PHOTO SERIES FOR QUANTIFYING FOREST RESIDUES IN THE:

PONDEROSA PINE TYPE PONDEROSA PINE AND ASSOCIATED SPECIES TYPE LODGEPOLE PINE TYPE





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ABSTRACT

Six series of photographs display different forest residue loading levels, by size classes, for areas of like timber type and cutting practice.

Information with each photo includes measured weights, volumes and other residue data, information about the timber stand and harvest or thinning actions, and fuel ratings.

These photo series provide a fast and easy-to-use means for quantifying and describing existing and expected residues.

KEYWORDS: Residue (forest), residue management, fuel (waste wood), slash (ponderosa pine) (lodgepole pine), management (forest), forest residues estimation.

COOPERATIVE ACKNOWLEDGMENT

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LIST OF PLANT SPECIES CITED

METRIC CONVERSIONS

1 acre = 0.4047 hectare
2.471 acres = 1 hectare
1 cubic foot = 0.02832 cubic meter
35.31 cubic feet = 1 cubic meter
1 foot = 0.3048 meter
3.281 feet = 1 meter
1 inch = 2.54 centimeters
0.3937 inch = 1 centimeter
1 ton (short) = 0.907 ton (metric)
1.102 tons (short) = 1 ton (metric)

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WHAT ARE THESE PHOTO SERIES?

These photo series are arrays of photos, with each array showing different residue loading levels generated from like timber types and cutting practices. Each photo is supplemented with information which includes:

- Measured quantities by size classes, average depth, ground area covered, and other residue data.
- Harvesting or thinning information.
- Fuel ratings.

Thus, the series provide a basis for quantifying and describing existing and expected residue loadings on other areas and serve as a communication link between users.

WHY ARE THEY NEEDED?

Timber harvesting, silvicultural practices, and land clearing operations annually generate forest residues on millions of acres in the Western United States where these photo series may have application. Projected increase in demand for wood products and the trend away from clearcutting practices will increase this acreage if the cut remains constant or increases.

Although some residues are beneficial for such purposes as nutrient cycling, soil protection, wildlife cover, and microclimate effect, excessive residues adversely affect the forest environment in many ways. Much of the forest contains residues in undetermined but excessive quantities from the standpoints of resource use, protection, and management. To reduce residues to a level considered desirable, estimates are needed on quantities that now exist or will be created by some activity.

Inventory techniques, such as the planar intersect method, are very useful when a high degree of accuracy is needed but are time consuming and costly to apply extensively. Photo series can be used to make fast, easy, and inexpensive quantifications of residue, adequate for most management needs.

There has been no way for all resource disciplines to become readily familiar with residue volumes and descriptions so that they can make quantitative inputs to residue management. Likewise, because fuel rating systems are specialized and subjective, they too are not readily adapted to other environmental components. These deficiencies can be overcome with the photo series.

HOW CAN THEY BE USED?

Inventory of Down Residue

Loadings in various residue size classes, average residue depth, and ground area covered are characteristics that are visible in the photographs: hence, users can

estimate any of these characteristics on an area being inventoried by comparing them with the photos as follows:

- 1. Observe each characteristic of the residue on the ground (e.g., 3.1- to 9-inch loading).
- 2. Select a photo which nearly matches, or photos that bracket, the observed characteristic.
- 3. Obtain the quantitative value for the characteristic being estimated from the data sheet accompanying the selected photo (or interpolate a value between photos).

These steps are repeated for each characteristic desired. If the general area being inventoried has zones of obvious differences in residue loading, the user should consider making separate determinations for each zone, which can then be weighted and cumulated for the whole area.

Residue characteristics not distinguishable in the photographs are duff and litter depth, proportion of sound residue by species, and proportion rotted. If values for these characteristics are desired in an inventory, they must be derived from independent sampling or observations.

Inventory information can be used by land managers to (1) evaluate impacts residues have on various aspects of forest management, (2) identify areas of unacceptable residue loading, (3) identify priority areas for treatment, (4) estimate amount of utilizable material, and (5) predict fire behavior characteristics.

Determination of Desired Residue Level

Land management objectives can be more nearly achieved if a team of appropriate specialists can participate in specifying residues which should remain on site after completion of a cutting activity. Individuals helping with these determinations can study the photo series to recognize the appearance of various quantities and distributions of residue. With this knowledge, each individual can describe in quantitative terms the residue he believes should be retained to meet environmental concerns and goals of his particular specialty. The group can then use the photo series as a communication tool to resolve differences in arriving at a desired level.

After treatment, the degree to which objectives were achieved can be judged by comparing observed posttreatment loading with the desired level description.

Prediction of Residues From Planned Cutting and Residue Changes From Treatments

Photo series are a rudimentary aid for predicting amounts of residue from cutting and residue changes from treatments. Many factors, such as condition of timber stand, topography, logging method, and utilization intensity, affect the volume of resulting residues, so users should bear in mind that these series depict only a few of the possible combinations.

To predict residue volumes from planned cutting, the user compares timber volume and size information from cutting plans with this kind of information in the

photo series. Selecting a photo series level or levels with similar stand characteristics, the user refers to data sheet loadings, considers factors which differ from the photo series situations, and quantifies the loading expected.

Predicted loadings can be used to support changes in cutting and removal actions and to plan appropriate treatments.

To predict residue changes from treatments, the user studies the treated and untreated levels in the photo series to gain knowledge of relative changes or reductions affected by sample treatments. Then, comparing residue inventory or preharvest prediction information with levels in the series, the user determines the change a specific treatment may produce.

Predicted change in residue from treatments can aid in (1) identifying treatments that will reduce residues to the desired level, (2) selecting the most cost-effective treatments, and (3) estimating tons that will be consumed by fire. Improved accuracy in estimating tons consumed by fire will increase reliability of particulate and chemical compound emission calculations.

HOW WERE THEY DEVELOPED?

Areas photographed for these series were selected to show typical residue loading variations resulting from commonly applied harvest and cultural practices in major vegetative types of the inland Pacific Northwest. Photos were taken and data collected

as follows:

- Areas were photographed and the material in the photo area sampled in accordance with U.S. Forest Service national guidelines.¹
- 2. Measurement technique was in accordance with the "Handbook for Inventorying Downed Woody Material." $^{\rm 2}$
- 3. Timber stand, logging, and residue treatment information was obtained from timber sale or project records in field offices.
- 4. Forest Service Region 6 fuel types were assigned by a panel of Forest Service fuel specialists. 3

HOW CAN THEY BE SUPPLEMENTED?

If users in the inland Pacific Northwest find they have important local residue loadings which are not adequately represented, they can supplement these series or develop additional series by following procedures described in the reference documents. The series in this publication may be usable, in total or in part, in appropriate vegetative types in other regions.

These series do not show residue loadings in stands undisturbed by cutting activities. Natural residue photo series may be developed in the future to aid in inventorying such areas.

A companion publication by the Pacific Northwest Forest and Range Experiment Station, containing photo series for use in coastal Douglas-fir-hemlock and coastal Douglas-fir-hardwood types, has been published.4

HOW ARE LEVELS IN THESE SERIES CODED?

The data for each level are presented on the page facing the photo. Facing picture and data pages have the same code for the residue situation shown. The

¹ USDA Forest Service. 1975. National fuel classification and inventory system, preliminary draft. 61 p., illus. Washington Office, Washington, D.C.

² Brown, James K. 1974. Handbook for inventorying downed woody material. USDA For. Serv. Gen. Tech. Rep. INT-16, 24 p., illus. Intermt. For. and Range Exp. Stn., Ogden, Utah.

 $^{^3}$ USDA Forest Service Region 6. 1968. Guide for fuel type identification. 48 p., illus. Portland, Oreg.

