INFORMATION FOR DOCENTS

This document includes background information that Armstrong Redwoods Docents may find useful. It includes much more information than docents will actually need, but many docents enjoy learning about the environment in which they will be working.

A caution: It is good for a docent to have lots of knowledge. We must, however, not yield to the temptation to be just a lecturer…a "sage on the stage." Our purpose is not just to inform. More importantly, our purpose is to help people come to love and understand the habitat and to care for it so that they want to become stewards…caretakers. Your job is not to be a font of knowledge. It is to be someone who helps people develop an appreciation…a "guide on the side".

And…rather than just telling facts and names, we should be encouraging people to think and wonder. One way to do that is to ask them questions and encourage them to try to figure out answers.

Geology 101 for Stewards Docents:

This section includes basic information about the coastal geology of California, including about plate tectonics. It also includes information about watersheds and salmonid habitat. The last part is about some of the common rock types that one might find in the area.

Organisms:

This section includes photographs and information about many of the organisms that one might find in Armstrong Redwoods or the Willow Creek/Pomo Canyon area. It is laid out in such a way that you can print a page and then cut it into two 5" x 7" sections, glue them back-to-back and then laminate them so that you can easily carry them with you as you learn about the organisms.

The "Organism Cards" include the following groups:

- Trees and Shrubs, Group A: The most common or important trees and shrubs in the area.
- Trees and Shrubs, Group B: Less common or less noticeable plants than those in Group A.
- Flowers
- Moss
- Ferns
- Animals
- Fungi and Lichens

Features:

This section includes photographs and information about many things ("features") that one encounters while walking the trails in Armstrong Redwoods and Pomo Canyon. There are many more features than you would share with any particular group, but it is good to be familiar with them so that you can answer questions as the opportunity arises. Like the organism "cards," these are laid out so that you can make 5" x 7" laminated cards to carry with you as you learn about the area.

Credits:

This document was prepared by Mike Roa, Stewards docent, with help from:

- Leslie Carrow, Rachel Hallaway, and Scott Lawyer, Stewards staff
- Hollis Bewley, Greg Corby, Karen Gebbia, and,Beth Lamb, Stewards docents
- Rebecca Perlroth, SRJC Geology Department
- Nicole Meyers, SSU Geology Department
- Sources of images are indicated on the "cards."

Geology 101 for Stewards Docents

1.28.22

Due to fracturing from faults, the disruption from subduction of the Farallon Plate, uplifting of coastal rocks and sediments, and other factors, California's geology is very complex. In *Roadside Geology of Northern California*, the authors refer to the Coast Ranges as "A nightmare of rocks."

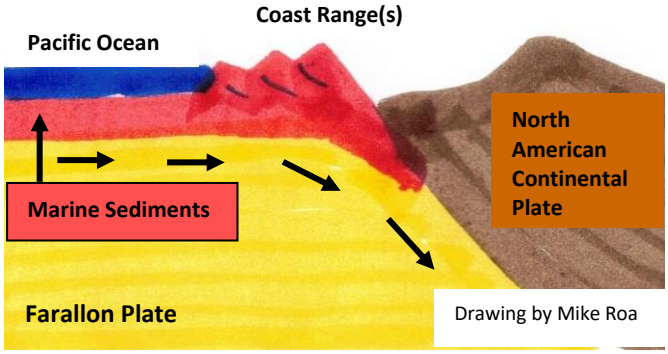
This short document is intended to give docents a very basic understanding of the "nightmare" geology of Armstrong Woods and Pomo Canyon. Even though it has just the basic information, it includes more than you will ever teach a group. But knowing about the geology of the area will help you answer some questions and generally feel more confident when leading groups.

To understand the geology of the coast mountain range(s), one must know a bit about plate tectonics. Basically, the continents are sort of rafts of relatively light (less dense) material such as granite and basalt "floating" on more dense material such as peridotite. Hot, molten material from the mantle of the Earth rises to the surface, primarily under the sea floor, forming mid-ocean ridges. As new material is pushed upward, the older, cooled material is pushed away from the ridges.

When the dense seafloor material collides with the "rafts" of less dense continental material, the sea floor rock is pushed under the continental crust material in a process called subduction.
In the process,

a. some of the seafloor material is scraped off by the overlying continental crust and

b. some of the scraped off material and some of the continental crust is pushed upward. (Think of a slice of pizza being pushed under a door. Some of the topping will be scraped off, wrinkled, and pushed upward.)



The seafloor material is not just solid basalt, though. The seafloor, especially near the coasts, is covered with thick layers of both sediments washed from the continents and the "shells" of microorganisms that lived and died in the oceans. Many of the shells contain high amounts of silica, which makes them very hard and durable. Over millions of years, those layers of organic and inorganic sediments are compressed and heated. Sedimentary rocks thus compressed and heated form metamorphic rocks. The coast mountain ranges of California are made up mostly of sedimentary and metamorphic materials scraped from the top of the subducting Farallon Plate.

As you might imagine, the subduction process is not smooth. Where pieces of crust collide, faults form. Sometimes plates subduct; other times they slide past each other, and not smoothly. The San Andreas fault is an example. The San Andreas fault lies just off the Golden Gate, runs through Tomales Bay and Bodega Bay, and then continues just off of the coast west of Jenner. Bodega Head contains material that has been brought from southern California by the northwestern movement of the Pacific Plate.

In addition to faults, these plate movements cause the sediments to heat up, resulting in the formation of metamorphic rocks. Magma from deep in the crust forms chains of volcanoes along the coast. This is the source of the obsidian ("volcanic glass") found at Annadel and elsewhere, and of the volcanic ash that buried the redwood forest that is now the petrified forest found north of Santa Rosa.

For more information on geology, see *Roadside Geology of Northern California*, by Alt and Hyndman. We have a copy in the Stewards docent library at the Volunteer Office.

For more information on the situation in the Willow Creek Watershed, see the *Willowcreek Watershed Management Plan*, which is available in the Stewards Volunteer Office and the Willow Creek Watershed Restoration document at: https://www.stewardscr.org/willow-creek-watershed-restoration.html.

drawing by Mike Roa

Constant Change: Morphology of Streams and Valleys

Erosion moves silt and rocks of various sizes into valleys. Some particles may get deposited in the valley as alluvium, while other particles are carried away by streams, so there is a constant battle between accumulation and erosion of the alluvium. The floor of Pomo Canyon, like the floor of Armstrong Woods, is filled with alluvium accumulated over thousands of years.

Willow Creek

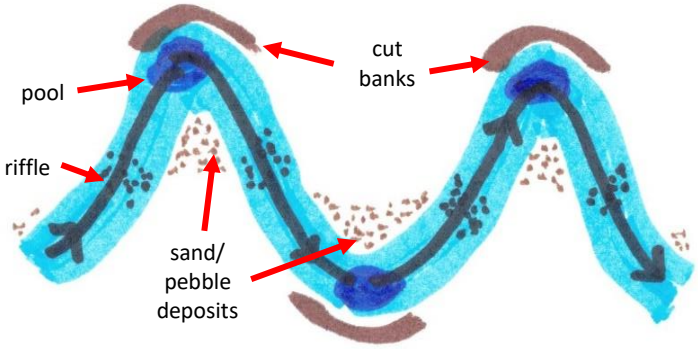
Streams do not maintain the same course forever. They flow wherever the alluvium is loosest, cutting new channels and meandering through the alluvial flats in the bottom of their canyons.

As creeks turn and "meander" through valleys, they tend to cut into (incise) banks that they hit "head-on," forming steep banks and scouring out pools.

On the other side of the bend, sand and gravel are often deposited; the banks may be less steep.

(**Note**: This process is not universal. At places in Pomo Canyon the opposite is true…the outside of the bend slopes gently while the inside of the bend is steep.)

"Riffles" often form in the shallow water between bends.



Roots from trees and other plants can <u>help</u> hold the soil and gravel in place, but streams can still erode the stream banks.

Strongly
eroded banks
at the outside of the bend.

Sand and pebble deposits
on the inside of the bend.

Of Silt and Sand and Stuff

"**Silt**" is a term for small particles that are between clay and sand in size. When rubbed between the fingers, individual particles can<u>not</u> be felt. Particles are less than 1/16 mm in diameter.
"**Sand**" particles are larger than silt. When rubbed between the fingers, individual particles <u>can</u> be felt. Particles of sand can be up to about 2 mm (a little less than 1/8") in diameter.
"Granules" are between 2 mm and 4 mm across.
"**Pebbles**" are larger particles between 4 mm and 64 mm (1/8" to 3.5") across.
"**Cobbles**" range in size from 64 mm to 256 mm (3.5" to 10") across.
Even larger rocks are referred to as "**boulders**."

Small particles are more easily moved downstream (or downhill) than larger ones, so a gently flowing stream may remove silt, leaving gravel. However, a rapidly flowing stream may undercut stream banks, adding silt and sand to the stream bed.

images and drawing by Mike Roa

Erosion and Salmonid Habitat

The normal flow of water in streams causes some erosion of the stream banks, especially as streams change course (meander) in fragmented soils such as found in Fife Creek and Pomo Canyon. Road construction, building, farming, landslides, heavy rain, logging and other factors can increase erosion of the land and cause the addition of sediments to streams.

Erosion of stream banks can undercut roads and topple trees along the stream. In order to prevent undercutting of roads and trees along Fife Creek in Armstrong Woods, portions of the creek were lined with logs and bags of concrete after the northern California floods of 1964. Such erosion control efforts disrupt the natural flow of not only water but also sand and gravel in the creek, negatively affecting fish reproduction.

Pomo Creek undercutting its bank. Note the exposed tree roots.

Erosion control efforts in Fife Creek

above images by Mike Roa

Logging in the Willow Creek watershed, 1911. (Courtesy Western Sonoma Co. Historical Society)

Logged over hillside near Guerneville, 1910. Note the devastation of the creek. (Courtesy Sonoma Co. Library)

Since before 1900, agriculture, road building and, especially, logging, resulted in huge amounts of silt being added to Willow Creek. Attempts to keep the stream from flooding the farms and roads by altering the location, shape, and depth of the creek further degraded it so much that by 2001 the stream bed was essentially filled with sediment in some areas, with no bed or banks remaining. Both upstream movement of adult salmon and downstream migration of juveniles were blocked.

Since the 1960s, sediment addition to the creek has decreased. Changes in the roads and bridges (especially the second bridge) and general use patterns in the watershed have improved the stream quality of Willow Creek so that salmonids are now beginning to re-establish themselves in the creek.

Healthy Streams for Healthy Fish

Salmonids (salmon, trout, steelhead rainbow trout) swish their tails to hollow out "nests", called **redds**, in which they lay their eggs. To make their redds, they need gravel that is loose enough to move so that silt and sand can be washed away, leaving space for the eggs between the gravel particles. The gravel protects the eggs and young fish ("fry") from predation. If silt and sand are not cleared out by moving water, the gravel can become embedded so firmly that the fish can not build their redds. If silt is added on top of the eggs, they can be smothered and killed.

Russian River steelhead making a redd. The female, at left, is flipping her tail to excavate a redd. The male, at the right, waits for the female to expel the eggs so that he can fertilize them, and "guards," keeping other fish from eating the eggs before they are covered with gravel. source of photo: U.C. San Diego Sea Grant Program

Silt and fine sand can bury the eggs and kill them. If poor logging practices, landslides, road building, or something else causes silt to be washed into the stream, salmonids can be extirpated from an area, as they were from Willow Creek. Willow Creek is now recovering from decades of sedimentation and once again provides salmon and steelhead breeding habitat.

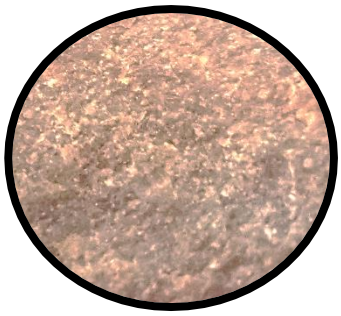
In addition to gravelly stream beds for building redds, salmonids need **cold water**. (Cold water holds more dissolved oxygen. Active fish such as salmonids need lots of dissolved oxygen.) Pools formed at bends in rivers and creeks and behind obstructions such as logs ("large woody debris") provide deep, cool water, especially if the stream is lined with trees and shrubs that provide shade and the water splashes over logs and rocks in riffles. Streamside vegetation also provides habitat for insects that are an important food source for fish.

Pool behind large woody debris in creek
Note bubbling, which adds oxygen to the stream.
(in Lassen Volcanic National Park)
image by Mike Roa

Since before 1900, agriculture, logging and road building added huge amounts of silt to Willow Creek, degrading the salmonid habitat so much that the fish were extirpated. Since the 1960s, sediment addition to the creek has decreased. Changes in the roads and bridges and general use of the watershed have improved the stream quality of Willow Creek so that salmonids are now beginning to re-establish themselves in the creek. Stewards, State Parks, and other organizations continue to work to improve the quality of the Willow Creek Watershed.

Sedimentary Rocks: Sandstone

Sandstone is formed when small rock particles are compressed. and cemented together. This usually happens when sediments are in the ocean or other large bodies of water, so such rocks are called sedimentary rocks. Since the sediments are laid down in layers, sandstone is often layered, but the layers may be very thick and, therefore, not evident in a small sample. Rock/sand particles in sandstone are usually pretty homogeneous in size. Most of the rocks found in Fife Creek and the creek at Pomo Canyon are sandstone.



Above: Sandstone at entrance to Armstrong Redwoods State Reserve, in Guerneville

Greywhacke is a type of sandstone. It is generally harder than other sandstones and the grains tend to be angular and **vary in size**. (Most sandstone has grains that are all of similar size and shape.) Greywacke deposits were formed by undersea landslides or turbidity currents, so sand and clay particles of varying sizes are mixed.

The rocks may be brownish-gray on the outside, but when split, the rocks are usually gray in color. (Greywacke often "weathers" to a brown color.) But greywacke can range from light tan to brown to black in color. In heavily shaded areas such as Pomo Creek, exposed rocks are often covered with a coating of algae, making them appear greenish.

Where to find/see: Greywacke is common on Sonoma Coast beaches.

Greywacke sandstone along Hwy 1 just south of Jenner

Greywacke rocks at Russian Gulch beach

Greywacke in Pomo Canyon, showing algal coating

Photos by Mike Roa

Sedimentary Rocks: Chert

Chert is a hard, sedimentary rock composed of the quartz skeletons of microscopic organisms such as diatoms and radiolarians ("siliceous ooze"). Chert can be many colors: reddish, green, brown, black, or even white. Locally, red is the most common color of chert.

Native Americans used chert for tools such as arrowheads, knives, and scrapers if obsidian was not available. Local Indians, however, could obtain obsidian from the Annadel area. Both obsidian and chert are very hard and can be shaped by conchoidal fractures. ("Conchoidal" fractures result in flakes and marks on the rocks that look sort of like (clam) shells.)

conchoidal fracture in flint, a very hard form of chert

Where to find/see: Chert rocks are common on Sonoma coast beaches. "Red Hill," between Shell Beach and Pomo Canyon is apparently named for red chert found there.

Chert rocks at Russian Gulch beach

Tools life-size. Not from Sonoma Co.

Flint is an especially hard form of chert. It can be used to spark a fire or ignite gunpowder, as in a "flintlock" gun.

Red **Chert** outcrop near Hwy 1 marker 17.36

Photos by Mike Roa

Sedimentary Rocks: Petrified Wood

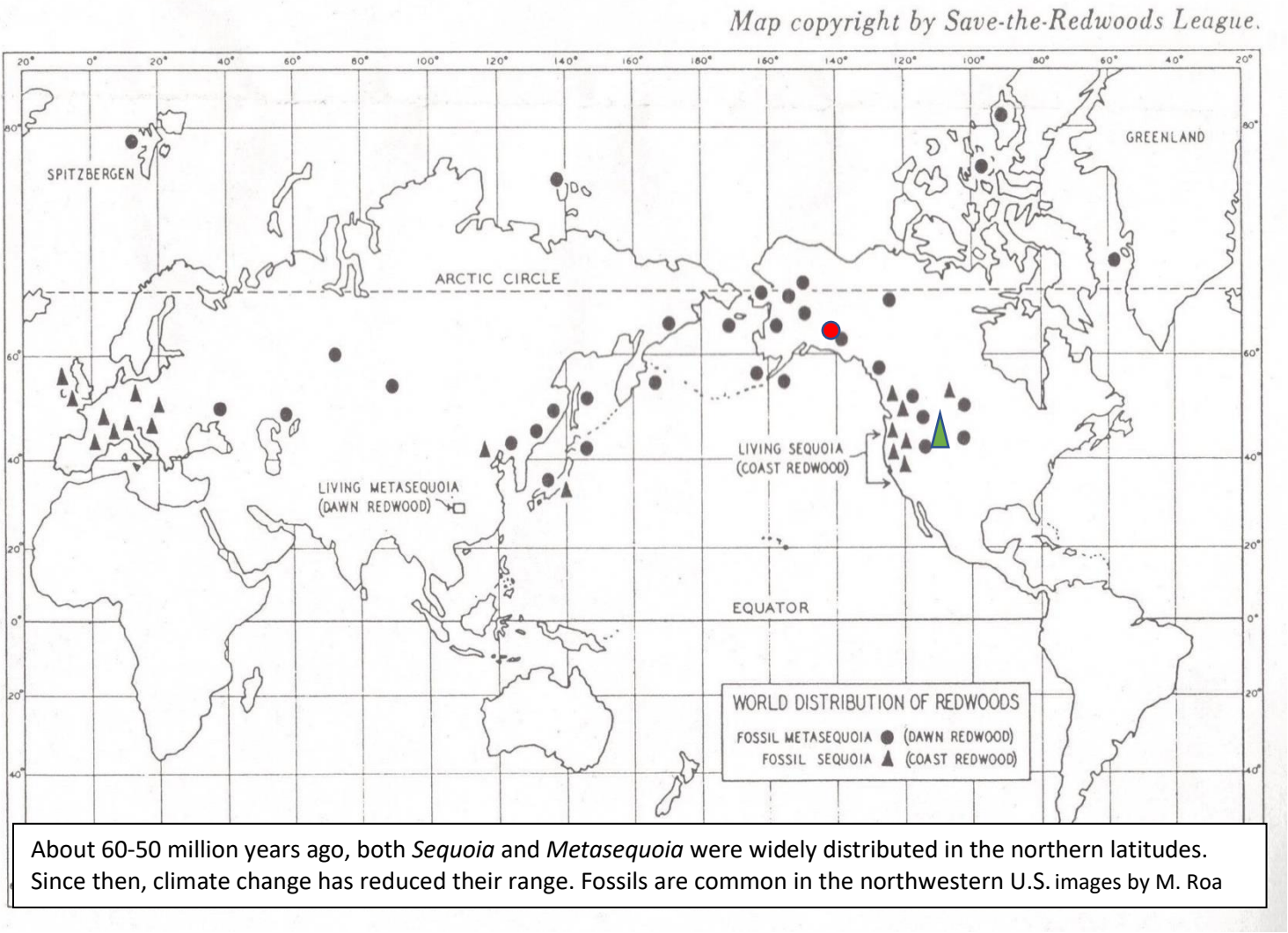
The Petrified Forest, between Santa Rosa and Calistoga, consists of "petrified wood" formed as a result of an eruption in the area of Mt. St. Helena about 3.4 million years ago. The eruption blew the redwood trees (*Sequoia langsdorfii*) over and covered them with ash. Over millions of years, water percolated through the ash, picking up minerals as it did so. The minerals, mostly silica compounds such as quartz and opal, precipitated out of solution and were deposited in the interiors of the cells, with the cell walls acting as a template. Thus, the minerals took the shape of the cells and show growth rings and other features.

Where to find/see: The Petrified Forest is a great place to see petrified wood. It can sometimes be found in other areas, and occasionally a piece is carried by creeks and rivers all the way to the coast.

Photos: "The Giant" above: from the Internet
petrified wood samples by Mike Roa

Fossil Redwoods

Some fossils, such as the redwood needle fossils pictured below, are imprints of leaves that were buried in layers of ash, sand or other sediments. Others, such as the cone pictured below are formed when bone, wood, or other material is buried in ash or other material. Over millions of years, water percolates through the ash, picking up minerals as it does. Minerals, mostly silica compounds such as quartz and opal, precipitate out of solution and are deposited in the interiors of the cells, with the cell walls acting as a template. Thus, the minerals take the shape of the buried material.



About 60-50 million years ago, both *Sequoia* and *Metasequoia* were widely distributed in the northern latitudes. Since then, climate change has reduced their range. Fossils are common in the northwestern U.S. images by M. Roa

Sequoia sp. Beaverhead Co., MT.

Metasequoia sp , Anchorage AK.

Sequoia dakotaensis, cone, N.D.

Metamorphic Rocks: Serpentinite

Serpentinite is formed by a hydrothermal metamorphic process, typically involving hot seawater. It ranges from light to very dark green, and often is smooth, with a slippery "greasy" feel. (The rock can feel like a smooth snake skin, and often contains veins of asbestos resembling scales, hence the name, "serpentinite.")

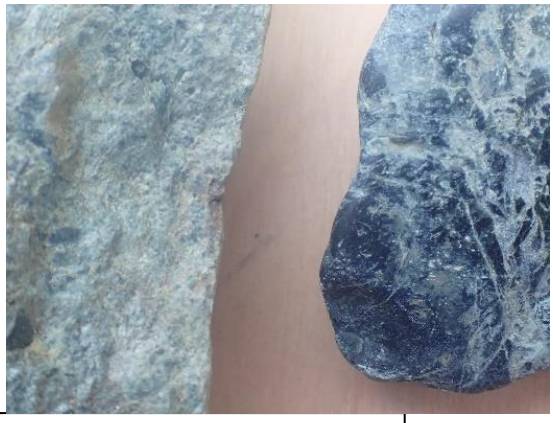
Soil above serpentinite is rich in magnesium, chromium, and nickel, which are toxic to most plants, and are poor in calcium, so most plants don't grow well in serpentine soils.

Serpentinite can contain water, which can result in unstable soils above serpentinite, sometimes resulting in landslides.

Serpentinite rocks tumbled in ocean waves are often a light green color. When wetted, they become a darker green.

Some serpentinite is soft enough to be carved with a knife and is called soapstone, although other rock types are also called soapstone. A variety of products are made from soapstone.

Where to find/see: Serpentinite is exposed on some Hwy 1 roadcuts. There is an outcrop at Goat Rock.



Serpentinite in an outcrop at south parking area at Goat Rock

a serpentinite rock at Russian Gulch beach – dry and wet

veins of asbestos fibers in serpentinite

Photo sources:
asbestos fibers: left from Ca. Dept of Conservation
asbestos fibers: right from Environmental Protection Agency
Others by Mike Roa

Metamorphic Rocks: Schists

Schist is a metamorphic rock with medium-sized grains. The mineral grains are oriented such that the rock is easily split into flakes or plates. This is because the minerals themselves are “platy,” displaying parallel alignment. Schist is often made up of micas, talc, chlorite, or graphite, interspersed with more granular minerals such as feldspar or quartz. Several forms of schist can be found locally, with shist, blueschist, and greenschist being the most common.

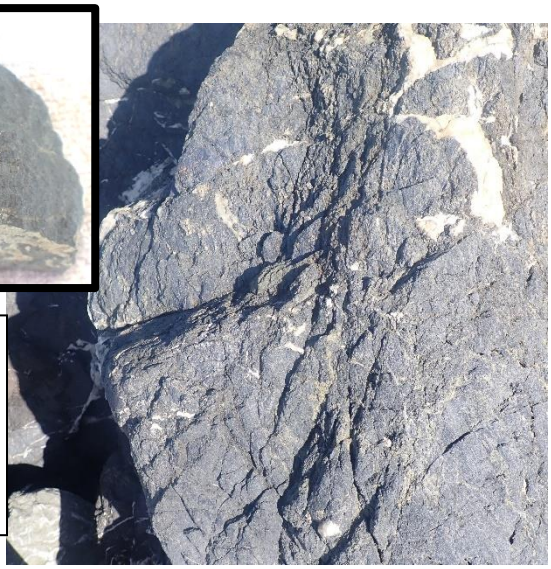
Schist

Photos by Mike Roa

Metamorphic Rocks: Blueschist

Blueschist is a metamorphic rock formed from basalt at low temperatures and high pressure, typically in subduction zones such as along our coast. Our local blueschist is very fine-grained, hard, and **may** include red-brown garnet crystals, which may look like tiny rust spots in the rock.

Where to find/see: Blueschist rocks are common on Sonoma Coast beaches. The outcrop shown below is at Goat Rock.



Blueschist outcrop at South Goat Rock Beach

Tiny garnets can **sometimes** be found in blueschist.

Blueschist from Austin creek

a blueschist rock at Russian Gulch beach (dry and wet)

Photos by Mike Roa

Metamorphic Rocks: Gneiss

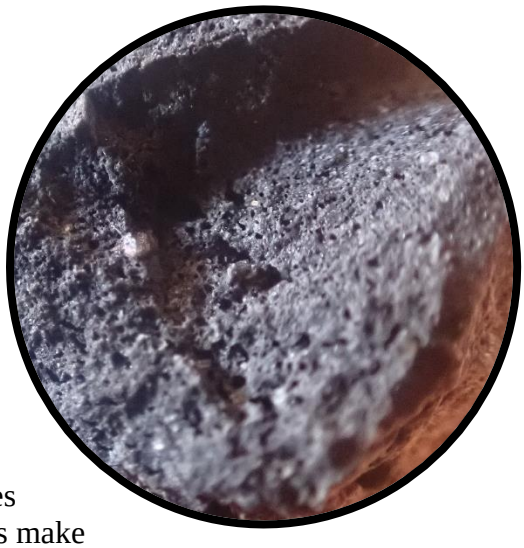
Gneiss is a coarse-grained metamorphic rock that has a distinct banding. Unlike schist, though, the bands or layers don't tend to cleave or split into layers. The bands or layers are often wavy in appearance.

Gneiss is not common in Sonoma County, but it does occur in some places.

Where to find/see: Some gneiss is exposed south of the creek at Kehoe Beach in Point Reyes.

Photos by Mike Roa

Igneous Rocks: Basalt



Basalt is an extrusive igneous rock formed by rapid cooling of magma (lava) on the surface. ("Extrusive" rocks are formed from magma that cools on the surface of the Earth, as opposed to "intrusive" rocks that form from magma that cools and solidifies beneath the surface.) Basalt is rich in magnesium and iron. Various forms of basalt make up more than 90% of Earth's volcanic rock.

When magma cools rapidly, there isn't time for large crystals to form, usually resulting in fine grained rock.

Basalt often contains holes, called vesicles. Vesicles are formed when dissolved gases bubble out of the magma as it approaches the surface of the Earth and decompress. The erupted lava then solidifies before the gases can escape, leaving holes in the rock. If the vesicles make up a substantial portion of the rock and have thick "walls", it is called scoria.

Where to find/see: Trione-Annadel state park has lots of basalt. Landscape supply places sell it as "field stone."

above: basalt "field stones" from landscape supply company (scoria at right)

Left and above: basalt at Trione-Annadel State Park

photos by Mike Roa

Igneous Rocks: Granitic Quartz Diorite

Granite is an intrusive igneous rock made up mostly of quartz, feldspar, and plagioclase. It is formed when magma cools and solidifies underground (hence, intrusive). Granite makes up most of the continents' bedrock. Since granite is less dense than basalt, when basaltic magma pushes against the continental granite, the denser basaltic magma "dives" beneath the granite, which, essentially, "floats" on the denser basalt.

Quartz diorite is a granite-like rock, but it has a higher quartz content than true granite.

Since granite (and diorite) are formed underground, the molten material cools slowly, which allows relatively large crystals to form. These large crystals are large enough to be easily seen with the naked eye.

Where to find/see: The San Andreas Fault runs just offshore along most of the Sonoma Coast. However, it cuts through Bodega Bay. Bodega Head is made of rock that is west of the San Andreas Fault. The chunk of quartz diorite that is Bodega Head was once at least 300 miles to the south. The composition of the rocks match up with rock in the Tehachapi Mountains. (Some geologists feel that they match best with the rocks in Baja California, even farther to the south!)

The Bodega Head quartz diorite granite was probably formed about 100 million years ago. The gray colored granite is overlain by brown sandstone deposits, but is visible along the shore.

Photos by Mike Roa

Igneous Rocks: Rhyolite

Rhyolite is the most silica-rich type of volcanic rock. Rhyolite magma is very viscous, which often results in explosive eruptions (as opposed to the flowing magma of basalt).

Sometimes the rhyolite ash settles into layers, which solidify into tuff. Water filtering through the ash of Mt. Saint Helena picked up silica minerals that helped form the petrified wood found at the Petrified Forest near Calistoga.

Where to find/see: The Mayacamas Mountains, including Pepperwood Preserve, have lots of rhyolite tuff deposits.

Sometimes rhyolite lava forms rock with lots of bubbles, resulting in a type of rock called pumice.

