

xerces
Society
presents

X KIDS AND THE Incredible Invertebrates



Become an X Kid!

This book belongs to:



Protecting the Life that Sustains Us

The Xerces Society protects the natural world through the conservation of invertebrates and their habitats. Our vision is a healthy environment for all and we contribute to this through our programs that focus on pesticide reduction and the conservation of pollinators, endangered species, and aquatic systems.

To learn more, visit xerces.org or follow us @xercessociety on Twitter, Facebook or Instagram.

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What is an X Kid?

An X Kid uses their superpowers to protect incredible animals called invertebrates. To protect means to take care of, look after, and stand up for what you value. Together, X Kids and invertebrates use their superpowers to help save the world.

How can you become an X Kid?

Step 1: Go on an adventure with Blue the butterfly to meet other invertebrates and learn about their superpowers.

Step 2: Complete the **Xperience** activities along the way.

Step 3: Submit your pledge to help invertebrates and get your X Kids badge!

Hint: This should be completed when the weather is warm enough to be outside and observe a variety of invertebrates.



A note to teachers, parents, and guardians

Kids can do this activity book on their own, but it can also be done with the help of an adult or in a group setting. Each activity acts as its own chapter and can be done in isolation from the rest of the book. Please note that all activities must be completed in order to earn a badge.



Hello!

My name is Blue and I can't wait to introduce you to my incredible invertebrate friends!

Maybe you're wondering—what is an invertebrate? An invertebrate is an animal without a backbone, like me!

Some invertebrates have an exoskeleton, a hard covering that supports and protects their bodies from the outside, instead of having bones that support their bodies on the inside. Like an ant! Other invertebrates have shells, like clams and snails, and others are soft all over, like a worm or a slug!



ant



earthworm



clam



slug

You might be thinking of insects like bees, ants, flies, and beetles, which is great! However, although many invertebrates are insects, not all are. Here are a few examples: spiders, crabs, sea stars, octopuses, and squid.



spider



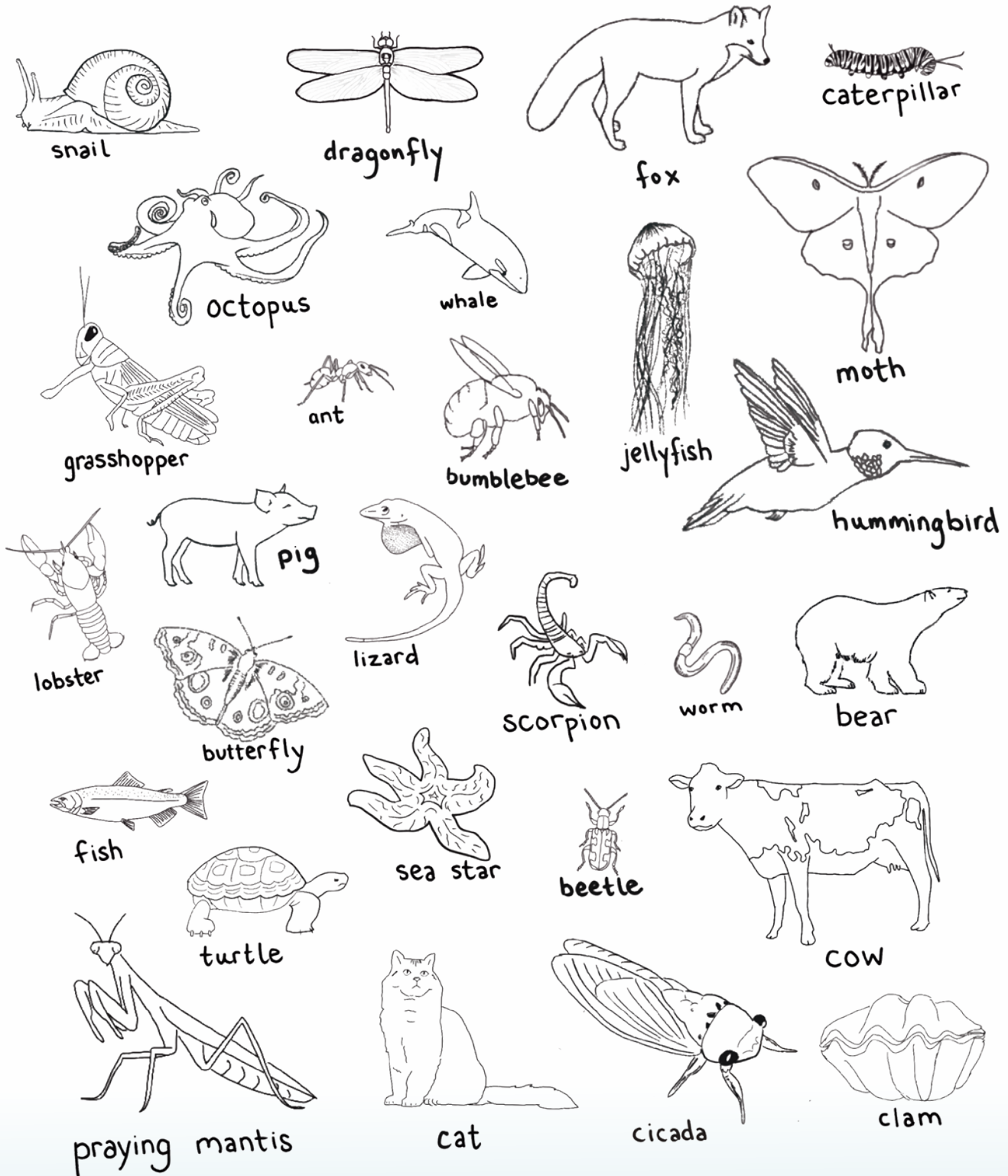
snail



crab

There are many different kinds of invertebrates in the ocean, in the forests, on farms, and in parks and backyards. **About 97% of all animals on the planet are invertebrates!**

Xperience: Which of the animals below are invertebrates? Circle or color them in. Remember—invertebrates don't have a backbone!









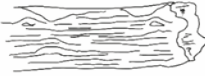





Invertebrates are small in size but have unique abilities that help support our big, beautiful world. These special abilities, called **superpowers**, are not limited to invertebrates. In fact, you have superpowers, too—and we could really use them! Join me as I go to visit my incredible invertebrate friends and discover your own superpowers along the way!

First, let's start in your neighborhood. Whether you live in a big city, the suburbs, on a farm, or a small town, invertebrates are everywhere! In order to find them, use one of your superpowers—your **senses**! Your senses (touch, sight, hearing, smell, and taste) allow you to discover and explore the natural world.

Xperience: Take 30 minutes to go outside and explore your surroundings. Use the bingo board below to help guide you. To get bingo, you need to connect four squares on the board or get them all for black out! Fill in the free spaces with whatever you want. Be sure to put back anything you move!

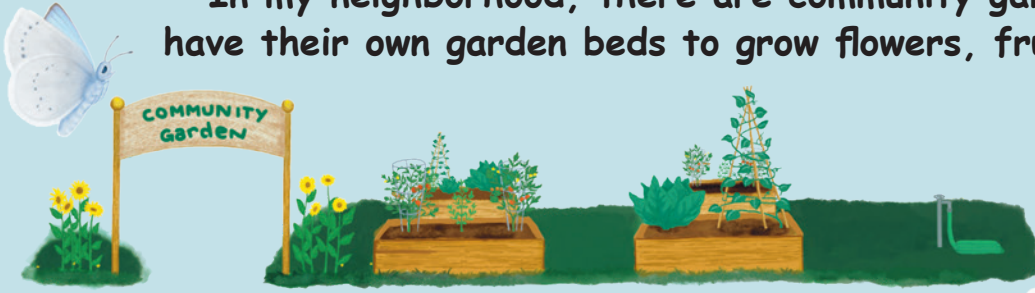


NATURE BINGO

 spider web	 bee	free space	 eaten leaf
 tree	free space	 flower	 fly
 fallen tree or log	 ant	 rock	free space
free space	 worm	 water	 beetle



In my neighborhood, there are community gardens, where people have their own garden beds to grow flowers, fruit, and vegetables.



