

Redwood Creek Nature Trail

MUIR WOODS
NATIONAL MONUMENT

This booklet is yours to use while discovering Redwood Creek Nature Trail. It may be returned at the end of your walk or, should you wish to keep it, please deposit 25¢ in one of the containers provided at either end of the trail.

Thank you

INTRODUCTION

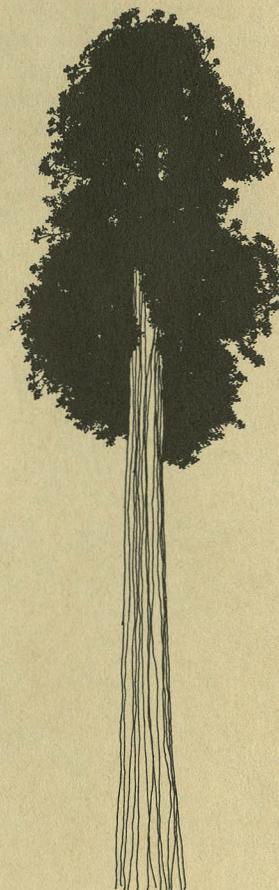
Welcome to Muir Woods National Monument! Here in this canyon situated on the southwestern slope of Mt. Tamalpais (pronounced Tam — al — pie — us) you will find a representative group of coast redwood trees and associated plants and animals. Here you may see how plants have adapted to living in moist, shady situations. Some of the conditions affecting the wild-life living in this area will also become apparent.

The Nature Trail, approximately 1/4 mile in length, has been planned for your relaxation and enjoyment. Unwind from your daily tensions and take the walk. . . uncover the mysteries of a redwood forest as you follow the numbers in this booklet which refer to locations of numbered posts along the route.

The trail has been used by thousands of people. Before fencing, it continued to widen until there was no vegetation (ground cover) 30 to 50 feet on each side of the present path. Fencing was the only solution and therefore we ask that you do not cross the fences.

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Coast redwood (*Sequoia sempervirens*) is the dominant tree in Muir Woods. It is named Sequoia after a Cherokee Indian, "Sequoyah" who developed the first alphabet used by that tribe. The term *sempervirens* is Latin for "always green" which, in view of the great tenacity of the redwood, is an excellent choice. The common name for the tree, redwood, comes from the rich, red-colored wood. Growing to over 360 feet in height and from 8 to 15 or 16 feet in diameter, these trees are found from the southwestern corner of Oregon to the southern boundary of Monterey county in central California, a distance of about 500 miles. Dependent upon summer fog to supplement high moisture requirements, the redwood seldom grows more than 40 miles inland from the ocean or higher than 3,000 feet in elevation. This "Redwood Belt" provides an environment of heavy fog and rain on which the redwood thrives.

