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Stereo Photo Series for Quantifying Forest Residues in the Douglas-fir-hemlock Type of the Willamette National Forest

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Abstract

Ottmar, Roger D.; Hardy, Colin C.; Vihnanek, Robert E. 1990. Stereo photoseries for quantifying forest residues in the Douglas-fir-western hemlock type in the Willamette National Forest. Gen. Tech. Rep. PNW-GTR-258. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 63 p.

A series of stereo photographs displays a range of residue loadings for harvested units in the Douglas-fir-western hemlock cover type common to the Willamette National Forest. Postburn residue levels are also represented for the Douglas-fir-western hemlock types. Information with each photo includes measured quadratic means and weights for various size classes, woody fuel depth, and duff depth. The stereo photo series is designed to help forest managers appraise woody residue after both timber harvest and treatment with fire in forest types not previously represented by a photo series.

Keywords: Residues, fuel loadings, slash, residue measurements, Douglas-fir *Pseudotsuga Menziesii,* western hemlock, *Tsuga heterophylla.*

Cooperative Acknowledgments

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Contents

What is the photo series?

This photo series contains single and stereo photographs of 19 harvested units before treatment with fire and 8 units after treatment with fire. Each photograph is supplemented with information on the measured forest residue. The series provides a basis for appraising and describing existing residue loadings on logged units in the Douglas-fir-western hemlock forest type common to the Willamette National Forest. [1]

Why is the Photo Series Needed?

Timber harvesting operations annually generate residue on thousands of acres in the Willamette National Forest. The appraisal of residue loadings based on this photo series can be used in planning fuel treatment and prescribed fire strategies to meet site preparation and fire hazard reduction objectives and to minimize any adverse effects on the site and adjacent resources. The photo series can also be used to estimate fuel loadings for smoke management reports.

Photo series have been a popular tool for appraising residue loadings for many years. The series developed by Maxwell and Ward (1976) was the model for this series.

The line-intersect method (Brown 1974) is useful to determine residue loading when a high degree of accuracy is needed. But this method is time consuming and very expensive. Photo series can be used to make fast, easy, and inexpensive determinations of quantities of residues when less accurate estimates are acceptable.

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[1] Forest types are according to SAF (1980). Scientific names are given on page 7.

How was the Photo Series Developed?

Areas photographed for these series were selected to show typical differences in residue loadings from logging and also After prescribed burning. Photographs were taken and residue loading data were collected as follows:

1. Sample plots were selected, laid out, and photographed per Maxwell and Ward (1979)

2. Measurement techniques used for inventorying dead and down woody material were patterned after procedures developed by Brown (1974) and described by Maxwell and Ward (1979).

Photographs

Stereopair photographs are included in this photo guide. The three-dimensional image obtained by viewing the photographs through pocket stereoscope (or with a well-trained eye) will improve the ability of the manager to appraise fuel loading by size class. A single but larger photograph has been included for additional comparison. The marker in these photographs is 1- foot square, and the pole painted in contrasting colors at 1- foot intervals to provide scale. The residue loading values relate to quantities visible in the photograph and not the average for the entire unit. Because the fuel inventory was concentrated in the immediate foreground near the center pole and the stereo photographs best come into view at the pole, we recommend that the fuels near the pole be the ones the estimate is based on.

Photograph Arrangement

The photographs and accompanying data sheets are presented in two series:

Series 1. Douglas-fir-western hemlock type (DFWH), preburn (pre).
Series 2. Douglas-fir-western hemlock type (DFWH), postburn (post).

In each series, the photos are ranked from the lightest to the heaviest loading.

Loading Data

The fuel complex shown in each stereo photograph is described on an accompanying data sheet by the following characteristics:

1. Diameter size class (size class).
2. Quadratic mean diameter for sound and rotten fuels (Q-mean diameter).
3. Fuel loading (load).
4. Percentage of residue by species and number of logs >3 inches in diameter.
5. Average residue depth.
6. Average duff depth.

Using the Photo Series

Make a visual inventory of downed residue by viewing the field of observable fuel and comparing it with the photos as follows:

1. Observe each characteristic for a specific size class of residue on the ground (for example, 3.1- to 9-inch loading).
2. Select a photo or photos that nearly match or bracket the observed characteristics.
3. Obtain the quantitative value for the characteristic being estimated from the data sheet accompanying the selected photo (or interpolate a value between photos).
4. These steps are repeated for each fuel size class or fuel characteristic needed.

The total loading can then be calculated by summing the estimates. If the general area being inventoried has areas with obvious differences in residue loading, the user should make separate determinations for each area and then weight and cumulate the loading for the whole area.

The photo series has been developed to determine a quantitative value for a particular size class of fuel. A comparison of the preburn series and postburn series was not intended by the authors.

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

List of Plant Species Cited

Common name	Scientific name
Douglas-fir	*Pseudotsuga menziesii* (Mirb.) Franco
Incense-cedar	*Libocedrus decurrens* Torr.
True fir	*Abies spp.*
Western hemlock	*Isuga heterophylla* (Raf.) Sarg.
Western redcedar	*Thuja plicata* Donn ex D. Don

Metric Conversions

1 inch = 0.4047 hectare
1 inch = 2.54 centimeters
1 foot = 0.3048 meter
1 ton = 0.907 tonne

Literature Cited

Brown, James k. 1974. Handboook for inventorying downed woody material. Gen. Tech. Rep. INT- 16. Ogden, UT: U.S. department of agriculture, Forest Service, Intermountain Forest and Range Experiment Station. 24 p.

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SERIES 1-DFWH-PRE

DOUGLAS-FIR AND WESTERN HEMLOCK PRE-BURN

A SERIES OF 19 LEVELS

DOWN AND DEAD WOODY FUEL LOADING

Size class (inches)	Load (tons/acre)	Mean diam.[a] (inches)	
		sound	rot
0.0-0.25	1.0	0.1	
0.26-1.0	1.7	.5	
1.1-3.0	4.7	1.7	
Subtotal 0-3 in	7.4		
3.1-9.0	7.1	5.1	5.0
9.1-20.0	0		
>20.0	0		
Subtotal >3 in	7.1	5.1	5.0
TOTAL	14.6		

[a] Mean diam.=quadratic mean.

