FIRESEV Field Sampling Methods

19 October 2009, Revised 9 November 2009

Greg Dillon and Penny Morgan

Purpose for sampling

Our primary purpose for this sampling effort is to collect field data we can use to assess the accuracy of the maps we'll be producing of the probability of severe fires for the western US. In addition, we are collecting data to analyze the degree to which various measures of burn severity interpreted from satellite imagery (NBR, dNBR, RdNBR) are correlated with field indicators of burn severity collected one year post-fire. We seek to assess measures in the field and remotely that can relate to three different axes of burn severity used in this project. These include a) soil heating, b) surface fuel consumption, and c) change in vegetation cover and mortality.

For the sampling methods and field form, we have drawn upon the GeoCBI (De Santis and Chuvieco 2009), CBI (Key and Benson 2005), ongoing analysis by S. Bunting and E. Strand of burn severity in woodlands and shrublands in southern Idaho (personal communications, University of Idaho) and our experience with sampling burn severity in multiple vegetation types (Hudak et al. 2007; Lentile et al.2007; Lentile et al. *In press*). Further, we have tried to produce a streamlined version of field sampling, with continuous measures (e.g. %) where possible. We have deviated from the CBI and GeoCBI forms because we have experienced the challenge that people enter a plot with an assumption of severity and then that influences the assessment of fire effects upon substrate and vegetation layers. Nonetheless, the data collected can easily be used to calculate CBI (Key and Benson 2005), GeoCBI (De Santis and Chuvieco 2009), fraction green and fraction charred (Hudak et al. 2007; Lentile et al. *In press*), size of smallest twig (Keeley et al. 2008), and other indicators of burn severity.

Field Methods

Landscape-Level Sampling: We will sample areas within selected areas burned by wildfires in 2008 and 2009 with the goal of sampling one year post-burn. Because we are focused upon high burn severity and the threshold for identifying high burn severity with the satellite imagery and field data, we propose to sample about ½ of all plots in high burn severity, with about ¼ in moderate and ¼ in low severity. Further, because we have assembled more data from others that were collected in forests than in woodlands, shrublands or grasslands, we wish to ensure that we have a balance of data across these four physiognomic types, or that we have more in the latter three than in forests.

We will opportunistically locate plots to represent areas of different burn severity levels (from BARC maps when possible), cover types, and successional stages. Our primary objectives in locating plots will be to: a) capture the diversity of sites that exist within a burned area, and b) get a wide geographic distribution of samples. We will reject locations for sampling if they are not large enough to allow for 90 m x 90 m area to be sampled, with that area relatively uniform with respect to overstory density and fire severity. Within locations subjectively chosen to be representative of a set of conditions, we will randomly locate plot center by taking a random number of paces (between 2 and 10) in a randomly chosen azimuth. This plot center must be at least 90 m from a road or stand boundary.

All plots will be 1/10 acre (400 m^2) fixed-area circular macroplots with a radius of 37.2 ft (11.3 m). We will use the FIREMON sampling protocols as the template for sampling in this study. Many of the fields on the sampling forms (attached) are from the Plot Description and CBI forms used in FIREMON.

Fields 17-65 on the FIRESEV PD form are from the FIREMON Plot Description form and instructions are available online for those (Keane 2006), or in the attached Appendix B.

Fields that identify the plot are at the top of both forms. These should be filled in as follows:

- **Reg ID**: This is the Registration Code, and is a four-character code determined by you or assigned to you. The Registration Code 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 Registration 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
- **Project ID**: This is a character code that identifies the project for which the data are being collected. For all FIRESEV plots, this will be "FIRESEV".
- **Plot ID**: This is an integer code that identifies the unique plot number. The numbering scheme used by MFSL personnel includes information about sequential fire number, examiner number, and sequential plot number. In this way, plots done simultaneously by different crew members will never have the same ID.
    - For example: If the plot is the 5th plot sampled by crew member number 3 on the 1st fire that's been visited, the Plot ID is 1305. Similarly, if it were the 10th plot on the 10th fire visited, the Plot ID would be 10310.
    - As long as the combination of Reg ID and Plot ID are unique, then any numbering system can be used for Plot ID.
- **Examiners**: Names (or initials) of all people present at the time of sampling.
- **Fire Name**: The official name given to the fire in the ICS (Incident Command System).
- **Plot Radius**: For FIRESEV plots this will always be 37.2 ft.
- **Field Date**: The date of field sampling.
- **Fire Date**: The official start date of the fire, as recorded in the ICS.