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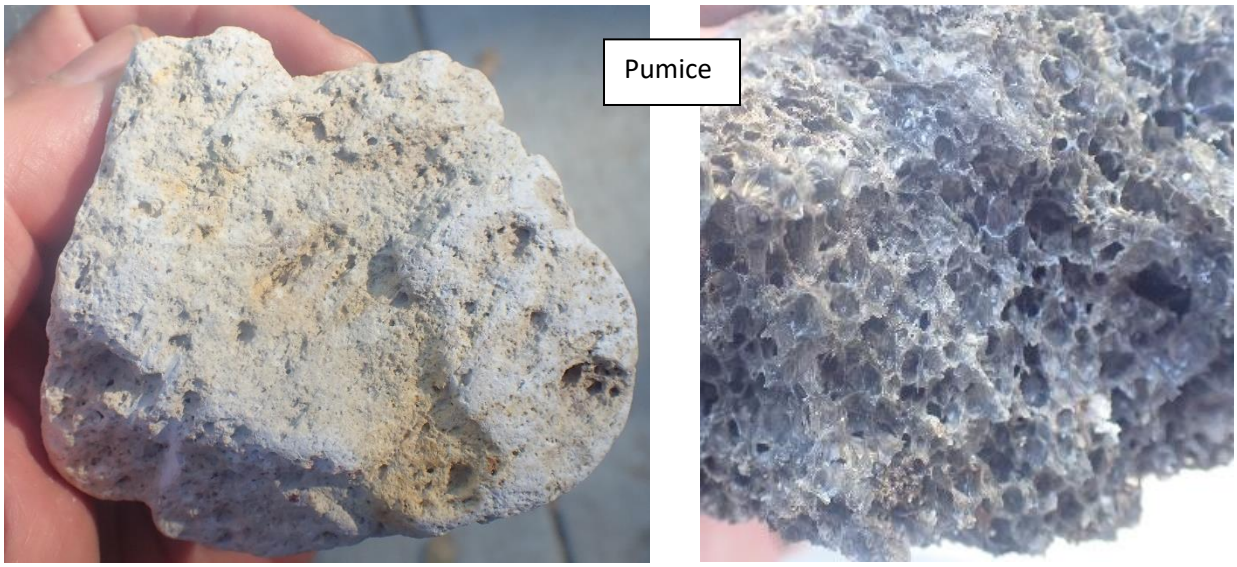
Pumice

Pumice is a kind of rock made of tiny bubbles (vesicles) with thin walls of extrusive igneous rock. It is generally light colored, but can be various colors, including black. Like obsidian, it has no crystal structure. The "bubbles" in pumice have thin walls that make it less dense than water, so it floats. (Scoria has thicker walls and doesn't float.)



Where to find/see: Landscape supply companies sometimes have pumice rocks. Rhyolite pumice is used as a skin exfoliant and can be bought at stores such as Bed, Bath, and Beyond.

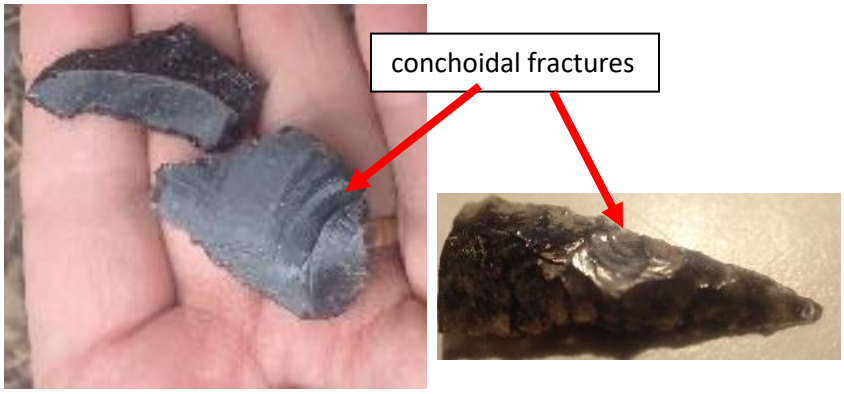
Photos by Mike Roa

Igneous Rocks: Obsidian

Obsidian is an extrusive igneous rock formed by very rapid cooling of magma (lava) on the surface. ("Extrusive" rocks are formed from magma that cools on the surface of the Earth, as opposed to "intrusive" rocks, such as granite, that form from magma that cools and solidifies beneath the surface.) Obsidian is rich in silica. Obsidian often forms when lava has sudden contact with air or water.

When magma cools rapidly, there isn't time for large crystals to form, usually resulting in fine grained rocks. In the case of obsidian, the lava cools so rapidly that crystals don't form at all, resulting in a glassy material. Rather than splitting in straight lines, obsidian (and chert) chip in what are called "conchoidal" fractures, which allowed Native Americans to fashion very sharp tools. Even today, scalpels that are sharper than steel blades are made from obsidian.

Obsidian from the Trione-Annadel area was a valuable trading commodity.



Dissolved gases bubble out of the magma as it approaches the surface of the Earth and decompresses. The erupted lava sometimes solidifies before the gases can escape, leaving holes in the rock. Those holes are called vesicles. Thin-walled vesicles in obsidian form pumice. (See previous page.)


Obsidian flakes found at Trione-Annadel State Park

Where to find/see: Obsidian can be found at Trione-Annadel State Park. Flakes can be found in many locations because the Indians would bring rocks to their campsites and villages and work it there. Gophers sometimes bring the flakes to the surface at Spring Lake in Santa Rosa and Ragel Park in Sebastopol. There's even an Obsidian Road in Santa Rosa!

Photos by Mike Roa

Organism Information for Docents

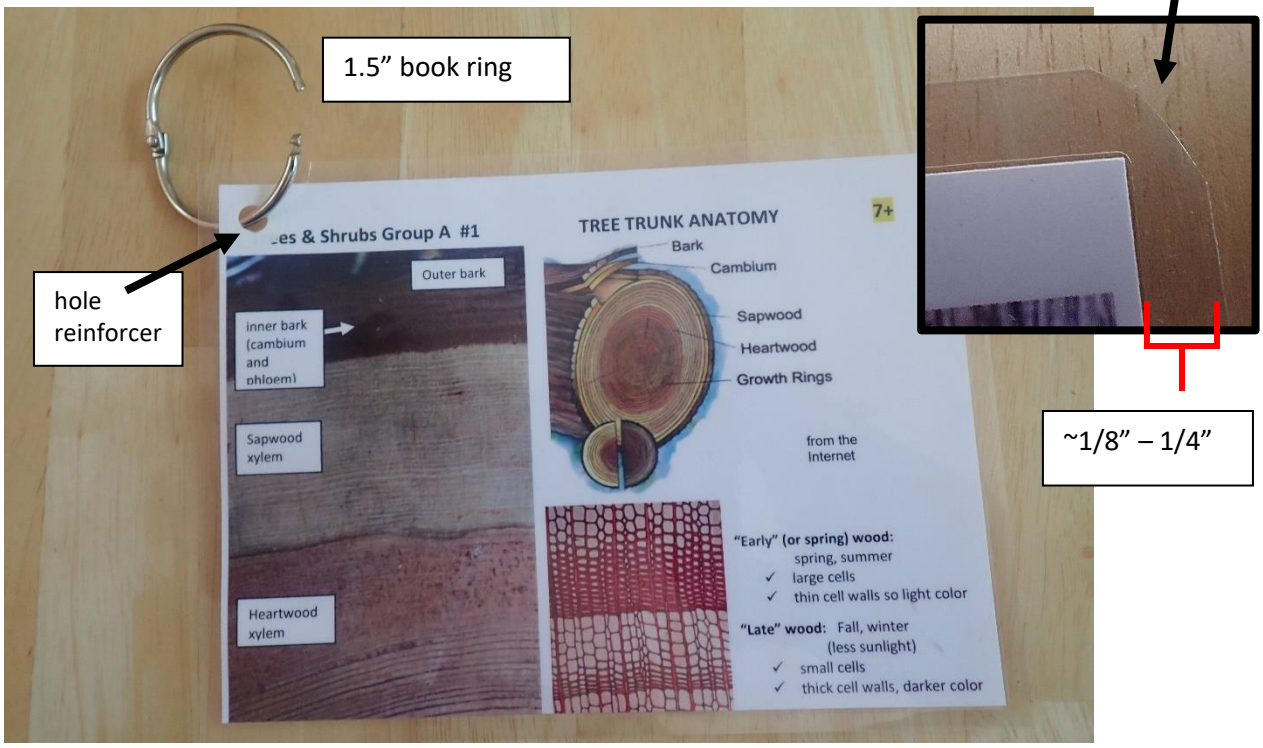
rev. 6.30.21

The following pages contain photographs and information about many plants and animals found in and around Armstrong Woods and Pomo Canyon. Don't worry about trying to learn all of them. If you're interested, you can do that over several years. The **most common** ones are indicated by **bold** lettering on the list on the next page. Learn about those first.

Each page has one or more photographs on the top half and some information and possibly more photographs on the lower half. This is so that you can make them into 5" x 7" laminated cards that you can carry with you if you want to.

Laminating and Binding Cards:

1. Print the cards; cut to size (5"x7").
2. Glue the information to the back of the photo.
3. Punch a hole in the upper left corner. Leave at least 1/4" of paper around the hole.
4. Add a hole reinforcer. (Clear reinforcers look better but are harder to attach than white.)
5. Laminate.
6. Cut so that there is a 1/8" – 1/4" margin of laminating material all around the paper.
7. Round the corners.
8. Punch again and use a book ring to keep them together in order.



Some Organisms Found at and near Armstrong Woods and Pomo Canyon
(Organism Information for Docent Education)

The main organisms to know about are in **bold**.

Trees and Shrubs Group A
(Most common or noticeable in Pomo Canyon and Armstrong Woods valley)

Tree Trunk Anatomy
Redwood Leaves and Cones
Douglas-fir
Coast Redwood or Douglas-fir?
Bay
Big Leaf Maple
Green Island Fungus
Blackberries
California Hazelnut
Evergreen Huckleberry
Poison Oak
Poison Oak Near Entrance to A.W.
Poison Oak Leaves
Poison Oak Reproduction
Red Alder
Red Elderberry
Tanoak
Tanoak Acorns
Tanoak Uses
Sudden Oak Death
Thimbleberry

Trees and Shrubs Group B
(Not so common or noticeable in the valleys, but may be common nearby)

Bishop Pine
California Black Oak
California Buckeye
California Nutmeg
Ceanothus (Wild Lilac, Buck Brush)
Coyote Brush
Live Oak
Madrone
Manzanita
Monterey Pine
Toyon
Willow

Flowers
Redwood Sorrel (*Oxalis*)
Western Trillium
Fetid Adder's Tongue
Andrew's *Clintonia*
Cow Parsnip
Fairy Bell
False Solomon's Seal(s)
Miner's Lettuce
Redwood Violet
Stinging Nettle
Trail Plant
Wild Ginger
Wood Rose

Moss

Ferns
Sword fern
Bracken Fern
Wood Fern
Five-Finger Fern
Giant Chain Fern (*Woodwardia*)
Goldback Fern
Horsetail (*Equisetum*)
Maidenhair Fern
Polypodium Fern

Animals
Banana Slugs
Millipedes
Beetles that feed on Redwood
Some Insects
Moths and Butterflies
Amphibians
Reptiles
Crows and Ravens
Woodpeckers
Columbian Black Tailed Deer
Wild Pig

Fungi and Lichens
Some Fungi
Some Fungi
Fruticose Lichens
Foliose Lichens
Crustose Lichens

A Few Words About Names

Is it important for docents to know the names of organisms found in our area?

The answer is yes – and no.

To paraphrase Juliet: "A wood rose by any other name would smell as sweet."

So, we could call the flower at the right a wood rose, a bald hip rose, *Rosa gymnocarpa,* or that plant with the small thorns and pretty pink flower, or Bob. It would still be the same plant.

But there are a couple of reasons to know the names of organisms.

1) Knowing the name facilitates communication. If I want to talk about the plant, it is easier to say "wood rose", or "*Rosa gymnocarpa*" than "that plant with the small thorns and pretty pink flower." Also, there are several plants with small thorns and pink flowers.
2) Knowing the name of something helps establish a connection. Visitors to any environment often ask the name of a plant, animal, kind of rock, or something else in the environment. Wanting to know the names of things seems to be a natural desire.

Many people are content to just know the name of an organism. But that is probably the least important thing to know. It is far more interesting, and important, to know something about the organism. What does it eat? What eats it? Why does it live here and not there? Do people use it for something? What other organisms live in the same environment? To what is it related?

As docents, it is useful to know the names of organisms, but it is at least as useful to know something about the organisms.

The "scientific," or binomial name of an organism has two parts: the genus name and the species name. A genus is a group of closely related organisms. The species is the particular kind of organism. Members of the same species can mate and reproduce fertile offspring with each other, but not with other species.

When written, the genus name is capitalized and the species name isn't. To identify the name as a scientific name, it is italicized or underlined. So, for the wood rose, the scientific name is *Rosa gymnocarpa.* It is a different species than *Rosa californica*, the California wild rose, or *Rosa nutkana*, the Nootka rose. The genus name, *Rosa*, tells us that it is closely related to other roses. The species name, "*gymnocarpa*," tells us something about it. In this case, the fruiting body or rose hip, quickly loses its sepals, leaving it "naked." "*gymno*" means naked, and "*carpa*" refers to fruit. Another common name for the plant is "bald hip" rose.

When a visitor asks the name of a plant, it can be interesting to ask them to look at it and think of a name that would help them remember what it looks like. You can even use that name the next couple of times that you encounter the plant before telling them the "real" name.

Citations

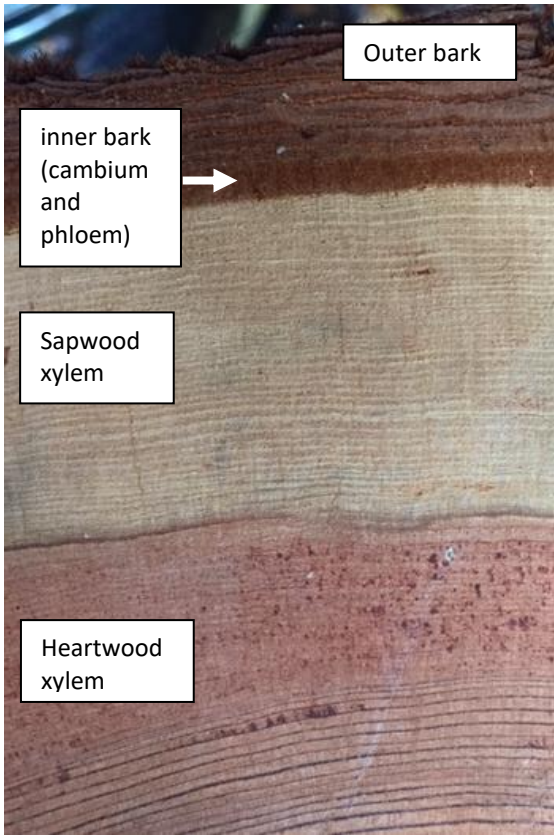
The vast majority of the photographs were taken by Stewards docents or staff. The photographers' names are indicated. Some were taken by other people; their names are also indicated. Many were taken from the iNaturalist or Flikr web sites. In those cases, we used only images for which use is allowed.

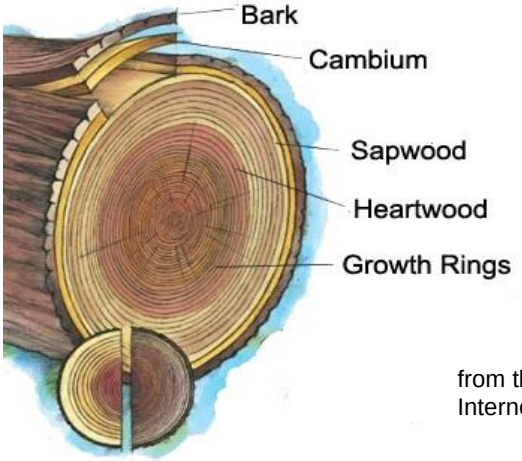
A few images were taken from the internet without permission, but we feel that "Fair Use" allows for that, as we are not benefitting financially and the images are being used for educational purposes. Those images are indicated with an "I" notation.

Trees & Shrubs Group A #1

TREE TRUNK ANATOMY

7+





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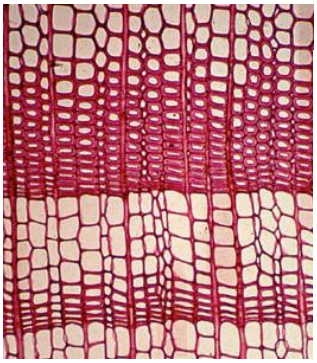


"Early" (or spring) wood: spring, summer
- ✓ large cells
- ✓ thin cell walls so light color

"Late" wood: Fall, winter (less sunlight)
- ✓ small cells
- ✓ thick cell walls, darker color

OUTER BARK: The outer bark serves to protect the tree, especially from insects, disease, and, in the case of coast redwoods, fire. Redwood bark is commonly 4"-8" thick, and may be over a foot thick! Redwood bark is high in tannins, which deters insects, and is very fibrous, not providing much nutrition for insects.

The outer bark's structure makes it sponge-like, allowing it to absorb moisture. Most naturally occurring fires would be lightning-caused, which usually happens during rain storms, so wet spongy bark would provide some protection. ***(Have visitors press their hands on the bark to sense its sponginess.)***

INNER BARK: The inner bark includes the cork cambium (which produces the outer bark), and **PHLOEM**. Phloem brings nutrients such as sugars down from the leaves to the rest of the plant. (Phloem flows down)

VASCULAR CAMBIUM: **Vascular cambium** is the tissue that produces the plant's vascular tissues, **phloem** and **xylem.** (Vascular tissues transport materials…our vascular system is our blood system.)

XYLEM (The **xylem** is the wood.)

Sapwood is light colored living tissue through which water and minerals move upward. (xy to the sky)

Dead xylem cells accumulate **tannins**, which are brought inward by groups of cells that form **rays**. Tannins accumulate in the darker colored **heartwood**, which provides structural strength to the tree.

Redwoods have a reputation for being resistant to insects and rot. This reputation was well earned when old-growth forests were being logged. A 1000-year-old tree had 1000 years to accumulate tannins. A 50-year-old second growth tree wouldn't have nearly as much tannin, so it isn't very insect and rot resistant.

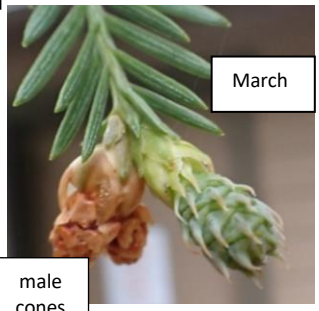
A year's growth is indicated by a light AND a dark ring. The light rings ("early" or "spring" wood) are made of large cells with thin cell walls as the tree grows rapidly in the spring and summer. Dark rings ("late wood") are formed of small, thick-walled cells formed during the slow growth period in the late fall and winter.

Credits: diagram of "layers" (upper right): U.S. Forest Service left photo of layers by Mike Roa
Microphoto of early and late wood/rings: https://www.geo.uzh.ch/microsite/alpecole/static/course/lessons/12/12d.htm

Trees & Shrubs Group A #2 REDWOOD LEAVES (NEEDLES) AND CONES 7+

Female cones:
Left: top of tree in May
Below: most of tree

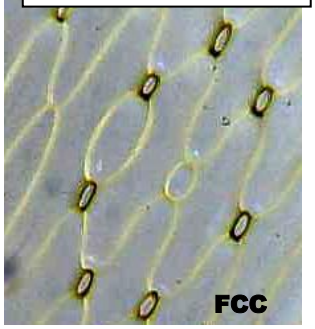
this year's female cone (same cone)



male cones

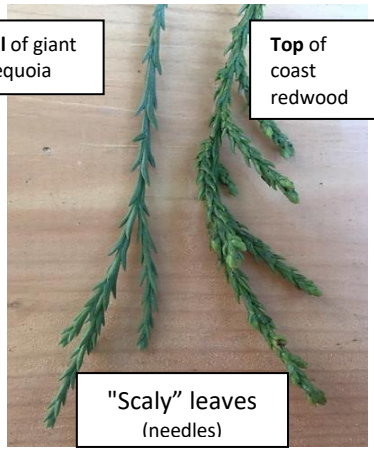
June

Stomata and guard cells



All of giant Sequoia

Top of coast redwood



"Scaly" leaves (needles)

Last year's male cones in December

This year's male Cones in December

"stomatal bloom"

1.UPPER LEFT: Most female (ovulate) cones are borne in the upper part of the tree; some are borne lower. Male (pollinate) cones form throughout the tree

2.UPPER MIDDLE: It is difficult to distinguish male from female cones until January or February.

3.LOWER LEFT: Leaves/needles pressing against the branchlet helps the tree conserve water because the stomata are shielded from the drying effect of wind and sun. Coast redwood leaves in the upper canopy of mature trees have such scale-like leaves.

The Giant Sequoia (*Sequoiadendron giganetum*) grows in the gravelly soil of the Sierra Mtns. That soil doesn't hold water well, so when rain falls, it percolates into the soil and becomes unavailable to the tree. In the winter, the water is frozen and is unavailable. Thus, giant Sequoia needles press against the twig.

4.LOWER MID.: After releasing pollen, pollinate comes dry up. They may remain on the tree for a long time.

5.BOTTOM RIGHT: Like the leaves of many plants, redwood needles have a waxy coating (cuticle). There is an especially thick layer on the ventral (under) side, surrounding the stomata. This is called "stomatal bloom."

6.TOP RIGHT: Stomata (singular: stoma or stomate) are tiny openings in the under side of a leaf. Gases can pass in and out through the opening. Photosynthesis produces oxygen gas, which exits through the stomata. Water vapor can also exit through the stomata; this is called **transpiration**.

When plants are stressed due to dry conditions, they have several methods of reducing transpiration.

- The stomata are surrounded by "guard cells". Guard cells close the opening when there is not enough water.
- The ventral (under) sides of many plants are "furry." California hazelnut is a good example. That "fur" traps air that is moistened by transpiration, thus reducing water loss.
- Redwood sorrel leaves droop downward when the plant is in warm sunlight for long. This helps shield the stomata, trapping moist air and reducing moisture loss.

photos: Stomata image from Flikr, by Yersinie Pastis all others by Mike Roa

Trees & Shrubs Group A #3 **DOUGLAS-FIR** ***Pseudotsuga menziesii*** **7+**

young Douglas-fir

pollinate cones in March

young, "middle aged", and mature bark **photos:** by Mike Roa

Douglas-fir is not a true fir, hence the genus name "***Pseudo****tsuga*." Among other differences, <u>true</u> firs have cones that stand upright on the twigs and fall apart when mature, while Douglas-fir cones hang down and fall from the tree intact.

The cones are easily identified by the bracts that extend out beyond the edges of the scales. A Native American tale says that this represents a mouse given shelter by the tree, allowing the mouse to hide from Coyote. In exchange, the mouse helped spread the tree's seeds. The mouse's legs and tail extend beyond the edge of the scale.

Doug-fir needles grow all around the twig; redwood needles extend out in one plane, feather-like.

Doug-fir bark is light colored and smooth when young and brown-gray, hard, and deeply furrowed when mature, while redwood bark is fibrous and rust colored throughout its life.

Douglas-fir is one of the most widely distributed conifers in western N. America. It is the major lumber-producing tree in N. America. The lumber in visitors' homes is probably mostly Douglas-fir. It is also used for particle board, plywood, and pulp.

It is moderately shade-tolerant and in redwood forests grows mostly in openings. It requires less water than redwoods, so it often grows upslope from the redwoods.

At both Pomo and Armstrong woods, the trees often have a lot of lichen, especially "old man's beard" growing on them. Animals, probably squirrels or porcupines, have fed on the tops of many Douglas-firs at Pomo, resulting in trunks that split.

Trees & Shrubs Group A #4 **COAST REDWOOD or DOUGLAS-FIR?** **7+**

Coast Redwood **Douglas-Fir**

LEAVES/NEEDLES

Coast Redwood needles grow out from opposite sides of the twig, and often stay attached to the twig when they fall.

Douglas-fir needles grow all around the twig, like a bottle brush., and break from the twig when it falls.

CONES

Coast Redwood cones are woody, olive-sized, and tend to stay attached to the twig when it falls.

Douglas-fir cones are soft, about 3" long, with bracts sticking out from the scales. They tend to fall from the tree without remaining attached to the twig.

photos: by Mike Roa

HABITAT

Coast Redwoods tend to grow in valley where there is shade, moisture, and fog.

Douglas-firs tend to grow higher on hillsides, where it is drier, but they may also grow among redwoods.

COAST REDWOOD BARK

Coast redwood bark is red-brown, fibrous and relatively soft .

DOUGLAS-FIR BARK

bark is gray and fairly smooth when it is young. As it ages, it becomes harder, scaly, and dark brown.

WHAT'S IN A NAME?

Douglas-fir is hyphenated because it is not a true fir, hence the species name ***pseudo****tsuga*.

The species name for the **coast redwood**, ***sempervirens***, means always green, a nod not only to its leaves but its longevity. ***Sequoia*** may be in honor of the Native American, or because a botanist was studying its scale sequence.

Trees & Shrubs Group A #5 **BAY** ***Umbellularia californica*** **4+**

Bay flowers in February

Bay seeds in July

Look for green or yellow leaves on the ground. Pick one up and smell it. Does it remind you of any spices that you might have at home?

This tree has many names, including **Bay, California Bay, Laurel, Bay-Laurel, Oregon Myrtle, and Pepperwood.**

Bay trees will readily sprout from root crowns after fire or cutting, or even from a healthy tree (right).

It is not the same species as the plant whose leaves we use in spaghetti sauce and soups, but it is closely related.

Fleas and some other insects don't like the smell of the leaves, so Native Americans used them as an insect repellant in their homes. They would also wipe crushed leaves on their bodies to disguise their scent when hunting. They also ate the nuts after roasting them.

The wood is used to make beautiful bowls.

photos: by Mike Roa

Trees & Shrubs Group A #6a **BIG LEAF MAPLE *Acer macrophyllum*** **4+**

P-4

Do you know what kind of leaf is on the Canadian flag?
It is the maple leaf, because many maple trees grow in Canada.

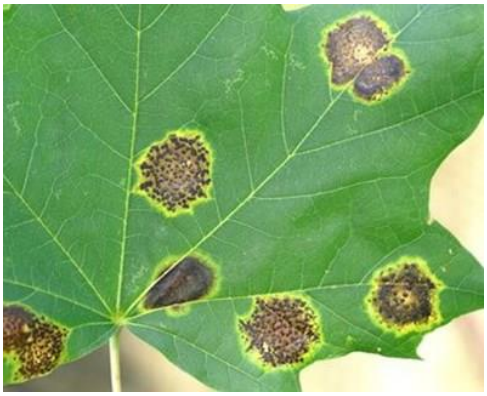
The **Big Leaf Maple** tree is common in redwood forests.

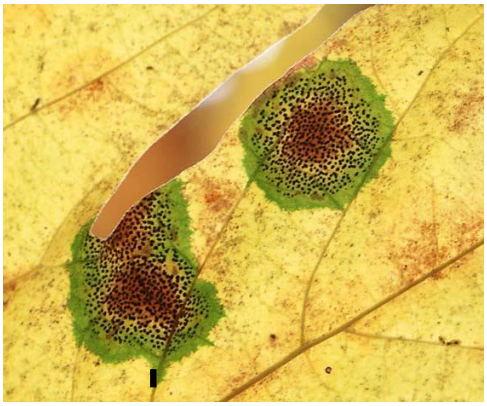
The seeds have wings that help them float to the ground by spinning like a helicopter blade. If you can find a seed on the ground, toss it up into the air and watch it slowly fall to the ground. If you can find several, have the visitors pick them up and toss them.

Why would it help the species survive to have the seeds take a long time to reach the ground? **(A longer time in the air allows the seed to be blown farther from the parent tree. That way the seedling won't be competing with its parent for sunlight and water.)**

photos: by Mike Roa

Trees & Shrubs Group A #6b GREEN ISLAND FUNGUS on Big Leaf Maple **9+**





Green Island Fungus

Big Leaf Maple leaves are sometimes infected with a disease called "**Green Island Fungus**." This disease also affects other maples and some other plants, including thimbleberry and hazelnut, but it doesn't seem to cause much harm other than early leaf drop in the fall. The fungus itself is called "speckled tar spot fungus."

The same effect can be caused by some bacteria and insects, notably leaf miners.

The black spots of the fungus give rise to its name *Rhytosoma punctatum*, because the spots look like punctuation points (periods).

The fungus (or insect or bacterium) produces hormones (cytokinins) that promote the retention of chlorophyll (delaying senescence) in the surrounding tissue, hence the "green island." (or maybe green atoll, or "chloratic halos"). In the case of insects, this active chlorophyll extends the availability of food. A good article can be found at:

https://simonleather.wordpress.com/2019/09/10/green-islands-mining-cytokinins/

The fungus overwinters in decaying fallen leaves on the forest floor. In the spring it produces "aerospores" that are carried by the wind to the new crop of leaves.

photos: upper left and lower left by Mike Roa others from the Internet

Trees & Shrubs Group A #7 BLACKBERRIES Calif. (*Rubus ursinus*) & Himalayan (*R. discolor*)
(The species name of the Himalayan seems to be unsettled. *R. armeniacus* and *R. bifrons* are other names)

California Blackberry
Note 3 leaflets and slender spines.

Himalayan Blackberry
Note 5 leaflets and stout spines.

