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Icon Description Summary

The table below provides a summary of the functionality of the icons.

Icon Descriptions		 Notes	 Help
 New Planar Intercept	 Open Planar Intercept	 Save	 Calculate
 New Photo Series	 Open Photo Series	 Validate Data	 Exit

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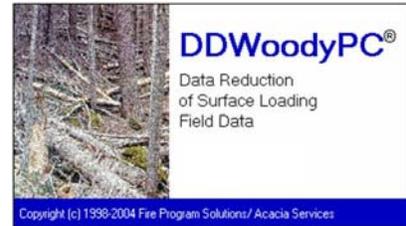
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Welcome to DDWoodyPC®

The Introduction that follows for inventorying downed woody material was taken from the Handbook For Inventorying Downed Woody Material by James K. Brown (USDA-FS GTR- INT-16, 1974). The explanations are repeated verbatim to insure no changes are implied from those documented in the Handbook.



Introduction

The GTR-INT-16 Handbook tells how to inventory weights, volumes, and depths of downed woody material. Downed woody material is the dead twigs, branches, stems, and boles of trees and brush that have fallen and lie on or above the ground. This material is usually called slash or logging debris if humans create it by cutting; it is called natural debris if it accumulates without cutting.

Inventorying downed woody material can help land managers practice fuel management, plan for prescribed fire, and estimate utilization potential. For example, undesirable fuel hazards can be identified and plans made for hazard reduction. Fire behavior in wilderness areas can be predicted to aid in implementing the fire policies. The volume of downed fiber can be estimated to plan for sales, removal, and utilization. Managers can communicate in exact terms about their debris problems.

The GTR-INT-16 Handbook provides a detailed description of how to inventory dead down woody material using the “Planar Intercept Method.” This method involves sampling data planes placed throughout the sample area with dead down woody material being counted and measured. The average fuel loadings by size class and average fuel bed depths can be determined for the sample area using the Planar Intercept Method in the DDWoodyPC program.

The inventory of volumes and weights using the planar intersect method (Brown 1971; Brown and Roussopoulos 1974), which has the same theoretical basis as the line intersect technique (Van Wagner 1968). The planar intersect method involves counting intersections of woody pieces with vertical sampling planes that resemble guillotines dropped through the downed debris. Volume is estimated, then weight is calculated from volume by applying estimates of specific gravity of woody material. The planar intersect technique is nondestructive and avoids the time consuming, costly, and often impractical task of collecting and weighing large quantities of forest debris.

This Planar Intercept Method described in GTR-INT-16 Handbook applies most accurately in the western United States because it contains average particle diameters for western conifers; however, the procedures are appropriate for forests everywhere. The inventory procedures are rapid and easy to use. For average amounts of downed debris, about 5 to 6 minutes per sample point are required for the measurements. More time is usually spent in traveling and locating sample points than in making the measurements. If only downed woody material is inventoried, a two-person crew can complete 20 to 40 plots a day, depending on how much debris is present.

As an alternative data gathering method, the fuel loading and fuel bed depths can be estimated using photos contained in the Photo Series. The average fuel loadings by size class and average fuel bed depths can be determined for the sample area using the Photo Series Method in the DDWoodyPC program.

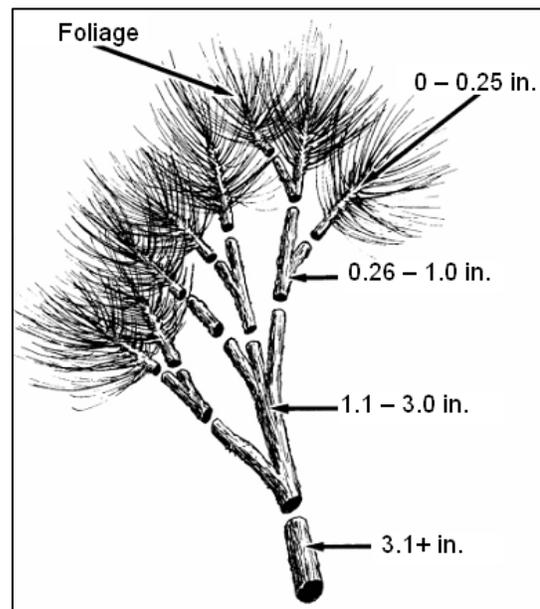
The DDWoodyPC program contains all photos and data plates from the following Photo Series:

- GTR-INT-46 Photo Series for Appraising Thinning Slash in Northern Idaho; Western Hemlock, Grand Fir and Western Redcedar Timber Types
- GTR-INT-96 Photo Guide for Appraising Downed Woody Fuels in Montana Forests: Grand Fir/Larch/Douglas-fir, Western Hemlock, Western Hemlock/Western Redcedar and Western Redcedar Cover Types
- GTR-INT-97 Photo Guide for Appraising Downed Woody Fuels in Montana Forests: Interior Ponderosa Pine. Ponderosa Pine/Larch/Douglas-fir, Larch/Douglas-fir and Interior Douglas-fir Cover Types
- GTR-INT-98 Photo Guide for Appraising Downed Woody Fuels in Montana Forests: Lodgepole Pine and Englemann Spruce-Subalpine Fir Cover Types
- GTR-NA-FR-22 Photo Series for Quantifying Forest Residues in the: Northern Hardwood and Oak-Hickory Types
- GTR-NA-FR-25 Photo Series for Quantifying Forest Residues in: Loblolly Pine, Eastern White Pine, Pitch Pine and Virginia Pine
- GTR-PNW-51 Photo Series for Quantifying Forest Residues in the: Coastal Douglas-fir-Hemlock and Coastal Douglas-fir Hardwood Types
- GTR-PNW-52 Photo Series for Quantifying Forest Residues in the: Ponderosa Pine, Ponderosa Pine and Associated Species and Lodgepole Pine Types
- GTR-PNW-95 Photo Series For Quantifying Forest Residues in Sierra Mixed Conifer and Sierra True Fir Types
- GTR-PNW-105 Photo Series for Quantifying Natural Forest Residues in Common Vegetation Types of the Pacific Northwest
- GTR-PSW-56 Photo Series for Quantifying Natural Forest Residues: Southern Cascades and Northern Sierra Nevada
- PMS 830 Stereo Photo Series for Quantifying Natural Fuels. Volume I: Mixed-conifer with Mortality, Western Juniper, Sagebrush and Grassland Types in the Interior Northwest.

- PMS 831 Stereo Photo Series for Quantifying Natural Fuels. Volume II: Black Spruce and White Spruce Types in Alaska.
- PMS 836 Stereo Photo Series for Quantifying Natural Fuels. Volume IIa: Hardwoods with Spruce in Alaska.
- PMS 832 Stereo Photo Series for Quantifying Natural Fuels. Volume III: Lodgepole Pine, Quaking Aspen and Gambel Oak Types in the Rocky Mountains.
- PMS 833 Stereo Photo Series for Quantifying Natural Fuels. Volume IV: Pinyon-Juniper, Chaparral and Sagebrush Types in the Southwestern United States.
- PMS 834 Stereo Photo Series for Quantifying Natural Fuels. Volume V: Midwest Red and White Pine, Northern Tallgrass Prairie and Mixed Oak Types in the Central and Lake States.
- PMS 837 Stereo Photo Series for Quantifying Natural Fuels. Volume Va: Jack Pine in the Lake States.
- PMS 835 Stereo Photo Series for Quantifying Natural Fuels. Volume VI: Longleaf Pine, Pocosin and Marshgrass Types in the Southeastern United States.

A surface fuel inventory can be done to provide all or any part of the following information:

1. Weights and volumes per acre of downed woody material for
 - Diameter size classes of 0 to 0.25, 0.26 to 1.00, and 1.1 to 3.0 inches
 - Diameters of 3.1 inches and larger for sound and rotten conditions
2. Average diameter of debris larger than 3 inches
3. Depth of fuel and forest floor duff
4. Herbaceous and shrub (woody) fuel loadings



Woody pieces 3 inches or less in diameter are tallied by size classes. Pieces 3.1 inches and larger are recorded by their diameters. Size classes of 0” to 0.25”, 0.26” to 1.0”, and 1.1” to 3.0” were chosen for tallying intersections because:

- The class intervals provide the most resolution for fine fuels and are small enough to permit precise estimates of volume.
- They correspond, in increasing size, to 1-hour, 10-hour, and 100-hour average moisture timelag classes for many woody materials (Fosberg 1970). These are standard moisture timelags used in the National Fire-Danger Rating System (Deeming and others 1972).

Inventory chosen areas as follows:

- Decide on length of sampling planes and number of sample points.
- Complete the fieldwork.
- Calculate weight or volume, size, and depth of debris using DDWoodyPC.

The Startup Menu

Below are the two possible selections from the initial startup screen in DDWoodyPC. If the user wants to reduce data taken by the Planar Intercept Method, select Planar Intercept. If the user used Photo Series to estimate fuel loadings, fuel bed depths and/or herbaceous and shrub fuel loadings, select Photo Series.

Planar Intersect Method



Photo Series Method



Both data reduction methods allow the user to:

- Start a new inventory
or
- Open an existing inventory

Program Menu and Menu Icon Descriptions

The File Menu

Use this menu item to create a new fuel inventory file, save a fuel inventory file, define tree species preferences to be displayed in pull down menus contained on the data input screen and to import data to a planar intercept inventory from an ASCII file.



New Planar Intercept, New Photo Series, Open Planar Intercept Open Photo Series

A new fuel inventory file is created for each set of plots. The fuel inventory file is a Microsoft Access data base file (mdb). To assist in the separation of data base files, planar intercept data base files have a DI3 extension. A planar intercept file name for a sample area “Plaster” might be named by the user as PLASTER.DI3. The DDWoodyPC program will automatically attach the DI3 extension. Photo series data base files have a DS3 extension (PLASTER.DS3).

The blue PI icon is for a NEW Planar Intercept file and the blue PS for a NEW Photo Series file. The PI icon is used to Open A Planar Intercept file and the PS icon to Open A Photo Series file.



Save and Save As

The two menu items function as they do in all Windows programs. Selecting the Save menu will save the inventory with the existing file name to the Data folder in the folder where FMAPlus 3 is installed. Selecting the Save As menu will allow the user to define a new file name for the inventory and to save it in any folder.



Hot Tip

It is recommended that the user save all inventory data files in the Data folder in the folder where FMAPlus 3 is installed.

The user may desire to create folders for projects inside the Data folder.

Import

The DDWoodyPC program supports import of a comma-delaminated ASCII file with field data measurements. The import is only supported in the Planar-Intercept mode. This is a new feature in DDWoodyPC. The ASCII file has three sections as follows:

- Header Row
- Site Record Row
- 0-3” Data, Depth Data and Live Loading Data Rows
- 3.1”+ Data Rows

The data file row that would produce entries shown in the screen above follows:

1,Big Creek,Trout Mountain Unit,7/10/2003,I.A.Good,1,30,100,3,6,10,50,PIPO,35,5,PSME,30,6,,,

Every import file must have one site record in the following format.

1,Site_Name,Organization,DateTaken,TakenBy,AgeClass,%Foliage,Acres,TL1,TL10,TL100,TL1000,0-3Sp1,0-3Sp1%,0-3Sp1DBH,0-3Sp2,0-3Sp2%,0-3Sp2DBH,0-3Sp3,0-3Sp3%,0-3Sp3DBH

Due to the page width of this document, the data file row is shown on two rows whereas in the ASCII import file, it would show on one row. Table 1 contains the definitions of the fields. Refer to earlier parts of this Users' Guide for a description of valid values and formats for the fields.

Table 1 – Site Record Row Field Descriptions

Field	Field ID	Field Description
1	1	Always enter a 1. This is flag to DDWoodyPC telling the program the format of the data that follows.
2	Site Name	Site Name
3	Organization	Organization
4	Date Taken	Date Taken
5	Taken By	Taken By
6	Age Class	Age Class: 1=Natural; 2=Fresh Slash; 3=1-Year Plus Slash
7	% Foliage	% Foliage Retained
8	Acres	Acres
9	TL1	Transect length for 0-0.25" dead down woody material
10	TL10	Transect length for 0.26-1.0" dead down woody material
11	TL100	Transect length for 1.1-3.0" dead down woody material
12	TL1000	Transect length for 3.1"+ dead down woody material
13	0-3Sp1	0-3" Species Composition: Species 1 Symbol
14	0-3SP1%	0-3" Species Composition: Species 1 Percent
15	0-3Sp1DBH	0-3" Species Composition: Species 1 Average DBH
16	0-3Sp2	0-3" Species Composition: Species 2 Symbol
17	0-3SP2%	0-3" Species Composition: Species 2 Percent
18	0-3Sp2DBH	0-3" Species Composition: Species 2 Average DBH
19	0-3Sp3	0-3" Species Composition: Species 3 Symbol
20	0-3SP3%	0-3" Species Composition: Species 3 Percent
21	0-3Sp3DBH	0-3" Species Composition: Species 3 Average DBH



Hot Tip

In field entries, adhere to the following protocols:

- Do not use commas in any field value itself (ie. Big, Creek)
- Do not enclose text values in quotes (ie. "Big Creek")

Blank or null data is represented as such: 1,,3 where 2 is a null value.

In DDWoodyPC, the species symbols (Table 2) are based on the plant scientific name and this symbol for a plant was obtained from the Internet (<http://plants.usda.gov/>).

Table 2 – List of Species Symbols

FMA3 Species Symbol	Species Name	Genus	Species
ALRU2	Alder, Red	Alnus	rubra
ALRH2	Alder, White	Alnus	rhombofolia
FRLA	Ash, Oregon	Fraxinua	latifolia
POTR5	Aspen, Quaking	Populus	tremuloides
FAGR	Beech, American	Fagus	grandifolia
BEPA	Birch, Paper	Betula	papyrifera
BEPAC	Birch, Western Paper	Betula	papyrifera
BEAL2	Birch, Yellow	Betula	alleganiensis
CHNO	Cedar, Alaska (Yellow)	Chamaecyparis	nootkatensis
THOC2	Cedar, Northern White	Thuja	occidentalis
CHLA	Cedar, Port Orford	Chamaecyparis	lawsoniana
THPL	Cedar, Western Red	Thuja	plicata
PREM	Cherry, Bitter	Prunus	emarginata
PRSE	Cherry, Black	Prunus	serotina
CACH6	Chinquapin, Giant	Castanopsis	chrysophylla
POBA	Cottonwood, Black	Populus	balsamifera
CONU4	Dogwood, Pacific	Cornus	nuttallii
PSME	Douglas-fir (East)	Pseudotsuga	menziesii
PSME	Douglas-fir (West)	Pseudotsuga	menziesii
ABBA	Fir, Balsam	Abies	balsamea
ABMA	Fir, California Red	Abies	magnifica
ABLAA	Fir, Corkbark	Abies	lasiocarpa var. arizonica
ABGR	Fir, Grand	Abies	grandis
ABPR	Fir, Noble	Abies	procera
ABAM	Fir, Pacific Silver	Abies	amabilis
ABSH	Fir, Shasta Red	Abies	shastensis
ABLA	Fir, Subalpine	Abies	lasiocarpa
ABCO	Fir, White	Abies	concolor
HWAK	Hardwoods (Alaska)	Hardwood	sp.
CRXX	Hawthorn	Crataegus	sp.
TSCA	Hemlock, Eastern	Tsuga	canadensis
TSME	Hemlock, Mountain	Tsuga	mertensiana
TSHE	Hemlock, Western	Tsuga	heterophylla
CAXX	Hickory	Carya	sp.
CADE27	Incense cedar	Calocedrus	decurrans
JUSC2	Juniper, Rocky Mtn.	Juniperus	scopulorum

Table 2 – List of Species Symbols

FMA3 Species Symbol	Species Name	Genus	Species
JUOS	Juniper, Utah	Juniperus	osteosperma
JUOC	Juniper, Western	Juniperus	monosperma
LALA	Larch, Eastern	Larix	laricina
LALA	Larch, Eastern	Larix	laricina
LALY	Larch, Subalpine	Larix	lyallii
LAOC	Larch, Western	Larix	occidentalis
ARME	Madrone, Pacific	Artutus	menziesii
ACMA3	Maple, Bigleaf	Acer	macrophyllum
ACNI5	Maple, Black	Acer	nigrum
ACRU	Maple, Red	Acer	rubrum
ACCI	Maple, Vine	Acer	circinatum
QUXX	Oak	Quercus	sp.
QUKE	Oak, California Black	Quercus	kelloggii
QURU	Oak, Northern Red	Quercus	rubra
QUGA4	Oak, Oregon White	Quercus	garryana
QUAL	Oak, White	Quercus	alba
PIAR	Pine, Bristlecone	Pinus	aristata
PIST	Pine, Eastern White	Pinus	strobus
PIBA2	Pine, Jack	Pinus	banksiana
PIJE	Pine, Jeffery	Pinus	jeffreyi
PIAT	Pine, Knobcone	Pinus	attenuata
PIFL2	Pine, Limber	Pinus	flexilis
PICO	Pine, Lodgepole	Pinus	contorta
PIRI	Pine, Pitch	Pinus	rigida
PIPO	Pine, Ponderosa	Pinus	ponderosa
PIRE	Pine, Red	Pinus	resinosa
PIST3	Pine, Southwestern White	Pinus	strobiformis
PILA	Pine, Sugar	Pinus	lambertiana
PIMO3	Pine, Western White	Pinus	monticola
PIAL	Pine, Whitebark	Pinus	albicaulus
PIMO	Pinyon, Singleleaf	Pinus	monophylla
PIED	Pinyon, Twoneedle	Pinus	edulis
LITU	Poplar, Yellow	Liriodendron	tulipifera
SESE3	Redwood, Coast	Sequoia	sempervirens
SEGI2	Sequoia, Giant	Sequoia	gigantea
PIMA	Spruce, Black	Picea	mariana
PIPU	Spruce, Blue	Picea	pungens
PIEN	Spruce, Engelmann	Picea	engelmannii
PIRU	Spruce, Red	Picea	rubens

Table 2 – List of Species Symbols

FMA3 Species Symbol	Species Name	Genus	Species
PISI	Spruce, Sitka	Picea	sitchensis
PIGL	Spruce, White	Picea	glauca
LIDE3	Tanoak	Lithocarpus	densiflorus
SALUX	Willow, Pacific	Salix	lasiandra
TABR2	Yew, Pacific	Taxus	brevifolia
MIXED	Mixed		
ROTTEN	Rotten		

0-3” Data, Depth Data and Live Loading Data Rows

This record shows one row per plot. It contains the entries for the number of depth measurements and live loading estimates from a photo series. These data fields in the DDWoodyPC input screen appear similar to the screen that follows:

	Plot ID	Slope	<-Fuel Bed 1	- Depth - 2	(Inches)-> 3	<-Duff Depth 1	(Inches)-> 2	<-Particle 0" to .25"	Count ---- .26" to 1"	-----> 1.1" to 3"	Herb (TPA)	Shrub (TPA)
▶	1	40	1	3	3	0.5	1.0	8	2	2	1.50	3.20
	2	30	2	6	1	0.5	1.0	11	4	0	0.53	1.30
	3	70	4	1	4	0.2	0.3	10	4	1	0.74	1.20
	4	15	7	0	2	0.1	1.0	6	1	0	0.00	0.56
	5	30	4	2	1	2.0	2.0	13	2	1	2.10	2.70
	6	10	5	6	2	0.5	0.7	10	3	2	0.65	0.00
	7	15	8	2	3	0.1	2.0	15	5	1	0.53	1.30
	8	10	1	2	6	1.5	2.0	11	3	2	0.33	2.90
	9	10	4	8	3	1.0	0.5	13	4	0	0.00	0.56
	10	45	10	8	6	0.7	1.0	6	1	1	0.74	1.20

The ASCII import file for these rows always starts with a 2.