CBI - Modified

Just as in CBI (Key and Benson 2006), field personnel need to judge whether a stratum or characteristic of a stratum to be rated has some minimal level of significance as a reference to burn severity on a plot. Did it have enough presence on the plot before fire so as to show representative effects after the fire, or did it influence and reflect fire behavior? If, for example, there is only one large fuel item, and it covered an insignificant portion of a plot, then it may not

be worth rating. That one piece of wood is not likely to provide much information about severity realized across the plot. If a factor is not assessed, do not enter zero (0) on the form, as that is a valid value. Instead, either draw a line through the entry box or enter NA.

Remember that the goal of this sampling is to evaluate the change in conditions as a result of the fire one year post-fire. You may need to compare burned and unburned locations on similar sites to get a sense of pre-burn conditions. Make sure to take in the whole plot in the average score, including unburned areas.

Strata to be assessed will vary with vegetation physiognomy. Further, we expect ratings of B (but not B1 and B2) in forests, and all three B, B1 and B2 (B represents the combination of B1 and B2) in woodlands, shrublands and grasslands. In woodlands, shrublands and grasslands, do not rate the strata C, D, E, or F unless they are present with at least 10% canopy cover.

Generally seek to avoid sampling in sites with extensive post-fire rehabilitation, salvage logging, or other post-fire disturbance that will likely greatly change the interpretation of change in vegetation attributed to fire (i.e. the burn severity). However, if such treatments cannot be completely avoided, please make note of them in the comments. Also, as with CBI, you should not include litter, duff, or woody fuels that accumulated after fire in your assessment of stratum A, substrates, because we are seeking measures of direct fire effects (fuel consumption) with these fields.

Below, we provide explanations of individual fields on the Modified CBI portion of the FIRESEV Burn Severity form. In general, when recording percent values, use the FIREMON classes (Table A-1).

- **% Plot Area Burned:** Before examining the individual severity factors within strata, record the percent surface area showing *any* impact from fire for the entire 1/10 acre plot. This always reflects the area of burned substrates and low-growing plants. If there is a rare case with area of burned overstory but unburned understory, count that overstory burn as well, as if viewed from the air. Do not subtract, however, unburned overstory from the burned area of the understory.
- **FCOV:** For each stratum (A through F), estimate the fractional cover both pre-fire and at the time of measurement. Record pre-fire values before the slash (/) and post-fire values after the slash, using the FIREMON percent cover classes (Table A-1). The total across all strata in each case (pre vs. post) must add to 100% (+/- 10%). In woodlands, shrublands, and grasslands, the FCOV for the B stratum should be the sum of values for strata B1 and B2. As FCOV is intended to be fractional cover that would be seen from a direct overhead view, we suggest starting with the tallest stratum and working downward.
- **Stratum A (Substrates):**
    - Record the **percent change of each of the following: litter, fine fuel (<3 inches (7.6 cm) diameter), duff, woody fuel (≥3 inches diameter).** Base consumption on the percent of volume or weight lost in relation to plot-wide pre-fire fuel load for each class. Consumption includes conversion of woody material to inorganic carbon (charcoal), as well as the complete loss woody fuel. Don't rate any of

these that cover less than about 5 percent of the plot. Ignore stumps that existed before fire.

- **Soil & rock cover/color:** Assess the change in percent cover of newly exposed mineral soil and rock, over and above estimated pre-fire levels plotwide. Exposed soil is considered soil or rock surface that is visible from eye level and not covered by litter, duff, or low herbaceous cover less than about 12 inches (30 cm) high. Such surfaces that are likewise visible, but under taller shrubs and trees, count as exposed soil. Ash and charcoal from consumed woody fuel, as well as newly exposed fine root mass within consumed duff layers, are overlooked when estimating exposed soil (that is, all the new soil below those components is considered). Change in soil color may also provide clues to severity. Base ratings on the proportion of exposed soil changing from native color to a general lightening with loss of organics at moderate to moderate-high severity, and up to 10 percent soil cover changing to a reddish color from oxidation at high severity. The amount of reddish soil varies by soil type, thus adaptation to particular ecosystems is warranted. See CBI methods (Key and Benson 2006) if you have further questions.
- **Soil color, fractional cover (must sum to 100%):** Record the fractional cover of soil color in percent, using FIREMON classes (Table A-1). This must add to 100% (+/- 10%), and includes %green/brown (this is unburned vegetation, litter), %black/grey (this is charred organic material and partially charred organic matter that is mixed with ash), and %red (oxidized soil). We suggest that you estimate those colors with smallest amounts first, then the largest category.

