Garden Detectives

In search of something to do? Tired of being inside? Let’s go outside into the garden! Choose from our different categories of activities to get you ready to be a garden detective.

Plants
Animals
Environment
Scavenger Hunts
Coloring Pages
Crafts

Visit www.csuchico.edu/gateway and our Gateway From Home page for more activities!
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Plants

Let’s explore the plant life of our yards, neighborhoods, and region! Learn about plant diversity and growth processes in these activities.
Pine trees are closely related to some of the earliest plants on the planet! Pines and their relatives have cones that hold their seeds – not flowers, like other plants, and each pine species has its own special cones. When their seeds drop from the cones, they either sprout into new trees, or become food for birds and small mammals.

How many of these California pinecones can you recognize? Bring this guide on a hike, or collect pinecones (where allowed) to bring home and identify!

You can also use the iNaturalist app to record and identify the pinecones you find, and turn empty pinecones into birdfeeders!

Pine needles come in bundles called “fascicles.” The number of needles in each bundle is different for different pine species.

Each woody scale on a pinecone contains two seeds, released when the cone is mature, which can take years! Scales also often have a pokey prickle on the end, to help protect the developing seeds from any hungry animals before the seeds are ready.
**Knobcone pine** – *Pinus attenuata*

Knobcone pine trees grow mainly in the coast ranges of California. Their needles are in bundles of 3, and the cones are **3-6” long**. The cones get their names from *knobby bumps* that you can find on one side.

**Western white pine** – *Pinus monticola*

These trees grow throughout the Pacific Northwest and in the Sierra Nevada mountains. You can recognize it by its bark, which breaks into squares on older trees. The needles are in bundles of 5, and the **long, thin, curvey cones** grow up to **12” long**. The **cone scales are thin**, and sometimes the **curve upwards** on the ends.

**Sugar pine** – *Pinus lambertiana*

These are the tallest of all the pine trees, and they also have the **longest cones**! There are 5 needles in a bundle, and the **cones can reach up to almost 20”** after taking two years to mature. They grow throughout the mountains of the western North America.
**Lodgepole pine** – *Pinus contorta*

The lodgepole pine grows throughout the mountains of western North America. Its needles are in bundles of 2, and it has very special **small, egg-shaped cones**. These cones are **serotinous**, which means they only open after exposure to fire.

**Whitebark pine** – *Pinus albicaulis*

The whitebark pine grows throughout the higher elevations of western North America. You can recognize it by the thin white lines on the needles, grouped in bundles of 5, and the closed cones. Unlike many other pine species, these cones remain closed when they are on the tree, even once they’ve matured.

**Foxtail pine** – *Pinus balfouriana*

This special pine species is **endemic** to California, which means it only grows in this state. It is found in the California northern Coast Range, and the southern Sierra Nevada. Its needles are in bundles of 5 and curve upward. The cones are **purplish when they’re young**, and grow to be **reddish-brown and 4” long**, when they produce a sappy amber substance.
**Coulter pine** – *Pinus coulteri*

The Coulter pine, or big-cone pine, grows mainly in southern California and has the **biggest cones** of all the pines. They reach **16” long**, and are wider than the 20” sugar pine cones. The trees are nicknamed “**widowmakers**” because of the large, dropping cones. The needles are in 6-12” long bundles of 5.

**Jeffrey pine** – *Pinus jeffreyi*

These trees grow mainly in California, but also extend into southern Oregon, western Nevada, and northern Mexico. The needles are in bundles of 3, and the cones reach 12”. It is nicknamed “**gentle Jeffrey**” because the cones are less prickly than other pines (like the Ponderosa, which looks very similar).

**Bristlecone pine** – *Pinus longaeva*

Bristlecone pines are some of the longest living organisms on the planet. Some trees in the Ancient Bristlecone Pine Forest are older than 4000 years! They are located in California, Nevada, and Colorado.

Their needles, in bundles of 5, cover branches that resemble bottlebrushes. The cones can reach 4” long, and the developing cones are purple with curved prickles at the ends of the scales.
Ponderosa pine – *Pinus ponderosa*

Ponderosa pine trees are well-known by the **vanilla or butterscotch scent** of their bark. These sweet-smelling trees are found throughout western North America. Their enormous trunks can reach 4’ across, and they have 3 needles in a bundle. The cones are **egg-shaped**, reach 5” long, and have a **stiff prickle** on the end of each scale.

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Gray pine – *Pinus sabiniana*

The gray pine, or foothill pine, is native to California and Oregon, and grows in the California valley and foothills – lower than most other pine species. It has 3 needles in a bundle, and its large, heavy cones have big spikes on the end of each scale.

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**Male cones**

All the other cones above are female cones that contain the seeds that will grow into new trees. Pine trees also have male cones. In these cones, each scale holds pollen, allows the seeds to form in the female cone after **wind pollination** happens. These male cones are much smaller, and are sometimes located higher on the tree than female cones.
Kitchen Composting!

In nature, leaves and other plant materials fall to the ground and eventually decompose with the help of microorganisms, worms, insects, and fungi, which break them down into nutrients. These nutrients keep the soils healthy and feed new plants. We can replicate these processes at home by making compost from our yard waste and kitchen scraps in a homemade compost bin. In a few weeks, you’ll have microbe-rich soil to add to your garden or use to sprout seeds!

