Plot Description (PD)

Sampling Method

Robert E. Keane

SUMMARY

The Plot Description (PD) form is used to describe general characteristics of the FIREMON macroplot to provide ecological context for data analyses. The PD data characterize the topographic setting, geographic reference point, general plant composition and cover, ground cover, fuels, and soils information. This method provides the general ecological data that can be used to stratify or aggregate fire monitoring results. The PD method also has comment fields that allow for documentation of plot conditions and location using photos and notes. The key for the FIREMON database - made up of the RegistrationID, Project ID, PlotID, and Date - is part of the PD form.

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INTRODUCTION

The Plot Description (PD) methods were designed to describe important ecological characteristics of the FIREMON macroplot. The macroplot is the area where the other FIREMON methods will be applied. If you need information on setting up a macroplot, see **How To Locate a FIREMON Plot**, **How To Permanently Establish a FIREMON Plot,** and **How to Define the Boundaries of a Macroplot** in the **How-To Guide** chapter. All fields in the PD method pertain to the entire macroplot, so they should be estimated and recorded to describe the macroplot as a whole.

The eight general categories of data in the PD method are 1) the required key or indexing fields, 2) plot information, 3) biophysical settings, 4) vegetation, 5) ground cover, 6) fire information, 7) photographic hyperlinks, and 8) comments. All fields in the required category *must* be completed regardless of the sampling methods employed. These fields uniquely identify the plot data within the FIREMON database. They are shown in red text on the PD data entry screen. The other seven types of fields can be completed as required for each study. However, within each category, there are some groups of fields that belong together and must be completed as a group. These will be evident on the PD data form and discussed in detail in this chapter. Not all of these fields will be used for every project. If there are data for one of these categories that you would like to collect but cannot due to broken equipment or other unforeseen circumstances, use the comments section to record each instance for the plot. For instance, if you cannot measure the slope because the clinometer was broken, leave the Slope field empty and note in the Comments field, "No slope measurements were taken because the clinometer was broken." This will explain empty fields to future users of the data. *Do not enter 0 (zero) in a field that could not be assessed.* Either leave the field blank or enter the code that denotes you were not able to assess the attribute.

SAMPLING PROCEDURE

This method assumes that the sampling strategy has already been selected and the macroplot has already been located. If this is not the case, then refer to the FIREMON **Integrated Sampling Strategy** for further details.

The PD sampling methods described here are the recommended procedures for this method. Later sections will describe how the FIREMON three-tier sampling design can be used to modify the recommended procedure to match resources, funding, and time constraints.

The sampling procedure is described in the order of the fields that need to be completed on the **PD data form**, so it is best to reference the data form when reading this section.

Required PD Fields – Database Key

The following four fields constitute the key for your FIREMON database and an index that connects all your data. If you are entering data, these fields *must* be entered.

RegistrationID (required) – The Registration ID is a four-character code determined by you or assigned to you. The RegistrationID should be used to identify a large group of people, such as all the people at one District of a National Forest or the people working under one monitoring leader. You are required to use all four characters. Choose your code so that the letters and numbers are related to your business or organization. For example:

MFSL = Missoula Fire Sciences Lab
MTSW = Montana DNRC, Southwest Land Office
CHRC = Chippewa National Forest, Revegetation Crew
RMJD = Rocky Mountain Research Station, John Doe

ProjectID (required) – The ProjectID is an eight-character code used to identify project work that is done within the group. You are not required to use all eight characters. Some examples of ProjectID codes are:

TCRESTOR = Tenderfoot Creek Restoration
BurntFk = Burnt Fork Project
SCF1 = Swan Creek Prescribed Fire, Monitoring Crew 1
BoxCkDem = Box Creek Demonstration Project

If you know you will need reports or analyses that are sorted by project, do not include digits in the left-most position of the ProjectID because the sorting procedure may result in an undesirable order to the list. For instance, if two of your projects are 22Lolo and 9Lolo, the sorted list will have 22Lolo listed before 9Lolo. The preferred option would be to name the projects Lolo09 and Lolo22, although Lolo9 and Lolo22 will also sort in the proper order.

To use the FIREMON Analysis Tools program, plots can be summarized and compared ONLY if they have the same Registration and Project Codes. This requirement is set because typically each monitoring project has unique objectives associated with sample size or has monitoring methods developed specifically for the project. Comparisons made between projects with dissimilar methods may not be appropriate.

PlotID (required) – The PlotID identifies the site where sampling methods are applied. It is input as an integer.

Date (required) – Enter the date of sampling as an eight-digit number in the MM/DD/YYYY format where MM is the month number, DD is the day of the month, and YYYY is the current year. For example, April 01, 2001 would be entered 04/01/2001. (Only the last two digits of the year will be seen on the data entry screen but all four digits are stored in the database.)

Other PD Fields - Organization Codes
These eight fields are provided so that users can sort and summarize data using agency location codes - for instance, USFS Region, Forest, and District. All eight fields allow alphanumeric characters.

Field 1: Org. Code 1 - fifteen-character field.
Field 2: Org. Code 2 - fifteen-character field.
Field 3: Org. Code 3 - fifteen-character field.
Field 4: Org. Code 4 – fifteen-character field.
Field 5: Org. Code 5 – fifteen-character field.
Field 6: Org. Code 6 – fifteen-character field.
Field 7: Org. Code 7 – fifteen-character field.
Field 8: Org. Code 8 – fifteen-character field.

Plot Information Fields (required fields are noted)

Field 9: Examiner Name - The name of the FIREMON crew boss or lead examiner should be entered using up to eight-characters. This is a nonstandardized field so anything can be entered here but we suggest the name follow the convention of first letter in first name followed by a dot followed by the entire last name. For example, Smokey Bear would be s.bear and John Smith would be j.smith. We strongly suggest that you do not use blanks in the text - for example, don't enter Smokey Bear as s. bear.

Field 10: Units (required) – Enter "E" if you will be collecting data using English units or "M" if you using metric units. These units are used for all measurements in the sampling. The only exception is the Error Units field for the GPS location. GPS error may be in an English or a metric unit regardless of what units are entered in Field 10.

Fields 11-12: Plot size and shape
Radius and width are used in the PD method to describe macroplot shape and size. Plot size and shape selection should be determined by the FIREMON project leader prior to entering the field because the size of the macroplot ultimately dictates the representative area that is sampled (table PD-1). If vegetation is dense, large plot sizes usually take longer to sample because it is difficult to traverse the plot. However, some ecosystems have large trees scattered over large areas so that large plot sizes are needed to obtain realistic estimates. Studies have attempted to identify the optimum plot size for different ecosystems but these studies have shown mixed results. We offer the following table to help determine the plot size that matches the fire monitoring application.

Table PD-1. Suggested FIREMON macroplot plot sizes.

Average plant height (feet)	Plant cover (%)	Suggested plot size (acres)	Plot radius (feet)	Suggested plot size (sq. meters)	Plot radius (meters)
X < 15	< 50	0.10	37.2	400	11.3
	>50	0.05	26.3	200	8.0
15 < X < 100	< 50	0.10	37.2	400	11.3
	>50	0.08	33.3	300	9.8
X > 100	< 50	0.40	74.5	1,000	17.8
	>50	0.13	42.5	500	12.6

Usually, the 0.1-acre circular plot will be sufficient for most ecosystems, and this size should be used if no other information is available. A general rule of thumb is that the plot should be big enough to capture at least 20 trees above 4 inches diameter at breast height (DBH) on average (across all plots in your project). It is important that the plot size stay constant across all plots in a sampling project. For example, if a FIREMON project contains shrublands, grasslands, and forests, don't change the plot size when you sample each one. Select the largest plot size (forests, in this example) and use it for all ecosystems. In general, we suggest using a circular PD macroplot because edge effects will be minimized.

To designate a circular plot shape, enter plot radius/length in Field 11 and enter 0 (zero) in Field 12. If a plot is rectangular, enter the length of the macroplot in Field 11 and the width in Field 12. No other plot shapes are used in FIREMON.

Plot size/plot shape

Field 11: Radius (ft or m) – If the macroplot is circular, enter the radius of the macroplot. If the macroplot is rectangular, enter the length of the macroplot.

Field 12: Width (ft or m) **–** Enter the width of the plot if it is rectangular, or enter zero (0) or leave the field blank if the macroplot shape is circular.

FIREMON data can be collected on "Monitoring" plots or "Control" plots. *Monitoring plots* are located inside the treatment area so that you can compare the effects of different treatments on the sampled attributes. *Control plots* are placed outside the treatment area and are used to compare attribute changes that have occurred in treatment area plots with attribute changes in plots that have not been treated. Setting up and using control plots are discussed more in the **Integrated Sampling Strategy** document.

Field 13: Plot Type – Enter "M" if you are sampling a monitoring plot or "C" if you are sampling a control plot.

