

PINACEAE, THE PINE FAMILY

CALIFORNIA'S MOST DIVERSE AND
IMPORTANT CONIFER FAMILY

The pine family has far more species in California than the other conifers combined. It includes...

- The pines in the genus *Pinus*, by far the most important genus,
- The true firs in the genus *Abies* with around 8 species,
- The spruces in the genus *Picea* with only 3 species,
- The hemlocks in the genus *Tsuga* with a mere 2 species, and...
- The Douglas-firs in the genus *Pseudotsuga*, also with 2 species

The pine family is identified by...

- Needlelike leaves,
- Alternate leaves,
- Pollen cones larger than other conifers (but still relatively small), and...
- Mostly substantial seed cones with spirally arranged scales, each scale bearing only 2 seeds

Members of the pine family live in many different environments,
including...

- A variety of coastal forests,
- Forests on special soils such as serpentine and volcanic ash,
- Mixed-evergreen forests,
- Foothill woodlands,
- A wide range of mountain forests,
- High desert forests and woodlands
- The habitats where they're missing are coastal dunes and bluffs, chaparral and coastal scrub, wetlands, and low deserts

We'll start with the genus *Pinus*, a genus that has over 100 species worldwide, and around 20 in California

- Pines are identified by...
- Needles borne in fixed numbers according to species on tiny spur shoots,
- Large clusters of pollen cones that emerge from buds as new growth resumes,
- Varied bark,
- Varied shapes and habitats,
- Substantial seed cones with woody scales, and...
- Usually winged, wind-dispersed seeds

Because of the diversity of forms and size of the genus, pines are divided into a number of groups, making recognition easier

- In California, the groups include...
- White pines with slender needles in 5s and long seed cones with papery prickless scales
- Whitebark pine with fat needles in 5s, multiple trunks, and squat purple seed cones that shatter when ripe
- Bristlecone pines with fat needles in 5s that are retained for many years and small seed cones with each scale usually ending in a bristle
- Pinyon pines with rounded crowns, thick needles of different numbers (according to species), and squat seed cones with large, nutrient rich seeds
- All of these groups are closely related and we'll deal with them first

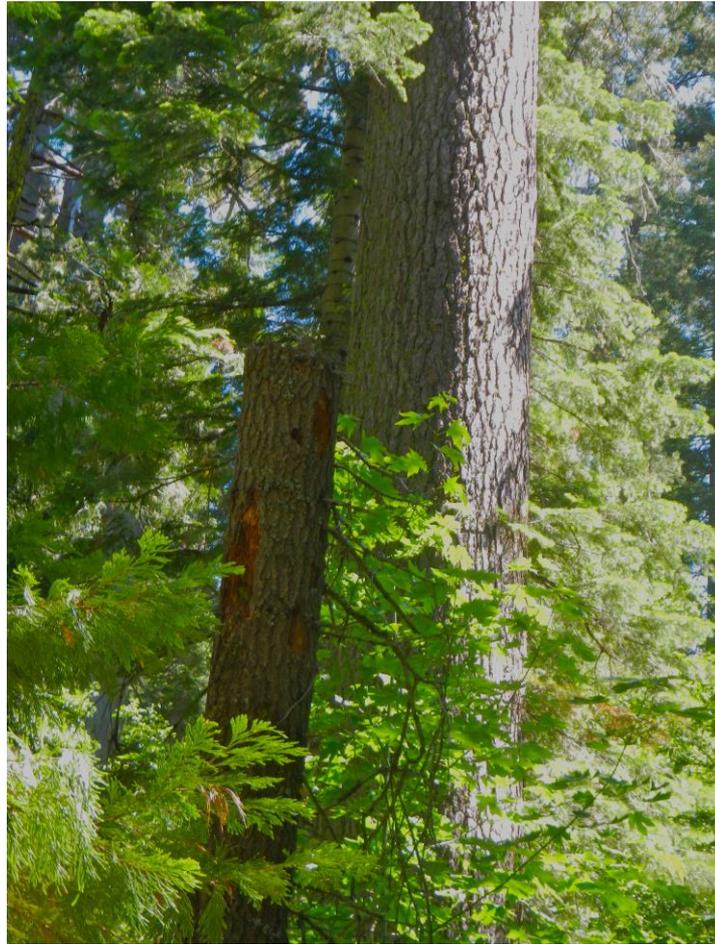
The so-called sugar pine, *P. lambertiana*, is California's most common white pine, widespread in the middle elevations of the mountains. Here you see the spreading branches w cones at the tips



As mentioned above, white pines like sugar pine feature slender needles in 5s.



Sugar pine has massive trunks and grows over 100 feet high, making it the tallest of pines



Sugar pine also has the longest cones in the world, often 18 inches or more long with light-weight scales and a handle at the base



The western white pine, *P. monticola*, replaces sugar pine at high elevations. Note again the widely spreading branches, but with the tips slightly upturned.



Western white pine also produces massive trunks, in this case with checkered brown bark



Western white pine cones have the same overall pattern of sugar pine but only reach around 6 inches long



Our third white pines, *P. flexilis* or limber pine, replaces western white pine in the southern mountains where conditions are drier. Here you see it in its westernmost location on Mt Pinos in Ventura County. Again notice the branch pattern.



Limber pine's cones are shorter yet and instead of hanging, are in horizontal whorls on the tree.



