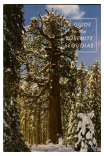
A Guide to the Giant Sequoias of Yosemite National Park (1949) by James W. McFarland



Bibliographical Information

James W. McFarland (1917-2006), *Yosemite Nature Notes* (Yosemite: Yosemite Natural History Association, 1949) First published in *Yosemite Nature Notes* 28(6) (June 1949), pp. 41 - 91 (51 pages). Reprinted June 1953. Illustrated. 24 cm. Paper wrapper with a color photograph. Saddle stitched. Photographs by Ralph Hopewell Anderson (NPS).

About the Author

James McFarland near Wildcat Creek bridge, Yosemite, April 1947
(family photo)

James W. "Jim" McFarland was born February 10, 1917 in Wynmere, North Dakota, to Rev. Ira J. and Alice L. McFarland and wife, the 4th of 9 children. He served as an Air Force officer during World War II and was in Normandy on D-Day.

McFarland was a graduate student at University of California, Berkeley, and started as a seasonal Ranger-Naturalist at Yosemite in June 1947. He worked with Carl Sharsmith to get the Yosemite School of Natural History started again after being shutdown during the war. McFarland also contributed articles to *Yosemite Nature Notes* and was a teacher outside of Yosemite. He died July 15, 2006 at Riverside, California.

Yosemite Nature Notes

THE MONTHLY PUBLICATION OF
THE YOSEMITE NATURALIST DIVISION AND
THE YOSEMITE NATURAL HISTORY ASSOCIATION, INC.

VOL. XXVIII JUNE 1949 NO. 6
Second printing June 1953

A GUIDE

to the

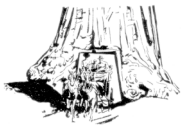
GIANT SEQUOIAS

of

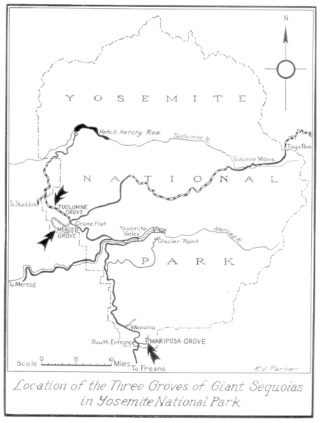
YOSEMITE NATIONAL PARK

By

JAMES W. McFARLAND



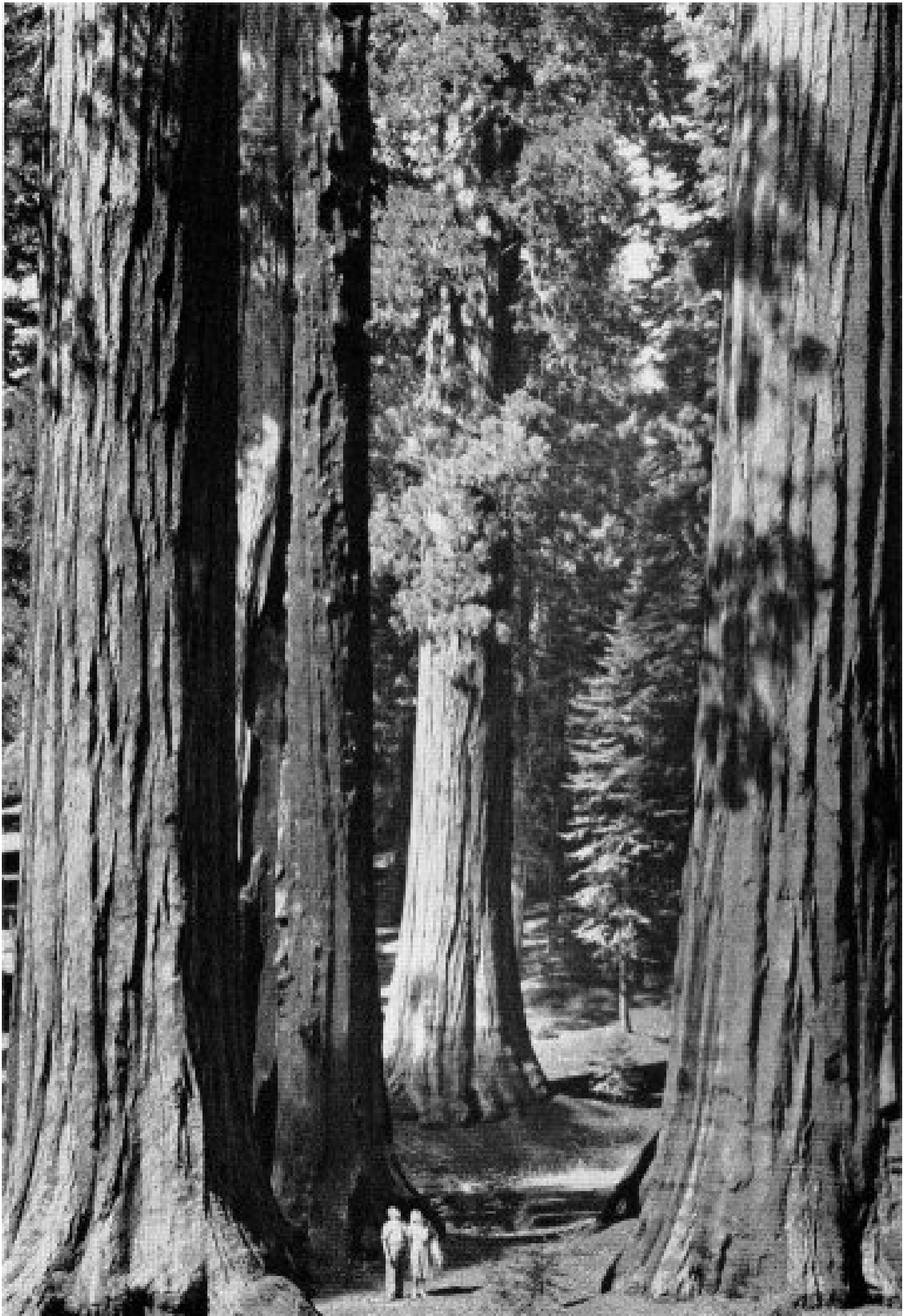
SPECIAL NUMBER—PRICE 50 CENTS



NOTE: In winter, the Tioga, Stockton and Hetch Hetchy roads are not open and the Merced and Tuolumne Groves therefore are not accessible by car. When conditions permit, the road in the Mariposa Grove is plowed open as far as the Grizzly Giant. [Editor's note: the Mariposa Grove road is now closed to traffic year-round and is not plowed in winter—dea.]

TABLE OF CONTENTS

Cover Illustration: The Grizzly Giant in winter. Color photo by Ralph Hopewell Anderson. *Unless otherwise specified, all photos are by Mr. Anderson.*



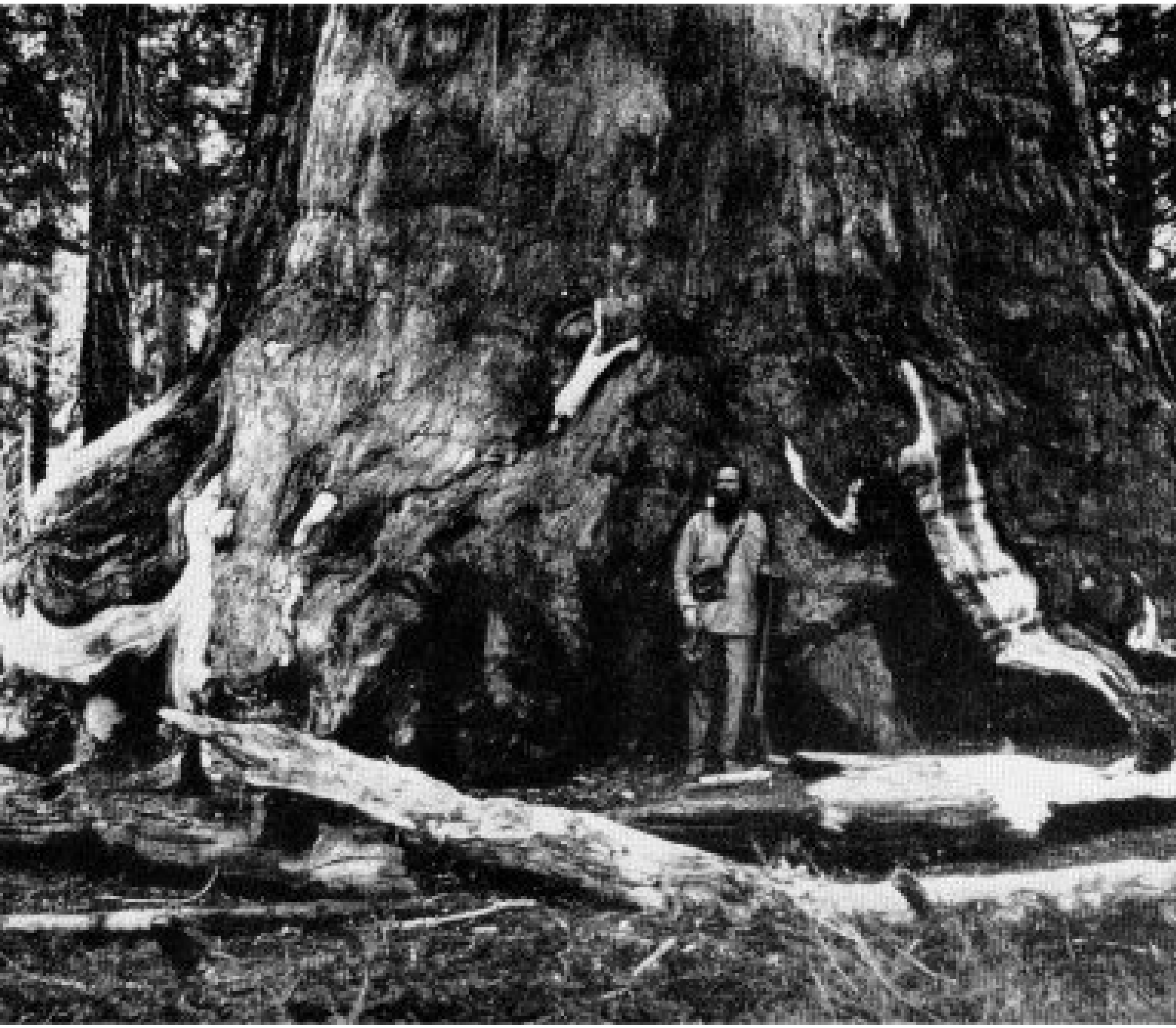
The Governor's Group, Mariposa Grove (See page 88).

Foreword

For over a hundred years, since their discovery, the giant sequoia, the "redwood" of the Sierra Nevada, has been a subject of wonder to scientists. The lumberman has come to appraise these "monarchs of the forest." Millions of visitors have come on foot, on horseback and by automobile to stand in awe of their size, their age and their majesty.

The preservation of natural areas had its beginning in America when a few farseeing Californians, not being willing to trust their future in the hands of private interests, obtained congressional action, climaxed by the signing of a document by Abraham Lincoln in 1864, reserving Yosemite Valley and the Mariposa Grove of Big Trees as a State park. This inception of the national park idea reached a climax with the Act of August 25, 1916, creating the National Park Service. The lands placed under its administration are to be held "to conserve the scenery and natural and historic objects and wildlife therein, and to provide for the enjoyment thereof in such manner and by such means as will leave them unimpaired for the enjoyment of future generations." In this policy is expressed the conviction that "some small part of America's abundant natural wealth of land and resources may be reserved for the purpose of creating a popular understanding and enjoyment of the natural and historic processes which make the nation distinctive and great." The giant sequoias of Yosemite are a part of the National Park System. Use them, but do not use them up!

This publication has been prepared primarily to give the Yosemite visitor a self-guiding auto tour of the Mariposa Grove of Big Trees (see page 70) as well as information that will enhance his appreciation and enjoyment of these giant sequoias. The tour starts from South Entrance Ranger Station (see guide map on pages 66 and 67). It includes an eleven-mile round trip through the Mariposa Grove to the famous Grizzly Giant, to the Museum, past the Telescope Tree, through the Wawona ("tunnel") Tree, and back to South Entrance Ranger Station. For directions as to how to reach Mariposa Grove see the map facing the table of contents. The other two groves of giant sequoias found within the park are also briefly described.



The Grizzly Giant and the discover of Mariposa Grove, Galen Clark. (Probably the first photo of a giant sequoia, taken by C. E. Watkins in 1858 or 1859.)

DISCOVERY

Giant sequoias were probably first seen by white men in 1833 when the Joseph Walker exploration party crossed the Sierra Nevada from the east and descended the western slope along the ridge between the Merced and Tuolumne Rivers. Zenas Leonard, a clerk with the expedition, wrote in his journal (published in Clearfield, Pennsylvania, in 1839) : “In the last two days travelling we have found some trees of the Redwood species incredibly large—some of which would measure from 16 to 18 fathoms [96 to 108 feet] round the trunk at the height of a man’s head from the ground.” These trees were in either the Tuolumne or Merced Grove in what is now Yosemite National Park.

Although Galen Clark is given credit for the discovery of the Mariposa Grove he undoubtedly was not the first white man there. In 1849 giant sequoias in Mariposa County are supposed to have been observed by Major Burney, the first county sheriff, and John McCauley. Measurements were taken and reported in the town of Mariposa but they were considered just another “tall story” of those pioneer days.

In 1857 Mariposa Grove was thoroughly explored and brought to public notice by Galen Clark. He named it Mariposa Grove of Big Trees as it was in the county of Mariposa.1 [1 Thus it is evident that the meaning of the Spanish word *Mariposa* (Butterfly) has no direct connection with the name of the grove.] The first tree he saw is located north and east of the Wawona “tunnel” Tree and is named in his honor. In the same year he established a stage station at the present site of Wawona. People came by stagecoach to his “Clark’s Station” and proceeded by horseback to Yosemite Valley and the Mariposa Grove.

Soon after Abraham Lincoln, in 1864, signed the proclamation into law, conserving the Mariposa Grove and Yosemite Valley as a park to be administered by the State of California, Galen Clark was appointed as the guardian. The area surrounding Yosemite Valley became a national park in 1890. In 1906 the State of California receded to the United States Yosemite Valley and the Mariposa Grove so that the whole became Yosemite National Park.

