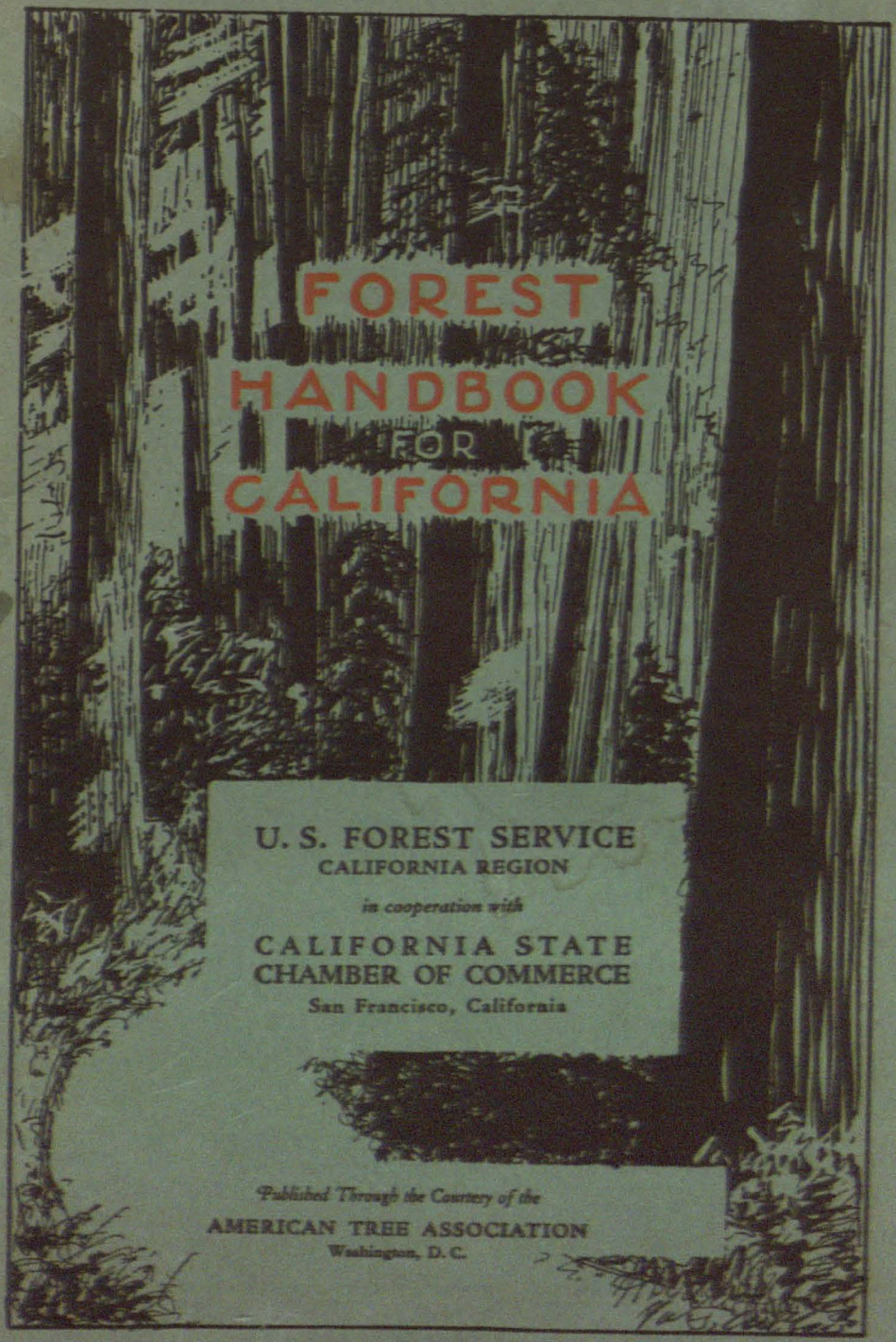


FOREST HANDBOOK FOR CALIFORNIA

U. S. FOREST SERVICE
CALIFORNIA REGION

in cooperation with

CALIFORNIA STATE
CHAMBER OF COMMERCE
San Francisco, California

Published Through the Courtesy of the
AMERICAN TREE ASSOCIATION
Washington, D. C.

MY FOREST CREED

▼

The forest is my friend.

I will look with reverence upon it.

I will use and enjoy it.

Its many foes are always mine.

The fire that cooks my food, gives me warmth, or lights my peaceful pipe, shall not destroy it.

I will cherish and protect it.

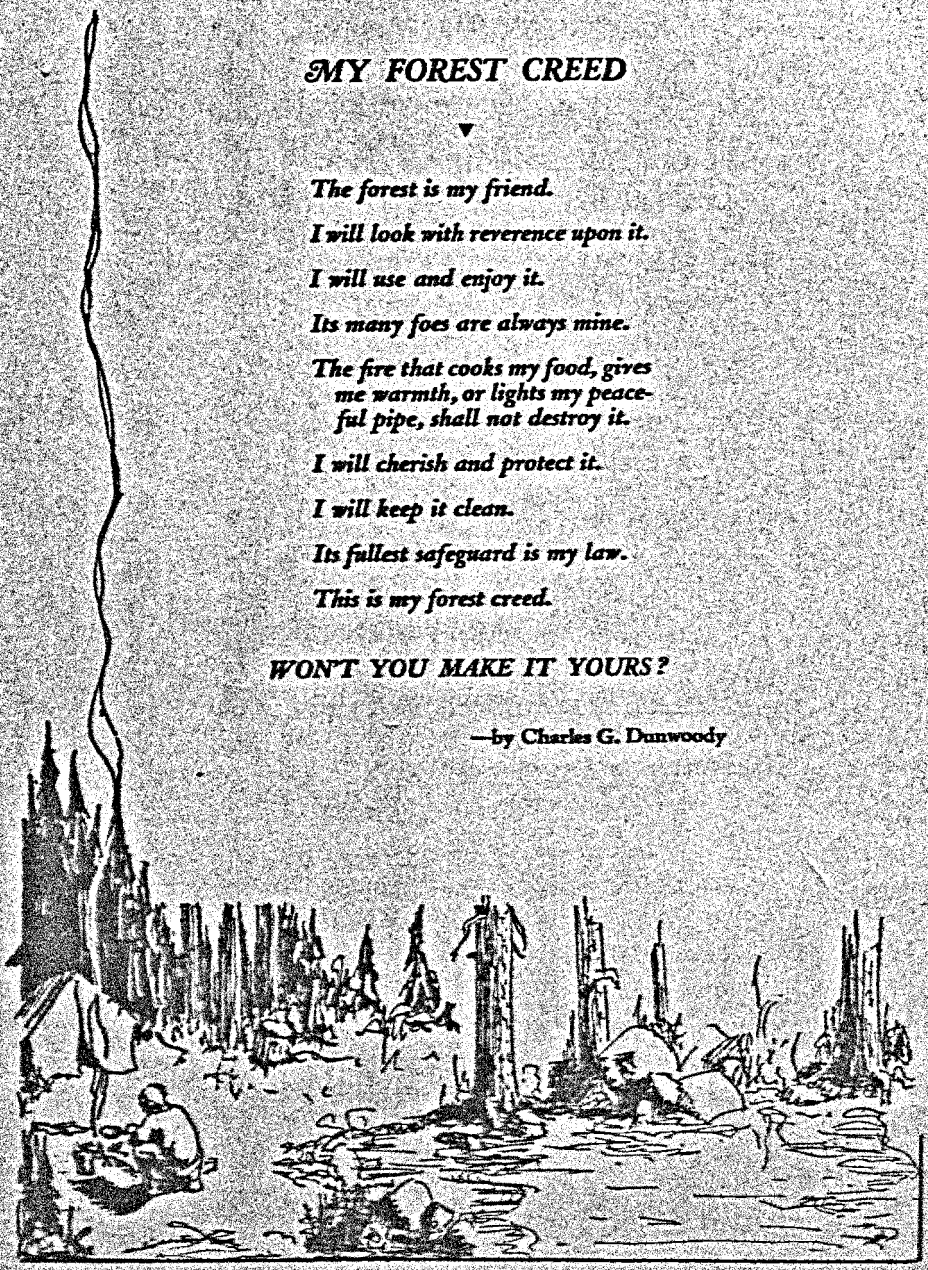
I will keep it clean.

Its fullest safeguard is my law.

This is my forest creed.

WON'T YOU MAKE IT YOURS?

—by Charles G. Dunwoody



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(First Printing, 50,000—1930)

FOREWORD

IN recognition of the great value of California's forests and other natural resources, and the important part they play in the social and economic welfare of the State, the California State Chamber of Commerce in 1925 established a Department of Conservation. Since that time, the major efforts of this department have been devoted to the protection, development and wise use of the forest resources of the State. In this work, public education has taken a large place, since it was early recognized that if we are to have adequate water, timber and forage for this and coming generations, a real forest consciousness must be aroused in every citizen of California.

Upon our future citizens, the boys and girls of today, will fall the task of safeguarding these forest resources in the future. It is important, therefore, that they, too, know of our forests and the necessity for their protection and wise use, in order that they may be prepared in due time to properly assume this great responsibility. It is with this thought in mind that the Forest Handbook was conceived and is here dedicated to the boys and girls of the schools of California.

In compiling this handbook we are deeply indebted to the following men for their splendid cooperation in the preparation of the text:

Prof. Walter Mulford, chief of the Division of Forestry, University of California, and chairman of the Forest Study Committee of the California State Chamber of Commerce; Prof. Woodbridge Metcalf, U. S. extension forester for California; S. R. Black, manager of the California Forest Protective Association; Dr. George P. Clements, manager of the Agricultural Department, Los Angeles Chamber of Commerce; Francis Farquhar, director of the Sierra Club; M. B. Pratt, chief of the Division of Forestry, State Department of Natural Resources; E. I. Kotok, director, and Duncan Dunning, assistant director, California Forest Experiment Station; S. B. Show, regional forester, J. W. Nelson, T. D. Woodbury, J. H. Price, Wallace I. Hutchinson, assistant regional foresters, California Region, U. S. Forest Service, and Mrs. D. S. Edgerton, U. S. Forest Service, Washington, D. C. Special credit is due to R. W. Ayres of the Forest Service for the editing of the text.

For the financial cooperation so generously provided for the publication of this handbook, we are indebted to the American Tree Association of Washington, D. C.

E. W. MURPHY, *chairman,*
Statewide Conservation Committee,
California State Chamber of Commerce.

Approved for use in public schools of California
State Department
of
Public Education
June 1, 1930

LESSON I

WHAT FORESTS MEAN TO CALIFORNIA

We have taken our truly wonderful California forests so much as a matter of course that it is hard to realize what they really mean to us. Try to imagine what California would be like if all our forests were suddenly swept away.

To begin with, one of the State's great industries would come to an end. The industries of California that are dependent on wood employ nearly one-fifth of all the wage earners in the State. California stands sixth among all the States of the Union in lumber production. Watch the loads of building material on the streets and highways and you will begin to get some idea of the size of this industry. Still better, visit one of the great logging operations in the redwood counties north of San Francisco, or in the pine regions of the Sierra, and see for yourself how rapidly the timber is being taken out to meet our needs for homes and for the almost numberless articles which we make from wood.

Forests have always been useful to man. They have furnished him with homes to live in, ships to explore and colonize the world, and fuel to warm his body and cook his food. Nations, as they have advanced in civilization and in the knowledge of science, have made increased use of the forests and their products. The furniture in your house, the newspapers and books you read, the rayon silk of your clothing, and many other items are only a few of the thousands of articles which are made from wood. It is quite possible that the science of chemistry will discover in the near future new and more valuable uses for wood than have been found in the past.

It is sometimes suggested that we use wood only because we have a plentiful supply, and that when it is gone we will use other materials. It is true that wood substitutes are often successful and for some purposes are better than wood itself. But it is also true that for many uses wood is by far the best material which we have, and often the cheapest. Our efforts should be to find the best material for each given purpose. If wood is not best, do not use it. But we should not be misled by substitutes in cases where these substitutes are not so desirable as the wood itself. There is no reason to expect that we shall ever want to get along without wood, any more than that we shall choose to do without bread.

You will learn from the following lessons what forests mean to California, about the lumber industry and the lumber production of the State, how forests are useful in storing rain and melting snows, and in regulating the flow of streams and preventing erosion. You will learn

how they furnish summer pastures for domestic livestock and are the home of the deer, bear, and other wild life. Finally you will learn, if you do not already know, how much forests are used as vacation grounds by the people of California. This is because forests are valued for their beauty as well as for their usefulness.

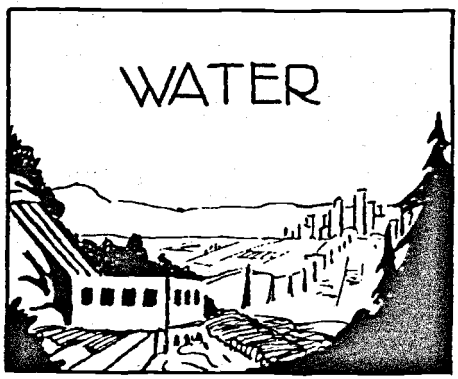
A country without trees is not beautiful. Look at the vast areas in China which are bare of all tree growth. Perhaps you have seen some of the barren, desert country in our own West. Did you ever see a park or recreation ground which had no trees in it? You probably never did unless it was a park which contained some special scenery. Would anyone willingly live or camp in a treeless place if shade trees or a forest could be found? It is only when the ax or a forest fire has felled or killed the trees which grew on some well known spot that we appreciate how much they can add to our pleasure and comfort, and how beautiful they are.