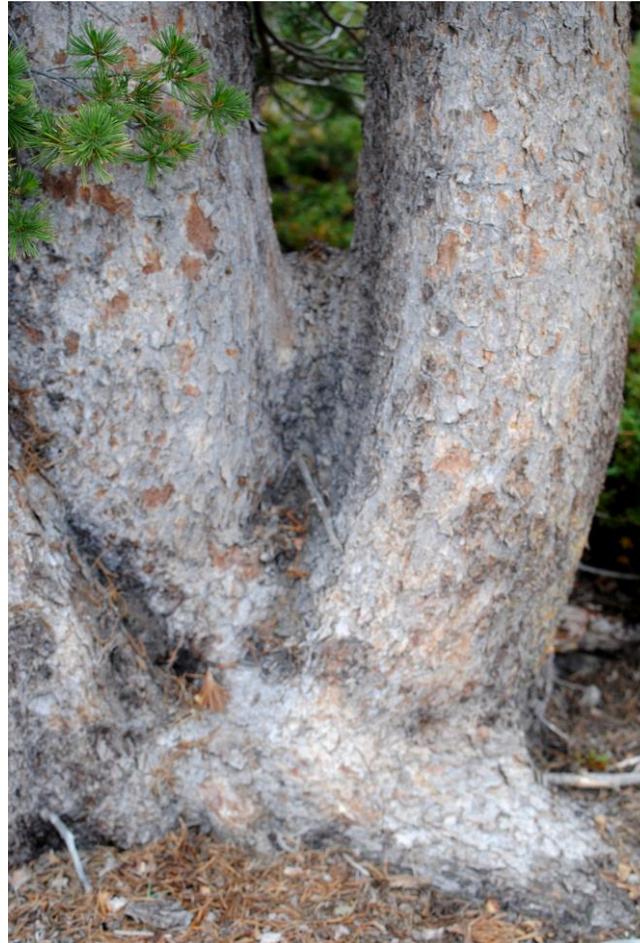
In addition, limber pine cones have more substantial scales, the tips conspicuously thickened as seen here



Our second pine group consists of a single species, whitebark pine (*P. albicaulis*), not to be confused with western white pine. It lives just below timberline and features multiple trunks.



Here you see the white bark of *P. albicaulis*, which is definitely aptly named



The old skeletons of western white pine also display white wood that resists rotting.



While most pines have yellow pollen cones, whitebark pine produces raspberry-colored pollen cones, a distinctive feature.



Whitebark seed cones are fat, in whorls, and don't hang. When ripe, they partially shatter and are extensively picked apart by the clark's nutcracker, a relative of the jays



Bristlecone pines, consisting of only 3 species, are also highly distinctive. Seldom growing more than 40 feet high, they live thousands of years in nutrient poor white soils called dolomite



The biggest concentration of western bristlecone, *P. longaeva*, occurs in California's White Mountains. The individual you see here is also over a hundred years old; these trees grow very slowly



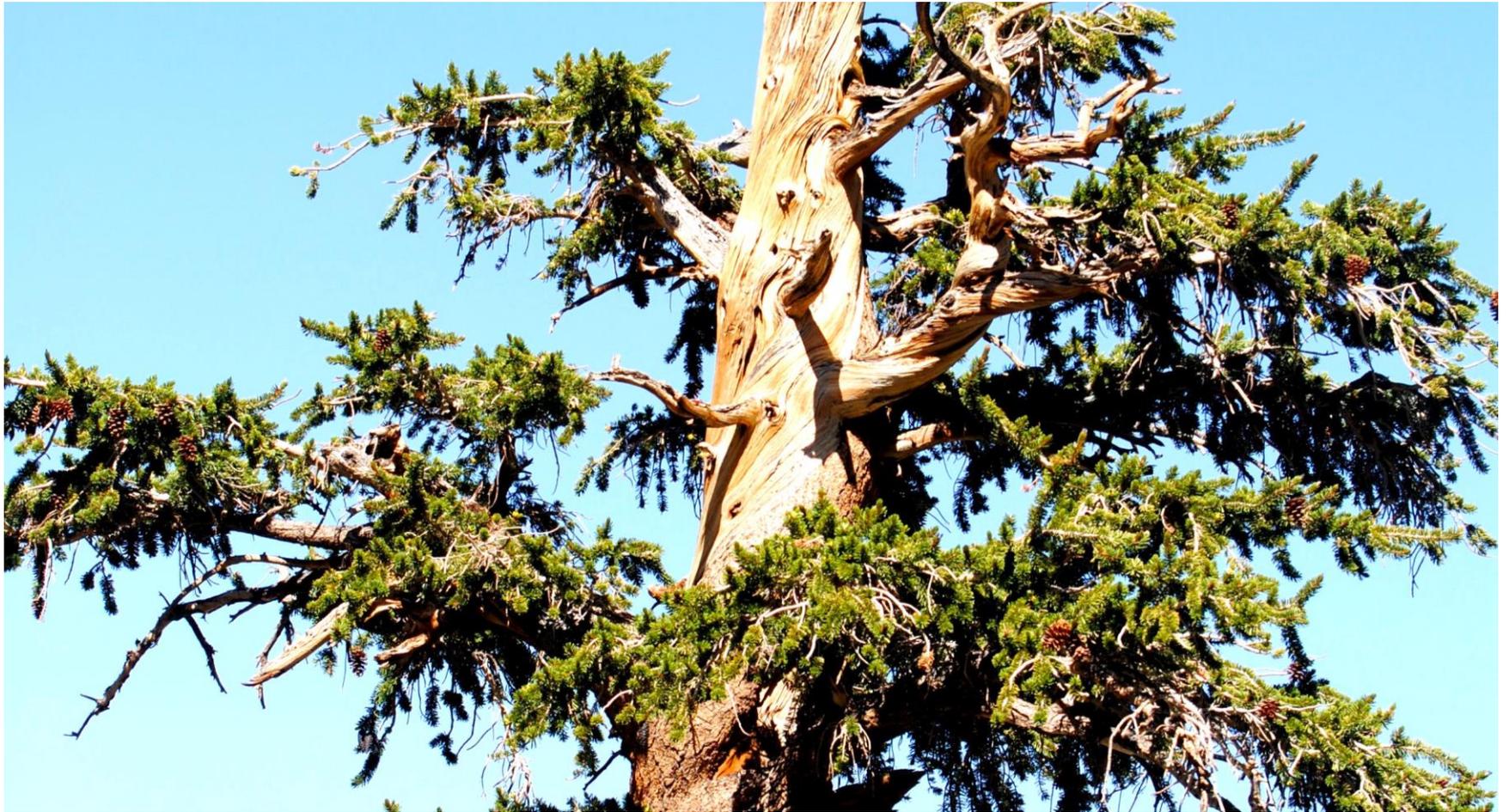
Here you see how thick the bristlecone needles are, extending way back on the branches, and the rather small, brown cones, each scale tipped with a small bristle