California and Himalayan Blackberries 7+

The native CA blackberry is also called trailing blackberry because the stems (canes) tend to trail along the ground. To tell it from the non-native and very invasive Himalayan species, check for:

- CA. leaflets are in groups of three. Himalayans are usually in groups of 5, but may have only 3.
- CA. blackberry thorns are straight, much thinner and less robust than those of the Himalayan.
- CA. blackberry stems are round, while those of Himalayan are more stout and ribbed.
- CA. blackberries are dioecious, with male and female flowers on separate plants.
- The petals tend to be narrower than those of the Himalayans, but this is variable.

Both are "semi-deciduous," retaining some leaves in the winter. The winter leaves of the CA. tend to be a dark maroon-red color, while those of the Himalayans tend to turn yellow-red.

There are large thickets or "brambles" of CA blackberries in the Willow Creek valley. Look for red mounds of vegetation from winter to spring. Most of the blackberries around Pomo Canyon are CA.

California Blackberry

Himalayan Blackberry

credits: from iNaturalist**: CA.** fruit: garmonbOzia all others by Mike Roa

Trees & Shrubs Group A #8 **CA. HAZELNUT *Corylus cornuta*** **4+**

Catkins left:
in January
Catkin at right:
in February

seeds in early May and early June

photos: seed in May by Karen Gebbia all others by Mike Roa

Don't pick the leaf, but gently feel it. How would you describe it? (Shake hands with Hazel.)

Have you ever had Nutella? Nutella is like peanut butter, but it is made from hazelnuts.

The **California (**or **Beaked) Hazelnut.** It is a different species from the one used for Nutella, but it is similar. Ca. Hazelnuts are smaller than the ones used in Nutella. Hazelnuts are also called filberts.

Native Americans prized the thin, pliable young hazelnut stems that sprouted after a fire because they were very useful for making baskets. (The photo of the basket was taken in the Jesse Peter Multicultural Museum at SRJC. It shows a cradle basket made partly from hazel stems. The basket was made by Elsie Allen, after whom a local high school was named.)

Ca. or Beaked Hazelnut
Corylus cornta

Common Hazelnut
Corylus avellana
(used commercially)

California or Beaked
Hazelnut seeds in July

Trees & Shrubs Group A #9 EVERGREEN HUCKLEBERRY Vaccinium ovatum 7+

There are over 400 species in the genus *Vaccinium*, including the commercially grown blueberries and cranberries. At least five species of huckleberry are native to California. Most are deciduous, but the evergreen huckleberry is not, hence the name "evergreen."

All produce fruit that is prized by wildlife.

At Pomo Canyon, huckleberries often grow from stumps.

Credits: from iNaturalist: hand w/flowers by Al flowers closeup by zigy
berries by Hollis Bewley stump and leaves by Mike Roa

Trees & Shrubs Group A #11a **POISON OAK** ***Toxicodendrum diversilobum*** **4+**

The vine growing on the tree is **poison oak**, which can grow as a shrub or vine.

What do you know about poison oak?

Notice that the leaves are in groups of three. There is a saying:
"Leaves of three, leave it be."

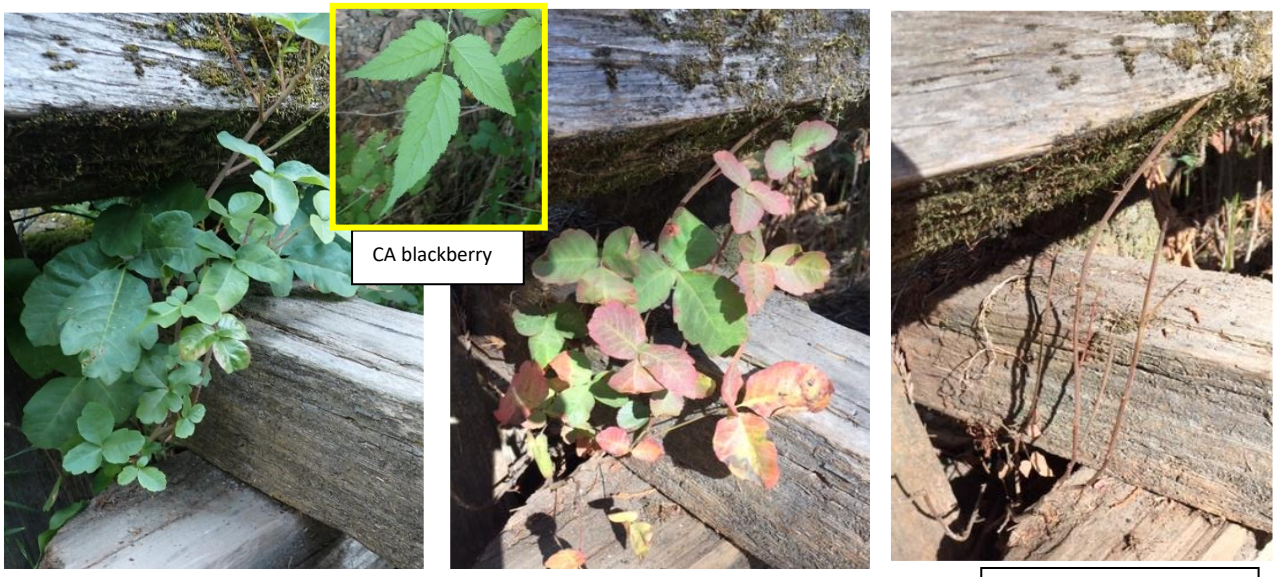
Do you see any other plants with "leaves In threes?"

The main photo is the Parson Jones tree, taken from the "back" side (opposite from the sign). The cut vine on the front side is poison oak. Notice/point out the black sap that oozed from the cut. Native Americans used poison oak sap for coloring baskets. They used poison oak ash for tattoos.

photos: by Mike Roa

Trees & Shrubs Group A #11b **Poison Oak (near base of Giant Sequoia)** **ALL**

spring and summer **fall** **winter**



photos: by Mike Roa

Poison oak near base of Giant Sequoia at entrance

Poison oak looks different at different times of year.

New leaves are red in the spring, turning to green. They may be shiny or dull. They turn red in fall.

In the winter, the leaves fall off, leaving a stem that tapers very little until the very end.

The winter stems contain the oils that cause dermatitis (itchy skin) so it is good to recognize and point out the stems in the winter in addition to the leaves at other times of year.

Notice the 3 leaves: "leaves of 3, leave it be." (But of course, **we let <u>everything</u> be in Armstrong!**) (Many redwood region plants have leaves in groups of three, though. <u>Native Ca.</u> blackberries, have leaves in groups of 3.) (The Himalayan blackberries growing near the entrance usually have 5 leaves and are not native. Those are very invasive and most of the blackberries in Armstrong are Himalayan.) Both CA. and Himalayan blackberries have thorns.
Leaves have serrated(saw-toothed) edges.

The edges of poison oak leaves can be deeply lobed (left photo), barely lobed (right photo), or in-between.
The species name is
Toxicodendron diversilobum:
Toxico (toxic/poisonous) *dendron* (tree)
diversi (diverse*) lobum* (lobes*)*

Trees & Shrubs **Group A # 11c** **Poison Oak Leaves** **ALL**

spring and summer **summer and fall** **winter**

Poison Oak Leaves in Different Seasons

Poison oak looks different at different times of year.

In early spring, the leaves are red and turn to green in late spring and summer. They may be shiny or dull.

In the fall, the leaves turn red.

In the winter, the leaves fall off, leaving a stem that tapers very little until the very end. There are often short branches jutting out alternately to the side, sort of like arms. Poison oak stems or vines are usually only about the diameter of a pencil, even when 6 or more feet tall.

Notice the 3 leaves: “Leaves of 3, leave it be.”
In the winter: “Stubby arms can still do harm.”

The winter stems also contain the oils that cause dermatitis (itchy skin), so it is a good idea to learn to recognize poison oak without its leaves!

photos: by Mike Roa

Trees & Shrubs Group A # 11d Poison Oak reproduction 7+

flowers in April

seeds in May

seeds in July

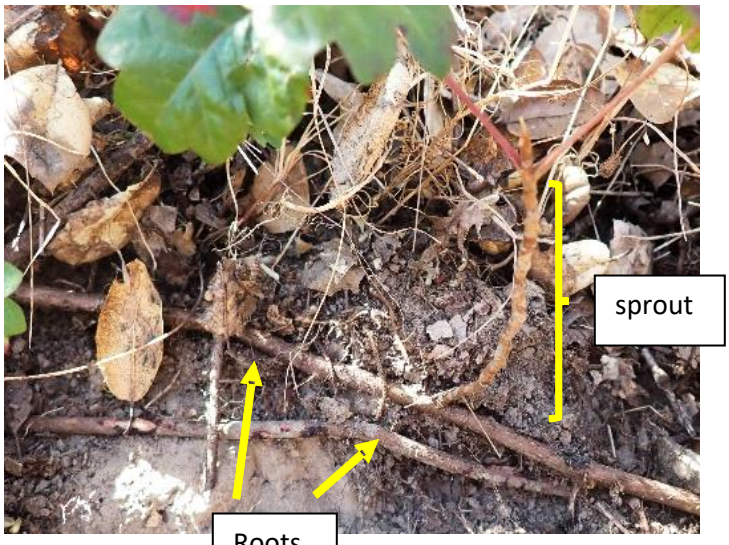
seeds in July

seeds in September

seeds in December

Poison Oak reproduces by both seeds and sprouts from the roots.
I (Mike) think that it might also sprout from a vine taking root while lying on the ground.

photos:
Seeds in Dec.: from iNaturalist by Paloma
all others by Mike Roa



Trees & Shrubs Group A #12 **RED ALDER *Alnus ruba*** **7+**

Alder in December (left) Alder in June (above and right)

last year's cones in Mar.

young cones in July

Alders are in the birch family.

Alders like lots of water, and are not very shade tolerant, so they usually grow along streams.

Nitrogen-fixing bacteria grow in alder root nodules. They add nitrogen to the soil.

Alder wood is used in furniture and in smoking fish and meat. Deer and elk. eat the buds, and birds eat the buds and seeds.

If beaver are reintroduced to Sonoma Co., streamside alders will be an important food source.

immature catkins in Dec.

last year's cones & mature catkins in Mar.

photos: by Mike Roa

Trees & Shrubs Group A #13 **RED ELDERBERRY** ***Sambucus racemosa*** **7+**

Red elderberry shrub near campsite 14 at Pomo Canyon in late April

photos: by Mike Roa

Red elderberry is a large shrub, growing to 25' tall. Leaves are deciduous and have 5-7 elliptical leaflets.

The small white flowers form dome-like clusters.

(Blue elderberries form flat-topped clusters of cream colored flowers.)

The fruits are red-black.

(Blue elderberries are dark purple with a waxy coating that makes them look blue.)

The fruits are eaten by wildlife but contain a cyanide compound and are toxic to humans unless properly prepared.

photos:
red elderberry flowers by Karen Gebbia
blue elderberry flowers and fruit by Mike Roa
red elderberries by Hollis Bewley

Red Elderberry flowers and fruit	**Blue Elderberry flowers and fruit**

Trees & Shrubs Group A #14a **TANOAK** ***Notholithocarpus densiflorus*** **4+**

Acorn in July

This tree was called the "Beautiful Tree" by Kashaya Pomo because its seeds, or acorns, were so large and plentiful. (*The Pomo word for the tanoak is "*she-chik kele*" or "*she chil le*", depending on the group.)

In a good year, a single tree could produce 200 pounds of acorns.

For what did the Native Americans use the acorns?

The **Tanoak**, or Tanbark Oak, has lots of chemicals called tannins in its bark. Tannins were used to tan leather, which means to preserve it so that it was soft and easy to use for things like saddles, belts, and other important items.

Even though it produces acorns, the tanoak is not a true oak. It is more closely related to chestnuts than to oaks.

Do you see any dead tanoaks?

A fungus is killing many tan oaks. The disease is called "Sudden Oak Death Syndrome" or SOD.

Even if some (or most) of the tanoaks survive, the dead ones will provide a fuel source. As a result fires will be larger and more likely to kill even redwoods.

*Source: C. Hart Merrian: *Indian Names for Plants and Animals Among Californian and Other Western North American Tribes* (in SRJC library)

photos: by Mike Roa

Trees & Shrubs Group A
#14b
Tanoak acorns
(and chestnuts)

Tanoak acorns were an important food crop for Native Americans

Tanoak
seeds (acorns), flowers, leaves

American chestnut
seeds, flowers, leaves

Acorns were an important food resource for California Indigenous peoples. Tanoak acorns were especially prized because they are large and plentiful. A single tree might give over 200pounds of acorns! The name of the tanoak in the Kashaya Pomo language is *chishkale,* which means “The Beautiful Tree.”

Native Americans managed their environment by setting fires, which helped keep grasslands open, providing a suitable environment for blackberries, deer, rabbits, and other desired resources, including tanoaks. Frequent fires also resulted in smaller fires that were less destructive than large ones. Tree ring data shows that, in the past, fires burned most redwood areas every 5-10 years, keeping the fuel load down.

The tanoak is more closely related to chestnuts than to true oaks. Note the similarity not only of the leaves and seeds but also the flowers

Chestnut trees were once a common sight in the eastern U.S., but a fungus practically wiped them out. Recently a fungus has attacked oaks in California, causing a disease called Sudden Oak Death. Will California's oaks go the way of the chestnut?

photos:
Mortar and pestle: from Flikr by John Rusk
Pomo acorn basket: West Sonoma County Historical Museum
Tanoak acorn and flowers (middle left): from iNaturalist by Todd Plummer
Tanoak acorns and leaves (middle right) from iNaturalist by Tri Do
Chestnut flowers and leaves: (lower left): from Flikr by Bob MacInnes
Chestnuts (lower right): from iNaturalist by Mario Vega

Trees & Shrubs Group A #14c **Tanoak Uses** **4+**

The bark of the tanoak is rich in tannins, the red colored chemicals that give red wines and redwood their red color.

Tanoaks were stripped of their bark to provide tannins for the **hide tanning** industry. Bark was shipped from the forests of Mendocino and Sonoma Counties to San Francisco and San Jose. In the 1800's, a cow's "tanned" hide was often worth at least as much as its meat.

Today tanoak wood is used for **furniture** and **flooring**, primarily in northern California and Oregon.

photos:
Top left: from *Redwood Ed*, image from the Humboldt Room collection at Humboldt State U.
Top middle: Flikr, photo by Karen Cox
Top right: image from Whitethorn Hardwoods, used with permission (californiahardwoods.net)
Bottom left: internet archive book image, from U.S.D.A. National Agricultural Library
Bottom right: stool made by Brendan Gaffney, student at the Krenov School of Fine Furniture Making

Trees & Shrubs Group A #14d Sudden Oak Death 4+

Healthy tanoak bark

SOD symptoms: Canker and "bleeding"

A fungus-like plant pathogen named *Phytophthora ramorum* is killing many tanoaks. The disease is called "Sudden Oak Death Syndrome" or SOD.

Do you see any dead or dying tanoaks?

Some tanoaks may be naturally resistant to SOD. The photo was taken near the parking area by the Armstrong Tree. The tanoak oak at the left appears healthy, while the nearby one at the right is dead. (These trees were burned in the 2020 Walbridge fire. Look for similar pairs along the trails.)

Even if not all of the tanoaks are killed, if many of them die they will present a great fire danger.

Also, there is concern that SOD may mutate and attack other species, including redwood.

The photo at the left bottom shows healthy tanoak bark. The photos at the right bottom show "bleeding" from a SOD canker infection.

photos:
Main background photo by Mike Roa, Armstrong docent
Left (healthy bark): from iNaturalist by terrydad2
Infected bark: both from California Oak Mortality Task Force, by Karl Buermeyer

Trees & Shrubs Group A #15 **THIMBLEBERRY *Rubus parviflorus*** **4+**

Thimbleberries are especially abundant at Pomo Canyon along the creek.

The plants grow to over 6’ tall. The thornless canes grow from the underground rhizome.

The deciduous leaves look somewhat like maple leaves and are soft and fuzzy.

Flowers range from white to pink, and may be present from late April into June.

The “berries” are scarlet red and soft when ripe. They have a mild taste. Many forest animals feed on them, and they can be made into jam.

Thimbleberries look like large, squat raspberries, to which they are closely related. Technically, both thimbleberries and raspberries are clusters of fruits, as opposed to true berries.

The leaves may exhibit green island fungus in the fall. (See Big Leaf Maple.)

photos: fruit by Hollis Bewley
all others by Mike Roa

Trees & Shrubs Group B #1 **BISHOP PINE** ***Pinus muricata*** 9+

note the old cones still on the tree

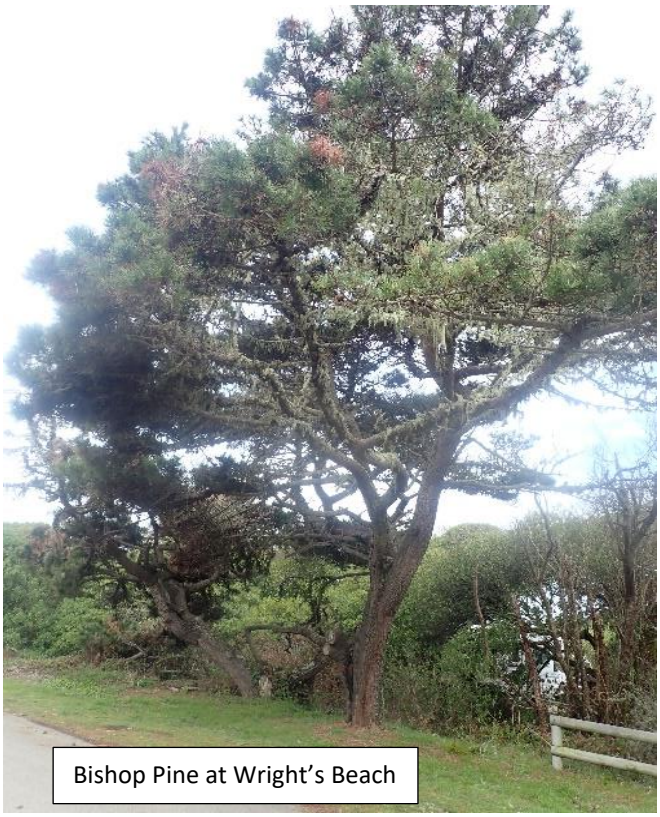
Also known as the Prickle-cone pine.

Like Monterey pine, the bishop pine is a ”closed cone” pine, meaning that the cones may remain closed until a fire heats them up. However, bishop pines are quite variable in that regard. They may open on a hot day without fire, or may stay closed for decades until heated by a wildfire. The cones are held closed by resin, which is melted by the heat of fire.

Bishop pines always grow within about 12 miles of the ocean. There are two populations of bishop pines, separated by about 200 miles. Sonoma Co. is at the southern end of the range of the northern variety.
The southern variety’s range extends from San Luis Obispo Co. to southern CA. and into Baja.

Bishop pines are threatened by a fungal infection. Those at Salt Point have been devastated.

photos: by Mike Roa



Bishop Pine at Wright’s Beach

Trees & Shrubs Group B #2 CALIFORNIA BLACK OAK *Quercus kelloggi* 7+

Above: young black oak trees in December

male (pollinate) "flowers" (catkins) in March

The black oak gets its common name from the color of the bark, especially when wet from rain or snow melt.

The CA black oak grows throughout the coast ranges and Sierra foothills.

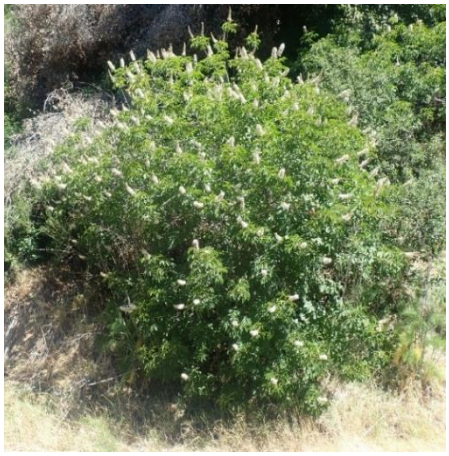
It is initially shade-tolerant, but becomes shade-**in**tolerant as it matures.

Native Americans made acorn meal from the seeds, and dyes from the bark. Some Native American groups feel that the black oak acorns are the best tasting of all acorns.

young black oaks (left) and live oak (right) in December

photos: by Mike Roa

Trees & Shrubs Group B #3 CALIFORNIA BUCKEYE *Aesculus californica* 7+



above: Buckeye tree along River Rd., just east of Rio Nido, in: (left to right) November, March, and May (all same tree)

The California buckeye (*Aesculus californica*) is a different species from the Ohio buckeye, which is *Aesculus glabra*. California buckeyes can grow as single-stemmed trees, but often grow as multi-stemmed large shrubs or small trees. They are summer-deciduous, losing their leaves in mid to late summer. They are among the first deciduous trees to grow new leaves, often starting in Feb.

leaf with young floret in early April

flowers in mid-May

Young/developing seeds

Right: seed photos taken in early November

All parts of the tree are toxic.
Native Americans ground up the seeds and tossed them into the water to stun fish, making them easier to catch.

photos: young seeds by Karen Gebbia others by Mike Roa

Trees & Shrubs Group B #4 CALIFORNIA NUTMEG *Torreya californica* 9+

young nutmeg tree in Guerneville

The California nutmeg (a.k.a. “stinking cedar”) generally grows as isolated trees in the coast ranges and western Sierra, but doesn’t form a continuous forest. It grows best in the moist understory of the redwood forest. They are very shade-tolerant and quickly resprout after fires. (Before the Walbridge fire there was one growing not far from Bullfrog Pond Campsite.) It will be interesting to see when and if It regrows. There are quite a few on the Islands in the Sky trail near Duncans Mills.

California nutmeg is more closely related to yews than to the nutmeg used as a spice, which is in a different genus.

Due to its elasticity, the wood was valued by Native Americans for making bows. Native Americans roasted the rich, oily seeds to eat. Pomo Indians used the roots in basketry, and used the sharp needles to prick the skin in tattooing. They also ate the seeds, which supposedly taste like peanuts.

The wood is decay-resistant; early settlers used its timbers for making bridges.

photos: seeds from INaturalist, by Nature Ali all other images by Mike Roa

Trees & Shrubs Group B #5 *Ceanothus* spp.: WILD LILAC or BUCK BRUSH 9+

There are at least 43 species of *Ceanothus* native to California.

The genus name, *Ceanothus*, is more often used than common names such as wild lilac or buck brush.

Flowers range from deep blue to pale blue, even to white.

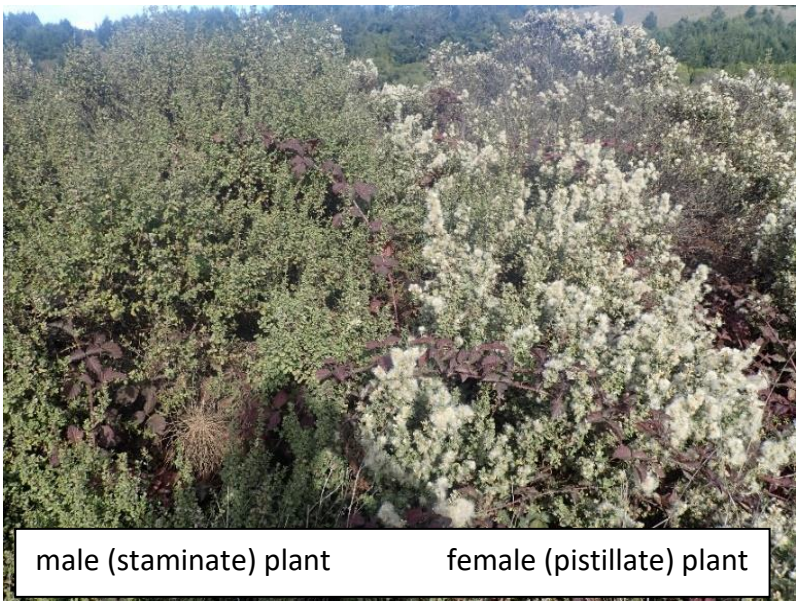
Ceanothus commonly sprout after fires. The heat cracks open their seed coats.

Several species of *Ceanothus* are used as ornamental plants.

photos: by Mike Roa

Trees & Shrubs Group B #6 **COYOTE BRUSH *Baccharis pilularis*** **9+**

Baccharis is dioecious, which means that the male and female flowers occur on different bushes.



male (staminate) plant

female (pistillate) plant

Coyote brush can grow to over 10' tall, but it is usually 3-6' in height. The shrub's branches are "leggy," meaning that the leaves cluster at the ends of stems that have few leaves. The leaves are somewhat variable in shape.

staminate (male) flowers

close-ups of male (left) and female flowers in August

female flowers in late September and late November

photos: staminate flowers at top left by Hollis Bewley all others by Mike Roa

Trees & Shrubs Group B #7 **LIVE OAK: *Quercus* spp.** **9+**

Above: young live oak in December

bark of mature live oak tree

Catkin in March

There are several different species of "live oaks", and there is a great deal of hybridization, so their classification is not clear. Most common in our area are the coast live oaks, *Quercus agrifolia*, but others can be found.

The "live oak" is so named because it doesn't lose its leaves in the winter… it remains green all year.

Native Americans used the acorns for food, as they did other acorns.
The Spanish found that the wood made good charcoal for cooking and making gunpowder. It was even used as fuel to generate electricity at times.

photos: by Mike Roa

young black oaks (left) and live oak (right) in December

Trees & Shrubs Group B #8 MADRONE (or MADRONO) ***Arbutus menziesii*** **7+**

fruit in early November

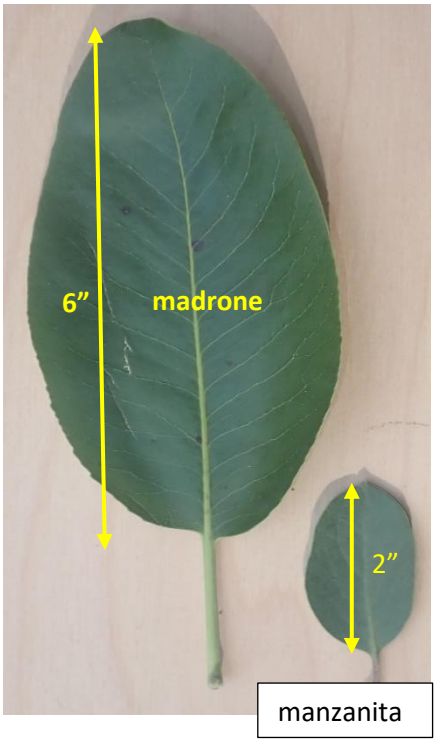
The smooth bark of a young madrone ranges from green to orange-red in color.
Mature bark is reddish brown and peels (exfoliates) as it ages.
Madrone generally grows as a tree, but in poor soils it may grow as a shrub.

The flowers have been likened to "ivory urns."
They are very similar to those of manzanita.

Some confuse madrone with manzanita (*Arctostaphylos* spp.).

- Manzanita is generally more shrub-like than tree-like.
- Madrone leaves are larger than those of manzanita.
- Madrone bark is a lighter orange-red than manzanita, especially when young.
- See the manzanita card.

photos: by Mike Roa



manzanita

Trees & Shrubs Group B #9 **MANZANITA** ***Arctostaphylos* spp.** **7+**





There are 60 species of manzanita, and 56 of them are native to California!
Some of the species have several subspecies.

The fruit looks like little apples. ("Manzana" is Spanish for "apple", and the suffix "-ita" means "little".)

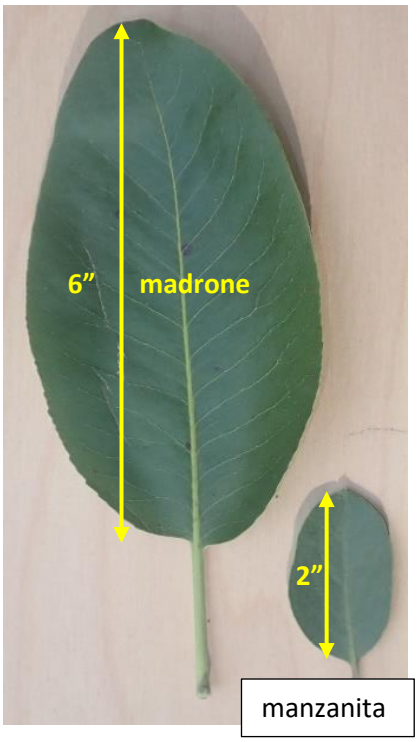
The fruits are a favorite of many animals during the summer. (The genus name means "bear berries".)

Native Americans used manzanita in many ways, including an anti-diarrhea tea, food, tools, and torches (the wood burns especially brightly.)

Manzanita readily grows in areas burned over by wildfires.

Manzanita looks somewhat like madrone.
See the madrone card.

