Interpretive Activities
for
Armstrong Redwoods Docents

August, 2023

Interpretive Activities for Armstrong Redwoods Docents

The activities on the following pages are intended to assist you in leading groups. They can help make your tours more educational and more enjoyable for both you and the visitors. **You do not have to do <u>any</u> of them**. **Some people on tours just want to walk through the forest, and others just want to have their questions answered. Our goal, especially with young children, is to provide a fun and educational experience that will motivate them to want to return to the forest again and again. We want them to feel connected to nature.** But it is good to have a few activities in mind in case it is appropriate to use them.

Consider this document a tool kit. It has more tools than you will ever need on a single tour of Armstrong Redwoods. Start by finding one or two tools/activities that you feel comfortable using and add more to your skill set as you become more experienced. Most of these activities include links to additional useful information or resources.

If you know of an activity that would be useful to docents, or an improvement in one of these, please contact the Stewards Programs Manager so that we might add it to this document.

Having a theme for your walk can help tie things together for you and the visitors. In its *Redwoods Interpretation Master Plan (R.I.M.P.)*, State Parks has suggested some themes.

Those *R.I.M.P.* themes are:

- **Redwoods are connectors of the coast.**
- **Redwood stewardship sustains the planet.** (Changing Values and Conservation)
- **Redwoods support interconnected coastal and inland communities.** (Ecology)
- **Redwoods inspire deep personal connections.** (Personal Connections)
- **Indigenous peoples connections** (to be developed)
- **Narrative Thread:** Past, Present, Future.

Other themes are possible. Examples of other themes include but are not limited to:

- **Everything in this forest is interconnected; it is a community.**
- **Redwoods have many adaptations that allow them to live for a long time.**
- **People have used this area for many years and for many purposes.**
- **There are lots of interesting things to see in Armstrong Redwoods.**

Building your tour plan around themes: For example, if your theme is Redwoods Inspire Deep Personal Connection, the activities Hug A Tree, Meet the Hazelnut, Color Walk, and/or In the Dark can all help visitors make **personal connections** with the redwood forest.

Building your tour plan around a teacher's goals: Some teachers just want their students to learn whatever they can about the redwood ecosystem, to feel comfortable in the woods, and enjoy the park. Others have specific learning objectives for their students. These generally involve "**standards**" that students are supposed to achieve. See below for an explanation about the Next Generation State Science Standards. The tables on the next page identify some science standards that the activities can help students achieve.

Building your tour plan around features: There are several park features that can be seen in more than one place along the trails. Examples are family circles of trees, root masses and root pulls, evidence of fire, and buds on trees. Other features such as the tallest tree, the oldest tree, or the history/date round may not be found in many places but are still **of interest to visitors**.

Some short activities can be done on the trails. (They need to be short so that your group doesn't clog up the trail.) Others take longer and are best done in the parking lot at the start of a tour, at the Forest Theater, or at the Burbank Circle during the tour, or at the picnic area at the end of the tour. Most tours are about two hours in length, **so be aware of time limits**. If you are going to do a 15-minute activity, you will need to minimize talk and activities on the trail.

Use your judgement to modify the activities. You don't necessarily have to do all the steps. Or you might want to add something. Always keep in mind to let the visitors' interests guide your interpretation. As one docent put it, "Let's see what the forest has to show us today!"

Some teachers want our docents to help their students meet **Next Generation Science Standards (NGSS).** An "S" on the tables that follow indicates that the activity can help students achieve one or more of the NGSS. The topics that the activity helps teach are indicated in the

descriptions of the activities themselves, which follow the tables. In reality, most teachers will be fine with whatever you can do to help the kids enjoy the forest, feel connected to it, and learn a bit about it.

What are Next Generation Science Standards? So that teachers know what they are supposed to teach at the various grade levels, the state has adopted "standards" in the different disciplines. In science, those are called the Next Generation Science Standards (NGSS). Docents don't need to know the actual wording of the NGSS, but it is useful for you to have an idea what students are supposed to be learning at the various grades. The activities presented here can help students achieve some of the NGSS, and we have indicated those. **But don't feel that you are responsible for teaching any of the NGSS to mastery; that's the teacher's job.**

A few examples of the NGSS are given below. (The K, 3, and 5 refer to grade levels; ESS refers to Earth and Space Science, LS refers to Life Science, and PS refers to Physical Science.) "Models" can be anything from pictures to diagrams to 3-dimensional things.

Sample Next Generation Science Standards:

- K-ESS3-1. Use a model to represent the relationship between the needs of different plants or animals (including humans) and the places they live.
- 3-LS3-2. Use evidence to support the explanation that traits can be influenced by the environment.
- 5-PS3-1. Use models to describe that energy in animals' food (used for body repair, growth, motion, and to maintain body warmth) was once energy from the sun.

You can find all of the NGSS at: https://www.cde.ca.gov/pd/ca/sc/ngssstandards.asp

Note: In California, the Next Generation Science Standards were adopted in 2013. Some resources, such as *Redwood Ed*, were written before then and contain older standards.

The tables on the next page list the activities and indicate the recommended age grade for which they are most appropriate. Activities that are appropriate for all ages are listed first, alphabetically.

Activities that are recommended for particular age/grade spans are listed with those recommended for younger visitors first.

Some potential *R.I.M.P.* themes are also indicated. Of course, you should use your judgment as to whether an activity is appropriate and also in modifying the activity.

To make it easy for you to find specific activities, the activities follow the table and are in alphabetical order.

Written in 2023 by Stewards docents Greg Corby, Nina Lowrey, and Mike Roa,
with editing by Stewards docents Lisa Bilodeau, Cynthia Halliday, Beth Lamb, and Jeffrey Smith.

Key:

✓ The activity is recommended for this grade level

"S" indicates that this activity can help students meet one or more Next Generation Science Standards at this grade level.

Suggested *R.I.M.P.* themes and their symbols in the table:

- **Redwoods are connectors of the coast.** (linking Armstrong and Sonoma Coast St. Park **(CC)**
- **Redwood stewardship sustains the planet.** (Changing Values and Conservation) **(C)**
- **Redwoods support interconnected coastal and inland communities.** (Ecology) **(E)**
- **Redwoods inspire deep personal connections. (PC)**
- **Indigenous peoples connections** (to be developed) **(In)**
- **Narrative Thread:** Past, Present, Future **(PPF).**

Quick and Simple Activities for on the Trail												
Activity	Theme(s)	K	1	2	3	4	5	6	7	8	H.S.	Adults
Baby Redwoods!	E, PPF	S	✓	S	S	✓	S	S	S	✓	✓	✓
Bay is Beautiful	E, PC, In	✓	✓	S	✓	S	✓	S	✓	✓	✓	✓
Hug A Tree	C, E, PC	S	✓	✓	✓	S	S	S	S	✓	✓	✓
Looking at Bark	E	✓	S	✓	S	S	✓	S	✓	S	✓	✓
Looking at Cones	E	✓	S	✓	S	S	✓	S	✓	✓	✓	✓
Looking at Leaves	E	✓	S	✓	S	S	S	S	S	S	✓	✓
Meet the Hazelnut	E, PC, In	✓	✓	S	✓	✓	S	S	S	✓	✓	✓
Old Man's Beard Lichen	E, In	S	✓	S	✓	S	S	✓	S	✓	✓	✓
Parson Jones Tree	C, E, PC, In, PPF	S	✓	S	S	S	S	S	S	✓	✓	✓
Short Activities for L.B. Cir or?	Varies depending on the activity											
Col. James Armstrong Tree	C, E, PC, In, PPF	S		S	S	S	S	S	S	✓	✓	✓
Color Walk	PC	S	S	✓								
Big Leaf Maple Helicopters	E, PC	✓	S	✓	✓	S	✓	S	✓	✓		
Redwood Cones and Seeds	E, PPF			S	S	S	S	S	✓	✓	✓	✓
Spotter Cards	E, PC			S	S	S	S					
In the Dark	PC				✓	S	✓	S				
Interpreting Tree Rings	C, E, PPF				S	✓	S	S	S	✓	✓	✓
A Cone in the Hand Is Worth...	E, PC					S	✓	S	✓	✓	✓	✓
Fire Adaptations	C, E, PC, PPF, In					S	S	S	✓	✓	✓	✓
Icicle Tree	C, PC, PPF					✓	✓	S	✓	✓	✓	✓

Longer Activities for the Start or End of a Tour												
Activity	Theme(s)	K	1	2	3	4	5	6	7	8	H.S.	Adults
Food Webs	C, E, PPF, In					S	S	S	S			
How Are We Like Trees?	E, PC, In	S	S	✓	S	S	✓					
I Notice, I Wonder, It Reminds Me of	E, PC					S	✓	S	✓	✓	✓	✓
Think, Pair, Share	C,E, PC, PPF			✓	✓	✓	✓	✓	✓	✓	✓	
Twenty Questions	E	✓	S	✓	S	S	✓	✓	✓	✓		

Quick and Simple Activities for on the Trail

A Cone in the Hand Is Worth…

Who and How Long: Grade 4 and older 3-5 minutes

Background: For such a large tree, coast redwood cones and seeds are surprising small. While there is some variation of course, the seeds are only about the size of a sesame seed, and the cones are about the size of a black olive.

Summary: Visitors are told that the docent is going to give them something and that they should notice what it feels like and try to guess what it is without seeing it. They are asked to close their eyes and hold out their hand. The docent places a cone (or acorn) into the hand and closes the fingers. The visitor is instructed to gently squeeze the cone and notice how it feels.

Why:

- Connections:
  - ✓ Most people will have a general idea of how big a pine cone is. Most will think of pine cones that are about 5-9 inches long. The small size of the coast redwood cone will be surprising to them.
- Next Generation Science Standards:
  - ✓ Fourth graders study plant and animal structures.
  - ✓ Sixth graders study plant structures.

R.I.M.P. **Theme(s):**

- **Redwoods support interconnected coastal and inland communities.** (Ecology) **(E)**
- **Redwoods inspire deep personal connections. (PC)**

When: Any time of year

Where in the park: Anyplace

Materials: Coast redwood cones for each visitor
Coast redwood seeds, preferably in magnifying boxes, but in a vial will do. (Stewards may be able to provide these. If you collect freshly fallen cones, place them in a paper bag or box and they will release hundreds of seeds.)
Optional: Tanoak or other types of acorns; giant Sequoia cones

Procedure:

1. Gather cones (and acorns if desired) outside of the park. So that they don't mold, store them in a dry place, such as a cardboard box in the garage. If you are not going to let the visitors keep them, gather about 30 so that you will have some for replacement. If you are going to let visitors keep them, gather a great many.
2. Prior to explaining about coast redwood reproduction by stump sprouting, tell the visitors that you have a game for them.

3. Explain that you are going to place an object into their hand without them seeing it. Tell that you would like them to gently close their hand around it and notice how it feels. Tell that they may gently squeeze the object, but ask them not to crush it.
4. Ask for a volunteer to help you demonstrate.
5. Have the volunteer hold out their hand, palm down, and close their eyes.
    a. Place a penny or other small object into their hand and close their fingers around it.
    b. Tell them that they can open their eyes.
    d. Ask them to gently feel the object but not to say what they think it is.
    e. Ask them to describe the object, but, again, not to say what they think it is.
6. Ask if there are any questions.
7. With younger visitors, assure them that the object isn't alive and won't hurt them.
8. Have all visitors, including adults, close their eyes and hold their hands out, palms down.
9. Place a cone in each person's hand and close their fingers around the cone.
   (If there are a lot of visitors, you might want to enlist an adult to help with this.)
10. When everyone has a cone, tell them that they can open their eyes without talking.
11. Tell them to notice how the object feels but not to worry too much about what it is.
12. After a couple of minutes, tell them that they may look at the object.
13. Ask them what they think the object is.
14. Tell that it is a coast redwood cone.
15. Explain that <u>you collected the cones outside of the park</u>.
15. Show some coast redwood seeds, preferably in a magnifying box.
16. Tell that coast redwood seeds don't usually germinate/grow into trees; they usually die or are eaten before they can grow their roots down into the soil. Explain that they do have a chance to germinate, though, if the leaf litter/duff has been burned off or if a landslide or root pull has exposed bare soil.
17. Collect the cones or, if you want to, offer to let them keep them if they promise to show and tell their parents about them when they get home.

<u>Optional:</u> Repeat using a Giant Sequoia cone or acorn.

Links:

- Links to other resources:
    - ✓ **Basic Organism Cards**: https://stewardscr.org/wp-content/uploads/2023/06/BASIC-Organism-Cards-rev-6.1.23.pdf
    - ✓ **Advanced Organism Cards:** https://stewardscr.org/wp-content/uploads/2023/06/ADVANCED-Organism-Cards-rev-6.1.23.pdf
- Connections to other activities:
    - ✓ See the activities "Baby Redwoods", "Looking at Cones", and "Redwood Cones and Seeds"

Baby Redwoods!

Who and How Long: All Ages 3-5 minutes

Background: Coast redwoods seldom successfully reproduce from seed; they mostly reproduce from stump or root crown sprouting. Because the seeds are so small, they have trouble reaching the soil to germinate before they dry out in the thick layer of duff, are eaten by animals, or are killed by fungus. However, fire, landslide, or other disturbances can expose the soil, allowing germination of the tiny seeds.

