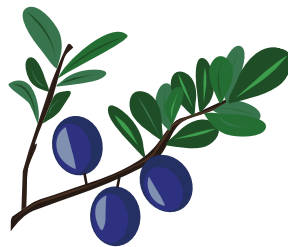


Berry Good Friends

A Guide to Exploring Native Plant-Pollinator Relationships

Native plants and pollinators play critical roles in our ecosystems. Native plants offer food and shelter for a host of organisms, both above and below the ground. They also help clean our air and water, and their roots provide stability for our soils. Native pollinators ensure that native plants continue to produce seeds so they can reproduce and thrive for generations to come. Learning about the relationship between native plants and native pollinators – and the amazing things they do together in our environment – offers intriguing and important lessons for kids.



Studying natives can serve as a springboard for hands-on investigations in STEM curricula, humanities, and other disciplines, as well as deepen kids' understanding of the natural world and encourage environmental stewardship. This lesson guide offers educators and parents a foundation of information about native plants and pollinators, along with engaging activities focusing on native berries and their "berry good" pollinator friends. The goal is to teach our next generation respect for native plants and pollinators while also inspiring and empowering them to take steps to protect and preserve native habitats in our communities.

Learning Objectives

Through these activities, kids will learn:

- Pollination basics and why are pollinators important
- To identify and gain an appreciation for native plants and native pollinators
- How their actions can help support and protect native plant and pollinator populations

Materials Needed

Activity 1:

- Making Berries Reading Page
- Plastic cups (minimum 1 per child and 1 extra)
- Strawberry flower petal and bee templates (1 each per child)
- Modeling clay or playdough (Here are recipes for no-bake homemade playdough and traditional homemade playdough from PBS Kids for Parents: <https://www.pbs.org/parents/crafts-and-experiments/no-bake-playdough-recipe> and <https://www.pbs.org/parents/crafts-and-experiments/rainbow-playdough>)
- Yellow chenille sticks or straws (you can substitute with other colors if needed)
- Yellow pompoms or tissue paper (you can substitute with other colors if needed)
- Tape

(*Note: Feel free to substitute any of the materials if needed)

Activity 2

For each child, have:

- Native Bee Profile Cards
- Bee Observation Worksheet
- Pen or pencil
- Clipboard (optional, but very helpful)

Activity 3

- Habitat Scavenger Hunt Worksheet

Native vs. Non-Native Plants



The term non-native (or non-indigenous) generally refers to species of plants that have been moved by people — rather than by natural means such as wind, water, or birds — to locations where they do not naturally occur. Non-native plants first arrived in North America at the time of European contact, when explorers brought familiar plants with them to use for edible, medicinal, ornamental, or utilitarian purposes. Many were brought from other continents, such as Asia or Europe, while others were relocated from different regions of North America.

Some non-native plants provide benefits without harming the native ecosystem. Others, however, can run rampant, usually because they are missing the natural pests, diseases, and weather conditions that kept them contained in their native land. When a non-native plant overtakes or otherwise disrupts native plant communities, it is known as an invasive plant. These plants may supply some food to native wildlife, but they generally do not provide the range of habitat benefits provided by native plants, making them unable to fully support wildlife populations. Also, because they compete for resources with and sometimes displace native plants and animals, they can decrease natural biodiversity and threaten native ecosystems.

Why Grow Natives?



Because native plants have evolved and adapted to local conditions, they're vigorous and hardy enough to withstand winter's cold, summer's heat, and other climate conditions. Once established, they often require less irrigation, fertilization, and/or pruning than non-native plants, and many are resistant to common pests and diseases. Combined, these traits make native plants ideal for drought-resistant, low-maintenance gardening and landscaping.