Field 14: SEvent – The SEvent, or sampling event, field is used to document why the plot is being measured at a particular time (as recorded by Date). Monitoring requires that sampling be stratified by space and time. Since monitoring is a temporal sampling of repeated measures, it is essential that you record the reason for sampling to provide a context for analysis. The SEvent field will help you track when a plot was sampled more easily than if you used only the sampling date because SEvent organizes your data temporally in relation to the project treatments. Standardized codes are required for this field. These codes include 1) P for the pretreatment measurement of the plot, 2) R for the posttreatment, remeasurement and 3) IV for an inventory plot that is not permanently monumented and won't be resampled (table PD-2). The codes P and R are followed by a numeric value that indicates the sampling visit of the current sampling. For instance, if you sample a plot once before a prescribed fire, the code would be P1; then when you sample after the fire, the code will be R1 for the first resample, R2 for the second resample, and so on. When you change event codes, from P to R, you should start the sequential sample number over at 1. The FIREMON database will accept data for up to three pretreatment

measurements. When you are resampling a plot that has been sampled prior to your visit, you will need to check the previously collected FIREMON data to pick the appropriate sequential sample number to enter in the SEvent field. For simplicity, we have only provided standardized codes for pre- and post-treatment measurements. This may be a problem if, for instance, you plan on three measurements: one preharvest, one postharvest/preburn, and one postburn. We suggest using the P code before any treatments are applied; then using R codes after the first treatment because the FIREMON Analysis Tool uses only the most recent P coded SEvent. (This is a requirement of the statistical tests used.) In the previous example, the samples would be coded with P1 for the preharvest sample, R1 for the postharvest/preburn sample, and R2 for the postburn sample. Be sure to note the sampling event numbering scheme in the Metadata (FIREMON MD) form.

Table PD-2. Sampling Event codes.

Code	Event
P*n*	Pre-treatment measurement, sequential sample number.
R*n*	Post-treatment re-measurement of a plot, sequential sample number.
IV	Inventory plot, not a monitoring plot.

Linking fields

The following fields contain a code to link the PD form to other FIREMON forms. These codes are set by the user.

Field 15: Fire ID - Enter a Fire ID of up to 15 characters. The ID number or name should relate the fire that burned this plot to the same fire described in the Fire Behavior (FB) table. This field links this plot-scale data with the fire-scale data in the FB method. There may be many FIREMON plots referencing one fire. This field will be empty until after the burn has been completed and the Fire behavior data is entered on the FB data entry form.

Field 16: MDID – Enter a code of up to 15-characters that links the plot data to the metadata (MD) records. The Metadata (MD) table is used to store information on the sampling intensity and methods used in the monitoring project. It is highly recommended that you complete this form so that important information is recorded for future reference.

Georeferenced plot positions

The next set of fields is important for relocating FIREMON sample plots and for using FIREMON plot data in mapping and map validation of remote sensing projects. These fields fix the geographic location of the plot center.

Geographic coordinates are nearly always obtained from a Geographic Positioning System (GPS). GPS technology uses data from at least four orbiting satellites to triangulate your position in three dimensions (X, Y, Z, or North, East, Elevation) to within 3 to 50 meters of accuracy. GPS receivers are available from many sources and there are a wide range of GPS models to choose from. GPS selection and training are not part of the FIREMON sampling methods. A

wide variety of public and private agencies also provide excellent training. We recommend that the georeferenced coordinates for FIREMON plots be taken from a GPS receiver and not from paper maps such as USGS quadrangle maps because of the potential error when reading maps. When using a GPS unit, average the plot location over at least 200 readings to reduce the location error.

Three options are available for recording FIREMON plot georeferenced coordinates. Users can choose latitude-longitude (lat-long), Universal Transverse Mercator (UTM) or Albers coordinate systems. If you select UTM or Albers, record easting and northing to the nearest whole meter. If you are using lat-long coordinates, record latitude and longitude to the sixth decimal place using decimal degrees (this corresponds to about 1 meter of ground distance at 45 degrees latitude). The down side of lat-long coordinates is that it is difficult to visualize the measurements on the ground. (How far is 0.05 degrees latitude?) When reading the GPS unit be sure you are recording latitude and longitude in decimal degrees and not degrees-min-seconds. If using lat-long coordinates, enter data in Fields 18, 19, 23, 24 and 25. If using UTM enter data in Fields 20 to 25 and if using Albers enter data in 20, 21, 23, 24 and 25.

Field 17 (radio buttons): Coordinate System – Select whether you are using a Latitude and Longitude (Lat-Long), Universal Transverse Mercator (UTM), or Albers coordinate system by clicking on one of the selection buttons.

Field 18: Latitude – If using the lat-long system, enter the latitude in decimal degrees to six decimal places.

Field 19: Longitude - If using the lat-long system, enter the longitude in decimal degrees to six decimal places.

Field 20: Northing – If using the UTM or Albers system, enter the UTM northing to the nearest whole meter.

Field 21: Easting - If using the UTM or Albers system, enter the UTM easting to the nearest whole meter.

Field 22: UTM Zone - If using the UTM system, enter the UTM zone of the plot center.

Field 23: Datum - If using the UTM or Albers system, enter the datum used in conjunction with the UTM coordinates.

Field 24: GPS Error - Enter the position error value provided by the GPS unit. This should be entered regardless of whether you are using lat-long or UTM coordinates.

Field 25: GPS Units (E or M) **-** Enter the units associated with the GPS error. These units may be different than the units listed in Field 6.

The following sections describe the measurement or estimation of various ecosystem characteristics that are important to fire effects monitoring.

Biophysical Setting Fields

The biophysical setting describes the physical environment of the FIREMON plot relative to the organisms that grow there. Many site characteristics can be included in a description of biophysical setting, but only topography, geology, soils, and landform fields are implemented in FIREMON.

Topography

Field 26: Elevation (ft or m) **–** Enter the elevation above MSL (mean sea level) of the FIREMON plot in feet (or meters) to the nearest 100 feet (30 m). Elevation can be estimated from three sources. Most GPS readings include an estimate of elevation and these estimates are usually fairly accurate. Elevation can also be estimated from an altimeter. There are many types of altimeters but most are barometric and estimate elevation based on atmospheric pressure. Altimeters are notoriously fickle and need calibration nearly every day. When there are frequent weather systems passing the area, altimeters should be calibrated every 4 hours. Elevation can also be determined by reading contours from USGS topographic maps.

Field 27: Aspect – Enter the aspect of the FIREMON plot in degrees true north to the nearest 5 degrees. Aspect is the direction the plot is facing. For example, a slope that faces exactly west would have an aspect of 270 degrees true north. Be sure to record the aspect that best represents the macroplot as a whole and not just the point where you are standing. Also, be sure you verify your compass reading with your knowledge of the area to be sure that the aspect indicated is really correct. Often, metal parts on sampling equipment, or an iron rebar plot center, can influence the estimation of aspect. For information about using a compass see **How to Use a Compass - Sighting and Setting Declination** in the **How-To Guide** chapter**.**

Field 28: Slope – Record the plot slope using the percent scale to the nearest 5 percent. The slope is measured as an average of the uphill and downhill slope from plot center. See **How To Measure Slope** in the **How-To Guide** chapter for more information. Be sure the recorded slope reflects the slope of the entire plot and not just the line where you are standing. Slope values should always be positive.

Field 29: Landform – Enter up to a four-character code that best describes the landform containing the FIREMON macroplot from table PD-3. See **Appendix C: NRIS Landform Codes** for a complete list.

Table PD-3. Landform codes.

Code	Landform
GMF	Glaciated mountains-foothills
UMF	Unglaciated mountains-foothills
BRK	Breaklands-river breaks-badlands
PLA	Plains-rolling planes-plains w/breaks
VAL	Valleys-swales-draws
HIL	Hill-low ridges-benches
X	Did not assess

Field 30: VertShape – Enter up to a two-character code using the classes in table PD-4, that best describes the general contour of the terrain upslope and downslope from plot center. As you look up and down the slope, estimate a shape class that best describes the horizontal contour of the land (fig. PD-1).

Table PD-4. Slope shapes.

Code	Slope shape
LI	Linear or planar
CC	Depression or concave
PA	Patterned
CV	Rounded or convex
FL	Flat
BR	Broken
UN	Undulating
OO	Other shape
X	Did not assess

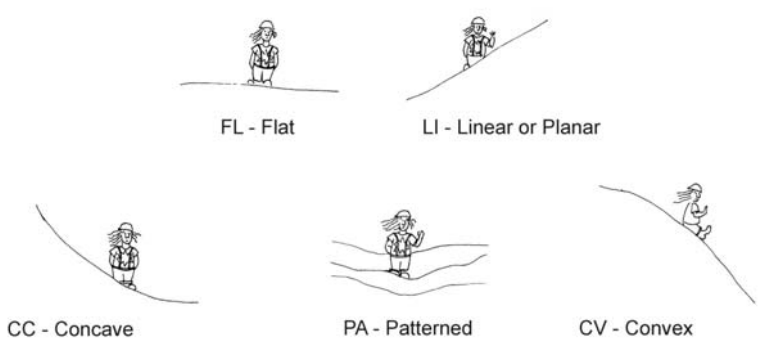


Figure PD-1. These illustrations depict the different types of vertical slope shapes. Horizontal slope shapes use the same classification but are determined by examining the across slope profile, rather than up and down the slope.

Field 31: HorzShape – Enter up to a two-character code using the classes in table PD-4 that best describes the general contour of the terrain as seen from plot center. This is an estimate of the general shape of the slope parallel to the contour of the slope. As you look across the slope along the contour, estimate a shape classes that best describes the horizontal contour of the land (fig. PD-1).

Geology and soils fields

Field 32: Geol1– This is the first of five fields used to describe surface geology and soils. Determine the primary geological rock type composing the parent material at the plot and enter the appropriate code from table PD-5 into the field. Generally, identification of surficial geology requires someone with specialized training and experience.

Table PD-5. Common primary surficial geology codes.