Summary: Visitors see redwood seedlings near the trails and learn why redwoods don't generally reproduce by seed germination.

Why:

- <u>Connections:</u>
  - ✓ With younger visitors: Young children generally like to see baby animals; they can also appreciate baby trees.
  - ✓ With grade 4 and older visitors: After learning about redwood reproduction by root crown sprouting, the rarity of seed germination, and the effect of fire, most people will appreciate seeing seedlings.
- <u>Next Generation Science Standards:</u>
  - ✓ Kindergarteners learn that organisms can change the environment.
  - ✓ Kindergarteners learn about organisms' needs and their environment.
  - ✓ Second graders learn about plants needing water
  - ✓ Third graders study life cycles.
  - ✓ Fifth graders learn about plants obtaining materials from air and water.
  - ✓ Fifth graders study the interactions between organisms and the abiotic environment.
  - ✓ Sixth graders study photosynthesis, and the flow of matter and energy.
  - ✓ Sixth graders study the effects of resource availability on organisms.
  - ✓ Seventh graders study the ways that physical components of an ecosystem affect populations.

R.I.M.P. **Theme(s):**

- **Redwoods support interconnected coastal and inland communities.** (Ecology)
- **Narrative Thread:** Past, Present, Future

When: Any time of year

Where in the park: At this writing, there are a very few redwood seedlings along the trails. A couple of seedlings that sprouted after the Walbridge Fire of 2020 were noticed early in 2022. They were (are?) along the Pioneer Nature Trail south of the Flohr memorial. They may or may not still be alive. Check with experienced docents or the Stewards Programs Manager.

Materials: Optional: water (possibly visitors' water bottles)

Procedure:

1. Locate seedlings before starting the tour.
2. During the tour, teach visitors about redwood reproduction by root crown/stump sprouting.
3. Show samples of cones and seeds and explain the rarity of reproduction by seed.
4. Tell the visitors that they are lucky because we have found a few redwood seedlings that they will get to see today.
5. When you come to the seedlings, point them out and encourage visitors to share some of their water with the seedlings. Maybe say something to the seedlings like "Here is some water. I hope that you grow big and strong!"

Links:

- Links to other resources:
  - ✓ **Carry Cards:** https://stewardscr.org/wp-content/uploads/2023/04/Carry-Cards-A-Tool-for-Docents.pdf
  - ✓ **Basic Organism Cards**: https://stewardscr.org/wp-content/uploads/2023/06/BASIC-Organism-Cards-rev-6.1.23.pdf
  - ✓ **Advanced Organism Cards:** https://stewardscr.org/wp-content/uploads/2023/06/ADVANCED-Organism-Cards-rev-6.1.23.pdf
- Connections to other activities:
  - ✓ See the activities "A Cone in the Hand is Worth…" and "Redwood Cones and Seeds"

Bay is Beautiful

Who and How Long: All ages 3-5 minutes

Background: Bay trees (*Umbellularia californica*) are common in Armstrong Redwoods. Their leaves produce odorous chemicals that Native Americans used to repel fleas and other insects and to mask their human scent when hunting. The bay tree has several names, including: Bay, Bay-Laurel, California Laurel, Pepperwood, and Oregon Myrtle. The California bay is related to, but not the same species as, the bay sold as a spice, which is *Laurus nobilis.* It is also related to avocado and the flesh around the seed is high in fats.

Summary: Visitors smell the leaves of the bay tree, learn that it is related to the bay used as a spice, and learn ways that Native Americans used the leaves.

Why:

- Connections: Most people like spaghetti sauce, and many have made it using bay leaves.
- Senses: uses the sense of smell. After doing this, visitors may smell bay in other areas of the park.
- Next Generation Science Standards:
  - ✓ Second graders learn about animals helping to disperse seeds.
  - ✓ Fourth graders learn about structures that help organisms reproduce.
  - ✓ Sixth graders study senses.

R.I.M.P. **Theme(s):**

- **Redwoods support interconnected coastal and inland communities.** (Ecology)
- **Redwoods inspire deep personal connections.**
- **Indigenous peoples connections** (to be developed)

When: Any time of year. Seeds are most common in the spring.

Materials: Since we can't pick fresh leaves in the park, you may want to bring some with you. Fallen leaves are generally easy to find along the trail.

Where in the park: Bay trees are found in many areas. Near the Visitor Center and on the Pioneer Nature Trail to the Parson Jones tree are good places to find leaves.

Procedure:

1. When you find some bay leaves on the trail, have visitors pick one up. Remind them not to pick any leaves in the park. Or bring out leaves that you have brought into the park with you. (Some visitors may have an allergic reaction to the chemicals, so **try to find yellow leaves,** which have less of the chemical. **If using green leaves, tell them NOT to crush the leaves.)**

2. If the leaf is yellow (not green), tell them to crush and smell it.
3. Ask whether they like the smell or not.
4. Ask what it reminds them of.
5. Ask whether they like spaghetti and whether they have ever made spaghetti sauce.
6. Tell them that this is a bay tree. It is not the same species as the one sold as a spice, but is closely related.
7. Tell them that fleas don't like the smell of the leaves and that Native Americans would spread the leaves on the ground in their sleeping areas.
8. Ask how bay leaves might be helpful when hunting deer. Native Americans would rub the leaves on their bodies to disguise the human odor.
9. If you can find seeds, or have brought some with you, show them. Explain that Native Americans would roast them for food. (They taste like very strong or burnt coffee!)

10. Older visitors might be interested to know that the tree has several "common names," including bay, bay laurel, California bay, pepperwood, Oregon myrtle. Explain that common names are not always accurate when referring to a particular species because different species of plant may share the same common name, or, as is the case with the California bay, a given species may have several common names.

Links:

- Links to other resources:
  - ✓ **Basic Organism Cards**: https://stewardscr.org/wp-content/uploads/2023/06/BASIC-Organism-Cards-rev-6.1.23.pdf

Big Leaf Maple Helicopters

Who and How Long: Grades K-8 5 minutes

Background: In the fall, big leaf maple trees produce seeds with "wings" attached to them. The wings cause the seeds to fall slowly to the ground, allowing them to be blown away from the parent tree. This helps the species survive by reducing competition between seedling and parent tree. Some people call these "helicopter seeds."

Summary: Visitors see how maple seeds spin as they fall to the ground. Older visitors learn that this is an adaptation that helps reduce competition between the parent tree and the seedling.

Why:

- Connections: Tossing and watching the seeds is simply fun!
- Next Generation Science Standards:
  - ✓ First graders study how people mimic plant parts to solve problems.
  - ✓ Fourth graders study structures that help with reproduction.
  - ✓ Sixth graders study plant structures that help with reproduction.

R.I.M.P. **Theme(s):**

- **Redwoods support interconnected coastal and inland communities.** (Ecology)
- **Redwoods inspire deep personal connections.**

When: In the fall (usually late August – December). Wet seeds are usually too heavy to fall slowly.

Where in the Park: There are a couple of big leaf maple trees in the parking lot. The largest is just north of the Visitor Center. Another is a bit south of the trailhead for the East Ridge Trail.

Materials: Maple seeds, like many others, have "wings" attached to them. (Such a seed is called a samara, but neither you or the kids need to know that.) In season, many of them can be found on the ground. Some docents collect numbers of them and save them to use when the seeds aren't found on the ground or when the seeds are too wet/heavy to spin and fall slowly.

Procedure: Remind the visitors not to take anything home with them.

1. Bring the group to one of the Big Leaf Maple trees. If there are several groups, you may want to collect a bunch of the seeds and take your group a bit away from the other groups, but stay where you can see the trees and the seed clusters still on the branches.
2. Hold up a seed and ask the students what it is.

3. Tell the students that you are going to toss the seed up into the air and that they should observe what happens.
4. Toss the seed up and watch it fall to the ground, spinning like a helicopter's blade.
5. Ask the students what they observed.
6. Have them pick up a seed and toss it. (Some will want to do this many times. That's okay.)
7. Tell the students that this is a Big Leaf Maple Tree and that is a relative of the trees from which we get maple syrup.
8. Remind them to leave their seeds there.

For older students:

1. After having them toss the seeds a couple of times, ask them what it means when we say that an organism has an "adaptation."
2. Elicit that adaptations are things that help an organism or kind of organism (species) survive.
3. Give an example or two, and ask how the adaptation helps the organism or species survive.
   a. Examples:
      i. Deer have big ears that help them hear approaching predators like cougars
      ii. Flowers have nectar that attracts bees and butterflies. This is an adaptation that helps the species survive, not just an individual plant.
      iii. Ask the students to suggest a couple more adaptations.
4. Ask the students to name a type of fruit. Most will name something that is round like an orange, tomato, apple, or grape.
5. Ask how having round fruit helps the species survive. (When the fruit rolls away from the parent tree, the seeds are carried with it. The seeds can then germinate someplace where they aren't competing with the parent tree for sunlight and water.)
6. Ask how the helicopter seed helps the maple tree spread its seeds so that the seedlings aren't competing with the parent tree. (Wind blows them away from the parent tree.)

Links:

- Links to other resources:
  - ✓ **Basic Organism Cards**: https://stewardscr.org/wp-content/uploads/2023/06/BASIC-Organism-Cards-rev-6.1.23.pdf

Colonel James Armstrong Tree

Who and How Long: All (different activities for different ages) 4-7 minutes

Background: For information on Colonel Armstrong and his daughter Lizzy, see the interpretive display, State Parks brochure, and resources in the Stewards docent library.

At 308 feet, the Armstrong Tree is not quite as tall as the Parson Jones Tree, which was 310 feet tall when it was measured, which was probably in the 1970s. However, Armstrong tree's measured diameter of 14.6 feet was larger than the Parson Jones Tree's diameter, which the sign indicates is/was 13.8 feet. The trees may be taller now, or they may be shorter due to die-back at the top, wind breakage, or even lightning strikes. They are probably bigger around due to growth, but the annual growth in width of a tree this big is not very much, maybe less than 1/16 inch per year.

a. The sign doesn't indicate where the diameter was measured, but it says that it was 14.6 feet. Foresters measure trees' diameters by measuring the circumference at 4.5 feet above ground ("diameter at breast height" or d.b.h.) and dividing it by pi. (C = pi x d, so d = C ÷ pi. Pi can be rounded to 3.14 or even 3.)

b. In March of 2023 we measured the Armstrong Tree's d.b.h. to be 12.4 feet and its diameter at ground level as 14.8 feet, so maybe it was measured near ground level in the '70s.

Since fire is a natural part of the ecosystem, the Armstrong Tree must have adaptations that have allowed it to survive the fires that would occur in this environment every 15-25 years if we hadn't been suppressing them for the last hundred years. Those fires might have been started by lightning, but the Native Americans also used fire to encourage the growth of plants that they used for food or medicine, and to increase visibility and allow for easier passage. Most of their fires were started in the grasslands and oak woodlands that surround Armstrong Redwoods, but sometimes those fires would burn into the forest. Fire scars in the wood provide ample evidence of repeated fires in the forest. Suppression of fires has allowed fuel to accumulate, threatening to make future fires larger, hotter, and more dangerous to the trees.

Summary:
The Armstrong Tree is one of two signature trees in the reserve. Visitors come from all over the world to see these huge and ancient trees. Seeing a tree that is over 1000 years old, as tall as a 20-story building, and has a trunk that is over 45 feet around is an amazing experience.

Younger visitors get a feel for how big the Armstrong Tree is and how it has endured for so many years. Older visitors can compare the overgrown understory to the south of the Armstrong Tree to the area burned in the Walbridge Fire in 2020.

Why:

- <u>Connections:</u>
  - ✓ Many visitors from Sonoma County and beyond will remember the fires of 2020 or other fires.
  - ✓ Many visitors come to Armstrong Redwoods specifically to see large old trees.

- Next Generation Science Standards:
  - ✓ Kindergarteners learn that plants and animals can change the environment.
  - ✓ Kindergarteners study how humans can reduce their impact on the environment.
  - ✓ Second graders learn that Earth events can occur quickly or slowly.
  - ✓ Third graders learn that traits can be influenced by environment.
  - ✓ Third graders learn that some organisms survive when the environment changes and some don't survive.
  - ✓ Fourth graders learn that organisms have structures that enable them to survive.
  - ✓ Fifth graders study ways that communities can use science to protect resources.
  - ✓ Sixth graders study how environment influences growth.
  - ✓ Sixth graders learn about monitoring and minimizing human impacts on the environment.
  - ✓ Seventh graders study how changes in physical or biological components of an ecosystem affect populations.

R.I.M.P. **Theme(s):**

Redwood stewardship sustains the planet (Changing Values and Conservation)
Redwoods support interconnected coastal and inland communities (Ecology)
Redwoods inspire deep personal connections (Personal Connections)
Indigenous peoples connections (to be developed)
Narrative Thread: Past, Present, Future

When: Any time of year

Where in the park: Near the Armstrong Tree

Materials: String or cord 14.6 feet long (or 14.8 feet or 12.4 feet, depending on what measurement you want to use).