STEREO PAIR: 1-DFWH-PRE-01

ADDITIONAL FUEL INFORMATION

Sound residue >3-inch diameter:	W. hemlock	51%	Average residue depth:	0.2 ft
	Douglas-fir	17%	Average duff depth:	1.2 in
	Other	15%		
Rotted residue >3-inch diameter:		17%		

Percent residue >3-inch diameter is based on number of logs.

DOWN AND DEAD WOODY FUEL LOADING

Size class (inches)	Load (tons/acre)	Mean diam.[a] (inches)	
		sound	rot
0.0-0.25	1.1	0.1	
0.26-1.0	1.9	.5	
1.1-3.0	5.5	1.7	
Subtotal 0-3 in	8.4		
3.1-9.0	4.8	5.1	5.6
9.1-20.0	5.1	12.3	11.4
>20.0	2.3		22.3
Subtotal >3 in	12.3	6.9	8.8
TOTAL	20.7		

[a] Mean diam.=quadratic mean.

STEREO PAIR: 1-DFWH-PRE-02

ADDITIONAL FUEL INFORMATION

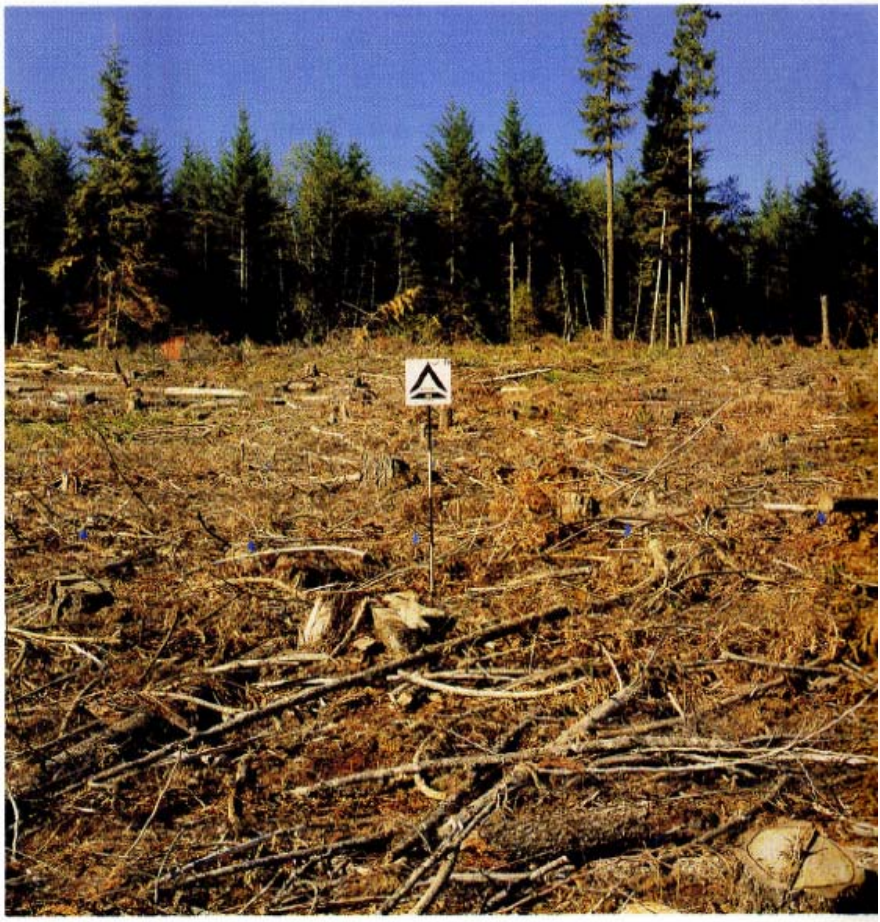
Sound residue >3-inch diameter:	Douglas-fir	52%	Average residue depth:	0.3 ft
	Other	14%	Average duff depth:	0.2 in
Rotted residue >3-inch diameter:		34%		

Percent residue >3-inch diameter is based on number of logs.

DOWN AND DEAD WOODY FUEL LOADING

Size class (inches)	Load (tons/acre)	Mean diam.[a] (inches)	
		sound	rot
0.0-0.25	2.2	0.1	
0.26-1.0	3.6	.5	
1.1-3.0	7.4	1.7	
Subtotal 0-3 in	13.2		
3.1-9.0	10.7	5.6	
9.1-20.0	2.0	10.7	
>20.0	2.0	20.0	
Subtotal >3 in	14.7	6.4	
TOTAL	28.0		

[a] Mean diam.=quadratic mean.



STEREO PAIR: 1-DFWH-PRE-03

ADDITIONAL FUEL INFORMATION

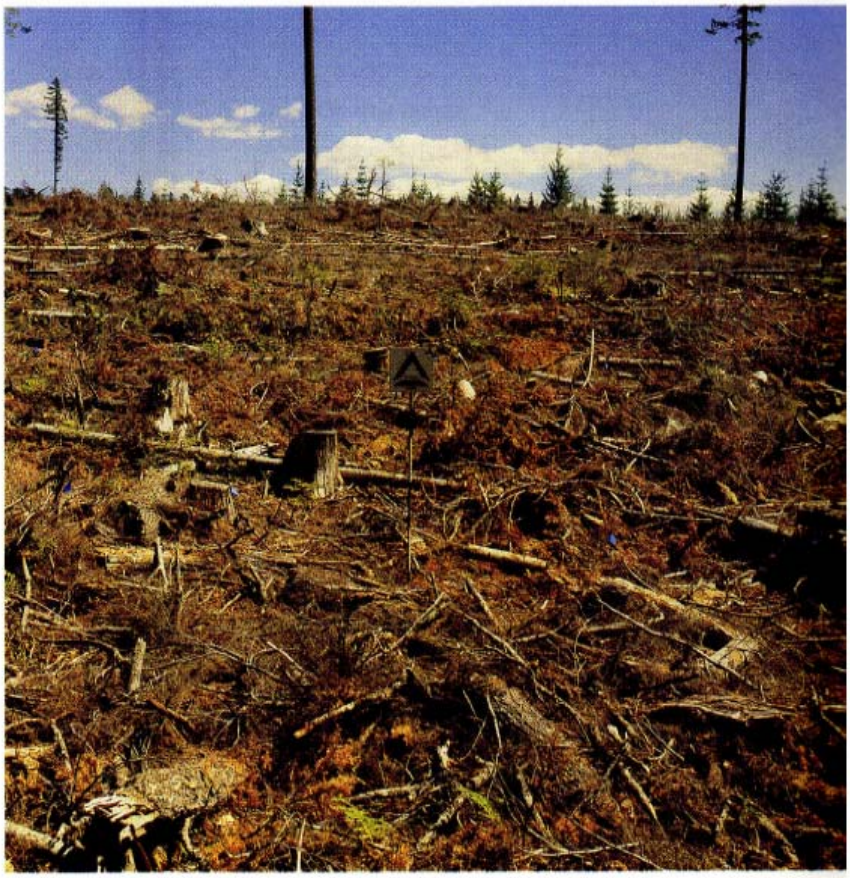
Sound residue >3-inch diameter:	Douglas-fir	34%	Average residue depth:	0.8 ft
	W. hemlock	17%	Average duff depth:	2.1 in
	Other	49%		
Rotted residue >3-inch diameter:		0%		