- **Strata B (B1, B2) and C:**
  - **% Foliage Altered (blk-brown):** Percent of pre-fire foliage that was turned black or brown by the fire. If a plant is resprouting, ignore the green vegetation (it gets assessed in the following rows). If as in many fires, including many of low intensity or severity, plants are all top-killed, then this is 100%.
  - **Frequency % living:** Percent of individual prefire plants still alive 1 year after fire. This is a measure of survivorship based on numbers of individuals and not necessarily on change in cover. Consider resprouting perennial herbs, low shrubs, and small trees plotwide. Resprouting plants are ones that burned but survive from living roots and stems. Include all green vegetation as well as burned plants that have not had enough time to resprout but remain viable. Burned plants may need to be examined for viable cambium or succulent buds near growth points. Dead stems will be brittle when bent; living ones will be supple. Do not include new colonizers or other plants newly germinating from seed. Make sure to take in the whole plot in the average score, including unburned areas.
  - **% change in cover:** Estimate the % increase (+) or decrease (-) in canopy cover, relative to pre-fire cover. For example, if there was 20% pre-fire cover in stratum C and half of it burned, then you would record -50%.
  - **Species composition – Relative abundance:** Rate this as **U**nchanged, **L**ittle change, **M**oderate change or **H**igh change. Change in species composition, and/or

relative abundance of species anticipated within 2-3 years post-fire. This is a community-based assessment that gauges the ecological resemblance of the post-fire community compared to the community that existed before fire. It represents alterations in dominance among species (biomass or cover) as well as potential change in the species present, such as absence of prefire species and/or presence of new post-fire species. Consider the distribution of abundance or dominance among the species present after fire, compared to before fire. Such factors qualitatively determine the similarity or dissimilarity of the site from before to after fire. Increases or decreases in certain species abundance and dominance, or changes in the species present after fire, raise the score for this rating factor. If all plants in a particular stratum were killed by fire, then this would be recorded as high change.

- **Diameter of smallest branch/base:** Assess the skeletons of the shrubs and record the diameter of the smallest branches that remain.
- **Species for smallest branch:** If possible, record the four-letter code for the species on which the smallest diameter branch was assessed.

- **Strata D, E and F:**
  - **%Green (unaltered):** Percent of pre-fire crown foliage volume (living or dead) unaltered by fire, relative to estimated pre-fire crown volume of the plot.
  - **%Black/Brown:** Record the percent black of pre-fire crown foliage (living or dead) that is now black or brown as a result of the fire. This includes foliage consumed (black) or damaged by heating or desiccation or because stem was girdled (brown, scorched). This includes delayed mortality from fire or insects and disease that has occurred post-fire.
  - **Frequency % living:** Percent of individual pre-fire plants still alive one year after fire. This is a measure of survivorship based on numbers of individuals and not necessarily on change in cover. For trees, only consider resprouting plants if the new sprouts can be anticipated to reach the height of the pre-fire individual within 2-3 years post-fire. For example, if a 30-foot-tall tree was top-killed and is resprouting from its base, only consider it as surviving if the new shoot will reach a height of 15-60 feet within 2-3 years. Otherwise, consider the tree to be dead and the new shoot as a new individual. Burned plants may need to be examined for viable cambium or succulent buds near growth points. Dead stems will be brittle when bent; living ones will be supple. Do not include new colonizers or other plants newly germinating from seed. Make sure to take in the whole plot in the average score, including unburned areas.

- **Comments:**
  - Please use this area to write any observations about the plot or surrounding area that are not captured by other fields. Information about the spatial context of the plot is particularly helpful (Is it representative of surrounding areas? Is there a mosaic of varying burn severity levels in the area? Is there any

intensive management (salvage logging, chaining, etc.) nearby?). Pictures supporting observations are particularly helpful, and photo numbers can be noted here or in the "Other photos" box on the PD form.

Additional Burn Severity Measures

In addition to the Modified CBI, we have included a few other measures of burn severity. These measures are tied to other on-going projects at the Missoula Fire Sciences Lab related to burn severity (e.g., FLEAT). We include them here because they are quick to obtain once the Modified CBI form has been completed, and will make the plot data useful for other purposes beyond the FIRESEV project.

