Nine Trees of the Santa Cruz Mountains

"Pay attention. Be astonished. Tell about it."
-- Mary Oliver

A dozen miles west of Silicon Valley stand the Santa Cruz Mountains. They're a series of ridges rising two or three thousand feet and cut by steep stream valleys. Nine California native tree species dominate the forest that covers these mountains.

I'll introduce you to what I love about them through pictures and the stories they tell.

Have fun with it!

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Introduction to the Second Edition

The Santa Cruz Mountains form a long, forested spine along the Pacific side of the San Francisco Peninsula. This forest is special, with almost all trees above 1,000 feet belonging to just nine California native species: Coast Redwood, Douglas Fir, Bigleaf Maple, Black Oak, Coast Live Oak, Tanbark Oak, California Bay Laurel, California Buckeye, and Pacific Madrone.

I love to spend time among them. If I pay attention, there is always something new to notice. These discoveries make me happy.

Although anchored in place, these nine tree species exchange pollen via wind and pollinators in intricate and sometimes unlikely ways. They produce leaves, flowers, and fruits in remarkable variety. This book shows the details of how they do it.

Photos, diagrams, and paintings guide this exploration. Drawn from a collection of over 140,000 images donated to my website, PlantID.net, each picture captures a small moment in a tree's life. Just as when you notice something in the woods, each page focuses on one small scene. Together, they build a portrait of the trees. Try it. Turn to a random page and see how the details draw you in.

Most of this book consists of nine Photo Essays that share my favorite observations. Following these essays, an Easy ID section compares the leaves, flowers, fruits, and bark of our nine trees. A Glossary introduces the fundamental structures plants use in reproduction.

This book invites you to slow down, look closer, and discover beauty in the details of this special place.

Bigleaf Maple female flower

Douglas Fir winged seeds

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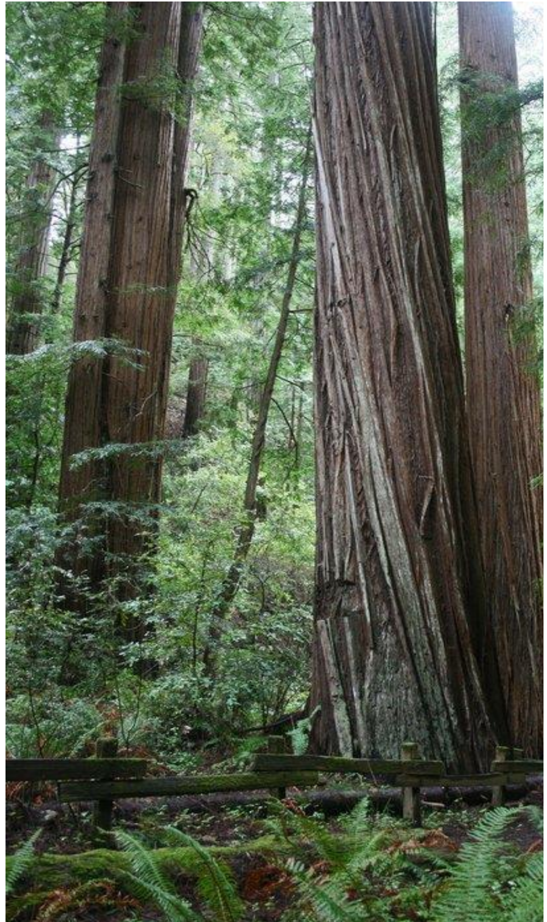
Coast Live Oak massive sideways limbs

Coast Redwood

Coast Redwoods (*Sequoia sempervirens)* create forests of filtered light where direct sunlight is rare and moisture lingers. Where they gather in groves, temperatures can be 10 degrees cooler than outside. Coast Redwoods create the living conditions for everything underneath.

Redwoods are columnar giants. Their shallow roots interlock, creating a stable foundation. They can live for 500 to 2,000 years. Over those centuries, they withstand dozens of fires, floods, and insect attacks. As they steadily grow bigger, they become kings of the forest, frequently reaching over 200 feet tall.

Photos by Susan Mayne, Wilde Legard, and © Neal Kramer



Coast Redwood

Coast Redwoods are the tallest trees in the world. The tallest recorded Coast Redwood is about 380 feet tall.

A unique community of ferns, shrubs, and wildflowers grows in Coast Redwood groves. Over time, redwood needles form an acidic layer of decomposing litter and organic matter that holds moisture and influences which plants can thrive. See my book, *Plants of the Redwood Grove: A Beginner's Guide*, for an introduction to the plants that grow in this special habitat.

Photo by Susan Mayne

Coast Redwood

Coast Redwoods do best in cool, rainy, foggy valleys along the Pacific coast of northern California, where ocean air meets steep terrain and summer drought is softened by persistent coastal fog.

In a special adaptation, they can receive up to 30 percent of their water from fog, absorbed through their needles and young branches. As water condenses on the foliage, some is taken directly into the tree through young, expanding shoots and newly formed needles. This is particularly useful as trees grow taller, because lifting water hundreds of feet requires tremendous upward pull in the xylem, the tree’s water-conducting tissue.

Photo by Zoya Akulova-Barlow

Coast Redwood

Flat, fan-like needles in the shade

Most redwood needles are flat and grow in distinctive fan-like sprays that pinch between each year's growth. New growth is pale green, soft, and flexible at first, turning darker with age as the needles thicken.

After three or four years, needles turn tan and fall from the tree, creating a pale-colored blanket on the dark forest floor. I can always tell when I'm walking under Coast Redwoods because the forest floor shifts to a lighter color. Needles muffle sound and help hold moisture in the soil.

Photo by Susan Mayne

Coast Redwood

Thick, waxy needles in the sun

A second kind of needle grows high in the tree, where branches are exposed to sunlight, wind, and fog, away from the shady forest floor. These needles are shorter, thicker, and awl-shaped, lying close against the branch.

With a smaller surface area and a thicker waxy covering, they are effective at conserving water, which is vital in hot, windy conditions. Their dense arrangement helps trap fog droplets, some of which can be absorbed directly through the leaf and twig tissues. Water absorption and retention support photosynthesis and other life processes high in the canopy.

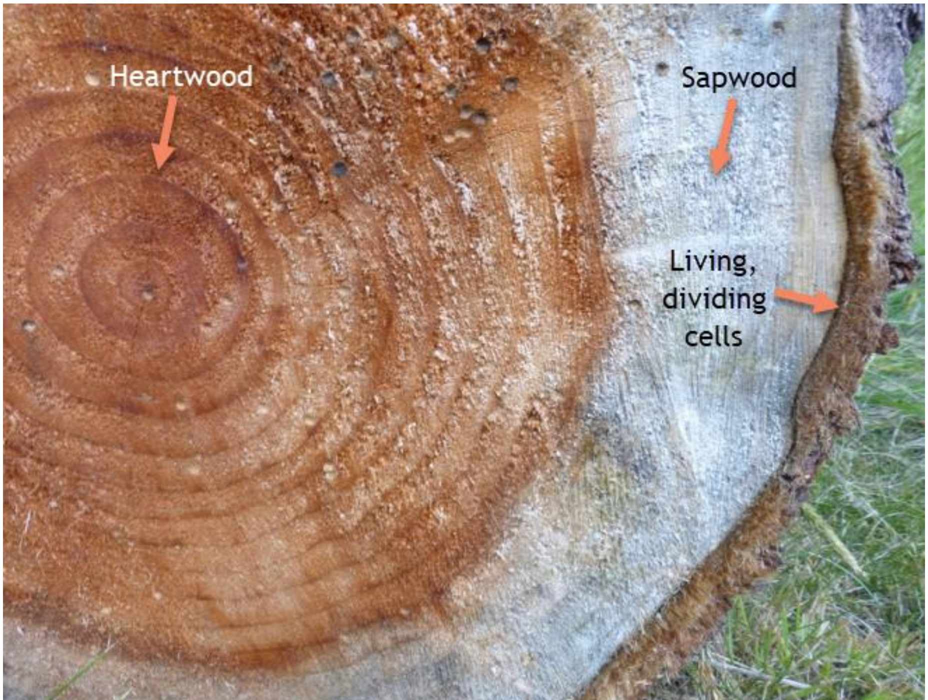
Photo by Zoya Akulova-Barlow

Coast Redwood

The red center of the trunk is heartwood, composed of dead cells infused with red, sweet-smelling, decay-resistant compounds that strengthen the wood. Surrounding it is pale sapwood, which conducts water upward. Just inside the bark are dividing cells that create new wood each year.

Over many centuries, the fibrous outer bark can thicken to nearly a foot. This thick, tannin-rich bark protects the tree from insects and fire. Unlike many other conifers, which rely on flammable resin for defense, Coast Redwoods depend on thickness and chemistry. This ancient strategy allows them to survive dozens of fires over their long lifetime.

Photo by Zoya Akulova-Barlow



In 2020, a large fire in the Santa Cruz Mountains swept through Big Basin Redwoods State Park. Trunks were charred and nearly all living needles died. Yet within a few years, hundreds of small green twigs emerged from dormant buds in the bark, forming a dense thicket of new shoots.

Coast Redwoods are among the few conifers that readily resprout after severe fire, drawing on stored energy in their massive trunks and roots. The species name, *sempervirens*, is Latin for "evergreen" or "ever living," reflecting this tree's ability to recover from extreme damage.

Photo © Neal Kramer – all rights reserved

Coast Redwood

Bud-filled burls respond to stress

Unlike most trees, Coast Redwood can sprout new growth directly from its base or trunk. It forms burls, woody swellings packed with dormant buds that can produce new shoots if the tree is damaged. These buds function like a seed bank embedded within the tree, ready to grow when conditions change.

In addition, if a tree is severely damaged or dies, burls in the original root system can start new daughter trees, each with its own root system and trunk, often producing a ring of genetically identical trees around the parent.

Photo by Zoya Akulova-Barlow

This Coast Redwood stands at the edge of a road cut where soil has been removed and the slope destabilized. It has developed a buttress at its base, helping it remain upright by widening the trunk and distributing mechanical stress into the surrounding soil.

When the root system is strained by erosion, slope instability, or soil disturbance, it can respond by producing new growth that explores for more stable conditions. At the bottom of this photo, a rounded burl is sending out shoots that reach toward the ground. They're seeking a place to take root and provide additional support, further stabilizing the tree on this altered slope.

Photo by Bruce Homer-Smith

Coast Redwood

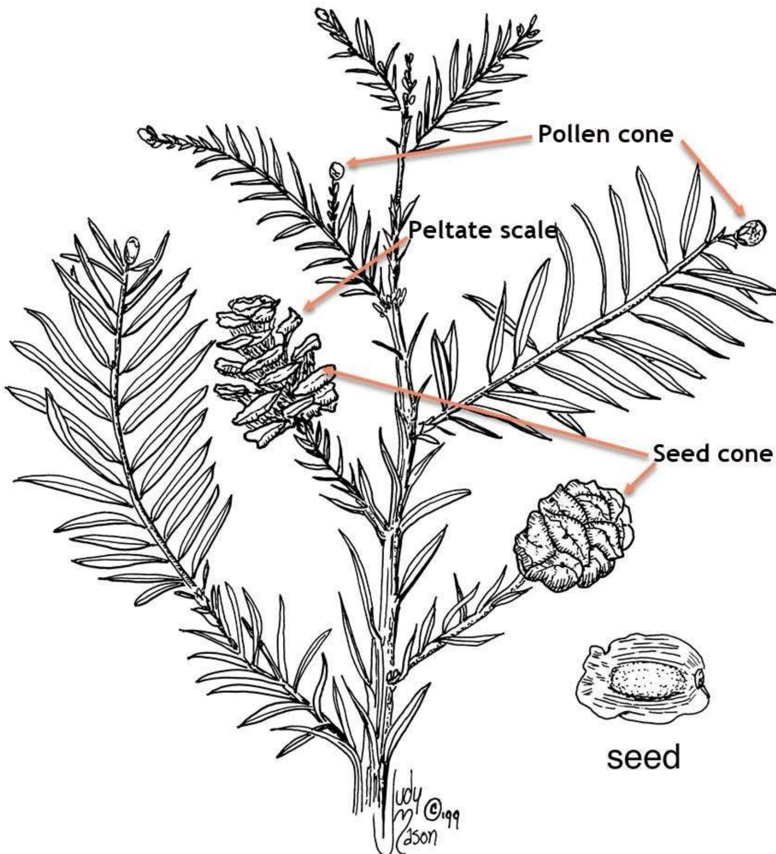
Coast Redwoods reproduce with two kinds of cones, male pollen cones and female seed cones, often borne on the same tree.

Tiny yellow pollen cones release vast quantities of pollen in late winter.

Female seed cones receive wind-borne pollen, then close up and become woody.

