

FOREST SERVICE PRACTICE
IN SELECTION CUTTING
OF PONDEROSA PINE

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INTRODUCTION

"In the uneven-aged virgin Ponderosa Pine forests of eastern Oregon and eastern Washington are found trees of all sizes and ages and in all stages of development, from thrifty young 'bull' pines to over-mature veterans several hundred years in age. Some are growing relatively fast, others exceedingly slow. Some are of high value, others of low or negative value. Here, in brief, are found wide variations both from the silvical and from the economic point of view--important differences in present value and in present and probable future earning power as influenced by growth rate, risk and life expectancy." (1)

It has long been thought that the most effective method of management for these forests is on the sustained yield basis--"to perpetuate the forest by regrowth after cutting, and to maintain in a given local district or on a given forest enough growing stock to provide raw materials for industry without interruption." (2) The cutting practice heretofore followed on private lands has been to cut all trees that would be economically profitable, usually comprising 80 to 90% of the original stand. This would be included in the term "selective logging" as now practiced by some lumbermen, but would only be profitable on a short term basis and not after the first immediate cut.

The United States Forest Service, thru a comprehensive investigation of the economics of Ponderosa Pine management,

has arrived at the conclusion that a light selection cut or economic maturity selection cut would be advantageous in many ways. This would comprise a light initial cut, followed by light and frequent return cuts. From an intensive study made on the Hines timber sale area (a representative stand of Ponderosa Pine) a 40% initial removal promised gratifying results. This marking was based primarily on selection of high value, over-mature trees which constituted on the whole, the least productive element of the stand. The removal of such trees converts the stagnant forest into a productive one.



Figure 1

A Stand of Selective Cut Timber

During the first cutting cycle, the net stumpage realization per M was nearly twice as high as under the system of heavy cutting. The heavy reserve stand produces approximately three times as much increment, due to only relatively fast growing trees being left. Another advantage is that the increment value is more than five times as great as on a light reserve stand.

Another advantageous possibility to consider would be to effect gradual site improvement through return of the slash to the soil. Under light selection, general slash disposal by burning is not deemed necessary. The productive capacity of the forest area might be increased by the creation of a duff layer to hold moisture. The light selection cut would serve to maintain natural forest conditions, thereby minimizing loss by blow down, build up the soil, lead to the rapid creation of a road system, decrease danger of beetle infestations and facilitate fire protection. The foregoing results applying specifically to the Hines sale area, could apply in principle elsewhere.

For the private timber owner who has only a relatively short time supply of over-mature timber and wishes to liquidate, the sustained yield system of management is not equitable in most cases. The timber owner is a business man in the game for a profit, too often concerned with immediate problems, and unable to hold the timber for an indefinite time. Often the tax situation, where the stand is over ripe and remaining equal or losing in increment, also forces the

private owner to liquidate from a sound business standpoint.

However, the United States Forest Service through a pre-cutting agreement has given the private owner an alternative if he wishes to cut on a sustained yield basis; thereby benefiting himself, stabilizing the community payroll and helping the National Government to put into use some of their unproductive land. This policy, which would involve taking only a light cut on the private land after which the private owner would transfer his operation into Forest Service owned timber for the removal of a light initial cut of over-mature trees of equal exchange value of his residual stand plus the value of the title to the land. There is no monetary transaction; all values being exchanged in timber. This method of handling the Ponderosa Pine forests would serve two purposes; to keep private timber lands productive, and to bring non-operating over-mature stands on Forest Service land into production at an earlier date. This system of liquidation by exchange allows the Forest Service to use its now idle timber capital.

It is the practice used in the acquisition of private timber lands by the Federal government through exchange by economic maturity selection, that I will illustrate on the following pages.

BASIS FOR ECONOMIC MATURITY SELECTION
AS USED BY THE U. S. F. S.

To illustrate the above practice a hypothetical case study has been prepared. The actual figures have been omitted, the procedure only being given.

The preliminary work consists of the initial offer of exchange being considered, satisfactory arrangements being made between both parties as to logging, location of exchange and many minor items.

After a preliminary agreement has been reached, the field work by a Forest Service representative is commenced. The field work consists of:

I. Log Grade and Structure Cruise

The following outline of procedures and general instructions is recommended for the proposed cruising.