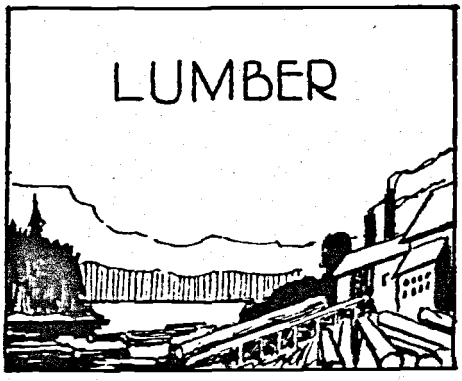
Forests are not only useful and beautiful but, when taken care of in the right way, can also be made profitable. Forests are what is known as a "renewable natural resource." Iron, oil and coal are natural resources, but when they are taken out of the ground they are gone forever. They are not renewable. Forests can be used, and with proper treatment we can renew them and keep them producing trees and wood for future use. We can cut the mature and slow-growing trees, leaving the young and thrifty ones, and protect them from fire, insects and disease. When we do this we are practicing forestry. The Sihlwald, or city forest of Zurich, Switzerland, pays all of the running expenses of the city so that the citizens do not have to pay any taxes. The village of Ebern in Germany is also tax free because of a forest which has been carefully managed for hundreds of years. Even in our own country the little town of Dansville, New Hampshire, set aside in 1763 a forest of 75 acres, the proceeds of which were to pay the town minister's salary. This has been done for 166 years and the fund now has a balance of $10,000. Every minister has received his salary from the sale of wood from this tract and it is capable of growing trees for many hundreds of years longer.

All of the great forests of France and Germany are managed in this way. They are used and yet they are renewed. The Scandinavian countries are noted for their forest protection and preservation practices. They are the older countries, which have learned what forests mean to them and how valuable they are in many ways. In Europe there are few forests grown by nature—what we call "virgin forests." They have nearly all been planted and managed for centuries by man.

We have taken possession, since the first white men came to America, of virgin forests grown by nature and ready for our use. Because these forests seemed then so vast and inexhaustible, and because we were a restless and improvident people, we have used them recklessly as our population moved from the Atlantic to the Pacific Coast. We did not realize how much they meant to us, for there have always been forests for

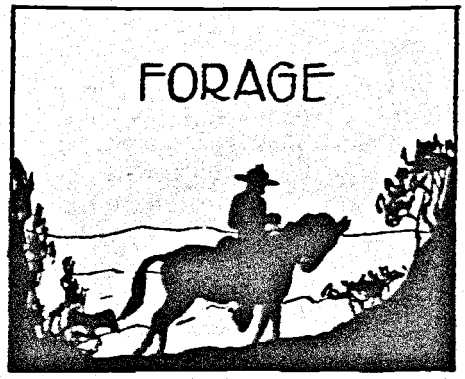
our needs. Where we cut them all away in one part of the country we simply moved further south or further west to other forests. But that cannot be done any longer. We are now cutting in our last timber region, and that is on the Pacific Coast. It is time we learned how valuable forests are and what they mean to us, before they are all gone.

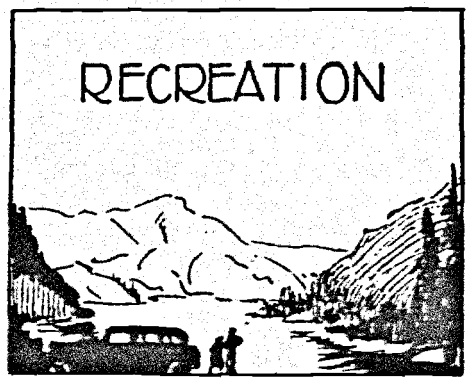




QUESTIONS:

1. **Name three important uses that man has made of the forests.**
2. **For what other reason besides the production of revenue do we value forests?**
3. **Why have the American people been wasteful of their forests?**
4. **How do the forests of Europe differ from those of America?**
5. **Why should more care be taken of our forests?**





LESSON II

FOREST TREES OF CALIFORNIA

The trees of California form a numerous company with striking differences in size, shape and arrangement of leaves; color, thickness and pattern of bark; size and general habit of growth, and in the elevation above sea level at which they are commonly found. They vary in size from massive Sequoias to tiny elfin trees of the chaparral, and in color from sombre-hued firs, hemlock and laurel to such brilliantly dressed species as madrone, fremontia and red-bud. Trees like desert juniper, mesquite and yucca grow under conditions of extreme heat and dryness, while others, such as elder, willow and black cottonwood, are not happy unless growing "with their feet in the water." A few can be seen only by climbing the highest mountains where the traveler is rewarded by the contrasting beauty of black hemlock and quaking aspen, the slender-stemmed beauty of lodgepole pine or the weather-beaten ruggedness of the sub-Alpine pines. Others like Bishop and Monterey pine, Sitka spruce, Monterey cypress and Torrey pine scorn the high country and are only found near the ocean shore. Redwood, Douglas fir, sugar pine, and western yellow pine are among the trees most sought after in the United States for lumber, while the oaks, sycamores, buckeye and other hardwoods are chiefly valuable for firewood, for protecting steep slopes from washing by heavy rains, or for the beauty they give to the valley and foothill landscape.

TEN TIMBER TREES (Conifers)

In the main timber belt of the Sierra Nevada are found the two great timber pines. These, like all of the pines, have long, needle-like leaves grouped in clusters which are surrounded at the base by papery scales. They all require two years to ripen their cones.

Sugar pine has five needles, blue-green in color, in a cluster. Its most striking feature is the long cone which hangs from the tips of long horizontal branches, and the deeply furrowed, dark purple-brown bark. The cone scales have no sharp spine at the tip. The tree grows to great size and is usually found on cool north slopes in mixture with one or more other conifers, very often white fir.

Western yellow pine—our most important lumber tree— has longer and stiffer dark green needles borne two or three in the cluster; short-stalked, prickly-scaled cones which spread at right angles from the branch, and bark which is broken into long and broad golden yellow

plates. It is usually found on drier and more southerly slopes than the sugar pine, growing with other trees that can live with small amounts of water. When young, western yellow pine has almost black bark. Its variety—Jeffrey pine—has larger cones than the typical western yellow pine, usually grows at somewhat higher altitudes, and its bark has an odor which strongly resembles apples. The lumber of all three of these pines is soft, easily worked, and is highly prized for doors, window casings and sash, and a variety of general uses.

White fir, with its long, gray-green, slightly upturned needles, stiffly regular whorls of branches and dark gray, flinty, deeply furrowed bark, is one of the commonest trees in the Sierra timber belt. Its seeds germinate easily and young trees are able to stand shade and severe competition from brush species which they eventually kill out. White fir cones are green and are borne in an upright position on the very topmost branches of the tree where they look like rows of green Christmas candles. They fall to pieces in releasing the seeds and so are rarely found on the ground. The lumber has not been considered of very much value but is coming into use for rough construction and where durability is not needed.

California red fir is much like white fir but usually grows at somewhat higher elevations, has bark which is blood-red when cut into, shorter and more blue-green needles, and cones which are larger and more barrel-shaped and usually darker in color than the white fir. The lumber is heavier and of a little better quality than that of white fir. It has been used for paper pulp wood, but thus far has only been manufactured into lumber in very small quantities because it grows at higher and often inaccessible locations.

Incense cedar can withstand as much drought as any of the Sierra trees and is generally found with western yellow pine or Jeffrey pine on dry, south slopes. Its leaves are small and scale-like, and form flat sprays of foliage, which have a spicy, cedar odor when crushed. The cones are tiny, cylindrical green bodies which are sometimes hard to see among the masses of foliage. Each cone bears a maximum of four seeds. When ripe these cones are chestnut-brown in color and the scales are gracefully curved in opening to release the seeds. The bark is tan colored, thick, and fibrous. The wood is durable in the soil, has a pleasant odor and peppery taste, and is valuable for fence posts, poles, and more recently, for the manufacture of pencils.

Big Tree or *Giant Sequoia* is the largest tree of the Sierra forests. It is found in scattered groves from Placer to Tulare Counties at elevations from 4000 to 7500 feet. Its leaves are short and sharply pointed like a shoemaker's awl, the crown of young trees being a symmetrical, feathery cone. The massive size of old trees and their fibrous, red-brown, deeply furrowed bark distinguish them from all other mountain trees. The small globular cones with their depressed cone-scales and tiny, yellow-brown, papery seeds will not be confused with any other tree. Big Tree

lumber is rose-red in color when freshly cut, light in weight, soft, and smooth in grain, and is very durable. It is scarcely a timber species now as only one or two small mills are cutting any lumber, though a few trees are cut each year for grape stakes and posts. The largest Giant Sequoias are said to be the oldest living things in the world.

Redwood, next to the pines, is California's most important timber tree. It is not found in the Sierra, but is confined to a strip of country within about 30 miles of the coast from Santa Cruz County north a little way into Oregon, and to elevations below 1000 feet. It reaches its best development on fertile, sheltered bottom-lands along the Russian, Eel and Klamath Rivers, where trees approaching 375 feet in height have been found. Redwood may be easily recognized by its flat, sharp-pointed leaves which are dark green above and have white lines of tiny pores on the under side, and by its globular cones which are much like those of the Big Tree but less than half as large. The seeds ripen in one year while those of the Big Tree ripen the second autumn. Redwood bark is fibrous, thick and deeply furrowed, and usually a much darker red-brown color than that of its mountain relative, the Big Tree. The most striking thing about redwood is its ablity to sprout from the stump, which makes the growing of a second crop of these valuable trees much easier than with species which grow only from seed. Redwood lumber is dark, red-brown in color, soft and even grained, easily worked and very durable in contact with the ground.

Douglas fir, the most important lumber tree of the Pacific Northwest, is found in the coast ranges as far south as Santa Cruz County. In this region it is usually referred to as "pine." In the Sierra forests it comes down in mixture with other conifers to a point about the center of Fresno County. Here it is often known locally as "spruce." This species is recognized by its blunt-pointed, stalked needles which come out all around the twigs, and the winter buds which are dark red and pointed. The foliage is soft and feathery and the twigs usually droop, giving an effect like a series of graceful fox-tails. Douglas fir cones are three to four inches in length and each cone-scale is ornamented with a little three-pointed bract. These stick out from under the scales and give the cones a rather spiny look. The bark is dark gray-brown with a pattern much like that of white fir, but is much softer when cut into and the cut surface shows yellow corky layers which white fir does not have. The lumber is strong and hard and is considered the best construction timber of the West. Many of our Christmas trees are Douglas fir.

Sitka spruce is found only in the northern portion of the redwood region, where it formerly occupied slopes and flats exposed to the full force of ocean winds, which redwood cannot withstand. It may be recognized by its four-angled, sometimes flattened, sharp-pointed needles, very rough twigs, small, drooping cones with gray-brown, crinkled, papery cone scales, and by its thin, scaly bark which flakes off in small,

dish-shaped plates. This is the largest spruce in the world and is a very important timber tree in Washington, British Columbia, and Alaska. The lumber is white, smooth and even grained, and has a strength and toughness due to its long fibers which suit it for many uses. This wood is extensively used for airplanes.

Port Orford cedar is an important timber species of Oregon which comes into California in the north coast ranges. Scattered individual trees are found in the upper Sacramento River drainage. The best specimens in California are found along the Trinity and Klamath Rivers. This is another tree with soft, light-brown fibrous bark which is softer and thicker than that of incense cedar. Its leaves are small and scale-like with a beautiful blue-green tinge. The branches and twigs are usually drooping, which gives the tree a graceful, feathery appearance. The cones are globular, about one-fourth inch in diameter, and have a decided purplish color before they dry out. The lumber is creamy white in color, has a smooth, easily worked grain and a strong, resinous odor which moths do not like. The wood is very durable in the soil.

Lowland white fir is a common tree in the redwood region but is rarely made into lumber at the present time. It is very similar to the white fir of the Sierra but has smaller cones. Its leaves are shorter, darker green above and more silvery beneath.

Western red cedar, with its scale-like leaves and thin, brown, fibrous bark, and *western hemlock,* with its nodding tip and gracefully drooping sprays of foliage, are both found here and there in the redwood country, but nowhere in sufficient numbers to be commercially important. They are both valuable timber trees of the north Pacific States and British Columbia.

