



A WORKING PLAN FOR THE WHITE RIVER DRAINAGE  
DESCHUTES BASIN  
OREGON NATIONAL FOREST.

Seminar Report in Forestry 509

by

Hans W. Looff

June 1, 1916.

## A WORKING PLAN FOR THE WHITE RIVER DRAINAGE.

### General Description

The White River drainage basin lies in western Wasco County, in Oregon, on the east slope of the Cascades. It is really a plateau, ranging in elevation from 2500 feet to 5000 feet.

It is cut up by several small streams all radiating from the direction of Mt. Hood. The most important of these are: White River, Badger Creek, and Boulder Creek. All of these streams have cut deep gorges which separate the area into distinct physical divisions.

The soil is volcanic ash on the lower levels, and well suited to agriculture where irrigation can be practiced, but not many irrigation projects have been completed as yet. Large smooth boulders deposited here and there bear evidence that at one time the glaciers from Mt. Hood extended far down and covered part of the area.

Less than 10 per cent of the area is true agricultural land, about 15 per cent grazing land, and the rest is forest land. The open prairies along the east boundary, when too rocky for agriculture, make excellent spring grazing for horses, cattle and sheep.

The nearest railroad runs up the Deschutes River Canyon, over forty miles to the east, and really does not affect the administration or development of the forest.



Nearly all of the agricultural soil is settled, but probably as some of the forest is cut off, more will be taken up.

The principal industries are ranching and grazing, while lumbering plays a minor part. There are, however, several small mills which produce enough lumber to supply the local demands. Most of the timber cut is from private holdings, and no silvicultural system of marking has been practiced.

### Timber

According to the best available estimates the 155 million feet of timber on the area is made up of yellow pine, 80 million board feet; Douglas fir, 60 million board feet; white fir, including *Abies grandis*, *nobilis* *amabilis*, 15 million board feet. Of the trees included under "other species," western red cedar, western hemlock, and western white pine are the most important.

The topography of the area divides it naturally into two parts,-- the Badger basin and the White River plateau. The stand of each of these is given in the following table:

#### Stand of Timber on the White River Basin, by Divisions.

	<u>Badger Basin</u>			<u>White River Plateau</u>		
	:			:		
	:Million B. F.:		Per Cent	:Million B. F.:		Per Cent
	:	:		:	:	
Yellow Pine	: 36	:	52	:	48	: 56
Douglas Fir	: 32	:	46	:	36	: 43
White Fir	: 0.6	:	0.8	:	0.9	: .4
Lodgepole Pine	: 0.01	:	0.2	:	.02	: .1
Other Species	: 1.0	:	1.0	:	1.0	: .4

### Forest Types.

The traveler through the timber in the White River Basin will meet three broad forest types: (1) Yellow Pine, (2) Douglas Fir, and (3) Sub-alpine. Below 3500 feet, he will encounter the yellow pine type on the south slopes and benches. Here the traveler will pass through a forest which, while rarely pure yellow pine, often is nearly so, especially on the slopes, benches and flats. Douglas Fir, White Fir, Incense Cedar, Western Red Cedar, Lodgepole Pine, and Western Larch, are usually present in mixture, though one or more may be absent. The stand on the type is comparatively open, and the forest floor is dry, though in places a heavy cover of snow brush, and in others manzanita and chinquapin, tend to retard evaporation.

The yellow pine is best developed where it is most nearly pure; that is, on the lower slopes and benches. The best stands of yellow pine are found in low valleys, on benches, and along eastern and southern slopes.

If the traveler should emerge from the yellow pine type near the edge of a marsh, or on a dry flat at a higher altitude, where fire has destroyed some other stand, he would most likely find himself in the lodgepole pine type. This might even be considered as a sub-type to the yellow pine type. Lodgepole, however, is found on a variety of sites. It grows on dry soils, where nothing else but yellow pine seems able to maintain a foot hold, on slopes, on the higher interior plateau, and on benches. It is also found along streams and on the



edges of lakes and marshes, where the soil is too damp to permit other pines to enter into competition with it. The stand on the type is one of pure lodgepole, usually a close thicket of slender poles. The forest floor is either comparatively bare or covered with a scanty mat of twigs and leaves. At first sight the type seems in many places to be encroaching upon the yellow pine, but though it has come in on the yellow pine type after fire, the latter, if fire is kept out in the future, will gradually regain the ground.