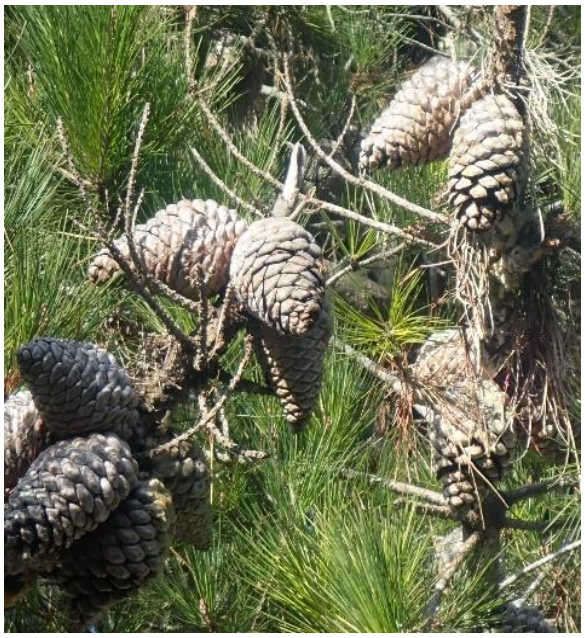
- Manzanita bark is a darker brown than that of madrone.
- Manzanita leaves are smaller than madrone leaves.



manzanita

photos: from iNaturalist: red fruit: (right) by Al Kordesch)
others by Mike Roa

Trees & Shrubs Group B #10 **MONTEREY PINE** ***Pinus radiata*** **7+**



Like bishop pine, the Monterey pine is a ”closed cone” pine, meaning that the cones may remain closed until a fire heats them up. However, they are quite variable in that regard. They may open on a hot day without fire, or may stay closed for decades until heated by a wildfire. The cones are kept closed by resin, which is melted by the heat of fire.

The cones are also “persistent,” meaning that they tend to stay on the tree. Note the cones that are still on the dead tree in the upper right above.

The native populations of Monterey pine are very small, but millions of acres of Monterey pine have been planted worldwide, including in the southern hemisphere, especially in Australia and New Zealand. It grows very fast, sometimes over 4’ in height in a single year! Most of the pines seen along Sonoma County roads are Monterey Pines.

It is used largely for paper pulp and as a decorative tree.

photos: by Mike Roa

Trees & Shrubs Group B #11 **TOYON** ***Heteromeles arbutifolia*** **7+**

upper leaf surface

edge of lower leaf surface

toyon bush and berries in December

toyon flowers in June

Toyon grows as a small tree or shrub, to 15' tall, but is usually smaller. It grows throughout much of California, especially in chaparral and woodlands.

Toyon is sometimes called Christmas berry because the red fruits ripen in winter. The winter-ripening fruit provide an important food source for birds, squirrels, and other wildlife.

(Common names can be confusing because sometimes different species or even different genera are called by the same common name. Although "toyon" is a common name (as opposed to the scientific name), it is a better common name than Christmas berry, because many plants produce red berries in the winter.)

photos: by Mike Roa

Trees & Shrubs Group B #12 **WILLOW *Salix* spp.** **7+**

Above and right: early February
Second from right: late March
Right: late March-early April

"male" (pollinate) flower

female flower w/seeds

seeds ready to be disbursed by the wind

There are many species of willow (30 species in California alone!), and they can be difficult to classify to species.

The arroyo willow (*Salix lasiolepis*) is a common species.

Willows are dioecious, meaning that male (pollinate) and female (ovulate) "flowers" develop on different plants. The seeds develop tufts of white "hairs" that help with dispersal by the wind.

Willow sap contains salicylic acid, the active ingredient in aspirin.
(The leaves and buds taste like aspirin.)

Willows like water and are fast-growing. They also readily sprout from twigs or pieces. Therefore they are useful in streamside restoration and protection.

photos: by Mike Roa

Flowers #1 **REDWOOD SORREL** ***Oxalis oregana*** **7+**

The plants that look like clover are called **Redwood Sorrel.**

When it is cool and shady, the leaves stick straight out, but when the plants are in the warm sunlight, the leaves often droop down.

Plants have openings called **stomata** on the bottom of their leaves. Air (with carbon dioxide, needed for photosynthesis) enters through the stomata, and water vapor and oxygen are given off to the atmosphere through the stomata.

How would drooping leaves reduce water loss from the leaves?
(The stomata are shielded from the sun and wind.)

Right: Several species of *Oxalis* have yellow flowers and re called "wood sorrel". They are common along Sonoma Co. roads.

Oxalis stems have oxalic acid in them. Oxalic acid has a sour taste that some people like, but some are allergic to it, so do not invite students to taste the stems.

photos: by Mike Roa

Flowers #2 WESTERN TRILLIUM *Trillium ovatum*

As the flowers get older and are fertilized, they tend to turn reddish.

Trillium or Wake Robin after bloom.

Trillium is the genus name for several plants, including the **Western Trillium** or **Wake Robin,** which has a flower on a stalk and is the most common in our area.

How many wheels does a tricycle have? The word root "tri" means 3.

Why do you think these plants are called Trillium?

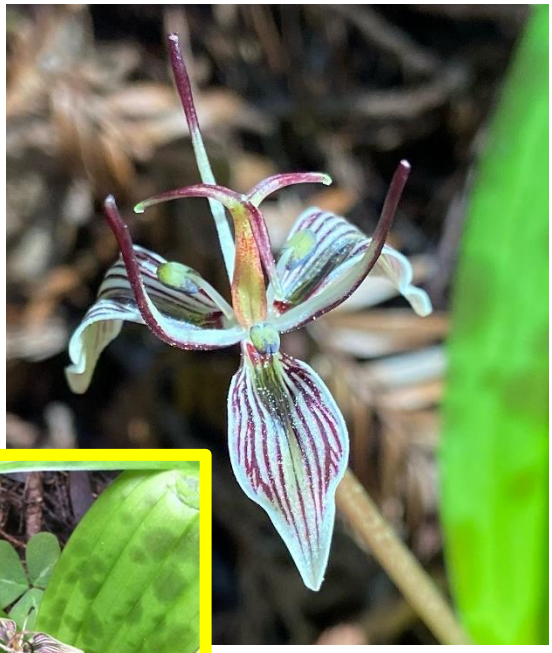
Giant White (a.k.a. Sweet) Trillium
(*Trillium albidum*)
(note lack of flower stem)

seed pod
late May

Western Trillium (*Trillium ovatum*)
(note the presence of the flower stem)

photos: by Mike Roa

Flowers #4 FETID ADDER'S TONGUE (a.k.a. Slink Pod) *Scoliopus bigelovii*



single flower (above)
by Rachel Hallaway

others by Mike Roa

Called "fetid" adder's tongue because the fresh flowers smell bad.
After pollination, the weight of the swelling seed pod bends the stalk do the ground, which gives it the other common name of slink pod.

Among the first plants to bloom each year.

To distinguish the leaves from other plants, look for the darker green mottling.

They are pollinated primarily by ant. The seeds have a fleshy covering called an elaiosome that is attractive to ants. After eating the elaiosome, the ants bury the seeds underground. This burial protects the seeds not only from rodents but from the fires that are a natural part of the environment.

Flowers #5 **ANDREW'S CLINTONIA** ***Clintonia andrewsiana*** **7+**



The leaves of this showy plant are typically 6-12" long and form a basal rosette from which a single stem emerges to support the umbel of flowers.

When ripe, the berries turn a dark blue, giving the plant its other common name: Blue Bead.

Photos: left and right by Karen Gebbia center by Mike Roa

Flowers #6 **COW PARSNIP** ***Heracleum maximum*** **ALL**





Leaves of cow parsnip are huge (3 large leaflets form a leaf that may be 12" wide), but the individual flowers are tiny. The flowers are borne in a large flat-topped cluster (umbel), so it looks like there is a large flower. The flowers are wrapped in a green sheath before opening.

Some people are allergic to the hairs that cover the plant and may develop dermatitis. Also, eating the outer skin can cause itching/blistering in the mouth.

Cow parsnip is a member of the carrot family. Another common name is Indian celery. Young shoots can be cooked and eaten, but the plant **resembles the poisonous *Ciocuta maculate***, a.k.a. spotted water hemlock - a relative of poison hemlock of Socrates fame. **Don't tell visitors that it is edible!** Native Americans had several medicinal uses for the plant. **photos:** by Mike Roa

Flowers #7 Fairy Bell: *Prosartes spp.* 7+

P. hookeri

Look for the tiny white flowers and red-orange berries under the leaves.

Hooker's Fairy Bell is similar to the Largeflower Fairybell (*P. smithii*) (below).

P. hookeri's flowers (and fruits) (above) are generally in pairs, and the stamens project beyond the inner floral leaves (petals).

P. smithii's stamens are hidden within the floral leaves, and there can be from 1-7 flowers and fruits.

P. smithii

photos: *P. hookeri*: from iNaturalist: whole plant by Randal flowers by Alec Heyman
P. smithii: from iNaturalist: flowers by Kathy Fulton
P. hookeri fruit by Mike Roa *P. smithii* fruit by Hollis Bewley

Flowers #8 FALSE SOLOMON'S SEAL *Mianthemum* spp. 7+

SLIM Solomon's Seal

FAT Solomon's Seal

False Solomon's Seal resembles Solomon's Seal, an East Coast plant. The berries are bright red when ripe, in late summer or early fall. They are said to be tasty, but are cathartic (cause diarrhea). The plant also resembles the **toxic** baneberry, so don't tell people that the berries can be eaten.
SLIM Solomon's Seal (Star-Flowered-Lily-of-the-Valley) (*M. stellata*) has 3-9 flowers in a smaller cluster, not branched.
FAT Solomon's Seal (*M. racemosum*) has many small flowers on branches in a 2-4" cluster.

photos: from iNaturalist: FAT: whole plant by minttoothpick fruit by yan kemper flower by Mike Roa
SLIM fruit by kat_the_nat SLIM plant and flowers by Mike Roa

Flowers #9 **MINER'S LETTUCE** ***Claytonia perfoliate*** **4+**




As it matures, the stem of the flower elongates.

The disc from which the flower stalk emerges is actually two leaves that are fused.

As its name implies, miner's lettuce is edible, a tangy addition to a salad, or cooked like spinach. **photos:** left and top center by Leslie Carrow right and bottom center by Mike Roa

Flowers #10 **REDWOOD VIOLET:** ***Viola sempervirens*** **7+**


Also called evergreen violet, the redwood violet is perennial; its leaves do not die back in winter.

4 petals point upward or to the side; one larger petal points downward. The 3 lower petals have purple-brown lines on them.

The leaves look similar to those of wild ginger, but are more pointed, have more scalloped edges, and are thinner.

photos: by Mike Roa

wild ginger leaf

Flowers # 11 STINGING NETTLE: *Urtica dioica* ALL

Leaves grow on opposite sides of the stem, about 3-6” apart.

Flowers develop at the bases of the leaf pairs (as opposed to at the top of the plant.)

Hairs or spines on the leaves and stem contain a chemical that produces a stinging sensation that can last more than 24 hours, although the severity quickly diminishes.

flowers in late May

photos by Mike Roa

Flowers #12 TRAIL PLANT: *Adenocaulon bicolor* 4+

The underside of the leaf is light gray, distinctly contrasting with the dark green of the upper side. The 2 colors of the leaves gives the plant its species name, “*bicolor*.”

The common name derives from the notion of breaking the leaves so that the white side points in a direction.

The tiny flowers produce club-shaped fruits covered with glands.

photos:
whole plant with flowers (center)
by Hollis Bewley
others by Mike Roa

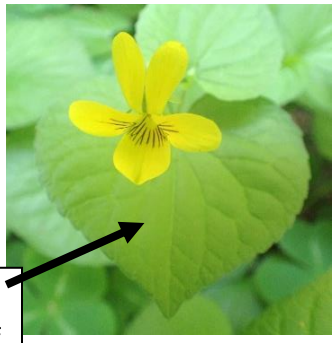
Flowers #13 WILD GINGER: *Asarum caudatum* 7+

The leaves and woody rootstocks smell somewhat like ginger.

The flowers, which are generally hidden under the leaves, are pollinated by slugs and ants.

The "petals" of the flower are actually sepals. Their thin "tails" give the species name, "*caudatum*."

The leaves look similar to those of redwood violet, but are thicker, rounder in shape, and have smoother edges.



Photos: by Mike Roa

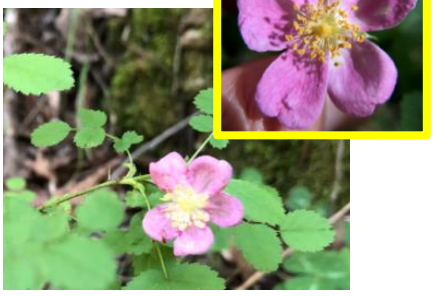
Flowers #14 Wood Rose (a.k.a. Baldhip Rose): *Rosa gymnocarpa* 4+

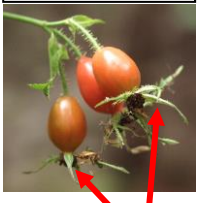
The flowers of the wood rose range from light pink to red.

The thorns are straight and slender, less robust than those of the California wild rose.

The sepals tend to fall from the fruit (rose hip) sooner than those of most other species, which gives it the common name of baldhip rose.

Rose hips make a vitamin C -rich tea.





Photos: single flower photos by Karen Gebbia
wild rose hip by Hollis Bewley
others by Mike Roa

Bryophytes: MOSS 7+

December

September

photos: by Mike Roa

This plant is moss. What do you know about moss?

Mosses are classified as Bryophytes…non-vascular land plants that reproduce by spores.

The picture at the right was taken in October. The picture on the left was taken in December. What differences do you notice?

Moss sometimes reproduces by producing spores, which are similar to seeds but don't need to be fertilized. Spores are produced in capsules when the moss is in the **sporophyte** stage. When it is in the **gametophyte** stage, moss produces sperm and eggs (gametes), which need water to travel.

Moss requires a moist environment in order to grow well. Is the redwood forest a moist environment?

It is sometimes said that one can find the north side of a tree by looking for moss, because many storms come from the north and the north side of trees tend to be moister and shaded. Would that work here?
(No, because the redwood forest is moist everywhere much of the year!)

photos: by Mike Roa

Ferns #1 **SWORD FERN** ***Polystichum californicum*** **4+**

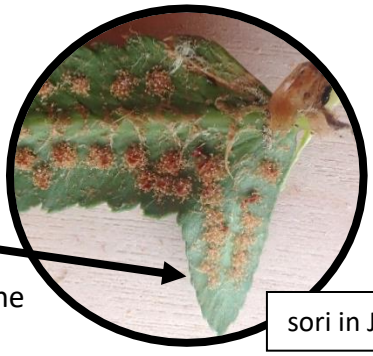
Fiddlehead in March

Sori in June

The big structure that looks like a big feather is called a frond. The leaflets projecting out from the side are called pinnae.*

The frond has many pinnae projecting out from each side

This is called a **Sword Fern** because at the base of each pinna has a projection that looks sort of like the hilt of a sword.



sori in July

Sori (singular sorus) can sometimes be found on the back of the pinnae. When they develop depends on the species of fern. These dark brown structures contain sporangia (singular: sporangium), which produce spores, which are sort of like seeds, but they don't need to be pollinated.

When a new frond grows, the tip is curled over. This is called a "fiddlehead." (see other side)

The fiddleheads of some ferns are edible **<u>when prepared properly (and toxic if not)</u> and eaten in moderation**, but **not all are.** Some ferns also have edible tubers. Of course, we don't pick any plants in Armstrong.

*The word root "pinna" (plural: pinnae) means feather or feather-like. If you use that term with students, ask them why it was chosen to describe ferns.

sword drawing: from the Internet **photos:** by Mike Roa

Ferns #2 BRACKEN FERN (a.k.a. Brake) *Pteridium aquilineum* 4+

Sori along rounded/smooth edges of pinnae

Fronds emerge from ground separately.

Fiddlehead in February

The big structure that looks like a feather is called a **frond**. The leaflets projecting out from the side are called **Pinnae**, which means "feather-like". The frond has many pinnae projecting out from each side.

As the frond grows, the tip forms a "fiddlehead." The fiddleheads of **SOME** ferns are edible **<u>when prepared properly</u>** and eaten in **<u>moderation</u>**. (and toxic if not). Some ferns also have edible tubers. Of course, **we don't pick any** plants in Armstrong.

Bracken fiddleheads are often eaten, but only in moderation, and they are toxic to livestock.

Most reproduction in bracken ferns is from sprouts from the underground **rhizomes**.

Sori (singular sorus) are structures that contain **sporangia** (singular sporangium).
The sporangia produce **spores**, which are sort of like seeds that don't need to be fertilized to grow.
Brackens that have grown in the sun for several years tend to produce sori more than younger plants growing in the shade. The upper photo at the right shows the ventral (lower) side of two ferns taken on the same day in July. The lower one grew in a sunny area on Guerneville Rd. near Hwy 116. The upper one grew in a shady area in Sebastopol.

sori with sporangia

- **Bracken** ferns turn **yellow and die back** above ground in the fall.
  Wood ferns stay **green** all year.
- **Bracken** fern fronds emerge from the ground **individually**.
  Several wood fern fronds emerge from the ground **in one place.**
- When present, **bracken sori** are found along the **edges** of the pinnae.
  Wood fern sori are found in **rows along the center** of the sori.
- The edges of **bracken** fern pinnae are either smooth or rounded (like the right side of a "**B**") But this is quite variable.
  The edges of **wood** fern pinnae are toothed (like a series of **WWW**s)

wood

bracken

photos: by Mike Roa

Ferns #3 WOOD FERN *Diopterus* spp. 4+

Note kidney-shaped sori and toothed edges on pinnae.

fiddlehead in Feb.

Many wood fern fronds emerge from the ground at the same place.

The big structure that looks like a big feather is called a frond. The leaflets projecting out from the side are called pinnae, which means feather-like. **(Ask students why they are called this.)**

The frond has many pinnae projecting out from each side

Sori (singular sorus) can sometimes be found on the back of the pinnae. When they develop depends on the species of fern. These dark brown structures contain sporangia (singular: sporangium), which produce spores, which are sort of like seeds, but they don't need to be pollinated.

As the frond grows, the tip forms a "fiddlehead." The fiddleheads of some ferns are edible **<u>when prepared properly</u> (and toxic if not) and eaten in moderation**, but **not all are.** Some ferns also have edible tubers.
Of course, we don't pick any plants in Armstrong.

Wood ferns look much like bracken ferns. (See the #3 fern card.)

wood bracken

- Wood Ferns stay green all year; bracken ferns turn yellow and die back in the fall
- Several wood fern fronds emerge from the ground at one place; bracken fern fronds emerge individually.
- When present, wood fern sori are kidney or horseshoe shaped and found in rows along the center of the pinnae; bracken ferns' sori are found along the edges of the pinnae.
- Wood Ferns' pinna edges are toothed; the edges of bracken Ferns' pinnae are rounded, although this is quite variable.

photos: by Mike Roa

Ferns #4 **FIVE-FINGER FERN: *Adiantum pedatum*** **7+**

The five-finger fern often grows along streams. The number of "fingers" varies; it is often more than five.

The pinnules change shape as the pinnae mature. They start out fan shaped and become more elongated.

The spore-producing sori are more or less hidden under the edge of the pinnae, on the lower (ventral) side. The curled edge is called a "false indusium."

June December

5-finger fern is closely related to the maidenhair fern. In fact, the 5-finger fern is also known as the western maiden hair fern.

photos: by Mike Roa

Ferns #5 GIANT CHAIN FERN: *Woodwardia fimbriata* 9+

Above, right: Giant chain fern near creek at camp-site 16 at Pomo Canyon.

Left and left above: chain fern at Tomales State Pk.

Right: chain fern on Hwy 116.

The Giant Chain Fern is often called by its genus name, *Woodwardia*.

Woodwardia can get very large, with fronds to 9' long!

The sori are oblong and arranged in chain-like rows parallel to the midrib of the pinnae.

Woodwardia fiddlehead on Joy Road

photos: by Mike Roa

Ferns #6 GOLDBACK FERN: *Pityrogramma triangjularis* 9+

This relatively small fern is often found on roadcuts or rocky outcroppings.

As the species name indicates, the fronds are distinctly triangularin shape.

The stipes are dark. (Native Americans used them for designs in their baskets.)

The small triangular fronds tend to curl up when dry.

Credits: from iNaturalist: above left: view of several plants by Alex
above right: single plant: by Hollis Bewley
right (curled frond) by Mike Roa

As the common name implies, the underside of the Goldback Fern appears gold, or, sometimes, silver. (The color is caused by a waxy powder, which can be rubbed off , as opposed to being a color of the fern frond itself.)
The sori form a sort of brown network that may obscure the gold/silver powder.

Credits: from iNaturalist: veined and brown ventral surfaces (left and center above): by Alex Heyman
silver ventral surface (right above): by Nathan Gonzales powder by Mike Roa

Ferns #7 HORSETAIL or SCOURING RUSH: *Equisetum* spp. 7+

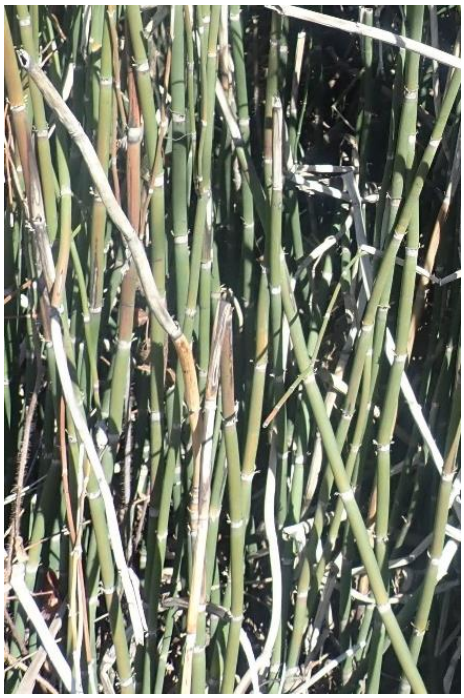
February/early March

late March

December

all images by Mike Roa

Although "horsetail" is a commonly used name, *Equisetum* is used almost as commonly. Horsetails are a very ancient group of plants. Students who are interested in dinosaurs will recognize them from drawings of dinosaur habitats. They prefer moist environments. They are sometimes referred to as "fern relatives" because, like ferns, they reproduce with spores.

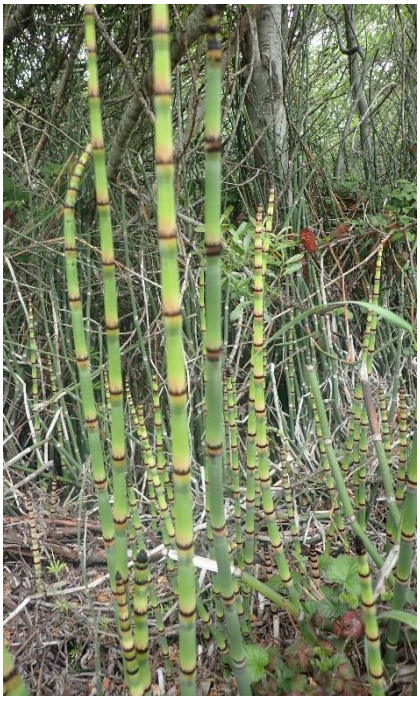


Scouring rush along Willow Creek Road
(less than 0.1 mi. beyond the barn as you leave Pomo.)

The unbranched species are known as "**scouring rush**".

They contain high amounts of silica, which they "mine" from the soil. This gives them a rough texture. Because the silica deposits make them rough, pioneers are said to have used them to scour their pots and pans. They were also used for polishing furniture and violins.

left: winter right: spring



Ferns #8 MAIDENHAIR FERN: *Adiantum* spp. 9+

above left: dorsal (upper) side of pinnule
above right: ventral (lower) side of pinnule

The maiden hair fern is closely related to the five-finger fern. (They are in the same genus.)

The spore-producing sori are more or less hidden under the edge of the pinnae, on the lower (ventral) side. The curled edge is called a “false indusium.”

They are often found along rocky outcroppings.

Native Americans used the black stipes in decorating their baskets, and to keep body piercings from closing while healing.

photos: by Mike Roa

Ferns #9 **POLYPODY FERN** ***Polypodium californicum*** **7+**

Polypody ferns generally grow on rock faces such as along road cuts, or on trees (Plants that grow on other plants are called "**epiphytes**".) The name *Polypodium* comes from the appearance of the rhizome branches, which are said to look like many (poly) little feet. They are popular ferns for shady garden areas.

CA. Polypody along Hwy 116

photos: by Mike Roa

Polypodium on oak (left) and bay tree (above)

Polypodium die back as the weather warms and their habitats dry out. (Photo above taken in May.)

Polypodium pinnae *look a little* like those of sword ferns, but they are smaller and lack the "hilt."

Animals #1 **BANANA SLUGS (Ariolimax spp.)** **ALL**

The banana slug most commonly found at Armstrong Woods and Pomo Canyon is the **Button's Banana Slug (*A. buttoni*) (right).** It can grow to be almost 10 inches in length!

Banana slugs can be pure yellow, have dark spots, or be yellow-brown, or even black.

The **California Banana Slug (*A. californicus*) (below)** is bright yellow throughout and grows to about 7" long. It is the mascot for U. C. Santa Cruz!

(In 1988, the banana slug was proposed as the Ca. State Mollusk, but the governor vetoed it. ☹)

Pacific banana slugs (*A. columbiana*) feeding on:
(clockwise from aboveleft):
plants (W. Sweet Coltsfoot)
mushroom dead frog fox scat

Banana slugs obtain moisture through "gills" on the lower sides of their body. The gills must be moist to function, so in dry weather banana slugs crawl into holes in the ground. They have been found 9' below ground in holes dug by other animals.

Photo credits:
California Banana Slug credit: from iNaturalist, by Paul P
Pacific Banana Slugs feeding on frog: by Jesse Bunkley, Wildlands Conservancy, Trinidad, Ca.
others by Mike Roa

Animals # 2 **MILLIPEDES** **ALL**

below: Yellow-spotted millipede

right: snake millipede

Millipedes have two pairs of legs per body segment; centipedes have one pair per body segment.

Millipedes are herbivores, feeding on plants, while centipedes are carnivores and have a stinging organ with which they kill their prey.

In general, centipedes are very flattened and millipedes are more rounded, but the yellow-spotted millipede is in-between.

The **yellow-spotted millipede** (to about 2 inches in length) glows under ultraviolet ("black") light.

Like many millipedes, it can give off odiferous hydrogen cyanide when threatened.

(Millipedes are sometimes called "thousand-leggers."
(A millennium is a thousand years and a millimeter is a thousandth of a meter). ~~But they do not have a thousand legs~~.
News flash! A new species of millipede, *Eumillipes persephone*, was discovered in 2020. It has over 1000 legs!

Similarly, centipedes don't have a hundred legs, even though there are 100 cents in a dollar and 100 centimeters in a meter.)

Centipede. Note one leg per segment.

photos:
Yellow-spotted on sword fern from iNaturalist, by Franco Folini
snake millipede on hand by Mike Roa
Millipede in u.v. light from iNaturalist, by "Caenvsci"
Centipede: from INaturalist, by Suzie Rose

Animals #3 BEETLES That Feed on Redwood 7+

The female bark beetle burrows through the bark and feeds on the cambium and wood just under the bark as she lays eggs in an "oviposition gallery". When the eggs hatch, the larvae burrow outward from that oviposition gallery to form a sort of centipede-like pattern. (The redwood bark beetle below is about ¼" long)

There is a good example of this to the west (left) side of the Pioneer Trail just north of the redwood that fell in 2019. You won't be able to show this to a large group of people, but if you have only one or two, they can look at it from the trail.

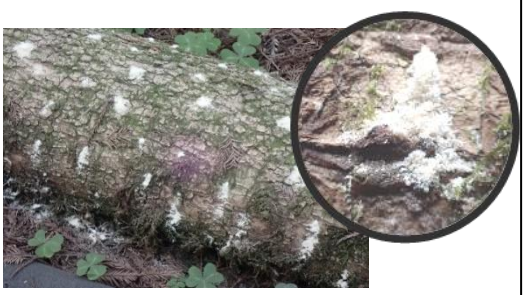
(For a specimen to carry with you, you might look for a branch along the roadside. If you peel the bark back, you may find galleries. See photo at lower left.)

photos: Bark Beetle: Forestry Images.com, by Javier Mercado Others: Mike Roa

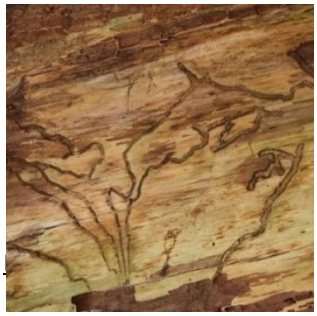
Powder Post Beetles (center) burrow into the wood and expel the waste out of holes. They often attack dead wood.

Left: powder post beetle holes in the log shown above, with galleries of the redwood bark beetle.

Right: powder post beetle waste expelled from a bay tree log. (Notice how white the bay tree's wood is.)



Below: long-horned wood boring beetle galleries and adults. (Adults feed on flowers, if at all.)



at "fallen giant"

at log near memorial

photos: Long-Horned Wood Borers from iNaturalist: left (in hand): by W Mason right: by Tony Iwane log photos by Mike Roa

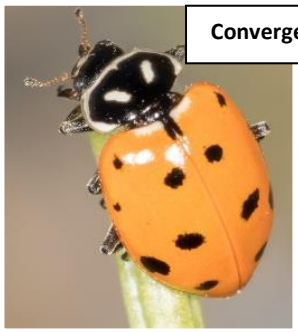
Animals #4 Some Insects That May Be Seen In The Redwood Forest ALL

Variegated Meadowhawk Dragonfly

Dragonflies and damsel-flies have immature (nymph) stages called naiads that live in the water. Both naiads and adults are predacious.

Dragonflies hold their wings perpendicular to their bodies when at rest. Most damselflies hold their wings above and parallel to their bodies when at rest.

