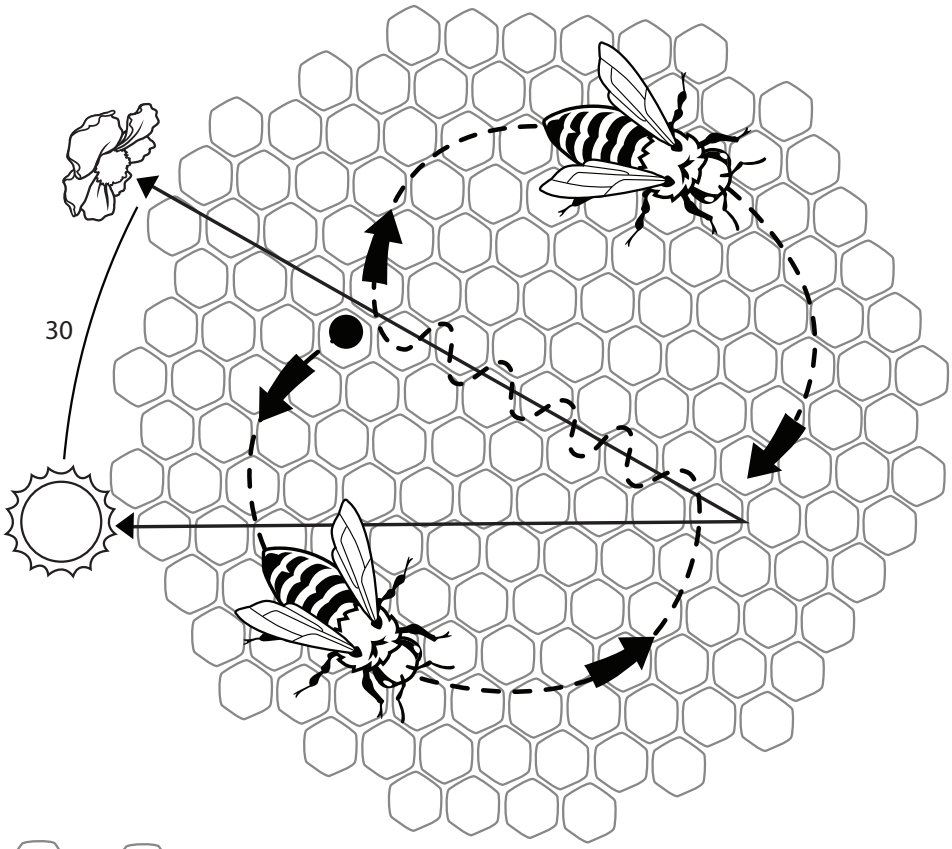
Review information on bee dance cards.

## Station Instructions

- Items for students to find should be spread out prior to the start of the activity.
- Ask students how they communicate with each other. It may be verbally, via body language, or even with the aid of a device like a phone or computer. Ask them if they know how honeybees communicate with each other and what information they would need to share.
- Explain that honeybees will communicate the distance and location of flowers with other bees in the hive. If necessary, explain that they do this to find the flowers that they rely on for food.
- Tell students that they are going to try out this method of communication.
- Have one student demonstrate the round dance and the waggle dance.
- Working in either one large group or two smaller groups students will work to find the items that have been placed in the designated bee foraging area. Students will go out one at a time to find an item and then indicate to the next student the location of another item using only a bee dance or non-verbal communication.
- Once all the items have been found or there are only a few minutes left, bring students together to discuss the activity. Was it easy or hard to communicate like a bee? What are some of the advantages of this communication method? What does this tell us about animals like bees?

## Evaluation

Students should be able to explain that animals like bees use different communication strategies. Honeybees will use a dance to communicate the location and distance of flowers that they rely on for food. Communication is an important survival strategy for humans and non-human animals.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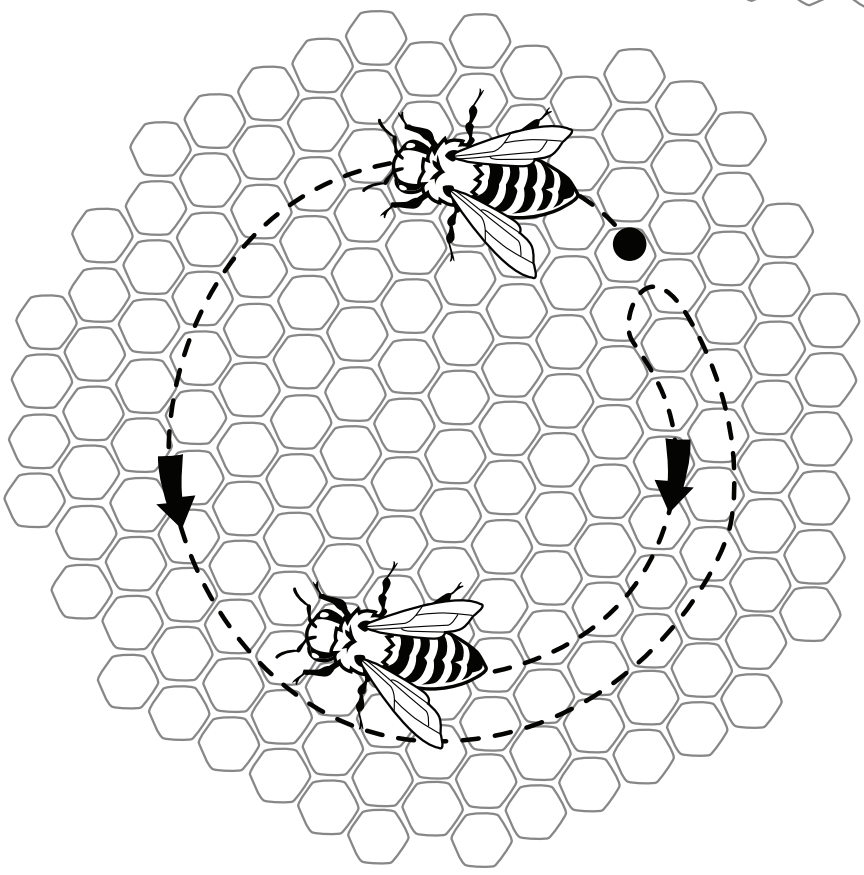


# POLLINATOR THAUMATROPE

## Materials

- Thaumatrope patterns on card stock, with some blank pieces available
- Scissors
- Hole punch
- String
- Glue
- Markers or colored pencils

## Background Information

Thaumatropes create an optical illusion, the spinning disc turns one image into two.
The thaumatrope templates at this station show pollinators and one of the plants that they rely on.

## Station Instructions

Ask students if they can identify the pollinators and plants pictured on the thaumatrope images. Ask if they can explain their relationship.

Explain how a thaumatrope works. This optical illusion was actually a popular toy during the Victorian era.

Let students choose a thaumatrope pattern or draw their own based on their knowledge of pollinators. Guide them through the process of making a thaumatrope:

Glue patterns together with images facing out. If the pattern's image is upside down on the sheet, ensure that it is also upside down when glued together.

Punch a hole on the left and right side of each pattern.

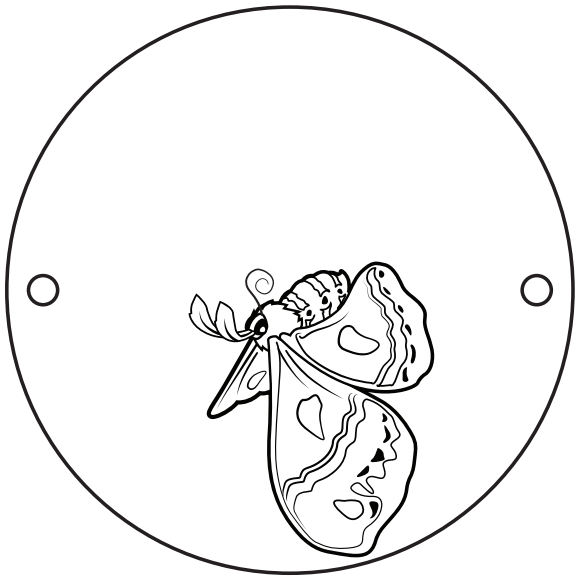
Tie a piece of string through each hole. The pattern should be in the center with two pieces of string on each side.

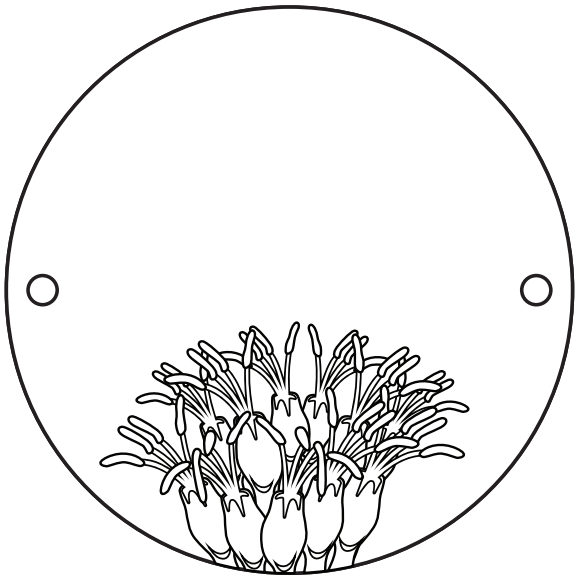
Twist the string and let the thaumatrope spin. The two pictures should look like one image.

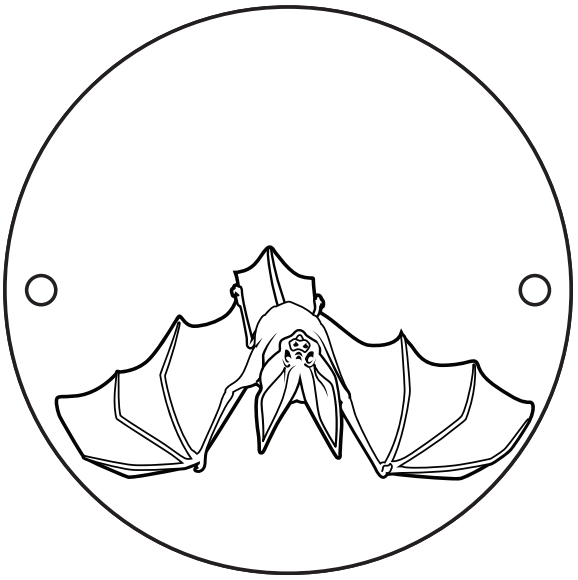
## Evaluation

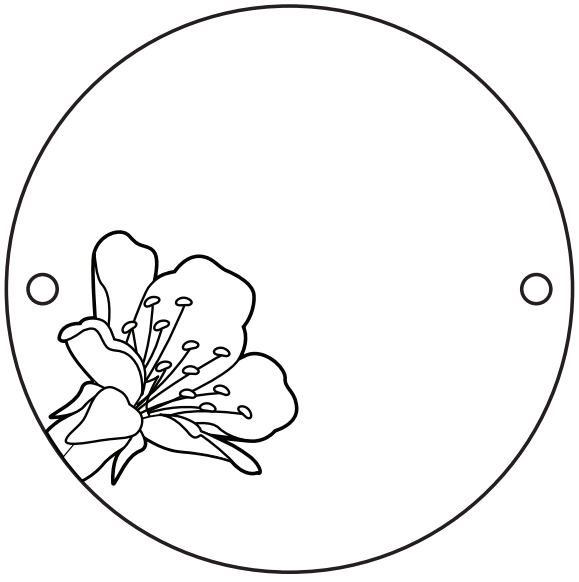
Students should be able to explain the relationship between the pollinator and the plant pictured on the thaumatrope template. If they draw their own, they should be able to explain their selection.