⁴Maxwell, Wayne G., and Franklin R. Ward. 1976. Photo series for quantifying forest residues in the: coastal Douglas-fir-hemlock type, coastal Douglas-fir-hardwood type. USDA For. Serv. Gen. Tech. Rep. PNW-51, 103 p., illus. Pac. Northwest For. and Range Exp. Stn., Portland, Oreg.

code shows:

- a. Order of rank from lightest loading to heaviest loading in the series of photographs.
- b. Forest type, e.g., PP = ponderosa pine, PP&ASSOC = ponderosa pine and associated species, LP = lodgepole pine.
- c. Forest size class, where:
 - 1 = <5-inch d.b.h.
 - 2 = 5- to 11-inch d.b.h.
 - 3 = 12 to 20 inch d. b. h.
 - 4 = 20 inch d.b.h.
- d. Cutting practice, where:
 - CC = clearcut
 - PC = partial cut (shelterwood, selection, overstory removal)
 - TH = precommercial thinning

Example: 1-PP-4-CC is the first photo in the series for ponderosa pine, >20-inch diameter trees, after harvest by clearcutting.

PONDEROSA PINE

SIZE CLASS 4

CLEARCUT

A SERIES OF 2 LEVELS

- 1. The marker in these photos is 1 foot square, and the pole is painted in contrasting colors at 1-foot intervals to provide perspective.
- 2. Stumps are not included in residue quantities.
- 3. Rotted residue is that which would come apart or splinter when kicked.



1-PP-4-CC

	LOADING			OTHER MEASUREMENTS				
Size class (inches)	Weight (tons/acre)	(ft ³ /acr	me ^e)	Average residue depth Ground area covered by residue 1/	(feet) <u>0.3</u> (percent) 75			
0.25-1.0	3.9	235		Average duff and litter depth	(inches)0.8			
1.1-3.0	6.7	439		Sound residue 3.1-inch diameter a	and larger ponderosa pine	(percent) 66 (percent) (percent) (percent) 34		
3.1-9.0	5.3	430		1				
9.1-20.0	3.1	332		Rotted residue 3.1-inch diameter	and larger			
20.1+	3.3	260		Notice 1 Carac City Their a tame oc.		(,, a. a a a ,		
Total	22.3	1,696						
HARVEST INFORMATION				COMMERCIAL THINNING INFORMATION	FUEL RATING			
Net volume of Average stem Average d.b. cut (inches Stand age ()	h. of stems s) years) scription <u>Clearc</u> nod <u>Tractor</u> ment <u>None</u> e cut or	15.9 18 34 250+	Stem Basa Basa Aver Aver Thin	s cut/acre s remaining/acre l area/acre before l area/acre after age d.b.h. before (inches) age d.b.h. after (inches) ning method h treatment	U.S. Forest Service Region fuel type identification REMARKS	6 <u>HM</u>		



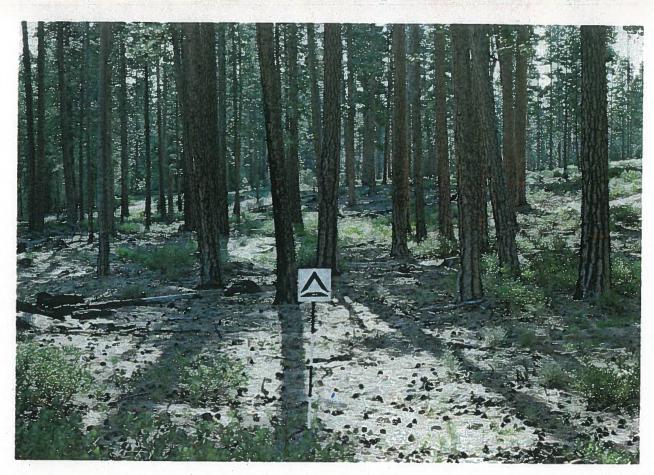
2-PP-4-CC

LOADING			OTHER MEASUREMENTS					
Weight (tons/acre)	(ft ³ /ac	ume re)	Average residue depth	P 1	(feet) 0.7			
8.1	492		Average duff and litter depth	/4-inch diameter and larger	(percent) 77 (inches) 0.7			
8.1	530		Sound residue 3.1-inch diameter	and larger ponderosa pine	_(percent)_96			
6.3	517			lodgepole pine	(percent) <u>1</u>			
17.2	1,375		Pottod worlder 2 1 inch diemster		(percent)			
6.6	529		Rotted residue 3.1-inch diameter	and larger	(percent) <u>3</u>			
46.3	3,443							
EST INFORMATION		PREC	COMMERCIAL THINNING INFORMATION	FUEL RATING				
•	. ———		· ———	U.S. Forest Service Region fuel type identification	6 EH			
acre cut	60	Basal	area/acre before	REMARKS				
Average d.b.h. of stems cut (inches) 22 Stand age (years) 200+ Cutting prescription Clearcut			age d.b.h. before (inches)					
Tractor t None								
ut or nths)	<12							
	(tons/acre) 8.1 8.1 6.3 17.2 6.6 46.3 EST INFORMATION ruised(M fbm/acre acre cut of stems rs) iptionClearcTractor tNone ut or	(tons/acre) (ft³/ac 8.1 492 8.1 530 6.3 517 17.2 1,375 6.6 529 46.3 3,443 EST INFORMATION 13.0 ruised(M fbm/acre) 11.5 acre cut 60 of stems 22 rs) 200+ iption Clearcut Tractor t t None	(tons/acre) (ft³/acre) 8.1 492 8.1 530 6.3 517 17.2 1,375 6.6 529 46.3 3,443 EST INFORMATION PRECENTIAL PROBLEM ruised(M fbm/acre) 13.0 Stems ised(M fbm/acre) 11.5 Stems acre cut 60 Basal of stems 22 Average rs) 200+ Average iption Clearcut Thing Tractor Slass t None	(tons/acre) (ft³/acre) Average residue depth Ground area covered by residue 1, Average duff and litter depth Sound residue 3.1-inch diameter at Sound residue 3.1-inch di	Average residue depth Ground area covered by residue 1/4-inch diameter and larger Average duff and litter depth Sound residue 3.1-inch diameter and larger Donderosa pine Dodgepole pine			

PONDEROSA PINE SIZE CLASS 4 PARTIAL CUT

A SERIES OF 5 LEVELS

- 1. The marker in these photos is 1 foot square, and the pole is painted in contrasting colors at 1-foot intervals to provide perspective.
- 2. Stumps are not included in residue quantities.
- 3. Rotted residue is that which would come apart or splinter when kicked.



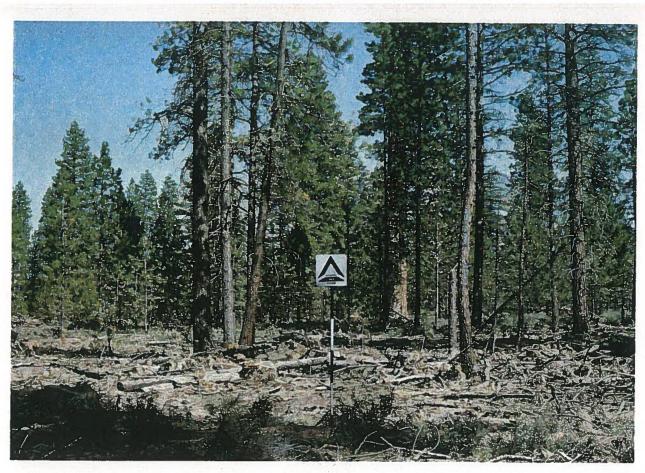
1-PP-4-PC

	LOADING			OTHER MEASUREMENTS				
Size class (inches)	Weight (tons/acre)	(ft ³ /ac	ume re)	Average residue depth	(feet)0.04 (percent) 16			
0.25-1.0	0.4	25		Ground area covered by residue 1 Average duff and litter depth	vered by residue 1/4-inch diameter and larger			
1.1-3.0	1.8	119		Sound residue 3.1-inch diameter	and larger ponderosa pine	(inches) <u>0.7</u> (percent) <u>100</u> _(percent)		
3.1-9.0	0.5	40						
9.1-20.0	0	0	-		er and larger (perce			
20.1+	0	0		Rotted residue 3.1-inch diameter				
Total	2.7	184						
HAR	RVEST INFORMATION		PREC	COMMERCIAL THINNING INFORMATION	FUEL RATING			
Net volume cruised(M fbm/acre) 15.0 Stems Average stems/acre cut 15 Basal Average d.b.h. of stems 29 Avera Cut (inches) 300+ Cutting prescription Shelterwood Thinn Carding method Tractor Slash				s cut/acre s remaining/acre l area/acre before l area/acre after lige d.b.h. before (inches) ling method n treatment	U.S. Forest Service Region fuel type identification REMARKS	6 <u> </u>	<u>L</u>	
Slash treatment Machine piled & burned Period since cut or treatment (months) 24								