Do you hear that buzzing sound? It's my friend Blossom the bumble bee!

Bees have a very special and important role in our world.

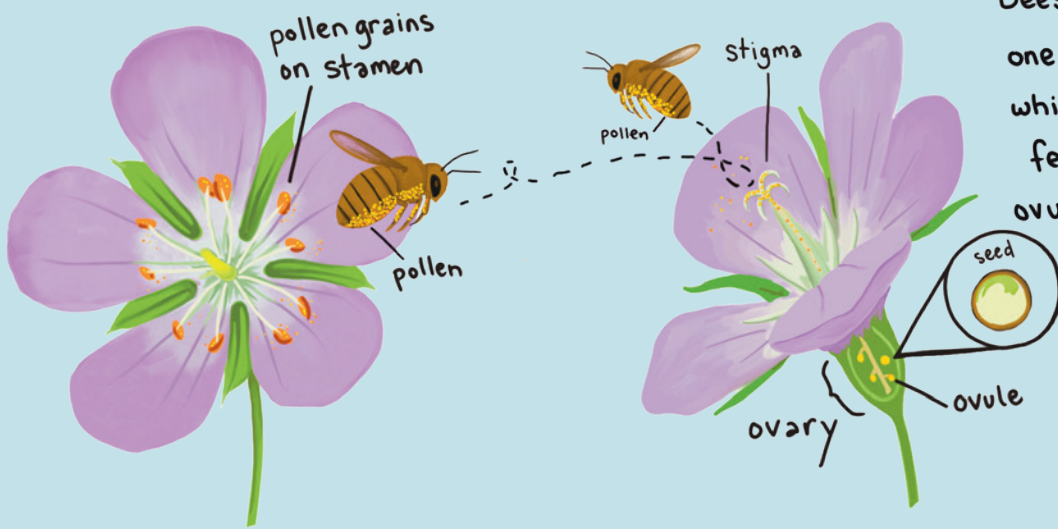


Their superpower, **pollination**, allows for the reproduction of many of the fruits and vegetables we love! By moving pollen from one flower to another, bees make it possible for plants to produce fruits, vegetables, and seeds (see illustration on the next page).

In fact, some of your favorite foods, like strawberries, apples, pumpkin, and more, come from plants pollinated by bees!

Did you know? A few types of bees, including bumble bees, have a special superpower called **buzz pollination**. Buzz pollination is when the female bee grabs the pollen-producing structure of the flower in her jaws and vibrates her wing muscles to release pollen that is trapped inside. When a bee buzz pollinates, it shakes pollen out of the flower like salt out of a salt shaker! Blossom is about to do that here to this tomato plant! Other foods like blueberries and peppers also benefit from buzz pollination.

Pollination



Bees move pollen from one flower to another, which results in the fertilization of the ovule, creating a seed!

Bees are the best pollinators because unlike other flower visitors, which are usually visiting flowers to drink their sugary nectar, female bees purposefully collect pollen from flowers to feed their young. Female bees even have special structures and specialized hair on their bodies to carry pollen. **Can you find where the bumble bee Blossom and the bee above carries her pollen?**

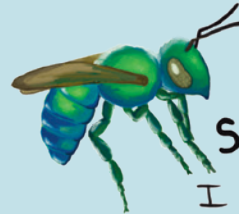
You might have heard of honey bees and bumble bees before, but there are over 4,500 different species, or types, of bees in the US, Canada, and Mexico!

Sweat Bee



I'm named for craving sweat and might land on you, but please don't swat at me!

Metallic Sweat Bee



I build my nest in the ground like 70% of native bees!

Blue Orchard Mason Bee



Some bees in my family build their nest with mud, giving us the name "mason" bee.

Mining Bee



We are very gentle bees. In fact, we are nicknamed the "tickle bee" because you can hold us and our feet will tickle you as we walk on your hands!

Leafcutter Bee



I use leaves to line my nest. I cut leaves better than scissors!

Xperience: Now it is time for you to use your superpower of **detection!** First, go outside and find a patch of flowers with bees. Hint: find a patch of flowers in the sun. **Worried about getting stung?** Bees rarely sting people unless they are concerned for their safety. If you move slowly near bees, they will probably ignore you! In fact, male bees don't even have a stinger!


Find a patch of flowers with a few bees. Pick a bee; observe it, then answer the questions below. Pick another bee and repeat.

Tip: To keep from scaring off the bees you're trying to watch, make sure your shadow doesn't fall onto the flowers they are visiting. Try to keep still—a bee might fly off if it sees you making sudden moves or getting too close!


	Bee #1	Bee #2	Bee #3
What color is the bee?			
What size is the bee compared to your fingernail?			
How many flowers did the bee visit?			
Were all the flowers the same color?			
Did you see any pollen on the bee? If so, where on the body was it?			
Draw your bee.			

What are the similarities between the bees? What are the differences between the bees?







Now, we are going to visit a local farm where I will introduce you to two of my special friends!



This is Pulp the paper wasp and Dots the lady beetle. You might be wondering why they are together, what could they possibly have in common? Well, it's their superpower! They are busy using their superpower right now. Can you guess what that is?





Can you tell what Pulp and Dots are eating?



It's **predation**! Predation means that they eat other insects! Aphids, beetle larvae, some small caterpillars, and mealybugs are a few of the insects that damage crops and important plants.

By eating these harmful bugs, wasps and lady beetles save plants from being destroyed! Because of this superpower, wasps and lady beetles are known as beneficial insects.

