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Guidelines for Developing or Supplementing Natural Photo Series

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Abstract

These guidelines provide the land manager with procedures for making local supplements to General Technical Report PNW-105, "Photo Series for Quantifying Natural Forest Residues in Common Vegetation Types of the Pacific Northwest"; the process used to photograph and measure residues and summarize the data is described.

KEYWORDS: Residue surveys, data recording methods, photography.

Introduction

Natural photo series have been developed for major forest types in the Pacific Northwest by the Pacific Northwest Forest and Range Experiment Station, the Pacific Northwest Region of the Forest Service, and cooperating land management agencies.[2] They are comprised of 86 photo examples, forming 25 series, in 12 vegetation types.

These photo series provide a suitable tool for managing residue in most of the forested area of the Pacific Northwest and much of the forested area in other regions of the West. It may be desirable, however, to develop local series for other vegetation types, or to supplement the published series for forests containing signficant amounts of residue not well represented by these series.

Locally produced series or supplements may be useful in other forest units or regions. Sharing photo series examples can save many man-hours and dollars by avoiding duplicate efforts. The acceptance of work done by neighboring units will depend in a large part on quality photography, use of established sample procedures, and display of complete data in a familiar format.

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[1]Wayne G. Maxwell is a forester and Franklin R. Ward a forestry technician with the Pacific Northwest Forest and Range Experiment Station.

[2]Maxwell, Wayne G., and Franklin R. Ward. 1979. Photo series for quantifying forest residues in common vegetation types of the Pacific Northwest. USDA For. Serv. Gen. Tech. Rep. PNW-105, 229 p. Pac. Northwest For. and Range Exp. Stn., Portland, Oreg.

These guidelines are provided to assist other forest units and agencies in producing natural photo series or supplements to fill their needs. Following the procedures outlined in this guide, users can:

- Capitalize on previous experience in producing natural photo series.
- Collect information on total available fuel from the areas photographed.
- Display data from each photo area in a familiar and standardized format.
- Assemble natural photo series that not only will improve fuel management capabilities on the home unit but will be readily acceptable and beneficial to other units with like forest types.

Major Objectives tor Preparing Natural Photo Series

The major objectives in forming natural photo series in timbered vegetation types are to provide an array of loadings of dead-down residue that will: (1) enable trained technicians to make logical comparative estimates of loading by size classes in similar stands and (2) enable multidiscipline groups to quantify desirable residue loadings.

Criteria for Loading Levels in a Series

There is no set number of loading levels needed to form a series. If tonnage of dead-down residue in a given vegetation type and size class ranges from 5 to 20, three levels may be adequate. If tonnage ranges from 20 to 300, 8 to 10 levels may be desirable.

Extensive series for brush, if they are made, should be based on vegetation type, age class, and density or stocking level, rather than the size classes used in timber stands.

Reconnaissance

Variations in loadings of dead-down residue in natural forest stands result from such events as windstorms, epidemics of insects and disease, ice breakage, and fire. Knowledge of where such events have occurred in the past several decades is helpful in locating variations in loadings of dead-down residue.

It is generally helpful to first find the very light and the very heavy loading examples in the proposed series, then determine the desired number of examples in between and search for such areas.

Select slightly concave topography so that residue in the 180 feet of possible sampling distance has the best chance of being visible in the picture.

In dense stands and brush fields, it is not possible to see the dead-down residue in 180 feet of possible sampling distance. In these situations, reconnoiter the entire sampling area to make sure the dead-down residue in the picture is representative of the sampling area.

Photographing

Some guidance on photographing is provided in the "National Fuel Classification and Inventory System" guidelines.[3] Most of the suggestions are included here, along with suggestions specific to natural stand and residue situations.