What is healthy compost made of?

A well-balanced compost mixture is made from brown and green wastes.

Brown waste is made of dead leaves and pine needles that have turned brown and dried out. These materials are high in carbon. Green waste comes from fresh materials like kitchen scraps (like eggshells and commonly unused parts of fruits and veggies), grass clippings, and weeds, which are high in nitrogen.

Meat and dairy products are not commonly composted. They are decomposed by different types of microorganisms than the ones that break down plants, and this process can be slow, smelly, and attract pests.
To build a kitchen compost bin, you will need: a clean, clear container with lid, knife or hole punch (if your container is plastic), dirt from outside, shredded newspaper, brown waste, green waste, spray bottle with water

**Step 1:** With an adult’s help, use the knife or hole punch to add a few air and drainage holes to the bottom and sides of the container. This will be your compost bin, and the holes will allow fresh air in and extra moisture out. If your container is not plastic, don’t seal the lid completely.

   Tip: this activity is a great way to repurpose an empty 2-liter bottle. Cut the top section off to add materials, and replace it – upside down and cap off – to close.

**Step 2:** Add a layer of soil from outside, shredded newspaper, and brown waste (dried leaves) to your compost bin, and spray the mixture with some water. The microbes that will break down your compost come from the soil you introduce to your mix.

**Step 3:** As you produce food waste in your kitchen (fruit and vegetable scraps, eggshells, coffee grounds…but no meat or dairy products), add it to your compost bin.

**Step 4:** Store your compost bin somewhere where sunlight can reach it, and spray the mixture with a little water each day. Every few days, stir the contents. Molds and fungi are signs of thriving microbes that help break down your food scraps into nutrients!

**More ideas:**

- If you have outdoor space, you can build a more complex compost bin for your household and experiment with different composting techniques.
- You can use some types of fruit and vegetable scraps to start your own kitchen scrap garden!
- Check your area for community composting sites! You can drop off your green waste at our very own Chico State Compost Garden anytime.
The plants in our gardens and communities might not move and play like animals do, but they lead very exciting lives! Plants can produce new leaves and flowers, change color, attract animal visitors, and go through many other changes.

This plant observation log will help you follow your favorite plants through the seasons as they grow and adapt!

**Step 1:**
Choose a plant (or two, or three!) in your garden or community to observe.

**Step 2:**
Print the observation log on pages 2 and 3 and answer the questions to help you document your plant’s activity and the conditions in its home!

**Step 3:**
Repeat at regular intervals (for example, every week) to see how your plant grows, changes, and responds to the seasons.

**Step 4:**
Use resources like iNaturalist or a field guide to identify your plant! Based on your observations, how does it respond to changes in weather or the seasons?
Plant Observation Log

My Plant’s Name / Species: ________________________________

Today’s Date: ______________________

Today’s Weather:

Conditions: Wind: Temperature:
- calm
- breezy
- windy

Circle your answers below, or fill in the blanks!

1. Does my plant have flowers? Yes / No
2. The flowers are: Buds / Opened Up / Wilted or not there!
3. Are there pollinators visiting my plant’s flowers? Yes / No
4. What do the pollinators look like? ______________________
5. Do birds, bugs, or other animals visit my plant? Yes / No
6. What kinds of animals do I see? ______________________
7. What shape are my plant’s leaves? ______________________
8. What color are the leaves? ______________________
9. My plant’s leaves are:
   Growing from buds / Fully grown / Falling off / Not there!

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10. Draw a picture of your plant the way it looks today!
Animals

What kinds of critters can we discover when we look closely at our environment? Learn about the animals of our garden spaces and the roles they play!
Whose Scat is That?

You can tell a lot about an animal based on what it leaves behind! Footprints, teeth marks on plants, scratch marks, fur, and feathers are all signs that an animal has been around. Scat is another sign, and we can learn about its owner’s diet by investigating!

**Vocabulary:**

*Scat*: animal poop! Mammals, birds, reptiles, and insects all leave scat behind after they’ve finished digesting their food.

*Animal signs*: anything that shows an animal has been in an area – including scat, burrows, nests, hair, or chew marks.

*Herbivore*: an animal that eats plants

*Carnivore*: an animal that eats other animals

*Omnivore*: an animal that eats both plants and animals
Step 1:
Head out into your yard, or on a walk or hike with a grownup. Keep an eye out for scat, big and small! Some animals, like mammals, likely leave their scat close to the ground, but bird and insect scat is often left on leaves.

Step 2:
When you’ve identified some scat, take a look and see if you can answer these questions about the animal that left it!

• Is it from an herbivore, carnivore, or omnivore?
• What type of animal left it (bird, mammal, reptile, insect)?

Step 3:
Document your findings! Take a picture of the scat and other animal signs you find along your way.

Step 4:
Be a community scientist and share your findings with the world! You can upload photos of animal signs like scat and footprints to the iNaturalist app so that members of your community and scientists around the world can learn from what you’ve found.

Step 5:
Look on the next page to learn about our local wildlife and their diets!
Examples of Northern California Wildlife & Their Scat

**Monarch butterfly: herbivore**

As a butterfly, I eat the nectar of flowers, but as a caterpillar, I eat the leaves of the milkweed plants. My scat is very small and is found on these leaves.