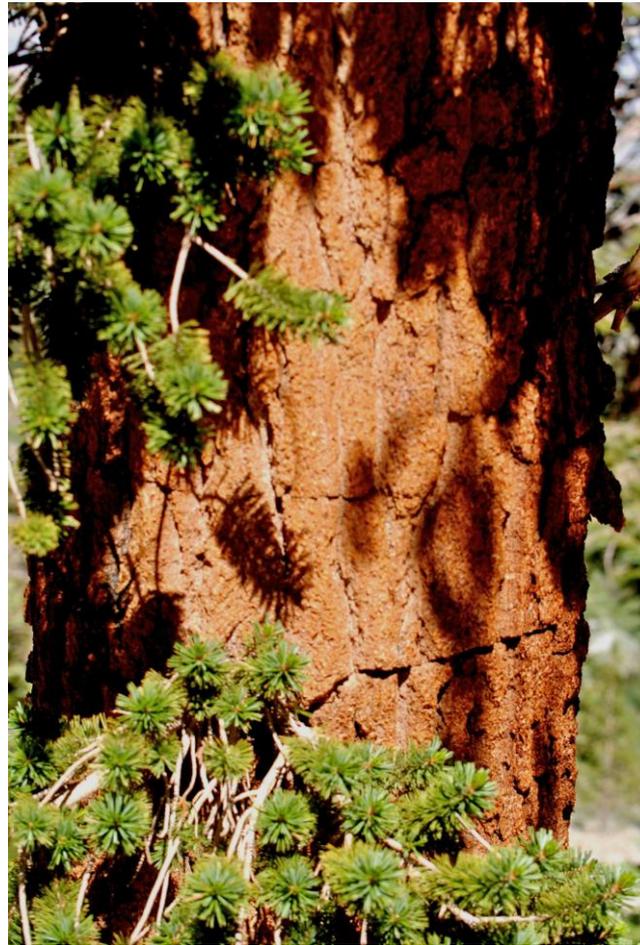
When they finally die, bristlecone pines leave behind massive skeletons of burnished wood that last for centuries because of the dry environment with few fungi.



Our second member of the bristlecone group is the foxtail pine, *P. balfouriana*, which lives in the high southern Sierra and far away in the Klamath Mountains of northwestern California. The thick needles in 5 that are retained for years on the twigs are almost exactly like bristlecone pine.



Foxtail pine, although long lived, does not attain the extreme old age of bristlecone pine and lives on more ordinary soils. The bark of this species is a fine orange-brown and often checkered.



Although foxtail pine cones are similar in shape and size to the bristlecone, they usually have no apparent bristle at the tip of the scales.



As mentioned above, the pinyon pines grow low with an umbrella-shaped crown because of the severely dry desert climate



Although there are a dozen or more species of pinyon pines—all from deserts—only one species is truly common in California. This one is called the single-needle pinyon, *P. monophylla*, because it has a single fat needle per spur shoot, the only pine to do so



All pinyon pines have scales resembling a double rose, each scale with 2 deep cavities to hold the large, nutlike seeds rich in nutrients. These provide food for the pinyon jay and also for desert Indians



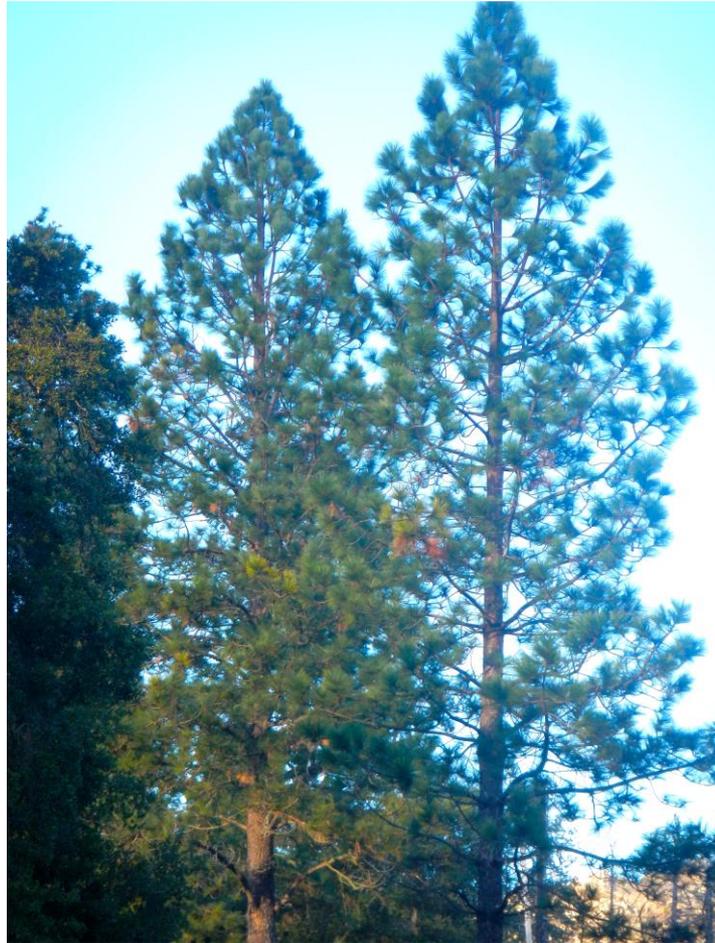
Now we'll move onto other important California pine groups...