Seeds are tiny, about the size of a sesame seed, and each has a small wing that helps it drift on the wind.

Illustration by Judy Mason



Male pollen cones form at the tips of branchlets and are about ⅛ inch across, clustered in small groups.

Each pollen cone contains many small pollen sacs, and each sac holds hundreds of pollen grains. As the grains develop, the cone swells slightly and turns a deeper yellow. At maturity, the sacs dry and split open, releasing clouds of pollen into the wind, which carries them to female cones on nearby trees. This random method has proven effective for millions of years because vast numbers of pollen grains are released.

Photo by Zoya Akulova-Barlow

Coast Redwood

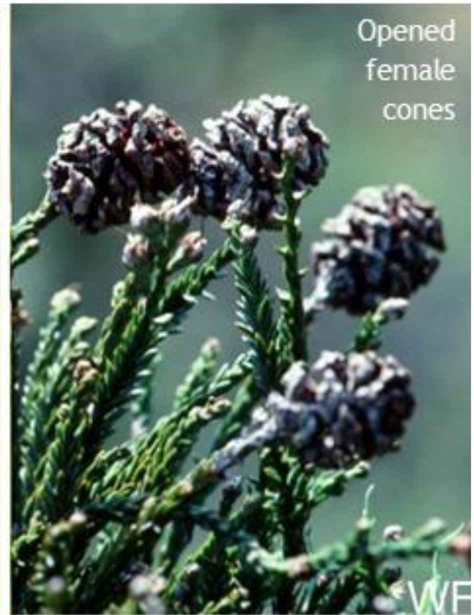
Female cones protect naked seeds

Female cones often form at the tips of high branches, where abundant sunlight fuels photosynthesis, which supplies the sugars needed for seed development.

New cones (on the left) secrete tiny pollen drops between their scales. If a viable pollen grain sticks to a drop, the drop contracts, bringing the pollen into the cone to an ovule and initiating seed development.

When cones mature, they open up, dropping their seeds to the ground. However, seeds succeed only if they find bare soil. Their tiny roots can't reach the dirt if they fall on a pile of needles.

Photos by Neil Kramer and William Follette



Coast Redwood

Coast Redwood groves are stable communities that can persist for centuries with little change.

Where they take hold, Coast Redwoods dominate the landscape, creating a distinct habitat of ferns and shade-loving shrubs that flourish in damp, acidic soil. Their tall canopies gather summer fog and, as moisture condenses, droplets fall to the forest floor, reinforcing the cool, damp conditions they require. This forest ecosystem is one of the most striking on Earth: tall, long-lived, and tightly bound to its coastal climate.

Photo by Brandon Piper, Wikimedia

Douglas Fir

Douglas Fir (*Pseudotsuga menziesii*) and Coast Redwood are the dominant needle-bearing conifers in the Santa Cruz Mountains. Douglas Fir thrives in a wide range of conditions and is commonly found on well-drained slopes throughout these mountains and across the Pacific Northwest.

Its wide-spreading roots anchor the tree in thin soils and help it withstand summer drought.

Short single needles radiate in all directions. Cones have prominent "mouse tails" hanging between the scales. No other local cone has these.

Paintings © John Muir Laws

Photo Walter Siegmund

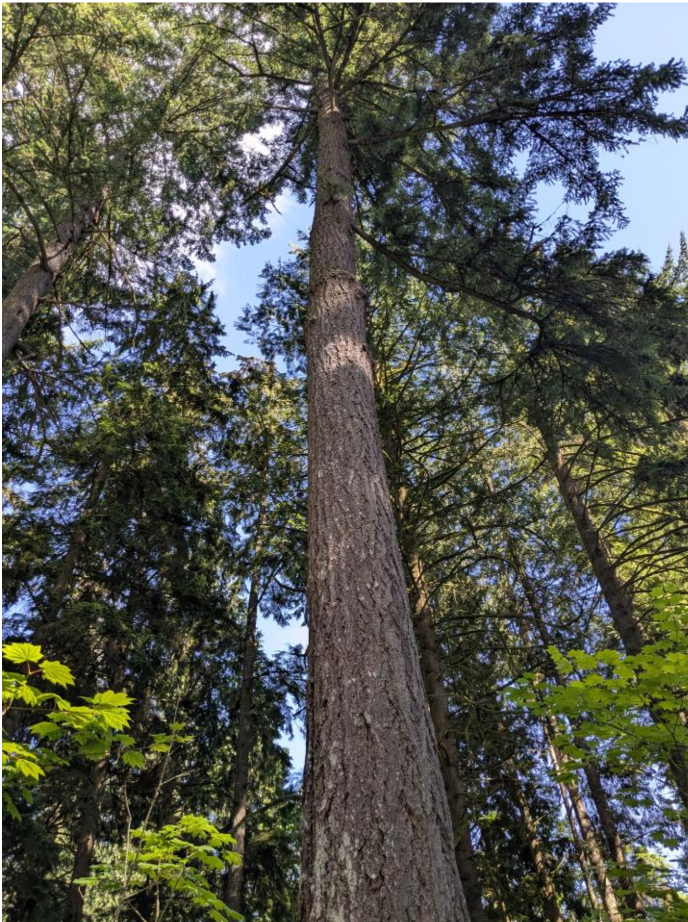
Douglas Fir

Widespread in the Pacific Northwest

In favorable conditions, Douglas Fir can grow over 200 feet tall and live for more than 500 years. Mature forests have tall, straight trunks that are widely spaced, creating an open, spacious feeling on the forest floor.

Douglas Fir does best with reliable moisture and well-drained soils. It is widespread along the northern California coast and the western slopes of the Sierra Nevada, extending north to British Columbia. Its thick bark and deep roots allow it to withstand periodic fires, and its winged seeds are widely dispersed, enabling it to colonize disturbed areas.

Photo by Bernini123 at Wikimedia Commons



Douglas Fir

Single needles in all directions

Single needles grow all around the twig. They're about one inch long. Unlike flat redwood sprays, these needles radiate in all directions, giving the branch a full, cylindrical appearance. Branches often droop slightly, creating a layered look. They're soft to the touch.

Each spring, stems grow new segments covered with needles. The needles live about eight years and then brown and drop, usually near the end of summer.

Photo by Keir Morse

Douglas Fir

Lopsided, oval needle pegs

Douglas Fir needles attach to the twig on small, lopsided, oval pegs. After the needles fall, the pegs remain, leaving the twig rough to the touch. These attachment points are arranged in a spiral. The needles twist at their bases, exposing their wide sides to the light to improve photosynthesis.

Douglas Firs have lopsided, oval needle pegs.

True Firs have no pegs; needles attach directly to the twig.

Spruces have round, more prominent, upright needle pegs.

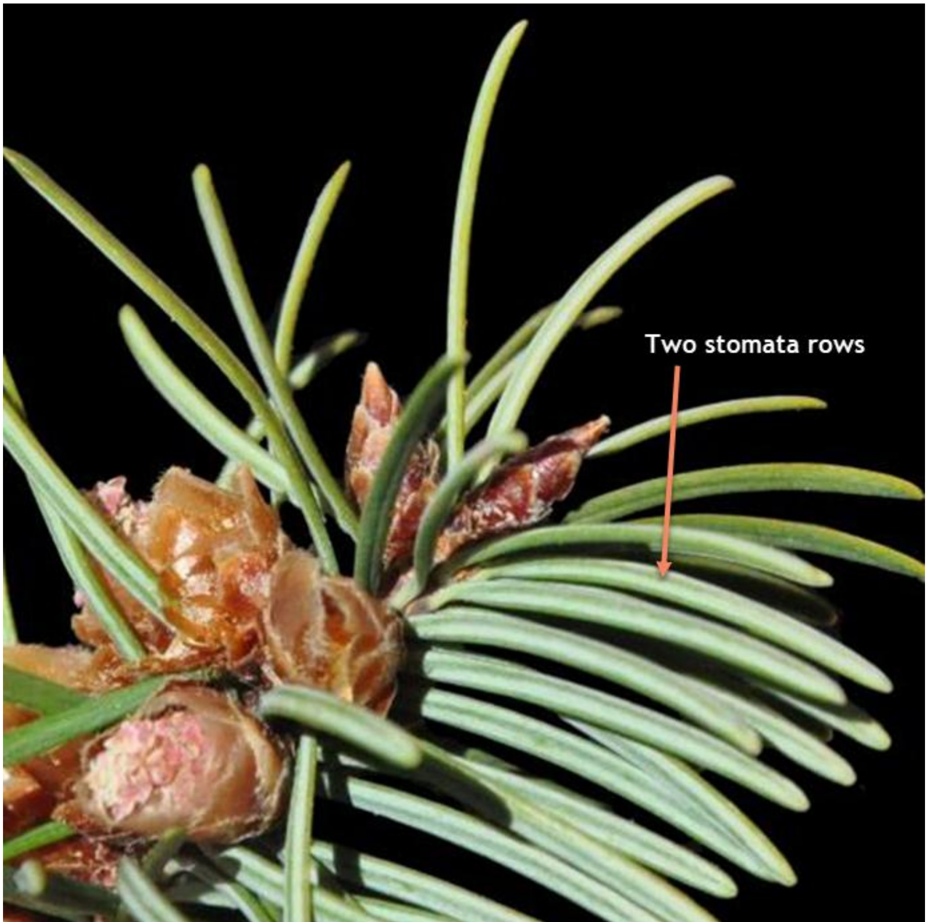
Photo by Keir Morse

Douglas Fir

Douglas Fir needles are flat with blunt tips and rounded edges. Their upper surfaces are solid and dark green, while the undersides, pictured here, show two pale bands formed by rows of stomata running the length of each needle, giving it a subtly striped appearance.

Stomata are tiny pores that control when gas can enter or leave the needle. During the day, when light and moisture are sufficient, they open to take in carbon dioxide for photosynthesis, releasing oxygen. Water vapor also escapes, cooling the needle and helping pull water and minerals up the tree. At night, when photosynthesis stops, the pores tighten, helping the tree conserve water.

Photo by Frank Rose



Douglas Fir

Buds protect future growth

The buds you see here are about half an inch long and are covered with overlapping, resin-coated scales. Within each bud is a short shoot bearing many tiny developing needles, already arranged in a spiral. In spring, the shoot will elongate, and each needle will expand to full size.

Rounder buds hold the tree's future cones. Male pollen cones cluster along one-year-old twigs, often on lower branches, while female cones hang down from the tips of upper branches where greater light fuels seed development.

Photo by Zoya Akulova-Barlow

Douglas Fir

Male cones and wind pollination

In spring, male pollen cones emerge, about half an inch long. They're packed with orange pollen sacs, each filled with developing pollen.

After several weeks of ripening, the pollen matures. When the weather turns warm and dry, the sacs split open, releasing clouds of fine, powdery grains. Light enough to ride air currents for miles, some grains will eventually land on the receptive female cones of other trees.

Photo by Keir Morse

Meanwhile, female seed cones emerge from orange-tinged buds in the upper branches.

Early cone scales are pale purple, soft, and slightly parted, leaving space for airborne pollen to slip inside. Ovules, tiny structures that will develop into seeds, sit on the inner surface of the scales. They produce a sticky pollination drop that captures pollen. If the pollen is compatible, the drop retracts, drawing it into the ovule where fertilization will occur.

Photo by Keir Morse

Douglas Fir

As the female cone matures, it turns brown and the scales tighten together, protecting the developing seeds within. Long, straight "mouse tail" bracts protrude between the scales. Once you notice them, you'll know you've got a Douglas Fir. Other conifer cones also have bracts, but they are usually short and hidden beneath the scales.

By late summer, the scales loosen and release seeds, ready to germinate when the rains return. The cone usually drops soon after releasing its seeds.

Photo © Neal Kramer - all rights reserved

Rounded cone scales radiate from a central woody stalk. Each scale bears a pair of naked (exposed) ovules on its upper surface. Each ovule develops into a seed with a thin wing derived from scale tissue.

When mature, the seed and its wing detach from the cone, gliding and spinning to the ground. When they fall from high in the canopy in windy conditions, they can travel hundreds of feet from the parent tree, potentially colonizing disturbed sites such as burns or landslides.

Photo by Zoya Akulova-Barlow

Young trees have smooth gray bark marked with horizontal resin blisters. These blisters are filled with pitch, a sticky, turpentine-like substance that helps seal wounds and repel insects from the tree's comparatively soft, young wood. Many other conifers also rely on pitch for defense. When exposed to air, pitch hardens quickly, forming a protective seal over damaged tissue.

Pitch is different from sap. Sap flows within the tree's vascular tissues: in the xylem it carries water upward from the roots, while in the phloem it transports dissolved sugars throughout the tree.