Each plot is represented by a single record in the following format:

2,Plot_ID,Slope,FB_Depth1,FB_Depth2,FB_Depth3,Duff_Depth1,Duff_Depth2,PC1,PC2,PC3,Herb,Woody

- Plot_ID must be numeric and must not duplicate another Plot number
- Slope is measured in percent (0-100)
- FBDepth is Fuel bed Depth in inches
- Duff_DepthX is measured in inches
- PCX is the particle counts for the X-hour timelag size class
- Herb is the herbaceous fuel loading in tons per acre
- Woody is the woody fuel loading from shrubs in tons per acre

The rows for the ASCII import file for the data shown in the screen above would be as follows:

```
2,1,40,1,3,3,0.5,1,0,8,2,1.5,3.2
2,2,30,3,6,1,0.5,1,0,11,4,0.53,1.3
2,3,70,3,1,4,0.2,0,3,10,4,0.74,1.2
2,4,15,7,0,2,0.1,1,0,6,1,0,0.56
2,5,30,4,2,1,2.0,2,0,13,2,2.1,2.7
2,6,10,5,6,2,0.5,0,7,10,3,0.65,0
2,7,15,8,2,3,0.1,2,0,15,5,0.53,1.3
2,8,10,1,2,6,1.5,2,0,11,3,0.33,2.9
2,9,10,4,8,3,1.0,0,5,13,4,0,0.56
2,10,45,10,8,6,0.7,1,0,6,1,0.74,1.2
```

3”+ Data Rows

There are two types of 3.1”+ plus records, one for diameters only and one for diameter/lengths (piece count method). The Piece_Count_Flag controls which type is to be used. The ASCII import file for these rows always starts with a 3.

Diameters Only Entered

Where diameters only are to be used, the format is:

3,PlotID,Species,d1,d2,di3,d4,d5,d6,d7,d8,d9,d10,d11,d12,d13,d14,d15,d16,d17,d18,d19,d20

- PlotID must correspond to one of the plot record’s Plot_ID
- Species entered using species code (See Table 2 for list of species and code)
- D1-D20 must be greater or equal to 3, except where there is no value when a zero can be used

For example, plot 1 of an inventory might have 3.1”+ material as shown in the screen and the ASCII import file would have rows that appear below.

```
3,1,PIPO,4,7,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0
3,1,PSME,6,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0
```

		3.1" + Diameters and Lengths																			
	Species	D1	D2	D3	D4	D5	D6	D7	D8	D9	D10	D11	D12	D13	D14	D15	D16	D17	D18	D19	D20
	Pine, Ponderosa	4	7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
▶	Douglas-fir (East)	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0



The Data Menu

There is only one menu item on the data menu.

Data

Validate Data

Validate Data

This menu item checks for complete data entry.

The user can also enact this menu item by clicking on the Validate



icon.

The Calculate Menu

There is only one menu item on the data menu.

Calculate

Calculate Fuel Loadings

Calculate

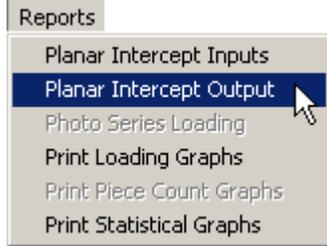
This menu item activates the fuel loading and depth calculations.

The user can also enact this menu item by clicking on the Calculate icon.



Planar Intercept Loadings

Selecting this menu item will produce the report that follows. It provides a summary of the data outputs for an area sampled using the planar intercept method.



Fuel Loading and Depth Results															
Plot	Dead Down Woody Fuel Loading (Tons per Acre)										Live Loading (Tons per Acre)			Avg. Duff Depth (Inches)	Avg. Fuel Bed Depth (Inches)
	0"- .25"	.26"- 1"	1.1"- 3"	Total 0"-3"	3.1"- 6"	6.1"- 9"	9.1"- 20"	20.1"+	3.1"+	Plot Total	Herb	Shrub	Total		
1	0.27	0.70	3.46	4.43	1.60	9.34	0.00	0.00	10.94	15.37	1.50	3.20	4.70	0.75	2.33
2	0.36	1.36	0.00	1.71	1.91	0.00	0.00	1.91	3.62	0.53	1.30	1.83	0.75	3.00	
3	0.38	1.59	1.96	3.92	0.00	6.82	0.00	0.00	6.82	10.75	0.74	1.20	1.94	0.25	2.67
4	0.19	0.33	0.00	0.52	1.51	4.15	9.42	0.00	15.08	15.59	0.00	0.56	0.56	0.55	3.00
5	0.42	0.68	1.68	2.78	5.54	0.00	0.00	5.54	8.32	2.10	2.70	4.80	2.00	2.33	
6	0.31	0.98	3.23	4.52	6.20	2.53	0.00	0.00	8.72	13.24	0.54	0.00	0.54	0.60	4.33
7	0.47	1.64	1.62	3.74	3.86	0.00	11.94	0.00	15.80	19.53	0.53	1.30	1.83	1.05	4.33
8	0.34	0.98	3.23	4.55	3.33	0.00	0.00	0.00	3.33	7.88	0.33	2.90	3.23	1.75	3.00
9	0.41	1.31	0.00	1.71	2.62	2.53	7.02	0.00	12.17	13.88	0.00	0.56	0.56	0.75	5.00
10	0.20	0.36	1.76	2.32	3.64	0.00	0.00	0.00	3.64	5.96	0.74	1.20	1.94	0.85	8.00
Mean:	0.34	0.99	1.69	3.02	3.02	2.54	2.84	0.00	8.39	11.41	0.70	1.49	2.19	0.93	3.80
S.D.:	0.09	0.48	1.35	1.42	1.90	3.32	4.71	0.00	4.96	4.96	0.65	1.08	1.59	0.54	1.74
S.E.:	0.03	0.15	0.43	0.45	0.60	1.05	1.49	0.00	1.57	1.57	0.21	0.34	0.50	0.17	0.55
%Err:	8.74	15.17	25.29	14.86	19.88	41.43	52.53	0.00	13.74	13.74	29.33	22.97	22.86	18.45	14.46
Needle Loading (Tons Per Acre):										0.31					
Total Needle and Dead Down Woody Loading (Tons Per Acre):										11.72					

Photo Series Loadings

Selecting this menu item will produce the report that follows. It provides a summary of the data outputs for an area sampled using the photo series method.



Dead and Down Woody Inventory - Photo Series Loading

Site: Big Mountain
 Organization: Your Agency
 Acres: 1000
 Taken By: I.A.Good
 Date Taken: 2/19/1999

Inventory Parameters:

Age Class: Natural Percent Foliage Retained (%): 20

3.1"+ Class Breaks 0-3" Fuel Composition

 3.1" - 9" Pine, Ponderosa 60% 15" Avg. Diameter

 9.1" - 20" Douglas-fir (East) 20% 12" Avg. Diameter

 20.1"+

Fuel Loading and Depth Results														
Plot No.	Photo Series (0" to 3" / 3.1"+ / Live / Depths)	Dead Down Woody Fuel Loading (Tons per Acre)							Live Loading (Tons per Acre)			Avg. Duff Depth (Inches)	Avg. Fuel Bed Depth (Inches)	
		0"- .25"	.26"- 1"	1.1"- 3"	Total 0"-3"	3.1"- 9"	9"- 20"	3.1"+	Plot Total	Herb	Shrub			Total
1	Demo Photo-1	0.03	0.90	2.00	2.93	3.50	0.00	3.50	6.43	0.00	0.00	0.00	3.20	1.20
2	Demo Photo-3	0.10	1.10	2.50	3.70	10.30	6.00	16.30	20.00	0.00	0.00	0.00	1.10	2.40
3	Demo Photo-5	0.04	2.50	6.90	9.44	8.10	8.40	20.10	29.54	0.00	0.00	0.00	0.60	3.60
4	Demo Photo-2/Photo-5	0.10	1.60	4.20	5.90	8.10	8.40	20.10	26.00	0.00	0.00	0.00	0.60	3.60
5	Demo Photo-2/Photo-1	0.10	1.60	4.20	5.90	3.50	0.00	3.50	9.40	0.00	0.00	0.00	3.20	1.20
6	Demo Photo-4	0.10	0.70	0.80	1.60	1.30	6.30	21.10	22.70	0.00	0.00	0.00	2.20	3.60
7	Demo Photo-2/Photo-4	0.10	1.60	4.20	5.90	1.30	6.30	21.10	27.00	0.00	0.00	0.00	2.20	3.60
8	Demo Photo-1/Photo-5	0.03	0.90	2.00	2.93	8.10	8.40	20.10	23.03	0.00	0.00	0.00	0.60	3.60
9	Demo Photo-3/Photo-2	0.10	1.10	2.50	3.70	2.10	2.90	9.70	13.40	0.00	0.00	0.00	1.60	2.40
10	Demo Photo-4	0.10	0.70	0.80	1.60	1.30	6.30	21.10	22.70	0.00	0.00	0.00	2.20	3.60
	Mean:	0.08	1.27	3.01	4.36	4.76	5.30	15.66	20.02	0.00	0.00	0.00	1.75	2.88
	S.D.:	0.03	0.56	1.88	2.43	3.50	3.24	7.30	7.74	0.00	0.00	0.00	1.01	1.01
	S.E.:	0.01	0.18	0.59	0.77	1.11	1.02	2.31	2.45	0.00	0.00	0.00	0.32	0.32
	%Err:	12.77	13.94	19.72	17.62	23.26	19.31	11.53	12.23	0.00	0.00	0.00	18.29	11.11
	Needle Loading (Tons Per Acre):								0.42					
	Total Needle and Dead Down Woody Loading (Tons Per Acre):								20.44					

Notes:

This is an example of how a fuels inventory can be done using Photo Series can be used to estimate fuel loadings along a transect.

2/19/99
I.A. Good

Print Loading Graphs, Print Piece Count Graphs and Print Statistical Graphs

Use these menu items to print the loading, piece count and statistical graphs. These graphs are viewed on the screen by selecting the appropriate tab from the Results - Quick View tab on the DDWoodyPC data entry screen.

The Help Menu

Help Contents

The DDWoodyPC program has a fully developed Help system. Use this menu item to activate the on-line Help system. Questions that cannot be resolved via the on-line support system should be addressed by contacting technical support.

Web Based Support

If the user has an active connection to the Internet, selecting this menu item will open the default Internet browser on the computer and direct the user to the FMAPlus 3 Home Page. From this page, you can obtain information on program features and program updates as well as make contact to FMAPlus Support Page.

About

This menu item will produce a screen showing the Version number of DDWoodyPC you are running as well as a copyright protection notice. The System icon can be activated to show the status of your systems resources.



The DDWoodyPC Data Input Screens - Planar Intercept

Data Entry: Area Setup Description

A description of each data input item follows.

Site Information

Site Name:
 Organization:
 Date Taken:
 Taken By:
 Age Class:
 % Foliage Retained: Acres:

Transect Lengths (ft)

Classes:
 0'' - .25'' : 3
 .26'' - 1'' : 6
 1.1'' - 3'' : 10
 3.1'' + : 50

3.1''+ Class Breaks

3.1''
 ↓
 6''
 ↓
 9''
 ↓
 20'' +

0-3'' Fuel Composition

Species	Percent	Avg. DBH
Pine, Ponderosa	0	5
Douglas-fir (East)	30	6
	0	0

Percent Allocated To Mixed Species: 70
 Enter 3.1'' + Log Lengths

Plots

Plot ID	Slope	<-Fuel Bed 1	- Depth - 2	(Inches)-> 3	<-Duff Depth 1	(Inches)-> 2	<-Particle 0'' to .25'	Count --- .26'' to 1''> 1.1'' to 3'	Herb (TPA)	Shrub (TPA)
1	40	1	3	3	0.5	1.0	8	2	2	0.00	0.00
2	30	2	6	1	0.5	1.0	11	4	0	0.00	0.00
3	70	3	1	4	0.2	0.3	10	4	1	0.00	0.00
4	15	7	0	2	0.1	1.0	6	1	0	0.00	0.00
5	30	4	2	1	2.0	2.0	13	2	1	0.00	0.00
6	10	5	6	2	0.5	0.7	10	3	2	0.00	0.00
7	15	8	2	3	0.1	2.0	15	5	1	0.00	0.00
8	10	1	2	6	1.5	2.0	11	3	2	0.00	0.00
9	10	4	8	3	1.0	0.5	13	4	0	0.00	0.00
10	45	10	8	6	0.7	1.0	6	1	1	0.00	0.00

3.1''+ Diameters and Lengths

Species	D1	D2	D3	D4	D5	D6	D7	D8	D9	D10	D11	D12	D13	D14	D15	D16	D17	D18	D19	D20
Pine, Ponderosa	4	7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Douglas-fir (East)	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Site Name

Enter the name of the sample area. This is an optional data entry but tracking of results via printouts and data files may be difficult if this entry is left blank.

Organization

Enter the name of the users' organization. This is an optional data entry.

Date Taken

Enter the date the inventory was performed. Use of the calendar icon is an optional method that can be used to enter the date. This is an optional data entry.

Calendar Button

Selecting the calendar icon causes the screen at the right to be displayed. The < and > buttons will cause the month (June) before and after (August) the displayed month to be shown. To select a date, click on the desired date. The calendar will close and the date selected will be entered into the Date Taken field.



Taken By

Enter names or initials of those taking the inventory data. This is an optional data entry.

Age Class

Select the age class of the dead down woody material being sampled. The options are natural, fresh slash and 1 year plus slash.



% Foliage Retained

Enter the percent of foliage retained on the dead down woody material. This percentage is used in the calculation of the needle fuel loading. The needle fuel loading calculation relies on the entries in the 0-3" Fuel Composition area. The tree species in the 0-3" Fuel Composition data entry section refers to the species and diameters of trees that created the dead down woody material on the ground. The needle loading is estimated using the % Foliage Retained entries based on the species and DBH sizes that created the dead down woody material on the ground. This is an optional data entry but use of this entry will allow for estimation of needle fuel loadings.



Acres

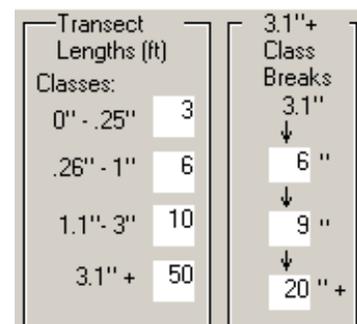
Enter the number of acres represented by the area sampled. The area acreage is not used in any of the calculations within DDWoodyPC and is an optional data entry.



Transect Lengths and 3.1"+ Class Breaks

Enter the length in feet of the transect line that each fuel size class category is sampled. See the Users' Guide section on The Field Sampling Procedure, Sampling Intensity, The Number and Size of Planes.

The user can define up to 4 size class breakpoints for categorization of the 3.1"+ dead down woody material. The Graphical and Output Reports will display the fuel loading in the 3.1"+ dead down material in these defined size class categories.



0-3" Fuel Composition

The purpose of this data entry section is to support the calculation of the needle fuel loading. It is an optional entry in that DDWoodyPC contains average estimates for the proportion of material in the needle, 1-hour timelag, 10-hour timelag and 100-hour timelag fuel categories. These average estimates are also applied to the proportion of the species not allocated to a specific species. This is why the sum of the percent values does not need to be equal to 100%.