Climbing higher, the traveler leaves the yellow pine and lodgepole and enters the sub alpine type. This he will find, in general, covering the higher peaks and mountain passes. Of the spruces which compose it, noble fir, white fir, mountain hemlock, white bark pine, and Engelmann spruce are characteristic. These are mixed in varying proportions according to altitude, exposure and soil. In exposed, thin-soiled situations, white bark pine constitutes a major portion of the stand, mixed with mountain hemlock and noble fir, and forming what might be considered a subtype. These areas are comparatively small, however. Noble fir is found in a large body on Boulder Ridge at an elevation of about 5000 feet. White fir grows over a large portion of the forest, but is chiefly characteristic of the subalpine type. It is very susceptible to rot, and is not wind firm. It can be used for box boards and rough lumber, and as it becomes better known more important uses may be found for it.

Because of its adaptability to a variety of soils it is likely to supplant the more valuable species in the stand. Mountain hemlock

is met with throughout the types in the Cascades. Engelmann spruce is found chiefly in draws and upper canyon bottoms and along a few marshes and streams at high altitudes. Western white pine grows in mixture with the firs on the upper eastern and western slopes at comparatively high elevations. Over most of the type the traveler will pass beneath a dense leaf canopy, among large, clear boled trees, with an understory of chinquapin, yew, vine maple, and other shrubby trees and a mat of ferns and other plants. Humus is deep, and the soil moist except late in the summer and on the lower yellow pine levels.

Beyond the yellow pine type on north slopes and ridges on the higher elevations the traveler enters the Douglas fir type. This covers about one tenth of the area at altitudes ranging from 3000 to 4500 feet .

White Douglas fir is not as valuable as western yellow pine; its abundance on the area makes it valuable. On the forests of the Cascades as a whole, Douglas fir is the most important timber tree. The stand on the type is never pure Douglas fir, but contains varying amounts of yellow and white pine, hemlock, lodgepole pine, white and noble fir, and sometimes Engelmann spruce. In many places Douglas fir far outnumbered the other species, while in others white fir leads.

The Douglas fir type contains the densest stand. It never has the open aspect of the yellow pine type. Except where the heaviest stands of mature timber shade the ground, there is a good undergrowth of many species of shrubs. Humus is fairly abundant, and, where fire



has not run over the ground for a hundred years or more, it is from three to five inches deep.

Besides the species mentioned under the different types, other species will be found here and there. Incense cedar in its most northern range is scattered over the lower slopes. It never grows in pure, but holds a subordinate position in mixed stands of other species, on the drier soils. Western red cedar is found almost in every swamp and stream, and is very valuable for posts, especially when fire killed, since in that condition it is more durable in contact with the soil than when green. Western hemlock is found along the upper headwaters of the White River; western yew in the dense, moist forests at high altitudes, where it is usually low and shrubby, but highly prized for posts; willow, aspen, cottonwood, and alder along streams, lakes, and marshes at medium altitudes, the last three finding use as fire wood; and here and there throughout the forest single individuals and small bodies of alpine, amabilis and grand fir. Black cottonwood, *populus trichocarpa*, is found along some streams, with long clear boles, and is well suited to the manufacture of lumber.

#### Insects and Diseases.

Over the whole White River Basin about 60 per cent of the timber is mature, while much is fire scarred and dying. Bark beetles, *Dendroctonus ponderosus*<sup>ae</sup>, are at work in the yellow pine throughout the forest, and during the past twenty-five years have done much damage

to the standing timber of that species. On the area included in the White River Basin, approximately 25,000,000 feet of timber has been killed during that time. Many of the older Douglas firs are affected by a dry rot which appears as white flakes or short streaks throughout the grain. This is especially noticeable in the vicinity of Keep's Mill and Camas Prairie. As a rule this starts from the roots or a wound at the base of the tree, and extends upward, so that while the first two or three logs may be affected, the remainder of the tree is sound. White fir is especially susceptible to decay, and many trees above 40 inches in diameter are so rotten as to be valueless even for cordwood.

In the cedar a fungus disease, known as pencil rot, is very common. White pine is peculiarly free from insects, probably because it is found only as isolated individuals and small stands, but it is often injured by wind shake. *Tremetis pini*, a fungus attacking yellow pine, is found here and there, but owing to its unimportance scarcely needs mentioning.