Photo by Zoya Akulova-Barlow

Douglas Fir

Douglas Fir bark is hard and brittle. By middle age, it is brown and grows darker. If you look closely at the picture below, you can see horizontal resin blisters still visible on some ridges.

As new bark continues to grow from inside the trunk, the outer bark is forced to expand, tearing at its weakest points and creating vertical fissures. Next to the fissures, bark blocks push outward, creating ridges. Over time, as the bark thickens, the furrows and ridges deepen.

Deep crevices provide shelter for insects and offer foraging sites for birds.

Photo by Zoya Akulova-Barlow

Douglas Fir

Douglas Fir is common in the hills and mountains of Northern California. It thrives on well-drained slopes that receive abundant rain or fog. You'll often find it just uphill from redwood groves, in a mixed evergreen forest with California Bay Laurel and Madrone.

In the absence of fire, over the course of decades, it can come to dominate these mixed forests, casting deep shade that creates a cool, quiet understory.

Photo by Bruce Homer-Smith

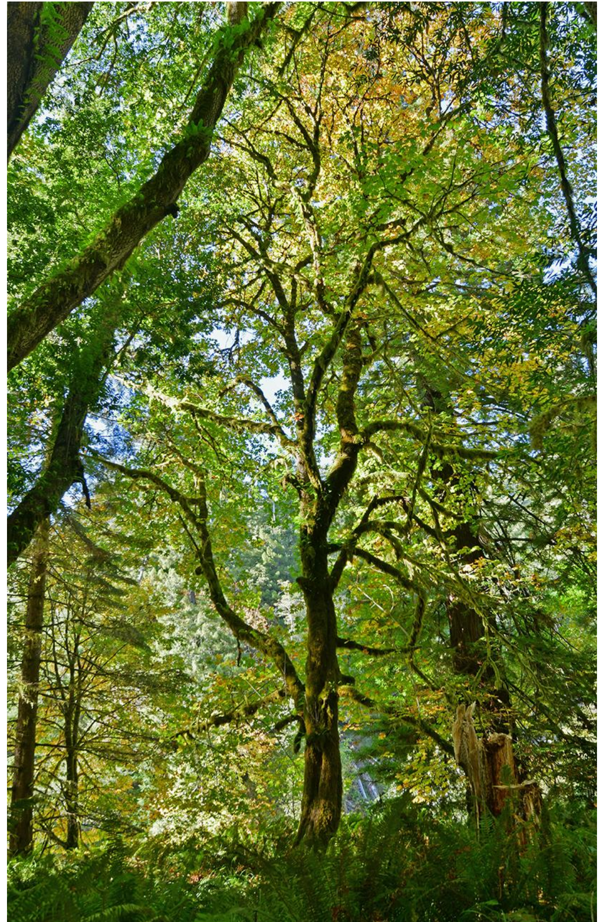
Bigleaf Maple

In the Santa Cruz Mountains, Bigleaf Maple (*Acer macrophyllum*) is found in shaded canyons, along stream corridors, and on north-facing slopes, where moisture lingers and summer heat is moderated by shade and cool air.

Maple leaves are big, up to eight inches across. Pairs of seeds form distinctive helicopter-like wings. In the winter, Bigleaf Maple loses its leaves, revealing its graceful shape and creating an excellent habitat for tiny plants and animals.

Paintings © John Muir Laws

Photo by John Chao, NPS



Bigleaf Maple

Big leaves create lots of energy

Big maple leaves are about the size of your hand: an easy ID!

These large leaves are economical to produce, with water-rich, flexible cells that the tree can make quickly. They function like a solar-panel array, generating substantial energy to support rapid spring growth.

Because its leaves lose water easily, Bigleaf Maple is sensitive to summer drought. It grows in cool, well-watered environments. In California, that means places with partial shade, along waterways, and on mountain slopes.

Photo by Julie Kierstead Nelson

Twigs are stout, smooth, and round in cross-section, often bright green or red. They have small, pale, bumpy pores in their skin, called lenticels. These pores allow gas exchange needed by the actively growing tissues inside.

The twig below bears a terminal bud that contains future leaves and shoots formed in miniature. The bud scales are about to loosen and open, releasing this year's flush of spring growth. At the left end of the twig are rings marking where last year's terminal bud once enclosed the stem.

Photo by Zoya Akulova-Barlow

Bigleaf Maple

Early leaves and blossoms

In late winter, soft, delicate new leaves expand from their buds to replace those shed in the fall.

At the same time and earlier than most other trees or shrubs, long, graceful pendant clusters of yellow-green flowers unfurl. They fill the air with a sweet fragrance and are one of my favorite signs of spring. Bees, flies, and other insects swarm to these early blossoms, eager for pollen and nectar after winter, and in the process leave behind pollen from the flowers of neighboring trees.

Photo by Keir Morse

Bigleaf Maple

Hormones trigger each flower's sex

Separate male and female flowers grow in a cluster, side by side. Their color and fragrance attract a wide variety of pollinators.

Each flower begins with both male and female structures, but hormones direct only one set to develop fully. In male flowers, the stamens produce pollen, while in female flowers, the stigmas become receptive to pollen. Male and female flowers ripen at different times, reducing the chance of self-pollination.

Photo by Wilde Legard

Here's a close-up of a female flower in exquisite detail, showing two receptive stigmas, moist and ready to receive pollen. Forgot what a stigma is? Check the Reproduction Glossary at the end of the book.

From their curled tips, the stigmas lead down to the base of the flower, where two ovules lie within the ovary. If a pollen grain is compatible, it will germinate on the stigma and grow a slender tube to an ovule, completing fertilization.

Female flowers also bear male stamens, but they're undeveloped. Only the stigmas are functional.

Photo by Keir Morse

Bigleaf Maple

Insect pollination

Unlike oaks and pines that scatter enormous amounts of pollen on the wind, Bigleaf Maples rely on insects to move pollen from one tree to another.

They attract pollinators with clusters of showy, fragrant flowers that dangle in the open air. They offer pollen and nectar as vital nourishment for insects emerging hungry after the long winter. In return, they receive focused attention from thousands of insects — bees dusted in yellow pollen grains, flies probing for nectar, and beetles wandering from flower to flower — delivering pollen precisely where it's needed.

Photo by Scott Mitchell

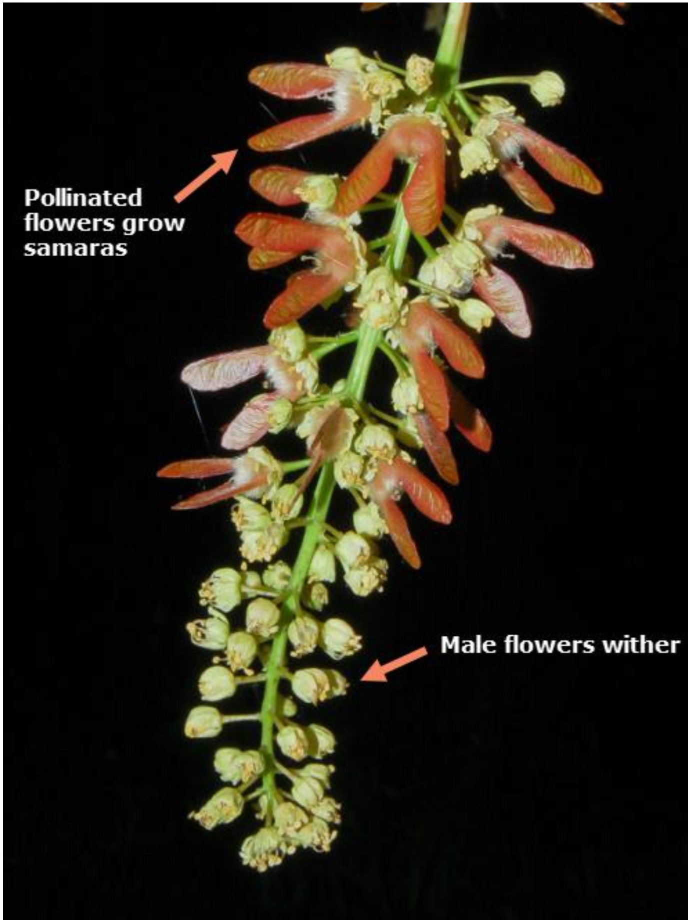
Bigleaf Maple

Winged seeds (samaras)

Emerging fruits develop as paired wings, each with a seed at its base. These helicopter-like structures are a hallmark of maples, ripening from pale green to flushed red before drying to tan.

Botanists call each seed-and-wing unit a samara. The broad, curved wings cause the seeds to spin and glide when they're released from the tree, slowing their fall and allowing wind to carry them to open ground.

Photo by Wilde Legard



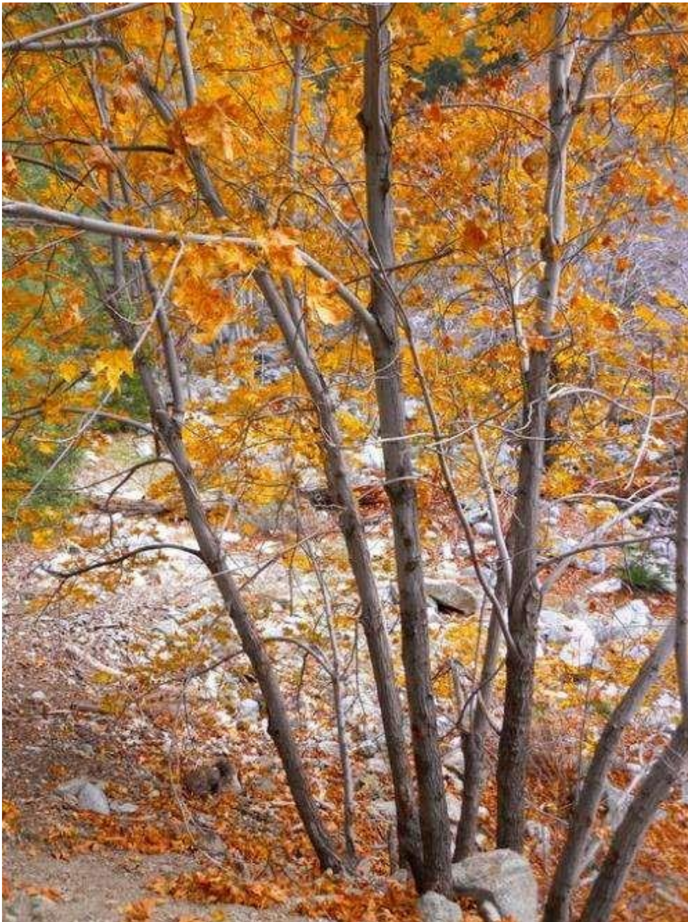
Bigleaf Maple

Fall color glow

In the fall, orange and yellow leaves glow in the sunlight, casting warm color across the forest. For a few weeks, shaded canyons blaze with color before winter rains arrive. As the tree prepares for dormancy, it withdraws nutrients from the leaves, breaking down chlorophyll and revealing the underlying yellow pigments.

Once on the forest floor, the damp leaves create fresh habitat for hundreds of species of fungi, insects, spiders, and other small forest dwellers. As the leaves decay, they enrich the soil and return nutrients to the roots, fueling the tree's future growth.

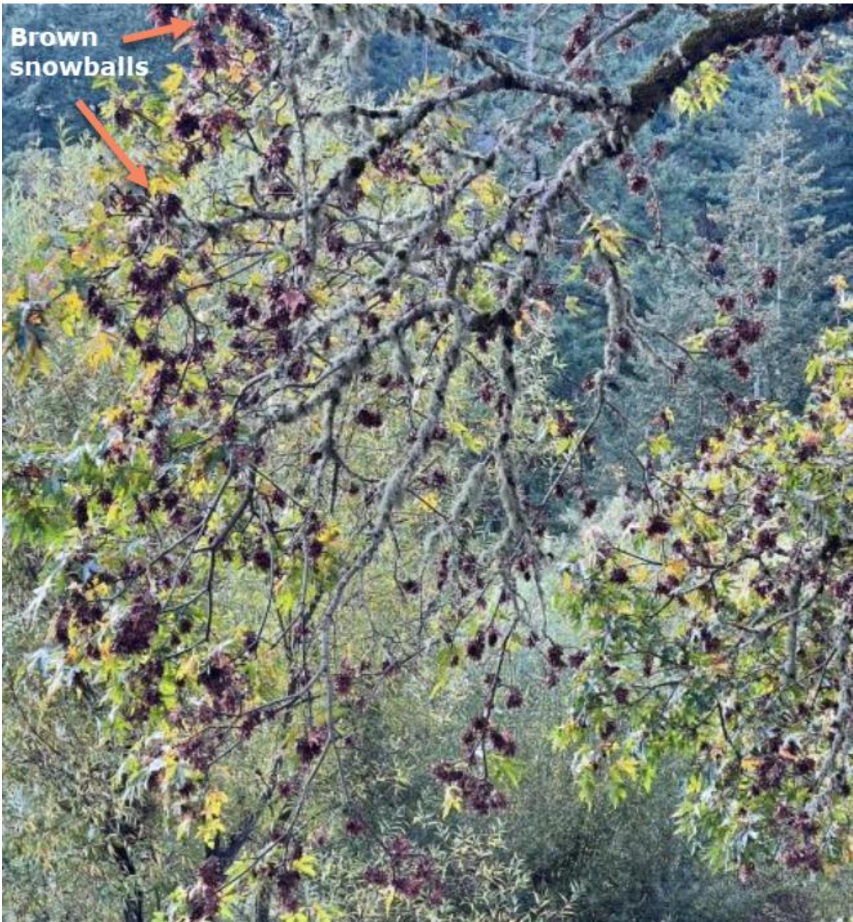
Photo by Dan Passerini



Samaras remain on the tree for a few more months. They look to me like brown snowballs, clustered along the branches long after the leaves have fallen. In the bare winter canopy, they're the last visible trace of the growing season.