- The yellow pines are noted for their pale yellow wood, thick green needles in 3s, jigsaw-puzzle-like bark, and moderately large seed cones, each scale with a small spine
- The big-cone pines, a closely related group, feature different bark, gray to pale green needles in 3s or 5s, and very large, very heavy seed cones with each scales ending in a stout spine,
- The closed-cone pines are noted for their fast growth and short life span, slender needles in 2s and 3s, and asymmetrical seed cones that stay closed until there's a fire, and...
- The lodgepole pines have thick, twisted needles in 2s, scaly bark, and small seed cones, each scale ending in a small prickle

California's two yellow pines are closely related, sometimes hybridizing. Here you see the ponderosa pine, *P. ponderosa*, forming broad forests in the middle elevations of the mountains.



Young ponderosa pines are slender but fill out more as they grow old. Their bright green needles are handsome. The older trees have branches that swoop down as though under weight, leading to the name ponderosa



Mature ponderosa pines have slightly fragrant, honey-colored bark that looks like a coarse jigsaw puzzle



Ponderosa pine seed cones are relatively small, perfectly symmetrical, and each scale ends in a prickle that turns outwards (“prickly” ponderosa)



The second yellow pine, Jeffrey pine (*P. jeffreyi*), replaces ponderosa pine at higher elevations or on the dry sides of mountains. Here you see how the wind often shapes the crown. The needles look just like those of ponderosa pine.



Here where the bark has sloughed off part of a Jeffrey pine, an acorn woodpecker has taken advantage, drilling holes to store acorns. The bark of Jeffrey has smaller segments and a strong, sweet, pleasant fragrance



Jefferey pine seed cones have the same shape as ponderosa but they're two to three times as large, and the prickles at the end of the scales turn inwards ("gentle" jeffrey)



California has three big-cone pines, pretty much confined to the state. The most widespread is the gray pine, *P. sabiniana*, a common sight around the Central Valley growing with oaks in areas of dry, hot summers



Gray pine features long, grayish needles in 3s and is often multitrunked. Here you see a tree loaded with seed cones.



Gray pine cones are very heavy, about as broad as long, and with each scale ending in a recurved stout spine. The large seeds are edible and similar to pinyon pine nuts.



The coulter pine, *P. coulteri*, is closely related to gray pine but lives in somewhat moister environments, often at higher elevations from Black Diamond Mines (pictured here) south into Baja California. Note the greener denser needles.



Both Coulter and gray pines have a similar bark pattern.



Coulter seed cones are if anything even heavier than gray pines, in fact the heaviest of all pine cones. They are somewhat longer than broad and with equally stout spines at the end of the scales



Like gray pine, Coulter pine seeds are large and nutrient rich. Note the wing, which in this species detaches from the seed and in its place, depends on birds and rodents to carry the seeds away.



Although both the Coulter and gray pines have a broad distribution, our third big-cone pine, Torrey pine (*P. torreyana*), is very rare, found only on bluffs north of San Diego, and on Santa Rosa Island. Here you see a wind-pruned tree.



Torrey pine typically has a broad, irregular crown due to wind shearing, and features very long, thick, gray-green needles in 5s.



Torrey seed cones are the same basic shape as gray pine but considerably shorter and somewhat lighter. Because of their rarity, the seeds were never an important food source like the others.



The closed-cone pines have 3 native species. Arguably, the world's best known pine is among them, the Monterey pine, *P. radiata*. Here you see a naturalized stand at the Marin Headlands. Note the bright green needle color.



In the wild, Monterey pine only occurs near Ano Nuevo in northern Santa Cruz County (pictured here), the Monterey Peninsula, and near Cambria and the Hearst Castle. Nonetheless, this is the world's most commonly planted pine, a fast-growing source of timber.



The craggy gray bark of a Monterey pine.



The fat seed cones of Monterey pine are asymmetrical and only open when a branch dies or there's a fire. Even then the cones remain tightly fastened to their branch.



Even this dead Monterey pine still has cones on its branches.



Our second closed-cone pine is *P. muricata* or bishop pine. Like the Monterey pine, this is a coastal species, growing on fog-shrouded forests on nutrient-poor soils. Mt. Vision at Pt Reyes has a major stand as you see here.



Bishop pine has needles comparable to monterey pine except the needles are a bit paler and in 2s, not 3s.



Bishop pine seed cones are smaller than Monterey's but like that species, are on the tree for life, even on the trunk as you see here.



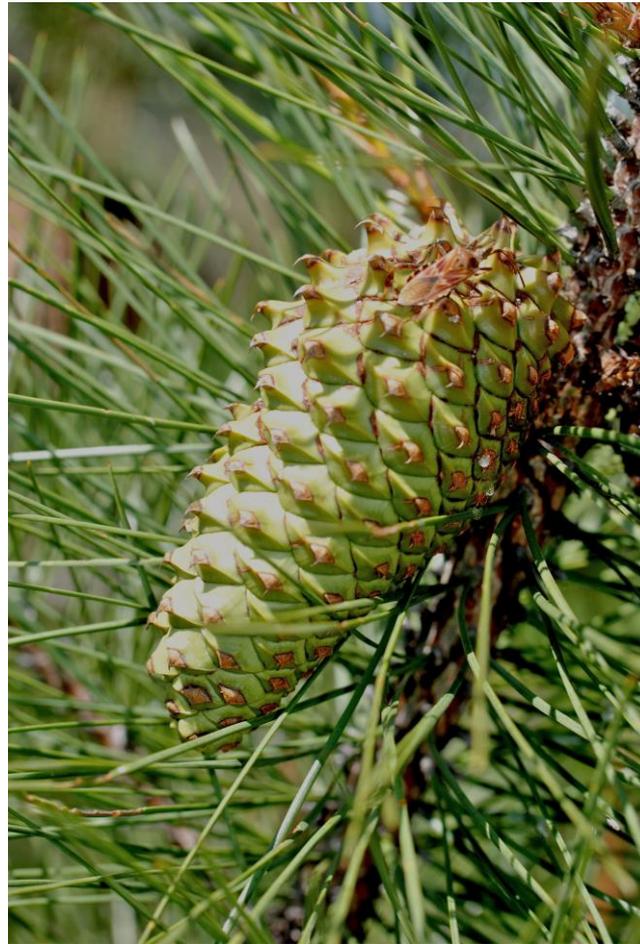
Our third closed-cone pine, *P. attenuata* or knobcone pine, differs from the others in growing inland, especially in the northern half of the state, where summers are hot and dry. Note the even-aged stand you see here, all the trees having started at the same time after a fire.