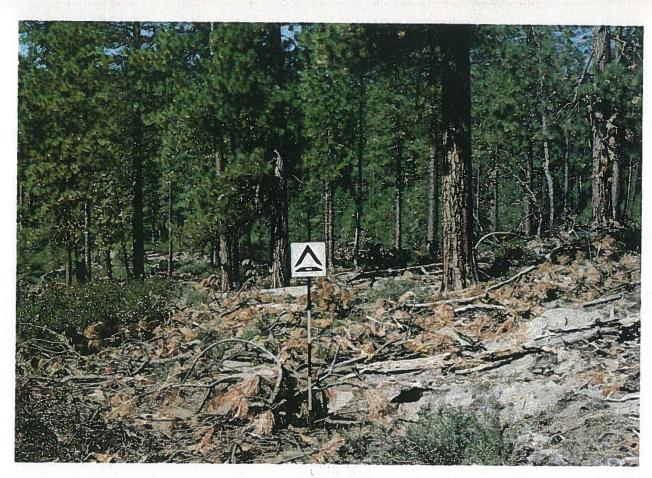
2-PP-4-PC

	LOADING			OTHER MEASUREMENTS				
Size class (inches)	Weight (tons/acre)	3 ^{Volu}	me re)	Average residue depth (feet)0 Ground area covered by residue 1/4-inch diameter and larger (percent)				
0.25-1.0	2.2	132		Average duff and litter depth	4-Inch drameter and larger	(inches)0.8		
1.1-3.0	3.4	220		Sound residue 3.1-inch diameter a	and larger ponderosa pine	_(percent)100		
3.1-9.0	2.9	234	:			(percent)		
9.1-20.0	0	0		Rotted residue 3.1-inch diameter	and larger	(percent) (percent) 0		
20.1+	0	0		Notice Corner of the corner	= 1	,		
Total	8.5	586				- / -		
HARVEST INFORMATION P				COMMERCIAL THINNING INFORMATION	FUEL RATING	LA.		
Net volume of Average stem Average d.b. cut (inches Stand age (y	h. of stems ;) years)	3.4 17 16 110	Stem: Basa Basa Aver	s cut/acre s remaining/acre l area/acre before l area/acre after age d.b.h. before (inches) age d.b.h. after (inches)	U.S. Forest Service Region fuel type identification REMARKS	6 <u>ML</u>		
Cutting prescription Tree selection Yarding method Tractor Slash treatment None Period since cut or treatment (months) <12				ning methodh treatment				



3-PP-4-PC

	LOADING			OTHE	OTHER MEASUREMENTS				
Size class (inches)	Weight (tons/acre)	(ft ³ /ac	ume re)	Average residue depth		(feet) <u>0.3</u>			
0.25-1.0	2.7	164	7.7-	Ground area covered by residue 1 Average duff and litter depth	/4-inch diameter and larger	(percent) <u>67</u> (inches)0.6			
1.1-3.0	5.0	324	-	Sound residue 3.1-inch diameter	and larger ponderosa pine	(percent)100			
3.1-9.0	5.7	456				(percent)			
9.1-20.0	0	0		Dotted worldung 2 1 imph dismeter	and launce	(percent)			
20.1+	0	0		Rotted residue 3.1-inch diameter	and larger	(percent) <u>0</u>			
Total	13.4	944							
HARVEST INFORMATION PR				COMMERCIAL THINNING INFORMATION	FUEL RATING				
Gross volume cruised(M fbm/acre) 4.7 Standage (years) Cutting prescription Shelterwood Standage method Rubber-tired skidder Standage method Rubber-tired skidder Standage Standa				s cut/acre s remaining/acre l area/acre before l area/acre after age d.b.h. before (inches) age d.b.h. after (inches) hing method h treatment	U.S. Forest Service Region fuel type identification REMARKS	6 <u>MH</u>			
				511.					



4-PP-4-PC

	LOADING			OTHER MEASUREMENTS				
Size class (inches)	Weight (tons/acre)	(ft ³ /acr	me 'e)	Average residue depth	// inch diameter and larger	(feet) <u>0.3</u>		
0.25-1.0	2.3	139		Ground area covered by residue 1 Average duff and litter depth	/4-inch diameter and larger	(percent) 61 (inches)1.0 (percent)100 (percent) (percent) (percent) 0		
1.1-3.0	4.8	315		Sound residue 3.1-inch diameter	and larger ponderosa pine			
3.1-9.0	4.3	341						
9.1-20.0	8.2	655		Rotted residue 3.1-inch diameter	and larger			
20.1+	2.5	200	81	20 July 1, 19 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1				
Total	22.1	1,650						
HA	RVEST INFORMATION		PRE	COMMERCIAL THINNING INFORMATION	FUEL RATING			
Gross volume cruised(M fbm/acre) 5.5 Net volume cruised(M fbm/acre) 5.4				s cut/acres remaining/acre	U.S. Forest Service Region 6 fuel type identification			
Average stem	s/acre cut	15	Basa	l area/acre before				
Average d.b.h. of stems cut (inches) 20 Stand age (years) 200+ Cutting prescription Shelterwood Yarding method Tractor Slash treatment None Period since cut or treatment (months) <12				Average d.b.h. before (inches) Average d.b.h. after (inches) Thinning method Slash treatment				
, e	···				11			



5-PP-4-PC

	LOADING			OTHER MEASUREMENTS					
Size class (inches)	Weight (tons/acre)	(ft ³ /acr	me e)	Average residue depth (for Ground area covered by residue 1/4-inch diameter and larger (perc					
0.25-1.0	3.8	231		Average duff and litter depth	/4-Inch diameter and larger	(percent) 77 (inches) 1.2			
1.1-3.0	7.4	482		Sound residue 3.1-inch diameter	er and larger <u>ponderosa pine</u> (perce (perce (perce				
3.1-9.0	7.1	575							
9.1-20.0	4.6	410	0 1	Rotted residue 3.1-inch diameter					
20.1+	6.6	531							
Total	29.5	2,229							
HA	RVEST INFORMATION		PRE	COMMERCIAL THINNING INFORMATION	FUEL RATING				
17				s cut/acres remaining/acre	U.S. Forest Service Region 6 fuel type identification				
Average stem	s/acre cut	20	Basa	l area/acre before	REMARKS	REMARKS			
Average d.b.h. of stems cut (inches) Stand age (years) Cutting prescription Tree selection				al area/acre after Area not cruised. Tingge d.b.h. before (inches) naige d.b.h. after (inches) nning method sh treatment		per sold on a			

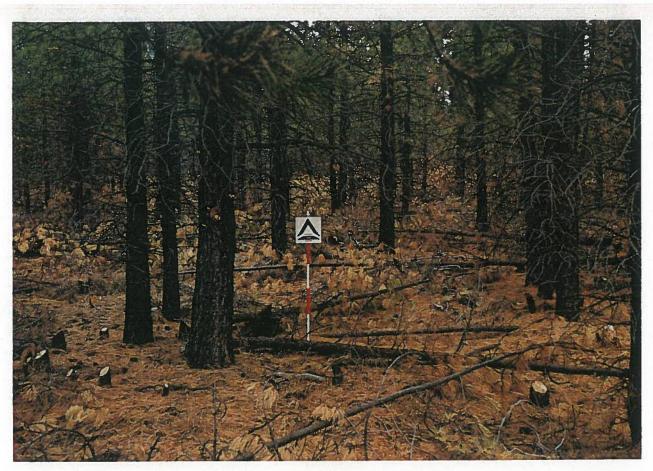
PONDEROSA PINE

SIZE CLASS 1

PRECOMMERCIAL THINNING

A SERIES OF 6 LEVELS

- 1. The marker in these photos is 1 foot square, and the pole is painted in contrasting colors at 1-foot intervals to provide perspective.
- 2. Stumps are not included in residue quantities.
- 3. Rotted residue is that which would come apart or splinter when kicked.