From 1906 until 1914, shortly before the National Park Service was organized in 1916, the enforcement of national park regulations was married out by a troop of cavalry of the United States Army who were stationed in Yosemite National Park during the summer months, a detachment being assigned to Mariposa Grove (see page 71). They made a significant contribution to Yosemite National Park by preventing serious damage to the area by sheep grazing and the depredations of lumbermen and poachers.

Galen Clark was born in New Hampshire in 1814. While visiting in New York City, in 1853, he saw an exhibition of California gold dust. In October of that same year, he started for California by way of the Isthmus. A short time after he arrived in Mariposa, in 1854, he suffered exposure and developed serious lung trouble from his mining and surveying experiences. After a medical examination, believing that he had only a few months to live, he decided to make his home on the South Fork of the Merced River near the present site of Wawona. As his health improved he built “Clark’s Station” and the first cabin in the Mariposa Grove.

Shortly after he became guardian of Yosemite Valley and the Mariposa Grove of Big Trees, he sold “Clark’s Station” to the four. Washburn brothers who did a great deal to make the grove accessible. They built the old Wawona Road, maintained the stagecoach lines, and provided hotel accommodations for visitors from 1866 to 1903.

When he died in 1910, aged 96, Galen Clark was buried beneath the shelter of four beautiful giant sequoias which he had planted in the cemetery near the present Yosemite Museum in Yosemite Valley.

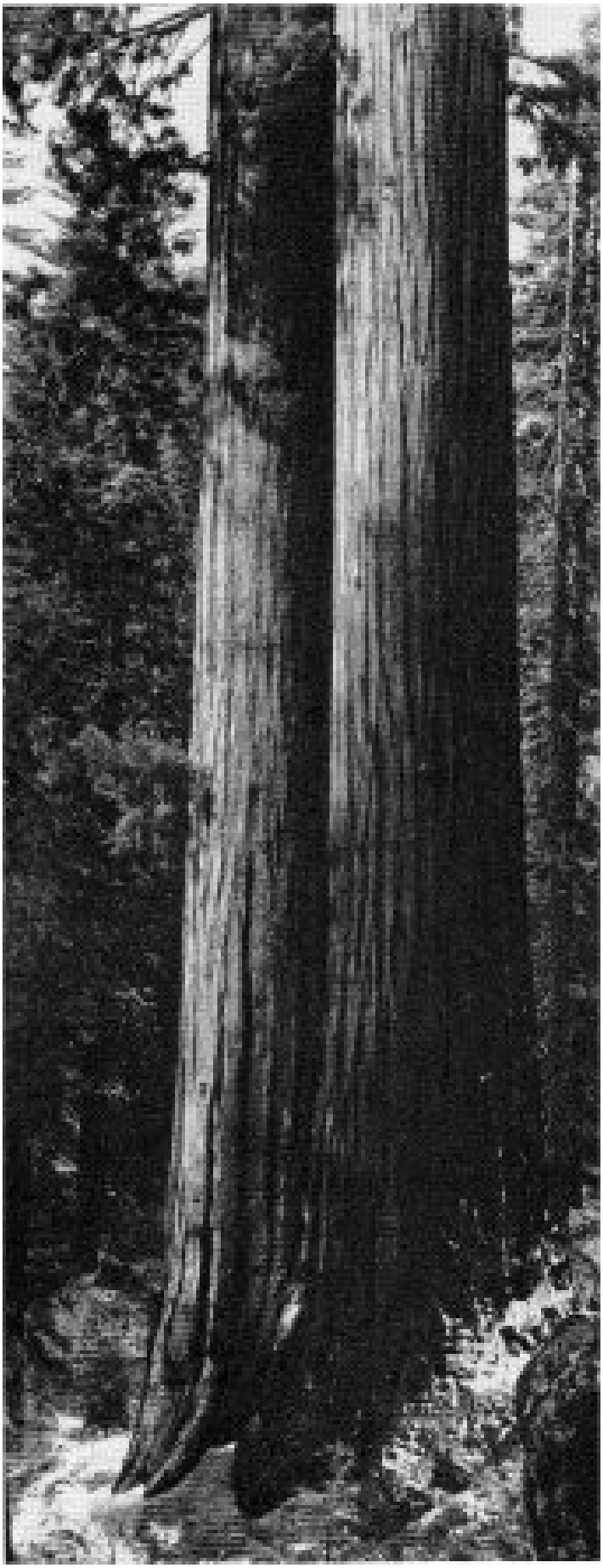
THE THREE GIANT SEQUOIAS GROVES

(See map facing Table of Contents)

The Tuolumne Grove is located near Crane Flat on the Big Oak Flat Road, the northwest entrance to Yosemite National Park. A small grove of about 25 large specimens, covering some 20 acres, it includes the Dead Giant which is 29 1/2 feet in diameter at the base. In 1878 a tunnel was cut through the Dead Giant so that a road then in use passed through it. Although trees of the Tuolumne Grove were perhaps first seen by members of the Joseph Walker Expedition in 1833, it was effectively discovered May 10, 1858, by a party from Garrote, California, Dr. J. L. Cogswell and eight friends. They named the snag, now known as the Dead Giant, “King Solomon’s Temple.”

Located four miles south of the Tuolumne Grove, the Merced Grove is the least accessible of the three groves of giant sequoias in Yosemite National Park. It consists of approximately 20 large trees. It can be reached from the Crane Flat Ranger Station.

Largest of the three and perhaps the most famous of all is the Mariposa Grove of Giant Sequoias. It consists of no less than 200 trees 10 feet or more in diameter and thousands of younger trees. It is located in the southwest corner of the park, 35 miles by highway from



The Twins: Two symmetrical trees
about 250-280 feet high in the Tuolumne
Grove.

Yosemite Valley. There one may see the Grizzly Giant, nearly 100 feet around and estimated to be 3,800 years old; drive through the Wawona ("tunnel") Tree; walk along the trunk of the fallen Massachusetts Tree; lunch on the outdoor terrace at Big Trees Lodge; visit the Mariposa Grove Museum; and enjoy the inspiring view from Wawona Point.2 [2 See pages 70-88 for self-guiding auto tour and detailed description of Mariposa Grove.]

Since human history in the groves of giant sequoias in Yosemite National Park has been coincident with so much of American history, many of the individual trees have historical names. Others have names that are descriptive of the tree's characteristics, as the Corridor Tree and the Telescope Tree. Many bear the names of famous men, cities and states of our country. At one time conspicuous signs were posted, naming each large tree. This was found to be a mistake in view of the incorrigible souvenir collecting instinct of many visitors. Now most of the signs have been removed, thus preserving their natural beauty and discouraging mutilation of the trees by souvenir hunters. Perhaps the most satisfactory souvenir which can be taken with you is a photograph which you, yourself, have taken of these natural wonders.

DESCRIPTION OF THE GIANT SEQUOIA

The name, *Sequoia* (the Latin spelling for Se-quo-yah), was first proposed for the coast redwoods in 1847 by the Austrian botanist, Stephen L. Endlicher. However, in 1823, an English botanist, A. B. Lambert, from specimens collected by Archibald Menzies in 1795 had mistakenly placed the tree in the same genus as the bald cypress, *Taxodium,* giving it the name *Taxodium sempervirens.* It is thought that the scientific, generic name, Sequoia, was given in tribute to a Cherokee Indian, Se-quo-yah, of marked nobility of character.

Se-quo-yah, whose English name was George Guess, was born about 1770 and died in 1843. He became a skilled silversmith and small farmer in Cherokee County, Georgia. Endlicher, who was a linguistic student as well as botanist, probably was aware that this uneducated, non-English-speaking Indian had developed, in 1821, an alphabet of 86 symbols, representing each sound in the language of his tribe. The alphabet was so simple that anyone in the tribe could quickly learn to read and write, and it is considered one of the cultural masterpieces of modern times. Se-quo-yah published the *Cherokee Phoenix* and also part of the New Testament in the Cherokee language. He was elected by the Cherokee Council in 1828 as their representative in Washington, where he became a highly respected citizen.

Because he lived for a time in that part of Oklahoma which was then known as Indian Territory, he is claimed by Oklahoma as one of her distinguished citizens and that state has placed a statue of Se-quo-yah in the Statuary Hall of the national Capitol. It is indeed fitting that the name of one of our original Americans should live on in the greatest and most noble of all trees.

Specimens of the giant sequoia of the Sierra Nevada were sent to England in 1853. There, the botanist, John Lindley, believing that it was sufficiently different from the coast redwood, *Sequoia sempervirens,*3 [3 See page 52 for a comparison of the two species.] created a new genus, calling it *Wellingtonia,* in honor of the Duke of Wellington who had died the previous year. He further gave it the species name, *gigantea,* because of the tree's size. In 1854, J. Decaisne, the French botanist, thought that the new species belonged to the same genus as the redwood and renamed the tree *Sequoia gigantea.* Later it was also given another name, *Sequoia Washingtoniana.* Nevertheless, the scientific name, *Sequoia gigantea,* was until recently generally accepted. Finally, in 1939, J. T. Buchholtz, on the basis of a careful study of the two sequoias and the fact that technically all previous names of the giant sequoia were invalid according to the rules of nomenclature, proposed the generic segregation of the two species, giving the name *Sequoiadendron giganteum* to the giant sequoia.

However, in line with the second edition of *Standardized Plant Names,* American Joint Committee on Horticultural Nomenclature, the scientific name *Sequoia gigantea* has the official sanction of the National Park Service, while it endorses the common name, *giant sequoia* given in the *Check List of the Native and Naturalized Trees of the United States,* 1944 edition, of the United States Forest Service.

In youth the giant sequoia has a tall, graceful, conical form, its slender trunk hidden by the branches which sweep the ground. The juvenile foliage is dark bluish-green while the purplish tinge adds interest to the bark. When the tree reaches its normal maximum height of of 250 to 300 feet, its crown broadens out, large lateral limbs are developed and the lower branches are gradually shed. As it reaches maturity the giant sequoia loses most of its smaller branches and assumes a broad conical or open oval shape with a few immense lateral limbs and large tufts of foliage. This characteristic is seen in the Grizzly Giant which has a large limb 6 feet in diameter over 95 feet above the ground. The trunks of older trees often show little taper for 100 feet or more above the large buttressed bases.

The soft, fibrous bark is a rich cinnamon brown, making it one of the most attractive features. Fluted in long vertical ridges, the sculptured columns rise branchless for a hundred feet. The bark is normally up to 15 inches thick, and may even be two feet thick where it has not been burned away by fire.4 [4 See specimens on display in the Mariposa Grove Museum or the Yosemite Museum in Yosemite Valley.] On the upper part of the trunk and on the large limbs the bark is usually not more than two inches thick, the outer thin platelets giving it a smooth burnished cast.

The wood of the giant sequoia is distinct from that of other conifers. The sapwood consists of a pale yellow band beneath the bark, whereas the heartwood is a bright, clear red, turning from darker to black with exposure. The annual growth rings are distinctly visible, except in very old trees where more recent growth may be so slight each year that the rings are almost microscopic in width. Resin canals are lacking, but the wood cells are heavily impregnated with a water-soluble, reddish, resinous gum.

Giant sequoias do not gradually die of old age. And yet, even to the casual observer, these ancient monarchs give visible evidence of their struggle for existence through the centuries. One of the characteristics is the frequent occurrence of dead tops. Most of these stag-headed crowns result from interruption of the water supply. This may be effected by partial destruction of the sapwood by fire near the base of the tree, since this portion functions as the channels through which water and minerals from the roots reach the needles, and an interruption of the conduction system may result in serious shortages. Practically all individuals with dead tops display large fire scars at their bases. An example of a giant sequoia which has sacrificed almost the entire crown in order to conserve its life may be seen just in front of the Mariposa Grove Museum porch.

The evergreen foliage of the giant sequoia consists of scale-like, sharp, pointed leaves closely overlapping each other along the twig, somewhat similar to the junipers. The bluish-green of the younger foliage ripens to a warm brownish-yellow like the incense-cedar (*Libocedrus decurrens*). Each leaf is 1/12 to 1/2 inch long and is closely appressed, extending outward from the axis of the stem about 1/4 of an inch.

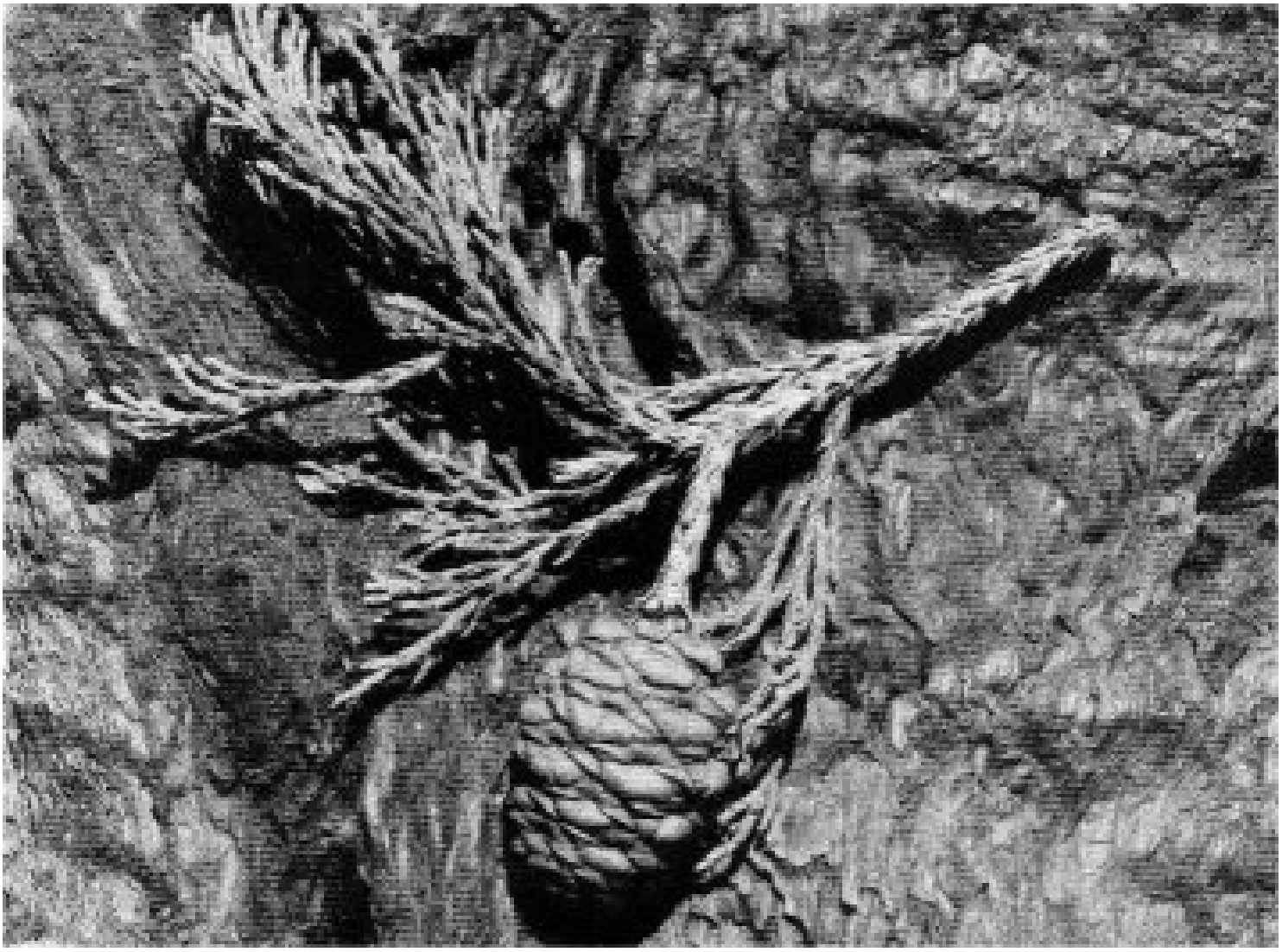
The root system of a fallen giant sequoia is a source of never-ending surprise since there is no tap root and there seem to be relatively few roots for such a gigantic trunk. Actually, the roots extend out from the trunk in every direction for a hundred feet or more in the top few feet of soil. And yet it is truly amazing that the small root systems can support such vast bulks against the storms of centuries. The trees are nicely balanced, however, and even leaning ones generally have their largest branches concentrated away from the direction of lean. When a tree finally topples over, the roots are generally broken off close to the base of the tree.