Winter storms loosen and carry them off, one by one, giving each seed a final wind-assisted ride before it settles onto the wet soil below.

Photo by Bruce Homer-Smith



Bigleaf Maple

A miniature, vertical forest

Young trees have smooth, gray bark. With age, deep vertical furrows reveal reddish inner bark, while weathered, flattened ridges expand as the trunk widens.

The trunk surface becomes increasingly fibrous and slightly yielding, trapping moisture and forming crevices that support a miniature forest of epiphytes such as mosses, lichens, and even ferns. Bigleaf Maple is often cited as hosting more epiphytes than any other tree in the Pacific Northwest.

Photo by Wilde Legard

In the dry months, the tree-hugging epiphytes lie largely dormant. But when the rains return, their cells swell with water. The tree's surface becomes a thriving vertical world, alive with snails, spiders, mites, and insects.

With its leaves gone, the maple's graceful branches soar into open space, spare and still against the winter sky. The tree rests. Yet among those arching limbs, a quiet, vibrant community flourishes.

Photo by Zoya Akulova-Barlow

Black Oak

Black Oak (*Quercus kelloggii*) grows on sunny ridges and warm, dry slopes in the Santa Cruz Mountains. It often forms open woodlands, mixed with Madrone, California Buckeye, and Coast Live Oak, where thin, rocky soils drain quickly.

Its thick, dark limbs spread wide, supporting a broad crown of sharply lobed, bristle-tipped leaves. In the fall, the branches often carry a heavy crop of acorns. Compare its skeleton with that of Bigleaf Maple on the previous page. Oak branches are thicker and relatively straight, supported by dense, strong wood, while maple branches tend to be lighter and more arching.

Painting © John Muir Laws, Photos by Wilde Legard and Zoya Akulova-Barlow

Black Oak

The easiest way to identify a Black Oak in California is by its leaves. They have deep lobes that end in one to three acute points, each point tipped with a slender bristle formed by a vein that extends slightly beyond the leaf edge.

This leaf is quite different from the leathery leaves of our other oaks. Those leaves are evergreen and have to last through several summers and winters. Black Oak is deciduous, dropping its leaves in the fall, so its leaves can be more lightly built to function for a single spring and summer.

Illustration © John Muir Laws - all rights reserved

Black Oak

Black Oak leaves often look visibly chewed, as below. Rather than relying on extensive chemical defenses common in other plants, Black Oak produces nutrient-rich leaves and acorns that attract many animals.

Black Oak provides key food and shelter for dozens, even hundreds, of animal species, earning it the title of a "keystone species." It feeds leaf-eating insects, which in turn feed birds that depend on them. The tree feeds jays, woodpeckers, deer, and squirrels with its acorns. In return, it receives services such as pest suppression by its inhabitants and the wide dispersal of its acorns.

Photo by Wilde Legard

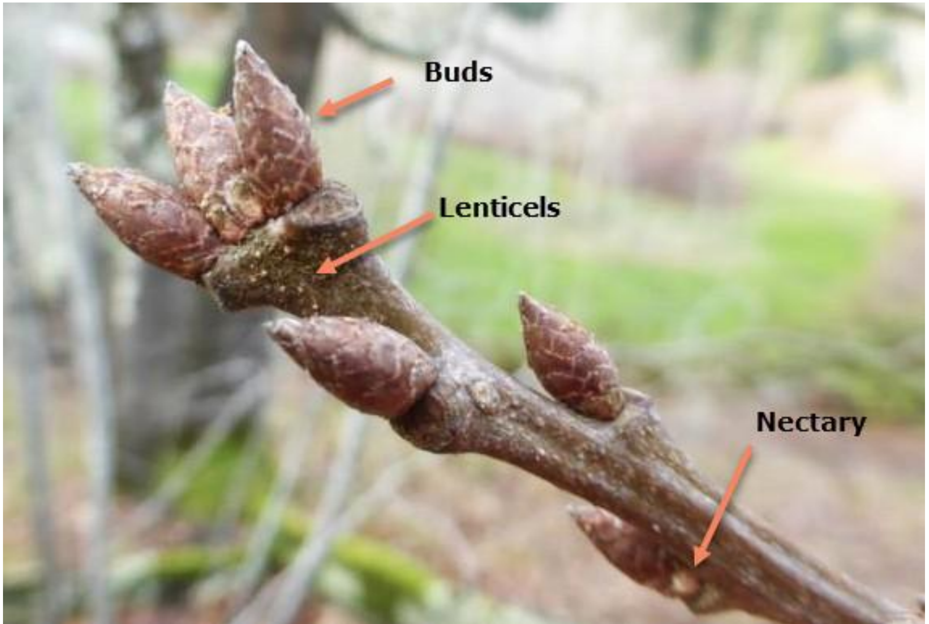
Young branches have thin, smooth, reddish-brown bark.

Buds are large and pointed, with overlapping scales that protect developing leaves and catkins that will emerge in spring.

Pale lenticels on the twig surface appear as tiny, light-colored dots scattered across the bark. They permit oxygen to enter and carbon dioxide to leave, supporting the growth of new cells. This flow is the reverse of gas exchange during photosynthesis.

Small nectaries at the base of some buds produce sugary secretions that attract ants and other insects, helping deter herbivores that might damage these nutrient-rich tissues.

Photo by Zoya Akulova-Barlow



Black Oak

Red and yellow spring growth

In early spring, as day length increases and temperatures rise, buds swell. Their scales loosen and separate, revealing tightly folded, velvety red leaves. For a few weeks, while the leaves grow to full size, their red pigment absorbs excess blue and UV light, protecting the rapidly developing tissues.

Hanging down from last year's twigs, yellow and green catkins grow, full of pollen-producing flowers, contrasting with the red new leaves.

Photo © Neal Kramer - all rights reserved

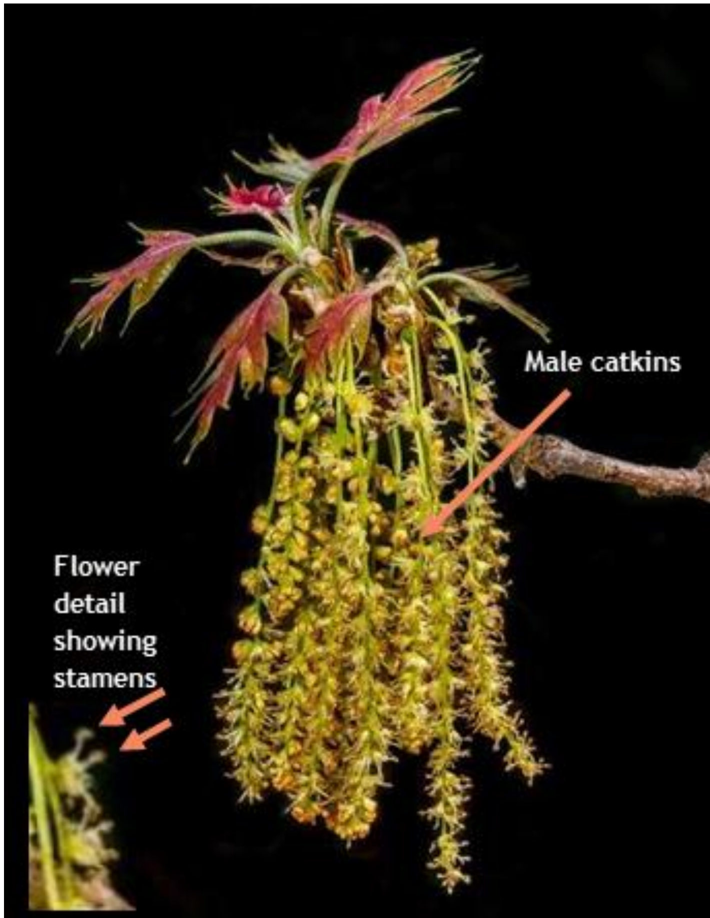
Black Oak

Male catkins and wind pollination

In a striking display, male flowers crowd hanging catkins. Each tiny flower has about ten stamens. Each stamen is topped by an anther that contains around 1,000 pollen grains. A mature tree can release hundreds of millions to billions of pollen grains in a season, creating a realistic chance that one will land on a neighboring tree's female flower.

The tree can afford to produce so many grains because each one is extremely small and efficient to make.

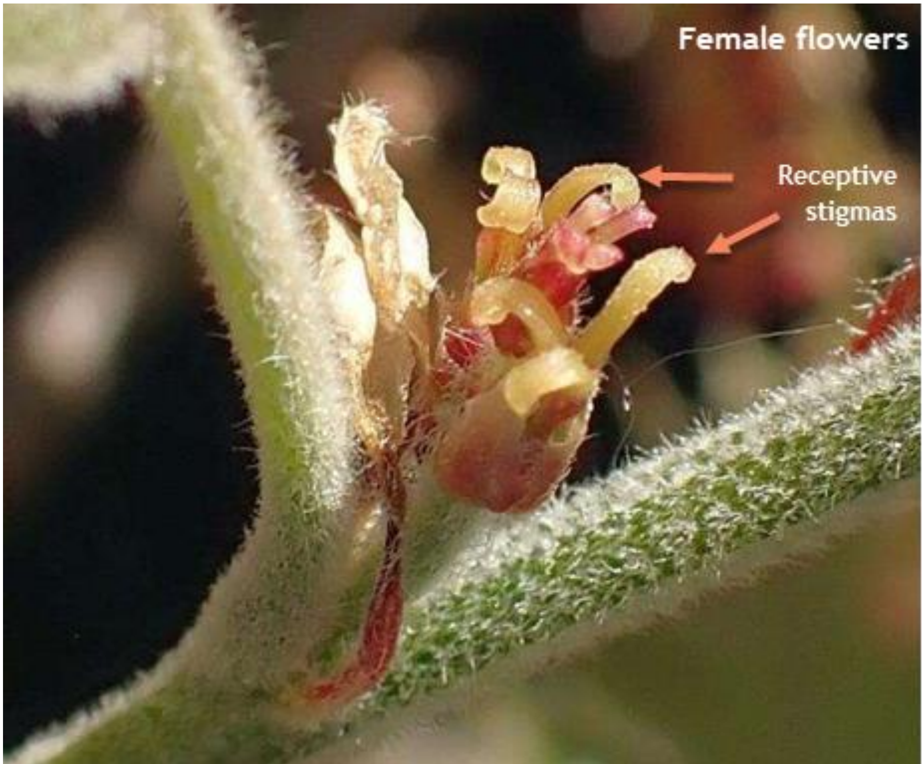
Photo by Wilde Legard



Meanwhile, separate female flowers, about the size of a grain of rice, nestle in the joints of new spring leaves. Here, each flower shows two or three sticky stigma surfaces ready to receive pollen.

Once pollinated, the female ovule starts growing into an acorn. The nascent acorn stays small through the first season, waiting for a flush of starches and proteins the following spring. This two-season acorn maturation allows the development of large, energy-rich acorns that are preferred by birds and mammals over smaller acorns.

Photo by Tom Chester



In the first summer after pollination, the tree drops the smallest and least promising acorns, retaining only the number it can bring to maturity given its carbon reserves and local conditions, such as water availability, temperature, and leaf health. You may find these undersized acorns scattered beneath the tree in midsummer.

Neighboring trees are likely making similar choices, so when conditions are good, local trees often produce a synchronized bumper crop of acorns, called a mast event. Mast crops are generally followed by years with less acorn production as trees rebuild their carbon reserves.

Photo by Julie Kierstead Nelson

Black Oak

Acorns mature in the second year

These acorns are in their second summer. After overwintering, they undergo a spring growth spurt and become larger than most one-season acorns. The cap scales have finished growing and have turned tan or light brown. They're smooth, with rounded tips that lift slightly away from the scales below.

