



# POLLINATORS AT MIZZOU



# Worms and Insects

What is pollination? .....	2
Bees .....	6
Birds .....	10
Bats .....	12
Butterflies .....	14
How you can help .....	16

# What is pollination?

Pollination is a very important part of a plant's life cycle. During pollination, pollen from the anther, the male part of the flower, is moved to the stigma, the female part of the flower, to form seeds that later grow into new plants.

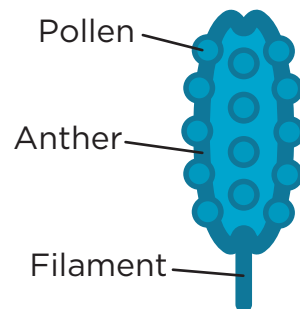
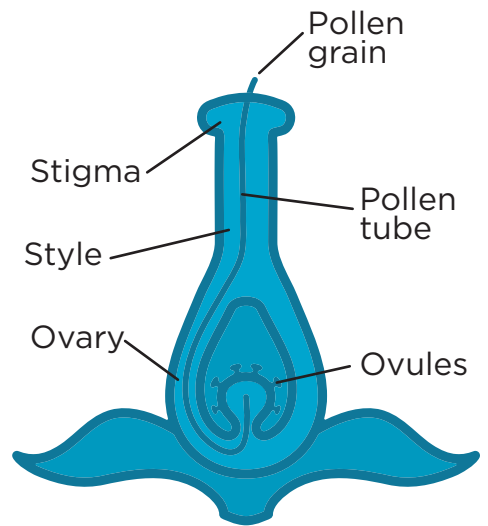
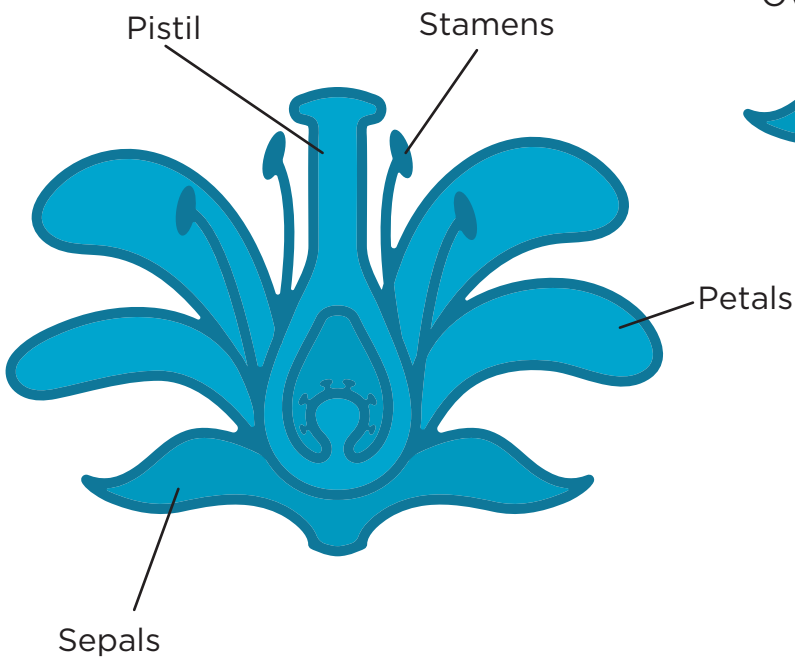
Some plants, such as wheat, rice, corn, rye, barley and oats, use the wind for pollination. The male plants make dry, lightweight pollen. When the wind blows, the pollen travels with it to the female plants.

Other plants need a little help from insects and animals called pollinators. Some examples are bees, birds, bats and butterflies. Plants and pollinators form special relationships with one another. The plants provide food, called nectar, to the pollinators. When a pollinator eats from a flower, it ends up getting some of the plant's pollen on it. When it flies to other flowers, it takes that pollen with it and spreads it to other plants.



# Plant anatomy

Pollen is found on the anther of the flower and can be all sorts of different colors. When pollen reaches the stigma, it is fertilized and turns into a seed for a new plant!



