Cone-bearing Trees

OF YOSEMITE NATIONAL PARK

CONE-BEARING TREES

OF YOSEMITE NATIONAL PARK

by James E. Cole

Published in cooperation with
the National Park Service

CONES ON THE COVER

giant sequoia

California torreya

sugar pine

mountain hemlock

incense-cedar

white fir

western juniper

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Yosemite Natural History Association
Yosemite National Park, California

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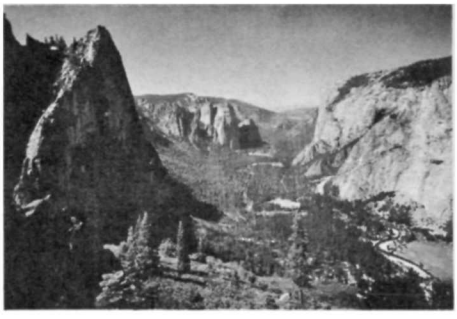
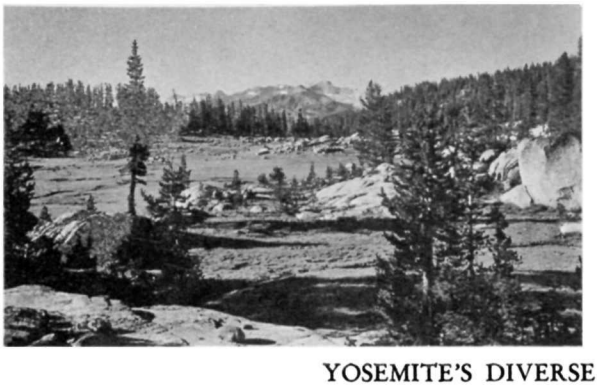
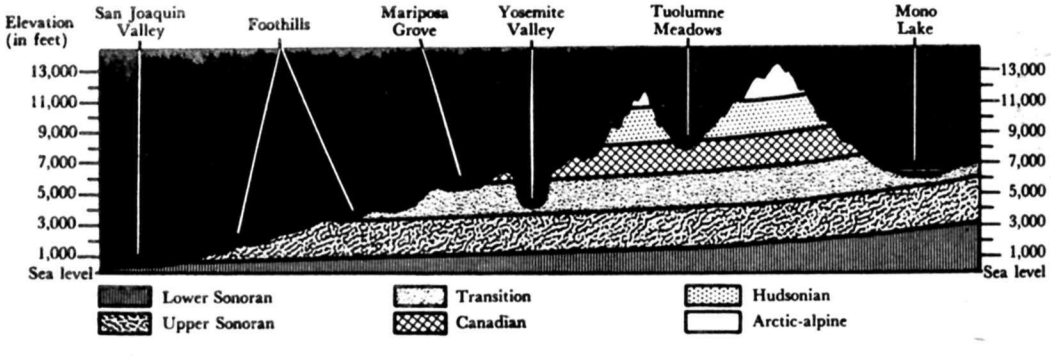




YOSEMITE'S DIVERSE FORESTS

YOSEMITE'S LIFE ZONES



INTRODUCTION

YOSEMITE'S DIVERSE FORESTS: Many and varied are the environments that occur within Yosemite National Park — from hot canyon bottoms at elevations of 2,000 feet in the western foothills to glaciers on 13,000 foot peaks along the eastern crest of the Sierra Nevada. While elevation is the greatest influence on Yosemite climate, lesser influences are the great topographic irregularities here — each canyon, plateau, lake, cliff, dome, and peak having its individual effect. The range in climate produced here by these varied conditions is as great as that which occurs between California and northern Alaska (a rise in elevation of one mile corresponding roughly to a trip to the north of 1,000 miles at constant elevation). Thus, diverse growing conditions occur in mountainous areas such as Yosemite National Park, and 18 species of cone-bearing trees grow here.

Each Yosemite conifer occupies a characteristic environment, although most grow with others with no definite elevation limits. Five regions of similar climate occur in Yosemite, each with distinctive plants and animals. These are known as life zones. The trees of each are shown in the table below. Remember, though, that the concept of a life zone is a generalized one, and that many exceptions exist.

TREES OF THE LIFE ZONES

[cone-bearing trees in **boldface**]

LOWER SONORAN — Sea level to 500 feet. Grassland with scattered valley oaks; otherwise largely treeless except along streams. (Confined to the lowlands of the San Joaquin Valley.)

UPPER SONORAN — 500 to 3,000-4,000 feet. **Digger pine, California torreya,** blue oak, interior live oak, scrub oak, mountain mahogany, toyon and other chaparral plants. (The brushland or chaparral zone of the foothills.)

TRANSITION — 3,000-4,000 to 6,000-7,000 feet. **Ponderosa pine, sugar pine, incense-cedar, white fir, Douglas-fir, giant sequoia,** black oak, canyon live oak, bigleaf maple, dogwood. (Wawona Road, Big Oak Flat Road, Yosemite Valley.)

CANADIAN — 6,000-7,000 to 8,000-9,000 feet. **California red fir, Jeffrey pine, lodgepole pine, western white pine, western juniper,** quaking aspen, chinquapin. (Glacier Point Road, White Wolf, Tenaya Lake, Tuolumne Meadows.)

HUDSONIAN — 8,000-9,000 to 11,000-11,500 feet. **Whitebark pine, mountain hemlock.** (Tioga Pass.)

ARCTIC-ALPINE — 11,000 to 11,500 feet and above. Dwarf willow, various dwarf or matted flowering plants, and turf-forming grasses and sedges. (The area above timberline.)

HOW TO USE THIS BOOK: This book is designed so that you — even with no earlier training — can learn to recognize the cone-bearing trees of Yosemite National Park. Descriptions and illustrations are given for each species in the pages that follow, general information on growth and structure is presented in The Life of a Cone-bearing Tree (pages 46-49), and a key based on leaf character begins on page 49. Remember that not all the cone-bering trees included here have typical pine cones (some have "cones" that look more like berries or nuts), but all have evergreen foliage, either with typical needles or with leaf-covered, needlelike twigs.

As you become more familiar with trees, you will discover that no two look alike — even members of the same species — just as no two people look alike, and that the appearance of a given tree changes with age. Also, you will find that you are not always able to examine every tree character — perhaps cones are not available — and you will have to use some judgement in your identifications. Finally, you will have learned a tree when you identify it not by the list of characteristics so essential at the beginning; but, just as you might recognize your grandmother, you will know the tree when you see it.

TREE DESCRIPTIONS

Common and scientific names used in this booklet are from *Check List of Native and Naturalized Trees of the United States (Including Alaska)*, by Elbert L. Little, Jr., 1953.

DIGGER PINE

Pinus sabiniana

An odd-looking pine, this is the first conifer met in ascending the Sierra from the west and occurs in Yosemite on the warmer slopes at low elevations. An appropriate description of this tree was written by Willis Linn Jepson in *The Silva of California*:

> Scarcely in any sense a beautiful tree, offering no comfort of shade to the inexperienced wayfarer who, dusty and sunbitten, seeks its protection, scorned, too, by the lumbermen, it is nevertheless the most interesting and picturesque tree of the foothills.

SIZE AND SHAPE: Characteristic of Digger pine is thin gray foliage through which forked trunks, large cones, and ascending branches are clearly visible. On a mature tree, the multiple trunks produce an irregularly rounded and open crown 50 to 75 feet high.

TRUNK AND BARK: Trunks of mature trees are 1½ to 2½ feet in diameter; and are covered with dark grayish-brown, rather thick bark that is trenched with deep, broad furrows.

AGE: Digger pines with trunks from 20 to 24 inches in diameter are 40 to 50 years old. Older trees may occasionally be found, and some live to 175 years.

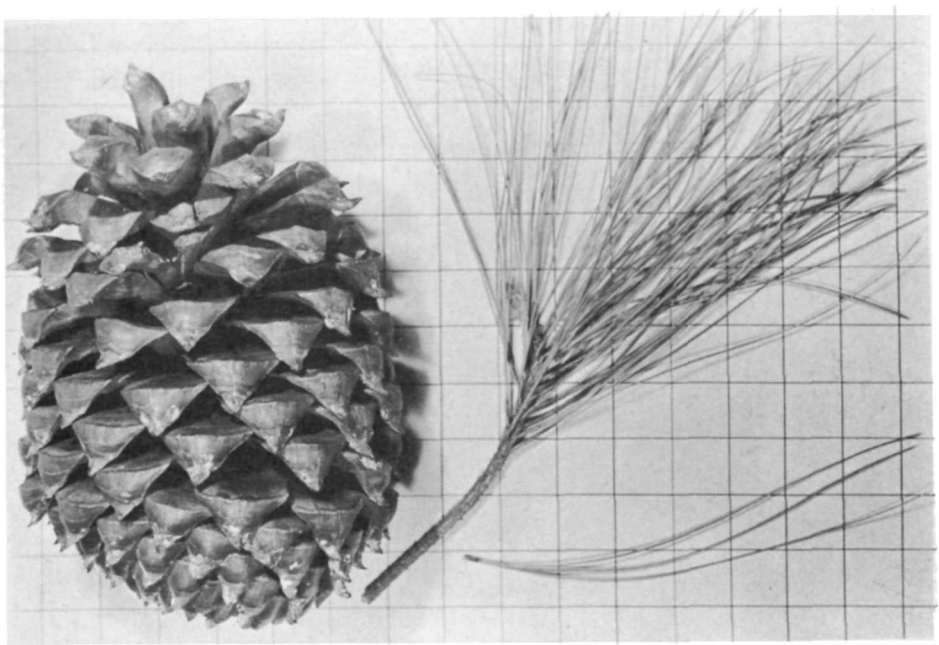
CONES: Cones of Digger pine are large, from 6 to 13 inches long and with a diameter of 5 to 10 inches. They may persist on the trees for several years, attached by stalks to stout branches or upper trunks. Cone scales are reddish brown or chocolate-colored, with large triangular prickles projecting downward at the tips. Digger Indians collected the cones and harvested large quantities of the hard-shelled pine nuts inside, a practice that resulted in the tree's name.

FOLIAGE: Needles are grayish green, in bundles of three, and from 8 to 12 inches long; they droop from the ends of erect pencil-like twigs. As though in keeping with the scattered and sparse occurrence of this tree, the foliage is likewise meager and thin. John Muir said of it in *The Mountains of California,*

> No other tree of my acquaintance, so substantial in body, is in its foliage so thin and so pervious to the light. The sunbeams sift through even the leafiest trees with scarcely any interruption.

OCCURRENCE: In the deep Merced Canyon, Digger pine grows sparsely from the western Park boundary to an elevation of 3,000 feet near Arch Rock. Near Wawona, a few trees occur at the 5,000 foot elevation. In the Hetch Hetchy region, the habitat is more suitable for this species, and the trees are rather abundant. There they grow on the sides of the canyon to an elevation of 6,000 feet on the ridge just south of Tiltill Valley, in association with Yosemite's one grove of singleleaf pinyon.

Digger pine occurs only in California, growing in the foothills of both the Coast Range and the Sierra Nevada. Rarely are trees dense enough to form forests; instead, they occur singly or in small groups scattered over the foothills — growing with oaks, rising above chaparral, or standing out on grass-covered canyon walls. Although ponderosa pine and incense-cedar occur with Digger pine in foothill canyon bottoms, the Digger pine is the main conifer of its zone.



Inch Squares

KNOBCONE PINE

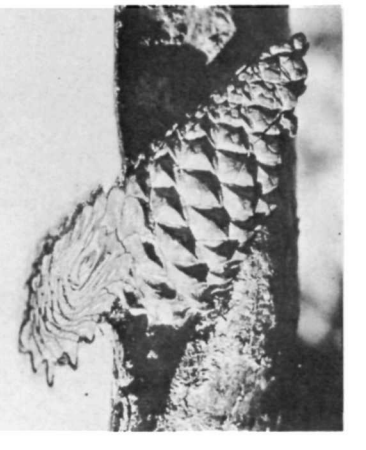
Pinus attenuata

Here is one tree species that may be said to carry fire insurance, for it reproduces abundantly following fire, not an infrequent occurrence in its foothill habitat. The heat of the fire causes its cones to open, and so nearly all the seeds produced since the last fire are discharged. Thus, fire, often considered as the destroyer of trees, is in this case almost essential to reproduction. Another characteristic of knobcone pine is the unusual persistence of its cones, which remain on the tree almost indefinitely. Seldom do they open and liberate their seeds until the tree or branch bearing them dies, and consequently they nearly cover the branches of some trees.

SHAPE: The shape of a knobcone pine tree depends upon whether it is growing alone in the open or with others in dense stands. If alone, the tree has a broad crown and its trunk is forked near the middle; it is then like the Digger pine, but smaller. The tree might be mistaken for the Digger pine, but can usually be distinguished by its many clusters of small cones. The grove form is slender and graceful with the branches ascending.

SIZE: Seldom is a trunk diameter much over 12 inches attained, and in the Yosemite region trees such as the one near Wawona Tunnel (which is 65 feet high and 14 inches in diameter), are considered large.

BARK: Trunks of old trees are covered with thin, dull gray-brown bark that is shallowly furrowed.



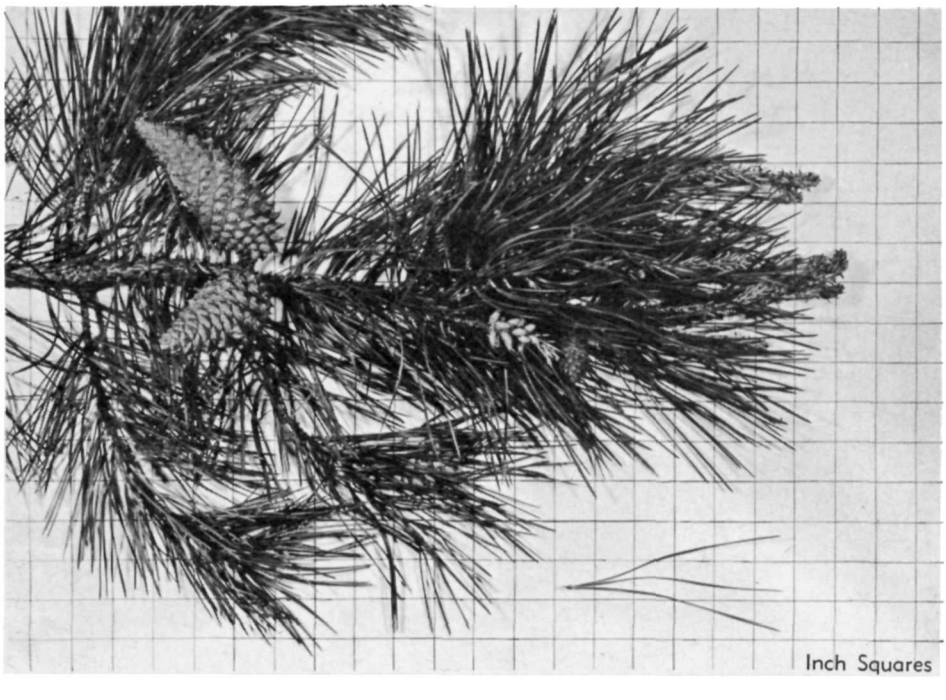
Knobcone pine cone partly embedded in tree trunk.

CONES: Knobcone pine produces its first cones when a mere sapling 2 or 3 feet high and 3 to 8 years of age. Cones are small, and are attached to the main trunk in whorls, persisting on the tree until either the increase in size of the trunk breaks them off or embeds them in the wood. Occasionally the tips of cones barely show through the bark on the lower trunk of a tree, while younger cones higher up are completely exposed. Its seeds show a high rate of germination, almost without regard to age.

FOLIAGE: Needles are pale yellow green, and 3 to 5 inches long (quite short for a three-needled pine). They droop like those of Digger pine, but are more evenly distributed along the branches, rather than being tasseled at the branch tips.