COMPARISON OF GIANT SEQUOIA WITH THE COAST REDWOOD

There are over fifty differences between the two kinds of trees, in many other respects similar. The characteristics which they have in common are: Evergreen, cone-bearing, reddish bark and reddish heartwood, absence of resin cells and abundance of tannin.

	GIANT SEQUOIA	COAST REDWOOD
Reproduction and Growth:		
	Cones, large 1 3/4 to 2 3/4 inches long; mature second season; may be retained up to 20 years.	Cones, smaller, from 5/8 inch to 1 1/8 inches long; mature first season; shed the first season.
	Cone scales, from 35 to 40 in each cone.	Cone scales, from 14 to 24 in each cone.
	Seeds, from 150 to 300 in each cone.	Seeds, from 50 to 60 in each cone.
	Reproduction by seeds only.	Reproduction by seeds and root sprouts.
	Young trees not tolerant of shade.	Young trees moderately tolerant of shade.
	Mixed stands generally found.	Pure stands often found.
Cultivation:		
	Moderate use in reforestation.	Extensive use in reforestation.
	Extensive planting as ornamental in Europe, Asia, and many parts of North America.	Extensive planting as ornamental in Hawaii, New Zealand, southern Europe, and warmer parts of North America.
Bark, Leaf and Root Characters:		
	Rich cinnamon-brown bark. Bark deeply furrowed with large ridges.	Dull red, richly colored bark. Bark shallowly fissured with small ridges.
	Bark from 1/2 to 2 feet thick at base of trunks of large trees. Leaves small, scale-like, resembling those of juniper or cypress. Leaves awl-shaped, sessile, 1/12 to 1/2 inch long, appressed all around the stem.	Bark from 1/4 to 1 foot thick at base of trunks of large trees. Leaves flat, needle-like, resembling hemlock or fir leaves. Leaves linear, petioled, from 1/4 to 1 1/4 inches long, spreading in two flat ranks.
	Root spread from 100 to 150 feet from base of tree at from 6-8 feet below surface of ground.	Root spread from 40 to 50 feet from base of tree at from 4-6 feet below surface of ground.
Commercial Uses:		
	Wood brittle, light and weak.	Dry weight of wood 26.2 lbs. per cu. ft.
	Wood has a tendency to break crosswise when tree is felled.	Wood has a tendency to split lengthwise when tree is felled. Waste in lumbering from 25 to 50 per cent.
	Waste in lumbering from 45 to 50 per cent (up to 80% in large trees).	Over half a million board feet lumbered each year; the redwood lumber of commerce.
	Almost no lumbering at the present time.	
Burls:		
	Burls cut from tree will not grow new foliage. Burls have little commercial value.	Burls cut from tree and placed in moist location will grow new foliage. Burls valuable for table tops, curios, etc.
Size and Age:		
	Average diameter of mature trees from 28 to 32 feet.	Average diameter of mature trees from 12 to 16 feet.
	Maximum known base diameter 40.3 feet.	Maximum known base diameter. 22.8 feet.
	Height of many trees from 250 to 300 feet.	Height of many trees from 300 to 350 feet.
	Average age of mature trees from 2,000 to 3,000 years.	Average age of mature trees from 800 to 1,500 years.
	Greatest reported age 4,000 years.	Greatest reported age 2,000 years.

Twig of coast redwood. Note needle-like alternate leaves and leafy cone-stalks.



Twig of giant sequoia. Note scale-like leaves and larger cones.

THE FOSSIL RECORD AND THE DAWN REDWOOD

Great forests of redwood once flourished in many parts of the world. Since the discovery of redwood leaf impressions in France and the later discovery of fossil redwood cones in Switzerland by the great paleobotanist, Oswald Heer, fossil leaves, cones and wood of the redwood type have been found throughout most of the Northern Hemisphere (see map page 57). Although some of them differ from those of the living sequoias, all of them were assigned to the genus *Sequoia.* Some of the fossil cones are attached to elongated stalks on which there are no needles. It was not until 1941 that the Japanese paleobotanist, Shigeru Miki, presented the evidence for referring cones of this type to a new genus, to which he gave the name *Metasequoia,* or "dawn redwood."

Then in February, 1946, came the startling announcement that the dawn redwood was still living. Tsang Wang, a Chinese forester, found the first one, the Discovery Tree, which is 64 inches in diameter and 98 feet high, among the rice paddies in a completely deforested valley near the village of Mo-tao-chi, more than a hundred miles northeast of Chungking in Szechuan Province. A second expedition, later in 1946, located 25 more trees, some over 7 feet in diameter and 100 feet high.

Dr. E. D. Merrill, director of the Arnold Arboretum of Harvard University, arranged for an expedition to collect seed for planting in as many places as possible, to insure continued survival of the species. Another expedition in March, 1948, headed by Dr. Ralph W. Chaney of the University of California, under the auspices of the Save-the-Redwoods League, made a further study, collected more specimens, and discovered several more small groves of the dawn redwood. Seeds have now been planted in numerous parks, arboreta, national forests and at several universities in the United States. Many of the seedlings, after only one year's growth, are almost one foot high. A further guarantee of their continued preservation is the formation of a national park in China for their protection.

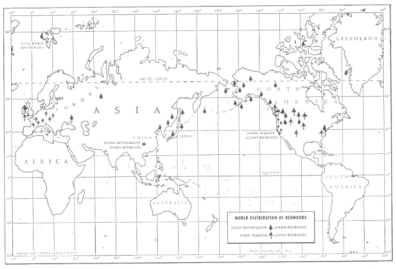
There are several characters by which the *Metasequoia* may be distinguished from the coast redwood, which it most nearly resembles. The most surprising of these characters is the deciduous habit of the dawn redwood, in striking contrast to the evergreen habit of the coast redwood which holds its leaves for 3 or 4 years. The branches of the dawn redwood are ascending, while those of the coast redwood come out horizontally and are turned down at their tips. A third character has to do with the ovulate cones; they are attached on long, naked stems, like those of certain American fossils and the ones described from Japan by Miki. A fourth character is the occurrence of the male cones on long spikes. Wholly unlike the corresponding structures of *Sequoia,* these staminate

Copyright photo courtesy of San Francisco Chronicle.

A twig of the dawn redwood, a “living fossil,” recently discovered in China.
From *Pacific Discovery Magazine.*

aments show a marked resemblance to those of the bald cypress, *Taxodium,* a related tree now living in the southern United States and Mexico. Finally, the needles are arranged in pairs on the shoots, while those of the coast redwood, and of the bald cypress as well, are alternately distributed.

By a restudy of all available fossil specimens, Dr. Chaney, of the University of California, has been able to refer the fossil collections of China, eastern Europe and Canada to *Metasequoia,* the fossils of British Columbia, western Europe and the United States being of the *Sequoia* type, except along the



Copyright map courtesy of Pacific Discovery Magazine.

Redwoods live today only in California and southwestern Oregon, and in a small section of China (black areas on map). From Chaney, *Redwoods of the Past.* Cut courtesy of Save-the-Redwoods League.

Pacific coast where the fossils were of both types, evidence that both the dawn redwood and the coast redwood were once part of the forests of this continent.

THE REDWOOD FAMILY

Although the dawn redwood has been placed in a new family, the *Metasequoiaceae,* with its one living species *Metasequoia glyptostroboides,* there are many things concerning all three species that still puzzle scientists. It may be many years before there is any prospect of agreement as to their natural relationships. For our consideration we shall place them all in the redwood family, *Taxodiaceae.*

This family is characterized by ancient lineage, peculiar modern distribution, and isolation of various species. The different genera which compose the family are widely scattered about the earth and are mostly very restricted in habitat. There are nine different genera, each with from one to three species:

Sequoia gigantea, giant sequoia. This species is found in the Sierra Nevada of California. Sequoia sempervirens, coast redwood. This species is found on the coast of California and southern Oregon.

Metasequoia glyptostroboides, dawn redwood. Only one living species, deciduous, found in Szechuan and Hupeh provinces in China.

Taxodium distichum and *T. mucronatum,* bald cypress. Two species; deciduous: the former located in the southeastern United States and the latter in Mexico.

Cryptomeria japonica, Japanese cedar. One species, native to Japan.

Sciadopitys verticillata, umbrella pine. One species, native to Japan.

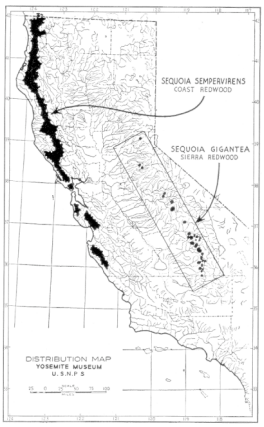
Cunninghamia lanceolata, common China fir. One species, native to Japan.

Athrotaxis. Three species, native to Tasmania and the Island of Victoria.

Glyptostrobus, China cypress. Two species, deciduous, found in China.

Taiwania cryptomerioides. One species, native to mountains of Formosa and southwestern China.

DISTRIBUTION OF THE GIANT SEQUOIA



From Shirley, Redwoods of Coast and Sierra, courtesy University of California Press.

The giant sequoia is native only on the western slopes of the Sierra Nevada in central California, occurring mostly at elevations of 5,000 to 8,400 feet, in a narrow belt for a distance north and south of about 250 miles. The most northerly grove, six standing trees, is on the Middle Fork of the American River in Placer County, and the most southerly is on Deer Creek in Tulare County. The trees do not grow in a continuous belt but occur on favorable or protected spots where the soil is deep, rich and moist, and thrive in a region where the average annual precipitation is from 45 to 60 inches. Most of this is in the form of snow which frequently lies from 10 to 14 feet deep and stays on the ground for from three to seven months in the year. The temperature in winter often falls to zero or below.

Mariposa Grove is the largest of the more northerly groves. However, farther south the groves approach forest dimensions, are more closely spaced, and occasionally are almost connected by scattered individual trees.

An explanation of the present distribution of giant sequoia in often widely separated groves has been of great interest ever since John Muir put forth the theory of the glacial origin of the lakes and valleys of the Sierra Nevada. The explanation is that many years ago the forests of giant sequoia were quite continuous and more extensive on the west slope of the Sierra Nevada than they are today. During the last glacial period, rivers of ice formed and moved down the Sierra slopes, eroding mountains, gouging valleys and destroying all plant life that lay in their path. Such was the fate of most of the giant sequoias. To the south "occurs the wide sequoia-less channel . . . of the ancient San Joaquin and King's River *mer de glace;* then the warm, protected spots of Fresno [Nelder] and Mariposa groves; then the sequoia-less channel of the ancient Merced glacier; next the warm sheltered ground of the Merced and Tuolumne groves; then the sequoia-less channel of the grand ancient *mer de glace* of the Tuolumne and Stanislaus.5 [5 Muir, *Mountains of California,* p. 196. The Century Co., New York, 1894.] Glacier scars and debris, which are not found within the old, well-established groves, bear mute evidence to the devastation that was wrought in all but relegating "nature's masterpiece" to the ranks of the extinct species of plant life.

Many of the sequoias are far from the beaten path, still almost as little known as they were when first discovered by the white man a hundred years ago, so that the visitor has somewhat the exhilaration of an explorer discovering a new form of life when he comes upon them. In all the groves—even those most frequently visited—one has a deep feeling of peace and reverence, as within a cathedral.

The species escaped extinction during the last glacial epoch, but there are probably fewer than 20,000 giant sequoia trees in the world today. These occupy less than 15,000 acres.

This is greatly contrasted with the distribution of the coast redwood which comprises a vast, almost continuous forest 450 miles from the north to south within the summer fog belt along the coast of California and southern Oregon.

Many people are of the opinion that the giant sequoia is a dying race. In spite of the fact that the older trees rain down millions of seed annually, the chances of an individual seed to germinate, survive and grow into a mature tree are less than one in a billion because of their particular growth requirements. There is little stored food in the tiny seed which weighs less than 1/6720th of an ounce. This makes it all the more necessary that the seed on germination have rich soil, constant supply of moisture and sunlight with which to make food. Only seedlings growing under continuously favorable circumstances have a chance for survival. A deep forest duff, heavy shade and severe root competition take a large toll of the relatively few seeds which germinate each year. Browsing deer stunt the growth and often pull up bodily the younger trees.