Mistletoe, *Razoumofskya robuata*, is a serious menace to western yellow and lodge pole pine, and in some places 30 per cent of the timber has been attacked. The mistletoe usually starts in the forks of the lateral branches, and spreads as the tree grows, or it may even infect seedlings. The seeds of the mistletoe, which are sticky, are formed in the summer and ripen in the fall. When the seed covering bursts they may be shot from 5 to 20 feet, and often adhere to the bark of the trees, soon developing roots which penetrate the cambium.



Saplings attacked by mistletoe are deformed. Some of their branches are killed outright, their height and diameter growth is stunted, and the seed crop is lessened. In case of a severe attack no seed is produced. Sometimes when a host tree is weakened, the mistletoe may die from lack of nourishment.

#### Damage by Grazing.

Damage to seedlings and saplings from uncontrolled sheep and cattle may be excessive. When the range is over stocked, cattle trample and injure seedlings, particularly in the vicinity of watering places, while saplings are occasionally horned and the bark partially rubbed off. If grass is scarce sheep nibble small seedlings, and when close herded, as in crossing regular drive ways, trample reproduction. Over extensive areas, however, grazing is very beneficial in lessening the fire hazard by killing the underbrush and breaking up the thick mat of twigs on the forest floor.

The value of properly regulated sheep and cattle grazing in securing reproduction is recognized, because it prevents the formation of a heavy mat of grass, and loosens the soil so that the seed can germinate. Grazing before a reproduction cutting is beneficial, but after seedlings have come up, and before they are firmly established, it should be restricted.

#### Lightning.

As a result of severe thunder storms during the summer months, the damage to timber is considerable. Trees are rarely killed out-

right, but lose a strip a strip of bark from 6 to 10 inches in width, circling the trees spirally. Occasionally, however, trees are killed when struck. Even if lightning-struck timber remains standing, there is a considerable loss in quality if not logged off in two or three years. Lightning scars may develop into serious rot.

### Fire.

Because of the open character of the stand and the fire-resisting bark, often three inches thick, the actual loss in yellow pine is less than with the more gregarious species. A crown fire in mature stands is almost an impossibility, and in a ground fire in the virgin forest young saplings often escape complete destruction, though with a fair wind on a steep slope destruction of seedlings and saplings is often complete. It is after logging that the damage from fire is greatest, on account of the inflammable and unburned brush and slash. The butts of mature trees are often fire-scarred, but ordinarily this does not result in either death or decay. Sometimes, however, they are so weakened as to make them susceptible to serious insect and fungus attacks. Even in the case of very serious fire scars, the butt log is usually sound, and much of the scar eliminated in the slab. During recent years the yellow pine type has been heavily grazed by both sheep and cattle, and in consequence the grass is kept short, and the damage from fire very much reduced.



### Fires of 1915.

During the fire season of 1915, eight fires occurred, all of which were small and unimportant except one on Bonny Butte which covered about 2,000 acres. The seven smaller fires occurred close to the settlements in the yellow pine type, and the damage was confined largely to the reproduction. The average size of the burned-over areas in each fire was about 20 acres.

While the greatest damage was done in groups, since there the fire seemed to burn with the greatest intensity, it was seldom that all the trees in any group were killed. A few trees with diameters from 6 to 10 inches, and even up to 20 inches, had been killed, but none of a diameter above 20 inches. The injury to the mature yellow pine was very slight.

The Bonny Butte fire started by lightning on the 13th of August, and burned until the rains started in, during the latter part of September. A large area was covered, but it was in the subalpine type where the timber was valuable only as a water shed cover. About seventy-five men were employed at different times in fighting the fires in the White River Basin, during the fire season of 1915, with a cost of about \$2500.

### Timber Operations.    Markets.

There is no market for lumber except that needed for local use, and consequently only a few small mills are needed to supply the demand. While a large part of the region will probably remain as a stock country,

numerous small reclamation projects, the most important being on the Wapinitia Irrigation Canal, will mean a development of a large agricultural area. It is also probable that portions of the open country now given over to range cattle will in the future be used for dairying. Since there is a smaller amount of timber in private hands than anywhere else in the state, the rapidly developing portions of the regions will come to rely early upon the forest for their supply.

Much of the timber in the White River Basin is inaccessible. The streams are not drivable, and to reach the railroad, the Oregon Washington Railroad and Navigation Company, means a wagon haul of at least 40 miles.