OCCURRENCE: Knobcone pine is rare in the forests of Yosemite. Places where it is known to occur are widely separated and generally difficult of access: One tree is growing on the steep canyon side several hundred yards beyond and below the west portal of the Wawona Tunnel. Others are on the little-used fire road to Deer Camp, along the old Coulterville Road above Big Meadows, near the Merced Grove of giant sequoias, on the ridge above Arch Rock Entrance Station, and along the Merced River at El Portal.

This little-known pine is seldom seen in the Sierra Nevada since the restricted areas in which it grows are frequently inaccessible, although in Oregon and northeastern California it forms extensive forests. Its scarcity here makes it a challenge to find.



PONDEROSA PINE

Pinus ponderosa

Ponderosa pine, the most common pine of the West, can be easily confused with Jeffrey pine, a tree of limited distribution. Not only is it difficult for laymen to tell the trees apart, but botanists argue over whether they are really two separate species. Consequently, a table comparing the two is presented on page 9 to make their identification easier.

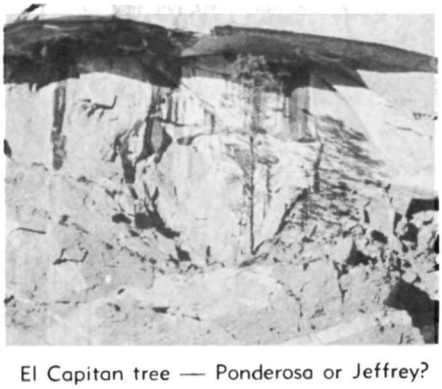
SHAPE: Crowns of young ponderosa pines are narrow and spirelike, but at maturity upward growth slows and the crowns flatten as large upper limbs develop. Main branches sweep downward, and then terminate in sharply ascending brushlike tufts of foliage.

SIZE: In the Sierra Nevada, mature ponderosa pines may be about 5 or 6 feet in diameter, and trees 3 and 4 feet in diameter are abundant.

BARK: The bark color of mature ponderosa pine is light yellowish tan. Thus, this pine's identity is narrowed long before other tree characteristics can be examined. At closer hand, the bark is seen to be arranged in massive, flat plates measuring as much as 3 to 4 feet in length by 1 to 2 feet in width. Closer still, the bark is 3 to 4 inches thick, and consists of thin scales which resemble the pieces of a jig-saw puzzle.

CONES: Cones of ponderosa pine are fragile, about 3 to 5 inches long, and rather light in weight. Prickles at the tips of cone scales characteristically turn out from the cone, so that they prick the hand when clasped, unlike those on the Jeffrey pine cone.

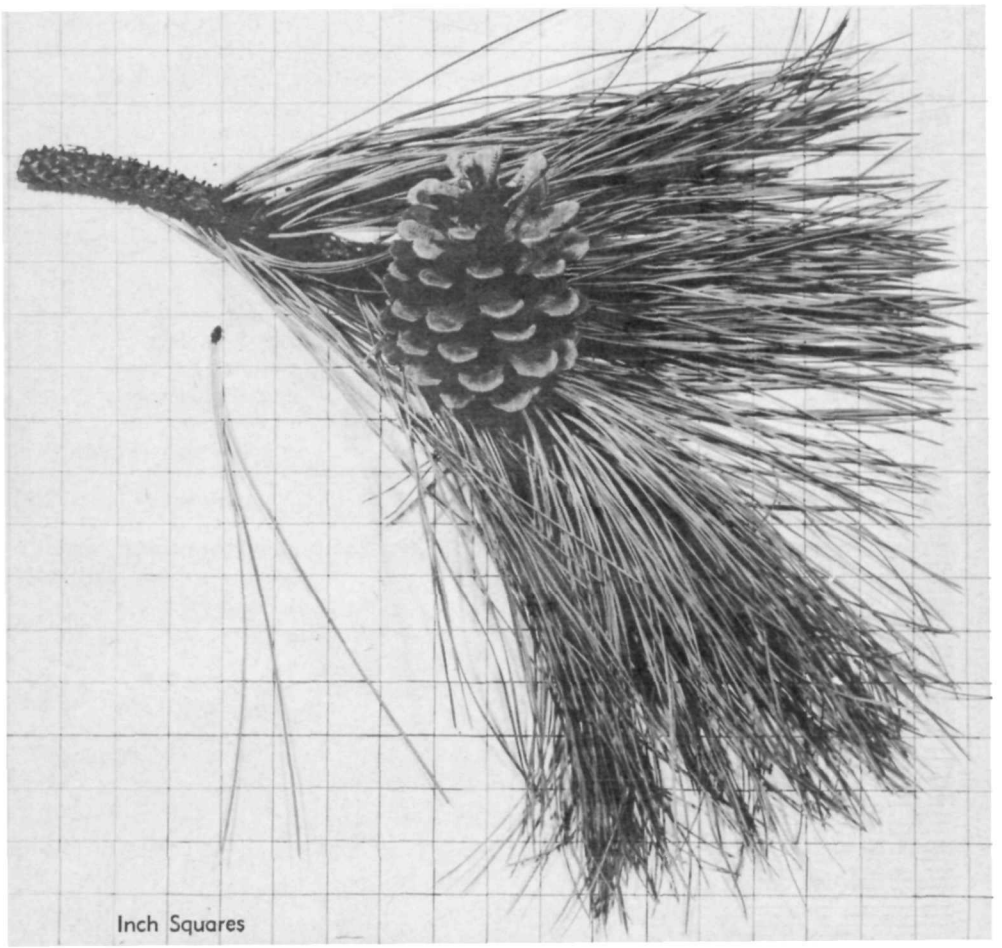
FOLIAGE: Needles are yellow green, long, grouped in bundles of three, densely clustered, and borne as upright tufts at the upturned tips of naked branches.



El Capitan tree — Ponderosa or Jeffrey?

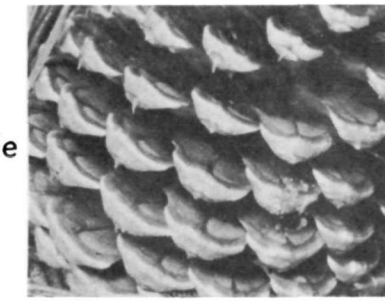
YOUNG TREES: Bark of young ponderosa pine is black or brown on the surface, with yellow and orange shades in the deeper fissures. The surface texture is rough with narrow ridges, and scales are so compact that they cannot be easily divided into individual flakes. These differences between the older and younger bark tend to confuse many who immediately recognize the mature form, but do not realize that other trees with dark bark may be of the same species.

OCCURRENCE: Ponderosa pine is the most widely distributed of all the North American pines: It is found in southern Canada, in northern Mexico, and in all the states west of the Great Plains. The tree grows in a great variety of habitats including desert slopes, granite ridges, moist mountainsides, and high valleys. The most abundant conifer in California, it dominates the middle forested belt of the Sierra Nevada, and is well represented in Yosemite Valley.



PONDEROSA PINE **JEFFREY PINE**

prickle of cone scale



points out points in

mature bark

Ponderosa pine and Jeffrey pine have similar bark, but Jeffrey pine has an odor of vanilla in its bark crevices.

immature bark

PONDEROSA PINE and JEFFREY PINE COMPARED

Ponderosa pine and Jeffrey pine have many similar characteristics. Some of their differing traits are listed below, but even these are not consistently reliable. In doubtful cases, several features should be considered. **In the list below, the most reliable traits are starred (*) :**

	PONDEROSA PINE	JEFFREY PINE
BARK (Mature)		
Fissures	well separated, shallow	close together, deep
Color	light yellowish tan	dark red or reddish brown
*Scales (inner surface)	soft; bright yellow or yellowish tan	hard; light cream or pinkish
Odor	no vanilla odor	vanilla odor
CONES		
*Size	small (3.2 x 2.8 in. —4.8 xx 3.6 in.)	large (4.8 x 4.0 in. —8.0 x 5.6 in.)
*Density	light (0.06 - 0.10)	heavy (0.12 - 0.18)
Scale color	lower surface much darker than upper	similar on both surfaces
Prickle	turned outward (pricks the hand)	turned inward (does not prick the hand)
ELEVATION RANGE (in Yosemite)	3,000 to 6,500 feet	5,750 to 8,750 feet
	(Scattered trees of each species occur both above and below these ranges.)	

Digger pine and knobcone pine have foliage similar to the ponderosa and Jeffrey pines. The cone of Digger pine is much larger than that of ponderosa, however, and the tree seldom grows at elevations as high as Jeffrey pine. Knobcone pine is a small, rare tree with shorter needles and sometimes with conspicuous clusters of cones.

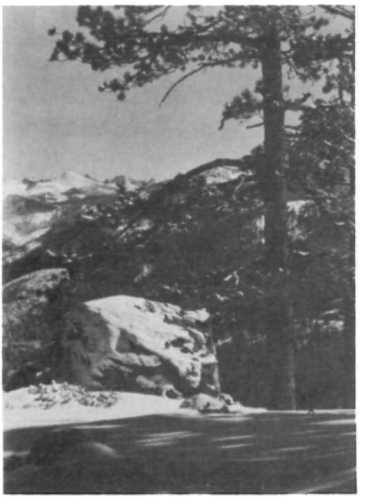
JEFFREY PINE

Pinus jeffreyi

Jeffrey pine varies sufficiently from ponderosa pine to be classed by many botanists as a separate species. Yet confusing them is easy. At the upper margin of the Jeffrey's range, the tree's characters readily identify it; but at lower elevations its characteristics converge with those of the ponderosa pine, and the trees are difficult to differentiate. Then, the cautious use of the table on page 9 should identify the tree in question.

SHAPE: The young Jeffrey pine is similar in appearance to the young ponderosa pine, but a mature Jeffrey is smaller and more widely branched than a mature ponderosa pine.

BARK: Young Jeffrey pine bark is dark brown and ridged, while mature bark is reddish brown and separated by furrows into plates. Usually, a vanilla odor may be smelled in the deeper bark crevices, especially those on the sunlit side of a tree, and on a warm day the odor may be detected at a distance of several yards. A difference in the chemical properties of the resins of the ponderosa and Jeffrey pines probably accounts for the distinctive smell of the Jeffrey.

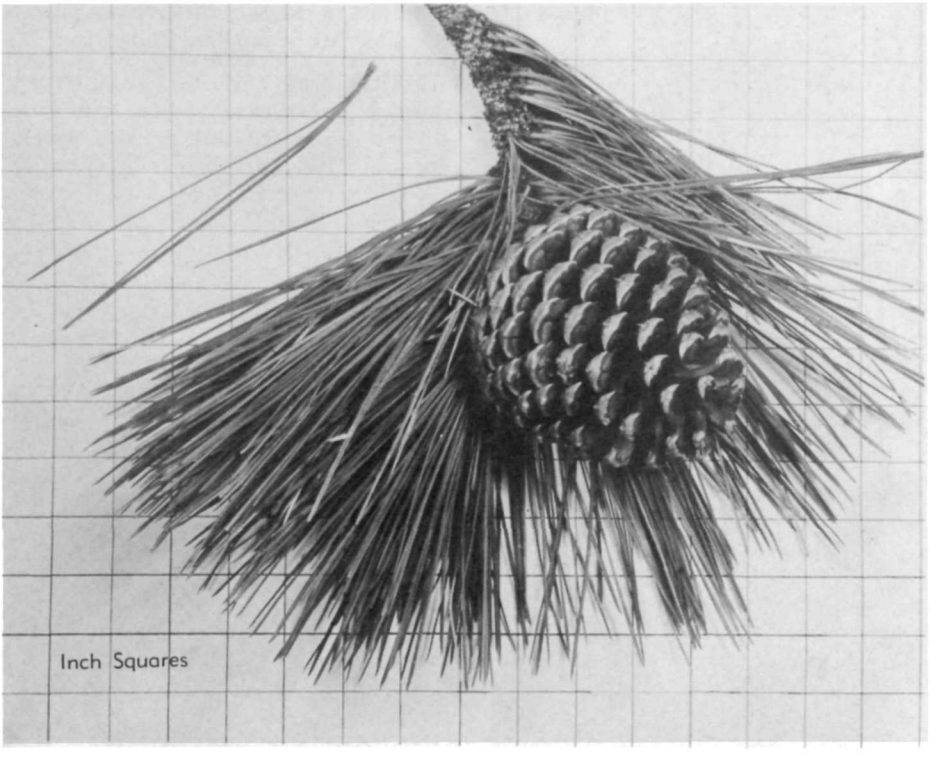


Winter in the Jeffrey pine belt

CONES: The cones, if available, present another method for differentiating ponderosa and Jeffrey pines. Jeffrey pine cones are 5 to 8 inches long, and are dense and firm. Prickles at the tips of the cone scales characteristically turn inward. Thus, they do not prick the hand when a cone is clasped as is the case with ponderosa.

FOLIAGE: Jeffrey pine needles remain on the branches 5 to 9 years instead of about 3 as in ponderosa, and consequently the foliage of Jeffrey pine is denser. Needles are in bundles of three, like those of the ponderosa, but are a dull, pale bluish green, whereas ponderosa needles are yellowish green.

OCCURENCE: Good examples of Jeffrey pine occur in the vicinity of Glacier Point, where it is associated with California red fir, white fir, and sugar pine. A fine open forest of Jeffrey pine is a mile or two beyond Nevada Fall in Little Yosemite Valley. Typical Jeffrey pines occur along the drier, warmer, north side of Yosemite Valley, and as low as 3,500 feet near the base of The Cascades in the Merced Canyon. Specimens grow at 9,000 feet along the Tioga Road above Tuolumne Meadows, as well as on or near the summits of several high peaks, including Chittenden Peak where it occurs at more than 10,000 feet. The dwarfed Jeffrey pine on top of Sentinel Dome (see outside back cover) illustrates the ability of trees of this species to adapt to exposed locations. Thus, the Jeffrey pine extends over a considerable vertical and environmental range.



SUGAR PINE

Pinus lambertiana

Towering above the symmetrical crowns of ponderosa pine, white fir and California red fir, sugar pine spreads huge branches over its forest associates. Not only is it the largest of the world's pines, but it bears the longest cone. Its name is descriptive, for white and resin-free sugar (a sweet and slightly laxative material formerly used by local Indians) may exude from fire burns in the heartwood. Younger sugar pines may be confused with other five-needle pines such as western white pine and whitebark pine, and so the three are compared on page 15.

SHAPE: Most evergreen tree species have a consistent structural form, so that from one vista thousands of similar trees may be seen, all appearing to have been cast from the same mold. Sugar pine, too, has a generalized form, but individual trees deviate sufficiently from the standard so that no two are the same. A mature tree has a massive trunk, frequently free of branches in the lower 100 feet. Long almost horizontal branches near the top produce the characteristic broad, open crown.

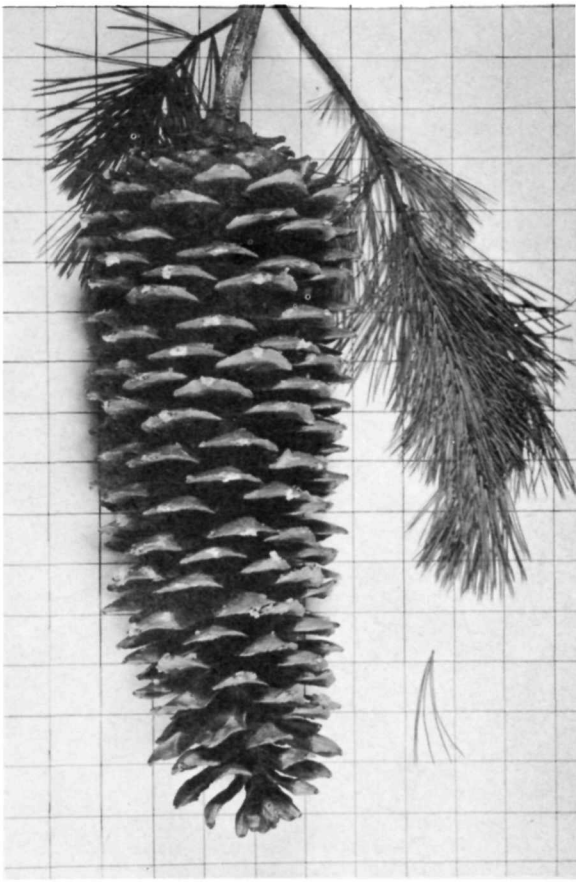
SIZE: Sugar pine trunks attain diameters greater than those of any other pine, averaging 6 to 8 feet. The largest sugar pine known in Yosemite is 10 feet in diameter at breast height. Another fine monarch 8 feet through grows on the bank of the Merced River in Yosemite Valley at Sugar Pine Bridge.