# Did you know?

Bees, birds and other pollinators work hard to help make some of your favorite foods. Here's a look at just a few foods that wouldn't be possible without pollinators.

- **Apples:** honey bees and blue mason orchard bees
- **Bananas:** birds and fruit bats
- **Blueberries:** more than 115 kinds of bees, including bumblebees, mason bees, mining bees and leafcutter bees
- **Cherries:** honey bees, bumblebees, solitary bees and flies
- **Chocolate:** midges (tiny flies) and stingless bees
- **Milk, cheese and ice cream:** Dairy cows eat alfalfa, which is pollinated by leafcutter and honey bees
- **Grapes:** bees
- **Strawberries:** bees
- **Tea plants:** flies, bees and other insects
- **Tomatoes:** bumblebees
- **Vanilla:** bees

How many of these foods have YOU eaten this month?

## Hey you!

Because plants need pollinators to help them produce fruit and seeds, they have developed some clever ways to get the pollinators' attention.

**Color:** Colors and markings on flowers help attract certain birds and insects. For example, bees like bright blue and violet flowers. Hummingbirds like red, pink, fuchsia and purple flowers. Butterflies like bright colors such as yellow, orange, pink and red.

**Fragrance:** Sweet-smelling flowers are a good way to get attention from a pollinator that doesn't see color. Moths and bats, which come out at night, are attracted to fragrant flowers.

**Shape:** A flower's shape also attracts pollinators. Butterflies like flowers with flat petals, which they use like a landing strip. Hummingbirds like long, tubular flowers that are easy for them to fit their long, thin beaks into to gather nectar.

Look around you. What kinds of pollinators do you think are attracted to the flowers you see?

## Who cares?

**You should!** Pollinators are responsible for producing one out of every three bites of food we take. Pollinators are so important that some farmers make a point to make homes for them in and near their fields.

Pollinators also play an important role in their natural ecosystems. They help 95 percent of all flowering plants reproduce, and they are an important food source for many larger animals. A bird, for example, can eat more than 700 caterpillars in one day!

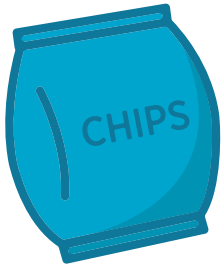
But pollinator populations have declined over the years because of habitat loss, pollution, chemicals, diseases and changing climates.

Today we will learn about some of the most common pollinators in our area and how we can help save them.

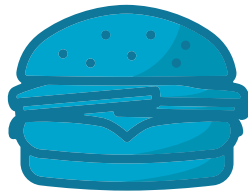
Did you know one out of every three bites of food is thanks to a pollinator? Without bees, butterflies, bats and birds, our diets wouldn't be as healthy or delicious. Let's take a look at what the lunchroom would look like without them.

## School Lunch:

What's on the menu with pollinators?



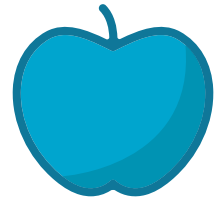
Chips with seasoning



Burger with sesame seed bun, cheese, lettuce, tomato, pickle, onion, ketchup, mustard

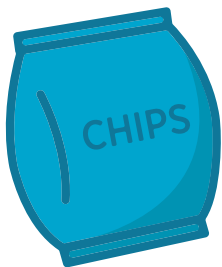


Milk

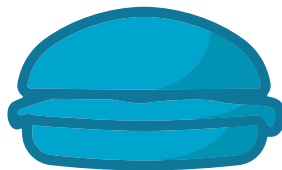


Apple

## What if we didn't have pollinators?



Chips



Bun with lettuce

Your lunch would be a really boring if we didn't have pollinators! A burger bun with lettuce doesn't match up to a burger and its toppings. Even if you were excited about your chips, some of the seasonings that make them tasty would be gone.

# Native Bees

Bees are one of the hardest-working pollinators around. There are more than 4,000 native bee species in the United States. Of these, about 452 live in Missouri. Here are some of the most common native bees you'll find around here.