The acorn is plump, ending in a firm, conical point. It's green now but will turn brown in the fall, ready to drop.

Photo by Wilde Legard

As fall approaches, leaves change color and mature, and second-year acorns fall to the ground.

Jays, woodpeckers, squirrels, and other rodents eat as many as they can, but also cache acorns for later. Many carry the acorns away from the tree and bury them just below the surface. These caching animals do not always return, so some acorns remain well planted and will germinate and grow into the next generation of Black Oaks.

Photo © Neal Kramer - all rights reserved

Black Oak

Hard, blocky, deeply furrowed bark

Black Oak bark is eye-catching. It is dark (often almost black), deeply furrowed, and blocky. In angled light, the deep furrows cast strong shadows, giving the trunk a rugged appearance. The bark is quite hard to the touch, offering good resistance to prying fingers, fire, and pathogens.

Its furrows trap water and provide a good base for lichens, mosses, fungi, and algae. These moist crevices also provide shelter for insects, spiders, and other small invertebrates.

Photo by Wilde Legard

Black Oak

An architectural skeleton

Because Black Oaks are deciduous, we can admire their skeletal structure in winter. The primary trunk is massive, supporting many tons of branches above it through a century or more of storms. Main branches are heavy and almost always ascend. Smaller branches fill gaps but do not form dense thickets of twigs as California Live Oaks do.

Hollows in the branches develop and persist for decades, providing important shelter for owls, woodpeckers, and other cavity-nesting birds, along with squirrels and bats. A single tree may host dozens of species.

Photo by Zoya Akulova-Barlow

Black Oak

Stepping back – stability through diversity

Rather than protecting itself from surrounding animals, Black Oak allows heavy use. Its leaves provide food for caterpillars and other leaf-eating insects. Birds eat the caterpillars. Its vast acorn crop is a primary food source for dozens of birds and small mammals. Its bark provides habitat for insects, fungi, and algae.

This complex community helps the oak disperse its seeds. It also keeps insect pests and diseases in check, as no single species can dominate when so many predators and competitors are present. Together, these relationships create a stable, resilient habitat that supports the oak over the long term.

Photo by Wilde Legard

Coast Live Oak

In the Santa Cruz Mountains, Coast Live Oak (*Quercus agrifolia*) occupies warm, dry slopes where thin soils and sun exposure limit the growth of less drought-tolerant trees.

Its dense canopy of evergreen leaves casts deep shade that cools the ground, creating a foothold for plants and animals that need relief from heat and exposure. Its acorns provide food for many animals, drawing in more wildlife and further increasing diversity.

Photo by Keir Morse

Coast Live Oak

Leaves sometimes have spiny edges

Leaves are evergreen and leathery, lasting for several seasons. The upper surface is shiny, with slightly sunken veins, and may bear small spines along the edges.

Leaf shape varies with growing conditions. Leaves high in the canopy tend to be smaller and thicker, reducing water loss, while those in the shaded interior are broader and thinner, maximizing light capture. On a single tree, leaves near the ground may be spiny, which deters browsing, while upper leaves are smoother-edged.

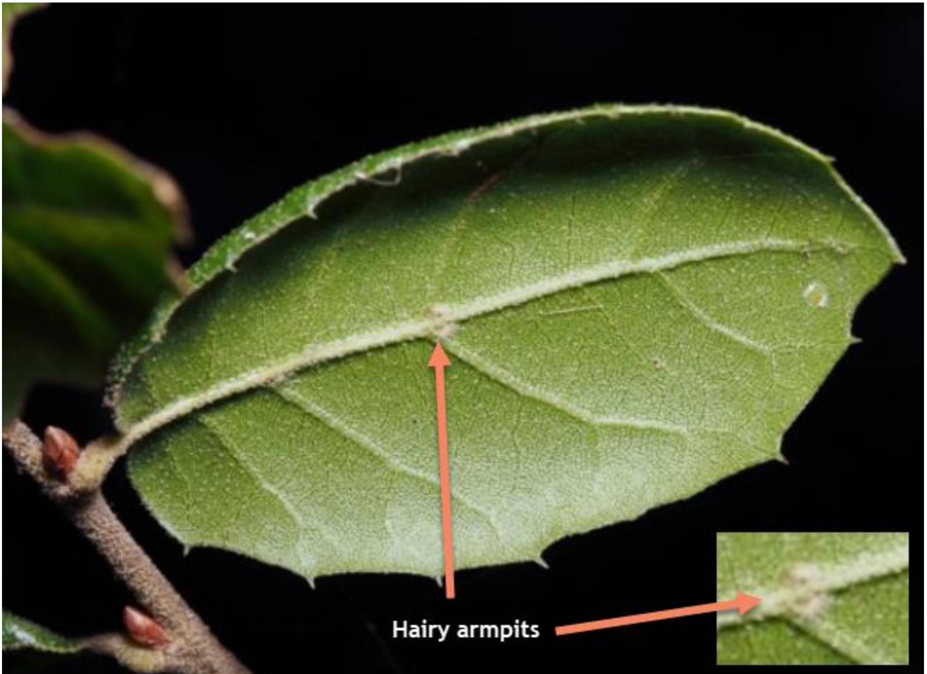
Photo by Keir Morse

Coast Live Oak

Coast Live Oak leaves often curl under, though leaves on trees experiencing little stress may remain flatter.

Coast Live Oak leaves are tricky to distinguish from those of Interior Live Oak, and the two species interbreed. But there are two things you can look for on the underside. If you notice "hairy armpits" at vein junctions, you'll know you've got a Coast Live Oak. Also, if you have five or fewer pairs of lateral veins, you've probably got a Coast Live Oak; Interior Live Oak often has more.

Photo by Keir Morse



Coast Live Oak

In March, mature Coast Live Oaks produce a flush of new growth. Pale, tender leaves emerge at the branch tips, and abundant yellowish catkins hang down in loose clusters.

For a few weeks, the canopy takes on a soft, golden cast visible from a distance, making Coast Live Oaks stand out against darker trees. Soon, the flush is over. Catkins dry and fall, and the tree settles back into its darker green summer foliage.

Photo by Bruce Homer-Smith

Close up, you can see many male flowers arrayed along drooping catkins. Each tiny flower has several white stamens, tipped by greenish anthers. Each anther carries hundreds of pollen grains.

When the pollen is mature and the weather is warm, the anthers split open, releasing clouds of pollen into the air. A mature tree produces hundreds of millions to billions of pollen grains each season.

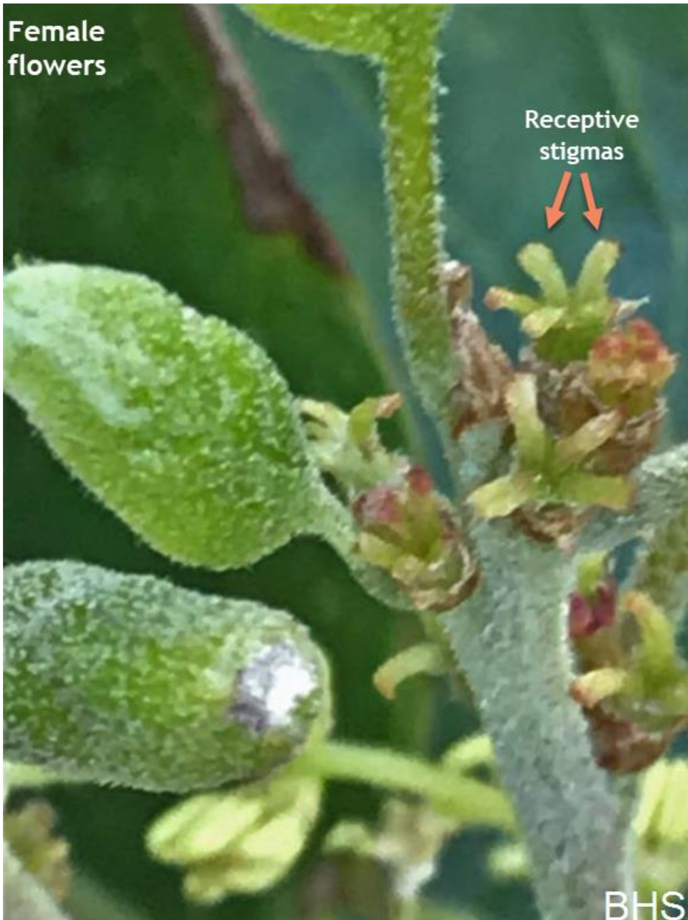
I've observed swarms of insects hovering around dense clusters of these catkins on warm days. They may be collecting pollen for food, but they're essentially getting a free meal. Pollination is carried out almost entirely by the wind.

Photo by Keir Morse

Female flowers are much less conspicuous than the male catkins. They're tiny and reddish-green, and grow at the base of new spring leaves.

There are no petals since the flower doesn't need to attract pollinators. The flower produces two or three stigmas coated with a sticky secretion that traps wind-blown pollen. If the grain is compatible, it germinates and sends a slender tube down to the hidden ovule.

Photo by Bruce Homer-Smith



After pollination, the small, leafy bracts at the flower's base grow and subdivide along their margins, developing into many rows of overlapping, thin, shingle-like scales. They lie tightly against one another, almost melting together, and form the acorn cap.

Photosynthesis in the leaves produces sugars that move into the developing acorn, filling it with food reserves. Within about six months, the nut ripens, turns glossy brown, and falls to the ground. The acorns often germinate with the first sustained autumn rains, sending down roots and gaining an early start on winter growth.

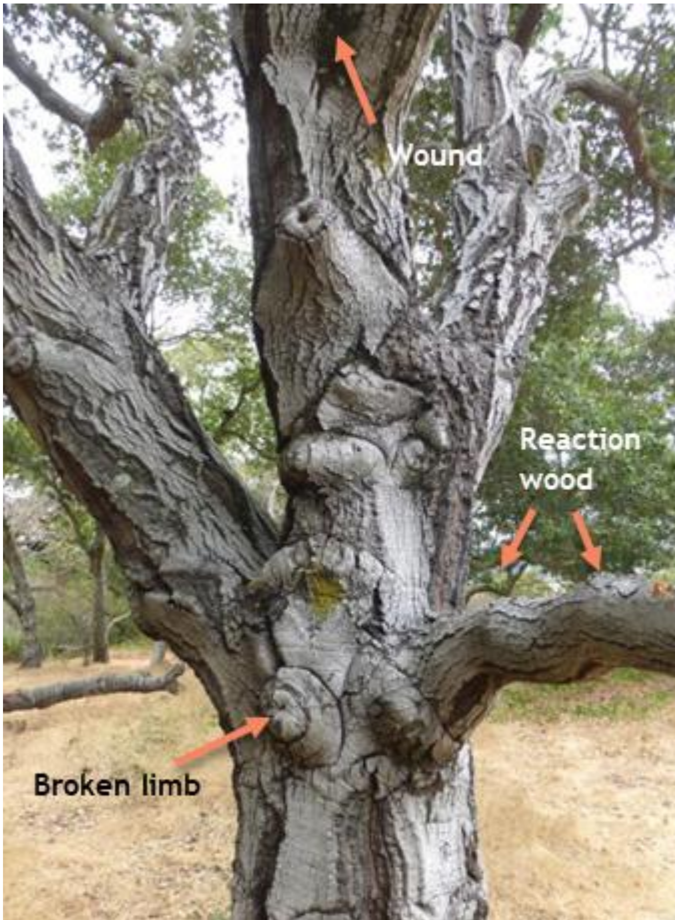
Photo by Keir Morse

Elephant skin bark

Live Oak bark is silvery gray and quite reflective. It looks like elephant skin to me.

This old tree bears the marks of significant events in its lifetime. The trunk divides early into several large branches, a form common in oaks growing in open light. Conical bulges in the trunk likely formed where bark took several seasons to grow over a broken limb. Horizontal, rounded ridges may be reaction wood, which forms along one side of a branch to counter weight and stress. An old wound has been compartmentalized by new tissue, forming a cavity that attracts insects, birds, and small mammals.

Photo by Zoya Akulova-Barlow



Coast Live Oak

A wide-reaching shade

Massive branches weighing many tons extend sideways. Coast Live Oak can support this heavy weight because it has very dense wood with interlocking fibers that allow branches to bend rather than snap. As the branch grows larger and heavier over the decades, the underside is placed under compression. The top side forms additional fibrous wood where stress is highest. Few California trees, even among the oaks, match this level of lateral strength.

Evergreen leaves on a wide canopy create a cool, open habitat beneath. Cavities in the trunk and branches shelter owls, woodpeckers, jays, and small mammals.

Photo by Zoya Akulova-Barlow

Coast Live Oak sustains a rich community under its canopy.