- **LS (LANDSUM) Burn Severity:** Assign an overall severity level (**NLS** = non-lethal surface, **MS** = mixed severity, **SR** = stand replacement), based on **overstory** mortality. Use the guidelines on the form for breaks between classes. Overstory is defined as the tallest lifeform (trees, shrubs, herbs) with at least 10% canopy cover pre-fire.
- **FH (FIREHARM) Burn Severity:** For each of the three elements of burn severity (overstory change/mortality, fuel consumption, soil heating) rate the overall degree of burn severity (**0** = unburned, **1** = low, **2** = moderate, **3** = high). Use the guidelines on the form for breaks between classes. After rating each of the three elements, record an overall rating in the top box (next to "FH Burn Severity").
- **Pre-fire and Post-fire vegetation type and structural stage:** Record your best estimates of the pre-fire and post-fire existing vegetation type (EVT), structural stage (SS), and PVT/ESP (potential vegetation type / environmental site potential). For EVT and PVG/ESP, use codes for LANDFIRE EVT and ESP units specific to the area being sampled. Post-fire ESP can be left blank, as this should always be the same as pre-fire ESP.

Table A-1. FIREMON classes for recording percentages (adapted from Keane 2006).

Code	Percent Range
0	0 %
0.5	>0 – 1 %
3	>1 – 5%
10	>5 – 15%
20	>15 – 25%
30	>25 – 35%
40	>35 – 45%
50	>45 – 55%
60	>55 – 65%
70	>65 – 75%
80	>75 – 85%
90	>85 – 95%
98	>95 – 100%

Literature Cited:

De Santis, A. and E. Chuvieco. 2009. GeoCBI: A modified version of the Composite Burn Index for the initial assessment of the short-term burn severity from remotely sensed data. Remote Sensing of the Environment 113: 554-562.

Hudak, A.T., P. Morgan, M.J. Bobbitt, A.M.S. Smith, S.A. Lewis, L.B. Lentile, P.R. Robichaud, J.T. Clark and R.A. McKinley. 2007. The relationship of multispectral satellite imagery to immediate fire effects. Fire Ecology. 3(1):64-90.

Keane, R.E. 2006. Plot description: sampling method. In D.C. Lutes, R.E. Keane, J.F. Caratti, C.H. Key, N.C .Benson, S. Sutherland, L.J. Gangi (Eds.). FIREMON: Fire Effects Monitoring and Inventory System. General Technical Report RMRS-GTR-164-CD. USDA Forest Service, Rocky Mountain Research Station, Fort Collins, CO. Available online: http://frames.nbii.gov/portal/server.pt?open=512&objID=286&&PageID=490&mode=2&in_hi_userid=2&cached=true [2009, November 5].

Keeley, J.E., T. Brennan, and A.H. Pfaff. 2008. Fire severity and ecosystem responses following crown fires in California shrublands. Ecological Applications 18:1530–1546.

Key C.H, Benson N.C. 2006. Landscape assessment: sampling and analysis methods. In D.C. Lutes, R.E. Keane, J.F. Caratti, C.H. Key, N.C .Benson, S. Sutherland, L.J. Gangi (Eds.). FIREMON: Fire Effects Monitoring and Inventory System. General Technical Report RMRS-GTR-164-CD. USDA Forest Service, Rocky Mountain Research Station, Fort Collins, CO. Available online: http://frames.nbii.gov/projects/firemon/FIREMON_LandscapeAssessment.pdf [2009, November 5].

Lentile, L.B., Smith, A.M.S., Hudak, A.T., Morgan, P., Bobbitt, M., Lewis, S.A. and Robichaud, P. 2009. Remote sensing for prediction of 1-year post-fire ecosystem condition, International Journal of Wildland Fire. *In press.*

Lentile, LB, P. Morgan, A.T. Hudak, MJ Bobbitt, SA Lewis, AMS Smith, and PR Robichaud. 2007. Burn severity and vegetation response following eight large wildfires across the western US. Fire Ecology. 3(1):91-108.

Appendix A: FIRESEV Field Forms

FIRESEV PD Form

Reg ID		Examiners		Field Date	
Project ID	FIRESEV	Fire Name		Fire Date	
Plot ID		Plot Radius	37.2 ft		