In keeping with its more stressful habitat, knobcone pine has shorter, sparser needles than the other two; the needles are in 3s. Note how again the cones often are on the trunks.



Here's a close view of the seed cone of knobcone pine. Again the cone is asymmetrical with the outer side displaying knobby prickles.



Here is a scene of knobcone saplings after a fire. Notice how bright the foliage is at this stage and how thick the seedlings are. Only a few will make it to maturity.



Our last group, the lodgepole pines, consist of a single variable species, *P. contorta*. Typical bark on this species, a good identifier, consists of tiny rounded brown to gray scales.



Lodgepole pines are also identified by their short twisted needles in 2 and their very small seed cones, each scale with a tiny prickle at the end.



P. contorta var. *contorta* is called beach pine, and lives on bluffs and old sand dunes on the northwest coast. It features broad, rounded crowns and the branches, as seen here, are often festooned with lichens because of the humid atmosphere.



By contrast, the true lodgepole pine, *P. contorta* var. *murrayana*, is a high mountain species with a narrower footprint and often growing tall and straight. Here you see a sapling.



Mature lodgepole trunks are often scarred by lightning strikes and porcupine damage as seen here.



The true firs, *Abies* spp., are also important in California forests, particularly on the north coast and in the mountains

- Firs are characterized by having resin blisters in their bark when young,
- Needles that leave a smooth scar when they fall from the twigs,
- Pollen cones underneath and between needles,
- Upright seed cones that shatter when ripe, so that they don't fall intact

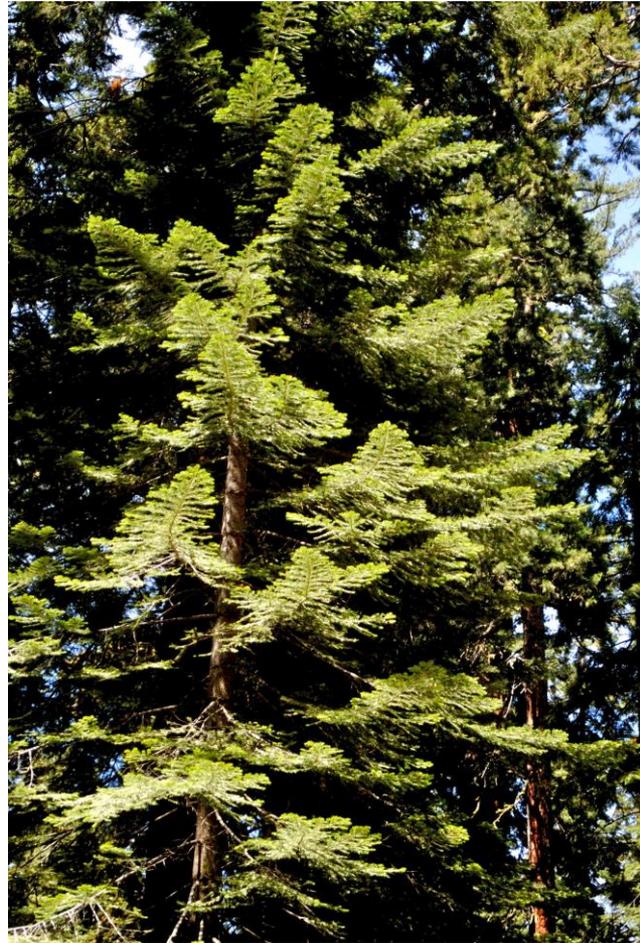
Here you see the resin blisters on a young fir trunk. These blisters disappear with age



Although California has 8 species of true firs, a few very rare species only occur in the far northwest of the state

- The firs we'll cover here include...
- The white fir, common in middle elevation mountain forests,
- The red fir, common in the subalpine zone above white fir, often growing with lodgepole pine
- The Santa Lucia fir, a rare species on limestone outcrops in the high Santa Lucia Mountains of Monterey County, and...
- The grand fir, a massive tree along the northern coast from northern Sonoma County onwards

White fir, *Abies concolor*, is a common companion to ponderosa and sugar pines as well as incense-cedar. It has skirtlike whorls of branches with pale green needles