The following should be helpful:

1. Photograph on cloudy or overcast days. If this is not possible, photograph early in the morning or late in the afternoon on clear days. Bright sunlight streaming through canopies creates sharp contrasts. Photographing under these conditions produces pictures with patches either too light or too dark to distinguish details.
2. Use a quality 35-mm camera with a 50- or 55-mm lens, or other quality camera with a comparable field of view.
3. Take photos with the long dimension horizontal.
4. Use a reasonably fast color film, such as Kodachrome 64.[4] This permits a reduced aperture (F-8 to F-16) which will provide reasonable focus of both background and foreground.
5. Always use a tripod, or similar stable platform, for the camera. Low light under timber canopies may require shutter speeds down to one twenty-fifth of a second. Under such a setting, the slightest camera movement causes a blurred photo.
6. Use the standard National Fuel System marker and pole (see footnote 3) placed 30 feet from the camera, in the center of the scene.
7. Use a light meter to determine proper exposure.
8. Take several pictures (three to five minimum), using slight variations of exposure. Occasionally, the exposure indicated by the light meter for the total picture is not the best for showing the detail of dead-down residue. Remember, the cost of film is minor compared with costs for salary and travel. A few extra shots may make a return trip unnecessary.

There are no known filters or flash attachments that will materially improve photographs taken in timbered stands.

Sampling Dead-Down Woody Material

Viewing the area through the camera viewfinder, establish five base lines with five sample points on each base line as shown in figure 1.

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[3]U.S. Department of Agriculture, Forest Service. 1975. National fuel classification and inventory system, preliminary draft. 61 p., illus. Washington Office, Washington, D.C.

[4]Mention of products does not constitute an endorsement by the U.S. Department of Agriculture.