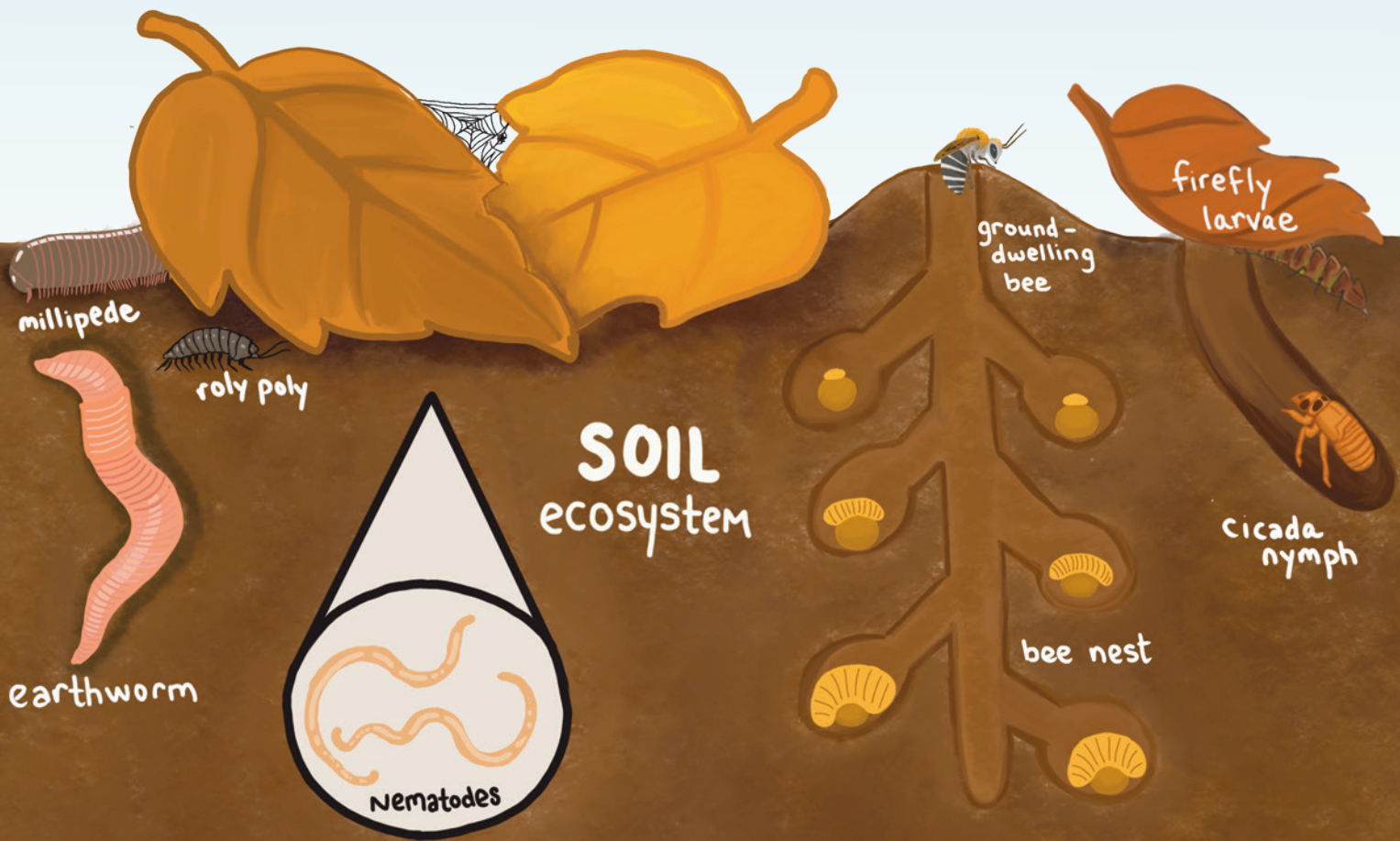


Did you know? Like other lady beetles, Dots was born with a specific spot pattern on their wing covers. That pattern is often helpful in identifying different species or kinds of lady beetles!

Beneficial insects are a great alternative to insecticides (a type of pesticide). Insecticides are chemicals used to kill unwanted insects, but these chemicals also harm insects like bees and butterflies—and I'm a butterfly! Pesticides also get into our rivers and oceans, which can harm aquatic animals (animals that live in water), most of which are invertebrates. **Why use chemicals when Pulp and Dots can get the job done for us?**

Beneficial insects can be found everywhere, even in your own community. They are an important part of many ecosystems. An ecosystem is a community of organisms that interact with one another and their physical surroundings. An organism is a living thing (like plants, animals, and fungi). Each ecosystem has a variety of different plants and animals, all playing an important role. There are many different types of ecosystems such as forests, streams, and deserts. **You might notice that each of my friends lives in a different ecosystem.**

Can you find all the organisms in the ecosystem below?



Xperience: It is time for you to use your superpower of **discovery!** Choose an ecosystem in your community. It can be as big as a forest or stream, or as small as a garden, a yard with a few plants, or even a single tree! Use the questions below to help draw your ecosystem. Spend at least 10 minutes observing your ecosystem.

- Is there water (a puddle, a pond, dew, a stream)?



- Is there vegetation (trees, flowers, grasses, shrubs, vegetables, fruits)?

- Are there animals (invertebrates, mammals, birds, people)?



- What are the animals doing? How are they interacting with each other?

Draw your ecosystem below. Label important features.

What role do you think the invertebrates play in your ecosystem? Write down some ideas about how they may interact with other invertebrates, other animals, plants, and even humans.



Let's get out of the sun and head over to that forest stream for some shade.

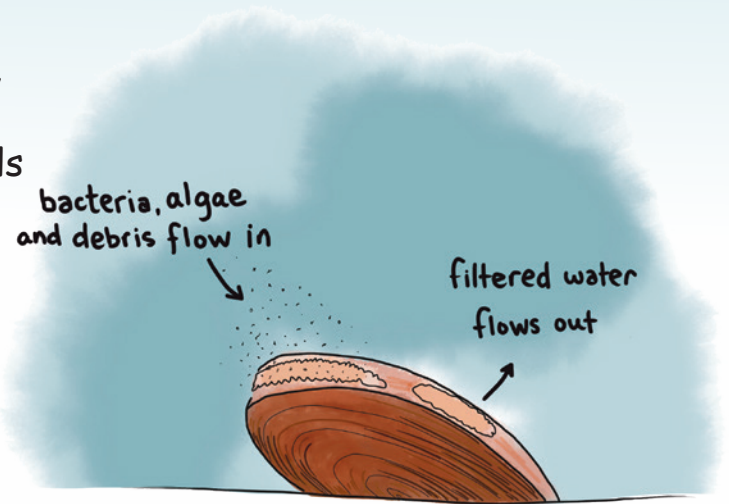


Look in the water! That is my friend **Bubbles the freshwater mussel**. Insects are not the only invertebrates. Bubbles is an example! Mussels are bivalves, meaning their shell is made up of two parts or valves. Can you see how Bubbles' shell is open? Inside their shell are their soft body parts. Mussels have no head, eyes, ears, arms, or legs—but they do have a foot! That's right, a single foot, which they use to move around and dig into the stream bed.



You must be wondering how freshwater mussels eat or breathe if they don't have a head! Look at Bubbles. Do you see the two wide openings coming out of the shell? One has ruffles and the other is smooth. Bubbles uses the ruffled opening to bring in water filled with yummy plankton (tiny animal and plant organisms). Once inside the shell, the water runs over their gills which absorb oxygen and capture the plankton, and the remaining water goes back out through the smooth opening.

But wait! Mussels don't just capture food, they can also remove algae and bacteria, even heavy metals, silt, and other materials which are harmful to our rivers. This is Bubbles' superpower—**water filtration!** Mussels filter our rivers, making them cleaner and safer for other animals and for us. Pretty amazing that so much is going on in that shell.



Xperience: Now that you have learned about water filtration in nature, let's see if you can create your own water filter by using your superpower of **experimentation!** You might need an adult to help you.

Experimentation is part of the scientific method, a process used by scientists to better understand the natural world. The scientific method has six steps that you will need to use in order to find the best water filter. **Follow the directions below and answer the questions.**

What you will need:

- A large container for water (a bottle, pitcher, or bucket) (A).
- Three clear cups or jars for catching water (B).
- Three rubber bands, ribbons, or ties to attach filters to the cups or jars (C).

Step 1: Question: The purpose of this experiment is to answer the following question: What material around your home or community would work best to filter water like a freshwater mussel?

Step 2: Gather information: What materials can you find around your home or community that would work as a filter? **Look around and choose three materials.** Here are a few suggestions: wax paper with small holes, a coffee filter, a sock, a washcloth, a paper towel, or a napkin.

List your three materials:

-
-
-



Step 3: Hypothesis: An educated guess based on the information you have. **Out of the three materials, which one do you think will work best? Why?**

Step 4: Experiment: Test your hypothesis!

1. Fill your large container (A) with three cups of water and add dirt and crushed up leaves.
2. Place your filters over each of the clear cups or jars so that the filter creates a cup shape and can hold water (B) and attach them with your rubber bands, ribbons, or ties (C).
3. Slowly pour one cup of the dirty water over each filter.