Photo: Smithsonian

**Brush rabbit & mule deer: herbivores**

We eat flowers, leaves, clover, grasses, twigs, and bark. Our similar diet means our scat is similar too – it’s small and round. Brush rabbit scat is smaller than a penny!

Rabbit scat photo: Kim Cabrerra, 2008

**California gray fox: omnivore**

I eat berries and small animals like mice, lizards, and rabbits. I use my scat to mark my territory, leaving it on objects like logs, rocks, or benches.

Scat on log photo: Kurt Geiger

**Mountain lion: carnivore**

I eat birds and small mammals like raccoons, squirrels, and deer. My scat is large – sometimes bigger than an adult human’s hand!
Invent an Insect!

Did you know that there are over one million species of insects that entomologists (scientists who study insects) have discovered on earth? Insects make up 40% of the world’s animals. They pollinate plants, break down dead plants and animals into nutrients, and are a food source for other organisms. Start this activity by learning about insects, where they live, and what they do – and then invent your very own species!

Insect anatomy:

- **Antenna**: these “feeler” structures help insects smell and feel their environment
- **Eyes**: simple eyes have one lens (like ours), and compound eyes have many lenses. Compound eyes help insects see fast movement and many angles.
- **Legs**: all insects have six legs
- **Body**: insects have three body sections – a head (front section), thorax (middle section) and abdomen (rear section).
- **Wings**: Most insects have wings with two sections, a front wing and hind wing (although some insects have no wings at all).
Insect Habitats
Insects live all over the world in many different habitats! Here are some common places you can find these crawly critters:

- Forests under leaves and logs
- Fruit trees
- Under rocks
- Freshwater ponds
- On and in other animals
- Beaches
- Mountaintops
- Caves

Insect Foods
Insects eat many different things, depending on what their habitat is. Can you tell which food sources come from each habitat above?

- Decaying leaves and plant matter
- Wood
- Worms and grubs
- Fruit
- Plant nectar and pollen
- Other insects
- Animal dung
- Blood

Other vocabulary
- **Arthropod**: all insects are arthropods, or animals that have an exoskeleton
- **Exoskeleton**: this is the “external skeleton,” or hard jointed shell, that all arthropods and insects have.
- **Adaptation**: insects have *adapted*, or developed special body parts and behaviors, to help them live in different environments and eat different kinds of foods.
- **Larva**: the “baby,” worm-like stage of an insect’s life cycle
- **Metamorphosis**: the process insects use to transition between body types in their life cycle, including from a caterpillar to a butterfly
Invent Your Insect!

My insect is called: ____________________________________________________________

My insect’s habitat: ____________________________________________________________

My insect eats: ________________________________________________________________

How my insect finds and eats its food: ____________________________________________

What eats my insect: ____________________________________________________________

How my insect moves around: __________________________________________________

My insect’s special behaviors ____________________________________________________

Draw Your Insect Here:
Botany for Breakfast: Who Eats That Plant?

The gardens and parks in our yards and neighborhoods are nice to look at and sometimes provide us with food to eat. Each part of a plant also provides food for animal visitors. Head outside and use this scavenger hunt checklist to see if you can find each plant part and the critters that depend on them. Some animals like birds and mammals are shy, so remember to be patient and watch closely!

**Flowers**
The petals of flowers are used by the plant to attract **hummingbirds** and **insects** like bees and beetles. These pollinators eat pollen and nectar from the flowers and help the plant by transferring pollen to other plants.

**Find:**
- flowers
- insect
- hummingbird

**Seeds & Fruits**
Seeds and fruits (which contain seeds) grow new plants and are favorite snacks for **birds**!

**Find:**
- fruits
- seeds
- birds
Leaves
Plants use leaves to convert sunlight into sugars they use as food. Animals like these sugars too, which is why **mammals** like deer and **insects** like caterpillars and beetles eat leaves so much! Some insects also eat dead and fallen leaves, helping them to decompose into soil.

Find:
- leaves
- insects
- mammals

Stems
Stems (including tree trunks) help plants move water and nutrients. **Insects** like aphids eat the sap from stems, and **mammals** like squirrels eat fiber from trunks.

Find:
- green stem
- woody stem
- tree trunk
- insects
- mammals

Roots
The roots of a plant help it to take up water and to store and absorb nutrients. Small **mammals** and **insects** can eat roots. Some special **fungi** – too small for us to see - also form connections with root systems to share nutrients with the plant!

Find:
- roots
- mammals
- insects

Check out the next page for examples of these hungry critters.

See a plant or its animal visitor that you don’t recognize? Take a photo or draw a picture! Field guides and apps like iNaturalist can help you identify plants and animals.
**Insects**
Caterpillars and butterflies, beetles, bees, wasps, aphids, and termites are all examples of insects that love to snack on different parts of plants.

![caterpillar](image) ![butterfly](image) ![beetle](image) ![bee](image)

![wasp](image) ![aphid](image) ![termite](image)

**Birds**
Look for hummingbirds drinking nectar and other birds like quail, finches, sparrows, and woodpeckers eating seeds and fruits.