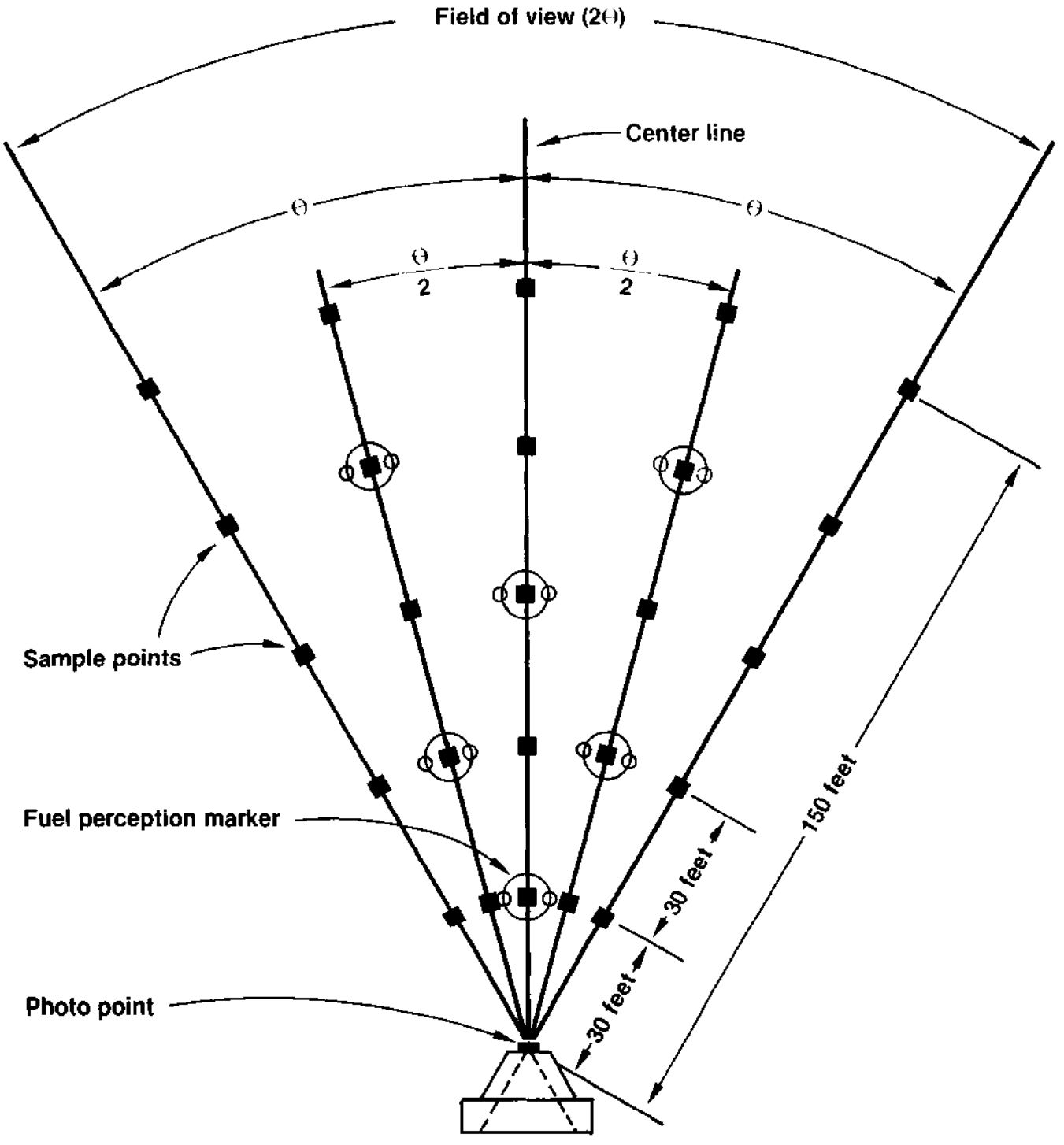

Figure 1.--The sampling pattern.

Angle of the sample plane from the base line will be determined by the toss of a die, as explained in the "Handbook for Inventorying Downed Woody Material," page 4.[5] All sample planes from the left base line will be alined with, or to the right of this base line. All sample planes from the right base line will be alined with, or to the left of this base line. Sample planes from the three interior base lines can be alined with, or to the right or left of the base line.

At each sample point on the three interior lines, flip a coin to determine whether the sample plane will go to the left or the right of the base line if the random angle is other than 0°.

Then conduct sampling from each of the 25 sample points, following instructions in the "Handbook for Inventorying of Downed Woody Material" (see footnote 5), starting with step 3 on page 3. Lengths of sample lines, however, are established at 3 feet for 0- to 1/4-inch material, 6 feet for 1/4- to 1-inch; 10 feet for 1- to 3-inch; and 30 feet for 3-inch and larger.

Use a separate Field Tally form for recording data from each sample plane (see fig. 2); a blank form is included at the end of this publication.

Complete sampling of dead-down material at each point before sampling live and dead standing material, to avoid disturbing the natural character of the dead fuel before measuring it.

Sampling Live and Dead Standing Material

Sampling of both live and dead standing material will be conducted at 6 sample points in the 25-point pattern, as indicated by the circled sample points (fig. 1). Measurements for both variable and fixed plots are made from these points. Dimensions and arrangement of fixed plots are detailed in figure 3.

Measurements of variable and fixed plots are recorded on the back of the "Field Tally" form for the appropriate sample point.

Following are detailed instructions for this sampling:

I. Variable Plot Information.
   Use a Relaskop, prism, or wedge (record factor for instrument on data sheet—fig. 2 (back)). Locate all trees and snags over 8 inches in d.b.h. in the plot.

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[5]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.

Figure 2.—"Filled in" "Field Tally" form.

FIELD TALLY FORM (front of form)

GENERAL INFORMATION

Photo point designation _____

Sample point number _____, _____ Date _____

Observers _____

Sample plane angle _____ Slope along sample plane _____

SLASH PARTICLE TALLY

Diameter class	Line length	Tally of intersections
0-1/4 inch	3 feet	
1/4-1 inch	6 feet	
1-3 inches	10 feet	
Over 3 inches	30 feet	

COMMENTS

	Species					
	Diam	Diam ^{2}	Diam	Diam ^{2}	Diam	Diam ^{2}
Sound						
Sum of squared diameters						
	All species					
Rotten						
Sum of squared diameters						

DEPTH MEASUREMENTS AND SPECIES COMPOSITION

Slash depths (nearest 0 1 foot)		Duff depths (nearest 0 2 inch)	
First foot		10 feet	
Second foot		20 feet	
Third foot		30 feet	

Species composition (nearest 10 percent)		
	Species	Percent
1.		
2.		
3.		