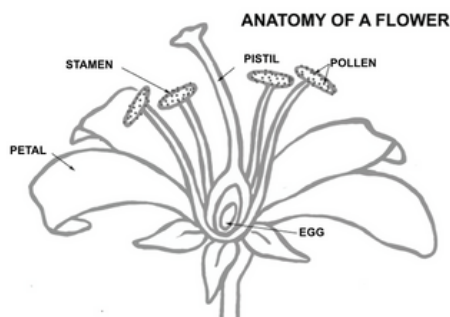
Here are more benefits to growing native plants:

- Native plants stay put. Each native plant species is a member of a community that includes other plants, animals, and microorganisms. This natural balance keeps each species in check, allowing it to thrive in conditions where it's suited, but preventing it from running amok. Native species rarely become invasive.
- Native plants support the soil ecosystem. The root systems of native plants support the native microbes essential to a healthy soil ecosystem. They also help rainwater percolate into the soil, reducing erosion and runoff and improving water quality.
- Native plants provide food. For millennia, native plants — including their fruits, leaves, flowers, roots, tubers, and stems — have served as important sources of food for both humans and wildlife.
- Native plants promote health. Humans have used native plants as medicine for thousands of years to fight infections, clot blood, alleviate pain, and soothe upset stomachs. According to the Center for Plant Conservation, Native Americans historically used more than 2,000 native plants for medicine. Plants and plant parts were traditionally gathered and converted into teas, tonics, tinctures, oils, and many other substances. Additionally, many modern medicines contain chemicals derived from or inspired by plants.
- Other uses for native plants. Native plants have long been used to make utilitarian products such as clothing, rope, baskets, glue, and soap; they have also been used as natural dyes. By taking advantage of certain plant characteristics, like strong fibers or colorful petals, people have been able to meet their everyday needs. Today, fruits, flowers, leaves, roots, fibers, gums, resins, and oils are harvested from both wild and cultivated native plants. Native plants are also used to build shelters.

Native Pollinators

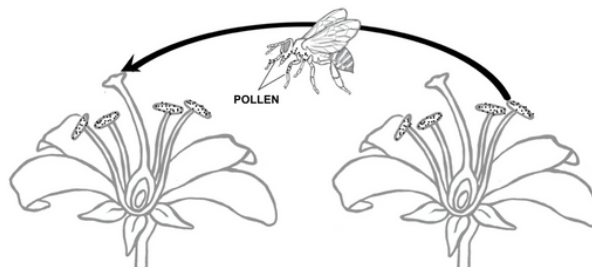
The very survival of many native plants relies on the presence of native pollinators!

Flowering plants have a distinctive way of making seeds. Their flowers make pollen in parts called stamens. To create a seed, the pollen must be transported and joined with egg cells in parts called pistils. This process is called pollination.



On some plants the pistils and stamens are in the same flower (as shown in diagram above); on others the pollen from one flower must be moved to the pistil of another flower.

Because pollen lacks wings or feet, it needs help moving from one place to the other. Some flowers rely on the wind or water to help make pollination happen. Other flowers rely on insects (or other small creatures) called pollinators to transport their pollen from flower to flower, as shown in the illustration below.



Sticky pollen grains adhere to this bee's body as it moves from one flower to another sipping nectar. In the process, the bee transfers pollen from one flower to the next.

In this symbiotic, or mutually beneficial, relationship, plants offer food (nectar and pollen) to the pollinator and the pollinator inadvertently helps the plant make its seeds by moving the pollen that it does not consume from flower to flower.

Over millions of years, many flowers and pollinators have adapted together and developed special relationships. For example, a pollinator may have an adaptation that allows it to detect the colors or scents of a certain flower so it's able to recognize it as a valuable source of nectar and pollen. Another type of pollinator may have evolved special structures, such as an extra-long tongue, so it can reach the nectar deep inside a tubular bloom. These special adaptations give the pollinators advantages over their less fortunate kin, and they pass the adaptations on to their offspring. Over many generations these traits become well established in pollinator populations. Meanwhile, flowers have also evolved, giving rise to specific characteristics or adaptations that attract certain pollinators.

Although bees are the best-known and most widespread pollinators, other kinds of native animals, including wasps, beetles, flies, butterflies, moths, birds, and bats, act as pollinators for various kinds of flowers.

Protecting Native Plants & Native Pollinators



The importance of native plants to all life on Earth cannot be overstated. They beautify our landscapes, support our treasured wildlife, and meet our most essential of needs. In a nutshell, these worthy wild ones are some of our most valuable species. Despite their value, or perhaps because of it, native plant populations worldwide are declining at an astonishing rate.