1- Quality cruise of an approximate minimum of five hundred trees which is necessary for a good stand analysis. The circular plot method of cruising is to be used, a brief outline as follows:

The South East corner of each section to be covered by the plot method of survey is theoretically assumed to be the initial point of survey. The reason for adopting this corner as the initial point is to eliminate the possibility of corrections in chaining distances along section lines when closing in on Township and Range lines. It is of course expected that the cruiser will have accurate map data with him whenever his work is concerned with the irregular sections

of a Township, so that he may orient himself accordingly.

The plot cards now used have spaces provided for designating the Section, Township, and Range and also for showing plot number. Instead of using a plot number, it has been found simpler and much more definite to describe the plot by reference to its distance in chains both North and West from the South East corner of the section. To be consistent and to facilitate systematic sorting and filing of data, the men are instructed to enter first the distance North, followed by distance West--for instance 30 N 70 W. This description would of course imply that the location is 30 chains North of and 70 chains West of the South East corner of the section. To further define the location, on the marker left on the ground at the plot center, the section to which it applies is indicated thus: 23-30N70W. The figure 23 would therefore be used as a prefix for all plot descriptions in that section.

This system is practical for use regardless of the cardinal direction in which the compass lines run when establishing the plot locations, but as pointed out previously, it is imperative that the cruiser know the position in reference to the South East corner. Especially is this true if he were to start his compass course from a township or range line forming the boundary of an irregular section.

The spacing of the compass lines or distances between plot centers does not in any way affect the practical application of the system, and when the system is properly used, no doubt is left as to the location referred to.

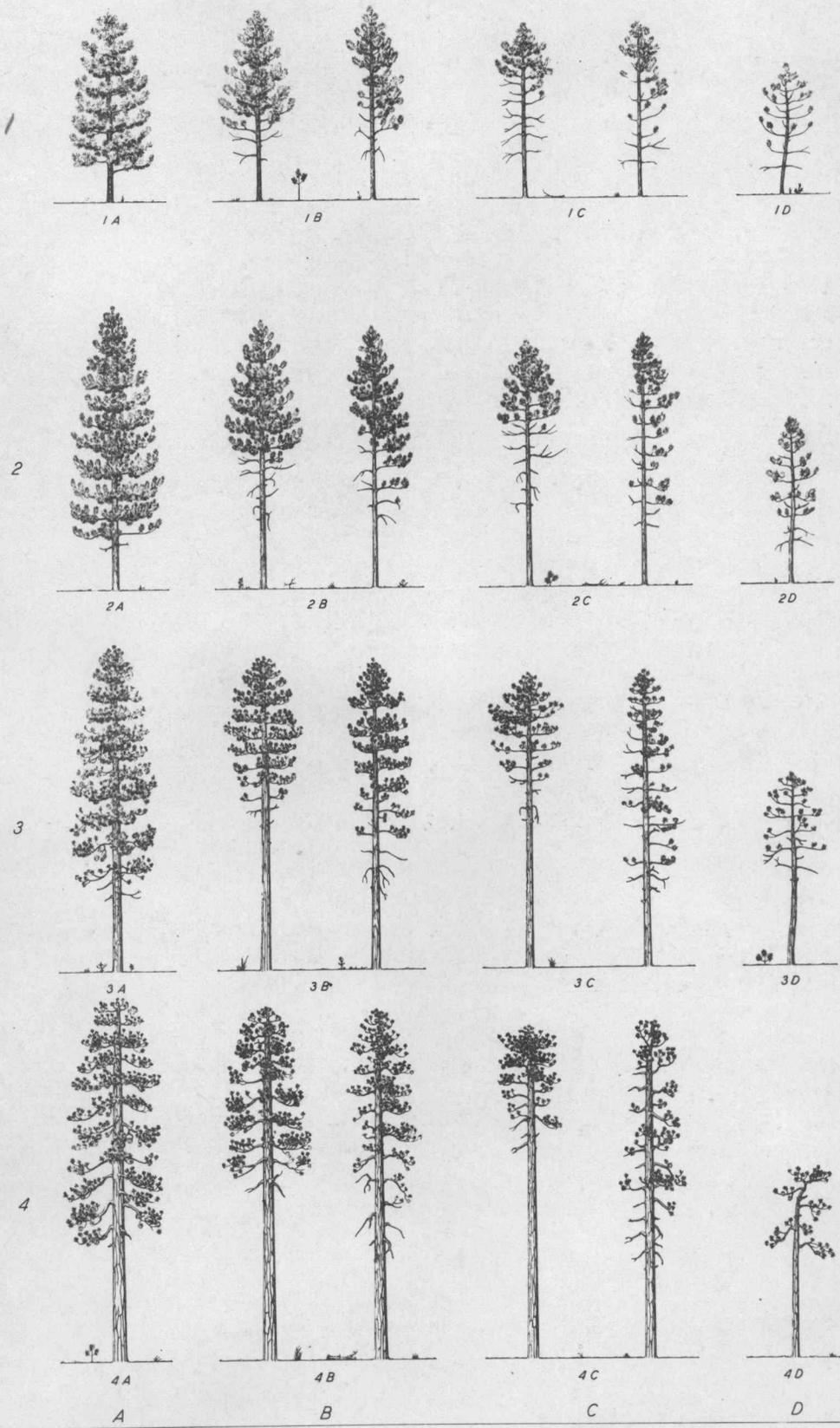
- a. D.B.H. of each tree 12" and over to nearest 2".
- b. Number of 16 foot logs to Washington Office table top diameters for Class 3 and 4 trees and Hanzlik table for Class 1 and 2 trees, for each tree.
- c. Keen tree class of each tree. "This tree classification is illustrated in the accompanying chart. 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 new classification uses these same basic characteristics to regroup all ponderosa pines into a larger number of 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 the 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.

