

**A FOREST FIRE PREVENTION PROGRAM  
FOR  
PACIFIC NORTHWEST FORESTS**

**by**

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FOR

## PACIFIC NORTHWEST FORESTS

### A DESCRIPTION OF THE AREA

The Pacific Northwest Forest territory is usually conceived as including the forested portions of the three Pacific Coast States of Washington, Oregon and California. Four distinct forest regions are recognized in this area. These are the Douglas Fir Region, the Northern Ponderosa Pine Region, the Sugar Pine-Ponderosa Pine Region and the Redwood Region. Since the Northern Ponderosa Pine Region extends from Eastern Oregon into Idaho with perfect continuity of silvicultural and economic conditions, this portion of the so-called Inland Empire is also included.

From the point of view of the available standing timber supply of the United States the regions covered contain approximately two-thirds of all of the privately owned merchantable timber in the country. In addition there are extensive national forest and other publicly owned lands that carry timber potentially available for Nation's timber industry. This industry is heavily concentrated in the Northwestern portion of the country, particularly in the states of Oregon and Washington.

The lines of demarcation between the regions are not too definite. This is especially true in Northern Washington and in the territory embracing Southwestern Oregon and Northwestern California. In Northern Washington there is a very large area east of the Cascades in which there is a coniferous mixture that is neither characteristic of the Douglas Fir Region nor of the Ponderosa Pine Region. Near the Oregon and California state line and extending for considerable distances on each side in the Siskiyou Mountain region is a transition belt involving a mixture of the trees of all four regions without conditions typical of any one of them.

What is said here with respect to the transition belt is also true of the Redwood Region, with some additional considerations. In the first place, the Redwood Region is really only a modified form of the Douglas Fir Region, being similar in many respects to the Port Orford Cedar belt on the Southwest coast of Oregon. Redwood really occurs in what amounts to a special type in a territory that does not otherwise depart greatly from the Oregon coast portion of the Douglas Fir Region. Within the confines of the Redwood Region there is a great deal of Douglas Fir, Western Hemlock, Sitka Spruce and other Fir-Region species.

The mature Redwood is characterized by a very low

susceptibility to fire. It is susceptible to damage through cat-facing and occasional burning down, however. Immature Redwood, at least in the earlier stages, is subject to fire damage like any other species, depending on conditions at the time of burning in either being partially or totally destroyed. This is also true of the accompanying species in both the immature and merchantable stages. There is not in the Redwood Region, however, a sufficient quantity of timber or a sufficiently wide departure from conditions found in the other regions to justify any detailed discussion. Therefore, generally speaking, factors in the Douglas Fir Region are similar to those in the Redwood Region.

### The Douglas Fir Region

**GENERAL.** The Douglas Fir Region lies in the portions of the states of Oregon and Washington west of the crest of the Cascade Range. Since the character of timber growth changes toward the south as the Siskiyou Mountains are entered, Jackson and Josephine counties in Southern Oregon are not considered as being in the Douglas Fir Region but are included in the Ponderosa Pine Region.

Socially this region is one of the newest in the country. A hundred years ago settlement and economic development had not begun. What the region is now, social-

ly, politically and economically, it has become since 1840. In 1930 the region had, according to the census, a population of 1,807,883 of which 774,215 or 42.8 percent was credited to the three cities of Seattle, Portland and Tacoma. (8)

For its livelihood this population is dependent mainly on the wood-using industries, other manufacturing and agriculture. Nearly fifty percent of the primary income of the region comes from the forest industries. (13) Climatic and soil conditions conspire to make entirely probable the continuation of this situation.

On the region's probable economic future, it may be mentioned that on large areas of land giving apparently no great promise for agricultural development, good timber can be grown at a rate of nearly one thousand board feet per acre per year. Individual acres have been known to carry as much as 200,000 board feet of timber, though the average for the region for the area now in merchantable timber is almost exactly 40,000 board feet. Authentic records have been made of trees fifteen feet in diameter at breast height and heights up to 325 feet have been officially recorded. Operated timber probably averages close to three or four feet in diameter at breast height and around 175 feet in total height. (15)

About half of the timberland and half of the timber in the region is in private ownership. Before the pri-

vately owned lands were cut into, they carried much heavier stands of timber per acre than the publicly owned lands most of which are in national forests. In spite of the fact that they have been cut more heavily, the private timber lands still carry only slightly less than the same average stand per acre as the public lands. In general, the private lands are superior in geographic location and timber-growing capacity, since they are for the greater part at lower elevations where the soil is better and timber markets are closer.

**SPECIES.** It is estimated that sixty-one percent of the timber in the region is Douglas fir. (18) The minor species are Western Hemlock, Mountain Hemlock, Western Red Cedar, Sitka Spruce, Silver Fir, Noble Fir, Lowland White Fir and Port Orford Cedar, with a sprinkling of Western White Pine and Engelmann Spruce at the higher elevations. There are a number of other species but with one exception, that of Oregon Red Alder, they are not of great commercial importance. The alder is used to a considerable extent in furniture manufacture in the region.

**USES.** The value of Douglas fir for construction and general utility lumber is widely recognized. Western Hemlock, while also utilized as lumber, probably attains its highest value as pulp material. Both of the spruces furnish excellent lumber and pulp but because of its limited

occurrence in the region the Engelmann Spruce is of no very great importance.

LOGGING. The heavy stands of timber, the large size of the trees and the practically pure conifer type of the forests have brought about a unique system of logging. The use of heavy power logging "Paul Bunyan" style as it has largely been practiced, with its inevitable production of large quantities of heavy debris, together with the system of clear cutting which as so far been the general rule, has resulted in forest devastation that presents a serious social problem.

SLASH. Because of the great accumulation of debris and the very serious fire hazard that exists if this debris is allowed to remain after cutting, it has become the general practice to broadcast-burn the out-over lands. Partial or spot-burning is being practiced in a few cases at present, however, in some instances. In general the practical effects of this burning are to reduce somewhat the amount of debris on the ground and to destroy very effectively any small trees that may have escaped destruction in the logging process but which might have helped to bring a second growth of timber on the land. The slash fire never consumes the logging debris entirely, though usually, if it is successful, it does reduce the current fire hazard very considerably. This intentional burning is conducted under the direction of an authorized state

fire warden at a time when the danger of loss of control is at the minimum compatible with obtaining a reasonably effective burn.

While a considerable amount of logged-off land remains a waste of brush and ferns for long periods after logging, nevertheless considerable areas do begin to restock sooner or later. When these areas escape fire during the early years of regrowth, they develop stands of second-growth timber. There is in the region a large amount of land covered with trees of various sizes, ages and densities which do not qualify at present as merchantable but which will reach that status within the next fifty years.

CLIMATE. Climatically it would be difficult to find a region anywhere in the world better suited to the growing of trees, the outstanding characteristics of the region being moisture and mildness. Making allowance for some local variations--the climate naturally tends to become warmer and drier toward the south and away from the ocean. Probably the best general index of climate is afforded by Portland, Oregon lying approximately midway between both extremities of the region and having the equable year-round temperature, the long growing period and the relative abundance of rainfall illustrated by the following data: (230)

Normal annual precipitation----- 41.62 inches  
 Normal period between killing frosts----- 251 days  
 Normal mean annual temperature----- 53.1 F.  
 Normal mean summer temperature----- 65.3 F.  
 Normal mean winter temperature----- 40.9 F.

There are locally wide departures from some of these figures within the region. At some points, for example, the normal precipitation is well over one hundred inches per year while at others it is less than thirty. Mean annual temperatures are affected more by elevation than by latitude except along the coast where this is the exception in the summer. (23)

**FIRE SITUATION.** In spite of the normally heavy precipitation throughout most of the region the forest fire problem has always been serious. This is because all of the precipitation comes, roughly, in nine months of the year, while in the other three almost drought conditions prevail. This situation is aggravated, from the fire point of view, by the tendency to low relative humidities during the warmer portions of the year coupled with strong dry east winds.

In the Douglas Fir region the period of greatest hazard ordinarily begins about the middle of June and continues with constantly increasing severity until rains come in the fall, which is ordinarily sometime in the month of September. Occasionally early spring conditions may be favorable to the inception and spread of fire, as for instance this year and it sometimes happens that rains

do not come September, so that this month occasionally sees heavy losses. In extreme cases the fire season may run into December.

A dry fall is more serious than a dry spring because in the spring green timber and dense second-growth have not yet lost enough of the moisture absorbed through the winter to be in danger of burning and only the more open areas will burn. When the fall is dry a dangerous hazard is produced because the summer drought has already effected a drying out of all classes of growth which, if continued through September, may produce a serious cumulative effect.

### The Ponderosa Pine Region

GENERAL. Socially and economically, the Northern Ponderosa Pine Region, like the Douglas Fir Region, is relatively young. A hundred years ago it had barely begun to be the abode of white men. Its real career, in this respect, began with the general westward expansion of the United States, which got strongly under way soon after 1840. Its economic development has not been so largely dominated by the forest-products industries as has that of the Douglas Fir Region. While lumber production here has come to be recognized as an important potential source of income, particularly within the past

thirty years, it has not and probably will not, come to account for as large a portion of the total income as is the case west of the Cascades.