## Bumblebees

- Bumblebees get their name from Middle English “bombeln,” which means to boom or buzz. To bumble also means to move in a clumsy manner, a lot like the way bumblebees fly.
- Bumblebees live underground in colonies with other bees.
- Bumblebees are such good pollinators that some farmers and plant growers release them in their fields and greenhouses.

## Sweat Bees

- On hot days, you might get a visit from a sweat bee. Sweat bees are attracted to salt in sweat.
- Sweat bees nest in the ground or in rotten wood. Some live alone and some live with other sweat bees.
- We think of bees as being black and yellow, but sweat bees also can be metallic green.

## Carpenter Bees

- Carpenter bees get their name because they make their nests in wood.
- The males hover around the nests to scare away predators, but don't worry — they can't sting.
- Carpenter bees are big. Some can grow almost the size of an adult's thumb!

## Leafcutter Bees

- Leafcutter bees get their name because they cut leaves to make their nests.
- Most bees carry pollen on their legs, but leafcutter bees carry it on their bellies.
- If you like ice cream, then the alfalfa leafcutter bee is your hero. Almost 100 years ago, farmers started noticing that it was harder to grow alfalfa, a legume like beans we feed dairy cows. But the alfalfa leafcutter bee saved the alfalfa crop — and in turn saved delicious ice cream!

## Buck's Ice Cream

Did you know that the University of Missouri has been studying ice cream since the 1920s? Buck's Ice Cream is famous for its favorite flavor, Tiger Stripe Ice Cream which is swirled to look like Truman the Tiger's coat!