Once native plant communities are destroyed, extinction may follow — and with it, the loss of potential medicines and other benefits. Even today, it's estimated that we've only unearthed a fraction of the native plants that have medicinal properties! The Center for Plant Conservation estimates that there are over 4,000 plants native to North America in danger of becoming extinct — and that number is growing. Why is this happening?

1. Invasive plants are displacing native plants from their natural habitats. With their notable knack for out-competing natives — in the absence of their natural biological controls — these invaders pose a serious threat to native biodiversity.
2. Humans are destroying their habitat. As the human population swells, so does the need for development. New or expanded urban and suburban centers, industrial sites, and agricultural land encroach on natural areas currently inhabited by native species. What's more, the activities taking place on developed land can change the soil composition of adjacent natural areas through pollutants and other runoff.
3. Last, but certainly not least, over-collecting native plants has led to their decline. Traditionally, the demand for native plants was local; most collectors harvested enough for their families. Occasionally they would gather additional plants to sell in the area market, but this was still a sustainable system. In recent years, the increase in global demand for plant-derived products, such as medicinal herbs, has attracted collectors who harvest and sell large quantities wholesale. These collectors don't always know how to properly collect native plants. As a result, plant populations are decimated, threatening some native species and leading to the extinction of others.

In addition to threats to native plants, researchers have documented a steep decline in the populations of many different native pollinators, such as certain bees, over the last few decades. They have linked this decrease in numbers to several factors, including:

- Loss of habitat, resulting in decreasing food supply and disruption of nesting sites due to land development
- Pollution of air, water, and soil
- Misuse of chemicals, such as pesticides, that impacts not only pest insects who are usually their targets but also beneficial insects such as pollinators
- Disease and parasite problems
- Climate change

What's Being Done?

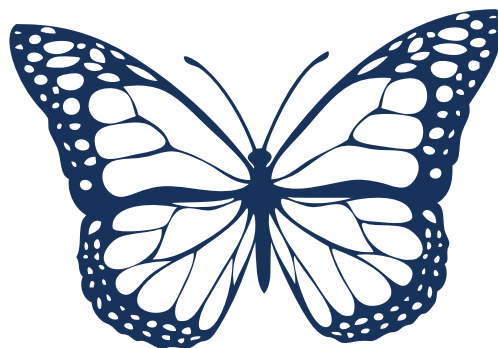
Across the country and around the world, actions are being taken to protect native plant populations. Under the United States Endangered Species Act of 1973, any plant (or animal) placed on the Endangered and Threatened Wildlife and Plants list cannot be exported, sold without a permit, or removed from federal lands.

To provide greater protection for native plants under this act, many private and statewide nonprofit organizations promote plant conservation through education and preservation activities. At local, regional, and state levels, native plant societies have been launched throughout the country. State Departments of Conservation or Natural Resources and state universities often have programs in place to conduct research and provide education on native plants. Many states have compiled lists of invasive plants and work to manage invasive plant populations and restrict planting of designated invasive species.

What Can WE Do?

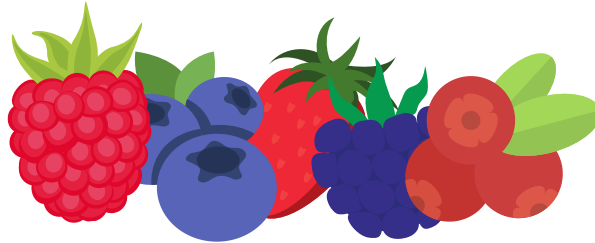
The good news to share with kids is that there are some very practical ways we can help native plants and pollinators in our daily lives. Here are a few ideas:

- Incorporate a diversity of native plants that bloom throughout the growing season at home, school, or community centers. This will provide a continuous supply of pollen and nectar for pollinators.
- Choose native plants that provide shelter and food for pollinators in all stages of their life cycles.
- Leave areas of uncut grass or wildflowers to provide shelter for pollinators.
- Spread the word to others! Teach your community about the importance of native plants and pollinators.