This is caused, in part at least, by the fact that the major portion of the land area of the region is not naturally forest land. Having, for the greater part, a semi-arid climate, the region is largely characterized by a sagebrush desert, the forest areas occupying only the higher, more moist sites. Roughly, the region as defined covers an area of approximately 203,600 square miles, of which only approximately 80,700 or almost exactly forty percent is natural forest land. (19) Partly because of the effect of natural site and because of the effects of past fires, not all of this forest area is of commercial importance. Some of the natural forest types carry practically no Ponderosa Pine, the only species of real commercial importance at the present time. Only about twenty to twenty-five percent of the total area of the region is occupied by commercially important timberland. (19)

The land of the region which carries no forest growth whatever is utilized partly for stock grazing, partly for dry farming and partly for agriculture under irrigation.

The Mississippi valley is the principal market for lumber from this region, absorbing approximately one-half of the total produced. (16) Most of the remainder is

consumed within the region itself, only a small portion going to other western states and the Atlantic coast. This dependence on rail shipment is an important factor in the economics of the lumber industry in the region and of the other industries as well. The results of its effect on local development are plainly apparent to anyone familiar with the region.

The importance of the forest-products industries relative to industry as a whole will probably continue to be less in the Ponderosa Pine Region than in the Douglas Fir Region, partly for reasons indicated above and partly because of other factors. One of the latter is the much greater proportion of public ownership of forest land. Another is the more limited capacity of the land with respect to annual production of timber, an important consideration in sound, long-run forestry practice.

**SPECIES.** According to some estimates, seventy per cent of the timber is Ponderosa Pine. (19) The minor species are Douglas Fir, White Fir, Western Larch, Lodgepole Pine, Engelmann Spruce and Western White Pine with local occurrence of Incense Cedar and Sugar Pine. The Western Juniper is very common but is of negligible commercial importance. A few deciduous species, among which Cottonwood predominates, also occur, mainly along stream bottoms. These cannot properly be said, however, to be forest species, nor the areas in which they grow to be

true forest land.

**LOGGING.** Ponderosa Pine attains a maximum size of eight feet in diameter and 230 feet in height but the average size of mature trees in the commercial stands of Oregon is about three to four feet in diameter and 110 feet in height. (20) Power logging with heavy equipment has never been the general rule in the Ponderosa Pine region as it has been in the Douglas Fir Region, chiefly because of the lighter yield per acre, the more open character of the stand and less rugged topography. Until recent years yarding to logging railroads was done mostly with horses but lately the use of tractors has become general. Most companies are now logging extensively with motor trucks as a substitute for railroads.

**SLASH.** The legal requirement that logging slash be disposed of by burning is somewhat effective in most of the Ponderosa Pine Region as it is in the Douglas Fir Region. Because of the lighter stand of timber, however, the problem of slash burning without complete destruction of the forest growth is less difficult than it is in the fir region, and better silvicultural practice, without modification of existing logging methods, can be more easily applied. (19)

Piling and burning of slash is generally practiced. In areas where selective cutting is common different types of slash disposal are used depending upon the percent of

out made. Where a heavy cut is made (80% out -- 20% leave) it has been the practice to pile and burn all the debris and slash resulting from the logging operation. However, on the more recent cutting areas where a 40 to 60 percent selection cut has been made, the slash resulting is thinly distributed over the entire area. The crown cover has not been so seriously opened up and it does not create as serious a fire hazard since mostly the overmature, thin-crowned trees are taken. On such areas the practice is to pile and burn the slash along the roads to prevent accidental fire starts, burn particularly heavy spots of slash accumulation and scatter the remainder so that it will lie close to the ground and decay more quickly. The chief result of these conditions is that a considerable higher proportion of cut-over land carries advance growth reproduction, even under present conditions. In the future it is highly probable that material improvements will be made in this respect on all classes of land. Mainly for this reason the forest problem of the Ponderosa Pine Region is not so much a problem of forest devastation, in the strict sense, as it is in the fir region. In many places the reversion of cut-over lands to brush types has in the past partaken virtually of the character of devastation as is noticeable even today and logging practices still in effect in some localities tend to cause such reversion. Nevertheless, the modification current pract-

ice necessary to bring needed improvement involves less drastic innovations than is the case in the fir region.

**ELEVATION.** Physically the region is largely a high plateau varying in elevation between 3,500 and 5,000 feet with distinct mountain systems locally distributed, in parts of which elevations of 8,000 to 10,000 feet are attained. Forests cover most, but not all, of the higher areas and in some portions, notably the eastern slopes of the Cascades, descend practically to the bases of the foothills.

**CLIMATE.** In its essential features the climate in all parts of the region is much the same, being characterized by scanty rainfall, wide ranges in temperature, low relative humidity, rapid evaporation and abundant sunshine. There are, however, some marked local differences in temperature and precipitation, because of the topography. The strong insolation in the plateau districts promotes active convectional currents, and these in turn tend to increase the velocity of the surface winds which in the daytime are apt to be strong. The conditions are reversed at night, when the air is usually calm and cool. Except in winter, rainfall is largely associated with thunderstorms and there are occasional cloudbursts. Tornadoes, however, are almost unknown. (23)

Summer temperatures of 119 degrees Fahrenheit and winter temperatures of minus 47 degrees F. are matters

of record. (23) There are large areas in which the average annual precipitation is less than ten inches, too little to support forest growth, while some established weather stations have recorded average annual rainfalls of more than forty-four inches. (23) Undoubtedly some parts receive an average of more than fifty inches of rain per year. (23)

In the mountains a large part of the annual precipitation is in the form of snow, some places getting as much on the average as 275 inches. The average for the whole region is about fifty inches. (23) The heaviest precipitation is in the winter months but there is a secondary maximum in May and June that in some localities is the principal maximum. Only six percent of the moisture falls in July and August on the average. (23)

Length of growing season is difficult to express but periods between killing frosts may vary between approximately 44 and 226 days. (23) Elevation is a stronger determining factor than latitude. Since forests occur only at the higher elevations they are subject to shorter growing seasons. Undoubtedly this factor of length of growing season is important in limiting the rate of tree growth, though it is probably secondary to the volume of rainfall in this respect, in most localities.

**FIRE SITUATION.** As might logically be expected from the climatic conditions described the Ponderosa Pine Reg-

ion presents a serious forest fire problem. Precipitation during the summer is not sufficient to maintain negative hazard conditions. Ordinarily the season of positive hazard begins between June 15 and July 1 and lasts until sometime in September.

Light rain and low humidity favor the development of fire but on the other hand they are adverse to the growth of vegetation of all sorts, so that a sort of balance is preserved. The aggregate forest fire hazard in this region is considerably less, therefore, in comparison with that of the fir region, than relative climatic conditions alone would indicate.

The idea has been widely held that, while the ponderosa pine type is definitely subject to fire, the mature stands are not ordinarily susceptible to serious injury because of the predominating tendency for fires to stay on the ground. This is not true in most instances, though. For one of the chief factors contributing to the tendency for fire to crown in this region is the prevalence of strong winds due to insolational convection. These winds are general and exert their greatest influence during the afternoon when relative humidity is lowest. At least 80% of the fire loss of merchantable timber takes place between one and seven p.m. (19) Being relatively high country, however, the region is characterized by wide diurnal ranges of temperature during the fire season. The depression

of the temperature at night, accompanied by fairly constant absolute humidity, causes a very material rise in relative humidity, which is an extremely important factor of fire behavior. Many times fires which at 3:00 p.m. were raging crown fires are brought under complete control during the very early morning hours. Consequently the importance of night fire fighting is very great and experienced firemen habitually base their strategy on a knowledge of local manifestations of this general rule.

The chief factor bringing the end of the fire season in the fall is often not so much an increase in the amount of precipitation as a general lowering of the average daily temperature with consequent raising of the minimum relative humidity and a decrease in air movement due to lessened convection.

#### The Sugar Pine-Ponderosa Pine Region

GENERAL. The Sugar Pine-Ponderosa Pine Region became famous in 1849 but not because of its forest growth. This is the portion of California that supported an important gold-producing industry for more than fifty years. That industry has given it a colorful history and has had profound and far-reaching effects on its development and social character.

The gold-mining industry exercised an important influence on the forests of the region, particularly along

its western side where the population was principally concentrated. Demand for mine timbers and fuel wood as well as for construction lumber brought about heavy cutting. The miners are also believed to have been very active forest burners, both through carelessness and intention. The result is that the whole western portion of the region and to a less extent the central and eastern portions exhibit at the present time plain evidences of the effects of this occupation with its resulting forest use and misuse. Large areas, formerly forest, are now brush fields which, because of their high fire hazard, repeatedly burn at sufficiently frequent intervals to prevent their reverting to their natural forest condition. There are nevertheless large areas of second-growth timber, mainly Ponderosa Pine, coming in on cut-over and burned areas.

Compared to the Douglas Fir and Ponderosa Pine Regions, the Sugar Pine Region is distinctly localized. Unlike them, also, it is throughout its full extent natural forest land, without breaks such as the Willamette Valley in the fir region and sagebrush deserts in the Ponderosa Pine Region. Mainly, this region occupies the lower and middle slopes of the west side of the Sierra Nevada from somewhat south of the Oregon line southward to the Mohave Desert. The commercial area is bounded on the west by a belt of woodland and chaparral type which covers the foothills east of the Sacramento and San Joaquin Valleys and

on the east by the fir and subalpine types of the higher Sierra. Roughly, it occurs between 2,000 and 6,000 feet in elevation, somewhat lower toward the north and higher toward the south.