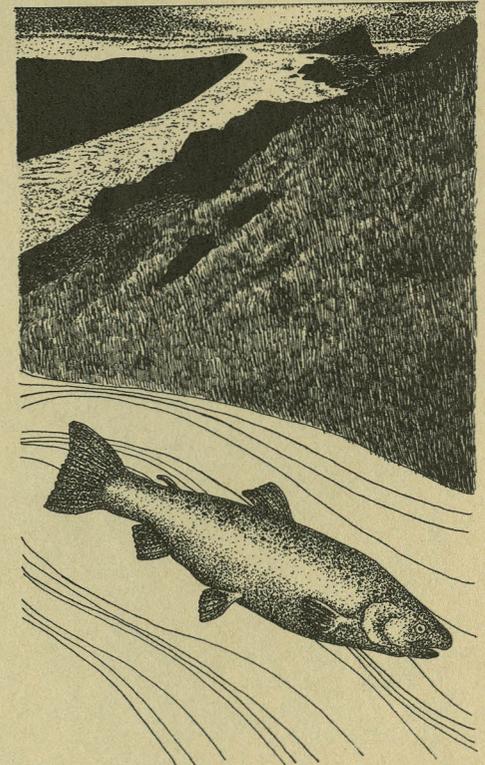


Reproduction of redwoods is accomplished by seeds and sprouts. Note a very thick group of young redwood sprouts along with older sprouts well along in their quest to mature into large, magnificent redwoods. This method of reproduction is quite unique in that the redwood is the only cone-bearing tree that reproduces by sprouting from the root system. These root, or stump sprouts, are remarkably hardy for they draw upon the well-developed root system of the parent tree for the materials from the soil which are required for life—water, minerals, and nutrients.

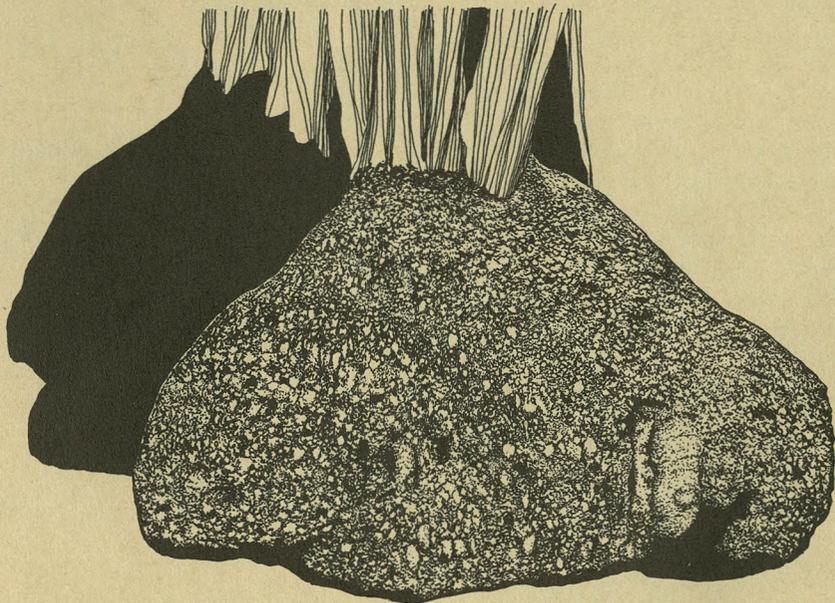
Although almost all redwood reproduction in the monument comes from root sprouts, cones and seeds are produced in large numbers. The male cones (*strobili*) mature between December and late February and release their pollen which is then wind blown to fertilize the female cones. The female cones mature in less than a year's time and release their seeds the following October through January. Thus in December it is possible to observe a golden cast to the trees from the pollen produced by the male strobili to insure a future crop of seeds and, at the same time, many seeds can be seen on the ground from the present year's crop. Seeds usually germinate readily, although not many seedlings can be found within the woods because the thick organic cover on the ground makes it virtually impossible for the young root system to reach the underlying mineral soil.

Redwood Creek originates on the higher slopes of Mt. Tamalpais, draining ten square miles of its watershed. Summer flow is a mere trickle; however, with the arrival of winter the rains begin and during the months of December, January, and February Redwood Creek can become a raging torrent. At this time, an opening is forced to the Pacific Ocean at Muir Beach, three miles below the monument, and coho or silver salmon and steelhead trout (an ocean-going rainbow trout) make their way upstream to spawn in monument waters. The adult salmon die upon completion of the spawning ritual but not the steelhead, who may make as many as three or four annual spawning runs before completion of their life cycle. The young salmon hatch in early spring and remain here until the creek rises again the following winter, at which time they swim to the ocean where they mature for 2 years. The trout, which hatch at the same time as the salmon, may spend one or two years in Redwood Creek as fingerlings, and after spending two years in the ocean, return for the first time as three or four-year-olds. The mature fish usually return to the stream of their birth to spawn, and thus the cycle is continued.