However, despite the difficulties of growth and the apparent scarcity of seedlings, the species is in no danger of extinction through lack of reproduction. There are young trees of almost every age in each of Yosemite's three groves of giant sequoias.6 [6 In some areas, especially in the Upper Mariposa Grove, the larger saplings or young tree stages are entirely lacking except in especially low, wet situations. There have been at least ten large fires, probably caused by lightning, whose record is indelibly written into the trunks of the trees, since the more general devastating fire of 1710 which seems to have destroyed all but the larger, more mature giant sequoias.] Again, the mature trees are so conspicuous that most people do not notice the young trees or mistake them for trees of some other species. Reproduction studies in Mariposa Grove in 1934 revealed that in some exposed areas, where the mineral soil had been mulched in 1932, there were more than 50 seedlings per square foot. This, in spite of the fact that germination of the seed is usually less than 15 per cent and as low as 3.3 per cent.

Few visitors see the flowers of the giant sequoia as they appear in winter from February to as late as May while deep snow is still on the ground. The tiny, bright yellow male blossoms burst forth in a solid mass and change the color of the crown from deep green to gold for a short time.

Clouds of yellow pollen are released. The female flowers, or cones, having been formed in clusters at the tips of branches during the previous year, are then pollinated, although fertilization does not occur until the last week in August. Then, the tiny seeds begin to develop but require still another season tc mature. Thus, the small, flat seeds, 150 to 300 of which are formed in each egg-shaped cone, do not approach maturity until July of the second year.

John Muir demonstrated the fruitfulness of the giant sequoia by two specimen branches, one and a half and two inches in diameter, on which he counted 480 cones.

The Douglas squirrel or Sierra chickaree (*Tamiasciurus douglasii albolimbatus*) is the happy harvester of most of the giant sequoia cones. With the first days of July he may be seen, hilariously exuberant, a couple of hundred feet up and out on the tip end of a branch cutting off the heavy cones with his ivory sickles at the rate of 20 to the minute, just as if there remained only a few moments in which to harvest his winter food supply. The prodigious activity of this small animal is shown by the great caches of cones in hollow logs, in one instance being more than 38 barley sacks of cones and their seed harvested by a single squirrel within a period of about 12 days.

Unless cut off by the squirrels the cone scales open, releasing the seed together with tiny flakes of reddish gum. Dissolved in water, this substance makes a good reddish-brown writing fluid. Letters which John Muir wrote with sequoia ink while in Mariposa Grove are still legible after 65 years. The cones, themselves, may remain on the tree for twenty years.

Saplings and even nursery stock a few feet high may bear cones, but tests have shown that their seed is infertile. Large quantities of fertile seed are normally produced only when the tree has reached several hundred years of age. As long as the tree survives it continues to develop large numbers of cones and fertile seeds. One can merely speculate on the vast numbers of seeds produced by a veteran that has withstood storms, fires and even geological changes during its life span.

Although erosion, fire and storm have taken their toll of the larger trees, nature has provided that the disaster which ends the life of one tree shall prepare the way for a dozen more. Ninety-four young seedlings were counted on a patch of sandy, flood soil once occupied by four large sugar pines. Eighty-six vigorous saplings were noted upon a piece of fresh ground prepared for their reception by fire. However, most reproduction occurs in the rich, mellowed soil of root craters left by the fall of old trees. Thus many trees are planted for every one that falls.

In every giant sequoia grove the thirsty traveler will find water. From this fact it has been assumed that this tree grows only in well-watered places. However, a more logical explanation, after a thorough study of the tree in its various habitats, is that a growth of giant sequoia creates these streams. The roots of this immense tree fill the ground for several acres, forming a thick sponge that absorbs and holds back the rain and melting snow, only allowing it to ooze and flow gently. So great is the retention of water in many place that bogs and meadows are created by the killing of the trees. A single trunk falling across a stream in the forest forms a dam 200 feet long, and from ten to thirty feet high, giving rise to a pond. Such a dam has been formed across Rattlesnake Creek in Mariposa Grove just below the Mariposa Grove Museum by the fall of several giant sequoias across the stream.

SIZE OF THE GIANT SEQUOIAS

The giant sequoia is unchallenged in size among the members of the plant world. No other species even closely competes with the vast volume of wood in the trunks of some of the larger specimens which rise as immense columns, gradually tapering for almost 300 feet into the sky.

This species, however, is exceeded in height by several others. The coast redwood, the world's tallest tree, reaches a height of 364 feet. This is attained by the Founders' Tree, dedicated to the memory of the founders of the Save-the-Redwoods League. It is located on North Dyerville Flat, about 800 feet east of Dyerville Bridge in Humboldt County, California. The Douglasfir, tallest tree of the Pacific Northwest, reaches a height of 324 feet. It is located near Ryderwood, Washington. The Eucalyptus or mountain gum of Australia reaches a maximum height of 326 feet, on Mount Baw Baw, near Melbourne, Australia. Thus the giant sequoia is probably fourth in height at about 300 feet. However, none of these other tall trees exceed 20 feet in diameter 4 1/2 feet above the ground, while the Grizzly Giant, itself, is 34.7 feet in diameter at the ground level.

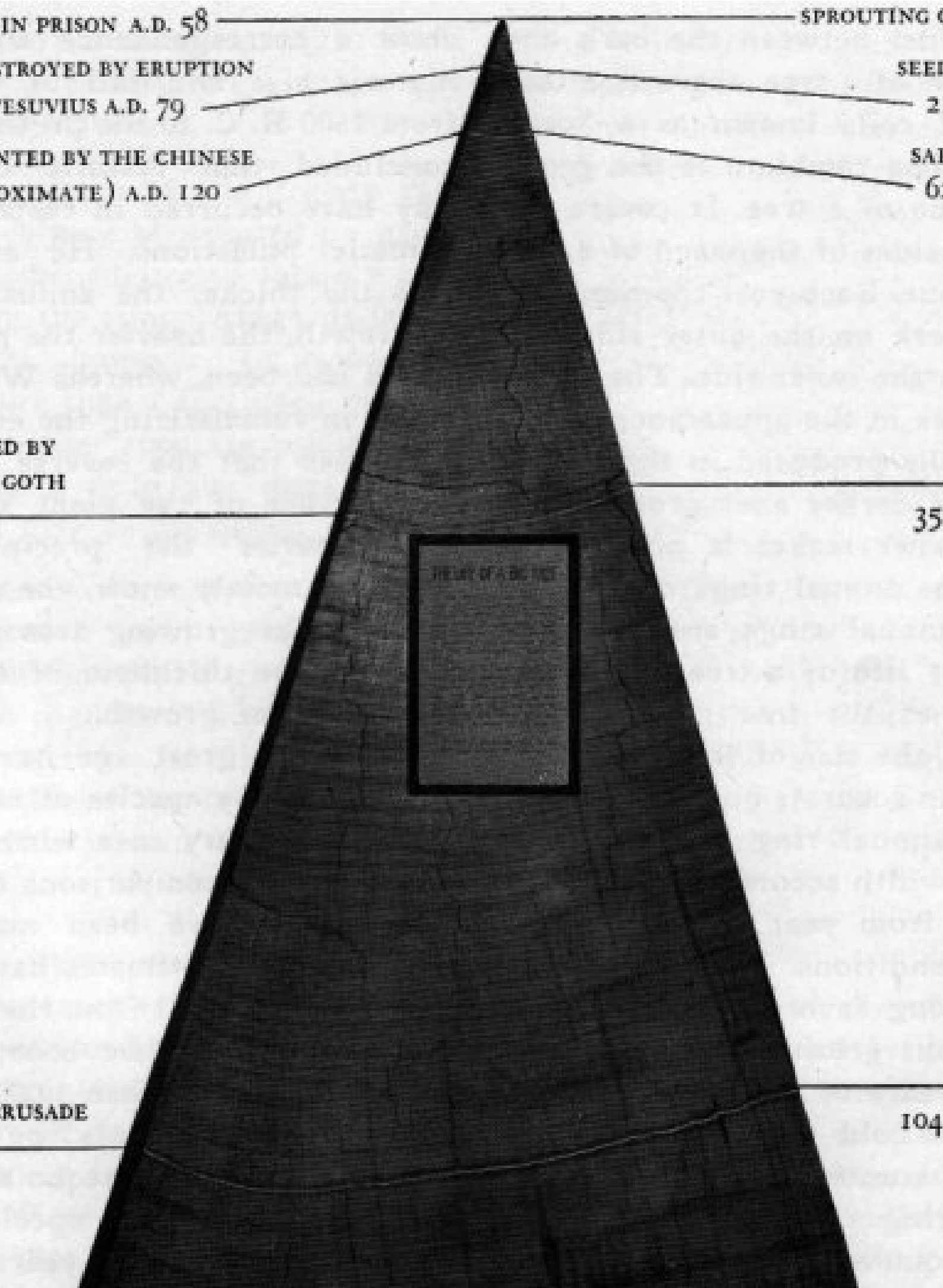
In diameter and circumference the giant sequoia is probably exceeded by only a single tree. A Tule cypress, far exceeding in size any other of that species, near Santa Maria del Tule, Oaxaca, Mexico, has a diameter of 36.1 feet and a circumference of 113 feet. This tree, however, is only 130 feet tall.* [* Recent research indicates a probability that this is more than one tree, grown together at the base.]

The vast size of the giant sequoia is difficult to comprehend fully. It is so out of proportion to commonly recognized measurements of trees or other familiar objects that figures regarding size do not register a clear picture of its vastness. One of the best illustrations is that furnished by a single branch of the Grizzly Giant in the Mariposa Grove. This branch is 6 feet in diameter as it turns upward from the trunk over 95 feet above the ground (see cover photo). Thus it is larger than the largest specimens of many more familiar tree species, yet, in itself, is an inconspicuous part of the tree.

AGE OF THE GIANT SEQUOIAS: How they grow

The age of a large, woody tree can be determined accurately only by an actual count of the annual growth rings on a cross section of the stump or butt log after the tree is cut down.

Fortunately, the age of each tree is recorded in the wood of the


IN PRISON A.D. 58
SPROUTING
TROYED BY ERUPTION
ESUVIUS A.D. 79
SEE
2
NTED BY THE CHINESE
OXIMATE) A.D. 120
SA
6
ED BY
GOTH
35
RUSADE
104

From Shirley, Redwoods of Coast and Sierra, courtesy University of California Press.

THE HISTORY OF A GIANT SEQUOIA

As illustrated by a section (bark to center) from an individual which for nearly twenty centuries lived in the Nelder Grove in Sierra National Forest. Familiar events of the Christian era which occurred within the lifetime of this tree are named at the left; on the right are indicated the corresponding periods in the growth of the tree. It was 57 feet in circumference at base, 234 feet high, when cut down.

trunk. Just between the bark and the wood of a tree, there is a thin layer of cells known as a "cambium." The cambium is the growing tissue of a tree. It covers the top and sides of the wood of a tree like a cone. Each year the cambium forms bark on the outer side and wood on the inner side. The slight difference in the appearance of the wood cells produced in the spring from the darker ones produced in the summer makes it possible to count the annual rings of growth. These annual rings are wider in the early life of a tree, and much thinner as the tree grows older. Further, the size of the tree is not always an accurate guide to its age, as the annual ring of wood may vary in width according to the difference from year to year in climatic conditions. Thick rings indicate long favorable seasons and prosperous growth, and thin rings record years of excessive drought or short cold seasons with consequent stunted growth. For example, ring counts made on two giant sequoias, both about 15 feet in diameter above the butt swell, revealed that one was 2,410 years old and that the other was a mere youth of only 1,740 years. Such counts made on a large number of giant sequoias of various sizes reveal that there may be a wide variation in the age of trees of approximately the same size.

The late Ellsworth Huntington of Yale University made a study of climatic changes reflected in the annual growth rings of the giant sequoias. From a curve based on this information he was able to show a correspondence with the historic rise and fall of nations from 1500 B. C. to the present, and concluded that historic changes may have occurred in response to climatic pulsations. He assumed that the thicker the annual rings of growth, the heavier the precipitation had been, whereas Waldo S. Glock in summarizing the evidence concludes that the reverse is true in the case of the giant sequoia. The heavier the precipitation, which is mostly snow, the shorter becomes the growing season, thus limiting the thickness of the annual rings of growth.

Claims of great age have been made for many species of trees. In practically every case where careful study and comparisons of very large trees have been made by scientists, age estimates have been materially reduced from the claims made by enthusiastic boosters, in some cases to less than 1,000 years.

Actual ring counts on many fallen and cut giant sequoias show that the age of this species frequently exceeds 3,000 years. John Muir writes, "The wood-rings in the section I laid bare were so involved and contorted in some places that I was not able to determine its age exactly, but I counted over 4,000 rings, which showed that this tree was at its prime, swaying in the Sierra winds, when Christ walked the earth. No other tree in the world, as far as I know, has looked down on so many centuries as the sequoia, or opens such impressive and suggestive views into history." (*Mountains of California.*) Another authenticated ring count proved an age of 3,210 years and some of the larger trees may exceed 3,500 years.

An estimate of the growth rate of a tree may be secured by using an increment borer to obtain a core showing the annual rings. It is not practical, however, to remove a core more than 2 feet deep in most trees, so that accurate information concerning only the more recent growth may be obtained.

All trees normally grow faster during their youth than in later life. For example, during the early years in the life of a giant sequoia, it may increase in diameter at the rate of about an inch every five years. One of our museum specimens actually increased its diameter more than one inch a year. However, in some veterans it may require more than 20 years to produce a one-inch diameter increase. Thus it is impossible to say with any degree of accuracy just how old a large, standing, living tree may be. On the basis of present verified evidence mature giant sequoias are the oldest living things on earth; and of all the giant sequoias, the Grizzly Giant in the Mariposa Grove, estimated at 3,800 years of age, is considered by many to be the oldest. However, the General Sherman and the President in Sequoia National Park have their supporters as contenders for this title.

ENEMIES OF THE GIANT SEQUOIA

Since trees renew their vital organs of wood, leaf, and root each year it would seem that they could live forever. It is true that trees do not get old in the same sense that we do. Were it not for the enemies of the giant sequoias they would indeed be "immortal." In spite of natural enemies, fire, insects, fungi, storms and erosion, they are able to survive to great old age.