Percent residue >3-inch diameter is based on number of logs.

DOWN AND DEAD WOODY FUEL LOADING

Size class (inches)	Load (tons/acre)	Mean diam.[a] (inches)	
		sound	rot
0.0-0.25	1.8	0.1	
0.26-1.0	3.0	.5	
1.1-3.0	5.0	1.7	
Subtotal 0-3 in	9.8		
3.1-9.0	12.2	4.8	7.1
9.1-20.0	10.8	10.7	11.8
>20.0	0		
Subtotal >3 in	23.1	5.9	9.0
TOTAL	32.9		

[a] Mean diam.=quadratic mean.



STEREO PAIR: 1-DFWH-PRE-04

ADDITIONAL FUEL INFORMATION

Sound residue >3-inch diameter:	W. hemlock	27%	Average residue depth:	0.7 ft
	Douglas-fir	19%	Average duff depth:	2.4 in
	Other	34%		
Rotted residue >3-inch diameter:		20%		

Percent residue >3-inch diameter is based on number of logs.

DOWN AND DEAD WOODY FUEL LOADING

Size class (inches)	Load (tons/acre)	Mean diam.[a] (inches)	
		sound	rot
0.0-0.25	2.0	0.1	
0.26-1.0	3.3	.5	
1.1-3.0	6.6	1.7	
Subtotal 0-3 in	11.9		
3.1-9.0	11.8	5.7	5.5
9.1-20.0	10.7	11.1	11.9
>20.0	0		
Subtotal >3 in	22.5	6.9	7.6
TOTAL	34.4		

[a] Mean diam.=quadratic mean.

STEREO PAIR: 1-DFWH-PRE-05

ADDITIONAL FUEL INFORMATION

Sound residue >3-inch diameter:	I. cedar	38%	Average residue depth:	0.5 ft
	Douglas-fir	17%	Average duff depth:	1.3 in
	Other	35%		
Rotted residue >3-inch diameter:		10%		

Percent residue >3-inch diameter is based on number of logs.

DOWN AND DEAD WOODY FUEL LOADING

Size class (inches)	Load (tons/acre)	Mean diam.[a] (inches)	
		sound	rot
0.0-0.25	3.0	0.1	
0.26-1.0	5.1	.5	
1.1-3.0	8.1	1.7	
Subtotal 0-3 in	16.2		
3.1-9.0	19.0	5.3	6.0
9.1-20.0	0		
>20.0	0		
Subtotal >3 in	19.0	5.3	6.0
TOTAL	35.2		

[a] Mean diam.=quadratic mean.

STEREO PAIR: 1-DFWH-PRE-06

ADDITIONAL FUEL INFORMATION

Sound residue >3-inch diameter:	True fir	41%	Average residue depth:	0.7 ft
	Douglas-fir	12%	Average duff depth:	1.6 in
	Other	29%		
Rotted residue >3-inch diameter:		18%		

Percent residue >3-inch diameter is based on number of logs.

DOWN AND DEAD WOODY FUEL LOADING

Size class (inches)	Load (tons/acre)	Mean diam.[a] (inches)	
		sound	rot
0.0-0.25	2.6	0.1	
0.26-1.0	4.3	.5	
1.1-3.0	12.1	1.7	
Subtotal 0-3 in	19.0		
3.1-9.0	12.7	4.8	6.7
9.1-20.0	4.4	11.1	13.0
1.1-3.0	0		
Subtotal >3 in	17.1	5.3	8.4
TOTAL	36.1		

[a] Mean diam.=quadratic mean.

STEREO PAIR: 1-DFWH-PRE-07

ADDITIONAL FUEL INFORMATION

Sound residue >3-inch diameter:	Douglas-fir	81%	Average residue depth:	0.6 ft
	Other	13%	Average duff depth:	1.7 in
Rotted residue >3-inch diameter:		6%		

Percent residue >3-inch diameter is based on number of logs.

DOWN AND DEAD WOODY FUEL LOADING

Size class (inches)	Load (tons/acre)	Mean diam.[a] (inches)	
		sound	rot
0.0-0.25	2.3	0.1	
0.26-1.0	3.8	.5	
1.1-3.0	6.2	1.7	
Subtotal 0-3 in	12.3		
3.1-9.0	19.6	5.1	5.1
0.26-20.0	6.3	9.8	10.5
>20.0	0		
Subtotal >3 in	25.8	5.5	7.2
TOTAL	38.1		

[a] Mean diam.=quadratic mean.

STEREO PAIR: 1-DFWH-PRE-08

ADDITIONAL FUEL INFORMATION

Sound residue >3-inch diameter:	W. hemlock	36%	Average residue depth:	1.1 ft
	Douglas-fir	32%	Average duff depth:	4.4 in
	Other	24%		
Rotted residue >3-inch diameter:		8%		

Percent residue >3-inch diameter is based on number of logs.