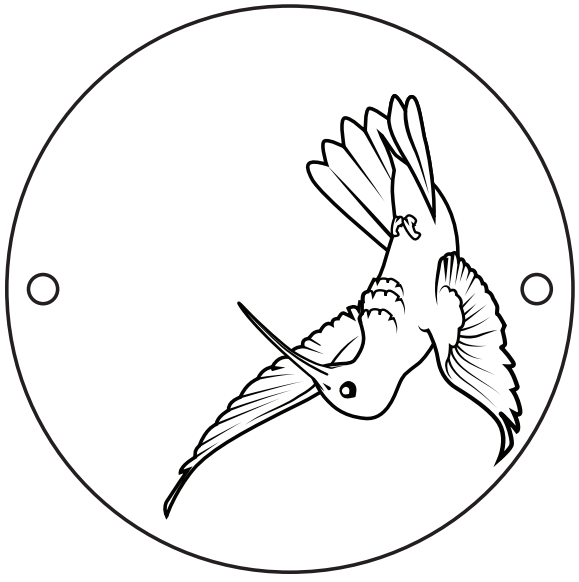
# POLLINATOR FIELD DAY STATIONS











# PLANT PIGMENTS

## Materials

- Large flower petals in red, blue and purple. You can also try other colors if they are available.
- Small plastic baggies
- Hammer, rubber mallet or rolling pin
- Water
- Small paper or plastic cups
- Measuring spoons (teaspoons)
- Droppers
- White vinegar
- Baking soda solution (two cups water, 1 teaspoon baking soda)

## Background Information

We know that many pollinators are attracted to flowers because of their beautiful colors, but where do those colors come from? Inside the flower petals are colored molecules called pigments. Each of these pigments has a particular shape. If there is a change in the molecular shape, the color can change. Depending on how much time is available and the ages of the students, you may want to omit adding the acid and bases to the petal juice and focus on observing the color.

## Station Instructions

Ask students if they have a favorite flower and why they like it. Many of the answers may relate to the color of the flower.

Ask students why flowers are so brightly colored. Ask if this matters to some of the pollinators they have learned about. Tell students that the color of a flower can be an adaptation to attract pollinators. But where does this color come from?

Tell students they are going to observe the pigments in flowers. Some students will need your help or the help of a chaperone.

Working in small groups (2-3 students), have students choose some flower petals (at least 5); tear them up into small pieces and place them in a plastic bag. Squeeze out the air and seal the bag.
Using a hammer, rubber mallet or rolling pin, carefully smash the petals into a pulp without damaging the bag.

Open the bag and slowly add 5 teaspoons of water. Have students use their fingers to keep squishing the petals until the water fully changes color. Make sure that each student gets a turn.

Let students carefully pour out the water that has been colored by the pigment in the petals into a small cup, leaving the pulp in the plastic bag.

Have the students gather some observations about the solution they created. Is there anything that they noticed?

If time permits, have students use droppers to add a few drops of their solution to an empty cup. Ask them to make a prediction about what would happen if they added a few drops of vinegar or a baking soda solution.

Give them the opportunity to add these items and observe what happens.

Explain that within each flower petal are pigment molecules that give the flower its color.

Ask students why they think flowers might change color during their lifecycle or why leaves change color in the fall. What does that tell us about the pigment in plants?

### Evaluation

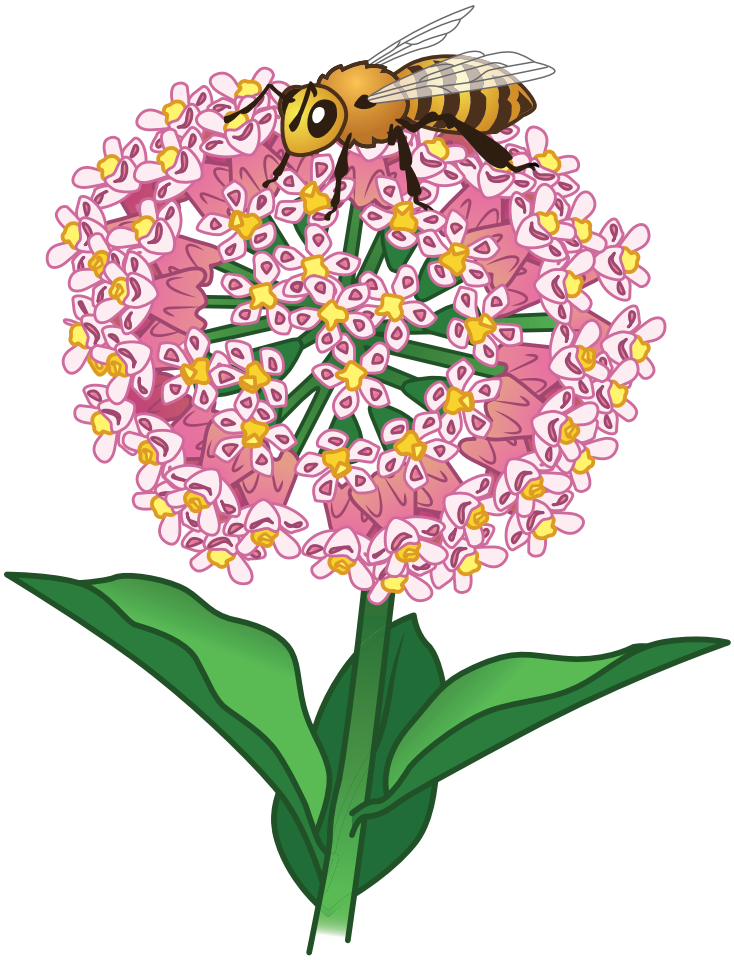
Students should be able to explain that flowers have pigment in their petals which gives them their color. Flowers have colors for many reasons, one of which is to attract pollinators so that they can reproduce.

## ADDITIONAL STATION IDEAS

Draw your favorite pollinator

Pollinator buttons - if you have access to a button maker, allow students to create buttons from existing templates or have them draw their own

Bee life cycle comic strip - illustrate and discuss the life cycle of a honeybee. Have students draw this in comic strip form



# POST-FIELD DAY LESSONS

## GENERAL POST-EVALUATION

**After your Pollinator Field Day, take a few moments to find out what students discovered. You can record responses and reflect on the responses collected during the Pre-Evaluation.**

- What do you know about bees?
- What do you know about pollinators?
- How do you feel about bees and other pollinators?
- What do you know about flowers and plants?
- Do you know where your food comes from?
- What do you think would happen if the Earth's pollinators disappeared?
- Is there anything that people can do to help pollinators?
- Is there anything new that you learned about pollinators?
- Are there any specific actions you are going to take to protect pollinators?
- Is there anything else you would like you learn about pollinators?

## K-2 LESSON • FIELD DAY REFLECTIONS

### NGSS Connections & Common Core Connections

**2-LS4-1.** Make observations of plants and animals to compare the diversity of life in different habitats. CCSS.ELA-LITERACY.W.K.8

With guidance and support from adults, recall information from experiences or gather information from provided sources to answer a question. CCSS.ELA-LITERACY.W.2.7

Participate in shared research and writing projects (e.g., read a number of books on a single topic to produce a report; record science observations).

### Time: 1 hour (can be divided into two 30-minute sessions) • Materials

Student Page
Optional: general art supplies like paper, colored pencils and markers

### Background Information

Students will have the opportunity to reflect on their field day experience. If necessary, review the pollinator activities students completed to help guide their reflection.

### Students Will

Explain and describe the characteristics of their favorite pollinator using information they obtained during the Pollinator Field Day

Write a short story (a few sentences to a few paragraphs) about their favorite pollinator

# LESSON

### Engage

Review the general post-evaluation questions and ask students what they enjoyed the most during the Pollinator Field Day. Is there anything they learned that surprised them? Do they now have a favorite pollinator?

### Explore

Tell students that they will write a short story about their favorite pollinator. They should describe the pollinator and a few characteristics that they like the most. They may also include drawings or images of their pollinator. If appropriate, review the basic components of a story or essay.

Students may write their story on the student page provided.

### Explain

After students write their stories, have them share with each other or the group. Review the importance of pollinators to the natural environment and to humans.

### Extend

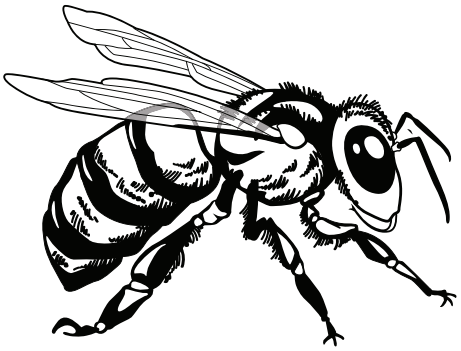
Provide or find a copy at your local library of the books listed in the at the end of this lesson plan. Read these books aloud to students or let them read independently.
Have students share their stories with other students that participated in the Pollinator Field Day.

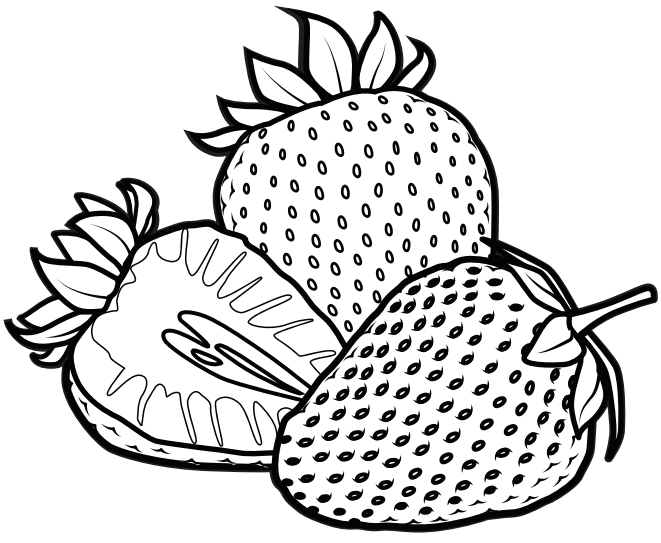
### Evaluate

Students should be able to describe what pollinators do and some of their characteristics by writing, drawing and expressing themselves verbally.
Revisit any questions or ideas that were generated during the post-evaluation and discussion.