Step 5: Observation: Look to see what happened. **Look at the water in the three cups or jars. Rate each filter from 1 to 3 from lightest to darkest and write the results below:**

Filter:

Rating:

Filter:

Rating:

Filter:

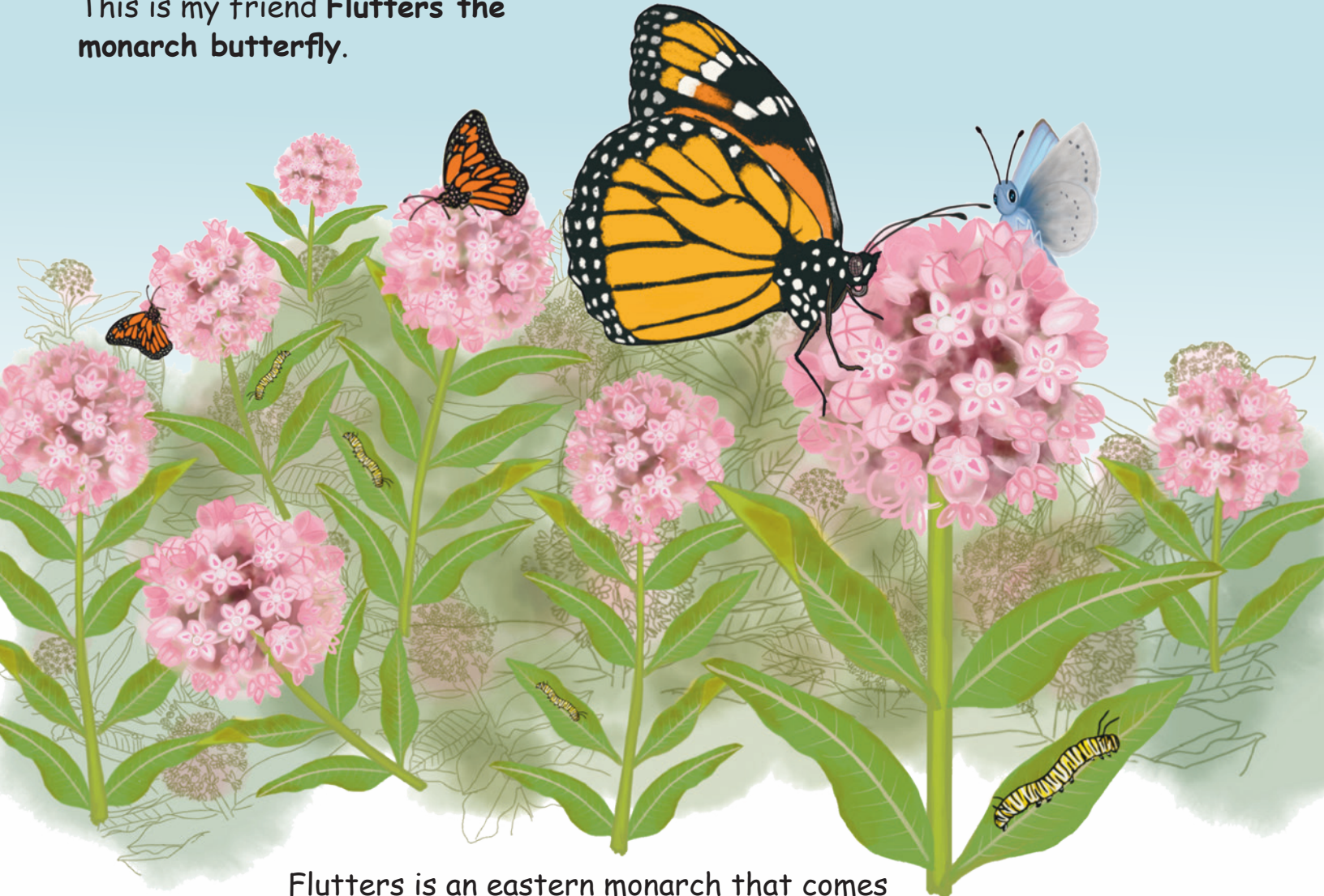
Rating:

Step 6: Conclusion: What did you learn? **Which material had the cleanest water (rating of 1)? Did you expect this filter to work the best? Why or why not? What did you learn from doing the experiment?**



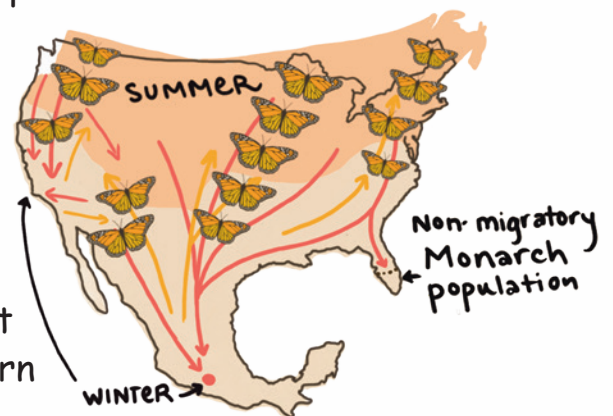
It feels good to be back in the sun. Look at those beautiful flowers. Oh, I think I saw one of my friends! Let's go say hi and see what they're up to!

This is my friend Flutters the monarch butterfly.



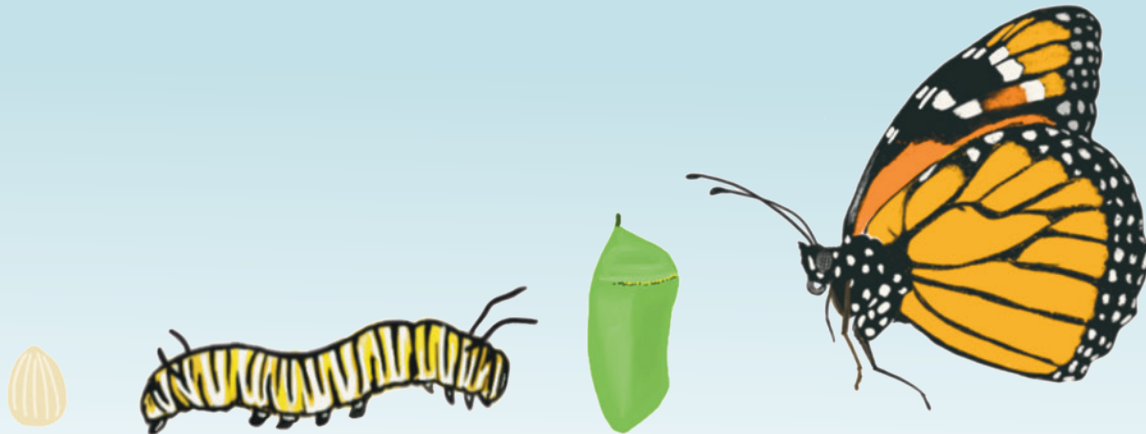
Flutters is an eastern monarch that comes from generations of monarchs who make a journey to Mexico every year, sometimes up to 3,000 miles! Eastern monarchs spend the winter in Mexico to escape the cold weather in the US and Canada. When the weather warms, they leave Mexico and fly north to their breeding grounds. Some monarchs will fly as far as Canada!

There is another population, known as western monarchs, that spends the winter along the coast in California and migrates back across the western US and parts of southern Canada to breed.



Monarchs and other butterflies begin their life as an egg. The **egg** hatches into a tiny, soft-bodied **caterpillar**, eating leaves and growing until it forms into a **pupa or chrysalis**. The chrysalis is the mummy-like stage where it completes its transformation into a winged **adult**.

Can you label the stages of the butterfly life cycle below?



Like other insects, butterflies are prey (a food source) for many different animals. In order to protect themselves, butterflies use a variety of methods such as looking like other animals (mimicry), blending into their surroundings (camouflage), and the use of toxins (chemical defense). These methods are a butterfly's superpower—**self-defense!**

Monarchs (adults and caterpillars) use toxins for defense—their bright colors warn predators that they taste nasty. **Are Flutter's' colors bright? Can you find the colorful monarch caterpillars by Flutter's?** Monarch caterpillars get their toxins from milkweed plants, which is the only group of plants that support their full life cycle. Milkweed plants contain toxins called cardenolides that are poisonous to most animals but not to monarchs. In fact, monarchs are able to store these chemicals without any harm to themselves. These stored toxins make monarchs taste horrible to birds and other predators.