BARK: Bark of mature sugar pine is purplish brown, and fissured into long, narrow ridges. The bark of mature western white pine is a lighter yellowish or reddish color, often fissured into rectangular plates. Rarely does sugar pine bark approach this pattern.

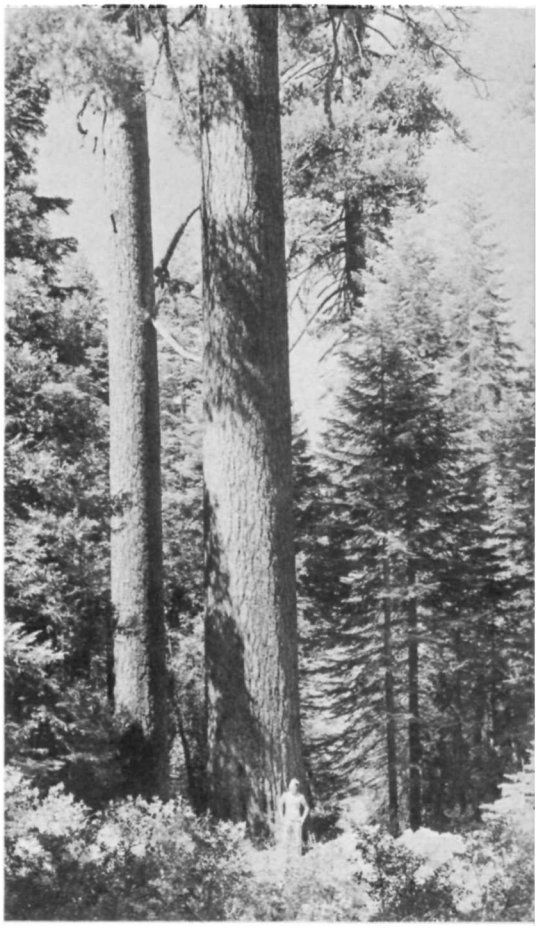
CONES: Sugar pine may be recognized not only by its form, but also by the enormous cones hanging from the tips of high branches. Cones average 14 to 18 inches long with a maximum length of 24 inches and are from 4 to 6 inches in diameter when open. When present, they are so ornamental and prominent that they readily identify the tree. Although sugar pine and western white pine are occasionally confused, these two species can be easily distinguished if mature cones are available: Those of western white pine are shorter than those of sugar pine.

FOLIAGE: A sugar pine too young to bear cones can be identified partly by its needles, which are in bundles of five, like those of whitebark pine and western white pine. Since whitebark pine always grows at a higher elevation than sugar pine, only the western white pine can be confused with sugar pine. Distinguishing between these trees on the basis of foliage alone is at best difficult, as the needles of both are from 2 to 3½ inches long, slender and bluish green in color.

OCCURRENCE: Sugar pine may be readily seen along the Wawona and Big Oak Flat Roads; some grow in Yosemite Valley and down the south side of the Merced Canyon to about 3,500 feet. Its normal range is 4,000 to 7,500 feet. The range of western white pine is generally above 8,000 feet, while whitebark pine occurs higher still.



Inch Squares



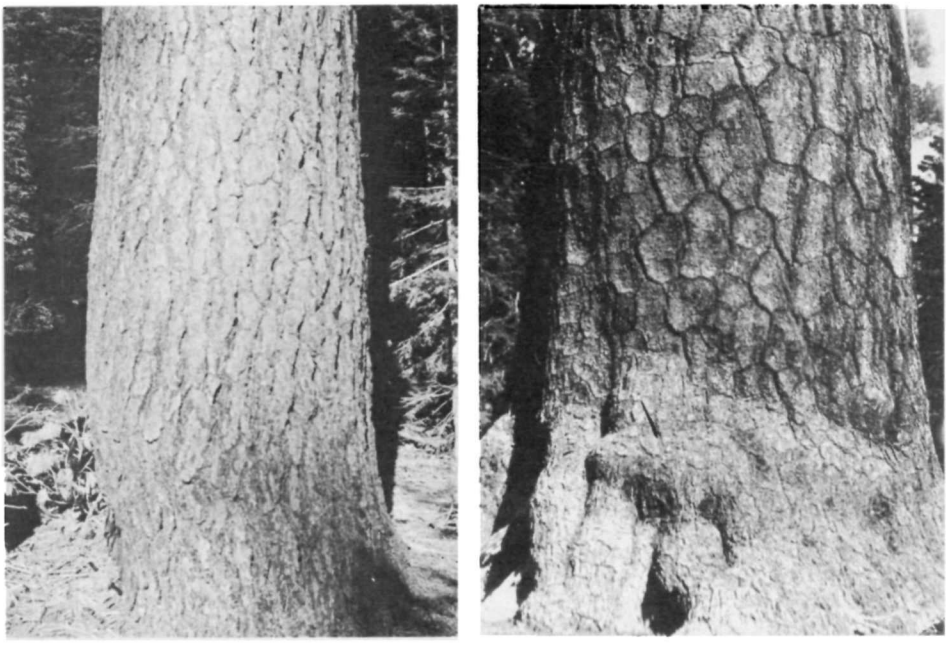
Yosemite's sugar pines, especially those in the northwestern part of the Park, form one of the few remaining virgin sugar pine forests of the world. Through the timely action of public-spirited citizens and the U.S. Congress, large virgin stands of these trees were added to the Park in 1930 and 1939, thus saving them from imminent destruction and preserving them for us to see today.

SUGAR PINE and WESTERN WHITE PINE COMPARED

Sugar pine and western white pine have many similar characteristics. Some of their differing traits are listed below:

	SUGAR PINE	WESTERN WHITE PINE
ELEVATION RANGE (in Yosemite)	4,000 feet to 7,500 feet	8,000 feet to timberline
CROWN BRANCHES	Horizontal and stout	Ascending and slender
BARK PATTERN	Ridged and furrowed vertically	Checkerboarded by furrows
MATURE CONES	12 to 16 inches long (occasionally up to 24" long)	6 to 10 inches long (occasionally longer)

Whitebark pine has foliage similar to sugar pine and western white pine. It never grows as low as sugar pine, however, and can be told from western white pine if cones are available.



Mature sugar pine Mature western white pine

BARK PATTERNS

WESTERN WHITE PINE

Pinus monticola

Western white pine is a common tree from elevations of 8,000 feet to just below timberline. Near the lower limit of its range it grows in company with California red fir, its wide-spreading upper branches hidden by the taller, sharp-pointed fir trees. But from the fir belt almost to timberline, western white pine retains its form and size, thus contrasting with the smaller trees of the upper zones. Some care must be used in differentiating this tree from the sugar pine and the whitebark pine, especially in youth. In some cases, only a skilled botanist could make a distinction in the field, and so the three trees are compared on page 15.

CROWNS: Upper branches of western white pine are slender and sharply ascending, often nearly upright at their tips unless gracefully recurved by the weight of cones. Upper branches of sugar pine are stout and horizontal. Western white pine may exhibit a few long, stout branches extending 10 to 15 feet beyond the other slender branches in a fashion somewhat like sugar pine, but usually even these are more nearly upright.

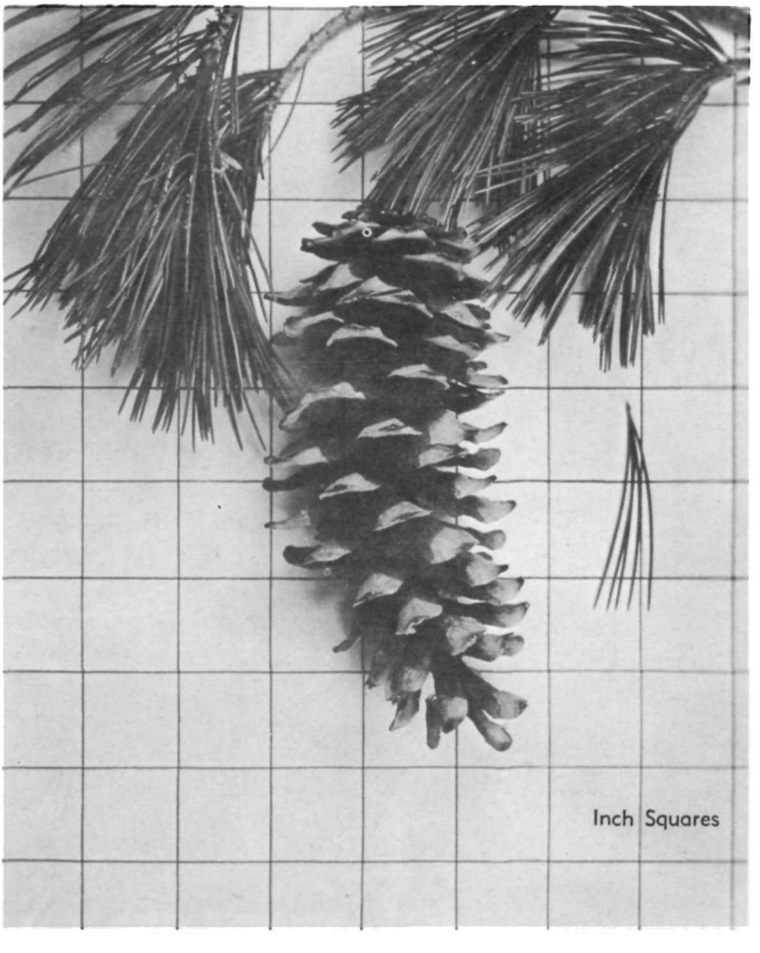
SIZE: Trunks of old trees commonly measure 5 feet in diameter and occasionally specimens 7 feet through are found. The largest western white pine known in Yosemite has a diameter of 8 feet above the root swell, and stands 120 feet high.

BARK: The western white pine may often be recognized at a distance by the rectangular pattern of its bark, a pattern shown by no other Yosemite conifer. Furrows follow a gridlike pattern through the bark, dividing it into small, nearly square plates. In exposed locations, the pattern is especially noticeable and the bark color is cinnamon red or yellow brown, different from the brownish gray normal to the young trees and to those dwelling in dense protected stands.

CONES: Immature cones are narrowly cylindrical and dark purplish or greenish. At maturity, they are usually 6 to 10 inches long, with richly contrasting colors on the cone scales — yellowish brown on the tips and purplish brown on the inner surfaces. They are like sugar pine cones, but are only half as large. Even so, they are nearly as conspicuous on their smaller parent as are the larger cones on sugar pine, and in both trees the cones hang in clusters at the ends of upper branches. Cones of western white pine are quite different from those of whittebark pine, and readily distinguish the trees when available.

FOLIAGE: Western white pine has the same number of needles in each bundle that the word "white" has letters — five. These needles, from 2 to 3½ inches long, grow in tufts at the tips of the branches. They are bluish green with a whitish tinge, very slender, and have blunter points than the needles of sugar pine, which they closely resemble. If any young shoots are present, the western white pine can be recognized by the brownish down covering them. But even a forester seldom attempts to distinguish between these two trees on the basis of foliage alone.

OCCURRENCE: Western white pine grows in the higher parts of the Park, from 8,000 feet almost to timberline. It occurs along the Glacier Point Road, and several small trees grow out of cracks in the bare granite of Sentinel Dome. Trees are numerous along the upper parts of the trails to Half Dome and Clouds Rest, and easily observed along the Tioga Road from White Wolf to Tioga Pass. Just below timberline, western white pine prefers shelter rather than an exposed slope. At lower elevations it grows well in exposed localities.

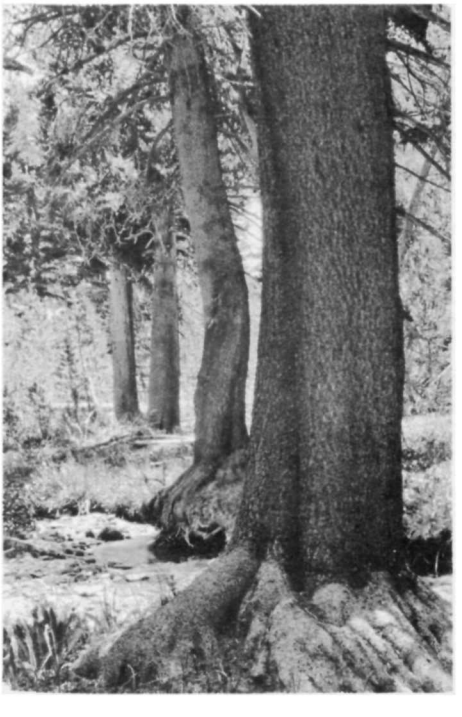


LODGEPOLE PINE

Pinus contorta

Generally, the lower forested area of Yosemite National Park consists of mixed conifers, often with one dominant species. Lodgepole pine, however, forms extensive pure stands at some higher localities. On the less level terrain from 8,500 feet to timberline, this tree occurs in association with western juniper, mountain hemlock, and whitebark pine.

SHAPE: Lodgepole pines grow tall and slender with narrow crowns in forests, and trees 50 feet high with trunk diameters of 5 or 6 inches are not uncommon. In fact, this growth characteristic resulted in the tree's name, for Indians of the Great Plains formerly journeyed to the Rocky Mountains to get slender poles from this tree for their lodges or tepees. In more open stands, the trees have dense rounded or pyramidal crowns with large, many-forked branches extending well down the trunks. Just below timberline, lodgepole pines may grow in clumps as small flat-topped trees, or even in semi-prostrate forms, like whitebark pine.



SIZE: Trees growing in open groves near timberline or alone at lower elevations attain trunk diameters of 2 or 3 feet. Whether crowded or alone, trees are never tall; the average height when mature is about 60 feet. Occasionally a large specimen occurs; one 62 inches in diameter has been measured near Moraine Meadows.

BARK: The bark helps to identify the lodgepole pine at a distance; it is scaly, thin, and grayish. Up closer, the bark scales are seen to have yellow edges.

CONES: Intermixed with and partially hidden by the needles are small cones, which remain attached to the branches for several seasons after the seeds have been shed. Usually, cones are abundant on the ground below a lodgepole pine.

FOLIAGE: Needles are in bundles of two — unlike those of any other pine in Yosemite, short (1 to 2½ inches long), stout, bright yellow green, and flat compared to other Yosemite pines. This shortness of needles coupled with the tree's general shape and location normally provide adequate information for identification at a distance.

Lodgepole pine forest fringing Tuolumne Meadows

OCCURRENCE: Practically all of the conifers in the Park are restricted in distribution to certain characteristic elevations. This is largely true with the lodgepole pine, too. It is a high mountain tree, preferring elevations between 7,000 and 10,000 feet, but it occurs both above and below this belt. Occasionally it is abundant outside its normal range, but more frequently is sparsely scattered along the water courses. Of the Yosemite conifers it is perhaps the most tolerant of wet soil. In Yosemite Valley (at an elevation of 4,000 feet), several specimens occur in the flatter meadows adjacent to the Merced River. The Glacier Point Road passes through a fine lodgepole pine forest in the meadows on both sides of Bridalveil Creek, and the tree is abundant along the Tioga Road between White Wolf and Tioga Pass.