DOWN AND DEAD WOODY FUEL LOADING

Size class (inches)	Load (tons/acre)	Mean diam.[a] (inches)	
		sound	rot
0.0-0.25	1.3	0.1	
0.26-1.0	2.2	.5	
1.1-3.0	6.0	1.7	
Subtotal 0-3 in	9.5		
3.1-9.0	14.8	5.7	5.3
9.1-20.0	7.5	10.5	11.1
>20.0	9.4	25.6	
Subtotal >3 in	31.7	7.9	7.0
TOTAL	41.2		

[a] Mean diam.=quadratic mean.

STEREO PAIR: 1-DFWH-PRE-09

ADDITIONAL FUEL INFORMATION

Sound residue >3-inch diameter:	Douglas-fir	29%	Average residue depth:	0.3 ft
	W. hemlock	13%	Average duff depth:	4.2 in
	Other	19%		
Rotted residue >3-inch diameter:		39%		

Percent residue >3-inch diameter is based on number of logs.

DOWN AND DEAD WOODY FUEL LOADING

Size class (inches)	Load (tons/acre)	Mean diam.[a] (inches)	
		sound	rot
0.0-0.25	2.5	0.1	
0.26-1.0	4.1	.5	
1.1-3.0	10.1	1.7	
Subtotal 0-3 in	16.8		
3.1-9.0	15.6	5.9	6.8
9.1-20.0	11.7	12.4	10.2
>20.0	0		
Subtotal >3 in	27.3	7.3	7.3
TOTAL	44.1		

[a] Mean diam.=quadratic mean.

STEREO PAIR: 1-DFWH-PRE-10

ADDITIONAL FUEL INFORMATION

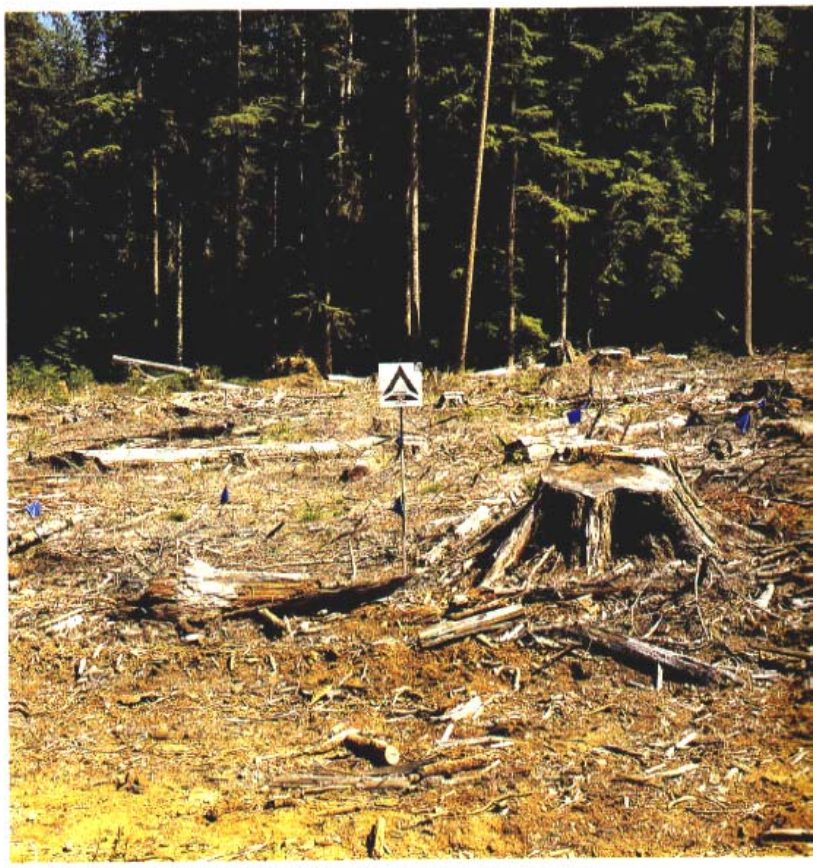
Sound residue >3-inch diameter:	Douglas-fir	39%	Average residue depth:	0.7 ft
	True fir	18%	Average duff depth:	2.4 in
	Other	22%		
Rotted residue >3-inch diameter:		21%		

Percent residue >3-inch diameter is based on number of logs.

DOWN AND DEAD WOODY FUEL LOADING

Size class (inches)	Load (tons/acre)	Mean diam.[a] (inches)	
		sound	rot
0.0-0.25	1.3	0.1	
0.26-1.0	2.1	.5	
1.1-3.0	4.6	1.7	
Subtotal 0-3 in	8.0		
3.1-9.0	7.3	4.8	5.3
9.1-20.0	21.4	13.3	13.9
>20.0	7.7	23.4	
Subtotal >3 in	36.3	9.0	9.1
TOTAL	44.4		

[a] Mean diam.=quadratic mean.



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STEREO PAIR: 1-DFWH-PRE-11

ADDITIONAL FUEL INFORMATION

Sound residue >3-inch diameter:	W. hemlock	28%	Average residue depth:	0.4 ft
	Douglas-fir	21%	Average duff depth:	2.5 in
	Other	42%		
Rotted residue >3-inch diameter:		9%		

Percent residue >3-inch diameter is based on number of logs.

DOWN AND DEAD WOODY FUEL LOADING

Size class (inches)	Load (tons/acre)	Mean diam.[a] (inches)	
		sound	rot
0.0-0.25	2.4	0.1	
0.26-1.0	3.9	.5	
1.1-3.0	11.0	1.7	
Subtotal 0-3 in	17.3		
3.1-9.0	21.8	5.6	5.3
9.1-20.0	5.8	10.5	10.8
>20.0	0		
Subtotal >3 in	27.6	6.0	6.1
TOTAL	44.9		

[a] Mean diam.=quadratic mean.

STEREO PAIR: 1-DFWH-PRE-12

ADDITIONAL FUEL INFORMATION

Sound residue >3-inch diameter:	Douglas-fir	46%	Average residue depth:	0.9 ft
	W. hemlock	7%	Average duff depth:	2.9 in
	Other	30%		
Rotted residue >3-inch diameter:		17%		

Percent residue >3-inch diameter is based on number of logs.