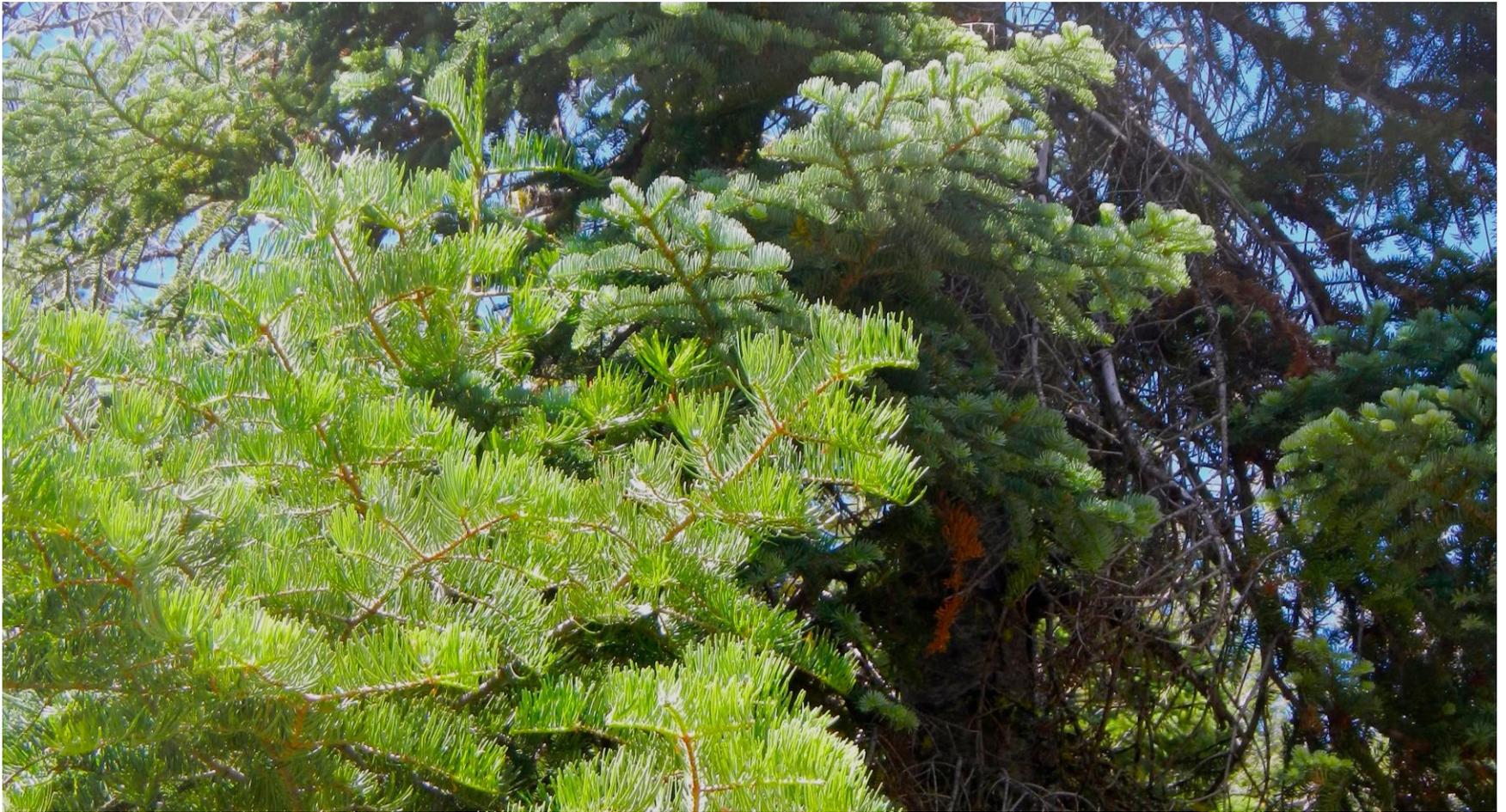
White fir needles are slender and blunt at the tip, and appear to lie flat in two rows, but in fact they do that because the base of the needle twists, as seen here



Occasionally a white fir cone will come to the ground intact, having been chewed off by a squirrel. Note the narrow scales and cylinder shape of the cone, typical for most firs



White fir and red fir overlap at around 5,000 to 6,000 feet elevation. In this photo, white fir is on the left, red on the right. Notice the difference in needle length and color



Red fir, *A. magnifica*, is called that because of the red-brown bark on mature trees. Young trees have whitish bark much like the white firs.



Red fir needles are stiff, short, upright and have a decided bluish cast to them. As a result red fir trees have a more “formal” look than white firs



Here you see the seed cone of a red fir, standing upright near the top of the tree.



A close view of a red fir cone. The shasta variety, var. *shastensis*, seen here, has bracts that extend beyond the cone scales



Grand fir, *A. grandis*, is indeed a grand tree with a massive trunk. It lives along the coastal fringe from Sonoma County north into Oregon and Washington, often growing with Sitka spruce and western hemlock.



Like white fir, grand fir needles lie flat by a twist at the base of each needle, but the needles are bright green and glossy



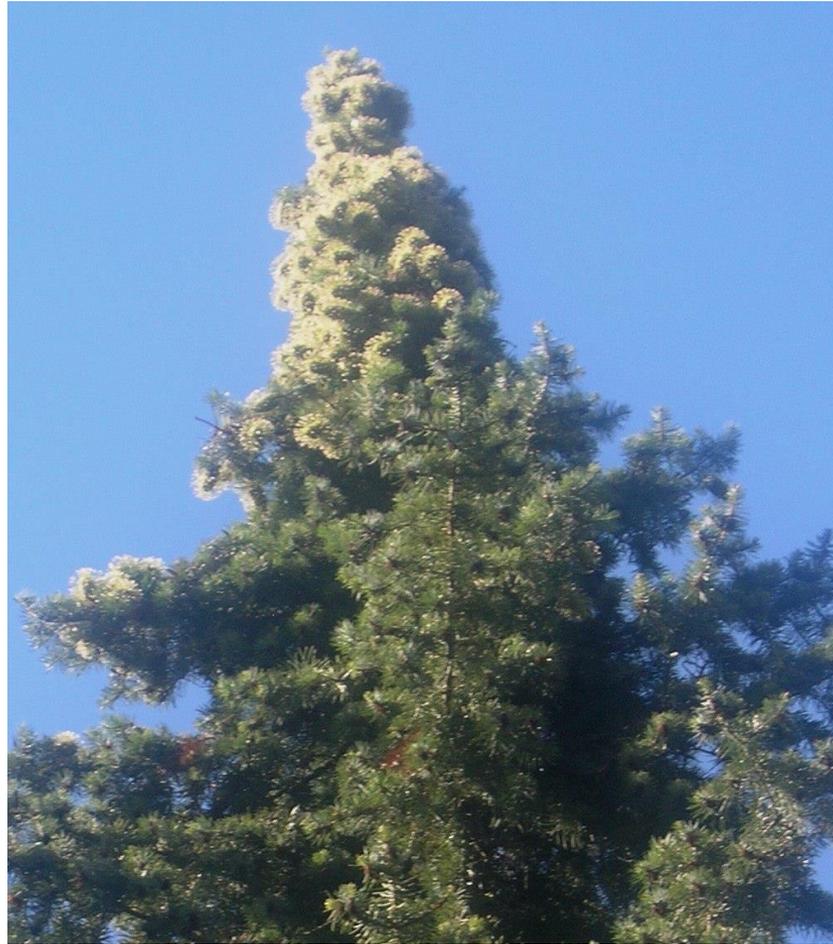
Grand fir needles are conspicuously bicolored, the underside with broad, waxy, white stomatal bands



Grand fir seed cones are narrower than red fir and longer than white fir but sit upright near the top of the tree just as the others do.



