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Selective Light Marking in Ponderosa Pine
of Eastern Oregon

by
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INTRODUCTION

Recent studies of log and tree value, forest stand structure and logging finance, in conjunction with present knowledge of silvics, growth and mortality rates, are throwing new light on the problems of the ponderosa pine type. It appears from these studies that the objectives of permanent forest management can be achieved better by light and frequent selection cuttings than by heavy and infrequent cuttings. This has been in the minds of many foresters for some time, but the exigencies of horse and railroad logging did not permit light cuttings. Now tractors and trucks give a flexibility to logging and lower fixed per acre costs to a degree that makes light cutting not only possible but apparently more profitable to both operator and land owner.

The objective of forest management, both for the public and private owner, should be the attainment of maximum sustained-value production of forest products, unless there be conflicting considerations of aesthetics, watershed protection and range or game management.

Hence the function of silviculture is to show the way to maximum quantity and quality production using means that are economically feasible and justifiable. Silvicultural and economic considerations therefore are not antagonistic, but are to a considerable degree parallel. Good silviculture is good economics and good economics good silviculture.

It is sound policy for both a public and a private forest owner to liquidate the low-earning trees and to reserve for volume and/or value increment the high earning trees.

Cribbed from Experiment Station mimeograph. Should have been acknowledged.

In this work it is the object of the writer to show how this can be brought about by the practice of selective light marking of the Ponderosa pine type as practiced by the United States Forest Service at the present time.

METHODS USED IN THE PAST:

The general principles and practice of marking timber under the selection system as it was first practiced was quite different to the system used at the present time. In the early days of the selection system, the system of marking timber was based on the fact that these forests are ordinarily irregular-aged, that is, the virgin forest as we find it, contains very old trees, thrifty middle-aged trees, poles, saplings and seedlings in intimate mixture. The principal objects in marking are:

- (A) To utilize the most mature trees;
- (B) To leave standing and undamaged the immature trees and reproduction as the nucleus of an early second crop;
- (C) To preserve a uniform and continuous forest cover that forest conditions may not be destroyed and the maximum volume increment be produced without interruption;
- (D) To secure additional seeding where the advance reproduction is not sufficient;
- (E) To make the marking as light as is consistent with good silviculture and the exigencies of logging, so that the cuttings--which are in the nature of improvement cuttings--may be extended over the largest possible acreage in the shortest possible cutting cycle;
- (F) Ordinarily to reserve from cutting 15% to 25% by volume of the original stand of yellow pine including all trees 12" D.B.H. and over, the proportion depending upon the character of the stand and the quality of the site;
- (G) Where other species are in mixture with yellow pine, to favor yellow pine, next larch, and next Douglas Fir, but not to the extent of marking any species so heavily as to be detrimental to the forest cover in general. (6)

In a general way these same objects hold good today, as practiced under the present system, but some radical changes have taken place, especially in article (F).?

These objects are accomplished--speaking broadly--by:

1. Retaining those trees which will make good growth until the next cutting, and form the capital stock for the next cutting;
2. Protecting advance reproduction;
3. Retaining mature trees, other than (1) above, of seed-bearing character, where there are not enough seed-bearing trees to reforest the area now or in the event of a later destructive surface fire. (6)

This plan of management for the yellow pine type contemplates cutting over each area about every 60 years, and that the trees which are marked for cutting will be about 180 years old. That is the cutting cycle will be about 60 years and the rotation 180 years. Our present marking contemplates returning for a second crop 30 years hence with the rotation remaining at 180 years.

Under the past method it was the practice to select first the trees to be left and then mark for cutting the remainder. The following classes of trees were left:

1. All thrifty yellow pines under about 14" D.B.H. and all those larger which were thrifty, pointed-crowned, dark-barked, and in good growing condition except where there is a surplus of such trees, and a thinning is desirable. Select on the basis of character of trees and not size alone.
2. The best available trees of the class larger and older than (1) above which are thrifty, to augment the supply reserved for growth, and to serve as seed-insurance trees and seed trees to assure reproduction in the openings. (6)

After selecting the trees to be left standing, the remainder were marked for cutting; where there was any choice, the aim was to first get rid of:

1. All spiked topped, seriously fire-scarred, partly decayed, lightning struck or otherwise defective yet merchantable trees. (Do not, however, consider that every tree with fire scars, a thin crown, or other defect must be removed. Few perfect trees are to be found, and trees with small basal scars or other minor injuries may be entirely suitable to leave standing. Snags and trees unmerchantable because of disease will be marked and disposed of under the "Sanitation clause" as specified in the contract.)
2. Trees with active insect infestation.
3. Seriously diseased or mistletoe infected trees.
4. The most mature tree, which apparently would not survive until the next cutting.
5. Trees interfering with reserved trees or reproduction.
6. Trees most likely to windthrow.
7. Suppressed trees which would not thrive and make good growth even if released.
8. Trees which will interfere with logging.
9. Thrifty merchantable "bull pines", where there are patches of such trees growing too thick for their best good. The overcrowded trees in such groups, especially those in the middle, should be thinned out, provided such trees can be felled without injuring the reserved trees or causing danger of windfall. (6)