0-3" Fuel Composition		
Species	Percent	Avg. DBH
Pine, Ponderosa	35	5
Douglas-fir (East)	30	6
	0	0
Percent Allocated To Mixed Species: 35		

Percent

Enter the percent of the dead woody material on the ground that was deposited from trees with the specified average diameter breast high (DBH).

Avg DBH

Examine the dead down woody material and enter the average diameter at breast height (DBH) of the trees that produced the dead woody material for each species.

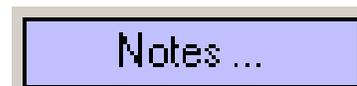
Enter 3.1"+ Log Lengths

Check this box if log lengths will be entered for each 3.1"+ log sampled. If log lengths are entered, DDWoodyPC will calculate the number of pieces per acre within the four defined 3.1"+ size classes defined. See the section titled "Plot Data Entry Description for 3.1"+ Material" for more information on the entry of log lengths. The formula for number of pieces per acre is $(68,424/NT) \times (\text{sum of } 1/L)$ where N is number of transects, T is length of transect (ft), and L is length of intersected pieces (ft).

Enter 3.1" + Log Lengths

The Notes Button

The **Notes** button activates a dialog box that allows the user to enter information, for the record, about the area sampled. The information in the Notes box is printed on the Inputs Report.



You can also activate the Notes entry window by clicking on the Notes icon on the toolbar. This allows for quick access to the Notes functionality from any screen in the program.



Plot Data Entry Descriptions - Intercepts Counts and Depth Measurements

The entry of measurements taken on each plot is described below and in the following section titled “Plot Data Entry Description for 3”+ Material.”

Plot (Data Entry Screen)

In this section, the user enters the data collected during the field sampling process. The guidelines for field sampling are contained in the Handbook For Inventorying Downed Woody Material by James K. Brown (USDA-FS GTR- INT-16, 1974). Since availability of this publication is limited, it has been reproduced in this Users’ Guide (See section titled, “The Field Sampling Procedure”). These guides are also contained in The Field Sampling Procedure section of the DDWoodyPC Help System. The Field Sampling Procedure only applies to application of the planar intercept method for sampling dead down woody material. Determination of fuel loading values on each plot for herbaceous and shrub is supported by the use of photo series.

	Plot ID	Slope	Plots									
			<-Fuel Bed 1	- Depth - 2	(Inches)-> 3	<-Duff Depth 1	(Inches)-> 2	<-Particle 0" to .25"	Count --- .26" to 1"	-----> 1.1" to 3"	Herb (TPA)	Shrub (TPA)
▶	1	40	1	3	3	0.5	1.0	8	2	2	1.50	3.20
	2	30	2	6	1	0.5	1.0	11	4	0	0.53	1.30
	3	70	3	1	4	0.2	0.3	10	4	1	0.74	1.20
	4	15	7	0	2	0.1	1.0	6	1	0	0.00	0.56
	5	30	4	2	1	2.0	2.0	13	2	1	2.10	2.70
	6	10	5	6	2	0.5	0.7	10	3	2	0.65	0.00
	7	15	8	2	3	0.1	2.0	15	5	1	0.53	1.30
	8	10	1	2	6	1.5	2.0	11	3	2	0.33	2.90
	9	10	4	8	3	1.0	0.5	13	4	0	0.00	0.56
	10	45	10	8	6	0.7	1.0	6	1	1	0.74	1.20

Plot ID

Each plot is assigned a numerical Plot Identifier when the plot is created. The procedure of taking this data is contained in The Field Sampling Procedure section. To add a plot, click on the Add Plot Button.

Slope

Enter the slope in percent as taken along the transect line. The procedure for taking this data is contained in The Field Sampling Procedure section.

Fuelbed Depth

Fuelbed depth is measured at three locations along the transect.. Record the value to the nearest inch. The procedure of taking this data is contained in The Field Sampling Procedure section.

Duff Depth

Duff depth is measured at two locations along the transect.. Record the value to the nearest tenth of an inch. The procedure for taking this data is contained in The Field Sampling Procedure section.

Particle Count

Enter the particle count for each of the three size classes: 0-0.25”, 0.26”-1.0” and 1.1" - 3.0”. The procedure for taking this data is contained in The Field Sampling Procedure section.

Herb (Fuel Loading)

DDWoodyPC supports the input of the herbaceous fuel loading on each plot. The user will need to determine the herbaceous fuel loading separately. A recommended process is to use photo series pictures that include sampled measurements of the herbaceous fuel loading that could be compared to observations on the plot.

Shrub (Fuel Loading)

DDWoodyPC supports the input of the shrub fine fuel loading on each plot. The user will need to determine the shrub fine fuel loading separately. A recommended process is to use photo series pictures that include sampled measurements of the shrub fine fuel loading that could be compared to observations on the plot. The fine fuel loading is defined here as the 1-hour timelag fuels.



Hot Tip

When entering plot data in cells, a pencil symbol will appear on the left side of the row. The data entered does not get saved in the database until the pencil symbol changes to a black right facing arrow. Entered data is accepted by clicking with the mouse on a different row or by moving to another row using the up or down arrows on the keyboard.

Plot Data Entry Description for 3”+ Material

The sampling process requires the measurement of the diameter, in whole inches, of all dead down woody material greater than 3" in diameter. DDWoodyPC allows for the calculation of the fuel loading by species if the user enters the data by species. Up to twenty logs can be entered by species. The procedure for taking this data is contained in The Field Sampling Procedure section.

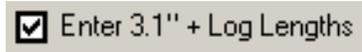
		3.1" + Diameters and Lengths																			
	Species	D1	D2	D3	D4	D5	D6	D7	D8	D9	D10	D11	D12	D13	D14	D15	D16	D17	D18	D19	D20
	Pine, Ponderosa	4	7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
▶	Douglas-fir (East)	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

To select the species, click on the box below the Species label. An arrow will appear on the right side of the box. By clicking on the arrow, a species list will be displayed from which the user can select the species. Note that by selecting the File menu option called Preferences, the user can select which species appear on the pulldown list.

In the example above, the plot had two 3.1+” Ponderosa pine logs and one Douglas-fir (East) log. Their diameters where they crossed the transect line are 4” and 7 for the Ponderosa pine species and 6” for the Douglas-fir (East) species. The 3.1+” log data entry area allows for up to 20 logs per species (row) to be entered on a single plot.

Entering 3.1"+ Log Lengths

If the "Enter 3.1"+ Log Lengths" has been checked, then the data entry for 3.1"+ material will appear similar to the screen capture below.



		3.1" + Diameters and Lengths															
	Species	D1	L1	D2	L2	D3	L3	D4	L4	D5	L5	D6	L6	D7	L7	D8	L8
	Pine, Ponderosa	4	10	7	20	0	0	0	0	0	0	0	0	0	0	0	0
▶	Douglas-fir (East)	6	15	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

If log lengths are entered, DDWoodyPC will calculate the number of pieces per acre within the four defined 3.1"+ size classes defined.

For each log, there is a corresponding column for the length of the log to be entered. The lengths should be in an integer and in feet. In the example above, the plot had a 4" diameter Ponderosa pine piece that was 10 feet long and a 7" diameter Ponderosa pine piece that was 20 feet long. It also had a 6" diameter Douglas-fir piece that was 15 feet long.

Add 3"+ Button

Click on this add a row in the data entry area for 3.1"+ material. By default, there are four rows for data entry. Clicking this button allows the user to add additional rows for data entry of additional species.



Delete 3"+ Button

The plot data is entered into two data entry areas. Selecting this button allows the user to delete the active row in the data entry screen for the 3"+ material. The active row is identified by the arrow to the left of the screen.



Add Plot Button

The **Add Plot** button is used to add a plot data entry row to the Data Input Screen. In the screen below, plots 1-3 existed initially and clicking on the **Add Plot** button resulted in a Plot 4 row to be added.



		Plots											
	Plot ID	Slope	<-Fuel Bed 1	-Depth- 2	(Inches)-> 3	<-Duff Depth 1	(Inches)-> 2	<-Particle 0" to .25"	Count --- .26" to 1"	-----> 1.1" to 3"	Herb (TPA)	Shrub (TPA)	
	1	40	1	3	3	0.5	1.0	8	2	2	1.50	3.20	
	2	30	2	6	1	0.5	1.0	11	4	0	0.53	1.30	
	3	70	4	1	4	0.2	0.3	10	4	1	0.74	1.20	
▶	4	0	0	0	0	0.0	0.0	0	0	0	0.00	0.00	

Delete Plot Button

The **Delete Plot** button is used to delete the active plot data entry row from the Data Input Screen. This active row is identified by the black arrow to the left of the row. To make a row active, click on that row with the mouse cursor set on that row.

A rectangular button with a blue gradient background and a black border, containing the text "Delete Plot" in a black sans-serif font.

Sort Plot Button

Plots may be assigned a different numeric plot identifier than the default identifier assigned by DDWoodyPC when the plot was added. These assignments can leave the data rows in a non-uniform manner. Selecting this icon will reorder the plot data entry rows in increasing numerical order.

A rectangular button with a blue gradient background and a black border, containing the text "Sort Plot" in a black sans-serif font.

The DDWoodyPC Data Input Screens - Photo Series

Photo Series Inventory

When the user selects New Photo Series from the File main menu, the user is required to provide a name for the file. The standard Windows dialog will appear (below right). The user may provide a file name. The default is Photo1.ds3. The user needs to only type in the file name as the program will automatically add the ds3 file extension. The file will be located in the Data folder at the file path location where DDWoodyPC is installed.

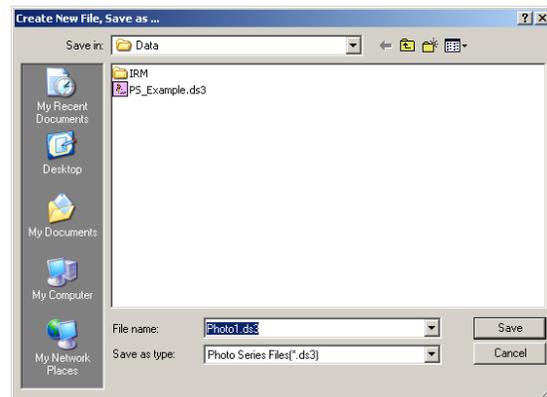


Photo Series Selection Screens

After a file name is selected, the screen below left appears. An inventory using multiple photo series photos can be selected as well as an inventory using a single photo series. If the single photo series book option is selected, the user is then prompted to select the photo series to be used (below right). To do this, click on the row which contains the photo series desired and click the **OK** button.

Create a New Photo Series Inventory

To create a new inventory select one of the following options:

- Inventory based on multiple photo series books
- Inventory based on a single photo series book

Cancel OK

Create a New Photo Series Inventory

To create a new inventory select one of the following options:

- Inventory based on multiple photo series books
- Inventory based on a single photo series book

Please Select a Photo Series Book

Book Label	Description
AK-BlackSpruce	Alaska Black Spruce
AK-WhiteSpruce	Alaska White Spruce
BlackHills	Black Hills
Demo	Demo Photos
INT-46	Thinning Slash/Northern Idaho -- WH-GF-WC
INT-96	DDW-Montana--GF-WH/RC
INT-97	DDW-Montana--DFI-LDF-PP-PP/L/DF
INT-98	DDW-Montana--LP-SF/ES
MixedOakTypes-Spi	Mixed Oak Types - Central and Lakes States

Cancel OK

Since there is no consistency between photo series as to the diameter breakpoints between size classes for dead down woody material greater the 3.1”+ diameter, all dead down woody material greater than 3.1”+ is grouped in the 3”+ category when a multiple photo series inventory is selected. Note in the screen below, the grouping of all 3.1”+ dead down woody material into one size class (3”+).

Plots (Photo Series Used 0" to 3" / 3.1"+ / Live / Duff-Fuel Bed Depths)

Plot ID	Book	Photo	0" to .25" (TPA)	.26" to 1" (TPA)	1.1" to 3" (TPA)	3.1"+ (TPA)	Herb (TPA)	Shrub (TPA)	Average Duff Depth (Inches)	Average Fuel Bed Depth (Inches)
1			0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00



Data Entry: Area Setup Description

A description of each data input item follows.

The screenshot shows the 'Dead and Down Woody Inventory' software interface. The title bar indicates the file path: C:\Program Files\FMAPlus 3\Data\PS_Example.ds3. The menu bar includes File, Data, Calculate, Reports, and Help. The toolbar contains icons for file operations and a help icon. The main window is titled 'Photo Series Inventory - Single Book' and has two tabs: 'Data Entry' (selected) and 'Results - Quick View'.

The 'Data Entry' section contains the following fields:

- Site Name: Big Mountain
- Organization: Your Agency
- Date Taken: 2/19/1999 (with a 'Calendar...' button)
- Taken By: I.A. Good
- % Foliage Retained: 20
- Acres: 1000

To the right of these fields is a '0-3" Fuel Composition' table:

Species	Percent	Avg. DBH
Pine, Ponderosa	60	15
Douglas-fir (East)	20	12
	0	0

Below this table, it states 'Percent Allocated To Mixed Species: 20' and there is a 'Notes ...' button.

The main data table is titled 'Plots (Photo Series Used 0" to 3" / 3.1"+ / Live / Duff-Fuel Bed Depths)'. It has the following columns: Plot ID, Book, Photo, 0" to .25" (TPA), .26" to 1" (TPA), 1.1" to 3" (TPA), 3.1" to 9" (TPA), 9.1" to 20" (TPA), 20" + (TPA), Herb (TPA), Shrub (TPA), and Ave. DBH (Inch).

Plot ID	Book	Photo	0" to .25" (TPA)	.26" to 1" (TPA)	1.1" to 3" (TPA)	3.1" to 9" (TPA)	9.1" to 20" (TPA)	20" + (TPA)	Herb (TPA)	Shrub (TPA)	Ave. DBH (Inch)
1	Demo	Photo-1	0.03	0.90	2.00	3.50	0.00	0.00	0.00	0.00	0.00
2	Demo	Photo-3	0.10	1.10	2.50	10.30	6.00	0.00	0.00	0.00	0.00
3	Demo	Photo-5	0.04	2.50	6.90	8.10	8.40	3.60	0.00	0.00	0.00
4	Demo	Photo-2/Photo-5	0.10	1.60	4.20	8.10	8.40	3.60	0.00	0.00	0.00
5	Demo	Photo-2/Photo-1	0.10	1.60	4.20	3.50	0.00	0.00	0.00	0.00	0.00
6	Demo	Photo-4	0.10	0.70	0.80	1.30	6.30	13.50	0.00	0.00	0.00
7	Demo	Photo-2/Photo-4	0.10	1.60	4.20	1.30	6.30	13.50	0.00	0.00	0.00
8	Demo	Photo-1/Photo-5	0.03	0.90	2.00	8.10	8.40	3.60	0.00	0.00	0.00
9	Demo	Photo-3/Photo-2	0.10	1.10	2.50	2.10	2.90	4.70	0.00	0.00	0.00
10	Demo	Photo-4	0.10	0.70	0.80	1.30	6.30	13.50	0.00	0.00	0.00

At the bottom of the window, there are buttons for 'Add Plot', 'Delete Plot', 'Sort Plot', and 'Dup Plot'.

Site Name

Enter the name of the sample area. This is an optional data entry but tracking of results via printouts and data files may be difficult if this entry is left blank.

Organization

Enter the name of the users' organization. This is an optional data entry.

Date Taken

Enter the date the inventory was performed. Use of the calendar icon is an optional method that can be used to enter the date. This is an optional data entry.

Calendar Button

Selecting the calendar icon causes the screen at the right to be displayed. The < and > buttons will cause the month (June) before and after (August) the displayed month to be shown. To select a date, click on the desired date. The calendar will close and the date selected will be entered into the Date Taken field.



Taken By

Enter names or initials of those taking the inventory data. This is an optional data entry.

% Foliage Retained

Enter the percent of foliage retained on the dead down woody material. This percentage is used in the calculation of the needle fuel loading. The needle fuel loading calculation relies on the entries in the 0-3" Fuel Composition area. The tree species in the 0-3" Fuel Composition data entry section refers to the species and diameters of trees that created the dead down woody material on the ground. The needle loading is estimated using the % Foliage Retained entries based on the species and DBH sizes that created the dead down woody material on the ground. This is an optional data entry but use of this entry will allow for estimation of needle fuel loadings.

% Foliage Retained

Acres

Enter the number of acres represented by the area sampled. The area acreage is not used in any of the calculations within DDWoodyPC and is an optional data entry.

Acres

0-3" Fuel Composition

The purpose of this data entry section is to support the calculation of the needle fuel loading. It is an optional entry in that DDWoodyPC contains average estimates for the proportion of material in the needle, 1-hour timelag, 10-hour timelag and 100-hour timelag fuel categories. These average estimates are also applied to the proportion of the species not allocated to a specific species. This is why the sum of the percent values does not need to be equal to 100%.

Species	Percent	Avg. DBH
Pine, Ponderosa	35	5
Douglas-fir (East)	30	6
	0	0

Percent Allocated To Mixed Species: 35

Percent

Enter the percent of the dead woody material on the ground that was deposited from trees with the specified average diameter breast high (DBH).

Avg DBH

Examine the dead down woody material and enter the average diameter at breast height (DBH) of the trees that produced the dead woody material for each species.

The NOTES Button

The NOTES button activates a dialog box that allows the user to enter information, for the record, about the area sampled. The information in the Notes box is printed on the Inputs Report.