### Age appropriate books about pollinators

*How to be a Butterfly? By Laura Knowles*
*Love Bees by Vanessa Amaral-Rogers*
*Animal Pollinators by Jennifer Boothroyd*
*Protect the Pollinators  by Rachel Zoller*
*These Bees Count by Alison Formento*





## MY POLLINATOR FIELD DAY EXPERIENCE

**Here's what I learned at our Pollinator Field Day!**

# K-2 LESSON : FRIENDLY NEIGHBORHOOD POLLINATOR

## NGSS Connections & Common Core Connections

**LS2.A:** Seeking matter and energy resources to sustain life, organisms in an ecosystem interact with one another in complex feeding hierarchies of producers, consumers, and decomposers, which together represent a food web.

**2-LS4-1**. Make observations of plants and animals to compare the diversity of life in different habitats.
CCSS.ELA-LITERACY.W.K.8

With guidance and support from adults, recall information from experiences or gather information from provided sources to answer a question. CCSS.ELA-LITERACY.W.2.7

Participate in shared research and writing projects
(e.g., read a number of books on a single topic to produce a report; record science observations).

## Time: 1 hour (can be divided into two 30-minute sessions) • Materials

- Hand-lenses
- Field guide for your area or region
- Student Page
- Optional: general art materials like paper, colored pencils and markers

## Background Information

Before this activity, identify if there is pollinator habitat near your location and if it is safely accessible to adults and students. Plan a route to walk there to investigate local pollinators.

Getting outside to explore the natural world and the pollinators that live in your area is a great way to allow students to practice their observation skills. Focus on what senses students can use to observe the world around them. We can use our eyes to see the colors of pollinators and flowers, our ears to hear the sounds of pollinators and other wildlife, our noses to smell flowers and our hands to gently feel leaves. Remind students that while they may use their sense of taste to gather observations about things like their lunch, it's generally not a good idea to use this sense when exploring things in nature, as they could be harmful.

Observations can be gathered in words, pictures or drawings. Encourage students to express their creativity as they are out in nature.

## Students Will

- Be able to identify pollinators and plants that are pollinated in their neighborhood
- Be able to identify and describe pollinator habitats

## Evaluate

- Students should be able to describe what pollinators do and some of their characteristics by writing, drawing and expressing themselves verbally.
- Revisit any questions or ideas that were generated during the post-evaluation and discussion.
- Protect the Pollinators by Rachel Zoller
- These Bees Count by Alison Formento.

## LESSON

### Engage

Review the general post-evaluation questions and ask students what they enjoyed the most during the Pollinator Field Day. Is there anything they learned that surprised them? Ask students if they have ever seen pollinators where they live. What do they think attracted them to those places?

### Explore

Let students know that they are going to take a walking trip to investigate local pollinators.

### Set expectations for going on a walk outdoors

- Stay together as a group
- Observe wildlife quietly and respect the space of living things
- You can observe, smell and touch things like flowers, plants and rocks, but all items found in nature need to stay there so others may enjoy them
- If you find insects like bees, know that they don't want to harm people. If students are scared or uncomfortable, let them know that they can always observe from a distance
- Ask if students have any other ideas for what they should be doing when they are outdoors

Walk to the site that was identified earlier and let students observe the plants and pollinators, if present. What things do they notice about the plants at the site? If there aren't any pollinators there at the time of your visit, have students identify things that would attract them to the site, including the different types of flowers and plants present. If there are pollinators, use hand lenses to carefully observe them and field guides to identify them.

### Explain

After your pollinator walk, have students reflect on their observations. What types of flowers and plants attract pollinators? Ask if they have seen any pollinators near where they live and why they think they were there.

### Extend

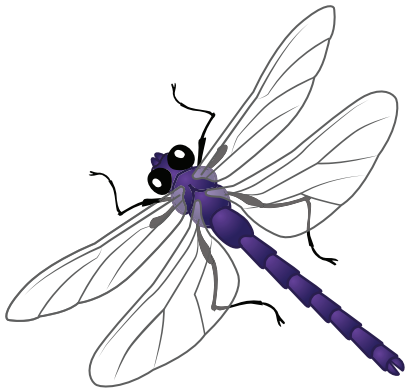
If possible, plan a visit to a local botanical garden to observe different types of flowers and pollinators.

### Evaluate

Students should be able to explain why pollinators might visit an area or habitat
Students should be able to gather information using multiple senses
Revisit any questions or ideas that were generated during the post-evaluation and discussion.

## OUR POLLINATOR WALK

**This is what I noticed on our pollinator walk.**



# 3-5 LESSON • WE'RE BUZZING ABOUT POLLINATORS

## NGSS Connections & Common Core Connections

**3-LS4-3** • Construct an argument with evidence that in a particular habitat some organisms can survive well, some survive less well, and some cannot survive at all.

**LS2.D** • Social Interactions and Group Behavior Being part of a group helps animals obtain food, defend themselves, and cope with changes. Groups may serve different functions and vary dramatically in size.

**LS4.D** • Biodiversity and Humans Populations live in a variety of habitats, and change in those habitats affects the organisms living there. (3-LS4-4)CCSS.ELA-LITERACY.W.3.1

Write opinion pieces on topics or texts, supporting a point of view with reasons. • CCSS.ELA-LITERACY.W.3.2

Write informative/explanatory texts to examine a topic and convey ideas and information clearly. CCSS.ELA-LITERACY.W.3.7

Conduct short research projects that build knowledge about a topic. • CCSS.ELA-LITERACY.W.3.8

Recall information from experiences or gather information from print and digital sources; take brief notes on sources and sort evidence into provided categories.

## Time: 1 hour (can be divided into two 30-minute sessions)

**Materials**
Student Page

## Background Information

Writing is a great way to share information about the natural world. People like authors and reporters use writing to communicate about the environment. An article or essay is a great way to share the experiences that students had at their Pollinator Field Day with peers and a general audience.

## Students Will

- Write a short article or essay (a few sentences to a few paragraphs) about their Pollinator Field Day experience
- Be able to communicate about their Pollinator Field Day experience in writing, both verbally and visually.
- Describe the characteristics of pollinators, the habitats they live in, and their importance to people and the environment.

# LESSON

### Engage

Review the general post-evaluation questions and ask students what they enjoyed the most during the Pollinator Field Day. Is there anything they learned that surprised them? What new facts are they most interested in sharing with others?

### Explore

Tell students that they will write a short essay or article about their Pollinator FIeld Day experience. They should include factual information they learned during the pre-activity and Pollinator Field Day. Students can write about a particular activity, their experience as a whole or something new they learned. They may also include drawings or images to accompany their article. If appropriate, review the basic components of an essay or news article.

Students may write their article on the student page provided or write their articles on a computer.

### Explain

Allow students to share the articles with their peers. Did their writing have anything in common? For example, did some students find the same fact interesting? Did they learn anything new from their peers?

### Extend

If time and resources permit, allow students to work together to craft their own pollinator newspaper with information about the field day and research on local pollinators and native plants.

Have students interview each other to create a short news story about their experience during the Pollinator Field Day.

### Evaluate

- Students should be able to communicate about their Pollinator Field Day experience in writing, both verbally and visually.
- Revisit any questions or ideas that were generated during the post-evaluation and discussion.

## MY POLLINATOR FIELD DAY EXPERIENCE

**Here's what I learned at our Pollinator Field Day!**

# 3-5 LESSON : WE CARE ABOUT POLLINATORS

## NGSS Connections & Common Core Connections

**3-LS4-3** • Construct an argument with evidence that in a particular habitat some organisms can survive well, some survive less well, and some cannot survive at all.

**LS2.D** • Social Interactions and Group Behavior  Being part of a group helps animals obtain food, defend themselves, and cope with changes. Groups may serve different functions and vary dramatically in size.

**LS4.D** • Biodiversity and Humans  Populations live in a variety of habitats, and change in those habitats affects the organisms living there. (3-LS4-4) • CCSS.ELA-LITERACY.W.3.1

Write opinion pieces on topics or texts, supporting a point of view with reasons. • CCSS.ELA-LITERACY.W.3.2

Write informative/explanatory texts to examine a topic and convey ideas and information clearly. CCSS.ELA-LITERACY.W.3.7

Conduct short research projects that build knowledge about a topic. • CCSS.ELA-LITERACY.W.3.8

Recall information from experiences or gather information from print and digital sources; take brief notes on sources and sort evidence into provided categories.

## Time: 1 hour (can be divided into two 30-minute sessions)

**Materials**

• General art supplies, including paper, poster board, markers and colored pencils

## Background Information

There are many ways to communicate messages about the environment. We may read articles or stories in print or online. Another way to communicate with a wide variety of audiences is through imagery. Perhaps you have seen an environmental documentary, or even a compelling Instagram post. Images can help us understand and see things in a way that is different than writing. This is especially important when talking about pollinators.

Depending on where you live, you may frequently see pollinators. If you don't see them, you certainly know about their impacts! One in every third bite of food we eat is dependent on a pollinator. People can help pollinators through their day-to-day actions, and we rely on pollinators for food. Students can convey these ideas through a visual medium to communicate the important message of pollinators with their peers and adults.

## Students Will

• Create posters with a message that conveys the importance of pollinators and why we should care about them.
• Be able to communicate about pollinators in writing, both verbally and visually.
• Describe the ways in which humans rely on pollinators and why pollinators may need help from people.

## LESSON

### Engage

Review the general post-evaluation questions and ask students what they enjoyed the most during the Pollinator Field Day. What did they learn about how humans and pollinators interact with each other? Write down any ideas that arise.

### Explore

Tell students that they are going to create posters about the importance of pollinators. They should include factual information they learned during the pre-activity and Pollinator Field Day. Students can include a few written elements, but the final product should convey their message visually.

If appropriate, review some of the posters about endangered species and protecting wildlife. What are some of the ideas or themes that they notice? Do any of the posters inspire them to take action? Why or why not?

Students may create their poster on the student page provided or may create one using their own art supplies

### Explain

Allow students to share their posters with their peers. Ask them to explain and describe the message they are conveying with their poster.

### Extend

If time allows, have a student art show showcasing the posters that were made. This is also a great opportunity to invite the organizations and volunteers to engage with your school or organization after your Pollinator Field Day.

### Evaluate

Students should be able to communicate about the importance of pollinators in writing, both verbally and visually.
Revisit any questions or ideas that were generated during the post-evaluation and discussion.

### Additional Resources

Images of posters

# 6-8 LESSON • DESIGN A POLLINATOR GARDEN

## NGSS Connections & Common Core Connections

**MS-LS2-5** • Evaluate competing design solutions for maintaining biodiversity and ecosystem services. Examples of ecosystem services could include water purification, nutrient recycling, and prevention of soil erosion. Examples of design solution constraints could include scientific, economic, and social considerations.

**CCSS.ELA-Literacy**
Write informative/explanatory texts to examine a topic and convey ideas, concepts, and information through the selection, organization, and analysis of relevant content.