From a silvicultural standpoint it would be desirable to get rid of the mature timber as fast as it can be cut. The present inaccessibility of most of the timber makes this impossible, even if no other factors were taken into account.

Small timber sales have been made from time to time, from the national forests to the smaller mills. However, government timber sales to settlers at the cost of administration are made. A few free use permits are issued every year to settlers for their winter supply of fire wood. Only dead, down, or insect infested timber is used.

#### Grazing.

During the fiscal year 1916, approximately 4000 head of cattle and 8,000 head of sheep were grazed in the White River Basin. The



grazing land is confined chiefly to the higher altitudes, on mountain meadows, burns, and in the open timber. The area offers practically nothing but summer range, except on small areas on the lower elevations where year-long permits are issued by the Forest Service.

The first permits for grazing on the Oregon National Forest, in the White River Basin, were issued in 1901. Prior to that time the range had been controlled by a few large stock owners, not local residents, whose policy it was to crowd the small owner off the land. This was not difficult to do, and, so far as the local owner was concerned, it was exceedingly doubtful at the opening of the grazing season whether he would be able to find range for his stock. With the creation of the Forest, however, was inaugurated the present system of range allotment, by which the bone fide settler living in or near the Forest, and who is dependent for his living largely upon the small band of stock he owns, has first right to the range, and is allotted a certain portion for his exclusive use.

Under this system the range has undergone a distinct improvement, and today is capable of supporting many more head of stock than at the time the forest was created. During the last few years the quality of the stock has also shown steady improvement. The greater number of cattle now grazed on the area are white-faced Herfords, which are found to do better here than any other breed.

The principle forage plants are as follows: Bunch grass, Lupine, salt grass, peavine, and fireweed. A little clover and timothy is

found here and there along streams. High up on the sheep range on the old burns is where the Lupine and peavine grow the best. There are also many forage shrubs on which sheep browse. Huckleberry bushes grown in the shade are valuable as browse for sheep.

The cattle range is down on the lower elevations, and the most valuable forage plants found there are bunch grass, Lupine, Fillerie and salt grass.

An organization of cattle men, called the Wapinitia Cattle Growers Association, controls practically all of the stock grazed in the White River Basin. A large amount of money has been spent by the Association in conjunction with the Forest Service in range improvements.

Many trails and watering troughs have been constructed by men of this Association. The north boundry of the Warm Spring Indian Reservation has been fenced to keep Indian horses and cattle off the White man's cattle range and vice versa. Much trouble has been avoided in recent years by this fence.

About twenty miles of Class A trail was built by the Forest Service and the Cattle men during the summer of 1916, each party bearing one half of the expense. The Boulder Ridge trail and the Camas-Beaver Butte Creek trail were themost important.

As a rule the cattle men in this region are the most progressive type, and work hand in hand with the Forest Service.



The Wapinitia Cattle Growers Association hires a fire guard each summer to do fire patrol duty over the cattle range. He wears a Forest Service badge and does general guard duties as well as tends to the salting of cattle.

While this cooperation is good business for the cattle men, it shows the right attitude toward the administration of the Forest Service.

## SALE OF TIMBER ON THE NATIONAL FORESTS.

Green merchantable timber on the National Forests is for sale when its removal will not endanger stream flow or reduce the timber supply below the point of safety or make a second crop doubtful. The opportunities for purchasing Government timber are many, and conditions of logging, especially in the yellow pine type, tend to make such investments profitable.

There are a number of different regulations that govern the cutting of all timber on the National Forests.

Upon formal application by the purchaser, the desired timber is mapped, estimated, and carefully described. When the formal application is filled out, embodying as clearly as possible the terms of the proposed contract, the timber is advertized for at least 30 days in the newspapers having circulation in that region. The purchasers must submit, with their sealed bids, a suitable deposit to guarantee good faith, and before cutting commences a small portion of the purchase price must be paid by the successful bidder. During the sale each log is carefully scaled, numbered, and recorded. Frequent check scales are made to determine the accuracy of the Government scales.