DEAD TREES: Having a very thin bark, this pine is damaged by fire more easily than most other conifers. Ground fires, which may not affect thick-barked trees, can kill lodgepole pines. The abundance of yellow resin on the bark and the presence of many dead branches low on the trunk may allow a ground fire to run up the trunk and into the crown so that even a green tree may catch fire. Nevertheless, extensive fires are rare in Yosemite's lodgepole forests, and the tree does grow rapidly and reproduce abundantly. The "Ghost Forests" of lodgepole pine along the Tioga Road have resulted not from fire but from the larvae of the needleminer moth, which bores holes in the needles. During periods when the moths are abundant, hundreds of trees are killed.

Ghost

trees

Fringing this mountain pond are dead lodgepole pines, killed by larvae of the needleminer moth. And growing up below the tree ghosts is a new young forest. In nature, death is in balance with birth; and for perhaps thousands of years, parts of Yosemite's lodgepole pine forest have been periodically killed — only to grow again — as surges and ebbs in the moth population have occurred. Some say the trees are ugly, others that they are majestic. Certainly, though, a forest of dead trees is neither pleasant nor safe for camping or picnicking, and so the National Park Service occasionally sprays trees adjacent to the Tioga Road and in Tuolumne Meadows in an effort to keep the most heavily used part of the forest alive. Elsewhere in the great wild lands of Yosemite National Park, the natural processes of death and birth go on.

WHITEBARK PINE

Pinus albicaulis

Whitebark pine is a bushy, timberline tree, often growing alone, and inhabiting high mountain slopes and passes. Daily it is exposed to extreme changes of temperature and seasonally to fierce winds and long periods of snow. In response to this environment, the tree occurs only in scattered stands or in isolated sprawling or matted forms. Curiously, whitebark pine does not grow much below timberline in environments that would seem less harsh; in fact, it might be said that conditions at lower elevations are harsh relative to the needs of the whitebark pine.

SHAPE: A little below timberline, where associated with lodgepole pine and mountain hemlock, whitebark pine is a small, erect tree from 15 to 40 feet high and 1 to 2 feet in diameter. At slightly higher elevations, the tree is prostrate, and at timberline its gnarled, twisted trunks sprawl low among the rocks.

AGE: Even in such a rigorous climate, whitebark pine attains more advanced ages than many pines of the lower forest belt. Growth rings of stunted speciments may average 100 per inch. John Muir wrote in *The Mountains of California* that he counted 255 annual rings in one tree not 3 feet high and only 3½ inches in diameter. Another trunk 6 inches across was 426 years old and a branch ⅛ inch in diameter had lived for 75 years.

BARK: It is from the characteristic white bark of the young trunk that this pine receives its name. The bark of young trees and that on the upper branches of old trees is smooth and almost white, or at times pale rose. On a mature specimen the trunk is roughened by small, reddish- or yellowish-brown scaly plates, making the tree difficult to distinguish from the lodgepole pine. The bark is very thin, rarely more than ½ inch thich even at the base of old trunks.

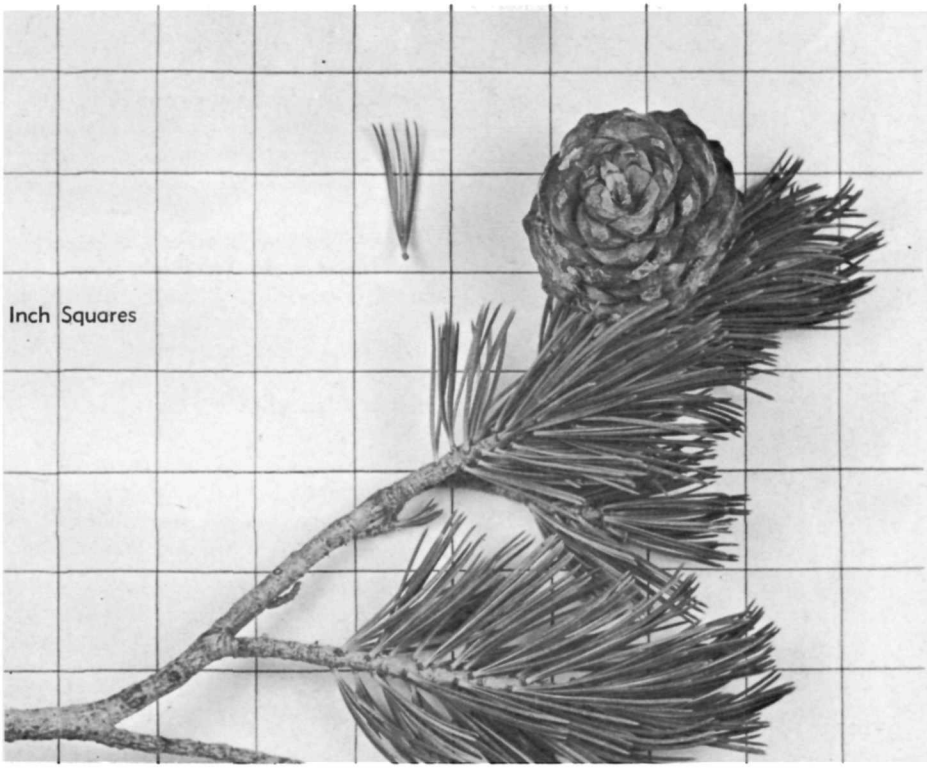
Sprawling form of whitebark pine

CONES: The cones of whitebark pine are unlike those of any other North American pine, in that they are broken up while attached to the tree and fall to the ground scale by scale after the fashion of the firs. The purplish, pitch-covered, glossy cones are clustered at the ends of the upper branches; they are not always found, however, for Clark's nutcrackers and alpine chipmunks tear them apart to get their seeds.

FOLIAGE: Needles are in bundles of five, dark blue green, and short (1½ to 2¾ inches long). They form clusters at the tips of the branchlets. Other pines with needles in bundles of five are western white pine and sugar pine, both of which have a cone very different from that of whitebark pine.

OCCURRENCE: Whitebark pine does not often grow in the soil of alpine meadows, but in rocky, higher areas, around large boulders, or in cracks in bedrock outcroppings. This may be due to the wet soil of meadows, to the protection from gales afforded by the boulders, or to the earlier melting of snow from rocky higher spots than from the lower places.

The most accessible place to see whitebark pine in Yosemite is Tioga Pass. There fine upright specimens occur along the road near Tioga Pass Entrance Station. From the Station, whitebark pine may be observed in its prostrate form fringing the mountains at timberline. A ½-mile hike on the Gaylor Lakes Trail to the top of the ridge behind the Entrance Station allows firsthand observation of this form.



SINGLELEAF PINYON

Pinus monophylla

Among the American pines, the singleleaf pinyon is unique in having needles singly attached to its branches. All other pines in the United States have needles in bundles of 2, 3, 4, or 5. Like the other pines, however, the one-needle "bundle" of the singleleaf pinyon is "held together" at the base by a papery sheath.

This pine is known less well by other names, the most common of which is nut pine, because of the large seeds in the cone. These provide nourishing food. Indians have used them many years, and where the tree is abundant, people still gather and eat the pine nuts. Certainly the desirable common name for this tree is singleleaf pinyon for that name calls attention to its most distinctive trait — the single arrangement of the needles. Its scientific name, *Pinus monophylla* means the same, a pine (*Pinus*) with single (*mono*) leaves (*phylla*).

SHAPE: Singeleaf pinyon usually has a shape like an old-fashioned beehive, low with a rounded crown; but some trees are flattened and irregular. Trunks are forked, bent, and crooked, while branches are short, heavy, twisted, and droop nearly to the ground. Often trees are so distantly and regularly spaced that groups of them resemble old orchards.

SIZE: This tree is never tall, generally being less than 25 feet high. Trunk diameter is usually not more than 12 to 15 inches, although in protected and fertile locations it may be larger. One tree near Tiltill Valley is 43 feet high and has a spread of 57 feet.

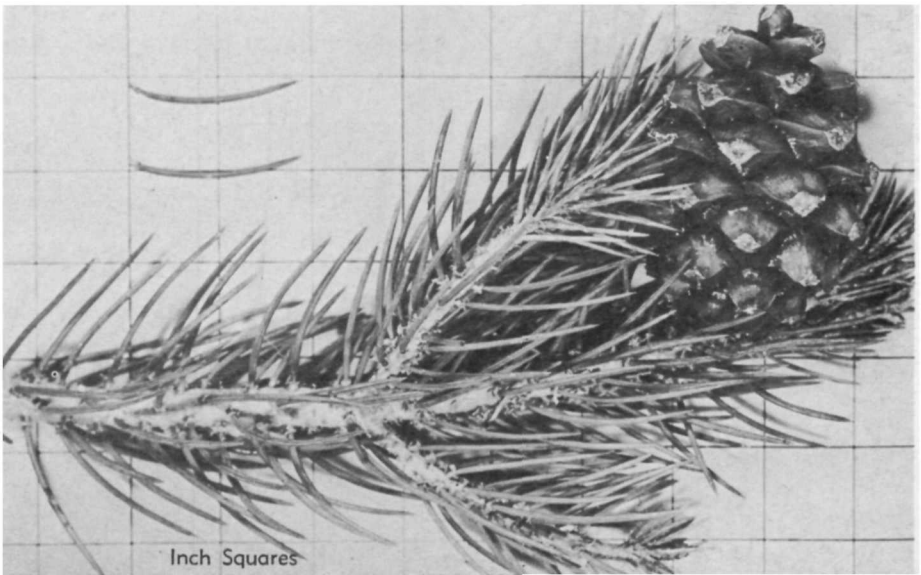
AGE: Singleleaf pinyon grows slowly, averaging well over 100 years at maturity. Occasionally, trees are as old as 225 years, and one tree had 250 annual rings.

FOLIAGE: Foliage consists of single, upward-curving yellow-green needles which average 1½ inches in length, and are cylindrical, spiny, and sharp.

OCCURRENCE: The singleleaf pinyon is a tree of arid foothill regions in Arizona, Utah, and Nevada, but its range extends west to the Sierra Nevada. On the eastern slope of the Sierra Nevada it is common between elevations of 4,000 and 9,000 feet from Alpine County south to Kern County. On the western slope, it occurs in a few restricted, widely scattered localities, the northernmost of which is in Yosemite National Park on a granite ridge between Tiltill Valley and Rancheria Creek overlooking Hetch Hetchy Reservoir. This grove, the only one in Yosemite, is some 2 acres in extent and contains about 100 trees. Isolated trees occur on Piute Creek in Muir Gorge and on Rancheria Mountain.

Branched character of singleleaf pinyon

Few visitors will see singleleaf pinyon growing in Yosemite National Park because all the trees are remote from roads. Nevertheless, those who enter or leave the Park by the Tioga Road will encounter singleleaf pinyon in Lee Vining Canyon and along the eastern escarpment of the Sierra Nevada.



WHITE FIR

Abies concolor

White fir and California red fir are true firs, and so similar that caution must be used when distinguishing between them. To help tell them apart, a table comparing them is presented on page 29. Quite different from these trees is Douglas-fir, which is not a true fir, and can be readily identified by its cones and the arrangement of its needles. Another tree with which all these might be confused is the mountain hemlock, since it, too, has needles singly attached to the branches. (Rarely if ever, however, would the mountain hemlock occupy the same habitat as white fir.) The California torreya when seen at a distance may resemble white fir, also, but it has different foliage and cones.

SHAPE: Branches of young white fir are regularly spaced about the trunk, and often rebranched in one curving plane, so that the overall appearance of the tree is one of symmetrically arranged, open, down-sweeping sprays. Older trees have straight trunks with less symmetrical foliage than the younger trees.

SIZE: White fir is one of the taller trees of the Sierra Nevada forests, growing to great height and girth here, especially in canyon bottoms. Trees 140 to 180 feet high and from 3½ to 5 feet in diameter are common in Yosemite. W. L. Jepson mentioned one in *Trees of California* near the upper end of Merced Lake that is 160 feet high, with a trunk 8½ feet in diameter.

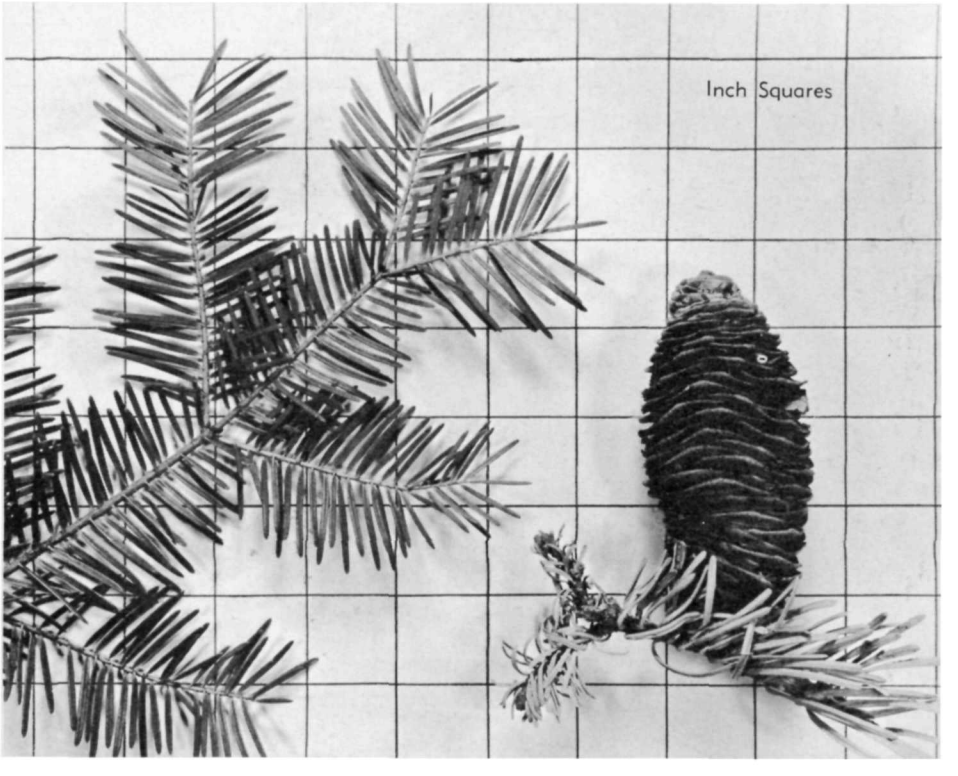
AGE: White firs such as the one 8½ feet thick may be of great age, for trees 5 feet thick are about 450 years old. In old age, many firs are attacked by a fungus which rots out the heartwood, sometimes resulting in the death of the tree. At the same time, however, the soft decayed heartwood provides a good place for bears to build their dens; and with few exceptions, all bear dens found in Yosemite trees have been in firs.

TRUNK AND BARK: Young bark (on young trees or at the top of an older tree) is a light silvery gray, but old bark (on the lower trunk of an older tree) is darker, ashy gray on the outside and brownish yellow within. Old bark is rough and broken by deep fissures, while young bark is smooth.

CONES: Cones of white fir stand upright on the branches near the top of the tree, and are 3 to 5 inches long, rounded at the top and base. Rarely can they be used for identification, however, for they grow only on the upper branches and seldom fall to the ground intact.

FOLIAGE: White fir needles are ¾ to 2 inches long and singly attached to the branches. When young their color is dark yellow green, but with age they acquire a whitish tinge and become paler. Needles on the lower branches are disposed in flat sprays, projecting horizontally on either side of the supporting twigs. Those on higher branches ascend, one rank rising vertically along each side of the twig. Such a needle arrangement is even more characteristic of the California red fir, but the white fir can be differentiated from that tree by the half-twist just above the base of its needle. Needles of California red fir may bend at their bases, but they do not appear to have been twisted about their long axes as do those of white fir.