Under this system there are several main points that the marker must keep constantly in mind. Briefly these are:

1. To decide first what should be left; then mark the rest, making sure that the quantity marked meets the requirements of the contract as to the percentage of merchantable timber which the Government agrees to sell.
2. To watch for indications of insects, diseases, and over-maturity.
3. To study the likelihood of wind damage, that the marking may be gauged accordingly. Windfall is one of the greatest problems in marking. Very tall trees and those with extra heavy crowns are especially liable to windthrow. Mark heavily in saddles and just over the brow of ridges and on soils that become soft in wet weather; mark lightly in protected places. Avoid breaking the forest canopy by openings larger than an acre.
4. To have at least three of four trees of seed-bearing size (over 17" D.B.H.) left per acre which might reforest the area in event that the advance reproduction is destroyed.
5. To leave the cutover land in good condition for growth. The primary job of the Forest Service is to grow timber and improve forest conditions. Financial considerations are secondary.

6. To mark especially lightly along roads, streams, lake shores, and camping places in consideration of preserving recreational and scenic attractions.
 7. On very adverse sites where there are but scattered trees, leave them as seed trees even though large and old rather than destroy the scanty forest cover.
- (6)

By and large these same considerations still hold true, but it will be shown under PRESENT MARKING RULES how they vary from the present marking practice.

Along with the changes in marking rules, also have gone changes in the conduct of the marking. As formerly practiced the marking was conducted in the following manner:

Unless familiar with the area to be marked, go over it beforehand in a general way and lay out the job. Be familiar with the contract requirements as to marking of live and dead timber, type of logging to be used, utilization requirements, etc., that the marking may be governed accordingly. Grid-iron an area systematically; on a side hill begin on the high ground and work back and forth along the slope. Watch the crowns of the trees ahead; you cannot judge these well from from underneath.

Put the stump blaze and stamp on the side from which you came, and the upper blaze and stamp on the side toward which you are going, both blazes quartering a little toward the unmarked area.

Go back over the marking while the falling is in progress to make sure that no trees were overlooked, or that the marking was not too heavy. (6)

In the section ACTUAL FIELD PROCEDURE it is shown how marking under the present system is conducted and in what ways it varies from this procedure.

TREE CLASSIFICATION USED:

The tree classification which was adopted for this purpose, and which may be called the "bark-beetle susceptibility classification", was worked out by Paul Keene of the Pacific Northwest Forest Experiment Station and is illustrated in Figure 1. It is based to a large extent upon the same considerations of age, dominance, and vigor which Dunning recognized as forming the basis for his seven classes. The two characteristics of age and vigor are given primary importance. Four age groups are recognized, designated 1 to 4; and four degrees of crown vigor, designated A to D. Combining these two major groups gives a series of 16 classes, covering all types of trees found in a stand.

The tree class descriptions to a large extent follow those defined by Dunning, but they have been modified to apply more specifically to mature ponderosa pine forests of average site IV quality in southeastern Oregon and northeastern California. Although trees throughout the pine region may be similarly grouped into 16 age and vigor classes, the class descriptions will have to be somewhat modified to apply in other localities and on poorer or better sites.

AGE GROUPS.

Trees are first divided into four age groups--young, immature, mature and overmature. In average site IV ponderosa pine stands of the Pacific region, the characteristics of these age groups are as follows:

A PONDEROSA PINE TREE CLASSIFICATION

FOR COMPARISON OF BARKBEETLE SUSCEPTIBILITY
CLASSES BASED ON AGE AND VIGOR

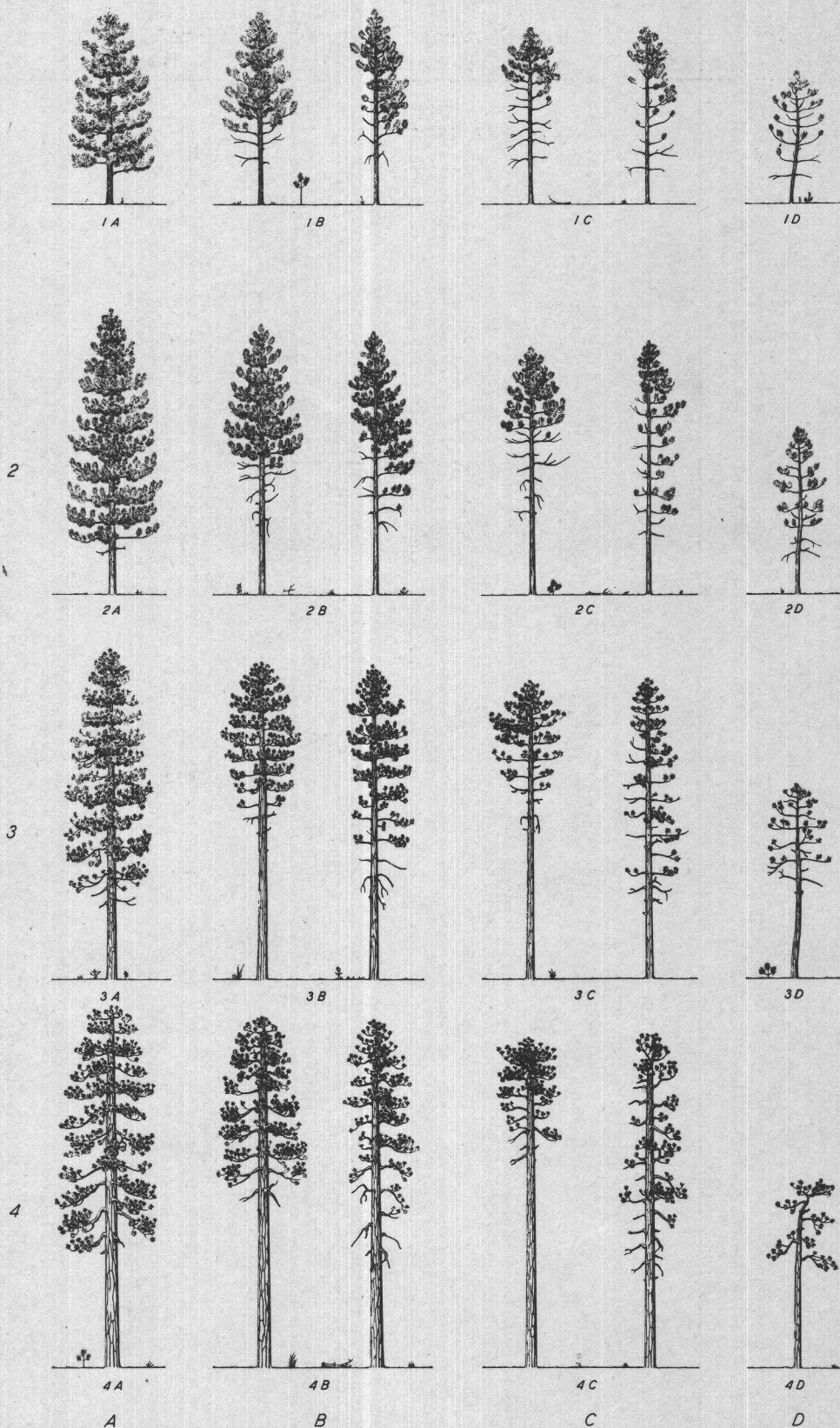
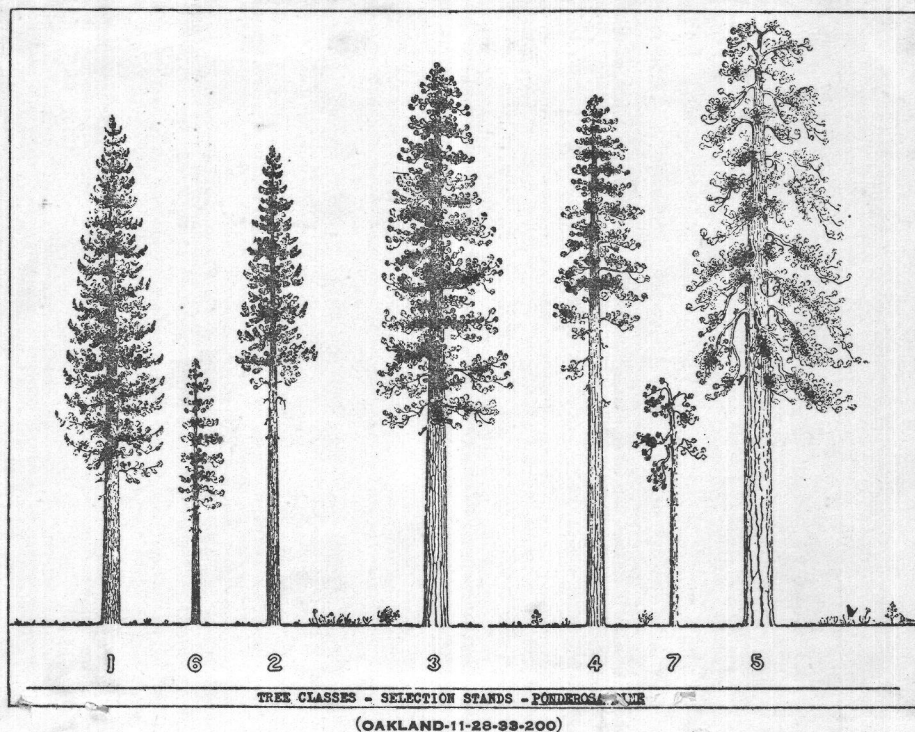


Figure 1.