SPECIES. Commercial timber occurs mainly in two principal types, the Ponderosa Pine type and the mixed-conifer type. It also extends slightly into the lower portions of the fir type. The Ponderosa Pine type occupies the lower slopes, principally between about 2,000 and 3,200 feet. It tends toward being a pure stand of Ponderosa Pine but carries over much of the area, in varying degrees of mixture, Oak, Incense Cedar and Douglas Fir, with, along the lower limits, some digger pine. Toward the upper limits Sugar Pine begins to appear. (20)

The mixed-conifer type carries Sugar Pine, Ponderosa Pine, Incense Cedar, Douglas Fir, and White Fir. Toward the upper limits Jeffrey Pine occurs locally. There is some oak, though this tends to occur as a separate type rather than in mixture. The mixed-conifer type extends mainly from about 3,200 feet up to 6,000 feet in the middle latitude of the region. (20)

Creek bottoms in both types often carry considerable stands of Oregon Alder and some Oregon Maple. Both types are characterized by a rather general occurrence of various species of Ceanothus, manzanita, bear clover and other relatively inflammable shrubby growths.

The big tree occurs in the mixed-conifer type but with very limited and local distribution. Economically this tree is of no importance and has no effect on fire hazard.

To a limited extent commercial sugar pine extends upward into the fir type, which consists principally of a mixture of red and white fir, with some Jeffrey pine. The better red and white fir trees in this type are sometimes cut for commercial purposes, especially for Christmas trees. (22)

Aside from mining, of which a few active projects still remain and stock grazing, there are no major economic activities east of the small ranch belt on the west side that do not involve actual forest exploitation. The timber industry centers around the exploitation of the sugar pine, an excellent commercial species yielding very high-grade lumber, well adapted to a number of specialized uses. In normal times it brings a good price and stumpage values are considerably higher than are those of Douglas fir and ponderosa pine, in spite of higher logging and transportation costs due to the relatively more difficult topography of the Sugar Pine Region.

LOGGING. Physically, the sugar pine region is difficult for logging and lumber transportation, which are consequently expensive and can be made possible only through

the solution of perplexing engineering problems. The topography is featured by steep and rugged river and creek canyons and by great differences in elevation within short distances. The main line of the Southern Pacific Railroad between Sacramento and Reno, which intersects the region approximately a third of its length from the north end, is the only common carrier line that offers transportation facilities within the limits of the region proper. Consequently lumber manufacturers are in many cases obliged to put in their own railroad lines all the way from the timber in the mountains to the common carrier shipping points in the valleys. The distances and the differences in elevation make construction of these lines and transportation over them expensive. The result is the manufacturing is not done at towns in the valleys, as is the common practice in the Fir and Ponderosa Piner Regions, but at sawmill towns established for that sole purpose high up in the mountains. The state has constructed a number of excellent highways through and over the mountains, so that at favorable locations truck logging is economical and is practiced to some extent.

Until recently logging has been done mainly with heavy power equipment similar to that used extensively in the fir region. With the development and improved adaptation of tractors, however, the practice of logging with them has been gaining steadily in favor, until it appears

now that the days of the donkey engine are distinctly numbered. Many of the operators have already abandoned them except for use on ground that has to be logged uphill. It is probable that within a very few years a donkey engine will be a rarity in the region. The development is looked on with favor by foresters, because tractor logging not only leaves the forest in much better condition for the second crop but is much less hazardous with respect to fire.

Silvically the region is well adapted to improved forestry practices. Selective logging that leaves a considerable portion of the stand and much advance-growth reproduction is economical for the logger and productive of an excellent growing stock without any serious threat of domination by inferior species. There is already a considerable area of logged-off land that bears very fine growth that will mature economically within twenty-five or thirty years.

This whole region is one of relatively rapid tree growth, in this respect resembling the fir region more than the ponderosa pine region proper. The average growth rate of ponderosa pine, for example, is in the sugar pine region, almost twice what it is in the ponderosa pine region. This is mainly due to better climatic conditions, particularly the more abundant precipitation mainly in

the form of snowfall of depths of more than ten feet being not at all unusual. This creates very favorable growing conditions even though practically no precipitation is received through the growing season.

**FIRE SITUATION.** Normal precipitation is very light between May 1 and November 1, so that by early summer and throughout the balance of the rainless season the ground surface is very dry, inevitably favoring the inception and spread of fire. Physically these forests are considerably more susceptible to rapid and serious fire than are those of the Ponderosa Pine Region, because of the characteristically greater volume and density of undergrowth. In this respect there is a closer resemblance to the forests of the fir region.

Nevertheless, the fire problem is far from being prohibitive, because the physical adversity is heavily balanced by three favorable conditions. The first of these is the relative rarity of strong winds; insolational convection does not affect this region seriously. The second is the relatively frequent occurrence of a humid southwest wind. Not all southwest winds during the fire season bring higher relative humidities but it is normal for the wind to come from this direction with sufficient frequency and duration and to carry sufficient atmospheric moisture, to effect an appreciable amelioration of the climatic hazard.

The third and most important factor is topography. In the Sugar Pine Region the peculiar conditions of universal steepness and ruggedness curiously effects a beneficial rather than an adverse condition. The fact that there is almost no level ground, the canyons running up on both sides to very narrow ridges, gives the region a great abundance of natural firebreaks. Since cool, still nights are the rule, good opportunities are frequently presented to stop fires on the ridges during the night. The working of crews at night is consequently of great importance, as it is in the Ponderosa Pine Region and the accepted technique of fire fighting is based on this understanding. The size and apparent seriousness of fires that can be brought under control in one night by comparatively small crews is evidence of this fact.

This should not be taken as an indication that the fire problem is not serious for losses are just as great as they are in the other two regions. Young growth especially is subject to a very considerable hazard if current losses can be taken as an indication. This is particularly true along the western edge where the forest is adjacent to the woodland type and exposed to the small-rancher inception hazard. The woodland type is a prolific fire breeder because of the particularly inflammable character of the grass which forms the ground cover.

OWNERSHIP. Along the west side of the region there are a few extensive privately owned areas. Elsewhere the ownerships are so intermingled that no large portions stand out as either publicly or privately owned, as is the case in the other two regions. The reasons for this are homesteading, extensive railroad grants and the establishment, after the surveys were completed, of patents on many scattered parcels through the activity of various interests subsidiary to the mining industry. In this region, therefore, the bulk of the privately owned land is within the national forest boundaries instead of outside as is more common in the other regions.

This mixture of ownerships and lack of continuity of private lands has had an important effect on the development of protective administration. Private and state administration of protection are almost entirely absent, the Forest Service being almost the sole protection agency. This does not mean that the fundamental setup is different. Private owners are required to furnish protection and the Clarke McNary principle is applied. The state law provides for taxation to cover the cost of protection directly defrayed but the funds are actually disbursed by the Forest Service through cooperative agreements. This arrangement has a number of favorable features. Duplication of effort and division of responsibility are reduced to a minimum and the spread of the protection effort is much more uni-

form than it would probably otherwise be.

TIMBER. Other privately owned merchantable timber, only about thirty-one billion feet can be called actually commercial according to the present standards. (2) At an average depletion value of \$2 per thousand, which is probably sufficiently conservative, there can be said to be in the region a timber value of nearly \$62,000,000.

(2) This is a small figure compared with the privately owned timber values in the fir and ponderosa pine regions, but it is of sufficient importance to justify some special attention. Natural reproduction of cut-over lands is not difficult to obtain and growth conditions are notably favorable to private forestry. No figure is available for unstocked land because the unstocked areas are practically entirely embraced within extensive brush fields and are consequently of little interest to private owners.

SUMMARY. The characteristics of the Douglas Fir Region, Ponderosa Pine Region and the Sugar Pine-Ponderosa Pine Region have been discussed in considerable detail on the preceding pages. This detailed description was designed to give the reader a background to the conditions prevailing in the Pacific Northwest. Although the area appears to be similar there are fundamental differences that are there and are important to remember. These are species of trees, logging methods, slash disposal, the

fire problem and the importance of the timber industry to the region in income producing capacity.

## THE NEED FOR FOREST FIRE PREVENTION

### General

To the uninstructed, forest fire prevention may be a rather vague term. Therefor the first thing to is to clarify its meaning. Prevention may be defined as the attempt to reduce the number of forest fires through education, law enforcement or danger reduction. This use of fire prevention in this paper is the accepted technical meaning and does not include the other two necessary divisions of fire control activity--presuppression and suppression.

PREVENTION VERSUS SUPPRESSION. The organized effort of effective fire suppression is readily seen with the application of man-power expenditures on a burning fire. However in the case of prevention activity the relation to cause and effect cannot be so readily discerned, for it is very difficult to measure the effectiveness of an education, law enforcement or danger reduction program. This situation is probably accountable for so much past effort directed toward control and very little towards prevention. At present with the expending of money for suppression reaching a point where with increased appropriations there is no minimizing of the number of fires

to any great extent, attention is being drawn more and more to the importance of prevention in fire control planning. (11)

To illustrate the importance of fire prevention in a forest fire control setup the Massachusetts Forestry Association carried on an experiment recently in forest fire prevention which was concentrated in an area of approximately 100000 acres. The purpose of the experiment was to determine the value of public education and forest patrol in the prevention of forest fires. Briefly stated, the experiment proved that for 1/5 less money spent in total for prevention, presuppression and suppression and with most emphasis on prevention, the losses were reduced 4/5. These figures were based on a three year period which was the duration of the experiment. (11)

The whole experiment was designed to determine the value of greater emphasis on the prevention aspects of fire control instead of weighing the suppression factor so heavily as had been done formerly. The principle involved was the application of the old adage of looking the stable before the horse was stolen or an ounce of prevention is worth a pound of cure. With this idea in mind the writer has surveyed the need for fire prevention, the methods of fire prevention and programs of fire prevention for the Pacific Northwest Forests.