You can also activate the Notes entry window by clicking on the Notes icon on the toolbar. This allows for quick access to the Notes functionality from any screen in the program.



Plot Data Entry - Photo Series

In this section, the user selects the photo series picture(s) that have been determined to best present the fuel loading and depths along the transect. Estimation of the fuel loadings and depths on a transect via photo series is an alternative to utilizing the planar intercept sampling of these fuels. DDWoodyPC allows for the user to select a separate photo series photo for the 0-3" fuel loading, the 3"+ fuel loading, fuel bed/duff depths, herbaceous fuel loading and the shrub fuel loading.

Add Plot

The first step is to add a plot by clicking on the Add Plot button. Plot 1 will appear. A single book example is shown.



Plots (Photo Series Used 0" to 3" / 3.1"+ / Live / Duff-Fuel Bed Depths)													
Plot ID	Book	Photo	0" to 25" (TPA)	26" to 1" (TPA)	1.1" to 3" (TPA)	3.1" to 9" (TPA)	9.1" to 20" (TPA)	20" + (TPA)	Herb (TPA)	Shrub (TPA)	Average Duff Depth (Inches)	Average Fuel Bed Depth (Inches)	
1			0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	

Each plot is assigned a numerical Plot Identifier when the plot is created. To add additional plots, click on the Add Plot Button.



Hot Tip

It is recommended that the user develop a "work area" to enter the inventory data by creating blank plot rows for the number of plots taken in the field.

For example, if 15 plots were taken in the field, then the user would click on the Add Plot button 15 times to create 15 blank plot rows.

Selecting Photo(s) To Represent A Transect

The user should double click on the row to select photos that represent the plot. A screen similar to the one below will appear. In this example, a single one photo series inventory was selected. The specific photo series that was selected is the Mixed-conifer with Mortality photo series book from PMS 830, Stereo Photo Series for Quantifying Natural Fuels, Volume I: Mixed-conifer with Mortality, Western Juniper, Sagebrush and Grassland Types in the Interior Northwest.

Photo Series - Single Book: PNW-Interior-MCwithMortality

Plot: 1

BookLabel	GroupLabel	PhotoLabel
PNW-Interior-MCwith	Int. PNW' Mixed Conifer with Mortality - Natural	MC01
PNW-Interior-MCwith	Int. PNW' Mixed Conifer with Mortality - Natural	MC02
PNW-Interior-MCwith	Int. PNW' Mixed Conifer with Mortality - Natural	MC03
PNW-Interior-MCwith	Int. PNW' Mixed Conifer with Mortality - Natural	MC04
PNW-Interior-MCwith	Int. PNW' Mixed Conifer with Mortality - Natural	MC05
PNW-Interior-MCwith	Int. PNW' Mixed Conifer with Mortality - Natural	MC06
PNW-Interior-MCwith	Int. PNW' Mixed Conifer with Mortality - Natural	MC07
PNW-Interior-MCwith	Int. PNW' Mixed Conifer with Mortality - Natural	MC08
PNW-Interior-MCwith	Int. PNW' Mixed Conifer with Mortality - Natural	MC09
PNW-Interior-MCwith	Int. PNW' Mixed Conifer with Mortality - Natural	MC10
PNW-Interior-MCwith	Int. PNW' Mixed Conifer with Mortality - Natural	MC11



Select Loadings

Current Selected Photos and Values

Select 0" to 3"	0". .25"	0.00 tpa	Show Photo
With Duff and Fuel Bed Depths	.26"-1"	0.00 tpa	
Select 3.1"+	3.01"- 9.1"	0.00 tpa	Show Photo
With Duff and Fuel Bed Depths	9.11"	0.00 tpa	
	20.11" +	0.00 tpa	
Duff and Fuel Bed Depths	Duff	0.00 in.	Show Photo
	Fuel Bed	0.00 in.	
Select Live	Herb	0.00 tpa	Show Photo
	Shrub	0.00 tpa	

Preview Photo

Average Duff Depth (In.):	1.30
Average Fuel Bed Depth (In.):	0.10
Vegetation Type:	MC
Activity Type:	Nat
Herb Loading (Tons per acre)	0.36
Shrub Loading (Tons per acre)	0.20
DDW Loading (Tons per acre)	
0" to .25":	0.30
.26" to 1":	0.60
1.1" to 3":	1.50
3.1" to 9":	4.20
9.1" to 20":	3.10
20.1" + :	0.00
Total 0" to 3":	2.40
Total 3"+ :	7.30
Total:	9.70

Select Photos for All Values Reset to Original Values View Cancel Accept and Close

List of Photos Area

The upper left part of the screen provides a list of the photos. The black arrow to the left of a photo designates that photo as the “active photo.” The user can do a left mouse click on a photo’s label to select that photo as the active photo. The user can also use the keyboard arrow keys to move the black arrow up and down which changes the active photo accordingly. The fuel attributes of the active photo are shown in the lower right part of the screen.

Preview Photo Check Box

By clicking on the Preview Photo check box, the user can view the graphic image of the active photo.

Preview Photo

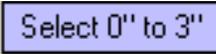
Select Loadings Area

In the lower left part of the screen, there are four separate areas where the user selects the photo that was assigned to that fuel category. The four fuel categories are shown at the right.

- 0 – 3” Dead Down Woody Material
- 3”+ Dead Down Woody Material
- Duff and Fuel Bed Depths
- Live Fuel (Herbaceous and Shrub)

Select 0" to 3"

Locate the photo that was identified in the field to represent this dead down fuel category. To assign this photo to this fuel category, click on the **Select 0" to 3"** button.



Select 3.1"+

Locate the photo that was identified in the field to represent this dead down fuel category. To assign this photo to this fuel category, click on the **Select 3.1"+** button.



Select Duff and Fuel Bed Depths

Either the photo assigned to the 0 – 3" dead down woody material fuel category or the 3"+ dead down woody material fuel category must be assigned to this fuel category. Since there is generally a relationship between the dead fuel categories and the fuel bed and duff depths, it seems reasonable to make this requirement. Perform a left mouse click on the radio button under the fuel category button that applies.



Select Live

Locate the photo that was identified in the field to represent this live (herbaceous and shrub) fuel category. To assign this photo to this fuel category, click on the **Select Live** button.



Select Photo for All Values

Click on this button to assign the active photo to all four fuel categories.



Reset to Original Values

Clicking on this button will change all photos selections to what they were at the most recent use of the **Accept and Save** button.



Viewing A Photo and/or Data Plate

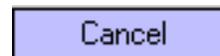
By selecting View, the selected photo series picture appears (below left). By clicking on the Data tab, the data plate (below right) from the photo series publication appears.



SITE INFORMATION					STAND INFORMATION					
Site location: N 45° 15' 05.72" W 118° 33' 27.12"					SAF cover type: Grand Fir					
Slope: < 10% Aspect: East					Species: <i>Abies grandis</i> 42%; <i>Larix occidentalis</i> 26%; <i>Pseudotsuga menziesii</i> 26%; <i>Pinus contorta</i> 6%					
Plant association: <i>Abies grandis</i> - <i>Carex geyerii</i>					Standing dead trees: 68% Crown closure: 42%					
Soil type: Loamy-skeletal, mixed, frigid Ultic Argixerolls					Seedling density: 358/ac					
Woody material depth: 0.1 ft Woody material loading: 39.9 tons/ac					Most common species: <i>Pinus ponderosa</i>					
Litter depth: 0.6 in Litter loading: 1.7 tons/ac					Sapling density: 119/ac					
Duff depth: 1.3 in Duff loading: 15.7 tons/ac					Most common species: <i>Abies grandis</i>					
OVERSTORY										
	Size Class (Diameter at Breast Height)									
	4 - 9"	9 - 15"	16 - 25"	> 25"						
Most common species	<i>Abies grandis</i>	<i>Larix occidentalis</i>	<i>Larix occidentalis</i>	--	<i>Abies grandis</i>					
Second most common species	<i>Pseudotsuga menziesii</i>	<i>Abies grandis</i>	--	--	<i>Larix occidentalis</i>					
Tree density (stems/ac)	231	51	17	0	219					
Live	50	34	17	0	109					
Dead	201	17	0	0	218					
Avg DBH (in)	5.6	9.8	22.9	--	7.2					
Live	7.2	10.1	22.9	--	10.8					
Dead	5.2	9.3	--	--	5.5					
Avg height (ft)	38.9	69.0	95.0	--	46.6					
Live	66.0	71.0	95.0	--	72.5					
Dead	32.2	65.0	--	--	34.7					
Avg holder fuel height (ft)	15.9	23.7	50.0	--	19.1					
Live	47.7	32.5	50.0	--	43.0					
Dead	7.3	6.0	--	--	7.2					
Avg height to live crown (ft)	47.7	32.5	50.0	--	43.0					
Live crown mass (tons/ac)	1.10	1.25	2.49	--	4.84					
UNDERSTORY										
	Shrub		Litterform		Grass					
Most common species	<i>Lonicera involucrata</i>	<i>Fragaria virginiana</i>	<i>Carex geyerii</i>							
Other common species	--	<i>Hieracium althiflorum</i>	<i>Bromus sparganii</i>							
Loading (lbs/ac)	42	240	423							
WOODY MATERIAL										
	Loading (tons/ac)			Density (pieces/ac)						
Diameter (in)	Sound	Rotten	Total	Sound	Rotten	Total				
≤ 0.25	0.8	0.0	0.8	--	--	--				
0.26 - 1.0	2.5	0.0	2.5	--	--	--				
1.1 - 3.0	4.4	0.6	4.4	--	--	--				
3.1 - 9.0	22.6	3.1	25.7	1,100	131	1,231				
9.1 - 20.0	1.5	3.5	5.1	15	44	58				
> 20.0	0.0	1.4	1.4	0	5	5				
Total	31.9	8.0	39.9	1,114	180	1,294				

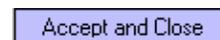
Cancel

By clicking on the **Cancel** button, the selections of photos for the fuel categories will be ignored and the user will be return to the main DDWoodyPC screen. The plot row will show blank values in each cell.



Accept and Close

If the user wishes to accept the selections of photos for the four fuel categories for the plot, then the user should click on the **Accept and Close** button.



The Plot row will now appear similar to the one below. A second plot has been added by clicking on the **Add Plot** button.

Plots (Photo Series Used 0" to 3" / 3.1"+ / Live / Duff-Fuel Bed Depths)													
Plot ID	Book	Photo	0" to .25" (TPA)	.26" to 1" (TPA)	1.1" to 3" (TPA)	3.1" to 9" (TPA)	9.1" to 20" (TPA)	20" + (TPA)	Herb (TPA)	Shrub (TPA)	Average Duff Depth (Inches)	Average Fuel Bed Depth (Inches)	
1	PNW-Interior-MCwithMortality	MC08/MC04/MC02/MC08	0.80	2.50	4.40	6.50	11.50	5.10	0.02	0.00	1.90	0.10	
2			0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	

Editing of Cells

The user can edit all of the fuel loading and depth cells. This allows for the user to tailor loading for a plot as necessary. In the figure at the right, notice the asterisk at the end of the photo designation. This asterisk indicates that at least one of the cells has been modified from the photo series loading or depth value. The user is encouraged to use the Notes feature to record changes that have been made for future tracking purposes.



Photo
MC08/MC04/MC02/MC08*

Delete Plot Button

The **Delete Plot** button is used to delete the active plot data entry row from the Data Input Screen. This active row is identified by the black arrow to the left of the row. To make a row active, click on that row with the mouse cursor set on that row.



Sort Plot Button

Plots may be assigned a different numeric plot identifier than the default identifier assigned by DDWoodyPC when the plot was added. These assignments can leave the data rows in a non-uniform manner. Selecting this button will reorder the plot data entry rows in increasing numerical order.



Dup Plot Button

Clicking on the **Dup Plot** button will add a new plot with the same photos, fuel loading and depth values of the active plot.



Using Local Photo Series

Documented below are the steps necessary to implement into FMAPlus the ability to use a photo series not provided with the software. These might be a local photo series developed by personal at the local level. Refer to the Users Guide to the PSExplorer program for a detailed description of how to implement these procedures using the Photo Manager program.

Photos

Photos from a locally developed photo series will need to be scanned and saved in a graphics file format. It is recommended that the JPEG format be used. These graphics files will need to be placed in a subdirectory of the PhotoImages folder with the photo series name, as its title.

Fuel Loading and Depth Values

Via the Photo Manager program, the user can enter the fuel loading and depth values for each photo. These values are saved in the photo3.mdb. Once these entries have been made and the photo graphics images are placed into the appropriate folder, the user can then make this local photo series active and use it with other published photo series.

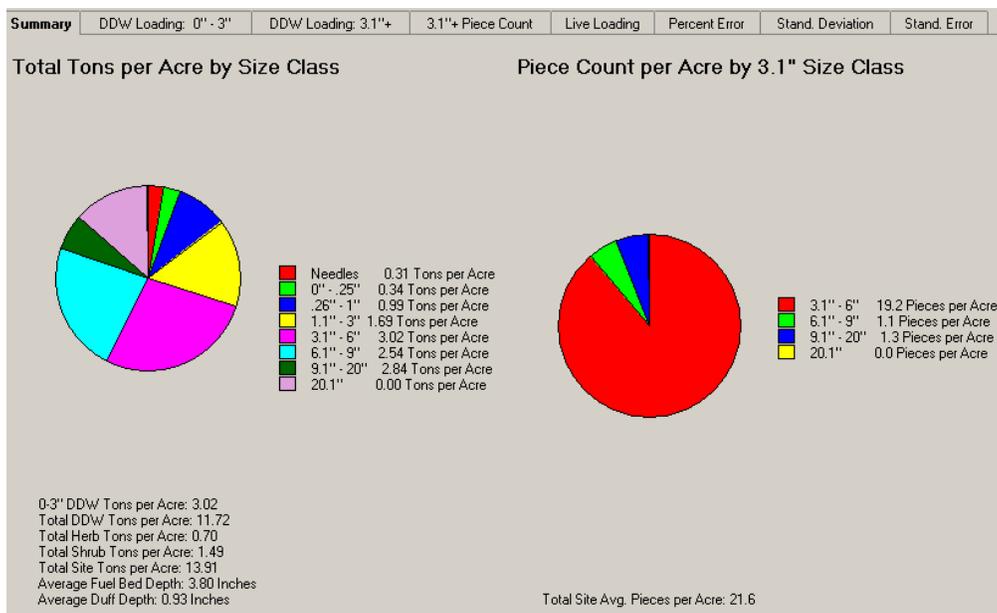
Results - Quick View

Clicking on the Quick Results Tab will activate the calculation process within DDWoodyPC. The use will then have access to eight tabs that display results.

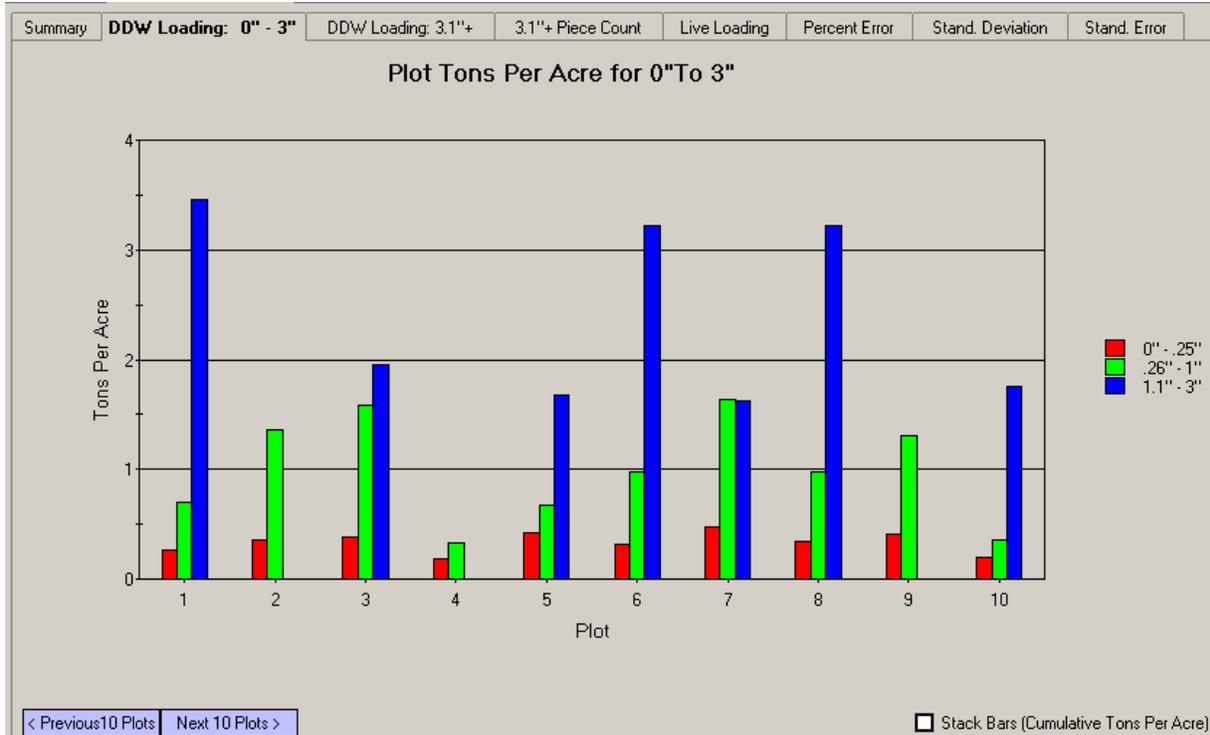
Data Entry	Results - Quick View						
Summary	DDW Loading: 0" - 3"	DDW Loading: 3.1"+	3.1"+ Piece Count	Live Loading	Percent Error	Stand. Deviation	Stand. Error

An example of each of the contents of these tabs follows.