TREES OF THE COAST

Monterey Pine	Bishop Pine
Beach Pine	Torrey Pine
Monterey Cypress	Gowen Cypress
Red Alder	Oregon Ash
California Laurel	Coast Live Oak
Western Black Cottonwood	Tanbark Oak

TREES OF THE HIGH MOUNTAINS

Lodgepole Pine	Western White Pine
Limber Pine	White Bark Pine
Black Hemlock	Sierra Juniper
Quaking Aspen	Brewer Spruce

TREES OF THE VALLEYS AND FOOTHILLS

Valley Oak	Highland Live Oak
California Sycamore	Fremont Cottonwood
Blue Oak	Oregon Oak
Digger Pine	California Buckeye

TREES OF THE DESERT

Tree Yucca	Desert Juniper
Honey Mesquite	Screw Bean Mesquite
Desert Willow	Palo Verde
Smoke Tree	Desert Ironwood

QUESTIONS:

1. **Name 10 California trees valued as lumber producers.**
2. **What are the principal characteristics of the sugar pine?**
3. **What are the principal characteristics of the redwood?**
4. **What are the principal characteristics of the Douglas fir?**
5. **What are the principal characteristics of the Sitka spruce?**

Oak **Sugar Pine** **Joshua Tree**

LESSON III

FOREST TYPES OF CALIFORNIA

Study the sketch which accompanies this lesson and then imagine yourself in a fire lookout station on the top of a mountain looking down into the San Joaquin Valley. Around you would be bare rock, a little further down would be scattered, stunted trees twisted and bent by the winds and weight of winter snows; then would come the green dense forests of trees. Still further away would be the foothills covered with brush, chaparral and digger pines; below them would be the park-like groves of oaks, and last of all the grassy plains and farm lands of the valley.

These variations in the landscape are largely caused by different kinds of vegetation, or forest types.

A forest type is a natural community of trees or shrubs. The simplest type consists of only one species of tree or shrub, as in the coast redwoods, the Monterey pine forest at Pacific Grove, or the chamise of the foothills. More often we find several species growing together in mixture. A type may be very large,—several thousand acres,—or very small,—a few acres,—or even a few trees as in the groves of Giant Sequoias in the Sierra Nevada. Chaparral and the open woodland of the foothills are included as types, as well as the true forests of the higher mountains.

Forest types are therefore a classification of the forest cover according to vegetation or plant life.

But what causes forest types? As you look down into the valley why do you see different bands of forest cover, and why do dense forests grow in some places and only grass or shrubs in another? The answer is that the different kinds of trees, shrubs and grasses require different kinds of soil, heat and moisture conditions. Some are able to live where the soil is shallow and where the climate is cold and dry. Others require deep, rich soils with plenty of heat and moisture. The redwood will live only in the damp, humid regions near the coast, and we find species of trees like the western yellow pine growing in places which have widely different climatic and soil conditions.

So we find that trees and shrubs, like other living things, must have food and warmth, and that certain species of trees and shrubs will live and thrive under conditions that will cause others to die. A plant (trees, shrubs and grasses), or a group of plants, can successfully live in and occupy an area when the conditions of climate and soil favor the ripening of the seed and the growth and establishment of seedlings. As a general rule climate is the most important of these two, although in some

places the soil decides what the type shall be. This is true of alkaline soils, of soils formed by volcanic action, or recently exposed by rapid erosion. In time the climate may be said to determine the soil itself.

EFFECT OF CLIMATE ON FOREST TYPES

The most important elements of climate affecting forest growth are temperature and rainfall. California has great variations in rainfall and temperature due to altitude, or height above sea level, and latitudes, or the distance north and south.

It must be remembered that California stretches north and south through almost eight hundred miles of latitude. It is much colder in Siskiyou County than in Imperial County. From the humid verdant coast it is not far to the arid barren desert. Altitudes vary from almost three hundred feet below sea level in Death Valley to over fourteen thousand feet above sea level at the summit of Mt. Whitney.

The Coast Range and Sierra Nevada act as barriers to the moisture-laden winds from the ocean so that the westerly slopes receive much rain, but the easterly slopes are relatively dry or in a "rain shadow." In most places the coast mountains are not high enough to cause the winds to lose all their moisture. When these winds strike the Sierra they are forced to rise, becoming cooler and losing most of their rain before the summit is reached. Thus the rainfall becomes heavier and heavier as the altitude increases, the greatest amount falling at elevations of from 4000 to 6000 feet. Thereafter the rainfall becomes gradually less on up to the summit and continues to decrease, even more rapidly, down the eastern slope, where desert conditions prevail.

Nearly all the rain falls in California during the winter, so that the plants are of species able to withstand excessive summer drought, unless they grow along streams or near the coast where there are summer fogs. Temperatures decrease as the mountains are ascended. The valleys and foothills are too hot and dry for the growth of large forest trees except along streams or near the sea. At middle elevations the best combination of moisture and temperature occurs and it is there where the finest forests are found. At higher elevations it is so cold trees can not exist, or they remain small and shrub-like.

The effect of latitude is not very distinct in California, since the change in climate from north and south is very gradual, but the changes due to altitude are usually quite clear. That is why we can see from the look-out house these different kinds of vegetation or forest cover. Temperature and rainfall control forest types with the few exceptions such as of alkaline soils and eroded land, and from the mountain top we are looking over a stretch of country which has a wide variation of these elements of climate due to the great difference in altitude between the top of the mountain and the valley.

DESCRIPTION OF TYPES

Around the lookout house is the Alpine type. It is barren of tree growth but there are a few species of shrubs, dwarfed and matted close to the ground. It never gets very warm here and some years there are snow banks even in summer.

Let us take the trail and descend the mountain. On our way to the valley we first come to timber line and enter

THE SUB-ALPINE TYPE

Now we come to a few scattered trees. Some may be bent and deformed by the weight of the snows and the winds. There will be mountain hemlock, white-barked pine and western white pine. There are still stretches of bare rock but in places there is soil, which has been formed by the weathering of the rocks by the snows and frost, and the decayed particles of former trees and shrubs. Next we will see mountain meadows and new kinds of trees, and will enter

THE RED AND WHITE FIR TYPE

We are now at an altitude of about 8500 feet. There are no more snow banks as a rule in summer, but the soil is deeper and it is much warmer than on the top of the mountain. We find dense forests of red fir and in places the white fir is mixed with red fir. Along the streams and on the moist flats are aspen with their white trunks and small leaves which turn a golden color in the fall. The lodgepole pine with its light colored scaly bark is also growing on the flats and around the meadows. Soon we begin to see the tall sugar pines with their flattened tops and long cones hanging from the ends of their branches, and we enter

THE SUGAR PINE-FIR TYPE

With this type begins, at about 6500 feet, the valuable commercial forests of California where the temperature and rainfall are the most favorable to tree growth. On the west slope of the Sierra the rainfall averages 60 inches annually. This type is not very wide for we soon begin to see western yellow pine, Douglas fir and incense cedar. In the northern part of the State the Douglas fir forms a type by itself but in the central and southern Sierra it is part of the next type which is known as

THE MIXED CONIFER TYPE

This is also part of the commercial timber belt, from 5000 to 3000 feet in elevation, where all the large logging operations are located and the most important tree is the western yellow pine and in some localities is found in pure stands, that is, with no other tree mixed with it. But in most regions on the west slope of the Sierra it is mixed with the Douglas

fir, sugar pine, white fir and incense cedar. In southern California and east of the Sierra summit we find similar conditions of tree growth at a much higher elevation than in the central Sierra.

Still descending the mountain we leave behind the sugar pines and white fir. There are now more yellow pines and cedar and several kinds of oak, mixed with the pine. There is the broad-leaved California black oak, canyon live oak, Oregon maple and dogwood. We are now almost out of this type and begin to see the foothills and open plains. Then we come to

THE CHAPARRAL AND WOODLAND TYPE

We are now in a much warmer and drier climate at about 2500 feet elevation. The rainfall is between 20 and 35 inches annually, the summers are hot and the winter season is short. First we see woodland, with trees only valuable for fire wood like the oaks and the digger pine with its grayish needles which grow in open scattering stands. There are great stretches of chaparral which is composed of a large number of shrubby species, the best known ones being the manzanita, Christmas berry, scrub oaks and the western red-bud or Judas tree. In southern California, under these same conditions, is the chamise which is a special kind of chaparral usually composed of one kind of a shrub called Adenostoma. This species covers the hills and forms a valuable protection to the soil and regulates the run-off of rain and snow and prevents erosion.

Then we enter open park-like groves of live oaks with grass growing between the trees. This is the last of the forest types. The oaks are left behind and we enter the open grassy plains of the valley.

INFLUENCES AFFECTING FOREST TYPES

On our way down the mountain we noticed that we did not suddenly go from one type to another. The changes were gradual. One type would overlap another on the upper and lower limits and one side of a ridge would be one type and on the other side would be another. This is because of their location in relation to the sun. The south and west-facing slopes are warmer and drier than the north and east-facing ones on the same side of the mountain. This means different climate and therefore different tree growth and types.

Types are changed from one to another by outside influences. Human activity has had a great effect and very seldom is it beneficial. Logging may destroy so much of the tree growth as to allow shrubs to crowd out the small trees. Repeated fires may destroy all of the seed trees and the seedlings and change the forest to fields of chaparral. The grazing of stock in too large numbers or at the wrong season of the year may kill the seedlings and prevent the renewal of the forest. Poisonous gases from smelters can kill all of the vegetation, or all but the most resistant kinds of plants. There are also natural changes going on slowly all the

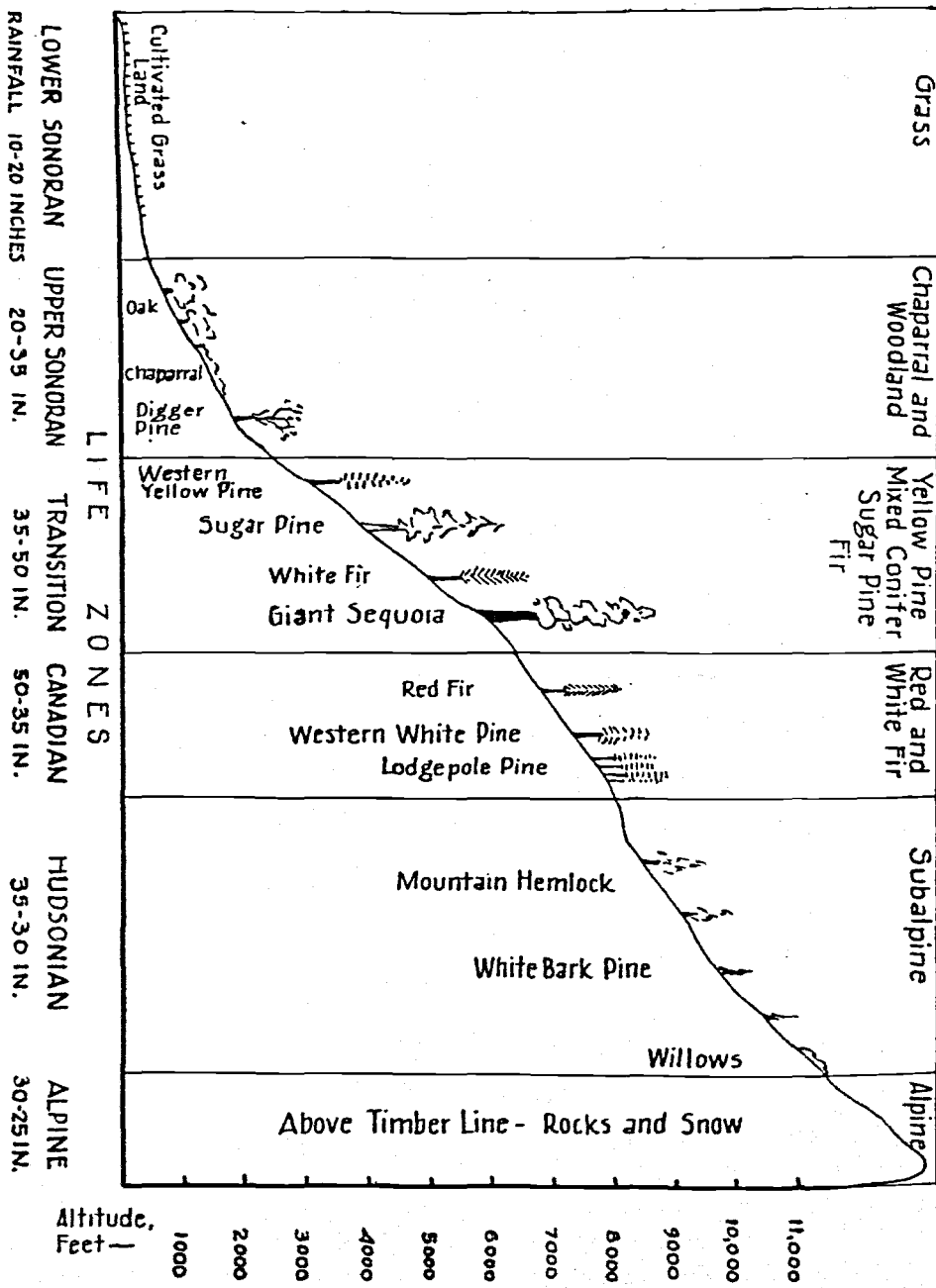
time—one species killing out another because one can exist and thrive better than the other. But these are very slow and unimportant compared with the changes and damage which may be the result of human carelessness and indifference.