Other creatures also feed, grow, and compete for life in the creek. . . often going unnoted by the casual observer. Water skippers (a small insect which can be seen "skipping" across the quiet pools of summer), crayfish, and the riffle sculpin (a small bottom fish) add to Redwood Creek's population. All stream dwellers are as much a part of Muir Woods as are the trees, ferns, and other vegetation and should be equally respected.

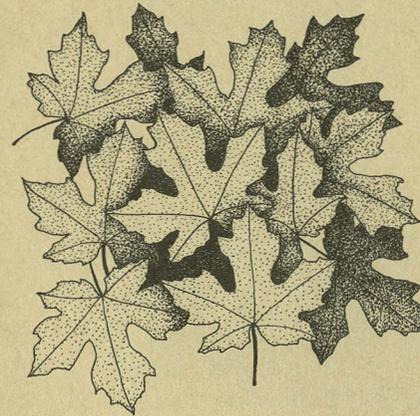


Look up. . . notice the large, lumpy protuberance growing on the redwood tree in front of you. This is a redwood burl and another fascinating feature of these trees. Large burls occur more frequently at the foot of the tree, as the one you can see to your left, however, they can be found singly or in clusters anywhere up and down the trunks of individual trees. The redwood, for some reason, produces burls of greater size than those of any other North American forest tree. Burls are natural growths. . . masses of undeveloped buds. . . which can be likened to a benign tumor. Just what causes these burls to develop is unknown. A burl begins in the growing layer of the trunk as a single bud which fails to sprout.



The bud grows somewhat faster than does the trunk of the tree and divides through the years to produce more buds which do the same, thus forming a larger burl. The wood of the burl is a mass of hard, distorted wood fiber containing a very twisted grain which produces beautiful designs and color effects when it is smoothed and polished. This is in contrast to the regular wood from the tree which is soft and straight-grained. Consequently, burl wood is highly valued for the manufacturing of souvenirs, veneer used on fine furniture, for panelling, and it is even used to make lamp shades.

In addition to the valuable role Redwood Creek plays in the life of the salmon and steelhead, it also enables many trees and other types of vegetation to grow in Muir Woods that would not be able to do so if a reliable water supply were not available. The tree in front of this post might be described as one which "likes to keep its feet wet!" The big-leaf maple (*Acer macrophyllum*) grows along many of the streams in this area and adds a beautiful golden touch to the woods in the fall when its leaves turn color. Big-leaf maples often grow to a height of 50 feet or more and have the largest leaf of any of the many maples.



Oregon oxalis or redwood sorrel (*Oxalis oregana*) is still another plant which has adapted to its shady environment. Oxalis, which carpets much of the forest floor, spreads its leaves in the shade and droops them in the sun. . . a technique which enables it to get the necessary amount of light and also to conserve water. Although the leaves of oxalis resemble those of clover, they are not related. The plant contains oxalic acid, a mild acid, which gives it a tart taste, thus giving rise to the nickname "sour grass."

. . . Do you know why few animals are found here in the lower part of the forest? In the deep shade of the forest floor, the production of flowers by plants is limited and thus fewer fruits and seeds develop for the wildlife to eat. . . which means less food and, in turn, fewer animals. Additionally, food supplies for birds are reduced even further by an absence of a great many insects in a redwood forest. Black-tail deer, Western gray squirrels, and Sonoma chipmunks are the mammals you are most likely to see while walking through the forest. The most common bird in the woods is the Steller's Jay.



California hazel (*Corylus cornuta*) is a common shrub of the north coast mountain ranges and occurs in abundance within Muir Woods. The hard-shelled tasty nuts which this plant produces ripen in the fall and are a favorite food of squirrels and chipmunks. The leaves are always toothed and velvety to the touch.