Pacific Forktail Damselfly



Convergent Ladybird Beetle

Both adult and larval ladybird beetles feed on **aphids.**

Fontana Grasshopper

Grasshoppers have wings.

photos: All from iNaturalist: Variegated Meadowhawk Dragonfly by royaltyler; Pacific Forktail Damselfly by suzir; Ladybird Beetles by Glmory; Fontana Grasshopper (left) by justin2; Fontana Grasshopper (right) by Scott Loarie;

Hover Fly (a.k.a. syrphid fly)

The adults may be mistaken for bees, but they don't sting or bite. Larvae are predacious on aphids. Adults feed on nectar and pollen.

Look for them hovering in sunlit patches. Unlike yellow jackets, they often hover in place and dart around.

left: Giant Western Crane Fly

Sometimes called a "mosquito hawk," adults feed on nectar or not at all. Larvae are aquatic or in damp soil and feed on decaying plant material.

Alaska Yellow Jacket

Carnivorous.

Nest in the ground.

May be confused with hover fly.

Carpenter Bee (above 3 photos)

The adult females chew round holes in wood and lay individual large eggs in chambers separated by chewed "sawdust" (right image) The left image shows a bee seeking nectar from a redwood sorrel flower. Center photo: bee looking out from a chamber

right: Box Elder Bug

True bugs, including the box elder bug, have sucking mouth parts with which they feed on plant fluids.

photos: From iNaturalist: Hover Fly by Robert Webster, Crane Fly by Kueda, Box Elder Bug by glormy, Yellow Jacket by Jdee, Carpenter Bee (left): by suzrj, Carpenter bee in hole: by adrian16 lower right photo of holes in redwood by Mike Roa

Animals #5 Moths and Butterflies of the Redwood Forest




California Oak Moth larvae are often found on and dangling from oak trees by a thread in August. Pupa photo in May. Adult in June.


Silver-spotted tiger moth.

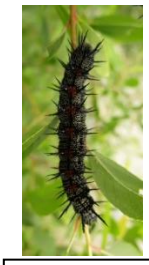
The **Sequoia Pitch Moth** is a clear-winged moth that infests Douglas-fir and most pines. Even though the larva infestation causes large amounts of resin to be produced, it doesn't seem to cause much harm to the tree.

Its mimicry of yellow jackets gives it some protection.

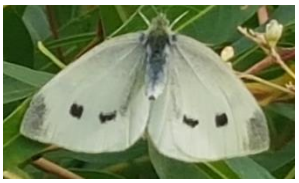
larva in pitch


photos: From iNaturalist. **Ca. oak moth** adult: by photon-hog. larvae (both) by euproserpinus, pupa by calloohcally.
Silver spotted tiger moth adult by sarka. larva by hawnzd.
Pitch moth from iNaturalist: adult by snifflin. Larva in sap **from Flikr**, by orangepet,
Damaged tree by susan K. Hagle, **from USDA Forest Service**, Bugwood.com


Oct. **Western Tiger Swallowtail** May

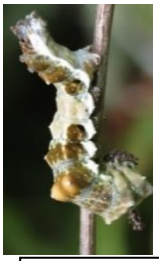



June **Mourning Cloak** September

August **Cabbage** September


June **Common Buckeye** October




May **Lorquin's Admiral** July


April **CA Tortoiseshell** July

photos: from iNaturalist: **W. Swallowtail**: larva by niallclandy, adult by jmaley.
Mourning Cloak: larva by reuvenm, adult by jmaley. **Common Buckeye** larva by gcwarbler, adult by Andy Wilson.
Lorquin's Admiral larva by psyllidhipster, adult by larsonek **Cabbage** larva by allan7 , adult by tomasp
CA Tortoiseshell: larva by eukproserpinus **CA Tortoiseshell** adult by Rachel Hallaway

Animals #6 AMPHIBIANS ALL

Amphibians need water in which they lay their eggs. They need to keep their skin moist because, as adults, they generally "breathe" through their skin. So they are generally found in or near water or in other damp areas such as under rotting logs.

Slender Salamander (3"-4")

May be found under logs or rocks in shady areas. Unlike most amphibians, does not lay eggs or live in streams. They lay eggs and live in damp soil under logs or rocks in shady areas. About 20 species of slender salamanders live in California.

Rough-skinned Newt (5"-7")

May be found near streams in winter or spring. Males become smooth-skinned during mating season. They produce toxins that may irritate the skin and may even be fatal if the newt is swallowed!

California Giant Salamander (to 12" or more)

The California Giant Salamander lives in Fife Creek. It is a voracious eater, with banana slugs among its favorite foods. They have even been known to eat mice! Note the gills on the immature or "larval" form at the right.

photos:
Slender Salamander: by Mike Roa
Rough-skinned Newt: from California Herps, by Gary Nafis
California Giant Salamander adult: from iNaturalist, by b_on_maui
California Giant Salamander larva: from iNaturalist, by Oscar Johnson

Animals #7 REPTILES ALL

This is a juvenilerattlesnake, with only one "rattle", which Is called a button. Since there is only one, it can't make a rattling noise. (Nor can a snake that has lost its rattles.)

Pacific Rattlesnake

The **pacific rattlesnake** is sometimes found in warmer, drier openings in the redwood forest. (The grassy openings are called prairies). They are sometimes seen near the picnic area or in the vicinity of the volunteer office and the Discovery, East Ridge, Pool Ridge, and Waterfall trails.

Adults often grow to over three feet in length, with the largest recorded being over five feet.

photos: The rattlesnake mage is from the web site of California Herps.
The photographer, Gary Nafis, gives permission for our use of them. sign by Mike Roa

Western Fence Lizard

The Western Fence Lizard (a.k.a. “Bluebelly”) ranges in color from light brown to charcoal black. They can grow to almost 8 inches in length, bur are usually shorter.

Like many lizards, their tail breaks off easily. If a predator pounces on the tail, it may break off and wiggle for a while, distracting the predator while the lizard escapes. Note the different texture (smaller scales) on the larger picture, and the re-growing stub of a lost tail in the photo in the upper right photo.

Fence lizard **photos:** Upper left: by Mike Roa
Upper right: from iNaturalist, by Jesse Rorabaugh
Lower right (belly): from iNaturalist, by Andrew J. Crawford

Animals # 8 **CROWS and RAVENS** **7+**

Murder of crows harassing a raptor

American Crow

Ravens

Subadult raven. Note pink throat patch.

A bird that one is likely to see (and hear) at Armstrong is the **Common Raven**, although **American Crows** may also be present.

They are closely related and look much alike, but people sometimes want to know the difference.

Their beaks are shaped a little differently… the raven's is more stout, and it has more feathers on top.

Both birds have a wide variety of calls. The raven's calls, especially its "rattle," has a deeper sound, often mistaken for a woodpecker.

Both crows and ravens are often seen in pairs of a male and a female. A flock of crows is called a "murder." Crows and ravens often will chase or harass raptors such as hawks.

There are a variety of online sites where one can listen to bird calls. The best site for all things avian is Cornell University's Ornithology site:

https://www.birds.cornell.edu/home/

photos: Ravens: Leslie Carrow
from iNaturalist: crows and raptor by Elizabeth Praetz individual crow and head by Robert Webster

Animals # 9 **WOODPECKERS** **ALL**

The **acorn woodpecker** grows to between 7.5 and 9 inches in length.

The acorn woodpecker makes holes in trees and stores acorns in them. This is called a granary.

As the acorns dry out and shrink, the birds will sometimes switch them to another hole where they will not fall out.

They use both the acorn "meat" and insects that feed on the acorns for food.

The granary log is beside the Discovery Trail.

The **pileated** woodpecker (right) is also found in Armstrong woods, but is more often heard than seen.

photos: Acorn Woodpecker picture is from Flickr by Mark Gunn
Pileated Woodpecker from iNaturalist, by reuvenmarten
Log by Mike Roa

Animals # 10 COLUMBIAN BLACK-TAILED (MULE) DEER ALL

There are several subspecies of mule deer in California. The one found in Armstrong is the **Columbian Black-tailed Deer.**

Deer generally spend their time in the prairies (grassy openings) on the hillsides, but sometimes come into the forest. They may be looking for water or feeding on tender vegetation.

Females (does) and fawns are commonly seen in Armstrong Woods; males (bucks) are rarely seen.

The antlers of the bucks in the photo are covered in "velvet,", which forms on the new antlers that grow in late Spring. (The photo was taken in June near Lake Tahoe.) By late summer or early fall the velvet has been shed by rubbing on bushes and trees.

The antlers themselves are shed in January or February.

Since hunting is not allowed in Armstrong, the deer are wary but not terribly skittish.

People should never feed deer because our food is not good for them and we don't want them to become too used to humans.

Also, deer can seriously hurt people with their sharp hooves.

The Columbian Black-tailed deer grow to a little over 3 feet tall and 4-5 feet in length.

photos: Bucks from iNaturalist, by Donna Pomeroy (photo taken in the Lake Tahoe area)
Doe in the redwoods by Greg Corby Doe on hillside near Stewards Volunteer Office by Leslie Carrow

Animals # 11 WILD PIG or WILD BOAR ALL

The animal is generally called a “Wild Boar”, even though female pigs are called sows and males are called boars.

Pigs were introduced to North America from Europe, and have spread throughout the country. They do great damage to ecosystems as they tear up the ground rooting for food. They can also be quite dangerous.

Note the damage done to the grassland around this sow and her piglets.

They can get to be over 200 pounds!

photos: from iNaturalist, photo by Eric Graham.

Fungi & Lichens, #1 Some FUNGI 7+

Felt-ringed Agaricans Fungus
Toxic.
When it emerges from the ground, the cap is convex. It flattens as the mushroom matures. The color changes from a pinkish brown to a reddish gray when mature.

Golden Ear Fungus

Bonnet Mushroom

Sulfur Tuft mushroom
Toxic
Has been used experimentally to treat some harmful coniferous fungi because it can out-compete them for limited resources.

photos: Sulfur Tuft: Darvin Deshazer others by Mike Roa

Scarlet Scarlet Wax Cap:
photo: from iNaturalist, by moranat

Yellow Wax Cap:
photo: from flikr, by James Manghi

Witch's Hat (Conical Wax Cap)
Looks similar to wax cap, but more pointed. **Probably toxic.**
photo: Alan Rockefeller (Sonoma Mycological Assoc.)

Cowboy's Handkerchief (Ivory Wax Cap)
"Cowboy's Handkerchief" common name comes from the mushroom's sliminess. Edible, but unappealing due to sliminess.
photo: from iNaturalist by mycowalt

Fungi & Lichens, #1a Some FUNGI 7+

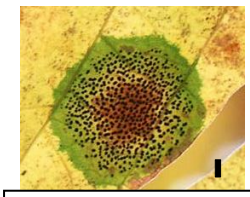
Turkey Tail
The scientific name of the Turkey Tail is *Tramates versicolor.* It is so-named because the color is quite variable. It is **not considered edible,** but it is sometimes used in Chinese medicine. **photo:** Mike Roa

Artist's Conk (Bracket Fungus)
This fungus has a white porous surface underneath. If a drawing is scratched into it, the drawing will remain when the conk is dried. It is edible.
photos: lower: from Flikr, by Joyce
upper: from iNaturalist, by laceypantalones

Bird's Nest Fungus
"Nests" are about 6 mm (1/4 inch) in diameter. The "eggs" are called "peridioles" and contain spores. **photo:** by Mike Roa

White Coral Fungus
Considered mycorrhizal. (provides nutrients to trees).Some are **toxic.**
photo: CalPhotos # 0000 1111 4321 0673
by Gerald and Buff Corsi

Red Coral Fungus
Considered edible, but may cause upset stomach.
photo: CalPhotos # 1342 3162 2660 0076
by Gerald and Buff Corsi



Green Island Fungus
see Big Leaf Maple

Dog Vomit (Scrambled Eggs) Slime Mold
(This photo was taken on a cloudy day in the shade. It was a much brighter yellow.) Slime molds are interesting fungi formed by an aggregate of cells. They may move in amoeba-like fashion. This type is highly tolerant of metals and may accumulate high concentrations of them, especially of zinc. It may have antibiotic properties.
It may trigger asthma and rhinitis in some people.
photo: by Mike Roa

Fungi & Lichens, #2 FRUTICOSE LICHENS 7+

above:
Old Man's Beard

right:
Beard Lichen

Methusela's Beard
(a rare lichen found in Armstrong Woods)

Lace Lichen
(California state lichen)
(not in Armstrong)

Lichens are made up of fungi and algae (and sometimes certain bacteria). The fungus provides shelter for the alga and the alga provides nutrients for the fungus.

Fruticose lichens grown in stringy masses.

As the name implies, beard lichens often hang from branches in beard-like masses. The lichen in the upper left picture is called "old man's beard." It is more commonly found on Douglas-fir and oak trees than on redwoods.

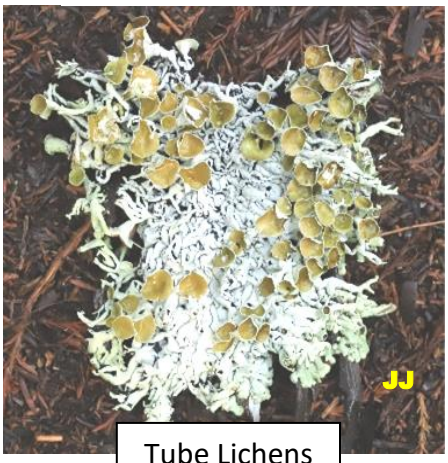
Beard lichens have a core made of the fungus' mycelia that can be stretched a bit, like a rubber band (if they aren't too dry).

Methuselah's Beard is a beard lichen that grows as a single strand. It is rare, but it is found in Armstrong woods on some oak trees along the road above the picnic area.

The lace lichen looks like more robust "old man's beard." It is California's state lichen. It is not found in Armstrong Woods, but is found in Annadel State Park and near Spring lake.

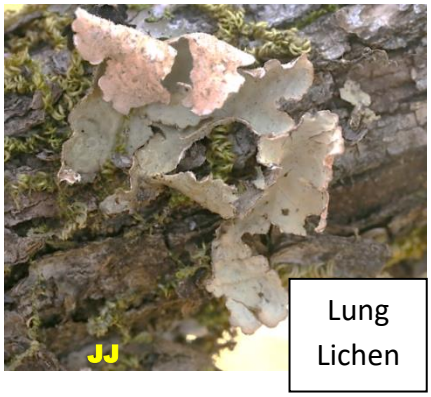
photos: by Mike Roa

Fungi & Lichens, #3 FOLIOSE LICHENS 7+



Tube Lichens

Textured lung Lichens



Lung Lichen

Common Greenshield Lichen

Lichens are made up of fungi and algae (and sometimes certain bacteria).
The fungus provides shelter for the alga and the alga provides nutrients for the fungus.

Foliose lichens have broader, less stringy forms than Fruticose lichens. (Think "foliage"… leaves.)

Tube lichens form tubes.

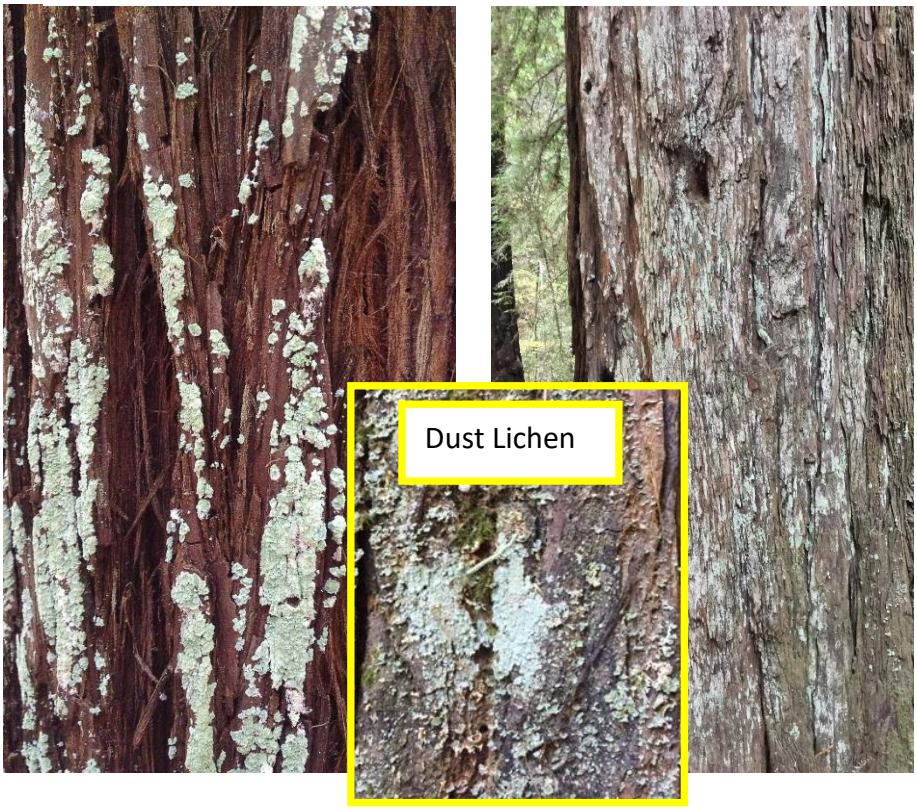
Lung lichens look a little like lung tissue.

The Greenshield lichen is broad (shield-like).

Photo Credits

Common Greenshield: from iNaturalist, by suzrj
All others: from iNaturalist, by Julene (JJ) Johnson

Fungi & Lichens, #4 CRUSTOSE LICHENS **7+**



Crab Eye Lichen

Lichens are made up of fungi and algae (and sometimes certain bacteria). The fungus provides shelter for the alga and the alga provides nutrients for the fungus.

As the name implies, crustose lichens form a low mass or crust, often on rocks and sometimes on trees.

“Dust Lichens” often give redwood bark a gray-green coloration that appears dust-like from a distance.

And speaking of crusty jokes, don’t forget that ***Freddy Fungus and Annie Algae took a lichen to each other!***

photos: by Mike Roa

Armstrong Woods Features Information for Docents

rev. 5.30.21

These pages show many of the features found along the trails at Armstrong Woods. They are intended for docent education. There are many more features illustrated than one would share with any one visitor group, but it is useful for docents to have the information in their mental tool box so that they can share it as appropriate, depending on the ages and interests of visitors.

The grade levels for which we consider the information most appropriate are given to the right of the title (4+, 7+, 9+, ALL, docents only).

Each page has one or more photographs on the top half and some information and possibly more photographs on the lower half. This is so that you can make them into 5” x 7” laminated cards that you can carry with you if you want to.

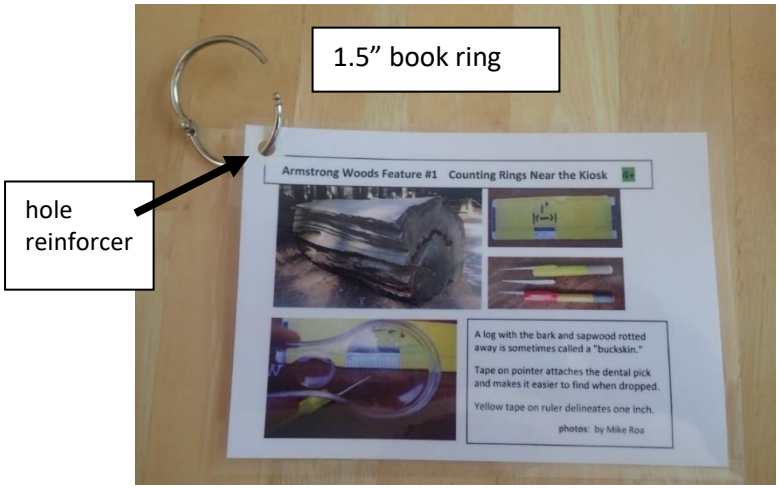
Many of the cards include questions that docents might ask visitors to stimulate their thinking. We have found that asking questions is a much better technique than just telling people facts. Questions engage the visitors more, and enhance learning by requiring them to think, rather than just listening. The questions are in ***bold italics***.

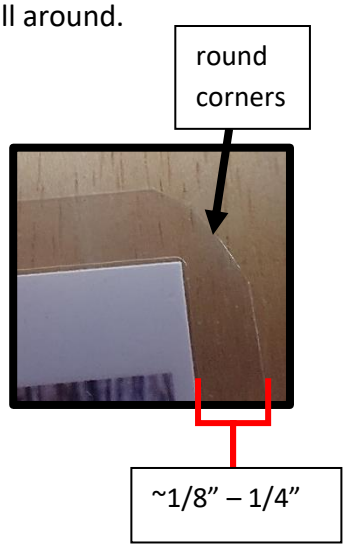
There are separate “sets” for Armstrong Woods and Pomo Canyon.

You can print and laminate whatever “cards” you want to carry with you, if any.

Laminating and Binding Cards:

1. Print the cards; cut to size (5”x7”).
2. Glue the information to the back of the photo.
3. Punch a hole in the upper left corner. Leave at least 1/4” of paper around the hole.
4. Add a hole reinforcer. (Clear reinforcers look better but are harder to attach than white.)
5. Laminate.
6. Cut so that there is a 1/8” – 1/4” margin of laminating material all around.
7. Round the corners.
8. Punch again and use a book ring to keep them together in order.





Armstrong Woods Features Information:

1. Counting Rings Near the Kiosk
2. Living with Fire
3. Nurse Log
4. Log Across Fife Creek
5. Basal Sprouts from Redwood
6. Basal Sprouts from Bay
7. Recently Fallen Tree
8. Root Pull
9. Snags
10. Leaner
11. Burned Base with Flaring
12. Graffiti Log
13. Parson Jones Tree
14. Dated Round

15a. Family Circle at Regeneration Sign

15b. Another Family Circle

16. Root Masses
17. Goose Pen
18. Root Mass
19. Redwood Seedling in Stump
20. Burbank Circle and Burls
21. Tree with Ramp
22. Cut Log on Trail (Rings and Rot)
23. Colonel Armstrong Tree
24. Forest Theater
25. Erosion Control/Hiker Safety
26. Acorn Woodpecker and Granary Log
27. Burl Growing Between Trees

28a. Fallen Giant

28b. Fallen Giant – Beetle Galleries

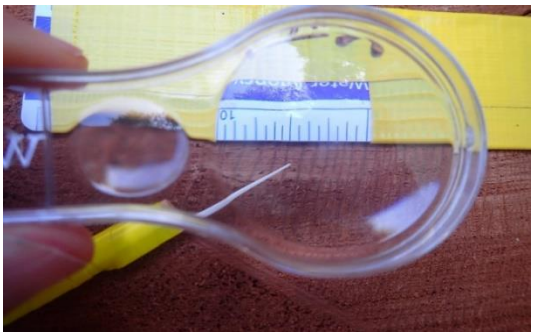
29. Base of Tree by Fife Creek
30. Icicle Tree and Popeye
31. Partially Healed Stump
32. Acorn Woodpecker Granary
33. Large Goosepen
34. Memorial and Mosquitoes

35a. Log with Beetle Engravings and Holes

35b. Insects that Feed on Redwood

36. Stream Bank Erosion Control Efforts

Armstrong Woods Feature #1 Counting Rings Near the Kiosk 4+



A log with the bark rotted away is sometimes called a "buckskin." Even though it has little tannin, the sapwood may remain because it dries out too much to support fungus that would rot it.

colored tape on the pointer attaches the dental pick and makes it easier to find when dropped.

Yellow tape on ruler delineates one inch.

photos: by Mike Roa

This log is near the start of the Pioneer Nature Trail. Kids often want to climb on it. Tell them not to.

If several groups are starting their tour at the same time, one group can spend a while at this log to allow for separation between groups.

Materials: tape measure, magnifier, pointer, plastic ruler section. Note pad and pencil for math.

(You can use a dental pick for a pointer, or make one by taping a dental pick to a short length of dowel or pencil that does not have a point. (Using a pointed pencil is likely to mark the sanded area.)

This log has a radius of about 35 inches, which gives it a diameter of just under six feet.

It has around 800-900 growth rings.

Kids can work in groups of 2 to count rings in sanded areas at both ends of the log.
Have them use a plastic ruler, magnifier, and pointer to count the rings for one inch.

- Have 2 students use a tape measure to estimate radius by measuring it in several places. (~35")
- Have several teams count rings for one inch in various areas… towards the center, middle, and outside. ***(Ask why they should measure in several different areas.)***
- They will probably find 24-27 rings per inch. Round to 25 per inch. Ask: **At that rate, how many inches would represent 100 years? (four). So if the log is 32" in radius, how many years would that represent?** 32/4 = 8, so 800. (Or, have them count how many hundred years as you point our 4" sections of the tape measure from the center and move out towards the circumference/edge.)
- Have them calculate how long it took that tree to grow a foot in radius and in diameter.
- Have them remember the approximate age and discuss when you get to the Parson Jones tree.

Armstrong Woods Feature #2 Living With Fire 7+


1


2


3


4


5


6

photos: by Mike Roa

Fire is a natural part of the ecosystem, and redwoods have several ways of surviving fires.

BARK: a. The bark is fibrous, not very flammable. Tannins in the bark also provide some fire resistance.
b. The bark is usually 3-8" thick, but can be over 12" thick in an old tree. **(1)**
c. Most natural fires would happen during thunder storms. With the storms comes rain. ***Have visitors press hands on redwood bark…notice that it is soft***…. During storms, or very foggy weather, the bark absorbs water like a sponge, which provides some protection against fire. **(2)**

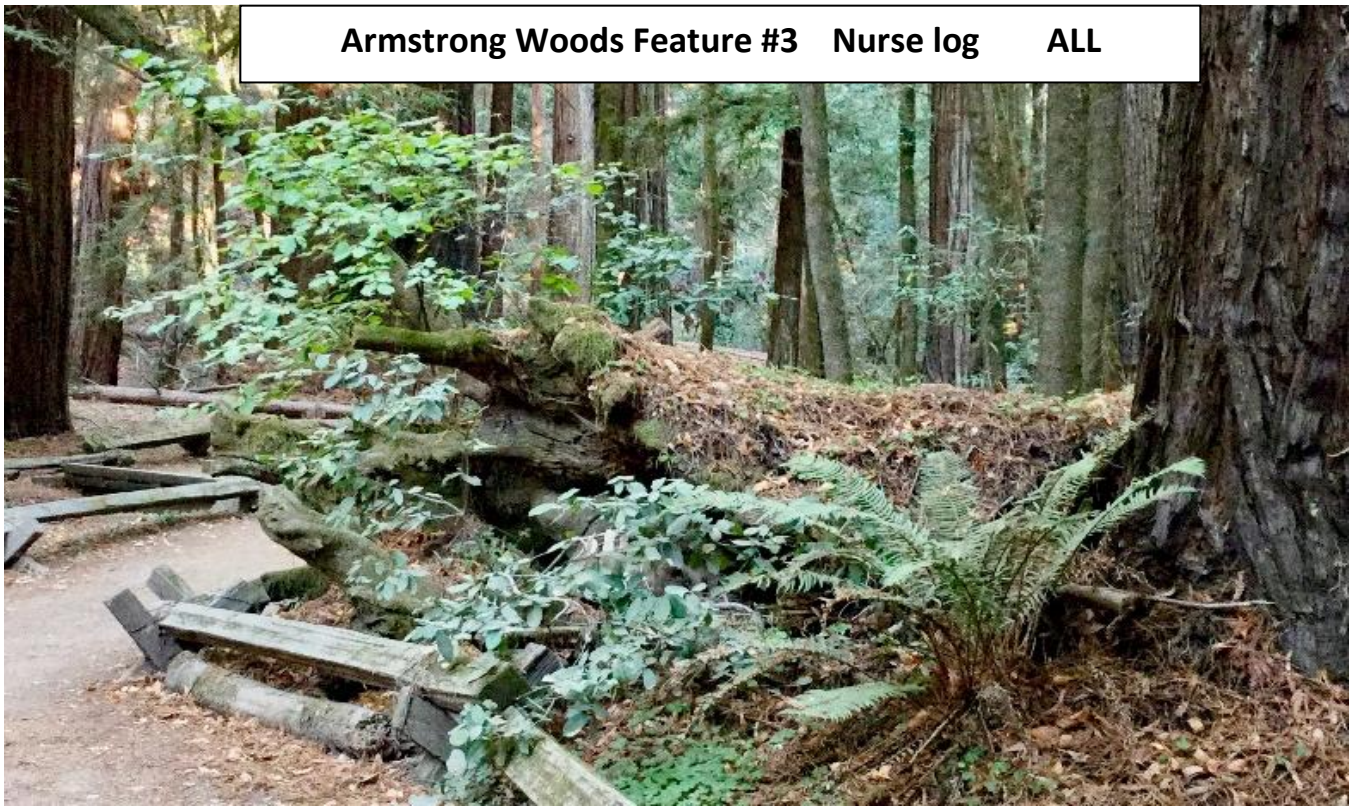
If fire is suppressed for too long, fuel accumulates and when a fire does happen, it may burn hot enough to get through the bark, resulting in a fire that can kill redwoods. The wood and brush is the **fuel load. (3)** (Sudden Oak Death thus not only threatens the oak trees but the redwoods and other trees!)

Ask visitors why they think there is such a fuel load in Armstrong. Removing the fuel requires workers and equipment, which is expensive. **Controlled burning is problematic** because of the proximity to Guerneville. There is less of a fuel load in the Pomo Campground because campers have used the wood. But there is lots of down wood on the hillsides away from the campground itself.