1. YOUNG. AGE: Usually less than 75 years. DBH: Rarely over 20 inches. BARK: Dark grayish brown, to black, deeply furrowed, with narrow ridges between the fissures. TOP: Usually pointed, with distinct nodes. BRANCHES: Upturned and whorls.
2. IMMATURE. AGE: Approximately 75 to 150 years. DBH: Rarely over 30 inches. BARK: Dark reddish brown, with narrow, smooth plates between the fissures. TOPS: Usually pointed, but with nodes indistinct. BRANCHES: Mostly upturned and in whorls for upper half of crown.
3. MATURE. AGE: Approximately 150 to 300 years. DBH: Rarely over 40 inches. BARK: Light reddish brown with moderately large plates between the fissures. TOPS: Pyramidal or rounded. BRANCHES: Upturned near top, those of middle crown horizontal, lower ones drooping; whorls incomplete.
4. OVERMATURE. AGE: More than 300 years. DBH: Usually of large diameter. BARK: Light yellow, the plates very wide, long and smooth. TOPS: Usually flat and making no further height growth. BRANCHES: Mostly drooping, gnarled or crooked. (1)

In dividing trees into these four general age groups, more weight should be given to relative maturity, or what might be called "physiological age", than to exact age as indicated by annual rings. Some trees growing under favorable conditions, particularly on good sites, retain their youthful appearance and vigor much longer than do trees that have been forced to struggle against unfavorable environmental conditions, such as those on poor sites. Since trees must be judged largely on the basis of external appearances, those having all the outward characteristics of a given age group should be classed in that group, even though they are actually somewhat younger or older than the designated age limits.

The distinction between Groups 1 and 2 is based largely on color and roughness of bark. While both are sometimes called "bull pines" or "blackjacks", only the Group 1 trees have the rough black bark which is so typical of juvenile growth.



DESCRIPTION OF DUNNING'S TREE CLASSES FOR PONDEROSA PINE (MERCHANTABLE TREES)
Region 6

Age Classes (Approx.)	1 Immature- Thrifty (60-150 yrs.)	2 Immature- Thrifty (60-150 yrs.)	3 Thrifty- Mature (150-300 yrs.)	4 Mature (150-300 yrs.)	5 Over- Mature (Over 300 yrs.)	6 Immature (60-150 yrs.)	7 Mature Over-mature (over 150 yrs.)
Position	Isolated or dominant	Usually codominant	Isolated or dominant	Usually codominant	Isolated or dominant	Intermediate or suppressed	Intermediate or suppressed
Crown lengths (Approx.)	55% or more	Up to 55%	55% or more	Up to 55%	Any length	Usually short	Usually short
Crown width	Ave. or wider	Less than ave.	Ave. or wider	Less than ave.	Any width	Any width	Any width
Form of top	Pointed 	Pointed 	Rounded 	Rounded 	Flattened 	Pointed 	Flattened 
Vigor	Good	Good-Mod.	Moderate	Mod.-Poor	Poor	Mod.-Poor	Poor
Diameter (Approx.)	Rarely over 30"	Up to 24"	18" to 40"	Except for the small, poorly developed crown, smaller size, and lower vigor, similar to Class No. 3	Largest trees	12" to 16"	Rarely over 18"
Bark	Dark ridges or small plates	Dark ridges or small plates	Reddish brown, mod. rough plates		Light yellow, wide, long, smooth plates	Dark and rough ridged	Light yellow thin and flat
Foliage	Rich green, dense needles long and coarse	Rich green, mod. dense, needles long and coarse	Lighter green than #1, mod. dense, shorter than #1	Except for the small, poorly developed crown, smaller size, and lower vigor, similar to Class No. 3	Pale green, thin, tufty on ends of twigs	Not so dense as #1 and #2	Very thin, scraggly branches
Annual whorls	Distinct except on lower crown	Less distinct than #1	Nodes indistinct, branches drooping		Branches droop- ing, gnarled and twisted	Inter- nodes short	Indistinct. Branches gnarled and drooping
Decision as to cutting	Leave always	Usually leave except when thinning bull-pine clumps	Good to leave for seed, value, incre- ment and volume	Usually cut, smaller sizes may be left when possible to give half to full release	Cut, except when needed for seed or reserve	Usually leave except when thinning bull-pine clumps	Cut, except when possible to accord half to full release
Risks	Good	Good	Fair to good	Poor to fair	Poor to fair	Fair to good	Poor to fair

(OAKLAND-11-28-33-200)

Figure 2. Dunning's Tree Classification for Ponderosa Pine.