Examine these two trees closely. . . the larger fire-scarred tree has a deep burn in its left side. Notice the gnarled, irregular growth along the outer edges of the burn cavity where the tree continued to grow following the fire. Another fire scar may be observed on the right side of the same tree. Note the lighter colored sapwood which became exposed when the bark burned and yet somehow escaped being charred. Scar tissue has grown at its upper end.

The tree on the right shows no evidence of having been burned (what looks like a fire scar in the center of this tree is a stain caused by tannin oozing from the tree as a result of injury). It is so close to the fire scar on the tree to the left that it could not have escaped being burned, had it been standing at the time of the fire. Two suppositions are possible: (1) either this tree has grown to its present size since the last severe fire (1845) or (2) the fire scar on the left hand tree is the result of a fire previous to the 1845 fire, thereby making the right hand tree older than 130 years. If the first supposition is correct, then this tree, which is 3 feet 3 inches in diameter and approximately 150 feet high, is perhaps the largest in Muir Woods to have grown since the fire in 1845.

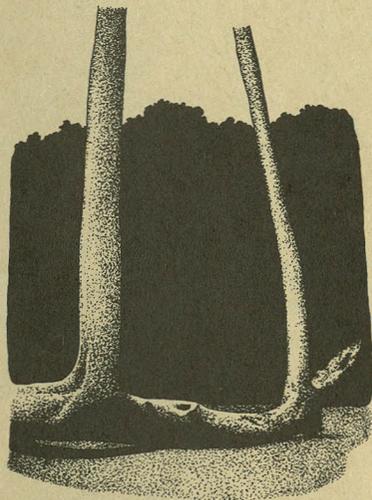
Notice the bark on this redwood. Bark serves a tree much as our skin serves us. . . by keeping out undesirable organisms; the redwood's unusually thick bark (up to 12 inches thick on some trees) effectively excludes many insects and fungi. These enemies usually enter the wood after the tree has lost part of its bark. . . from fire (as previously discussed), or from some other injury. One can help to protect these trees by keeping the bark in good condition; please do not climb on any part of the redwoods and never pick at or cut their surface. Bitter chemicals called tannins are found in the bark and wood of the redwood and this also helps to discourage attacks by insects and fungi.

Ferns are a common associate of the redwood forest. Here, under the shade of the tall redwoods, ferns find those conditions in which they can grow abundantly and luxuriantly. . . plentiful moisture, deep shade, and rich soil. Two types of ferns can be seen in front of you. The sword fern (*Polystichum munitum*) is the coarse fern and gets its name from its long, sharp-pointed leaflets. This sturdy fern is green all year long and is the most common fern in the monument. Large lacy triangles of almost flat-lying leaves identify the bracken fern (*Pteridium aquilinum*), an annual fern which tolerates more sun and poorer soil than other ferns and is among the first plants to grow in a cleared area. The young shoots of these ferns were eaten by the native Indians and fronds were used by pioneers for thatching summer shelters. Other types of ferns, such as lady fern (*Athyrium filix-femina*), maiden-hair fern (*Adiantum jordani*), chain fern (*Woodwardia fimbriata*) and licorice fern (*Polypodium glycyrrhiza*) also can be found growing in the park. Ferns are shade loving plants and thus do well in a redwood forest environment.



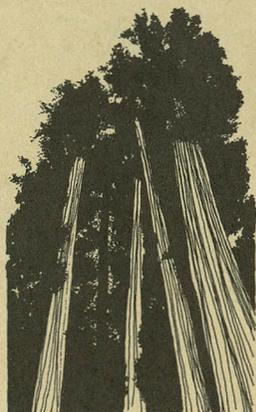
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Here another effect of shade can be seen. . . the California Bay or Laurel (*Umbellularia californica*) grew out from under the shade toward the light, and so doing, acquired such a lean that it fell to the ground. Enough of the root system remains in the soil to permit continued life and the new stems can be seen growing from the top of the trunk, again toward the light. Perhaps you have met this tree under a different name. . . it is also known as pepperwood, spice wood, and Oregon myrtle. The wood is hard, pale yellow, and has a mottled appearance. It is used extensively in the manufacture of souvenir items and in its manufactured form is usually known as myrtlewood. Leaves of this tree may be used as a spice but most of the bay leaves one buys in the store are from a related tree found in Europe. Take a deep breath and see if you can detect the fragrant, spicy odor of this tree.