Notice that most trees have shed lower branches. **(4)** This is called "**natural pruning"** or **"self-pruning**." ***How does that help trees survive fire?***

a. "Self-pruning" of shaded leaves conserves energy.
b. Trees depend on leaves to provide food via photosynthesis. If a fire burns the leaves in the canopy, the tree will lose its food source.
c. Removing lower branches removes the natural "**fire ladder**" that might allow fire to climb into the canopy. **(5)** If no fire has gone through the area in a long time, dead branches or other more flammable trees such as tanoaks may form a fire ladder that brings fire to the canopy
d. Even if the above-ground part of the tree is killed (or cut or breaks), the roots often survive. Redwoods are able to **sprout** from the root crown or root collar **(**called **stump sprouting. (6)**

Armstrong Woods Feature #3 Nurse log ALL



How many different types plants can you see on this log?
(Don't worry about their names…
Just point to them and describe them.)

We call this a "**Nurse Log**."
Why do you think that we call it a nurse log?

Watch for these plants during our walk today, and for other nurse logs.

(Plants include hazel nut, moss, sword fern, tanoak, redwood sorrel, partly dead bay tree with some <u>new growth at base</u>)

photo: by Mike Roa

Armstrong Woods Feature #4 Log Across Fife Creek 7+

1. ***Was that log cut, or did the top break off? What makes you do you think so?***
   Cut…a break wouldn't have been so straight.
2. ***Was it cut before it fell, or after? Why do you think do?***
   Probably cut before it fell. If they cut it after it fell, they wouldn't have been able to make the right angle to the left and then continue downward. They probably would have cut straight through the log.

(I (Mike Roa) think that the ground level was a couple of feet below where the fern is growing. The cut is about 9' above that.)

3. ***<u>Why</u> would they cut the tree 9' above ground?***
   a. The weight of the tree compresses the wood at the base so that it develops a wavy grain, which does not make for good lumber.
   b. The base of many older redwood trees flares out. To cut through that dense flaring would have required a lot of work that would not have yielded much lumber.
   c. The weight of the wood compresses the wood at the base making it very dense. It might be so dense that it would sink if they tried to float it down the river to a sawmill.
4. ***<u>How</u> would they cut the tree 9' above ground level?***
   They used springboards. See the "Carry Cards."

Photo: by Mike Roa

Armstrong Woods Feature #5 Basal Sprouts from Redwood 4+

Look around for redwood trees sprouting at the base of other redwoods.

Redwoods can readily sprout from the root crown (root collar), or from a cut tree. If the roots aren't killed, this helps redwoods regrow after a fire. (The photo at the right was taken in Armstrong Woods about 7 months after the Walbridge fire.)

Whether from a root crown or a stump, this is usually called "stump sprouting." Trees that sprout from an above ground stump don't usually survive very long, while those that grow from the root crown/root collar may live for hundreds or thousands of years.

Redwoods are one of the few gymno-sperms that do this readily, but many angiosperms such as bay, tanoak, and fruit trees do.

photos: by Mike Roa

Armstrong Woods Feature #6 Basal Sprouts from Bay 4+

How would you describe the leaves of that tree?

Notice the sprouts growing from the base of the tree.
That is called **root crown sprouting** or, if the tree has been cut, **stump sprouting**
Bay trees root crown sprout and stump sprout quite readily.

As you walk today, notice that many bay trees bend. ***Why is that?***
Notice also that many of those have branches only on the top side. ***Why?***

Trees grow towards the light, and tend to put more energy into the branches that receive more light. (In a dark forest, it's all about competing for light.)

Look for green or yellow leaves on the ground.
Smush one up between your fingers. Smell your fingers. What do you notice?

This is a Bay tree. Have you ever used bay leaves in spaghetti sauce or soup?
Our Bay trees are of a different but related species.
The Bay is also called Laurel, California Bay, Bay-Laurel, or Pepperwood.

The Native Americans used bay leaves to keep insects from their sleeping areas and granaries. When hunting, they would also smear smashed leaves on their body to disguise their scent so that the prey wouldn't smell them.

photos: by Mike Roa

Armstrong Woods Feature #7 Recently fallen tree 7+

This tree fell in February, 2019, when we had heavy rains and wind.

What do you think caused it to fall?

Notice that the roots are not very large, especially for a tree of this size.

Redwood roots tend to interlace with those of their neighbors. This helps keep trees from falling in wind storms.

(Have kids interlock fingers with their neighbors and lean back.)

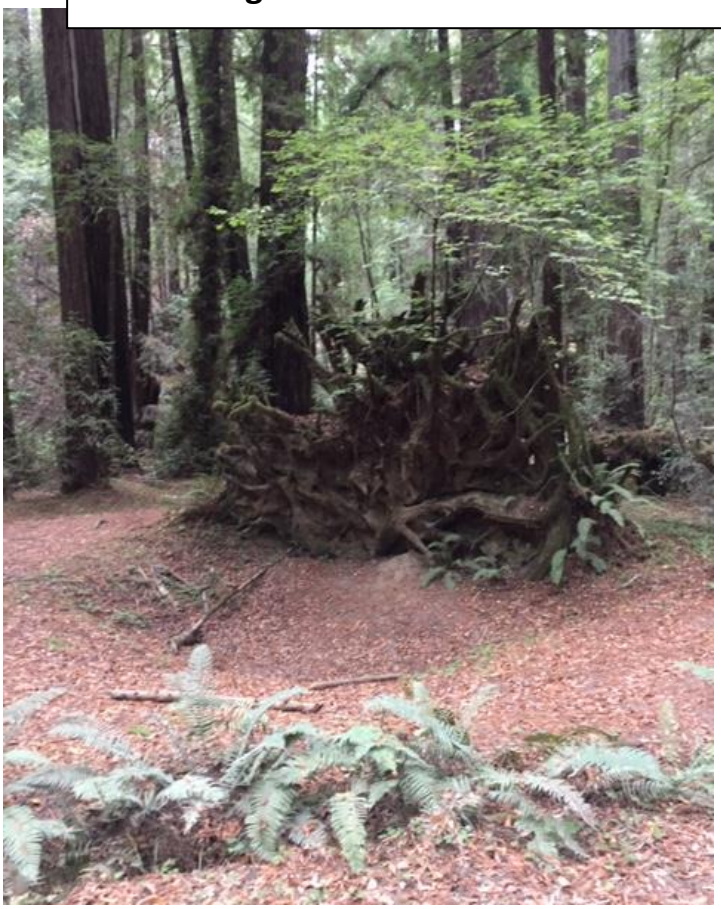
When loggers cut redwoods for lumber, they do not want them to shatter like this one did. To prevent shattering they will sometimes cut surrounding smaller trees and bushes to create a bed for the tree to fall onto.

Loggers become expert at “aiming” the tree so that it won’t hit other trees.

Native Americans would use wood and bark from a shattered tree like this to build a variety of different structures. This would be a lumber yard for them!

photo: by Mike Roa

Armstrong Woods Feature #8 Root Pull from Wind Throw 7+



The photo above is the tree at the left, viewed from the other side. It was probably blown down by the wind before it was cut. A stump is unlikely to "catch" enough wind to be blown over, and the tree fell towards the top of the valley, so it probably wasn't knocked over by flood waters of Fife Creek.

A tree that is blown down by the wind is called "**wind throw**." The roots often pull up a lot of dirt with them.

This makes a crater or depression in the ground called a **root pull.**

Root pulls are important because the bare soil provides a good place where many kinds of seeds might start to grow. (But accumulated fallen leaves, called **duff**, inhibit seed germination, much like mulch in a garden bed.)

Do you see any large plants growing in this root pull? Why not?

In the winter root pulls may become small ponds where a variety of animals like mosquitoes, salamanders, or frogs might breed.

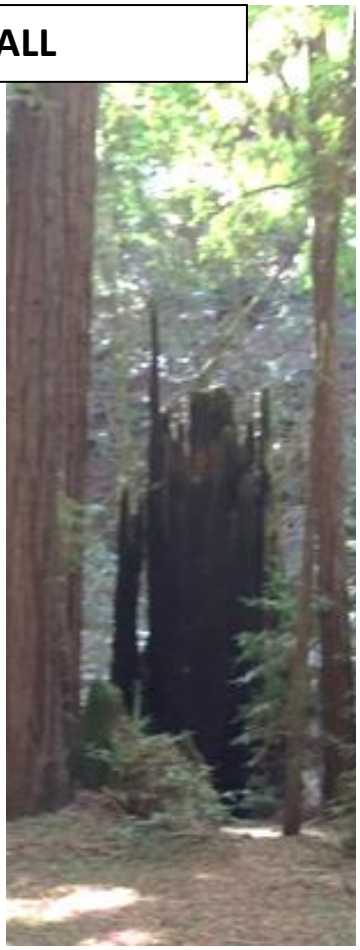
(I (Mike Roa) <u>think</u> that these winter "ponds" tend to drown any plants such as redwood trees that might start to grow there. Combined with mulch, plant growth is inhibited.)

Do you recognize the tree growing on top of that stump? (California Hazel)

The bole (main trunk) was cut, as were several other apparently wind-thrown trees near the entrance to Armstrong Woods. Compare the straight-through cut of these trees to the stump across the creek seen earlier, which shows undercutting and back-cutting. I think that they were blown down by the wind and the boles were cut while they were on the ground.)

photos: by Mike Roa

Armstrong Woods Feature #9 Snags ALL



Do you see any dead trees, or the remains of dead trees? These are called "snags."

Snags are important to the forest ecosystem because they provide habitat for many different kinds of animals.

Over 600 types of plants and animals have been found to live on snags in the redwood forest!

photos: by Mike Roa

Armstrong Woods Feature #10 Leaner **7+**

photos: by Mike Roa

What is happening with those trees?

Wood and bark cells are produced by the cambium layer, which is just under the bark. When the bark rubs off of trees, the cambium layer is exposed.

In this case, the cambia of the trees have started to produce new wood or scar tissue.

(This is essentially like grafting that some gardeners and fruit tree growers do.)

Right photo: What is happening to the scar tissue?

Do you think that the split will heal, or continue to grow?

What do you think will be there in 100 years?

Let's meet back here then and see!

Armstrong Woods Feature #11 Burned Base with Flaring & Old Bench 7+

What happened to this tree?

A fire, probably in the 1920s, burned through the bark and burned part way into the wood. But it didn't burn enough to kill the tree.

Ever since then, the tree has been recovering and growing scar tissue.

We don't know whether the flaring out at the base (butt swell) was there before the fire, or whether it is scar tissue that formed after the fire. It is probably some of both.

What do you think the log at the base of the tree is?

(Good place to discuss why loggers would cut tree far above base if flared.) (May have been discussed earlier in the walk.)

photo: by Mike Roa

Armstrong Woods Feature #12 Graffiti log **4+**

What have people done to this log?

Do people come to Armstrong Redwoods, or any other park, to see other peoples' names carved into trees, fences, tables, stumps, logs, or other park Features?

Why do you think people carve their initials?

Will you ever carve your initials into a log or table in a park?

Notice how smooth the wood is. What happened to the bark?

The bark has fallen off and decomposed. One might think that the sapwood, without much tannin, would also have rotted away, but apparently it doesn't necessarily rot rapidly because it dries out too fast after the bark comes off.
This is seen on many of the trees that fell or were cut more than just a few years ago.
Logs from which the bark has decomposed are sometimes called "buckskins."

Some of the exterior wood of this log shows the wavy grain (ribbon wood) that, while it is pretty, doesn't make very good lumber, which is why loggers may cut above that wavy wood.

According to the Docent Manual, somewhere the date of 1924 was carved into this log.

From near this log one can see all the way to the top of the Parson Jones Tree.

photo: by Mike Roa

Armstrong Woods Feature #13
Parson Jones tree 4+

How tall is the Parson Jones tree?

How do you know?

Is it really that tall today?

What if it was measured 50 years ago?

Would it still be the same height?

Could it be shorter?

How might it have become shorter?

What does "diameter" mean?

What is the diameter of the Parson Jones tree?

Is that really the diameter today?
What if it was measured 50 years ago?

Would the diameter be different at different heights?

According to the Docent Manual, this tree and the Armstrong Tree were measured in 1970.

At right: "spike top" trees. The tops probably died back due to drought, but they may recover and start to grow again when conditions improve, or they may break off.

Foresters measure the diameter of trees at 4.5' above ground on the uphill side. This is the "Diameter at Breast Height"(DBH). e

Actually, the diameter isn't measured. The circumference (distance around) is measured and divided by pi to get the diameter. (We pretend that the tree is circular.)

We recently measured the circumference of the Parson Jones tree again. We found that the diameter at the base is now about 16.9', and at 4.5' it is about 13.3', so they probably measured somewhere in between.

Notice black poison oak sap in the cut poison oak vine. Native Americans used it for color when making designs on baskets and for making tattoos.

photos: by Mike Roa

Armstrong Woods Feature #14 Dated Round 4+

Notice the dates marked on this round. It was installed in 1978, I think.

When a seed starts to grow, it is said to have germinated. According to the marked dates, this tree germinated in the year 948.

How long ago was 948?

If the tree ring at the center was formed in 948, but this section of the tree was 3' above the ground, did the tree actually germinate in 948?
(No…it germinated before 948.)

photos: by Mike Roa

Notice how close together the rings are on this round.
Was the tree growing fast or slowly? Why do you think that?

One thing that might cause a tree to grow slowly is lack of water or drought.

Do you think that this tree lived during a thousand-year drought?

It grew slowly because it was in a dark shady forest. In some years it did grow faster than others. Those were probably particularly wet years.

Armstrong Woods Feature #15a Family circle (@ Regeneration sign) 4+

Notice that these trees are growing around a rotted stump.

This is called a "**family circle**." The circle of trees sprouted from the root crown (or root collar) of the tree that was cut.

Root crown sprouting, or stump sprouting, is an important way that redwood trees reproduce.

(Discuss why seeds seldom survive to germinate: (1) low fertilization rate because they are wind pollinated, (2) animals eat them, (3) fungus attacks them, and (4) because of the thick duff layer, the roots dry out before they can reach soil.)

But if soil is exposed in a root pull, landslide, fire, or silt from a flood, seeds can germinate.

Since the sprouted trees in the circle all came from the root crown of a previous tree:

Can they be considered to be that same original tree? If so, these trees began their lives when the original tree from which they sprouted began its life. And if that tree sprouted from another tree's roots, it could be considered that same tree…and one might go back several "generations" of sprouted trees. Let's say that the trees in the current family circle (Call it generation A) are 100 years old. If they sprouted from the root crown of a tree that was 1000 years old (generation B), Gen. A could be considered to be 1100 years old. And if Gen. B sprouted from a 1000 years old Gen C., Gen. A would be 2100 years old. Could you go back even more generations? Might Gen. A be to be 10,000 years old?

Look around…Do you see trees sprouting from the root crowns of living trees?

photo: by Mike Roa

Armstrong Woods Feature #15b Another Family Circle docents

This family circle is about 100 paces north of Regeneration sign, across from the dinosaur. (The opening is to the east of the trail, so you won't be able to take the group there, but the photo taken from inside the circle shows the circular arrangement of the sprouted trees.).

An estimate of the size of the stump in the center of this family circle indicates that the tree was probably even larger than the Colonel Armstrong and Parson Jones trees!

photo: top by Mike Roa bottom by Greg Corby

Armstrong Woods Feature #16 Root Masses ALL

Left photo: ask: ***Do you see a dinosaur over there?***

What is it really? (roots)

What is it covered with? (moss)

Does it look like any other kind of animal?

right photo: ***ask: What does this root system look like to you?***

Tyrannosaurus rex skull? Triceratops? Wild boar skull?

What part of the tree is it?

photos:: by Mike Roa

Armstrong Woods Feature #17 Goose pen (fire cave) ALL

When fire burns through the bark of a tree it sometimes burns some of the wood in the center of the tree, creating a hollow called a “goose pen" or "fire cave.”

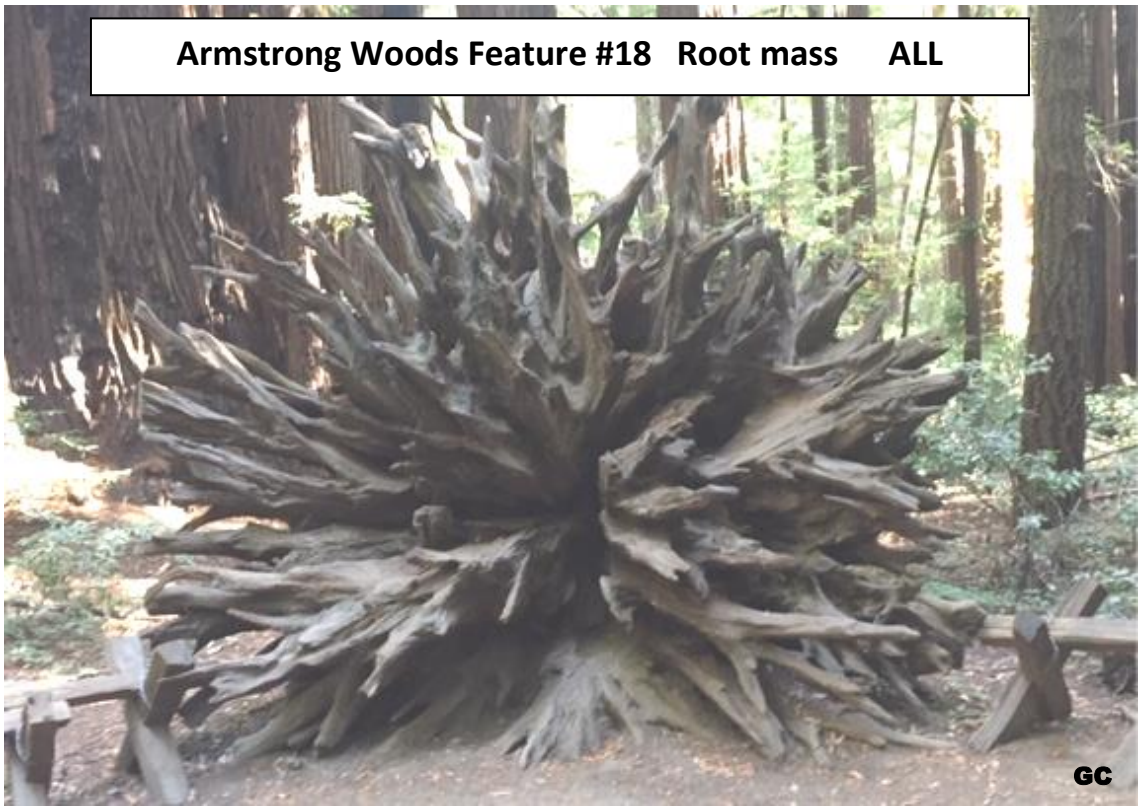
Why do you think it might be called a goose pen?

Notice how far up the tree burned, and how much scar tissue has grown to help it heal.

What might live in a goose pen? (spiders, bats)

NOTE: At the time of this writing, the opening has been fenced off. I presume that is to keep people from going inside, so if the fence remains in place, do not allow people to go inside.

photos: left by Greg Corby right from U.S. Forest Service (location unknown)



What do you think this is?
(Roots, which we've seen before in the skull and also at the root pull.)

CAUTION! Kids will often make a bee-line for the roots and start climbing on them. Have the teacher either give permission or deny it!

If allowed to climb on the roots, this is a good photo op.

Tell kids NOT to climb down the back…
They should stay on this side of the fence.

It would be good to have adults "spot" kids if they climb on the root mass, especially coming down.

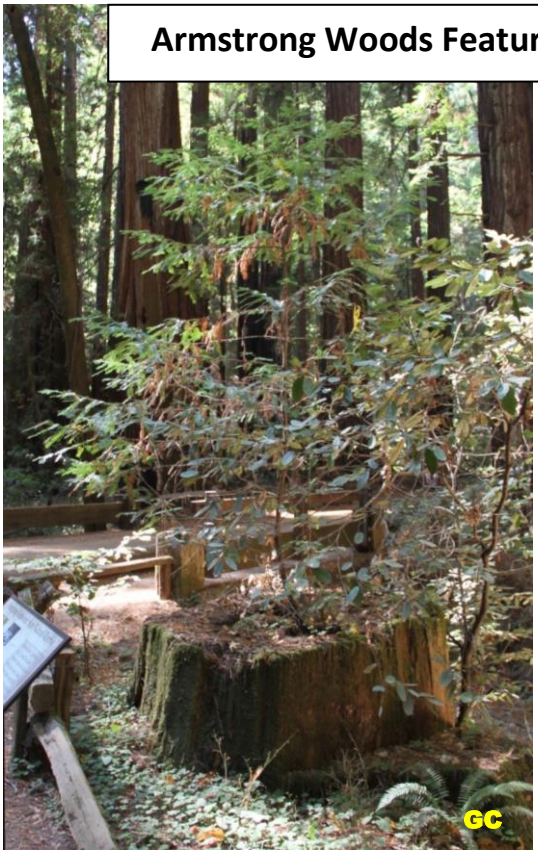
(The stump was moved here from Johnson's Beach on the Russian river.

Root mass of fallen Deyerville Giant in Humboldt Redwoods St. Pk. The man in the picture is over 6' tall.

photo(s): root mass from Johnson's beach by Greg Corby.

Deyerville giant root mass by John Griffith

Armstrong Woods Feature #19 Redwood seedling in stump 4+



In order to sprout, a plant seed needs soil and moisture, and in order to grow it also needs sunlight.

This redwood tree probably grew from a seed that fell into the rotting center part of the stump. The rotting wood acts as a sponge, absorbing and holding water and decomposing leaves that nourish the seedlings.

Fungus needs moisture, and the outer part of the trunk tends to dry out too much for fungus to thrive. This is called “case hardening.”

What else is growing on the stump?

Could it be called a nurse stump?

Watch for other nurse stumps along the trail.

photos: left by Greg Corby right by Mike Roa

Armstrong Woods Feature #20 Burbank Circle and Burls 7+

Burbank Circle:

What do you notice about this group of trees?

Any ideas what might have caused them to grow in a circle?

(We don't really know…possible ideas are that it is a family circle, or ceremonial area from Native Americans, or picnic area from when the Armstrong family owned the land.)

Burls

Notice the bump near the base of the large tree.

A "**burl**" is an abnormal growth. In redwoods, they can occur near the base of the tree or on the trunk. Burls are formed by the repeated formation of buds, sort of like a benign cancer.

Burl wood is very beautiful and some-times people cut down whole trees, including in parks, just to get the burls, from which they make expensive furniture to sell. The burl high in the tree is probably about 4 feet across and might contain over $1000 worth of burl wood. (See Carry Cards.)

***How might cutting a burl off the tree kill the whole tree*? (It would be like cutting your skin…allows bacteria and fungi (germs) to enter. Just like a small cut in your skin can become infected, so can a cut through a tree's bark become infected.)**

photos: by Mike Roa

Armstrong Woods Feature #21 Tree with Ramp ALL

A good place to hug a tree!

And to note how thick the bark is.

The ramp helps protect some of the tree roots from damage from tree lovers!

photo: by Mike Roa

Armstrong Woods Feature #22 Cut Log on Trail…Rings and Rot 4+

Chemicals called tannins give redwood its beautiful color.

Insects and fungi don't like tannins, so redwood is **resistant** to rot and insects.

The longer a redwood tree grows, the more tannins collect in the heartwood.

But the resistance is not perfect…Redwood will eventually rot, and insects will attack redwood.

Sapwood tends to dry out sooner than the heartwood, and fungi need moisture to thrive. So sapwood in a log may remain fungus-resistant even though it doesn't have much tannin.

What might live in the holes in this log?

What would the forest look like if redwood trees never rotted?

(The insert shows rot development in sapwood but not heartwood.)

photos: larger photo by Greg Corby inset by Mike Roa

Armstrong Woods Feature #23 Col. Armstrong Tree ALL

CalFire crew works to save Armstrong Tree during Walbridge Fire, Sept. 2020

Photos: left by Greg Corby right by Branden O'Neil

Who was Colonel Armstrong?

How tall is the Armstrong Tree?

How do you know?

Is it really that tall today?

What if it was measured 50 years ago? Would it still be the same height?

Could it be shorter?

How might it have become shorter?

What does "diameter" mean?

What is the diameter of the Armstrong Tree?

Is that really the diameter today?

What if it was measured 50 years ago?

Where is the diameter measured? At the base? 1'above ground? 10'above?

Armstrong Woods Feature #24 Forest Theater ALL

photo by Mike Roa

The **Forest Theater** was used for musical performances, plays, weddings, and other events in the 1930s.
Now it is only used for a few occasions each year. ***Why do you think that its use is restricted?***

Performance in 1936. Source: Sonoma Co. Library

Armstrong Woods Feature #25 Erosion Control & Hiker Safety **4+**

Photos: by Mike Roa

(between the Armstrong Tree and the section of trail with railing, on uphill side.)

What do you think those pegs are for? Why were they put there?

This is a place where some people walked off the trail.
Branches were put behind the pegs to keep people from doing that.

Why do you think we don't want people going off the trail and around trees on the hillside?

When people walk off of the trail, they knock the leaves out of the way, exposing bare soil to rain and wind, which causes erosion. The leaves provide ground cover, preventing erosion on hillsides. (The hiking trail is fairly level, so the water doesn't run off very fast. Therefore, the soil doesn't erode soil very fast.)

Also…***Do you see any plants growing on the trail?*** When people walk off the trail they trample whatever plants might grow there. Whey they stay on the trail, such trampling is contained to the trail area.

And… People who go off the trail are more likely to trip or fall and get hurt.

Armstrong Woods Feature #26 Acorn Woodpecker Granary Log **4+**

What made the holes in this log? (The log is on the north side of the trail.)

Were the holes made from the inside or outside of the branch?

There are several kinds of woodpeckers that live in Armstrong Woods.

One of them, the **acorn woodpecker**, made these holes in this branch when it was on the tree, and stored acorns in them.

As they dry, the acorns shrink. The woodpeckers will move an acorn from a hole that is too big to a smaller one so that it doesn't fall out.

The woodpeckers eat the acorns and insects that feed on them.

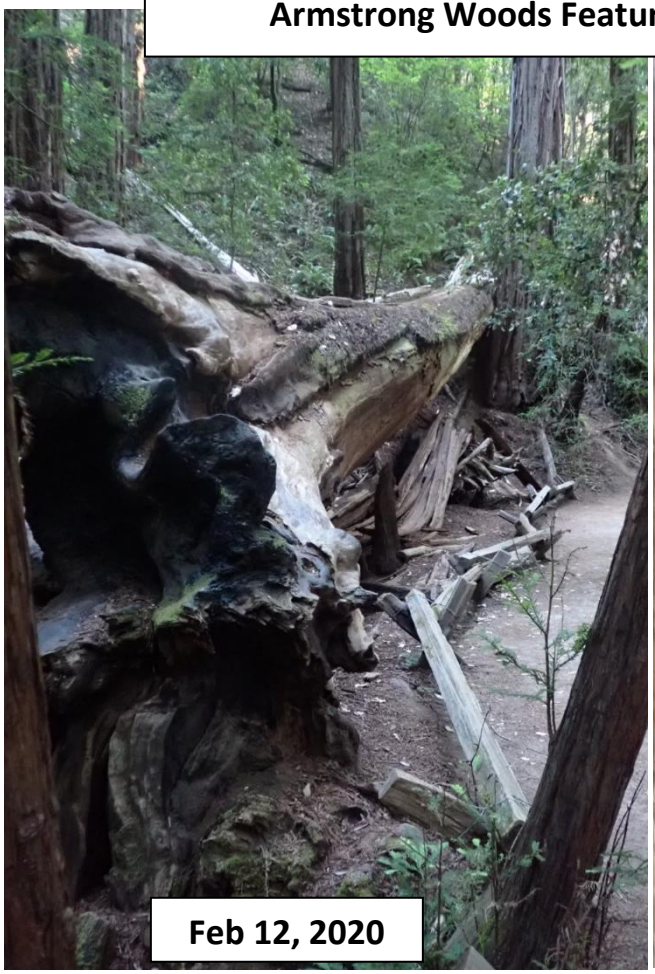
photos: Acorn Woodpecker photo from Flikr, by Mark Gunn Log: Mike Roa

Armstrong Woods Feature #27 Burl growing Between Trees 7+

The larger tree is growing a large burl. The burl has grown into the smaller tree and may either eventually push it over or it may rub the bark off and the two trees may grow together (forming a graft) like the tripod tree seen early in our walk.

photo: by Mike Roa

Armstrong Woods Feature #28a Fallen Giant ALL



Feb 12, 2020

May 6, 2021

This tree is sometimes called the **Fallen Giant.**

What do you think killed it? It was probably killed by the fire in 1923, but didn't fall until 1984.

What evidence do you have for your answer?

photos: by Mike Roa

Armstrong Woods Feature #28b Fallen Giant - Beetle Galleries ALL

Notice how thick the bark on the tree is. That thick bark and the sap and tannins in the tree help protect it from insects. However, when the tree dies, a variety of beetles sometimes lay their eggs in the tree. Those eggs hatch into larvae that feed on the wood (xylem) and the cambium and phloem layers under the bark. The marks on the wood (the "gallery") show the path that the beetle larvae made as they fed.

The 2020 Walbridge Fire obliterated most of the galleries, but some are still visible.

A page that shows some insects that attack redwood follows later in this document.