Primary code	Rock type 1
IGEX	Igneous Extrusive
IGIN	Igneous Intrusive
META	Metamorphic
SEDI	Sedimentary
UNDI	Undifferentiated
X	Did not assess

Field 33: Geol2 – Use this field, which designates secondary geological rock types, only if you have coded a primary surficial geology type. Determine the secondary geological rock type composing the parent material at the plot and enter the appropriate code from table PD-6 into the field. Generally, identification of surficial geology requires someone with specialized training and experience. Table PD-6 is an abridged list of common surficial types. A complete list is included in **Appendix B: NRIS Lithology Codes.**

Table PD-6. Common secondary surficial geology codes. Additional codes are listed in Appendix B.

Secondary code	Rock type 2	Secondary code	Rock type 2
ANDE	Andesite	CONG	Conglomerate
BASA	Basalt	DOLO	Dolomite
LATI	Latite	LIME	Limestone
RHYO	Rhyolite	SANS	Sandstone
SCOR	Scoria	SHAL	Shale
TRAC	Trachyte	SILS	Siltstone
DIOR	Diorite	TUFA	Tufa
GABB	Gabbro	MIEXME	Mixed Extrusive and Metamorphic
GRAN	Granite	MIEXSE	Mixed Extrusive and Sedimentary
QUMO	Quartz Monzonite	MIIG	Mixed Igneous (extrusive & intrusive)
SYEN	Syenite	MIIGME	Mixed Igneous and Metamorphic
GNEI	Gneiss	MIIGSE	Mixed Igneous and Sedimentary
PHYL	Phyllite	MIINME	Mixed Intrusive and Metamorphic
QUAR	Quartzite	MIINSE	Mixed Intrusive and Sedimentary
SCHI	Schist	MIMESE	Mixed Metamorphic and Sedimentary
SLAT	Slate	X	Did not assess
ARGI	Argillite		

Field 34: Soil Texture – The description of soil on the FIREMON plot is very generalized because fire effects are not influenced by fine-scale soil characteristics. However, many fire effects can be related to general soil characteristics, and soil texture is one such characteristic. Enter the code that best describes the texture of the soil on the FIREMON macroplot (table PD-7). Generally, identification of soil texture requires someone with specialized training and experience, but soil textures are described in many soils textbooks. If you are unsure of how to evaluate soil texture or have no confidence in your estimates, then use the X code in this field or leave it blank. We have only included the codes for soil texture required by FOFEM. If additional codes are needed, you may design them on your own and note them in the MD table.

Table PD-7. Soil texture codes.

Code	Description	Code	Description
C	Clay	S	Sand
CL	Clay loam	SC	Sandy clay
COS	Coarse sand	SCL	Sandy clay loam
COSL	Coarse sandy loam	SI	Silt
FS	Fine sand	SIC	Silty clay
FSL	Fine sandy loam	SICL	Silty clay loam
L	Loam	SIL	Silt loam
LCOS	Loamy coarse sand	SL	Sandy loam
LFS	Loamy fine sand	VFS	Very fine sand
LS	Loamy sand	VFSL	Very fine sandy loam
LVFS	Loamy very fine sand	X	Did not assess

Field 35: Erosion Type - Erosion is an important second-order fire effect to document on sample sites. We have based FIREMON's erosion codes on the classification used by the Natural Resources Conservation Service Soil Survey Manual, available at: http://soils.usda.gov/technical/manual/ (Erosion codes are listed in Chapter 3). If your macroplot is on a site that has moved in its entirety due to landslipage, include that information in the Comments field of the PD form then code Field 35 with a code that identifies the erosion conditions you are seeing on the surface. Be sure to record erosion on pretreatment plots in order to provide the reference conditions. Erosion types, along with their codes, are listed in table PD-8. Enter the code that best describes the erosion occurring on the plot.

Table PD-8. Erosion type codes.

Code	Erosion type
S	Stable, no erosion evident
R	Water erosion, rill
H	Water erosion, sheet
G	Water erosion, gully
T	Water erosion, tunnel
W	Wind erosion
O	Other type of erosion
X	Did not assess

Field 36: Erosion Sev - The severity of the erosion event is extremely difficult to assess and is best estimated by those who have some experience with erosion processes. We have based the Erosion Severity codes in FIREMON on the classification used by the USDA Natural Resources Conservation Service Soil Survey Manual (table PD-9). These codes use depth and extent of erosion to quantify severity. Enter the code that best fits the severity of the erosion on the plot in this field. Severity codes do not apply to tunnel erosion. If you have tunnel erosion on your plot, enter –1 in this field.

Table PD-9. Erosion severity codes.

Code	Erosion severity
0	Stable, no erosion is evident.
1	Low erosion severity; small amounts of material are lost from the plot. On average less than 25 percent of the upper 8 inches (20 cm) of soil surface have been lost across the macroplot. Throughout most of the area the thickness of the soil surface layer is within the normal range of variability of the un-eroded soil.
2	Moderate erosion severity; moderate amounts of material are lost from the plot. On average between 25 and 75 percent of the upper 8 inches (20 cm) of soil surface have been lost across the macroplot. Erosion patterns may range from small, un-eroded areas to small areas of severely eroded sites.
3	High erosion severity; Large amounts of material are lost from the plot. On average 75 percent or more of the upper 8 inches (20 cm) of soil surface have been lost across the macroplot. Material from deeper horizons in the soil profile is visible.
4	Very high erosion severity; Very large amounts of material are lost from the plot. All of the upper 8 inches (20 cm) of soil surface have been lost across the macroplot. Erosion has removed material from deeper horizons of the soil profile throughout most of the area.
-1	Unable to assess

Vegetation Fields

These PD fields describe general aspects of the vegetation using percent canopy cover as the measurement unit. Each vegetation fields requires an estimate of the percent vertically projected canopy cover recorded by class (table PD-10). Cover estimation methods are described in the **How To Estimate Cover** section of the **How-To Guide** chapter.

Table PD-10. Cover codes. Use these codes to record vegetation cover in the fields that call for cover estimation.

Code	Cover class
0	Zero percent cover
0.5	>0-1 percent cover
3	>1-5 percent cover
10	>5-15 percent cover
20	>15-25 percent cover
30	>25-35 percent cover
40	>35-45 percent cover
50	>45-55 percent cover
60	>55-65 percent cover
70	>65-75 percent cover
80	>75-85 percent cover
90	>85-95 percent cover
98	>95-100 percent cover

Vegetation cover in these PD fields is stratified by life form and size class. This makes determining canopy cover difficult because estimations require quite a bit of experience to arrive at consistent assessments of life form and size class cover when life forms and classes are unevenly distributed in all three dimensions. The seasonal timing of cover estimates can also lead to substantially different cover estimation especially for the shrub and herbaceous components. Critically consider how and when cover should be estimated based on project objects, resources, and the sampling experience of the crew. One option may be to attempt to estimate what the cover would be at the peak of the growing season. Doing so can remove some of the seasonal variation in vegetation sampling. However, it can also lead to error in the cover estimates.

Cover of herbaceous plants often appears greater when they are dormant because they fall over and lie flat on the ground. To get accurate values for these species, estimate cover as if they were erect.

Vegetation cover does not need to sum to 100 percent by life form because there will probably be overlapping cover across all life forms. However, the total cover for each life form must always be greater than any of the covers estimated for the size classes within that life form.

If you are unable to make an estimation of cover for any reason, leave the field blank and note the reason in the comments section (Field 86). Always enter the code 0 (zero) when there is no cover for that ground element.

Vegetation - trees

The following fields provide an estimate of tree cover by size class.

Field 37: TotTreeCov - Enter the percent canopy cover of all trees using the canopy cover codes presented in table PD-10 or click on the drop-down menu to choose a cover-value range. This estimate includes cover of ALL tree species from the smallest of seedlings to the tallest of old growth stems. It includes all layers of canopy vertically projected to the ground.

Field 38: SeedTreeCov - Enter the percent canopy cover of all trees that are less than 4.5 feet (1.4 m) tall using the codes in table PD-10. This cover estimate includes only the small seedlings.

Field 39: SapTreeCov - Enter the percent canopy cover of all trees that are greater than 4.5 feet (1.4 m) tall and less than 5.0 inches (13 cm) DBH using the codes in table PD-10.

Field 40: PoleTreeCov - Enter the percent canopy cover of all trees that are greater than 5 inches (13 cm) DBH and less than 9 inches (23 cm) DBH using FIREMON cover codes in table PD-10.

Field 41: MedTreeCov - Enter the percent canopy cover of all trees that are greater than 9 inches (23 cm) DBH up to 21 inches (53 cm) DBH using the codes in table PD-10.

Field 42: LrgTreeCov - Enter the percent canopy cover of all trees that are greater than 21 inches (53 cm) DBH up to 33 inches (83 cm) DBH using the FIREMON codes in table PD-10.

Field 43: VLargeTreeCov - Enter the percent canopy cover of all trees that are greater than 33 inches (83 cm) DBH using the codes in table PD-10.

Vegetation - shrubs

The next set of fields allows the FIREMON sampler to estimate shrub cover in three height classes.

Field 44: TotShrubCov - Enter the percent canopy cover of all shrubs on the plot using the FIREMON canopy cover in table PD-10 or select a cover-value range from the drop-down menu on the form. This cover estimate includes vertically projected cover of all shrub species of all heights.

Field 45: LowShrubCov - Enter the percent canopy cover of all shrubs that are less than 3 feet (1 m) tall on the plot using the codes in table PD-10.

Field 46: MedShrubCov - Enter the percent canopy cover of all shrubs that are greater than 3 feet (1 m) tall and less than 6.5 feet (2 m) tall on the plot into using the codes in table PD-10.

Field 47: TallShrubCov - Enter the percent canopy cover of all shrubs that are greater than 6.5 feet (2 m) tall on the plot into using the codes in table PD-10.