The bark carries a living tapestry of moss, lichens, galls, and mistletoe, offering nesting space and foraging ground for all sorts of birds. More than a hundred species of small animals, such as insects, mites, spiders, gall wasps and their parasites, snails, slugs, sow bugs, termites, and centipedes, inhabit this aerial jungle. Another hundred species, including springtails, many more mites, beetles, ants, and worms, thrive in the leaf litter and fallen limbs below.

Photo © Neal Kramer - all rights reserved

Tanbark Oak

Tanbark Oak (*Notholithocarpus densiflorus*) grows in the cool, shaded forests of coastal California, often as an understory tree, although here we see the base of an unusual, well-developed tree.

Its leaves are tough and distinctive, adapted to life in deep shade. Thick and leathery, they have many parallel veins, giving the leaf an almost quilted appearance.

It can be distinguished from the true oaks by its acorn caps covered with curling bristles, a feature it shares with chestnuts and chinquapins.

Photos by Keir Morse, William Follette, and Bruce Homer-Smith

Tanbark Oak

A leathery, many-veined leaf

Tanbark Oak leaves are leathery and stiff, with about ten pairs of strongly impressed veins branching out from a central midrib. Each vein ends in a small bump at the leaf margin, giving the leaf a slightly wavy edge. From a distance, the leaf's thick texture, evenly spaced veins, and smooth oval shape are easy to recognize.

Leaves are evergreen, staying on the tree for about four years.

Photo by Keir Morse

Tanbark Oak

Fuzz under the leaf

I like to turn these leaves over to see their very different undersides. They start woolly and pale, though the wool gradually wears away. The felt-like fuzz traps a thin layer of still air against the leaf, reducing water loss and possibly deterring herbivores.

Parallel veins are made of fibrous tissue and form strong structural ribs across the leaf surface, supporting the thick blade and helping it resist tearing and heavy rain.

Photo by Keir Morse

Tanbark Oak

Silvery new leaves

New leaves are pale yellow and covered in fine hair, creating a soft, silvery sheen in bright light. The pale, hairy surface helps reflect excess sunlight while the leaf's photosynthetic tissues are developing, protecting the tender leaves from overheating and drying out.

These leaves were formed last summer and held in buds over winter. Now, as spring conditions turn favorable, they expand quickly, taking advantage of the moist conditions before the forest dries.

Photo by Keir Morse

Tanbark Oak

In the spring, you can spot Tanbark Oak trees in the sun from far away. Their new leaves, pale and fuzzy, emerge all at once and reflect much more light than the surrounding foliage, forming bright patches in the woods that stand out against darker neighboring trees.

Tanbark Oaks are typically shorter than the surrounding trees, so their bright crowns form a glowing layer beneath them.

Photo © Neal Kramer - all rights reserved

Tanbark Oak

Male catkins and inconspicuous females

Tiny male flowers crowd onto stiff, yellowish catkins. They release pollen in spring, relying on wind rather than insects for delivery.

Although the catkins are hard to miss, you'll probably have to look closely to find female flowers nestled close to the branch. They don't need to be noticed by pollinators; they're simply waiting for a grain of pollen to land.

Below, you can see an emerging acorn, the result of a successful pollination. Its scaly cup forms first, followed by a growing nut which will take about a year and a half to mature.

Photo by William Follette

Hundreds of anthers crowd each catkin, each containing thousands of pollen grains. When the pollen is mature and conditions turn warm and dry, the anthers split open, releasing pollen light enough to be carried high by shifting air currents. Release is staggered, with different anthers opening over time.

Most pollination happens between nearby trees, helping form dense local stands. Some pollen travels farther, maintaining genetic connections between more distant trees.

Photo by Keir Morse

Curly-bristled acorn cap

Pollinated female flowers develop into emerging acorns.

The acorn caps differ from those of true oaks. Although called an oak, this tree belongs to its own genus, sharing ancestry with oaks, chestnuts, and chinquapins. Its caps are covered with long, curly bristles, more like those of chestnut and chinquapin than the shingled caps of true oaks.

By late summer of the second year, a somewhat spherical nut will fill out from its bristling cup, ripening and eventually dropping to the forest floor.

Photo by Keir Morse

Tanbark Oak

Tannin-filled bark

The bark is pale and relatively smooth until old age, when vertical ridges emerge. Unfortunately, very few old-growth trees remain today.

In the mid-1800s, settlers discovered that the bark could be stripped and processed to extract tannins, natural compounds that bind to proteins in animal hides, turning them into durable, flexible, long-lasting leather. The lucrative process required a great deal of bark. It often took the bark from four large trees to tan a single hide. Estimates suggest that about seven million mature trees were harvested over roughly 60 years, dramatically diminishing Tanbark Oak forests across California's Coast Ranges.

Photo by Zoya Akulova-Barlow

Tanbark Oak

An understory tree

In 1846, John C. Fremont described giant Tanbark Oaks as "handsome and lofty." These days most Tanbark Oaks are confined to the understory or mid-canopy, where they grow more slowly than their local competitors. Sudden oak death also kills many saplings and pole-sized trees. Few individuals reach the towering stature recorded by early explorers.

In this picture, pale-leaved Tanbark Oaks grow in the foreground, overtopped by fast-growing Bigleaf Maple and mature Douglas Fir, illustrating their shift from canopy dominants to subordinate forest trees.

Photo by Bruce Homer-Smith

Tanbark Oak

Although Tanbark Oak acorns resemble those of true oaks, their spiny caps reveal their close relationship to chestnuts and chinquapins.

During the ice ages, Tanbark Oaks likely retreated to the relatively stable, fog-moderated climate of coastal California. Today, like Coast Redwoods, they spread slowly and can tolerate only a narrow range of conditions, remaining largely confined to cool, maritime forests. They're the enduring remnants of a forest lineage that extends back tens of millions of years.

Photo by William Follette

In the Santa Cruz Mountains, California Bay Laurel (*Umbellularia californica*) is found in cool, moisture-retaining sites. It is shade-tolerant, self-sprouting, and readily establishes seedlings in its own deep shade, forming dense, stable stands.

Leaves are distinctive: long, narrow, and smooth-edged. Rub them and you'll smell the familiar bay leaf fragrance used in cooking. Their olive-sized fruits are structurally similar to avocados.

Paintings © John Muir Laws

Photo by Zoya Akulova-Barlow

California Bay Laurel

Evergreen, fragrant leaves

Leaves are stiff, flat, oblong, up to four inches long, and pointed. They have smooth edges, unlike similar Toyon leaves that have small teeth. A strong central midrib runs the length of the leaf. The upper surface is shiny green, and the underside is much paler. The leaves have a strong, spicy fragrance when crushed.

Bay Laurel leaves are evergreen and provide photosynthetic energy year-round. This enables winter flowering, an advantage over deciduous trees, which must grow leaves in spring to supply the energy for reproduction.

Photo by Julie Kierstead Nelson

California Bay Laurel

Ancient flower design

Small yellow flowers are about one-third of an inch across and have six petal-like tepals, with about a dozen stamens clustered at the center. This is an ancient flower design with parts arranged in multiples of three, unlike most trees whose flowers typically have parts in fours and fives.

Bright orange nectary glands at the base of the stamens offer a generous amount of sugar-rich nectar, a welcome source of energy for winter-active bees, flies, and beetles.

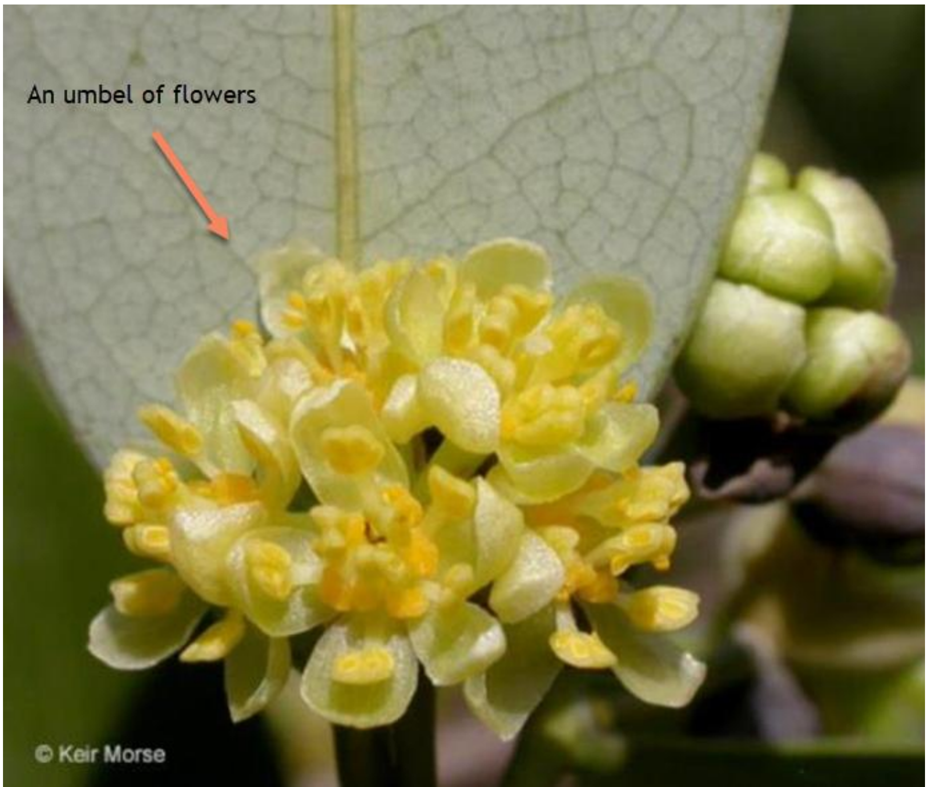
Photo by Steve Matson

California Bay Laurel

Eight to twelve small flowers radiate on stalks from a central point at the tip of a stem, like the spokes of an umbrella. This arrangement is called an umbel. The scientific name *Umbellularia* comes from the Latin word for "little umbrella."

Each flower cluster blooms for approximately a month. Clusters in warmer parts of the tree (sunny or south-facing) tend to open first. Clusters in cooler parts open later, extending the overall bloom period through winter storms and brief warm spells from December through March, a time when few other trees are in bloom.

Photo by Keir Morse



Although many flowers are pollinated, the tree supports only a few fruits per cluster, aborting the rest and conserving the resources needed to build its large, nutrient-rich fruits. See if you can find these aborted fruits among the ground litter under the tree in spring — they're small, green, and about the size of a pea.

Maturing fruits begin yellowish-green, grow to about one inch across (the size of an olive), and turn deep purple when mature. They resemble a tiny avocado, with a single large seed surrounded by a thin layer of flesh. When ripe, the flesh softens, attracting birds and mammals that disperse the seed.

Photo © Neal Kramer - all rights reserved

California Bay Laurel

Thin, aromatic bark

Young Bay Laurels have smooth bark. As the trunk widens with age, the bark remains relatively thin and breaks into scaly plates. The little circles you see on each plate are lenticels, which allow gas exchange.

The bark is thinner than that of conifers and oaks. For defense, it relies on high concentrations of aromatic terpenes. These natural plant oils disrupt insect nervous systems, damage cell membranes, and interfere with fungal growth. Both animals and humans have spread these leaves on their floor to repel fleas. These terpenes also give the tree its characteristic sharp, minty, resinous smell, a warning to would-be attackers.

Photo by Zoya Akulova-Barlow

California Bay Laurel

Wind-shaped canopies

Bay Laurels grow from many flexible stems. Repeated wind pressure shapes these shoots into smooth, domed clusters, letting air flow easily over the top.

Where trees grow close together, their crowns merge into a single, wind-combed surface that bends and sways, shedding the force of strong gusts. This low, resilient form allows Bay Laurels to persist on exposed coastal slopes where stronger, upright trees would snap or uproot. These dense thickets stabilize the slope and provide cover for birds and small mammals.

Photo by Zoya Akulova-Barlow

California Bay Laurel

Old Bay Laurel trees often grow in a ring, the result of daughter trees sprouting from a parent. My grandson calls it a family tree.

Over time, the base of a family group may grow to 15 to 20 feet across, with a flaring ring of trunks that spread to form a very wide crown. Clonal growth like this allows Bay Laurels to persist for centuries, even as individual trunks die. Unlike Coast Redwoods, whose trunks often develop their own root systems over time, Bay Laurel clusters often share a common root system.

Photo by Thewellman, Wikimedia Commons

California Bay Laurel

In calm areas with little competition from other trees, Bay Laurels form a dome-shaped canopy. This broad crown casts deep, cool shade year-round, providing food and shelter for many insects, small mammals, and birds. The deep shade also maintains conditions that allow the Bay Laurel to dominate its habitat, excluding many sun-loving plants.