Plot Description

	Field	Description			Field	Description	
Geo. Position	17	UTM E plot center		Composition	48	Upper Dom Spp 1	
	16	UTM N plot center			49	Upper Dom Spp 2	
	18	UTM Zone			50	Mid Dom Spp 1	
	19	GPS Datum			51	Mid Dom Spp 2	
	20	GPS Error (m)			52	Lower Dom Spp 1	
Biophysical Setting	22	Elevation			53	Lower Dom Spp 2	
	23	Aspect			54	Potential Veg ID	
	24	Slope			55	Potential Lifeform	
	25	Landform		Ground Cover	56	Bare Soil Cover	
	26	Vert. Slope Shape			57	Gravel Ground Cover	
	27	Horiz. Slope shape			58	Rock Ground Cover	
Tree Cover	33	Total Tree Cover			59	Litter & Duff Cover	
	34	Seedling Tree Cover			60	Wood Ground Cover	
	35	Sapling Tree Cover			61	Moss & Lichen Cover	
	36	Pole Tree Cover			62	Charred Ground Cover	
	37	Medium Tree Cover			63	Ash Ground Cover	
	38	Large Tree Cover			64	Basal Veg. Cover	
	39	Very Lg. Tree Cover			65	Water Ground Cover	
Shrub Cover	40	Total Shrub Cover		Photos	North ground photo ID		
	41	Low Shrub Cover			North stand photo ID		
	42	Medium Shrub Cover			Other phots (ID and description):		
	43	Tall Shrub Cover					
Herb Cover	44	Graminoid Cover					
	45	Forb Cover					
	46	Fern Cover					
	47	Moss & Lichen Cover					

Site Comments:

FIRESEV Burn Severity Form

Reg ID		Examiners		Field Date	
Project ID	FIRESEV	Fire Name		Fire Date	
Plot ID		Plot Radius	37.2 ft	% Plot Area Burned	

CBI - Modified

A. SUBSTRATES	FCOV= /	
Duff		% consumed
Litter		% consumed
Fine fuel, <3" diameter		% consumed
Woody fuel ≥3" diameter		% consumed
Soil & rock cover/color		Δ % cover
Soil color, fractional cover (must sum to 100%)		
%green/brown		
% gray/black		
% red		

B. HERBS, LOW SHRUBS AND TREES < 3 FT (1 M)	FCOV= /	
% Foliage altered (blk-brn)		% altered
Frequency % living		% living
Spp comp - Rel abundance		*
Diam of smallest branch left		#
Species for smallest branch		

B1. HERBS	FCOV= /	
% Foliage altered (blk-brn)		% altered
Frequency % living		% living
Spp comp - Rel abundance		*

B2. LOW SHRUBS	FCOV= /	
% Foliage altered (blk-brn)		% altered
Frequency % living		% living
Spp comp - Rel abundance		*
Diam of smallest branch left		#
Species for smallest branch		

C. TALL SHRUBS AND TREES 3 TO 7 FT (1-2 M)	FCOV= /	
% Foliage altered (blk-brn)		% altered
Frequency % living		% living
% change in cover (+/-)		% pre-fire cov
Spp comp - Rel abundance		*
Diam of smallest branch left		#
Species for smallest branch		

D. SMALL TREES 7 TO 15 FT (2-5 M)	FCOV= /	
% Green (unaltered)		% rel. cover
% Black/Brown		% rel. cover
Frequency % living		% living
Diam of smallest branch left		#
Species for smallest branch		

E. INTERMEDIATE TREES 15-60 FT (5-20 M)	FCOV= /	
% Green (unaltered)		% rel cover
% Black/Brown		% rel.cover
Frequency % living		% living

F. TALL TREES > 60 FT (> 20 M)	FCOV= /	
% Green (unaltered)		% rel. cover
% Black/Brown		% rel. cover
Frequency % living		% living

COMMENTS:

* level of change: **U**= unchanged **L=** low **M=** moderate **H=** high
# categories: **0**: < 0.25 in **1**: 0.25 - 0.5 in **2**: 0.5 - 1 in **3**: none

LS Burn Severity		NLS = Non-lethal Surface (0-10% mortality)	MS = Mixed Severity (10-90% mortality)	SR = Stand Replacement (90% + mortality)

FH Burn Severity		0	1	2	3
Overstory change/mortality		unburned	<40%	40-70%	>70%
Fuel Consumption		unburned	<20%	20-50%	>50%
Soil Heating		unburned	low	moderate	high

	Pre-fire	**Post-fire**	**Code**
EVT			See EVT Key
SS			herb (HE), shrub (SH), seedling (SE), sapling (SA), pole (PO), mature (MA), very mature (VM), old growth (OG)
PVG / ESP			See PVG/ESP key

Appendix B: Excerpted information from FIREMON Plot Description Sampling Method (Keane 2006)

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 topographical 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 Registration Key, Project ID, Plot Number, and Date—is part of the PD form.

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. All fields in the PD method pertain to the entire macroplot and should be estimated and recorded so that they describe the macroplot as a whole.

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.

If there are data that you would like to collect but cannot due to broken equipment or other unforeseen circumstances, record each instance in the Comments field 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.