OCCURRENCE: Usually, white fir grows scattered among other trees rather than in nearly pure stands as does California red fir. It occurs at elevations from 3,500 to 8,000 feet, and may be seen at numerous places, including Yosemite Valley, Glacier Point, and White Wolf. In the middle and upper part of its range, it often grows in company with California red fir.



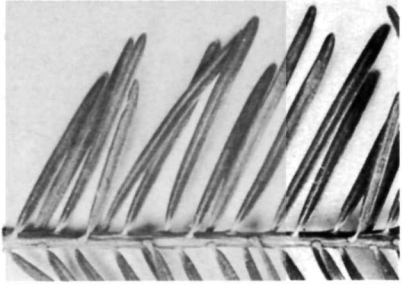
Winter in Yosemite's red fir forest
—snow often piles 10 feet deep.

WHITE FIR and CALIFORNIA RED FIR COMPARED

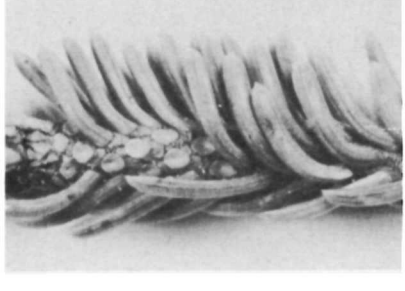
White fir and California red fir have many similar characteristics; some of their differing traits are listed below:

	WHITE FIR	CALIFORNIA RED FIR
ELEVATION RANGE (in Yosemite)	3,500 to 8,000 feet	6,000 to 9,000 feet
MANNER OF OCCURRENCE	Scattered	In nearly pure stands
NEEDLE ATTACHMENT	Attached with half-twist at base	No twist at base
MATURE BARK		
Outer	Gray	Dark red
Inner	Yellow brown, corky	Bright red
CONES	3 to 5 inches long	5 to 8 inches long
FOLIAGE	Thin, pale blue green	Dense, dark blue green

Douglas-fir, California torreya, and singleleaf pinyon have needles singly attached to their branches, as do white fir and California red fir, but each has a distinctive cone.



White fir
(with a half-twist)



California red fir
(with no twist)

NEEDLE ATTACHMENT

CALIFORNIA RED FIR

Abies magnifica

California red fir eclipses all trees in regularity of architecture. Particularly in youth it has a perfection of form that has made it famous; outside national parks the tree is grown commercially and sold as the familiar silvertip Christmas tree. Since this tree can be confused with white fir, a table comparing them is presented on page 29.

SHAPE: Seen from a distance, a mature red fir has a flat open crown above a tall, gradually tapering trunk that is clothed in the upper half with densely foliated short branches. It is a tall tree, with a slender trunk for its height.

BARK: No other tree in Yosemite has bark similar to that of mature California red fir either in pattern or color. Young bark is smooth and white, but the thick bark of mature trees is deeply fissured and irregularly ridged. Weathered outer bark scales are dark red or purplish, while the fresh inner bark is bright red (contrasting with yellow in white fir). If the foliage of a large fir cannot be examined, as is generally the case, the inner bark color will identify it; outer bark color differences are not as consistent.

The bark of red fir makes excellent coals, and may be used in place of charcoal for barbecuing in the mountains. Of course, only dead and down wood can be burned within the Park, and none can be removed from the Park.

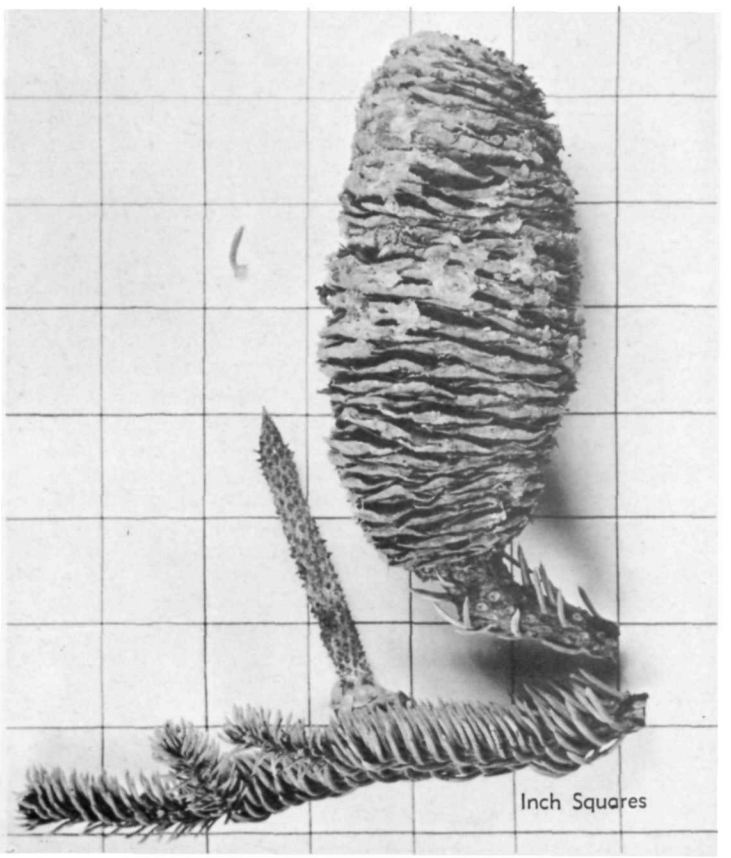
CONES: Like the cones of other firs, those of California red fir stand erect as blunt cylinders on the upper branches. When mature, they are 5 to 8 inches in height and about half as wide. Usually, cone scales and seeds fall away one by one from the thin cone axes, leaving them standing on the branches looking like thin black candles on a Christmas tree.

FOLIAGE: The needles of California red fir are ¾ to 1½ inches long, singly attached to the branches, and conspicuously four-sided in cross-section. Older needles are dark blue green tinged with white, while young needles are a lighter shade of green with enough white to look silvery. Foliage is darker and denser than that of white fir, and while California red fir needles may be curved or straight, they never have a half-twist at their bases as white fir needles do.

When small, California red fir is characterized by its orderly pattern of branching, both on the tree as a whole and within each fanlike branch. Whorls of branches stand out along the trunk at regular intervals of 6 to 12 inches, one whorl being added each year. So methodical is this branching system that the age of a young fir can be determined within close limits by counting the whorls. Upper branches are short and stand out horizontally, but lower branches are longer and sweep down, out, and then up slightly at the tips. When seen against the sky a young California red fir (or the top of an older one) has a precision of symmetry not equalled by any other Yosemite conifer.

OCCURRENCE: Extensive forests of California red fir occur on the Tioga Road and the road to Glacier Point. It grows well on the ridges and rocky areas, but abruptly gives way to lodgepole pine at meadow edges.

SHASTA RED FIR: A variety of California red fir, the Shasta red fir (*Abies magnifica* var. *shastensis*), is known both north and south of Yosemite. It may grow here as well, although observations are not conclusive. It is like the California red fir in all respects except that papery, pointed bracts protrude between its cone scales. Forms intermediate between the two occur.



CALIFORNIA TORREYA

Torreya californica

The California torreya has evergreen, needlelike foliage with a striking resemblance to that of the firs, even though its "cone" looks more like a nut and would seem to disqualify it from being a cone-bearing tree. It belongs to the yew family (Taxaceae) and is also commonly known as California nutmeg, because its seeds bear a vague resemblance to the nutmegs of commerce. (True nutmegs are obtained from a tropical tree, however.)

SHAPE AND SIZE: In Yosemite the California torreya is a small tree of irregular shape. Its branches and leaves form flat, horizontally spreading or down-sweeping sprays. Because of its resemblance to Douglas-fir and white fir it is often misidentified.

TRUNK: The habit of trunk sprouting of California torreya is unusual, for only two other cone-bearing trees (the redwood of California's Coast Range being one) are so characterized. When damaged by a forest fire, its burned limbs and leaves are replaced by new growth that originates beneath the bark of the trunk and main branches. Consequently, the whole trunk of a torreya may be thickly clothed with branches.

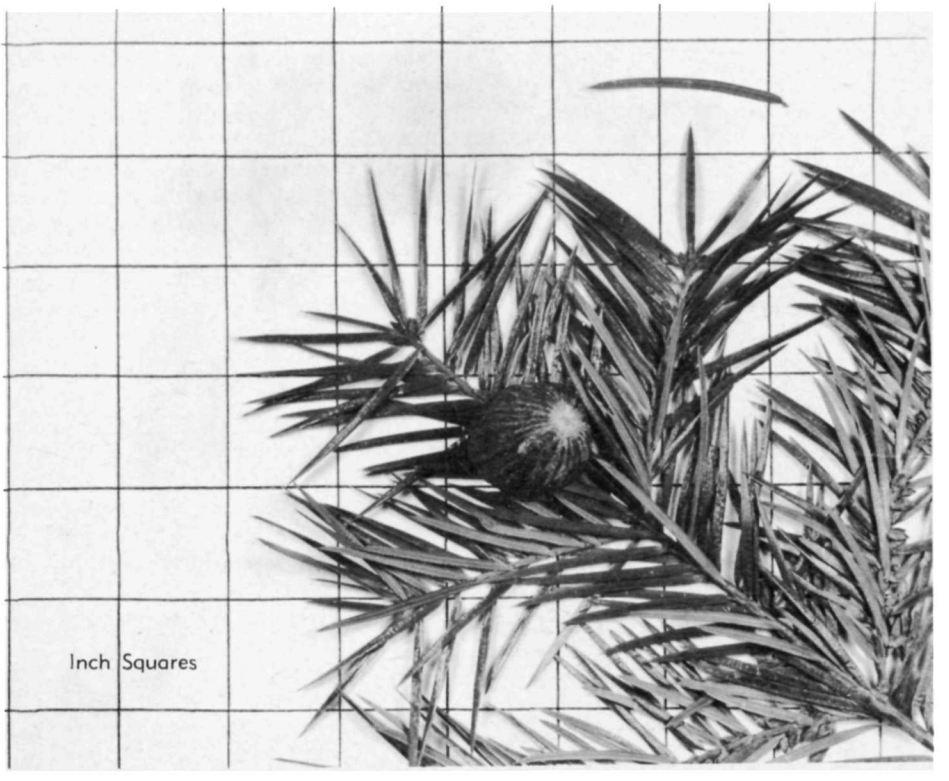
BARK: The bark on young branches is bright green, but on older branches and trunks it is an ashy-yellow color. It is thin, rather soft and checked into narrow ridges with numerous diagonal connections.

CONES: Conspicuous blue-green plum-like cones hang from the tips of outer branches in the fall, and serve well in identifying the tree at that time of year.

FOLIAGE: Foliage is dark green and glossy, consisting of rigid needles 1 to 2½ inches long that spread laterally to form a two-ranked fanlike spray comparable to that of firs. As in white fir, the short petioles (leaf stalks) of the needles are distinctly twisted, but California torreya needles are flat, lance-shaped, and armed with keen points on the tips. When crushed, the foliage gives off a pungent odor.

OCCURRENCE: This rare tree is of ancient lineage, but today it has few close relatives and occupies a very restricted range. At one time near-relatives of the California torreya grew in what is now the Arctic Zone, and later in Europe. Now there remain just five species of *Torreya* in the world, one in Florida, two in China, one in Japan, and this one in California. The California torreya is restricted to the central mountains of the Coast Range and to the Sierra Nevada, where it inhabits but a few widely separated areas. In no place is it abundant, and the few trees in each locality are generally scattered.

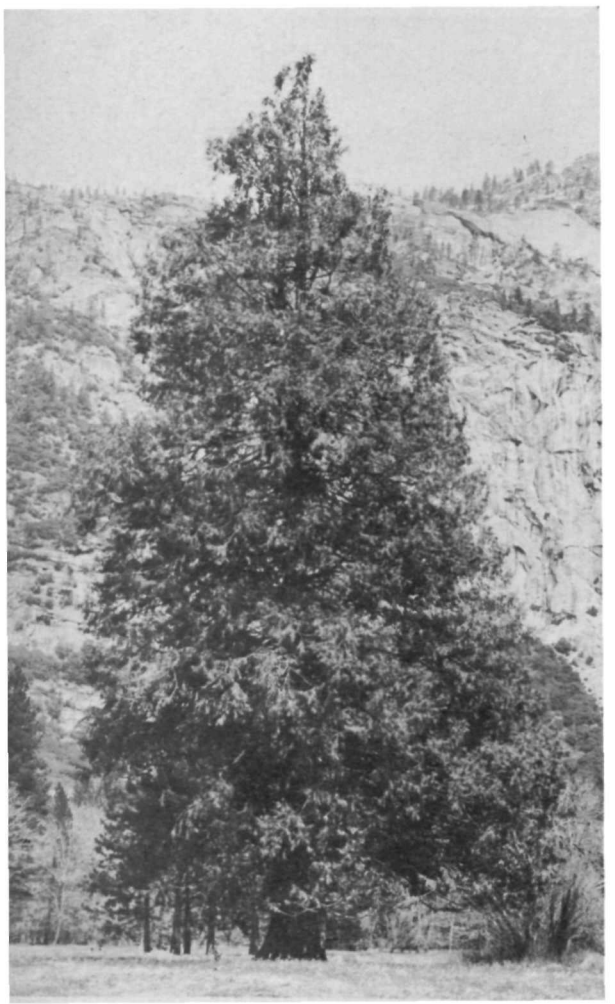
In Yosemite National Park between Arch Rock Entrance Station and The Cascades, the California torreya may be seen growing along the Merced road. Some shrublike trees occur along the Big Oak Flat Road below Cascade Creek. Others may be seen near the west portal of the Wawona Tunnel, and near the 5,000 foot elevation along the Wawona Road. A fairly good and representative stand of California torreya exists north of Hetch Hetchy, and the tree occurs in the Mariposa Grove.



INCENSE-CEDAR

Libocedrus decurrens

Incense-cedar is named for the distinctive and pungent odor of its wood, an odor which is also emitted from minute glands on each leaf. Its scientific name has reference to this odor, too, for the word *libocedrus* is derived from the Greek words *libas* (frankincense) and *cedrus* (cedar).



The bark color and texture and the buttressing at the base give incense-cedar a decided resemblance to the redwood of the Coast Range and the giant sequoia of the Sierra Nevada, and these three trees are often confused by Yosemite visitors. None of the redwoods of the Coast Range grow here, however, and the giant sequoia is restricted in Yosemite to three small areas (Mariposa, Merced, and Tuolumne Groves) except for a few that were transplanted many years ago and are now growing as tall but immature trees near some of the buildings and roads.

SHAPE: A young incense-cedar has a broadly conical, symmetrical form, with a triangular outline. Its sides are roughly twice as long as its base, and they rise to terminate in a sharply pointed top, Mature incense-cedar, on the other hand, has an irregular top. Instead of the dense, peaked pinnacle borne in youth, an old cedar may have an open flat crown made up of a dead top and huge, trunklike upper branches that have turned at right angles and grown upward parallel to the trunk.