## Causes Of Forest Fires

It must be recognized that the possibilities for forest fires in the Pacific Northwest are innumerable. The woods themselves are mostly resinous and are littered with highly combustible tinder. For several weeks the lack of rain makes the fuels so dry that it takes but a spark to make a conflagration. That there are not more fires is attributed to the carefulness of most people and to the efficiency of the forest protective agencies. Through years of educational work and tactful law enforcement the public is learning to avoid starting fires. In spite of all this too many forest fires start. It is therefore appropriate to make some analysis of the causes of forest fires and consider particularly the types of fires that seem especially needless and require further measures to prevent.

The proportion of causes varies somewhat in different parts of the region. On the Coast Range in the Douglas Fir Region, for example, lightning caused fires are almost unknown and on the rest of the private land west of the Cascade Range are rare. Incendiarism is usually localized. Fires from land clearing settlers are chiefly confined to west of the Cascades. Lumbering fires are more frequent and of more serious consequence in the Douglas Fir Region than in the Ponderosa Pine Region partly because

of the amount and nature of the forest fuels and partly because of the logging methods employed.

In considering the various types of man-caused fires it must be remembered that a vast majority of forest users and forest dwellers are careful with fire. Those who do start fires are the very small minority who are careless or who are ignorant of the danger of fire in the forest during the dry season. More often than not the fire does damage to others than to the one that started it and the damages are commonly far beyond the ability of the originator of the fire to pay. It is the common case of many suffering from the acts of the ignorant and careless minority.

To give the reader a picture of the problem, the main causes of forest fires are shown below in the fire record for Oregon and Washington, based on a five year average from 1932 to 1936 inclusive. (24)

Cause	Oregon (%)	Washington (%)
Lightnings-----	24.0	13.6
Smokers-----	26.0	27.8
Incendary-----	18.5	27.1
Campers-----	12.0	11.3
Debris Burning-----	9.0	11.1
Miscellaneous-----	6.0	12.0
Lumbering-----	3.5	3.5
Railroads-----	1.0	4.6
Total Fires-----	100.0	100.0
Man-Caused Fires-----	76.1	86.4

From the above table it can be seen that about one-third of the forest fires in Oregon are due to lightning. In Washington this percentage is somewhat less. In the national forests of Oregon and Washington, though it causes about fifty percent of the fires occurring there. (24) Several hundred fires may be started by a single storm but at present nothing can be done to prevent lightning from striking and causing fires. Therefore prevention effort cannot help to reduce this source of fire.

However, the majority of fires are man-caused and are therefore preventable. The percent of man-caused fires varies with each state in the region but it can be safely stated that about seventy-five percent of the total number of fires are man-caused. These fires are usually more destructive than lightning fires. Lightning usually strikes on the tops of ridges and in most cases starts a small fire which spreads slowly, especially if the lightning storm is accompanied by a rain. Man-caused fires most frequently start along roads, trails, and streams, in canyons or on the lower slopes of the hills, spread rapidly uphill and often become conflagrations. Fires intentionally set nearly always occur during periods of high fire hazard and in more or less remote localities.

**SMOKERS AND CAMPERS.** Smoker and camper fires represent a major portion of the man-caused fires occurring

in this area. In most cases the people who cause these fires are in the woods for recreation and the fires they start are due to either ignorance, carelessness or indifference. Ignorance of the use and potential danger of the lighted match, cigarette or campfire accounts for most of these fires. There isn't any malicious intent in the mind of the recreationist to start a fire.

**LUMBERING FIRES.** In this class fires starting from actual logging operation and fires starting from debris burning are usually included. This cause alone is usually responsible for around half of the monetary damage resulting from forest fires. More than half of all out-over lands in the Douglas Fir Region alone suffers from at least two fires and on some of these logged-over areas fires are an annual occurrence.

Control over burning of debris has had much to do with reducing the number of fires in the past few years. Passage of state laws to close logging operations during dangerous weather will go far in reducing serious conflagrations. For, it is certain that many disastrous fires such as the Silver Falls Fire of 1929 and the Tillamook Fire of 1933 would not have occurred if the practice of closing down had been effective.

**INCENDIARY FIRES.** Incendiary fires rank second in the number of fires occurring and second only to lumber-

ing in causing damage to the forest resource. In the past two decades twenty-three percent of all fires starting on private lands in Oregon were attributed to this one cause. (8)

It is a peculiarly difficult and baffling problem. To a certain extent it is localized in Southwestern Oregon in the Siskiyou Mountains. The incendiary invariably sets his fires during a period of bad fire weather and generally in open areas such as slash or brush where fire spreads most rapidly. Sometimes these fires occur singly but often the incendiary attempts to overwhelm the local protective forces and often does by setting a large number of fires at one time. There is one instance on the records of fifty-four fires in one group, all of unquestioned incendiary origin. Some of these fires are started by mental defectives but the pyromaniac is not the chief cause of incendiary fires. By far the largest proportion is due to backwoods settlers pursuing the mistaken idea that frequent fires, as they express it keep down the brush improve the pasturage and facilitate hunting and to those who start fires to wreak vengeance on their enemies or to create jobs for themselves as fire fighters.

It is the same problem that is confronted foresters in the Southern States as in Oregon. These settlers or hill-billies live off the land to a large extent. They

have a cabin with a garden, fruit trees and a few head of stock. They kill a deer now and then to provide an ample supply of fresh meat for the table. The only thing they lack is money to buy some of the necessities of life such as clothing. Many of them are not capable of earning a living in town at some occupation and besides they don't relish the idea of leaving their homes when all they have to do is to set fire to some of the timber and obtain enough money in wages on the fire line to tide them over for another year.

This situation has presented a problem to the protective agencies in this area to solve. Perhaps the Forest Service has done more in this locality than any other agency. Psychologists have been consulted to determine the reason these individuals persist in these acts. Money has been appropriated to carry on law enforcement. Fire fighters have been shipped into the area from the outside to discourage setting the fires for financial gain. It looks like some immediate results have been obtained for the 1940 fire season saw a considerable reduction in fires from this cause. Effort must be continued though, for more prevention effort is still needed to whittle down the number of fires occurring from this cause.

**RAILROADS.** Fires due to the presence of railroad equipment are a minor factor in this region. Engines

traveling under forced draft emit a great many sparks and are bound to cause some fires as are log trains on downhill grades when hot pieces of the brake shoe melt and drop off. Passengers on the trains are another source of fire for many are often careless with cigarettes or matches and throw them along the right-of-way. In firing locomotives that burn coal the fireman often kicks hot clinkers off the platform and causes a fire. All these causes of fires have been reduced to a very low figure at present through establishing fire breaks along the right-of-way, providing containers for tobacco in the passenger train, education of the employees of the railroad and a follow-up patrol after a train passes through a dangerous area.

MISCELLANEOUS. Under this heading are fires the origin of which may be known but do not fit under any of the above headings. They include broken bottles or glass in which the glass acts as a magnifier concentrating the sun's rays, and causing a fire; the breaking of electric power lines; sparks from burning buildings; fire works; spontaneous combustion; a burning automobile, set on fire as the result of an accident; friction and fire from trees rubbing together; and other uncommon causes.

On the whole little can be done to reduce the number of these fires and since they do not represent a very important cause of forest fires they do not merit much

attention.

### Damages Of Forest Fires

A tour of the state or a survey of our forest regions from high points readily shows the costly toll that fires have taken and are still taking in our forest resources both present and potential.

**LOSS OF STUMPAGE VALUE.** Economic damage that is caused by fires is probably the most important immediate effect that is felt by the forest property owner. Actual loss of the intrinsic value of the stumpage killed and not salvable and of logging or other equipment or improvements in the path of the forest fire ranks first.

**LOSS TO COMMUNITY IN WAGES.** This loss represents money that would have been spent in lumbering this timber had it not been burned. This is an important factor for thirteen percent of Oregon's population derive their livelihood directly from the forest. (12)

**LOSS TO THE PUBLIC OF TAXES.** Loss to public agencies of tax revenues that the green forest contributes but the burned over land does not, thus shifting the tax burden suddenly and disturbing public credit, debt retirement, etc.

**LOSS OF RECREATIONAL VALUES.** Wrecking of recreational values, including game, that pertain to the forest only so long as it is green and attractive and the indir-

ect losses and inconvenience to various interests from smoke nuisance.

The forests offer scenic beauty, scientific and historic interest and advantages and attractions for the tourist and camper in abundance in Oregon, Washington and California. The Forest Service and the states are the main agencies that are facilitating the enjoyment of these resources to the public by building roads and trails, establishing campgrounds, issuing map folders and giving advice and assistance to the travelers and visitors to the forest areas.

**LOSS OF FISH AND GAME.** Fish and game are the products of forests and mountain streams. They add materially to the enjoyment of the forests by the public and increase the economic value of the areas. Deer, bear, mountain sheep, mountain goats, antelope and elk are the most important game animals. Antelope, mountain goats and the remanant bands of mountain sheep are fully protected by law. The most important game birds are blue and ruffled grouse, sage hens, ducks and geese. When a fire burns the forest all these game animals are directly affected by the destruction of their habitat.