The galleries were likely made by the Spiny Wood Borer or some other long-horned wood boring beetle. The holes are where the larvae bored out of the wood and fed on the phloem and cambium.

Other beetles, called Bark Beetles, form galleries as they feed on the cambium and phloem.

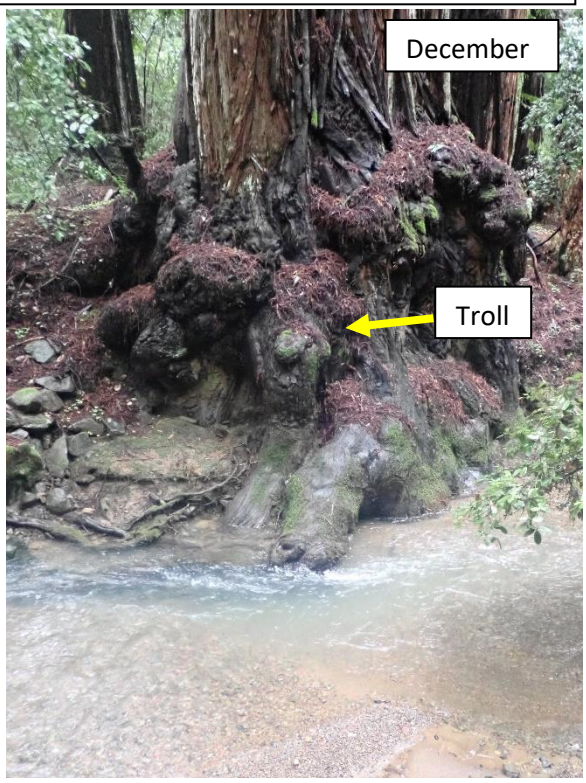
Bark beetles are also called "engraver beetles." Why is that?

Notice the bark that has fallen from the tree. Native Americans used slabs of bark and wood from fallen/shattered trees like the one near the start of our walk to build various structures. A tree like this would be their lumberyard!

A shattered tree in Humboldt Redwoods St. Pk.

photos: by Mike Roa

Armstrong Woods Feature #29 Base of Tree Along Fife Creek 4+



What has happened to the soil at the base of this tree?

Every few years, heavy rains cause Fife Creek to become a raging torrent. (The Russian River flooded 38 times between 1940 and 2019!)

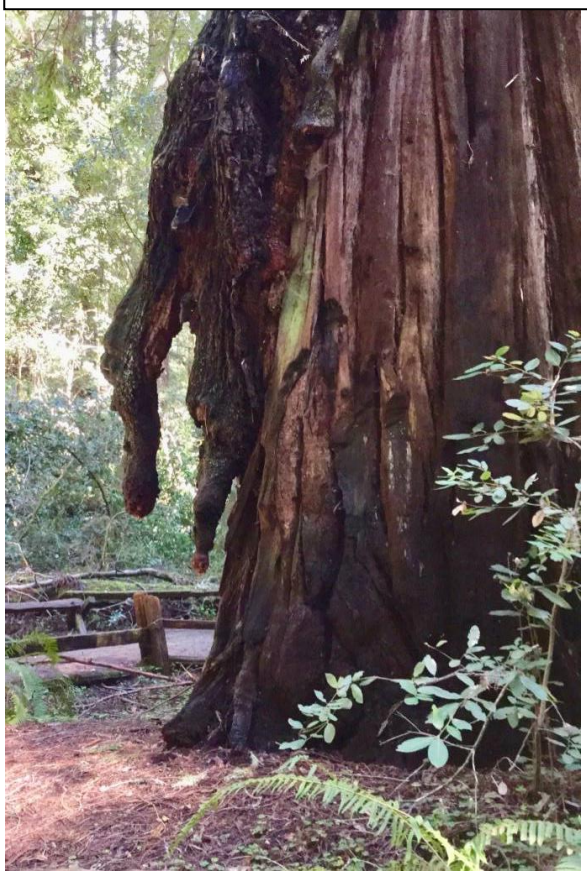
That running water erodes the soil from the bank. Eventually this tree may be undercut and fall.

Even though redwood roots generally don't go very deep, these have grown downward along the creek bank. **Roots seek water**. For most redwoods, that means **spreading out near the surface** to catch rain and fog drip, which may not sink very deep into the soil. This tree is next to Fife Creek, which dries up in the summer, but **still has water several feet down in most summers.**

This tree is sometimes called the Troll Tree. Can you see why?

photos: by Mike Roa

Armstrong Woods Feature #30 Icicle Tree and Popeye 4+



Some unusual long, hanging burls have grown on the "**Icicle Tree.”**

Why is the tree called the Icicle Tree?

If you look closely, you can see that the burls were cut off by someone who thought that it was more important for them to have the wood than for you to be able to enjoy an undamaged unusual natural burl growth.

In the winter and spring roots grow from the cut burl, but they die back in the summer and fall because they don't reach soil.

Can you see Popeye?

Is "Popeye" a burl?

photos: by Mike Roa drawing from the Internet

Armstrong Woods Feature #31 Partially Healed Stump 7+

When approached from the west (from the Armstrong Tree direction), this "healing stump" is about 60-70 paces west of the intersection of the Discovery Trail and the Pioneer Trail.

Approaching from the west, it appears to be a pretty complete stump. (left photo)

From the other side, though, it can be seen that most of the stump has rotted away. The outer part of the stump hasn't all rotted, possibly because fungus needs moisture to thrive and the outer part tends to dry out. This is called "case hardening."

The roots survived long enough, though, for considerable healing on one side.

I (Mike Roa) would be surprised if the resources stored in the roots alone were enough to sustain the healing/scarring process long enough to form that much wood. It seems like it would have taken several years. So I suspect that there were root crown sprouts at one time.

So I wonder if maybe the tree was cut and some stump sprouts supported it for a while but have since died. (True stump sprouts don't tend to live as long as trees that sprout from the root crown/root collar.)

photos: by Mike Roa

Armstrong Woods Feature #32 Acorn Woodpecker Granary in Snag Wood **4+**

This piece of wood is near or in a root pull just east of the "healing stump.

Stand the wood up so that visitors can see the holes. Show both sides.

Ask visitors what might have made the holes.

Ask whether the holes are on the inside or outside of the tree, and how they know. (Inside, as shown by the curve of the wood.)

Ask how the woodpeckers made the holes on the inside.
(The wood is from a snag… the rest of the tree had rotted away or was burned.

Ask where the snag is and how the specimen got here. The nearest snag is a bit farther east on the trail. The specimen was probably put here by people or may have been moved when Fife Creek flooded.

The specimens at the right are from the top of a living redwood that fell across the creek in the Walbridge fire in 2020. The top of the tree was dead and rotting. Watch for these specimens on the creek side of the trail.

photos: by Mike Roa

Armstrong Woods Feature #33 Large Goose Pen (Fire Cave) Near Road ALL

Visitors may want to exit through the "back" side of the goosepen. Tell them not to do that…Coming out that side puts them on the "wrong" side of the fence.

This large **goose pen** can hold a lot of people.

Can your whole class fit?

It is possible to leave the goose pen through the opening at the back, but **please don't.**

What kinds of animals might live in a goose pen?

NOTE: At the time of this writing, the opening has been fenced off. I presume that is to keep people from going inside, which may damage the roots as they approach the entrance, and also any roots that are alive inside of the cave.

SO: IF THE FENCE REMAINS IN PLACE, DO NOT ALLOW PEOPLE TO GO INSIDE.

(From a little to the east (towards the road), looking south (towards the entrance) you can see a tall tree that broke off in a wind storm and is growing a couple of new trunks from the top.) **photos:** by Mike Roa

Armstrong Woods Feature #34 Memorial and Mosquitoes 4+

This memorial was made to honor Marcus Flohr, who was sheriff of Sonoma County in the early 1930s. This resting spot and watering hole was created in 1934 in his memory by the Sonoma County Sportsman's Club.

When there is water in it, mosquitoes lay their eggs here. Look for larvae and pupae in the water.

What does the word <u>mosquito</u> mean in Spanish?

(*mosca* is "fly"; *-ito* means little, so mosquito means "little fly.")

<u>Photo credits:</u>
Mosquito larvae (left): from Flikr, by Jenn Forman Orth
Mosquito pupae (middle): from Flikr, by IAEA Imagebank
Mosquito adult (right): from Flikr, by Volkmar Becher
Memorial: by Mike Roa

Armstrong Woods Feature #35a Log with Beetle Engravings and Holes 4+

Spined wood borer adult and larva

Long-horned wood boring beetles.
Many adults feed on flowers.

(This log is beside the trail almost to picnic area)

What made the <u>grooves and holes</u> in this log? (beetles)

The grooves are called “galleries”. They show the path that the larvae took as they fed on the cambium and phloem. The holes are where the beetles emerged from feeding on the wood (xylem).

Are all of the holes the same shape, or are some round and some oval?

Different shapes may indicate different types of beetle, or maybe just different angles of exiting the wood. Different types of beetles also make different patterns in their galleries.

Long-horned wood boring beetles are also called round-headed wood boring beetles. They lay their eggs on the surface of the bark and the larvae bore into the wood (xylem). Later the larvae bore out from the wood and feed on the cambium and phloem under the bark, making a sort of meandering path in the wood as they feed. Their larvae make round or oval-shaped holes.
(In contrast, bark beetle females bore trough the bark and feed on the cambium and phloem while laying eggs in an “oviposition gallery”. The eggs then hatch and feed laterally, making a sort of centipede-like branched pattern as they feed on cambium and phloem. See card D-36a)

<u>Photo credits:</u>
Spined wood boring beetle (*Trichocnemis*) adult: from iNaturalist, by W. Mason
Spined wood boring beetle larva from iNaturalist, by “true72”
Top right (on sword fern): long-horned wood boring beetle (*Dorcasina*) : from iNaturalist, by Tony Iwane
Lower right: Large Cedar Borer (a long-horned wood boring beetle) (*Semanotus*) from iNaturalist, by “Buddy”)
Log by Mike Roa

Armstrong Woods Feature #35b Insects that Feed on Redwood 4+

4 mm (< 1/4

Redwood Bark Beetle *Phleosinus*

The grooves in the log were made by **Bark Beetles**, also called Engraver Beetles. Bark beetles feed on the cambium and phloem layers under the bark.

Note that the Redwood Bark Beetle pictured is actually only about 4 mm long… < ¼" Different bark beetles make different patterns in their engravings or galleries. The Redwood Bark Beetle's gallery looks a little like a centipede.

Termites will attack redwoods, accessing the wood where branches break off or the bark is compromised in some way.

Note that the termites have fed on the sapwood in the lumber but hardly touched the heartwood, which has more tanins.

Termites and termite damage to redwood lumber

Long-horned (Round-headed) Wood Boring Beetles make round or oval holes. Holes in the sapwood in the right photo were likely made by the Spined Wood Borer (below)

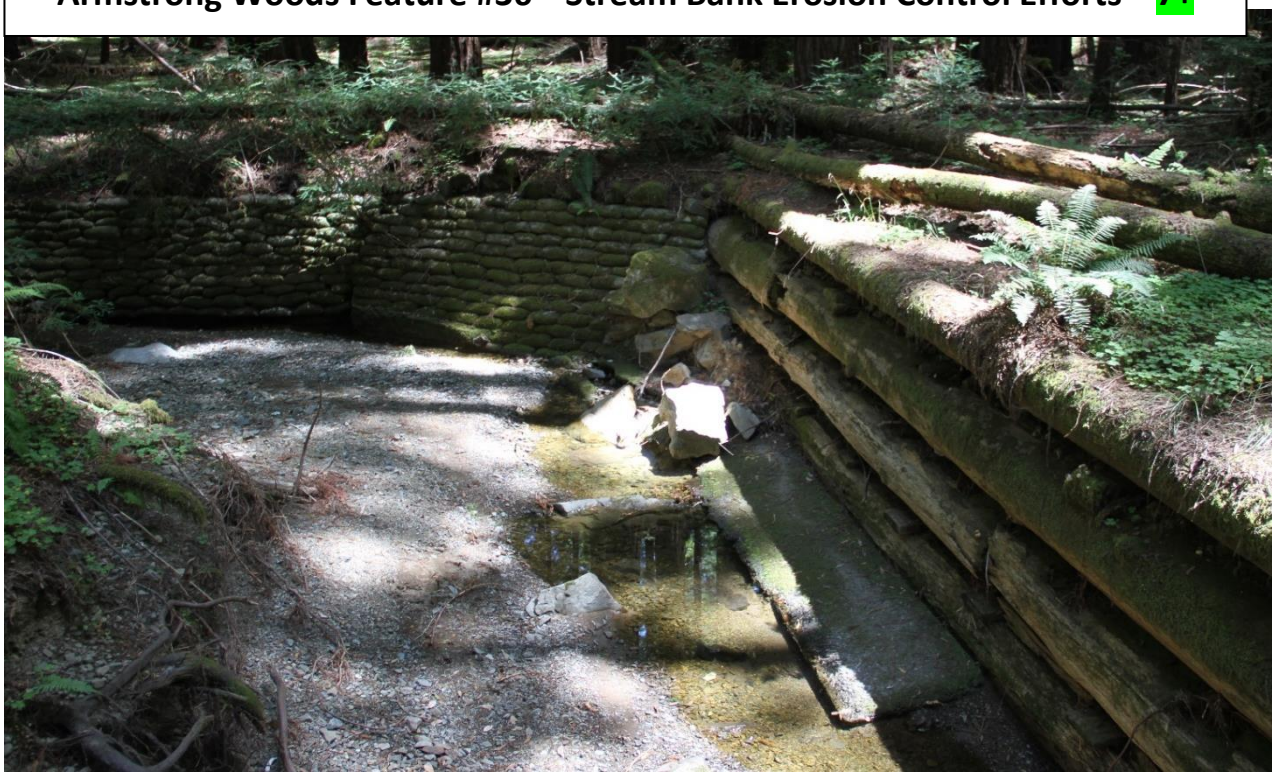
The undigested waste, basically saw-dust, fills the tunnel as the larva moves through the log. It is called "frass".

The California Prionus (root borer) beetle (above) is a long-horned wood borer whose larva feeds on the roots of many types of trees.

Other insects that will attack the wood include flat-headed wood borers, powder post beetles and carpenter bees. There are also several insects that feed on the leaves/needles.

Photo credits: Bark beetle: From Forestry Images.com by Javier Mercado
Bark beetle galleries by Mike Roa
Termite-damaged wood from Reddit by u/sverdrupian
Termites: from Flikr, by Don Loarie
Spined wood borer from iNaturalist, by W. Mason
CA. Prionus adult: from iNaturalist, by Cynthia Bardouka-Large
CA. Prionus larva: from iNaturalist, by Richard Wasson
round with hole and rulers, by Mike Roa

Armstrong Woods Feature #36 Stream Bank Erosion Control Efforts 7+



Fife Creek flows through the valley in Armstrong Woods. Over the years, the creek erodes its banks and changes its course.

In the winter of 1964-65 there were HUGE floods in northern California. People became concerned about the possibility of Fife Creek eroding its banks and undercutting trees and the road. So they installed concrete slabs, bags of concrete, and logs to try to prevent erosion. (This is called “revetment.”)

Unfortunately, revetment like that has a negative impact on fish habitat. Also, when the water hits the concrete and logs, it tends to reflect back and erode the opposite bank. In many places, such creek bank alterations are being removed and replaced with placement of “large woody debris” (logs) carefully placed in the creek bed.

What might happen if the creek erodes its banks and changes course?
(Things like roads and trails may be damaged and trees may be undercut and fall.)

photo: by Mike Roa

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Pomo Canyon Features Information for Docents

rev. 6.30.21

These pages show many of the features found along the trails at Armstrong Woods. They are intended for docent education. There are many more features illustrated than one would share with any one visitor group, but it is useful for docents to have the information in their mental tool box so that they can share it as appropriate, depending on the ages and interests of visitors.

The grade levels for which we consider the information most appropriate are given to the right of the title (4+, 7+, 9+, ALL, docents only).

Each page has one or more photographs on the top half and some information and possibly more photographs on the lower half. This is so that you can make them into 5” x 7” laminated cards that you can carry with you if you want to.

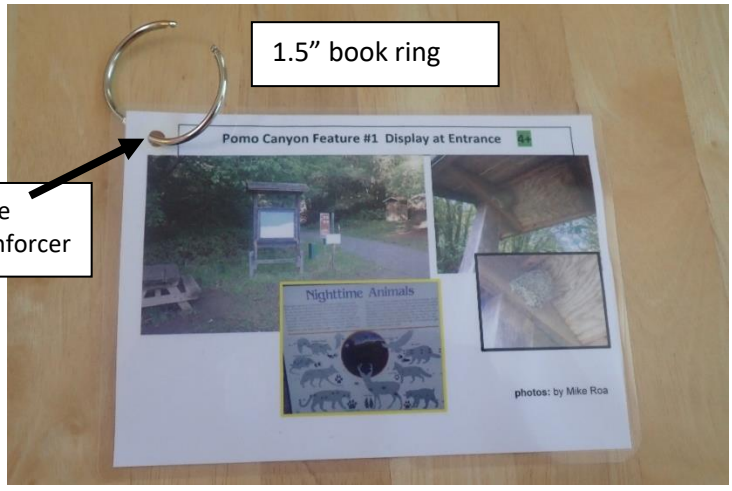
Many of the cards include questions that docents might ask visitors to stimulate their thinking. We have found that asking questions is a much better technique than just telling people facts. Questions engage the visitors more, and enhance learning by requiring them to think, rather than just listening. The questions are in ***bold italics***.

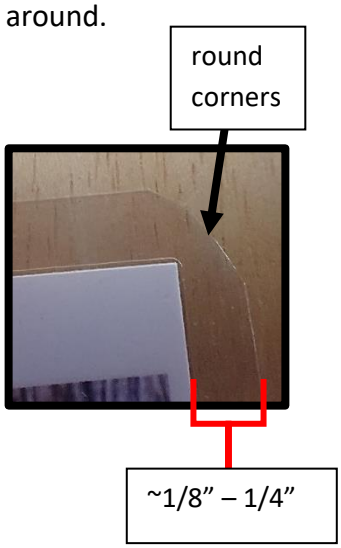
There are separate “sets” for Armstrong Woods and Pomo Canyon.

You can print and laminate whatever “cards” you want to carry with you, if any.

Laminating and Binding Cards:

9. Print the cards; cut to size (5”x7”).
10. Glue the information to the back of the photo.
11. Punch a hole in the upper left corner. Leave at least 1/4” of paper around the hole.
12. Add a hole reinforcer. (Clear reinforcers look better but are harder to attach than white.)
13. Laminate.
14. Cut so that there is a 1/8” – 1/4” margin of laminating material all around.
15. Round the corners.
16. Punch again and use a book ring to keep them together in order.

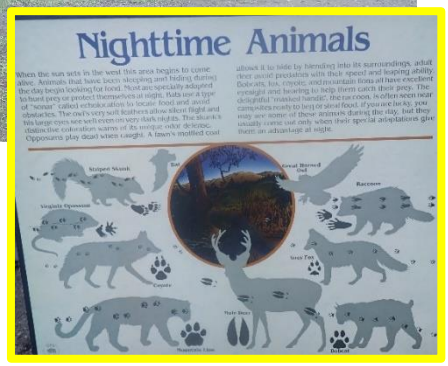




Pomo Canyon Features Information:

1. Display at Entrance
2. Bands of Vegetation
3. Alders
4. Stinging Nettle and Poison Oak
5. Living With Fire
6. Basal Sprouts on Redwoods
7. Basal Sprouts on Bay
8. Redwood Burls
9. Snags
10. Misshapen Redwoods
11. Split Douglas-firs
12. Springboard Notches
13. Hillside Stumps
14. Beetle Holes
15. Nurse Logs and Nurse Stumps
16. Fragile Area Sign
17. Bracket Fungus
18. Stump Enigma and Regrowing Stump
19. Large Flared Stump
20. Family Circles
21. Goose Pen?
22. Stream Bed and Rocks
23. Small Stump with Notches
24. Fallen Douglas-fir
25. Redwood Log with Beetle Signs
26. Large Stump Across Stream
27. Douglas-firs
28. Creek Rocks and Erosion
29. Roadside Plants
30. Roadside Plants for Docents

Pomo Canyon Feature #1 Display at Entrance 4+



photos: by Mike Roa

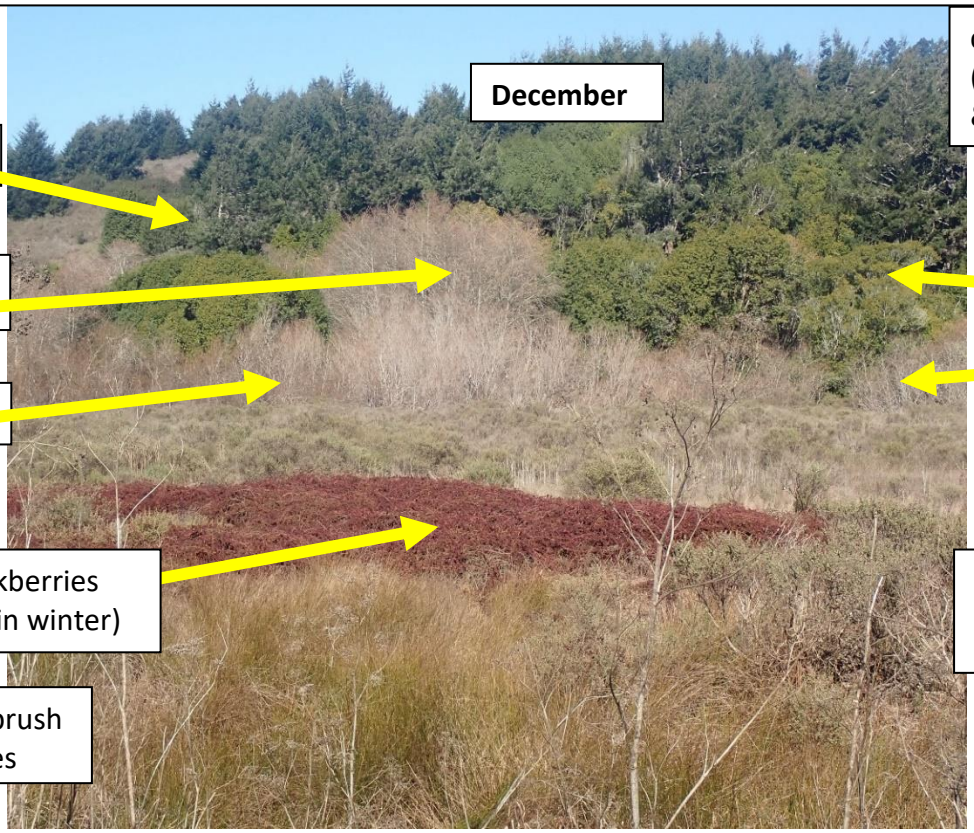
Check the display for any new or pertinent information.

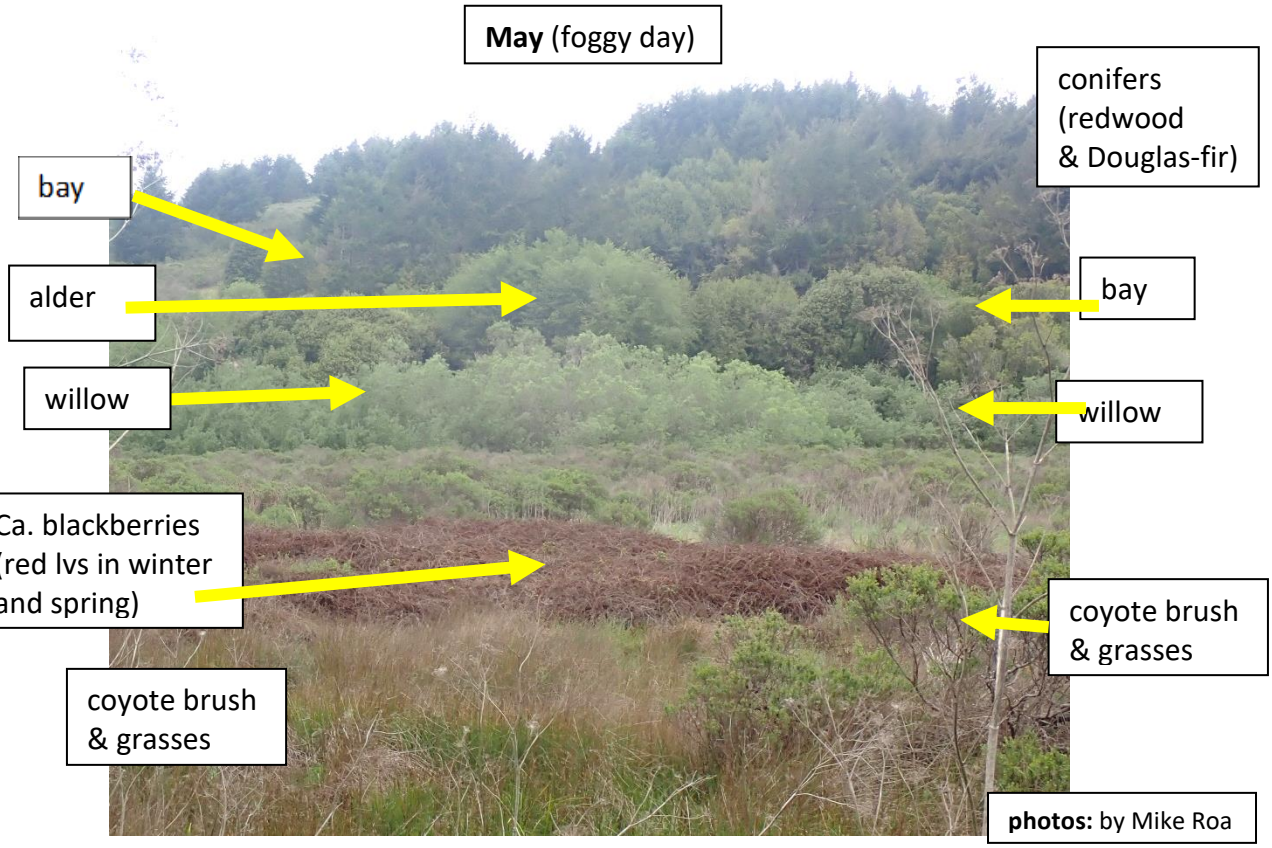
On the back of the display is a graphic showing “Nighttime Animals”, including tracks.

As this is written, there is a bird nest under the display roof. Cliff swallow?
Ask students what it is.
(The focus of kindergarten social studies and science is “homes.”)

See Pomo Feature Cards 2 and 3:
Looking eastward from the parking area one can see bands of different types of plants. The bands form because different plants need (or tolerate) different amounts of light and water.

Pomo Canyon Feature #2 Bands of Vegetation 4+





photos: by Mike Roa

Pomo Canyon Feature #3 Alders 7+

Red Alder trees along Willow Creek Road (left) and from Pomo Campground parking lot (above center and right) in **December** **photos:** by Mike Roa

Red Alder trees along Willow Creek Road (left) and from Pomo Campground parking lot (above center and right) in **June**

Pomo Canyon Feature #4 STINGING NETTLE and POISON OAK ALL

Stinging Nettle

right: flowers in late April

right: flowers in late May

Stringing nettle and poison oak are found mostly along the beginning of the Pomo Canyon valley trail. Docents should point them out to visitors.

Stinging nettle is found mostly near campsites 11 and 12, but also elsewhere:

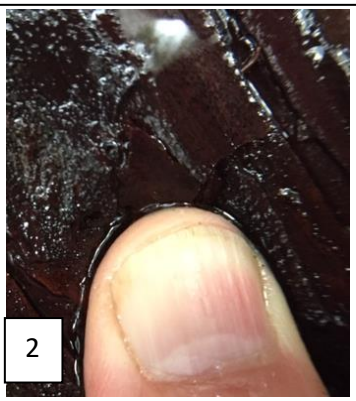
- The toothed, hair-covered leaves grow opposite each other around the stem.
- Leaves are soft and fuzzy.
- The stinging hairs, found on both the leaves and stems, contain an irritating chemical.
  The "sting" hurts for a short time and then diminishes, but can be felt for many hours.

Poison oak is found mostly near the entrance.

- "Leaves of three, leave it be."
- The stem also contains the irritating oils, even in the winter when they are leafless.
- The leafless stems often have short side branches jutting out like arms. "Stubby' arms can still do harm."

Pomo Canyon Feature #5 Living With Fire 7+


1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3


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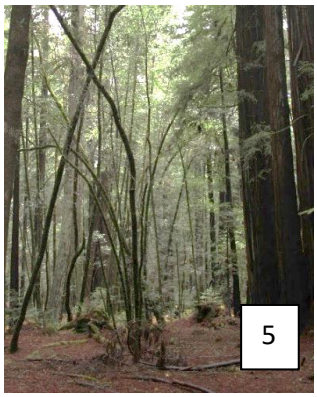

5


6

photos: by Mike Roa

Fire is a natural part of the ecosystem, and redwoods have several ways of surviving fires.

BARK: a. The bark is fibrous, not very flammable. Tannins in the bark also provide some fire resistance.
b. The bark is usually 3-8" thick, but can be over 12" thick in an old tree. **(1)**
c. Most natural fires would happen during thunder storms. With the storms comes rain. ***Have visitors press hands on redwood bark…notice that it is soft***…. During storms, or very foggy weather, the bark absorbs water like a sponge, which provides some protection against fire. **(2)**

If fire is suppressed for too long, fuel accumulates and when a fire does happen, it may burn hot enough to get through the bark, resulting in a fire that can kill redwoods. The wood and brush is the **fuel load. (3)** (Sudden Oak Death thus not only threatens the oak trees but the redwoods and other trees!)