DOWN AND DEAD WOODY FUEL LOADING

Size class (inches)	Load (tons/acre)	Mean diam.[a] (inches)	
		sound	rot
0.0-0.25	1.7	0.1	
0.26-1.0	2.8	.5	
1.1-3.0	5.9	1.7	
Subtotal 0-3 in	10.5		
3.1-9.0	25.3	4.4	5.2
9.1-20.0	2.0	10.0	
>20.0	10.1	21.1	39.0
Subtotal >3 in	37.5	4.8	9.4
TOTAL	47.9		

[a] Mean diam.=quadratic mean.

STEREO PAIR: 1-DFWH-PRE-13

ADDITIONAL FUEL INFORMATION

Sound residue >3-inch diameter:	W. hemlock	43%	Average residue depth:	0.6 ft
	Douglas-fir	10%	Average duff depth:	4.5 in
	Other	35%		
Rotted residue >3-inch diameter:		12%		

Percent residue >3-inch diameter is based on number of logs.

DOWN AND DEAD WOODY FUEL LOADING

Size class (inches)	Load (tons/acre)	Mean diam.[a] (inches)	
		sound	rot
0.0-0.25	3.0	0.1	
0.26-1.0	5.0	.5	
1.1-3.0	9.0	1.7	
Subtotal 0-3 in	17.0		
3.1-9.0	24.1	4.9	4.9
9.1-20.0	17.2	11.3	
>20.0	6.7	30.3	
Subtotal >3 in	48.0	6.4	4.9
TOTAL	65.0		

[a] Mean diam.=quadratic mean.

STEREO PAIR: 1-DFWH-PRE-14

ADDITIONAL FUEL INFORMATION

Sound residue >3-inch diameter:	Douglas-fir	39%	Average residue depth:	1.2 ft
	True fir	32%	Average duff depth:	3.9 in
	Other	28%		
Rotted residue >3-inch diameter:		1%		

Percent residue >3-inch diameter is based on number of logs.

DOWN AND DEAD WOODY FUEL LOADING

Size class (inches)	Load (tons/acre)	Mean diam.[a] (inches)	
		sound	rot
0.0-0.25	2.4	0.1	
0.26-1.0	4.0	.5	
1.1-3.0	8.4	1.7	
Subtotal 0-3 in	14.8		
3.1-9.0	18.5	5.0	4.1
9.1-20.0	21.5	12.4	13.9
>20.0	30.0	21.6	26.7
Subtotal >3 in	70.0	6.7	18.4
TOTAL	84.4		

[a] Mean diam.=quadratic mean.

Continued

STEREO PAIR: 1-DFWH-PRE-15

ADDITIONAL FUEL INFORMATION

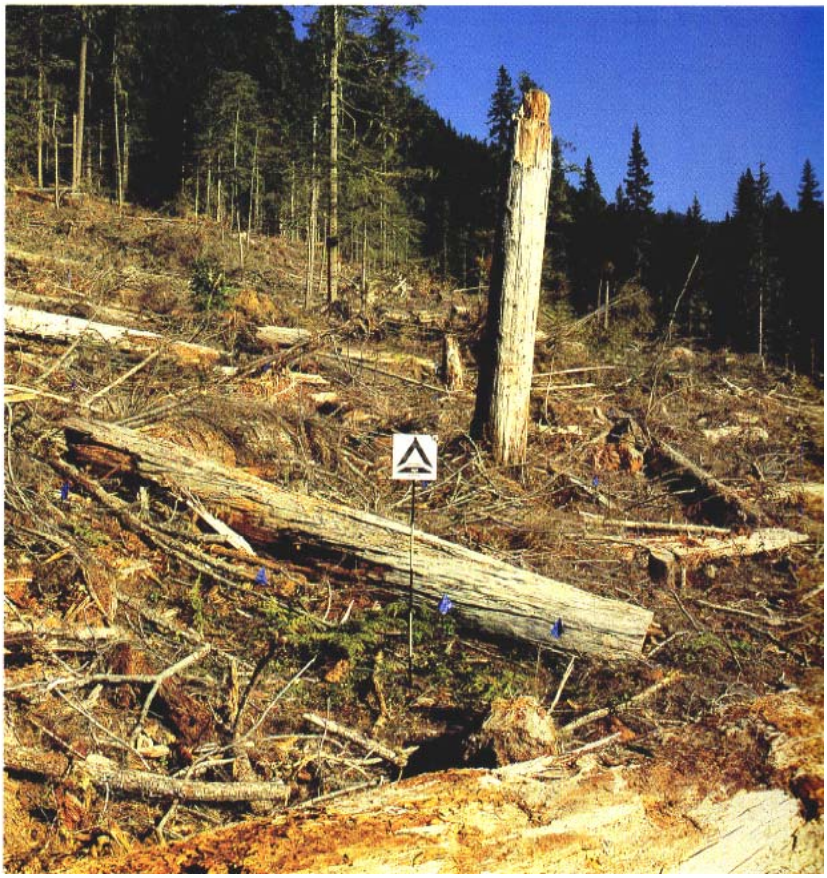
Sound residue >3-inch diameter:	W. hemlock	56%	Average residue depth:	0.8 ft
	W. redcedar	7%	Average duff depth:	2.2 in
	Other	23%		
Rotted residue >3-inch diameter:		14%		

Percent residue >3-inch diameter is based on number of logs.

DOWN AND DEAD WOODY FUEL LOADING

Size class (inches)	Load (tons/acre)	Mean diam.[a] (inches)	
		sound	rot
0.0-0.25	2.5	0.1	
0.26-1.0	4.2	.5	
1.1-3.0	8.7	1.7	
Subtotal 0-3 in	15.5		
3.1-9.0	8.5	4.7	4.5
9.1-20.0	18.6	13.8	13.9
>20.0	72.7	26.2	25.6
Subtotal >3 in	99.9	12.2	15.5
TOTAL	115.3		

[a] Mean diam.=quadratic mean.



STEREO PAIR: 1-DFWH-PRE-16

ADDITIONAL FUEL INFORMATION

Sound residue >3-inch diameter:	W. hemlock	33%	Average residue depth:	1.6 ft
	Douglas-fir	30%	Average duff depth:	5.3 in
	Other	10%		
Rotted residue >3-inch diameter:		27%		

Percent residue >3-inch diameter is based on number of logs.