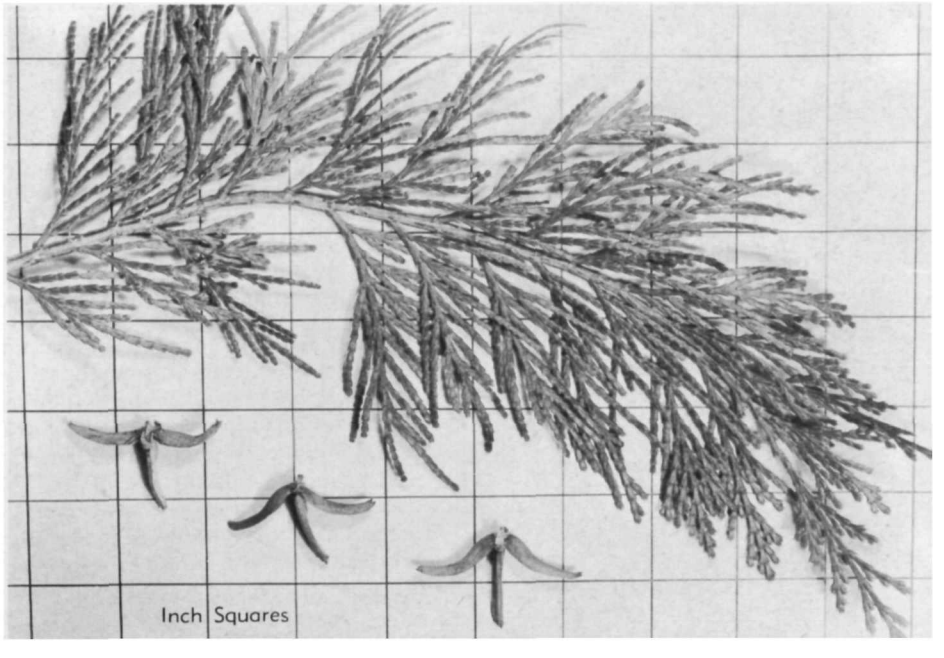
TRUNK AND BARK: The trunk of a mature incense-cedar has a large swell at the base and then tapers rapidly. It is covered with thick (6 to 8 inches), cinnamon-red, deeply fissured and vertically ridged bark, with a fibrous or stringy aspect. Slabs of this bark were used by Yosemite Indians in constructing their dwellings.

CONES: In September, small light-green cones hang near the ends of upper branches. They average about an inch in length, and later in the autumn when dry and open are reddish brown with three prominent scales. Staminate flowers of incense-cedar bloom in the winter, and then the tiny yellow male catkins grow near branch tips, sometimes mantling the foliage with their gold-colored pollen or releasing it as puffs in the wind.

FOLIAGE: Foliage is composed of numerous branchlets arranged in a flattened spray-like pattern and disposed more or less vertically. These sprays sag from the limbs except near the treetop and at branch ends, where they stand more nearly upright. Close inspection of the foliage shows that what seems to be "needles" are really slender branchlets covered tightly by tiny leaves arranged in overlapping whorls, with four leaves to a whorl. Twigs become covered with red bark as they grow and shed older leaves.

OCCURRENCE: Incense-cedar is the second most abundant conifer in Yosemite Valley and the only species of the genus *Libocedrus* native to North America. It grows in Oregon, throughout the mountains in California, and in Lower California. In the central Sierra Nevada its vertical range lies roughly between 3,000 and 5,500 feet; but it reaches its maximum development in moist valleys at about 4,000 feet, such as Yosemite Valley where trees 140 feet high and 6 feet in diameter are not uncommon.

RELATIVES: Although several North American trees are commonly called cedar, there are no true cedars (representatives of the genus *Cedrus*) native to this country. Perhaps the widespread application of the word cedar to cedar-like trees can be traced to the scriptural record familiar to many of the "Cedars of Lebanon", true cedars growing in Syria and Asia Minor. Actually, incense-cedar is more closely related to the cypress and the arborvitae, and can be confused with them because of the similar foliage.



DOUGLAS-FIR

Pseudotsuga menziesii

A host of slender drooping branchlets, hanging from spreading branches and instantly responsive to the slightest wind, are characteristic of this tree.

NAMES: Douglas-fir is something of a botanical puzzle, as indicated by its 20 common names and the numerous changes in its scientific name. Known to woodsmen as red fir or yellow fir, it is sold for lumber as Oregon pine, and called Douglas spruce by many and false hemlock by others. Nevertheless, it is neither fir, pine, spruce nor hemlock. Botanically it is closely related to fir, hemlock, and spruce; but it differs sufficiently from each to be classified separately, and the first word of its scientific name, *pseudotsuga*, means false hemlock. The second word of its scientific name, *menziesii*, is after Archibald Menzies, who discovered it. Its common name (Douglas-fir) honors the early explorer-botanist, David Douglas, and directs attention to its bark, which is like that of firs.

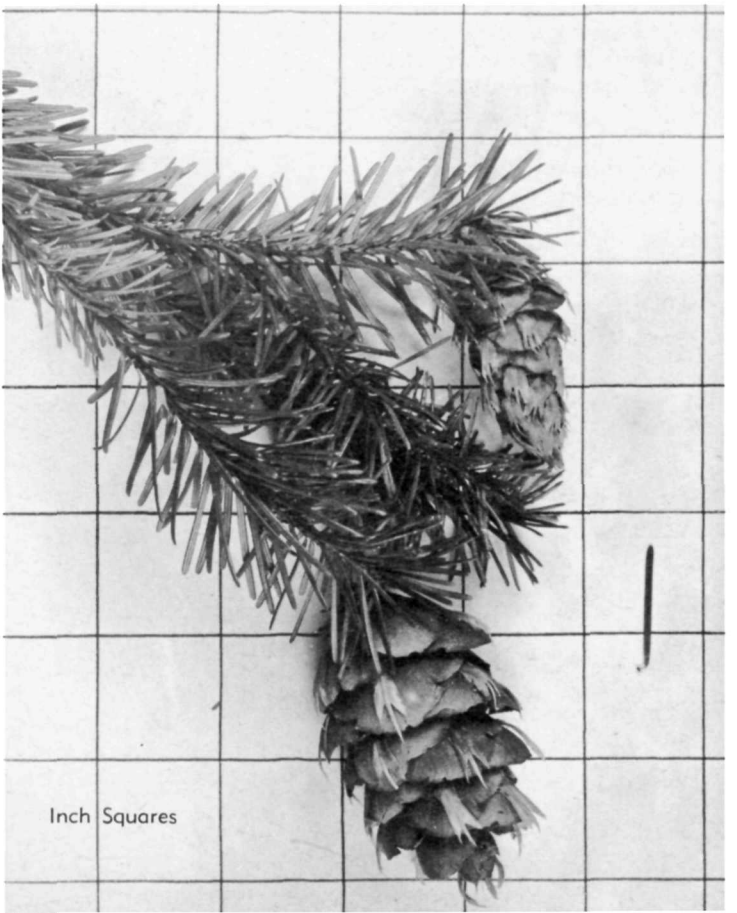
SIZE: In Washington and Oregon where Douglas-fir attains its maximum development, it may grow more than 200 or even 300 feet high. The tallest known to be standing now towers 330 feet, the same as Yosemite's tallest tree (a giant sequoia in the Merced Grove), and just 29 feet shorter than the tallest tree in the world (a redwood known as the Tall Tree in California's Humboldt Redwoods State Park). A Douglas-fir 385 feet high at one time stood near Mineral, Washington, according to Wm. M. Harlow in *Textbook of Dendrology*.

BARK: Bark of young Douglas-fir is whitish or ashy, and is smooth except for balsam blisters. Older bark is rough with ridges and furrows, and dark gray or dark brown, sometimes with an ashy sheen along the sides of the ridges. The inner bark consists of alternate layers of tan and red, thus combining the inner bark colors of both white fir and California red fir.

CONES: Distinctive three-pointed papery bracts protrude between the cone scales of Douglas-fir, and distinguish this tree from all others in North America except the bigcone Douglas-fir of Southern California. The cones themselves are reddish brown, drooping from the branch tips and falling entire, in contrast to the way cones of white fir and California red fir stand erect and break up on the tree. Douglas-fir cones frequently remain on the trees for a year after ripening, and may be quite abundant.

FOLIAGE: Douglas-fir needles are singly attached to branches and grow out from all sides. As in other trees with singly attached needles, the foliage tends to be flattened on horizontal branches, but the drooping branches of Douglas-fir have more of a rounded aspect with needles more evenly spaced all around the twigs. The needles are ¾ to 1½ inches long, flat, glossy, and light green above with gray green beneath. In late spring, new needles grow at branch tips, their yellow green contrasting with the darker green of older foliage. This new foliage grows from conical reddish-brown bud scales, which remain on the twigs as brown, papery scales and serve as an additional identification mark.

OCCURRENCE: The vertical range of Douglas-fir in Yosemite is between 3,500 and 5,500 feet. It grows best in shaded and rocky areas, and rarely is a dominant tree in any given area.



GIANT SEQUOIA

Sequoia gigantea

While standing in a grove of giant sequoias for the first time, you may wonder at the ages through which these trees live. A few of the largest living were majestic giants when Christ was born, and have remained standing through the development of religions and the building of empires, through the ages of darkness when ideals toppled, through the industrial and scientific revolutions, and through the entire history of an experiment in self-government called the United States of America.

But we have been thinking mostly of men. What of the tree itself? All the information available indicates that a giant sequoia can go on living indefinitely if not toppled by mechanical forces, for it has few or no insect enemies, and cells of the cambium layer appear never to decline in their ability to grow and reproduce. Conceivably, some of the trees of today may be here to awe our descendants a hundred generations hence. Even after a giant sequoia has fallen, its heartwood may stay sound for hundreds of years.

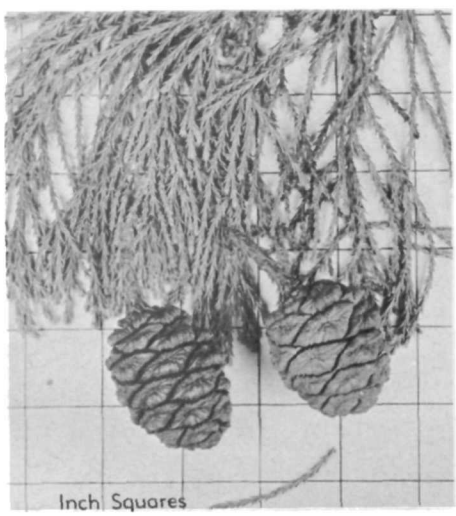
SIZE AND SHAPE: An old giant sequoia is recognized by its size, the tallest being about 300 feet high and the thicker ones about 30 feet through. Trunks are completely free of branches for 50 feet or more above the ground, and foliage is high in the tree. Upper limbs are massive, in some cases as large as trees in their own right.

AGE: Accurate determination of the age of a large giant sequoia is difficult while it is standing, although careful analysis of increment borings (cuttings taken by an auger from the trunk) can give this information. Trees have been cut for lumber; one was 3,100 years old by annual ring count. By comparing the size of these cut trees with giants still standing in similar locations, botanists find that many are old indeed. Trees 15 feet in diameter above the swelled base may range in age from about 1,500 to 2,500 years. A "sapling" 2 or 3 feet in diameter may be from 50 to 400 years of age. The Grizzly Giant in the Mariposa Grove is estimated to be 2,700 years old, according to recent research by Dr. Richard J. Hartesveldt.

Large giant sequoias were long thought to be the oldest living things on earth, but in 1958 Dr. Edmund Schulman reported in *National Geographic Magazine* that certain bristlecone pines in the Inyo National Forest of California's White Mountains are probably older — one specimen is known to be 4,600 years old. Unlike old giant sequoias, the old bristlecone pines are small and grow near timberline.

TRUNK AND BARK: A mature giant sequoia has fibrous bark of a rich red-brown color that is as much as 2 feet thick or even more. Its trunk is conspicuously swollen or buttressed at the base and surrounded by a mound of soil a foot or more high that it pushed out and up as it grew. Dead leaves pile up on this mound over the years, accentuating its height.

FIRE SCARS: Some giant sequoia trunks are partially black, where they have been burned. Although the bark burns poorly and insulates well because it is nonresinous, porous, and thick, a long-continued hot fire may penetrate it and burn into the heartwood. Some trees have been burned complettely through and even with the loss of much of their support are still standing. Thus, fire does not necessarily kill mature giant sequoias, and the trees can heal their wounds. Most of the fires that have affected the giant sequoia groves were started by lightning, although man — both aboriginal and civilized — has started fires there, too. Fires still originate in these ways, but most are readily extinguished. Occasionally, a lightning strike in the top of a tall giant sequoia starts a fire that burns for some time. While fire will burn up young trees and has damaged a few large individuals which have not yet healed and may never heal completely, it has killed few if any of the giants. Further, fire has been a part of the giant sequoia's environment for a long time with no adverse effect on the species as a whole. In fact, recent research indicates that the giant sequoia may require fire — or effects similar to those produced by fire — in order to reproduce and successfully compete with its forest associates.



CONES: The giant sequoia seldom produces cones before it is 75 years of age. As it grows older, the tree bears cones in profusion; but since they may remain unopened on the tree for years, there is no easy way of knowing one crop from those produced in other seasons. Tiny male and female flowers are borne in midwinter but the cones do not fully mature until the second summer, when they are about the size and shape of chicken eggs. Each cone contains about 125 to 350 seeds, and each seed is so small that 5,700 weigh only 1 ounce.

Most cones open on the tree and disperse their seeds by wind; in some cases, flowing water transports the seeds farther and aids in preparing the mineral seed bed. Other cones are cut off by chickarees or Douglas squirrels as they scamper about in the treetops in late summer and early autumn, getting ready for the winter ahead. After cutting down a quantity of cones, the squirrels come down and hide them in holes, under logs, and in other niches. Cones stored in damp places usually remain closed, but others soon dry out, open up, and shed their seeds. Since the germination rate of the seds does not seem to decline appreciably with age, forgotten cones may eventually disperse their seeds and start new trees. Still other cones fall when their supporting branches are broken off from the trees during heavy wind and snow storms.

YOUNG SEQUOIAS AND FOLIAGE: Conditions must be favorable for sequoia seeds to germinate and the seedlings must have mineral soil, proper moisture, and sufficient sunlight to survive. Consequently, the probability that any seed will develop into a mature tree under natural conditions is slight. Nevertheless, young sequoias are growing in most groves in quantities sufficient to maintain the species, and can be expected to do so if environmental conditions are favorable. Often the young giant sequoia is unrecognized because it is so different from the mature form and because people are not familiar with the appearance of the leaves. These are spirally arranged on the twigs and cling to them except for short spreading points. When well started, a young sequoia grows rapidly and produces a tall, sharply-pointed crown.

LEANING AND FALLEN SEQUOIAS: Erosion, wet soil, and the effects of wind and heavy, unbalanced loads of snow in the tree crown take their toll of the big trees. Fire, too, may reduce a tree's stability by burning away supporting tissue in the trunk or by burning away wood on one side of the tree and unbalancing it. Even a slight change in strength or weight distribution in one of these large trees throws tremendous leverage against the roots, for some weigh more than 2 million pounds. Some trees have fallen; others are standing which have been leaning for many years. Increased growth in both their trunks and tops on the side opposite the lean has reduced if not eliminated their handicaps.

NAMES AND RELATIVES: Often confused are the giant sequoia of the Sierra Nevada and the redwood of the Coast Range, two trees of similar size and fame and with similar reddish bark and wood. Their foliage is a little different, however, and their cones cannot be confused. Certainly, though, their distribution is the best way to distinguish them, for they never occur together. Giant sequoia is called less commonly by other names, including bigtree and Sierra redwood, thus causing more confusion between it and the redwood of the coast. The incense-cedar, common in Yosemite National Park, is another tree sometimes mistaken for the giant sequoia as well as the redwood of the Coast. Bark and foliage of all three are similar.

Giant sequoia and its close relatives, the redwood and baldcypress, had in ages past a much wider distribution. Today the genus *Sequoia* is restricted to California and southwestern Oregon and is represented only by *Sequoia sempervirens* (the redwood of the Coast Range) and *Sequoia gigantea* (the giant sequoia of the Sierra Nevada.)*

OCCURRENCE: Giant sequoias are native only to the west slope of the Sierra Nevada from Plumas County on the north to Tulare County on the south, at elevations from about 4,000 to 8,000 feet. Most of the groves that have not been cut for lumber are in national parks, national forests, or state parks. In fact, the desire to preserve the Mariposa Grove in Yosemite played a large part in beginning the national park movement, and the Grove has been in public ownership and managed for the people since 1864.