Bay Laurels are a relic of ancient laurel forests that once covered much of western North America. They thrive in our mild, wet winters and dry summers, but they cannot tolerate the weather extremes found outside our maritime belt. As a result, they are locally abundant yet largely confined to California and southwestern Oregon.

Photo by Barry Breckling

California Buckeye (*Aesculus californica*) grows in sunny, dry areas where its taproot can reach water. In the Santa Cruz Mountains, that puts them on south- and west-facing slopes, in open places near drainages. They are often scattered among oaks and other drought-tolerant trees.

Sweet-smelling flower clusters rise above the leaves, offering lots of pollen and nectar for hungry pollinators. Buckeyes avoid drought stress by dropping their leaves by midsummer, before their fruits fully mature.

Photos by Toni Corelli and Keir Morse Painting © John Muir Laws

California Buckeye

Buckeyes send a taproot deep into the ground. Where the taproot reaches water, the tree can thrive even in places that look dry in summer. Here, a line of Buckeyes is in full bloom along a streambed that's dry at the surface.

The California Buckeye growth cycle is well adapted to our state's mild, wet winters. They leaf out early and build elaborate flower clusters over several months, while water is abundant. By midsummer, they finish blooming and drop their leaves.

Photo © Neal Kramer - all rights reserved

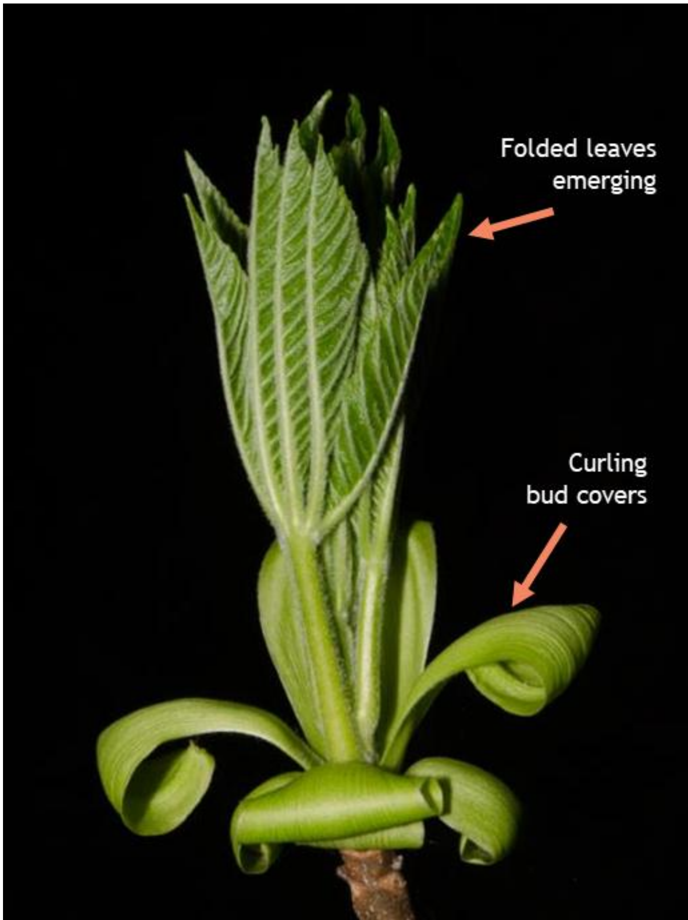
California Buckeye

Early new leaves

California Buckeyes start leafing out as early as January, well before many other deciduous trees. This initiates an intense period of photosynthesis during which the tree builds the sugars it will use to support a showy flower display and the development of large buckeye seeds.

Tight, folded leaf clusters emerge from prominent, curling bud covers, an eye-catching sight that tells me spring is coming.

Photo by Wilde Legard



California Buckeye

Opposite, palmate leaves

Buckeye leaves capture lots of sunlight with minimal material. Each leaf divides into five- or seven-pointed leaflets joined at the center, spreading to cover a large surface area. A long stalk extends the leaf well away from its branch, improving light exposure. These quickly built, expansive leaves support rapid spring photosynthesis just when soil moisture is abundant.

Leaves are opposite on the branch, making the Buckeye the only California tree with opposite, palmately compound leaves.

Photo by Julie Kierstead Nelson

California Buckeye

A spectacular bloom

Sweet-smelling blossoms cover the tree starting in late April, creating a flowery canopy. Upright clusters, often six inches tall, reach up from sun-exposed branches.

Each cluster holds dozens of small, tubular flowers, ranging from white to pale pink, with protruding stamens tipped in soft hues. The creamy flowers stand out against the fresh green leaves and the bright spring sky. They draw my eye from across the landscape. That same display draws pollinators in, offering nectar and pollen to bees, butterflies, and hummingbirds.

Photo by Tony Corelli

California Buckeye

A bonanza for native insects

In May and June, blooming Buckeyes become a center of pollinator activity. Showy, aromatic blooms provide large amounts of nectar and pollen and attract a wide range of native bees, flies, beetles, and occasional spring butterflies.

However, buckeye nectar and pollen contain compounds that can be toxic to non-native honeybees. While native pollinators appear well adapted to these chemicals, non-native honeybee colonies may suffer if buckeye becomes their primary nectar source.

Photo © Neal Kramer - all rights reserved

California Buckeye

Few female flowers in a cluster

Most flowers in the cluster are male only. They provide a bright display, nectar, and pollen to pollinators, but cannot be fertilized themselves.

Only a few flowers in the cluster have fully-developed female parts that can produce buckeyes. When these flowers are pollinated, they produce a large, nutrient-rich seed—a major investment and a heavy load for the flowering stalk.

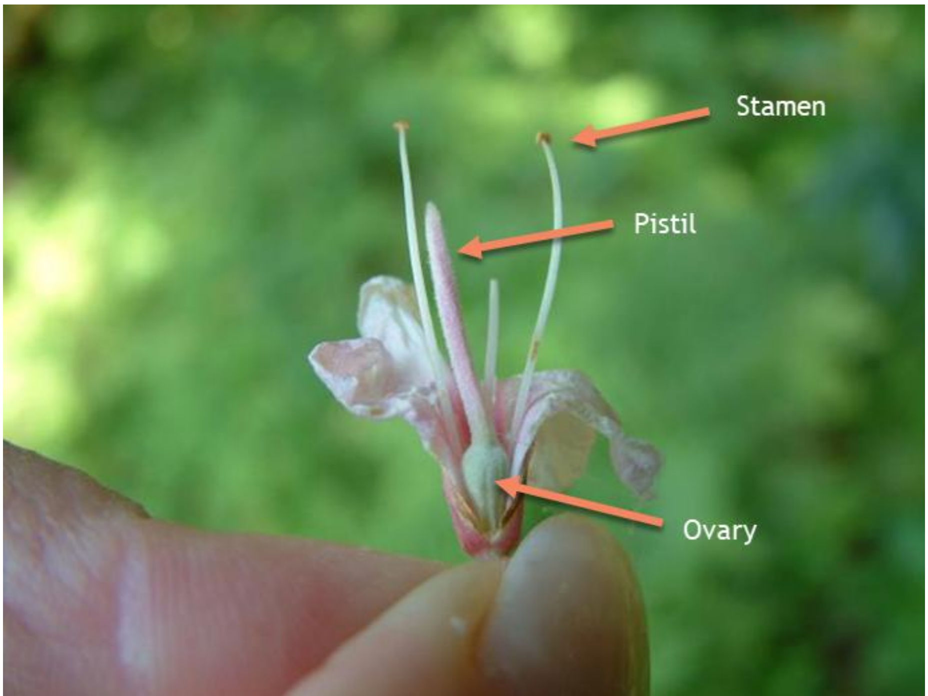
Buckeye flower clusters offer many invitations, but can develop only a few costly fruits.

Photo by Wilde Legard

Here's a single flower that shows both male stamens and a central female pistil. Its creamy petals open around a colored floral throat that acts as a bullseye for pollinators. The throat turns from yellow to pink after pollination is successful, likely signaling to pollinators that they'll find better nectar and pollen in still-waiting, yellow-throated flowers nearby.

The stamens extend well beyond the petals, giving the flower a delicate, open appearance. The receptive pistil sits above a swollen ovary. After pollination, the ovary enlarges through the summer, ripening into the large, heavy seed that gives the buckeye its name.

Photo by Kathy Korbholz



Fruits are heavy and covered with a leathery coating that gradually dries and splits open as summer progresses. Inside is a single glossy brown seed, one of the largest produced by any tree in a temperate climate. These hefty buckeyes can be more than an inch across and contain a large store of carbohydrates to fuel a young seedling during its rapid winter growth.

Their size and weight cause these buckeyes to drop straight to the ground beneath the parent tree, rarely traveling far from where they are formed. As a result, California Buckeyes often form loose groves near their parents.

Photo by Wilde Legard

California Buckeyes lose their leaves earlier than other trees, in July or August. With the canopy gone, the tree's smooth, light-colored trunk and branches stand out.

Buckeyes remain on the tree for several more months, growing bigger and maturing, drawing on starches stored in the tree earlier in the season. Each fruit typically contains one large seed, called a "buckeye" for its resemblance to a deer's eye. The seeds are toxic to squirrels and other animals, helping them remain uneaten as they develop.

Photo by Keir Morse

When mature, the seed's leathery coating peels back, revealing a lovely mahogany-colored seed.

As the rains arrive, a single root emerges from the seed, pushing downward to anchor the young buckeye and begin its descent into the soil in search of moisture. Once the taproot is established, a small shoot grows upward to become the stem of the new tree. The large seed provides the energy for a substantial root system and nearly six inches of stem growth before new leaves begin producing their own food through photosynthesis.

Photo by Kathy Korbholz

California Buckeye

Well adapted to our climate, California Buckeyes are widespread in the state's foothills, thriving in well-drained soils and on sun-exposed slopes. However, their heavy seeds and dependence on a mild, wet winter followed by a dry summer limit their range to California and just beyond.

Early leafing, spectacular blooms, and their large mahogany seeds make them an iconic California tree. On dry slopes, they're an important food source for pollinators and cast dappled shade over grasses and wildflowers. They're a valuable member of our mixed woodland and savanna communities.

Photo © Neal Kramer - all rights reserved

Madrone

Madrone (*Arbutus menziesii*) is one of a small group of broadleaf evergreen trees along the Pacific coast, including live oaks, Tanbark Oak, and California Bay Laurel. These trees can photosynthesize year-round, but that strategy requires avoiding hard freezes and extreme heat. California's coastal climate provides these conditions.

I like every part of a Madrone: its smooth brown skin, thick spreading leaves, bright flower clusters, and bunches of red berries.

Photos by Keir Morse, Zoya Akulova-Barlow, and Julie Kierstead Nelson

Madrone

Lady's leg

My eye is drawn to the smooth, cinnamon-brown bark of Madrone trees. Without dense inner foliage, their twisting, muscular trunks and branches stand exposed, broad "lady's leg" limbs bending and crossing as they reach toward sunlight.

Since Madrones are frequently found in openings or along the edges of crowded woodlands, their beautiful limbs are often on display, catching the light against the darker forest around them.

Photo by William Follette

Madrone

The bark is thin and peels away in curls. Beneath it, new bark grows green with chlorophyll, a living surface that carries out photosynthesis, much like a leaf.

Touch the inner bark and you'll find it surprisingly cool. Heat flows from your hand into the water-rich living tissues, which absorb it quickly.

Shedding outer bark helps prevent pests, mosses, and fungi from gaining a foothold.

Photo by Keir Morse

Madrone

Madrone leaves are thick, glossy, and evergreen, often five inches long. They cluster near the tips of branches, forming broad, leathery fans of dark green. Leaf margins are usually smooth, though some may show fine teeth. By comparison, Toyon's leaves are more noticeably serrated.

In spring, both leaves and flowers form a bouquet at the branch tips. Sprays of small, pale, urn-shaped flowers cluster tightly, forming an invitation to pollinators.

Photo by Keir Morse

Madrone

Madrone leaves are evergreen and have been photosynthesizing all winter, building up starches that support early spring growth. Buds open and branch-like sprays of delicate, urn-shaped flowers emerge. These flowers, rich in pollen and nectar, are an important food source for early pollinators.

Each flower hangs upside down, its narrow opening facing the ground. This pendant position helps protect pollen and nectar from rain and wind and favors insects able to work beneath it.

Photo © Neal Kramer - all rights reserved

Bees are the primary pollinators of Madrone. This yellow-faced bumble bee will grasp a flower and vibrate its flight muscles at a high frequency, shaking pollen loose like a salt shaker. Madrone flowers are built for buzz pollination, closely linking the tree to these bees. Pollen clings to the bee's hairy body as it forages, rubbing off on the flowers of adjacent trees.