LIFE ZONES

It has been explained that types are controlled by temperature and rainfall and that the temperatures decrease and it gets colder as we go from south to north and from low altitudes to high altitudes. Also that the rainfall increases as one goes northward in California and increases as one ascends the mountains up to a certain point, becoming less at the summits of the mountain ranges and on the east side of the range. These differences in temperature and rainfall are divided into what are known as Life Zones and within them are found the kinds of trees and shrubs which are adapted to each kind of climate. Life Zones control forest types. The life zone which contains the sugar pine is at a higher elevation in southern California than it is in northern California because the amount of rain necessary for the sugar pine falls at a higher elevation in the south than it does in the north. In the northern part of the State this zone extends down to sea level, where are the great forests of coast redwoods. That is why we do not always find a certain forest type at the same elevation in all parts of the State. On the sketch accompanying this lesson are seen the life zones and the forest types contained in them as they are found in the central Sierra region.

QUESTIONS:

1. **What are forest types?**
2. **What causes forest types?**
3. **What are the most important forest types in California?**
4. **What outside influences cause changes in forest types?**
5. **Name two life zones and at what elevation they are found in the central Sierra region.**


FOREST TYPES
Grass
Chaparral and Woodland
Yellow Pine Mixed Conifer Sugar Pine Fir
Red and White Fir
Subalpine
Alpine
LIFE ZONES
LOWER SONORAN
UPPER SONORAN
TRANSITION
CANADIAN
HUDSONIAN
ALPINE
RAINFALL 10-20 INCHES
20-35 IN.
35-50 IN.
50-35 IN.
35-30 IN.
30-25 IN.
Cultivated Grass Land
Oak
chaparral
Digger Pine
Western Yellow Pine
Sugar Pine
White Fir
Giant Sequoia
Red Fir
Western White Pine
Lodgepole Pine
Mountain Hemlock
White Bark Pine
Willows
Above Timber Line - Rocks and Snow
Altitude, Feet —
1000
2000
3000
4000
5000
6000
7000
8000
9000
10,000
11,000

LESSON IV

CALIFORNIA FORESTS AS LUMBER PRODUCERS

When James W. Marshall picked up a few flakes of gold in 1848 he was working in the mill race of John Sutter's sawmill which was built on the South Fork of the American River at Coloma. Sutter's mill was run by water power and Sutter had built it to saw lumber for his trading post, which is now the capital city of Sacramento. Marshall's discovery started the gold rush which also brought settlers to California in great numbers and marked the beginning of the lumber industry of the State. Little sawmills were built wherever the miners needed lumber for flumes to wash out the placer gold and later for the building of the cities, towns and ranches which sprang up suddenly all over the State after the days of '49.

Today lumbering is the fourth most important industry in California. There are over forty thousand men employed in the logging camps, sawmills, planing mills and other wood-working plants. The value of all wood products amounts to $60,000,000 each year and instead of the few boards which the old sawmills cut, there is produced about two billion board feet of lumber each year.

A board foot is used as a measure of all lumber, and is a board an inch thick and 12 inches square. The amount of lumber cut in California each year, if put all together, would make a board walk over a hundred feet wide, one-inch thick, extending from San Francisco to New York City. If it were all loaded on box cars at the same time, it would make a train of cars long enough to reach from San Diego to the Oregon line.

Californians are great users of wood; in fact, they use more lumber per person than do the people of any other state or country.

The annual lumber consumption of the State is approximately three billion board feet, but as some of the lumber cut by the California mills is shipped to other states and foreign countries, we have to bring in from the Pacific Northwest about two billion feet a year to meet our needs.

There were 193 sawmills running in California in 1928. Some of them are great plants capable of sawing over a thousand logs a day. Small cities have grown up around these mills and there are several towns in the State where a large part of the population is either employed in the mills or engaged in furnishing food and supplies to the other workers.

If we did not look about us and see how many things are made of wood we might sometimes wonder what becomes of all the lumber that the sawmills produce. Just look around your home or schoolroom, point out, and make a list of the things you see that are made of wood. The

floor, the dining-room chairs, beds, stands, bookcases, the radio, the phonograph, the piano and even the handle on the butcher knife are all largely made of wood. There are over two thousand articles in common daily use that are made at least partly of wood. Even newspapers and wrapping paper are made of wood.

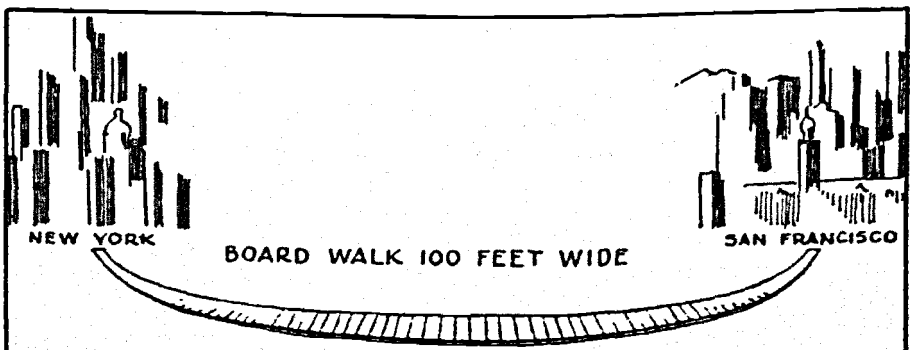
Out of doors there are hundreds of places where wood is in general use. You will find wooden ties under all our railroad tracks. In fact there are about three thousand ties under every mile of railroad. We usually think of the automobile as being almost entirely composed of steel, except perhaps for the tires, when, as a matter of fact, the automobile industry uses up nearly one-tenth of all the trees that are cut into lumber. Wood is used in the body of automobiles, to make the strong frame-work over which the steel covering is placed. The running boards, floor boards and some dash-boards are also made of wood and when automobiles are shipped from the factories to foreign countries, the whole automobile is encased in a big wooden box.

In California there are millions of fruit boxes made from wood in which the fruit crops of the State are sent to market. Ranchers use thousands of wooden racks on which to place prunes and peaches for drying. Grapes that are to be made into raisins, are also placed on wooden trays in the sun to dry. Later, both the dried and canned fruits are packed in wooden boxes for shipment to all parts of the world.

Of course the people engaged in lumbering have to be fed and clothed, and millions of dollars worth of food and clothing are purchased every year by the lumber industry for the use of those employed. Lumbering is a very important industry and while it is carried on in the mountains away from large cities, so that most people are not aware of its great size, nevertheless, it plays a vital part in the prosperity of California.

QUESTIONS:

1. **How many men are employed by the lumber industry in California and what is the annual value of wood products produced?**
2. **Name ten articles in common use made from wood.**
3. **What part does wood play in California's fruit industry?**
4. **What is a board foot of lumber?**
5. **How many board feet of lumber do California's sawmills produce each year?**



CALIFORNIA'S ANNUAL LUMBER CUT

LESSON V

FORESTS AND WATER CONSERVATION

If you could take an airplane ride over California, from Oregon to the Mexican border, you would see a series of long mountain ranges, broken up by fertile valleys and rolling foothills. The valleys are covered with farms and orchards producing the abundant and varied crops for which California is famous. Here and there are dotted towns and villages, and running like thin ribbons, a network of streams and rivers, winding their way to the ocean. At the mouths of these streams are the cities.

The industrial and agricultural life of the State is entirely dependent upon the forested and brush-covered mountain slopes which appear from the airplane as the backbone of the State. It is not only because these mountains grow timber and the rolling hills furnish forage for innumerable herds of stock that they are of such importance. They play even a larger and more important part in delivering and conserving the water which gives life and substance to our prosperity.

THE NEED FOR WATER

Water is one of the chief necessities of our civilization. Suppose that we had no cities, farms or factories and only moved from place to place, camping out as we went, as we often do on a summer vacation in the mountains. We would drink from springs and streams and get our water for cooking from them. But when we live in towns we cannot do that. Each town must have its water supply, and as towns grow into cities this supply must be increased to meet the needs of the inhabitants and to supply the factories. Our population and our industries are dependent on water. The water supply determines the extent of our population and our industries.

Water is particularly important in California. The most important industry in the State is agriculture and its most valuable crops are citrus and other fruits. In other parts of the United States rain falls in the growing season and supplies the farms with water. In California, however, little or no rain falls in the agricultural valleys during the growing season and water must be obtained by irrigation or by pumping from wells. Strangely enough, the wells dug in the valleys and the irrigation ditches are all fed from the mountains. The reservoirs which supply the irrigation ditches are filled by water from the mountain streams. These streams are fed by springs and brooks, which in turn are supplied

by seepage water from the soil and the underground channels of the mountains. In the case of wells dug many miles away from the mountains, waters find their ways to them through the soil and the underground channels which lie below the surface of the earth. Sometimes these wells are supplied by seepage from a nearby river or stream but in any case our water comes down to us from the forest and brush-covered mountains.

In California more than 120 cities and towns with a population of over three million people are dependent on the forests for their water supply. Do you know how much trouble it makes when the water in your home is turned off for even a short time? We can go without washing, or sprinkling the lawn, for a while, but when the lack of water interferes with our cooking three meals a day it is not so pleasant. It is to prevent this lack of water and to provide for more inhabitants that our big cities are reaching back into the mountains for water. Los Angeles long ago outgrew the supply it could get from the nearby mountains and has been receiving water from the Sierra Nevada for many years through an aqueduct 250 miles long. San Francisco, Oakland, Berkeley and Sacramento are all building dams and aqueducts to supply themselves with water from California's forested mountains.

Electricity, which has now become a necessity in our lives to furnish light and heat and for power to run the mills, factories, electric cars and all the modern appliances in our homes, is largely produced by the mountain streams. California develops more electric power from water, or hydro-electric power, than any other state. Every year 1¾ million horsepower is manufactured by the force of water. This water is first stored in reservoirs far back in the mountains. Ditches, flumes and conduits carry it to smaller reservoirs directly above the power houses. From there it flows through pipes to the electric generators. Long transmission lines carry the power to the towns and cities of the State. Only a part of the streams in the mountains have been developed for hydro-electric power and it is estimated that it will be possible to produce three times as much electricity in the future as we are now doing.

Navigation. The Sacramento and San Joaquin Rivers have formed since pioneer days an important link in our transportation system. In the early days, steamers plied their way to Red Bluff in the north and nearly to Fresno in the south. Destruction of our mountain cover of grass, shrubs and trees, as will be described later, has been responsible for the silting up of these streams for considerable distances. The unsilted reaches of these rivers still form an important means of cheap transportation between San Francisco Bay and the two great interior valleys. These rivers are dependent for their waters on the forested mountains and brushfields of the Sierra Nevada and Coast Range.

The Water Cycle. Where does our water come from? The vast stretches of the ocean evaporate daily enormous quantities of water,

which rise to higher levels of the air and, as they meet colder currents of air, condense and ultimately fall as rain or snow over the sea and land. When the prevailing winds blow from the ocean onto the land the water-laden air proceeds slowly inland over our State and is forced upward by the mountains of the Coast Range, the Sierra Nevada, the Sierra Madre, and other secondary ranges. During the fall and winter, when low temperatures prevail, the incoming stormy, moist ocean air is chilled by hills and mountains, forms clouds and falls as rain or snow on the mountain slopes. The mountains act as barriers, intercept this moist air, hasten the forming of rain clouds on the ocean side of our mountain ranges, and extract most of the moisture from the winds before they cross the summits to the east-side desert slopes. Rain falls most heavily in the mountains, and in decreasing amounts through the valleys and to the south. In the summer, rains occur but rarely in the form of occasional thunder showers in the mountainous regions of the State.

What becomes of this rain and snow? As it falls in the forests, foothills and valleys, part of it is intercepted by the leaves of the trees and shrubs and is partially evaporated back into the air. The rest reaches the ground; a part soaks into it; the remainder runs off on the surface until it reaches the streams and rivers, and finally returns to the ocean. The water which soaks into the ground is again divided: One part supplies the moisture for trees, shrubs and herbage which transpires it back to the air, and the remainder replenishes the ground water supplies.

THE FORESTS AND WATER

We will consider here the part that the forested mountains and the brush-clad hills perform when rain and snow falls upon them. Rain is divided first into two unequal parts; the smaller quantity is held back in wetting the foliage and twigs and bark of trees and shrubs. When the vegetation is once wetted, then all the rainfall drips through to the ground. The rain water finds under the natural and well protected forests and brushfields a very important ground covering. This covering is made up of fallen leaves, needles, twigs, fragments of cones and bark scales, which accumulate from year to year. The top of this layer consists of fresh fallen material from the trees and shrubs; the bottom of this layer lies next to the soil and is continuously rotting and enriches the forest and brushfield soils. This layer of forest litter, duff and humus plays an important part in conserving the rain and snow waters that reach the ground. It breaks the force of falling rain, it absorbs a part of the rain and snow as does a sponge. But most important of all, it helps to lead the water deep into the forest soils and into the interior of the mountains, whence it feeds springs throughout the year. The forest and brush litter and duff performs this beneficial function by keeping the water clear, and by holding open the fine pores leading down into the soil, so that the rain and snow waters soak into the earth.