![quail](image) ![finch](image) ![sparrow](image) ![woodpecker](image)

**Mammals**
There are many kinds of small and large mammals that like to eat different parts of plants. Deer and rabbits eat mostly leaves, and gophers eat roots from tunnels underground. Squirrels eat seeds and tree bark, and bears are known for their taste for fruits like blackberries.

![deer](image) ![rabbit](image) ![gopher](image) ![squirrel](image)
What factors make a healthy habitat? How do we perceive the environment using our senses? What do we find when we look outside the Earth? Let’s look at our environment at a larger scale!
Because the Earth travels around the sun throughout the year, the night sky and objects we can see in space change during each season. What can we learn when we look up at the sky in the winter?

Because of the tilt of the Earth, the sun’s rays strike different parts of the planet from different angles in each season. In the northern hemisphere, **December 21** is the **winter solstice**, when the sun is at its furthest south in the sky. This is the day with fewest daylight hours and longest nights in the northern hemisphere. In the southern hemisphere, this date is the **summer solstice**, and the peak of the summer season’s daylight.
What can we see in the winter night sky?

The longer nights of winter in the northern hemisphere provide extra time for viewing the night sky! We can see many objects in space with only our eyes or binoculars. You can also use the Night Sky app on a smartphone to help you identify planets, stars, constellations, and satellites. How many winter sky sights can you find?

**Constellations** are groups of stars that we can recognize by the shapes they form in relation to one another. **Orion** is one of the easiest constellations to find in the winter southern sky, and contains the orange star, Betelgeuse. Learn how to make [origami star finders](#) to help you find and recognize the different constellations throughout the year!

The phases of the **moon** occur each month, as the moon orbits the Earth and casts shadows from the sun. For example, when the moon is full, its shadow is on the side of the moon we cannot see. Because the nights in winter are longer, there are often more nighttime hours when we can clearly see the moon. Learn more about the **moon phases**, and make them from [Oreos](#)!

Image credit: NASA

Image credit: sciencekids.co.nz
The natural world is full of items of all different kinds! These items come from different sources, serve different functions in their environment, and have different effects on our senses. In what ways can these very different pieces of nature also be the same?

**Materials:**
- Bucket or bag
- Cookie sheet, newspaper, or containers for sorting

**Step 1:**
Head out to the yard or on a walk through your neighborhood with a grown-up and your collection bucket or bag and collect small items from the environment like rocks, sticks, leaves, flowers, feathers, bones, bark, pieces of mosses and lichens, and seeds.

Remember not to collect from your neighbors without permission, or from protected spaces like parks where these items are a part of the habitat!
**Step 2:**

When you get home, empty your collected materials onto the cookie sheet or newspaper. Start looking for qualities that these pieces of nature have in common, and sort them into piles or into separate containers based on their similarities. How many different ways can you categorize your natural treasures?

To get you thinking, here are some examples of ways to sort!

- **Type of item**: what’s its identity? Is it a stick, rock, leaf, feather?
- **Size**: is it big, small, or somewhere in the middle? Try arranging items all in a row in order of increasing or decreasing size.
- **Color**: where does the item fall on the rainbow?
- **Shape**: is it round, angular, long, short?
- **Source**: is it from an animal, plant, or non-living thing?
- **Smell**: does it have a smell? Is its smell familiar or unfamiliar?
- **Sound**: does it have a sound when you tap it with a pencil? Is it loud, quiet, low, high, or familiar?
- **Texture**: is it rough, smooth, soft, hard, made up of big or small parts?
- **Composition**: can you break it into smaller pieces?

**Use your imagination to come up with more categories!**
Garden Sensory Bins

Sensory bins are a great way for young and sensory-sensitive scientists to explore the many different textures of objects in nature! You can make a simple bin with a collection of different items, or a texture-hunt bin for using your sense of touch to search for items.

**Simple Sensory Bin**

**Step 1:** Find a basket, bucket, or another bin for storing your texture collection.

**Step 2:** Explore your yard and neighborhood for natural items to add to your sensory bin. Keep an eye out for items of varied shapes, sizes, and surfaces. For example, you could choose:

- Acorns
- Fresh leaves
- Small rocks
- Pinecones
- Sticks
- Shells
- Twigs from evergreens, with needles
- Flowers
- Seeds and seed pods

**Step 3:** Explore the different textures you’ve collected! How are they similar? How are they different? Are they soft? Smooth? Bumpy? Prickly?
Texture-hunt Sensory Bin

**Step 1:** Fill a large bowl, a small bucket, or another container with dry beans, lentils, or rice. This will be the part of the sensory bin that you sort through with your hands to identify objects by their textures.

**Step 2:** Repeat Steps 1-2 of the basic sensory bin activity above to collect items for your texture-hunt bin.

**Step 3:** Add the natural items you’ve collected to the container of beans, lentils, or rice, and mix them in well, so that you can no longer see them.

**Step 4:** Use your hands to explore the container, sifting through it to feel for the items you collected. How many of them can you find and identify through your sense of touch?

Other Ways To Explore

*Gateway Parents!* This activity is a great way for your young or sensory-sensitive scientists to explore the items of their natural environment with their hands, but you can add all kinds of items to your child’s sensory bin, depending on their interests or sensory needs.

Your scientist can also experiment with using toy shovels, spoons, or tweezers to find and remove items from their sensory bins.