The stipulations under the contract vary considerably, but in western yellow pine the usual conditions are in brief: Timber can not be cut or removed until paid for, nor until scaled, measured, or



counted; it must be cut from a specified area; live timber must be marked; merchantable timber used in construction is charged for; felling is done with a saw; unnecessary damage is penalized; stumps must, if practicable, be lower than 18 inches; brush and debris must be properly disposed of as required by the Forest Officers; a proportionate amount of timber must be cut each year; scaling is by the Decimal C, Scribner Rule; dead trees, considered a fire menace, are ordinarily felled at the expense of the purchaser; location of the cutting camps, roads, etc., is determined after conference with the Forest officers; locomotives and all wood burning engines must have spark arresters during the fire season; steam skidders and donkey engines are subject to the approval of the Forest officers; and a reasonable bond is required for the proper carrying out of the contract.

In addition to green timber, all merchantable dead timber within the National Forest is for sale, except where it is needed to supply the demand of the local settlers. Application for information concerning the sale of timber on the National Forests of the Northwest should be addressed to the District Forester, Portland, Oregon.

## MANAGEMENT OF YELLOW PINE ON THE NATIONAL FORESTS.

### General Policy.

The chief aim of management of western yellow pine on National Forests must be conservatism. The marking must be conservative, the brush disposal safe, and the utilization as close as practicable. Not only must a sufficient stand be left upon the ground to protect the soil and to insure a second crop, but a supply of timber must be available in the future for purely local industries. Waste by private owners, even if it amount to only 5 or 10 per cent of their total cut, will mean a shortage in the future timber supply.

In managing western yellow pine, therefore, it is essential that provisions be made for a sustained annual yield. This does not mean, however, that only the annual growth will be cut. In the average virgin forest, growth is offset by decay. Most of the stands on the national forests in the Northwest are virgin, and consequently the mature timber that goes to waste each year is a great loss. It is true that this natural loss is offset theoretically by the growth of new stands, but full use is not made of the Forest unless the mature stands are cut and the thrifty growing immature stands left for future needs. Moreover, it is the desire of the Forest Service not only to maintain a sustained annual yield, but to improve the quality of the timber as well. If only timber of the lower grades is produced, export shipments will suffer. It is



therefore particularly essential, on account of the long hauls and consequent heavy freight rates, that a fair proportion of higher grades be supplied. Yet the Forest Service is bound to dispose of all over-mature timber, and if this is done the annual cut will be more than the estimated annual growth of the normal forest. It will be necessary not only to dispose of the annual growth, but also to reduce the excess growing stock represented by the virgin stands. For instance, if there were 100,000 acres, every one stocked to its full capacity, under normal conditions it might be the duty of the Forest Service not only to cut the actual annual increment, but also to reduce the excess growing stock to what would be considered normal;--in this case one-half of the present mature stand.

#### Method of Cutting.

The regulation of the cutting of western yellow pine depends upon the method of cutting, which in turn must be governed by the sylvical requirements of the species. In the past the cutting in Government timber sales has removed about two-thirds of the stand. Wherever possible, the one-third left standing has been selected from thrifty young stuff, though frequently it has been necessary to retain mature trees. It is planned to return and cut this one-third of the original stand as soon as reproduction is complete. It is not known how long the reproduction period must last, but probably 15 years, and perhaps 20, will pass before satisfactory

regeneration takes place. The present method of cutting might be termed a group selection or a primitive application of the shelter wood system applied to irregular stands. At all events, the idea has been to prepare for a second crop by cutting two-thirds of the original stand, and when the new crop is established, to cut the remainder.

#### Marking The Timber.

Ordinarily all mature and over mature western yellow pine should be marked, except when required for seed or protection, since they have practically stopped growing. Similarly, all trees which show such defects as punk knots, spike tops, bad crooks, low forks, and injurious fire scars, should be marked for cutting. Even an approximate diameter limit should be flexible. Young, thrifty, rapidly growing trees should not be marked, even if larger than the stated diameter. Defective trees of any usable size should be marked unless there are technical or practical objections.

At least one-third of the stand should be left to re-seed the area, provide a second cut, and protect the soil. No iron clad rule however, can be made that will apply to all conditions; consequently the amount left standing should be varied according to local requirements. The economic need of an early second crop should have weight.



Where the danger of wind fall is great, but few trees should be marked for cutting. This rule would also apply where a dense forest cover is needed for the protection of a water shed or to prevent erosion. The probable harm from too heavy marking on all slopes and in exposed situations must be carefully considered. Each tree left should have its crown free enough for vigorous growth. If usable, trees which have been badly grouped, and have only small, sickly crowns, should be marked, unless needed to preserve proper soil conditions.