Ask visitors why they think there is such a fuel load in Armstrong. Removing the fuel requires workers and equipment, which is expensive. **Controlled burning is problematic** because of the proximity to Guerneville. There is less of a fuel load in the Pomo Campground because campers have used the wood. But there is lots of down wood on the hillsides away from the campground itself.

Notice that most trees have shed lower branches. **(4)** This is called "**natural pruning"** or **"self-pruning**." ***How does that help trees survive fire?***

e. "Self-pruning" of shaded leaves conserves energy.
f. Trees depend on leaves to provide food via photosynthesis. If a fire burns the leaves in the canopy, the tree will lose its food source.
g. Removing lower branches removes the natural "**fire ladder**" that might allow fire to climb into the canopy. **(5)** If no fire has gone through the area in a long time, dead branches or other more flammable trees such as tanoaks may form a fire ladder that brings fire to the canopy
h. Even if the above-ground part of the tree is killed (or cut or breaks), the roots often survive. Redwoods are able to **sprout** from the root crown or root collar **(**called **stump sprouting. (6)**

Pomo Canyon Feature #6 Basal Sprouts from Redwood 4+

Look around for redwood trees sprouting at the base of other redwoods.

Redwoods can readily sprout from the root crown (root collar), or from a cut tree. If the roots aren't killed, this helps redwoods regrow after a fire. (The photo at the right was taken in Armstrong Woods about 7 months after the Walbridge fire.)

Whether from a root crown or a stump, this is usually called "stump sprouting." Trees that sprout from the above ground stump don't usually survive very long, while those that grow from the root crown/root collar may live for hundreds or thousands of years.

Redwoods are one of the few gymno-sperms that do this readily, but many angiosperms such as bay, tanoak, and fruit trees do.

photos: by Mike Roa

Pomo Canyon Feature #7 Basal Sprouts on Bay 4+

How would you describe the leaves of that tree?

Notice the sprouts growing from the base of the tree.
That is called **root crown sprouting** or, if the tree has been cut, **stump sprouting**
Bay trees root crown sprout and stump sprout quite readily.

As you walk today, notice that many bay trees bend. ***Why is that?***
Notice also that many of those have branches only on the top side. ***Why?***

Trees grow towards the light, and tend to put more energy into the branches that receive more light. (In a dark forest, it's all about competing for light.)

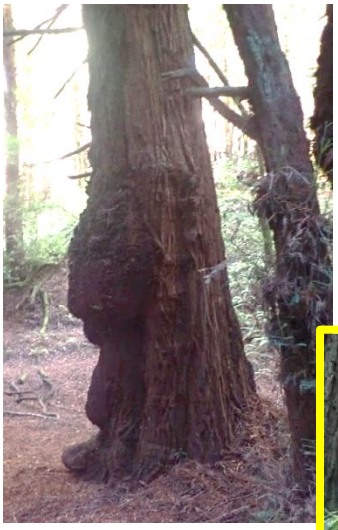
Look for green or yellow leaves on the ground.
Smush one up between your fingers. Smell your fingers. What do you notice?

This is a Bay tree. Have you ever used bay leaves in spaghetti sauce or soup?
Our Bay trees are of a different but related species.
The Bay is also called Laurel, California Bay, Bay-Laurel, or Pepperwood.

The Native Americans used bay leaves to keep insects from their sleeping areas and granaries. When hunting, they would also smear smashed leaves on their body to disguise their scent so that the prey wouldn't smell them.

photos: by Mike Roa

Pomo Canyon Feature #8 Redwood Burls 7+



Above:
near where the trail from camp-sites 1-10 comes down

Above and left:
Burl on tree at start of trail to campsites 1-10 (Pomo Canyon Trail.)

Bay with root crown sprouts can be seen across the trail.

photos: by Mike Roa

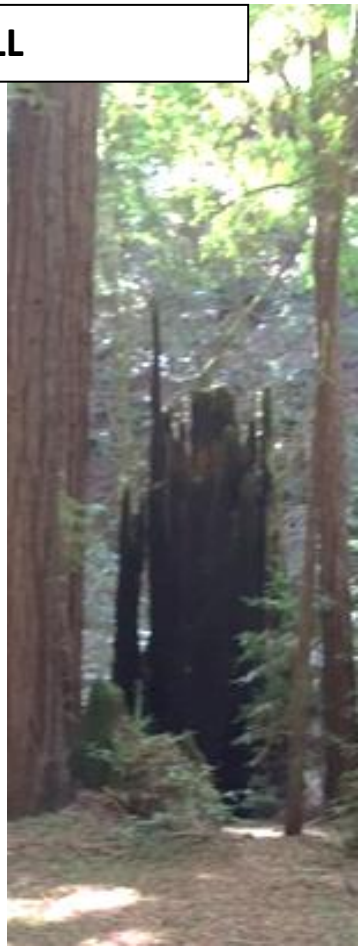
Since Pomo Canyon was apparently first logged in the late 1800s or early 1900s, the oldest trees, which would have had the largest burls, are gone. Some of the second growth trees have good sized burls, though.

Have students watch for them, and point out redwood branches, and, possibly, roots sprouting from them.

Discuss that there are also buds that form at the root crown, and that wood is also called burl wood (basal burl).

The coast redwood is one of only a few gymnosperms (cone-bearing plans) that readily sprout from the root crown. But many angiosperms, including bay trees, sprout from their root crowns. Bay trees also form burls. Watch for them.

Pomo Canyon Feature #9 Snags ALL



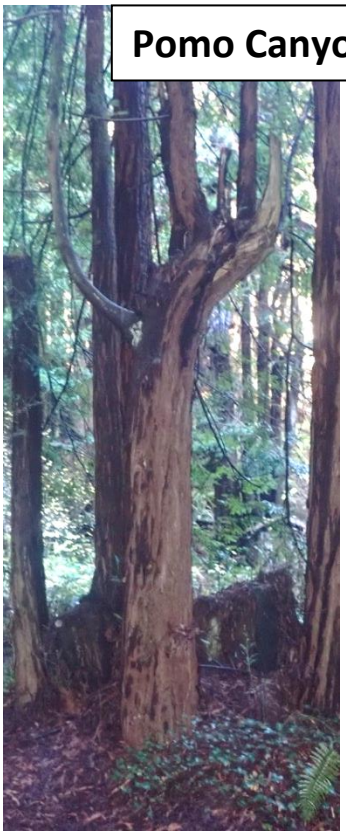
Do you see any dead trees, or the remains of dead trees? These are called "snags."

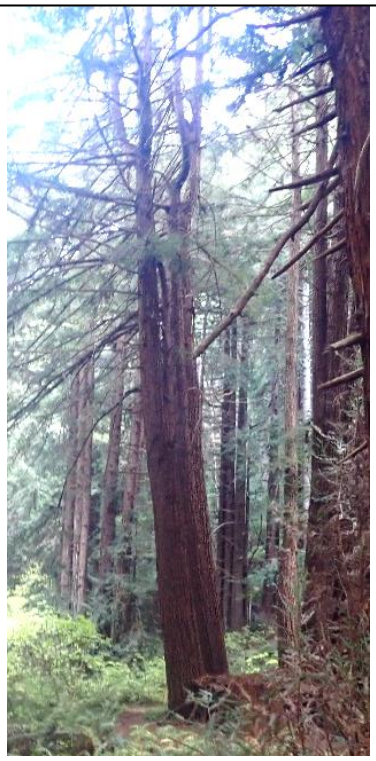
Snags are important to the forest ecosystem because they provide habitat for many different kinds of animals.

Over 600 types of plants and animals have been found to live on snags in the redwood forest!

photos: by Mike Roa

Pomo Canyon Feature #10 Misshapen Redwoods 7+





Most stands of redwood trees have an occasional tree that is misshapen, but for some reason there are many such trees at Pomo Canyon.

Some were probably broken during wind or (rare) snow storms, and the new branches grew outward as they grew toward sunlight.

(Several examples are visible at Campsite 1. Have visitors watch for other examples as they walk through the campground.)

photos: by Mike Roa

Pomo Canyon Feature #11 Split Douglas-firs 7+

From the trail near campsites 1-3 one can see several Douglas-fir trees that have double trunks beginning part way up.
Another (below) fell across the trail southwest of campsite 6.

This may have been caused by an animal such as a squirrel or porcupine feeding on the growing tip of the young tree.

Fallen Douglas-fir between campsites 8 and 9.

photos: by Mike Roa

Pomo Canyon Feature #12 Springboard Notches ALL

Stumps with Springboard notches at Campsite 16 and near Campsite 21.

Most of the stumps in the Pomo Canyon Campground are tall. (We did a quick survey of the stumps between the creek and the base of the hill to the southwest of the trail, from Campsite 11 to Campsite 21. Of the 74 stumps measured, the <u>average</u> height where it was cut was 5.5 above ground! And that included 23 cut at 3' or lower. The other 51 averaged over 7'!)
A little beyond Campsite 21 and across the creek there's a stump that was cut 17' above ground (on the downhill side)! (See Feature sheets # 17 and #24.)

WHY were the trees cut so far above ground?

1) The trees were so massive that they compressed the wood at the base so much that it became so dense that it would sink when they tried to float it to Duncan's Mill.
2) The massive trees also compressed the wood at the base so that it became wavy, which makes for pretty wood, but it isn't good for lumber.
3) Often, the bases of the trees were flared. Cutting through the wide, dense wood of the "butt flare" would be a lot of work for little usable lumber, co they cut above the flare.

HOW were they cut so far above ground?

The loggers would cut a series of notches in the thick bark and insert "spring-boards" on which they would stand. Many of the stumps in the valley floor don't show notches, possibly because the bark was so thick that the wood itself wasn't notched. Most of the stumps uphill (between Campsites 1 and 10) do show notches, maybe because the trees were smaller and had thinner bark. (See Carry Cards)

Pomo Canyon Feature #13 Hillside Stumps 7+

photos: by Mike Roa

These stumps, found along the trail from campsites 6-9, show the undercut on the uphill side.

ASK why loggers would want the tree to fall uphill.

1. If the top of the tree pointed downhill, it would be more likely to slide downhill, possibly hurting someone there or breaking.
2. It wouldn't fall as far before hitting the ground, so it would be less likely to break.

The stumps also show obvious springboard notches.

Ask whether the trees were cut before or after the fire.

(The notches are charred, showing that the fire was after they were cut.) (See Carry Cards.)

They also show an accumulation of branches and needles, mostly on the uphill side. When fires came through the area, this fuel caused the fire to burn most intensely on the uphill side. Note that most of the burned out stumps were burned most severely on the uphill side.

Pomo Canyon
Feature #14
Beetle Holes 7+

This stump is found on the downhill side of the trail from campsites 1-10, just before the trail joins the trail at the bottom of the canyon*.

Several holes made by emerging wood boring beetles can be seen.

Some people think that redwood is immune to attack by fungus and insects.

Rather, the tannins that give redwood its red color, in conjunction with its thick bark, make it resistant to insects and fungus, but not immune.

Ask: ***What would the forest look like if redwood were truly immune to attack by insects and fungus?*** (The forest floor would be a pile of down wood that hadn't decomposed!)

Another stump with beetle holes is just beyond the bridge that leads to campsites 17-19, between the trail and the creek. (See photo at right.)

photos: by Mike Roa

Pomo Canyon Feature # 15 : Nurse Logs & Nurse Stumps 4+

This "nurse log" is on the west side of the trail, just before the fence begins. On it can be found moss, sorrel, and a small bay tree. A trillium may also be seen next to the small bay.

Many stumps at Pomo have huckleberries growing on them. Moss, ferns, sorrel (*Oxalis*), and even redwood and tanoaks also sprout on them.

ASK *how many different types of plants they see. Have the students describe the plants*. They can make up names before you tell them the actual names.

ASK what the log or stump provides. (The decaying log acts like a sponge, holding moisture that plants need.)

ASK how the plants got there. (Seeds in animal droppings? Wind-blown seeds?)

The nurse log at the left is across the trail from the campsite 13 sign, between the trail and the creek. It is so covered with plants and so decomposed that it doesn't look like a log, but it is.

In April, 2021, we identified 7 different kinds of plants on it, including moss; *Equisetum*; 5-finger ferns, sword ferns, wood ferns; *Oxalis*, and Ca. blackberry.

photos: by Mike Roa

Pomo Canyon Feature #16 Fragile Area Sign ALL

Ask: Why do you think the fence and signs were put here?

These areas were heavily used for years because they are level and close to the entrance to the canyon.

Too much use caused trampling of the plants and loss of the duff layer that protects the soil from erosion and roots from compression.

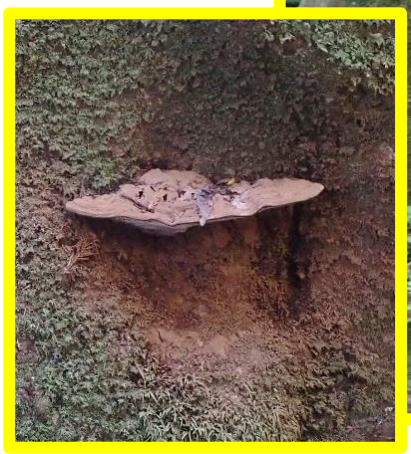
Park managers were concerned that the soil would erode into the creek and that root compression would harm the trees.

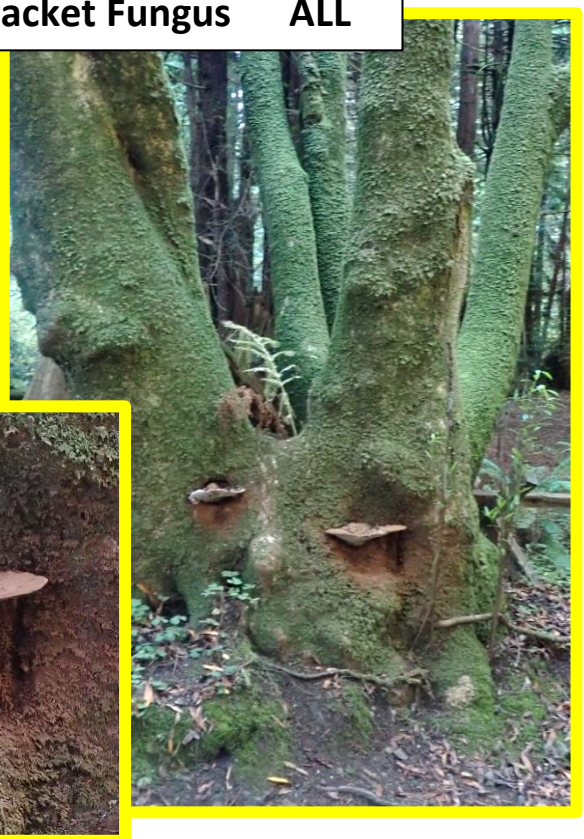
photos: by Mike Roa

Pomo Canyon Feature #17 Bracket Fungus ALL

below: in creek bed near campsite 11.

Right and below: bay tree by trail between campsites 12 and 14. The fungus was broken off in 2021, but it may regrow





These are a kind of fungus called Bracket Fungus, Shelf Fungus, or Artist's Conk.

These pictures were taken in the winter. Notice the brown spores coating the bay tree below the fungi.

Why would they be called shelf fungus?

Why would they be called Artist's Conk? The underside of the fungus is soft and white. If it is scratched, it turns brown. Sometimes people break them from the tree or log and draw on them.

Would it be okay to break these off? Why not? (Someone broke them off in April of 2021. Let's hope they regrow.)

Image at right from Flikr, by Joyce
other images by Mike Roa

Pomo Canyon Feature # 18 A Stump Enigma

You probably won't share this with visitors.

The pictured stump is between the trail and the creek, in the fenced off Fragile Area, not far beyond campsite 12 as you enter the valley.

If you look closely, you can see that the loggers started to fell it about 3 feet off the ground. The horizontal saw cut is only part way through, and you can see that they used axes to complete the undercut.

For some reason, they then cut it about 7 feet above ground.

There's another similar stump nearby, with the partial undercut at about 2.5' above ground and the final cut at about 13'

Why did they start a low cut and then cut higher?

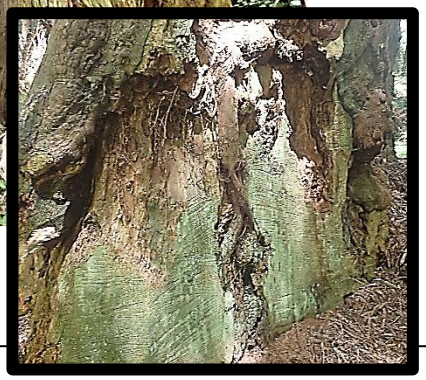
Photos: by Mike Roa

Pomo Canyon Feature # 18 A Regrown Stump

You probably won't share this with visitors.

The pictured stump is between the trail and the creek, in the fenced off Fragile Area. It isn't far from where the trail comes down from campsites 1-10.

From the trail, one can see a cut stump with a tree growing to the left, and the tree has some burls formed around the base.



On the other (creek) side, there is a large vertical cut. I (Mike Roa) think that someone cut off a very large slab of burl wood there.

Photos: by Mike Roa

Pomo Canyon Feature #18 Large Flared Stump 7+

same stump from uphill side

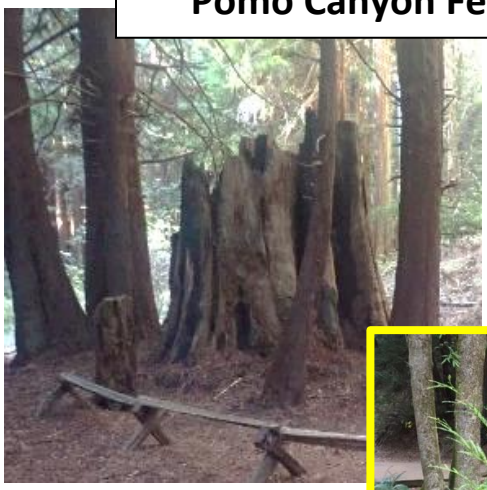
This large stump is near the end of the fence on the west side of the canyon floor trail, just before the trail from campsites 1-10 joins the canyon floor trail.

It was cut about 15’ above ground level. It was probably cut that high to get above the wavy wood at the base, which makes poor lumber, and because it flared out at the base. (Cutting through the flared base would be a lot more work for not much lumber.)

I estimate that the tree probably had a diameter of around 15’ at the base and around 12-13’ where it was cut. (A circle with a 15’ diameter would have an area of ~177 square feet, while a 13’ diameter circle would have an area of only ~133 square feet. So cutting at a 13’ diameter would reduce the sawing by about 25% as compared to cutting at a 15’ diameter.)

photos: by Mike Roa

Pomo Canyon Feature #19 Family Circles 4+



root crown sprouting

photos: by Mike Roa

Notice that these trees are growing around a rotted stump.

This is called a "**family circle**." The circle of trees sprouted from the root crown (or root collar) of the tree that was cut.

Root crown sprouting, or stump sprouting, is an important way that redwood trees reproduce.

(Discuss why seeds seldom survive to germinate: (1) low fertilization rate because they are wind pollinated, (2) animals eat them, (3) fungus attacks them, and (4) because of the thick duff layer, the roots dry out before they can reach soil.)

But if soil is exposed in a root pull, landslide, fire, or silt from a flood, seeds can germinate.

Since the sprouted trees in the circle all came from the root crown of a previous tree: ***Can they be considered to be that same original tree?*** If so, these trees began their lives when the original tree from which they sprouted began its life. And if that tree sprouted from another tree's roots, it could be considered that same tree…and one might go back several "generations" of sprouted trees. Let's say that the trees in the current family circle (Call it generation A) are 100 years old. If they sprouted from the root crown of a tree that was 1000 years old (generation B), Gen. A could be considered to be 1100 years old. And if Gen. B sprouted from a 1000 years old Gen C., Gen. A would be 2100 years old. Could you go back even more generations? Might Gen. A be to be 10,000 years old?

Look around…Do you see trees sprouting from the root crowns of living trees?

photo: by Mike Roa

Pomo Canyon Feature #20 Goosepen?? 4+

photo: by Mike Roa

All of the large trees in Pomo Canyon were cut and removed prior to the last fire, so no goosepens were formed in living trees by that fire.

But some of the stumps are hollowed out, especially on the uphill side. Some of these may have been goosepens that formed before the tree was cut.

The stump pictured is across the trail from campsite 14. No charring is evident on the top of the stump, which may indicate that it formed before the fire, but when the tree was cut above it the newly cut wood was uncharred. Or maybe the charred wood from the top has just worn away in the last 100 years.

They may also have formed in stumps when the fire came through.

Note that the most severe burning was usually on the uphill side, where fuel accumulated.

Pomo Canyon Feature #21 Stream Bed and Rocks 4+

Most of the rocks in the stream bed are a sedimentary rock called greywhacke. But chert, blueschist, and serpentinite may also be found.

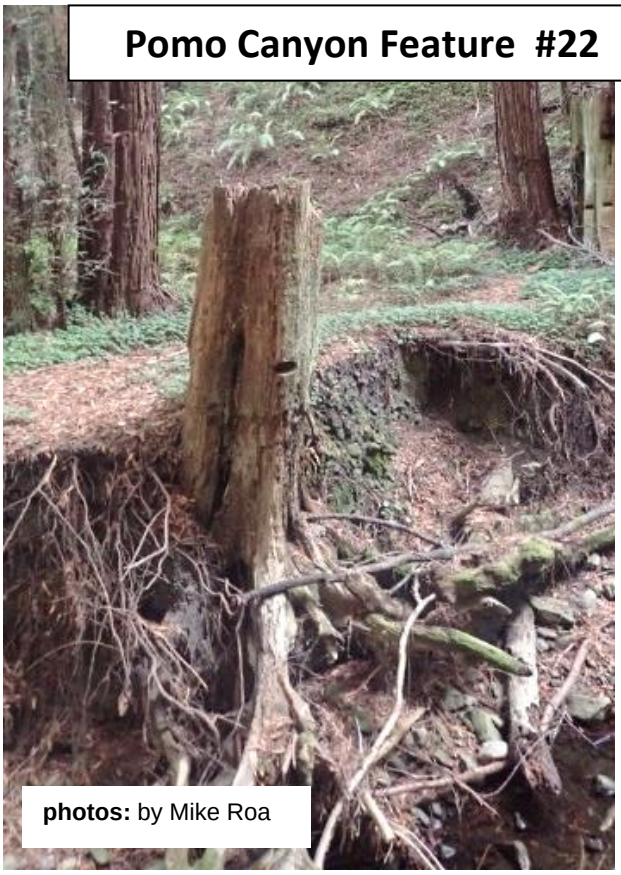
Note the roots hanging out above the creek.
Do you think that they grew out into the air that way?
What happened to the soil that used to cover them?

Look at the rocks in the stream bed.
Are their edges completely rounded, somewhat rounded, or not rounded at all?
What causes rock edges to become rounded?
Do you see a greenish tint on the rocks? What might that be?

Look at the rocks embedded in the stream bank.
Are there rocks embedded in it?
Do those rocks look like the ones in the stream?
How do you think they got into the stream bank?

photo: by Mike Roa

Pomo Canyon Feature #22 "Small" Stump w/ Notches 9+



photos: by Mike Roa

Use a stick to act out cutting a tree with a whipsaw. At what level does one naturally cut the tree? (Probably around waist or chest high.)

Point out to students that many trees in Pomo Canyon were cut well above ground level. Some were cut over 10' above ground! ASK:

(1) ***WHY were they cut so high?*** *and*
(2) ***HOW were they cut so high?***

This tree, which can be seen across the creek from campsite 21, was cut around 5' above ground. It has a diameter of only about 31 inches where it was cut.

I'm not sure why it was cut so high. (Maybe the wood was wavy even though the tree wasn't all that massive?)

Point out the roots, which have been exposed by the creek. ***What will happen to the stump as the creek continues to erode the soil?***

Pomo Canyon Feature #23 Fallen Douglas-fir 4+

photos: by Mike Roa

A bit past campsite 21 a Douglas-fir fell across the trail and has been cut.

Growth rings can be seen in the sections that were removed and in the trunk itself.

Discuss what growth rings represent.

Students can count the growth rings to determine the age of the tree at that point.

Ask: I*s the age at the point of the cut the age of the tree?*

Where would we have to count the rings to get the actual age of the tree when it fell?

Have students feel and describe the bark of the Douglas-fir and compare it to redwood bark.

Several kinds of fungus are growing on the dead tree.
Discuss decomposition.

Ask: *What would happen if fallen trees didn't decompose?*

Pomo Canyon Feature #24
Redwood Log w/ Beetle Signs 7+

photos: by Mike Roa

This redwood log is a bit farther along the trail.

“Engravings” made by beetles can be seen where the bark has come off, as can holes where the adults emerged.

Pomo Canyon Feature #25 Large Stump Across Stream 7+

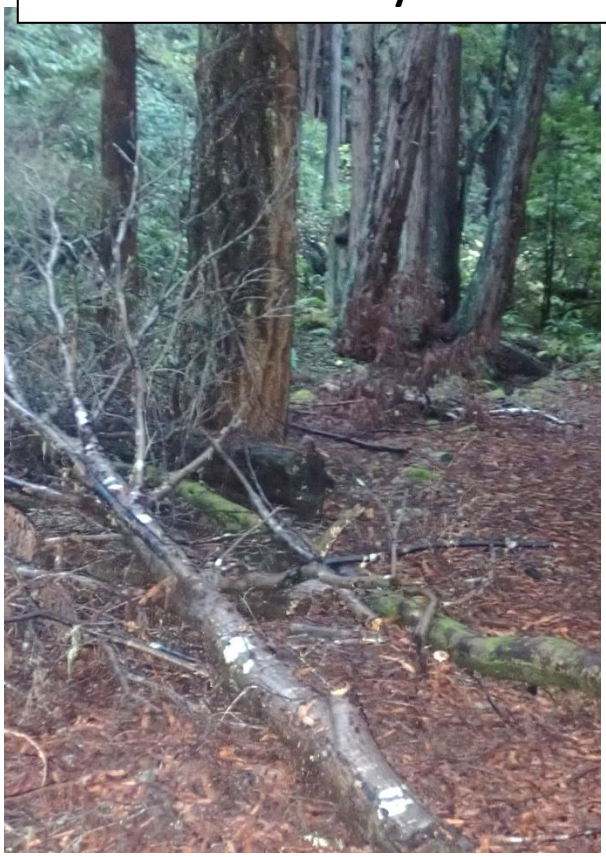
This large stump can be seen across the creek, from a little beyond the redwood log with the beetle engravings.

It has a circumference of about 38’ where it meets the ground on the uphill side, but much of the tree is burned away on the uphill side. I (Mike Roa) estimate that it had a circumference at the base of about 44’ when it was cut, which would give it a diameter of around 14’.

It was cut about 17’ above ground on the downhill side and over 10’ above ground level on the uphill side.

photos: by Mike Roa

Pomo Canyon Feature #26 Douglas-firs 7+



Douglas-fir by Trail

The fallen tree (lower left) is a young Douglas-fir.

Just beyond it is a larger living Douglas-fir.

Have visitors feel and describe the bark of both the young and mature Douglas-fir and compare it to redwood bark. Also look for cones.

photos: by Mike Roa

Have visitors look across the creek.

Point out that there are both redwood and Douglas-fir trees growing on the hillside.

Can they distinguish between them at a distance?

Pomo Canyon Feature #27 Creek Rocks and Erosion 4+

photos: by Mike Roa

Campsites 20-21 have a good view of the creek.

Ask students to observe how the creek is cutting into the bank and to look at the rocks embedded in the bank

Also observe the sizes and shapes of the rocks. **Agular** edges indicate that they have not weathered much. **Rounded** edges indicate that tumbling in the stream and other rocks bumping into them have worn themn down.

Ask: What will happen to the shape and size of the rocks as they are moved downstream by the water, eventually to reach Willow Creek and then on to the Russian River and then on to the ocean?

Point out that many rocks are exposed in the far bank by the cutting of the creek. Over the centuries, rocks have alternately been deposited and exposed by erosion as the creek as it changed course.

Pomo Canyon Feature # 28 **Roadside Plants** **7+**

Challenge students to try to identify the types of trees that they learned about today as they leave the area.
They will see:

- **red alder**
- **willow**
- **coast redwood**
- and **Douglas-fir**, at least.

Redwoods and Bay trees can be seen as they leave Pomo Canyon.

Red alder trees and willow trees/bushes can be seen along the road to Willow Creek Road and along Willow Cr. Rd.

photos: by Mike Roa

Pomo Canyon Feature # 29

Roadside Plants for Docents

As you head out from Pomo Canyon on Willow Creek Road, some scouring rush can be seen to the right of the road less than 0.1 miles after the barn.

In the early spring (May) the new plants (right) are more colorful than the older ones (left).

photos: by Mike Roa

Pomo Canyon Feature # 29

Roadside Plants for Docents

As you leave Pomo Canyon via Willow Creek Road, the dead alder tree pictured is on the left, about 0.1 miles after the first bridge that you cross (the one with the salmon painting).

If you have some time, you might watch for the woodpeckers.

If you can identify the species, please let me know and I'll update this document.

photos: by Mike Roa