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

1. YOUNG. Age: Usually less than 75 years. D.b.h.: Rarely over 20 inches. Bark: Dark grayish-brown to black, deeply furrowed, with narrow ridges between the fissures. Tops: Usually pointed, with distinct nodes. Branches: Upturned and whorls.

A PONDEROSA PINE TREE CLASSIFICATION
FOR COMPARISON OF BARKBEETLE SUSCEPTIBILITY
CLASSES BASED ON AGE AND VIGOR



2. IMMATURE. Age: Approximately 75 to 150 years. D.b.h.: 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. D.b.h.: 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. D.b.h.: Usually of large diameter. Bark: Light yellow, the plates usually very wide, long, and smooth. Tops: Usually flat and making no further height growth. Branches: Mostly drooping, gnarled, or crooked.

"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 largely based on color and roughness of bark. While both are sometimes called "bull pines" or "black-jacks", only the Group 1 trees have the rough black bark which is so typical of juvenile growth. 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 overmature trees, Groups 3 and 4, is more difficult to recognize, and involves character of crown as well as bark differences.

"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 subgroups 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 subnormal, considering age."(4)

d. Log grading of each tree. Ponderosa Pine
Log grade descriptions:

"Grade 1: Shall be smooth and surface clear without indications of knots near the surface, providing, however, that 1 pin knot is permissible any place on the log.

"Grade 2: Shall be smooth and surface clear on three faces but with knots permissible on the fourth face; or shall be smooth and surface clear on the lower three-fourths of the length, above which a few knots are permissible; or shall be smooth and surface clear to within 2 feet of the upper end, above which any number of knots are permissible. In any case 1 pin knot is permissible on the clear portion of the log.

"Grade 3: Shall display knots which may vary from small black knots to large sound or unsound knots but which are spaced at least 3 feet apart (longitudinally) when the knots are staggered or 6 feet apart when they are in solid whorls. The surface clear areas must aggregate at least 50 percent of the total surface of the log, provided that each clear area must be at least 4 feet long by one-fourth the circumference in width.

"Grade 4: Shall display numerous small and medium-sized red (live) knots, provided, however, that black (dead) knots which in the grader's judgment will cut out sound beneath the surface (usually on black barked logs) are permissible. The size of the knots shall be proportionate to the size of the log. For a 12-inch log 2-inch live or 1-inch dead knots and for a 24-inch log 4-inch live or 2-inch dead knots are permissible. An average longitudinal spacing of not less than 2 feet shall be required for logs with maximum knot sizes.

"Grade 5: Shall display numerous live and/or dead knots, the maximum size of which shall be proportionate to the size of the log. For a 12-inch log, 4-inch live and 2-inch dead knots, and for a 24-inch log, 5-inch live and 3-inch dead knots, and for a 36-inch log, 6-inch live and 4-inch dead knots are permissible. An average longitudinal spacing of not less than 2 feet shall be required for logs with maximum knot sizes.