The change from Group 1 to Group 2 takes place at approximately 75 years of age in the site IV stands of southern Oregon. At that age there is a slowing down in the rate of height and diameter growth, narrow plates appear between bark fissures, and the bark starts to take on the reddish-brown color characteristic of maturity. Suppression in the seedling stage may greatly extend the period of juvenile growth and advance subsequent age limits. The distinction between mature and over-mature trees, Groups 3 and 4, is more difficult to recognize, and involves character of crown as well as bark differences.

VIGOR GROUPS:

In judging the relative vigor of different trees of a given age, the size of crown and abundance of foliage are probably the best outward indicators. Therefore, each age group is further subdivided into four sub-groups based upon relative crown vigor. These are designated by letters A to D as follows:

- A. Full, vigorous crowns, with a length of 55 per cent or more of the total height, and of average width or wider; foliage usually dense; position of tree isolated or dominant (rarely codominant); diameters large for age.
- B. Fair to moderately vigorous crowns with average width or narrower, and length less than 55 per cent of the total height; either short wide crowns or long narrow ones, but neither sparse nor ragged; position, usually codominant but sometimes isolated or dominant; diameters above average for age.
- C. Fair to poor crowns, very narrow and sparse or represented by only a tuft of foliage at the top; foliage usually short and thin; position usually intermediate, sometimes codominant, rarely isolated; diameters below average for age.
- D. Crowns of very poor vigor; foliage sparse and scattered or only partially developed; position suppressed or intermediate; diameters decidedly sub-normal, considering age.

By combining the four age sub-groups with the four sub-groups of crown vigor, a total of 16 classes were obtained which could be analyzed for relative susceptibility.

DEVELOPMENT OF TOOLS USED.

The marking axe that is used by the Forest Service has been a dependable tool used by timber markers for some time. In days past an instrument called a "sock" was used to some extent. This was nothing but a long narrow bag of loosely woven cloth tied on the end of a stick. The bag was filled with lime or plaster and when swung against the tree the lime or plaster sifted through the loose cloth of the bag leaving a white mark on the tree.

During recent years certain companies manufacturing equipment of lubricating purposes, have developed a gun for marking timber. This is similar to the oil spray guns used for lubricating springs of automobiles. A piston draws the paint up from the container of the gun into the cylinder and then when the trigger is pulled the paint is forced out through the nozzle. The container of the gun holds a pint of paint and a stream can be thrown approximately twenty feet from the nozzle, depending on the size of the nozzle used and to what extent the paint used is thinned. The proportions used are generally one part of white paint to three parts of kerosene or mineral spirits.

An extensive test of the practicability of this marking gun was made on the Edward Hines Timber Sale of the Malheur National Forest. The manufacturers advocated its use on the ground that it was lighter in weight, easier to get through the brush and cuts out the danger of carrying an axe over rough ground or through dense brush and reproduction. The tests made did not carry out these arguments, however.

It was found that the gun with a full container of paint weighed as much as the axe, and in addition, this supply of paint would not last more than a third of the day if the stand being marked had many trees to be marked. This makes it necessary to carry at least another quart of paint to reload the gun when the original supply has been exhausted, adding considerably to the weight that each marker must carry.

The fact that it was not necessary to walk directly up to the tree in order to mark it is true. The tree could be marked easily from ten to fifteen feet away except on very windy days. After the paint has been shot from the nozzle, it stays in a solid stream for a short distance and then tends to spray out. On a windy day the stream of paint may never reach the tree or it may be necessary to remark the tree in order to get it well marked. If the wind is blowing directly toward the marker the paint spray blows back on the marker, making the use of the gun undesirable. *Quite!*

The nozzle of the gun has a diameter of $1/32$ of an inch. In order to keep this from plugging with particles of pigment from the paint, the paint is forced through a fine screen before it enters the nozzle. After a short time, this screen has filtered out a sufficient quantity of the particles so that it is impossible to force the paint through the screen. These particles also cause excessive wear to the walls of the cylinder so that it is necessary to replace the cylinder with a new one from time to time.

Where timber is marked on a large scale, nothing as yet has been introduced that is as practicle and efficient as the marking axe.

MARKING RULES USED:

In order to give a clear idea of what trees are marked on a timber sale by the United States Forest Service, the marking rules for the Edward Hines Timber Sale are stated here. Live timber shall be marked for cutting as follows. Trees 22 inches D.B.H. and over.