LIVE AND DEAD STANDING VEGETATION (back of form)

VARIABLE PLOT Basal area factor_____ FIXED PLOT

TREES AND SNAGS

SPECIES	D B H	HEIGHT	CROWN HEIGHT	AGE
Abbrev	Nearest inch	Nearest 5 feet	Nearest 5 feet	Nearest 5 years
LIVE FREES OVER 20-INCH D B H				
Estimated available crown space occupied %				
LIVE TREES 8- TO 20-INCH D B H				
Estimated available crown space occupied %				
SNAGS 8 INCHES AND OVER				

COMMENTS

TREES—LIVE AND DEAD<8-INCH D B H , 1/300 ACRE

SPECIES	D B H	HEIGHT	CROWN HEIGHT
Abbrev	Nearest inch	Nearest foot	Nearest foot
Estimated available crown space occupied %			

BRUSH % MIL-ACRE (2)

SPECIES	STEM DIAMETER at 6 inches	HEIGHT	CROWN HEIGhT	AVERAGE CROWN DIAMETER
Abbrev	Nearest 1/10 inch	Nearest inch	Nearest inch	Nearest inch
LEFT PLOT				
Ground space occupied %				
RIGHT PLOT				
Ground space occupied %				

GRASS AND FORBS, 1/4 MIL-ACRE (2)

	Ground space occupied	Predominant species	Average height
	Percent	Abbrev	Inches
L			
R			