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 depending on various sampling criteria. GPS selection and training are not part of the FIREMON sampling methods. However, a number of resources provide advice on purchasing the right GPS for your sampling needs. 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 high degree of error. Average the plot location over at least 200 readings to reduce the location error.

Many map projections are available to record FIREMON plot georeferenced coordinates. Users can use either latitude-longitude (lat-long) or the UTM (Universal Transverse Mercator) coordinate system. If you are using UTM coordinates, 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). Be especially alert because units of degrees-min-seconds look similar to decimal degrees. If using lat-long coordinates, enter data in Fields 14, 15, 19, 20, and 21. If using UTM coordinates enter data in Fields 16 to 21

Field 13: Coordinate System—Record the coordinate system being used. Latitude and longitude (lat-long) or Universal Transverse Mercator (UTM).

Field 14: Latitude—If using the lat-long system, enter the latitude, in decimal degrees to six decimal places.

Field 15: Longitude—If using the lat-long system, enter the longitude, in decimal degrees to six decimal places.

Field 16: Northing—If using the UTM system, enter the UTM northing to the nearest whole meter.

Field 17: Easting—If using the UTM system, enter the UTM easting to the nearest whole meter.

Field 18: Zone—If using the UTM system, enter the UTM zone of the plot center.

Field 19: Datum—If using the UTM system, enter the datum used in conjunction with the UTM coordinates.

Field 20: Position 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 21: Error Units (E/M)—Enter the units associated with the GPS error. 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 22: Elevation (ft/m)—Enter the elevation above MSL (mean sea level) of the FIREMON plot in feet (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, estimating elevation from 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. Finally, elevation can be taken from USGS topographic maps.

Field 23: Plot 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 check your compass reading with your knowledge of the area to be sure that the aspect indicated is really correct. Often, metal on sampling equipment, or 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 24: 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 25: 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.

Field 26: Vertical Slope Shape—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).

Field 27: Horizontal Slope Shape—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. 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 class that best describes the horizontal contour of the land (fig. PD-1).

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

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

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

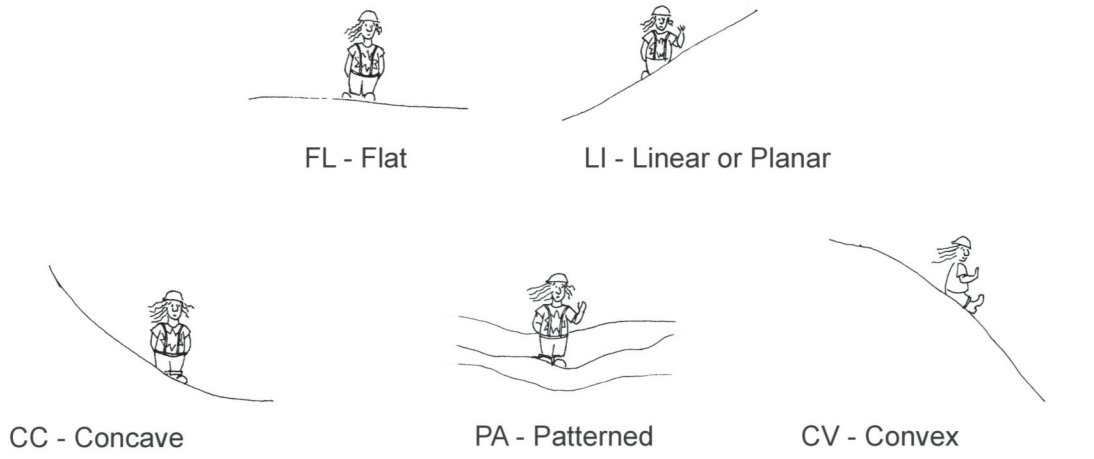

Figure PD-1—These illustrations depict the different types of vertical slope shapes. Horizontal slope shapes use the same classification but are determined by examining the across slope profile, rather than up and down the slope.

Vegetation Fields

These PD fields describe general aspects of the vegetation using percent canopy cover as the measurement unit. All vegetation fields require 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.

The seasonal timing of cover estimates can lead to substantially different cover estimations 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 in these PD fields is stratified by lifeform and size class. This makes determining canopy cover difficult because estimations require quite a bit of experience to arrive at consistent assessments of lifeform and size class cover when lifeforms and classes are unevenly distributed in all three dimensions. If you are unable to make an estimation for any reason, leave the field blank and note the reason in the comments section (Field 81). Always enter the code 0 (zero) when there is no cover for that ground element.