Class 4 trees: All trees will be marked except those needed to furnish seed or fill openings and except Class 4A and 4B trees of relatively low value between 22 inches and 30 inches D.B.H., inclusive, which will be reserved in sufficient volume to offset the volume of Class 3B trees 30 inches D.B.H. and over which will be marked as described below. The necessary reserve will be attained by marking all trees with Grade 1 butt logs, regardless of grades of other logs in the tree, and by marking all trees with Grade 2 butt logs, Provided, that the second log is of Grade 3, or 4, or better.

Class 3A trees: No trees will be marked except those which, in the judgement of the Forest officer, should be cut from the standpoint of risk or in order to effect release.

Class 3B trees: No trees will be marked except those of high risk because of defects such as heavy lean, serious fire scar, and hazardous fork; and high value trees 30 inches D.B.H. and over which will be marked for cutting in a volume not exceeding an average of 500 board feet per acre. This volume of high value trees will be attained by marking all trees with butt logs of Grade 1 or 2, regardless of the grades of other logs in the tree, and by marking all trees with Grade 3 or 4 butt logs, Provided, That the second and third logs are Grade 3, or 4, or better.

Class 3C and 3D trees: All trees to be marked for cutting.

Trees of any diameter

Trees of any diameter or class may be marked for cutting which in the judgment of the Forest officer should be cut from the standpoint of risk or in order to effect release; Provided, That such trees shall contain at least one merchantable 32-foot log at least 12 inches in diameter at the small end, of a grade equivalent to that of a 32-foot Grade 4 log or better. The cutting of such trees less than 22 inches D.B.H. shall be optional with the purchaser. (7)

ACTUAL FIELD PROCEDURE

In the actual field work of marking timber no attention is paid to section lines except at the boundaries of the sale which have been previously run and posted with the Forest Service "TIMBER SALE BOUNDARY" sign. The whole work is done according to watersheds.

If the road construction is far enough ahead of the logging, the markers wait until the roads are built into the area to be marked. These roads, as a rule, follow along the streams or in the bottom of the draws. With the roads built into the area, the marker is afforded easy access to the timber to be worked, and can drive almost directly to his work in a car.

When two or more markers are working together one man "leads out" about five chains ahead of the next man. Each marker takes a strip about five chains wide from the bottom of the draw and marks this strip to the ridge top. The marker in the lead will "lead out" and keep one edge of his strip in the bottom of the draw and with his marking axe chop a shallow ring in the bark of the trees on each edge of his strip. The marker following behind him will work from this line of rings keeping his strip wide enough that he will be able to keep within about five chains of the man in the lead and ring the trees on the outside of his strip. If the timber is sparse, he will be able to widen his strip while the denser the timber, the narrower the strip must be in order to cover the ground well.

When the strips have been run through from the bottom of the draw to the top of the ridge, the man who is last in line doubles back on his own rings after the end of each strip has been closed off by ringing the bark of the trees along the ridge top. This is done because the man on the outside is better able to follow his own rings back to the starting point than the others would be. That is, the man who was last in line on marking up the ridge leads out and the others fall in behind him and the original "lead out" man is the last in line.

The strips are much easier worked directly up and down hill than if they run along the side of the hill because the greater distance walked is back and forth across the strip and not parallel to it. This keeps the amount of climbing at a minimum, and thus speeds up the work and increases the amount of ground that can be covered by each man.

In order to work rapidly and efficiently, the marker must judge the trees to be marked while he is still some distance from them. It is difficult to judge the crown class from directly under the tree, and if the marker does not decide whether the tree is to be marked or not before he gets to it, he must walk away from the tree in order to get a better view. It is then often necessary to view the tree from several different angles taking more time and effort, while if he keeps looking ahead on the strip, he will get a view of the tree from several different angles while he is crossing and recrossing his strip. This is the principal

factor that makes marking up a slope slower than marking down the slope. While coming down hill, the marker is afforded a good view of the tree at all times as the crown is more or less level with him, while the reverse condition is true while working up hill.

When a marker has decided that a tree is to be marked, he stands on the downhill grade of the tree and makes a smooth, shallow blaze in the bark with his axe and then stamps in the blaze a U. S. with the brand on the reverse side of the axe. This blaze should be about shoulder high or perhaps a little higher, depending on the steepness of the ground. Then the stump blaze is put on in exactly the same manner. This blaze should be as close to the ground as possible, because of the low stumps now being cut. The stump blaze should be at a right angle or a quarter of the way around the tree from the tree blaze. The marks are put on in a quartering position in order to facilitate easier checking of the marked trees.