**LOSS OF WATER CONSERVING AND EROSION CONTROL FUNCTIONS.** Loss of those water conserving and erosion control functions which the green forest performs but the burned

area does not. Loss of soil due to exposure to the action of wind and water is tied up here. Also the decrease in the fertility of the soil due to the killing of the organisms that live in it.

The forests play a very important part in the water supply of Oregon, Washington and California. Most of the important cities and irrigation districts in the region draw their water from streams originating on forest areas. A deeply rooted forest cover is of major importance in regulating under-ground storage and surface flow of waters and maintaining nature's balance between soil and water resources upon which man's very existence depends.

With respect to the social and industrial welfare of the area, forests again are very important. A total of over 1.2 million electrical horsepower is installed in water power plants in the state of Washington and over 0.36 million in Oregon. (24) The potentially available firm power in the two states is 13.2 million horsepower. (24) Reclamation projects and industries which are dependent on water and hydro-electric energy furnish homes and livelihoods to hundreds of thousands of people and produce millions of dollars worth of agricultural and other products.

LOSS OF IMMATURE AND POTENTIAL FOREST GROWTH. Loss of immature trees and of potential growth in the case of fire in young forests. The repeated burning of logged-

off lands, preventing new forest growth is perhaps the most serious and most neglected sore spot in the present forest protective system. The increased fire hazard on the burned area predisposes an area to more fire. The hazard is greatly increased due to the annual grasses, weeds and brush that come in on the burn. Due to their flashy nature they ignite very readily and a reburn results. The Tillamook burn is a very good example of this. Since the original one in 1933 several reburns have occurred over parts of the original area and have taken on new areas of cut-over and timber lands also.

The problem of whether we can have managed forests on a sustained yield basis is tied up here. (4) It has been recommended that in order to have sustained yield not more than 0.2 to 0.3 of one percent of the forest area can be burned per year. (4) This is considered to be the maximum burning rate permissible on managed forest lands if they are to be economically profitable. These figures represent an average annual burning rate over the Douglas Fir Region and over a long period of time. It is obvious that such fires as the Tillamook catastrophe of 1933 will consume several years annual allowable burn and if any more conflagrations occur within a relatively short period of ten to fifteen years, it will be impossible to meet this objective of 0.2 to 0.3 of one percent.

SUMMARY. It is seen here that the forest owner is by no means the chief loser when the forest burns. The general public in the long-run is the greatest sufferer from forest fires because when commercial timber is killed the public loses the money that would have been spent for labor, supplies and transportation on converting the trees into marketable lumber or other products. Most of Oregon's forest products are marketed outside the state. Destruction of this forest resource deprives the state of the cash that this timber might have brought. In the case of the recent big Tillamook County Fire for example, for every thousand feet of timber killed and not salvaged, the owners might be said to lose approximately three dollars, the public approximately eighteen dollars for labor, supplies etc. and transportation interests approximately five dollars for freight on lumber from the mill to the market. (8) In the case of immature forests and of re-foresting land made non-productive by fire the public is again the greatest loser. It has been estimated by some that the timber killed in the Tillamook Fire if manufactured would have brought into the state perhaps two hundred million dollars. (8)

Another aspect of why we need fire prevention is especially timely with respect to the present defense emergency. The newly coined slogan "Forest Defense Is National

Defense" is necessary for the present and for possible future wars. One must remember that to wage a successful war many raw materials are needed and a good portion of these come from the forest in the form of wood products and in indirect forms such as electric power. Many hold that the day is not far distant when a man who deliberately sets fire to the forest would be regarded as a traitor to his country and treated as such.

The trend in forest fire occurrence in Oregon is not encouraging. In spite of gradually increasing expenditures for forest protection, in spite of notable improvement in the equipment, technique and efficiency of the protective organization and in spite of an increased fire consciousness on the part of the public, the forests are still far from safe from the inroads of fire. Several factors operate to increase the fire hazard existing in Oregon, Washington and California at a rate with which the protective effort has hardly kept pace. The most important are:

1. A growing acreage of logged-off land and the connecting of one logging operation with another to make huge areas unbroken by green timber, recognizing the fact that logged land, regardless of whether the slash has been burned or not, is several times more ignitable than virgin forest. Coupled with this problem is the using of this

of this land for grazing with the subsequent danger from land clearing.

2. An increase in the number of persons who go into forest areas which formerly were inaccessible to the masses. More leisure time and the development of the automobile is largely responsible for this change.

3. A gradual increase in the last five or six years and a sudden increase in the fall of 1940 and spring of 1941 in the amount of logging activity, which means more acres of fresh slashings, more slash burning and more spark-emitting locomotives.

4. A tendency for incendiarists to set fires to obtain employment or for other reasons.

#### Statistics On Forest Fires

An analysis of the 1940 fire season for the area is timely and important to see what happened. The percent of the total number of fires by causes are for public and private lands in the states of Oregon, Washington, California, Idaho and Montana.

Cause	Percent of Total
Lightning-----	44.0-----
Smokers-----	22.0-----
Debris Burning-----	6.0-----
Incendiary-----	5.0-----
Lumbering-----	1.0-----

Note: Data is incomplete on other causes. (25)

The total area burned this last year is reported as 403,303 acres. This represents a very decided reduction over both 1938 and 1939. For the area as a whole, five states, this represents approximately one-fourth of one percent. The burned area was divided approximately fifty-fifty on federal and state and private lands. (25)

Of the three states, California, Oregon and Washington, California heads the list in area burned, Washington is second and Oregon is third. (25)

CONCLUSIONS. If the data were available it would be interesting to see if the annual allowable burn for Oregon, Washington and California was met. Also what the percent of the total number of fires were incendiary in each state.

## METHODS OF PREVENTING FOREST FIRES

### Education

Education of the public is the most important activity of fire prevention and therefor more emphasis should be placed on it. A definition of education may clarify the exact meaning of the word to the reader. Education is the changing of the beliefs of those you are dealing with or enlarging their knowledge of the subjects you are concerned. Better stated, it is the act or process of discipline of mind or character through study or instruct-

ion.

**PRINTED CHANNELS.** Printed material is one of the most valuable channels of reaching large numbers of people. It may be in the form of a newspaper, magazine or articles in magazines, letters, posters or leaflets.

In arranging with the local press for fire prevention articles, editorials and fillers for the spring and summer months the old "scarehead" type of appeal should be avoided. The aim should be to bring out constructively the economic, social and rehabilitation aspects of the forests as the real reason for preventing forest fires. During the fire season, current news of going fires should be given the press. If editors and reporters are not given the facts, they will get news, probably distorted, from other sources. In such items, it is desirable to play up the damage done and causes rather than numbers of men employed and amounts spent for suppression. Prompt and adequate publicity should be given to law enforcement cases while they are fresh.

**RADIO CHANNELS.** Radio is fast becoming the most important channel of reaching the American people. The average citizen listens to a radio at least once during the day either over his coffee at breakfast, on his car radio on the way to work, possibly at his place of business, at the lunch hour or at home in the evening after

dinner. Therefor, all the local radio stations should be used during the spring and summer to broadcast the general message of fire prevention. The method of presentation of message may be in a news broadcast, through plays, lectures or by word slogans.

The use of a news broadcast to remind the public of fire prevention is usually about the most effective, since the majority of the people haven't time or will not take time to listen to plays and lectures.

Word slogans interjected at the beginning of programs, at the end of programs or along with the hour announcement of the time are very effective. An example is the word slogan used by the Richfield Reporter at the end of each program.

Fire prevention lectures presented over the radio should be made by either forest officers qualified for this type of work or by a qualified local citizen.

Fire prevention plays should be presented by skilled individuals along this line. Therefor the function of the forest officer would be as an adviser and a source of information for writing the script for the play, if he is not qualified to take an active part in the presentation. Amateur attempts do not produce the results that are obtained by using trained talent, for all the bored listener has to do is switch the dial to another station

and find something that is more interesting to him.

**VISUAL CHANNELS.** Another channel that is used quite extensively in fire prevention work is the visual channel. Movies, slides, exhibits and highway signs fall into this group.

Movies can be used quite frequently alone or in conjunction with a lecture. They can be either of the silent type or a talkie. One important thing to remember in giving any movie to a group of people is to secure one that is not worn out with use or one that was taken about ten years ago. A timely picture, then, not over five years old, will create a better impression than an antiquated one.

Slides as a whole are of little value in education work unless accompanied with a complete explanatory lecture.

Exhibits are very effective for putting forestry across to the public. They may be placed in store windows and at numerous fairs and shows in the surrounding communities.

Highway signs are all right if not overdone so as to mar the scenic value of the highway. Constructing and placing of signs so as to be effective is almost an art in itself.

**ORAL CHANNELS.** The fourth channel used in education

is the oral approach. This is accomplished by informing people by word of mouth of the material you are trying to put across to them. The oral channel of education may be administered as a group contact or by individual contact of forest users.

The group application of forest prevention is usually done by lectures to civic organizations, schools, youth organizations, lodges and sports clubs. It must be kept in mind that different approaches must be used when contacting adult and juvenile groups. It is a well recognized fact that results from juvenile education are much higher than in the case of adults. Although the long time view should emphasize the need for juvenile education it must be recognized that children are not the base of our present man-caused fires, except to a very small degree and in most cases these instances are directly traceable to adult influences. Therefore for the present reduction of fires more weight should be placed on adult education. It is a more difficult problem for adults react to group lectures in many cases with a feeling of being insulted for not knowing and therefore do not have the proper mental attitude. Many have the opinion that the most effective direct education for adults is the contact by the field personnel while the people are actually on the forest area being protected.