Where there are not enough young trees to form a good stand in the future, seed trees must be left. These should be thrifty and capable of bearing large quantities of seed at once. Occasionally it will be necessary to retain seed trees too misshapen or defective to be merchantable, but as a rule young trees which will yield good lumber in the future should be chosen. Where western yellow pine is growing in mixture, all seed trees should be of the more valuable species, but poorer species are better than none. In situations where logging is difficult the practicability of logging individual trees should be considered.

Fewer seed trees should be left where partial reproduction is already established than where there are no seedlings, yet if there is danger that fire will run over the area enough trees should be left to seed the ground fully, whether reproduction is present or not. Large openings should not be made, or small openings enlarged, where the future forest will suffer.

Seed trees should always be left on the edge of openings, such as old burns, on the side from which the prevailing winds blow. On ridges and along the edges of parks it is usually advisable to mark very conservatively.

It often happens that some dry topped and diseased trees which can and should be removed, are overlooked in the original marking. It may also be advisable to reserve seed trees that were originally marked. Necessary changes in the first marking should be made before the sawyers have moved away. It is only by careful re-marking that undesirable trees can be completely eliminated and necessary seed trees retained.

In marking timber, a simple rule to remember is: Mark all the mature yellow pine and leave all healthy young stuff except when in need of thinning. If the timber is mature, with no reproduction, it may be necessary to retain trees that are fully mature, and approximately one-third of the volume may have to be left standing, even at some risk of wind-fall, and decline in vigor. In a mature stand with good reproduction, the marking may be heavier, but enough trees should be left to provide for reproduction in case of fire. The marking should aim to open up the reproduction and enable each group to enlarge. It should also tend to improve the stand by removing dry topped or otherwise deteriorating trees. In a thick, dense stand of young yellow pine a thinning can often be made to advantage, but these should never be heavy, and should aim to



preserve a close canopy. Trees which should be left are those that are deteriorating and which may be eventually suppressed.

In marking any sale area, innumerable variations will be encountered; no uniform system should be adopted for the entire stand. On the border of the wood land type, the marking should be merely an improvement cutting, and if the stand is less than 2,000 feet per acre no cutting whatever should be allowed, except the occasional removal of dying trees, and this is only practicable from a lumberman's standpoint. On the borders of parks and where rainfall is likely, or where it is desirable to preserve forest conditions, marking should be very conservative. On dry south slopes and on ridge crests but a very few trees should be removed. Ordinarily in western yellow pine a diameter limit of 20 inches should be slated, though not followed exactly in the marking, as was explained. Where practicable, advantage should be taken of good seed years to increase the cut or to direct the marking where the local seed crop is best. The scenic and aesthetic value of timber along roads should be carefully weighed in marking.

#### Rotation of Cut.

The best rotation for western yellow pine can not be predicted with certainty until regulated cutting has been more thoroughly tried out. At present a rotation of 180 or 200 years is used in the management of yellow pine by the Forest Service.

Ordinarily the over-mature yellow pine which is now being lumbered is from 300 to 400 years old. All available figures indicate that it will take 180 years to grow saw timber.

In some localities approximately one per cent of the total growing stock is believed to be a safe annual cut. This figure will, of course, vary with local conditions. It is justified by Van Mantel's method of regulating the yield, in which the growing stock divided by half the number of years in the rotation, is the annual cut. This method tends to reduce automatically the excess growing stock to normal, and to increase the growing stock where it is dangerously low. The Austrian method of regulating the yield may also be followed. By this the annual cut is equal to the mean annual increment, plus the difference between the real growing stock and the normal growing stock, divided by the number of years in the period during which the surplus is to be removed. The normal growing stock in turn is determined by multiplying the mean annual increment by half the rotation. The chief difficulty in applying this method in the west is the lack of exact information regarding annual growth after cutting. Accurate data is not yet available but it will be within the next 5 years.

#### Brush Disposal.

As a general rule, brush from western yellow pine should be piled and burned, except where there is little danger from fire,



or where there is no reproduction. In this case the brush should be scattered thickly enough to afford actual protection to the seedlings. A cover of brush apparently dense when green, will, when it dries out and the needles drop off, give little protection against the sun and wind. Occasionally, in openings where it is necessary to keep cattle or other stock away from existing or expected reproduction, the brush may be merely left as it falls. Ordinarily the brush should be lopped so as to lie not higher than 2 feet above the ground. Brush disposal should always keep pace with logging.