**CCSS.ELA-LITERACY.W.6.2.A**
Introduce a topic; organize ideas, concepts, and information, using strategies such as definition, classification, comparison/contrast, and cause/effect; include formatting (e.g., headings), graphics (e.g., charts, tables), and multimedia when useful to aiding comprehension.

## Time: 1-2 hours

**Materials**
- Field guides of plants native to your area. If you're looking for region-specific planting guides, Pollinator b Partnership is a great resource.
- General art supplies or design software
- Internet access

## Background Information

A pollinator garden is a garden that is comprised of a variety of flowering plants specifically to attract a variety of pollinators in your area. From bees to butterflies, and even hummingbirds and bats, a pollinator garden can provide habitat and food for a number of different species.

Through research, it's easy to find out the specific types of plants that support pollinators appropriate for your region. It's also a great opportunity to learn more about topics like organic gardening and permaculture.

## Students Will

- Research the elements needed to build a pollinator garden at their school or location. This can include space, plants, watering and maintenance requirements, the type of pollinators they would like to attract, and cost.
- Design a pollinator garden using art materials or on a computer.
- Be able to communicate about their pollinator garden design in writing, both verbally and visually.
- Describe the ways in which a pollinator garden can impact the environment.

## LESSON

### Engage

Review the general post-evaluation questions and ask students what they enjoyed the most during the Pollinator Field Day. What did they learn about the needs of pollinators? Is there anything that students can do to support pollinators where they live? Write down any ideas that arise.

### Explore

Introduce the concept of a pollinator garden - a garden planted specifically to attract and support local pollinators. Have students brainstorm the elements of a pollinator garden. What do they think they will need?

After brainstorming a list of pollinator garden elements, have students form small groups to walk around their school or organization to see if they could find a potential space for their pollinator garden. Ask them why they chose a specific location. If you are having students design a pollinator garden specifically for their school or location, have them measure out the area so they can draw a more accurate model garden. Ensure that they include elements like the location of buildings, sidewalks, other plants, and sprinklers or irrigation.

Once students have an idea of the general elements of a pollinator garden and a proposed location, allow them to work in small groups to research the specific plants they would like to include and which pollinators they would like to attract. They can conduct research using field guides or the Internet. Design parameters can be introduced, like a budget for plants or a water-wise garden. Have students draw their gardens and write a design summary - why did they include specific plants and what pollinators are they hoping to attract?

### Explain

Have students present their pollinator gardens to their peers. What design elements did they decide to include and why? Are there any particular pollinators they are trying to attract? How might the garden be beneficial to the environment and people?

### Extend

If time and budget allows, try your hand at planting a pollinator garden based on the designs that students created. Use the garden for observation - see what types of pollinators you are able to attract. You can keep updating the garden throughout the year as you learn more information about native plants and pollinators.

### Evaluate

- Students should be able to conduct research to inform the design of a pollinator garden.
- Students should be able to communicate about their pollinator garden design in writing, both verbally and visually.
- Students should describe the ways in which a pollinator garden can impact the environment.
- Revisit any questions or ideas that were generated during the post-evaluation and discussion.

# MY POLLINATOR GARDEN DESIGN

**Design a Pollinator Garden**

# 6-8 LESSON : WRITE A LETTER TO THE EDITOR

Students research how to write a letter to the editor of their local newspaper and send in submissions about their Pollinator Field Day experience.

## Common Core Connections

**CCSS.ELA-LITERACY.W.6.7**
Conduct short research projects to answer a question, drawing on several sources and refocusing the inquiry when appropriate.

**CCSS.ELA-LITERACY.W.6.4**
Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.

## Time: 1 hour (can be divided into two 30-minute sessions)

**Materials**
- Student Page
- Access to the Internet
- Examples of letters to the editor (can be sourced from the print or online additions of local or national newspapers)

## Background Information

Writing a letter to the editor is one way that individuals can express their opinion about an issue or topic to the general public. Published in a newspaper or magazine, a letter to the editor is typically a short letter that includes an opinion and the reasoning behind it.

Writing a letter to the editor is a great way to get students to think critically about a topic and to hone persuasive writing techniques. In this lesson, students can use the information that they gained during their Pollinator Field Day experience in addition to independent research.

## Students Will

- Write a letter to the editor about pollinators. If possible, students will submit their letters to a local newspaper or magazine.
- Be able to communicate about their Pollinator Field Day experience in writing and verbally.
- Conduct independent research on pollinators.
- Describe the characteristics of pollinators, the habitats they live in, and their importance to people and the environment.

# LESSON

## Engage

Review the general post-evaluation questions and ask students what they enjoyed the most during the Pollinator Field Day. What did they learn about the needs of pollinators? Is there anything in particular that they think the general public should know about pollinators? Write down any ideas that arise.

## Explore

Ask students if they know of a way that they can communicate their ideas about pollinators with the people that live in their community. Explain that one way that people can share their ideas with community members is by writing a letter to the editor for publication in their local newspaper or a local magazine.

Have students review examples of letters to the editor. What are a few things that they have in common? What elements should they include in a letter to the editor about pollinators?

## Explain

Allow students time to draft and write a letter to the editor using the student page or a computer. Students should conduct additional online research to support their opinions and arguments.

Have students peer edit each other's letters and allow them to share their letters with each other.

If you are planning on having students submit their letters to the editor, they should research local newspapers and magazines to find the appropriate contact information and submission instructions.

## Extend

If appropriate, have students send in their letters to the editor. If any of them get published, share the print and online versions with your class or group.

If any journalists in your area cover environmental issues or local news, invite them to come to your classroom or location to share their experience writing and reporting on these issues.

## Evaluate

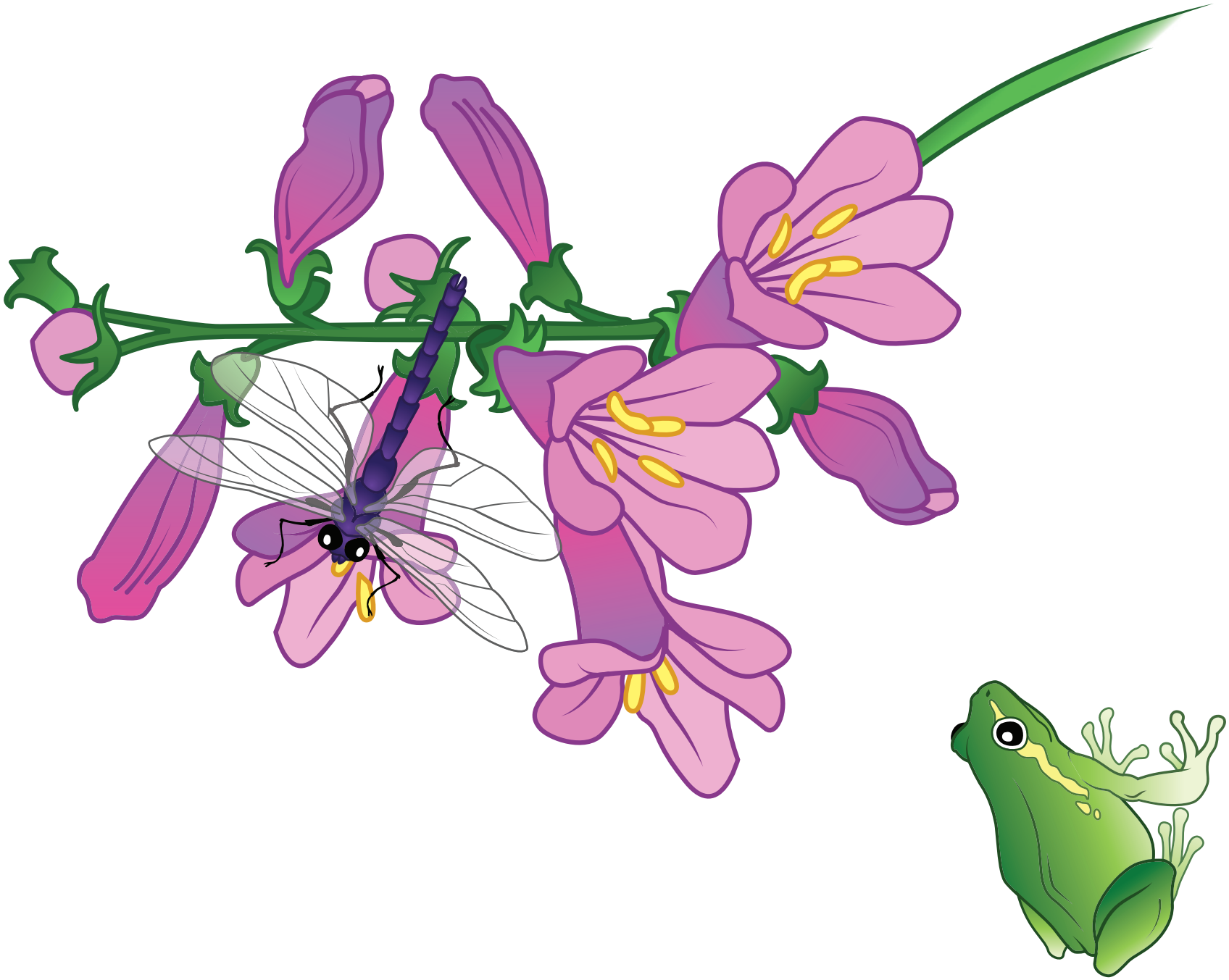
Students will write a letter to the editor about pollinators.

Students should be able to communicate about their Pollinator Field Day experience, the characteristics of pollinators, the habitats they live in, and their importance to people and the environment, both in writing and verbally.

Students should be able to conduct independent research on pollinators.

Revisit any questions or ideas that were generated during the post-evaluation and discussion

## LETTER TO THE EDITOR

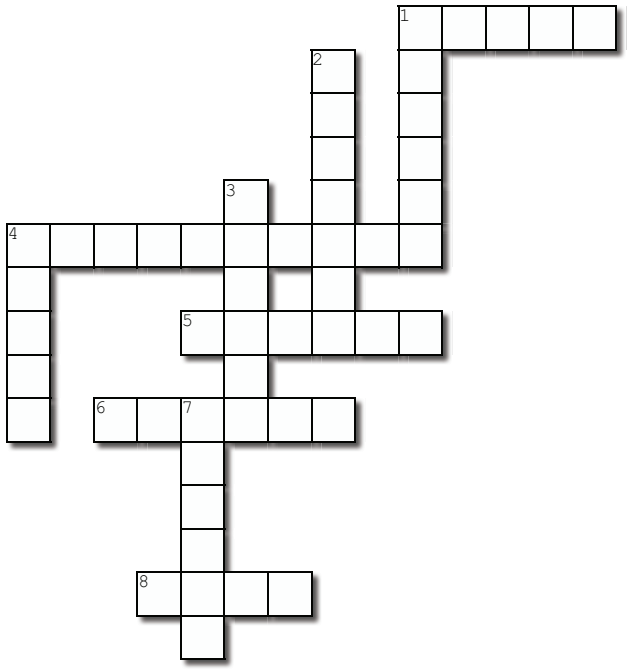


# CROSSWORD PUZZLE

Name:_____

## Pollinator Crossword

Test your pollinator knowledge by completing this crossword!