Activity 1: No Pollinators, No Berries



Berries, such as blueberries, strawberries, raspberries, and blackberries, are edible crops greatly enjoyed by animals of all kinds, including humans! Providing a concentrated source of calories and essential nutrients, they are important foods in many ecosystems — and as a bonus they are sweet and tasty to eat! Similar types of berry plants can be found native to different ecosystems across the world; however, for each of the berries listed above there are certain species native to the North American continent.

1. With your kids, make a list of favorite berries and find or draw pictures of them. Next, conduct background research to discover the berries' native regions (for an extension, plot the locations on a map) and their preferred growing conditions. Ask local gardeners or farmers which berry plants grow best in your area and when they are traditionally harvested.
2. Share the "Making Berries" Reading Page with your students. Explain that most berry plants rely on pollinators to move their pollen and produce their fruit.
3. Give each child a copy of the strawberry flower petal template and bee coloring page.* Have them color the bee and then cut out both the petals and bee. Have them create a flower by attaching their petals to the edge of a small plastic cup with tape so the petals hang down the outside of the cup. Have them attach their bee to the end of a pencil, straw, or stick. *Note: If you are doing this activity with one child rather than a class, you will want to make more than 1 flower.
4. Instruct them to create a pistil and stamens using chenille sticks. To make the pistil, have them create a loop at the top of one chenille stick to create a pollinator landing pad. To make the stamens, have them wrap small pompoms around the tops of the chenille sticks. Explain that strawberry flowers have lots of stamens so they can add as many as their cup can hold (and supplies allow).
5. Have kids place a piece of modeling clay or playdough in the bottom of each cup, and then poke the bare ends of the pistil and stamens into it.
6. Designate an additional plastic cup as a "hive."
7. Give kids a chance to have their bees gather and move pollen (pompoms) from one flower to another to demonstrate the pollination process. Then have them move some of the pollen to the hive cup. As they work, help them understand how the pollination process is beneficial for both the plants and the pollinators.

Reading Page: Making Berries



Blueberries, strawberries, raspberries, blackberries, cranberries... what does this list have in common? They're all popular—and nutritious—fruits. They're so sweet and yummy that some people call them Nature's Candy! However, unlike manmade candy, these tasty treats are packed full of important vitamins that our bodies need to grow.

Another thing these fruits all have in common? They would not exist without the helping hand of pollinators. To make fruit (and seeds which are part of the fruit), many plants need the help of pollinators. Pollinators are insects and animals that move pollen between flowers, which allows the plant make its fruits and seeds needed to grow more plants. Pollinators don't do this on purpose, however. While they are gathering their food (nectar and pollen) from one flower, some pollen grains stick to their bodies and are carried to the next flower.