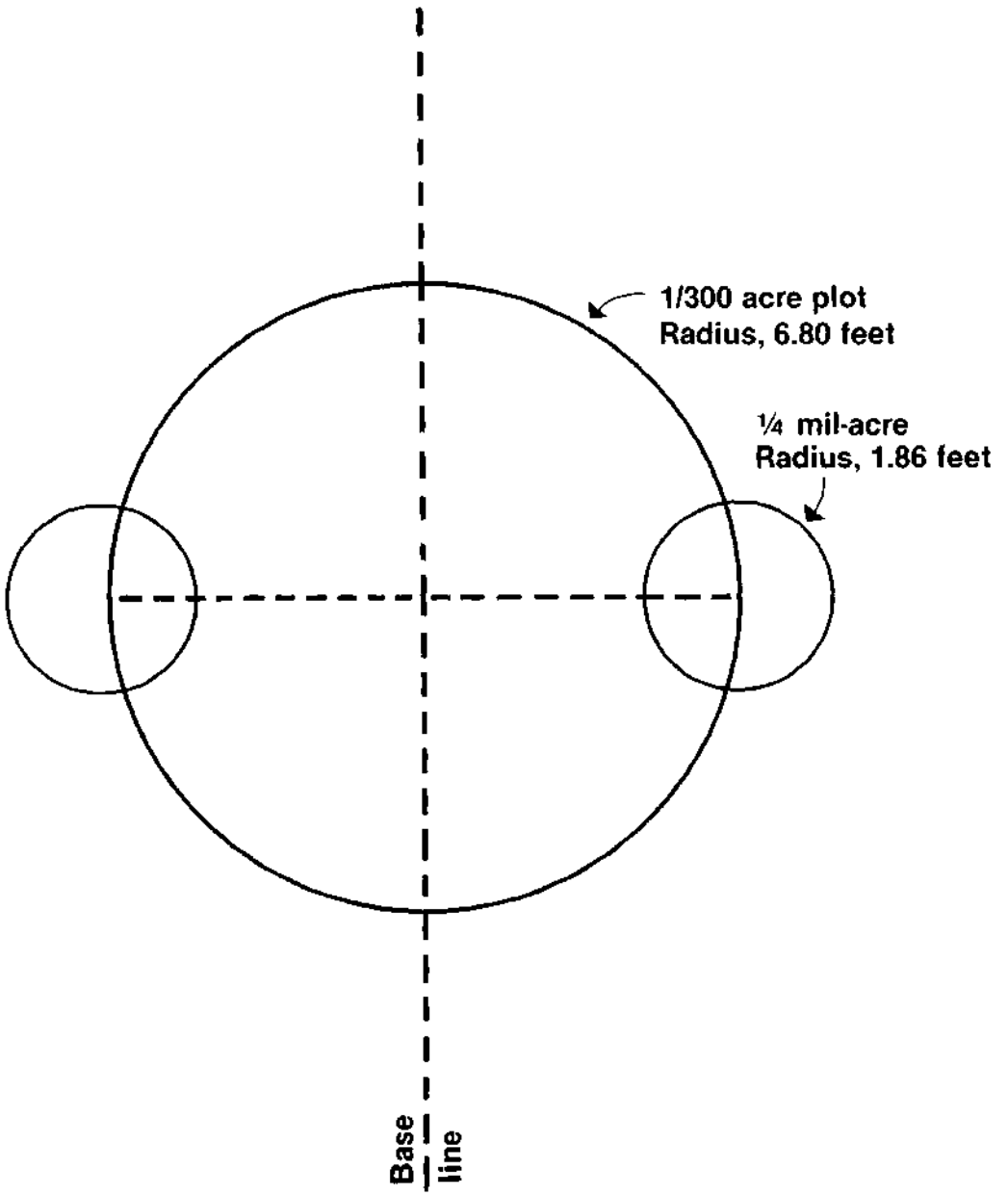

Figure 3.--Dimensions of fixed plots.

A. For each tree in the plot, record in the 8- to 20-inch d.b.h. block or the ≥20-inch d.b.h. block the following information:
   1. Species (identify).
   2. D.b.h. (measure).
   3. Height (measure).
   4. Crown height (measure).
   5. Age (bore and count). When at least four dominant trees have been bored in the photo sample area, if the observer is confident that these samples represent the stand age, no additional trees need be bored.

B. When all information on live trees on variable plots has been recorded, estimate to the nearest 10 percent the available space occupied by the crowns of trees in each of the two diameter classes. Visualize being high above the sample area looking straight down; judge how much of the ground would be blocked from view by crowns of trees in each of the two diameter classes.

C. For each snag over 8 inches, record in the snag block:
   1. Species (identify).
   2. D.b.h. (measure).
   3. Height (measure).

II. Fixed Plot Information.

A. For trees under 8 inches in d.b.h. on the 1/300-acre plot, record:
   1. Species (identify).
   2. D.b.h. (measure).
   3. Height (measure).
   4. Crown height (measure).
   5. Crown space occupied (estimate to nearest 10 percent); use the method recommended for larger trees.

B. For brush, on each of the two one-fourth mil-acre plots, record:
   1. Species (identify).
   2. Stem diameter at 6 inches from ground (measure).
   3. Height (measure).
   4. Crown height (measure).
   5. Average crown diameter (measure). For crowns, measure the widest and narrowest dimensions and average these for diameter. Measure the crowns on stems that originated in the plot even though the crown extends beyond the plot boundary. Do not measure crowns extending into the plot from stems outside the plot.
   6. Ground space occupied (estimate). Estimate the percentage of plot area covered by crowns. Visualize being above the plot looking straight down and judge how much of the ground would be blocked from view by the crowns.

C. For grass and forbs on the two one-fourth mil-acre plots, record:
   1. Ground space occupied (estimate). Use method recommended for brush.
   2. Dominant species (identify).
   3. Average height (estimate).

Computation of Loadings of Dead-Down Material and Other Measurements

Computations of weights, volumes, and depth of dead wood and depth of duff and litter are conducted in accordance with the "Handbook for Inventorying Downed Woody Material" (see footnote 5).

Percentages of ground area covered by residue and ground area covered by duff and litter are determined by dividing total points sampled into points that had measurable material. For example, if depth of woody residue was measured on 50 of the 75 sample segments, the ground area covered by residue would be 67 percent. Similarly, if depth of duff and litter was measured on 60 of the 75 sample points, the ground area covered by duff-litter would be 80 percent.

Computation of Data on Standing Fuel

Calculate the average heights of trees, crown heights of trees and brush, height of grass and forbs, and average diameter of trees by summing the units in each category and dividing the total by the number of units. The average in this case is the mean or:

$$\bar{X} = \frac{\Sigma X;}{n}$$

where:

$\bar{X}$ = average (mean);
X = observed values in each category;
n = number of trees sampled.