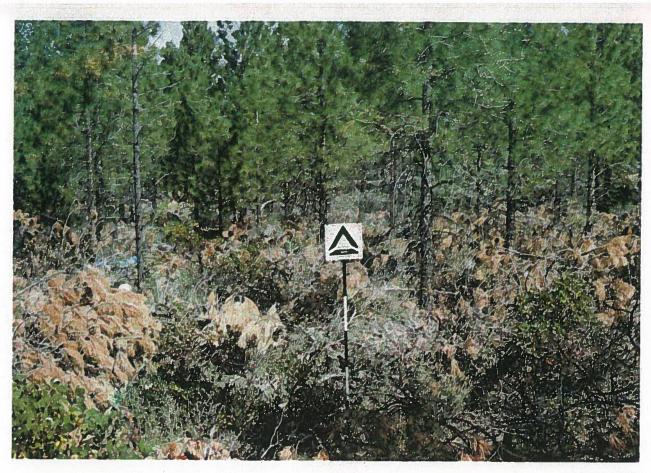
1-PP-1-TH

t (ft ³ /3 205 205 152 149 0 0 506 MATION fbm/acre)	PRE	OTHER MEASUREMENTS Average residue depth Ground area covered by residue 1/4-inch diameter and larg Average duff and litter depth Sound residue 3.1-inch diameter and larger ponderosa pin Rotted residue 3.1-inch diameter and larger FUEL RATIN	(inches) 1.1 ne (percent) 100 (percent) (percent) (percent)
205 152 149 0 0 506	PRE	Ground area covered by residue 1/4-inch diameter and larg Average duff and litter depth Sound residue 3.1-inch diameter and larger ponderosa pin Rotted residue 3.1-inch diameter and larger	ger (percent) 68
152 149 0 0 506	PRE	Average duff and litter depth Sound residue 3.1-inch diameter and larger ponderosa pin Rotted residue 3.1-inch diameter and larger	(inches) 1.1 ne (percent) 100 (percent) (percent)
149 0 0 506 MATION	PRE	Sound residue 3.1-inch diameter and larger ponderosa pin Rotted residue 3.1-inch diameter and larger	(percent) (percent) (percent)
0 0 506 MATION	PRE		(percent) (percent)
0 506 MATION	PRE		(percent)
506	PRE		VG
MATION	PRE	RECOMMERCIAL THINNING INFORMATION FUEL RATIN	NG
		RECOMMERCIAL THINNING INFORMATION FUEL RATIN	VG
fbm/acre)	Stem		
m/acre)	-	ems cut/acre 3,700 U.S. Forest Service Reg	
	Basa	sal area/acre before 336 REMARKS	S
		The second secon	
	- Slas	ash treatment None	
П	_		
	_		
		——— Ave ——— Ave ——— Th	Average d.b.h. before (inches) 4 Average d.b.h. after (inches) 6 Thinning method Chainsaw



2-PP-1-TH

					DATA SHEET Residue descriptive code 2-PP-1-TH				
	L	OADING			OTHER MEASUREMENTS				
Size class Weight 3Volume (inches) (tons/acre) (ft³/acre)				3 ^{Volume} /acre)				(feet) 0.7 (percent) 79	
0.25-1.0	2.7	0	164	0	Average duff and litter de		4-Inch diameter and larger	(inches) 1.1	
1.1-3.0	5.5	0	358	0	Sound residue 3.1-inch dia	meter a	nd larger ponderosa pine	_(percent)_39	
3.1-9.0	2.3	$\frac{1}{0.7}$	184	$\frac{1}{71}$				_(percent)	
9.1-20.0	0	<u>1</u> /9.8	0	$\frac{1}{1}$,044				_(percent)	
	0	0	0	0	Rotted residue 3.1-inch di	ameter	and larger	(percent) 61	
20.1+		-							
Total	10.5	1/10.5	706	1/1,115					
Н	ARVEST :	NFORMATIO	N	PRE	COMMERCIAL THINNING INFORMAT	ION	FUEL RATING		
Gross volum			. —		s cut/acre	2,825 175	U.S. Forest Service Region fuel type identification	6 <u>HH</u>	
Average ste			·	Basa	l area/acre before _	262	REMARKS		
	Average d.b.h. of stems Bas				l area/acre after 34 Residue loadings footnote			were present	
Stand age (age d.b.h. after (inches) _	6	One-half of tonnage in old	-arowth cull.	
Cutting pre				11111	ning method <u>Chainsaw</u>		one navi or connege in ore	g. c	
Yarding met				—— Slas	h treatment <u>None</u>				
Slash treat Period sinc	_								
treatment									
								2	



3-PP-1-TH

	L	OADING				OTHER	R MEASUREMENTS	1152/15 #
Size class (inches)		eight s/acre)	(ft ³	Volume /acre)				(feet) 1.2 (percent) 87
0.25-1.0 1.1-3.0 3.1-9.0 9.1-20.0	3.5 3.2 5.4 0	0 0 <u>1</u> / _{0.6} 0	214 210 431 0	0 0 <u>1</u> / ₅₁ 0	Average duff and litter d	epth ameter a	and larger ponderosa pine	(inches) 1.3 (percent) 98 (percent) (percent) (percent) 2
20.1+ Total	0 12.1	0 1/ _{0.6} NEORMATIO	0 855	0 1/ ₅₁	. COMMERCIAL THINNING INFORMA		FUEL RATING	
Stand age (years) Care Stand age Care Car				Stem Basa Basa Aver Aver Thin	s cut/acre s remaining/acre l area/acre before l area/acre after age d.b.h. before (inches) age d.b.h. after (inches) ning method Chainsaw h treatment None	4,825 175 436 34 4 6	U.S. Forest Service Region fuel type identification REMARKS Residue loadings footnoted prior to thinning.	нн