The reason for placing the tree blaze on the downhill side is so that it may be more easily seen by the fallers. The timber is laid out in strips five chains wide before falling starts; each set of fallers working within their own strip. As a rule, they begin working at the bottom of the hill and work toward the top. If, however, this is not the case, they know exactly where to find the mark if it is not readily visible and do not have to look around the tree for the mark. In this way, fewer marked trees are

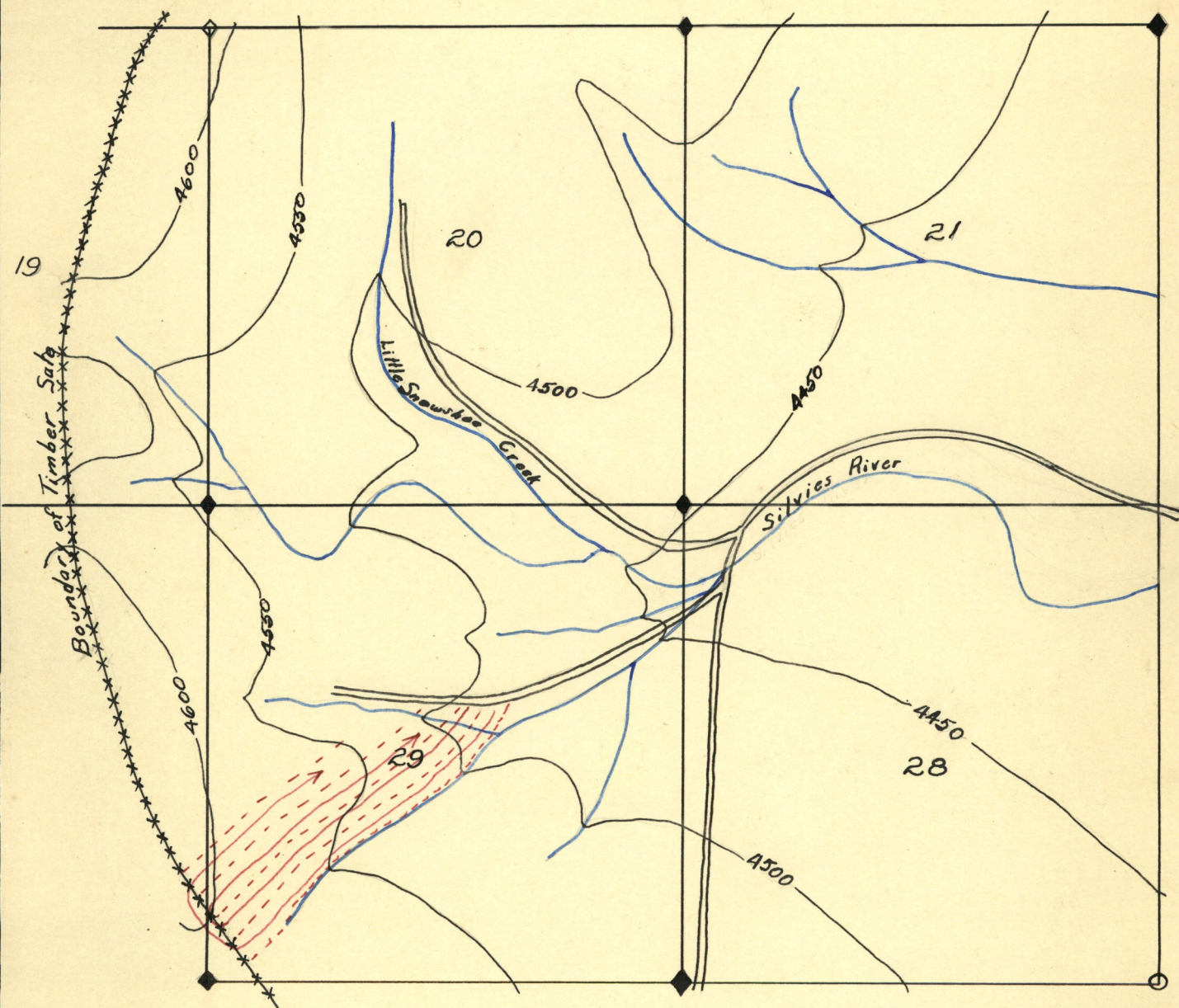


Figure 3. Illustrating how marking is carried out in accordance with the drainage and how the markers follow in order.

Dotted red lines ----- indicate edge of each strip.

Solid red lines ———→ indicate the path of each marker and the strip marked by him.

missed by the falling crews.

A good rule to follow is always to be on the lookout for missed trees when walking through an area of marked timber. Since the marker often gets a view of a tree from a different angle while just walking through again, many missed trees are picked up.

MARKING COSTS:

Marking costs are difficult to compute as it is hard to say what costs are contributed directly to marking. If a marker goes into the field and posts boundary signs during the day, these costs may go toward the marking and yet there has been none of this work done.