Procedure:

1. With younger visitors (TK-grade 4 or so):
   a. Have them look at the Armstrong Tree. Ask how old they think it might be. (Possibly use the Think, Pair, Share strategy described in this document.)
   b. Ask them to think about what it might have been like in this place when the tree started to grow, 1400 years ago. 100 years ago? Ask them to share their thoughts.
   c. Ask them to think about how old they will be in 50 years and what they think it will be like here then. 100 years from now? 1000 years from now?
   d. Have the students and adults form a circle. Give one end of the cord to an adult and have them pass the spool to the next person, who should hold the cord gently and continue passing the cord until the end is back at the starting adult. Have everyone continue to hold the cord and gently step back until the string is taught. That represents how big the Armstrong Tree is!

2. For a little older students (Grades 4-8 or so):
   a. Ask what the diameter of the tree is (14.6 feet, according to the sign).

b. Ask who knows how to find circumference from diameter (C = pi x d, so d = C ÷ pi. Pi can be rounded to 3.14 or even 3).
c. Have somebody make that calculation, then proceed to step d above.

3. With older visitors (Grade 4 up):
   a. After discussing the accuracy - or lack of accuracy - of the measurements noted on the sign, have visitors describe the appearance of the forest to the north of the Armstrong Tree (up the valley and hillside).
   b. Then have them turn around and describe the appearance of the forest to the south.
   c. Ask what might have caused the difference. Elicit or explain that the Walbridge Fire in 2020 burned off the understory shrubs and fallen branches. The forest probably would have looked much like the burned area for most of the tree's life, until we started suppressing fire over 100 years ago.
   d. Ask what happens if fuel isn't burned periodically. Elicit that it accumulates.
   e. Ask whether a forest with a lot of fuel will be more likely to have fires that will kill large trees than a forest whose fuel is frequently removed by small fires.
   f. Ask how redwood trees might protect themselves from fires. Explain the adaptations of redwoods for surviving fires, such as thick fibrous bark with tannins, natural pruning, stump sprouting, relatively little resin, and reseeding after duff is burned off.
   g. Ask whether fire fighters should have allowed the Walbridge Fire to burn into the valley floor. Why didn't they (There was concern about the fire getting to Guerneville). What should we do from now on? Should we let fuel continue to accumulate? Are there other options?

Links:

- Connections to other activities: See the activities "Fire Adaptations", "Parson Jones Tree", "How are We Like Trees?", and "Think, Pair Share"
- Links to other resources:
  - ✓ **Carry Cards:** https://stewardscr.org/wp-content/uploads/2023/04/Carry-Cards-A-Tool-for-Docents.pdf
  - ✓ **Basic Features Cards**: https://stewardscr.org/wp-content/uploads/2023/06/BASIC-Features-Cards-rev.-6.1.23.pdf
  - ✓ **Spotter Cards:** https://stewardscr.org/wp-content/uploads/2023/04/Spotter-Cards-A-Tool-for-A.R.-Docents.pdf
  - ✓ **Armstrong Redwoods Fire Ecology Walk brochure:** https://stewardscr.org/wp-content/uploads/2021/09/Fire-Brochure_7.13.21.pdf
  - ✓ **Walbridge Fire Fact Sheet** https://stewardscr.org/wp-content/uploads/2023/04/FAQ-and-Walbridge-Fire.pdf

Color Walk

Who and How Long: Tk-K (or First Grade) 5 minutes at start, then various times during walk

Background: Younger visitors may know the names of colors such as brown, green, and yellow, but they may not have noticed the different shades of those colors. All visitors can have richer experiences when they start to notice details such as different shades of colors.

Summary: Students look for different shades of green and brown during the walk. After noticing that many things in the forest are shades of green or brown, they then watch for things that have different colors, such as flowers, charred bark, gray rocks or lichens, or white/cream colored sapwood in broken branches.

Why:

- <u>Connections with nature:</u> The Color Walk activity encourages us to slow down with the children in our lives and take in all of the beautiful color variations and subtle nuances of natural color.
- <u>Next Generation Science Standards:</u>
  - ✓ Kindergarteners learn about the relationship between what organisms need and the places where they live. For example, why are leaves green?
  - ✓ First graders learn that young plants are not exactly like their parents. They may note that young leaves or needles are a lighter shade of green than mature leaves, or that the bark of a young redwood tree is often softer and a different color than that of a mature tree.
  - ✓ General Science Standards: Students can learn to focus their attention on details of things around them.

R.I.M.P. **Theme(s):**

Redwoods inspire deep personal connections.

When: Introduce the activity at or near the start of the walk, then various times during the walk.

Where in the park: Introduce the activity someplace near the start of the walk where some natural thing, such as a flower, that is <u>not</u> green or brown can be seen.

Materials: Optional: cards or photographs of something green and something brown, preferably more than one photograph or cards that show different shades. Paint color sample cards showing various shades can be useful for this.

Procedure:

1. Find something green, such as a leaf. Ask the children what color it is.
2. Hold up or point out a leaf that is a different shade of green. Ask what color it is.
3. Hold up both leaves and ask whether there are different kinds of green.
4. Elicit that yes, there are different kinds of green. Tell that these are called “shades” of green.
5. Repeat for brown items, such as bark, wood without bark, or dead leaves.

6. Have the children look around and notice that the forest has many different shades of green and brown.
7. Ask whether everything in the forest is either brown or green.
8. Have the children point out things that are not green or brown.
9. Ask them to be watching for different colored things during the walk.

An option: A parent will probably have a digital camera or cell phone with which they can take pictures of the items. Those can be sent to the teacher to review the colors when in the classroom.

Links:

- Connections to other activities:
  - ✓ See the activities “Looking at Bark”, “Looking at Cones”, and “Looking at Leaves”.
- Links to other resources:
  - ✓ Color Scavenger Hunt https://teachbesideme.com/color-scavanger-hunt/
  - ✓ Go On a Color Walk https://buggyandbuddy.com/printable-scavenger-hunt-for-kids-go-on-a-color-walk/

Fire Adaptations

Who and How Long: Grades 4 and up 7-10 minutes

Background: Fire is a natural part of California's landscape. Over millennia, our plants and animals have evolved a variety of adaptations that enable them to survive frequent fires. Coast redwoods have several readily observable such adaptations.

Summary: Visitors learn about several adaptations of coast redwoods for living in a fire-prone area such as California.

Why:

- Connections: Most students will remember the 2020 wildfires in Sonoma County.
- Next Generation Science Standards:
  - ✓ Fourth graders learn about structures that enable organisms to survive.
  - ✓ Fifth graders study the interactions of biosphere, geosphere, and atmosphere.
  - ✓ Fifth graders study ways that communities use science to protect the environment.
  - ✓ Sixth graders study the water cycle.
  - ✓ Sixth graders study ways to minimize human impacts on the environment.
  - ✓ Sixth graders study global temperature increase.

R.I.M.P. **Theme(s):**

Redwood stewardship sustains the planet. (Changing Values and Conservation)
Redwoods support interconnected coastal and inland communities. (Ecology)
Redwoods inspire deep personal connections.
Indigenous peoples connections (to be developed)
Narrative Thread: Past, Present, Future

When: Any time of year

Where in the park: Any place where visitors can touch redwood bark, preferably younger trees. (Unless wet, older bark can be pretty hard (not spongy). However, when it is wet, the bark can provide a thick damp covering.) Try to find a place where there are several trees in a wide spot in the trail so that visitors won't have to wait for a turn or clog up the trail.

Materials: None needed, but, at least with adults, you might want to have several copies of the Armstrong Redwoods Fire Ecology Walk brochure.

Procedure:

1. Before the group arrives, locate one or more trees that have soft bark.
2. Have the visitors press the bark with their hands. **Remind them not to scrape or remove any bark**.
3. Ask what the bark feels like. Somebody will probably say that it feels like a sponge.

4. Tell them that redwood bark is very fibrous, with lots of air spaces when dry, and that it holds water like a sponge when wet. It is often very thick, too.
5. Ask what would probably cause natural fires. Elicit that most are started by lightning.
6. Ask what usually accompanies a thunderstorm. Elicit that there is usually rain.
7. Ask how the bark might help protect the tree from fire.
8. Air is a poor conductor of heat, so even dry bark helps protect the tree.
9. Tell them that redwood bark can provide a protective layer that is over a foot thick.
10. Tell them that the tannins that give the bark its red color are also a little bit fire resistant.
11. Point out that most of the mature redwood trees have shed their lower branches, a process called "natural pruning." This helps keep fire from getting into the canopy, where the leaves that keep the tree alive are.
12. Frequent fires rarely heat the soil very deeply. So even if the above-ground part of a redwood tree is burned, the roots may survive. Buds in the root crown may sprout and grow new trees. This is called stump sprouting or root crown sprouting. Look for and point out examples during the tour.
13. Another adaptation is the production of millions of seeds annually by mature trees. When fire burns off the layer of leaf litter (duff), the seeds may germinate.



Links:

- Connections to other activities:
  - ✓ See the activities "Baby Redwoods!", "Looking at Bark", and "Redwood Cones and Seeds".
- Links to other resources:
  - ✓ **Fire Ecology Walk brochure** https://stewardscr.org/wp-content/uploads/2021/09/Fire-Brochure_7.13.21.pdf
  - ✓ **Walbridge Fire** https://stewardscr.org/wp-content/uploads/2023/04/FAQ-and-Walbridge-Fire.pdf
  - ✓ **Basic Features Cards**: https://stewardscr.org/wp-content/uploads/2023/06/BASIC-Features-Cards-rev.-6.1.23.pdf

Hug A Tree

Who and How Long: All ages 5 minutes

Background: For trees that can grow to over 300 feet tall, redwoods have shallow roots. The roots generally don't go deeper than eight or ten feet down, but may spread out over 100 feet in all directions, with many fine roots near the surface of the soil. This enables them to take in water from fog drip in the summer. Roads and trails with millions of people walking on them every year can damage those shallow roots, especially near large trees that people want to stand next to and touch. The ramp was built to allow people to hug this large tree without trampling at least part of its roots.

Summary: Visitors are reminded of the many ways that trees enrich our lives and have the opportunity to express their gratitude.

Why:

- Connections: Even the youngest visitors can appreciate that people benefit from trees in many ways.
- Next Generation Science Standards:
  - ✓ Kindergarteners study the importance of reducing human impacts on the environment.
  - ✓ Fourth graders learn about structures (such as roots) that help organisms survive.
  - ✓ Fifth graders study the interaction of the geosphere and biosphere.
  - ✓ Fifth graders study ways that communities use science to protect resources.
  - ✓ Sixth graders study ways of minimizing human impacts on the environment.
  - ✓ Seventh graders learn about how changing the physical components of an ecosystem affects populations.

R.I.M.P. **Theme(s):**

Redwood stewardship sustains the planet.(Changing Values and Conservation)
Redwoods support interconnected coastal and inland communities. (Ecology)
Redwoods inspire deep personal connections.

When: Any time of year

Where in the park: On the Discovery Trail at the tree with a ramp if you are going to have the visitors actually hug a tree. This can also be done in the picnic area. However, other large trees along the trail don't lend themselves to hugging without going over the fence. The discussion about why we should be thankful for trees can be had anywhere.

Materials: None needed

Procedure:

1. Before you get to the tree on the Discovery Trail that has a ramp, or when you get there, ask the visitors to tell some things that trees and forests give us. Elicit such things as:
   a. lumber
   b. shade

c. fruit
d. oxygen
e. beauty
f. habitat for animals
g. reduced soil erosion

2. Ask if they know what a “tree hugger” is. Elicit that a tree hugger is someone who loves trees.
3. Ask if they would like to thank this tree and give it a hug.
4. Explain that the ramp was built so that people could get close to the tree without trampling the roots on most sides.
5. Remind them, too, that **thousands of people hug this tree every year, so they should be gentle and take care not to rub off any of the bark.**

Links:

- Links to other resources:

  ✓ **Basic Features Cards**: https://stewardscr.org/wp-content/uploads/2023/06/BASIC-Features-Cards-rev.-6.1.23.pdf

Icicle Tree

Who and How Long: Grade 4 and older 3-5 minutes

Background: The "Icicle Tree" is one of the Armstrong Redwoods features mentioned on the State Parks website, so many people are curious about it.

Burls are common on older redwood trees. Some burls seem to be caused by injury or by some sort of infection, but many have no obvious causes. Burls often form at the base of trees and can grow roots that help anchor the tree and take in water and minerals. Some think of them as benign tumors. They may develop far up the trunk or at the base.

Whatever the cause, burl wood often has quite beautiful patterns and is much desired for making furniture or turned bowls. In the 1970s, as the last of the old growth trees some of which had large burls, were being logged, a market developed for redwood burl tables and other furniture. Since old growth trees are no longer being logged, burl wood is hard to come by. Much of the burl wood now for sale comes from old stumps found in the forest or even hauled out of river beds. It is so valuable that people will sometimes actually go into a park and cut off burls from the base of a tree or even cut down a tree to get at the burl.

The Icicle Tree has some unusual elongated burls. If you look closely, you can tell that they have been cut off and are now regrowing. Somebody apparently sawed them off to make something, maybe coasters?

Summary: After looking at the burls on the Icicle Tree, and finding out what they are, visitors are asked to consider the effects of burl poaching.