4-PP-1-TH

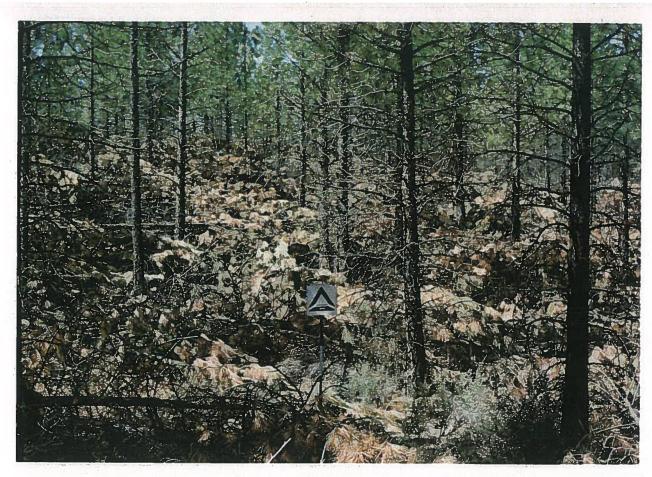
	L	OADING			OTHER	R MEASUREMENTS			
Size class (inches)		/eight us/acre)	(ft	Volume /acre)	Average residue depth (feet) Ground area covered by residue 1/4-inch diameter and larger (percent)				
0.25-1.0 1.1-3.0 3.1-9.0 9.1-20.0	2.1 4.7 5.3 0	0 0 1/0.5 1/2.0	142 373 423 0	0 0 <u>1</u> / ₅₅ <u>1</u> / ₁₆₁	Average duff and litter depth Sound residue 3.1-inch diameter a	(inches) 1.4 and larger ponderosa pine (percent) 83 lodgepole pine (percent) 12 (percent) (percent) 12			
20.1+ Total	0	0 2.5	0 938	0 <u>1</u> / ₂₁₆	Notice (College of Parison distinction and large)				
Gross volume Net volume Average ster Average d.b cut (inche Stand age (Cutting pre Yarding met Slash treat Period sinc	HARVEST INFORMATION Gross volume cruised(M fbm/acre) Net volume cruised(M fbm/acre) Average stems/acre cut Average d.b.h. of stems cut (inches) Stand age (years) Cutting prescription Yarding method Slash treatment Period since cut or treatment (months)				COMMERCIAL THINNING INFORMATION s cut/acre 4,825 s remaining/acre 175 l area/acre before 436 l area/acre after 34 age d.b.h. before (inches) 4 age d.b.h. after (inches) 6 ning method Chainsaw h treatment Crushed by Tomahawk	FUEL RATING U.S. Forest Service Region 6 fuel type identificationMM_ REMARKS Residue loadings footnoted were present prior to thinning.			

^{1/} See remarks.



5-PP-1-TH

							PP-1-TH		
	L	OADING			OTHER MEASUREMENTS				
Size class Weight 3 ^{Vo} (inches) (tons/acre) (ft ³ /a		Volume /acre)	Average residue depth Ground area covered by residue 1/4						
0.25-1.0	5.2	0	317	0	Average duff and litter depth	4- Then diameter and furger	(percent) 89 (inches) 0.7		
1.1-3.0	13.0	0	850	0	Sound residue 3.1-inch diameter an	_(percent) <u>98</u>			
3.1-9.0	3.9	$\frac{1}{0.3}$	309	1/28			_(percent) (percent)		
9.1-20.0	0	0	0	0	Rotted residue 3.1-inch diameter a	and larger	(percent) 2		
20.1+	0	0	0	0					
Total	22.1	$\frac{1}{0.3}$	1,476	1/28					
Н	ARVEST I	NFORMATIO	N	PRE	COMMERCIAL THINNING INFORMATION	FUEL RATING			
Gross volum Net volume				_ ;	s cut/acre 11,850 s remaining/acre 150	U.S. Forest Service Region fuel type identification	6 <u>MH</u>		
Average ste				Basa	1 area/acre before 589	REMARKS			
Average d.b cut (inche	s)	tems		1	l area/acre after 30 age d.b.h. before (inches) 3	Residue loadings footnoted prior to thinning.	were present		
Stand age (— Aver	age d.b.h. after (inches) 6				
Cutting pre					ning method <u>Chainsaw</u>				
Yarding met				Slas	h treatment <u>Crushed by Tomahawk</u>				
Slash treat				-					
Period sinc treatment			I	_					
				1					



6-PP-1-TH

	LC	ADING			OTHER MEASUREMENTS
Size class (inches)		eight s/acre)	(ft ³)	/olume /acre)	Average residue depth (feet) 1.8
0.25-1.0	5.5	0	330	0	Ground area covered by residue 1/4-inch diameter and larger (percent) 85 Average duff and litter depth (inches) 1.9
1.1-3.0	6.7	0	439	0	Sound residue 3.1-inch diameter and larger ponderosa pine (percent) 99
3.1-9.0	12.8	0	1,029	0	(percent)
9.1-20.0	0	$\frac{1}{0.2}$	0	1/22	Rotted residue 3.1-inch diameter and larger (percent) 1
20.1+	3.5	0	283	0	(parameter and target
Total	28.5	$\frac{1}{0.2}$	2,081	1/22	
Н	ARVEST IN	FORMATIO	N	PRE	COMMERCIAL THINNING INFORMATION FUEL RATING
Gross volume Net volume Average ster Average d.b cut (inche Stand age (Cutting pre Yarding met Slash treat Period sinc treatment	cruised(M ms/acre c .h. of st s) years) scription hod ment e cut or	fbm/acr	e)	Stem Basa Basa Aver Aver	s cut/acre 4,825 s remaining/acre 175 1 area/acre before 436 age d.b.h. after (inches) ning method h treatment None

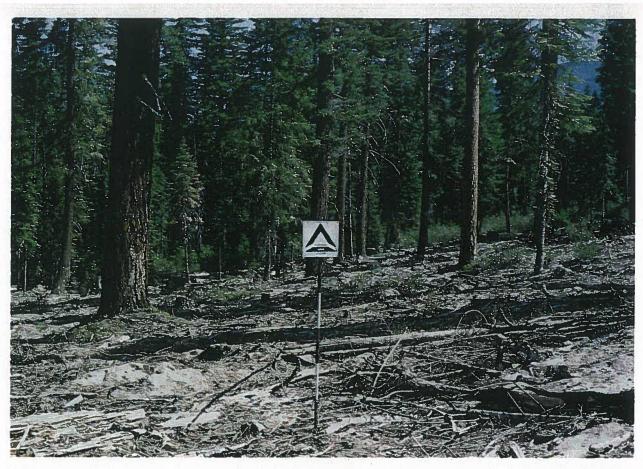
 $[\]frac{1}{}$ See remarks.

PONDEROSA PINE AND ASSOCIATED SPECIES SIZE CLASS 4

PARTIAL CUT

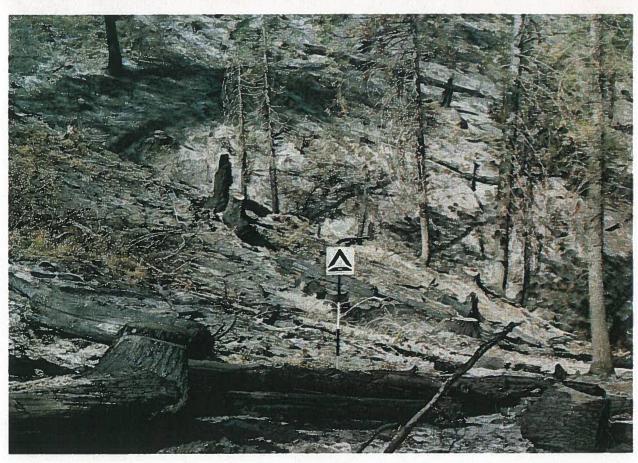
A SERIES OF 8 LEVELS

- 1. The marker in these photos is 1 foot square, and the pole is painted in contrasting colors at 1-foot intervals to provide perspective.
- 2. Stumps are not included in residue quantities.
- 3. Rotted residue is that which would come apart or splinter when kicked.