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

Vegetation—trees

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

Field 33: Total Tree Cover—Enter the percent canopy cover of all trees using the canopy cover codes presented in table PD-10. 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 34: Seedling Tree Cover—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 35: Sapling Tree Cover—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 36: Pole Tree Cover—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 37: Medium Tree Cover—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 38: Large Tree Cover—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 39: Very Large Tree Cover—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 size classes.

Field 40: Total Shrub Cover—Enter the percent canopy cover of all shrubs on the plot into using the FIREMON canopy cover in table PD-10. This cover estimate includes vertically projected cover of all shrub species of all heights.

Field 41: Low Shrub Cover—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 42: Medium Shrub Cover—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 using the codes in table PD-10.

Field 43: Tall Shrub Cover—Enter the percent canopy cover of all shrubs that are greater than 6.5 feet (2 m) tall on the plot 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 lifeforms, 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, making cover estimation difficult. Follow the suggestions in the **How To Estimate Cover** section of the **How-To Guide** chapter to get the correct cover estimates.

Field 44: Graminoid Cover—Enter the percent canopy cover of all graminoid species on the plot into using the codes in table PD-10. Graminoid cover includes all grasses, sedges, and rushes in all stages of phenology. This cover is for all sizes and species of graminoids.

Field 45: Forb Cover—Enter the percent canopy cover of all forbs on the plot using the FIREMON cover codes in table PD-10.

Field 46: Fern Cover—Enter the percent canopy cover of all ferns on the plot using the FIREMON cover codes in table PD-10.

Field 47: Moss and Lichen Cover—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 in satellite classification for mapping vegetation, developing existing vegetation community classifications, and for stratifying FIREMON fire effects results.

For a species to be dominant it has to have at least 10 percent canopy cover in that stratum, and the species must have higher cover than any other species in that 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.

There are three strata for stratifying dominant existing vegetation. The first stratum is called the Lower Stratum and is the cover of all plants less than 3 feet (1 m) tall. The Mid Stratum is for plants 3 to 10 feet (1 to 3 m) tall, while 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.

If there are no species above 10 percent cover in a stratum, enter the code N indicating that there are no species that qualify for dominance. The same applies if there is no secondary species for dominance.

Field 48: Upper Dominant Species 1—Enter the species code of the 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 49: Upper Dominant Species 2—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 50: Mid Dominant Species 1—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 51: Mid Dominant Species 2—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 52: Lower Dominant Species 1—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 53: Lower Dominant Species 2—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 lifeforms. 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 lifeforms to aid in the interpretation of FIREMON results.

Field 54: Potential Vegetation Type ID—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 own PVT code to stratify FIREMON results. This field is not standardized and any combination of alpha or numeric characters can be used. Do not use spaces in the text (enter ABLA/VASC). Be sure you document your codes in the FIREMON MD table. There are 16 characters available in this field.

Field 55: Potential Lifeform—Enter the potential lifeform code that best describes the community lifeform that would eventually inhabit the FIREMON plot in the absence of disturbance (table PD-11).

Ground Cover Fields

This next set of PD fields describes the fuels complex on the FIREMON plot. The first group of fuels fields characterizes ground cover by various characteristics important for evaluating fire effects. The

Table PD-11—Potential lifeform codes.

Code	Potential lifeform
AQ	Aquatic—Lake, pond, bog, river
NV	Nonvegetated—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 lifeform
X	Did not assess

standard FIREMON percent cover class codes (PD-10) are used to quantify ground cover. Ground cover is critical for describing fuel continuity and cover, but it is also used for evaluation of erosion potential and for classification of satellite imagery.

A group of generalized fuel attributes are used to describe biomass characteristics for the entire FIREMON plot. The first fields describe surface fuel characteristics through standardized fuel models, while the last fields describe crown fuel characteristics important for fire modeling.

Ground cover

Ground cover attempts to describe important attributes of the forest floor or soil surface. Ground cover is estimated into 10 categories, with each category important for calculating subsequent or potential fire effects. Ground cover is another difficult sampling element. Cover within a 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 where the sum *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 duff/litter) to make your estimate add to 100 percent. See **How to Estimate Cover** in the **How-To Guide** chapter for more information. If you are unable to make an estimation for any reason, leave the field blank and note the reason in the **Comments** section (Field 81). Always enter the code 0 (zero) when there is no cover for that ground element.