Why:

- Connections:
  - ✓ Many older visitors have seen or at least heard of redwood burl furniture.
  - ✓ There is a growing concern about the sources of materials that we use in our lives.
- Next Generation Science Standards:
  - ✓ Sixth graders learn about minimizing human impacts on the environment.

R.I.M.P. **Theme(s):**

Redwood stewardship sustains the planet. (Changing Values and Conservation)
Redwoods inspire deep personal connections. (Personal Connections)
Narrative Thread: Past, Present, Future.

When: Any time of year

Where in the park: The Icicle Tree

Materials: None needed, but having a sample of burl wood or a photo is desirable

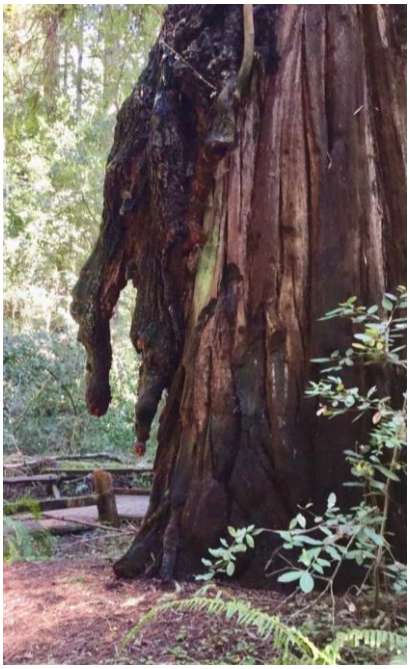
Procedure:

1. At the Icicle Tree, point out the burls and explain that there are several reasons why burls form, but we don't always know why a given burl formed.

2. Then point out that the burls were cut off some time back, apparently by somebody that wanted the wood to make something, possibly coasters. Or, possibly, they put the burl tip in some water and tried to grow a new redwood tree, which is sometimes possible.
3. If you have a sample of burlwood, or a photo, show it.
4. Tell that most large burls form in older trees, and we are no longer cutting large old trees, so burl wood is hard to come by and expensive. Ask where burl wood that is for sale now might come from. Elicit or tell that burl wood now mostly comes from old stumps found in the woods or in rivers. Some come from trees cut on private property, and some is poached from parks.
5. Ask whether people should buy burl furniture or other things such as bowls if they aren't sure of the source of the wood.

Links:

- Connections to other activities: See the activity "Hug a Tree"
- Links to other resources:
  - ✓ **Carry Cards:** https://stewardscr.org/wp-content/uploads/2023/04/Carry-Cards-A-Tool-for-Docents.pdf
  - ✓ **Basic Features Cards**: https://stewardscr.org/wp-content/uploads/2023/06/BASIC-Features-Cards-rev.-6.1.23.pdf
  - ✓ **Spotter Cards:** https://stewardscr.org/wp-content/uploads/2023/04/Spotter-Cards-A-Tool-for-A.R.-Docents.pdf

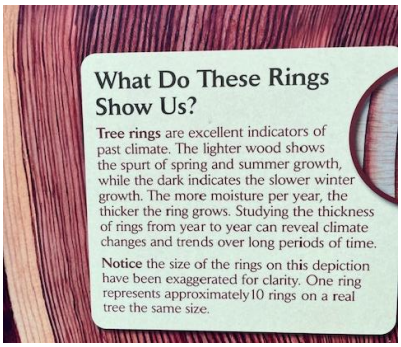


Interpreting Tree Rings

Who and How Long: Grades 3 and up 5-7 minutes

Background: Redwood trees typically produce two growth rings each year, one light colored and one dark. The light ring is formed when the tree is growing rapidly because it has plenty of sunlight and water, resulting in large, thin-walled cells, usually in the spring and early summer. In the late summer, fall, and winter, growth slows, resulting in small, thick-walled cells that form dark rings. So, an "annual ring" is actually two rings, one light and one dark.

If there is ample sunlight and water, the rings are wider, possibly more than a half inch of growth in radius each year. That would be an inch of growth in diameter in one year! If sunlight and/or water are lacking, growth is inhibited. So tight, narrow, rings indicate slow growth. Old growth trees usually grow in shady forests, so their rings are tight. After logging, sunlight comes into the forest, so second- or third-growth trees usually have wide rings.



Note that the illustration of rings on the large display near the visitor center implies that tight/narrow rings are due to lack of water. But old-growth redwoods may have tight rings for several hundred years, and they didn't endure droughts of several hundred years. Old growth trees' tight rings are usually due to lack of light in a dark old growth forest. But, of course, drought will also slow growth.

Summary: Visitors examine samples of wood exhibiting rapid and slow growth and learn what might cause such variation.

Why:

- Connections: By third grade, most visitors have heard that one can tell the age of a tree by counting its growth rings. They may have looked at the tree ring display near the Visitor Center.
- Next Generation Science Standards:
  - ✓ Third graders learn that organisms have life cycles that include growth.
  - ✓ Third graders learn that traits can be influenced by the environment.
  - ✓ Fifth graders study ways that biosphere, hydrosphere, and atmosphere interact.
  - ✓ Sixth graders learn that both genes and environment influence growth.
  - ✓ Seventh graders study the effects of resource availability on organisms.
  - ✓ Seventh graders learn that changes to physical or biological components of an ecosystem affect populations.

R.I.M.P. **Theme(s):**

Redwood stewardship sustains the planet. (Changing Values and Conservation)
Redwoods support interconnected coastal and inland communities. (Ecology)
Narrative Thread: Past, Present, Future

When: Any time of year

Where in the park: This is best done where tree rings can be seen, such as at the display near the Visitor Center, at the log near the kiosk, at the date round/history log, or where a fallen tree has been cut for the trail.

Materials: Wedges of redwood and slices of fence posts showing rapid and slow growth. These are given to docents when they receive training.

Procedure:

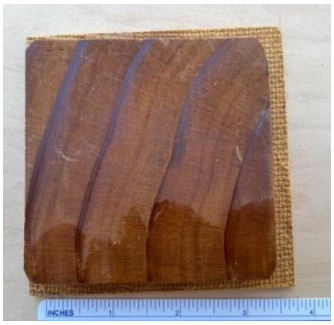
1. Ask how we know the age of a tree. Usually somebody will say that we can tell by counting growth rings.
2. Ask what a plant needs to grow. Elicit that it needs soil nutrients, air (CO_2 for photosynthesis and oxygen for cellular respiration throughout the plant), water, and light.
3. Show a showing with fast growth (wide growth rings) and point out that there are both light and dark rings. Explain the formation of light rings (spring and early summer, when there is plenty of water and light) and dark rings (fall and winter, when there is little water or light).
4. Ask how one might estimate the age of a tree without cutting it down. We do this by counting the rings in nearby trees that have fallen or been cut. We then assume that standing trees have the same growth rate. (For older visitors, you might mention the use of increment corers, but those aren't very useful for determining the age of a large tree with thick bark. They are useful for determining the growth rate of the sampled part of the tree.)
5. Then show the smaller wedge with tight growth rings, indicating slow growth.
6. Ask which wedge took longer to grow. Some may say the larger, rapid growth specimen.
7. Have someone count aloud as you point to the rings in the rapid growth specimen.
8. Then give the slow growth specimen and ask them to estimate how long it took to grow.
9. Ask what might have made the difference. Point out that sunlight and water are the most variable factors. The slow-growing tree most likely had plenty of water for most of its life,, or at least didn't endure a drought of hundreds of years. But it probably lived in the shade of other trees, so its rings are tight. The rapidly growing tree probably had plenty of both water and sunlight. But it came from an area that had been logged, which allowed lots of sunlight for growth. Such a forest is called "second growth."
10. Then show the fence post samples from second growth and old growth redwoods. Point out that the old growth sample has much tighter rings and is much darker because it had hundreds or even thousands of years to accumulate tannins. Tannins are the chemicals that give redwood its color and its resistance to insects and fungus. Recently harvested redwood is still beautiful, but it hasn't had hundreds of years to accumulate tannins, so it isn't very resistant to fungus or insects.

Links:

- Links to other resources:
  - ✓ **Basic Features Cards**: https://stewardscr.org/wp-content/uploads/2023/06/BASIC-Features-Cards-rev.-6.1.23.pdf
  - ✓ **See the following activities** from *Redwood Ed*:

- The Great Tree Cookie Mystery (p. 201)
  https://stewardscr.org/pdf/red_ed16_lessons_activities_pgs242to279.pdf
- Fence Post Studies (p. 313), Slow Growth and Rapid Growth in the Redwood Forest (p. 320), and Slow Growth or Fast Growth? (p. 363)
  https://stewardscr.org/pdf/red_ed17_lessons_activities_pgs280to328.pdf

Active docents may be able to obtain samples like those below from Stewards.



Above left and center: The tree took about 25 years to grow about 12 inches in radius.
Above right: section of a 4x4 (3.5”x3.5”) fence post. The tree took about 5 years to grow 3.5” in radius.

Above left: samples from a tree that fell in Armstrong in January of 2023. The longer specimen took about 950 years to grow 10.25”in radius. The shorter one took about 500 years to grow 6.75”. Inches.

Left: a section of an old fence post that had probably been in the ground for 50 years or more and is still solid. The old growth tree took over 150 years to grow 3.25” in radius.

Right: a specimen showing sapwood and heartwood.

In The Dark

Who and How Long: Grades 3-6? 3-5 minutes

Background: Some kids haven't had the opportunity to spend time in a forest and may be afraid. This activity should help them feel more comfortable.

In case some kids might be unusually afraid, you might want to discuss it with the teacher before doing it.

Summary: Students spend some time sitting with their eyes closed, experience the park with senses other than sight.

Why:
Connections: Experiencing the forest with one's eyes closed can help one notice sounds, and possibly even scents or the feel of a light breeze that wouldn't be noticed when looking around. Also, "surviving" a few minutes with eyes closed can help kids feel more comfortable in the forest.

- Next Generation Science Standards:
  - ✓ Fourth graders learn about structures and behaviors that enable organisms to survive.
  - ✓ Sixth graders study the senses.

R.I.M.P. **Theme(s):**
Redwoods inspire deep personal connections.

When: Ideally, this activity would be done very early in the tour, perhaps even in the parking lot. But it can also be done later, such as at the Burbank Circle or Forest Theater.

Where: Parking lot, Burbank Circle, or Forest Theater

Materials: None

Procedure:
1. Find a wide spot in the trail. (This activity can also be done at the parking lot, Luther Burbank Circle or Forest Theater.)
2. Have the kids line up along one side of the trail so that they aren't blocking it.
3. Ask the students to name the five senses. (sight, taste, hearing, smell, touch). Ask them to name the organs for each sense (eyes, tongue, ears, nose, skin), and where those organs are located. (Most of these organs are located on the head, which enables us to sense things even if in tall grass or a similar environment.)
4. Ask which sense we use the most (sight).
5. Tell them that you are going to ask them to shut their eyes and just stand still for one minute, with no talking or giggling. (If you are doing this at the Burbank Circle or in the Forest Theater, they can sit.) Tell them that they can hold their friend's hand if they want to. And tell them that the parents and you will make sure that they are safe.

6. Ask if there are any questions.
7. Tell them to shut their eyes…Check for any student who hasn't closed their eyes and motion for them to do so.
8. After one minute, tell them to open their eyes. What was that like?
9. Then, have them sit down on the ground (not on the fence rails!).
10. Tell them that this time they are to keep their eyes shut for three minutes. They should again be quiet, but they should listen for any sounds from the forest.
11. After three minutes, have them open their eyes and ask them to share what they noticed.
12. Ask…Was it scary? Is everybody okay? What did they hear? What did they not hear that they thought they would? Discuss how we tune out background noise, which they probably will notice when sitting quietly. What if we didn't or couldn't tune it out?
13. Point out that if we use common sense, the forest is a safe place to be.

Links:

- Links to other resources:
  Senses other than sight can also be used when doing other activities such as "Hug a Tree", "Old Man's Beard Lichen", "Looking at Bark", and "Bay is Beautiful".

Looking at Bark

Who and How Long: All grades 3-5 minutes to start, then 1 or 2 minutes periodically

Background: Bark provides protection from insects, fire, abrasion, and other hazards. The bark of different trees can look very different. In fact, the bark of very young, middle-aged, and mature trees of the same species can look and feel very different. Looking closely at bark can help visitors appreciate the diversity present in the redwood forest. They may even spot some tiny insect or spider that they wouldn't notice without looking closely.

Summary: Visitors use sight, touch, and smell to compare and contrast the bark of various trees.

Why:

- Connections:
  - ✓ Uses senses other than sight to make observations
  - ✓ See the activity "Looking at Leaves"
- Next Generation Science Standards:
  - ✓ First graders note differences between young and mature organisms.
  - ✓ Third graders learn about variation within a species.
  - ✓ Fourth graders study plant animal structures.
  - ✓ Sixth graders study plant structures.
  - ✓ Eighth graders study genetic variation.