1-PP&ASSOC-4-PC

			DATA SHEET	Residue descriptive code1-PP&ASSOC-4-PC
	LOADING	11 100-	ОТН	ER MEASUREMENTS
Size class (inches)	Weight (tons/acre)	(ft ³ /acr	me e) Average residue depth Ground area covered by residue	(feet) 0.2 1/4-inch diameter and larger (percent) 57
0.25-1.0	1.4	94	Average duff and litter depth	(inches) 0.7
1.1-3.0	3.7	298	Sound residue 3.1-inch diameter	and larger Douglas-fir (percent) 45
3.1-9.0	3.5	274		ponderosa_pine(percent)_ <u>11</u>
9.1-20.0	0	0	Rotted residue 3.1-inch diamete	other (percent) 17 er and larger (percent) 27
20.1+	0	0	Rotted residue 3.1-inch diamete	er and larger (percent)
Total	8.6	666		
НА	RVEST INFORMATION		PRECOMMERCIAL THINNING INFORMATION	FUEL RATING
	cruised(M fbm/ac		Stems cut/acre Stems remaining/acre	U.S. Forest Service Region 6 fuel type identificationLL
Average stem		35	Basal area/acre before	REMARKS
Average d.b.		20	Basal area/acre after Average d.b.h. before (inches)	
Stand age (y	vears)	160+	Average d.b.h. after (inches)	
Cutting pres	cription <u>Shelt</u>	erwood	Thinning method	
Yarding meth	nod <u>Tractor</u>		Slash treatment	
Slash treatm	ment <u>Machine pile</u>	d & burned		
Period since treatment (36	57457674	



2-PP&ASSOC-4-PC

	LOADING			OTHER MEASUREMENTS				
Size class (inches)	Weight (rons/acre)	(ft ³ /ac	ume re)	Average residue depth	(
0.25-1.0	0.4	27		Ground area covered by residue 1 Average duff and litter depth	/4-inch dia	meter and larger	(percent) 28 (inches)0.02	
1.1-3.0	2.3	185		Sound residue 3.1-inch diameter and larger white fir			_(percent) 98	
3.1-9.0	2.7	212		Douglas-fir		Douglas-fir	_(percent)1	
9.1-20.0	4.2	343		Rotted residue 3.1-inch diameter	and larger	•	(percent) (percent) 1	
20.1+	8.4	671	60 Y 1	= 1	(per derio)			
Tota1	18.0	1,438	4.1					
НАГ	RVEST INFORMATION		PRE	COMMERCIAL THINNING INFORMATION		FUEL RATING	To A To T	
	cruised(M fbm/acruised(M fbm/acre					est Service Region be identification	6 <u>LL</u>	
Average stems	s/acre cut	11	Basal area/acre before			REMARKS		
Average d.b.h. of stems cut (inches) 26 Stand age (years) 250 Cutting prescription Tree selection Yarding method High-lead Slash treatment Broadcast burned Period since cut or treatment (months) < 12				al area/acre after rage d.b.h. before (inches) rage d.b.h. after (inches) nning method sh treatment				



3-PP&ASSOC-4-PC

			DATA SHEET	Residue descriptive code3-PP&ASSOC-4	1-PC		
- 2 - 10	LOADING		ОТН	R MEASUREMENTS			
Size class (inches)	(inches) (tons/acre) (ft ³ /acre)		me Average residue depth				
0.25-1.0	. 3.2	213	Ground area covered by residue : Average duff and litter depth	· " "	nt) <u>85</u> es)5.0		
1.1-3.0	4.8	386	Sound residue 3.1-inch diameter		nt) 89		
3.1-9.0	12.3	1,020			nt)3		
9.1-20.0	5.4	443		other (percent			
20.1+	0	0	Rotted residue 3.1-inch diameter	r and larger (percei	nt) <u>3</u>		
Total	25.7	2,062					
HA	ARVEST INFORMATION	Ø 1	PRECOMMERCIAL THINNING INFORMATION	FUEL RATING			
	cruised(M fbm/accruised(M fbm/acre	, 	Stems cut/acre Stems remaining/acre	U.S. Forest Service Region 6 fuel type identification	нн		
Average stem	ns/acre cut	23	Basal area/acre before	REMARKS			
Average d.b. cut (inches		17	Basal area/acre after Average d.b.h. before (inches)				
Stand age (y		200+	Average d.b.h. after (inches)				
	scription <u>Tree s</u>	election	Thinning method				
Slash treatm	nod <u>Tractor</u> ment None		Slash treatment				
Period since treatment (cut or	<12					
		**					



4-PP&ASSOC-4-PC

	2:			DATA SHEET	Residue de	scriptive code <u>4-P</u>	P&ASSOC-4-PC
	LOADING		161	OTHER MEASUREMENTS			
Size class (inches)	Weight (tons/acre) (ft ³ /acre)		Average residue depth Ground area covered by residue 1/4-inch diameter and larger			(feet) <u>0.3</u>	
0.25-1.0	3.0	198		Average duff and litter depth	/4-inch dia	meter and larger	(percent) 75 (inches) 2.0
1.1-3.0	5.4	433		Sound residue 3.1-inch diameter	and larger_	Douglas-fir	_(percent) <u>78</u>
3.1-9.0	9.1	681				ponderosa pine	(percent)14
9.1-20.0	0	0	11,	Rotted residue 3.1-inch diameter	and larger	other	(percent) 1 (percent) 7
20.1+	11.7	781		Notice 1 corder or 1 mon arameter	4114 14.90		(10.00.00)
Total	29.2	2,093					
НА	ARVEST INFORMATION	V	PRE	COMMERCIAL THINNING INFORMATION		FUEL RATING	
	cruised(M fbm/acruised(M fbm/acr	. ——-		cut/acre		st Service Region e identification	6 _MH_
Average stem	s/acre cut	110	Basa	area/acre before	7 5	REMARKS	
Average d.b.h. of stems cut (inches) 14 Ave Stand age (years) 80 Ave Cutting prescription Tree selection Thi Yarding method Rubber-tired skidder Sla			Avera Avera Thina	l area/acre after age d.b.h. before (inches) age d.b.h. after (inches) ning method h treatment			
Period since	ment <u>Machine pile</u> cut or	d & burned				it.	
treatment (<12					
				10			



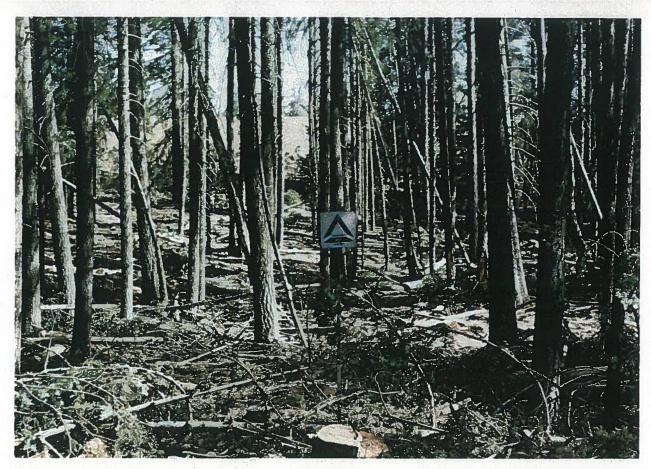
5-PP&ASSOC-4-PC

84	LOADING			OTHER MEASUREMENTS				
Size class (inches)	Weight (tons/acre)	(ft ³ /acr	me 'e)	Average residue depth (feet) C Ground area covered by residue 1/4-inch diameter and larger (percent)				
0.25-1.0	2.4	162		Average duff and litter depth	4-men an		(inches) 0.7	
1.1-3.0	5.1	409		Sound residue 3,1-inch diameter a	and larger	Douglas-fir	_(percent) <u>73</u>	
3.1-9.0	10.2	768				white fir	_(percent) 9	
9.1-20.0	8.6	617		Rotted residue 3.1-inch diameter	other		(percent) 2 (percent) 16	
20.1+	3.0	200		Notice Testade 5.1 Men d'amere.	una range		(por come)	
Total	29.3	2,156						
HARVEST INFORMATION PRE				COMMERCIAL THINNING INFORMATION	9,	FUEL RATING	(1	
· -	cruised(M fbm/acruised(M fbm/acre	· ———		cut/acre		est Service Region pe identification	6 <u>MH</u>	
Average stem	· •	17		area/acre before		REMARKS		
Average d.b.h. of stems cut (inches) 15 Stand age (years) 200 Cutting prescription				erage d.b.h. before (inches) erage d.b.h. after (inches) inning method ash treatment			n	