The rare Santa Lucia fir, *A. bracteata*, only occurs on steep limestone slopes at the higher elevations of the Santa Lucia Mountains near Big Sur. The shape of the tree is narrow. Here you see the seed cones at the top.



Like grand fir, Santa Lucia fir has bicolored needles, again with striking white stomatal bands underneath but...



...Santa Lucia fir needles are long and sharply pointed, so sharp in fact that they can draw blood. In this respect, they differ from most other firs



Next, we'll look at the spruces, *Picea* spp. Only three occur in California. Spruces are characterized by...

- Scaly bark on the trunks,
- Sharp-tipped needles that leave a “peg” behind when they fall from the twigs,
- Similar pollen cones to firs, and...
- Nodding, light-weight seed cones that fall intact
- In addition, spruce seed cones have fluted or toothed, light-weight, papery scales

Sitka spruce, *P. sitchensis*, is a massive tree from Mendocino County coast north to Sitka, Alaska. It often grows with grand fir and western hemlock. Note the stiff, up-trending branches



Here you see the coarsely scaly bark of Sitka spruce



Sitka spruce features very shallow, widely spreading roots as seen here.



Here you see the sharp, bright green needles and pegs on the branches of Sitka spruce, where the needles have fallen off



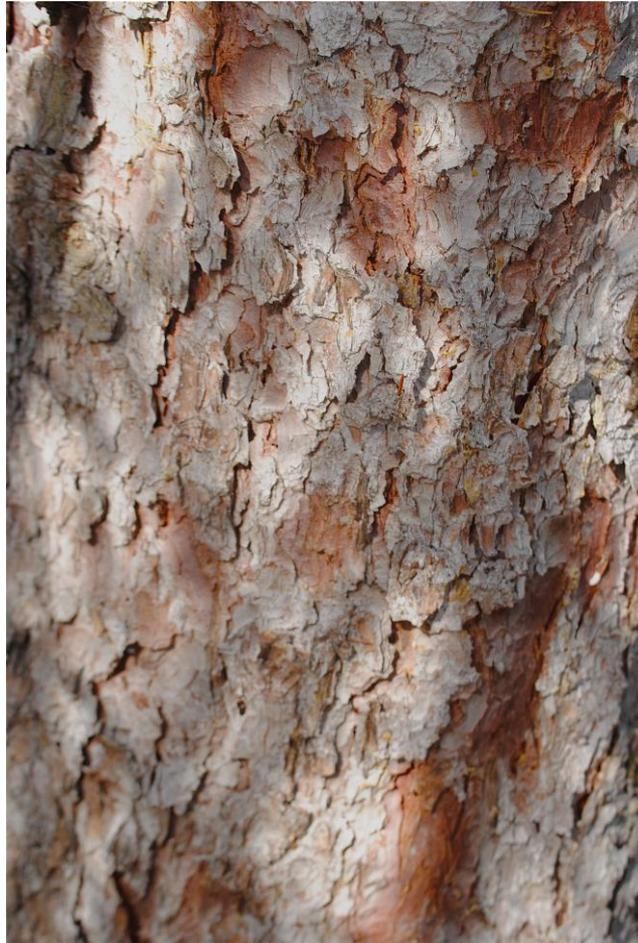
Sitka spruce cones are long and light weight. Note the toothed papery scales.



The overall shape of Engelmann spruce, *P. engelmannii*, is similar to Sitka spruce but the trees seldom grow as large. Common in the Rockies, this spruce is confined to the Klamath Mountains in northern California.



Engelmann spruce bark is similar to Sitka spruce



Engelmann spruce differs from Sitka spruce in having blue-tinted needles and somewhat shorter seed cones



When people see this branch gall, they often assume it's the cone but this kind of gall is not uncommon on spruces



Our third spruce, *P. breweriana* or weeping spruce is confined to the Klamath Mountains only. It is a beautiful tree with gracefully drooping branches that set it apart from other native spruces.



A closer view of the drooping branches of weeping spruce



Although weeping spruce needles are not as sharp tipped as the others, they leave behind the same characteristic pegs when they fall



Weeping spruce seed cones are somewhat longer than the other spruces.



The hemlocks, *Tsuga* spp., are found on the north coast and in the high mountains. Only two are native to California.

- Hemlocks are characterized by...
- Trunks with vertical strips and fissures of bark,
- Short often soft needles which leave a rough place on the twig when they fall, but not a peg,
- Drooping side branches and leader,
- Tiny pollen cones, and...
- Hanging seed cones that are similar to spruce cones except the scales are not fringed or fluted and the size is often much smaller

The mountain hemlock, *T. mertensiana*, lives close to timberline in the mountains. Note the drooping side branches and leader, which instantly tell it apart from spruces and firs



Mountain hemlock needles are short and arranged all around the twigs and have a silvery tint when fresh.