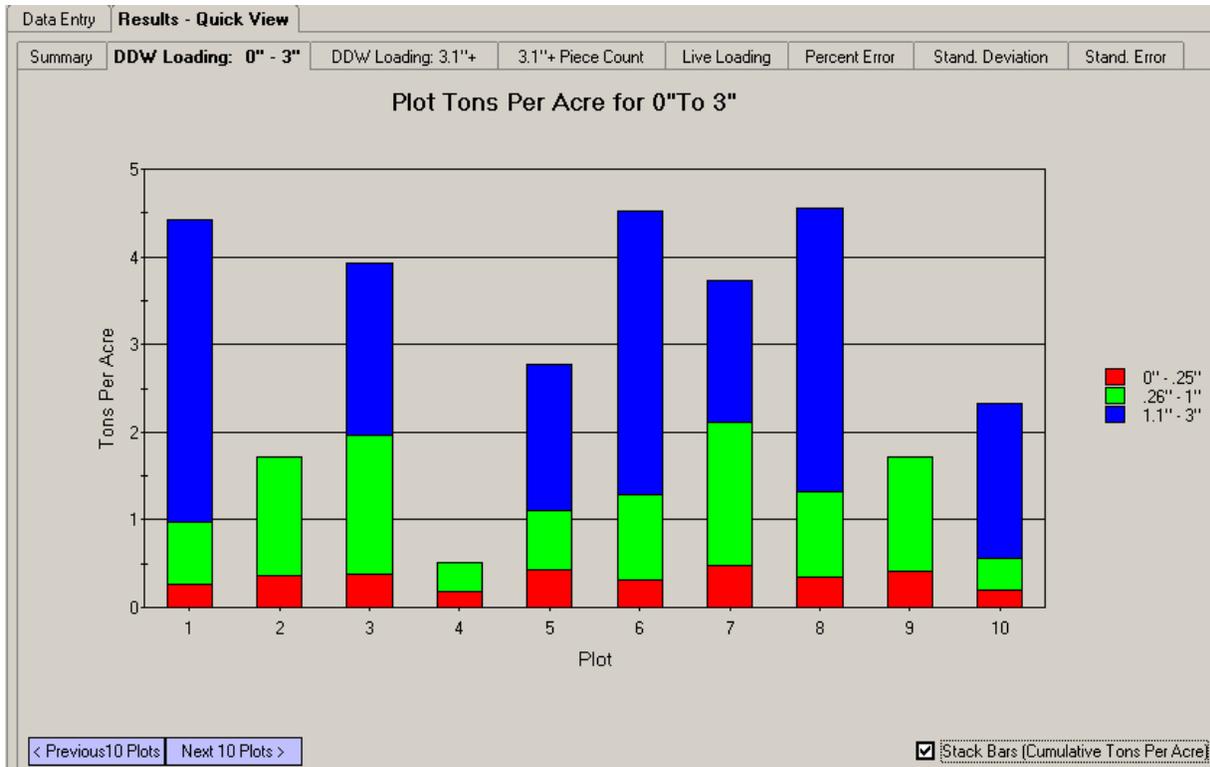
Summary Tab- Total Loading Pie Chart



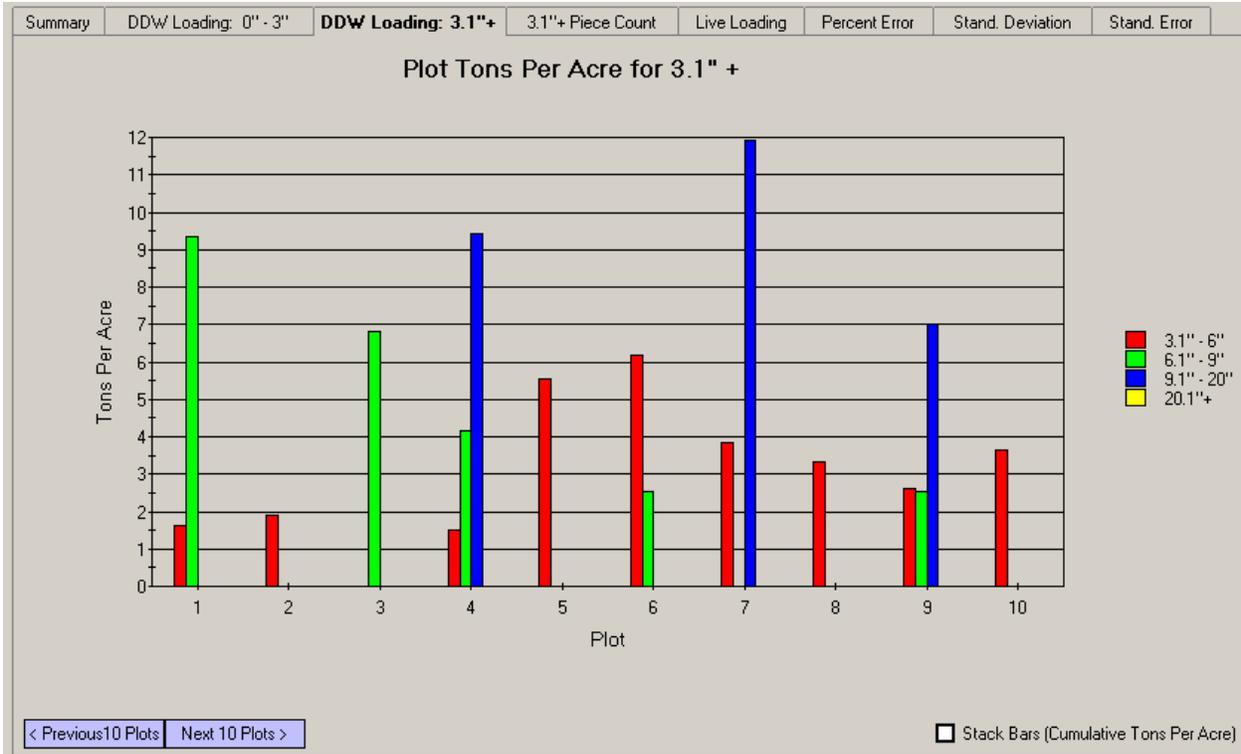
DDW Loading: 0"-3" - Bar Charts



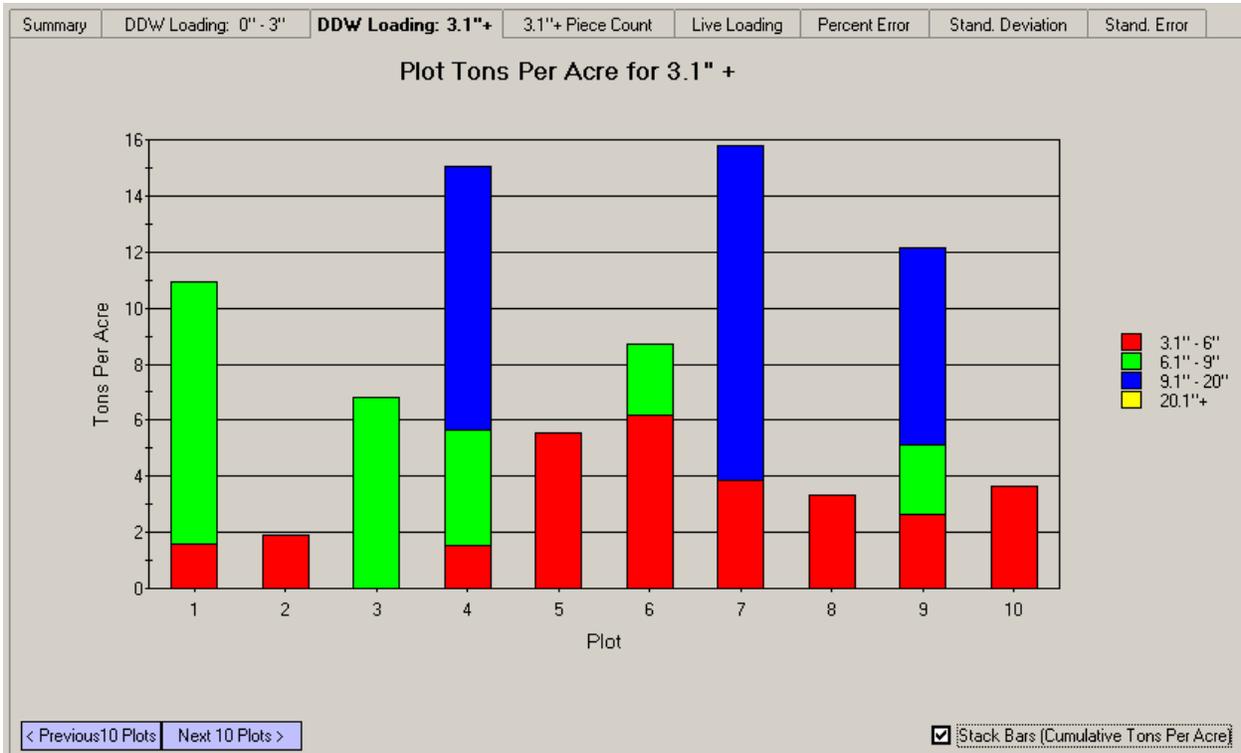
DDW Loading: 0"-3" - Stacked Bar Charts



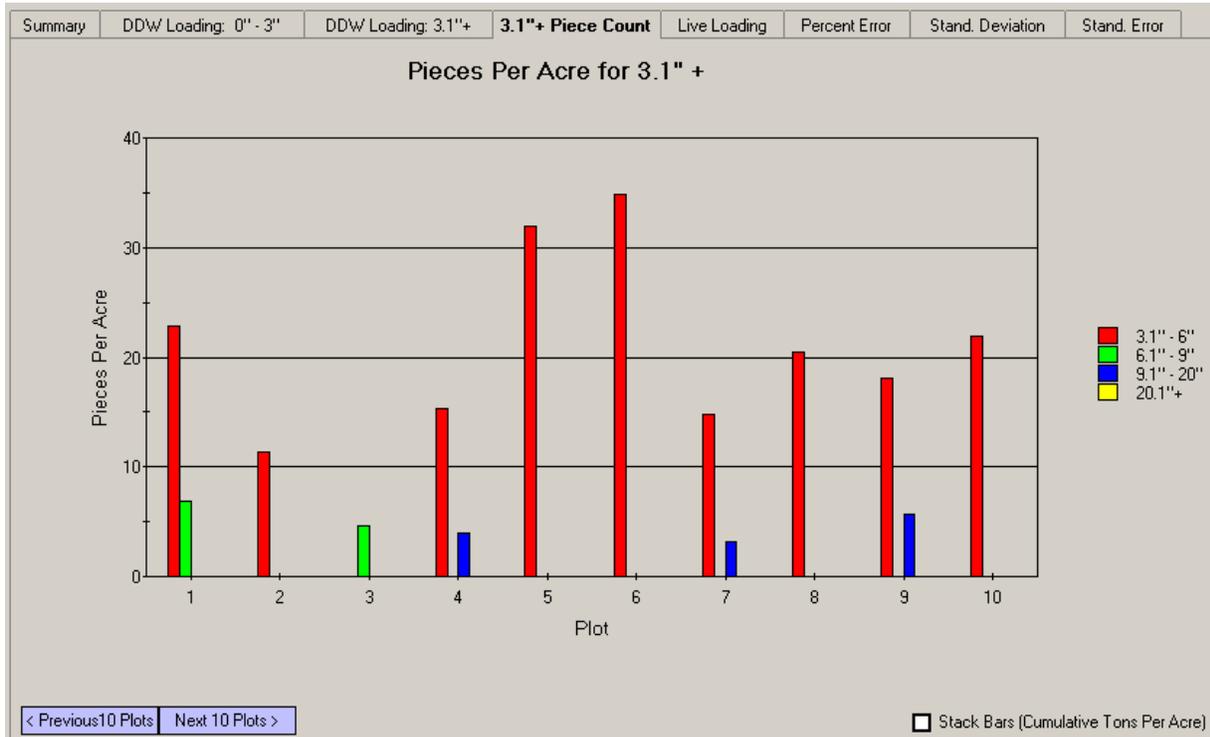
DDW Loading: 3.1”+ - Bar Charts



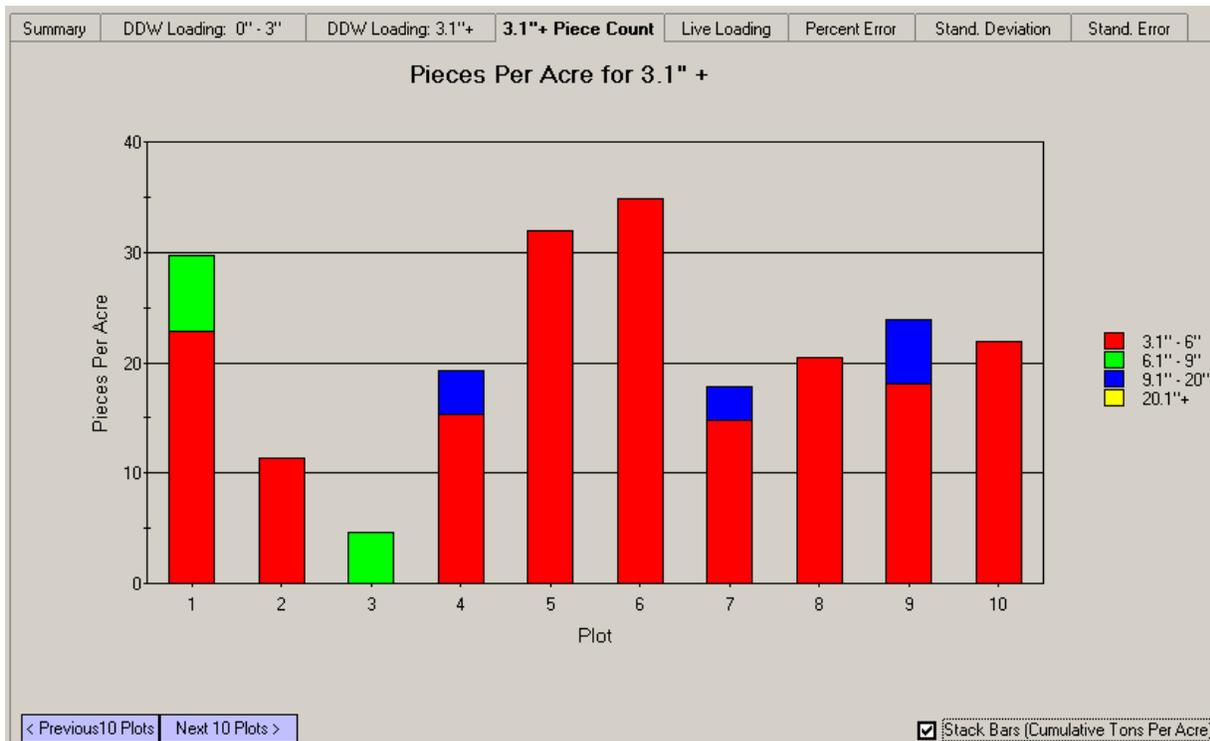
DDW Loading: 3.1”+ - Stacked Bar Charts



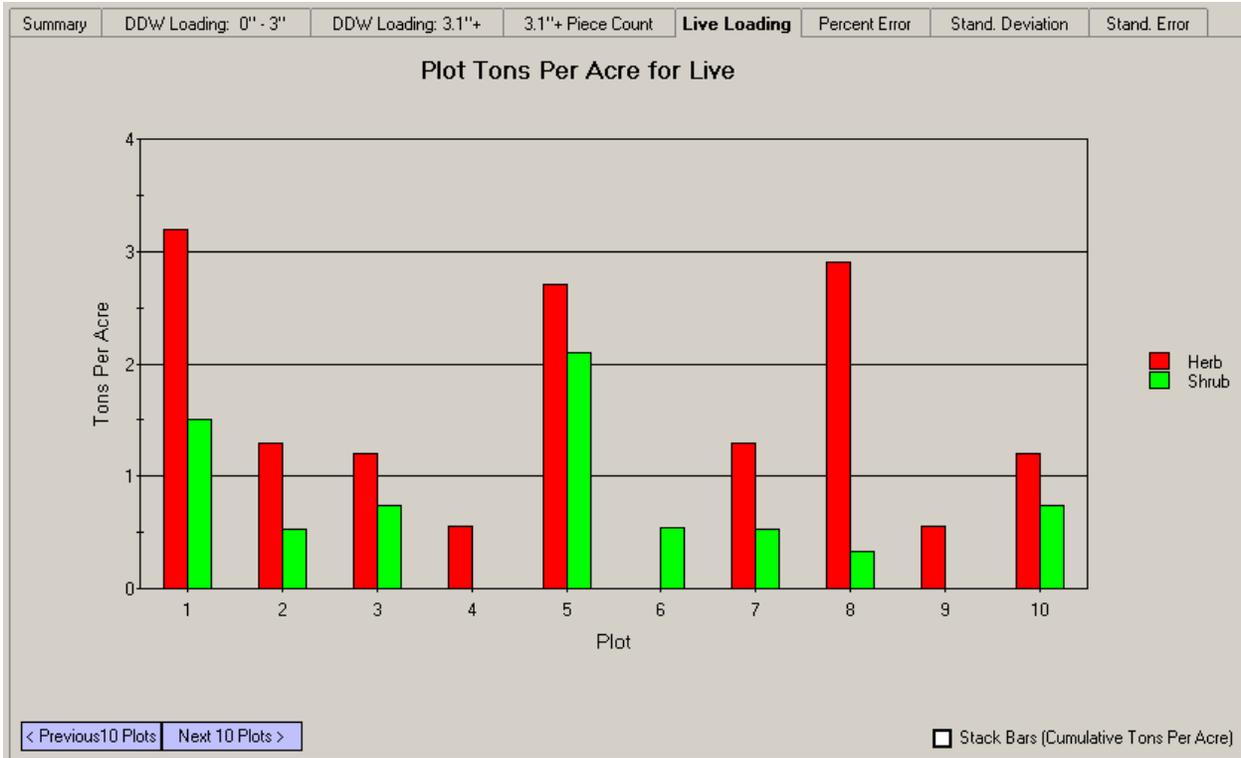
Piece Count: 3.1”+ - Bar Charts



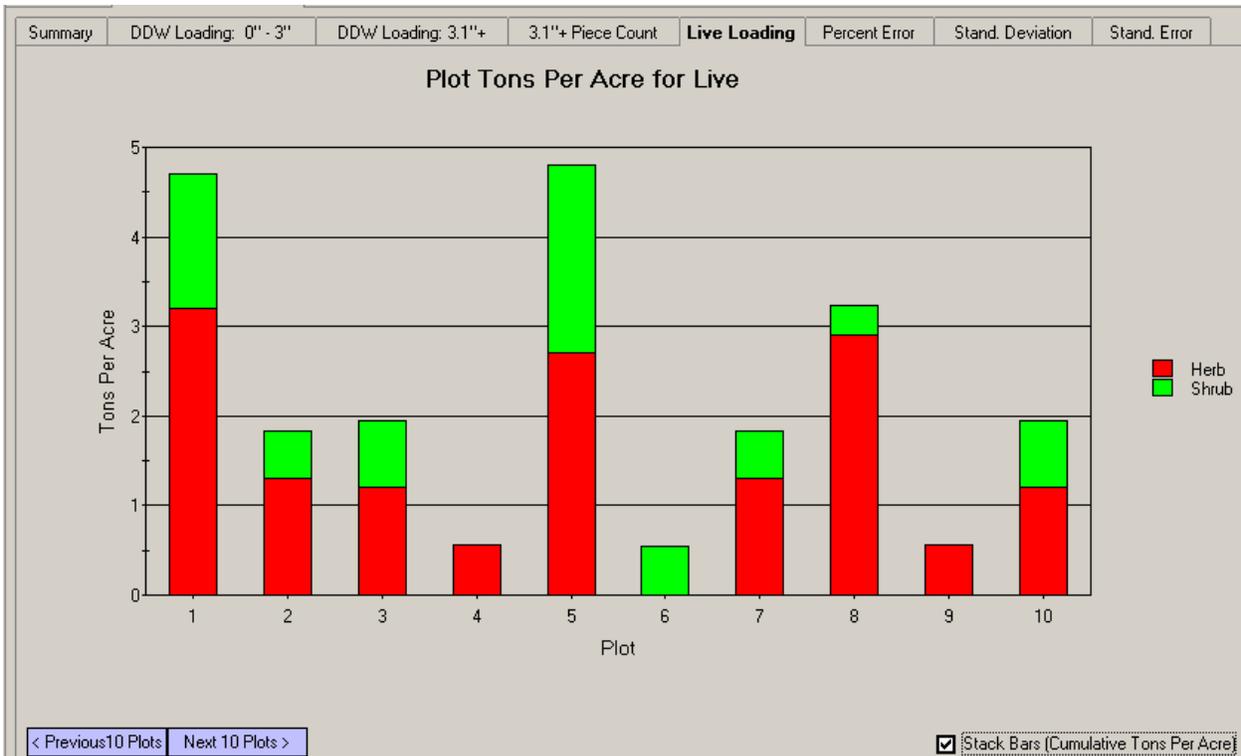
Piece Count: 3”+ - Stacked Bar Charts



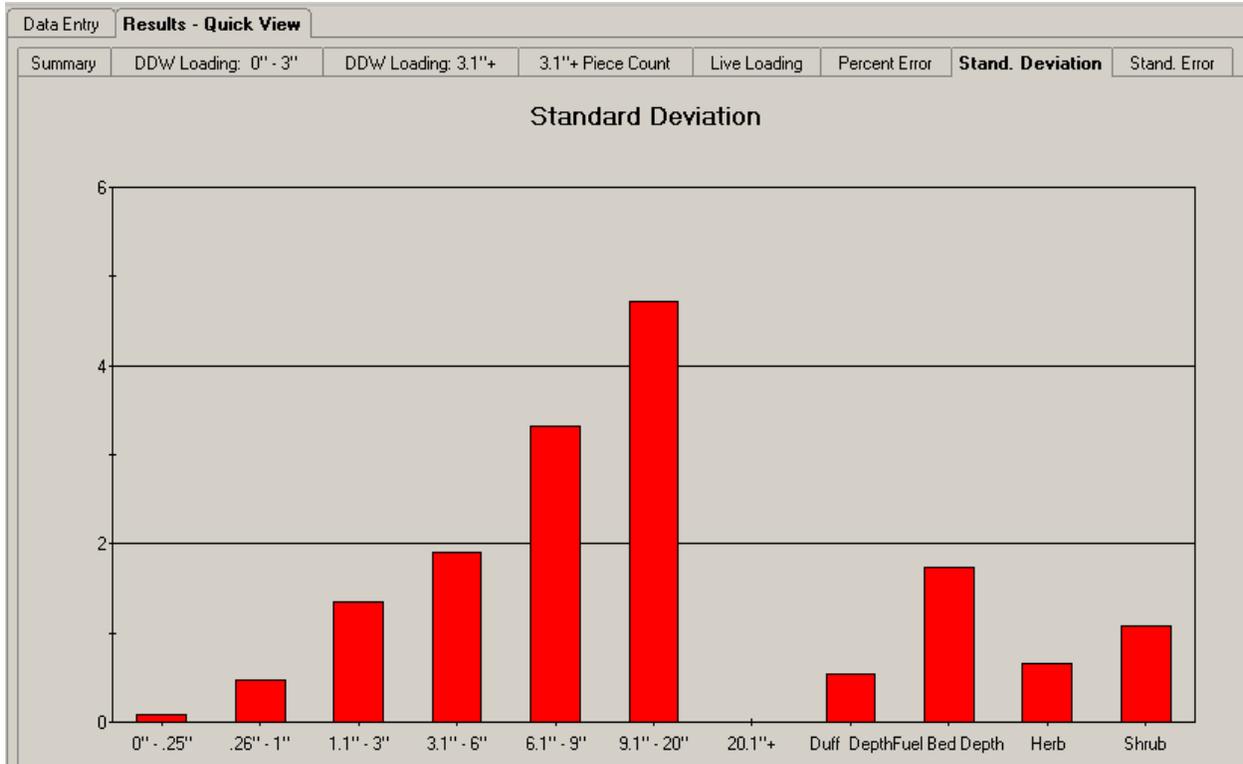
Live Loading – Bar Charts



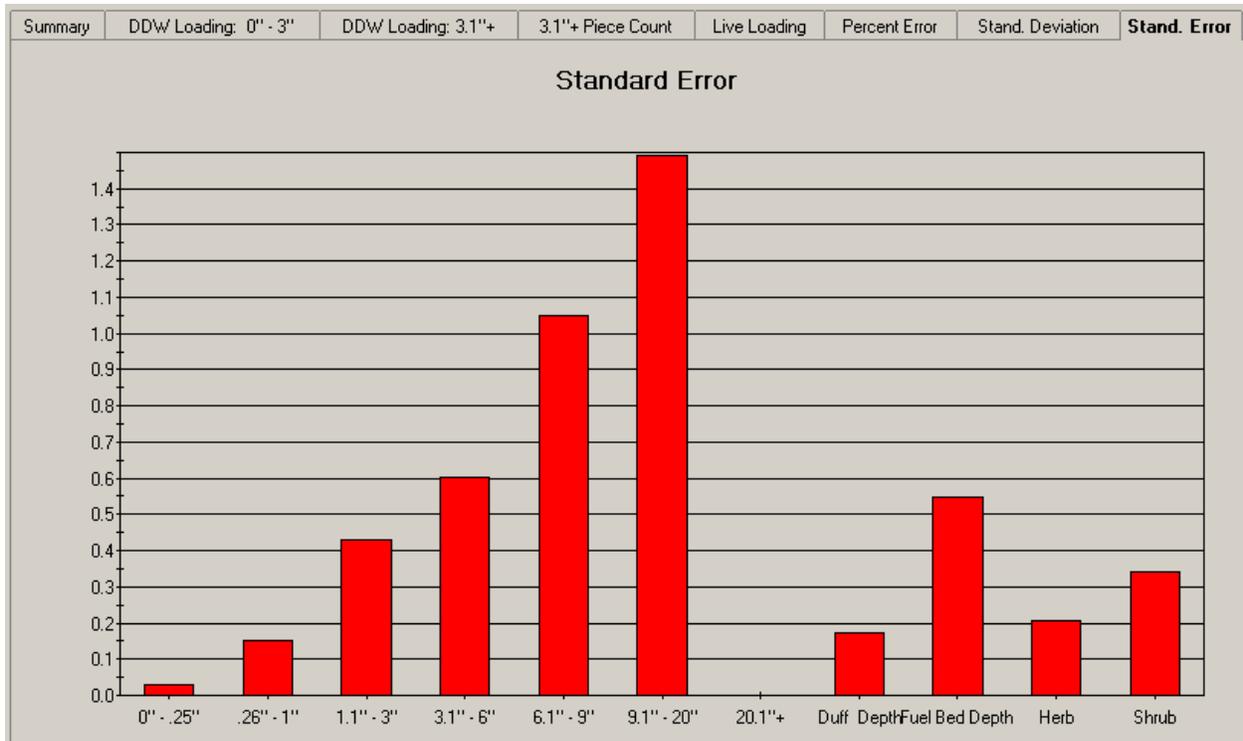
Live Loading – Stacked Bar Charts



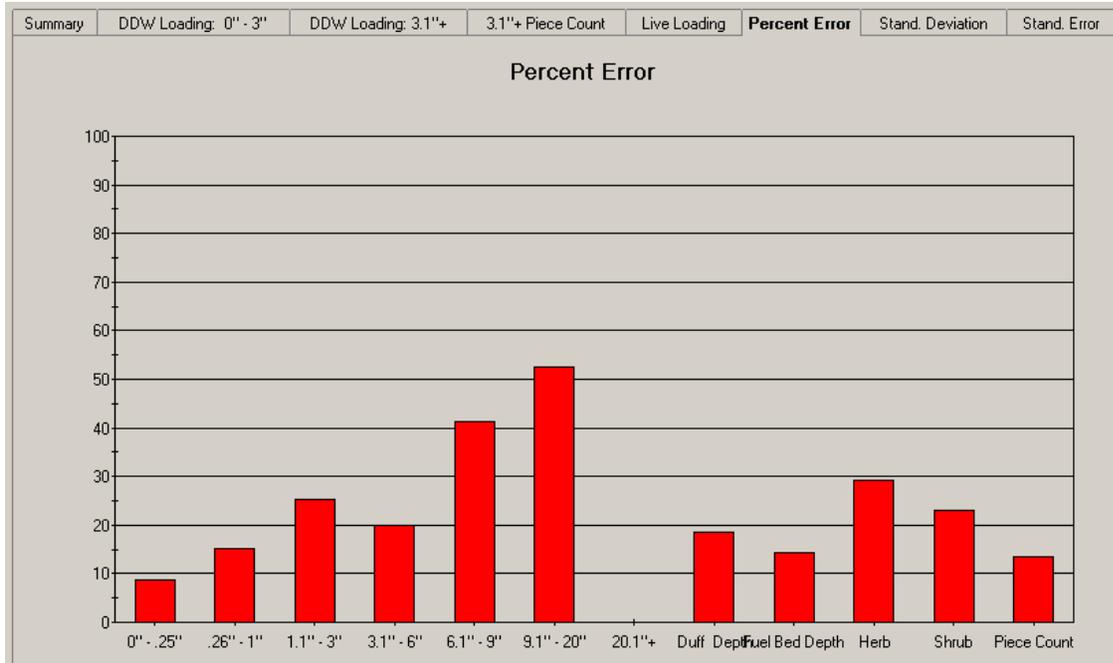
Statistics Bar Graph - Standard Deviation



Statistics Bar Graph - Standard Error



Statistics Bar Graph - Percent Error

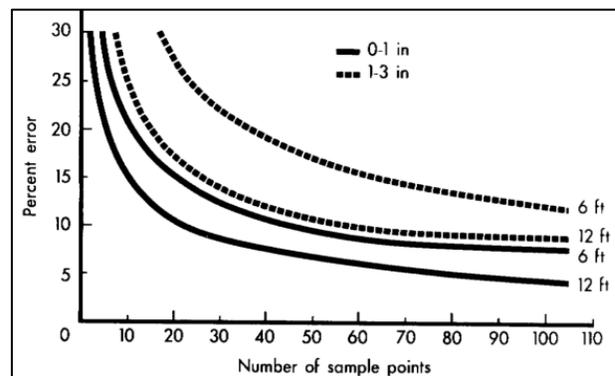


Number and Size Of Sampling Planes

Suggested sampling plane lengths are provided below.

Table 3	Diameter of Dead Down Woody Material		
	0-0.24" & 0.25"-0.99"	1" - 2.99"	3"+
Downed Material	0-0.24" & 0.25"-0.99"	1" - 2.99"	3"+
Non-Slash (Natural)	6 feet	10 -12 feet	35 - 50 feet
Discontinuous Light Slash	6 feet	10 -12 feet	35 - 50 feet
Continuous Heavy Slash	3 feet	6 feet	15 - 25 feet

For any area where the material is discontinuous, 15 to 20 sample points should be located using the sampling plane lengths shown in the table. This sampling intensity will often yield estimates having standard errors within 20 percent of the mean estimates. Areas larger than approximately 50 acres that contain a high diversity in the amount and distribution of downed material should be sampled with more than 20 points. If material larger than 3 inches in diameter is scanty or unevenly distributed, the longer sampling planes shown in the table should be used.



Assumptions and Calculations Process

Dead Down Woody Fuel Loadings

The assumptions and the process that DDWoodyPC uses to calculate the dead down fuel loading follows. DDWoodyPC calculates the fuel loadings, fuel bed depth and duff/litter depth for each sample transect and displays these results. The fuel loadings by size class, fuel bed depth and duff/litter depth for the entire area sampled are arithmetic averages of the transect data. In addition, DDWoodyPC calculates the standard deviation, standard error and percent error for the fuel loadings, fuel bed depth and duff/litter depth outputs.