"Logs with larger knots shall also be admitted to this grade if their surface clear areas aggregate at least one-third of the total surface of the log, provided that each clear area must be at least 3 feet long by one-fourth the circumference in width.

"Grade 6: Shall be rough, coarse or densely knotted logs unsuited to any of the previous grades.

"General Considerations: Foregoing specifications as to spacing between knots refer to distance between knot or limb edges rather than from center to center. Defects for which deductions are made in scaling shall not be considered in determining log grades. Standing trees shall be graded on the basis of 16-foot logs and each log shall be graded solely on the basis of its own grade characteristics, i.e., the grade characteristics of adjoining logs shall not be allowed to influence the grader's judgment."

1. Log grade all logs to the W. O. table top diameters or Hanzlik top diameter.
2. No top diameters of logs to be taken.
3. In case of trees with top diameters of last log much in excess of that given in the W. O. or Hanzlik volume tables, estimate the the top diameter of the last log and record it on the card in the proper place.
4. Do not log grade any tree below 16" D.B.H.

- e. Place plot number, section and township number on each card.
- f. Place ownership on each card at night and not in the field.
- g. Use one card for each tree and use only one side of the card.
- h. Estimator's initial on each card.
- i. Enter as far as possible the W. O. table volumes for Class 3 and 4 trees and Hanzlik's volumes for Class 1 and 2.
- j. In addition to the above information, all trees unmerchantable according to accepted local standards of utilization should be identified by writing "unmerch" or "non-merch" prominently on the card. On some cards "cut" and "leave" will be indicated to show where actual practice should vary with a general or paper marking rule.

Office work consists of:

1. Stand structure data

- a. Entering the volumes on each card for each tree in board feet.
- b. Entering the top diameter of each log which has been log graded, using a taper table. Example of a taper table is shown on the next page.
- c. Divide the cards by ownership--one pile for National Forest, and one pile for each private ownership.
- d. For each ownership divide the cards into piles by tree classes, throwing all Class 1 and 2 trees into one pile. Place the trees in each pile by diameters.

Figure 4

Taper Table for Ponderosa Pine
 Made from Hines' Study on Malheur Nat'l Forest

D.B.H.	Number of Logs								D.B.H.	Number of Logs							
	1	2	3	4	5	6	7	8		1	2	3	4	5	6	7	8
12"	9"	7"							28"	21	17						
	Top diam.									22	19	14					
										23	21	18	12				
14"	10									23	21	19	16	11			
	10	9								23	22	20	18	15	10		
	11	9	8							24	22	20	19	17	14	10	
16"	11								30"	24	21	16					
	12	10								25	22	19	13				
	12	11	9							25	23	21	17	11			
	13	11	11	8						25	23	22	19	16	12		
										25	23	22	20	19	16	11	
18"	13	11								25	23	22	21	20	19	15	10
	14	12	10						32"	25	22	16					
	14	13	12	9						26	24	20	14				
	14	13	12	11	8					26	25	22	19	12			
										26	25	23	21	17	12		
20"	14	12								26	25	24	22	20	17	11	
	15	14	10							26	25	24	23	21	20	16	10
	16	14	13	9						26	25	24	23	21	20	16	10
	16	15	13	12	9												
	16	15	14	13	11	8			34"	27	24	16					
										28	25	22	15				
22"	16	14								28	26	24	19	13			
	17	15	11							28	26	25	23	18	13		
	17	16	14	11						28	27	25	24	21	18	12	
	17	16	15	13	10					28	27	25	24	23	21	18	11
	18	17	15	14	12	8											
	18	17	16	15	13	12	7		36"	28	25	17					
										29	27	23	16				
24"	18	14								30	27	25	21	15			
	18	17	12							30	28	26	24	19	14		
	19	17	16	11						30	28	27	25	22	19	13	
	20	18	16	14	10					30	28	27	26	24	22	19	12
	20	18	17	15	13	9											
	20	19	17	16	15	13	8		38"	32	28	24	17				
										32	29	26	22	15			
26"	19	16								32	30	27	25	21	14		
	20	18	13							32	30	29	26	24	19	13	
	20	19	17	12						30	28	27	26	24	22	19	12
	21	20	18	15	10												
	21	20	19	17	14	9			40"	33	30	25	18				
	22	20	19	17	16	14	9			33	31	28	23	16			
										33	32	29	26	22	15		
										34	32	30	27	25	20	14	
										34	32	30	29	26	24	20	13

Figure 4 (Cont.)