The contact by the employees may be while on official duty either in the office or in the field. The value of contacts when not on official duty has been overlooked in many instances and should be considered in any prevention setup. However, it is practically impossible to separate the two since they should be integrated with each other. This last statement can be well illustrated by a discussion of fire prevention by Mr. Tedrow, Fire Chief on the Rogue River National Forest to the personnel of the forest.

#### A Fire Prevention Program

"We, and that means each one of us, should carefully study and perhaps write down on a piece of paper each method by which we could prevent a fire. Each winter the rangers make up a detailed plan of action for prevention work. A written plan accomplishes nothing in itself but it does get our thoughts organized and centers our attention on the problem. If we do nothing more than simply write the plan and if we do not make a concerted drive to follow it and accomplish something, then we have wasted our time and let the opportunity pass.

Perhaps it will be hard for the lookout on some isolated peak to see where he can accomplish anything. He may not have many visitors at the most, nor will his work permit outside trips but nevertheless, if he is a forester at heart, the few chances he does get will be made to count. His work will not die immediately when he lowers the last shutter in the fall but it will be carried on in the winter at home or in school. Tell your associates of the work the protection agencies are doing; tell of the danger and damage from fires; tell of the need for public cooperation and above all, tell the person on the outside what he can do, not only in his own actions but in helping others.

The Rogue River National Forest has had the benefit of from 130 to 150 employees' activities during the fire season. There is not one of these employees--be they clerks, C.C.O., E.R.A., F.R.D. or timber sale men--whose work may not be affected by fire. The job of the Forest Service is the management of one of our greatest national resources--the National Forest and all it contains. It is our job to be a leader. Are we giving everything to the public that they justly expect of us? A recluse is a person who shuts himself up from normal contact with other people. If you are not a recluse, there will be many opportunities to talk forestry to your associates. Just because fire is not your principle duty is no excuse to say "Oh well, someone else is taking care of it and when my seven or eight hours are done, I am through."

Now for something specific that can be done by all of us:

1. Do we make full use of our official time and contacts? A word of caution properly given is never out of place. Likewise a word of praise for good work accomplished will do more towards keeping up the good start than anything else which we could do. Are we a credit or a liability to the organization of which we are a member?
2. Are we careful of our fires and smoking? Do we obey fire regulations? Do we set a good example to the public?
3. In the normal contacts in our private lives, do we take advantage of every opportunity to explain the work and the needs of forestry? When we see the possibility of a fire being left or a match thrown away, do we caution the party and explain the danger? Are we aware of our possibilities to prevent fires and do we develop this awareness in others?

After all, forestry must be more than skin deep. We have accomplished much during this year but the season is not ended. Let's keep up the good work. Let's be a forester and live a forester. The job is not done but the field of forestry is always ahead.

## Law Enforcement

What one might call another tool of fire prevention is law enforcement. This is a very important tool in some cases of fire prevention.

**LAWS.** First of all a study of laws should be made both for federal and state statutes. Note should be made of the ones applying for the full year and ones that apply at different seasons of the year. Since these laws are rather detailed no attempt will be made to discuss them in this paper.

**PERSONNEL.** Personnel required to enforce the laws will be considered next.

Selection: Selection of the members of the organization may be through a competitive examination, by a board of review, an interview, personnel records or personnel recommendations at the last place or position of employment of the individual. In most cases more than one method is used for selection.

Training: The applicant may be required to take training prior to service. This may be accomplished through formal schooling, taking of special courses of study or study of random printed material.

After the applicant has been drafted for service and in order that he will be better trained, he will be required to attend a school in which he will be given more

detailed training about his job. This will be followed with special courses, apprenticeship, conferences and study followed by more random printed material.

Other Points: Placement, promotion and transfer of the employee may be done for the interest of the individual or for the interest of the organization.

**APPREHENSION.** In actual law enforcement after apprehending the violators the suggested procedure should be followed.

Collection of Evidence: The evidence needed to prove violation of the law should be collected. The following questions should be answered.

1. Who. Who is the person committing the offense. This would involve taking names and addresses.
2. When. One should note the time of day and the date of the offense.
3. Why. Determine the motive, whether it was intentional, unknowingly or carelessness.
4. How. Explain the method followed by the violator.
5. Where. Give a pretty accurate legal description of the location of the violation as to section, township and county.
6. What. Tell what was violated. In order to do this will require a knowledge of all fire laws.

**ACTION.** Justices of the Peace have authority to de-

side cases involving misdemeanors. If the offense is a felony, such as willfully and maliciously setting fire to the forest, the case can be tried only upon indictment by the grand jury but a justice of the peace can hold a hearing to determine probable guilt. Whether the offender pleads guilty or not, a complaint must be signed and sworn to by the complaining witness. It must charge the violation of some specific statute and show facts constituting the offense.

Officers having state appointments in the state of Oregon may arrest without a warrant any person who violates the state forest laws within their view or when it is necessary to prevent the commission of such a crime in their presence.

Administrative action may take the form of collection of damages and costs because the party failed to meet a regulation. It may, in the case of a lumbering operation, result in closing the operation by canceling a permit to operate or it may be simply a reprimand.

#### Danger Reduction

Danger reduction is reducing the probability of fire starting and spreading after starting.

**RISK.** The probability of a fire starting is termed risk. Risk deals with the causes of a fire starting.

Risk Factors: A study of factors that cause fires

in a given area must be made. The planner must find out whether the causes are due to natural causes, industrial operations or public use. He will then decide on a program of directed use.

Directed Use: Directed use may be in the form of concentration of campers to a certain area to reduce the number of fires. Closures to all use can be instigated or to special uses such as to smoking, hunting, fishing, camping, logging or grazing.

Control Measures: Control measures that help to reduce the chance of a fire starting are such ones requiring the use of spark arresters on all donkeys or cats, construction of debris burners at a sawmill or designation of sanding stations along logging railroads.

**HAZARD.** The term hazard refers to the fuels available and conditions of their arrangement. A study of the hazards on an area are necessary. Slash disposal, roadside cleanup, trail, stream, lake or railroad cleanup, cleanup of high use areas such as camps and logging areas, snag falling and fire breaks are the main hazard reduction practices. When funds are available for hazard reduction, work projects will as a general rule be given the following order of priority.

1. Fire breaks and fire lines.
2. Fire lines and debris burning in blow-down areas

3. Fire lines and slash disposal in old cut-over areas.
4. Roadside clean-up.
5. Clean-up in recreational areas.
6. Cleanup along trails.

Fire Breaks: Fire breaks are becoming more prominent in hazard reduction work in certain areas. It will pay to construct fire breaks on ground areas that have extremely high risk and hazard ratings. Also in certain types as the chaparral brush fields of California where it is a proved policy to construct fire breaks as trails and truck trails due to the nature of the dense, brushy vegetative ground cover. Although this work is expensive it will pay big dividends in some locations where control is difficult due to vegetation and in places where extremely high values exist.

Fire breaks are of two main types: (1) clearing and (2) planting of a type of vegetation that remains succulent and green all during the fire season and does not accumulate a lot of dry matter on the ground over a period of a few years. Clearing may take the form of complete removal of vegetation and the digging of a trench to mineral soil or consist merely of clearing a right of way through the timber. There are many types and modifications that have been used. The particular type to be incorporated into a hazard reduction plan would have to be

carefully correlated with the needs of the area and the economic feasibility. As an example, with the advent of the C.C.C. in 1933 the Forest Service built many fire breaks, lanes and trails in the brush lands of California. Now that the C.C.C. have been reduced many of these improvements had to be abandoned and only the ones that could be maintained with machinery kept open.

Roadside Cleanup: The cleaning up of debris resulting from road construction projects deserves more attention than has been given to it in the past. This work is of great importance from a fire prevention standpoint because the probability of fires starting from cigarettes, burning matches, etc., thrown away by travelers along roads where the debris has not been cleaned up is greatly increased. Piling and burning is usually the most common method of decreasing the hazard. This work must be done, of course, during the spring or winter when there is no danger of the fire escaping.

Recreational Areas: The purpose of work in the recreational areas is to decrease the probability of fires starting by removing all or some of the fuel that might catch fire and burn if a cigarette or match was flipped into the material. Instructions should be issued as to clean-up along lakes, streams, around campgrounds, summer home sites, and other recreation areas. Streams heavily used by fishermen which flow through areas of high haz-

ard should receive particular attention. In such areas it is desirable to restrict fishermen to a narrow strip along the banks of the stream and a good way to do this is to make a foot trail for them. Clean-up should be done along existing trails which pass through hazardous areas and are heavily used.

## PROGRAMS OF FOREST FIRE PREVENTION

### For Other Areas

The following few pages give examples of fire prevention programs that have been put into practice. They are examples of how certain problems have been solved by the unique application of methods of fire prevention.

#### Cooperative Meadow Burning

"Each spring the Mesaga District of the Superior National Forest has faced the problem of meadow burning and the carelessness with which it has been handled. Many of the farmers, when they were alone, touched off meadows and frequently did not even have a shovel or any other equipment with which to suppress the fire when the desired area was burned off. The result has necessitated the sending of suppression crews to control the fire after it has broken away and the initiation of law enforcement cases which are disagreeable and at times result in lessened public cooperation.