Vegetation - herbaceous

Cover of grasses, forbs, ferns, mosses, and lichens are entered in the next set of vegetation fields. If you feel uncomfortable distinguishing between species within and across life forms, try to get some additional training from the ecologist, forester, or other resource specialists at your local office. Phenological adjustments must be made for many herbaceous species because most cure during the dry season, which makes cover estimation difficult. Follow the suggestions in the **How To Estimate Cover** section of the **How-To Guide** chapter to estimate cover.

Field 48: GramCov - Enter the percent canopy cover of all graminoid species on the plot using the codes in table PD-10 or use the drop-down menu to select a cover-value range. Graminoid cover includes all grasses, sedges, and rushes in all stages of phenology. This estimate is for all sizes and species of graminoids.

Field 49: ForbCov - Enter the percent canopy cover of all forbs on the plot using the FIREMON cover codes in table PD-10.

Field 50: FernCov - Enter the percent canopy cover of all ferns on the plot using the FIREMON cover codes in table PD-10.

Field 51: MossLichCov - Enter the percent canopy cover of all mosses and lichens on the plot using the codes in table PD-10. These mosses and lichens can be on the ground or suspended from plants in the air (arboreal).

Vegetation - composition

The following fields document the dominant plant species in each of three layers or strata on the FIREMON plot. These fields are used to describe the existing vegetation community based on dominance in cover. These descriptions are especially useful for mapping vegetation with satellite data, developing existing vegetation community classifications, and stratifying FIREMON fire effects results.

For Fields 52-57, vegetation is stratified by plant height and species dominance in the stand. The **Lower Stratum** includes an estimate of the cover of all plants less than 3 feet (1 m) tall. The **Mid Stratum** field is an estimate for plants 3 to 10 feet (1 to 3 m) tall; and the **Upper Stratum** is for plants taller than 10 feet tall (3 m). Only species cover within the stratum is used to assess dominance. Many shade-tolerant tree species can be dominant in all three strata.

A dominant species must have at least 10 percent canopy cover in its stratum and must cover more area than any other species within its stratum. In the PD method, two species per stratum are used to describe dominance. The first species (Species 1) is the most dominant in terms of canopy cover, and the second species (Species 2) is the second most dominant. Use the NRCS plant code or local species code to record the species.

If a stratum has no species that exceed 10 percent cover, enter “None” in the following fields to indicate that there are no species that qualify for dominance. The same applies if there is no secondary species that meets the 10 percent minimum cover limit. (You will have to add “None” to the Other Items Code list in the FIREMON software)

Field 52: UpDomSpp1 - Enter the species code of the most dominant species in the upper level stratum of the FIREMON plot or select a code from the drop-down menu. This is the stratum that is greater than 10 feet (3 m) above ground level.

Field 53: UpDomSpp2 - Enter the species code of the second most dominant species in the upper level stratum of the FIREMON plot. This is the stratum that is greater than 10 feet (3 m) above ground level.

Field 54: MidDomSpp1 - Enter the species code of the most dominant species in the mid level stratum of the FIREMON plot. This is the stratum that is greater than 3 feet and less than 10 feet (1 to 3 m) above ground level.

Field 55: MidDomSpp2 - Enter the species code of the second most dominant species in the mid level stratum of the FIREMON plot. This is the stratum that is greater than 3 feet and less than 10 feet (1 to 3 m) above ground level.

Field 56: LowDomSpp1 - Enter the species code of the most dominant species in the lowest level stratum of the FIREMON plot. This is the stratum that is less than 3 feet (1 m) above ground level.

Field 57: LowDomSpp2 - Enter the species code of the second most dominant species in the lowest level stratum of the FIREMON plot. This is the stratum that is less than 3 feet (1 m) above ground level.

Potential vegetation

An important characteristic for describing biotic plant communities, especially in the western United States, is the potential vegetation type. Potential vegetation generally describes the capacity of a site or FIREMON plot to support unique vegetation species or life forms. Potential vegetation is evaluated by describing the vegetation that would eventually occupy a site in the absence of disturbance over a long time. For example, an alpine site can only support herbaceous communities because these sites are too cold for shrubs or trees, whereas a clearcut cedar-hemlock site has the potential to support coniferous forest ecosystems. Potential vegetation classifications are highly ecosystem specific and are locally developed for certain regions so a

standardized potential vegetation classification for the entire United States does not currently exist. In FIREMON, potential vegetation is evaluated to broad life forms to aid in the interpretation of FIREMON results.

Field 58: PVT ID – This is a user-created code for potential vegetation on the plot. Potential vegetation types are the foundation of many management decisions. Many forest plans and project designs stratify treatments by potential vegetation type to achieve better results. Unfortunately, there is no national standard list of potential vegetation types in the United States. Instead, we have provided a generic field for the user to enter his or her PVT codes, which can be used to stratify FIREMON results. These codes can be any combination of alpha or numeric characters. Do not use spaces in the text (for example, enter ABLA/VASC instead of ABLA VASC). Be sure you document your codes in the FIREMON MD table. There are 16 characters available in this field.

Field 59: Pot Form – Using the codes in table PD-11 enter the potential life form code that best describes the community life form that would eventually inhabit the FIREMON plot.

Table PD-11. Potential life form codes.

Code	Potential life form
AQ	Aquatic - Lake, pond, bog, river
NV	Non-vegetated - Bare soil, rock, dunes, scree, talus
CF	Coniferous upland forest - Pine, spruce, hemlock
CW	Coniferous wetland or riparian forest - Spruce, larch
BF	Broadleaf upland forest - Oak, beech, birch
BW	Broadleaf wetland or riparian forest - Tupelo, cypress
SA	Shrub dominated alpine - Willow
SU	Shrub dominated upland - Sagebrush, bitterbrush
SW	Shrub dominated wetland or riparian - Willow
HA	Herbaceous dominated alpine - Dryas
HU	Herbaceous dominated upland - grasslands, bunchgrass
HW	Herbaceous dominated wetland or riparian - ferns
ML	Moss or lichen dominated upland or wetland
OT	Other potential vegetation life form
X	Did not assess

Ground Cover Fields

The next two sets of PD fields describe the fuels complex on the FIREMON plot. The first group of fields (Fields 60-69) characterizes ground cover, which can be important for evaluating fire effects. It provides information on attributes of the forest floor and soil surface. Ground cover is critical for describing fuel continuity and cover. It is also important for evaluating erosion potential and classifying surface characteristics on satellite imagery. Estimates of ground cover are important for calculating subsequent or potential fire effects. The second group of fuel fields (Fields 70-74) describes the fuels on the plot in more detail.

Ground cover

Ground cover within any single category is evaluated as the vertically projected cover of that category that occupies the ground. *Only elements that are in direct contact with the ground are considered in the estimation of ground cover*. Ecosystem components suspended above the ground, such as branches, leaves, and moss, are not considered in the estimation of ground cover.

Ground cover is described by a set of 10 fields that, when summed together, ***must add to 100 percent*** (unlike the PD vegetation cover fields) plus or minus 10 percent. We suggest the following strategy for making these cover estimates. First, estimate ground cover for those categories with the least ground cover. These categories are the easiest to estimate with high accuracies. Be sure you scan the entire FIREMON plot to check for mineral soil, moss/lichen, and rock ground cover. Next, estimate the basal vegetation field to the cover codes 0.5, 3, or 10 (basal vegetation rarely exceeds 15 percent ground cover). Lastly, use the ground cover fields with the most cover (this is often only one or two fields, such as Litter/Duff) to make your estimate equal 100 percent. See **How to Estimate Cover** in the **How-To Guide** chapter for more information. If you are unable to estimate cover for any reason, leave the field blank and note the reason in the Comments section (Field 86). Always enter the code 0 (zero) when there is no cover for that ground element.

Field 60: BareSoil - Estimate the percent ground cover of bare soil using the codes in table PD-10 or select a cover range from the drop-down menu. Bare soil is considered to be all those mineral soil particles less than 1/16 inch (2 mm) in diameter. Bare soil does not include any organic matter. The bare soil can be charred or blackened by the fire.

Field 61: Gravel - Estimate the percent ground cover of gravel using the codes in table PD-10. Gravel is mineral particles greater than 1/16 inch (2 mm) in diameter and less than 3 inches (80 mm) in diameter. Again, gravel does not include any organic soil colloids. The gravel can be charred or blackened by the fire.

Field 62: Rock - Estimate the percent ground cover of rock using the codes in table PD-10. Rock ground cover is considered to be all those mineral particles greater than 3 inches (8 cm) in diameter, including boulders. Rocks can be blackened by the fire.

Field 63: LitterDuff - Estimate the percent ground cover of all *uncharred* litter and duff on the soil surface using the codes in table PD-10. Litter and duff cover is mostly organic material. For example litter includes such non-woody material as cones scales, dead leaves and needles not attached to the plant on which they grew. Other ground cover elements that are included in this category include plant fruits, buds, seeds, animal scat, and bones. If human litter appears on the FIREMON plot, pick it up and pack it out, and do not include it in the ground cover estimate. Duff is the same material but decomposed to the point it can not be identified. Do not include any woody material in this ground cover category unless it is highly decomposed twigs or logs that appear to be part of the duff. Sometimes after a fire the litter and duff will be charred. If this

happens on your plot, leave Field 63 blank and use the "Char" Ground Cover field (Field 66) to record percent cover of the charred litter and duff.

Field 64: Wood - Estimate the percent ground cover of all *uncharred* woody material using the codes in table PD-10. Woody ground cover is only those wood particles that are recognizable as twigs, branches, or logs. Do not include cover of suspended woody material, such dead branches connected on shrub or tree stems, in this field.