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Notice the trunks of these lofty monarchs. The sustained rapid vertical growth (up to 2 feet per year) prevents branches from growing to a large size. This self-pruning results in small limbs which die and eventually fall, leaving small knots and clear trunks and thus increasing the value of the timber. No single answer explains the awesome height and age attained by the redwood. Could it be that this tree out-competes its neighbors for available air, sunlight, moisture, and nutrients from the soil; has a rapid growth rate; is quite resistant to fire and attacks by fungi and insects; is an elite race; or is it a combination of these factors? Studies have shown the normal life span of the coast redwood to be 500 to 800 years and the average diameter to be 7 to 10 feet. The redwood is also capable of attaining heights of over 300 feet—the tallest tree in the world being a coast redwood located in Redwood National Park near the town of Orick and measuring 367.8 feet in height.



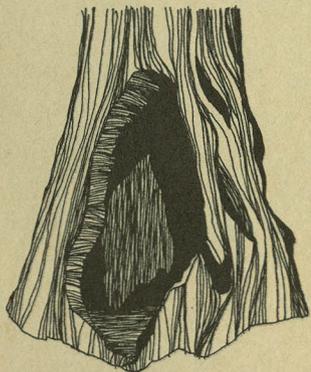
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Redwood is quite resistant to most forms of decay and to wood-boring insects because of its thick bark and tannins in the tree. Look at the logs lying on the forest floor. Dead redwoods, either as standing snags or lying on the forest floor, persist much longer than most other kinds of trees because of this; however, decay will eventually break down even this hardy material. Downed wood is part of the natural scene that parks are established to preserve. Decaying vegetation forms humus which assists the growth of living plants. This is one of the reasons that the gathering of "souvenirs" is prohibited in your national parks and monuments.

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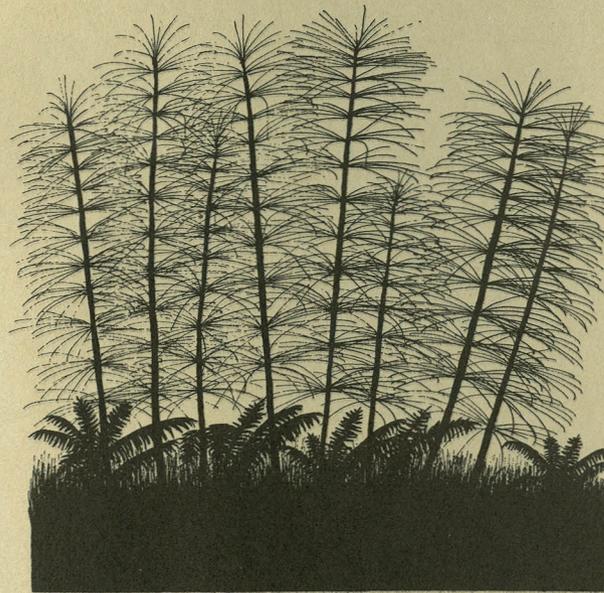
Look at the soil in this location. It is covered with a good deal of organic material from the plants and animals which live in this community. Soil, of course, develops from the underlying rock which, in Muir Woods, is basically sandstone. The sandstone gradually disintegrates and combines with decomposing organic material to form mineral soil. Abundant moisture on the floor and lower slopes of the canyon enables plants, such as the redwood, to grow in profusion and to a large size. Under these conditions, soil forms relatively rapidly. On the higher slopes of the canyon, less moisture is available, plants are smaller and more scattered, and soil forms more slowly. . . as a result, you will find fewer and smaller redwoods.