Remember to be aware of choking hazards with small items used in the bins, as well as the bean, lentil, or rice filler material.
Seasonal weather changes look many different ways. There are changes in temperature, rainfall, and winds, and meteorologists – scientists who study the weather – have tools to measure each of these changes. Learn how to build an anemometer and capture the wind to measure its speeds!

You will need:

- Six paper cups
- Three wooden skewers, straws, thin dowels, or sticks trimmed to 34cm
- Bottle or Jar
- Tape (electrical works best, but other kinds will do!)
- Gravel, small rocks, beans, or another weight material
**Step 1:**
Use the first skewer to pierce through both sides of three of the cups near the rims. The center cup should face up, and the cups on the sides should face sideways in opposite directions.

**Step 2:**
Add the second skewer so that it passes through the center cup at right angles (*perpendicular*) to the first skewer. Reinforce each cup-skewer connection point with a small piece of tape.
Step 3:
Push the third skewer up through the bottom of the center cup, so that it is perpendicular both of the other skewers.

Step 4:
Fill the bottle with the gravel, place the fifth cup face down over the top of the bottle, and stick the last skewer through the cup into the bottle.

Step 5:
Set your new anemometer outside on a breezy day and watch it turn! To roughly estimate the wind speed, you can count the number of rotations that it makes in one minute by 60, and divide by 1000. The resulting speed is in kilometers per hour!

If there are 1.6 kilometers in one mile, how do you calculate your windspeed in miles per hour? You can find the answer at the bottom of the page!

When you’re done with your anemometer, you can reuse the cups as pots for growing seeds or veggie scraps into plants in your kitchen! Visit the other Gateway Garden Detectives activities to learn how.
Build a Rain Gauge

Meteorologists, or scientists who study the weather, use many tools to take measurements of the atmosphere and the environment. Some tools, like rain gauges, are easy to use at home to compare your own weather observations with the meteorologists’ weather forecasts.

You Will Need:

- Two-liter plastic bottle or glass jar
- Scissors
- Masking tape
- Ruler
- Marker
- Sand or pebbles
- Water

Tip: When you’re finished with your rain gauge, reuse the bottle to create a kitchen scrap garden!
**Step 1:**
If you’re using a plastic bottle to make your rain gauge, remove the cap and use the scissors to cut the top part of the bottle off at the place where the straight sides begin to curve in toward the cap.

**Step 2:**
Add sand or pebbles in the bottom of the bottle to keep the rain gauge upright in windy weather (you can [build an anemometer](#) to measure the wind speeds!).

**Step 3:**
Place the uncapped bottle top that you removed in Step 1 in the bottom half of the bottle, so that it points downward and forms a funnel. The cut edges should line up. Tape these two pieces together so that the funnel stays in place.

**Step 4:**
Attach a long, vertical strip of masking tape to the bottle or jar, starting at the bottom and ending at the top edge.

**Step 5:**
Hold the ruler up to this piece of tape so that the “zero” mark on the ruler is near the top of the pebbles or sand, and mark every quarter inch up to the top edge. Label each inch (every four quarter-inch marks!) starting from the bottom of the rain gauge and working your way up. You can also mark centimeters.

**Step 6:**
Add water to the bottle until it reaches the “zero” mark at the bottom of the rain gauge. This will allow you to measure all additional water that enters the gauge.

**Step 7:**
On a day that rain is predicted in the weather forecast, make sure the gauge is filled to the “zero” mark and find a level place to set up your gauge to capture the rainfall. Check the rain gauge after 24 hours to see how much rainwater you’ve collected! How does it compare to the rainfall reported for your area by local meteorologists? Repeat on more rainy days to see how rainfall varies!
Garden Detectives

Scavenger Hunts

Look at your own habitat in new ways and see how many of the natural curiosities you can find from these themed scavenger hunts!
Backyard Scavenger Hunt!

You don’t have to go far to find natural wonders! How many of these natural curiosities can you find in your own yard or neighborhood?

Our yards, parks, and even the cracks in the sidewalk are full of animals to discover!

California has more species of plants than any other state. Look for unique colors, shapes, and textures of different plant parts!

Habitats are the homes of living organisms. These abiotic or non-living things are all part of a healthy habitat!
Pipevine Swallowtail
*Battus philenor*
This butterfly is found across North America and lives much of its life on pipevine plants.

California Poppy
*Eschscholzia californica*
Our state flower, this poppy grows throughout the state in a wide range of habitats.

Blue Oak
*Quercus douglasii*
This California oak is common in the Sierra Nevada foothills and can survive long droughts.

California Scrub Jay
*Aphelocoma californica*
This familiar California bird can remember over 200 locations of acorns it has hidden!

Pill Bug (Rolly Roly)
*Armadillidium vulgare*
These crustaceans originated in Europe and are important decomposers.

Valley Oak
*Quercus lobata*
This is the largest oak species in North America. It can live over 600 years old and grows only in California.

“Nurse” Rocks
Rocks like these are called “nurse” rocks because they support life, like mosses, lichens, insects, and lizards living here.

Worm Castings
These tiny mounds of soil are produced when worms help process healthy soil. That’s right—it’s worm poop!

Leaf Litter
Fallen leaves add nutrients to the soil and provide food and shelter for invertebrates like insects and worms.

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Fall Scavenger Hunt

How many of these natural fall curiosities can you find in your yard or neighborhood? Circle your discoveries!