Field 65: MossLich - Enter the percent canopy cover of all mosses and lichens on the plot using the codes in table PD-10. These mosses and lichens can be on the ground or suspended from plants in the air (arboreal). This is the same estimate as in Field 51. The duplication is because some people consider moss and lichens ground cover and some consider it vegetation.

Field 66: Char - Estimate the percent ground cover of all *charred organic* material using the codes in table PD-10. Char is the blackened charcoal left from incomplete combustion of organic material. Char can occur on any piece of organic matter, such as duff, litter, logs, and twigs, and cover of all char is lumped into this category. Do not include ash into the charred ground cover. If it is difficult to distinguish char and black lichen, try to scrape the black area with your fingernail and then rub your nail on your plot sheet. Char will usually leave a mark.

Field 67: Ash - Estimate the percent ground cover of all ash material using the codes in table PD-10. Ash can sometimes look like mineral soil, but mineral surface feels sandy or gritty when touched and ash will often feel like a powder. Ash can occur in a variety of colors (red, gray, white) but light gray is often the primary shade.

Field 68: BasalVeg - Estimate the percent ground cover of basal vegetation using the codes in table PD-10. Percent basal vegetation is the area of the cross-section of the stem where it enters the ground surface expressed as a percent of plot cover. Basal vegetation rarely exceeds 15 percent cover, so you will usually choose one of four valid FIREMON cover codes: 0, 0.5, 3, or 10. This field is only used for vascular plant species. All nonvascular species are estimated in the MossLich field.

Field 69: Water - Estimate the percent ground cover of standing water using the codes in table PD-10. Water ground cover includes rainwater puddles, ponding, runoff, snow, ice, and hail. Do not include wet surfaces of other ground cover categories in this estimate. Although water is usually ephemeral, its cover must be recorded to make cover estimates sum to 100.

Fuels

This second set of fuel-related fields provides a basic set of data that can be used with fire simulation models. These fields describe general, plot-level fuel attributes used to map and model fuel characteristics and to predict fire behavior and effects. For instance, these fields can provide the information needed to run the FARSITE model. The crown-fuel description fields (Fields 72-74) are often used as model inputs to determine crown fire spread rates, especially in the FARSITE fire growth model. Because these fields only pertain to crown fuels, they should

only be completed if there is a significant tree canopy layer (greater than 10 percent canopy cover) above the surface fuel layer (>6 feet [2 m] tall) on the plot. The canopy layer can extend into the surface fuel layer (below 6 feet [2 m]); however, the canopy layer must extend above the surface fuel layer to be considered canopy fuels instead of surface fuels.

Estimation of fuel characteristics is highly subjective and dependent on the experience of the FIREMON crew. If more objective, repeatable, and accurate fuel estimates are needed, then use the Fuel Load (FL) and the Tree Data (TD) methods to more accurately and objectively measure information on surface and crown fuels.

Field 70: SurfFuelMod - Choose the appropriate fire behavior surface fuel model from the Anderson 1982 publication, *Aids for Determining Fuel Models for Estimating Fire Behavior*; or Scott and Burgan 2005, *Standard Fire Behavior Fuel Models: A comprehensive set for use with Rothermal's surface fire spread model*. Or, enter a locally developed custom fire behavior fuel model.

Field 71: Fuel Photo ID – Input a code for a photo series picture using up to 12 characters. Many areas in the United States have their own photo series guides. The guides use photos to describe typical fuel loadings by major cover types and geographical area. Each picture is linked to intensively sampled fuel loadings. Photo series are used to visually estimate fuel loadings by matching a picture from the guide with the current conditions of different fuel classes on the macroplot. If used as described in the guides, you would record a photo number for each component. For instance, you would record a picture number for the photo that best correlates to the 1-hour fuels on the macroplot, record another picture for the 10-hour fuels and so on. However, often only one picture is recorded per plot for two reasons. First, many people don't know that each fuel component should be matched to a separate photo. Second, in many of the guides it is difficult to see the fine woody debris or make an accurate assessment of the duff and litter from the photographs. It is important to note that this method is highly subjective but it is often the only means available for quantifying the fuelbed loadings.

In FIREMON we provide only one field for photo guide information. Compare the current fuel conditions on the macroplot with the pictures in a photo series. Record the photo number of the picture that most closely matches the plot conditions using the locally designed code. You can use the publication number combined with the picture number to uniquely identify the photo. For instance, if you are using the photo series for estimating natural fuels in the Lake States (Ottmar and Vihnanek 1999) you could combine the NFES publication number, 2579, and the plot number of the photo that best describes your fuels conditions and enter, for example, NFES2579MP04 in Field 71. You can use up to 12-characters to create a unique identifier. Design this field to best suit your needs but document your code conventions in the FIREMON MD table. If you want to record more than one photo number, record them in the PD Form's Comments section.

Field 72: StandHgt (ft or m) **–** Enter the height of the highest tree stratum that contains at least 10 percent canopy cover. This value is used to model crown fire spread. Estimate to the nearest 3 feet (1 m).

Field 73: CanFuelHgt (ft or m) **–** Enter the average lowest height at which there is a sufficient amount of tree canopy fuel to propagate a fire vertically into the canopy. Canopy fuel base height is a stand level measurement that provides an index for crown fire initiation and should account for dense dead vertical fuels (lichens, needle-drape, dense dead branches) that could provide a conduit for entrance of a surface fire into the crown. Estimate canopy base height to the nearest foot (0.3 m). Remember that this is a macroplot-based assessment. Take into account the dead fuels attached to standing trees that on individual trees might not be sufficient to move flames up the tree, but when intermingled with the branches from other trees would be sufficient to carry flames into the canopy. A trick to estimating canopy base height for the entire FIREMON plot is to envision a plastic sheet on the ground with a hole for each tree. Then, mentally lift the plastic sheet to the first dense section of the crown (part of crown having burnable biomass that could catch fire). The average height of the imaginary plastic sheet is the canopy fuel base height for the plot.

Because the canopy fuel base height assessment is subjective and some crews may not feel able to make an accurate assessment. Optionally, estimate the live canopy base height for the stand by imagining a plastic sheet lifted to the live crown on each tree and record the average height of the sheet. This assessment is somewhat less subjective than canopy fuel base height but it does not capture the dead canopy fuels. If you collect these data rather than canopy fuel base height, be sure to note which method you have used in the Metadata table.

Field 74: CanopyCov - Estimate the percent canopy cover of the forest/tree canopy above 6 feet (2 m) using the codes in table PD-10. This value is used to estimate crown bulk density for crown fire spread modeling. Be sure you estimate cover as percent vertically projected canopy cover that includes the cover for all species.

The Fire Behavior and Effects Fields

These FIREMON fields are used to identify the fire event and to describe the fire behavior and the subsequent fire effects. Fire behavior is a physical description of the fire as it is burning, whereas fire effects are assessed from observations of the ecosystem after the fire has burned the area. Fire behavior data will generally be collected at two scales: the plot scale and the fire scale. Plot scale data are collected on the FIREMON macroplot and are contained in just two fields on the PD field form: flame length and fire spread rate. There is also one field to enter the file name of a fire behavior photo. There will probably never be a fire where samplers are able to collect these data on every macroplot, but collecting even on a portion of the burn provides information can be useful in determining relationships between fire behavior and fire effects. Recording flame length and spread rate, as well as taking a fire behavior photo, on even a subset of the total plots will always be to your advantage. You will be collecting only flame length and spread rate data during a fire event. Any other fields on the PD form that are important to your project will be completed before the fire. Fire-scale data, including fuel moistures, plume behavior, and spotting observations, are recorded in the FIREMON Fire Behavior (FB) table.

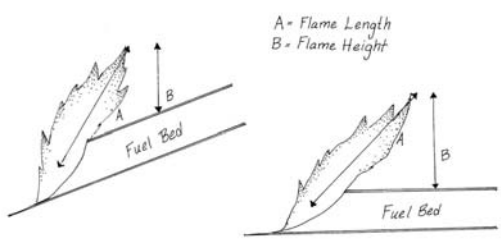
Fire behavior and fire effects

Enter the plot scale estimates of flame length and fire spread in the following two fields. This information will be collected during the fire event but recorded on data sheets from the most recent sampling that preceded the fire. For example, if there were two preburn sampling visits, record fire behavior data in Fields 75 and 76 on the fields forms where P2 was coded in the Sampling Event field (Field 14). This may be confusing when you are doing most of your sampling before the fire then waiting until the weather allows you to burn at a later date. During the burn, you will have to relocate the field forms and fill in the Fire ID, Flame Length, Spread Rate, and Fire Behavior Picture. Remember, you can also use the Date field to identify the most recent forms.

Fire effects must be evaluated from the burned evidence left on the FIREMON plot after the fire has passed. The fire severity classification used in the PD method is based on the NPS Fire Monitoring Handbook. Fire severity on larger areas (30 X 30 m) can be obtained by completing the Composite Burn Index methods (see the **Landscape Assessment** methods).

Field 75: Flame Len (ft or m) **–** Estimate the average flame length within the FIREMON macroplot boundaries to within 20 percent, rounded to the nearest whole number. Flame length is the length of the flames from the center of the combustion zone to the end of the continuous flame. It is more highly correlated with fire intensity than flame height (fig. PD-2).

Figure PD-2. Illustration showing flame length vs. flame height measurement. Enter your flame length estimate (A) into Field 75.