Did you know? Monarchs are an important part of Mexican culture, because to some people, monarchs represent the souls of their ancestors. When monarchs arrive in the fall, it coincides with Día de Muertos (or Day of the Dead), a celebration of those who have passed.

This is a viceroy butterfly. It mimics a monarch to trick its predators, such as birds, into thinking it tastes bad, but it doesn't! What an interesting butterfly!



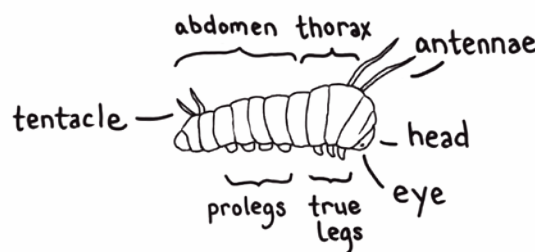
Viceroy



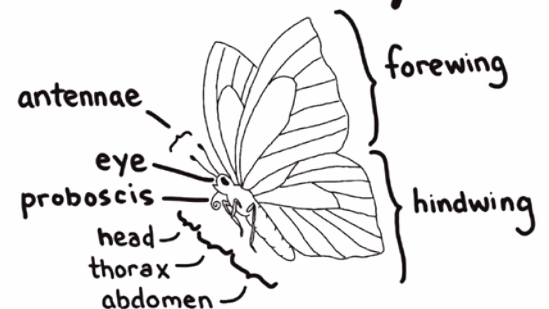
Monarch

Xperience: Imagine if you were a butterfly and had to protect yourself. Would you be bright colors or blend into your surroundings? Would you look like another animal? Use your superpower of **creativity** to think like a butterfly and create a new species. Use the space below to invent your own butterfly and caterpillar.

Caterpillar



Butterfly



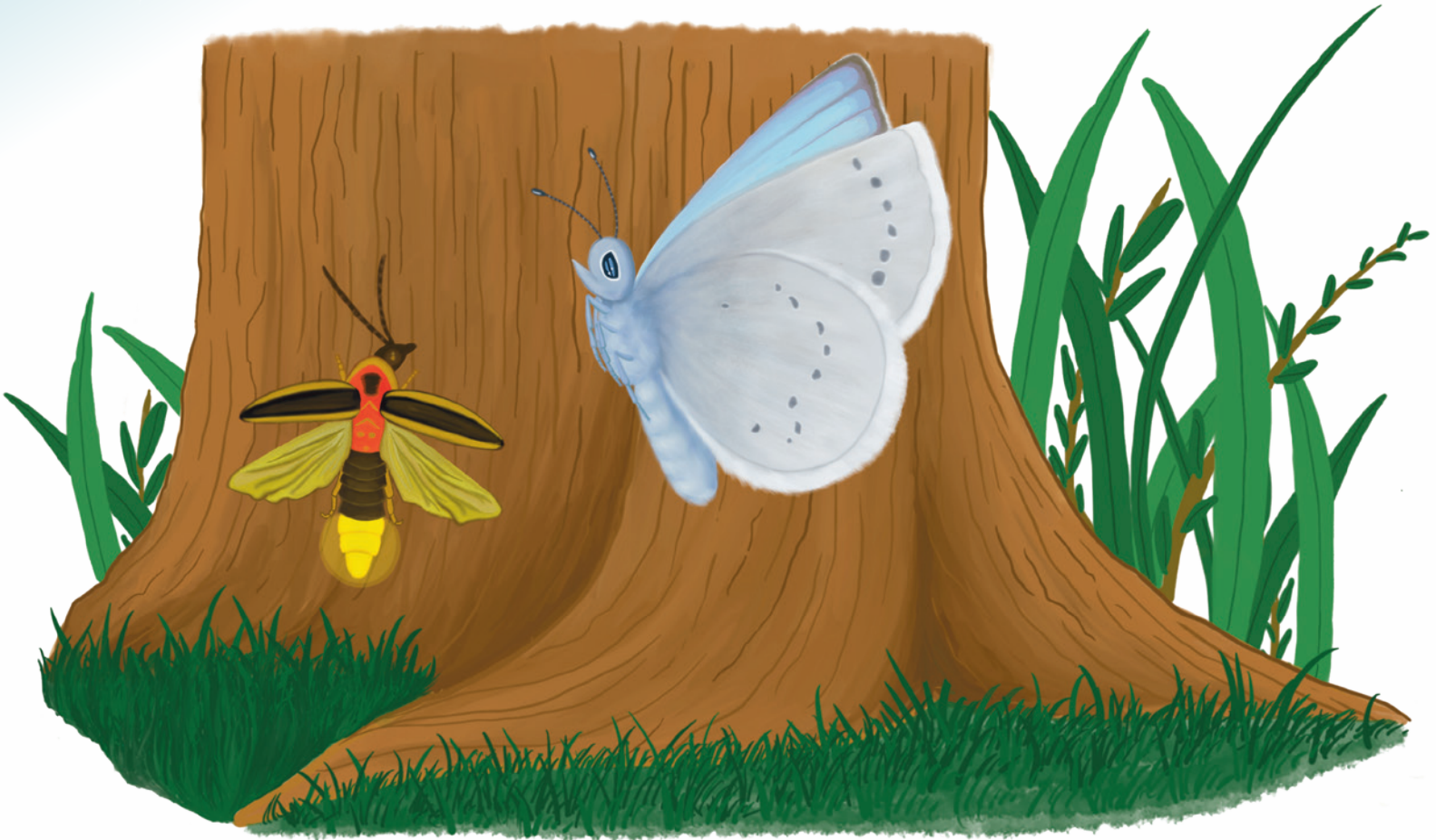
Did you know? Female butterflies lay their eggs on or near the plants that the caterpillars can eat. To find the correct plant, female butterflies use their feet! No, they don't walk, but butterflies have sensors on their feet that allow them to 'taste' the plant. Can you imagine if you tasted with your feet? What would you stand on?





The sun is going down quickly and I see lights in the forest. I wonder if we will find my friend!

Hey, it's Lumine the firefly!



You might think that fireflies are flies but they are actually a type of beetle, and although they are known for their ability to flash light, not all of them do! There are three types of fireflies: daytime dark fireflies, which are active during the day and do not produce light; glow-worms, whose flightless females produce long-lasting glows; and flashing fireflies (also known as lightning bugs), like Lumine, which are known for their quick, bright flashes.



Did you know? Different species of fireflies use different colors of light, ranging from red, to yellow, to green!

Lumine has a special superpower—**bioluminescence**! Bioluminescence is a chemical reaction that produces light. Flashing fireflies store a substance called luciferin in special cells inside their abdomen. When flashing fireflies take in oxygen, it combines with luciferin and produces light! **Can you see where the light is coming from on Lumine?**

Fireflies use their light to communicate. Lumine is currently flashing to attract a mate. In fact, every species of flashing firefly has a distinct pattern of flashes and some flash in sync with each other (at the same time). If you have fireflies where you live and the temperature outside is warm, go outside when it starts to get dark and see if you can determine the flashing pattern of those fireflies!

Just like fireflies, all invertebrates communicate. There are four different types of communication: chemical (taste and smell), visual (sight), tactile (touch), and auditory (hearing). Invertebrates use communication to find food, defend a territory, find a mate, signal alert, and identify members of the same species. It is important for invertebrates to communicate in order to survive.