Created using the Crossword Maker on TheTeachersCorner.net

**Across**

**1.** Surrounds the seed of a plant. Examples include melons, avocados, peaches, tomatoes.
**4.** An organism that aids in the transfer of pollen.
**5.** This sweet fluid attracts pollinators.
**6.** The female reproductive organs of a flower comprised of the stigma, style and ovary.
**8.** It contains an embryo and the nutrients needed for a new plant to grow.

**Down**

**1.** The reproductive unit of many types of plants.
**2.** the place where an organism or community of organisms is found, includes living and nonliving things,
**3.** These organisms have only three pairs of legs and usually have wings.
**4.** A living organism that produces energy from soil, water, carbon dioxide and the sun.
**7.** The male reproductive organs of a flower comprised of the anther and the filament.

# SPELLING CHALLENGE

Name:_____

## Pollinator Word Scramble

Can you unscramble these words about pollinators?

Created on TheTeachersCorner.net Scramble Maker

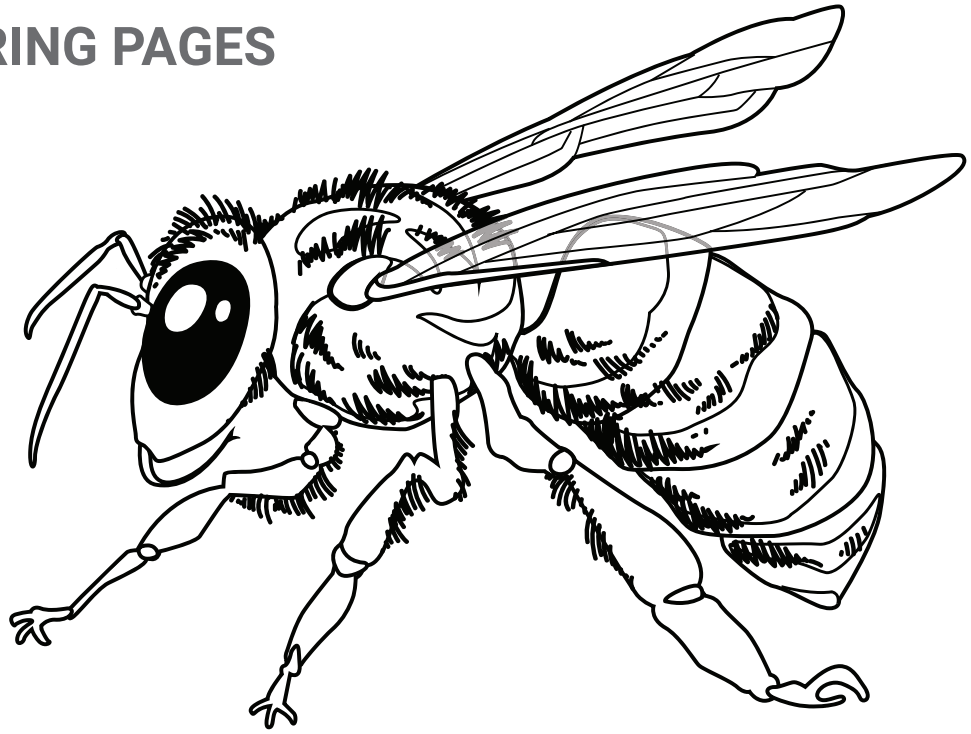
1. cneart _____
2. snteic _____
3. aatntodpai _____
4. welrof _____
5. tithaba _____
6. pailtloinon _____
7. tseapl _____
8. crtane _____
9. dees _____
10. uftir _____
11. onimretevnn _____

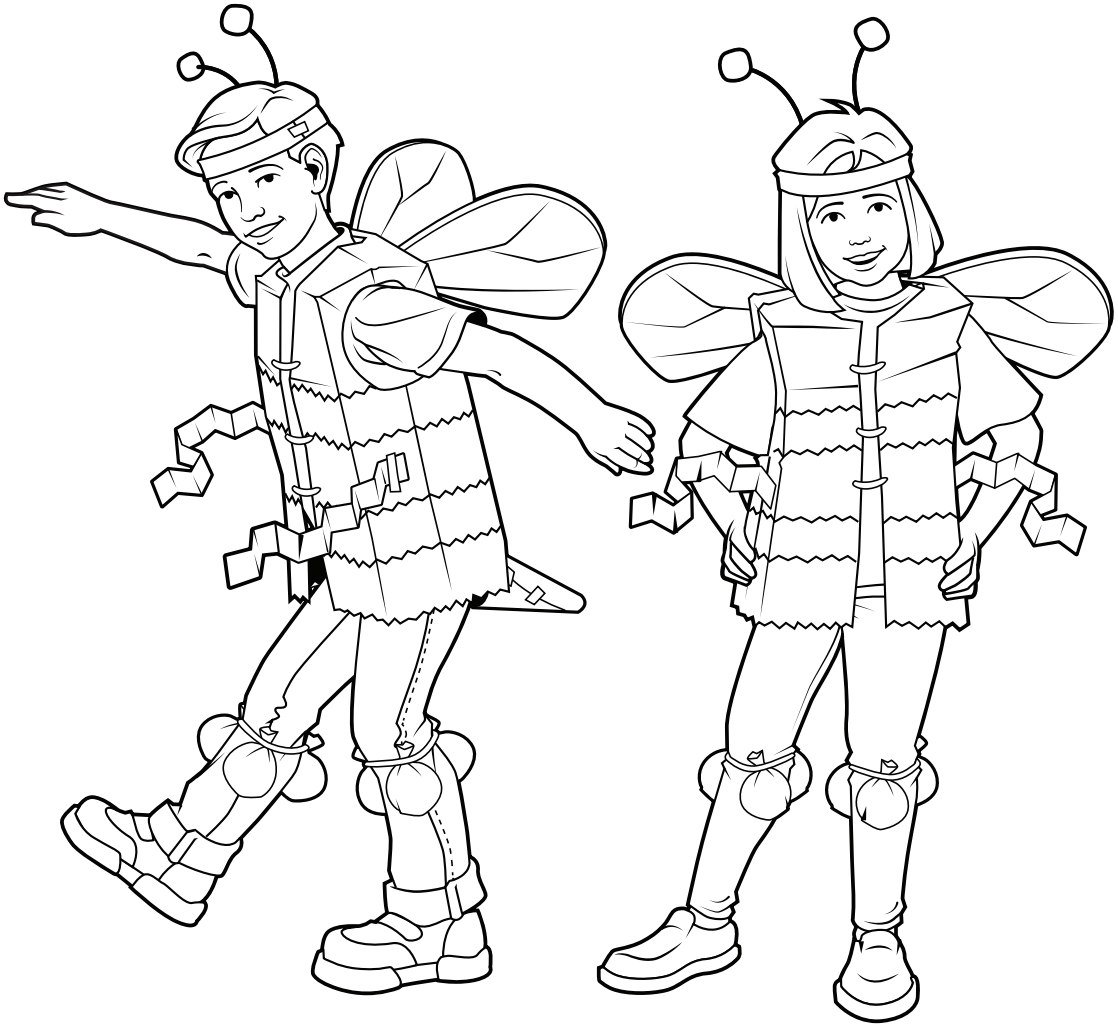
## WORD SEARCH

B A X C Q N I C F A X S I X D H S J V S V F G U D
V I O G E W E O Q E P L V X J C D E W W O M H R Y
G H O L W V D S E O V A P L G V M X E O V Z G E O
M E L D I N J T L M P T H P E F Q V D D I F K Q W
G O T H I G F L R E H E N W R S R S J B S G C Z C
P N E R Q V I I I I W P M Y M V T V U M E O A F G
T E E J O N E F I L Z I A N I O H J E S P I V I K
B A O D A C P R N K Z V Q G N J X M I N I X J W D
V O O T R S S O S M D P L J A M V H H H W C M H J
J L O Z T A N D T I E W X G T V N K R G L L P M A
Q R R A M F G X P R T T X B I P M I T N G T I F D
U G M M G Y M B C W L Y S C O I M B A H V X S K Q
U E H P E C W Q F X B B P Y N S H F T F Y R T E L
N I U K K P L F V F K I G D S Z H K I M X B I Q K
T C E S N I L N I K T R E U Y O L G B C N L L E Y
M C X D F O Z V O F L D N N R W C O A Z T G P O M
N O I T A T P A D A L S B K O H G E H G E F Y P O
V V U P B G P P K R C O P V H Y N Z F H H M P P F
Q Q E T I U J O C L T L W O V P D B Y T S P W N R
W P C G T M W P X S K S R E H H I E W N C U L X B
S N E C T A R K Y I X A U C R F W L S R S L I H P
L K Y E J V I H P A O R M I R G F Z P I S R H E X
D S E E B Z W I I D L W H Z C R Z X U O O R F L V
F Q D Y L M J I J R Z X N R P O R F R U I T K E T
O R F Q C P X D W S T L P S F S E D U Z T O G L B

ADAPTATION
BEEHIVE
BEES
BIODIVERSITY
BIRDS
ECOSYSTEM
FLOWER
FOOD
FRUIT
GARDEN
GERMINATION
HABITAT
INSECT
NECTAR
PETALS
PISTIL
POLLEN
POLLINATOR
SEEDS
STAMEN

## COLORING PAGES





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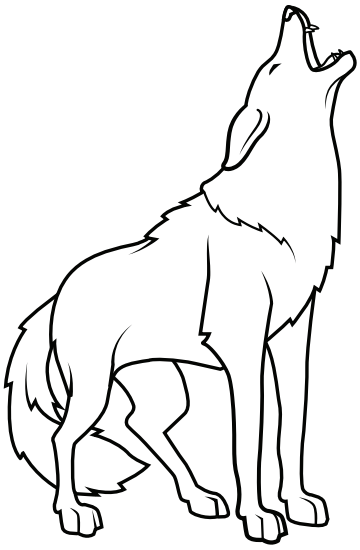