R.I.M.P. **Theme(s):**

Redwoods support interconnected coastal and inland communities. (Ecology)

When: Any time of year

Where in the park: Anyplace, but good to start in the parking lot

Materials: Optional: magnifiers

Procedure:

1. Anywhere in the park, but best near the parking lot, have visitors describe the bark of redwood and another type of tree, like Douglas-fir, bay, or big leaf maple. They will probably describe how the bark looks.
2. Then ask them to use other senses. How does the bark feel? Smell?
3. Either have the visitors make up names for the trees or tell them the names.
4. Have them compare two or more types. How are they **alike**?
   (If possible, have them compare both young and mature trees)
5. Have them contrast two or more types. How are they **different**?
6. To help with memory, you might have visitors take photographs of the bark, possibly including close-up.
7. As you tour the park, have them examine the bark of other species.

Links:

- Connections to other activities: See the activity "Looking at Leaves"
- Links to other resources:
  - ✓ **Tree and Fern keys on Stewards website at:** https://stewardscr.org/wp-content/uploads/2023/04/Tree-Fern-Keys-Tools-for-A.R.-Docents.pdf
  - ✓ **Basic Organism Cards**: https://stewardscr.org/wp-content/uploads/2023/06/BASIC-Organism-Cards-rev-6.1.23.pdf
  - ✓ **Advanced Organism Cards:** https://stewardscr.org/wp-content/uploads/2023/06/ADVANCED-Organism-Cards-rev-6.1.23.pdf
  - ✓ **See the activity** "Similar but Not the Same" in *Redwood Ed*. Here's the link https://stewardscr.org/pdf/red_ed16_lessons_activities_pgs242to279.pdf

Douglas-fir trees behind Visitor Center

Above: Douglas-fir bark. Left to right: young, "middle-aged", two samples of mature bark

Tanbark oak bark

Big leaf maple bark

Bay/bay laurel bark

Looking at Cones

Who and How Long: All grades 3-5 minutes

Background: Many visitors are familiar with pinecones, but may have never noticed a redwood cone. They are often amazed to learn how small redwood cones are. After learning what they look like, they may begin to notice them along the trail.

Redwood and Douglas-fir cones look different and are different sizes. Redwood cones often remain attached to a length of twig when they fall from the tree, while Douglas-fir cones usually fall from the tree without any twig.

Cones are the reproductive organs of conifers. The "female" cone is the seed-bearing organ, which we usually think of as a cone. It produces ovules, which become seeds after fertilization by pollen, which is produced by much smaller male cones, which tend to fall apart or shrivel up after releasing their pollen. The pollen is spread by wind, which is not a very efficient way of pollinating the ova. So many of the seeds in a cone are not fertile and won't germinate. But a mature tree produces millions of seeds every year, mostly from cones near the top of the tree.

See the links for an interesting legend about the Douglas-fir cone.

Summary: Visitors compare and contrast redwood and Douglas-fir cones.

Why:

- Next Generation Science Standards:
  - ✓ First graders note differences between young and mature organisms.
  - ✓ Third graders study life cycles, including reproduction.
  - ✓ Fourth graders study plant animal structures.
  - ✓ Sixth graders study plant structures.

R.I.M.P. **Theme(s):**

Redwoods support interconnected coastal and inland communities. (Ecology)

When: Any time of year, but best when newly fallen cones are available

Where in the park: Anyplace, but both Douglas-fir and redwood cones can often be found in the parking lot. There are some Douglas-fir trees on the hill to the east of the Visitor Center.

Materials: Cones from redwood and Douglas-fir trees. (You might bring some cones with you in case cones that are in good shape can't be found on the ground)

Optional: Giant Sequoia cone(s) and samples of seeds from coast redwood, Douglas-fir, and giant Sequoia.

Procedure:

1. Find some redwood and Douglas-fir cones. (The hillside above the Visitor Center is a good place to look for Douglas-fir cones.)
2. Ask visitors how plants reproduce. Elicit that plants produce seeds.
3. Point out that most familiar plants, including many trees, produce seeds in flowers.
4. Ask what part of redwood trees produces seeds. Elicit that they produce seeds in cones.

5. Tell that redwoods are called “conifers” or cone-bearing plants.
6. Show coast redwood cones. If available, show coast redwood seeds.
7. Tell that another conifer that we have here is the Douglas-fir.
8. Show Douglas-fir cones. If available, show Douglas-fir seeds.
9. Ask visitors to compare the two types of cones. How are they similar? How different?
10. With older visitors, point out that without flowers, the cones don’t attract pollinators such as bees or other insects. Conifers are generally wind-pollinated, which isn’t very efficient. So they produce a great many cones and seeds every year.

Previous year’s coast redwood cones, approximately life size. The center and right cones are typical size.

Above: Current year redwood cones from the top of a tree, in June.

Douglas-fir cone, approximately life size.

Links:

- Connections to other activities: See “A Cone in the Hand is Worth…”, “Big Leaf Maple Helicopters”, “Looking at Leaves”, and “Redwood Cones and Seeds”.
- Links to other resources:
  - ✓ **Tree and Fern keys**: https://stewardscr.org/wp-content/uploads/2023/04/Tree-Fern-Keys-Tools-for-A.R.-Docents.pdf
  - ✓ **Basic Organism Cards**: https://stewardscr.org/wp-content/uploads/2023/06/BASIC-Organism-Cards-rev-6.1.23.pdf
  - ✓ **See the activity** “Similar but Not the Same” in *Redwood Ed*. Here’s the link https://stewardscr.org/pdf/red_ed16_lessons_activities_pgs242to279.pdf
  - ✓ **Here’s a link** to an interesting legend about why the Douglas-fir cone looks the way it does: https://www.savetheredwoods.org/blog/futures/the-douglas-fir-and-the-mouse/ (note: Another version has a mouse fleeing from a coyote and promising to help spread the tree’s seeds if the tree will hide them.

Looking at Leaves

Who and How Long: All grades 3-5 minutes to start, then 1 or 2 minutes periodically

Background: Leaves are the food factory for the plant. Chlorophyll in the leaves uses light energy to convert water and carbon dioxide to sugar compounds that are used to "build" the plant. In a shady redwood forest, the name of the game is competition for sunlight.
Many visitors have never looked closely at leaves. Doing so can not only help them learn to identify different types of plants, but also to appreciate the great diversity of leaf shapes.

Summary: Using sight, touch, and smell, visitors compare and contrast the leaves of a variety of plants.

Why:

- Connections: Uses senses other than sight to make observations
- Older visitors can learn to use dichotomous keys
- Next Generation Science Standards:
  - ✓ First graders note differences between young and mature organisms.
  - ✓ Third graders learn about variation within a species.
  - ✓ Fourth graders study plant animal structures.
  - ✓ Fifth graders study photosynthesis.
  - ✓ Sixth graders study plant structures.
  - ✓ Seventh graders study photosynthesis.
  - ✓ Eighth graders study genetic variation.

R.I.M.P. **Theme(s):**

Redwoods support interconnected coastal and inland communities. (Ecology)

When: Any time of year, but best when all trees have leaves (not mid-winter)

Where in the park: Anyplace, but good to start in the parking lot

Materials: Optional: Magnifiers, tree or fern keys, possibly leaves brought into the park

Procedure:

1. Anywhere in the park, but best done near the start of a tour. Have visitors describe the leaves of two types of trees, such as redwood and bay. Remind them NOT to pick leaves. They will probably describe how they look.
2. Then ask them to use other senses. How does the leaf feel? Smell? (Because of possible allergic reactions, do not have them taste the leaves.)
3. Either have the visitors make up names for the plants or tell them the names.
4. Have them compare two or more types. How are they alike?
5. Have them contrast two or more types. How are they different?
6. Have visitors find leaves on the ground to carry during the walk. Remind them NOT to pick leaves. As long as they don't remove the leaves from the park, visitors can carry the specimens during the walk so that they can compare and contrast to other types of plants.
7. You might pick some leaves outside of the park and bring them in with you.

8. Dichotomous keys to common trees and ferns found in Armstrong Redwoods are available for checkout in the shed by the Visitor's Center or from the library in the Volunteer Office. The keys are also on the Stewards website in a digital format (link below). Visitors from about fifth grade and older can be taught how to use the keys.

   Notes:
   a. It will take a while for the visitors to learn to use the keys. You should only plan to do this if you are sure that you will have enough time.
   b. Be sure to tell them that these keys include only a few of the plants found in Armstrong Redwoods. They may encounter plants not included in the keys, so they should be sure to use the photographs and descriptions to confirm their identifications.

Links:

- Connections to other activities: See "Looking at Leaves", "Looking at Cones", and "Color Walk".
- Links to other resources:
  - ✓ **Tree and Fern keys**: https://stewardscr.org/wp-content/uploads/2023/04/Tree-Fern-Keys-Tools-for-A.R.-Docents.pdf
  - ✓ **Basic Organism Cards**: https://stewardscr.org/wp-content/uploads/2023/06/BASIC-Organism-Cards-rev-6.1.23.pdf
  - ✓ **Advanced Organism Cards:** https://stewardscr.org/wp-content/uploads/2023/06/ADVANCED-Organism-Cards-rev-6.1.23.pdf
  - ✓ **See the activity** "Similar but Not the Same" in *Redwood Ed*. Here's the link https://stewardscr.org/pdf/red_ed16_lessons_activities_pgs242to279.pdf

Douglas-fir

tanbark oak

coast redwood

bay

CA. hazelnut

big leaf maple

Meet the Hazelnut

Who and How Long: All ages 3-5 minutes

Background: The California, or "beaked," hazelnut is native to our redwood forests. It is related to the commercially grown hazelnut or filbert, which is native to Europe. The nuts, while smaller than filberts, look much the same. They may develop singly or in pairs.

The plant is deciduous, but the yellow leaves stay on the shrub for quite a while in the fall.

The hairs that give the leaf a fuzzy feeling may help reduce water loss from the leaves by trapping a layer of moist air near the surface.

Summary: Visitors look at and feel the leaves of California hazelnut. If available, they also see specimens of the nuts. Native American uses of the plant are discussed.

Why:

- Connections: Many people enjoy Nutella, which is made from hazelnuts.
- Senses: Even adults are surprised at how soft the leaves are.
- Next Generation Science Standards:
  - ✓ Second graders study seed dispersal by animals.
  - ✓ Fifth graders study movement of matter among plants and animals.
  - ✓ Sixth graders study reproduction in plants.
  - ✓ Seventh graders study flow of matter and energy into and out of organisms.

R.I.M.P. **Theme(s):**

Redwoods support interconnected coastal and inland communities. (Ecology)
Redwoods inspire deep personal connections.
Indigenous peoples connections (to be developed)

When: This activity is seasonal. Hazelnut shrubs leaf out in the spring, but by mid-December, most hazelnut leaves have turned yellow and then fallen. However, even the fallen leaves can be used.

Where in the park: Hazelnut plants can be found along the trails at various points. So that the leaves don't get worn, and to avoid clogging up the trail, let's not all use the one by the first bridge/nursery log on the Pioneer Nature Trail. Others are found beside the road on the hillside north of the Visitor Center and along the trails.

Materials: It is desirable to have samples of California Hazelnuts and commercial nuts to show. California hazelnuts can be found and collected from plants outside of the park; commercial nuts (hazelnuts or filberts) can be bought at Andy's Produce, in Sebastopol.

Procedure: Remind the visitors that we are not to pick any leaves.

1. Ask/tell them to gently feel the leaves of the plant. (Don't name the plant yet.)
2. Ask them to describe how the leaf felt and the shape of the leaf, including its edges.
3. Ask them to give the plant a name based on its characteristics.
4. Ask them if they like Nutella.
5. Tell them that Nutella is made from hazelnuts and that this is the California Hazelnut. It is a close relative of the hazelnut used in Nutella. It is also called a filbert. (If you have them, show samples of California hazelnuts and filberts.
6. The California hazelnut is also called the beaked hazelnut. (If you have a specimen showing the sheath/beak, show it.)
7. Tell them that the Pomo Indians valued the hazelnut not only for its nut but also for the young stems that sprouted after a fire. They are very flexible. (If you can find them show young stems on the burned hillsides along the Armstrong Trail or where plants have been cut.) One of the Carry Cards has a picture of a basket that is made partly of hazelnut stems.

Links:

- Links to other resources:
  - ✓ **Basic Organism Cards**: https://stewardscr.org/wp-content/uploads/2023/06/BASIC-Organism-Cards-rev-6.1.23.pdf

Notes:

You can make a display like this and carry it with you for your tours.

Filberts are usually available at Andy's Produce in Sebastopol.

California hazelnuts can be hard to find. Keep your eyes open when hiking trails **outside of Armstrong Redwoods.** They may be found along Sweetwater Springs, Drake, or Neely roads in the Guerneville area. Look for them from mid-June to mid-August.

This container is a hockey puck display box from Tap Plastics, but any plastic box of an appropriate size can be used.

Old Man's Beard Lichen

Who and How Long: All ages; best for younger 5 minutes

Background: Lichens are usually a combination of a fungus and algae. Through photosynthesis, the alga provides nutrients, while the fungus provides protection from drying out. This type of mutually beneficial relationship is called mutualism.

To help people remember this mutualistic relationship, you can say that "When Annie Algae met Freddy Fungus they took a lichen to each other."

Lichens are generally classified according to the type of fungus.

Lichens in the genus *Usnea*, which includes old man's beard, seem to have antibiotic properties. The lichens can be applied topically directly to a scrape or cut. They may also have some value in treating some digestive issues, but we probably shouldn't be encouraging people to forage, and certainly not to forage in the Reserve. For more information, you might go to:

https://practicalselfreliance.com/usnea-lichen/

Summary: Visitors examine old man's beard and other lichens and learn what lichens are.