DOWN AND DEAD WOODY FUEL LOADING

Size class (inches)	Load (tons/acre)	Mean diam.[a] (inches)	
		sound	rot
0.0-0.25	1.7	0.1	
0.26-1.0	2.9	.5	
1.1-3.0	7.4	1.7	
Subtotal 0-3 in	12.0		
3.1-9.0	18.3	5.0	6.8
9.1-20.0	28.2	11.5	13.7
>20.0	61.9	31.6	29.4
Subtotal >3 in	108.3	10.2	14.1
TOTAL	120.3		

[a] Mean diam.=quadratic mean.

STEREO PAIR: 1-DFWH-PRE-17

ADDITIONAL FUEL INFORMATION

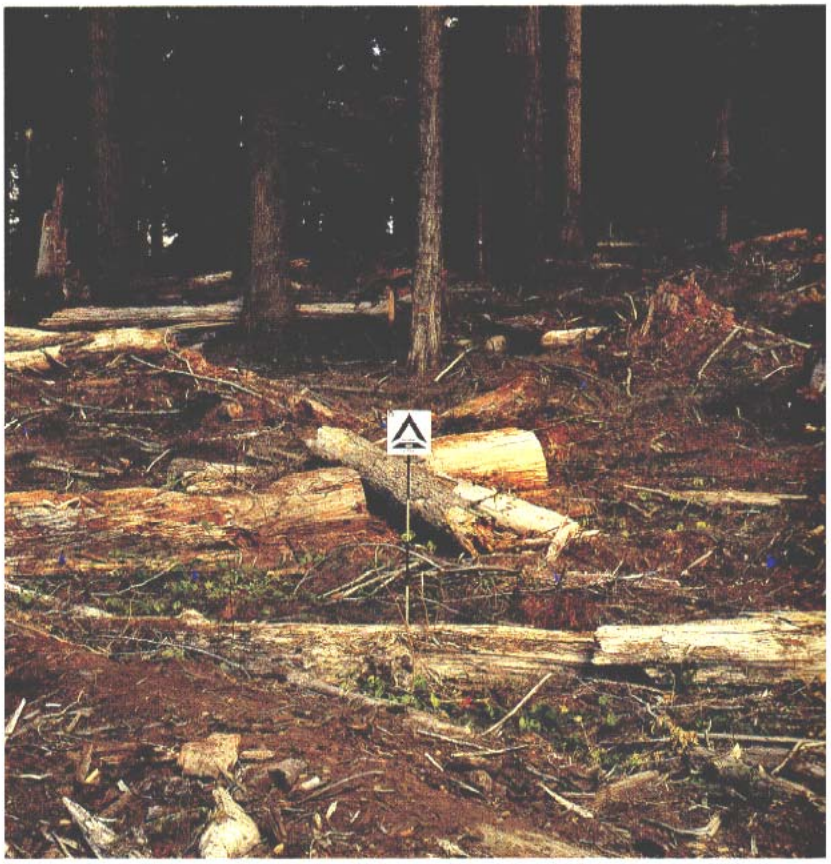
Sound residue >3-inch diameter:	Douglas-fir	68%	Average residue depth:	0.7 ft
	Other	24%	Average duff depth:	3.5 in
Rotted residue >3-inch diameter:		8%		

Percent residue >3-inch diameter is based on number of logs.

DOWN AND DEAD WOODY FUEL LOADING

Size class (inches)	Load (tons/acre)	Mean diam.[a] (inches)	
		sound	rot
0.0-0.25	1.1	0.1	
0.26-1.0	1.8	.5	
1.1-3.0	4.1	1.7	
Subtotal 0-3 in	6.9		
3.1-9.0	5.0	5.1	5.1
9.1-20.0	16.3	14.5	13.2
>20.0	112.3	32.6	22.1
Subtotal >3 in	133.5	19.1	14.1
TOTAL	140.5		

[a] Mean diam.=quadratic mean.



STEREO PAIR: 1-DFWH-PRE-18

ADDITIONAL FUEL INFORMATION

Sound residue >3-inch diameter:	W. hemlock	34%	Average residue depth:	0.7 ft
	Douglas-fir	30%	Average duff depth:	4.9 in
	Other	21%		
Rotted residue >3-inch diameter:		15%		

Percent residue >3-inch diameter is based on number of logs.

DOWN AND DEAD WOODY FUEL LOADING

Size class (inches)	Load (tons/acre)	Mean diam.[a] (inches)	
		sound	rot
0.0-0.25	1.0	0.1	
0.26-1.0	1.6	.5	
1.1-3.0	3.7	1.7	
Subtotal 0-3 in	6.3		
3.1-9.0	9.3	5.4	6.1
9.1-20.0	21.9	14.3	13.1
>20.0	115.3	32.2	21.1
Subtotal >3 in	146.5	16.6	14.6
TOTAL	152.8		

[a] Mean diam.=quadratic mean.

STEREO PAIR: 1-DFWH-PRE-19

ADDITIONAL FUEL INFORMATION

Sound residue >3-inch diameter:	W. hemlock	56%	Average residue depth:	0.8 ft
	True fir	16%	Average duff depth:	4.0 in
	Other	20%		
Rotted residue >3-inch diameter:		8%		

Percent residue >3-inch diameter is based on number of logs.

SERIES 2-DFWH-POST

DOUGLAS-FIR AND WESTERN HEMLOCK POST-BURN

A SERIES OF 7 LEVELS

DOWN AND DEAD WOODY FUEL LOADING

Size class (inches)	Load (tons/acre)	Mean diam.[a] (inches)	
		sound	rot
0.0-0.25	0.1	0.1	
0.26-1.0	.2	.5	
1.1-3.0	.7	1.7	
Subtotal 0-3 in	1.1		
3.1-9.0	7.3	4.9	6.2
9.1-20.0	3.9	11.0	17.2
>20.0	0		
Subtotal >3 in	11.2	5.6	9.5
TOTAL	12.3		

[a] Mean diam.=quadratic mean.

STEREO PAIR: 2-DFWH-POST-01

ADDITIONAL FUEL INFORMATION

Sound residue >3-inch diameter:	89%	Average residue depth:	0.1 ft
Rotted residue >3-inch diameter:	11%	Average duff depth:	0.4 in

Percent residue >3-inch diameter is based on number of logs.

