

## Monitoring Immediate Post-burn Vegetation and Fuel Characteristics

### *Mothership Plot Protocol*

CFRI-1917

### Methods Overview

Fuel treatment effectiveness monitoring plots installed in prescribed burn units require an immediate postburn visit to collect observations of factors affecting substrate and vegetation burn severity, tree mortality, and fuels reduction. Immediate postburn monitoring should be conducted within 2-3 weeks, or up to 2 months, after fire has interacted with sampling plots.

Repeat measurements of plot photos, litter, duff, and fine woody fuel should be taken following pre-burn methods described in Colorado Forest Restoration Institute's *Field Data Collection Protocol for Evaluating Forest Restoration and Fire Mitigation Management Effectiveness*. This immediate postburn protocol includes methods used to repeat these measurements, however, be sure that sampling crews always have with them the full protocol that was used to measure plots pre-treatment.

The Fire Monitoring Handbook (FMH) (USDI 2003) provides rational and protocols the National Park Services uses to establish and monitor fire effects. Those data are organized and served using the national FEAT and FIREMON Integrated (FFI) database system. Postburn condition of overstory trees, saplings, substrate, and vegetation burn severity will be recorded using FMH protocols. Additional observations relating to soil burn severity will be made according to RMRS-GTR-243.

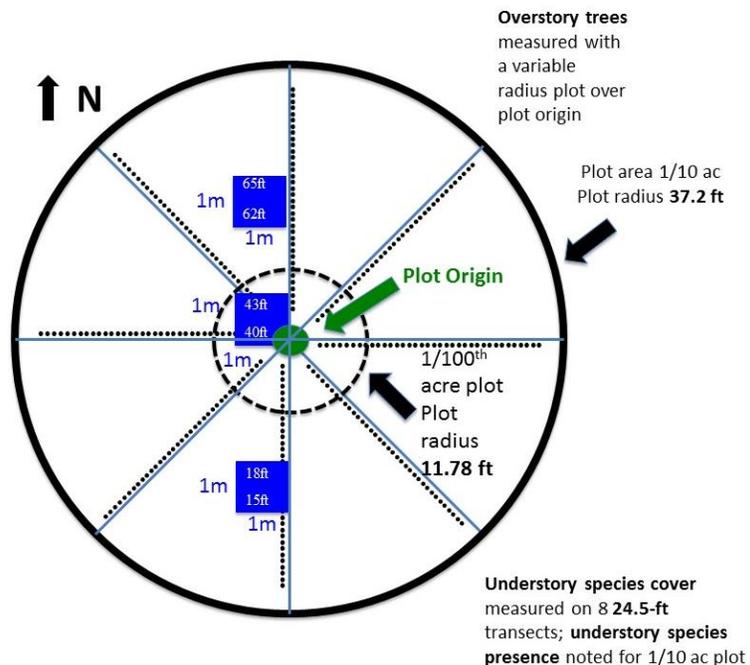


Figure 1: Colorado Forest Restoration Institute mothership plot layout.

## **Field Protocols**

### *Navigate to plot location*

Bring sampled plot map and plot information packets to assist with relocating plots. Always have the full pre-treatment data sheets available (paper or electronic copies) to assist in plot relocation, to verify sampling methods used, and any data collection errors or anomalies encountered. The minimum plot information should include plot coordinates, elevation, slope, aspect, transect azimuth, pre-treatment photos, and the tree and sapling list. A metal detector can assist in finding the steal monuments. Please be aware of plots with duff pins installed and use caution so as not to tread on them.

### *Plot Center*

Check that plot monuments remain in place and remain viable following fire. If necessary, replace damaged monuments. Ensure that each monument has a silver “CFRI Long-term Monitoring Plot” tag (be sure to mark monument location (North, East, or Center), the plot code, and sample date on the silver tag using a ballpoint pen).

Pink flagging should be wrapped around each washer. If flagging is missing in post-treatment years, re-flag washers.

1. Standing at the plot center, take 6 photos. Match the photos as best you can to the pre-treatment photo sequence and protocol. Fill out a white board with the plot code and date. Photos should be framed such that the white board is legible and minimizing visible people and sample equipment in the photo. Photos will be used to describe fuel conditions, plant growth, and to help locate plots post treatment.

### *Postburn Overstory Tree and Sapling Condition*

Overstory trees and saplings, as measured pre-treatment, should be tagged with sequentially numbered steel tags. Typically, overstory trees were measured in a variable radius plot using a prism basal area factor (BAF) of 10, and saplings within a 0.01-ac fixed radius plot, but be sure to repeat the pre-treatment methods and BAF. Snags or trees broken or fallen below breast height do not need to be re-tagged, but leave a note if a tagged tree fell down.