Why:

- Connections: People are surprised and delighted to learn about the elasticity.
- Next Generation Science Standards:
  - ✓ Kindergarteners study patterns of what organisms need to survive.
  - ✓ Kindergarteners study how plants can change the environment.
  - ✓ Second graders study the need of plants for sunlight and water.
  - ✓ Fourth graders study organism structures that enable them to survive.
  - ✓ Fifth graders learn that plants get needed materials chiefly from air and water.
  - ✓ Seventh graders study interactions among organisms, including mutualism.

R.I.M.P. **Theme(s):**

Redwoods support interconnected coastal and inland communities. (Ecology)
Indigenous peoples connections (to be developed)

When: The lichens can be found year-round, but are most "stretchy" when wet.

Where in the park: This can be done anywhere that you can find some Old Man's Beard Lichen. (Methuselah lichen can also be used. It is a rare type of lichen found at Armstrong.)

Materials: Bunches of Old Man's Beard or Methuselah Lichen gathered from the ground.

Procedure:

1. This can be done in the parking lot at the start of a tour. Doing so can help spread out groups on the trail. If you want to do that, gather the lichen before the group gets there.
2. You can also carry some lichen with you to use when you find a little on the trail.

3. Show some of the lichen to the group and ask if they know what it is. They will often say "moss." Explain that this is an organism called a lichen and it is actually made up of an alga and a fungus that help each other survive. Point out some moss and have them describe how moss looks different from the lichen.
4. Hold up a wad of the lichen by your chin and tell them that this is called "Old Man's Beard" lichen. Ask why it is called that. (If you are using Methuselah Lichen, you can use a wad of that for younger kids. For older visitors, you can tell them that it is called Methuselah Lichen and ask if they know who Methuselah was and tell them that is a close relative of another lichen called "Old Man's Beard.")
5. Give each visitor or pair of visitors a bit of the lichen and show them how it can stretch like a rubber band. Have them gently stretch their specimen. (If it is dry, you might wet it.)
6. When they are done with it, explain that you picked it up from the ground and that they need to return it to the forest floor. Demonstrate by tossing yours to the ground and maybe saying something like "Thank you for helping us learn about lichens."
7. While on the trail, look for opportunities to point out other types of lichen. You will certainly see dust lichen on redwood trees, and will probably find other types.
8. Older students and adults can be taught that a lichen is an organism that is actually two organisms that live together and help each other survive (mutualism). It is usually an alga which produces "food" by photosynthesis, or a cyanobacterium, and a fungus that provides a substrate and some shelter from the sun for the alga.

Links:

- Links to other resources:
  - ✓ **Basic Organism Cards**: https://stewardscr.org/wp-content/uploads/2023/06/BASIC-Organism-Cards-rev-6.1.23.pdf
  - ✓ **Advanced Organism Cards:** https://stewardscr.org/wp-content/uploads/2023/06/ADVANCED-Organism-Cards-rev-6.1.23.pdf

Left and below: Old Man's Beard lichen.

Right: Methuselah lichen

Parson Jones Tree and the Date Round

Who and How Long: All ages 3-5 minutes to start, then 1 or 2 minutes periodically

Background: For information on Parson Jones, see the interpretive display, State Parks brochure, and resources in the Stewards docent library.

At 310 feet tall, the Parson Jones Tree is a little taller than the Armstrong Tree, which was 308 feet tall when it was measured, which was probably in the 1970s. But the Parson Jones Tree's diameter of 13.8 feet was smaller than the Armstrong Tree's diameter, which the sign indicates is/was 14.6 feet. The trees may be taller now, or they may be shorter due to die-back at the top, wind breakage, or even lightning strikes. They are probably bigger around due to growth, but the annual growth in diameter of a tree this big is not very much, maybe less than 1/16 inch per year.

The sign doesn't indicate where the diameter was measured, but it says that it was 13.8 feet. Foresters measure trees' diameters by measuring the circumference at 4.5 feet above ground ("diameter at breast height" or d.b.h.) and dividing it by pi. (d = c / 3.14). In March of 2023 we measured the Parson Jones Tree's d.b.h. as 13 feet, and its diameter at ground level as 17.2 feet, both of which are larger than the Armstrong Tree's corresponding measurements at that time. Note that the d.b.h. of 13 feet is smaller than what the sign says, and that diameter at ground level is much larger. So we don't really know where the diameter was measured.

Since fire is a natural part of the ecosystem, the Parson Jones Tree must have adaptations that have allowed it to survive the fires that would occur in this environment every 15-25 years if we hadn't been suppressing them for the last hundred years. Those fires might have been started by lightning, but the Native Americans also used fire to encourage the growth of plants that they used and to open up the forest for better visibility and easier passage. Suppression of fires has allowed fuel to accumulate, threatening to make future fires larger, hotter, and more dangerous to the trees.

Summary: Visitors are asked to consider the natural and human-caused hazards that the Parson Jones Tree has endured during its 1300 plus years of life, including fires, floods, and logging. They then are asked to think about redwoods' adaptations that enable them to survive.

Why:

- <u>Connections:</u>
  - ✓ Many visitors from Sonoma County and beyond will remember the fires of 2020 or other fires, and the frequent flooding of the Guerneville area.
  - ✓ Many visitors come to Armstrong Redwoods specifically to see large old trees.

- Next Generation Science Standards:
  - ✓ Kindergarteners learn that plants and animals can change the environment.
  - ✓ Kindergarteners study how humans can reduce their impact on the environment.
  - ✓ Second graders learn that Earth events can occur quickly or slowly.
  - ✓ Third graders learn that traits can be influenced by the environment.
  - ✓ Third graders learn that some organisms survive when the environment changes and some don't survive.
  - ✓ Fourth graders learn that organisms have structures that enable them to survive.
  - ✓ Fourth graders learn about erosion.
  - ✓ Fifth graders study ways that communities can use science to protect resources.
  - ✓ Sixth graders study how the environment influences growth.
  - ✓ Sixth graders learn about monitoring and minimizing human impacts.
  - ✓ Seventh graders study how changes in physical or biological components of an ecosystem affect populations.

R.I.M.P. **Theme(s):**

Redwood stewardship sustains the planet. (Changing Values and Conservation)
Redwoods support interconnected coastal and inland communities. (Ecology)
Redwoods inspire deep personal connections. (Personal Connections)
Indigenous peoples connections (to be developed)
Narrative Thread: Past, Present, Future

When: Any time of year

Where in the park: Near the Parson Jones Tree

Materials: None needed

Procedure:

1. Near the Parson Jones Tree, ask visitors how old it is. Somebody will read the sign and say "About 1300 years old." Ask when that estimate was made. Tell that it was probably measured in the 1970s, and, therefore, is now about ____ years older.
2. With older groups, point out that the wood that makes up the tree, including its roots, trunk, branches, and leaves, contains carbon. Ask where that carbon came from and how it became part of the tree. Elicit that it came from CO_2 in the air and was incorporated into the tree by photosynthesis.
3. Point out that some of that carbon, from CO_2, has been stored in the tree for over 1300 years and, therefore, hasn't been contributing to climate change for that long.
4. Ask what threats to its survival it has endured. Elicit fire, flood, drought, and logging. Some may suggest attacks by insects or disease.
5. Point out how amazing it is that a living thing can endure fires, floods, high winds, attacks by insects and fungi for over 1300 years. These trees are tough and tenacious!
6. Ask whether the same thing is happening in all of the other trees in the forest.
7. Ask the visitors how redwoods such as the Parson Jones Tree might have survived those threats. Elicit or tell the following adaptations:
   a. Fire:

i. thick, fibrous, moisture-absorbent bark that has fire-resisting tannins
ii. natural pruning of lower branches that would provide fire a route to the crown
iii. the ability to sprout and regrow if the root crown survives

b. Flood: roots that extend far from the tree and interlock with other trees' roots
c. Drought: the ability to take in water from fog even if it doesn't rain much
d. Logging: the ability to sprout and regrow if the root crown survives
e. Insects and disease: thick bark and wood that have tannins that are fungus-resistant and insect-resistant.

8. Ask whether those threats are increasing, decreasing, or staying the same, and, if increasing, what we might do to mitigate them.
9. Ask how tall the Parson Jones Tree is. Somebody will read the sign and say "310 feet." Ask, again, when the sign was made. Ask whether it is now the same height? Usually, they will say that it is now taller. Ask whether it could be shorter. It could be shorter due to the top breaking, dying back due to drought or some other cause, or a lightning strike.
10. Point out that 310 feet is longer than a football field or soccer pitch. It is about as far as the Keep Right sign by the kiosk.
11. Near the Parson Jones Tree is the Date Round (or History Log). Tell that the plaque that is missing from the center used to say that the tree germinated in the year 948. (Actually, that part of the tree started to grow in 948. The date round no doubt came from above ground level, so the seed that started the tree would have germinated before that date.) Tell that the outermost (broken) plaque used to say 1906…the year of the San Francisco earthquake and fire, which also did a lot of damage in Santa Rosa.
12. The date round log was from a tree cut in 1978, but the plaque is missing. To determine the approximate age of the tree when it was cut, have them round 948 to 1000 and 1978 to 2000 and subtract to find that the tree was about 1000 years old when it was cut. (For younger kids, have them subtract 1 from 2 and then point out that 2000 – 1000 = 1000.)

Links:

- Connections to other activities: See the activities "Fire Adaptations", "Col. James Armstrong Tree", "How are We Like Trees?", and "Think, Pair Share."

- Links to other resources:
  - ✓ **Carry Cards:** https://stewardscr.org/wp-content/uploads/2023/04/Carry-Cards-A-Tool-for-Docents.pdf
  - ✓ **Basic Features Cards**: https://stewardscr.org/wp-content/uploads/2023/06/BASIC-Features-Cards-rev.-6.1.23.pdf
  - ✓ **Spotter Cards:** https://stewardscr.org/wp-content/uploads/2023/04/Spotter-Cards-A-Tool-for-A.R.-Docents.pdf

Redwood Cones and Seeds

Who and How Long: Grade 2 and up 5 minutes

Background: Many visitors are familiar with pinecones, but may have never noticed a redwood cone. They are often amazed to learn how small redwood cones are. After learning what they look like, they may begin to notice fallen cones along the trail.

Cones, of course, are the reproductive organs of conifers. The "female" or ovulate cone produces the ova and is what we usually think of as a cone. The "male" or pollinate cone is much smaller and tends to fall apart or shrivel up after releasing its pollen. The pollen is spread by wind, which is not a very efficient way of pollinating the ova. As a result, many of the seeds are not fertile and won't germinate. But a mature tree produces millions of seeds every year, mostly from cones near the top of the tree.

Like redwood cones, the seeds are surprisingly tiny for such a large tree. To successfully germinate, the seed needs to grow its root through the duff down to the soil before it dries out, is eaten, or is killed by fungus. Thus, few seeds actually germinate to form seedlings.

Summary: Visitors examine samples of redwood cones and seeds and learn why redwoods seldom reproduce from seed.

Why:

- Connections: Most visitors of this age will be familiar with pinecones, even if they haven't actually seen one.
- Next Generation Science Standards:
  - ✓ Second graders learn about seed dispersal and pollination.
  - ✓ Third graders learn about reproduction.
  - ✓ Fourth graders learn about reproductive structures.
  - ✓ Fifth graders learn about the interaction among biosphere, geosphere, and hydrosphere.
  - ✓ Sixth graders learn about reproductive structures.

R.I.M.P. **Theme(s):**

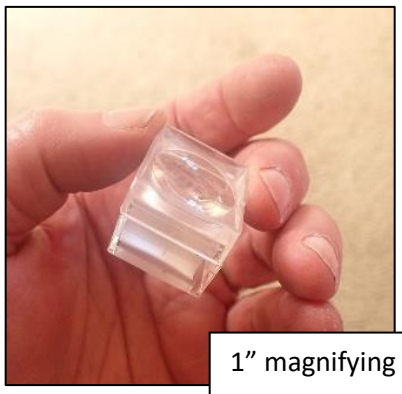
Redwoods support interconnected coastal and inland communities. (Ecology)
Narrative Thread: Past, Present, Future

When: Any time of year

Where in the park: Can be done anywhere. The trail by the Redwood Regeneration sign near the Date Round is a good place, as is any place where there are cones on the ground.

Materials: Redwood cones, seeds, and seeds in magnifying boxes, or magnifiers

Seeds can be carried in a small vial or jar and passed around to visitors. (Small vials available at Tap Plastics.)



1" magnifying box

Procedure:

1. After discussing redwood regeneration by root crown sprouting (stump sprouting), ask visitors how most plants reproduce. Elicit that they reproduce by seeds.
2. Tell visitors that redwoods produce seeds in cones. Ask them whether they have ever seen a pinecone, and have them use their hands to show you how big a pine cone is.
3. Point out that coast redwoods are the tallest trees in the world, much taller than pine trees. Have them guess how big they think a redwood cone would be.
4. Show them a redwood cone, or cones.
5. Explain that each cone produces 40-100 tiny seeds, but that many aren't fertile because the seeds are pollinated by the wind, which isn't very efficient.
6. Show redwood seeds.
7. Explain that redwoods rarely sprout from seeds because the seed needs to get its root through the a thick layer of leaves and twigs on the ground before it dries out, is eaten, or is attacked by fungus.
8. Explain that fire, landslides, or root pulls can expose the soil to seeds, so sometimes redwood seeds can germinate where and when those events occur.
9. If you know where redwood seedlings are growing, tell the visitors that you will be showing them seedlings later in the tour.