Because of the large tannin content of the wood (the sap is 74 per cent tannin), it is practically immune to attack by either fungous diseases or insects. The chipmunks , robins and juncos, as possible evidence of the insecticidal qualities of even the bark, can frequently be seen taking sequoia bark baths in the depressions about seven feet above the ground in the buttressed base of the Lafayette Tree. In these depressions is a quantity of finely powdered bark. And yet there are several insects that attack the giant sequoia. The short longitudinal galleries that may be seen beneath the bark on fallen branches are due to the work of the sequoia bark beetle (*Phloeosinus rubicundulus*). The large horizontal branches in the crowns of the more mature trees are sometimes ringed by this insect, killing the branch. Because of the consequent danger to persons below, they have acquired the name of "widow makers." Also the insect known as the sequoia scale (*Aonidia shastae*), has been known to attack and discolor the foliage of young giant sequoias, although no fatal attacks have been observed. Termites seldom attack even the fallen trees. However, termites have been at work many years on the uprooted base of one large tree which has fallen across Rattlesnake Creek just below the Mariposa Grove Museum.

Attacks by fungi are chiefly limited to a small amount of "heart" rot, but since heartwood is non-living tissue the life of the tree is not imperiled. "Heart" rot could easily have been a contributing cause of the fall of the Massachusetts Tree in the Mariposa Grove, making a fine "punk" in which fire could tunnel up through its trunk. Further weakened by soil erosion, storm, and mutilation of its supporting roots by road builders, it crashed to the ground under a heavy mantle of snow in the spring of 1927.

The real threat to the life of giant sequoias is man's destructive acts. Fire is deadly to the young and has been the single greatest source of destruction of the mature trees. The effects of past fires are to be seen everywhere in the groves. Many of the large black scars must have been produced centuries ago, since the nearby large but much younger pines and firs often do not show fire scars, and, therefore, could not have been standing at the time of the fire. By the use of the increment borer a study of the more recent fire scars in the larger living trees has been made. Thus far the dates of the occurrence of 14 fires in the Mariposa Grove have been determined: 450 A. D., 1622, 1652, 1690, 1710, 1734, 1742, 1752, 1760, 1775, 1803, 1807, 1809, 1842 and 1862. Before the coming of the white man to these groves, most of the fires were started by lightning. Now 50 per cent are started by lightning—the remaining 50 per cent are man made.

Giant sequoias have a most astonishing resistance to fire. A single fire has perhaps never killed a mature tree. It would take weeks of burning, fed by branches of other trees, for a fire to penetrate the great thickness of its asbestos-like bark and reach the living tissues beneath. It is only by a succession of fires that many such as the Haverford, Corridor, and Telescope Trees in Mariposa Grove have acquired great cavernous fire burns which have eaten into the heartwood and weakened the bases of their massive trunks. It is only then that the factors of lop-sided growth, soil erosion about the roots and the winter storms may cause their downfall. Thus fire is at least a contributing factor to the untimely end of many of these forest giants.

Fortunately time and efficient fire control has prevented the occurrence of a destructive fire among these giant trees since the devastating fire of 1862.

The recuperative power of the giant sequoia is remarkable. Soon after the bark is burned away new wood and bark begin to form around the scarred areas and slowly, at the rate of about one-fourth inch a year, close the wounds. The average, short-lived tree would find difficulty in closing a large wound even though it were not killed by insect and fungi attack; but the giant sequoia, with centuries in which to effect recovery, often succeeds.

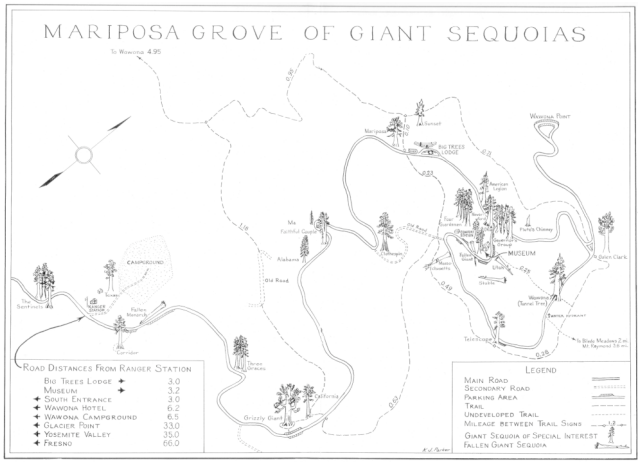
Lightning is seldom a cause of death to these trees. The only known instance is an individual 14 feet in diameter located just across the road from the Telescope Tree in Mariposa Grove. The lightning bolt struck about 100 feet above the ground, beheading it and the larger tree against which it is now leaning. The second tree is still alive, as it was hit above some of the lowest branches. In its cratered crown a large vine of California wild grape has grown. Hanging down the golden brown trunk, it waves in each passing breeze.

With increase of travel to the groves, man has become an unnatural enemy of the giant sequoias. Not only does he start 50 per cent of the fires, but the soil covering the surface roots of the trees has been trampled and the bark and the base of the trunks have been injured. The continued trampling of several hundred thousand feet around the bases of some of the more famous trees is a cause of concern to those who have made a careful study of its effect. That such damage may be kept to a minimum a great deal of thought, effort and money has been spent on the area surrounding the Grizzly Giant in Mariposa Grove.

In the 1890's grazing and the sawmill came to the giant sequoia groves. John Muir, speaking from his experience as a sheepherder, terms the sheep which were herded in droves up the quiet valleys among the giant trees, "hoofed locusts." And surely they earned the name!

Five sawmills were already at work, wreaking havoc among the giant sequoias by 1894. Fortunately the groves in Yosemite National Park had been reserved by the public for a higher purpose.

MAP OF THE MARIPOSA GROVE



[Editor's note: The campground on the map is now a parking lot and shuttle bus boarding area. The road is closed to automobile traffic east of the parking lot. The Big Trees Lodge no longer exists and the Wawona Tunnel Tree fell down in 1969. —dea.]

USES OF THE GIANT SEQUOIA

Today most of the giant sequoia groves are protected in State parks or national parks and national forests . At one time a considerable volume of lumber was produced from the giant sequoias; but, owing r to the difficulty of logging such immense trees and the great loss, up to 80 per cent, as a result of logging breakage, comparatively little reached the market. Although some of the largest trees contain more than 300,000 board feet (enough to build 30 six-room houses), most of this would be lost in logging or is of too poor a quality to be economically useful.

The wood of giant sequoia is light, soft, brittle and rather weak. It has a fuel value of 38 per cent and a breaking strength of 49 per cent in comparison with white oak (*Quercus alba*). Its chief value is for use where resistance to decay is important but strength is a minor

factor. The excellent condition of old fallen logs, some of which fell centuries ago before the discovery of the species, testifies to its durability and ability to re, sist decay. It is a sad commentary that many of the larger trees that were logged ended up as grape stakes.

Although it would appear that today the giant sequoias are of sentimental rather than of commercial importance, this is not altogether true. The few remaining virgin areas of our country it which the vegetation is left in essentially its original natural state are becoming of increasing importance to scientists in solving the varied problems of agriculture wild game management and reforestation.

Indirectly the giant sequoia is of inestimable value in the maintenance of flood control and in conserving the water supply in the areas lying to the west of the Sierra Nevada crest. The roots of this immense tree fill the ground, forming a thick sponge that absorbs and holds back the rains and melting snows, only allowing them to ooze and flow gently. So great is the retention of water in many places that bogs and meadows have been created by the fallen trees.

The giant sequoia is becoming increasingly popular as an ornamental. Its youthful, slender conical form graces many a mile of our boulevards and highways.

Planted in reforestation in Denmark, excellent stands were killed by unusually low temperatures before the roots were protected by a blanket of snow in the winter of 1942.

Several hundred thousand visitors come each year to see the giant sequoias of Yosemite National Park. In their harmony of color, in their symmetry of form, and in the cathedral-like aspect of their sculptured columns towering toward azure skies, they have found pure enjoyment and inspiration to a better way of life.

WHAT TO SEE AND DO IN MARIPOSA GROVE

A Self-Guiding Auto Tour

SOUTH ENTRANCE STATION TO THE SENTINELS (2 miles)

Mariposa Grove may be approached either from Yosemite Valley or from the Fresno road. In any event, if you are pulling a trailer, it will be to your advantage to leave it at the South Entrance Ranger Station unless you plan to camp overnight at Big Trees Campground. One and nine-tenths miles beyond, at the bottom of a long grade, giant sequoias come into view. Recognized by their great height and girth and golden-brown bark, they stand like sentinels on either side of the road, guarding the entrance to this famous grove. These trees are difficult to photograph as little sun-light filters through to the great boles of their trunks.

SENTINELS TO THE GRIZZLY GIANT (2 miles)

As we continue up the next grade, the rangers’ cabin area on

Courtesy Southern Pacific Railway

The Fallen Monarch and Troop F, Sixth Cavalry.

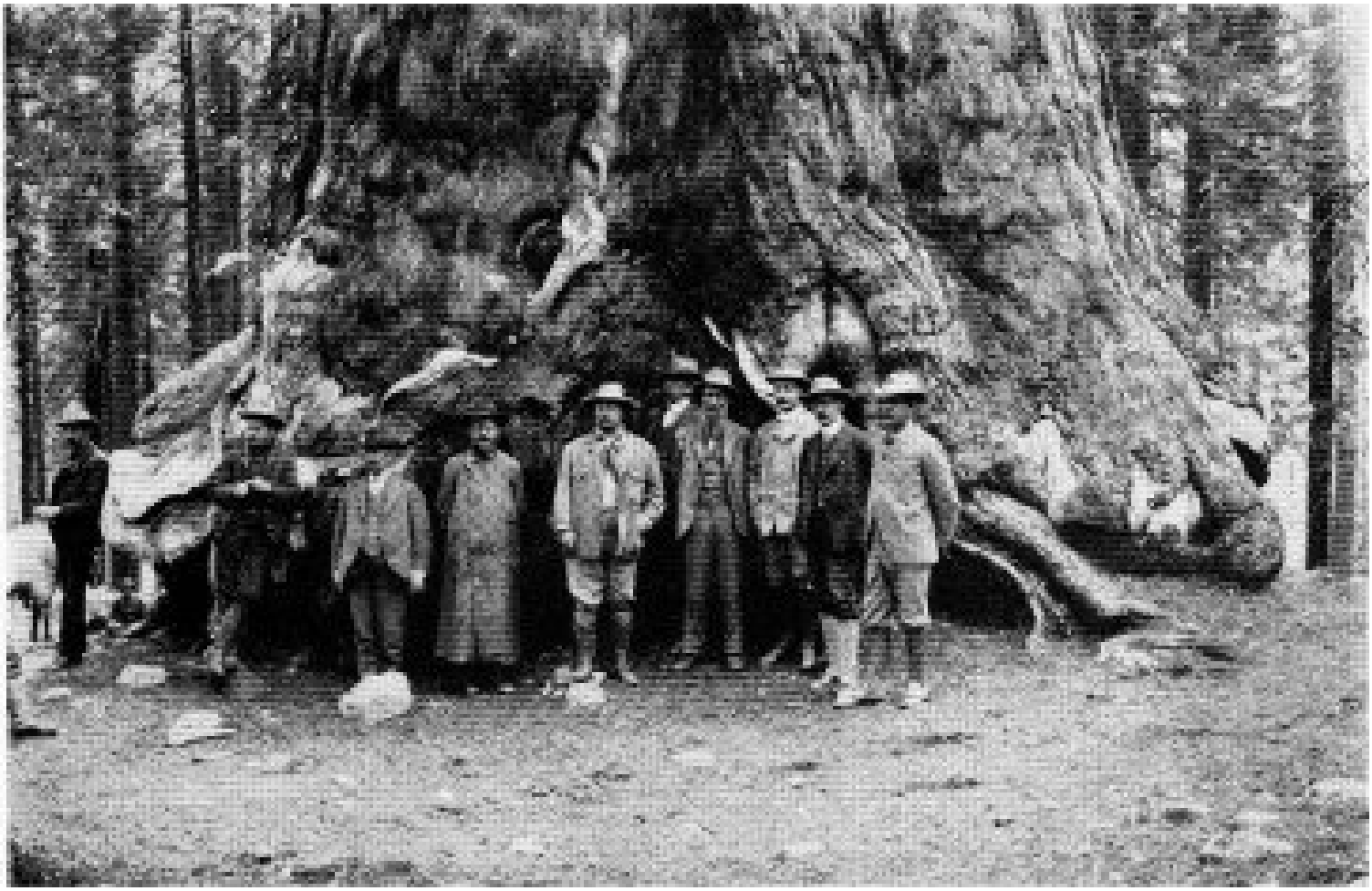
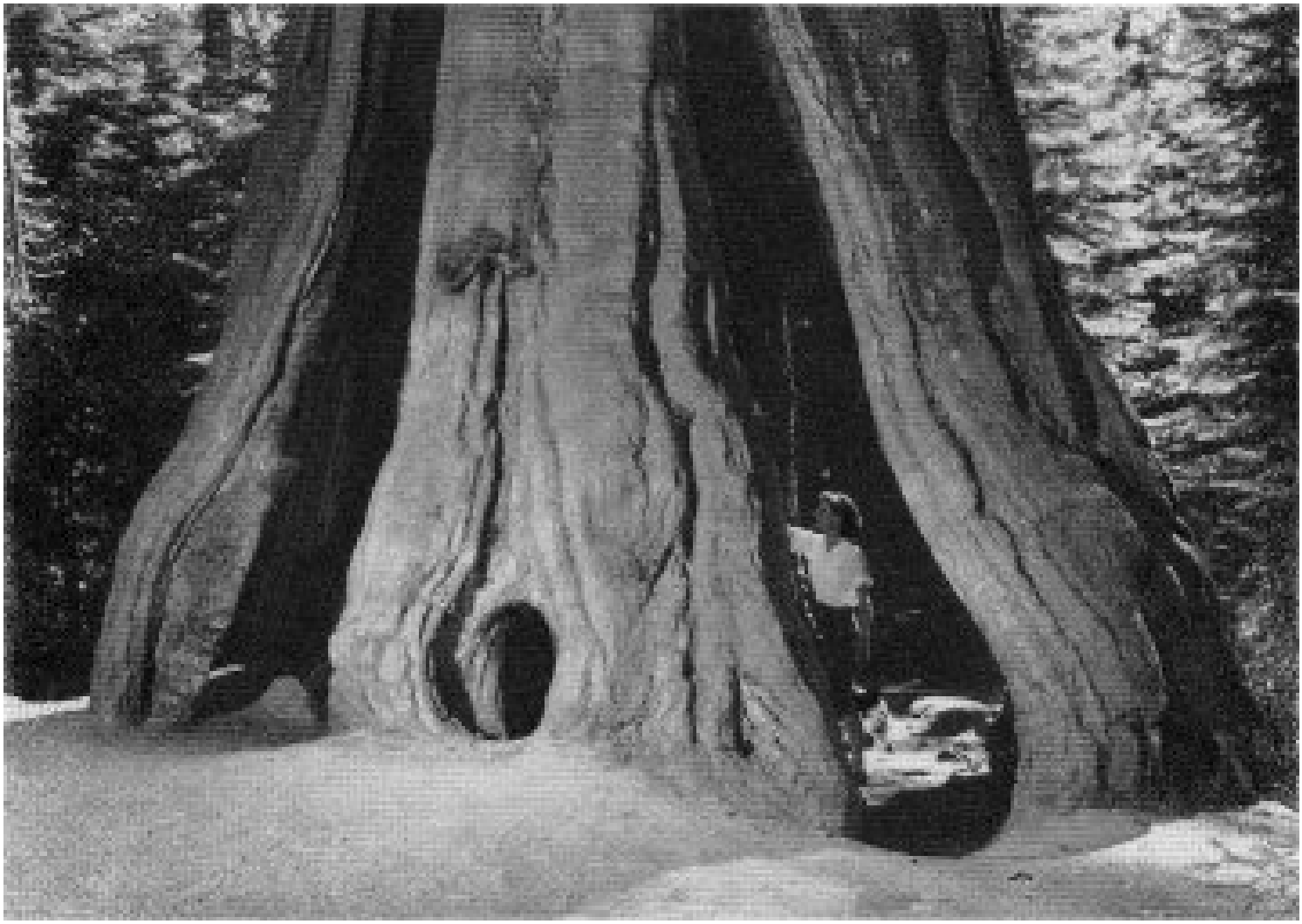


Photo by Joseph Le Conte.