Field 76: FireSevCode-Sub – Enter the number (0 to 5) corresponding to the fire severity observed in the substrate using the descriptions in table PD-12. Examine the fire severity of the substrate component across the macroplot and select a severity code from the table that most closely matches the effects you see for the whole macroplot. Be sure the Fire Severity Code is determined only from observations made inside the macroplot. Fire severity should be estimated for both the substrate (Field 76) and vegetation (Field 78) to have a complete description of fire severity. This fire severity classification is based on that used in the NPS Fire Monitoring Handbook (www.fire.nps.gov/fmh/books.htm).

Table PD-12. Use these fire severity class to determine the fire severity across the FIREMON macroplot.

Fire severity code	Substrate	Forest Vegetation	Shrubland Vegetation	Grassland Vegetation
Unburned (5)	Not burned	Not burned	Not burned	Not burned
Scorched (4)	Litter partially blackened; duff nearly unchanged; wood/leaf structures unchanged	Foliage scorched and attached to supporting twigs.	Foliage scorched and attached to supporting twigs.	Foliage scorched
Lightly Burned (3)	Litter charred to partially consumed; upper duff layer may be charred but the duff is not altered over the entire depth; surface appears black; where litter is sparse charring may extend slightly into soil surface but soil is not visibly altered; woody debris partially burned; logs are scorched or blackened but not charred; rotten wood is scorched to partially burned.	Foliage and smaller twigs partially to completely consumed; branched mostly intact.	Foliage and smaller twigs partially to completely consumed; branched mostly intact; typically, less than 60 percent of the shrub canopy is consumed.	Grasses with approximately two inches of stubble; foliage and smaller twigs of associated species partially to completely consumed; some plant parts may still be standing; bases of plants are not deeply burned and are still recognizable.
Moderately Burned (2)	Litter mostly to entirely consumed, leaving coarse, light colored ash (ash soon disappears, leaving mineral soil); duff deeply charred, but not visibly altered; woody debris is mostly consumed; logs are deeply charred, burned out stump holes are evident.	Foliage twigs and small stems consumed; some branches still present.	Foliage twigs and small stems consumed; some branches smaller branches (0.25-0.50 inches) still present; typically, 40 to 80 percent of the shrub canopy is consumed.	Unburned grass stubble usually less than two inches tall, and mostly confined to an outer ring; for other species, foliage completely consumed, plant bases are burned to ground level and obscured in ash immediately after burning.
Heavily burned (1)	Litter and duff completely consumed, leaving fine white ash (ash disappears leaving mineral soil); mineral soil charred and/or visibly altered, often reddish; sound logs are deeply charred, and rotten logs are completely consumed.	All plant part consumed, leaving some or no major stems or trunks; any left are deeply charred.	All plant parts consumed leaving only stubs greater than 0.5 inches in diameter.	No unburned grasses above the root crown; for other species, all plant parts consumed.
Not Applicable (0)	Only inorganic material on site before burn.	None present at time of burn.	None present at time of burn.	None present at time of burn

Field 77: SpreadRate (ft/min or m/min) **–** Estimate the average speed of the fire as it crosses the macroplot in feet per minute (or m/min) to within 10 percent, rounded to the nearest whole number. Estimate spread rate by noting the number of minutes it takes for the flaming front to pass two points separated by a known distance.

Field 78: FireSevCode - Veg – Enter the number (0-5) corresponding to the fire severity observed in the above-ground plant parts on the FIREMON plot using the descriptions in table PD-12. Select the appropriate type – forest, shrubland, or grassland – from the table and choose a severity that best describes conditions on the whole macroplot. Estimate vegetation along with substrate for a complete description of fire behavior on the macroplot.

Field 79: Fire Behavior Picture - Enter the picture code – up to 50 characters - for a picture that best shows fire behavior as the flaming front crosses the FIREMON plot. This code will link to a digital picture placed into the FIREMON database. The picture code could be something like R01P02 for Roll 1, picture number 2 for film cameras, or it could be a filename (for example, file0001.jpg) for digital cameras. Scan slides or paper photographs into JPEG files for entry into the FIREMON database. See the **Photos and Local Fields** section below for more information on assigning photo filenames.

Photos and Local Fields

Photographs - conventional or digital - are a useful means to document the FIREMON plot a number of ways. They provide a unique opportunity to visually assess fire effects and document plot location in a database format. Previously established FIREMON plots can be found by orienting the landmarks in photos to visual cues in the field. Photos can be compared to determine important changes after a fire. Last, photos provide excellent communication tools for describing fire effects to the public and forest professionals. FIREMON provides four fields to record photograph numbers that show characteristics of the macroplot (Fields 80-83) and two fields (Fields 84-85) to record ecological data not included elsewhere in FIREMON fields. We strongly recommend a comprehensive photo-documentation of the plot conditions.

Document the FIREMON macroplot location using four photographs taken facing north, east, west and south. For the north-facing photo, move about 10 feet (3 m) south of the FIREMON macroplot center, then take the photo facing north, making sure that the plot center stake or rebar will be visible in the picture (fig. PD-3). Then, move west of the plot center about 10 feet (3 m) and take a photo facing east, again being sure that the plot center stake or rebar will be visible in the picture. Follow the same procedures for the west- and south-facing pictures. For all of these pictures, make sure that the camera is focused on the environment surrounding the plot, not the distance or foreground, and that the camera is set for the correct exposure and aperture for existing light conditions. A flash might be needed in low-light conditions.

Figure PD-3. Take your plot photos so that they show the plot center and the general plot conditions.

Picture codes will depend on the camera type and personal preferences. Photos taken with conventional film can be identified by assigning a code that integrates the roll number or name (John Smith Roll 1) and the picture number (number shown on the camera). For example, John Smith Roll 1 and picture 8 might be assigned JSR01P08 on the PD data form. You must label the roll so that you will be able to find the correct photos after the film has been developed. One way is to take a picture of a card with the roll information on it, as your first photo. Or you could write the roll information on the film canister before you load it into the camera. The first method is the more foolproof. Film photos will need to be scanned once they are developed and stored on your computer in digital format. For digital cameras, enter the file name of the digital picture in the photo fields. The file names in the following fields will be linked to the plot photos when you enter your data into the FIREMON database.

Field 80: Photo1– Enter code of up to 50-characters that uniquely describes the file location of the photo taken in the direction of due south. This field in the PD database will be linked to the actual digital photo when you enter data into the FIREMON database.

Field 81: Photo2– Enter code of up to 50-characters that uniquely describes the file location of the photo taken in the direction of due west. This field in the PD database will be linked to the actual digital photo when you enter data into the FIREMON database.

Field 82: Photo3 - Enter a code of up to 50-characters that uniquely describes the location of the photo taken in the direction of due north. This field in the PD database will be linked to the actual digital photo when you enter data into the FIREMON database.

Field 83: Photo4– Enter code of up to 50-characters that uniquely describes the location of the photo taken in the direction of due east. This field in the PD database will be linked to the actual digital photo when you enter data into the FIREMON database.

If you are interested in documenting the before-and-after plot conditions using a series of photos we suggest looking at the methods described by Hall (2002) for photo-point documentation. Hall's method establishes and analyzes photo points over time, and it is useful for fire monitoring. You can download Hall's publication at: www.fs.fed.us/pnw/pubs/gtr526/. If you are going to use photo point documentation use the photo fields for use with Hall's method rather than the directional photos

Field 84: Local1 - Enter a user-designed code that is up to 25 characters in length and uniquely describes some condition on the FIREMON plot. To avoid confusion and database problems, do not to embed blanks in your codes. Document your coding method in the Comments field.

Field 85: Local2 - Enter a user designed code that is up to 25 characters in length, and uniquely describes some condition on the FIREMON plot. To avoid confusion and database problems, do not to embed blanks in your codes. Document your coding method in the Comments field.

Comments

The Comments field is provided so that the field crew can record any information associated with the macroplot that cannot be recorded elsewhere on the PD form. For example, you can record ecological conditions on the plot, directions for plot location, sampling conditions that might affect data quality and/or other attributes important for management objectives. The Local 1 (Field 84), Local 2 (Field 85), and Comments fields (Field 86) are places to store and document this information.

Fields 84-86 are unstandardized field that can be used to record ecological data that do not fit in any standardized fields in other sections of FIREMON. For example, you will notice that there is no PD field for structural stage, which is an important vegetation attribute for many land management applications. We omitted structural stage in the standardized form because there are many unstandardized classifications of structural stage across the United States that are applicable for only local conditions and for a limited number of management objectives. In addition, some FIREMON users may have developed their own structural stage classes that they want to use. It is important that field samplers accurately describe ecological characteristics on a FIREMON plot so that they can be integrated into the monitoring analysis. Important ecological attributes include: wildlife utilization (browsing, grazing), human use (clearcutting, logging, mining), fire characteristics (abnormalities, burn coverage), topographic characteristics (seeps, swales), and/or disturbance (insects, disease).

The comments section should also be used to record details on plot locations. The notetaker should provide detailed notes for relocating the plot for future remeasurements including succinct, short directions such as "proceed 140 degrees azimuth from junction of roads 432 and 543 exactly 200 meters to a blazed 100 cm spruce." Write the directions clearly, so it will be easy for others to use them when the plot needs to be resampled.

It is also important to record observations of any factor that might affect the quality and integrity of the collected data in the comments section. An often-recorded sampling condition is the weather – such as "cold, rainy, windy day" - but many other factors can be entered, like "high stand density that precluded accurate measurement of diameter and canopy cover."