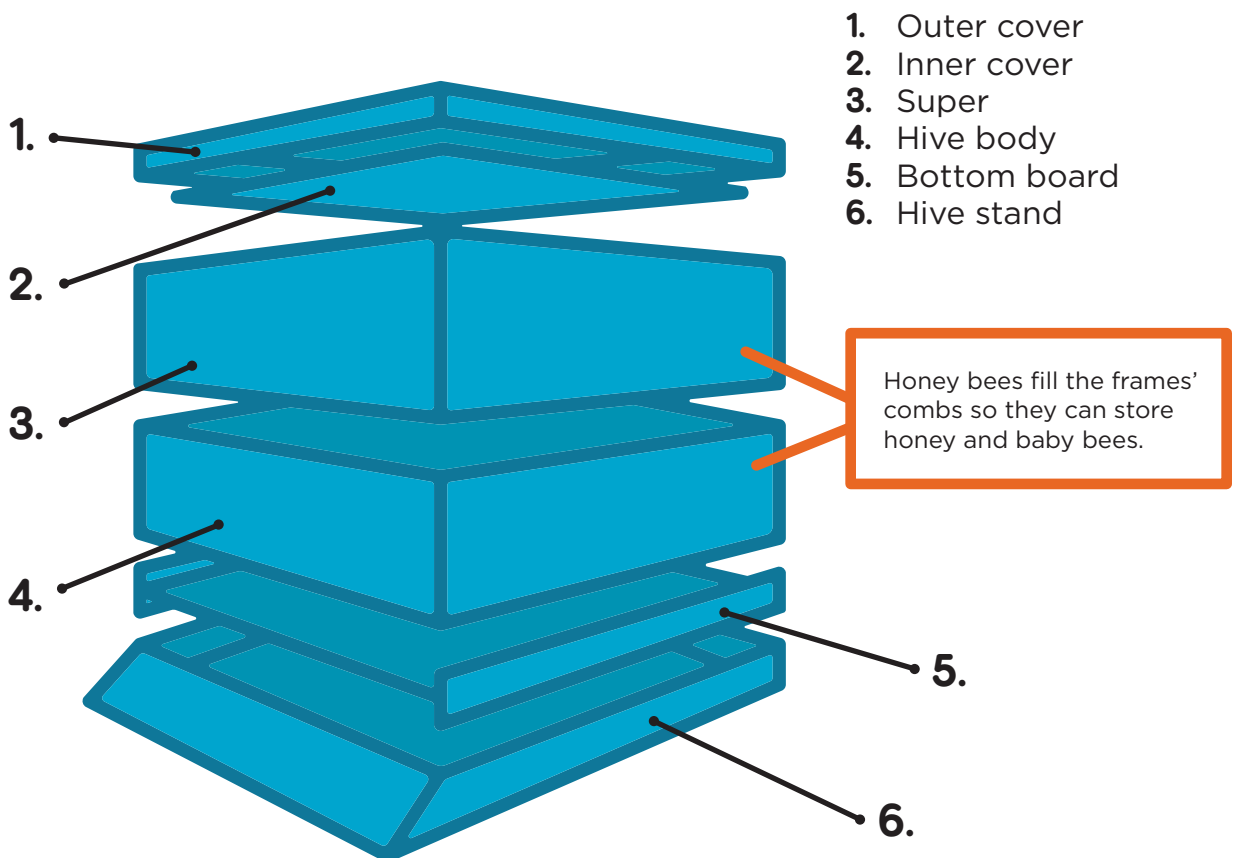




# Honey Bees

Honey bees are responsible for more than just pollination — they make delicious honey! In the wild, honey bees make their homes in old tree trunks. But most of the honey we eat is harvested by beekeepers who manage the hives.

## Hive Structure:



## Worker Bees



Smaller than drones and the queen, workers bees are all female and make up the majority of the bees in a hive. Sometimes they wear “pollen pants,” which is what beekeepers call it when a bee carries bundles of pollen on its legs. Worker bees also help with cleaning and guarding the hive, looking for food and caring for baby bees and the queen.

## Drones



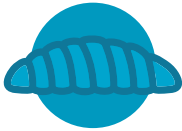
Each hive has a small population of male drones. They mate with queens from other hives and then die. Sometimes they are mistaken for the queen because of their size, but they have much bigger, bulgier eyes.

## Queen



The queen has a long, slender, pointy body. She lays eggs all day and is fed and cleaned by her royal court of worker bees. There is only one queen per hive.

## Brood



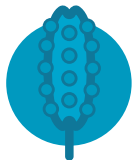
The brood is the egg, larva and pupa are stages for bees when they grow from babies to adult worker bees. The bees cover or “cap” the brood to protect it while the baby bee gets ready to hatch. Eggs are very hard to see because they are smaller than a grain of rice. The larvae look like little white worms that curl up into a circle. Pupae eventually hatch from the capped brood and wiggle their way out.

## Honey



Everyone knows what honey looks like! After bees have finished making it, they seal or “cap” it. Honey is syrupy and sweet and can have different flavors depending on the flower the nectar came from. Bees feed themselves with honey over the winter when there are no flowers blooming. Did you know honey can be used to treat wounds and allergies? The best thing about honey is that it is the only food in the world that stays fresh forever if it is properly stored. Scientists have even found honey in the Egyptian pyramids!

## Pollen



Pollen looks dusty and helps feed bees. Honeybees carry pollen on their legs. It comes in all sorts of different colors depending on the plant. Bees store pollen in their comb so they can feed themselves while in the hive. When it is stored in the hive, it looks clumpy.

## Wax



Wax is the structure bees make their comb with. It is shaped like a hexagon and filled with the brood, pollen and honey. Bees are very particular when they build their homes, and even have a universal spacing in between the wax combs called “bee space.” Humans use beeswax for things like candles and lip balm.

## Propolis



Propolis is a dark, glue-like substance bees use to seal cracks in the hive. Bees make it by mixing their spit with tree sap.

# What's the buzz?

## Honey bee fun facts

- Honey bees were first brought from Europe to the United States in the 17th century.
- Honey bees pollinate 80 percent of flowering crops in the United States.
- Missourians love honey bees so much they made the honey bee the official state insect!
- Many bees live in social colonies, which are a lot like tiny towns. The queen bee is the boss of all the other bees, and she is the only bee that can have babies. The worker bees make honey, clean the hive and feed baby bees. The males leave the nest to mate and then die.
- As many as 60,000 bees live in one hive. Can you imagine living with that many people in such a small space?
- Nobody likes getting stung by a bee, but it hurts the bee more than it hurts you. In fact, honey bees die after they sting people, so do not scare them!
- Bees can nest in the wild, but they are easily managed by humans.