Ground space occupied is also an average of the number of samples taken. So the above formula also applies here.

Calculate the number of trees or snags per acre from the formula for a single tree:

$$T = \frac{43{,}560;}{TT(DR)2}$$

where:

T = trees per acre;
D = d.b.h.
R = plot radius factor based on basal area factor (BAF) used (the plot radius factor for BAF's of 5, 10, 20, and 40 are 3.889, 2.750, 1.944, and 1.375, respectively).

Add the trees per acre for each diameter at breast height by plot; then compute the average by dividing by the number of plots.

Weight of grass and forbs can be estimated by an ocular method or by clipping and weighing. The ocular method can best be done by asking an experienced range specialist to estimate the amount on the basis of pounds per acre. If clipping and weighing is the desired method, plants from each one-fourth mil-acre plot are clipped and allowed to air dry until an equilibrium for an average summer day is reached. Average the weights from the plots. Then multiply the average weight by 4,000 to obtain the average weight per acre.

Trees less than 8 inches in d.b.h. in each 1/300-acre plot are counted and then computed on a per-acre basis. The formula is:

$$y = 300x;$$

where:

y = trees per acre for each plot;
x = count by plot.

$$\text{Average trees per acre for all plots} = \frac{\Sigma y}{n};$$

where:

n = number of plots.

Remember, for all size classes of trees per acre, include all plots to calculate the average even though some may be zero.

Record completed computations for the various categories of material in the appropriate blocks on the data sheet (fig. 4) which accompanies the photo.

Recommended Descriptive Codes of Local Natural Photo Series and Supplements

1. Descriptive codes for supplements:
   When supplementing published series, precede the code with the unit name. Then use decimal numbers for order of rank in the total series. For example, if the Bend District is supplementing the three level mixed conifer, size class 3 series (General Technical Report PNW-105) with two levels of loading lighter than number 1, one level between number 2 and number 3 and two levels heavier than number 3, photos in the supplements would be coded as follows:

   Bend-O.l-MC-3
   Bend-0.2-MC-3
   Bend-2.1-MC-3
   Bend-3.1-MC-3
   Bend-3.2-MC-3

DATA SHEET

Residue descriptive code _____

LOADING

Size class (Inches)	Weight (tons/acre)	Volume (ftVacre)
0.0 - 0.25		
0.26- 1.0		
1.1 - 3.0		
3.1 - 9.0		
9.1 -20.0		
20.1+		
Total		

OTHER MEASUREMENTS

Average residue depth (feet)_____

Ground area covered by residue (percent)_____

Average duff and 1itter depth (Inches)_____

Ground area covered by duff and litter (percent)_____

Sound residue 3 1 inch diameter and larger (percent)_____

Rotten residue 3 1-inch diameter and larger (percent)_____

STAND INFORMATION

Trees over 20-Inch d.b.h.

Dominant species_____

Trees per acre _____

Average d.b.h. (Inches)_____

Average tree height (feet)_____

Average crown height (feet)_____

Estimated crown space occupied (percent)_____

Trees and dead stems under 8-inch d b h

Dominant species_____

Trees per acre _____

Average d.b.h. (Inches)_____

Average tree height (feet)_____

Average crown height (feet)_____

Estimated crown space occupied (percent)_____

Trees 8- to 20-1nch d.b.h.

Dominant species_____

Trees per acre _____

Average d b.h. (Inches)_____

Average tree height (feet)_____

Average crown height (feet)_____

Estimated crown space _____

Snags 8-inch d.b.h. and over

Number per acre _____

Average d.b.h. _____

Average height _____

BRUSH INFORMATION

Dominant species _____

_____

Averaqe height (Inches)_____

Average crown height (Inches)_____

Ground space occupied (percent)_____

GRASS AND FORBS INFORMATION

Dominant species _____

_____

Average height (inches)_____

Ground space (percent)_____

Estimated weight (pounds per acre)_____

ASSESSMENT ()F FIRE BEHAVIOR AND SUPPRESSION DIFFICULTY

Spread rate (chains/hour)_____

Flame length (feet)_____

Resistance to suppression(chains/man-hour)_____

Ecoclass coding _____

REMARKS

Figure 4.—Data sheet.