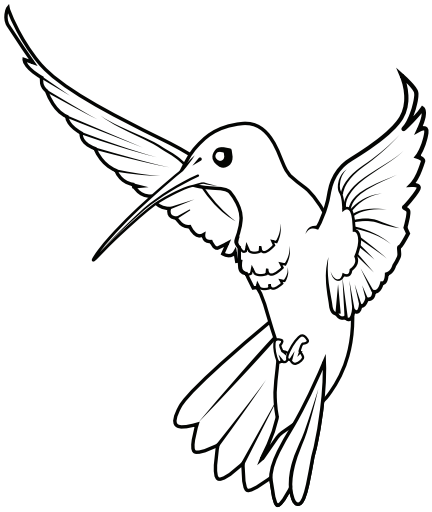

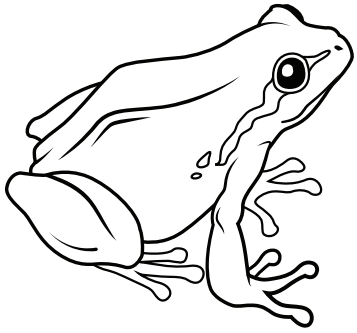

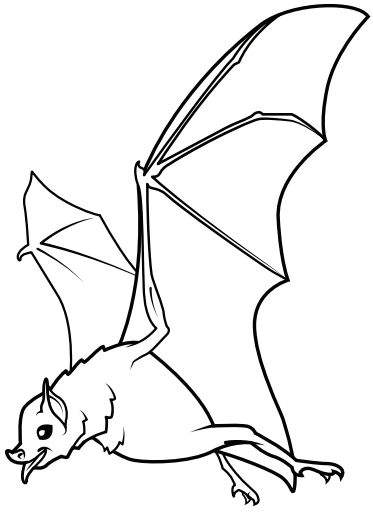

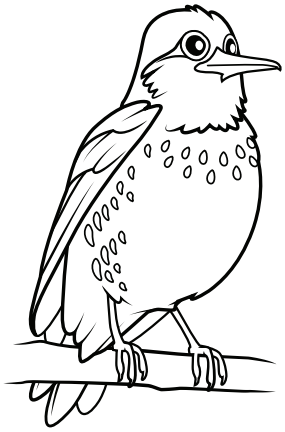

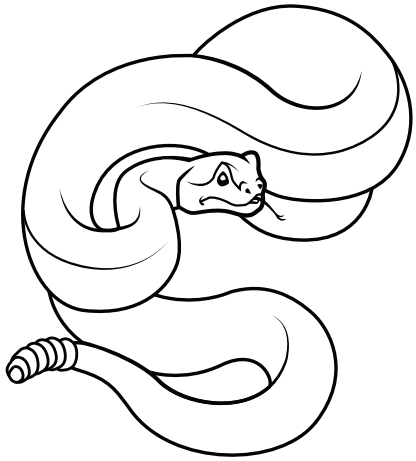

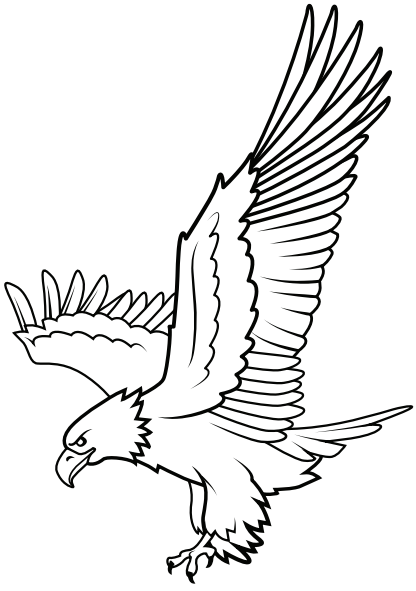

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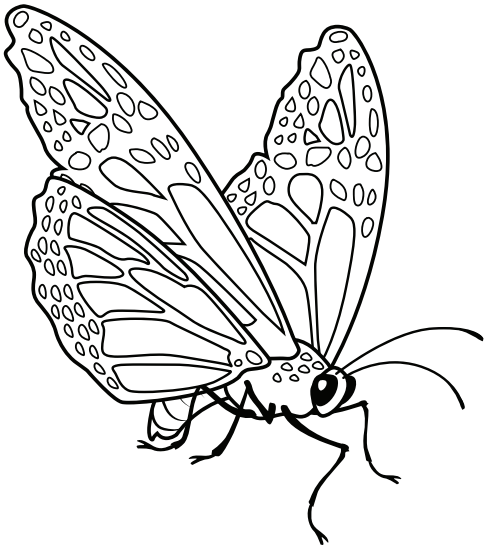

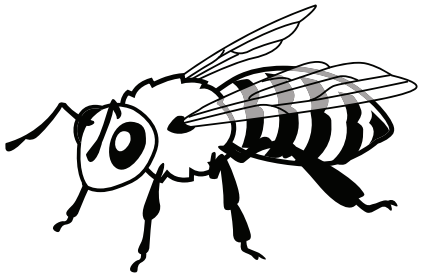

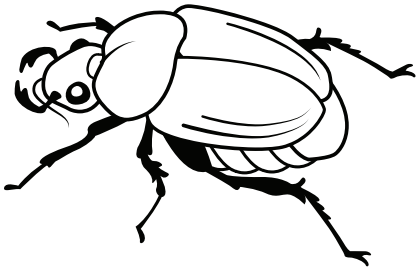

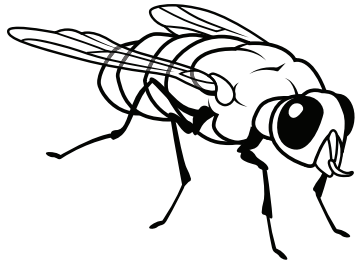

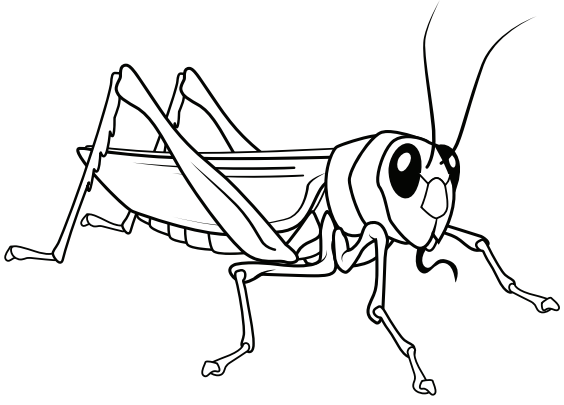

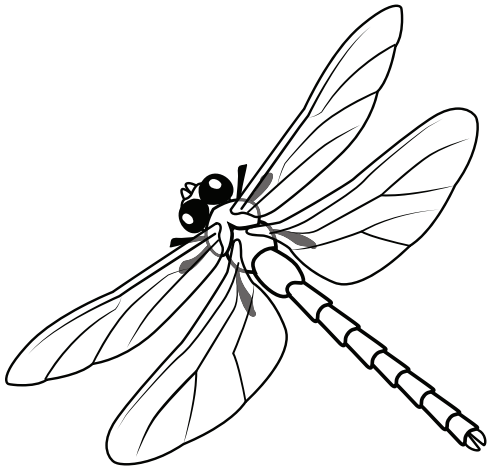

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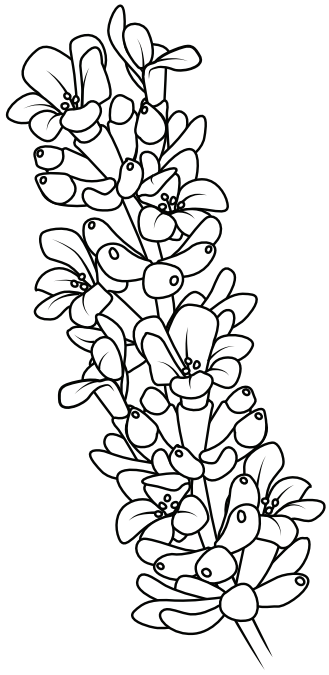
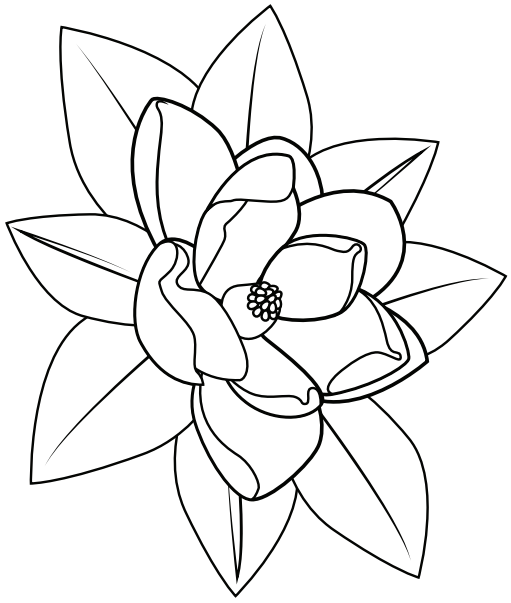
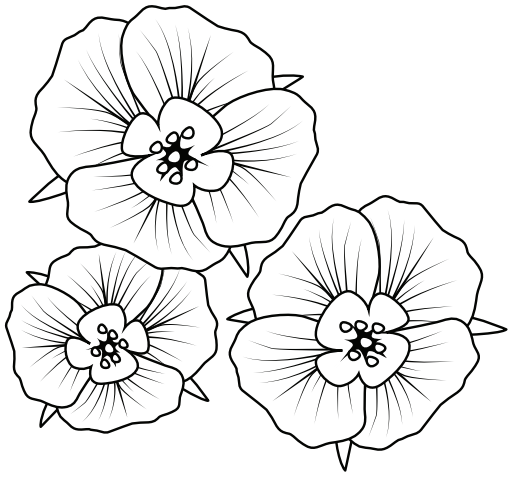
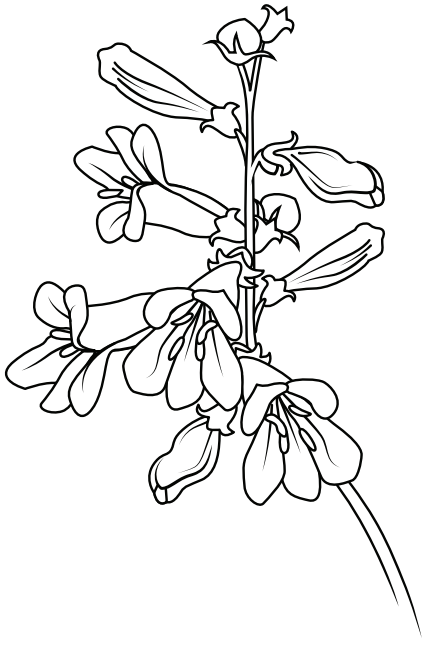
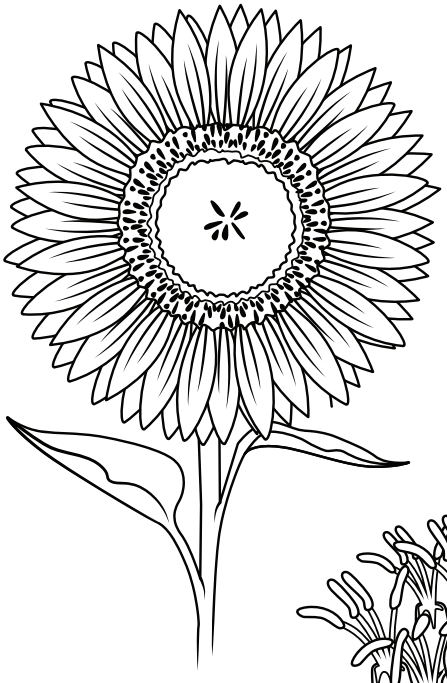
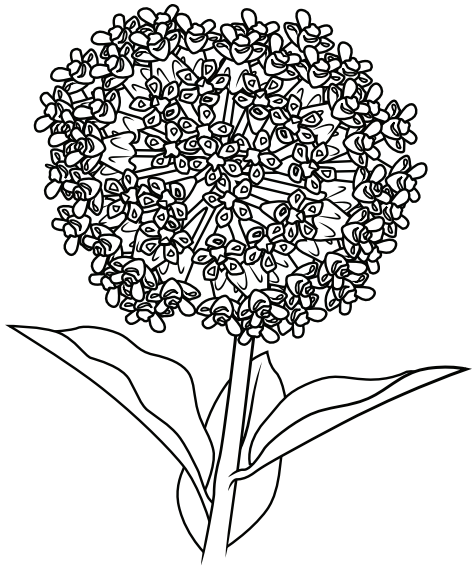