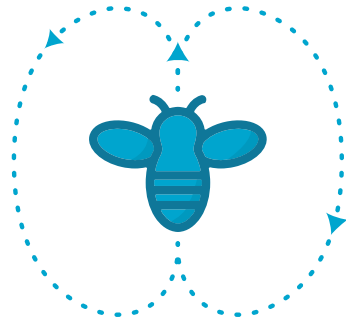


A beekeeper at Mizzou Botanic Garden shows off a frame from a hive.

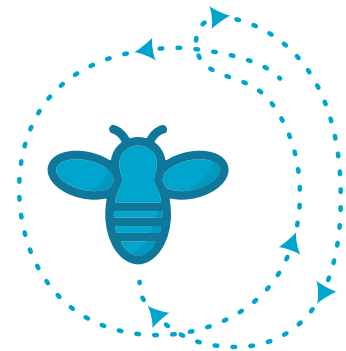
## Did you know?

### They like to move it, move it

Honey bees might make a lot of noise, but they “talk” to each other by dancing. They use a round dance to tell each other how to get to nearby food sources and a waggle dance to tell each other how to get to food located farther away.



Round Dance



Waggle Dance

# Birds

There are between 350 and 400 bird species in Missouri. Although birds do not pollinate food crops, some species play an important role in pollinating wildflowers. Hummingbirds are especially important pollinators.

## All about Bluebirds

Pollinators make food for us, and they are food for many of our favorite songbirds, including the Eastern bluebird, which is Missouri's state bird. Here are some fun facts about bluebirds:

- Bluebirds live in open areas and edges of woodlands with assorted trees and shrubs. They live in tree cavities and make their nests out of twigs, loose grasses and pine needles.
- Bluebirds love to eat wild fruit and insects. If you want to attract them to your yard, you should put out feeders filled with mealworms, dried fruit, suet, peanut butter and cornmeal.
- Male bluebirds are a beautiful bright blue, while females are pale blue and brown, which allows them to hide from predators while they sit on their eggs.
- Bluebirds don't just have blue feathers. They also lay small, pale blue eggs.

Since 1996, almost 2,500 have hatched and fledged in the birdhouses at Mizzou's A.L. Gustin Golf Course. In addition to bluebirds, more than 80 bird species have been seen by golfers and bird enthusiasts. Many have been common Missouri birds such as blue jays and robins, but there also have been some unusual visitors you might not expect on a golf course. These include:

- Turkey vultures
- Mallards
- Barred owls
- Yellow-bellied sapsuckers
- Eastern wood pewees
- Bald eagles
- Snow geese

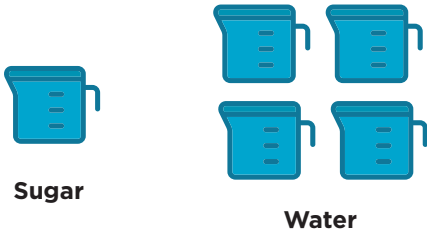
At Mizzou's A.L. Gustin Golf Course, staff have helped restore bluebird populations by putting out birdhouses for them.



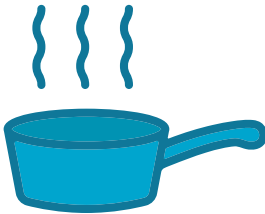
# How to:

## Make hummingbird food

Combine 4 cups water and 1 cup sugar in a pot and stir until sugar is dissolved.



Stir regularly as you bring water to a boil, then remove from heat.



Cover pot and allow to cool, then pour into hummingbird feeder.



Hang your hummingbird feeder in a quiet spot where the hummingbirds won't be disturbed.