The formula used to compute the fuel loading in tons per acre follows:

Table 4 - Formulas Used To Calculate Dead Down Fuel Loading	
Size Class Of Material	Formula
0.0 to 0.25" (0 to 0.6 cm)	$\frac{11.64 * n * d^2 * s * a * c}{N * L}$
0.26" to 1.00" (0.6 to 2.5 cm)	
1.1" to 3.00" (2.5 to 7.6 cm)	
3.1"+ (2.6+ cm) Sound	$\frac{11.64 * \Sigma d^2 * s * a * c}{N * L}$
3.1"+ (2.6+ cm) Rotten	
Where:	
n = The number of intercepts for the plots the data reduction applies to. The number of plots referenced is variable N.	
d ² = The average quadratic mean diameters	
Σd ² = The sum of the square of the log diameters	
s = Specific gravity	
a = Non-horizontal secant correction factor	
c = Slope correction factor	
N = Number of plots	
L = Length of the sample plane	

An explanation of each of the variables in the formula follows.

Equation Variable = n - The Number of Intercepts for Which the Plots the Data Reduction Applies

This variable is used in the formulas for the calculation of the fuel loading for material in the 0-3.0" size classes. DDWoodyPC calculates the fuel loadings for each sample plot so "n" is equal to the number of intercepts on the sample transect only for the size class being calculated.

Please note that it is possible to "lump" all sample plot data and to calculate the fuel loading for the sample area. In this case, "n" would be equal to the sum number of intersects per plot for all of the sampling transects. The disadvantage of "lumping" the data to obtain the fuel loadings for the sample area is that no statistical data is available to provide estimates of the accuracy of the fuel loading estimates.

Equation Variable = d^2 - Squared average quadratic mean diameter

This variable is used in the formulas for the calculation of the fuel loading for material in the 0-3.0” size classes and the 3.1”+ size classes differently. See the next section for 3.1”+ material treatment. Table 5 contains appropriate squared average diameters (d^2) for each size class. For material in the 0-.25”, .26’-1.0” and 1.1”-3.00” size classes, the value in the table can be viewed as the “diameter of a particle within the size class squared.” Hence, if one took the square root of the value in the table, one would get the average diameter of a particle within the size class. DDWoodyPC calculates the fuel loadings for each sample plot using a weighted average d^2 based on the percent species composition within the fine fuel categories (0-3.0” material).