Taper Table for Ponderosa Pine

D.B.H.	Number of Logs								D.B.H.	Number of Logs							
	1	2	3	4	5	6	7	8		1	2	3	4	5	6	7	8
42"	35	32	26	18					44"	37	35	33	29	25	18		
	35	33	29	24	17					38	35	34	31	28	23	17	
	35	33	31	27	23	16				38	35	34	32	29	26	22	14
	36	33	32	29	26	21	15			39	37	35	32	29	27	22	17
	36	33	32	30	28	25	21	14									

- e. Enter on stand structure table for each ownership all the trees which were classified (12" and over) by diameter and volume giving total number of trees and total volume in board feet. For an example of the form used for the stand structure table see Figure 5.
 - f. Total all vertical and horizontal columns.
 - g. Compute percentages on bottom of form.
 - h. Fill out completely the top of the stand structure form.
2. Log grade data
- a. Determine what marking rules to be followed. Following is an illustration of marking rules used in one specific instance:
Leave--under Keen's tree "Classification"
 - (1). All 1's
 - (2). All 2's (except those C's and D's which are large enough to be merchantable).

(3). All 3A's and B's (Except those which have heavy fork, bad fire scars, heavy lean and bad fire scars.

(4). All 4A's where they are needed to fill openings.

Cut--

The remaining tree classes under Keen's Tree Classification.

This marking practice leaves a group of trees most resistant to pine beetle attack and also leaves that group in the forest that is of the age to grow the most increment.

- b. Divide the cards for each ownership into two piles--cut pile and leave pile, based on the marking rules.
- c. Determine minimum merchantability standard for log grades 4, 5, and 6; i.e., all grade 4 logs below 10", grade 5 below 12", grade 6 below 15", or whatever standard is deemed to be applicable.
- d. Enter all logs on the log stock table--see Figure 6--for the cut ones, one form, and for the leave another and for each ownership, using the dot system.

Figure 6
LOG STOCK TABLE

National Forest _____
 Name of Area _____
 Acreage of Area _____
 Acreage actually covered by log
 grading _____
 Name of log grader _____
 Date of log grading _____

Top Dia- meter	Grade 1		Grade 2		Grade 3		Grade 4		Grade 5		Grade 6		All Grades	
	No.	Vol.	Number	Volume										
6														
7														
8														
9														
10														
11														
12														
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43														
44														
45														
46														
47														
48														
49														
50														
51														
52														
Total														

Log Diameters by 3" Classes

Lumber Grade	18"	21"	24"	27"	30"	33"	36"	39"	42"
	% Cut /M of Each Grade								
C & Btr.	7.46	8.62	22.47	19.60	19.30	14.83	18.94	14.10	19.93
D. Sel.	23.08	24.67	29.79	25.98	26.71	33.05	31.64	38.65	25.80
Misc. Sel.	1.13	2.40	5.40	1.81	7.35	9.09	7.34	4.62	13.07
1	--	.13	.03	.04	.16	.16	.34	.08	--
2	--	2.48	.88	.76	1.29	.71	2.74	1.76	.21
3	--	.65	.23	.20	.35	.19	.73	.48	.05
4/4s	--	.04	--	.17	.09	.25	.02	.32	.13
1 & 2 Com.	--	--	.28	--	--	--	.12	--	--
3 Com.	3.62	--	.73	--	.70	.82	1.02	.42	--
4 Com.	1.13	1.04	1.15	.44	.66	.45	.46	.59	.19
Sht. Com.	--	.26	.12	.17	.04	.02	.15	.14	--
Box	63.58	59.71	38.92	50.83	43.35	40.43	36.50	38.34	40.62
% Total	100	100	100	100	100	100	100	100	100
No. Logs	2	7	14	13	14	13	15	16	3

Figure 7

Lumber Grade Recoveries--% of Shipping Tally--Grade 1 Logs

- h. Compute the percentages from the totals of the vertical columns.
- i. Enter the Scribner volumes opposite the "All Grade" volumes for each diameter.
Eliminate the logs and volumes which are regarded to be unmerchantable, but keep a record of these unmerchantable logs by log grade diameter and volumes on a separate form.
- j. Total the shipping tally and the Scribner volume and compute overrun.
- k. Then multiply the above total in each grade of lumber by the selling value and total.