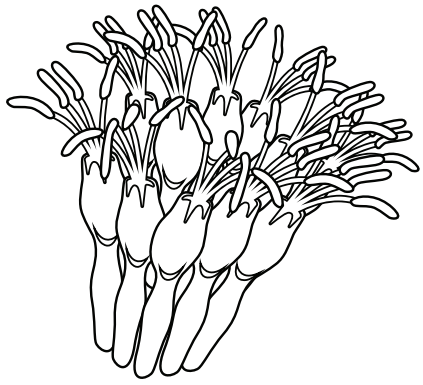












# FIELD DAY EXTENSION ACTIVITES

**There are multiple ways to extend the learning from your Pollinator Field Day. Consider the following activities:**

### Planting a pollinator garden

If you have the space at your school or site, consider planting a pollinator garden to support local pollinators in your area. No matter how large or small, a pollinator garden is a great way to introduce students to plants and areas found in your area and an easy way to take learning outside. You can learn more about how to plant a pollinator garden by visiting:

*https://www.fs.fed.us/wildflowers/pollinators/gardening.shtml*

### Participating in a citizen or community science project

A citizen or community science project allows students to contribute data to real scientific research. You can learn more about projects appropriate for students by visiting:

*https://pbskids.org/scigirls/citizen-science*

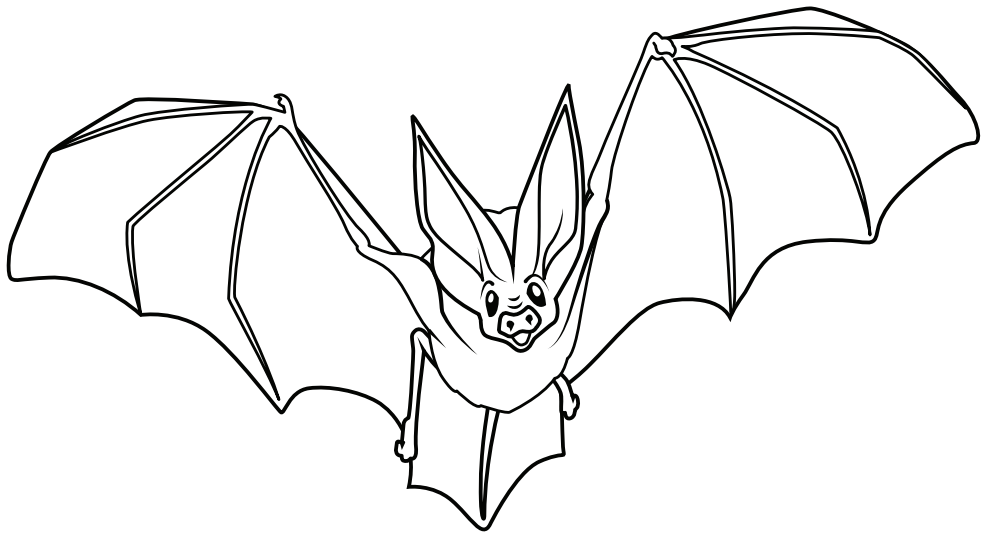
### Field trips

Extend the learning of your Pollinator Field Day by going on a field trip! Visit a local botanical garden or farm to see pollinators in action.

### Building bat boxes or bee homes

A great addition to a pollinator garden or stand-alone project to support pollinators is a bat box or a bee home. Research which species are found in your region so you can build an appropriate structure to support them. You can find more information on building a bat box by visiting:

*http://www.batcon.org/resources/getting-involved/bat-houses*



# APPENDICES : SAMPLE LETTERS

## Sample Letter to Parents and Guardians

**DATE**

**Dear Parents and Guardians,**

On [DATE], our [CLASS/ORGANIZATION/GROUP] will participate in a Pollinator Field Day from [TIME to TIME] at [LOCATION]. We wanted to share this exciting information with you and extend an invitation to come and learn with us!

Over the past few [DAYS/WEEKS/UNIT], our [CLASS/ORGANIZATION/GROUP] has spent time learning about the importance of pollinators. From bees to bats, hummingbirds to moths and everything in between, we have learned about how pollinators impact our daily life, from the food we eat to the flowers and plants we enjoy. During our Pollinator Field Day, we will build on this knowledge by engaging in hands-on learning and activity stations. We are also looking forward to having [COMMUNITY GROUP OR PARTNER] join us for the day to share their knowledge with our students.

We hope that you will be able to attend as a visitor or volunteer! We have learned so much, and we are looking forward to continuing learning about pollinators with you and your students.

Sincerely,

[INSTRUCTOR NAME]

## Sample Letter to Community Group

One of the challenges during setting up a Pollinator Field Day can be limited time for outreach to community members. This sample email text should make it easier for your organization to contact individuals and organizations in your community for assistance in putting together your Pollinator Field Day program.

### DATE

### Dear Community Group,

On [DATE], our [CLASS/ORGANIZATION/GROUP] will hold a Pollinator Field Day from [TIME to TIME] at [LOCATION]. We would like to invite you to participate in this event to share your knowledge with our students during this event.

Hosting a Pollinator Field Day highlights these incredible animals and plants that we rely on and illustrates this process and our connections to the environment in a fun and hands-on way.

In addition to providing more connections to nature, hosting a Pollinator Field Day is a great way to build connections in the community with natural resource professionals, local colleges and universities and your local conservation district.

Over the past few [DAYS/WEEKS/UNIT], our [CLASS/ORGANIZATION/GROUP] has spent time learning about the importance of pollinators utilizing curriculum from the National Association of Conservation Districts [link to curriculum].

During our Pollinator Field Day, we will build on this knowledge by engaging in hands-on learning and activity stations. We would be glad to have [COMMUNITY GROUP OR PARTNER] join us for the day to share knowledge with our students. We will have [NUMBER] of stations and would like for [COMMUNITY GROUP OR PARTNER] to [HOST A TABLE HIGHLIGHTING THEIR ORGANIZATION OR FACILITATE AN ACTIVITY WHICH WE WILL PROVIDE]. All activities will last from 10-15 minutes and will allow your organization to impact [TOTAL NUMBER OF STUDENTS].

We hope that your organization will be able to help make our Pollinator Field Day a success. Please contact me by [DATE] to let me know if you can attend.

Sincerely,

[INSTRUCTOR NAME]

# APPENDICES

## VOCABULARY

**adaptation** • a physical trait or behavior that helps an organism survive in their environment.

**agriculture** • growing crops, raising livestock and cultivating soil. Includes the field of study and occupations like farming.

**anther** • found in the stamen, the male part of the flower where pollen is produced.

**apiculture** • the practice of keeping honeybees and their hives, commonly called “beekeeping”.

**beehive** • a human-made structure for honeybees.

**biodiversity** • the variety of living things found in habitats, ecosystems and the Earth as a whole. Includes plants, animals, bacteria and fungi.

**carnivore** • an organism that primarily feeds on and gets their energy from other animals and animal matter. Examples include some insects, sharks and cats.

**coevolution** • when a change in an organism impacts a change in the physical characteristics or behavior of another or multiple organisms. For example, a change in a flower could affect an insect’s characteristics.

**colony** • a group of bees. A colony may live in a beehive or a nest. Other insects like ants or termites live in colonies.

**communication** • an exchange of information from one individual or organism to another. Humans may communicate verbally or non-verbally; bees may communicate through movement like a waggle dance.

**consumer** • an organism that obtains its energy by eating other organisms or plant material.

**decomposer** • organisms that breakdown organic matter and return it to the environment. Examples include fungi and bacteria.

**defense mechanism** • a special adaptation that an organism uses to avoid being preyed upon or for protection. Examples include bees and their stingers.

**ecosystem** • living and nonliving organisms and their many interactions. Can vary in size and are found on land and in water. Examples can include school gardens and entire forests.

**ecosystem services** • the benefits that humans receive from the environment. Examples may include food production, raw materials, recreation and other resources.

**energy** • in a food web or chain, energy is created by producers and utilized by producers. Producers may get their energy from sources like the sun and the soil. This transfer of energy creates physical changes in the food web, chain or even ecosystem.

**environment** • the living and nonliving organisms and other physical and chemical factors present in a particular place.

**fertilization** • in flowers, the process of pollination. When pollen is transferred from the male stamen to the female pistil, the pollen travels down the ovary and develops into a seed.

**filament** • part of the anther, the male reproductive organ of the flower. Often long and stalk-like, the filament supports the anther, which produces pollen.

# VOCABULARY

**flower** • the reproductive unit of many types of plants. Both male and female reproductive parts are found in flowers. Many plants rely on pollination of flowers for reproduction.

**food chain** • the linear progression of organisms in an ecosystem. As one organism eats another, nutrients and energy pass through the ecosystem.

**food web** • the complex interactions of all the food chains found in an ecosystem.

**fruit** • in flowering plants, the mature ovary and the result of pollination.The fruit surrounds the seed of the plant. In many cases, the fruit is edible to distribute seeds. Examples include melons, avocados, peaches, tomatoes and many others.

**generalist** • organisms that are able to thrive in many different environments in varied conditions. Examples of generalists include raccoons, coyotes and humans.

**germination** • the growth of a seed, which contains a plant embryo.

**habitat** • the place where an organism or community of organisms is found. Includes the other living and nonliving things that are found there.

**herbivore** • organisms that primarily feed on and get their energy from plants. Examples include some insects, cows and elephants.

**insect** • organisms with a segmented head, thorax and abdomen. These organisms have only three pairs of legs and usually have wings.

**life cycle** • the stages of an organism's growth, which can include changes in form and function as the organism goes from one stage to the next.

**natural resource** • materials and other items found in nature, like organisms or substances that are beneficial to humans. This includes solar and wind energy, oil and mineral deposits, to name a few.

**nectar** • a sugary secretion produced by glands in flowers and stems. This sweet fluid attracts pollinators.

**nest** • a structure built by an organism for its eggs, young or itself.

**omnivore** • an organism that eats a variety of items, including plants, animals and fungi.

**organism** • living things capable of growth and reproduction. Examples include plants, animals, fungi and bacteria.

**ovary** • part of the pistil, the female reproductive organs of a flower. This is where ovules are produced.

**petals** • the often brightly colored part of the flower which surrounds its reproductive organs.

**pistil** • the female reproductive organs of a flower comprised of the stigma, style and ovary.

**plant** • a living organism that produces energy from soil, water, carbon dioxide and the sun.

**pollen** • grains formed in the male organs of a flower. When transferred to the female organs of a flower through pollination, fertilization occurs.