Xperience: Go outside and take 10 minutes to look around and listen. How are animals communicating with each other? Do you hear any noises? Do you see any interactions? Hint: observe a few different insects on plants or listen for animals at night. What do you think they are trying to communicate? If you are unable to go outside, use a window and stay inside.

Write your observations here:

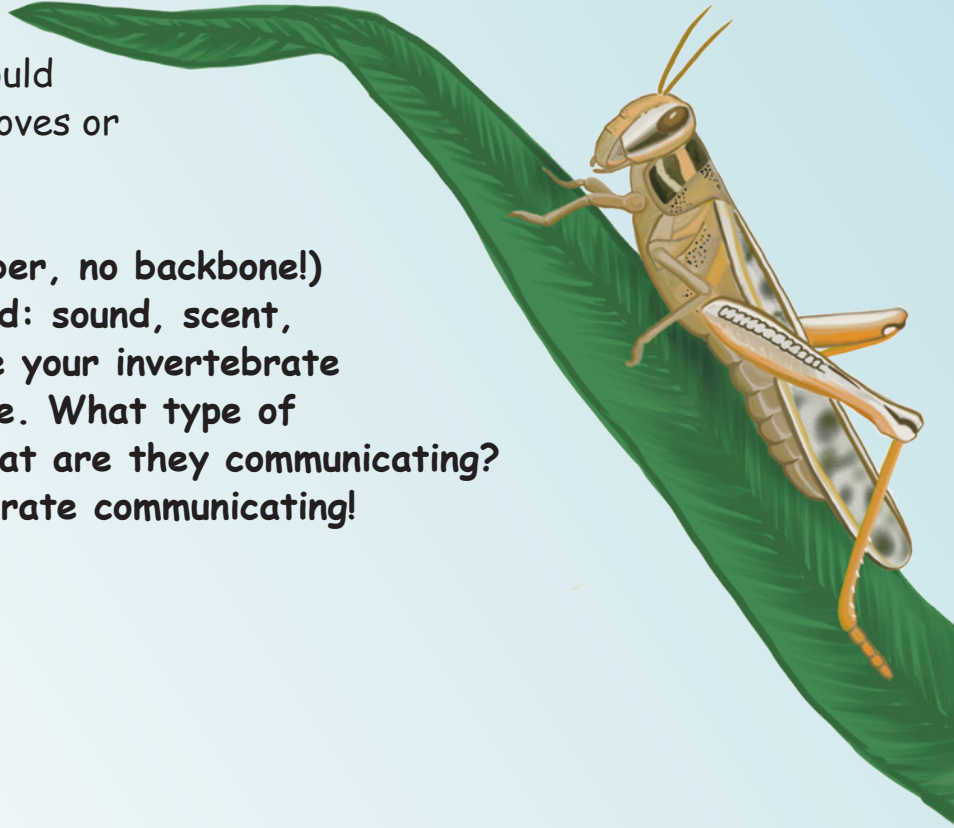


Xperience: Now use your superpower of communication!

If you were an invertebrate, how would you communicate? Would you use light or make sounds? Would you move your body with dance moves or use a chemical?

Choose an invertebrate (remember, no backbone!) and pick a communication method: sound, scent, sight, taste, or touch. Describe your invertebrate below and how they communicate. What type of communication do they use? What are they communicating? Feel free to draw your invertebrate communicating!


grasshopper



Did you know? Male grasshoppers communicate by rubbing their hind legs against their wings to make a chirping sound; cicadas use a special organ called a tymbal, made up of ridges that click when they flex their stomach muscles; beetles use chemicals called pheromones to communicate.