Figure 8

An Example of Representative Selling Values

	\$/M		\$/M
C & Btr.	61.16	4/4 Shop	19.64
D. Sel	45.54	1 & 2 Com.	27.05
Misc. Sel.	50.00	3 "	18.22
No. 1 Shop	35.22	4 "	13.96
No. 2 "	23.16	5 "	9.25
No. 3 "	15.88	Box	12.00

- l. Total the column to find log selling price per M.
- m. An appraisal is then made on the following order to determine the conversion value sacrificed by selective cutting, mature Forest Service timber being marked to equal that value.

Appraisal (taken from an actual exchange)

	Clear Cut Cost M.b.m.	Selection Cut Cost M.b.m.
Logging Costs		
Falling & Bucking	\$1.15	\$1.15
Skidding	.75	.75
Loading	.53	.53
Transportation		
Construction	.26	.38
Maintenance	.15	.20
Hauling	2.29	2.29
Unloading	.02	.02
Depreciation	.78	.78
Equipment Maintenance	.10	.10
General Overhead		
Insurance	.30	.30
Supervision	.43	.43
Slash Disposal	.03	.15
Total Cost Log Basis	6.79	7.08
Log Selling Price-----Territory	10.50	10.86
Margin per M	3.71	3.78

The aggregate value for clear cutting (entire cruise estimate) and for selective cutting (that which the Forest Service marks for removal) is found, the difference being the income less selective cutting or conversion value sacrificed. This value is then exchanged for an equal value of For. Service timber after a suitable appraisal has been completed.

PROBLEMS ARISING FROM SUCH PRACTICE

It is to the best interests of the country at large and especially to that area embracing the Ponderosa Pine region to have the private timber lands cut on a sustained yield basis, thereby insuring a constant payroll from lumbering and a continued yield of range grasses, irrigation, water and tax revenue.

At the present time the government can offer practically no inducement to the owner of private timber lands not to cut every tree he can market, because the Forest Service cannot prepare a definite contract until after the private owner has finished logging. If the Forest Service could obligate the government to grant a definite value to the property as a consideration for marking trees it desires to have left, logging in such a manner as to protect the second growth, and disposal of the slashings in accordance with approved forestry practice, the above lack of initiative would be remedied.

The loss of present tax revenues of the county, due to decrease in taxable wealth is increased proportionally with the acreage exchanged. As the governmental expenditures of the county are relatively stable, this will mean the shifting of the tax burden, mainly to agricultural lands. As the law now stands, the counties receive no immediate income from such exchange transactions, for no cash changes hands when the size of the national forest

is increased by exchange of mature timber, but private acreage is removed from the tax rolls. Under the present statutes the counties now receive 25 per cent of all cash income derived from national forests, but under this new practice of acquisition it is the next cutting cycle, or 30 to 60 years, before any return to the county is realized from another timber crop on national forest land.

As a suggestion for improvement of this situation, the tax law could be changed so that the county would receive an immediate credit of 25 per cent of the appraised value of the private property so acquired. This amount could be paid by the government at the rate of 10 per cent per year out of the retained percentages of national forest revenues; thereby, the counties would be relieved of the immediate tax problem.

This proposal would not require an annual specific appropriation by Congress for support of the counties. This annual specific appropriation, a proposition backed by an association of several Oregon counties, would probably be unsound as it would depend upon political favor and cause hardships for any county whose income was subject to severe fluctuations.

It is only fair that the Federal Government, as a consideration to the County government which has made past expenditures for the benefit of the property and

which has bonded its future upon this property, should pay some consideration to the county in part payment of the decrease in taxable wealth or in partial reimbursement for the taxes it would have received if the government had not adopted its present practice of enlarging the national forests.

I believe the Forest Service method of exchange is fair and just to both parties involved, being based upon the latest and most accurate data that can be collected. It is entirely justified where such purchases and exchanges will insure the economic stability of sound economic units, although the revenues from the lands so acquired should be divided among the counties as though this property had always been in public ownership

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