Three distinct giant sequoia groves occur in Yosemite National Park, all in the western part: Merced Grove, Tuolumne Grove, and Mariposa Grove. Good surfaced roads — though narrow in the last few miles — lead to the Tuolumne and Mariposa Groves while the Merced Grove is remote. The Mariposa Grove is the largest and most frequently visited,

*Some botanists now place the giant sequoia in a seperate genus and have given it a new species designation: *Sequoiadendron giganteum*. The scientific name for the redwood of the Coast Range is agreed by all to be *Sequoia sempervirens*.

and contains the famous Wawona Tree, through which a tunnel for stagecoaches was cut in 1881 and through which hundreds of thousands of people have driven in stage and auto. Also within the Mariposa Grove is the Mariposa Grove Museum.

In addition to the trees growing naturally in these three groves, a few giant sequoias have been transplanted to Yosemite Valley. These are growing as tall, young trees, about 50 years old, in the vicinity of some of the buildings and roads.

THE FUTURE: Today, ecologists have learned that fire is to some tree species an essential environmental factor. Giant sequoia is apparently one such species. For many years, management of the giant sequoia groves (and other forests as well) has involved the suppression or exclusion of fire in order to eliminate its obviously harmful effects on individual trees, plants, animals, and buildings. Such management has been so successful in the giant sequoia groves that the forest understory has thrived, and now the soil below is shaded, deep, and rich in many areas. Seemingly, this would be an ideal environment for tree reproduction — and it is for white fir and many other plants and trees. Young giant sequoias, however, need mineral soil and plenty of sunlight to thrive, and so a plant succession is occurring in the groves with white fir shading out giant sequoia seedlings. Too, young trees and brush have grown up in such quantity that there is probably more combustible debris in the groves now than at any time since management began — and probably in the history of the giant sequoia. Fire today could be a holocaust, and could seriously damage a grove, killing many of the trees — perhaps even some of the giants, while smaller and more frequent fires might not have harmed the thick-barked giants yet provided the mineral soil and sunlight needed for the seedlings.

Civilized man has had other effects on the ecology of the groves. Roads, buildings, and water systems have been constructed in them, causing roots to be cut, changing the soil character and the drainage; and thousands of pairs of feet have walked around the trees, causing soil compaction and foot erosion, while the owners of some have carved their initials into the trees and collected cones, bark, and foliage as souvenirs.

To protect these trees, the National Park Service has long enforced the regulation that no sequoia wood, cones, or foliage may be removed. It places mulch around the more frequently visited trees to reduce the effects of human erosion, and it conducts and analyzes careful research studies to learn more about the needs of the trees themselves. The cautious use of scientific data, then, should ensure the continued existence of this fascinating tree species as well as the majestic individual specimens.

MOUNTAIN HEMLOCK

Tsuga mertensiana

Mountain hemlock is an inhabitant of the higher elevations, "the most singularly beautiful of all the California coniferae," according to John Muir in *The Mountains of California.* Its lightness of form contrasts with the more rugged trees around it, which may include western white pine, lodgepole pine, western juniper, and whitebark pine.

SHAPE: The narrow columnar crown, perhaps 20 feet high or more though less than 3 feet wide, has a limber drooping top. A few upper branches may extend beyond the others, but more commonly the trunk is closely clothed with branches clear to the ground. Drooping tops are characteristic, as is the habit of retaining the lowermost branches.

SIZE: Mountain hemlock is generally not a large tree, but does reach 3 feet or more in diameter and over 100 feet in height. W. L. Jepson reported one in *Trees of California* near the base of Mount Lyell that was 80 feet high and 5½ feet in diameter.

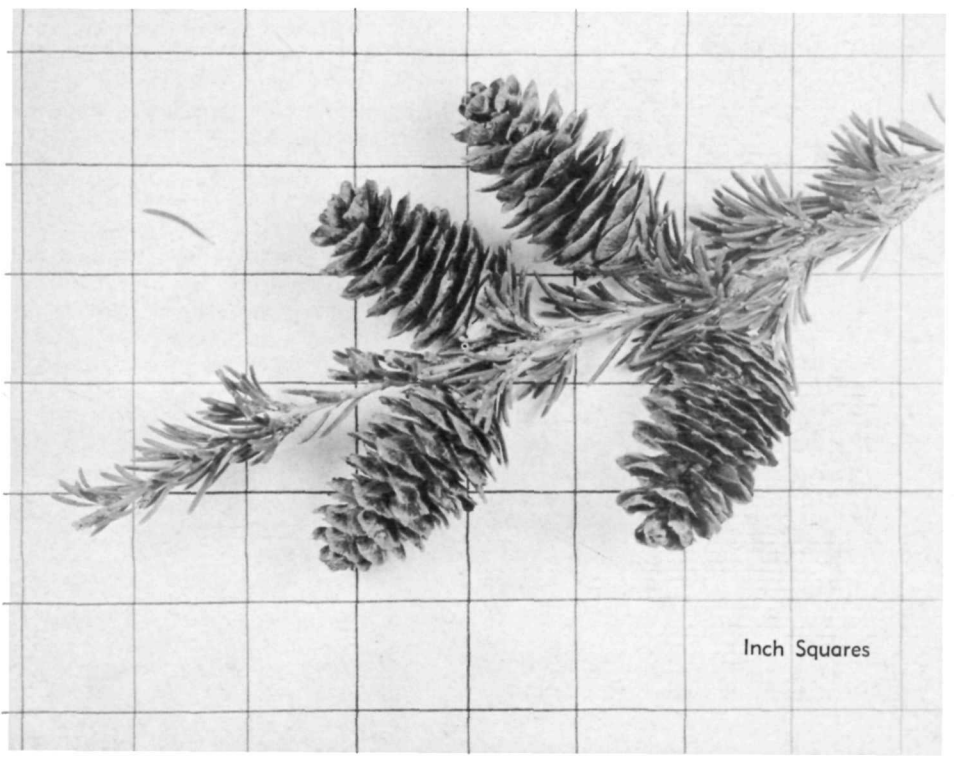
TRUNK: Mountain hemlock trunks are often bent near the base, and thus it appears that the tree never recovers completely from its period as a sapling when it is bent over as the snow piles up, and is then held fast for much of the year until the snow melts. From a distance, the trunk color appears bluish gray; closer by, the bark is seen to be narrowly and deeply fissured and its color appears dark reddish brown.

CONES: Cones are borne throughout the upper part of the crown, their weight bending down the ends of the slender twigs. Young cones, seen by summer visitors, are bluish purple. They mature in the fall, and when oepned are about 2 inches long by 1 inch wide, with light-brown scales standing out at right angles to the cone axis. Empty cones may remain on the trees for a year while the new crop is developing.

FOLIAGE: Needles are singly attached to the branches, in a fashion similar to that of California red fir, with which this tree may be associated. Mountain hemlock needles differ in having a distinct and conspicuous petiole (leaf stalk) and in standing out more on all sides of the branchlets. The needles thickly clothe the short lateral branchlets, are rounded, and ½ to ¾ inch long. Older foliage is dark green, but mottled by pale, blue-green new growth at twig tips in summer.

OCCURRENCE: Mountain hemlock is a characteristic tree in shaded northern exposures at elevations around 9,000 to 10,000 feet (not far below timberline), where snow banks melt slowly. In its typical habitat it may be easily identified, even from a distance. Such a location occurs along the Tioga Road about midway between Tenaya Lake and the western end of Tuolumne Meadows, and there many trees grow in a mixed stand with western white pine and lodgepole pine. Pure stands of hemlock occur in the northern section of the Park, such as those surrounding many lakes at around 9,000 feet in the Eleanor Creek Basin. Some exist up to timberline, as on Ragged Peak Ridge at about 11,000 feet and on Mt. Clark at 10,500 feet, where the tree assumes the prostrate form so characteristic of timberline dwellers. The limber branches and drooping tip of this tree suit it well for its environment, for it often grows at the side of a boulder or below a cliff where the snow piles deep and melts so slowly that a rigid tree would be broken.

Much can be written about the alluring beauty of the mountain hemlock, but quite in vain, for as John Muir said in *The Mountains of California*, "the best words only hint at its charms. Come to the mountains and see."



WESTERN JUNIPER

Juniperus occidentalis

Unlike most conifers, the western juniper grows on desolate wind-swept slopes, there detached from other species as well as from others of its kind. In such places, it develops grotesque shapes, and becomes picturesque to a degree rarely found in Yosemite trees. Long, exposed roots cling to small cracks at the base of its stocky, gnarled, and widely buttressed trunk. Seldom does it attain any great height, for it is dismembered by snow avalanches, lightning, and fierce winds. Branches may be dead or missing on the side exposed to storms but flourishing and standing out almost horizontally on the protected side.

SIZE AND AGE: Even though their existence sems constantly threatened, many junipers survive to great age. One stump less than 3 feet in diameter had 1,140 annual rings, and John Muir came to the conclusion in *The Yosemite* that some of the largest specimens had been living for 2,000 years. A later investigator, Dr. Waldo S. Glock, wrote in "Observations on the Western Junipers" that the longevity of this species

> certainly equals that of the coast redwood and in a few instances rivals that of the giant sequoia. Perhaps it is significant that the sequoia, the juniper and the bald cypress of Oaxaca, Mexico, all longlived trees, belong to kindred families.

A large juniper reported by Glock north of Yosemite had a diameter of 14 feet, and was computed to be 2,900 years old. None in Yosemite equals this size, although many are 8 feet in diameter. The maximum height of Yosemite junipers growing on granite is normally about 30 feet, but some on fertile, well watered soil are twice as high.

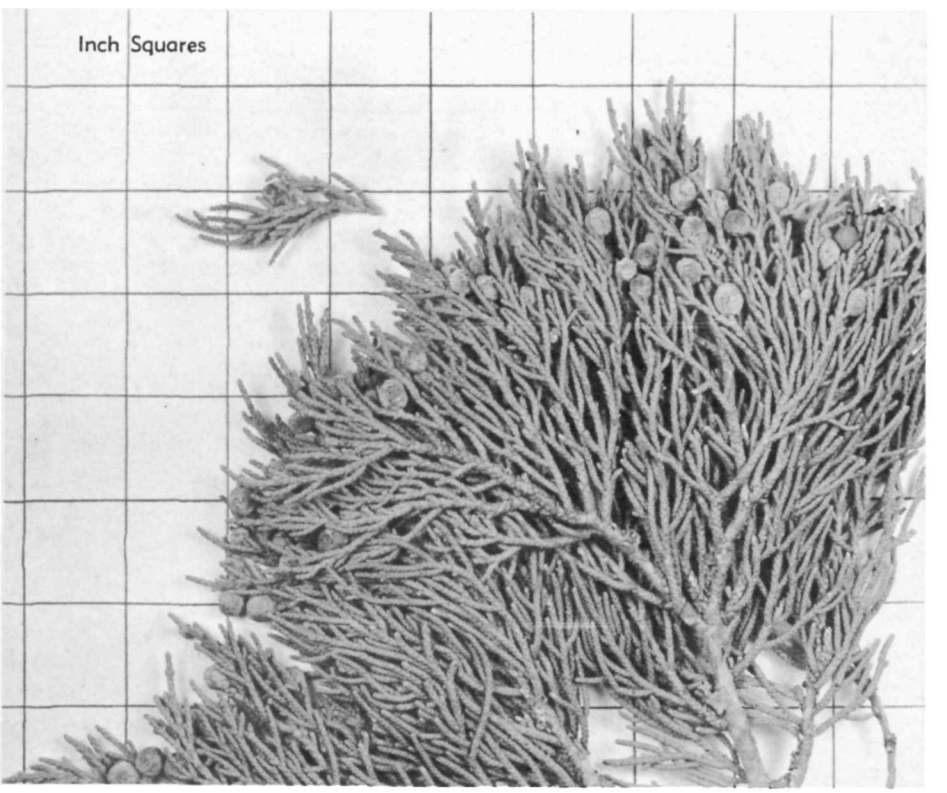
BARK: Older bark of western juniper is a rich reddish brown, and has a shredded or fibrous aspect that couses it to separate and peel off in thin ribbons. Younger bark is grayer. On some trees, wind erodes the bark completely from their exposed sides and reveals the pale yellow wood beneath.

CONES: When in fruit, the western juniper is quickly recognized. Instead of bearing woody cones like most Yosemite conifers, junipers produce cones which look more like berries. When ripe the berries are about ¼ inch in diameter, bluish black, and covered with a whitish bloom. The sweet resinous flesh surrounding the two rather large seeds inside is relished by animals and was eaten by Indians.

FOLIAGE: Foliage is gray green, rather dense, and consists of tiny overlapping scalelike leaves that are closely appressed to stiff twigs in six longitudinal rows.

OCCURRENCE: Although principally a high mountain tree of rocky places, a few western junipers grow in and near Yosemite Valley and around the rim. Probably this tree is most accessible along the Tioga Road near Tenaya Lake, where it grows exposed on bare granite, and assumes its characteristic picturesque form.

COMMON JUNIPER: The common juniper (*Juniperus communis*) also occurs in Yosemite; it is half-prostrate and shrublike, seldom as much as 2 feet high, and grows in the remote high elevations in the northern part of the Park. Instead of the scalelike leaves common to the genus, it has fairly long, needlelike leaves. It will be encountered by few visitors and recognized as a tree by fewer still.



THE LIFE OF A CONE-BEARING TREE

BIRTH: A cone-bearing tree is born when a nut from a cone germinates in soil and a seedling starts to grow. Although hundreds of seedlings may start from the thousands of nuts produced by a cone-bearing tree in its lifetime, on the average only one grows into a mature tree. If more survived, the forests would become denser.

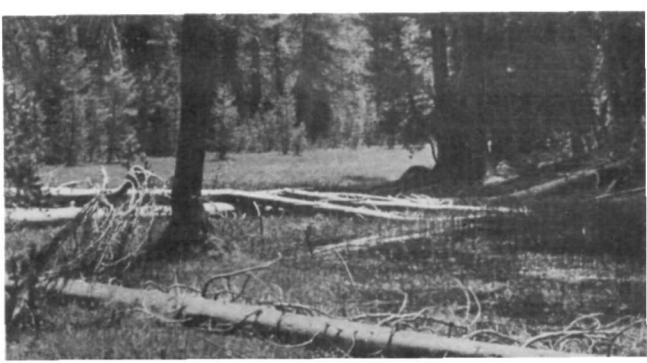
GROWTH: As trees grow, they add branchlets, their tops and branch tips get longer, and their branches and trunks get bigger around. **Crowns** of young trees are spire-shaped because their tops grow up faster than their branches grow out during their rapid climb to sunlight from forest shade. Later, the tops of the few trees successful in the race grow more slowly than the branches, and the trees assume their mature form with flattened crowns and large upper limbs. **Trunks** of some older trees are clear of branches for great heights. (Their lower limbs died and then broke off as they became shaded by new foliage added above.) Trunks and branches grow bigger around to provide better support and increased space for the transmission of food (downward) and water and minerals (upward). **Bark** grows, too, expanding to cover growing trunks and branches and becoming thicker. At the same time it heals wounds. Young bark is smooth, light colored, and thin, and is found on young trees and younger parts of older trees, such as tops and branch ends. Older bark, composed of more layers of yearly growth, is rough, dark, and thick, and occurs lower on the trees. **Forked trees** may form after the top of a tree dies, upon which several upper branches abandon their former horizontal growth and start to grow upward. One of these may become the new treetop, but if two or more continue to grow, a forked tree is produced. Some trees with forks near their bases are really two trees (sometimes of different species) that have grown together. In other cases, the seed itself may have given rise to two or more seedlings.