Theodore Roosevelt and party, 1903. John Muir is to right of Mr. Roosevelt.

the left marks the entrance to the Big Trees Public Campground, the only place in the grove where camping is permitted overnight. It was in this grove that President Theodore Roosevelt, in 1903, instead of staying in a hotel, deserted his erstwhile political friends, preferring to spend the night about a glowing campfire at the feet of these forest giants. Such experiences as his in this outdoor cathedral have been the inspiration for much prose and poetry since the discovery almost a hundred years ago.

The Fallen Monarch. Diameter 10 feet above the base: 15.4 feet.* [* All measurements marked thus are taken from *Mariposa Grove Big Tree Survey.* Prepared by E. C. Smith, Chief Engineering Aide, National Park Service, January 1942. (Measurements were made during summer of 1941.)] Within sight on the left side of the road is the Fallen Monarch. The date when this tree fell is a matter for speculation as even Indian legend fails to reveal a time when it was standing. Although the centuries have rotted the bark and sapwood away, the stone-like durability of the heartwood is a permanent monument to the majestic tree which once grew here. It was the custom in earlier days for the stagecoach filled with visitors to drive out upon the trunk to be photographed. Although the massive trunk shows great charred scars which it must have suffered in its last years, preliminary borings show a lack of any prior fire scars which might be used in dating its fall (see page 71).



The Corridor Tree

The Corridor Tree. Height: 249 feet; diameter 14.8 feet at 10 feet above mean base. A favorite stopping place of travelers of earlier days, the Corridor Tree, a hundred yards up the old stagecoach road, across the road from the Fallen Monarch, gives mute evidence of the ravages by fire. The freakish burning of ancient fires ate deeply into the heartwood, leaving a shell of little more than sapwood separated into six columns. Here one may enter into the tree, walking with ease around the central column of solid heartwood while looking out between the pillars of bark and sapwood as though they were doors and windows. The ceiling of this unusual chamber ends with the fire scars 30 feet above the ground. A wonderful example of the tree's great healing powers is the new bark and new layers of wood added to repair the extensive damage.

The Three Graces and Bachelor Tree. Height : 254 feet, diameter 18.9 feet; height 258 feet, diameter 13 feet; height 219 feet, diameter 16 feet; height 241 feet, diameter 21.9 feet. Diameters were measured at ground level. Typical of the grace and beauty of line that has inspired artists and poets alike is this group of younger giant sequoias . Easily seen from the roadway, their beauty is richly enhanced in the morning sunlight.

The Grizzly Giant. Height 209 feet, circumference 96.5 feet, basal diameter 34.7 feet; diameter of first large limb 6 feet, 95 feet above the ground. Estimated age: 3.800 years. Signs and ample parking space mark the location of the largest and most conspicuous tree of the Mariposa Grove. Towering high above the surrounding great sugar and yellow pines and incense-cedars, the massive bole of the Grizzly Giant seems to fill entirely the clearing in the center of which it stands. No tree in this grove, or in any other grove of giant sequoias appears so rugged, so ripe with age. It is fittingly thought of as the patriarch of the grove.

A comprehension of the size of the Grizzly Giant is difficult, standing as it does among other great trees of the forest. It is best expressed, perhaps, by the total volume of its trunk and the thickness of its many large limbs. The greatest thickness of the trunk at the base is 34.7 feet while the mean perimeter is 96.5 feet. The tapering of the massive trunk is so slight that ninety feet above the base it still has a perimeter of over 46 feet. Its tremendous size can better be appreciated when one realizes that the first large limb 95 feet above the ground on the south side of the trunk is six feet through, being itself greater in diameter than most mature forest trees. Growing about 100 feet above the ground on this large limb is a Sierra currant (*Ribes nevadense*). It was first noted about 1930. The Grizzly Giant, eliminating saw cuts and bark, would make 363,528 board feet of lumber if the brittle wood could successfully be logged. Many visitors find it interesting to speculate on how many houses could be built from such a quantity of lumber. Meanwhile, the tree is "used" for enjoyment and inspiration by thousands of visitors each year, but it is not "used up" as would be the case if it were converted to lumber.

The Grizzly Giant is thought by many to be the oldest of the five largest known living giant sequoias although it has less volume than the others: the General Sherman, General Grant and Hart trees of Sequoia-Kings Canyon National Parks and the Boole Tree of Converse Basin near that park. No accurate method has yet been found of measuring the age of large trees. By the use of such an instrument as the ordinary increment borer the annual growth rings of only the outer two feet may be counted. Ever since the noted scientist, David Starr Jordan, estimated the age of the Grizzly Giant at 8,000 to 10,000 years, men have speculated as to its age. The conservative estimate of 3,800 years is based on a comparison of its size with that of other fallen trees whose annual growth rings have been counted, an attempt

to tell whether it grew fast or slow in its earlier years by a study of the locality in which it is growing, and by its present appearance of antiquity.

Fire has consumed over eighty per cent of the bark and sapwood at the base of the Grizzly Giant, and has eaten many feet into the heartwood, almost severing the living tissue connecting the trunk with the roots. Being able to procure only one-fifth of its normal supply of nutrients, it is able to grow and heal its old scars only very slowly.

Following reports of the highest plant authorities that the excessive trampling of the soil above the shallow root structure of the tree was leading to its destruction, and that roads should not be located near the roots, a number of projects were undertaken for the protection of the Grizzly Giant. These included fencing and landscaping. Finally the roadway that once approached close to the Grizzly Giant was re-established some distance to the south and east of the tree, its present location. The new road, which affords passing motorists views from the most advantageous points, was built entirely with hand tools since the use of explosives might further injure some of the widespread roots which extend in some cases 300 feet from the trunk.

There has been much concern regarding the stability of the Grizzly Giant ever since the State Highway Commissioner made a statement to the press in 1904 that the Grizzly Giant leaned 18 feet from its center axis and was doomed unless immediate steps were taken to prevent its fall. In answer to suggestions that cables be installed to help support the Grizzly Giant, Superintendent W. B. Lewis stated that the tree had an approximate weight of 3700 tons and that there was little man could do in propping such a weight. According to the most recent report of the park engineer, the tree has a natural lean in the form of a uniform curve extending from the base to the top, where it leans south 17.5 feet and west 5.5 feet. This lean, together with the largest of the limbs which are on the south side, causes the only hazard to the tree's long continued life. The center of gravity, determined by volume, neglecting limbs and foliage, is at an elevation of 59 feet, where the lean is 4 feet, throwing it without the middle third line of stability as determined from the average base measurement . Overturning is prevented by two small, irregular sections of the trunk extending in such a manner as to retain the center of gravity within the stability limit counterbalanced by limbs and foliage on the opposite side and by the extensive root spread in all directions.

Damage by fires which occur more than once each century and lightning strikes perhaps account for the dead branches in the top and the great fire scars in its trunk. In one storm in 1942 lightning was observed to strike the Grizzly Giant six times, wreaking great havoc and leaving on the ground mounds of cones and branches several feet deep. Still the branches of the Grizzly Giant bear each year many thousands of cones in which are a million tiny seeds. Having weathered a thousand storms through the centuries, the Grizzly Giant shows no evidence of giving up the struggle for existence.

The California Tree.* Height 232 feet, diameter 14.8 feet at 10 feet above mean base. The old stagecoach road from the Grizzly Giant

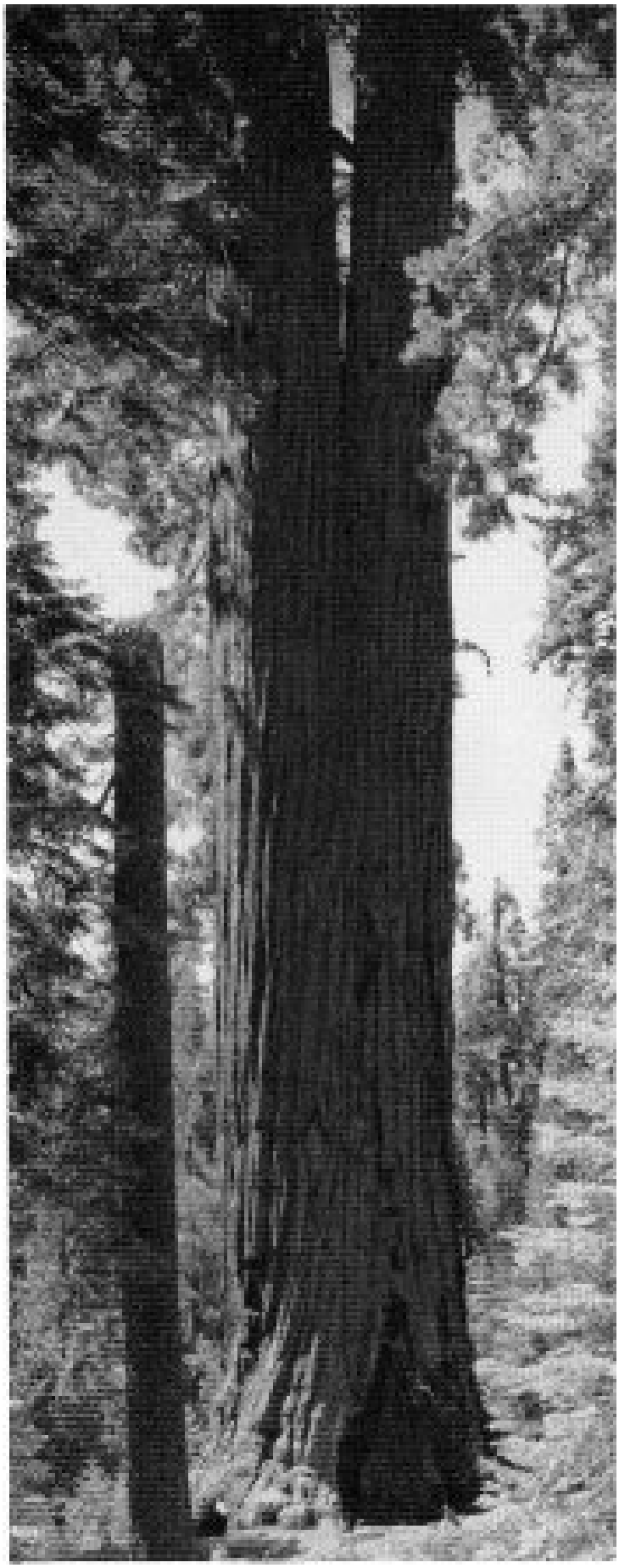
The California Tree

may be followed northeastward for about a hundred yards to the California Tree. It is one of the two living giant sequoias in the Mariposa Grove which has been tunneled . The cut was made in 1895. For many years it served as a substitute for the larger Wawona ("tunnel")

Tree which became inaccessible when the winter snows blocked the road through the upper part of the grove. With the relocation of the road adjacent to the Grizzly Giant in 1932, the loop road to and through the California Tree was abandoned and landscaped as a footpath.