Links:

- Connections to other activities: See "A Cone in the Hand is Worth…", "Baby Redwoods," and "Looking at Cones".

- Links to other resources:
  - ✓ **Basic Organism Cards**: https://stewardscr.org/wp-content/uploads/2023/06/BASIC-Organism-Cards-rev-6.1.23.pdf

Short Activities at the Luther Burbank Circle or Forest Theater

Who and How Long: Various Ages 10 minutes

Background: Depends on the activity

Summary: A variety of activities can be done at the Burbank Circle or Forest Theater.

Why:

- Connections: Spending time in a park can be pleasant and healthful.
- Next Generation Science Standards:
  - ✓ Depends on what you do, read, discuss.

***R.I.M.P.* Theme(s):** Depends on the activity

When: When you get to the Burbank Circle or Forest Theater

Where: Burbank Circle or Forest Theater

Materials: Depends…See Procedure

Procedure:
Depending on the age of the group, how crowded the Burbank Circle area is, group activity level, and other factors, this may be a good place to:

1. Do the activity "In the Dark"
2. After looking at the circle, *Oxalis*, burls, etc., have the visitors simply look up.
3. Read a book such as *Raven* by Gerald McDermott or *The Great Kapok Tree* by Lynne Cherry, or read a poem. The Save the Redwoods League has an extensive list of children's books at:
   https://www.savetheredwoods.org/learning-center/reading-list/
4. Have the students sit quietly and just listen, possibly with their eyes closed. Ask what they noticed.
5. If at the Forest Theater, lead them in a song
6. Discuss how nice it is to have a quiet, beautiful place like this.
7. Ask what they have learned so far and whether they have any questions.

Spotter Cards

Who and How Long: Grades 2-5 3 minutes to get started, then some time on the trail

Background: The Spotter Cards can help keep children engaged while walking through the forest. The cards can also encourage them to be watching for a variety of features rather than just looking at the big trees or talking with their classmates.

Summary: Students are given cards with photographs of and information about a variety of plants and other features. As they walk through the park, they look for ("spot") those features and point them out to the group. Older students share the information on the cards.

Why:

- Connections: Using Spotter Cards can help keep students engaged, help them see various features, and, if the students teach their peers, it can be empowering.
- Next Generation Science Standards:
  - ✓ Varies with the Spotter Cards used.

R.I.M.P. **Theme(s):**

Redwoods support interconnected coastal and inland communities. (Ecology)
Redwoods inspire deep personal connections.

When: At the start of the tour

Where: At or near the start of the walk, probably in the parking lot

Materials:

Sets of Spotter **Cards**

Spotter Cards are laminated cards with pictures of things that students will see while on the walk. There should be some sets of them that you can check out in the shed by the Visitor Center. **Preferably, make your own set of Spotter Cards**. See the link below.

Procedure:

1. Give one Spotter Card to each student, or each pair of students, and tell them to let you know when they see (spot) the thing in the picture.
2. Tell them that they **do not have to find the exact tree** (or whatever the thing on the card is), but should be looking for trees with that **type** of leaf.
3. Be sure to collect the cards as the kids spot their things, or at the end.
4. When someone spots their thing, discuss what it is.
5. Older kids can read/share the information on the back of their card with their peers.

Link(s):

- Links to other resources:
  - ✓ Spotter Cards: https://stewardscr.org/wp-content/uploads/2023/04/Spotter-Cards-A-Tool-for-A.R.-Docents.pdf

Longer Activities for the Start or End of a Tour
(or possibly at the Forest Theater)

Food Webs

Who and How Long: 4th-7th grades 15-20 minutes

Background: A food chain is often used to show how organisms are related by showing what eats what. For example, a hawk eats a snake that eats a mouse that eats grass seeds. But reality it is much more complex than that. The hawk may also eat the mouse, or a rabbit. And the snake might eat the mouse, but might also eat a rat. And the mouse might also eat a flower seed or an acorn. A food **web** shows these more complex relationships among various organisms.

This activity is a variation on a common food web activity that just includes the organisms. This variation includes the abiotic or non-living components and also includes people.

Summary: Students form a model of a food web, showing the interconnectedness of organisms with each other and with the physical environment.

Why:

- Connections: Understanding food webs can help one understand the complexity and diversity of the redwood forest, or any other, community.
- Next Generation Science Standards:
  - ✓ Fourth graders learn about organisms having structures and behaviors that enable them to survive and reproduce.
  - ✓ Fifth graders learn about plants obtaining materials from air and water.
  - ✓ Fifth graders learn the movement of matter among plants, animals, decomposers, and the environment.
  - ✓ Fifth graders study the interaction of the geosphere, biosphere, hydrosphere, and the atmosphere.
  - ✓ Fifth graders study how organisms obtain their energy ultimately came from the sun.
  - ✓ Sixth graders study the flow of matter and energy into and out of organisms.
  - ✓ Sixth graders study patterns of interactions among organisms.
  - ✓ Sixth graders study energy flow among living and non-living parts of an ecosystem.
  - ✓ Seventh graders study how changes in an ecosystem affect populations.

R.I.M.P. **Theme(s):**

Redwood stewardship sustains the planet. (Changing Values and Conservation)
Redwoods support interconnected coastal and inland communities. (Ecology)
Redwoods inspire deep personal connections.
Indigenous peoples connections (to be developed)

When: Start or end of a tour

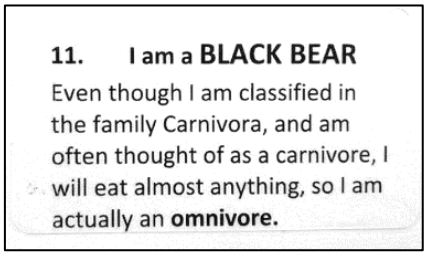
Where in the park: Parking area or picnic area

Materials: See the write up of "We're All in This Together" on pages 227-230 in *Redwood Ed*, on the Stewards website.

Images that you can copy and laminate follow. Rather than use large pictures or models hung around the students' necks, you can use a "deck" of small (3"x5"?) cards that are easy to carry with you. A deck of those follows.

Procedure:

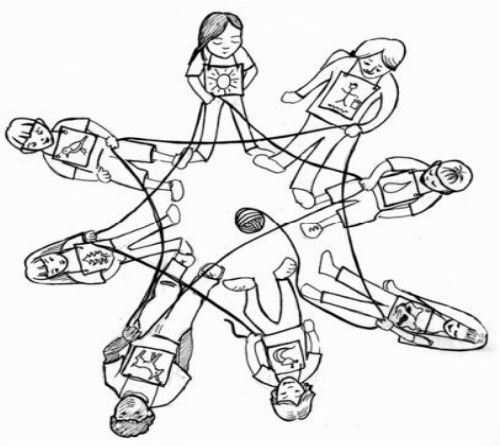
1. See the write up of "We're All in This Together" on pages 227-230 in *Redwood Ed*, on the Stewards website.
2. Rather than just using pictures, have some 3-dimensional objects to represent the various parts. For example: a small jar of water, a bag of soil, a plastic deer, or a rubber worm from a fishing tackle shop.



Images might have information provided on the back.

Realia or models can be used but take more space to store and carry.

Laminated 3"x5" cards, with or without information on the back are easy to carry.



"Wally's" sign, front and back

Illustration from *Redwood Ed*, page 229

Links:

- Links to other resources:
  - ✓ ***Redwood Ed:*** https://stewardscr.org/pdf/red_ed16_lessons_activities_pgs242to279.pdf
  - ✓ This is also written up in ***The Conifer Connection*****,** which is available in the Stewards library and also on the Ca. State Parks website at: https://www.parks.ca.gov/pages/735/files/Table%20of%20Contents%20ADA.pdf

3” x 5” Food Web Pocket Cards

These can be printed, folded, cut to 3”x5” and laminated, or printed, cut out, attached to 3”x5” cards and then laminated.

You do not have to use all of these, of course, but you should include all four of the abiotic cards (sun, soil, air, and water), and the human, as well as at least one each of the producers/plants, herbivores, carnivores, omnivores, and decomposers.

SUN 	**I am the Sun.** Plants store my energy in chemicals that they build through the process of photosynthesis. That energy is used by plants and the animals that eat them. I also heat the air, land, and water, as well as provide light. Image free on the internet from: clipart
SOIL 	**I am soil.** I am made of minerals, water, decomposing plants and animals, and even have some air in me. Plants need me for the minerals that they need, and animals get the minerals that they need from their food. Image free on the internet from: unsplash

AIR

I am the air

I contain carbon dioxide that plants need for photosynthesis, and oxygen that both plants and animals need.

I also contain water vapor and many other gases. In fact, I am made up mostly of nitrogen.

I contain chemicals that shield the Earth from too much radiation, but I also contain chemicals such as carbon dioxide and methane that trap heat, causing climate change.

Image free on the internet from: pexels

WATER

I am water.

All living things need water. Some can get water from their food, but most need liquid water.

Image free on the internet from: pexels

MOSS

I am MOSS.

I am a plant, and I photosynthesize.

I don't have roots with which to soak up water, so I need a moist environment in which to live.

Since I use sunlight, minerals, water, and carbon dioxide to produce my own food, I am called a **producer**.

Photo by Stewards docent Mike Roa

FERN

I am a FERN.

I am called "sword fern." Ferns usually need to live in a moist environment.

I am one of the most common kinds of fern found in Armstrong Redwoods.

Since I use sunlight, minerals, water, and carbon dioxide to produce my own food, I am called a **producer**.

Photo by Stewards docent Mike Roa

REDWOOD TREE

I am a REDWOOD TREE.

I am a plant, and I photosynthesize.

I provide shade in the forest, and fog condenses on my leaves, or needles, and drips to the forest floor.

Since I use sunlight, minerals, water, and carbon dioxide to produce my own food, I am called a **producer**.

Photo by Stewards docent Mike Roa

REDWOOD SORREL

I am REDWOOD SORREL.

I live on the shady redwood forest floor. I am a plant, and I photosynthesize.

Since I use sunlight, minerals, water, and carbon dioxide to produce my own food, I am called a **producer**.

Photo by Stewards docent Mike Roa

DEER

I am a DEER.

I feed on leaves of many different kinds of plants, especially grasses.

Since I eat plants, or herbs, I am called an **herbivore**.

Since I consume other organisms, I am also called a **consumer**.

Photo from iNaturalist, by Claude Lyners

TERMITE

I am a TERMITE.

I feed on wood.

Since I eat plants, or herbs, I am called an **herbivore**.

Since I consume other organisms, I am also called a **consumer**.

Photo from iNaturalist, by Jesse Rorabaugh

SPIDER

I am a SPIDER.

I feed on insects and other invertebrates.

Since I eat animals, I am called a **carnivore**.

Since I consume other organisms, I am also called a **consumer**.

Photo from iNaturalist, by jbindernagel

BROWN BAT

I am a BROWN BAT.

I feed on insects.

Since I eat animals, I am called a **carnivore**.

Since I consume other organisms, I am also called a **consumer**.

Photo from iNaturalist, by Stephen_buckingham

BOBCAT

I am a BOBCAT.

I feed on mice, woodrats, and other animals.

Since I eat animals, I am called a **carnivore**.

Since I consume other organisms, I am also called a **consumer**.

Photo from iNaturalist, by Mike Mullins

NEWT

I am a ROUGH-SKINNED NEWT.

I feed on insects and other invertebrates such as worms.

Since I eat animals, I am called a **carnivore**.

Since I consume other organisms, I am also called a **consumer**.

Photo from iNaturalist, by Corinne Helmer

CENTIPEDE

I am a CENTIPEDE.

I feed on insects and other invertebrates.

Since I eat animals, I am called a **carnivore**.

Since I consume other organisms, I am also called a **consumer**.

Photo from iNaturalist, by Stephen W. McWilliam

OWL

I am a SPOTTED OWL.

I feed on insects and other invertebrates, woodrats, mice, squirrels, and other animals.

Since I eat animals, I am called a **carnivore**.

Since I consume other organisms, I am also called a **consumer**.

Photo from iNaturalist, by Matt D'Agrosa

RACCOON

I am a RACCOON.

I feed on almost anything, plants, animals, even human kitchen waste.

Since I eat both plant and animal matter, I'm called an **omnivore**.

Since I consume other organisms, I am also called a **consumer**.

Even though I am an omnivore, I am classified in the order carnivora.

Photo from iNaturalist, by Zigy

BLACK BEAR

I am a BLACK BEAR.

I feed on almost anything, plants, animals, even human kitchen waste. Since I eat both plant and animal matter, I'm called an **omnivore**.

Since I consume other organisms, I am also called a **consumer**.

Even though I am an omnivore, I am classified in the order carnivora.

I am called a black bear, but my fur may be black, brown, reddish, or even almost white.