# APPENDICES

## VOCABULARY

**pollination** • the transfer of pollen from the male stamen to the female pistil.

**pollinator** • an organism that aids in the transfer of pollen from the stamen to the pistil.

**proboscis** • in pollinators like insects, a long tube that is used to suck up nectar. Examples can be found on butterflies and moths.

**producer** • also called autotrophs, organisms that create their own food. Examples include plants, algae and phytoplankton.

**reproduction** • the process of creating offspring in animals and plants.

**seed** • a fertilized ovule. It contains an embryo and the nutrients needed for a new plant to grow.

**self-pollination** • the pollination of a flower without the aid of wind, water or a pollinator.

**sepal** • the leafy, green outer covering of the bud of a flower.

**specialist** • organisms that require a specific environment, conditions or food source to thrive. Examples of specialists include giant pandas, koalas and pollinators that are adapted to feed on one species of flower.

**stamen** • the male reproductive organs of a flower comprised of the anther and the filament.

**stigma** • part of the female pistil, where pollen from the stamen is deposited.

**style** • part of the female pistil that connects the pistil to the ovary. Pollen travels down this tube to the ovary.

**waggle dance** • the specialized series of movements a bee performs to tell other bees about the location of a food source.

## GETTING STUDENTS OUTDOORSY

**There are many ways to support learning in the outdoors. Whether you are going to a small patch of grass at your school or site or going on a field trip, there are many benefits to taking students outside. Here are a few tips and tricks to ensure that students have a great experience in the outdoors:**

- If you're able, visit the site ahead of time. Assess any risks and any accessibility issues. For example, can all students get to the site? Will it be comfortable for the length of the lesson you are planning? Are there any insects or animals at the site to be aware of?

- Ensure students have what they need to be comfortable outdoors. Depending on the time of year you may want students to have a jacket, rain jacket, water bottle or sunscreen.

- If you plan on being outdoors for an extended period of time and want students to sit down, ensure that the surface you are sitting on is dry and can support multiple students. A simple way to ensure comfortability on a variety of surfaces is by using carpet squares for students to sit on.

- Before going outdoors, ensure that students are aware of the expectations for learning. Discuss how you should treat plants and animals you encounter and protocols for collecting at your site.

# RESOURCES

**About Pollinators**
*https://www.pollinator.org/pollinators*

**Adaptation**
*https://www.nationalgeographic.org/encyclopedia/adaptation/*

**Adaptations: Specialist and Generalist**
*https://vetmed.illinois.edu/wildlifeencounters/grade9_12/lesson2/adapt_info/specialist.html*

**Additional Pollinator Resources**
*https://www.nps.gov/subjects/pollinators/additionalresources.htm*

**Ag in the Classroom Elementary Science: Pollination**
*https://www.agclassroom.org/va/teachers/lesson_subject/pollination.pdf*

**Agriculture**
*https://www.nationalgeographic.org/encyclopedia/agriculture/*

**Attracting Pollinators to Your Garden Using Native Plants**
*https://www.fs.fed.us/wildflowers/pollinators/documents/AttractingPollinatorsV5.pdf*

**Autotroph**
*https://www.nationalgeographic.org/encyclopedia/autotroph/*

**Bee Anatomy**
*https://askabiologist.asu.edu/honey-bee-anatomy*

**Bee Colony Life**
*https://askabiologist.asu.edu/bee-colony-life*

**Bee Issues**
*https://www.pollinator.org/learning-center/bee-issues*

**Bee and Butterfly Fund**
*https://beeandbutterflyfund.org/honey-bees-and-pollination*

**Beekeeping**
*https://www.nal.usda.gov/afsic/beekeeping*

**Biodiversity**
*https://www.nationalgeographic.org/encyclopedia/biodiversity/*

**Bug Word Of the Day: Proboscis**
*http://blogs.ifas.ufl.edu/entnemdept/2018/04/05/bug-word-day-proboscis/*

**Butterflies and Moths, Teacher's Guide**
*https://www.floridamuseum.ufl.edu/wp-content/uploads/sites/16/2017/02/Butterfly-Educators-Guide.pdf*

**The Buzz on Bees**
*https://www.pollinator.org/pollinator.org/assets/generalFiles/TimeBeeArticle.pdf*

**Carnivore**
*https://www.nationalgeographic.org/encyclopedia/carnivore/*

**Coevolution**
*https://evolution.berkeley.edu/evolibrary/article/evo_33*

**The Description Of Flowers**
*https://www.cs.rochester.edu/~nelson/wildflowers/glossaries/flowers/index.html*

# RESOURCES

**Ecological Interactions**
*https://www.khanacademy.org/science/high-school-biology/hs-ecology/hs-ecological-relationships/a/ecological-interactions*

**Energy Flow & Primary Productivity**
*https://www.khanacademy.org/science/biology/ecology/intro-to-ecosystems/a/energy-flow-primary-productivity*

**Food Chain**
*https://www.nationalgeographic.org/encyclopedia/food-chain/*

**Food Chains & Food Webs**
*https://www.khanacademy.org/science/biology/ecology/intro-to-ecosystems/a/food-chains-food-webs*

**Food Web**
*https://www.nationalgeographic.org/encyclopedia/food-web/*

**Habitat**
*https://www.nationalgeographic.org/encyclopedia/habitat/*

**Habitat Videos from Pete Berthelsen At Conservation Blueprint**
*http://www.conservationblueprint.com/videos/*

**Herbivore**
*https://www.nationalgeographic.org/encyclopedia/herbivore/*

**Honey, I'd Love to Dance**
*https://naitc-api.usu.edu/media/uploads/2015/05/06/HoneyDance_1.pdf*

**Insect**
*https://kids.britannica.com/students/article/insect/275066*

**Life Cycle**
*https://kids.britannica.com/students/article/Life-cycle/312184*

**List Of Pollinated Food**
*https://www.pollinator.org/list-of-pollinated-food*

**Living Things**
*https://kids.britannica.com/students/article/living-things/275509*

**Make Your Classroom Bloom With Ideas**
*https://www.pollinator.org/pollinator.org/assets/generalFiles/Pollinator-Poster-Curriculum.pdf*

**NACD Curriculum Where Would We BEE Without Pollinators?**
*www.conservationlearn.org*

**The Nature Conservancy**
*https://www.nature.org/en-us/about-us/who-we-are/our-people/*

**Natural Resource**
*https://kids.britannica.com/students/article/natural-resource/599843*

**National Association of State Conservation Agencies**
*http://www.nascanet.org/*

**Nationwide Directory of Conservation Districts**
*https://www.nacdnet.org/general-resources/conservation-district-directory/*

**National Association of Conservation Districts**
*https://www.nacdnet.org/about-nacd/what-we-do/pollinators/*

**Nectar**
*https://www.britannica.com/science/nectar*

**No Fear Of Stings Blog**
*https://www.pollinator.org/blog-old/no-fear-of-stings*

**Omnivore**
*https://www.nationalgeographic.org/encyclopedia/omnivore/*

**Plant**
*https://www.britannica.com/plant/plant*

**Plant Morphology**
*https://www.amnh.org/learn/biodiversity_counts/ident_help/Parts_Plants/parts_of_flower.htm*

**The Plants & the Bees: Plant Reproduction**
*https://www.khanacademy.org/science/biology/crash-course-bio-ecology/crash-course-biology-science/v/crash-course-biology-13*

# RESOURCES

**Pollen**
*https://www.britannica.com/science/pollen*

**Pollinator Ecosystem Services**
*https://www.pollinator.org/pollinator.org/assets/generalFiles/4-Vicki-Wojcik-2.pdf*

**Pollination Fast Facts: Educators & Students**
*https://www.pollinator.org/pollinator.org/assets/generalFiles/Pollination-Fast-Facts-Educators-Students-2019.pdf*

**The Pollinator Game**
*https://www.nrcs.usda.gov/Internet/FSE_PLANTMATERIALS/publications/stpmcot12246.pdf*

**Pollinators: Outreach and Education**
*https://www.fws.gov/pollinators/PollinatorPages/Outreach.html*

**Pollinator Partnership**
*https://www.pollinator.org/*

**Pollinator Partnership Curriculum**
*https://www.pollinator.org/learning-center/education*

**Seed Germination**
*https://aggie-horticulture.tamu.edu/wildseed/info/3.1.html*

**Seeds • Arthur Cronquist-Martin Zimmermann**
*https://www.britannica.com/plant/angiosperm/Seeds*

**Self-pollination**
*https://www.britannica.com/science/self-pollination*

**Summary of the 5E Instructional Model**
*http://cbm.msoe.edu/teacherWorkshops/mspResources/documents/day1/5eSummary.pdf*

**Sustainable Agriculture: Definitions and Terms. Related Terms**
*https://www.nal.usda.gov/afsic/sustainable-agriculture-definitions-and-terms-related-terms#term4*

**U.S. Forest Service**
*https://www.fs.fed.us/wildflowers/pollinators/*

**USAD: Natural Resources Conservation Service**
*https://www.nrcs.usda.gov/wps/portal/nrcs/main/national/plantsanimals/pollinate/*

**USDA Service Center Locator**
*https://www.nrcs.usda.gov/wps/portal/nrcs/main/national/contact/*

**U.S. Forest Service**
*https://www.fs.fed.us/wildflowers/pollinators/*

**U. S. Forest Service Regional Directory**
*https://www.fs.fed.us/organization*

**U. S. Forest Service National Programs and Offices**
*https://www.fs.fed.us/about-agency/contact-us/national-programs-offices*

**Soil and Water Conservation Society**
*https://www.swcs.org/*

**USAD: Natural Resources Conservation Service**
*https://www.nrcs.usda.gov*

**U.S. Forest Service**
*https://www.fs.fed.us/*

**What Is an Ecosystem?**
*https://www.khanacademy.org/science/biology/ecology/intro-to-ecosystems/a/what-is-an-ecosystem*

**Working Trees for Pollinators**
*https://www.fs.usda.gov/nac/assets/documents/workingtrees/brochures/WTPollinators.pdf*

**Working Trees Infosheet: How Can Agroforestry Help Pollinators?**
*https://www.fs.usda.gov/nac/assets/documents/workingtrees/infosheets/WTInfoSheet_HelpPollinators.pdf*

**Working Trees Infosheet: How Does Agroforestry Help Crop Pollinators?**
*https://www.fs.usda.gov/nac/assets/documents/workingtrees/infosheets/WTInfoSheetCropPollinationJune2016.pdf*

**Xerces Society for Invertebrate Conservation**
*https://xerces.org/*

National Association of
Conservation Districts

**Support for this project was provided by
The David Rockefeller Fund and Pollinator Partnership.**

DAVID
ROCKEFELLER
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