DOWN AND DEAD WOODY FUEL LOADING

Size class (inches)	Load (tons/acre)	Mean diam.[a] (inches)	
		sound	rot
0.0-0.25	0.3	0.1	
0.26-1.0	.6	.5	
1.1-3.0	3.0	1.7	
Subtotal 0-3 in	3.9		
3.1-9.0	12.3	4.5	4.5
9.1-20.0	4.4	14.7	
>20.0	3.0		25.5
Subtotal >3 in	19.7	5.2	7.4
TOTAL	23.5		

[a] Mean diam.=quadratic mean.

STEREO PAIR: 2-DFWH-POST-02

ADDITIONAL FUEL INFORMATION

Sound residue >3-inch diameter:	82%	Average residue depth:	0.3 ft
Rotted residue >3-inch diameter:	18%	Average duff depth:	4.0 in

Percent residue >3-inch diameter is based on number of logs.

DOWN AND DEAD WOODY FUEL LOADING

Size class (inches)	Load (tons/acre)	Mean diam.[a] (inches)	
		sound	rot
0.0-0.25	0.2	0.1	
0.26-1.0	.3	.5	
1.1-3.0	1.5	1.7	
Subtotal 0-3 in	2.0		
3.1-9.0	11.3	5.2	
9.1-20.0	11.4	11.3	11.3
>20.0	0		
Subtotal >3 in	22.7	6.6	11.3
TOTAL	24.7		

[a] Mean diam.=quadratic mean.

STEREO PAIR: 2-DFWH-POST-03

ADDITIONAL FUEL INFORMATION

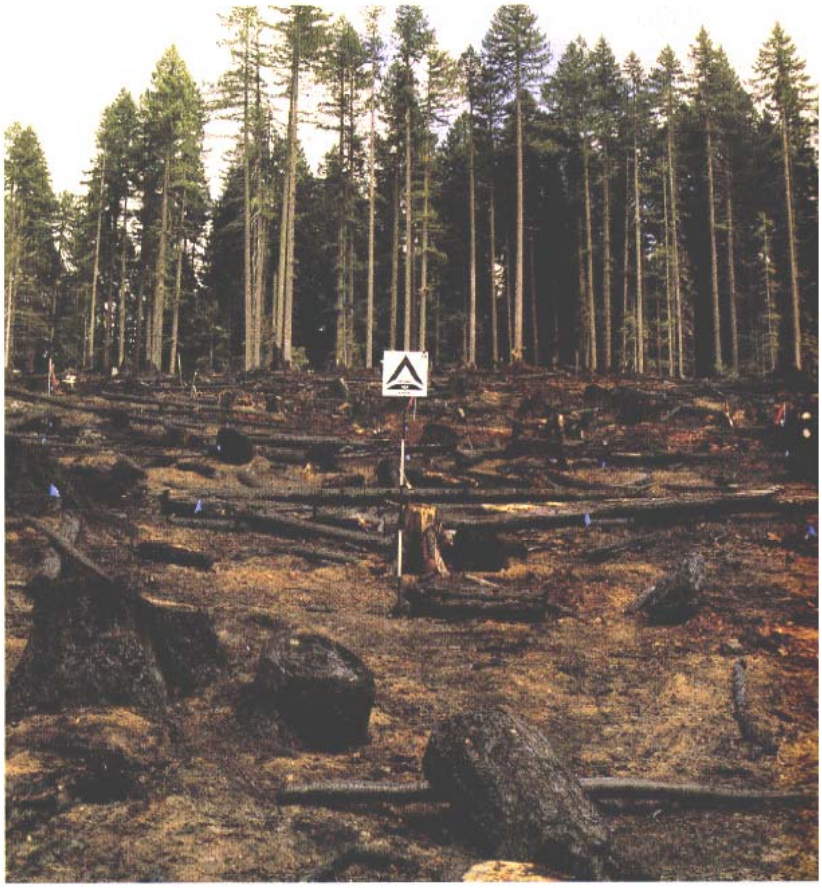
Sound residue >3-inch diameter:	99%	Average residue depth:	0.2 ft
Rotted residue >3-inch diameter:	1%	Average duff depth:	1.2 in

Percent residue >3-inch diameter is based on number of logs.

DOWN AND DEAD WOODY FUEL LOADING

Size class (inches)	Load (tons/acre)	Mean diam.[a] (inches)	
		sound	rot
0.0-0.25	0.0	0.0	
0.26-1.0	.1	.5	
1.1-3.0	1.2	1.7	
Subtotal 0-3 in	1.4		
3.1-9.0	15.8	6.1	5.0
9.1-20.0	11.7	10.4	10.0
>20.0	0		
Subtotal >3 in	27.5	7.2	6.3
TOTAL	28.9		

[a] Mean diam.=quadratic mean.



STEREO PAIR: 2-DFWH-POST-04

ADDITIONAL FUEL INFORMATION

Sound residue >3-inch diameter:	94%	Average residue depth:	0.2 ft
Rotted residue >3-inch diameter:	6%	Average duff depth:	1.1 in

Percent residue >3-inch diameter is based on number of logs.

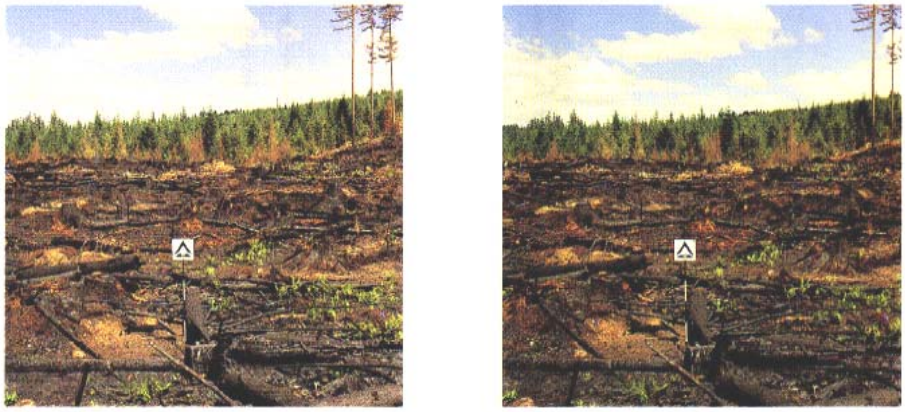
Continued

DOWN AND DEAD WOODY FUEL LOADING

Size class (inches)	Load (tons/acre)	Mean diam.[a] (inches)	
		sound	rot
0.0-0.25	0.2	0.1	
0.26-1.0	.3	.5	
1.1-3.0	3.8	1.7	
Subtotal 0-3 in	4.3		
3.1-9.0	14.7	5.9	6.0
9.1-20.0	16.7	11.2	12.8
>20.0	4.7		22.4
Subtotal >3 in	36.2	7.4	10.2
TOTAL	40.4		

[a] Mean diam.=quadratic mean.