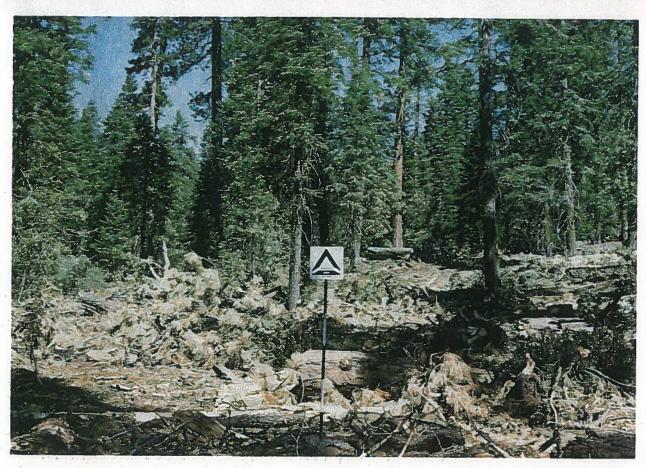
6-PP&ASSOC-4-PC

				DATA SHEET	Residue o	lescriptive code ^{0-rr}	'AA33UL-4-PL	
II	LOADING			OTHER MEASUREMENTS				
Size class (inches)	Weight (tons/acre)	(ft ³ /acr		Average residue depth				
0.25-1.0	3.9	263	1.	Ground area covered by residue 1 Average duff and litter depth	/4-Inch d	ameter and larger	(percent) 77 (inches) 0.7	
1.1-3.0	4.8	386		Sound residue 3,1-inch diameter	and larger	white fir	(percent)43	
3.1-9.0	10.0	778				Douglas-fir	(percent) 33	
9.1-20.0	5.5	410	e III		other	(percent)22		
20.1+	6.9	458		Rotted residue 3.1-inch diameter	er	(percent) 2		
Total	31.1	2,295						
HA	RVEST INFORMATION		PRE	COMMERCIAL THINNING INFORMATION		FUEL RATING		
	cruised(M fbm/acruised(M fbm/acre			s cut/acres remaining/acre		rest Service Region ope identification	6	
Average stem	•	41		al area/acre before		REMARKS		
Average d.b. cut (inches		15		l area/acre after				
Stand age (y		170	Aver	age d.b.h. after (inches)				
	cription Tree s	election	Thin	ning method				
	od Tractor		Slas	h treatment				
Slash treatm								
Period since treatment (<12			= 12			
		- A						



7-PP&ASSOC-4-PC

	LOADING			OTHER MEASUREMENTS				
Size class (inches)	Weight (tons/acre)	(ft ³ /acr	me re)	Average residue depth (feet) 0				
0.25-1.0	2.6 5.9	176 474	- 1	Average duff and litter depth				
3.1-9.0	27.1	1,874		Sound residue 3.1-inch diameter	white fir (perc	(percent)50 (percent)42		
9.1-20.0	2.3	196	п., :	Rotted residue 3.1-inch diameter	and larger	other	(percent) ¹ (percent) ⁷	
20.1+	0	0					(70.00.0)	
Total	37.9	2,720						
НАЯ	RVEST INFORMATION		PREC	OMMERCIAL THINNING INFORMATION		FUEL RATING		
	cruised(M fbm/acre	·		cut/acre	U.S. Forest Service Region 6 fuel type identification			
Average stems/acre cut 17 Average d.b.h. of stems cut (inches) 15 Stand age (years) 200 Cutting prescription Tree selection Yarding method Tractor Slash treatment None Period since cut or treatment (months) <12		Basal Avera Avera Thinn	area/acre before area/acre after ge d.b.h. before (inches) ge d.b.h. after (inches) ing method treatment		REMARKS			



8-PP&ASSOC-4-PC

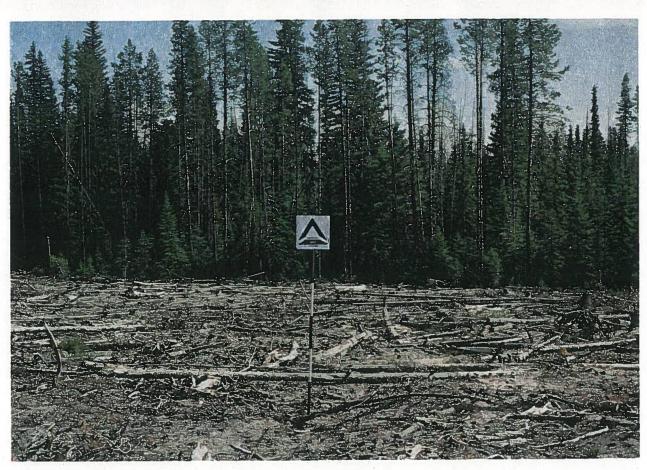
	LOADING			OTHER	R MEASUREMENTS		
Size class (inches)	Weight (tons/acre)	(ft ³ /ac	ume re)	Average residue depth		(feet)_(
0.25-1.0	2.1	143		Ground area covered by residue 1, Average duff and litter depth	/4-inch diameter and larger	(percent)_ (inches) (
1.1-3.0	6.3	507		Sound residue 3.1-inch diameter a	and larger ponderosa pine	_(percent)_	71
3.1-9.0	10.3	918			white fir	_(percent)_	
9.1-20.0	10.8	895	L S	Rotted residue 3.1-inch diameter	and langer	(percent) (percent)	
20.1+	11.6	930		Rotted residue 3.1-Mch diameter	and larger	(percent)_	10
Total	41.1	3,393					
HARVEST INFORMATION			PREC	OMMERCIAL THINNING INFORMATION	FUEL RATING		
Gross volume cruised(M fbm/acre) 9.9			acre) 9.1 Stems remaining/acre		U.S. Forest Service Region fuel type identification		4H
			Avera Avera Thinn	ge d.b.h. before (inches) ge d.b.h. after (inches) ling method treatment			
	cut or	<12					

LODGEPOLE PINE SIZE CLASS 3

CLEARCUT

1 LEVEL

- 1. The marker in these photos is 1 foot square, and the pole is painted in contrasting colors at 1-foot intervals to provide perspective.
- 2. Stumps are not included in residue quantities.
- 3. Rotted residue is that which would come apart or splinter when kicked.



1-LP-3-CC

	LOADING			OTHE		
Size class (inches)	Weight (tons/acre)	(ft ³ /ac	ume re)	Average residue depth	16 inch diameter and lawren	(feet) 0.2 (percent) 60
0.25-1.0	1.3	89		Ground area covered by residue 1 Average duff and litter depth	1/4-Inch diameter and larger	(inches) 0.4
1.1-3.0	5.5	442		Sound residue 3.1-inch diameter	and larger lodgepole pine	(percent) 100
3.1-9.0	8.1	636				(percent) (percent) (percent)0
9.1-20.0	1.1	88		Rotted residue 3.1-inch diameter	and larger	
20.1+	0	0				
Total	16.0	1,255				
НА	ARVEST INFORMATION		PRE	COMMERCIAL THINNING INFORMATION	FUEL RATING	
Gross volume cruised(M fbm/acre) 5.5 Storm Net volume cruised(M fbm/acre) 4.6 Storm Average stems/acre cut 51 Base Average d.b.h. of stems cut (inches) 31 Average Stand age (years) 150 Average Cutting prescription Clearcut The control of the co				us cut/acre us remaining/acre ul area/acre before ul area/acre after rage d.b.h. before (inches) rage d.b.h. after (inches) uning method ush treatment		

LODGEPOLE PINE

SIZE CLASS 3

PARTIAL CUT

A SERIES OF 5 LEVELS

- 1. The marker in these photos is 1 foot square, and the pole is painted in contrasting colors at 1-foot intervals to provide perspective.
- 2. Stumps are not included in residue quantities.
- 3. Rotted residue is that which would come apart or splinter when kicked.