EROSION

Wherever this layer or blanket of forest and brushfield litter and duff is destroyed, as by a forest fire, or by over-grazing with sheep and cattle, or by destructive logging, the falling rain acts in quite a different way when it reaches the ground. The rain drops hit with a splash direct on the bare soil. Their force falling directly on the ground works up fine soil particles, called silt or detritus, and the water becomes muddy as it flows along the surface of the slope. This water chokes up the fine pores of the soil with mud at the surface and tends to reduce the capacity of the soil to absorb the rain waters. Consequently, little rivulets of unabsorbed rain water form on the slopes; begin to dig into and carry away the rich surface soil; they join other streams on their downward course, carry larger and larger pebbles and rocks and hurl them along finally in a mad and dangerous torrent. Such a wearing and cutting away of the land by water is called erosion. Erosion goes on at abnormal and destructive rates where the forest and brush litter has in any way been destroyed.

When the mountain slopes are deprived of their natural protective blanket of leaf, needle and twig litter, rapidly flowing run-off waters from heavy rains often carry enormous amounts of soil, sand and pebbles down to the valleys to choke the stream channels with silt or to spread them over valuable farm fields and orchards. Let us look at some striking examples of this destructive process of erosion in our own State. In 1913 the brush cover on a small branch of the Los Angeles River was wiped out by fire. Studies made of this area the following year show that 100,000 cubic yards of soil had been washed from an area of 1.2 square miles. In San Diego County, the soil washed by rain from a burned hillside of 200 acres completely buried a 12-acre field of growing alfalfa. The smelter fumes near Kennett on the Sacramento River completely denuded a vast area of brush and trees. It is estimated that at least 400 cubic yards of soil from each acre of that area has been washed into the Sacramento River and is in part responsible for obstructing this river channel and even the upper San Francisco Bay. In one of the small burned-over canyons in southern California, 20 to 40 times as much sediment came down in one storm as from an adjoining forested canyon. These instances could be multiplied many times over.

THE FOREST AS A WATER HOLDER

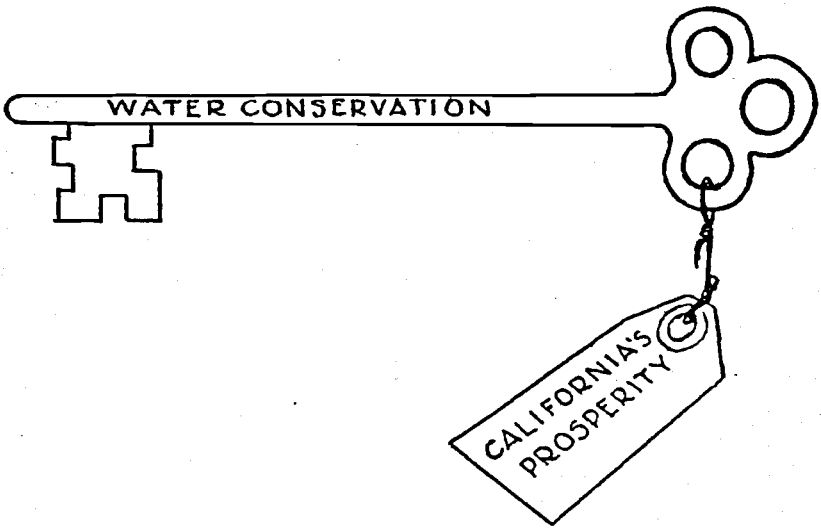
The things that make the forest a good soil holder by checking erosion also make it a good water holder. As has been pointed out, in a forested cover the flow of surface water is retarded, more of it sinks down through the spongy leaf litter and humus and so down into the mineral soil. Finally, it reaches the great reservoir of underground water that feeds

springs, brooks and rivers. Under natural conditions forest soils absorb most of the available rainfall. Observations in southern California show, in one instance, that where brush was burned in a small canyon the run-off, due to heavy rains the winter following the fire, greatly exceeded that in an adjoining brush-covered canyon. In another case in southern California, the burning of the litter and humus, and the loss of top soil through erosion, reduced the water-holding power of a brush-covered canyon by one-half over a period of three years.

REGULATION OF STREAM FLOW

By maintaining a forest or brush cover, we not only conserve rainfall and prevent erosion, but also secure more even and better regulated flow of streams. On denuded lands the great portion of the rainfall finds its way immediately down to the streams and rivers, rushing onward to the ocean. Since our rains in California occur in the fall and winter, these onrushing waters must be held back in reservoirs if they are to be used later for domestic, agricultural, and power purposes. This would require enormous and costly reservoirs. Run-off from denuded areas bring down enormous quantities of sediment which reduce storage capacities of the largest reservoirs. In several instances in California, where watersheds have been burned over and reservoirs built, it is found that they are filling with sediment at a rate which will destroy their value within ten years. Where the natural forest and vegetative cover is kept intact and protected, nature itself holds back the water in the soil and slowly feeds it to springs and streams, delivering water in reservoirs evenly instead of in torrents, and clear instead of muddy. Artificial reservoirs only supplement the great natural reservoirs of the forested slopes.

It is thus seen how the mountains of California capture the moisture from the water-laden storm winds that blow off the ocean onto the land; and how they are instrumental in delivering the water supplies necessary for agricultural, industrial and city development. The mantle of vegetation of all kinds which covers the hills, valleys and mountains provides the most dependable protection against abnormal erosion of the soil, and especially the brush and forest cover is the most effective agency to increase absorption of rain by the land surface, and in insuring water supplies through the streams and reservoirs. Fires, overgrazing and destructive logging destroy the beneficial effects of forests and brushfields, their litter and duff layers. The maintenance of a deep layer of forest litter and duff is the most important measure for water conservation in our hills and mountains.



QUESTIONS:

1. **What are the uses of water in California?**
2. **Describe the water cycle.**
3. **How does forest cover assist in conserving water?**
4. **What happens when water falls on bare ground?**
5. **What part do forests play in regulating stream flow?**

LESSON VI

CALIFORNIA'S FORESTS AS PLAYGROUNDS

Nearly all Americans have a natural liking for the out-of-doors. It is not so very long ago in the life of our Nation that we were pioneers ever pushing westward toward the Pacific Ocean, fighting Indians and making homes in the wilderness. The tales about the old scouts and explorers who blazed the way for the early settlers, and the immigrants who crossed the plains in prairie schooners, will endure as part of our Nation's history. It is said that our desire to fish and hunt has descended to us from our ancestors who were forced to obtain their food in that manner. It is probable that most of us inherit a love of the woods, of camping out, hiking and exploring, from our more recent forefathers who settled this western country. Whatever may be the cause it is certain that Californians are using their mountain country as a summer vacation ground. Over 18½ million people pass through the mountain regions each year and over 3½ million of these stop for some length of time to camp out, fish, hunt, or spend a vacation at some hotel or summer resort. The number of these visitors who seek recreation is increasing rapidly each year.

In the early days many people who lived in the valley regions went each year to the mountains to avoid the summer heat. The Yosemite Valley was visited by people from all over the country because of its waterfalls, cliffs, lakes and other scenic wonders. The Valley was given to California by Congress in 1864 together with the Mariposa Grove of Big Trees, to preserve these features and keep them in public ownership. In 1890 Congress created the Yosemite National Park and greatly enlarged its size. In 1906 it was ceded by the State back to the Federal Government. In 1890 the General Grant and Sequoia Parks were established by Congress, to preserve groves of Big Trees.

The national parks were the first mountain playgrounds to be established and they were created especially to preserve some area of outstanding scenic, geologic or historical features in which no commercial enterprises could be carried on except those necessary for the park uses. National parks are game sanctuaries where no hunting is allowed. There are now four national parks in the State: Yosemite, Sequoia, General Grant and Lassen Volcanic. They are administered by the National Park Service of the U. S. Department of the Interior. Their total area is about two million acres.

In 1892 came the creation of the first national forest, the San Gabriel Timberland Reserve. National forests were established to protect and maintain in a permanently productive and useful condition lands not

suited for farming, but capable of growing timber, regulating the flow of water and producing forage for livestock. Commercial enterprises are allowed in the national forests, such as the cutting of timber, development of water power and irrigation systems, and the grazing of livestock, so long as they are not harmful to the continuous production of these resources. There are now 18 national forests in the State, covering about 19 million acres located on the middle or higher elevation of the Coast Range, southern Cascades, the Sierra Nevada, and the mountains of southern California. National forests are administered by the Forest Service, a bureau of the United States Department of Agriculture.

After the automobile came into general use, and particularly after the close of the World War in 1918, the number of people who came to the mountains each summer began to increase rapidly. About this time also there was a demand for better roads followed by new construction and the improvement of the existing mountain roads. Camp grounds were established in the national forests for the convenience of recreationists, tracts were surveyed and subdivided into lots so that those who wanted a permanent summer camp could rent a plot of ground and build a house. Boy Scouts, Girl Scouts, Camp Fire Girls, fraternal organizations, and cities, towns and counties have rented land in the national forests and built summer recreation camps for their members or citizens. There are 6000 summer homes in the national forests of California and 330 improved camp grounds. The Forest Service has built 1567 miles of roads and 10,294 miles of trails, and assists in maintaining over 12,388 miles of existing roads and 17,500 miles of trails. Still the demand for more roads and playgrounds continues as the number of forest visitors increases.

The national parks are mainly used for recreation and are developed for that purpose. Recreation in the national forests is only one of several resources for the use of the people. The national forests contain areas of special scenic beauty which are worth preserving in their natural state, as is done in the parks. Although many people prefer to take their vacation in the mountains, traveling by automobile and living at hotels or resorts, yet there are some who like to camp out, hike or travel on horseback on trails and away from roads, automobiles and hotels. These are the real mountaineers, and for their enjoyment the Forest Service has established what are known as "Primitive Areas," which are typical wildernesses in mountain and forest areas of California and southwestern Nevada, which will be preserved in their natural state. There are 15 Primitive Areas, covering 1,750,000 acres, located in the rougher and more remote parts of the national forests of the State, in which roads or any permanent recreational buildings or improvements will not be permitted. The use of the timber, water and forage will be allowed when economic conditions demand, but not so as to interfere with the value of the area for camping and other forms of outdoor enjoyments.

Other tracts in the national forests are dedicated to public recreation. These also contain special scenic features but are made accessible by roads, and permits are issued for summer resorts, summer homes and other recreational uses. There are four of these Recreation Areas totaling 75,000 acres in area in the national forests of California.

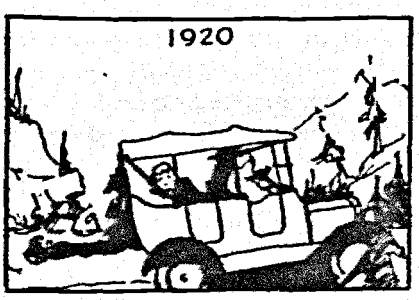
Fish and game, the wild life of the forests, belong to the State. They are a natural resource of great importance. Some people go to the mountains only to hunt and fish; others enjoy studying the wild animals and hunt them only with a camera. Hunting is allowed in the national forests, the open season being governed by State laws. In order to give further protection to wild life the State has established 30 game refuges within the national forests where no shooting is allowed and the Federal Government has proclaimed three migratory bird refuges. These are all for the purpose of protecting the breeding grounds of wild animals and birds. It is estimated that in the national forests there are 245,000 deer, principally of the Columbian blacktail and Rocky Mountain mule deer species, 11,000 black bear, 700 mountain sheep, 770 antelope, and 190 elk. There are 55,000 coyote, 22,500 lynx and bobcat and 2000 mountain lion, all of which are predatory and take a heavy toll of deer and game birds. Of the fur-bearing animals there are marten, mink, badger and some ermine, fisher, raccoon and otter. The national parks are also game sanctuaries and contain many game animals and birds.

The mountain streams are nearly all stocked with trout and other species of game fish, and are kept well supplied with fish by the planting of fry or small fish which are reared in the State hatcheries. Lakes and streams are stocked by the Division of Fish and Game, State Department of Natural Resources, in cooperation with the Forest Service, National Park Service, sportsmen's associations and private individuals.

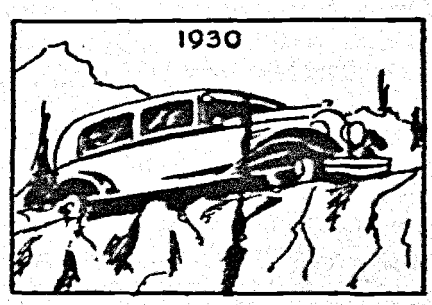
In addition to national forests and national parks, California also has 15 State parks created for recreation or the preservation of scenic or historic attractions. The total area of State parks is 22,000 acres, of which about 12,000 acres are redwood groves in Santa Cruz County and along the Redwood Highway. In 1929, a statewide survey of areas suitable for State parks was made by the Division of Parks, State Department of Natural Resources, which has jurisdiction over the parks.