Notice the fire scars on the trunk of this tall redwood and, specifically, the large burned-out cavity at its base. Redwoods are quite fire resistant as their thick bark has many of the same qualities as does asbestos; however, if a fire is severe enough, it will gradually eat its way through the protective bark, thus causing the underlying wood to become dried out and subject to attack from spores of dry rot. When the next fire burns through the area, the tree is quite vulnerable in this spot and the flames can then gain access to the very heart of the tree where they will burn perhaps for months. After a series of successive fires, often many years apart, a large cavity will develop like this one. The last major fire to sweep through redwood canyon occurred about 130 years ago so the trees that you see in the monument that have been scarred by fire show the remains of fire damage from many years past. But the tenacity of life in the redwood is great, and trees which have been badly damaged by forest fires struggle for life, put on new foliage, and attempt to heal their gaping scars.



This tree, the tanoak (*Lithocarpus densiflorus*), is another of the principal broad-leaved, evergreen trees in the redwood forest. It succeeds here because of its relatively high tolerance to shade. This species is considered the connecting link between the oaks and chestnuts. The bark, which contains large quantities of tannin (as does the redwood), is collected to make tannic acid, used in the process of tanning leather.

The strange looking plant which can be seen growing along the creek bank is perhaps older in its history than the redwood. Giant horsetail (*Equisetum telmateia*) is a descendent of the Carbon Age. . . when it grew as a forest tree 50 to 100 feet tall. In the spring and early summer this relative of the ferns is in the spore-producing state. The spores are borne on a cone-like structure at the tips of special stems. During the summer these stems are replaced by vegetative stems which have whorls of thin stemlike growths. Horsetail has the ability to store silica in its stems and branches, thus giving the plant a gritty texture much favored for scouring pots and pans in pioneer days.



Moss grows on trees as well as on rocks. Here you can see moss growing on a tanoak. . . the tanoak provides an environment which supplies the moss with everything it needs for life without harming the tree. Sunlight filters through from above; carbon dioxide comes from the air; water also comes from the air; and minerals come by way of the trunk from particles carried there by wind and other agencies. Thus, the moss takes nothing from the living tissues of the tree. . . it is not a parasite. As you walk through the forest, look for moss on the trunks of redwood trees. You will find very little.

Remember the tree that "likes to keep its feet wet!" . . . the big-leaf maple? The red alder (*Alnus rubra*) is another streamside plant which, because of its high moisture requirements, grows only along the course of the stream. Growing at elevations below 5,000 feet, it reaches from 30 to 100 feet in height and from 1 to 3 feet in diameter. Lumbermen cut more of this deciduous tree than any other northwest hardwood, mostly for making furniture. Another valuable aspect of the alder lies in the fact that its seeds take root quite fast in burned-over areas, stabilizing the soil made vulnerable to erosion. Here it competes successfully for light by stretching out over the stream, into the open space above it, where the redwoods are absent.

Look uphill from this post approximately 30 yards. . . notice the different-looking leaves high in the two redwoods. Now, look at the trunk of the closest redwood. . . do you see the vine clinging to it? This large vine is an excellent example of one of the various forms in which poison oak (*Rhus diversiloba*) may grow. It may be a climbing vine, as in this case, reaching heights of over 100 feet. In open sunny meadows, it will be a stiff, wire-like shrub, and in shaded areas it is a low, creeping shrub. Poison oak, a plant which can cause severe skin irritation upon contact, provides color in the woods during the autumn season when the leaves turn a rich orange, yellow, or red.



This is the last stop on the Redwood Creek Nature Trail.

We hope you have enjoyed learning a little about the environment of Muir Woods. The staff will be happy to answer questions not covered in this guide. Please remember to place this booklet in the container by the bridge, or to deposit 25¢ in the same container should you wish to keep it.

Thank you.

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