- acorn
- western gray squirrel
- red leaf
- evergreen tree
- yellow leaf
- feather
- brown leaf
- moss
- bare tree
- spider web
- mushroom

You can upload pictures of the items you find to the community science app, iNaturalist, to identify and document them for other scientists to use in research projects around the world!
A habitat is a place where a plant or animal lives. Habitats provide resources for food, water, and shelter for the critters that live in them. These plant and animal occupants depend on each other to keep the habitat healthy!

Start by answering the questions below, learn on the next page, and then head outside to investigate the habitat around you!

If you were a lizard, where would you spend the day?

If you were a mason bee, where would you build your nest?

If you were a monarch caterpillar, where would you get your food?

If you were a hummingbird, what materials would you use to build your nest?

If you were a pipevine swallowtail butterfly, where would you lay your eggs?

What food sources, nesting materials, land features, water sources, and other habitat features can you identify?

1. ____________________________
2. ____________________________
3. ____________________________
4. ____________________________
5. ____________________________
6. ____________________________
7. ____________________________
8. ____________________________
9. ____________________________
10. ____________________________
These animals are all important parts of their habitats, but they also depend on other habitat features to survive.

Because they’re cold-blooded, lizards like to bask in sunny places during the daytime to maintain their body temperature.

Hummingbirds nest in trees high above ground where they are sheltered by leafy branches and open to the ground beneath. They use materials like moss, lichen, cotton, and spider webs to build a nest and keep it warm.
Plant Protection Scavenger Hunt!

Many plants have qualities that help protect them from herbivores, or animals that eat plants. Which of these characteristics can you find on the plants in your yard or neighborhood?

- **Fuzzy leaves** are uncomfortable to eat and can be irritating to touch.
- **Spiky leaves** and **thorns** make it difficult for mammals like deer and humans to get too close to a plant.
- **Waxy leaves** can be tough for insect herbivores to chew through.
- **Thick bark** protects trees and shrubs from wood-eating insects and some mammals.
- **Strong smells** that come from broken leaves or stems sometimes mean that a plant has chemical defenses which make it taste bad!

- Leaves of the **desert mallow** are fuzzy and irritating to herbivores’ hungry mouths!
- Oregon grape’s **spiky leaves keep away leaf-eating mammals**.
- The incense cedar **tree produces natural chemicals that we can smell and that are distasteful to herbivores**.
Garden Detectives

Coloring Pages

Bring out your art supplies and learn about the natural diversity of our region with the help of your creativity and coloring skills!
What Plant Part Am I?
The fruits and vegetables we love to eat come from many different parts of a plant!

What part does your favorite food come from?
Can you recognize these plant parts from your yard or garden?

FLOWERS
Flowers are the part of a plant that attracts pollinators like bees. When a flower is pollinated, it can produce fruits and seeds, which allow the plant to make more plants.

FRUITS
Many foods we think of as vegetables are actually fruits! A fruit is the part of a plant that contains seeds. The part of the fruit that we eat nourishes the growing seed, just like it nourishes our bodies!

LEAVES
Leaves contain pigments which convert the energy from the sun into food!

ROOTS
Roots allow plants to absorb water and nutrients from the soil, which feed the rest of the plant. Roots are also storage places for nutrients, which is also why they are so good for us to eat!

SEEDS
Seeds grow new plants!

STEMS
Stems are the tough, fibrous part of a plant that supports the leaves and fruits. Stems also transport water and nutrients from the soil to the rest of the plant!
Mini Coloring Book

Happy National Coloring Book Day!

2020

Nurse Rocks

Many kinds support life!

Salvia

Western Tiger swallowtail

Paper wasp

Valley carpenter bee

Monkey flowers
use this awesome guide from
tallisalevelphoto.weebly.com/zine-making-resources.html
to cut and fold your Gateway Mini Coloring Book!
Who Are Our Pollinators?

*Pollinators* are animals that move pollen between flowers, and this process, called *pollination*, is required for plants to produce seeds. Hummingbirds, bats, butterflies, bees, wasps, beetles, and flies are all important pollinators!

The species on this page are native to California and can be found in our parks, gardens, and other natural areas. How many of these helpful animals have you seen in your neighborhood?

(1) Anna’s hummingbird (2) Pallid bat (3) Western tiger swallowtail (4) Paper wasp (5) Valley carpenter bee (6) Valley elderberry longhorn beetle (7) American hoverfly (8) Achemon sphinx moth (9) Cabbage white butterfly
Anna’s hummingbird: *Calypte anna*
This hummingbird is a Northern California “resident”, staying in the region all year long while other species migrate.

Pallid bat: *Antrozous pallidus*
Most bat species eat insects, but many also drink nectar from flowers, pollinating them in the process.

Western tiger swallowtail: *Papilio rutulus*
This butterfly is common in California, especially in riparian areas (along rivers and creeks).

Texas paper wasp: *Polistes apachus*
This wasp is found throughout the Western United States and feeds on the plant nectar and small insects.

Valley carpenter bee: *Xylocopa sonorina*
These large carpenter bees get their name because they live in holes that they bore into solid wood.

Valley elderberry longhorn beetle: *Desmocerus californicus dimorphus*
This threatened species is an important pollinator of the valley elderberry.