QUESTIONS:

1. **For what purposes are national parks created?**
2. **Under what bureau and department of the Government are they administered?**
3. **For what purpose are national forests created?**
4. **Under what bureau and department are they administered?**
5. **How do national forests provide for recreation?**



1 million forest visitors



3½ million forest visitors

LESSON VII

GRAZING AS A FOREST RESOURCE

The first settlers of every State in the Union depended largely on livestock to supply them with food and clothing. California was no exception to this rule. The padres in establishing the early missions along the coast brought domestic animals with them.

Cattle were first brought to California from New Spain (Mexico) in 1769 and sheep followed four years later in 1773. Large grants of land were given individuals for the special purpose of raising cattle. The abundance of forage along the coast and in the interior valleys caused the stock, particularly cattle, to flourish and increase rapidly. Cattle soon became so numerous they were slaughtered for their hides and tallow alone. Many were killed to relieve forage conditions. It was during this time that owing to the scarcity of money among the inhabitants, hides were used as a medium of exchange. Trading vessels loaded with food, clothing and other necessities came around the Horn and engaged in trade with the settlements along the coast, receiving hides in payment. Warehouses were established at central points where the hides were prepared and stored for ocean shipment to eastern ports. Thus the first trading between the Atlantic and Pacific coasts became established.

The discovery of gold in 1848 brought farmers and settlers as well as miners, who were attracted by the rich soil and mild climate of California. The use of much of the best grazing lands for agricultural crops soon reduced the range that stockmen formerly used. The increased demand for butter and cheese from mining camps and other settlements also resulted in greatly increased dairy herds. Dairy cows need green feed and there were then no irrigated alfalfa fields as there are today. The long dry summers also dried up the forage plants on the foothills. Naturally the owners of these dairy herds looked for range where the forage remained green and succulent throughout the summer season. Such areas were found in the high mountains and it was to these ranges the dairy herds were taken.

In the meantime, competition for forage between sheep and cattle was constantly going on in the valley and foothill ranges. New herds were arriving overland from the eastern states. The foreign sheepman who respected no rights or range boundaries appeared on the scene. Range wars broke out between cattlemen and sheepmen, often resulting in large loss of stock and even human life.

While the grazing of this increased number of stock was going on, the range was also being greatly reduced in area. Much of it passed into

private ownership under the Homestead Act and other land laws. Too many stock were pastured on certain parts of the range and the grass roots and herbs were killed. Stock were driven to the range too early in the spring, when the ground was soft, and the young plants and grasses were trampled and prevented from sowing their seed. There were no range boundaries or rules about grazing.

The stockmen seeing their old range disappear began to look for other ranges. The green pasturage in the mountains naturally attracted them and they moved their cattle and sheep from the valleys to these areas. The same general practice as before was followed here. The stockmen grazed at any and all times as many animals as they desired without regard to the future welfare of the range. They set fires to the timber and brush, as soon as it was dry enough to burn, in order to make it easier to handle their stock and to open up new ranges. Many of them also had the erroneous idea that burning increased the forage. It was the common practice to set the country afire as the stock was being removed from the mountains at the end of the season. These fires burned unmolested until fall rains or snows extinguished them, as no one was interested in or thought of putting fires out. Much valuable timber was thus destroyed and the watersheds of many streams denuded. This greatly affected stream flow on which farmers in the valleys were dependent for the irrigation of agricultural crops. Continued grazing of burned areas denuded the soil of all plant and tree growth and caused serious erosion on these valuable watersheds.

This devastation of our mountain areas caused the people of the State to ask the Federal Government to protect their timber supply and the headwaters of their streams for the upbuilding of their State for the generations that were to come. This request was complied with through the creation of "forest reserves," now called national forests.

The primary purpose in establishing national forests was to insure a perpetual supply of timber and preserve the forest cover which regulates stream flow. Stock of all kinds were at first excluded, but very shortly cattle in limited numbers were allowed to graze in the forests and later sheep were admitted on the non-timbered portions.

The initial grazing restrictions in the national forests have since been broadened to include a detailed plan of grazing for both cattle and sheep ranges, such as requiring the owner of cattle to supply a definite amount of salt to be placed on the range at such time and place as required by the forest officer, improvement of springs to provide water for the stock, construction of fences to control the stock, and herders to look after the animals at all times.

The sheepman is required to use designated driveways in reaching his range, graze his sheep in small bands, and where possible bed them in a different place each night. In no case is the same camp to be used more than three nights during the season, and sheep are to be bedded at least

three hundred yards away from running streams or living springs. Both cattle and sheep men are required to keep their stock off areas set apart for recreation, areas that are being planted to forest trees, or areas burned over, until the little trees have reached sufficient size so as not to be injured by grazing.

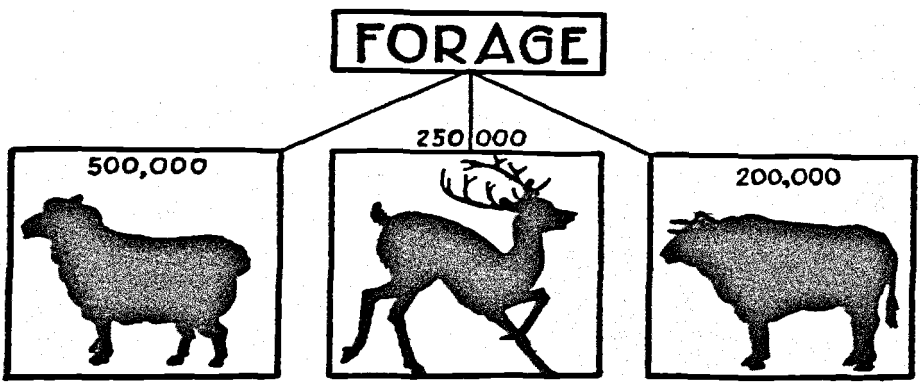
Not all of the land in the national forests of California is suitable for grazing. Some of it is too rocky and rough to be grazed by stock while other areas are too heavily timbered to produce forage plants. Of the 24 million acres within the national forests in the State, including private land, only about 12½ million acres are used for grazing. This area normally supplies forage during the summer months for some 200,000 cattle and 550,000 sheep belonging to more than 2500 stockmen, who own large areas of nearby agricultural and foothill lands where the stock is pastured during the winter season.

Permits to graze stock on the national forests are issued according to rules which give preference to those who live on improved ranch property and are dependent on the national forest range. The owners of small numbers of cattle and sheep are given preference over the large owners. Settlers and farmers living within national forests are allowed to graze a few head of stock free, as are miners, prospectors, and travelers.

Range boundaries are carefully laid out so as to provide feed best suited to cattle and horses or sheep and goats, and all permittees must keep to their allotted range.

QUESTIONS:

1. **From where and in what year were cattle first brought to California?**
2. **In what year were sheep first brought to California?**
3. **How did unregulated grazing of stock injure the ranges?**
4. **How many head of stock are annually grazed in the national forests of California?**
5. **How many acres of national forest lands in California are suitable for grazing?**



LESSON VIII

REFORESTATION IN CALIFORNIA

Reforestation means the renewing of the forest by replacing with young trees or seedlings the older trees which have been cut or removed by various causes. Reforestation may be natural, that is, by the reseeding of the ground with seeds furnished by the large trees of the forest which are standing, or it may be artificial, as when young trees which have been grown from seed in forest nurseries are planted by hand.

Many people think that in California foresters do a large amount of artificial reforestation, or tree planting, and that we are relying on this means to keep the forests producing and growing trees. This is only partly true. A good deal of tree planting is done in the coast redwood region, but very little, as yet, in the pine regions of the Sierra Nevada and the Coast Range.

The climate of the redwood region is very favorable to tree planting. In the winter it does not become cold enough to stop tree growth and there are warm rains which enable the young seedlings to get well started before the dry season. In summer, cool moist fogs from the ocean help the trees to grow. The dense shade, even in the young forests, keeps the forest floor cool and damp so that serious fires do not occur in such numbers as in the pine region. Redwoods also sprout from the stump, so that a uniform and denser forest can be grown by planting up the blank spaces between the stumps. With climate and soil conditions aiding, it is practical to replant the forest by hand. Nearly all the young seedlings will grow, and the growth they make will produce trees which will be valuable for lumber in from 50 to 70 years.

In the pine regions of California nearly all of these conditions are the opposite. The summers are hot and dry with very little, if any, rainfall; there is great danger from fires; and the winters are so cold that the sap does not flow, and the trees do not grow. In this region it is estimated that it will take from 75 to 120 years for a seedling to grow to a tree large enough to be valuable for lumber. Frequently in the Sierra there will occur years when the trees will produce a large seed crop and there will be plenty of snow and rain in the winter, followed by a summer with not too great heat. During such years there will spring up on all the open and exposed parts of the forest thousands of seedlings which have been germinated from the seed ripened the year before or which has been lying dormant in the duff and litter of the forest floor for perhaps several years.

Such natural reforestation in the pine region is sometimes more successful than artificial reforestation. Nature will select just the right

time for her planting and also the squirrels, rats, mice and rabbits do not seem to disturb the seedlings planted by nature as they do those planted by man. It is for these reasons, combined with the high cost of artificial planting, that foresters depend more on natural reforestation in the pine region than on tree planting.

In some places, however, planting is being carried on in the pine region. There are areas which have been burned by such a destructive fire that even the largest trees have been killed and there are no trees left to produce and scatter seed. If such burned areas are very large in extent it will not be possible for the surrounding unburned forest to scatter the seed far enough to reseed all the ground. In such places the Forest Service is replanting those parts of the burns which have the most favorable soil conditions. Seedlings are grown in three nurseries operated by the Forest Service, and western yellow pine is the tree most commonly used. Every year about 600 acres are reforested and in time this amount may be increased.

NURSERY PRACTICE IN THE PINE REGIONS OF CALIFORNIA

The western yellow pine is the best kind of tree to plant in the pine region because: (1) young trees can be easily raised; (2) they are hardy and make good growth after planting in almost any kind of soil, even where climatic conditions are unfavorable; (3) the lumber produced by this species has high value. For the above reason the following descripton of planting practice will deal with this species only:

SEED COLLECTION

The seeds of pines grow in pineapple-shaped cones. It takes two years for western yellow pine cones to ripen on the tree. While generally some cones may be found each year, good crops occur at from two- to four-year intervals. Cones ripen between September 15 and October 30. They may be collected by climbing the trees and cutting them off, or, more readily, from felled trees on areas where cutting is being done.

After collection, cones should be placed in burlap sacks and taken to a central point where they are opened by spreading on canvas in the sun, or by placing in a warm drying oven. During this process they should be protected from dampness. When opened, the seed may be secured by shaking the cones in a box. The seed taken from the cones should then be cleaned and placed in dry containers where rats, mice and chipmunks cannot steal them. They should be kept in a cool, dry place until needed. About two-thirds of a bushel (20 pounds) of cones will produce one pound of seed. There are about 9000 to 10,000 seed in one pound. About one-half of this seed will produce good young seedlings.

PREPARATION OF NURSERY BEDS

Nurseries should be located on well drained, sandy-loam soil. Water for irrigating or sprinkling the trees should always be available. Nursery beds 4x12 feet should be prepared with paths 2 feet wide between them. Each bed should be surrounded by a frame of 1x10-inch boards sunk 2 inches in the soil to keep out mice and moles, and should be covered by a screen frame to keep out birds. Before the seed is sown the soil should be well spaded and prepared as for a garden crop.

SEED SOWING

In the early spring when the ground is fairly dry, about 80 western yellow pine seeds per foot should be sown to a depth of about one-quarter of an inch in drills extending across the width of the bed. After sowing, the drills should be pressed down with a board and covered with a thin sprinkling of fine, dry sand. The surface of the bed should then be covered with a single thickness of burlap mulch.

CARE OF SEEDLINGS

As soon as the young trees begin to appear above the surface of the ground the burlap should be removed. The soil in the seed beds should be kept moist, but not wet, by irrigation or sprinkling and all weeds should be removed. Injury to seed or seedlings by birds or rodents should be checked at once. A plant disease known as "damping-off" frequently causes serious injury soon after the young seedlings appear. This disease causes the tender plants to wilt and die rapidly. The best remedy for this trouble is to cultivate the soil between the rows and dry it out as rapidly as possible. A thin layer of dry sand sprinkled over the beds is sometimes helpful. In clay soil, damping-off has been checked by applying to the seed beds, immediately after sowing, a solution made up of 3/16 of a fluid ounce of sulphuric acid in 1 quart of water to each square foot of seed bed. In light soil this treatment is usually not necessary.

TRANSPLANTING

In order to develop a good, spreading root system it is desirable to lift the young trees carefully out of the seed beds after growth has stopped at the end of the first growing season and transplant them to other similar beds where they should be set about 2 inches apart in the rows, with rows 6 inches apart. During the course of this operation all of the spindly, deformed trees should be discarded, and the roots of the trees to be transplanted should be pruned to a length of about 5 inches. The soil in the transplant beds should be kept slightly moist and free from weeds at all times.

The transplants are set in trenches about six inches deep so as to allow their roots to spread out in a natural position. Great care must be taken to keep the roots from drying out during the transplanting. Only a few trees should be dug up from the seed bed at one time and they should be kept covered with wet moss or burlap in a bucket until needed. The earth must be packed firmly about the roots when they are planted and the transplant bed must be well sprinkled as soon as the work is finished. The beds should be kept free from weeds and sprinkled enough to keep the soil moist but not wet.