2. Descriptive codes for new series:
When assembling a series for a vegetation type, start coding with the name of the unit; continue as with published series, using the appropriate abbreviation for the vegetation type.

Assessment of Fire Behavior and Difficulty of Suppression

Anticipated rate of spread of wildfire and length of flame are estimated for each photo example; selected moisture content of fine fuels and wind conditions are used. Conditions selected for the assessment should approximate the average of conditions expected during the critical portion of the fire season. Results should provide a benchmark for judging fire behavior when conditions are more or less critical.

The assessments of fire behavior and difficulty of suppression for photo series examples in General Technical Report PNW-105 (see footnote 2) were determined from fuel model scaling tables developed by Dr. David V. Sandberg, and a resistance to suppression matrix developed by Wayne G. Maxwell.[6]

[6]These unpublished procedures are on file at Pacific Northwest Forest and Range Experiment Station, Portland, Oreg.

Metric Equivalents

1	acre	=	0.404 7 hectare
2.471	acres	=	1 hectare
1	foot	=	0.304 8 meter
3.281	feet	=	1 meter
1	inch	=	2.54 centimeters
0.3937	inch	=	1 centimeter
1	pound	=	0.453 6 kilogram
2.205	pounds	=	1 kilogram
1	ton (short)	=	0.907 2 ton (metric)
1.1023	tons (short)	=	1 ton (metric)

FIELD TALLY FORM

GENERAL INFORMATION

Photo point designation _____

Sample point number _____ Date _____

Observers _____

Sample plane angle _____ Slope along sample plane _____

SLASH PARTICLE TALLY

Diameter class	Line length	Tally of intersections
0 1/4 inch	3 feet	
1/4 1 inch	6 feet	
1 3 inches	10 feet	
Over 3 inches	30 feet	

COMMENTS

	Species					
	Diam	Diam ^{2}	Diam	Diam ^{2}	Diam	Diam
Sound						
Sum of squared diameters						
	All species					
Rotten						
Sum of squared diameters						

DEPTH MEASUREMENTS AND SPECIES COMPOSITION

Slash depths (nearest 0 1 foot)		Duff depths (nearest 0 2 inch)	
First foot		10 feet	
Second foot		20 feet	
Third foot		30 feet	

Species composition (nearest 10 percent)		
	Species	Percent
1		
2		
3		

LIVE AND DEAD STANDING VEGETATION

VARIABLE PLOT Basal area factor_____

TREES AND SNAGS

SPECIES	D B H	HEIGHT	CROWN HEIGHT	AGE
Abbrev	Nearest inch	Nearest 5 feet	Nearest 5 feet	Nearest 5 years
LIVE TREES OVER 20-INCH D B H				
Estimated available crown space occupied %				
LIVE TREES 8- TO 20-INCH D B H				
Estimated available crown space occupied %				
SNAGS 8 INCHES AND OVER				

COMMENTS

FIXED PLOT

TREES—LIVE AND DEAD<8INCH D B H , 1/300 ACRE

SPECIES	D B H	HEIGHT	CROWN HEIGHT
Abbrev	Nearest inch	Nearest foot	Nearest foot
Estimated available crown space occupied %			

BRUSH *VA* MIL-ACRE (2)

SPECIES	STEM DIAMETER at 6 inches	HEIGHT	CROWN HEIGHT	AVERAGE CROWN DIAMETER
Abbrev	Nearest 1/10 inch	Nearest inch	Nearest inch	Nearest inch
LEFT PLOT				
Ground space occupied %				
RIGHT PLOT				
Ground space occupied %				

GRASS AND FORBS, 1/4 MIL-ACRE (2)

	Ground space occupied	Predominant species	Average height
	Percent	Abbrev	Inches
L			
R			

GPO 990 795