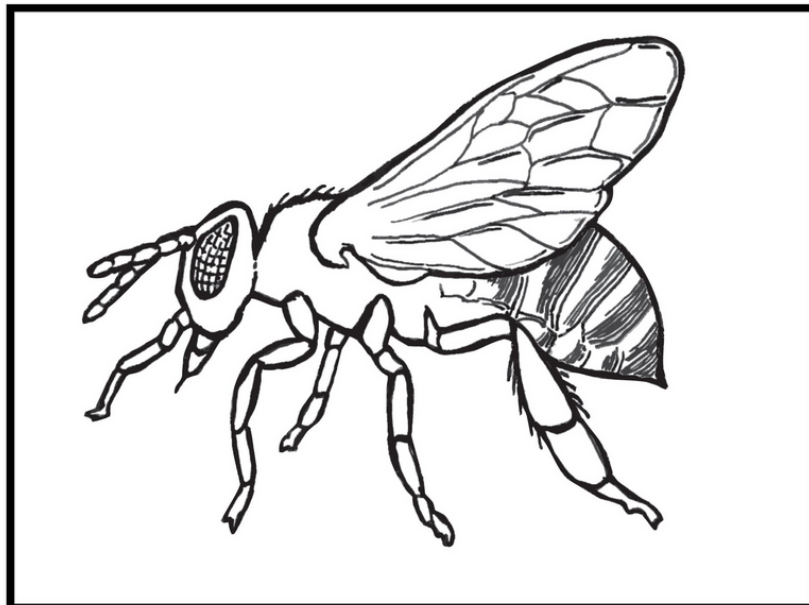
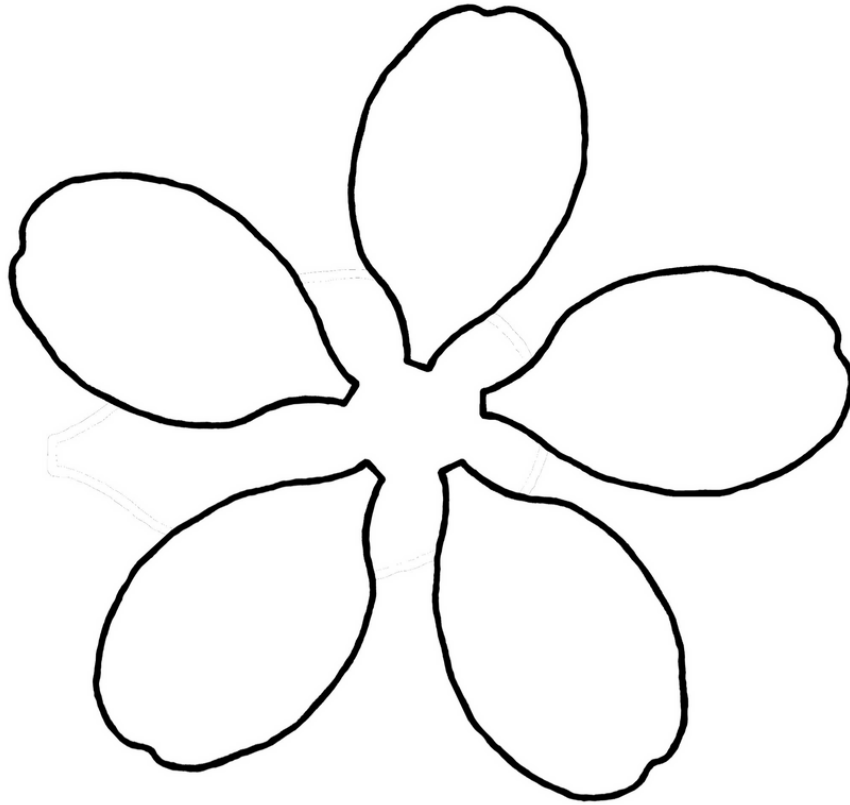
Many plants, including the berry plants mentioned above, can't produce seeds without the help of pollinators. Other types of plants can make some fruit and seeds without the help pollinators because their pollen will move with the wind or rain, but they can make a lot more if pollinators help them out. For example, orange trees can grow oranges (and orange seeds) without the help of pollinators, but they will make a lot more oranges if there are pollinators to help them. Some plants do not need pollinators to help them make seeds at all. Grass and corn plants get help from the wind to move their pollen.

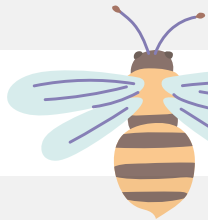
Which pollinators help berry plants grow? Bees are the most common helpers. There are lots of different kinds of bees, including honeybees and bumblebees. There's even one bee named the Southeastern Blueberry Bee that pollinates blueberry flowers. Scientists also think there are moths that visit berry plants for tasty nectar at night, helping move pollen.

Just think: Without pollinators we couldn't enjoy blueberry muffins, strawberry shortcake, or cranberry bread. Berries are also important foods for other wildlife like birds, squirrels, and many more! In addition, without pollinators, berry plants would not be able to make their seeds and then they could not make more berry plants!

What is your favorite berry or berry treat to eat? Next time you eat it, make sure to say thank you to the pollinator that helped bring it to your table!

Coloring Page





Activity 2: Native Bee Love

Bees are very important pollinators of berries. For many people, the first bee that comes to mind is the honeybee, a non-native species that was originally brought to North America from Europe during Colonial times. However, there are thousands of lesser-known native bee species that serve as berry pollinators.