FIELD PLANTING

After one summer in the seed beds and one summer in the transplant beds, the little pines should be large enough to plant on the treeless areas. At elevations of not over 3000 feet, fall, after the first good rain, is the best time for planting trees in the field. At higher elevations the early spring is the best season, immediately after the snow has disappeared.

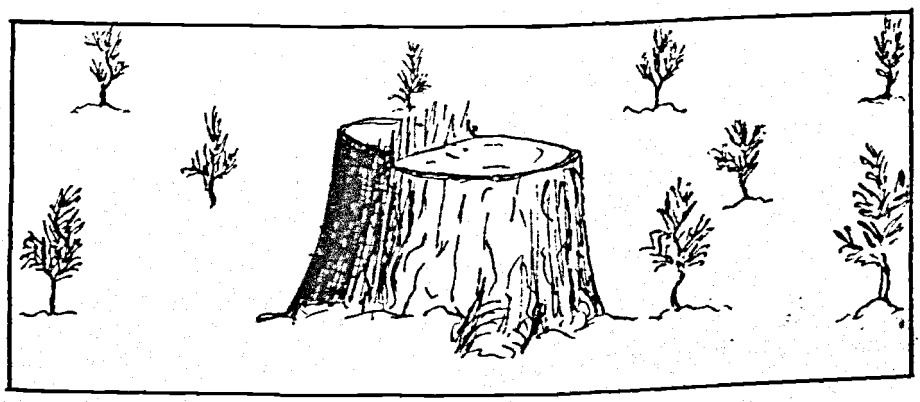
The trees should be carefully dug from the transplant beds, poor plants thrown away and roots lightly pruned. They should then be packed in wet sphagnum moss in convenient bundles and taken at once to the planting site. Never let the tree roots become dry. Drying is sure to cause death.

At the planting site, holes sufficiently deep to accommodate the tree roots without crowding or bending should be prepared with mattocks. The trees should usually be spaced about 8x8 feet. Each tree should be carefully set in its hole a little deeper than in the transplant bed with the roots in a natural position. Clean dirt free from leaves, rocks or debris should then be packed about the roots and stamped down with the foot. It is very important to have the dirt firm about the roots. Care should be taken to set the tree in a straight, natural position.

Always remember when handling young trees to keep the roots moist. This is the most important part of planting work.

QUESTIONS:

1. **Describe two methods of reforestation.**
2. **What is the best method of reforestation in the pine region of California and why?**
3. **What is the best method of reforestation in the redwood region and why?**
4. **How are forest seeds collected and prepared for nursery use?**
5. **Describe a field planting operation in the pine region.**



LESSON IX

FOREST ENEMIES

All living things have enemies, and the forest is no exception. Every year a great many trees, young and old, fall prey to one enemy or another. Sometimes large areas are laid waste, particularly by that most spectacular enemy of the forest—FIRE.

FOREST FIRES

You have learned about the forest resources of timber, water, forage and recreation and how important they are to the prosperity of California. Fire is the arch-destroyer of them all. Californians of all people need to learn this lesson well. It is not only because fire reduces the timber supply and turns forests into brush fields, destroys the litter and duff on the surface of the ground and interferes with the water supply, changes valuable grazing grounds into areas covered with worthless plants, and transforms beauty spots into desolate, blackened wastes that we need to pay heed to this arch-enemy. Fire does all of these things in other states. But because in California, with its unusually long dry summers when little or no rain falls, the chances for destruction by fire are much greater than in other regions.

In the national forests, where a large portion of the forest resources both in Government and private ownership are located, the records for the past ten years show that on an average 223,700 acres are burned over each year and the value of the resources of timber and forage destroyed is $427,000. We have no way of estimating the exact losses caused by damage to the watersheds which result in the silting of reservoirs and destruction of agricultural lands by floods, but they are very high. We do know that the losses to irrigated farms and fruit orchards are important because the people of southern California spend millions of dollars each year in preventing and suppressing fires and in controlling floods.

What are the causes of fire? There are two main agencies, namely man and lightning. In some years thunder storms occur in the summer when the forest cover is very dry. If these storms are not accompanied by heavy rains, and sometimes even if they are, the lightning sets the forest on fire. Such fires have been occurring in California for hundreds of years. Go into a logging camp and examine the stumps of the big trees that have just been cut. At certain intervals on the surface of the stump you will see faint black lines with the layers of wood growth or annual rings curling around them and finally covering them entirely.

These black lines will have more pitch near them than the other annual rings. Sometimes there will be several of these marks on a big stump. These are old fire scars which have healed over. Foresters have examined thousands of such stumps and by counting back on the rings can prove that fires swept our forests as long ago as 1685. They have found that in certain years large fires occurred which covered vast areas. Tradition says that the Indians set these fires, but it is certain that lightning also set them then as it does now, for many of the trees show scars made by lightning. The records for the past ten years show that of the fires in the national forest regions of the State, 898 fires per year are caused by man, and of this total 289 are charged to smokers, 167 to campers, and 124 to incendiaries.

You will ask why it is, if there were so many fires in the past, that we have any forests left. The answer is that after every fire, Nature does her best to repair the damage. Scars are healed over and the bare spots are reforested by seed blown from the living trees. But this takes a long time, and Nature is not always successful in restoring the forest to its former value. If fires burn over the same ground too often all of the young trees are wiped out and brush takes the place of the forest.

Examine the brush patches at the edge of the forest or in the forest and you will find little trees growing under or through the brush cover. In time these trees will overtop the brush and kill it out and the land will again be forested. But if a fire burns the brush all the small trees will be killed with it. It takes a long time for trees to come back on a burned area, but the brush will sprout from the blackened roots and will be as large as before in a few years. If all of the larger trees which furnish seed are killed, the forest will never have a chance to come back. This is why, where repeated fires have occurred in our California forests, one acre out of every seven which should be producing trees has been taken over by worthless brush.

We have forests now, it is true, but if fires had never burned in them we would have much finer and denser forests, besides more forested land, than we have at present. We know this because we find on good soils young forests not over 50 years old which have produced an average of 74,000 board feet per acre, whereas the virgin forest from 200 to 300 years old, growing on the same class of soil has yielded only 34,000 board feet per acre. The young forest was thickly stocked with trees because no fires had burned in it. The old forest was less than half stocked, chiefly because of centuries of repeated fires. If fires had never burned in the forests of California it is certain that much more land would now be covered with trees and there would be about twice as much wood and lumber as we now have.

All of the damage caused by a forest fire is not seen unless a close examination is made. We can see the blackened trunks of the trees which have been killed, but there are injuries not so apparent. You will find

that nearly all of the older trees have a fire scar on the up-hill side of the base. Some of these scars, or "cat-faces" as they are called, are eaten away and hollowed out by former fires. Every new fire will eat into this hollow or cavity a little deeper, until the base of the tree is so weakened that it will no longer support the trunk and it will fall. That means a loss of lumber and more fuel to add to the next fire. Even if the tree is cut before it falls probably one-third of the best wood in the first log is either burned away or is so filled with pitch due to the burns that it is of no value for lumber. Sometimes one-seventh of the total volume of the tree is lost by fire scars. A single fire has been known to increase the area of the old tree scars 50 per cent, and to form many new scars. Trees are also killed by the heat from fires even if they are not actually burned. The needles will shrivel up and the trees will die. The crowns of trees that are not killed will be partly burned, thus reducing the leaf canopy which manufactures food for the tree and the rate of growth will be reduced. Finally, fire prepares the way for the other enemies of the forest—insects and disease.

INSECTS AND DISEASES

Insects of various kinds cause a great deal of damage to the forest. Sometimes the destruction is as easily seen as that due to fire, but more often the loss is scattered—a tree here and a tree there, but amounting to a large total of loss. Not all forest insects are harmful by any means. Some are quite beneficial; for example, the wood borers that work in old logs and stumps and hasten their decay. One of the most harmful of the forest insects is the western pine bark beetle. It is dark brown in color and so small that a dozen beetles could easily walk around on your thumb-nail at once. The beetles work in great numbers. They bore into the pine tree and make tunnels in the inner living bark, in which they lay their eggs. These eggs hatch and the larvæ tunnel along the surface of the wood in all directions; the tree thus becomes completely girdled, the flow of sap is cut off, the needles turn brown, and the tree dies. The new broods of beetles then emerge to seek fresh victims.

Either the beetles must kill the tree or the tree kills the beetles by drowning them with pitch. It is a battle to the death. The insects appear to have an instinct for selecting weak trees that they can overcome readily. The more trees there are of this nature the more successful the beetles are, and huge broods are quickly built up under favorable conditions. One of the common reasons why there may be a great number of weakened trees in the forest is on account of fires. Trees badly damaged by fire can rarely throw off the insect attack. Thus we see that the damage caused by fires does not stop with the trees that are directly killed.

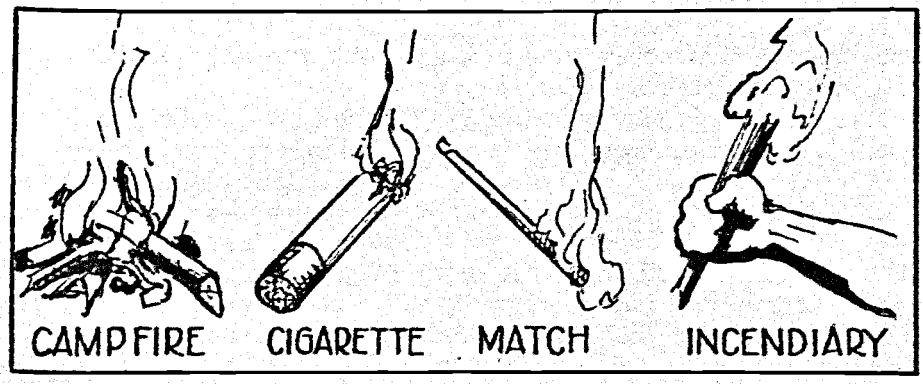
Various diseases also attack trees. Much of their destructive work is hidden away in the centers of the trunks. The fungus diseases work upon the heartwood and gradually transform it into a crumbly mass. To the

untrained eye there is often little evidence of the damage until the tree dies, is broken off by the wind, or is cut for lumber. In addition to the enemies that work in the heart of the tree there are many parasites that attack through the bark and live upon the food brought up by the sap. A common parasite is mistletoe. Generally the effect is merely to retard the growth, but sometimes the attack results in the death of the tree.

Usually the diseases at work in the heartwood enter through wounds in the trunks. These wounds are caused by various agencies. A common one is fire. The fire scars that you see at the base of the trees in the forest offer a ready entrance for fungus diseases. Thus we see that forest fires play still a third part in damaging the forest.

QUESTIONS:

1. **What is known as the forests' most spectacular and dreaded enemy?**
2. **Name three ways in which forests are injured by fire.**
3. **Why should the young trees be protected?**
4. **How does the western pine bark beetle injure the forest?**
5. **How do fungus diseases affect the forest trees?**



LESSON X

THE FUTURE OF CALIFORNIA'S FORESTS

In the preceding lessons you have learned what the forests mean to California, how valuable they are in furnishing wood and many other useful materials; how they conserve and regulate the flow of streams necessary for water power, irrigation and domestic use; how they furnish pasture grounds for the livestock of the State, and are the home of our game animals, birds and fish, and how important they are as summer playgrounds for thousands of our people.

Why are you being told all these things, and what does it mean to you? The answer is, that in spite of the value and usefulness of our forests there is danger that they may be so injured and reduced in size by forest fires and unwise use that you and the people of future generations will suffer for the want of the many benefits which we now obtain from them. As was explained in Lesson I, we have always taken our forests for granted. We have not yet felt the lack of wood, although we pay more for it now than did our fathers. We have not been compelled to plant forests by hand and tend them carefully for a long period until they were large enough to saw into lumber as they do in France, Germany and many other countries of Europe.

Three hundred years ago, when the first white men landed on the Atlantic Coast, there were 822,000,000 acres of forested land in what is now the continental United States. Today, we have left 138,000,000 acres of virgin forests and 250,000,000 acres of cut-over land that will grow forests again, or less than half of the original forested area. As the population has increased the forests have decreased. We have cut them into lumber to build our homes, put them into mines to take out coal and precious ore, laid them in railroad tracks as ties, used them to carry telephone and telegraph lines, and manufactured them into thousands of different articles. Now we find that we are cutting our forests four times as fast as they are growing and that forest fires, insects and disease are rapidly reducing their value.

California has been very fortunate. This State had great forests and some the most magnificent trees to be found in the world. The redwoods and the Giant Sequoia are found nowhere else. The lumbering of the forests did not commence until about 80 years ago and did not become a large industry until about 30 years ago. When California became part of the Union, it is estimated that 19,195,000 acres or about one-fifth of the land area of the State was covered with forests and woodland. Now over 4,000,000 acres has been cut and burned over and of this 1,300,000 acres will not produce forests again unless they are planted. Every year

nearly 50,000 acres are cut over by lumber companies. No one can tell accurately how long California's forests will last, but we do know that they cannot last forever unless better care is taken of them than at present.