Table 5 - Squared Average Quadratic Mean Diameters For 0-3.00” Material				
Size Class	Non-Slash		Slash	
	Cover Type	Average d^2	Cover Type	Average d^2
0 - 0.25”	PP	0.0342	PP, LP	0.0248
	LP	0.0201	L	0.0149
	S, DF, AF, C	0.0122	DF, GF, C, S	0.0122
	L	0.0149	Composite	0.0151
	Composite	0.0151		
0.26” – 1.00”	LP	0.344	PP, C	0.317
	S, DF, AF, C	0.304	DF, GF, LP, L, S	0.278
	L, PP	0.238	Composite	0.289
	Composite	0.289		
1.1” - 3.00”	PP, AF	3.12	LP	3.50
	S, DF, C, LP	2.87	DF, PP, GF	2.83
	L	2.17	L, C, S	2.30
	Composite	2.76	Composite	2.76

PP=Ponderosa pine (*Pinus ponderosa*); LP=lodgepole pine (*Pinus contorta*); S=Engelmann spruce (*Picea engelmannii*); DF=Douglas-fir (*Pseudotsuga menziesii*); L=western larch (*Larix occidentalis*); GF=grand fir (*Abies grandis*); C=western redcedar (*Thuja plicata*); AF=subalpine fir (*Abies,Zasiocarpa*).All composite values are averages of nonslash and slash fuels with each cover type and species weighted equally.

Equation Variable = Σd^2 - The sum of the square of the log diameters

For the 0-3.00” diameter size classes, the “average diameter of a particle within the size class squared” is multiplied by the variable n ($n * d^2$) to obtain the product of n and d^2 . For the 3.1”+ material, each individual log diameter is squared and then summed to obtain the “sum of the d^2 's” (Σd^2). DDWoodyPC does this calculation for each of the three size classes defined by the user for sound 3.1”+ woody material and for the rotten material 3.1”+ in diameter.

Equation Variable = s - Specific gravity

Decay and variability in density make it difficult to estimate the specific gravity with accuracy. Estimates for large sound material can be obtained by using specific gravities from the USDA Forest Service (1999) Wood Handbook and from special studies. The Woody Handbook is available on the Internet at: <http://www.fpl.fs.fed.us/documnts/fplgtr/fplgtr113/fplgtr113.htm> The specific gravities are based on oven-dried weight and air-dried volume. Specific gravity values used in DDWoodyPC are in Table 6.

Table 6 – Specific Gravity Values by Specie				
Species	0 – 0.25”	0.26” – 1.0”	1.1” – 3.0”	3.1”+
Incense Cedar	0.48	0.48	0.40	0.37
Port Orford Cedar	0.48	0.48	0.40	0.43
West. Red Cedar	0.48	0.33	0.33	0.32
Douglas Fir (Inland)	0.56	0.56	0.52	0.48
Douglas Fir(Coast)	0.56	0.56	0.52	0.48
Grand Fir	0.48	0.48	0.40	0.37
Noble Fir	0.48	0.48	0.40	0.39
Silver Fir	0.48	0.48	0.40	0.43
Alpine Fir	0.41	0.40	0.40	0.32
White Fir	0.48	0.48	0.40	0.39
West. Hemlock	0.48	0.48	0.40	0.45
Mtn. Hemlock	0.48	0.48	0.40	0.45
West. Larch	0.46	0.55	0.55	0.52
Lodgepole Pine	0.49	0.41	0.41	0.41
Ponderosa Pine	0.57	0.53	0.49	0.40
Sugar Pine	0.57	0.53	0.49	0.36
White Pine	0.57	0.53	0.49	0.38
Engelmann Spruce	0.34	0.34	0.34	0.35
Sitka Spruce	0.48	0.48	0.40	0.40
Chinkapin	0.48	0.48	0.40	0.48
Madrone	0.48	0.48	0.40	0.69
Tanoak	0.48	0.48	0.40	0.58
Red Alder	0.48	0.48	0.40	0.41
Vine Maple	0.48	0.48	0.40	0.48
Mixed	0.48	0.48	0.40	0.37
Rotten	N/A	N/A	N/A	0.30
Average	0.48	0.48	0.40	0.40
Sources: William R. Beaufait and Charles E. Hardy. Fire quantification for silvicultural use. USDA Forest Service., Intermountain Forest. & Range Experiment. Station, Brown (1972) and USDA Forest Service (1955) Wood Handbook.				

Equation Variable = a - Average secant of non-horizontal angles for correcting orientation bias

This correction factor adjusts weight estimates for the fact that all particles do not lie horizontally as assumed in the planar intercept theory. For non-slash fuels 0-3” in diameter, a = 1.13. For non-slash fuels 3.1”+ in diameter, a = 1.00. For slash fuels, the value of “a” is given in Table 7.

Table 7 - Correction Factors for Slash (a)			
Size Class	Species	Average for “a”	
		Fresh slash	1-yr and older slash
0-.25”	PP / Others	1.25 / 1.40	1.25 / 1.15
0.26” - 1.00”	PP / Others	1.25 / 1.13	1.25 / 1.13
1.1” - 3.0”	PP / Others	1.22 / 1.10	1.22 / 1.10
3.1”+	All (An Assumption)	1.00	1.00

PP is ponderosa pine; Others are based on data from Douglas-fir, lodgepole pine, Engelmann spruce, western red cedar, western larch and grand fir.

Equation Variable = c - Slope correction factor

The average slope correction factor (c) for each sampling plane is calculated as c equals the square root of the quantity $((1 + \% (\text{Slope}/100))^2)^{0.5}$. Table 8 contains values for the slope correction factor.

Table 8 - Slope Correction Factors (c)			
Slope %	Factor (c)	Slope %	Factor (c)
0	1.00	60	1.17
10	1.00	70	1.22
20	1.02	80	1.28
30	1.04	90	1.35
40	1.08	100	1.41
50	1.12	110	1.49

Equation Variable = N - Number of plots

The variable N is the total number of sampling transects (plots) included in the calculation. DDWoodyPC calculates the fuel loadings for each sample plot so N=1.

Please note that it is possible to “lump” all sample plot data and to calculate the fuel loading for the sample area. In this case, N would be equal to the number of sampling transects. The disadvantage of “lumping” the data to obtain the fuel loadings for the sample area is that no statistical data is available to provide estimates of the accuracy of the fuel loading estimates.

Equation Variable = L - Length of the sample plane

The variable L is the length of the sample transect line in feet.

Calculating Average Duff Depth and High Particle Intercept

DDWoodyPC calculates the sum of all measurements for duff depth per plot and divides by the number of measurements taken (generally 2) to obtain an average duff depth for the plot. The average duff depth for the sampling area is the arithmetic average of the plot duff depths.

DDWoodyPC calculates the sum of all measurements for high particle depth per plot and divides by the number of measurements taken (generally 3) to obtain an average high particle depth for the plot. The average high particle depth for the sampling area is the arithmetic average of the plot high particle depths.

Caution should be exercised to not confuse the average high particle depth with the bulk depth. The bulk depth can be estimated from the average high particle depth as, “on the average,” it is 63.3% of the average high particle depth.

Calculating Cubic Feet

If desired, calculate volumes in cubic feet per acre by multiplying the tons per acre by 32.05 and dividing by the specific gravity.

Calculating Needle Loading

Weight of needles can be determined if the fuel loading of the 1-hr, 10-hr, 100-hr and 1000-hr branchwood crown weights is known. Also necessary to know are the specie and DBH of the tree that is producing the material. In addition, one needs to know the proportion of the crown that is in needles and also in the 1-hr, 10-hr, 100-hr and 1000-hr branchwood categories. These crown weights and crown proportions are contained in the following publications and this information is used in the program to calculate needle loading remaining on the dead down woody material.

Brown, James K. 1978. Weight and Density of Crowns of Rocky Mountain Conifers. USDA For. Serv. Res. Pap. INT-197, 56 p.

Brown, James K., J.A. Kendell Snell and David L. Bunnell. 1977. Handbook for Predicting Slash Weight of Western Conifers. USDA For. Serv. GTR INT-37, 35 p.

Snell, J.A. Kendell and James K. Brown. 1980. Handbook for Predicting Residue Weights of Pacific Northwest Conifers. USDA For. Serv. GTR PNW-103, 44 p.

Snell, J.A. Kendell and Brian F. Anholt. 1981. Predicting Crown Weight of Coast Douglas-fir and Western Hemlock. USDA For. Serv. Res. Pap. PNW-281, 13 p.

Snell, J.A. Kendell and Susan N. Little. 1983. Predicting Crown Weight and Bole Volume of Five Western Hardwoods. USDA For. Serv. GTR PNW-151, 13 p.

Snell, J.A. Kendell and Timothy A. Max. 1985. Estimating the Weight of Crown Segments of Old-Growth Douglas-fir and Western Hemlock. USDA For. Serv. Res. Pap. PNW-329, 22 p.

Piece Count

The formula for number of pieces per acre (DeVries 1973) is:

$$\text{Number of Pieces / Acre} = (68,424/NT) \times (\text{sum of } 1/L)$$

where: N is number of transects,
 T is length of transect (ft), and
 L is length of intersected pieces (ft).

The number of pieces per plot is calculated for each of the 4 user defined size class categories. The total piece count for the plot is the sum of these. The piece count by 3.1"+ size class category for the unit sampled is the average of plot values. The piece count for all 3.1"+ material for the sampled unit is the average of plot values.

Developing Coefficients For Local Areas

When inventorying large areas that hold many species it is practical to use composite values and approximations for diameters, specific gravities, and non-horizontal corrections. For example, a timber management and downed-debris inventory in the Northern Region of the USDA Forest Service utilizes composite average diameters, composite average non-horizontal correction factors, and best approximations for specific gravities. For the Northern Region inventory, the formulas simplify to:

Table 9 - Example Of Formula Simplification - Northern Region (USDA-FS)	
Size Class	Formula
0 - 0.25"	FL = 0.09533 * nc/NL
0.26" - 1.00"	FL = 1.825 * nc/NL
1.1" - 3.00"	FL = 14.52 * nc/NL
3.1"+ Sound	FL = 4.656 * Sd ² c/NL
3.1"+ Rotten	FL = 3.492 * Sd ² c/NL



The Field Sampling Procedure

The explanation of the sampling process for inventorying downed woody material are taken from the Handbook For Inventorying Downed Woody Material by James K. Brown (USDA-FS GTR- INT-16, 1974). The explanations are repeated verbatim to insure no changes are implied from those documented in the Handbook.

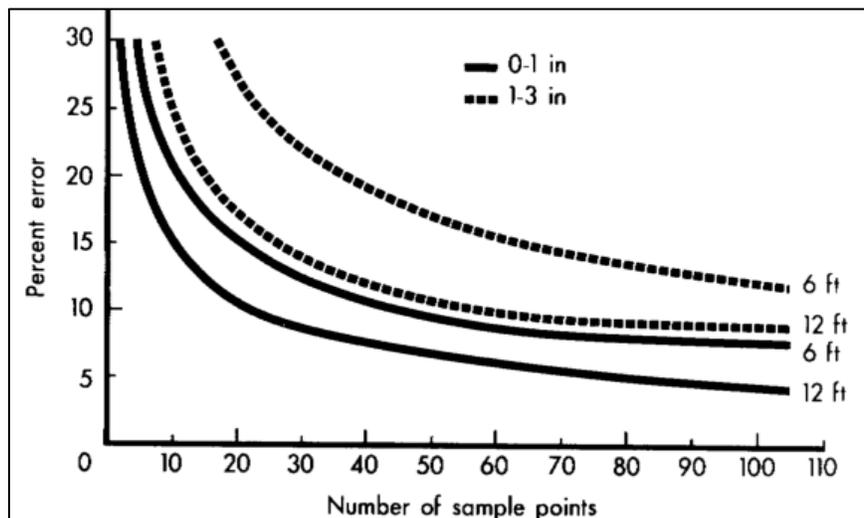
Sampling Intensity

Number And Size Of Sampling Planes

Choose sampling plane lengths from the following table:

Downed Material	Diameter of Dead Down Woody Material		
	0-0.25" & 0.26"-1.00"	1.1" - 3.00"	3.1"+
Non-Slash (Natural)	6 feet	10 -12 feet	35 - 50 feet
Discontinuous Light Slash	6 feet	10 -12 feet	35 - 50 feet
Continuous Heavy Slash	3 feet	6 feet	15 - 25 feet

For any area where the material is discontinuous, 15 to 20 sample points should be located using the sampling plane lengths shown in the tabulation. This sampling intensity will often yield estimates having standard errors within 20 percent of the mean estimates. Areas larger than approximately 50 acres that contain a high diversity in amount and distribution of



downed material should be sampled with more than 20 points. If material larger than 3 inches in diameter is scanty or unevenly distributed, the longer sampling planes in the table should be used.

The amount and distribution of downed woody material vary greatly among and within stands. Thus, these sampling recommendations should be considered approximate because a greater or fewer number of plots may be required to furnish adequate precision for any given area. Sampling intensities are discussed further in.

Sampling precision can be controlled by altering the number of plots and length of sampling planes. As a general rule, the more downed material on an area, the fewer the number and shorter the length of sampling planes required to achieve a given level of precision. The data in the figure is based on average sampling variation for number of intersections of 0- to 1-inch and 1- to 3-inch particles and can help in choosing number of plots and length of sampling planes.

The data in the figure on the previous page are from many stands of varying composition and downed debris accumulations in northern Idaho and western Montana. Curves for all material under 3 inches in diameter would fall between those for the 0- to 1-inch and 1- to 3 inch classes.

Percent errors of 20 percent or less are probably adequate levels of precision for assessing most fuel problems. Percent error is the standard error of the estimate divided by the mean estimate and expressed as a percentage. More precision, such as percent errors of 10 to 15 percent, may be desirable for evaluating utilization potential of downed woody material.

Precision is maximized using a different length of sampling plane for each size class. However, considering both field effort and precision, it is more efficient to use the same plane length for sampling the 0- to 0.25- and 0.26- to 1-inch classes. The following suggestions will help determine the most efficient number and length of sampling planes for a given area:

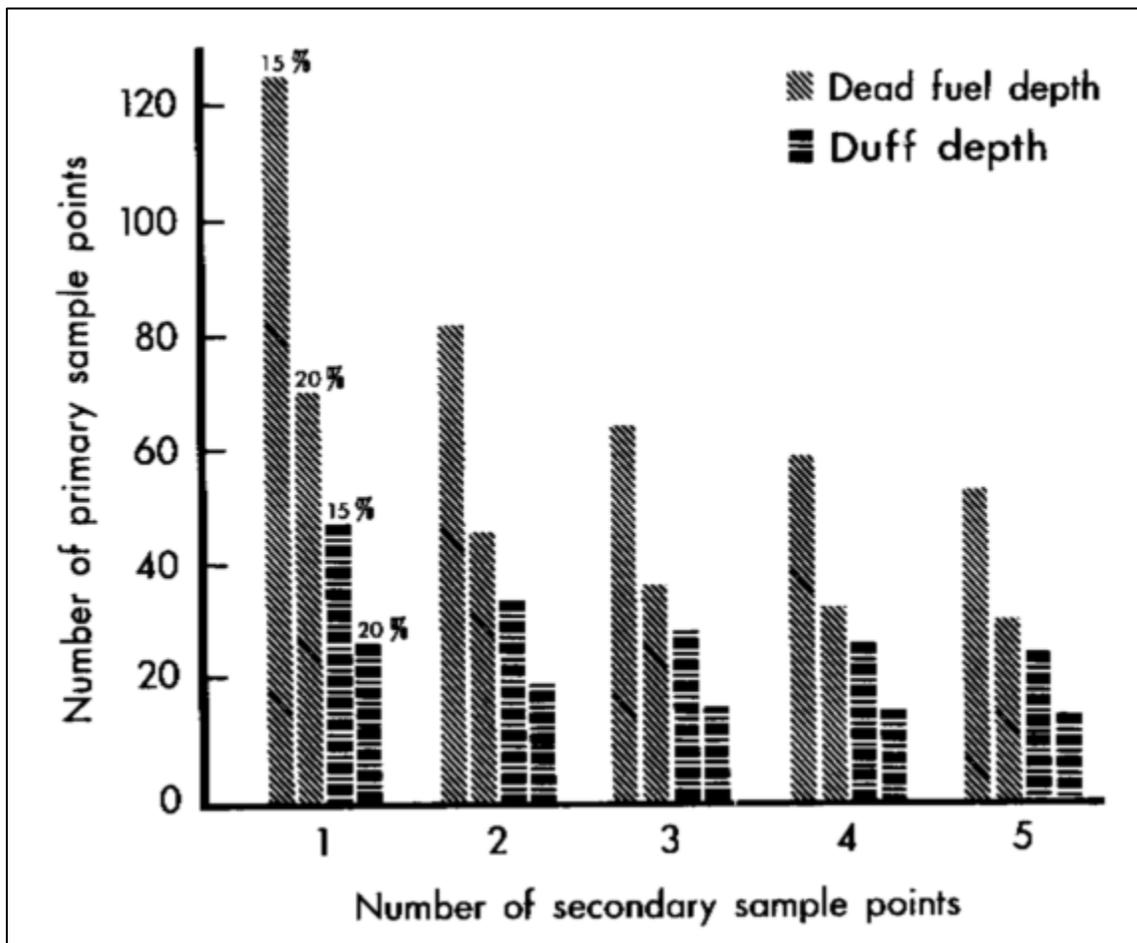
1. Record data from about 20 sampling planes in an area and calculate the variation for guiding further sampling.
2. For material larger than 3 inches in diameter, the sampling plane should be long enough so that on the average at least one intersection occurs with three-fourths or more of the planes. A large sampling variance results when many zeros are recorded for intersections. In areas where very little downed material exists, sampling planes should actually be one to several hundred feet long to provide respectable precision. Where many sampling planes have zero entries, other methods such as measurement of length and diameter of all downed pieces may be the most efficient method of inventory.
3. The number and length of sampling planes should be chosen so that for a piece size of interest, such as material over 3 inches in diameter, at least 35 to 50 intersections occur over an entire sampled area.