Back at the nest, pollen is mixed with a little nectar and saliva (enzymes) to make bee bread. It is stored in a wax container called a pollen pot and allowed to ferment, preserving it for later use. This food reserve is shared among developing larvae and adult bees.

Photos © Robert P. Sikora - all rights reserved

Madrone

Dimpled berries emerge after pollination. Brown flower parts persist at the top of each fruit.

The berries begin green, then ripen to bright orange or red. The underlying ovary wall, rough and bumpy, shows through the skin. Most berries, such as those of Toyon and Manzanita, have a smoother, glossier surface.

Photo © Neal Kramer - all rights reserved

Madrone

A mature Madrone can produce more than 10,000 berries each fall, adding a red swath to the green forest canopy. They hang in clusters, like small bunches of grapes, turning the canopy into a wash of red.

The berries are an important winter food for birds, deer, and small mammals, often persisting well into January. Watch for flocks of robins, cedar waxwings, and other berry-eating birds gathering in these trees through the winter.

Photo by Doreen L Smith

Madrone

A seed bank

Madrone berries contain many seeds, which pass through the birds and mammals that eat them and are scattered across the forest floor within the animals’ range.

The seeds can lie dormant for years, their hard coats resisting water penetration until conditions are favorable. They eventually let in water, germinate, and sprout when the timing is right, such as after fire, during a stretch of steady winter rains, or when shifts in soil temperature signal an opening in the forest canopy.

Illustration © John Muir Laws - all rights reserved

Madrone

Madrones do best with lots of light to generate sugars, which fuel their large crops of flowers and berries. They thrive on slopes and rocky ground, where winter rainfall drains quickly into the soil and is stored within reach of their deep roots. As you see below, an old-growth tree can dominate its space.

However, many Madrones grow in the shade of taller trees such as Coast Redwoods and Douglas Fir. Without periodic fire or other disturbances, they receive less sun exposure and are less vigorous, eventually yielding their place in the forest.

Photo by William Follette

Madrone

In 2020, the Big Basin Fire burned large areas of Coast Redwood and Douglas Fir forest. Madrones are now making a strong comeback in this newly sunny landscape. After less than five years, this Madrone pioneer has already grown to 25 feet tall! Fire has reset the competition for light, and quick-growing Madrones have a head start.

Madrones are edge specialists, living along forest margins where they can find more light. They also form small groves when disturbance opens the canopy, shaping the early stages of regrowth.

Photo by Bruce Homer-Smith

Madrone

Madrones evolved in conifer-broadleaf mixed forests that developed along the Pacific Coast as climates cooled five to ten million years ago. They've adapted to our mild, wet winters and warm, dry summers. Today, they are native nowhere else in the world.

In autumn, their broad glossy leaves, smooth cinnamon bark, and heavy clusters of red berries glow against a deep blue sky. Their twisting trunks and sculptural branches are among my favorites.

Photo © Neal Kramer

Easy ID

Our nine trees are easy to identify, which is very useful. Once you learn to recognize a Black Oak, for example, you can connect your many experiences observing it, remembering how it looks in spring, what habitats it prefers, and what you've read about it in books like this one.

Then, when you see it next in the field, you can slow down and look for new details to fit into your growing understanding.

Use the next pages to easily identify your tree by leaf, flower, fruit, or bark.

Leaf Gallery

Coast Redwood
Short needles in flat sprays.

Douglas Fir
Short needles in all directions.

Bigleaf Maple
Big maple-leaf shape.

Black Oak
Deep lobes with pointed tips.

Coast Live Oak
Leathery with bristles along the margin.

Tanbark Oak
Leathery with many parallel veins.

Bay Laurel
Narrow with smooth margins.

California Buckeye
Leaflets in a palm-shaped cluster.

Madrone
Leaves connect separately to the branch.

Flower Gallery

Coast Redwood
⅛-inch spheres.
Wind pollination.

Douglas Fir
½-inch bundles.
Wind pollination

Bigleaf Maple
¼-inch flowers.
Bees, flies, etc.

Black Oak
Catkins.
Wind pollination.

Coast Live Oak
Catkins.
Wind pollination.

Tanbark Oak
Spikes.
Wind pollination.

Bay Laurel
¼-inch flowers.
Insect pollination.

California Buckeye
¼-inch flowers.
Native bees, etc.

Madrone
¼-inch urn-shaped.
Bee pollination.

Fruit Gallery

Coast Redwood
1-inch cones with plate-tipped scales.

Douglas Fir
Mouse-tail bracts between scales.

Bigleaf Maple
Helicopter-wing seeds.

Black Oak
Scales are triangular, thin, and separate.

Coast Live Oak
Cap scales are rounded and lie flat.

Tanbark Oak
Stiff cap bristles curl outward.

Bay Laurel
¾-inch olive-sized fruits.

California Buckeye
Large (2 to 3 inches). Mahogany-colored

Madrone
Clusters of ¼-inch red berries.

Bark Gallery

Coast Redwood
Soft, fibrous, reddish, rounded edges.

Douglas Fir
Deep rough furrows. Hard, bumpy ridges.

Bigleaf Maple
Gray, scaly plates. Ridged when old.

Black Oak
Dark with broad, irregular plates.

Coast Live Oak
Smooth and silvery, like elephant skin.

Tanbark Oak
Pale and relatively smooth until old age.

Bay Laurel
Smooth, thin bark. Scaly with age.

California Buckeye
Smooth, gray bark. Thin shingles with age.

Madrone
Beautiful orange, red, and brown bark. Peels easily.

ID From a Distance

A botany professor of mine could identify trees on the neighboring mountains by texture, color, and shape. This caught my imagination. I often scan neighboring hillsides to see what patterns I can discern.

Here's a view across a streambed at 1,600 feet in the Santa Cruz Mountains. Bay Laurels are in shady places, lower down. Madrone shows its pale flowers and reddish bark. A Tanbark Oak is lit with a bright flush of pale, reflective leaves. The Coast Live Oak canopy is shaped like billowing puffs of smoke. And Douglas Fir, rising above all, shows needles on branches arranged in horizontal layers, like a ladder.

Photo by Bruce Homer-Smith

Reproduction Glossary

Tree sexual reproduction requires three things: pollen that contains male cells, an ovule that contains an egg, and a way to bring them together. Conifers and oaks pass pollen between trees in the air. Other trees pass pollen by animal pollinators. Here are the basic terms you'll want to know:

Pollen – a tiny grain that carries male cells. It needs to be transferred to a female cone or flower to accomplish pollination and fertilization.

Anther or **pollen sac** – a structure that holds lots of maturing pollen.

Cone – the reproductive structure of conifers. Female cones hold ovules that develop into seeds.

Flower – holds female parts and, in many trees, male anthers.

Stigma – a female receptive surface for accepting pollen. If the pollen is compatible, it grows a tube through the style to the ovule, fertilizing it.

Ovule – a structure that develops into a **seed** if it is fertilized.

Ovary – a structure that holds ovules and turns into a **fruit** after fertilization.

Male parts (pollen sources)

Pollen cones

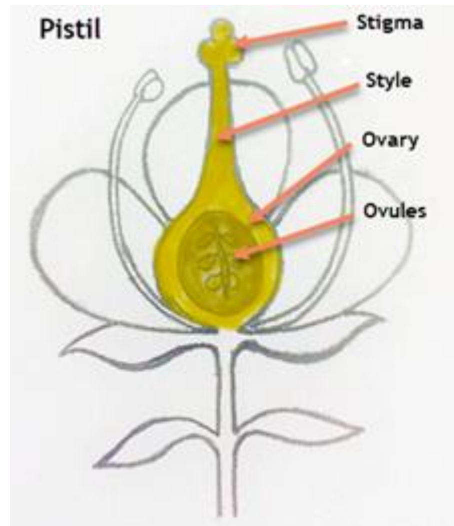
Oak catkins

Flower anthers

Flower anthers

Diagram by Carrie Liz Carpenter

Female parts (cones in conifers)



Seasonal Calendar

<table>
<tr><th></th><th colspan="3">Jan</th><th colspan="5">Apr</th><th colspan="5">Jul</th><th colspan="4">Oct</th></tr>
<tr><td>Coast Redwood</td><td colspan="3">Wind pollen</td><td colspan="8">Cones develop</td><td colspan="5">Seeds drop</td><td></td></tr>
<tr><td>Douglas Fir</td><td colspan="3">Wind pollen</td><td colspan="8">Cones develop</td><td colspan="5">Seeds drop</td><td></td></tr>
<tr><td rowspan="2">Bigleaf Maple</td><td colspan="2">No leaves</td><td colspan="2">New leaves</td><td colspan="7">Mature leaves</td><td colspan="4">Leaves fall</td><td colspan="2">No leaves</td></tr>
<tr><td></td><td></td><td colspan="4">Blossoms</td><td colspan="7">Samaras develop</td><td colspan="4">Release in a storm</td></tr>
<tr><td rowspan="3">California Black Oak</td><td colspan="3">No leaves</td><td colspan="3">New leaves</td><td colspan="9">Mature leaves</td><td colspan="2">Leaves fall</td></tr>
<tr><td colspan="3"></td><td colspan="3">Wind pollen</td><td colspan="11">First-year acorns develop</td></tr>
<tr><td colspan="13">Second-year acorns mature</td><td colspan="3">Acorns drop</td><td></td></tr>
<tr><td>Coast Live Oak</td><td colspan="2"></td><td colspan="3">Wind pollen</td><td colspan="5">Acorns develop</td><td colspan="7">Acorns drop</td></tr>
<tr><td>Tanbark Oak</td><td colspan="2"></td><td colspan="3">Wind pollen</td><td colspan="4">Acorns develop</td><td colspan="5">Acorns drop</td><td colspan="3"></td></tr>
<tr><td>CA Bay Laurel</td><td colspan="2"></td><td colspan="5">Blossoms</td><td colspan="5">Fruits develop</td><td colspan="5">Fruits drop</td></tr>
<tr><td rowspan="2">California Buckeye</td><td colspan="2">No leaves</td><td colspan="3">New leaves</td><td colspan="4">Mature leaves</td><td colspan="8">Leaves fall early</td></tr>
<tr><td colspan="5"></td><td colspan="3">Blossoms</td><td colspan="5">Buckeyes develop</td><td colspan="4">Buckeyes drop</td></tr>
<tr><td>Pacific Madrone</td><td colspan="2"></td><td colspan="3">Blossoms</td><td colspan="5">Fruits develop</td><td colspan="7">Fruits often stay on trees</td></tr>
</table>

Conifers release wind-borne pollen in midwinter, earlier than our flowering trees.

Bigleaf Maple samaras develop by early fall but remain until winter storm winds pull them off.

California Black Oak acorns require two growing seasons to mature.

California Buckeye leaves fall by midsummer, avoiding drought stress.

Pacific Madrone fruits often persist into winter, feeding birds.

Past and Prospects for Our Nine Trees

Coast Redwoods evolved from an ancient lineage that dates to the age of the dinosaurs, more than 200 million years ago. California Bay Laurel's lineage dates back over 100 million years. Laurels were a significant part of the world's forests for tens of millions of years. Our other trees derive from lineages that arose over the past 50 or 60 million years, still ancient but bearing more modern reproductive structures. Our specific California species are relatively recent, taking shape through the shifting ice-age cycles of the past few million years.

The future holds very different prospects for our trees.

Coast Redwood is built for stability, dominating cool, fog-bound valleys. It will likely remain a major part of our California fog belt, but its dependence on that narrow habitat may limit its resilience if fog patterns shift.

Douglas Fir, on the other hand, is well adapted to disturbance and change. It tolerates varied moisture and temperature conditions and is likely to shift its range as climates change.

Bigleaf Maple thrives where shade and reliable water soften summer heat. It will likely persist in sheltered sites here and in other cool, moist climates.

Black Oak regenerates well after disturbance and spreads through animal-dispersed acorns. It may expand where repeated fires open forests, but will remain limited to areas without severe winter freezes.

Coast Live Oak tolerates heat and thin soils that limit other trees. Deep-rooted and slow to migrate, it will likely remain a defining tree of our California dry slopes, even as other species come and go.

Tanbark Oak, once a major California tree, has fallen on hard times. Pressured by Sudden Oak Death and constrained by slow growth, it is likely to persist only in cool, shaded refuges.

California Bay Laurel forms dense stands in sheltered canyons. It will likely provide long-term structure for other shade-loving plants.

California Buckeye sheds its leaves by midsummer to avoid drought stress. It is well-positioned to persist in our seasonally dry landscapes.

Pacific Madrone benefits from moderate disturbance but declines in prolonged deep shade. Its future will likely be shaped by disturbance patterns, including human fire management.

Acknowledgements

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9 Trees grows directly from PlantID.net, making extensive use of the materials on this collaborative site. It is a non-commercial book, and none of us receives compensation for its sales. This book is a gift from all of us:

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