Forest fires and lumbering are changing one acre out of every seven from valuable timber land to brush fields. This is mainly on the privately owned timber lands. From 2 to 3 per cent of the cut-over land is burned each year, killing the small trees and making it impossible to grow another crop of timber for many years. For a long time most lumber companies cut nearly all the trees in the stand, and failed to leave the small ones, which are worth very little for lumber, to grow for a future cutting and to serve as seed trees. Now some of the lumber companies in the pine region of the Sierra are leaving the saplings and poles, and many large trees of the less valuable species, and are using tractors, which are less destructive than the steam donkey engines, for logging. In the coast redwood region many of the companies are replanting their cut-over lands with redwood seedlings grown in their tree nurseries.

The Forest Service, which regulates the amount and size of the trees cut in the national forests, so that enough are left to serve as a basis for a future forest, controls less than one-half of the standing timber in the State. The total amount of timber in California is estimated to be 284 billion board feet. Of this amount, 187 billion feet are owned by lumber companies and individuals, the Forest Service owns 96 billion feet, and the State of California 225 million feet, mostly in State parks.

Whatever affects our forests also affects a great many people, some of whom may not live anywhere near them. If we cut all the forests of the State then more lumber will have to be brought in from other regions, and the cost of homes and all structures made of wood will be higher. If the forests which protect watersheds are cut and burned, the soil will be eroded, reservoirs will be filled with silt, water for irrigation which may be used many miles away from the forests will be reduced in its flow, and the cost of growing our alfalfa, vegetables and citrus fruits will increase. Erosion also causes the silting of navigable streams and harbors. The destruction of forests means the destruction of our vacation grounds in the mountains.

Forests can rightly be considered as a national resource. This means their influence is so widespread that nothing should be done to them which will tend to injure their beneficial qualities. They are part of our national prosperity both on account of their usefulness and their value for recreation. They are really a public trust which we have in a way inherited, and as trustees it is our duty to use them wisely and hand them down to our successors, who will be our children and grandchildren, in as good or in better condition than we found them.

What, then, should we do to preserve our forests? First we must see them, for not to do so would be a form of waste. But we must find ways to reduce the losses that are now going on from fire and other causes. Now we only use one-third of every tree that is cut; the other two-thirds is left in the woods or goes to the sawmill burner. Uses must also be found for the material which is now considered worthless. We must save all of the young growth, the small trees, so that they will grow and form a new forest for the future. There are several million acres of land covered with brush which could produce forests and are good for no other purpose. These should be put to work. That is one of the big jobs for the future—to make all land which can grow trees produce forests. Growing forests, which is forestry, is a business. It must pay dividends. Therefore, there must be a plan to tax such lands so that there will be a chance for the forest owner and lumberman to make a profit from practicing forestry.

These are the things we must do, and they can be accomplished if we fully realize the value of our forests and all work toward this end.

QUESTIONS:

1. How many acres in California were covered with forests when it became a state?
2. How many acres have been cut over since California entered the Union?
3. What are some of the private owners of timber land doing to perpetuate the forests?
4. How much faster are we using the forests of the country than they are growing?
5. What must we do to preserve our forests?

LESSON XI

FOREST ETIQUETTE AND LAWS

Woods' manners are good manners!

Good manners in the forest are just as important as good manners in the home. Nothing more quickly marks the "tenderfoot" than the way he acts when in the woods.

If you would be a Good Woodsman, there are three essential things that you must learn:

1. **How to behave in the woods.**
2. **How to take care of yourself.**
3. **How to be careful with fire.**

How to behave in the woods. What would you think of a person who went about his home dropping burning matches on the carpet, scribbling on the walls, pulling the flowers out of the flower beds, hacking the shade trees, and littering up the front lawn with tin cans and papers?

Yet many people who go to the mountains for a vacation do these very things. They seem to forget that the forest is Nature's front yard. They throw burning matches and tobacco on the dry, needle-covered floor; they write on the signs posted for their guidance; they destroy the beautiful wild flowers; they hack the trunks of trees and cut the branches; and they leave their picnic and camp grounds littered with old papers and refuse. If they have any good manners they evidently leave them at home.

These ill-mannered people should be taught good woods' manners.

How to take care of yourself. The Good Woodsman knows how to take care of himself in the woods. He carries a compass and knows how to use it. He has a first-aid packet in his duffle bag and understands how to treat simple injuries and sickness. If he becomes lost, he does not get panicky but sits down and thinks, looks around him and then travels slowly.

The woodsman carries a light pack of food, clothing and blankets. He knows what to wear, and what to eat and how best to cook it. He makes himself a comfortable camp and bed so that he can rest well after the day's work.

All this knowledge comes largely by experience in the woods, but it is knowledge that everyone must have who wishes to enjoy a trip in the mountains.

How to be careful with fire. Most important of all, and the true mark of a Good Woodsman, is care with fire. The "tenderfoot" usually builds a bonfire and cooks himself while burning his food. The woodsman digs a hole, builds a little, quick fire in it and when the fire dies down, sits beside it in comfort and does his cooking. He never builds his fire near

trees, brush or logs, or without first clearing a space of all needles and trash so that the fire will not spread. Before he leaves camp, even for a short time, he completely extinguishes his fire with water, stirring and soaking the embers until they are dead. A woodsman is as careful with fire in the forest as he is in his own home.

The Good Woodsman is also careful not to pollute the waters of streams and lakes from which people have to drink. He keeps a clean camp and leaves it in an orderly and sanitary condition, just as you would wish to find a camp ground. He lives up to the game laws of the State and takes a personal interest in his furred and feathered friends of the woods.

If you would be a Good Woodsman, you, too, must learn to do all these things, for by your acts the people who follow you in the mountains and forests will judge your woods' manners and your good woodsmanship.

FOREST LAWS

If your behavior in the forest is good you will be obeying the laws. The laws of the forest are based on an old Roman law which provides that no use shall be made of property that will damage another party.

The forest laws of California were made to protect the trees, forage, water and wild life. They do not prohibit the wise use of these gifts of nature but they do seek to guard them against unwise use and carelessness, because they belong to all the people. When forests burn, streams dry up and game is destroyed because of unlawful acts, all the people of the State suffer. You can help protect and save these forests by observing these laws and teaching others to obey them.

As fire is the most dangerous enemy of the forest there are several laws concerning it.

1. Camp fires must never be left burning unattended even for a short time.

2. Throwing burning materials such as matches or tobacco from a moving vehicle, such as an automobile, train or airplane, is prohibited.

3. Camp fires can not be built in the national forests without a camp fire permit issued by a forest officer or authorized agent. Outside the national forests the law requires that written permission of the owner of the land is necessary or the person building the camp fire must have a permit issued by the Forest Service.

4. Grass or brush cannot be burned between May 15 and October 31 without a permit from a State Fire Warden, except when the burning is done at least 100 feet from any inflammable material and is watched while it is burning.

5. All automobile or pack train parties camping in the national forests must carry a shovel and an ax suitable for fighting fire.

6. Destroying or mutilating a forest sign is forbidden.

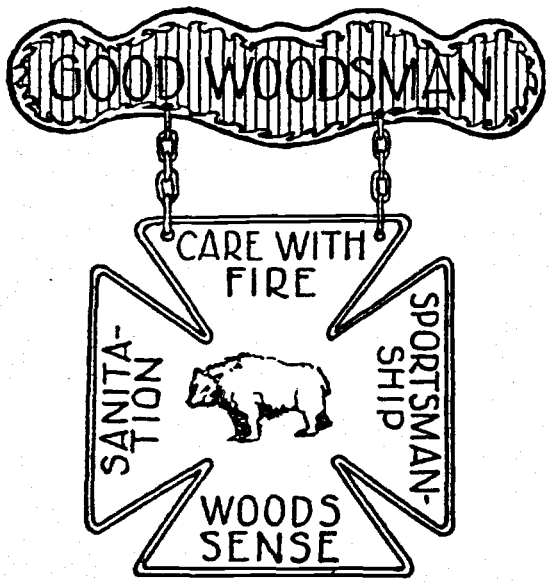
7. Do not take Christmas trees or Christmas berries without permission of the owner of the land or from a State or Federal officer. Trees, shrubs, ferns and flowers must not be cut or mutilated.

8. Do not put refuse or waste matter in streams, lakes or springs.

9, Obey the fish and game laws.

QUESTIONS:

1. **How should you treat your camp fire before leaving it?**
2. **What should one do with his match in the woods before throwing it away?**
3. **From whom should one get a permit before burning brush or grass (outside the national forests)?**
4. **When in national forests from whom should one obtain a camp fire permit?**
5. **How should one treat trees, shrubs, flowers and ferns when in the woods?**



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(FOREST HANDBOOK FOR CALIFORNIA)

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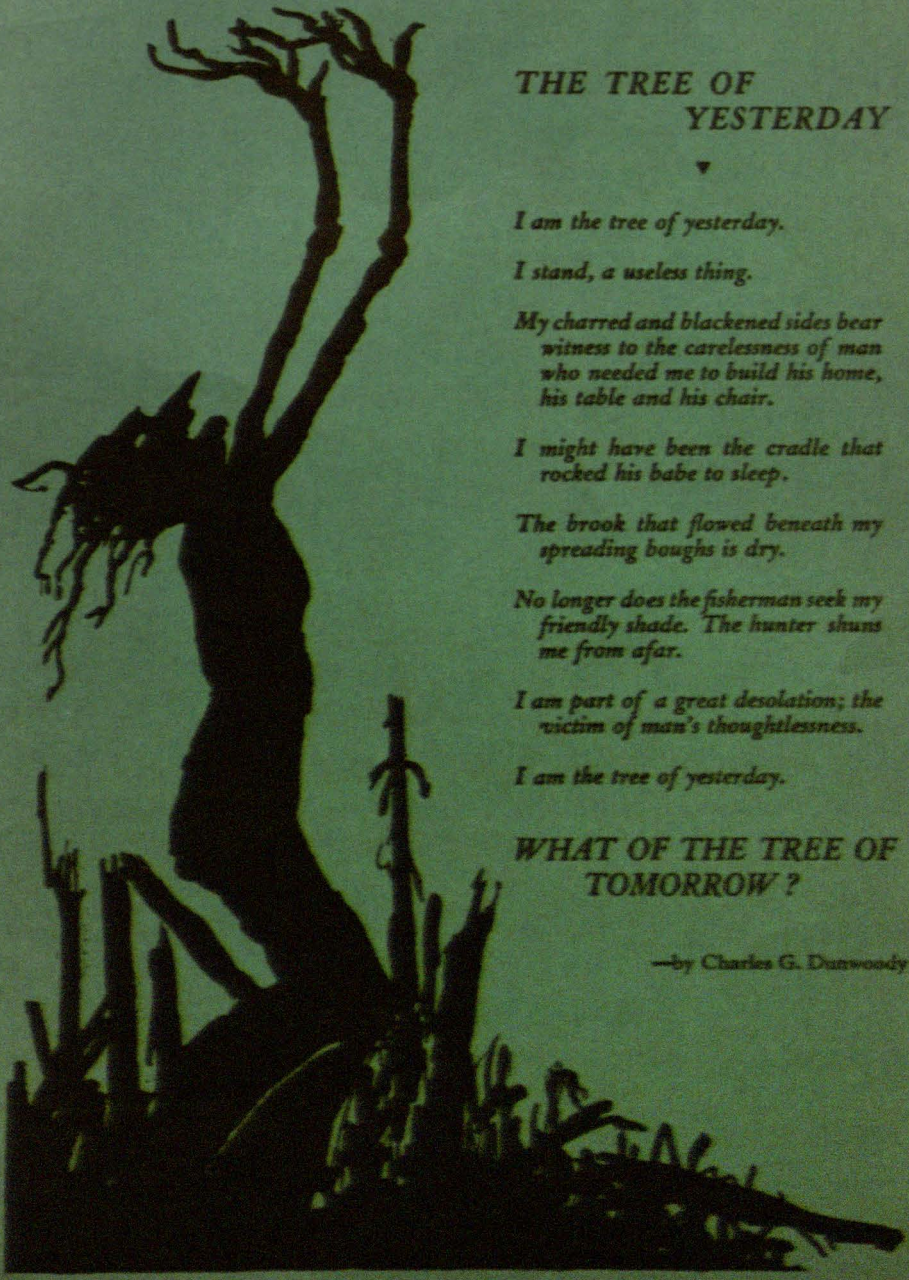

THE TREE OF YESTERDAY

▼

I am the tree of yesterday.

I stand, a useless thing.

My charred and blackened sides bear witness to the carelessness of man who needed me to build his home, his table and his chair.

I might have been the cradle that rocked his babe to sleep.

The brook that flowed beneath my spreading boughs is dry.

No longer does the fisherman seek my friendly shade. The hunter shuns me from afar.

I am part of a great desolation; the victim of man's thoughtlessness.

I am the tree of yesterday.

WHAT OF THE TREE OF TOMORROW?

—by Charles G. Dunwoody

"If the Nation saves the trees, the trees will save the Nation."

—Charles Lathrop Pack
President, American Tree Association