## What's the buzz?

### Hummingbird fun facts

- The ruby-throated hummingbird is the most common hummingbird in Missouri. These migratory birds are seen in Missouri from May to September, then they fly to Mexico and South America for the winter.
- These tiny birds don't take up much space — their nests are half the size of ping-pong balls!
- But don't be fooled by their small size. Hummingbirds have huge appetites. They drink eight times their bodyweight in nectar each day.
- Hummingbirds can't smell, so they rely on their sight to find food. Bright red and orange flowers like Indian Pink, Columbine and Butterfly Milkweed are good for attracting hummingbirds.
- Hummingbirds are amazing flyers! They flap their wings an average of 53 times per second, which allows them to hover over the flowers they feed from. They also can fly backward and even upside down!
- If you want to attract hummingbirds to your yard, you should fill a red feeder with sugar water.

# Bats

They might be easy to overlook because they come out at night, but bats also play a big role in pollination of tropical and desert plants— and in their ecosystems! There are 14 bat species in Missouri. Here are some you might see flying around Columbia:

## Big Brown Bat

If you encounter a bat in Columbia, it's very likely to be a big brown bat. This species eats beetles, so it has large teeth that allow it to crunch through hard beetle shells. These are the largest bats you'll find living in Missouri caves, but they've also learned to live in people's barns, attics and porches. Despite the name, they are not really very big — the largest are about the size of an iPhone.



## Eastern Red Bat

Eastern red bats are a hibernating species, meaning they fly south for the winter so they can keep hunting their favorite food — moths. In the summer, this species roosts in the tops of oak and maple trees, where it hangs on to the ends of leaves, which means they are pretty light. Most weigh as much as two nickels. These clever animals have learned to use human inventions to help them hunt. Moths are attracted to street lights, and so the eastern red bat often can be found in neighborhoods or city parks.



## Eastern Pipistrelle

Also called the tri-colored bat, the eastern pipistrelle usually is yellowish or pale reddish brown in color. They have small ears and are 3 - 3 ½ inches long with an additional tail length of 1 ½ to 1 ¾ inches. In the summer, they roost in trees and in crannies in cliffs or buildings. They primarily eat insects.



## Gray Bat

Gray bats are the largest of the myotis, or mouse-eared bats. Their bodies are only about 3 inches long, but they have a wing span of 10 - 12 inches. Gray bats are insectivores, and they mostly eat “on the wing,” or while flying. Gray bats once flourished in Missouri’s limestone caves, but today they are an endangered species.

Other bat populations in the United States are declining, too. Some causes include habitat loss; white-nose syndrome, a fungal disease brought over by humans traveling from Eurasia; and deaths caused by wind turbines.

## Fact or Fiction: Bat Edition

There are a lot of myths about bats. Here’s a look at what’s true and false.

### **Bats are flying mice.**

Actually, they aren’t even related to mice. Bats have much more in common with primates — including humans! — and lemurs. Bats are the only flying mammal in the world, and baby bats — called pups — can start flying as soon as five weeks after they are born.

### **Bats are vampires.**

Well, that’s partially true. There are three species of vampire bats, but they do not attack humans or drink our blood. Instead, they suck the blood of sleeping animals, such as cattle or sheep in a pasture. The rest of the world’s bat species live on insects, fruit, nectar and pollen. Many of the insects bats eat are harmful to Missouri crops such as cotton and corn. In addition to helping protect the food we eat, bats provide food to other animals — bat poop, also called guano, helps feed many of the other animals found in caves.

### **Bats are blind.**

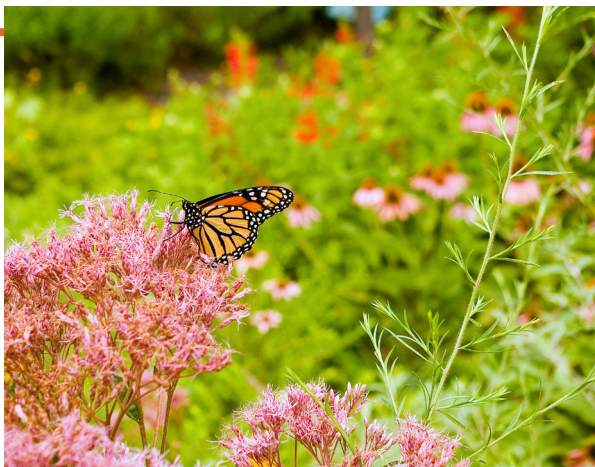
Not true at all. Most bats see at least as well as humans. However, because they fly at night, they have to use their other senses. Bats navigate and find their food through echolocation. They make a high-pitched noise and then listen to hear how long it takes for the sound to bounce back to them.