During the fiscal year of 1936 the cost of marking was reported to be \$.0337 per thousand. This marking was done under the old cutting practice. In the fiscal year of 1937 the cost was reported as \$.0285 per thousand. However, this latter figure was somewhat complicated by re-marking and other factors. (4)

As stated above, re-marking is one of the factors that complicates the computation of marking costs at the present time. Much timber has been marked on the different timber sales under the old cutting system. This has to be gone over since the new system has been adopted and re-marked in accordance with the marking rules. This is a slow and tedious task and has decidedly increased the marking costs on several timber sales. Instead of following the procedure as stated before, the markers go through on strips as in marking, and with a crayon cross out the marks on the trees which are not to be cut under the present marking rules. If the timber has been marked for any period of time, the blazes have darkened and are often times hard to find or reproduction and brush have grown up around the tree. No attention is paid to the stump blaze, however; only the tree blaze is marked out.

CONDITION OF THE RESIDUAL STAND:

Under the old system of marking where 80% of the stand was removed and 20% left standing, a stand averaging 14,000 board feet per acre the cut average 11,200 board feet left a reserve of 2,800 board feet. An average of 12 trees per acre was marked.

The types of trees left were Keene's 3A's 3B's and all in the 1 and 2 classes.

Today under the 40% cut, an average of 4 trees per acre are marked and 13 trees per acre are left. The take averages about 5,500 board feet per acre and the leave about 8,400 board feet.

Naturally, the marked trees are the older, larger trees and of high quality with the reserve being made up on the classes 1, 2, and 3 trees with thrifty crowns. Class 3C trees over 22" in diameter being marked.

INSECT CONTROL.

No direct insect control measures are initiated under any methods of cutting, but it is an accepted fact that through light marking the loggers are taking the trees most susceptible to insect attack by the rapid cutting over of the forested areas. Losses from insects in the residual stand are light under any selection method of marking practiced in Ponderosa pine. However, the lightly cut areas are yet too new to be able to tell what the losses might be.

In the Edward Hines Timber Sale area of the Malheur National Forest, beetle control plots of 320 acres each were

established in 1938 over the light cutting area by the Pacific Northwest Forest Experiment Station. These plots will be checked annually for insect and other losses. Location of the plots are staggered to give a good cross section of the area treated and number six or seven to the township.

UTILIZATION.

Since cutting is mainly in the larger and older trees, the percentage of defects is greater and utilization in the tops is not as close under the new method of marking as under the old. For example, a grade 6 log (the upper logs in the tree) has a zero value below 18" in diameter and a grade 5 log has a zero value below 15" in diameter.

Where the defect in logs hauled to the mill under an 80% cutting was 4% the same volume now on a 40% cutting contains from 7 to 8% defect.

CONCLUSIONS.

" In comparing the merits of one system of selection cutting with another, that is, light versus heavy cutting, the effect upon the whole forest should be considered and not the effect upon the current cutting area alone. Thus, considering the whole forest, it is more desirable to remove the most overripe half of the mature trees from the whole area in 30 years than to take twice that length of time to get over the whole area with a cutting that takes all the mature trees. In this way a 30 year cutting cycle converts the whole forest from the stagnant to the growing condition twice as quickly as does a 60 year cutting cycle."

" If a large percentage of the stand is cut, the forest capital is so reduced that the net increment is small, even though mortality is nearly eliminated and the growth of all trees is good. Thus in one case it was calculated that after an 80 per cent cut the net annual growth per acre will be 72 board feet, while after a 40 per cent cut it will be 94 board feet, in a stand which in the virgin condition is making a gross growth of about 120 board feet per acre per year."

" The shorter the cutting cycle the better the chances for salvaging before deterioration, windfalls and insect-killed trees in the course of regular periodic cutting."

" The lighter the cut, the greater will be the logging cost per thousand board feet. With the modern tractor and truck logging, the fixed per acre costs are so small that the

cost does not increase rapidly with lowering of the cut. Lighter cutting also lowers the charges for slash disposal and cut-over land protection."

"Following this system the whole forest is more quickly put under control with roads, and hence the better will be the opportunities for special salvage cutting of timber killed by fire, insect epidemic or wind throw."

-Pac. N.W. For. & Range Expt. Sta.

LITERATURE CITED:

1. Journal of Forestry--Volume 34.

Personal Correspondence

2. C. W. Waterbury, U. S. F. S. Timberman, Edward Hines Timber Sale.
3. O. F. Ericson, U. S. F. S. Assistant Regional Forester Division of Timber Management.
4. J. M. Whiteside, U. S. F. S. Assistant Entomologist Pacific Northwest Forest Experiment Station.
5. Loren L. Stewart, U. S. F. S. Timberman Baker, Oregon
6. Instructions for Marking Timber in the Yellow Pine Region. August 2, 1923.
7. Marking Rules of Edward Hines Timber Sale. Seneca, Oregon

Entire
Bibliography
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