Where the fire risk is great, all lops and debris, including large chips, should be piled at a safe distance from standing trees. The piles should be large and compact enough to kindle easily and burn cleanly. Brush should not be piled on stumps, large tops, or unmerchantable logs, nor in groups of seedlings or young growth, or against dead snags. Whenever possible, the brush should be piled in openings with all branches lopped from the tops placed together with those cut from the logs. The trimmed tops and large branches should be left where they lie, and should not be covered with brush piles. Where there are no large openings, and the brush must be piled near living timber, the piles should be small.

Brush burning is necessary wherever there is danger of fire. Ordinarily, however, it is not advisable over an entire sale area. It is frequently possible to burn the brush so as to form fire lines, especially along railroads and wagon roads. Fire lines through

brush should ordinarily follow ridges rather than canyons, and should be laid out according to the topography rather than section lines. Where to burn brush completely would result in damage to existing reproduction or would be destructive to sound seed, unburned piles should be left, unless the fire danger is excessive. The effect of burning on grazing and future reproduction should be carefully considered. The best time to burn brush is after a light snow, or early in the spring before the snow has melted, or during or after the first fall rain.

In insect infested areas brush should be burned, if the pupae can thus be destroyed. The debris from fungus-infested trees should be burned, but not necessarily that from trees infested with parasites, such as mistletoe.

#### Cost of Handling Government Timber Sales.

An objection often raised against conservative methods of forest management is that their cost is excessive. It has been claimed by some lumbermen that to log western yellow pine conservatively entails an extra cost of from 75 cents to \$1 per 1,000 board feet. In considering the question of cost, it should be borne in mind that from 40 to 50 per cent of the added expense is chargeable directly to the cost of brush disposal, which is often an essential operation if the future stand is to be safe-guarded against fire and reproduction secured. The cost of supervision on Government timber sales in the



Northwest varies, of course, with the size of the sale, and the local difficulties of administration. An estimate based on past experience shows the cost per 1,000 feet board measure, under favorable conditions, to be:

Examination of sale . . . . .	\$ .02
Marking . . . . .	.04
Scaling . . . . .	.15
Brush burning . . . . .	.03
General administration . . . . .	.10
	<u>\$ .34</u>

Assuming that 34 cents is an average figure for operations of any size, it does not seem an excessive figure to pay for conservative management, including scaling. A private company could probably supervise conservative logging on a very large operation for a less amount.

#### Conservative Lumbering on Private Lands.

The common question of the lumberman operating in yellow pine, "Will it pay me from a financial standpoint to practice forestry?" can be answered in the affirmative. Just how much it will pay will depend, of course, upon the conditions under which each individual lumberman operates. The lumberman's chief loss is undoubtedly through fire. Surely, then, it will pay him to protect his timber from fire, and to use reasonable precautions in his logging operations. To burn oil in his engines and to see that his steam skidders are provided with suitable spark arresters, may be the means of preventing large and irreparable losses. Close utilization is undoubtedly

wise from a financial standpoint. While the lumberman may not care to work his trees to a 6 or 8 inch top diameter for narrow gauge ties, mine props, and the like, it would certainly be profitable to cut western yellow pine to a top diameter inside the bark of from 8 to 10 inches. Dead timber can be closely utilized if for nothing more than fuel. The loss from waste in the woods is often ignored, since by permitting waste the cost of logging is slightly reduced. A loss of 10 per cent on the original product will decrease the life of a manufacturing establishment and take away 5 years from a 50 year undertaking, while the cost of equipment must be distributed over 45 years instead of 50, a factor to be reckoned with in considering profits.

A problem which always confronts the owner of private land is whether to log it clean or leave enough timber on the ground for a second cut. Manifestly, a small tree yields a disproportionately small amount of lumber. A yellow pine 28 inches in diameter breast high, cutting four 16-foot logs, scales 950 board feet, while a younger tree 14 inches in diameter breast high scales but 70 feet and will yield nothing but a few ties, a couple of mine props, or possibly only a knotty saw log. By comparing the volumes of the two trees it is apparent that that of the 28-inch tree is more than 13 times greater than that of the 14-inch tree, though the diameter of one is only double that of the other. Small timber, moreover, yields products of poor quality and cost more to log and saw at the mill. Consequently, the lumberman with an eye to the future may reasonably



plan to leave the small timber and return in 20 years to re-log when the young stand has increased from 40 to 65 per cent in volume. Trees left after logging with plenty of light for their crowns will increase rapidly in diameter.