Sampling Precision For Depth Measurements

To achieve percent errors of 15 and 20 percent using two-stage sampling, the most efficient number of secondary sampling units appears to be three for fuel depth and two for duff depth.

The data in the figure below represents average variation from sampling a wide variety of forest and downed fuel conditions in northern Idaho and western Montana. Several thousand measurements were taken using two secondary sample points for duff depth and three secondary sample points for fuel depth. Vegetation qualifying for fuel depth measurements included all dead downed woody material and dead brush, grass, and forbs. The data were subjected to analysis of variance for two-stage sampling.

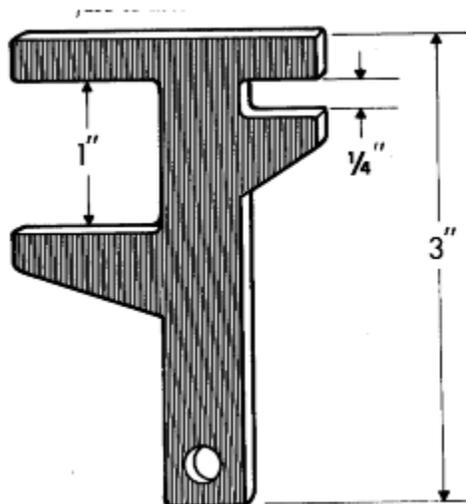
The number of sample plots required to attain a given level of precision varies considerably among different areas. For choosing sampling intensities for specific areas the number of primary sample points in the figure could be adjusted up or down considerably, depending on homogeneity of the dead vegetation strata.



Field Equipment

The following equipment is suggested to accomplish the field sampling.

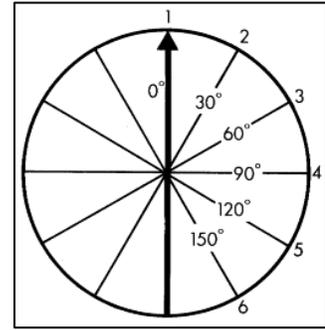
Table 11 - Field Equipment		
	Item	Use
1	Hand Compass	Transect And Plot Layout
2	Gaming Die	Random Orientation Of Sampling Planes
3	Fifty (50) foot Tape And One Chaining Pin	Delineate The Sampling Planes
4	Plot Rod	Delineate Sampling Planes And If Calibrated, Measure Fuel Depth
5	Go-No-Go Gage (Below)	Determine Size Class Of Borderline Particles
6	One (1) Foot Ruler Or Steel Pocket Tape	Measure Duff Depth And Diameters Of Pieces Over 3 Inches. Fuel Depth Could Be Measured With Steel Pocket Tape
7	Hypsometer With Percent Scale	Slope Measurement.
8	Sampling (Data Entry) Forms	Record Data
9	Jacob's Staff With Attached Yard/Meter Stick and Level (Optional - Use In Slash Desirable)	Delineate Sampling Plane For Counting Small Particles



Locating Sample Points

Locate plots systematically; two methods are:

- Locate plots at a fixed interval along transects that lace regularly across a sample area (uniform sampling grid). For example, on a sample area, mark off parallel transects that are 5 to 10 chains apart. Then along the transects locate plots at 2- to 5-chain intervals.
- Locate plots at a fixed interval along a transect that runs diagonally through the sample area. To minimize bias, have the transect cross obvious changes in fuels. Before entering the sample area, determine a transect azimuth and distance between plots.



Sample Point Procedures

Step 1

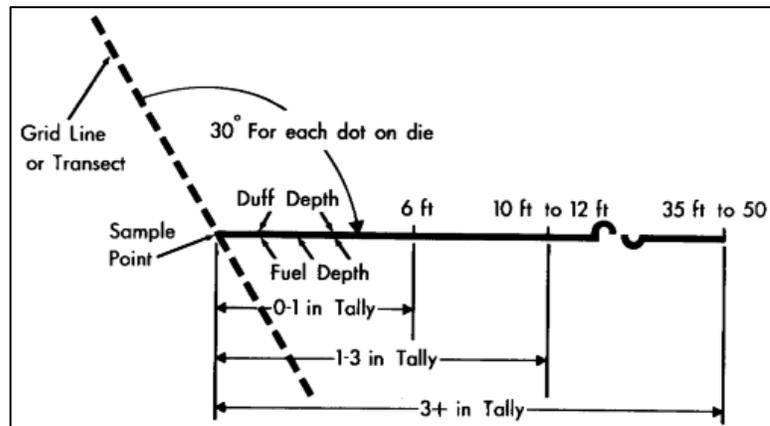
Mark the sampling point with a chaining pin (No. 9 wire or similar item). Avoid disturbing material around the point. Accurate estimates require measurements of undisturbed material. If standing tree measurements (d.b.h. and height) are a part of the inventory, measure downed material first.

Step 2

Determine direction of sampling plane by tossing a die to indicate one of six 30° angles between 0 degrees and 150 degrees. The 0 degree heading is the transect direction. Turn a fixed direction, such as clockwise, to position the sampling plane. As an alternative for indicating direction of the sampling plane, use the position of the second hand on a watch at a given instant. To avoid bias in placement of the sampling plane, do not look at the fuel or ground while turning the interval.

Step 3

Denote position of the sampling plane by running a tape or string out from the sampling point parallel to the ground in the direction determined in Step 2. Extend the tape to the length of the longest sampling plane. A fiberglass rod or 1/2-inch aluminum tube placed along the string beginning at the sampling point facilitates counting pieces less than 1 inch in diameter. The rod should be 6 feet long, the length of sampling plane for small particles. The tape and rod fix the position of vertical sampling planes.



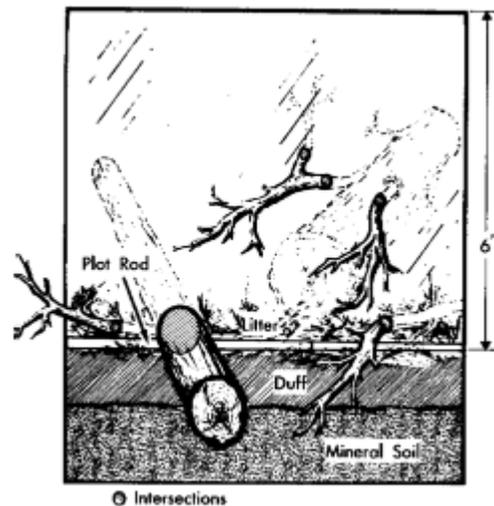
Step 4

Measure or estimate slope by sighting along the sampling plane from the sample point using an Abney level or similar device. Ample precision is the nearest 10 percent, which can be coded using one digit (10 percent = 1, 90 percent = 9, etc.).

Step 5

Tally the number of particles that intersect the sampling plane by the following size classes:

- 0.0 to 0.25" (0 to 0.6 cm)
- 0.26" to 1.0" (0.6 to 2.5 cm)
- 1.1" to 3.0" (2.5 to 7.6 cm)



The intersections can be counted one size class at a time or "dot tallied," which takes slightly longer than counting.

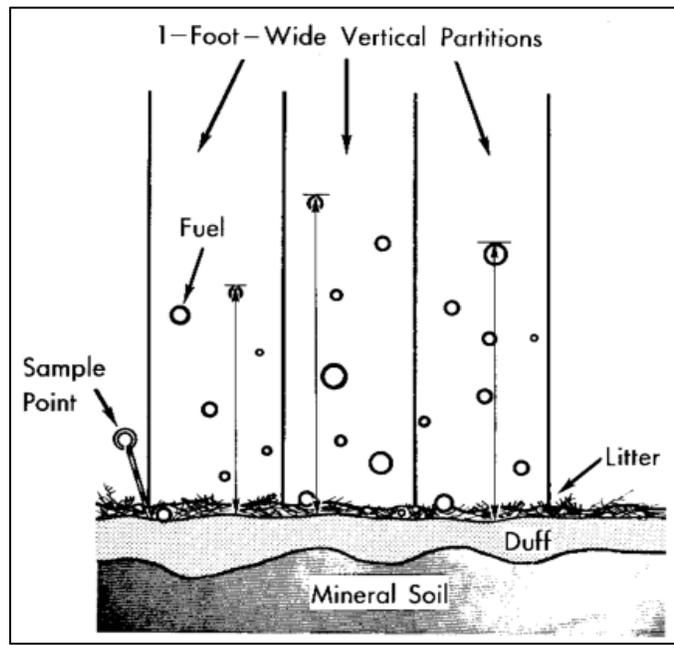
The actual diameter of the particle at the point of intersection determines its size class. A go-no-go gage with openings 0.25 inch, 1 inch, and 3 inches works well for separating borderline particles into size classes and for training the eye to recognize size classes.

The vertical plane is a plot. Consequently, in counting particle intersections, it is very important to visualize the plane passing through one edge of the plot rod and terminating along an imaginary fixed line on the ground. Once visualized on the ground, the position of the line should not be changed while counting particles. See tally rules for qualifying particles.

Step 6

Take three measurements of dead fuel depth. Record depth as the vertical distance from the bottom of the litter layer to the highest intersected dead particle for each of three adjacent 1-foot-wide vertical partitions of the sampling plane. Litter is the surface layer of the forest floor and consists of freshly fallen leaves, needles, twigs, bark, and fruits. Begin the vertical partitions at the sample point. Record to the nearest whole inch.

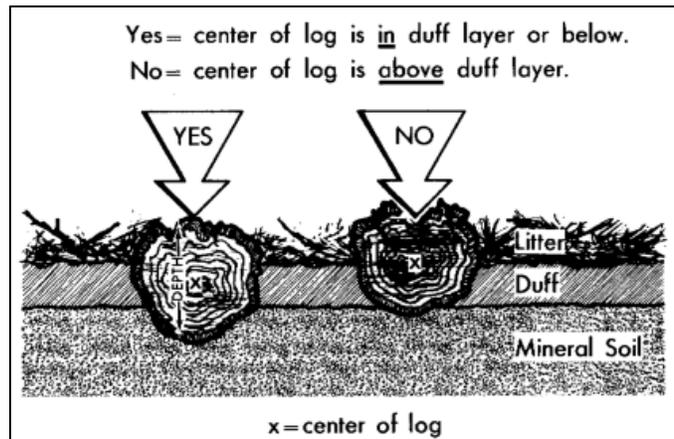
Depth should be measured from only those particles included in the inventory for loading. For example, particles acceptable for measurement by the planar intersect technique are also acceptable for determining depth. If other techniques are used to estimate weight per acre of grass and forbs, this vegetation would also qualify for determining depth.



Step 7

Measure vertical depth of duff to the nearest 0.1 inch using a ruler along the sampling plane at two points: (1) 1 foot from the plot center; and (2) a fixed distance of 3 to 5 feet from the first measurement.

Duff is the fermentation and humus layers of the forest floor. It does not include the freshly cast material in the litter layer. The top of the duff is where needles, leaves, and other castoff vegetative material have noticeably begun to decompose. Individual particles usually will be bound by fungal mycelium. When moss is present, the top of the duff is just below the green portion of the moss. The bottom of the duff is mineral soil.



Carefully expose a profile of the forest floor for the measurement. A knife or hatchet helps but is not essential. Avoid compacting or loosening the duff where the depth is measured.

When stumps, logs, and trees occur at the point of measurement, offset one foot perpendicular to the right side of the sampling plane. Measure through rotten logs whose central axis is in the duff layer.

Step 8

Measure or estimate the diameters of all pieces 3.1 inches in diameter and larger that intersect the sampling plane. Measure the diameters at the point of intersection to the nearest whole inch.

Record diameters separately for rotten and non-rotten pieces. Consider pieces rotten when the piece at the intersection is obviously punky or can be easily kicked apart.

A ruler laid perpendicularly across a large piece of fuel works satisfactorily for measuring diameter. Be sure to avoid parallax in reading the ruler. Calipers also work well for measuring diameter. A diameter tape, however, is unsatisfactory for pieces in contact with the ground.

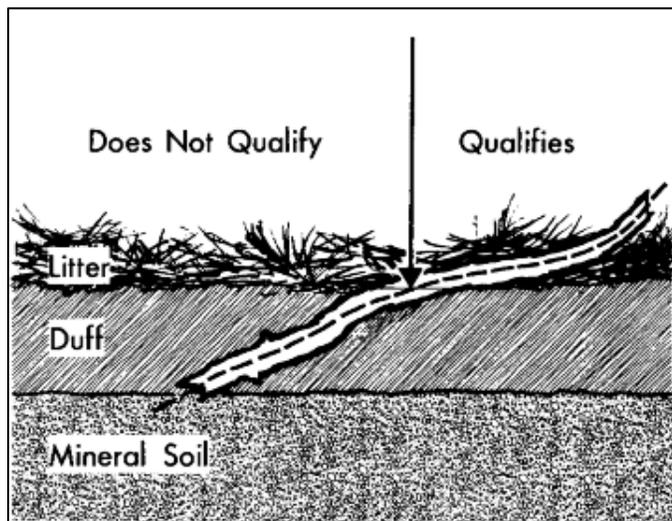
Step 9

For the entire sample area, record the predominate species of the 0- to 1.0” diameter branchwood. An average diameter for the 0- to 0.25-inch, and 0.26- to 1.00-inch size classes will be selected from this information. If several species comprise the downed debris, estimate the proportion of the two or three most common species. Base this estimate on a general impression of what exists on the sample area and record as percentages of total 0- to 1.00-inch branchwood. Or, for a slight reduction in accuracy, omit this step and in the calculations use an average diameter for a composite of species.

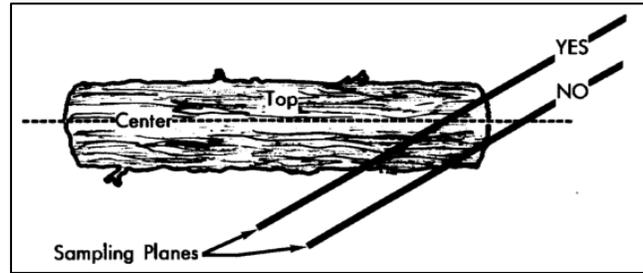
Tally Rules

The following rules apply to downed woody pieces of all diameters:

1. Particles qualifying for tally include *downed, dead* woody material (twigs, stems, branches, and bolewood) from trees and shrubs. Dead branches attached to boles of standing trees are omitted because they are not downed vegetation. Consider a particle downed when it has fallen to the ground or is severed from its original source of growth. Cones, bark flakes, needles, leaves, grass, and forbs are not counted. *Dead woody stems and branches still attached to standing brush and trees are not counted.*
2. Twigs or branches lying in the litter layer and above are counted. However, they are not counted when the intersection between the central axis of the particle and the sampling plane lies in the duff (forest floor below the litter).

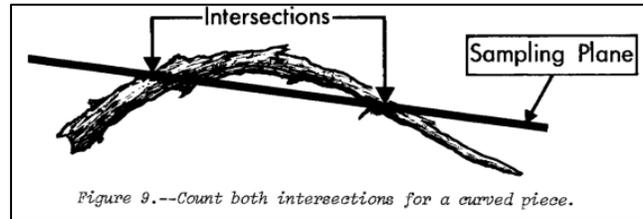


3. If the sampling plane intersects the end of a piece, tally only if the central axis is crossed. If the plane exactly intersects the central axis, tally every other such piece.



4. Don't tally any particle having a central axis that coincides perfectly with the sampling plane. (This should rarely happen.)

5. If the sampling plane intersects a curved piece more than once, tally each intersection.



6. Tally wood slivers and chunks left after logging. Visually mold these pieces into cylinders for determining size class or recording diameters.
7. Tally uprooted stumps and roots not encased in dirt. For tallying, consider uprooted stumps as tree boles or individual roots, depending on where the sampling planes intersect the stumps. Do not tally undisturbed stumps.
8. For rotten logs that have fallen apart, visually construct a cylinder containing the rotten material and estimate its diameter. The cylinder will probably be smaller in diameter than the original log.
9. Be sure to look up from the ground when sampling because downed material can be tallied up to any height. A practical upper cutoff is about 6 feet. However, in deep slash it may be necessary to tally above 6 feet.

When standing trees are inventoried along with downed material, it is necessary to fix a limit above the ground for sampling downed material. An upper limit helps define a downed tree so that inventory of standing and downed materials will not overlap.

Options When There Is a Large Amount Of Material

1. A yardstick attached to a Jacob's staff is useful for marking the sampling plane and speeds the counting of small particles. Erect the Jacob's staff at the sample point. Aline the yardstick with the direction of the sample plane and level it using an attached bubble level.
2. In areas with considerable slash, sampling efficiency is improved by ocularly estimating the number of 0- to 0.25-inch intersections and actually counting the number of intersections at a sub-sample of points. The ocular-estimates are adjusted using the ratio of ocular estimates-to-actual counts. This method, incorporating 3P sampling, is described in detail by Beaufait and others (1974).
3. For each sampling plane, estimate the proportion of 0 to 1 inch diameter branchwood to the nearest 10 percent for the three most common species.



Utilization Options

For pieces over 3 inches in diameter, the following additional measurements can be useful for describing utilization potential:

1. Species
2. Length of piece
3. Diameter at large end
4. Degree of checking, rot, and other defects that applies to the entire piece.



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