A YEAR'S GROWTH: Each year, tree buds begin to grow in late spring or early summer, and soon light-colored foliage at the treetop and at branch tips contrasts with the darker foliage of earlier years. By late summer, the new foliage is dark, too. Some cone-bearing trees add a whorl of branches where each bud begins its growth, and so the age of such trees can be told as far back from the growing tips as the whorls can be counted. Where whorls are missing, nodes (ridges circling the branch or trunk) and branch stubs reveal their former points of attachment. Each year, trees add an annual ring

around their trunks and branches in the form of two cylindrical layers of wood, a light-colored layer in the spring and a dark one in summer. Counting the dark rings on a section of trunk or branch reveals the tree's age at that point. Remember, though, that any cross section above the ground is younger than the section at the ground, for the same reason that a twig is younger than a trunk. Cone-bearing trees shed their leaves in autumn, just as do broadleaf or deciduous trees. But the cone-bearers shed only part of their leaves — the older ones nearer the trunk. Before falling, dead, brown needles hang down just back of the green foliage at the branch tips, and the trees seem to be dying. Later, the newer growth remains as green tassels at the tips of naked branches.

REPRODUCTION: The tree cones that we usually think of are female organs, larger than the less conspicuous, pollen-producing staminate or male cones. Fertilization occurs between winter and early summer, before the growing season, and at that time a shake of a branch or a puff of wind sends pollen into the air. Pollination is effected mainly by wind, and the yellow dust falls on trees (including female cones), ground, or water, sometimes giving them a visible coating. Male and female cones may be produced by the same tree, but after pollination the female cones grow large, maturing their seeds in the autumn, or for some tree species, in the autumn of the following year. Upon drying out in the late summer or autumn, the cone scales open up and release their seeds, some of which have wings that enable the wind to transport them to new locations. Squirrells and birds break many cones apart at this time of year to get at the ripe seeds, and they cut others off the trees to store for winter.

DEATH: Few seeds germinate, and most seedlings die because of unsuitable sunlight, minerals, moisture, or temperature. Competition from trees more favorably situated or better adaped kills many that get beyond the seedling stage. Mature trees may die from natural causes such as erosion, a lightning strike, fire, insect attack, or fungus. But death is not necessarily a tragedy, and in national parks, where no trees are cut for lumber, the death of a tree is looked upon as a process just as natural as its birth. A dead tree furnishes homes for birds, then insects (which are eaten by birds), then grubs (which are eaten by bears), and finally its minerals return to the soil to be used by a new tree.



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KEY TO YOSEMITE CONE-BEARING TREES

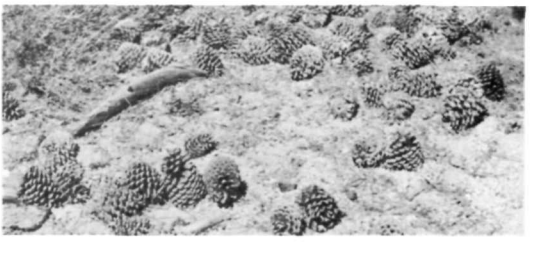
TO IDENTIFY A YOSEMITE CONE-BEARING TREE:

Compare its foliage with the sketches and pictures on the following two pages, placing it in one of the three groups.

Check other tree characteristics (shape, size, bark, cone, occurrence, etc.) with the brief descriptions and decide which tree it is.

Read the more complete description on the page number indicated.

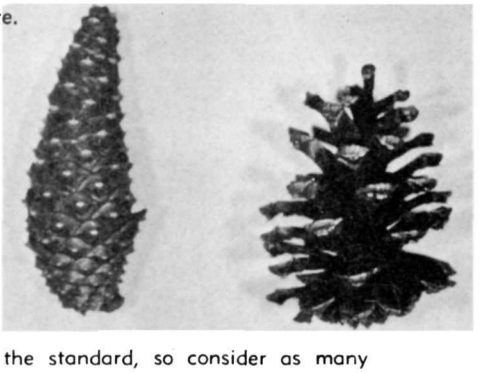
Some tips —



If the foliage or cones on a tree are too high for you to inspect, look for them on the ground below (but remember that cones and foliage *from other trees might be there, too.*)

Sometimes a needle will be missing from a bundle. Count several bundles to be sure.

Opened cones look different from closed cones.

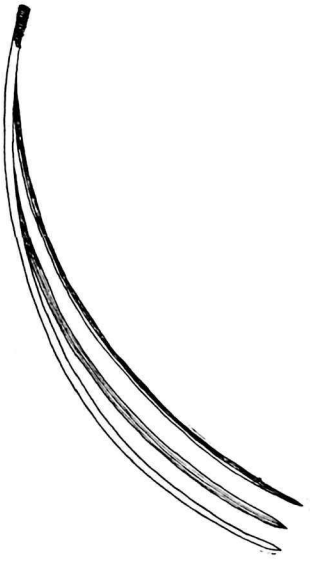


Individual trees may depart from the standard, so consider as many characteristics as possible.

NEEDLES CLUSTERED IN BUNDLES — SHEATH AT BASE

SINGLELEAF PINYON (*Pinus monophylla*). **Size:** 10 to 25 feet high. **Bark** thin, dark brown, irregularly fissured. **Cones** 1½ to 2½ inches long, egg shaped, chocolate brown. **Needles** 1½ to 2 inches long, stiff, round, sharp-pointed, curved, yellow green — only pine in America with papery sheath encasing one needle. **Occurrence:** A foothill tree in desert ranges east of Sierra Nevada, one isolated grove in Yosemite. Page 24

LODGEPOLE PINE (*Pinus contorta*). **Size:** 30 to 80 feet high. **Bark** grayish yellow, thin, scaly. **Cones** 1 to 2 inches long, when ripe basal scales remain closed. **Needles** 1 to 2½ inches long, stiff, flat, bright yellow green — the only 2-needled pine in Yosemite. **Occurrence:** Yosemite Valley to timberline, most abundant from 7,000 to 10,000 feet. Page 18

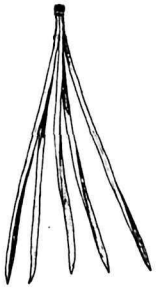


DIGGER PINE (*Pinus sabiniana*). **Shape and Size:** Crown broad and open, 50-75 feet high, trunk generally forked. **Bark** dark grayish brown, deeply fissured. **Cones** persistent, 6 to 10 inches long with triangular, downcurving hooks on ends of cone scales. **Needles** 8 to 12 inches long, gray green, tasseled and drooping from ends of branches. **Occurrence:** A foothill tree, restricted to canyon bottoms, valley sides, and low mountains in western Park, generally 600 to 3,000 feet. Page 2

KNOBCONE PINE (*Pinus attenuata*). **Shape and Size:** Slender, 15 to 60 feet high, knobby with conspicuous clusters of persistent cones. **Bark** dull grayish brown, shallowly fissured. **Cones** 3 to 6 inches long, persistent and whorled on main branches and trunks. **Needles** 3 to 5 inches long, pale yellow green, drooping. **Occurrence:** Grows along ridgetops west of Yosemite, at El Portal, and in Park at few and widely scattered locations, about 2,000 to 6,000 feet. Page 4

PONDEROSA PINE (*Pinus ponderosa*). **Shape and Size:** A tall forest tree 80 to 200 feet high, densely foliated with tips of branches conspicúously upturned. **Bark** of young tree dark brown; of mature tree, yellow, arranged in massive plates. **Cones** 3 to 5 inches long, scales armed with straight, slender prickles. **Needles** 4 to 11 inches long, bright yellow green. **Occurrence:** Dominant tree in Yosemite Valley and abundant from 3,500 to 5,500 feet. Page 6

JEFFREY PINE (*Pinus jeffreyi*). Similar to ponderosa pine; see page 9 for detailed comparison. **Bark** has vanilla odor, evident in crevices. **Cones** 5 to 10 inches long, stout, cone-scale prickles incurved. **Occurrence:** Mingled with ponderosa pine in Yosemite Valley, commoner in higher elevations, up to 10,000 feet. Page 10



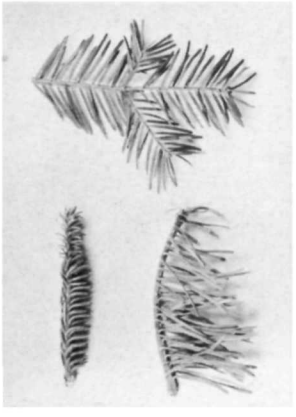
SUGAR PINE (*Pinus lambertiana*). **Shape and Size:** Massive, flat-topped tree 180 to 240 feet high with unequally lengthened branches. **Bark** thick, flaky, purplish brown or reddish, deeply fissured. **Cones** normally 12 to 16 inches long (up to 24 inches), pendant, clustered at ends of branches. **Needles** short (2 to 3½ inches), rigid, slender, sharp-pointed, deep blue green. **Occurrence:** 4,000 to 7,500 feet. Page 12

WESTERN WHITE PINE (*Pinus monticola*). **Shape and Size:** Similar to sugar pine, but smaller (80 to 120 feet high) with upper branches sharply ascending. **Bark** whitish or reddish, broken into small nearly square blocks. **Cones** like sugar pine but 6 to 10 inches long. **Needles** short (2 to 3½ inches). **Occurrence:** Common from 7,000 feet nearly to timberline. Page 16

WHITEBARK PINE (*Pinus albicaulis*). **Shape and Size:** 10 to 50 feet high, with irregular crown, many trunks; shrublike or prostrate at timberline. **Bark** whitish, especially on limbs and younger trees. **Cones** 1½ to 3 inches long, purple, remain closed after ripe. **Needles** 1½ to 2¾ inches long, stout, stiff, dark blue green. **Occurrence:** The timberline tree, common from 10,000 feet to timberline. Page 22

NEEDLES INDIVIDUAL — NO SHEATH AT BASE

Needles in Flat Sprays or Ascending

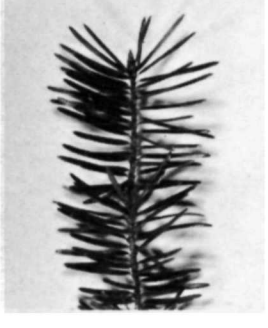


WHITE FIR (*Abies concolor*). **Shape and Size:** A symmetrical tree 60 to 200 feet high, with regularly whorled layers of spraylike branches. **Bark** thick, deeply fissured, ashy outside, yellow brown inside, white on young trees and limbs. **Cones** 3 to 5 inches long, erect, rounded at top and bottom, brown, break apart while still attached to branches. **Needles** pale blue green, ¾ to 2 inches long, with twisted petiole (leaf stalk), forming flat sprays or sometimes erect in 2 rows. **Occurrence:** 3,500 to 8,000 feet. Page 26

CALIFORNIA RED FIR (*Abies magnifica*). **Shape and Size:** Symmetrical tree 100 to 200 feet high, similar to white fir, with regularly whorled layers of spraylike branches, but denser, bluer foliage. **Bark** thick, dak red on outside, brighter red on inside, white on young trees and limbs. **Cones** 4 to 8 inches long, erect, blunt, purple or brown. **Needles** dark blue green, ¾ to 1 inch long, 4-sided in cross-section, petiole not twisted, tend to grow up but may be flat. **Occurrence:** 6,000 to 9,000 feet. Page 30

CALIFORNIA TORREYA (*Torreya californica*). **Shape and Size:** Firlike tree, 15 to 20 feet high. **Bark** gray, thin, with short narrow ridges. **Cones** olive green, plumlike (not a typical cone), 1 to 2 inches long. **Needles** glossy dark green, 1 to 2½ inches long, flat, rigid, and keenly pointed. **Occurrence:** Merced road from Arch Rock to Cascade Fall, Big Oak Flat Road below Cascade Creek, Hetch Hetchy. Page 32

Needles Standing Out All Around the Branches

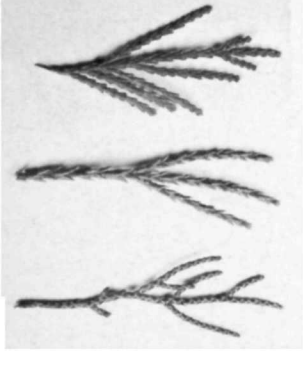


DOUGLAS-FIR (*Pseudotsuga menziesii*). **Shape and Size:** 150 to 180 feet high, with feathery, drooping branchlets. **Bark** dark brown, thick, rough. **Cones** red brown, 1¾ to 3½ inches long, pendant, with conspicuous 3-pointed bracts extending between scales. **Needles** flat, soft, ¾ to 1½ inches long, light green above, grayish green beneath (new foliage yellow green), with short and distinct petioles. **Occurrence:** 3,500 to 5,500 feet. Page 36

MOUNTAIN HEMLOCK (*Tsuga mertensiana*). **Shape and Size:** 60 to 100 feet high with drooping top. **Bark** red brown, deeply fissured. **Cones** 1½ to 3 inches long, purple to light brown. **Needles** blue green, ½ to ¾ inch long, growing in short tufts, petioles short and rounded. **Occurrence:** A high mountain tree growing on north slopes from 8,000 feet to timberline. Page 42

SINGLELEAF PINYON (*Pinus monophyla*). See brief description on opposite page. Page 24

LEAVES SCALY, TINY, PRESSED AGAINST TWIGS



INCENSE-CEDAR (*Libocedrus decurrens*). **Shape and Size:** 50 to 150 feet high, with dense foliage pendant in flat sprays. **Bark** cinnamon red, thick, with conspicuous vertical fissures. **Cones** ¾ to 1 inch long, with 3 scales only. **Leaves** light yellow green, fragrant ⅛ to ½ inch long, overlapping with 4 in each whorl and with blunt tips protruding. **Occurrence:** Abundant in Yosemite Valley and from 3,000 to 5,500 feet. Page 34

GIANT SEQUOIA (*Sequoia gigantea*). **Shape and Size:** Massive tree, 200 to 300 feet high, with huge trunk widely buttressed at base. **Bark** thick, up to 24 inches, fibrous, deeply grooved, cinnamon red. **Cones** 2 to 3 inches long, egg shaped. **Leaves** ⅛ to ½ inch long, overlapping and closely adherent to branch, with sharp tips protruding. **Occurrence:** Detached groves in southern Sierra Nevada (Mariposa, Merced, and Tuolumne Groves in Yosemite) from 5,000 to 8,000 feet. Page 38

WESTERN JUNIPER (*Juniperus occidentalis*). **Shape and Size:** Gnarled and twisted, 15 to 30 feet high. **Bark** cinnamon brown, in long flat shredded strips. **Cones** berrylike, bluish black covered with white bloom, ¼ inch in diameter. **Leaves** grayish green, about ⅛ inch long, in 6 longitudinal rows, tips not protruding. **Occurrence:** A high mountain tree, scattered on bare granite at 7,000 to 9,000 feet. Page 44

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Common and scientific names are from *Check List of Native and Naturalized Trees of the United States (Including Alaska)*, by Elbert L. Little, Jr., 1953.

COMMON NAMES

SCIENTIFIC NAMES

ANY FOOL CAN DESTROY A TREE

ANY FOOL can destroy trees. They cannot run away; and if *they could, they would still be destroyed — chased and hunted* down as long as fun or a dollar could be got out of their bark hides, branching horns, or magnificent bole backbones. Few that fell trees plant them; nor would planting avail much toward getting back anything like the noble primeval forests. During a man's life only saplings can be grown, in the place of the old trees—tens of centuries old—that have been destroyed. It took more than three thousand years to make some of the trees in these Western woods — trees that are still standing in perfect strength and beauty, waving and singing in the mighty forests of the Sierra. Through all the wonderful, eventful centuries since Christ's time — and long before that — God has cared for these trees, saved them from drought, disease, avalanches, and a thousand straining, leveling tempests and floods; but he cannot save them from fools — only Uncle Sam can do that.

—John Muir,
Our National Parks, 1901