It seemed that better public relations could be maintained by assisting the farmers in burning over their meadows safely as well as by preventing additional burned area with the resulting necessity of law enforcement action.

A "burning ring" was organized of several

several farmers who had meadows to burn. These men were called together in a separate group and selected one of their members to serve as a foreman. The foreman's function was to call the group together when one of the members desired to burn his meadow and make arrangements for needed equipment. This system insured the presence of a suppression crew at each burning and lessened the possibility of a fire breaking away. Each member of the ring was repaid for his efforts by getting his own meadow burned over safely. The Forest Service assisted by offering the use of equipment, such as backpack pumps during the burning. Briefly, the advantages are:

1. Permits for burning meadows and grass may be issued with greater confidence.
2. The farmer has protection against the necessity of law enforcement.
3. The contact the ranger makes in such an organization is important since it proves to the farmer that he is interested in the farmer's problems.
4. The farmer is accomplishing a job which in his mind is an absolute necessity and is doing it safely.
5. The ring can also include debris burning on a large scale in connection with land clearing."

(27)

A program of similar nature would be especially applicable to farmers along the coast who are clearing out-over Douglas fir land.

#### Cooperative Fire Prevention

"Due to the large number of man-caused fires in a ranger district in the Wenatchee National Forest it was decided that something must be done to curb them. For the 1939 season up to July 10, of twenty-four fires on the district seventy percent were man-caused and sixty percent of these were charged to local residents.

Accordingly a fire prevention program was put into action by the formation of a group of citizen fire wardens who served in a cooperative capacity, without reimbursement. These

men were selected for their honesty and dependability. Any fire law violation observed by the wardens was corrected on the ground if possible. If not, the violation was reported to the supervisor on a card designed for that purpose. A sticker as a means of identification was placed on the car driven by a citizen fire warden. This also served as a mark of authority.

Each warden was furnished with franked postcards on the reverse side of which was printed a "Report of Forest Fire Violations". Should he discover a fire law violation, he would check which law was violated, where and when it occurred and the license number of the car. Each warden was assigned a number to be used instead of his signature on the bottom of the card. On the receipt of the card the supervisor wrote a letter to the offender calling attention to the violation asking his cooperation in the future in the prevention of fires.

Additional measures were also used in the program. Editorials in the local papers, radio announcements, cooperation of the state police in enforcement of fire laws and warning of tourists passing through the forest were carried on. Even service station operators added ash-tray service to their regular duties to help out.

The plan was inaugurated about the middle of July and continued through the fire season. Material results were that only eight more fires were caused by men." (28)

Here was a simple, practical and workable plan that worked in putting the idea of fire prevention across.

#### For The Pacific Northwest Forests

PLANNING OF THE PROGRAM. The method of action is too varied for any given area or locality. Therefore a general outline will be more applicable in planning fire prevention work.

The first thing to consider what the objective of your plan will be. A general objective would be to re-

duce to the minimum the annual number of man-caused fires through educational work, law enforcement and damage reduction effort.

The next step would be to make an inventory of the area. One would consider such items as class of people using the area, income of these people and other vital factors needed before actual construction of the plan could be started.

The third step is the analyzing and evaluating of all this data.

The fourth step is the actual construction of the plan by using the data that has been collected.

Checking and testing the plan is the next logical step to follow. This is important in order to produce the best plan possible.

The final step is of course the presentation or application of the plan. It must be kept in mind that at this point the plan should not be static but dynamic. In other words the plan should be flexible enough so that it can be changed.

**THE PROGRAM.** The following forest fire prevention program analyzes each type of man-caused fire and suggests prevention measures to adopt.

**SMOKERS**

## 1. Who Committed The Offense?

A Forest User: A forest user is one in the forest for the purpose of personal enjoyment. He may be either a city dweller who resides in the city or small town or he may be a rural dweller who lives in the country. Then he may be either an adult, that is, an individual over twenty-one years of age or a youth who is less than twenty-one years of age.

A Non-Forest User: A non-forest user is a person who starts a fire while passing through the forested area. As in the classification above they would be either city dwellers or rural dwellers, adults or youths.

PREVENTION. Prevention effort at this point would involve for city people, adults, contact of men's clubs, women's clubs, sport associations, newspapers, and radio stations.

For city people, youths, contact the schools, youth organizations such as the Boy Scouts or Girl Scouts and others of somilar nature.

For rural people, adults, contact granges and other farmer organizations also various farm papers and journals.

For rural people, youths, contact rural schools, youth organizations such as the Boy Scouts, Girl Scouts, Future Farmers of America and Four-H Clubs.

## 2. What Did They Commit?

These individuals discarded burning material such

as lighted matches, cigarettes, cigars or pipe heels. This burning material was thrown while traveling in an automobile, on horseback or on foot.

Prevention. To prevent this material from being thrown from an automobile warning signs and posters along the road should be used. Radio programs designed to reach the motoring public should also be used. Personal contact by field personnel as the visitors enter the forested area would be desirable. For people traveling by horseback or on foot, in addition to the above, warning signs should be placed along roads and trails and at camping spots. Printed material distributed to various sporting goods stores might be effective also.

### 3. Why Did They Commit The Offense?

Ignorance: Ignorance may be one reason the act was committed. Many people are uninformed as to what will happen if burning material is thrown away in a forested area.

PREVENTION. Prevention here should be by educational methods. Printed material, radio, movies, displays and lectures would be effective here. Use law enforcement only if act is repeated after warning.

Carelessness: Carelessness may be another reason the act was done. Failure to think of the consequences may be the reason the material was discarded.

PREVENTION. Prevention effort should be toward educational methods and law enforcement.

Poor Judgment: Poor judgment is much the same as ignorance. Methods of education should be used here followed by law enforcement if the act is repeated.

Where Did They Commit The Offense?

Along Roads: The act may have been committed along a road leading into a forest area or through a forest area.

PREVENTION. Prevent by erecting warning signs along the road, personnel contact if possible, danger reduction work along the road by constructing fire breaks or burning excessive amounts of debris. On bad days it might be advisable to close the area to entry.

Along Trails: Again the act may have been committed along a trail in the forested area.

PREVENTION. Prevent by erecting warning signs along the trails and have the field personnel contact these users. During dangerous periods the forest may be closed to entry.

Along Water Courses: Some fires may be started along streams or lakes. The danger here of fires starting is usually not so great due to green vegetation.

PREVENTION. Preventing such fires would involve posting warning signs and contact by some member of the protective force.

At Camping Areas: Another source of smoker fires may be around the campsite of the individual.

PREVENTION. Prevention here should be by warning signs, field personnel contact of the user and danger reduction work by clearing away dangerous inflammable material and construction of a fire break around the area.

#### 5. When Did They Commit The Offense?

Dry Season: Because of weather conditions and the moisture content of the forest fuels practically all fires will start during the time of the year when there is little or no rainfall. Fires may also be more prevalent on week-days or on Sundays and holidays and they may occur more in the morning or more in the afternoon.

Prevention. Prevention effort will call for coordinated action in issuing warnings, contact by field personnel, hazard reduction work and law enforcement. Smoker fires have a tendency to occur more in the afternoon and in a greater number on Sundays and holidays therefor additional effort should be expended at this time in prevention.

#### 6. How Are Smoker Fires Started?

Dry Grass: Burning material is often thrown into places where there is a quantity of dry grass present with a fire resulting.

PREVENTION. Prevent the material from being thrown away by education and law enforcement methods. Hazard reduction should be relied on also. Construction of a fire break parallel to the edge of the dangerous area and the

intervening strip of grass burned off to fireproof the area.

Brush: Burning material may also be thrown into places where brush constitutes the ground cover.

PREVENTION. Prevent by education and law enforcement. Also carry on hazard reduction by putting or burning a strip of brush along the roads to form a fire break.

Debris: In areas with considerable litter on the ground, such as logs, and branches, a fire can be easily started in the material.

PREVENTION. Prevention in such areas should amount to hazard reduction in burning the debris and constructing fire breaks if necessary. Education and law enforcement are also important here.

#### CAMPERS

##### 1. Who Committed The Offense?

An individual camping in the forest committed the offense. He may have been either a city dweller or a rural dweller. Then he may have been either an adult or a youth.

PREVENTION. Prevention effort for city people, adults, would amount to contact of men's clubs, women's clubs, sports associations, newspapers and radio stations.

For city people, youths, contact the schools and youth organizations such as the Boy Scouts and others of

similar nature.

For rural people, adults, contact granges and other organizations also various farm papers and journals.

For rural people, youths, contact rural schools, youth organizations such as Boy Scouts, Girl Scouts, Future Farmers of America and Four H Clubs.

## 2. What Did They Commit?

Building of Campfires: Camp fires were built in either dangerous places, fire left unattended or the fire was not put out completely.

PREVENTION. Prevent this by limiting the building of campfires to definite areas and improve these areas by removing dangerous hazards such as logs and brush and constructing a fire break around the edge of the area. Education of the users before they come into the forest and after they come on the area in the correct method of building a campfire. This could be accomplished by the distribution of printed material, by movies or radio or by some of the field personnel. Posting of warning signs is important also. Require a campfire permit which makes it necessary to possess adequate equipment to build and control a fire. Finally, law enforcement should be used to prevent this type of fire.

## 3. Why Did They Commit The Offense?

Ignorance: Ignorance may be one reason the act was

committed. Many people are uninformed as to how to build a safe campfire in the forest.