Refer to the tree lists from prior visits to verify all sampled pre-burn overstory trees are remeasured. Trees are intentionally measured and listed in clockwise order starting along the North transect. Trees within the plot not measured during the pre-treatment visit should be tagged and completely measured post-treatment (including DBH, height, and CBH if possible), with a note explaining the tree was only measured post. If a tree tag is missing, replace it with a new tag and record the new tag number for the given tree.

Nail numbered tag into tree at breast height, oriented facing plot center, so that the nail is angled downwards and at least one inch of nail remains exposed, leaving ample space for tree growth. For trees on a slope, determine breast height while standing on the upslope side of the tree.

Record the following postburn condition information for each tree and sapling:

1. Tag number

2. Maximum scorch height

Measure distance from ground level to the highest point in the crown where foliar death is evident (to the nearest ft) (Fig 2: Fig 35. USDI, 2003).

3. Percent crown volume scorched

Estimate the percent of the entire crown that is scorched (to the nearest 10%). This is estimated as the proportion of brown fire scorched needles in the total canopy, with brown and green needles summing to 100%. This should be collected no longer than 2 months after the burn to limit needles lost to cast.

4. Maximum stem char height

Measure from ground to the maximum point of char on bole (1-ft). Note, this is absolute highest point of char, not continuous point. Use an ocular estimate up to 10ft and employ a range finder when height is >10ft.

5. Bark beetle evidence

Record presence or absence (Y/N) of pitch tubes or frass on each bole. To standardize for heights of observers, observation area should remain within 6' of the ground.

Forest Floor Substrate

Record forest floor substrate present at each of 25 points per transect (Figure 1). Each transect should have exactly 25 substrate counts, i.e. 1 substrate for every point measured. Burn evidence is tallied when it occurs.

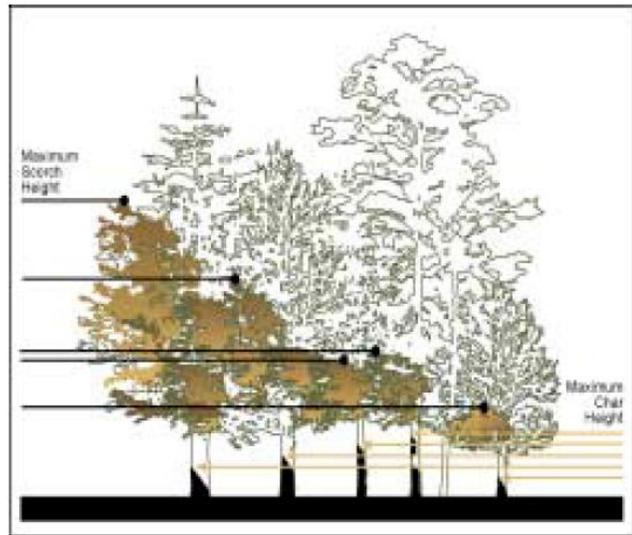


Figure 1: Max scorch and max char height. Fig 35, USDI, 2003

1. Burn Evidence: Record visible evidence of fire when it occurs at each point along the transect. This includes scorching, charring, or ash on the substrate, woody fuels, or vegetation. For tablet data entry, add species code "BURNED".
2. Substrate categories: litter/duff, soil/gravel (<0.5 in), rock (>0.5 inch), coarse fuels (1000hr, rotten or sound), moss/lichen, woody basal, and herbaceous vegetation basal.
  - a. If stumps or live tree trunks occur in the frame, record them as woody basal.
  - b. If large dead plant material suppresses growing space, record as herbaceous vegetation basal (rarely found in Colorado).

- c. When estimating ground cover, exclude live vegetation from estimates.

### Fine Fuels

1. Record fine woody fuels (wood in 1hr, 10hr, or 100hr size classes) when they are encountered at each point along the eight transects. Record fine fuels with species code “WOODY”. Note that larger 1000hr fuels are included as a substrate, but fine fuels are not.
2. In each of the three 1m<sup>2</sup> sampling frames located at 15-18ft, 40-43ft, and 62-65ft along the north-south transect (Figure 1), estimate fuel loading for 1hr, 10hr, and 100hr fuels in tons/acre using the photoload technique (Keane and Dickinson 2007).