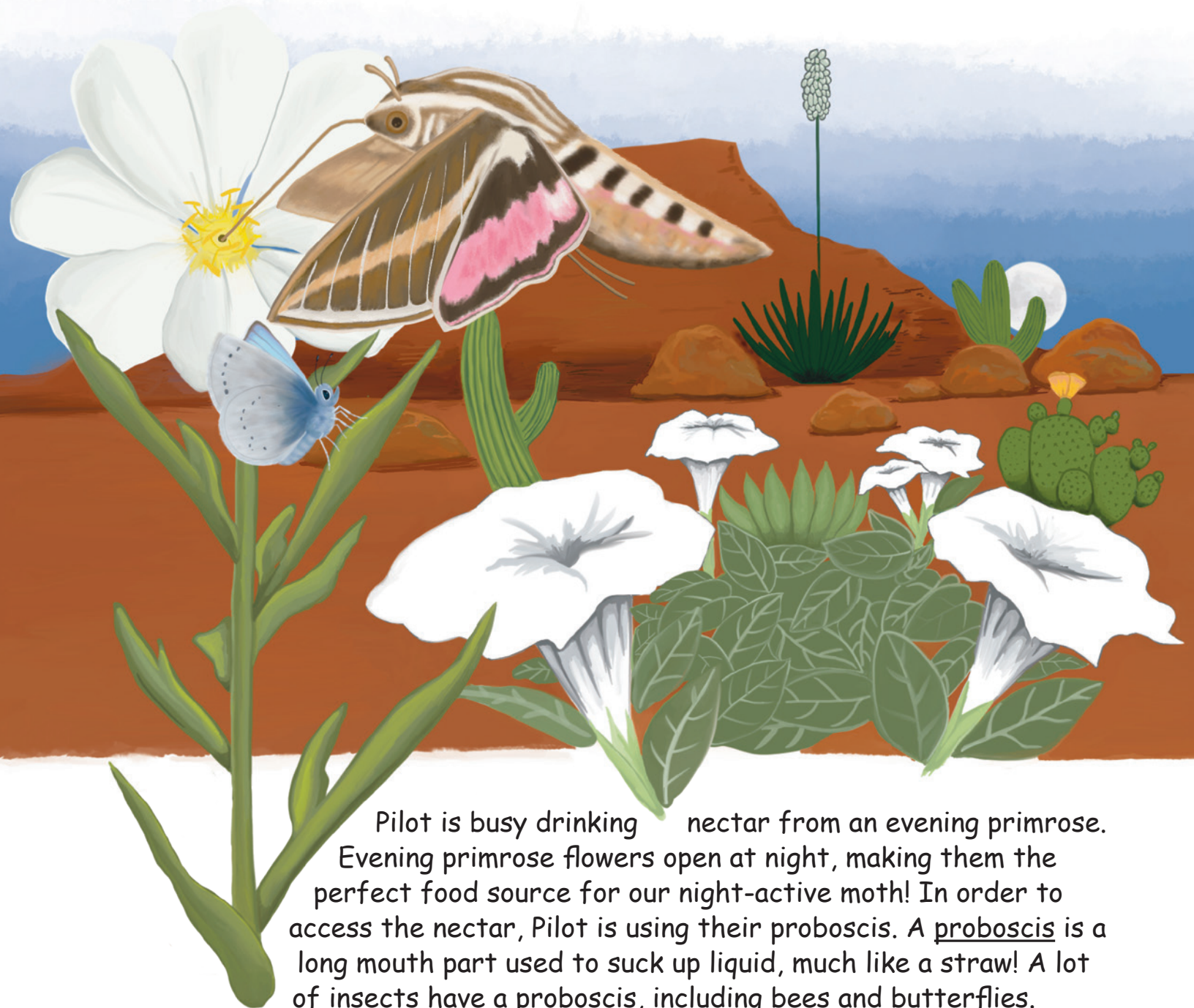


burying beetle



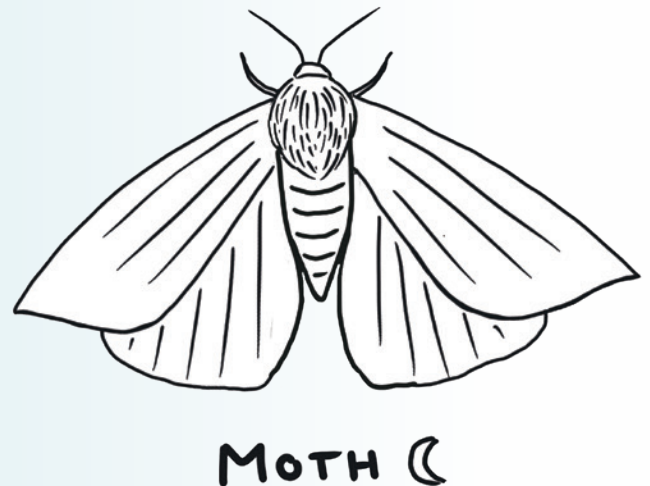
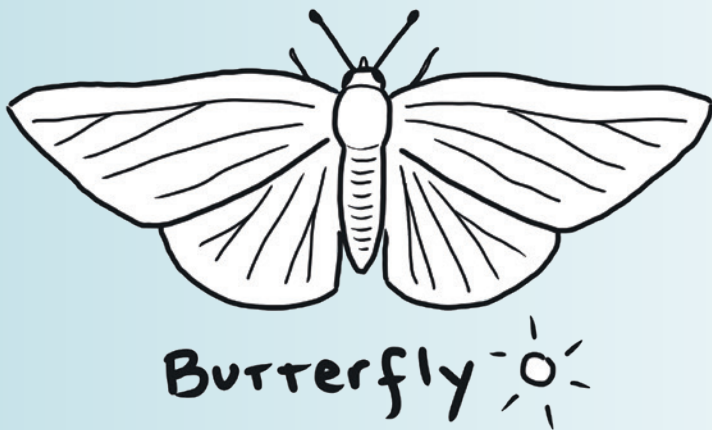
The sun should be coming up soon, we need to find one of my friends that is typically active from dusk to dawn, when it starts to get dark to when it starts to get light. Animals that show this behavior are called nocturnal.

Meet my friend, Pilot the sphinx moth!



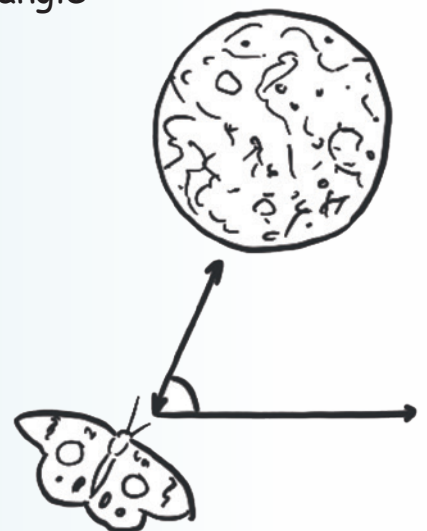
Pilot is busy drinking nectar from an evening primrose. Evening primrose flowers open at night, making them the perfect food source for our night-active moth! In order to access the nectar, Pilot is using their proboscis. A proboscis is a long mouth part used to suck up liquid, much like a straw! A lot of insects have a proboscis, including bees and butterflies.

Moths and butterflies are in the same insect order, Lepidoptera. Although they are related, they have some key differences. Butterflies generally have slender bodies and antennae with a club or knob at the tip, while moths generally have thicker bodies and antennae that are feathery (males) or slender coming to a point at the tip (females). Butterflies generally rest with their wings closed and are active during the day, but moths typically rest with their wings open and most are active at night (some are day-active). **Next time you see a fluttering insect that you think is a butterfly, look closely—maybe it's a moth!**



While moths may not be as colorful or well-known as butterflies, they have an incredible superpower—**moonlight navigation!** Navigation refers to how moths are able to find their way through the night or go in a specific direction. In order to navigate, moths use the moon! By flying at a consistent angle to the moon, moths can fly in a straight line without getting disoriented. This also explains why moths get disoriented by artificial light, like outdoor lights around houses! Because artificial lights are so close by, maintaining a consistent angle means the moths go in circles.

Did you know? There are almost 11,000 species of moths in the United States. As a comparison, their relatives, the butterflies, have more than 800 different species in the US. That is a lot of moths—more than all bird and mammal species combined!



Xperience: If you have ever observed lights outside at night, you may have noticed a flying visitor—a moth! Scientists are not sure why, but moths are attracted to artificial light. Let's use your light to see if we can attract some moths and your superpower of **observation** to learn about them!

What you will need:

- A light (a flashlight, electric lantern, or other light source)
- A white cloth (bed sheet, pillow case, tablecloth, paper towel, or towel)

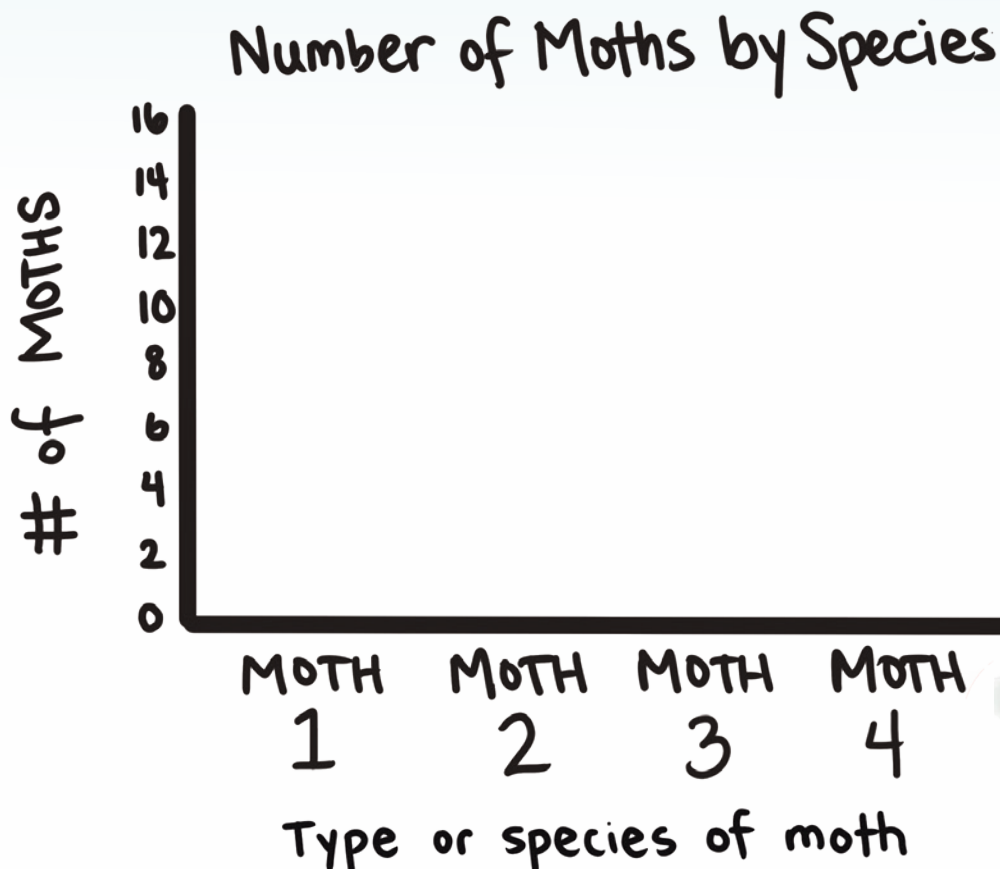
* If you do not have the supplies above, observe an outdoor light, from a safe location where you can be close enough to see any moths that fly to it.

Step 1: Find a time when the weather is warm, preferably late spring to early fall. When it gets dark, take your light and linen and find a safe space to sit outside.