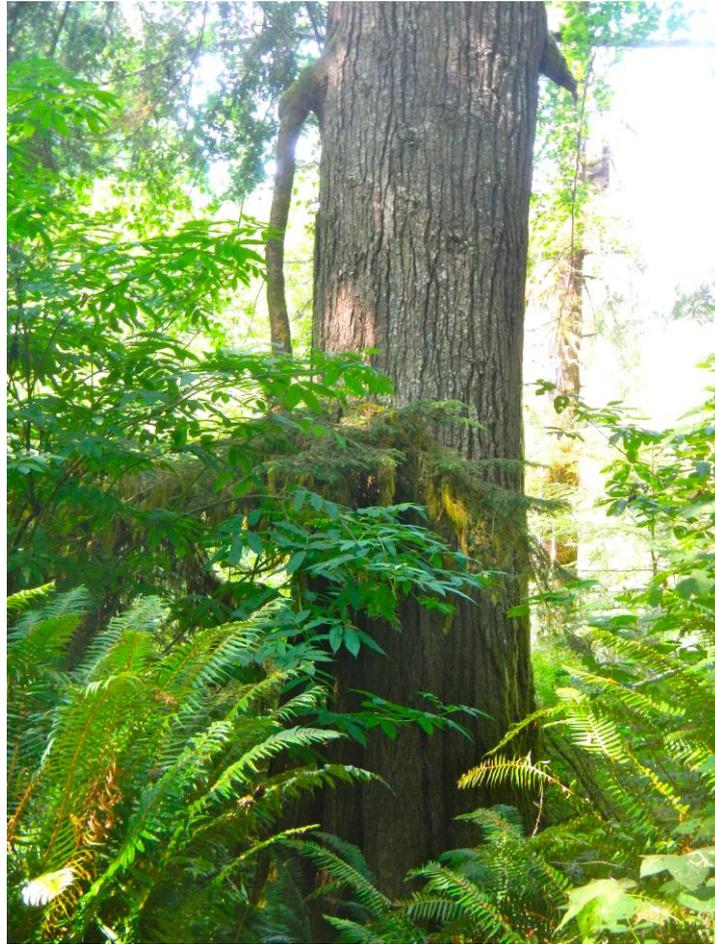
Here you can see how much mountain hemlock seed cones resemble spruces. This species is unusual in having such long cones; most other hemlocks feature tiny cones no more than an inch long.



The western or coast hemlock, *T. heterophylla*, has bright green foliage and lives in highly humid coastal forests, often in company with redwoods and spruces



Like its cohorts, western hemlock can grow large. Note the vertical fissures on the bark.



The specific epithet of the western hemlock means different lengths of needles as you see here. The needles lie more or less flat but alternate long and short



Here are the tiny, hanging seed cones of the western hemlock, clearly different from the surrounding firs, spruces, and redwoods.



Our last native genus is *Pseudotsuga* or Douglas-fir, not a true fir at all but unfortunately hampered with that popular common name.

- California has but 2 species
- The genus is characterized by...
- Trees with irregularly fissured, craggy bark,
- Spirally arranged soft needles that leave a slight edge when they drop,
- Clusters of pollen cones underneath the branches, and
- Hanging seed cones with rounded scales between which there are long, protruding, 3-pronged bracts (“mouse tails”)
- The cones fall intact
- As you can see, Douglas-fir is not that similar to a true fir; in fact the genus name means false hemlock!

The principal species is *P. menziesii*, which has a broad distribution in the Coast Ranges and northern mountains north to British Columbia and east to the Rocky Mountains into Mexico



Douglas-fir grows to heights over 200 feet and with massive trunks. Here you see the typical bark pattern.



Douglas-fir needles are usually bright yellow-green (some variation outside California) and with a refreshing lemony scent.



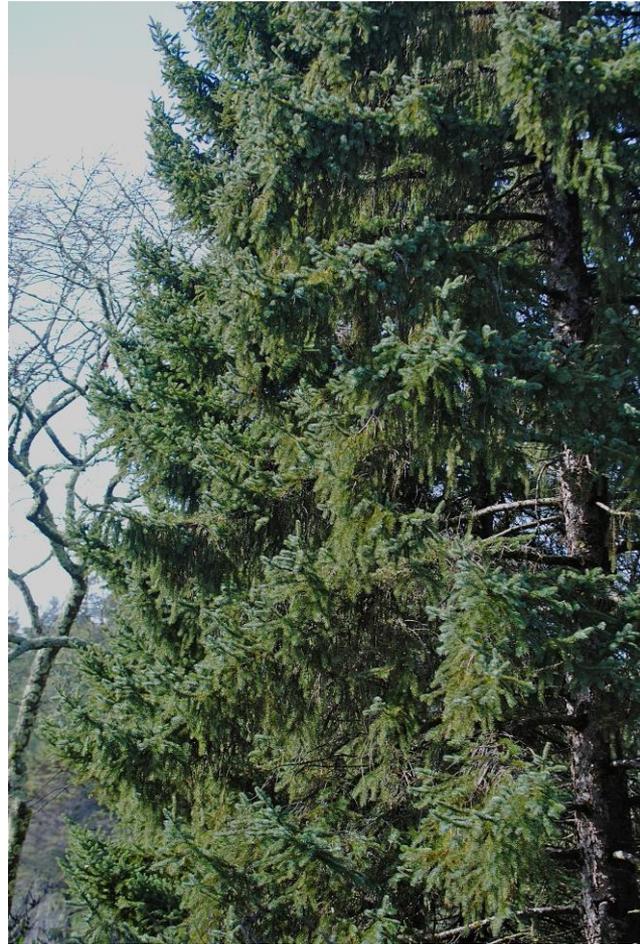
Here you see the drooping pollen cones on the underside of the branches



And here are the seed cones. Note the rounded scales and long, protruding bracts which immediately identify the genus



Few know our southern species, *P. macrocarpa* or big-cone Douglas-fir (sometimes erroneously called big-cone spruce!). It lives at middle elevations in the mountains from Santa Barbara south and doesn't grow nearly as tall as *P. menziesii*.



In most characteristics, big-cone Douglas-fir is like its big sister but the needles are more a pale gray green, reflecting the much drier habitat



Besides these subtle differences, big-cone Douglas-fir does, in fact, have larger cones, up to 2 or 3 times the volume of *P. menziesii* but otherwise the same shape and structure.