### Duff Consumption

1. Duff Consumption

If duff pins have been installed across the East-West transect, measure the distance from the bottom of the nail head to the surface of the substrate and to mineral soil.

### Litter, Duff, and Ash Depths

1. At regularly spaced intervals along N, E, S, and W transects, measure ash, litter and duff depths to the nearest 0.25 in. Measurement are at 10 ft, 20 ft, and 30 ft in each direction from plot center (e.g. 10 ft, 20 ft, 30 ft, 50 ft, 60 ft, and 70 ft on each transect tape). **Do not include ash as litter or duff. Record ash depth with the soil burn severity measurements.**

### Soil and Vegetation Burn Severity

1. Record soil and vegetation burn severity observed at the 12 ash, litter, and duff depth locations along the N, E, S, and W transects. Place the southwest most corner of a 6 in x 6 in frame at each observation point. Record the following in each observation frame:
  - a. Observers initials
  - b. Substrate and vegetation burn severity  
Classify severity of each variable using the characteristics defined in Table 1 (FMH-21, USDI, 2003).
  - c. Ash depth  
Measure depth from top of ash to substrate to the nearest 0.25 in
  - d. Ash color  
Note the color of ash (i.e. black, grey, red, white)
  - e. Comments  
Notable burn severity or intensity effects

	Unburned (5)	Scorched (4)	Lightly Burned (3)	Moderately Burned (2)	Heavily Burned (1)	Not Applicable (0)
<b>Substrate (S)</b>	not burned	litter partially blackened; duff nearly unchanged; wood/leaf structures unchanged	litter charred to partially consumed; upper duff layer may be charred but the duff layer is not altered over the entire depth; surface appears black; woody debris is partially burned; logs are scorched or blackened but not charred; rotten wood is scorched to partially burned	litter mostly to entirely consumed, leaving coarse, light colored ash; duff deeply charred, but underlying mineral soil is not visibly altered; woody debris is mostly consumed; logs are deeply charred, burned-out stump holes are common	litter and duff completely consumed, leaving fine white ash; mineral soil visibly altered, often reddish; sound logs are deeply charred, and rotten logs are completely consumed. This code generally applies to less than 10% of natural or slash burned areas	inorganic preburn
<b>Vegetation (V)</b>	not burned	foliage scorched and attached to supporting twigs	foliage and smaller twigs partially to completely consumed; branches mostly intact	foliage, twigs, and small stems consumed; some branches still present	all plant parts consumed, leaving some or no major stems/trunks; any left are deeply charred	none present preburn

Table 1: Substrate and Vegetation Burn Severity Codes, FMH-21, USDI 2003

## References

- Keane, R.E., and L. Dickinson. 2007. The Photoload Sampling Technique: Estimating Surface Fuel Loadings From Downward Looking Photographs of Synthetic Fuelbeds. USFS General Technical Report RMRS-GTR-190, pages 15-17.  
[http://www.fs.fed.us/rm/pubs/rmrs\\_gtr190.pdf](http://www.fs.fed.us/rm/pubs/rmrs_gtr190.pdf)
- Parsons, A., P.R. Robichaud, S.A. Lewis, C. Napper, and J.T. Clark. 2010. Field Guide for Mapping Post-Fire Soil Burn Severity. Gen. Tech. Rep. RMRS-GTR-243. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station.
- USDI. 2003. Fire Monitoring Handbook. Fire Management Program Center, National Interagency Fire Center, Boise, ID.

## **Gear List**

### Plot Layout

- 4 — 100ft reel tape
- 1 — 1m<sup>2</sup> sampling frame
- 1— 6 in<sup>2</sup> sample frame
- 1 — Camera
- 9 — Chaining pins
- 1 — Compass
- 1 — GPS and Batteries
- Pink flagging
- 25 – Plot tags and washers

### Fine Fuels

- 2 — Go no go fuels gauge
- 2 — Litter/duff ruler
- Photoload template for 1hr, 10hr, and 100hr fuels

### Overstory Trees and Saplings

- 1 — 10 BAF basal area prism
- 1 — Clinometer
- 1 — Hammer
- 1 — Hypsometer
- 2 — Loggers tape
- 15 — Pin flags 2 color
- Numbered tree tags and aluminum nails

### Miscellaneous

- Batteries: AAA (4), AA (3), 9V (1)
- Data sheets
- Fire effects monitoring protocol
- Maps of site
- Pencils, Dry erase markers, Pens, Sharpies
- 1 — Walkie-talkie
- 1 — White board
- 1 — Yard stick