Field 56: Bare Soil Ground Cover—Estimate the percent ground cover of bare soil using the codes in table PD-10. 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 57: Gravel Ground Cover—Estimate the percent ground cover of gravel using the codes in table PD-10. Gravel is those mineral soil particles greater than 1/16 inch (2 mm) in diameter to 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 58: Rock Ground Cover—Estimate the percent ground cover of rock using the codes in table PD-10. Rock ground cover is considered to be all those mineral soil particles greater than 3 inches (8 cm) in diameter, including boulders. Rocks can be blackened by the fire.

Field 59: Litter and Duff Ground Cover—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, such as partially decomposed needles, bark, and leaves, deposited on the ground. Do not include any woody material into 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 and the cover of this charred litter/duff is estimated into the Charred Ground Cover field and not here. 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, throw it away, and do not include it in the ground cover estimate.

Field 60: Wood Ground Cover—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, into this field.

Field 61: Moss and Lichen Cover—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 43. The duplication is because some people consider moss and lichens ground cover and some consider it vegetation.

Field 62: Charred Ground Cover—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 63: Ash Ground Cover—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, while 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 64: Basal Vegetation Ground Cover—Estimate the percent ground cover of basal vegetation using the codes in table PD-10. 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. This category is extremely difficult to estimate, but fortunately, it has some repeatable characteristics. First, basal vegetation rarely exceeds 15 percent cover, so it will only get four valid FIREMON cover codes: 0, 0.5, 3, or 10. Next, it is highly ecosystem specific. Usually only forested ecosystems have high basal vegetation ground covers. This field is only used for vascular plant species. All nonvascular species are estimated in the Moss/Lichen Ground Cover field.

Field 65: Water Ground Cover—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 often only ephemeral, its cover must be recorded to make cover estimates sum to 100.

Common 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.

Document the FIREMON macroplot location using two photographs taken facing north and east. For the north-facing photo move about 10 feet (3 m) south of the FIREMON macroplot center, then take the photo facing north, being 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. For these pictures be 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.

Enter an identifier in Field 75 for the north-facing photo and Field 76 in the east-facing field. 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. For digital cameras, enter the file name of the digital picture. Film photos will need to be scanned once they are developed and stored on your computer in digital format. The file names in Fields 75 and 76 will be linked to the plot photos when you enter your data into the FIREMON database.

Field 75: North Digital Photo—Enter a code of up to 15 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 76: East Digital Photo—Enter code of up to 15 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 tactual digital photo when you enter data into the FIREMON database.

There are many methods for documenting the before and after plot conditions using a series of photos. Rather than describe these procedures in FIREMON, we recommend you use the methods of Hall (2002) for photo point documentation. Hall's guide 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/. We have provided fields for two photo points per FIREMON plot. We strongly recommend a comprehensive photo documentation of the plot conditions. These two additional photo fields will provide you with the opportunity to record important changes on the FIREMON plot.

Enter an identifier in Fields 77 and 78 for the first and second photo points, respectively. The file names in these fields will be linked to the plot photos when you enter your data into the FIREMON database.

Field 77: Photo Point 1—Enter a code of up to 15 characters that uniquely describes the first photo taken at a point in or near this FIREMON plot. This field in the PD database will be linked to the actual digital photo when you enter data into the FIREMON database.

Field 78: Photo Point 2—Enter a code of up to 15 characters that uniquely describes the first photo taken at a point in or near this FIREMON plot. This field in the PD database will be linked to the actual digital photo when you enter data into the FIREMON database.

Comments Fields

It is impossible for any standardized sampling methodology to estimate all ecosystem characteristics that are important to fire effects monitoring. There may be attributes that are locally important but of limited value in a nationwide fire effects sampling system such as FIREMON. A sampling method design that accounts for all ecological variables across North America would be so large and complex it would be difficult to use and apply. We have tried to reduce complexity in FIREMON, but as a result, we probably missed some variables that describe important ecological conditions for your region. The Comments Fields allow locally important observations to be included into standardized and nonstandardized fields.

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.

It is important that field samplers accurately describe ecological characteristics on the FIREMON plot so that these 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 disturbances (insects, disease).

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 important that observations of any factor that might affect the quality and integrity of the collected data be recorded. An often-recorded sampling condition is the weather—"cold, rainy, windy day," for instance—but many other factors can be entered, such as "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 81: 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.

FIREMON PD Cheat Sheet

Vertical and horizontal slope shape

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

Cover classes

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

Common landforms

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

Potential lifeform codes

Code	Potential lifeform
AQ	Aquatic—Lake, pond, bog, river
NV	Nonvegetated—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 lifeform
X	Did not assess

Plot description (PD) equipment list

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