Comments should directly address the purpose of FIREMON sampling. For example, a sampling objective might be an evaluation of coarse woody debris, so a useful comment might be "many large logs consumed by fire; most were rotten."

Field 86: Comments– Enter up to a 256-character comment. Try to use shorthand and abbreviations to reduce space as long as the comments are still understandable. You might try to organize comments in a standard order with appropriate punctuation. For example, you might describe weather first and use only colons to separate the next major category of comments.

Precision Standards

Use these standards for the PD method (table PD-13).

Table PD-13. Precision guidelines for TD sampling.

Component	Standard
Latitude	±0.000001 degree
Longitude	±0.000001 degree
Northing	±1 meter
Easting	±1 meter
Elevation	±100 ft/30 m
Aspect	±5 degrees
Slope	±5 percent
All cover estimates	±1 class
Stand Height	±3 ft/1 m
Canopy Fuel Base Height	±1 ft/0.3 m
Flame Length	±20 percent, rounded
Spread rate	±10 percent, rounded
Severity Class	±1 class

SAMPLING DESIGN CUSTOMIZATION

This section will present several ways that the PD sampling method can be modified to collect more detailed information or streamlined to collect only the most important tree characteristics. First, the suggested or recommended sample design is detailed, then the modifications are presented. Use your project objectives to determine the best sampling intensity and modify our suggestions in order to collect the data you need.

Recommended PD Sampling Design

We recommend following the Alternative FIREMON sampling intensity where the optimum number of fields is sampled to achieve a strong, but limited field sample. With the Alternative sampling intensity you should complete all fields in the **Biophysical Setting** field set, the **Vegetation** field set, and the **Comments** field, in addition to the **Required** PD field set. This leaves the Fuels and Fire field sets empty. However, completion of both of these field sets would require less than about 5 minutes per plot, even under the worst conditions; so it probably would be prudent to complete all PD fields, even if you are working under the Alternative FIREMON sampling intensity.

Streamlined PD Sampling Design

The streamlined PD sampling design follows the Simple FIREMON sampling intensity where only the minimum sets of fields are measured. For the PD method, the minimum sets of fields are simply those in the **Required** field set. No other fields need be completed. However, completion of the **Comments** and the two plot pictures would add helpful detail to this simple structure.

Comprehensive PD Sampling Design

The comprehensive PD sampling design follows the Detailed FIREMON sampling intensity and is quite easy to implement. Simply leave no fields on the PD data form blank.

User-Specific PD Sampling Design

There are three ways to create user-designed fields for describing local ecological conditions. The two local fields in the Photo and Local Fields code set each allow up to a 25-character code in the database. This means the user can design a complex code to describe some important ecological characteristic critical to fire management. For example, the presence of weeds may be a significant management concern, so these fields might describe the cover and species, respectively, of the dominant weed.

Creative approaches can be used to enter local data if more than two fields are needed. Using the weed example, the cover and weed species can be integrated in one field by making the first six characters the local species code and the next two characters the FIREMON cover code. A third attribute, say plant height, could be added as a two-character code.

The 256-character comments field also can contain mixes of locally designed fields. Some people create search engines within a database query that look for certain combinations of special characters and numbers to link to a locally created standard field. For example, the term $SRF could be entered in the comments field to indicate the dominant fire regime (Stand-Replacement Fire).

Sampling Hints and Techniques

Field sampling can become quite complicated, especially when visiting complex ecosystems with many canopy strata and high biodiversity. It can be easy for the field crew to become overwhelmed by all the heterogeneity on the landscape. It is important that the field crew concentrate their evaluation of the PD fields to those ecosystem characteristics inside the FIREMON macroplot.

PLOT DESCRIPTION (PD) FIELD DESCRIPTIONS

Required PD Fields – Database key

Registration Code (RegistrationID). A four-character code determined by you or assigned to you. All four characters must be used.

Project Code (ProjectID). An eight-character code used to identify project work that is done within the group. You are not required to use all eight characters.

Plot Number (PlotID). Identifier that corresponds to the site where sampling methods are applied. Integer value.

Sampling Date (Date). Eight-digit number in the MM/DD/YYYY format where MM is the month number, DD is the day of the month, and YYYY is the current year.

Organization Codes

Field 1: **Org. Code 1**. Fifteen-character field used to identify part of the agency location code.

Field 2: **Org. Code 2**. Fifteen--character field used to identify part of the agency location code.

Field 3: **Org. Code 3**. Fifteen-. Two-character field used to identify part of the agency location code.

Field 4: **Org. Code 4**. Fifteen-. Two-character field used to identify part of the agency location code.

Field 5: **Org. Code 5**. Fifteen-. Two-character field used to identify part of the agency location code.

Field 6: **Org. Code 6**. Fifteen-. Two-character field used to identify part of the agency location code.

Field 7: **Org. Code 7**. Fifteen-. Two-character field used to identify part of the agency location code.

Field 8: **Org. Code 8**. Fifteen-. Two-character field used to identify part of the agency location code.

Plot Information Fields

Field 9: **Examiner's Name (Examiner)**. Eight-character field used to identify the crew boss or lead examiner.

Field 10: **Units**. (E or M). Units of measure use on the plot – English or metric.

Field11: **Plot Radius (Radius)**. (ft or m). Radius of the macroplot. If the macroplot is rectangular, plot length.

Field 12: **Plot Width (Width)**. (ft or m). Width of the plot if it is rectangular. Enter 0 (zero) or blank if the plot is circular.

Sampling information

Field 13: **Plot Type**. (M or C). Plot type - Monitoring or Control.

Field 14: **Sampling Event (SEvent)**. (P*n*/R*n*/IV). Sampling relative treatment identification. Valid codes are in table PD-2 of the sampling method.

Linking fields

Field 15: **Fire ID (FireID)**. Fire ID of up to 15 characters. The ID number or name that relates the fire that burned this plot to the same fire described in the Fire Behavior (FB) table.

Field 16: **Metadata ID (MDID)**. Metadata ID of up to 15-characters that links the plot data to the MD table.

Georeferenced Plot Positions

Field 17: **Coordinate System (select one radio button)**. Identifies whether lat-long, UTM, or Albers coordinates were used.

Field 18: **Latitude**. Latitude. Precision: ±0.000001 decimal degree.

Field 19: **Longitude**. Longitude. Precision: ±0.000001 decimal degree.

Field 20: **Northing**. UTM northing. Precision: ±1 m.

Field 21: **Easting**. UTM easting. Precision: ±1 m.

Field 22: **Zone**. UTM zone of the plot center.

Field 23: **Datum**. Datum used in conjunction with the UTM and Albers coordinates.

Field 24: **Position Error (GPS Error)**. Position error value provided by the GPS unit.

Field 25: **Error Units (GPS Units).** (E or M). Enter the English or metric units associated with the GPS error. May be different than the units listed in Field 10.

Biophysical Setting Fields

Topography

Field 26: **Elevation** (ft or m). Plot elevation. Precision: ±100 ft/30 m.

Field 27: **Plot Aspect (Aspect)** (degrees). Aspect measured in degrees true north. Precision: ±5 degrees.

Field 28: **Slope**. (percent). Average plot slope. Precision: ±5 percent.

Field 29: **Landform**. Four-letter landform code. Valid codes are in table PD-3 of the sampling method.

Field 30: **Vertical Slope Shape (VertShape)**. Two-letter slope shape code. Valid codes are in table PD-4 of the sampling method.

Field 31: **Horizontal Slope Shape (HorzShape)**. Two-letter slope shape code. Valid codes are in table PD-4 of the sampling method.

Geology and soils fields

Field 32: **Primary Surficial Geology (Geol1)**. Four-letter code describing the geological rock type composing the parent material. Valid codes are in table PD-5 of the sampling method.

Field 33: **Secondary Surficial Geology (Geol2)**. Four-letter code describing the secondary geological rock type composing the parent material. Use this field only if you have coded a primary surficial geology type. Valid codes are in table PD-6 of the sampling method. Table PD-6 is an abridged list of common surficial types. A complete list is included in the Lithology Codes Appendix.

Field 34: **Soil Texture Class (Soil Texture)**. Up to four-letter code that describes the soil texture. Valid codes are in table PD-7 of the sampling method.

Field 35: **Erosion Type**. One-letter code describing the erosion on the plot. Valid codes are in table PD-8 of the sampling method.

Field 36: **Erosion Severity (Erosion Sev)**. One-number code describing the severity of the soils erosion. Valid codes are in table PD-9 of the sampling method.

Vegetation Fields

Vegetation – trees

Field 37: **Total Tree Cover (TotTreeCov)**. Vertically projected canopy cover of all the trees on the macroplot. Valid codes are in table PD-10 of the sampling method. Precision: ±1 class.

Field 38: **Seedling Tree Cover (SeedTreeCov)**. Vertically projected canopy cover of all trees that are less than 4.5 feet (1.4 m) tall. Valid codes are in table PD-10 of the sampling method. Precision: ±1 class.

Field 39: **Sapling Tree Cover (SapTreeCov)**. Vertically projected canopy cover of all trees that are greater than 4.5 feet (1.4 m) tall and less than 5.0 inches (13 cm) DBH. Valid codes are in table PD-10 of the sampling method. Precision: ±1 class.

Field 40: **Pole Tree Cover (PoleTreeCov)**. Vertically projected canopy cover of all trees that are greater than 5 inches (13 cm) DBH and less than 9 inches (23 cm) DBH. Valid codes are in table PD-10 of the sampling method. Precision: ±1 class.

Field 41: **Medium Tree Cover (MedTreeCov)**. Vertically projected canopy cover of all trees that are greater than 9 inches (23 cm) DBH up to 21 inches (53 cm) DBH. Valid codes are in table PD-10 of the sampling method. Precision: ±1 class.