Step 2: Put the light under the cloth so that the light shines through.

Step 3: Wait and watch for the moths to come!

How many different types of moths do you see? This indicates diversity. How many of each type do you see? This indicates abundance. Use your observations to fill out the chart below.



Now that the sun has come up, let's head back to my home.

It looks like there are some people in the local park planting native plants! Native plants provide habitat for many different invertebrates. Habitat is a place where an animal has everything it needs to survive: food, water, shelter, and space. Creating habitat is one of the many ways to help me and my incredible invertebrate friends. In fact, loss of habitat is one of the reasons we are in trouble.

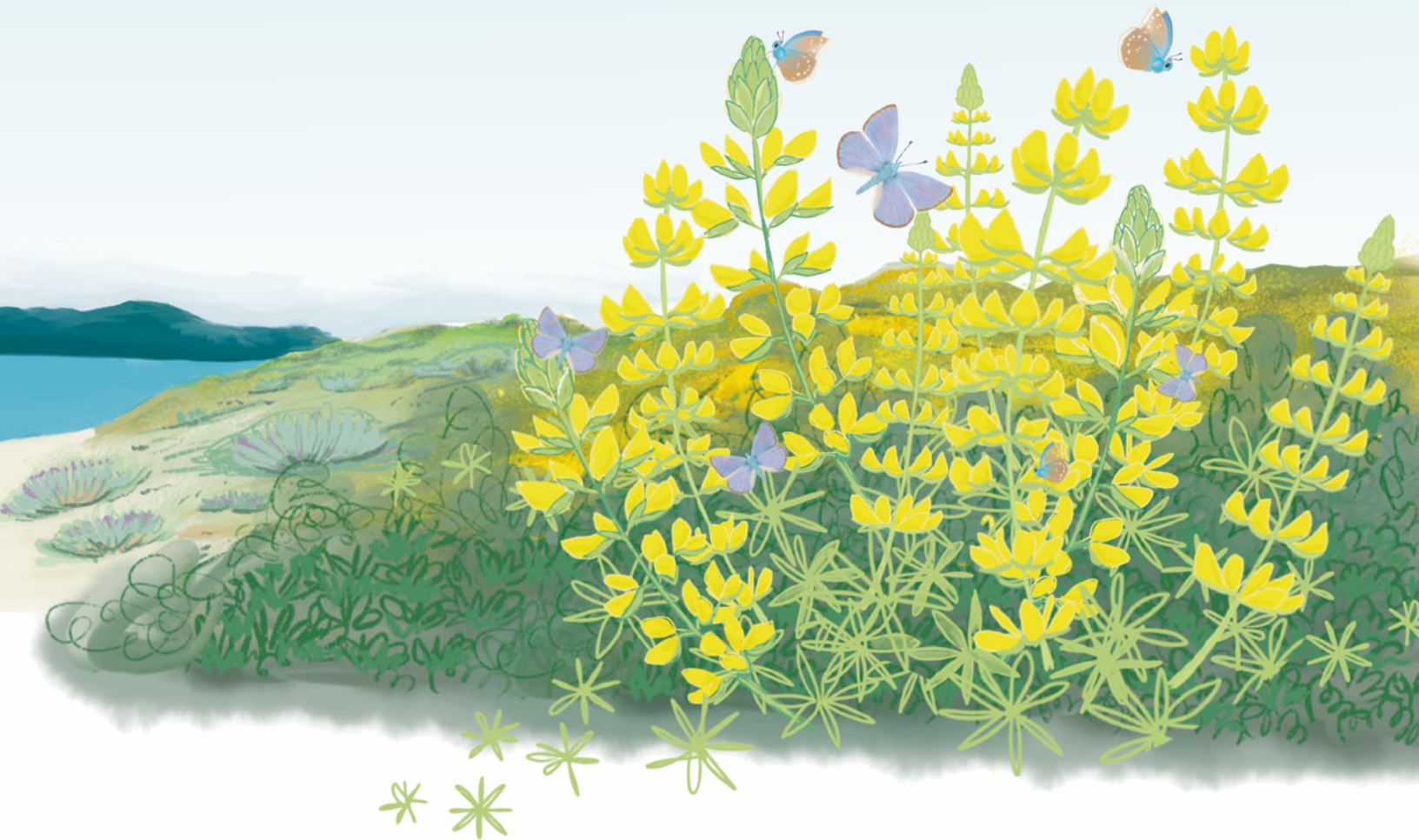


Xperience: Can you circle all of the places where invertebrates could find food or shelter? Hint: Where is the vegetation? Soil?



Many years ago, there was a butterfly that looked like me called the Xerces blue butterfly. Can you say Xerces, pronounced "zer-sees"? The Xerces blue butterfly lived in sand dunes on the edge of San Francisco in California and its caterpillars depended on specific plants growing there to eat. Over the years, the habitat got smaller as the city got bigger and eventually the butterflies no longer had the food and

shelter they needed to survive. The last Xerces blue butterfly was seen in the early 1940s. It was the first butterfly in the United States that we know of to go extinct (no longer existing) due to human activity.



While this story is very sad, it sparked the idea to start an organization of people to help prevent this from happening to other butterflies and their invertebrate friends. In 1971, named after the Xerces blue, the Xerces Society for Invertebrate Conservation was founded. The "X" in X Kid stands for Xerces. **As an X Kid, you will use your superpowers to help the Xerces Society save incredible invertebrates!**

Xperience: Part of being an X Kid is to use your greatest superpower—**action!** Below is a list of ways you can take action to help my (and your!) incredible invertebrate friends. You may need an adult to help you. **Choose any two of these actions to complete.** You can do more if you want!

Community Science is a way for people to contribute to science by collecting data. Anyone with a camera and access to a computer or a phone can do it!

- Bumble Bee Watch: Take a few pictures of a bumble bee and submit the photos at bumblebeewatch.org. You can also download the Bumble Bee Watch app on your phone.
- iNaturalist: Take a few pictures of a butterfly, a bee, a lady beetle, or other insect and submit the photos at inaturalist.org. You can also download the iNaturalist app on your phone.

Community Engagement is a way to encourage communities to get involved with conservation or get involved with what your community is doing. There are many ways to do this, here are a few!

- Bee City USA: Go to beecityusa.org and find the list of cities that are Bee Cities. Can you find your hometown? If it is on the list, write a letter to your local city council thanking them for being a Bee City. If it's not on the list, write a letter to your city council to encourage them to become a Bee City to help save the bees. For help with the letters, reach out to beecityusa@xerces.org.
- Volunteer: Look up local nonprofit organizations, parks, or wildlife refuges and see if there are any volunteer opportunities. You might be able to take part in plantings, trash clean ups, or data collection.

Outreach is all about getting the word out! Here are a few ideas, but you can also come up with your own.

- Tell a friend: Tell a friend about the X Kids program. If they are interested, send them to the website for more information: xerces.org/xkids.
- Present in school: Give a presentation on the X Kids program and what you learned to your class.
- Talk to your parent or guardian: Ask the adult in your household to plant a native plant! It can be in a pot outside, in your yard, or in your neighborhood. For information on what to plant go to xerces.org/resources.
- Share about X Kids on social media using #XercesKids
- Other:

Congratulations! You have completed the X Kids Program!
Thank you for taking this journey with me.

**Now, order your badge and let's continue the
adventure with all of our incredible invertebrate
friends!**



Have you completed the activities?
Get your badge today!
xerces.org/xkids

Now that you are a Xerces Kid, you are part of a community that works to save these important animals. Be sure to wear your badge and continue to use your superpowers, combined with those of your invertebrate friends, to save the world!



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If you loved X Kids, please support our work with a tax-deductible donation to the Xerces Society today!

Visit xerces.org/donate to learn more.