American hoverfly: *Eupeodes americanus*
Hoverflies are often mistaken for bees because of their markings.

Achemon sphinx moth: *Eumorpha achiomn*
This large moth features great camouflage, except for its pink hindwings!

Cabbage white butterfly: *Pieris rapae*
Identify this wide-ranging butterfly by its symmetrical black spots.
Learning Our Leaves!

California is home to a wide variety of tree species that are native to our state, which means they occur here naturally and were not introduced by humans. They come in many shapes and sizes! Use this coloring page as a guide to learn the leaves of trees found in Gateway Gardens and your Northern California neighborhood!

How many of these leaves can you find?

- Western dogwood: *Cornus sericea ssp. occidentalis*
- Incense cedar: *Calocedrus decurrens*
- Narrowleaf willow: *Salix exigua*
- Black oak: *Quercus kelloggii*
- Fremont cottonwood: *Populus fremontii*
- California sycamore: *Platanus racemosa*
- Western redbud: *Cercis occidentalis*
- White alder: *Alnus rhombifolia*
Crafts

Let’s use nature in our crafts, and use crafts to learn about nature! What creations will you design and invent using simple materials?
Pinecone Bird Feeders

During fall and winter months, we can find a huge diversity of small birds that are migrating and overwintering. These birds depend on nuts, seeds, and other fatty foods to provide them energy during cold weather. Learn how to make a bird feeder using materials from your environment and home.

You Will Need:

- Pinecones or sticks
- String
- Butter knife
- Peanut butter or Crisco
- Birdseed (or you can make your own mix from sunflower seeds, peanuts, dry corn, and chopped dried fruit)
- Notebook, or page 3 of this activity
- Pencil
**Step 1:**
Tie a length of string to the top of the pinecone or sticks, creating a loop you can hang your feeder by.

**Step 2:**
Use the butter knife to coat the pinecone or stick in peanut butter or Crisco. If you’re using a pinecone, try to make sure there is peanut butter between the scales.

**Step 3:**
Cover your coated pinecone or stick in birdseed mix. The seeds will stick to the peanut butter or Crisco, which will harden after a few hours and hold the seeds in place, creating a tasty snack for the visiting bird species.

**Step 4:**
Hang the feeder by the string in a tree, bush, or another place outdoors. Your feeder will be visited more often if it’s located somewhere the birds will feel sheltered from predators.

**Step 5:**
After the birds have had time to discover your feeder, you can record the visiting species on the Observation Notes page of this activity. How many different types of birds do you see? Which species visit most often? What do they look like?

**Tip:** You can use the iNaturalist app to help you identify the bird species you observe. Your uploaded photos will be identified and provide observation data for researchers to use worldwide!
**Bird Observation Notes**

Use this space to record your observations of bird visitors! What do the different species look like? How many of each have you observed?

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Leaf Rubbings and Stamps

Why do deciduous trees lose their leaves in the fall? When temperatures drop in the winter, these trees drop their leaves instead of spending valuable energy to protect them from frosts.

Fall is a great time to observe the broad diversity in leaves and leaf shapes, and there are many ways we can preserve the images of leaves! Learn how to make rubbings and stamps of the leaves of your neighborhood.

You will need:

For rubbings: Leaves of different shapes and sizes, paper, crayons or oil pastels

For stamping: Leaves of different shapes and sizes, paper, craft paint

Try this activity with leaves in the fall, and with flowers and petals in spring and summer!
Leaf Rubbings:

Step 1: Gather the leaves you’ve collected, and place them underside up on your work surface. The underside is the side of the leaf where you can more easily feel the veins. This side is also where most of the stomata of the leaf are located, which are special plant parts that help the plant exchange oxygen and carbon dioxide!

Step 2: Place a sheet of paper on top of the upside-down leaf.

Step 3: Holding the leaf and paper in place, gently rub over the area of paper covering the leaf. Continue until the entire shape of the leaf has appeared!

Step 4: Repeat with more leaves to fill your page and create a work of art documenting the diversity of leaves you’ve observed!

Leaf Stamping:

Step 1: Gather your leaves on a protected work surface (use a tray or newspaper to keep your surface clean!).

Step 2: Use a brush, piece of foam, or your fingers to paint the lower surface of your leaves.

Step 3: Gently press the leaves, painted-side down, onto sheets of paper. Make sure to press all areas of the leaf so that the entire leaf image transfers, and then remove the leaf.

Step 4: Repeat and enjoy your painted leaf images!
Fossil Molds & Casts

Become a paleontologist (a scientist who studies fossils) by learning about how fossils are formed and making your own “fossils” of materials you can find at home and in your yard or neighborhood!

What are fossils?

Fossils give us clues about how animals’ bodies fit together based on their fossilized skeleton. They can also tell us what they ate (based on teeth or fossilized poop) and whether they had scales, feathers, or hair. Fossilized plants show what the earliest leaves, flowers, and trees looked like. Did you know that the first “trees” were actually giant, ferns that grew over 65 feet tall over 200 million years ago? That’s before trees, flowers, and even dinosaurs!

Fossils form in special cases when plants and animals are buried in mud or other soft soils. If they don’t decay right away, they can be compressed by many layers of sediment over thousands or millions of years and preserved as a fossil. The two main types of fossils are molds and casts.