Field 42: **Large Tree Cover (LrgTreeCov)**. Vertically projected canopy cover of all trees that are greater than 21 inches (53 cm) DBH up to 33 inches (83 cm) DBH. Valid codes are in table PD-10 of the sampling method. Precision: ±1 class.

Field 43: **Very Large Tree Cover (VLrgTreeCov)**. Vertically projected canopy cover of all trees that are greater than 33 inches (83 cm) DBH. Valid codes are in table PD-10 of the sampling method. Precision: ±1 class.

Vegetation - shrubs

Field 44: **Total Shrub Cover (TotShrubCov)**. Vertically projected canopy cover of all shrubs on the plot. Valid codes are in table PD-10 of the sampling method. Precision: ±1 class.

Field 45: **Low Shrub Cover (LowShrubCov)**. Vertically projected canopy cover of all shrubs that are less than 3 feet (1 meter) tall. Valid codes are in table PD-10 of the sampling method. Precision: ±1 class.

Field 46: **Medium Shrub Cover (MedShrubCov)**. Vertically projected canopy cover of all shrubs that are greater than 3 feet (1 meter) tall and less than 6.5 feet (2 meters) tall. Valid codes are in table PD-10 of the sampling method. Precision: ±1 class.

Field 47: **Tall Shrub Cover (TallShrubCov)**. Vertically projected canopy cover of shrubs that are greater than 6.5 feet (2 meters) tall. Valid codes are in table PD-10 of the sampling method. Precision: ±1 class.

Vegetation – herbaceous

Field 48: **Graminoid Cover (GramCov)**. Vertically projected canopy cover of all graminoid species on the plot. Valid codes are in table PD-10 of the sampling method. Precision: ±1 class.

Field 49: **Forb Cover (ForbCov)**. Vertically projected canopy cover of all forbs on the plot. Valid codes are in table PD-10 of the sampling method. Precision: ±1 class.

Field 50: **Fern Cover (FernCov)**. Vertically projected canopy cover of all ferns on the plot. Valid codes are in table PD-10 of the sampling method. Precision: ±1 class.

Field 51: **Moss and Lichen Cover (MossLichCov)**. Vertically projected canopy cover of all mosses and lichens on the plot. Valid codes are in table PD-10 of the sampling method. Precision: ±1 class.

Vegetation – composition

Field 52: **Upper Dominant Species 1 (UpDomSpp1)**. NRCS plants species code or the local code of the most dominant species in the upper level stratum (greater than 10 feet [3 m] above ground level). Plant code is either the NRCS plant code or locally defined code.

Field 53: **Upper Dominant Species 2 (UpDomSpp2)**. NRCS plants species code or the local code of the second most dominant species in the upper level stratum (greater than 10 feet [3 m] above ground level). Code is either the NRCS plant code or locally defined code.

Field 54: **Mid Dominant Species 1 (MidDomSpp1)**. NRCS plants species code or the local code of the most dominant species in the mid level stratum (greater than 3 feet and less than 10 feet [1 to 3 m] above ground level). Code is either the NRCS plant code or locally defined code.

Field 55: **Mid Dominant Species 2 (MidDomSpp2)**. NRCS plants species code or the local code of the second most dominant species in the mid level stratum (greater than 3 feet and less than 10 feet [1 to 3 m] above ground level). Code is either the NRCS plant code or locally defined code.

Field 56: **Lower Dominant Species 1 (LowDomSpp1)**. NRCS plants species code or the local code of the most dominant species in the lowest level stratum (less than 3 feet [1 m] above ground level).

Field 57: **Lower Dominant Species 2 (LowDomSpp2)**. NRCS plants species code or the local code of the second most dominant species in the lowest level stratum (less than 3 feet [1 m] above ground level).

Potential vegetation

Field 58: **Potential Vegetation Type ID (PVT ID)**. A 10-character, unstandardized code used to identify locally determined potential vegetation type.

Field 59: **Potential Life form (Pot Form)**. Two-letter potential life form code. Valid codes are in table PD-11 of the sampling method.

Ground Cover Fields and Fuel Characteristic Fields

Ground cover

Field 60: **Bare Soil Ground Cover (BareSoil)**. Percent ground cover of bare soil. Valid codes are in table PD-10 of the sampling method. Precision: ±1 class.

Field 61: **Gravel Ground Cover (Gravel)**. Percent ground cover of rock. Valid codes are in table PD-10 of the sampling method. Precision: ±1 class.

Field 62: **Rock Ground Cover (Rock)**. Percent ground cover of rock. Valid codes are in table PD-10 of the sampling method. Precision: ±1 class.

Field 63: **Litter and Duff Ground Cover (LitterDuff)**. Percent ground cover of all uncharred litter and duff on the soil surface. Valid codes are in table PD-10 of the sampling method. Precision: ±1 class.

Field 64: **Wood Ground Cover (Wood)**. Percent ground cover of all uncharred woody material. Valid codes are in table PD-10 of the sampling method. Precision: ±1 class.

Field 65: **Moss and Lichen Cover (MossLich)**. Percent canopy cover of all mosses and lichens on the plot. Valid codes are in table PD-10 of the sampling method. Precision: ±1 class.

Field 66: **Charred Ground Cover (Char)**. Percent ground cover of all *charred organic* material. Valid codes are in table PD-10 of the sampling method. Precision: ±1 class.

Field 67: **Ash Ground Cover (Ash)**. Percent ground cover of all ash material. Valid codes are in table PD-10 of the sampling method. Precision: ±1 class.

Field 68: **Basal Vegetation Ground Cover (BasalVeg)**. Percent ground cover of basal vegetation using the codes. Valid codes are in table PD-10 of the sampling method. Precision: ±1 class.

Field 69: **Water Ground Cover (Water)**. Percent ground cover of standing water. Valid codes are in table PD-10 of the sampling method. Precision: ±1 class.

Fuels

Field 70: **Surface Fire Behavior Fuel Model (SurfFuelMod)**. Fire behavior fuel model from the Anderson 1983 publication, Aids for Determining Fuel Models for Estimating Fire Behavior; Scott and Burgan 2005, Standard Fire Behavior Fuel Models: A comprehensive set for use with Rothermal's surface fire spread model; or custom fire behavior fuel model.

Field 71: **Fuel Photo Series ID (Fuel Photo ID)**. A 12-character, unstandardized field to enter a photo guide publication number and photo number that is similar to fuel characteristics seen on the plot.

Field 72: **Stand Height (StandHgt)**. (ft or m). Height of the highest stratum that contains at least 10 percent vertically projected canopy cover. Precision: ±3 ft/1 m.

Field 73: **Canopy Fuel Base Height (CanFuelHgt)**. (ft or m). Lowest point above the ground at which there is a sufficient amount of canopy fuel to propagate a fire vertically into the canopy. Precision: ±1 ft/0.3 m.

Field 74: **Canopy Cover (CanopyCov)**. Percent canopy cover of the forest canopy above 6 feet (2 m). Valid codes are in table PD-10 of the sampling method. Precision: ±1 class.

The Fire Behavior and Fire Effects Fields

Fire behavior and fire effects

Field 75: **Flame Length (FlameLen)**. (ft or m). Length of the flames from the center of the combustion zone to the end of the continuous flame. Precision: ±20 percent, rounded to nearest whole number.

Field 76: **Fire Severity Code-Substrate (FireSevCod-Sub)**. A two-number code describing the fire severity on the substrate of the plot. Valid codes are in table PD-12 of the sampling method. Precision: ±1 class.

Field 77: **Spread Rate**. (ft/min. or m/min.). Average speed of the fire across the macroplot. Precision: Precision: ±10 percent, rounded to nearest whole number.

Field 78: **Fire Severity Code-Vegetation (FireSevCode-Veg).** A two-number code describing the fire severity on vegetation in the plot. Valid codes are in table PD-12 of the sampling method. Precision: ±1 class.

Field 77: **Fire Behavior Picture (FireBehavPic)**. Up to a 50-character filename used to identify the location of a digital photo showing the fire behavior on the plot.

Photo and Local Fields

Photo fields

Field 80: **Photo Point 1 (Photo1)**. Up to a 50-character filename used to identify the location of a digital photo showing general plot conditions facing south.

Field 81: **Photo Point 2 (Photo2)**. Up to a 50-character filename used to identify the location of a digital photo showing general plot conditions facing west.

Field 82: **Photo Point 3 (Photo3)**. Up to a 50-character filename used to identify the location of a digital photo showing general plot conditions facing north.

Field 83: **Photo Point 4 (Photo4)**. Up to a 50-character filename used to identify the location of a digital photo showing general plot conditions facing east.

Local Codes

Field 84: **Local 1**. User designed code that is up to 25 characters in length.

Field 85: **Local 2**. User designed code that is up to 25 characters in length.

Comments

Field 86: **Comments**. A 256-character, unstandardized comment field.

PLOT DESCRIPTION (PD) EQUIPMENT LIST

Camera with film and flash
Clear plastic ruler (2)
Clinometer (2)
Clipboard
Cloth tape (2)
Compass (2)
Flagging
Geographic Positioning System or GPS receiver
Indelible ink pen (Sharpie, Marker)
Lead pencils with lead refills
Maps, charts and directions
Map protector or plastic bag
Logger's tape (2 plus steel tape refills)
Magnifying glass
Pocket calculator
Plot sheet protector or plastic bag
Previous measurement plot sheets
Field notebook
PD data forms and cheat sheet