# Butterflies

Butterflies are another pretty pollinator. In Missouri, there are about 200 butterfly species. Here are a few common types:

**Viceroy**s, which have black and orange wings, look very similar to monarchs. You can tell them apart by looking for a line that crosses the black hindwing and a row of white spots in the black wing margins.

**Sulphurs** are medium-sized butterflies that can be yellow, orange, white or neon green.



**Monarchs** are large butterflies with black and orange wings. They eat only milkweed, and many Missourians have started planting milkweed to encourage monarch population growth.

**Swallowtails** are recognizable by the long tails on their bottom wings. The Eastern Tiger Swallowtail is a large butterfly. They often are yellow with black tiger stripes, but can also be black and blue.



# How to:

## Build a butterfly garden

First, choose a spot that gets plenty of sun but isn't too windy. Trees or shrubs will provide butterflies with a place to get out of the wind, which makes it easier for them to explore. You'll also get more butterflies if you provide some sort of water feature such as a puddling station.

Next, choose an assortment of plants that butterflies like. Butterflies love bright colors and flowers with plenty of pollen and nectar. Some of their favorites are:

- Butterfly Weed
- Blazing Star
- Purple Coneflower
- Asters
- Joe Pye Weed

You also should choose some plants for butterflies to lay their eggs. We refer to plants butterflies lay their eggs on as "host plants," and some butterflies will only use certain plants. Some good choices are:

- Milkweed
- Hackberry
- Parsley
- Spicebush
- Pawpaw

While we tend to think of gardening as a summer activity, a butterfly garden should have plants that bloom in the spring and fall as well. Monarchs lay their eggs in the spring and migrate in the fall, and they need fuel! Other species do not migrate and so will need cover to hibernate.

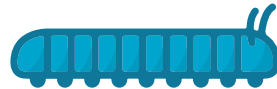
If you're just starting your butterfly garden, it might be a while before you have enough flowers to feed a kaleidoscope of butterflies, but you can use over-ripe fruit from your kitchen as a food and nectar source for them. If you're just starting your butterfly garden, it might be a while before you have enough flowers to feed a kaleidoscope of butterflies, but you can use over-ripe fruit as a food and nectar source for them. Just cut it up to allow the butterflies easy access to the fruit's juices.

## Butterfly Life Cycle

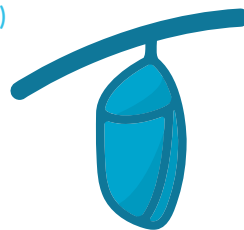
### 1. Egg



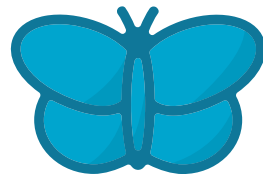
### 2. Larva (Caterpillar)



### 3. Pupa (Chrysalis)



### 4. Adult (Butterfly)



# How you can help

Now that you know how important pollinators are to our day-to-day lives, you might be wondering what you can do to help them. Fortunately, there are a number of things to do to help. Here are a few ideas:

**Plant pollinator gardens.** Choose flowering plants pollinators like, such as blue wild indigo, wild hydrangea, blazing star, bee balm, foxglove beardtongue and showy goldenrod. Trees also are important for pollinators. Oak, blueberry, maple and elm tree leaves are favorite foods for many butterfly and moths. Don't forget a water source!

**Provide nesting areas for pollinators.** Butterfly gardens, bird houses, bat houses and bee hotels all make great homes for pollinators.

**Buy local food** — especially honey — at the farmers market. Many local farmers know how important pollinators are, so they make efforts to use fewer chemicals — if any at all — and plant pollinator-friendly plants in their fields.

Tell your friends and family how important pollinators are!









Mizzou Botanic Garden

University of Missouri