Introduce the topic of native bees. Here are some fun facts to share:

- There are over 4,000 bees native to the United States.
- The largest native bee is the bumblebee, which can be up to an inch long. The smallest bee is the fairy bee (scientific name is *Perdita minima*) which is less than 1/16" long. Have kids compare the measurements on a ruler.
- Some bees live together in a hive and are known as social bees. The bumblebee is the only species of social bee native to the United States.
- Other bees build individual nests to produce their young and live on their own. These bees are called solitary bees. Most bees native to the United States are solitary bees.
- Bees can build their homes in lots of different places, including in the ground, in tree cavities, and in abandoned animal holes.

Print out the Native Bee Profile Cards for your students. If you have a color printer, you can also print out the pictures of bees to go with the cards. If you do not have a color printer, share the pictures with your students on an electronic device (alternatively, you can also share photos from a field guide or book). Talk about the similarities and differences between the different bees — size, shape, and color, for example. Explain that species differ in their living arrangements: Some live in groups; others live on their own. Have kids sort their profile cards in various ways based on these different characteristics.

Bring kids to a garden or green space containing blooming plants (the more the better). Have them watch the flowers, looking for any flying visitors. Have them use the Bee Observation Worksheet to make notes on what they see. Ask them to try to identify the bees that they discover using the Bee Profile Cards or another identification tool. Note that many bees are similar in appearance and many are quite small, making it a challenge to identify them.

Here are a few digital resources for you to consult:

- Bee Identification Guides, from the Pollinator Partnership:
<https://www.pollinator.org/bee-guides>
- Seek by iNaturalist, created by California Academy of Sciences and National Geographic:
https://www.inaturalist.org/pages/seek_app
- Citizen Scientist Pollinator Monitoring Guide, by The Xerces Society for Invertebrate Conservation at the University of California at Berkeley:
https://xerces.org/sites/default/files/2018-05/11-010_01_XercesSoc_Citizen-Science-Monitoring-Guide_California_web.pdf

Native Bee Profile Cards

Instructions: Print the cards front and back so the text corresponds to the correct image on the next page.
If printing them single-sided, tape the pages together and then cut each card out.

<p>Name: Bumblebee Color: Black with yellow bands Size: Large Solitary or Social: Social Home: Nest near or under the ground – rock piles, tree stumps or abandoned animal holes</p>	<p>Name: Sweat Bee Color: Can be black or metallic green or blue Size: Small Solitary or Social: Solitary Home: Nest in the ground</p>
<p>Name: Blue Orchard Mason Bee Color: Metallic blue Size: Medium Solitary or Social: Solitary Home: Nest in tube-shaped holes</p>	<p>Name: Leaf Cutting Bees Color: Black (long hairs on under side of abdomen usually yellow from pollen) Size: Medium Solitary or Social: Solitary Home: Nest in rotting wood or stems</p>
<p>Name: Southeastern Blueberry Bee Color: Yellow and black Size: Medium Solitary or Social: Solitary Home: Nest in the ground</p>	<p>Name: Digger Bees Color: Variable (most shiny metallic or dark) Size: Medium Solitary or Social: Home: Dig nest in ground leaving distinctive mound of soil</p>

Native Bee Profile Cards





Bee Observation Worksheet



Date:

Location:

Plants in Bloom:

Pollinators Observed:

Bees Observed:

Sketch:

Notes:



Activity 3: Home Sweet Home

Both the populations and diversity of native plants and native pollinators are in decline. There are many reasons, with loss of habitat a major factor. Explain to kids how the growth of urban and suburban development has destroyed the homes of native plants and pollinators. Native plants have been cleared from land for construction of homes and roads. Often, they're replaced with a limited palette of non-native landscape plants or lawns. The removal of plants—and specifically native plants—reduces biodiversity and results in a loss of nesting sites and food supplies for native pollinators. Development can also lead to air, water, and land pollution that makes the disruption even more detrimental.