1-LP-3-PC

	LOADING			OTHER	R MEASUREMENTS	
Size class (inches)	Weight (tons/acre)	(ft ³ /acr	ne e)	Average residue depth Ground area covered by residue 1,	/4-inch diameter and larger	(feet) <u>0.04</u> (percent) 31
0.25-1.0	0.8 1.7	56 135		Average duff and litter depth Sound residue 3.1-inch diameter		(inches)0.1 (percent)100
3.1-9.0	0.9	70				(percent) (percent)
9.1-20.0	0	0		Rotted residue 3.1-inch diameter	and larger	(percent) 0
20.1+ Total	0 3.4	0 261			- Eliza,	
HA	RVEST INFORMATION		PRE	COMMERCIAL THINNING INFORMATION	FUEL RATING	
Net volume of Average stem Average d.b. cut (inches Stand age (y Cutting pres Yarding meth	h. of stems) ears) cription Shelte od Tractor ent Machine pile cut or	2) 6.6 64 13 150 erwood	Stems Basa Basa Aver Aver Thin	s cut/acre s remaining/acre l area/acre before l area/acre after age d.b.h. before (inches) age d.b.h. after (inches) ning method h treatment	U.S. Forest Service Region fuel type identification REMARKS	6 <u>LL</u>



2-LP-3-PC

				DATA SHEET Residue descriptive code 2-LP-3-PC		
LOADING				OTHER MEASUREMENTS		
Size class (inches)	Weight (tons/acre) (ft ³ /acre)		Average residue depth Ground area covered by residue 1/4-inch diameter and larger		(feet) 0.2 (percent) 64	
0.25-1.0	1.9	127	Au.	Average duff and litter depth Sound residue 3.1-inch diameter and larger lodgepole pine		(inches) 0.4 (percent) 100 (percent) (percent)
1.1-3.0	5.1	407				
3.1-9.0	3.4	263				
9.1-20.0	4.1	319		Rotted residue 3.1-inch diameter	r and larger	(percent) 0
20.1+	0	0				
Total	14.5	1,116				
HARVEST INFORMATION PRE			PRE	COMMERCIAL THINNING INFORMATION	FUEL RATING	
Net volume cruised(M fbm/acre) 3.1 Stem Average stems/acre cut 25 Basa Average d.b.h. of stems Basa				s cut/acre s remaining/acre	U.S. Forest Service Region fuel type identification	6 <u>LM</u>
				1 area/acre before	REMARKS	
				l area/acre after age d.b.h. before (inches)		
Stand age (years) 150 Aver			Aver	age d.b.h. after (inches)		
				nning method		
Yarding method <u>Tractor</u> Slas Slash treatment <u>Machine crushed</u>				h treatment		*
Period since		usiled			i i	
treatment (36				



3-LP-3-PC

LOADING				OTHER MEASUREMENTS			
Size class (inches)	Weight (tons/acre)	(ft ³ /acre)		Average residue depth Ground area covered by residue 1/4-inch diameter and larger			(feet) 0.3 (percent) 6
0.25-1.0	1.7 4.1 6.5	114 325 508		Average duff and litter depth Sound residue 3,1-inch diameter and larger lodgepole pine ponderosa pine			(inches) 0.5 (percent) 99 (percent) 1
3.1-9.0 9.1-20.0 20.1+ Total	5.2 0 17.5	410 0		Rotted residue 3.1-inch diameter	and larger		(percent)
			PREC	OMMERCIAL THINNING INFORMATION	1 %	FUEL RATING	
				cut/acre		st Service Region e identification	6 <u>HM</u>
Average stems/acre cut 18 Average d.b.h. of stems cut (inches) 10 Stand age (years) 80+ Cutting prescription Overstory removal Yarding method Rubber-tired skidder Slash treatment None				Basal area/acre before Basal area/acre after Average d.b.h. before (inches) Average d.b.h. after (inches) Thinning method Slash treatment		REMARKS	
Period since treatment (<12				T	



4-LP-3-PC

LOADING				OTHER MEASUREMENTS			
Size class (inches)	Weight (tons/acre)	(ft ³ /acre)		Average residue depth (Ground area covered by residue 1/4-inch diameter and larger (per			
0.25-1.0 1.1-3.0 3.1-9.0 9.1-20.0 20.1+	2.5 6.6 15.8 1.2 0 26.1	169 526 1,231 91 0		Average duff and litter depth Sound residue 3.1-inch diameter Rotted residue 3.1-inch diameter	and larger lodgepole pine	(percent) 79 (inches) 0.7 (percent) 100 (percent) (percent) (percent) 0	
HARVEST INFORMATION			Stems Stems Basa Basa Avera Avera	COMMERCIAL THINNING INFORMATION s cut/acre s remaining/acre l area/acre before l area/acre after age d.b.h. before (inches) age d.b.h. after (inches) ning method h treatment	FUEL RATING U.S. Forest Service Region fuel type identification REMARKS	6 <u>HH</u>	



5-LP-3-PC

				DATA SHEET	vestane nescriberre cons		
LOADING				OTHER MEASUREMENTS			
Size class (inches)	Weight (tons/acre) (ft ³ /acre)			Average residue depth Ground area covered by residue 1	(feet) 0.5 (percent) 85		
0.25-1.0	2.4	162		Average duff and litter depth	(inches) 0.9 (percent) 86 (percent) (percent)		
1.1-3.0	6.9	555		Sound residue 3.1-inch diameter			
3.1-9.0	20.7	1,628					
9.1-20.0	5.8	525		Rotted residue 3.1-inch diameter	and larger	(percent) 14	
20.1+	0	0					
Total	35.8	2,870			271		
HARVEST INFORMATION PRE				COMMERCIAL THINNING INFORMATION	N FUEL RATING U.S. Forest Service Region 6 fuel type identification		
Net volume cruised(M fbm/acre) 3.2 Stem Average stems/acre cut 51 Basa Average d.b.h. of stems Basa cut (inches) 13 Aver Stand age (years) 110 Aver				s cut/acres remaining/acre			
				1 area/acre before	REMARKS		
				l area/acre after age d.b.h. before (inches) age d.b.h. after (inches)	1		
				h treatment			
Slash treat	ment None				1)		
Period sinc		<12			1		
					<u> </u>		

The mission of the PACIFIC NORTHWEST FOREST AND RANGE EXPERIMENT STATION is to provide the knowledge, technology, and alternatives for present and future protection, management, and use of forest, range, and related environments.

Within this overall mission, the Station conducts and stimulates research to facilitate and to accelerate progress toward the following goals:

- Providing safe and efficient technology for inventory, protection, and use of resources.
- 2. Developing and evaluating alternative methods and levels of resource management.
- Achieving optimum sustained resource productivity consistent with maintaining a high quality forest environment.

The area of research encompasses Oregon, Washington, Alaska, and, in some cases, California, Hawaii, the Western States, and the Nation. Results of the research are made available promptly. Project headquarters are at:

Fairbanks, Alaska Juneau, Alaska Bend, Oregon Corvallis, Oregon La Grande, Oregon Portland, Oregon Olympia, Washington Seattle, Washington Wenatchee, Washington

Mailing address: Pacific Northwest Forest and Range
Experiment Station
P.O. Box 3141
Portland, Oregon 97208

The FOREST SERVICE of the U.S. Department of Agriculture is dedicated to the principle of multiple use management of the Nation's forest resources for sustained yields of wood, mater, forage, wildlife, and recreation. Through forestry research, cooperation with the States and National Grasslands, it owners, and management of the National Forests and National Grasslands, it strives — as directed by Congress — to provide increasingly greater service to a growing Nation.

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