We find molds where an animal or plant was buried in mud or soft soil and decayed away, leaving behind an impression of their bodies, leaves, or flowers.

Casts are formed when these impressions are filled with other types of sediment that form rocks, which take the place of the animal or plant.
Materials:

- Something to fossilize: leaves, flowers, shells, sticks, bones, or small toys
- Mold material: oven-safe clay, salt dough (recipe below), or play dough
- Toilet paper tubes, aluminum foil, or other sturdy but flexible materials
- Flour or plaster-of-Paris
- Water
- Salt (optional)

Mold Fossils:

*If you’re using salt dough, mix together 2 cups flour, 1 cup salt, and 1 cup cold water to make a soft dough.*

**Step 1:** Roll out a ball of clay, salt dough, or play dough until it’s 1-inch thick and a little larger than the item you’re going to make a mold fossil of. Try to keep the top surface smooth and flat.

**Step 2:** Gently press the item you’re fossilizing into the clay or dough. Try to transfer as much detail from the item as you can! For flat items like leaves, you can get a better mold by rubbing your hand over a sheet of paper placed over the item in the clay.

**Step 3:** Carefully remove the item from your mold material.

**Step 4 (optional):** If you want to preserve your mold fossil you can bake salt dough molds at 250°F on cookie sheets for 2 hours, or follow the directions of your oven safe modeling clay. Allow to cool and marvel at your mold fossil!
Cast Fossils:

_start with Steps 1-3 to create a mold, and move your mold to a tray or cookie sheet to create your casts!_

**Step 4:** If using aluminum foil, fold it a few times to get a stronger, thicker strip and coil to form a cylinder larger than the imprint in your mold. If using a toilet paper tube, cut to form a shorter cylinder. Press the cylinder into the mold around the imprint.

**Step 5:** Mix equal amounts of flour and water to make the “plaster” that will form your cast (2 tablespoons each is great for single small fossils!), or mix plaster-of-Paris according to the manufacturer’s instructions. Pour the plaster into the mold and tube until about ½” to 1” full and tap the tray or cookie sheet on the table to remove any air bubbles from the plaster.

**Step 6:** Fossil formation takes time! Allow the molds and plaster to sit for 1-3 days to dry and cure completely. Remove the foil or plastic cylinder, peel off the mold, and enjoy your cast fossil!
Design A Seed!

How do plants move and grow in new places? Plants can’t walk, swim, or fly around like animals can, so they rely on their seeds to travel to new homes. Learn about different types of seed dispersal and design your own seed – and don’t be afraid to use your imagination and create a completely new seed type!

You will need: seed-making materials like beads, pipe cleaners, paper, string, pom-poms, glue, packing peanuts, buttons, paper clips, Velcro, and other items

Step 1:
Learn about seed dispersal methods on the next pages to get thinking about how seeds find the home they’ll grow in.

Step 2:
Find a plant outside or invent your own and draw a picture of it! What do you think your plant’s seeds look like? How do they leave the plant and settle in a new place to grow?

Step 3:
Use the materials you’ve gathered to create your imaginary seeds!
How do a plant’s seeds find their new homes?

Plants in nature use five main methods for sending their seeds out into the world: wind, water, gravity, animals, and special launching mechanisms. Will the seeds you create use these ways of dispersing, or will they get to their new homes another way?

**Wind Dispersal**

Seeds from plants like maples, grasses and sedges, and thistles and dandelions have seeds that easily catch the wind and fly away. Test your wind-dispersed seed creations using a fan to see if they fly!

**Water Dispersal**

The California buckeye, coconut palms, and the white alder produce seeds that can float away on the water that the plants grow near. See if your made-up seeds float when you place them in a cup of water.
Gravity Dispersal

Annual plants like these California poppies, clarkia, and goldfields produce seeds that fall to the ground beneath the parent plant. The parent dies back at the end of the spring, leaving room for the seeds to sprout new plants in the same place.

Animal Dispersal

Many plants rely on animals to help move their seeds around. Sometimes their seeds are inside tasty fruits or berries that animals like to eat. Other plants have seeds that stick to animals’ fur and are carried off. If the seeds you designed can be carried by animals, they might also stick to a mitten on your hand.

Mechanical Dispersal

Mechanical dispersal happens when the seeds “explode” from the plant and are thrown far from the parent. This happens with violets and impatiens when they are touched. In some pea plants, the pod twists as it dries and when enough pressure is built up, the pod bursts open.
The garden exhibits of Gateway Science Museum showcase the vast and unique biodiversity of Northern California.

The Glenn E. and Ruth Gray Cunningham Foothills exhibit highlights the four ecoregions of the California foothills, while the Native Plant Pollinator Garden attracts and celebrates the wide range of pollinators that visit our state’s native plants.

The garden exhibits serve to celebrate native biodiversity and provide an environment for outdoor learning, activities, and education for the California State University, Chico and surrounding community.

The Garden Detectives activities in this booklet have been developed by the curator of Gateway Gardens, Laura Lampe.

Laura cares for the plants and habitats of the garden exhibits at Gateway, and develops educational content relating to the gardens and regional environment. She loves citizen science projects and incorporating art and creativity into outdoor education. Her favorite activities in this booklet are the coloring pages and scavenger hunts!