GRIZZLY GIANT TO BIG TREES LODGE (1.6 miles)

Young Giant Sequoias. On the left of the roadway a sign has been placed by a group of young giant

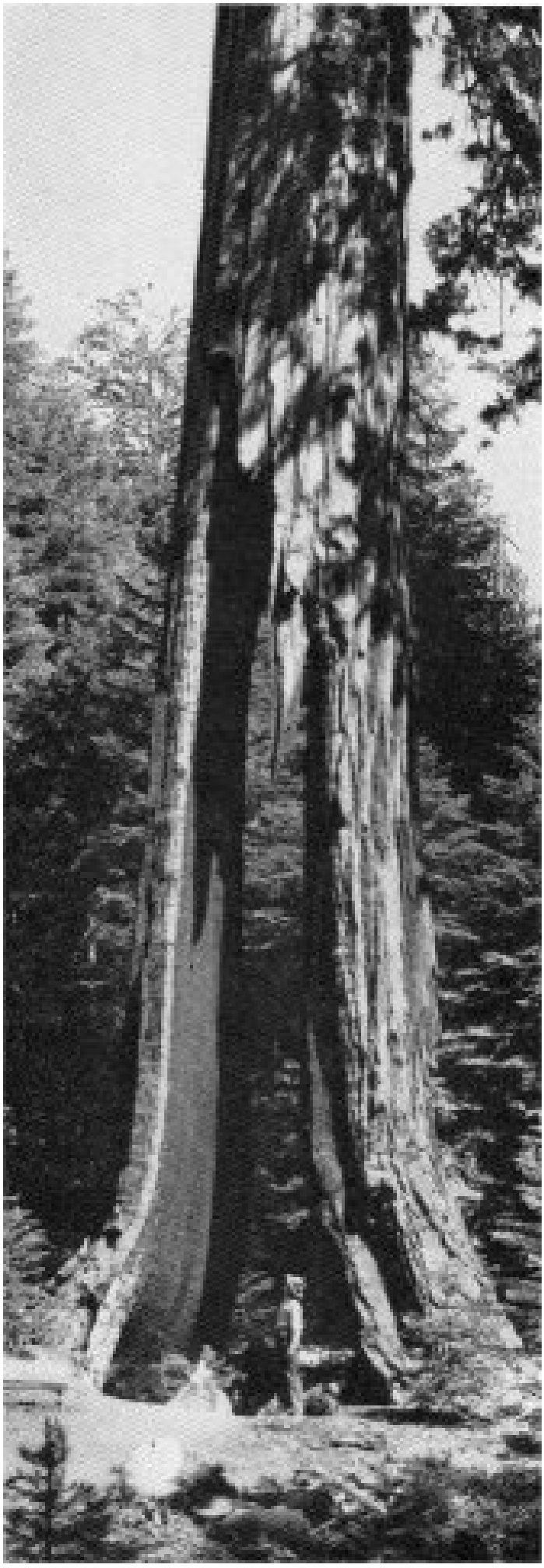


The Faithful Couple

sequoias. It is difficult for the casual visitor to recognize in these small saplings with the dark bluish-green foliage, purplish bark, and perfect pyramidal form the precursors of the forest giants which shade them. A closer examination reveals that even their juvenile foliage differs in the shape and arrangement of the leaves from their parents.

The Faithful Couple (0.7 mile from the Grizzly Giant). *East: Height 248 feet, diameter 19 feet at 10 feet above mean base. *West: Height 248 feet, diameter 19 feet at 10 feet above mean base. A thousand years ago they were two separate young trees struggling with each other for soil nutrients and sunlight. Now, their living tissues are so intermingled that water absorbed by the roots of one may be used in making food by the other. Their great fire scars make it seem still more remarkable that they have both attained exactly the same height and girth.

The Mather Tree (0.1 mile from the Faithful Couple). *52 feet high. Beyond the Faithful Couple, a short distance on the left, is the Mather Tree. This 50 (estimated) year old giant sequoia was officially dedicated to Stephen T. Mather, a Californian, who became the first Director of the National Park Service when it was established by an Act of Congress on August 25, 1916. He held the same position until January 12, 1929, under three administrations, two of them Republican and one Democratic, serving under five different Secretaries of the Department of the Interior. He justly deserves honor from all American people for carrying the National Park Service through its most critical period and for personally financing the donation of many areas to the National Park Service.



The Clothespin Tree

The Clothespin Tree (0.2 mile from the Mather Tree). Height: 266 feet, diameter 15.5 feet at 10 feet above the mean base. Extensive fire burns have left the trunk of this tree in the shape of an old-fashioned clothespin. By a 50-yard walk to the base of this tree the size of

the opening, 70 feet high and 16 feet across, can be more easily realized. Although decidedly leaning, it may see the coming and going of many more generations before succumbing to the force of gravity.

The Mariposa Tree (0.4 mile from the Clothespin Tree).* Height: 247 feet, diameter 17.4 feet at 10 feet above mean base. This tree and the grove have been given the name of the famous gold rush county. The county of Mariposa was named after a stream called “Las Mariposas” (Spanish for “butterflies") because they are seen in great numbers in this area at certain times of the year. Note that the fire scars of this tree are in the last stages of healing over.

Big Trees Lodge (0.2 mile from the Mariposa Tree). Completed in June, 1933, Big Trees Lodge, in the heart of the grove, offers restful accommodations and distinctive meals served on an outdoor terrace. Needless to say it is necessary to .. make reservations well in advance during the summer months. The management will appreciate the courtesy of making meal arrangements for parties of any size at least a few hours in advance. This will make it possible to more satisfactorily serve you, especially during the rush season.

Elephant’s Foot.* 12.2 feet diameter 10 feet above the base (no

The Elephant’s Foot

bark). This large fallen tree is ir front of the Big Trees Lodge. The annual growth rings show an age of 820 years at the road cut 60 feel above its base. Allowing 50 year; to grow 60 feet gives it an estimated age of 870 years. The year it fell, 1817, has been accurately determined by matching its fire scar pattern (the intervals of growth between the fire scars) with that of living nearby trees It shows damages from fires which occurred in 1775, 1742, 1690 and 1652.

The Sunset Tree. Height: 20: feet, and 17 feet diameter at 10 feel above mean base. A little to the left, behind Big Trees Lodge stands the Sunset Tree. Here, truly, is a tree living on “borrowed time.” Its base is chiefly a charred, ugly fire scar 51 feet across. It was very likely the great fire of 1710 which all but caused the death of this tree. It is characteristic that a tree sheds the foliage of the crown in proportion to the extent of the damage to its trunk. Having suffered more from fire and storm than any other tree in Mariposa Grove, this fire all but severed the living connection to the roots. The most westerly situation of all the ancient monarchs in the Mariposa Grove, it stands like a huge candle through the day, to be relit by the crimson glow of the setting sun. It is known as the Sunset Tree because the last rays of the setting sun reflect through its branches as twilight merges into darkness.

BIG TREES LODGE TO THE MUSEUM (0.4 mile)

The American Legion Tree

The American Legion Tree Height: 250 feet, 18.3 feet in diameter 10 feet above mean base. Be yond the Big Trees Lodge, on the left, a plaque marks the location of the American Legion Tree, dedicated to the unknown dead of the First World War in 1921. Extensively damaged by fire and storn it still shows strength in its struggle to survive.

The Haverford Tree.* Height 269 feet, 16.6 feet in diameter 10 feet above mean base. On the right as you enter the one-way loop road is the Haverford Tree. It has periphery of 106 feet around its great spreading trunk. Remarkable for its three great opening: which expose a cavity measuring 28 feet by 35 feet, it is said that as many as 15 horses have fount shelter there during stormy weather in stagecoach days. Then it was known as the “Shelter Tree.” Carved during past centuries by repeated forest fires, its huge fire scars are more photographed than any other in the grove. The tremendous weight of its stately bole is supported by three individual remnants of its trunk which hold the tree balanced in weird conspicuousness.

During the period from May 27 to June 1, 1940, reports were heard for some distance as the fibers gave way and great cracks appeared in its cavernous bulk. Believing that another monarch was soon to fall, rangers controlled the traffic on the nearby road to prevent possible injury to visitors. One crack had widened to 1 1/2 inches by June 3rd. However, by some inner strength, its tissues and fibers have held.

Excavated by fire to the very center as it is, one may touch the wood, part of a living tree, which was formed 1640 years ago. It is possible to date fires by counting the number of annual growth rings outside each of the fire scars. Its scars indicate that the tree was damaged when it was but 150 years

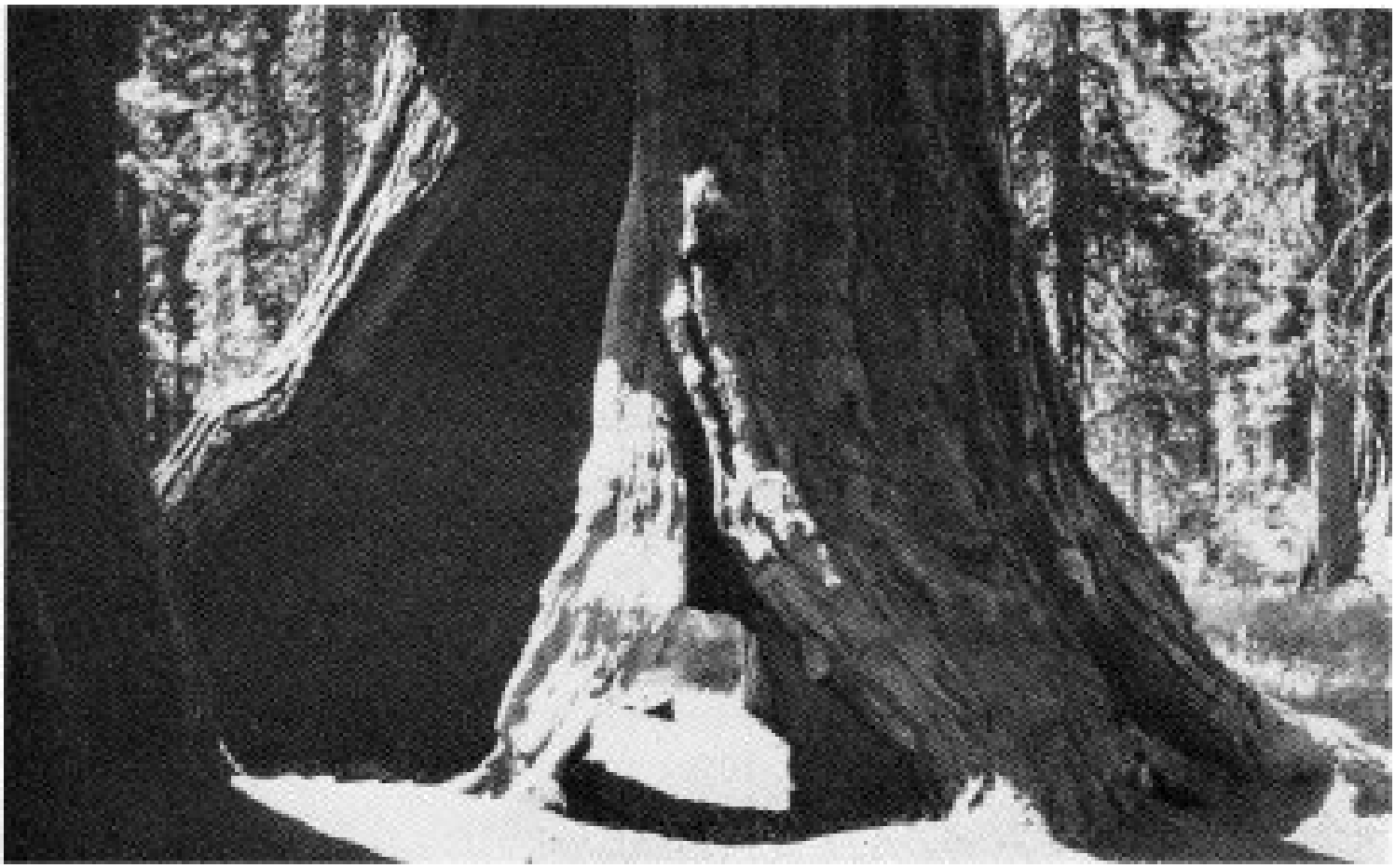


Photo by the author

The Haverford Tree

old, about 450 years after the birth of Christ. Although injured by many fires, the great fire of 1710 did the greatest damage.

After parking your car in the Mariposa Grove Museum area, you will want to walk over to this tree and see these things for yourself.

The Lafayette Tree. Height: 271 feet, 17.5 feet in diameter at 10 feet above mean base. To the left of the Haverford Tree is the Lafayette Tree with its large basal swell. Chipmunks, robins and juncos are often seen taking bark baths in the depressions in the bark just above the basal swell about seven feet high. In these depressions is a quantity of bark, finely powdered. Could it be that these animals have discovered insecticidal qualities of giant sequoia bark due to its high tannin content?

The MUSEUM (Trailers and trucks are not permitted beyond this point)

The Mariposa Grove Museum marks the site of the original cabin built by Galen Clark soon after he discovered the grove in 1857. The original cabin was destroyed about 30 years later and in 1885 the State Board of Commissioners built a second one on the same site. It housed the curio shop which was enlarged in 1902. In 1930 the present cabin, a replica of the former structure, was constructed by the National Park Service to house the museum exhibits.

These exhibits are devoted exclusively to the story of the giant sequoias, therefore the cabin and its furnishings were designed to harmonize with the natural surroundings . The massive furniture was hewn by hand from a giant sequoia that fell in 1919. Even the exhibit panels are made of giant sequoia wood.

Here brief lectures are given throughout the day during the summer months by ranger naturalists of the Yosemite National Park staff. Fossil “sequoia” specimens are on display. A large relief map vividly portrays the near extermination of vast giant sequoia forests by rivers of ice descending the west slope of the Sierra Nevada during the last glacial period. The present limited distribution of the coast redwood and the giant sequoia are similarly shown. Specimens of wood, bark, foliage and cones of each species aid in further distinguishing the two species.

Two exhibit panels portray the human history of the grove from its discovery by Galen Clark until the present time, a period of 92 years. Of special interest is the wedge-shaped section, more than 18 centuries old, showing the life of a relatively young giant sequoia (see page 63 for photograph). This exhibit includes a panel showing six important historical events that occurred during the life. of the tree, and a panel of photographs showing the appearance of the tree at each one of the six growth stages. It is interesting to note that the earliest event portrayed is the imprisonment of St.

The Mariposa Grove Museum

Paul in 58 A.D., thus identifying the life of the tree with the duration of the Christian Era.

Colored photographs and dimensions of the four largest giant sequoias are displayed—the General Sherman, the General Grant, the Boole and the Grizzly Giant. The first three are located in or near Sequoia-Kings Canyon National Parks, which contain 60 per cent of all the living giant sequoias in the world.

Current, temporary displays of some of the plants and animals with which the giant sequoias are associated are attractively arranged for your enjoyment throughout the museum. For your convenience the ranger naturalist on duty has for sale selections of books and pamphlets to meet your immediate interests in the giant sequoias and the wildlife of the region.

MUSEUM AREA

The General Grant (Height: 267 feet by 13.7 feet at 10 feet above mean base) is the tree directly in front of the museum porch. The tree next to the left is the ***General Sherman;*** height: 267 feet, diameter 13.4 feet at 10 feet above mean base. Still farther to the left is the ***General Sheridan Tree,*** height: 259 feet, diameter 16.5 feet at 10 feet above mean base, near which is a rustic plaque with the following sentiments so well expressed by the former Park Superintendent Charles Goff Thomson:

> These Sequoias gigantea are of a noble lineage
> That bridges humanity back through eons to
> The age of reptiles.
>
> Here live venerable forest kings in reveries that
> Carry back a thousand years before Jesus Christ
> Walked the shores of Galilee.
>
> In their majestic shadows fretting men may well
> Pause to ponder values—To consider the ironic
> Limitations of three score years and ten.
>
> Here, through a compelling humility, men may
> Achieve a finer integrity of soul.