STEREO PAIR: 2-DFWH-POST-05



ADDITIONAL FUEL INFORMATION

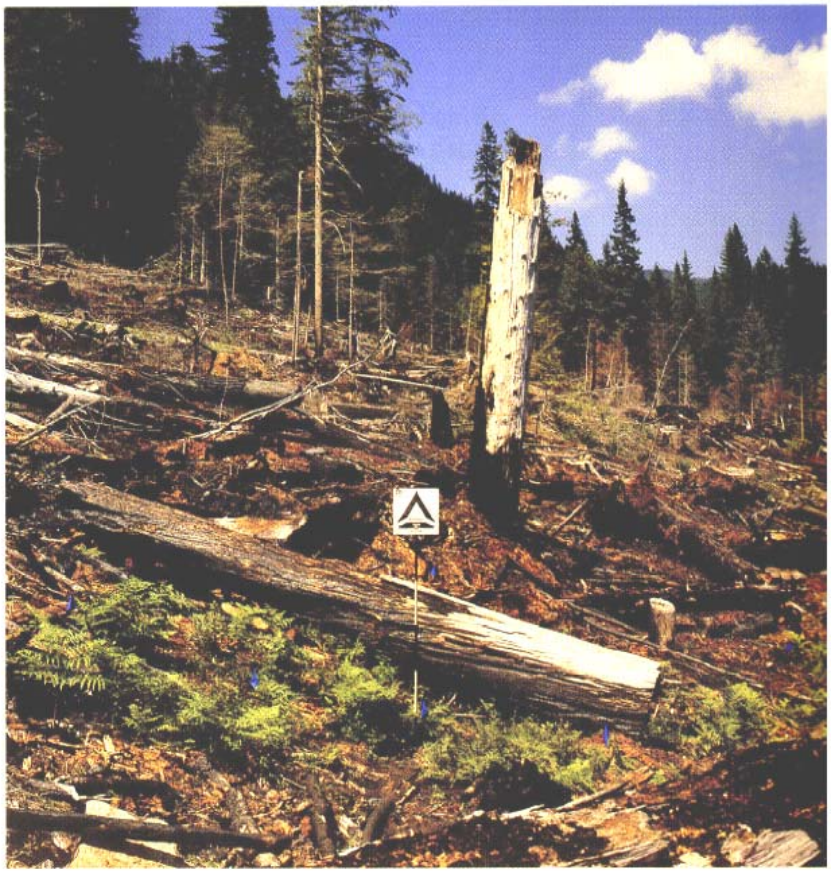
Sound residue >3-inch diameter:	70%	Average residue depth:	0.3 ft
Rotted residue >3-inch diameter:	30%	Average duff depth:	3.0 in

Percent residue >3-inch diameter is based on number of logs.

DOWN AND DEAD WOODY FUEL LOADING

Size class (inches)	Load (tons/acre)	Mean diam.[a] (inches)	
		sound	rot
0.0-0.25	0.5	0.1	
0.26-1.0	.9	.5	
1.1-3.0	4.0	1.7	
Subtotal 0-3 in	5.3		
3.1-9.0	6.9	4.8	7.8
9.1-20.0	24.2	15.1	14.2
>20.0	64.0	28.0	25.1
Subtotal >3 in	95.1	14.0	16.5
TOTAL	100.4		

[a] Mean diam.=quadratic mean.



STEREO PAIR: 2-DFWH-POST-06

ADDITIONAL FUEL INFORMATION

Sound residue >3-inch diameter:	62%	Average residue depth:	0.5 ft
Rotted residue >3-inch diameter:	38%	Average duff depth:	5.6 in

Percent residue >3-inch diameter is based on number of logs.

DOWN AND DEAD WOODY FUEL LOADING

Size class (inches)	Load (tons/acre)	Mean diam.[a] (inches)	
		sound	rot
0.0-0.25	0.2	0.1	
0.26-1.0	.4	.5	
1.1-3.0	2.0	1.7	
Subtotal 0-3 in	2.6		
3.1-9.0	10.6	5.4	5.7
9.1-20.0	12.0	11.2	14.4
>20.0	80.6	32.1	40.6
Subtotal >3 in	103.2	11.5	24.9
TOTAL	105.8		

[a] Mean diam.=quadratic mean.

STEREO PAIR: 2-DFWH-POST-07

ADDITIONAL FUEL INFORMATION

Sound residue >3-inch diameter:	82%	Average residue depth:	0.4 ft
Rotted residue >3-inch diameter:	18%	Average duff depth:	2.6 in

Percent residue >3-inch diameter is based on number of logs.

Ottmar, Roger D.; Hardy, Colin C.; Vihnanek, Robert E. 1990. Stereo photoseries for quantifying forest residues in the Douglas-fir-western hemlock type in the Willamette National Forest. Gen. Tech. Rep. PNW-GTR-258. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 63 p.

A series of stereo photographs displays a range of residue loadings for harvested units in the Douglas-fir-western hemlock cover type common to the Willamette National Forest. Postburn residue levels are also represented for the Douglas-fir-western hemlock types. Information with each photo includes measured quadratic means and weights for various size classes, woody fuel depth, and duff depth. The stereo photo series is designed to help forest managers appraise woody residue after both timber harvest and treatment with fire in forest types not previously represented by a photo series.

Keywords: Residues, fuel loadings, slash, residue measurements, Douglas-fir *Pseudotsuga Menziesii,* western hemlock, *Tsuga heterophylla.*

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