PREVENTION. Prevention, here, should be by educational methods. Printed material, radio, movies, displays and lectures would be effective. The use of law enforcement is important also.

Carelessness: Carelessness may be another reason the act was done. Failure to think of the consequences if the campfire should become uncontrollable.

PREVENTION. Prevention effort should be directed toward education and law enforcement.

Poor Judgement: Poor judgement is much the same as ignorance.

PREVENTION. Methods of education should be used here followed by law enforcement if the act is repeated.

#### 4. Where Did They Commit The Offense?

The offense may have been committed along roads or trails and improved or unimproved camping areas.

PREVENTION. Prevention here should involve hazard reduction work on the unimproved camp areas and issuance of campfire permits where this is not done. Education and law enforcement is not to be forgotten.

#### 5. When Did They Commit The Offense?

The Dry Season: Because of weather conditions and the moisture content of the forest fuels practically all

fires will start during the time of the year when there is little or no rainfall. Fires may be more prevalent on week days or on Sundays and holidays and they may occur either in the morning or in the afternoon.

**PREVENTION.** Prevention effort will call for coordinated action in issuing warnings, contact by field personnel, danger reduction work and law enforcement. Camper fires have a tendency to occur more in the afternoon and evening and in a greater number on Sundays and holidays, therefore additional effort should be expended at this time in prevention.

#### 6. How Is The Offense Committed?

By building fires in dangerous places, fire left unattended or the fire was not put out completely.

**PREVENTION.** Prevent this by limiting the building of campfires to definite areas and improve these areas by removing dangerous hazards such as logs and brush and construction of a fire break around the edge of the area. Education of the users before they come into a forest and after they come on the area in the correct method of building a campfire. This could be accomplished by distribution of printed material, by movies, or the radio or by personal contact of the field personnel. Posting of warning signs is important also. Require a campfire permit on unimproved camp sites which will make it necessary to possess ade-

quate equipment to build and control a fire. Finally, law enforcement should also be used.

## LUMBERING

### 1. Who Committed The Offense?

Loggers are primarily responsible for this class of fire. Farmers also may cause fire by engaging in this type of enterprise along with their agricultural pursuits.

PREVENTION. Prevention here would consist of contacting the farmers and loggers personally in following any fire prevention action.

### 2. What Did They Commit?

Operation of equipment during dangerous fire weather, operating equipment without adequate safeguards or burning of debris during dangerous fire weather.

PREVENTION. Prevention might involve closing down during dangerous periods, requiring and checking by inspection to see that spark arrestors and other safety devices are used. In burning debris a permit would be required which would allow the permittee to burn debris under safer conditions.

### 3. Why Do They Commit The Offense?

Again this may be through ignorance, carelessness, poor judgement or indifference.

PREVENTION. Prevention here would involve contact of

of the operators and law enforcement if necessary.

#### 4. Where Did They Commit The Offense?

Donkey: Around the donkey setting is a common place for fire to start.

PREVENTION. Prevent fire here by requiring a spark arrester on the donkey and sprinkling with water around the machine.

Blocks: Fires frequently start around the haul-back blocks when a high-lead system is used for yarding.

PREVENTION. Prevent this danger by clearing debris away from vicinity of the block and have employees watch these places.

Skid Roads: The "cat" may start a fire along the skid road on the way to the landing due to sparks from the motor.

PREVENTION. Prevention here will consist of the use of a spark arrester on the machine.

#### 5. When Do They Commit The Offense?

Most fires from this cause occur during the week days and either in the morning or afternoon. Operations are usually closed down on Sundays and holidays. Afternoon operation is usually more hazardous because of the lower humidity.

PREVENTION. Prevention should involve inspection and enforcement of laws on the necessary safeguards required.

Suspending of operation should be practiced during bad fire weather.

#### 6. How Did They Commit The Offense?

Operation: The offense is usually committed by operating the donkey or cat without the spark arrester.

PREVENTION. Prevention here should follow inspection and enforcement of laws.

Debris: Fires start from this cause by burning debris during dangerous fire weather.

PREVENTION. Prevention would entail requiring a permit to burn under supervision of a field man and under safe conditions. Encourage cooperation among farmers in burning debris.

### INCENDIARISTS

#### 1. Who Committed the Offense?

A farmer stockman or backwoods settler may have started the fire.

PREVENTION. Prevention effort here should be toward contact of these people either individually or through granges stockmen associations or at rural school meetings.

#### 2. What Did They Commit?

These individuals intentionally set fire to forest land brush areas and grass lands.

PREVENTION. Prevention here would entail law enforcement

in apprehending the guilty person.

### 3. Why Do They Commit The Offense?

Farmer and Stockman: The farmer and the stockman will give reasons for burning as to keep down the brush and to improve the pasturage. While it is true that fire will keep down the brush and improve the pasture this advantage is only temporary and continued burning will so impoverish the soil that it will produce practically no vegetation.

PREVENTION. Prevention here could be accomplished very effective by setting up some demonstration plots of burning and not burning an area. Law enforcement will be necessary in many cases.

Backwoods Settler: The hill billy or backwoods settler usually sets fire to wreak vengeance on some enemy or to create a job for himself on the fire line.

PREVENTION. Prevention here should follow strict law enforcement by employing special officers and using bloodhounds to track the violators. Men from other areas should be shipped in for fire fighting.

### 4. Where Do They Commit The Offense?

Farmers and Stockmen: In the case of farmers and stockmen the offense is usually committed on forested areas adjacent to farms and range lands. These individuals set fire on their own lands and it escapes into the

forest.

PREVENTION. Prevent by promoting cooperation in burning of debris and brush and by organizing the farmers and stockmen into groups to carry on the work. Law enforcement should be used here also.

Hill Billy or Backwoods Settler: The hill billy or backwoods settler usually sets fire on the forest property in the more hazardous places.

PREVENTION. Prevention here would involve strict law enforcement by employing officers to track down the offenders.

#### 5. When Did They Commit The Offense?

Most of these offenses will naturally occur during the dryer part of the year when the material will burn. Backwoods settlers usually pick the most hazardous day and time of day to set a fire to insure success.

PREVENTION. Prevention here in the case of farmers and stockmen would be to require burning permits which would allow burning to be carried on under safe conditions. For backwoods settlers law enforcement is about the only prevention effort that can be carried on.

#### 6. How Did They Commit The Offense?

Farmers and Stockmen: In the case of farmers and stockmen the offense is usually committed by setting fire to brush and grass areas and the fire escapes into

the forest.

PREVENTION. Prevention here would involve the use of burning permits, cooperative burning and law enforcement if necessary.

Backwoods Settler: With the backwoods settler it is merely a case of planning on setting a particular portion of the forest on fire.

PREVENTION. Prevention effort would be toward strict law enforcement.

## RAILROADS

### 1. Whowcommitted the offense?

Main Line Railroads: The main line railroads may be responsible for setting fires in the forested area.

PREVENTION. Prevention here would entail contact of the railroad company operating on the particular forest area.

Logging Railroads: Logging railroads are many times responsible for setting fires in forested areas.

PREVENTION. Prevention effort would be to consult the owners of the logging railroad in reducing fires.

### 2. What Did They Commit?

Main Line Railroads: They may have started a fire by incorrect operation of their equipment. They may have failed to use spark arresters, to sand flues at designated stations, or failed to possess a pan under the fire

box. Hot pieces of the brake shoes may have melted and fallen into some debris with a fire resulting. Passengers may have thrown burning material from the train and started a fire.

PREVENTION. Prevention here would be directed to inspection to see that proper safeguards were employed on the engine. In the case of passengers warnings should be posted and ash trays should be provided in the car. Law enforcement should be employed also.

Logging Railroads: Logging railroads may have started a fire by incorrect operation of the equipment. They may have failed to use spark arresters, to sand flues at designated sanding stations, or failed to possess a pan under the fire box. Hot pieces of the brake shoes may have melted and fallen into some debris along the right of way with a fire resulting. The crew may have been careless about smoking.

PREVENTION. Prevention would involve inspection of equipment to see that it possessed adequate safeguards as prescribed by law. Law enforcement would be necessary if the safeguards were not used. Warnings and enforcement of laws would also be necessary in the case of the crew.

### 3. Why Did They Commit The Offense?

In the operation of the equipment carelessness and indifference is usually the reason the safeguards are not

employed. In the case of the passengers and crew carelessness, indifference and possibly ignorance are involved.

PREVENTION. Prevention in the case of railroads in the operation of equipment would be directed toward inspection and law enforcement. In the case of passengers and crew, some form of education might be necessary by using printed warnings and followed up by law enforcement.

#### 4. Where Was The Offense Committed?

The location of where the offense was committed would be along the railroad right-of-way through a forest area.

PREVENTION. Prevention here would involve besides education and law enforcement, some effort directed toward hazard reduction along the right-of-way to reduce the amount of debris.

#### 5. When Was The Offense Committed?

The offense is of course committed at the time the train passed through the forested area.

PREVENTION. Prevention would involve effort directed toward reducing the number of fires before the train passed through the area.

#### 6. How Was The Offense Committed?

Fire was started in most cases by the improper operation of equipment in failing to employ safeguards. Passengers and crew also may have started a fire by throwing burning material from the train.

## MISCELLANEOUS

These fires are not of sufficient importance to merit any consideration. Therefore, except in extreme cases there is not much need to consider them in fire control prevention planning.

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