Between the General Sheridan and the General Grant in the foreground can be seen the large ***Fallen Giant*** through which the roadway has been cut. The outer sapwood is decayed but the heartwood is well preserved although the tree fell in 1873. The cut through which the road passes is as black as though someone had painted it with creosote. This is actually a natural preservative, chiefly tannin, which is present in both the living and the fallen trees. The Fallen Giant also shows the shallow root system. Note there is no tap root. Before the cut was made in 1934 the roadway came in front of the museum porch and past the foot of the Fallen Giant.

The Columbia Tree. Height 286 feet, diameter 16.4 feet 10 feet above mean base. Beyond the Fallen Giant on the right side of

From Shirley, Redwoods of Coast and Sierra, courtesy University of California Press.

The Four Guardsmen

the road are three giant sequoias. The farthest and largest one with the inverted V-shaped fire scar is the tallest tree in the grove, the Columbia Tree. It is pictured on page 89.

HIKES

Those who achieve the greatest enjoyment and appreciation of these primeval forests are those who walk alone or in small groups among the giant sequoias on the trail.

Some of the most popular hikes are the upper loop trail or one of the trails down to the Grizzly Giant. With the map on the center pages in your hands you should have no difficulty in planning a most interesting two hours on the trails.

Short, unscheduled, nature hikes may be conducted in summer by the ranger naturalists to local points of interest. These are seldom of more than 30 minutes duration.

The Four Guardsmen. Ranging in height from 210 to 247 feet and from 8.4 to 10.5 feet in diameter at 10 feet above mean base. Approximately 100 yards to the west of the museum porch are the Four Guardsmen. It is interesting to speculate on this most interesting formation of trees. Since giant sequoia seeds normally germinate only in mineral soil, could it be that once a great log lay here under which the Sierra chickaree burrowed nests in which to store its winter supply of giant sequoia cones; and these four trees are the ones that successfully survived the struggle for existence? In the early morning the Four Guardsmen is one of the most photogenic groups of trees in the Mariposa Grove.

The Fallen Utah Tree. Length: 233 feet, diameter 16.2 feet 10 feet above mean base. The most common

The Massachussetts Tree

The Telescope Tree

finish for the giant sequoia is death by falling; they seem never to die standing. Even after falling has severed the roots that supply them with water, signs of lingering life are apparent for several years. At 7:00 a.m. April 7, 1935, two days after it was weakened by a wind storm, the 233-foot Utah Tree fell through the calm air of the Mariposa Grove to the forest floor. 1,200 days later the prostrate trunk still waved a small seven-foot banner of green foliage 132 feet above its severed roots as a last sign of its fading life. Thus this tree showed signs of life three years after it had officially died. Severe damage by fire and erosion of the soil around its roots played their part in bringing low this forest monarch.

The Fallen Stable Tree. Length 245 feet, diameter 17.2 feet 10 feet above base. Within sight, south and east of the Utah Tree is the prostrate form of the Stable Tree. Great fires have eaten into the heart of its great trunk, forming a semicircular cavern. In the early days of stagecoach travel mangers were built in this space, thus affording a stable for the horses. On the morning of its fall there was no wind, although three days previous a severe wind storm had occurred .This undoubtedly weakened the roots of this tree. In the fall the trunk broke into three sections, all the major limbs were snapped off and the roots were completely severed from the ground. In the summer of 1936 one of the large branches was still producing a surprising amount of new growth, although this famous tree officially died August 28, 1934.

MUSEUM TO WAWONA (“TUNNEL”) TREE (0.8 mile)

The Fallen Massachusetts Tree (0.3 mile from the museum). *280 feet height, diameter 28 feet 10 feet above base. Even the longest lived things on earth must inevitably face all-conquering death. One of the largest trees in the Mariposa Grove, two-thirds of its base was burned away by fire in 1710 which funnelled 51 feet up through the dry rot in the heartwood. In the 1870’s a road was constructed across the few roots remaining on the weakened side. In the spring of 1927, under a heavy mantle of snow, fire, erosion and man had finished their damage and gravity pulled it down.

In falling, such was its height, that it broke in many sections over the brow of the hill. It had limbs 5 feet in diameter 195 feet above its base. Sections of its 28-foot trunk may be found halfway down the ravine on the opposite side of the hill on which it grew. Shattering in its fall, the Massachusetts Tree is an example of the fact that seldom is more than 20 per cent of the larger trees recovered as lumber. Although dead, it is still a monument of unusual interest. A stairway was built up its trunk in 1933. Its diameter of 28 feet 10 feet above the base can be appreciated only by standing on its prostrate trunk and viewing the area from that commanding height.

The Telescope Tree. Height: 188 feet; diameter 16.4 feet at 10 feet above base. Much of the crown as well as two-thirds of the heartwood have been burned away by the repeated attacks of fire. Standing inside and gazing aloft, one sees branches and glimpses of blue sky as though the eye were directed through the small end of a telescope. Although 39 feet of its 74 feet of circumference have been destroyed by fire, leaving it “hardly a leg to stand on,” sufficient of the essential bark and sapwood is intact so that the hollow shell of a tree goes on living in spite of its handicap. Ax marks show where the road builders of the ’70’s started to cut a tunnel. Fortunately, they

were stopped by a wise foreman who, seeing that this tree had suffered enough, realized that cutting a tunnel through this tree would so weaken it that the first storm would bring it crashing to the ground.

The Fallen Mark Twain Tree. Length: 274 feet; 17.7 feet base diameter. Before falling in 1943 this tree had a 35 foot lean due south and was badly scarred by fire on the other side. At this writing (1949) it is the most recent of the well known individuals in the grove to topple over.

The Wawona ("Tunnel") Tree (0.3 mile from Telescope Tree). *Height: 234 feet, diameter 19.8 feet at 10 feet above mean base. Ever since a tunnel was cut through this famous tree by the two Scribner brothers in 1881 for wages of

From an old glassplate negative, probably by Boysen.

The Wawona Tree has been famous since stagecoach days.

only $75.00 from the Yosemite Stage and Turnpike Company, the Wawona Tree has enjoyed more publicity than any other tree in the world. Hundreds of thousands of people visit it each summer. The question asked most frequently of the ranger naturalist at the museum is, “Where is the tree you can drive through?” The tunnel itself is eight feet wide, 26 feet long and 10 feet high. A favorite subject of artists and photographers alike, its portrait has been published in geography texts for over 50 years. The name “Wawona” was appropriately selected from the language of the Miwok Indians— *Wah-wo-nah*—meaning “big tree.” [Editor’s note: The origin of “Wawona” is unknown. It is not Miwok for “big tree,” however —dea.]

WAWONA TREE TO GOVERNOR’S GROUP (1.5 miles)

The Galen Clark Tree. Height: 240 feet; diameter 15.3 at 10 feet above mean base. Galen Clark discovered and named the Mariposa Grove in 1857, although other men besides the Indians had certainly made unrecorded visits to this area at an earlier date. (See pages 47 and 48 for more complete description of his history.)

Wawona Point (0.4 mile from the Wawona Tree). By keeping to the right at the next intersection it is only half a mile to the Wawona Observation Point where there is a fine view of the South Fork of the Merced River and the Wawona Basin. This is also a choice spot from which to watch the colorful and inspiring sunsets.

The Governor’s Group (0.5 mile from Wawona Point turn-off, see frontispiece). Just before reaching the museum area and the end of the one-way loop road, on the left, is the Governor’s Group. This name appropriately recognizes the majesty and stateliness of these giant sequoias. There are few places where one may so completely experience the sensation of being in a great outdoor cathedral, as standing here among these giant, fluted columns reaching into the vast, blue vault of the sky.

PICNICKING AMONG THE BIG TREES

The road now leads back past the Big Trees Lodge, Big Trees Campground, and the South Entrance Ranger Station. However, many visitors, having brought their lunch, take advantage of the picnic area near the museum. This will give you more of an opportunity to get acquainted with the mule deer, chipmunks, squirrels, many birds and perhaps even a black bear. The National Park Service requests that you do not feed the wild animals for two reasons: (1) The foods which you have available are very likely harmful to the animals; and (2) it is dangerous to feed them, especially in the case of the black bear. Extreme care should be taken to keep small children away from the deer as they may cause injury with their forefeet if suddenly frightened.

[Editor’s note: picnicking is no longer allowed in Mariposa Grove. It attacts Carpenter Ants that destroy Giant Sequoias by carving numerous chambers in the tree. —dea.]

Picnicking in the Mariposa Grove.

CHRONOLOGICAL HISTORY OF THE MARIPOSA GROVE

450	A. D. Fire.
1652	Fire.
1690	Fire.
1710	Fire.
1742	Fire.
1803	Fire.
1809	Fire.
1842	Fire.
1849	Major Burney and John Macauley report Big Trees east of Chowchillas.
1857	Galen Clark discovered and explored the Mariposa Grove.
1862	Fire.
1854	Grove and Yosemite Valley became a California State Park. Galen Clark made guardian of the grove and Yosemite Valley.
1858	John Muir made his first visit to Yosemite.
1873	Fallen Giant fell.
1881	Tunnel cut through Wawona Tree by Yosemite Stage and Turnpike Co. at a cost of $75.00.
1885	State Board of Commissioners built a cabin as replica of Galen Clark's old one.
1889	Fire threatens grove.
1895	Tunnel cut in California Tree (near Grizzly Giant).
1902	Old cabin enlarged to accommodate curio shop.
1906	Mariposa Grove and Yosemite Valley re-ceded to United States. U. S. Army administered the areas.
1914	Civilian employees replaced Army in administration of park.
1916	National Park Service established by Act of Congress.
1927	Massachusetts Tree fell.
1930	Present museum constructed as replica of former cabin.
1932	Road rerouted around the Grizzly Giant.
1934	Stable Tree fell August 28.
1934	More than 15,000 seedlings and saplings counted in north section of the grove.
1935	Utah Tree fell April 7th.
1943	Mark Twain Tree fell.

SELECTED REFERENCES

BOOKS

Clark, Galen. *The Big Trees of California.* Redondo, California, Reflex Publishing Company, 1907.

Ellsworth, Rodney Sydes. *The Giant Sequoia.* Oakland, California, J. D. Berger, 1924.

Fry, Walter, and White, John R. *Big Trees.* Stanford, California, Stanford University Press, 1938.

Muir, John. *Mountains of California.* New York, The Century Company, 1894.

———. *Our National Parks.* Boston, Massachusetts, Houghton Mifflin Co., 1901.

———. *The Yosemite.* New York, New York, The Century Company, 1912. Russell, Carl P. One Hundred Years in Yosemite. University of California Press, 1947.

Shirley, James Clifford. *The Redwoods of Coast and Sierra.* Berkeley, California, University of California Press, 1947.

Stewart, George W. *Big Trees of the Giant Forest.* San Francisco, California, A. M. Robertson, 1930.

PAMPHLETS AND PERIODICALS

Bellue, Alfred J. A Technical Report on the Sequoia Gigantea of Mariposa Grove. *Engineers Report, 1930.* Yosemite National Park, California.

Buchholz, J. T. The Generic Segregation of the Sequoias. *American Journal of Botany* 26:535-538, 1939.

Carlson, S. T. Sequoia Reproduction Studies in the Upper Mariposa Grove of Big Trees. *Yosemite National Park, California,* 1935.

Chaney, Ralph W. The Bearing of the Living Metasequoia on Problems of Tertiary paleobotany. *Proceedings of the National Academy of Sciences* 34: 503-515, 1948.

———. Redwoods of the Past. Berkeley, California, *Save-the-Redwoods League*, 1948. San Francisco, California.

Cook, Lawrence F. *The Giant Sequoia of California.* Washington, D. C., United States Government Printing Office, 1942.

Cowell, A. E. Report of measurements of Grizzly Giant. Yosemite National Park, California, *Engineer's Report*, 1932.

Glock, Waldo S. Growth rings and climate. *Botanical Review* 7: 649-713, 1941.

Godfrey, William C. *Yosemite Nature Notes*, Vol. VIII, No. 4, April 1929.

Hastings, Cristel. Naming the Sequoia. *American Forests* 34: 202-205, 1928.

Huntington, Ellsworth. The Secret of the Big Trees. Washington, D. C. United States Department of the Interior, *National Park Service*, 1928.

Kramer, Paul J. Absorption of Water by Plants. *Botanical Review* 11: 310-355, 1945.

Merrill, E. D. Living Metasequoia in China. *Science* 107: 140, 1948.

Phillips, William A. Se-Quo-Yah. *Harpers Magazine* 41: 542-548, 1870.

Presnall, C. C. Fire Studies in Mariposa Grove. *Yosemite Nature Notes*, Vol. XII, March 1933, No. 3.

———. Translating the Autobiography of a Big Tree. Yosemite National Park, California, *Yosemite Nature Notes* 12: 5-7, January, 1933.

Stebbins, George Ledyard, Jr. Chromosomes and Relationships of Metasequoia and Sequoia. *Science* 108: 95-108, 1948.

Smith, E. C. Mariposa Grove Big Tree Survey. Yosemite National Park, California, *Engineer's Report*, 1942.

"Like a letter from home!"

THAT IS THE WAY one reader of YOSEMITE NATURE NOTES described this publication. We have never thought of it that way, but if it serves that purpose for our readers who have come to know and love Yosemite, there must be others, not now subscribers, who would like to hear from Yosemite each month.

The Yosemite Natural History Association assists the park naturalist division in the development of a program for better understanding of Yosemite geology, history, Indians, plants, birds and animals.

To know Yosemite is to appreciate it more fully. We are confident many visitors achieve more inspiration and wholesome benefit from the park as a result of this program.

Won't you join us as a regular reader of YOSEMITE NATURE NOTES?

YOSEMITE
NATURE

A $1.50 subscription will bring you the Yosemite story accurately and interestingly told twelve times a year.

NOTES

Revenue derived from the activities of the Yosemite Natural History Association is devoted entirely to assisting the park naturalist division in the furtherance of research and the interpretation of the natural and human story in Yosemite National Park.

SEND SUBSCRIPTIONS TO

NATURAL HISTORY ASSOCIATION, INC.
BOX 545, YOSEMITE NATIONAL PARK, CALIFORNIA