Let kids know that they can help by incorporating native plants in landscapes and green spaces. They can also include the elements native pollinators need to live, including:

- **Food sources.** Many pollinators require specific foods and habitats at different stages of their life cycles. Butterflies, for example, feed on nectar; however, their larval (caterpillar) stages consume plant leaves. The larvae of some species eat just one or a few types of plants. (Monarch caterpillars, for example, eat only milkweed foliage.) In addition, pollinators need food sources throughout the season. We can help provide food by planting a wide diversity of flowering plants that bloom at staggered intervals.
- **Water.** All living organisms need water to survive, and pollinators are no exception. They may, however, use water in different ways. Butterflies, for instance, sip at shallow pools, birdbaths, and mud puddles; some bees and wasps use mud to build homes. Mud puddles also provide important minerals for some pollinators.
- **Nesting sites and overwintering materials.** Pollinators need places and materials for building nurseries to raise their young and to spend down time. We can provide for these needs by undisturbed areas in our landscapes, such as small piles of brush and mud puddles. Manmade accommodations, like overturned flowerpots (with drainage holes facing up) can offer additional sites for nesting and resting.

Explain that native plants have needs, too. Basic plants needs are light, water, nutrients, air, and room to grow. When the growth of non-native plants is unchecked by insects or diseases they may become invasive, outcompeting native plants so that they struggle to fulfill their basic needs.

Both native plants and pollinators need something to be missing from the environment too—pesticides and herbicides. Even organic pesticides derived from plants and microbes can be harmful to pollinators as well as pests. Herbicides may wipe out unwanted plants (weeds), but they can also damage plants needed by pollinators.

Visit your yard, schoolyard or a local park or greenspace. Have kids use the Habitat Hunt Scavenger Worksheet to search for the elements that native plants and pollinators need to call that space “Home Sweet Home.” If they can’t find everything on the worksheet, brainstorm ways to add those elements into the area. In particular, investigate the option of incorporating more native plants. To find native plants that will thrive in your ecosystem consult the Pollinator Partnership’s Ecoregional Planting Guides available at: <https://www.pollinator.org/guides>

Habitat Scavenger Hunt Worksheet

How many of these habitat features and flower shapes can you find?



Water source



Piles of leaves



Mud puddle



Flat-topped flower



Tube-shaped flower



Clusters of small flowers



Shrub



Tree



Soil on ground

Additional Resources

Books:

- The Reason for a Flower by Ruth Heller - Beautiful illustrations and simple text provide an overview of the purpose of flowers in the plant world.
- Bea's Bees by Katherine Pryor - Follow Bea as she learns what kind of flowers bees like and their other habitat needs.
- The Thing About Bees: A Love Letter by Shabazz Larkin - A poetic book about why we need bees.

Videos:

- Slo-Mo Footage of a Bumble Bee Dislodging Pollen from the Smithsonian Channel:
<https://www.youtube.com/watch?v=J7q9Kn1rhRc>
- The Beauty of Pollination from Moving Art(TM):
<https://www.youtube.com/watch?v=MQiszdkOwuU&t>

Pollinator Guides:

- Pollinator Partnership's Ecoregional Planting Guides: <https://www.pollinator.org/guides>
- Seek by iNaturalist: https://www.inaturalist.org/pages/seek_app

More from KidsGardening:

- Lessons to Grow By – Pollinators: <https://kidsgardening.org/product/lessons-to-grow-by-pollinators/>
- Petal Attraction: <https://kidsgardening.org/resources/lesson-plans-petal-attraction/>
- Wonderful Wildflowers: <https://kidsgardening.org/resources/lesson-plan-wonderful-wildflowers/>
- Insect Safari: <https://kidsgardening.org/resources/lesson-plans-insect-safari/>
- Bug Hunt: <https://kidsgardening.org/resources/garden-activities-bug-hunt/>
- Wildlife Inventory: <https://kidsgardening.org/resources/garden-activities-wildlife-inventory/>
- Plant Families for Pollinators: <https://kidsgardening.org/resources/digging-deeper-plant-families-for-pollinators/>
- Flower Adaptations to Lure Pollinators: <https://kidsgardening.org/resources/garden-how-to-flower-adaptations/>
- Pollinator Celebration Meal: <https://kidsgardening.org/resources/garden-activities-pollinator-celebration-meal/>
- Choosing Flowers to Attract a Diversity of Pollinators: <https://kidsgardening.org/resources/digging-deeper-welcome-pollinators/>