Photo from iNaturalist, by Kim Selbee

COYOTE

I am a COYOTE.

I feed on almost anything, plants, animals, even human kitchen waste.

Since I eat both plant and animal matter, I'm called an **omnivore**.

Since I consume other organisms, I am also called a **consumer**.

Even though I am an omnivore, I am classified in the order carnivora.

Photo from iNaturalist, by Dario Taraborelli

PEOPLE

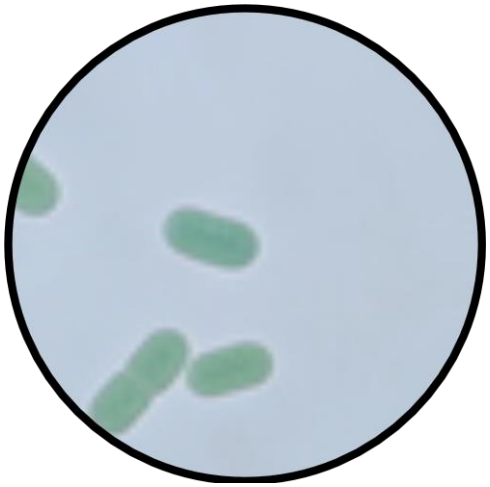
I am a HUMAN.

Since I eat both plants and animals, I am an omnivore.

Since I consume other organisms, I am also called a consumer.

I can choose to harm the environment or to help protect it.

Image from dreamster, free on the internet

BACTERIA 	**I am BACTERIA.** I am a **decomposer**. That means that I get my nourishment by chemically breaking down dead organisms. Photo from: iNaturalist, by Randal
FUNGI/MUSGHROOMS 	**I am a MUSHROOM, which is a kind of FUNGUS.** I am a **decomposer**. That means that I get my nourishment by chemically breaking down dead organisms. Photo by Stewards docent Mike Roa

How Are We Like Trees?

Who and How Long: Grades K-5 10 minutes

Background: Trees and people have many things in common. For example, we both grow and die, and we both need food, air, and water. This activity helps the children realize the commonality of living things.

Summary: Through a dialog with the docent, students come to understand that trees are like all living things – including people - in many respects.

Why:

- Connections: See Baby Redwoods!, Looking at Bark, Looking at Cones, Looking at Leaves
- Next Generation Science Standards:
  - ✓ Kindergarteners learn about what organisms need to survive.
  - ✓ First graders learn about plant external parts.
  - ✓ Third graders learn about life cycles.
  - ✓ Fourth graders learn about organism structures that enable them to survive.

R.I.M.P. **Theme(s):**

Redwoods support interconnected coastal and inland communities. (Ecology)
Redwoods inspire deep personal connections.
Indigenous peoples connections (to be developed)

When: Good for at the start of the tour. Can help create separation between groups. But can be done at most any point.

Where in the park: Someplace where you won't be clogging up the trail

Materials: None
Optional: a large drawing of a tree showing roots, stem, branches, and leaves

Procedure:

1. Ask the students how we are like trees, changing their answers into questions:
   a. If they say trees are alive, say Yes! Trees are alive! Are we alive?
   b. Trees need water. Do we need water?
   c. Trees need sunlight. Do we need sunlight? Yes, to be healthy we need sunlight. Also, the plants that we eat need sunlight.
   d. Trees grow. Do we grow?
   e. Trees have bark. Do we have bark? How is our skin like bark?
   f. Trees have leaves. Do we have leaves? What do leaves do for the tree? How do we get our food? (If they say "from the store," point out that somebody grew the food that we buy at the store.)
   g. Trees have stems or trunks that hold their leaves up in the sunlight. What holds us up?
2. If they can't think of more, reverse it…What else do we need to live?

3. We need food. Do trees need food? Yes…trees need food. But they can make their own food using water and air (carbon dioxide for older kids) and energy from the sun. Trees also need minerals from the soil. (For older kids, tell that the process is called photosynthesis. And you can point out that the minerals from the soil are such things as nitrogen and phosphorous, which is what is in fertilizers.)
4. So…do trees need air?
5. Something else that we need is our families and our communities. Discuss what a community is. Tell them that we are going to spend the day in the redwood forest community, and we will be meeting many members of the community, both plants and animals.
6. As you walk through the forest, point out leaves, bark, stems/trunks/boles, and roots and ask the children what they do for the tree.

I Notice; I Wonder; It Reminds Me Of

Who and How Long: Grades 4 and up 15+ minutes, depending on group size

Background: Most people rarely look closely at something like a leaf, twig, or lichen. Doing so can open up a whole new world to them and help them to appreciate the beauty and complexity of the natural world.

Summary: Visitors look closely at a leaf or other natural artifact and think about it.

Why:

- Connections: When we look closely at something, we can become more connected to it, which can lead to caring about it.
  Many teachers teach "the scientific method," which starts with an observation.
- Next Generation Science Standards:
  - ✓ Fourth graders study organism structures.
  - ✓ Sixth Graders study plant structures.

R.I.M.P. **Theme(s):**

Redwoods support interconnected coastal and inland communities. (Ecology)
Redwoods inspire deep personal connections.

When: Any time of year

Where in the park: Someplace where the group can form a circle without blocking the trail

Materials: Found objects such as leaves or a stick with lichen or moss on it

Procedure: Instruct the visitors to:

1. Find something that looks kind of interesting to you, maybe a leaf. (But don't pick living leaves!)
2. For about a minute or less, look closely at it. What do you notice?
   a. Not something that you already know, and don't just name something that you see.
   b. Not an opinion – not "It's pretty."
   c. Not something that is an explanation – not "It was chewed on by a deer."
   d. Give a couple of examples such as "I notice that it has little hairs along the edge," or "I notice that it has brown spots on a green background," or "I notice that one side is a darker green than the other."
3. With a partner, share your observations. **Start your statement with "I notice."**
4. Then your pair should share your observations with another pair.
5. Repeat the process, but this time state out loud **"I wonder…"**
6. Now, look at your object and **ask yourself what it reminds you of**…an experience, some other object, some information (e.g., The lines on this leaf remind me of road map. The smell of this bay leaf reminds me of spaghetti sauce. Those leaves remind me of raking leaves on lawn.). Share with the others in your group of four.

7. Then discuss the activity with the whole group.
   a. Anything particularly interesting?
   b. What did you see that you hadn't noticed before?
   c. Other thoughts? (With adults, discuss the importance of letting kids explore nature and encouraging them to look closely.)

Links:

- Connections to other activities:

  This can be done in conjunction with any of the activities that involve observations, such as "Meet the Hazelnut", "Looking at Bark", "Looking at Leaves", "Old Man's Beard Lichen", or others.

- Links to other resources:
  - ✓ This activity is from the **Lawrence Hall of Science Beetles Project**. Here's the link: http://beetlesproject.org/resources/for-field-instructors/notice-wonder-reminds/

I notice some gray-green stuff on this twig.
I wonder what it is.
It reminds me of Einstein's hair.

I notice some round-ish green and brown things on the tips.
I wonder what they are.
It reminds me of a feather.

Think, Pair, Share

Who and How Long: Grades 2 – High School 10-15 minutes

Background: This is a common activity in elementary classrooms. It encourages children to think about a prompt and then to express their thoughts. By hearing other children's thoughts, children can come to new realizations and develop their own questions.

Summary: Students think about caring for the forest. They then pair up with another student and share their thoughts. Then some of the students share either their own thoughts or their partner's.

Why:

- **Connections:** Students have things in their homes that they care about. This activity can help them realize that there are things outside their home that are worth caring for.

  Also, we can connect their experience today with the idea of volunteering to help protect the environment or in other ways.

- Next Generation Science Standards:
  ✓ Depends on the prompt.

R.I.M.P. **Theme(s):**

Redwood stewardship sustains the planet. (Changing Values and Conservation)
Redwoods support interconnected coastal and inland communities. (Ecology)
Redwoods inspire deep personal connections.
Narrative Thread: Past, Present, Future.

When: At the end of the tour or near the end

Where in the park: Forest Theater or picnic area

Materials: None needed

Procedure:
Students may be familiar with this activity because some teachers use it in the classroom. The teacher may use a somewhat different process, though. If possible, check with the teacher to see if they use "Think, Pair, Share", and, if so, how they do it.

1. Ask students to sit or stand beside another student. (It should not be an adult.) If the number of students is not an even number, ask the "extra" student to help you model the activity and then join the buddy group of his/her choice for the rest of the tour.
2. Tell them that you will be doing an activity called "Think, Pair, Share".
3. Ask whether they have done "Think, Pair, Share" before. If they have, explain that the way we will be doing it may be a little different, but it may also be the same as what they have done.
4. Ask them to watch and listen as you show them how we will be doing "Think, Pair, Share".
5. Model the 3 step process for the students:

a. Mime **think** by putting a fore finger to your forehead. Say **"Think."**
b. Tilt your head toward your buddy. Say **"Pair."**
c. Mime saying ("sharing") a short sentence into your partner's ear. Say **"Share."**
d. Mime listening to your buddy's response.

6. Give the following prompt (or another of your choosing) to the whole group
   "What is one thing at your house or home that you love and take care of?"
7. With a partner, model the process:
   a. Take a moment to think.
   b. You and your partner each quietly share what you love and take care of in your home.
   b. Then either you tell the group what you love, or your partner tells the group.
   c. Ask if there are any questions.
   d. Have the students (and adults!):
      Think of something that they care about.
      Pair up.
      Quietly share their response to the prompt with their partner.
8. If necessary, ask kids to watch you one more time, this time with each of you sharing out loud so the group can hear. If they seem comfortable, give the prompt one more time, reminding them to think, pair and share as you circulate around listening. Adults should participate!
9. Tell them that they will have only a couple of minutes to do this.
   After just a couple minutes, stop everybody and ask a couple of students to share their or their partner's answer with the whole group.
10. Repeat the process with the following prompt:
    "What is something about Armstrong Redwoods that you like and want to take care of?"
11. If there is time, repeat again with the following prompt:
    "What is something that you can do to help take care of Armstrong Redwoods?"
    The students will probably say things like "Don't litter." "Don't pick leaves." or "Stay on the trails." You might suggest other things that they can do to help protect Armstrong such as:
    - Ask your parents to bring the family to visit Armstrong.
    - Learn more about the park and the things that live here.
    - Talk to your friends about how cool this place is.
    - Pick up litter dropped by somebody else.
    - If you see somebody litter, ask them to pick it up, or pick it yourself.
    - When you're older, you can volunteer.
    - When you are old enough to vote, vote for people who will protect the environment.
    - When you decide what career you want, consider one that helps protect the environment.

Twenty Questions

Who and How Long: K-8 15 minutes

Background: This activity can be used to help spread out the tour groups by delaying the start of one or more groups. As the questions are asked and answered, children can not only learn about the organisms, but they can also come to realize how much they already know. It can also be beneficial for children to see an adult struggle to identify the organism; even teachers don't know everything!

Summary: The teacher or other adult holds a picture of an animal found in the redwood forest over his or her head. They try to guess the animal by asking yes/no questions. The students answer the questions, with help from the docent if necessary.

Why:

- Connections: Students learn to use deductive reasoning to answer a question.
- Next Generation Science Standards:
  - ✓ First graders study animal external parts.
  - ✓ Third graders learn about variation in inherited traits.
  - ✓ Fourth graders learn about organisms' structures.

R.I.M.P. **Theme(s):**

Redwoods support interconnected coastal and inland communities. (Ecology)

When: Any time of year

Where in the park: Parking lot, Forest Theater, picnic area

Materials: Pictures of one or more animal (Examples follow. You can also use postcards, calendar images, images from the Organism Cards on the Stewards website, or other sources.)

Procedure:

1. Have the students gather in front of the teacher or other adult.
2. Tell the students that they, the students, will know something that the teacher or other adult doesn't know, and the adult will ask questions to try to figure out their secret.
3. The teacher, you, or another adult, holds a picture of an animal above the teacher's head so that the students can see it but the teacher can't.
4. The teacher tries to identify the animal by asking "yes/no" questions such as:
   a. Does the animal chase after its food to catch it?
   b. Does the animal fly?
   c. Does it have a tail?
5. The students answer "yes" or "no".
6. If the students don't know the answer, the docent can nod "yes" or "no" to help.
7. If the students answer incorrectly, the docent should correct or clarify. You might say something like "sometimes" or "not always" or "I think it does"…gently correcting.
8. After the game, the teacher or other adult might discuss their deductive reasoning process.
9. The teacher might offer to play some other games of 20 questions when they get back to school.

Links:

- **Basic Organism Cards**: https://stewardscr.org/wp-content/uploads/2023/06/BASIC-Organism-Cards-rev-6.1.23.pdf

- **Advanced Organism Cards:** https://stewardscr.org/wp-content/uploads/2023/06/ADVANCED-Organism-Cards-rev-6.1.23.pdf
✓

20 Questions Animals: Attach to 5” x 8” cards, back to back. Laminate?

Mule Deer from iNaturalist, by kathlinsimkins

Spotted Owl from iNaturalist, by Matt D’Agrosa

Raccoon from iNaturalist, by henrya

Raven (or Crow) from iNaturalist, by Dario

Button's Banana Slug
Photo by Mike Roa

Black Bear
From iNaturalist, by Joe D.