The private timber owner to secure best results should remove trees that are deteriorating in value, since these will not increase in volume and will decrease in quality. Reproduction must be protected. Experience in New England has shown that forest land without merchantable timber, but fully stocked with reproduction, has a much greater sale value than land absolutely denuded. The steady development of the central Oregon country assures a strong local market for the conservative operator who gets his present profit out of the mature and over mature stands and reserves his thrifty young growth for the future.

In Wasco County cut-over tracts may be assessed as grazing land at 25 cents per acre. The average tax rate on this class of property is estimated at 4 per cent, or 1 cent per acre per year. Assuming that 2,000 board feet of timber is left per acre, this means, at a stumpage rate of \$2.50 per thousand, an investment per acre of \$5.00. If this land is held for from 10 to 20 years, what will be the cost of the profit? A reasonable charge for fire protection in this type of country is 1 cent per acre per year. It will be much greater immediately after logging, but when the needles and debris have rotted, an efficient patrol, with occasional expenses

for fire fighting, will mean but a small annual cost distributed over a wide area. From experience and the tendency of the lumber market, stumpage is bound to increase in value. In main stumpage values have increased \$1 per 1,000 board feet, per decade, and in a comparatively newly settled country like eastern Oregon, a future stumpage price of \$4 in ten years and \$6 in 20 years seems a conservative estimate. Placing the interest at 5 per cent, compounded annually, fire protection at 1 cent per acre, land valuation at 25 cents, taxes at 4 per cent per annum, present stand 2,000 feet, valued at \$5, initial expenses at 10 cents per 1,000 board feet, stumpage at \$4 in ten years and \$6 in 20 years, and growth at 10 per cent per decade, the total cost and sale value would be as follows:

Present valuation, - - - - -	-\$5.00
With initial expense - - - - -	5.20
In 10 years	
Total cost - - - - -	8.72
Sale value - - - - -	8.80
In 20 years	
Total cost - - - - -	-14.46
Sale value - - - - -	-14.40

Under total cost is included all annual expenses and taxes compounded at 5 per cent, so that it will seem that the investment has netted almost exactly 5 per cent on the capital. If the shortage of lumber becomes as great as our professors in forestry indicate, stumpage values will be much higher than those just given and the profits in consequence much greater. Changes in the present method of taxation to one in which a tax will be levied only on the final output, would also greatly increase the net returns. In addition



to the revenue from the timber, most tracts can be leased for grazing during the 20 years between the first and second cuts, and a substantial sum of money secured from this source.

#### Summary.

Western Yellow pine in the White River Drainage Basin, attains its best development. It is a tree admirably adapted to the semi-arid conditions of the region and is capable of yielding the excellent saw timber. It withstands disease well and except in early life is not especially susceptible to fire, drought, frosts, or snow. Its growth is slow; from 160 to 200 years are usually required to produce a good saw log. The better grades of lumber are excellent for finish, and with preservative treatment the wood is durable in the ground. Lumbering is expensive, chiefly on account of the high price of labor. The higher grades of lumber are easily disposed of, but the lower grades are difficult to market. Nevertheless the timber in the yellow pine belt in Wasco County offers excellent opportunities for investment. A conservative method of management must be adopted upon the National Forest land, and it appears essential that the cut should be regulated, either by volume or by area, upon the basis of <sup>a</sup>200 year rotation.

While fire lines are not essential, an efficient patrol is an absolute necessity. The private owner can well afford to protect his holdings from fire, to insist upon a close utilization of the

product, to plan for a second cut, and to adopt many of the conservative methods of lumbering used on the National Forests. By doing this he may reasonably expect a 5 or 6 per cent return upon his investment, plus the rental value of his land for grazing purposes during at least a portion of the time.

- - - - -

Appendix---Blue Print map of White River Drainage Basin.

- - - - -

Note:- Some of the data for this paper was taken from Forest Service Bulletins, especially that concerning the management. The general data was collected by myself during the summer of 1916.

- - - - -





### LEGEND

ROADS =  
TRAILS ---  
IRRIGATION  
DITCHES ---  
PATENTED LAND   
TELEPHONE LINES . . .  
SAW MILL   
MOUNTAINS

SCALE 1 INCH = 1 MILE.

*H. W. Loeff*