



Assessing Soil Burn Severity

Considerations for forest landowners

Burn Severity Classifications

Burn severity is used to describe the immediate and direct effect of wildfires on soils and vegetation. Soil burn severity, specifically, is useful for characterizing the degree to which soils were affected and for determining soil erosion potential. While fire effects on vegetation may give clues about how the soil was affected, characterizing soil burn severity requires additional observation and measurements beyond other metrics used to characterize fire effects on vegetation.

Biological, chemical, and physical changes occur at varying degrees when soils are heated. Soil burn severity is often assessed in the days and weeks following a fire through satellite imagery and field surveys to measure these changes and target post-fire rehabilitation. The following five elements reflecting the degree and duration of soil heating are measured in assessments of soil burn severity:

1. **Ground cover: amount and condition.** Surface litter and plants hold soils in place and reduce the distance that sediment is carried by surface water.
2. **Ash color and depth** indicates the intensity of soil heating and whether organic matter holding soils together has been consumed.
3. **Soil structure.** Soil heating and consumption of organic matter changes soil structure and the amount of moisture and nutrients soils can hold.
4. **Fine roots** hold soils together and the loss of roots increases erosion potential.
5. **Soil water repellency (hydrophobicity).** A water-repellent (hydrophobic) layer may form from intense heating, reducing the ability of soils to hold and absorb water, limiting infiltration and increasing runoff.

Assessing Post-fire Ground Cover



Low Soil Burn Severity

Needles mostly intact, some char, less than 50% consumption of litter



Moderate Soil Burn Severity

Up to 80% consumption of litter & duff, some recognizable needles remain



High Soil Burn Severity

All or most litter consumed, ash and bare soil remain

Figure 1: Evaluation and metrics of ground cover severity following wildfire. For more images depicting ash, soil structure, roots, soil water repellency, review [Parsons et al. 2010](#), pg. 12-17. [Credit: USFS]

Assessing Burn Severity on Your Property

Spatially, fire does not burn with consistent intensities and leaves behind a patchwork of differing burn severities. Remote sensing products are generally only available for large fires and are limited by the resolution available through the imagery. Assessing the soil burn severity on your property soon after a wildfire is important for targeting where you should focus your erosion control efforts. The water drop penetration test [Table 1] provides the information needed to assess soil burn severity on your property.

Table 1: The Water Drop Test

This is the simplest way to obtain a general measure of soil repellency in severely burned soils. Because the degree and spatial distribution of repellency can vary widely, it is important to conduct several drop tests at an individual site, across many different sites that are at high risk of increased runoff and erosion.

Repeat this test at a few different soil depths by scraping away some soil after each test is complete. This field assessment technique is not a perfect assessment of repellency, but it is generally adequate to estimate repellency and can be done by a nonscientist for low cost. Other techniques are more accurate and require specialized equipment and training. If you have serious concerns about your soil, you should consult with a registered professional forester or a soil scientist to conduct a more accurate assessment. (Source: Shive & Kocher 2017)

You will need: a dropper, water, a stopwatch, and a notebook

How to do it:

Find a place in your notebook to take notes on the results for each test for an area. Take the water dropper and drop one droplet onto the soil surface and start the timer. Watch the drop and record how many seconds it takes to penetrate the soil surface. Average your results for each site you visit and evaluate its repellency.

- Wettable or non-water repellent: less than 5 seconds
- Slightly repellent: 5 seconds to 1 minute)
- Strongly repellent: 1 minute to 10 minutes
- Severely repellent: 10 minutes to 1 hour
- Extremely repellent: greater than 1 hour

Utilizing Remote Sensing Resources

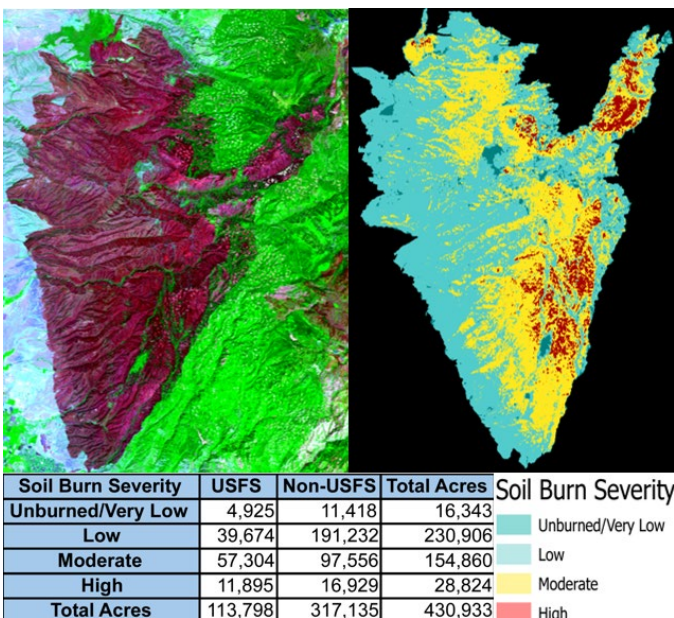


Figure 2: Example of BAER Soil Burn Severity map for the 2024 Park Fire [Credit: BAER] A false color composite photo (left) uses different spectral bands to highlight burned areas (red) and assess vegetation health (green). From there, specialists classify burn severity (right) from unburned to high severity. This visualization enables rapid assessment of fire damage, helping inform recovery strategies and restoration efforts. Information on amount of area burned by severity is provided.

component of the assessment process is the development of a soil burn severity map, which identifies changes in soil and ground surface properties that may impact infiltration, runoff, and erosion. Remote sensing and GIS technologies are essential for assessing fire effects and identifying areas of concern rapidly [Figure 2]. However, it's crucial that soil burn severity mapping includes field verification rather than relying solely on remote sensing. Resources such as BAER, as well as [MTBS](#), [RAVG](#), and [RECOVER](#), can be a gateway to evaluating your land and the overall postfire landscape.

Management Considerations

Determining soil burn severity helps inform future management considerations, such as erosion-control. A variety of methods of erosion control are outlined at UCANR Fire Network [website](#) and the [Post-Fire Erosion Control Factsheet](#).

Works Cited

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. 49 p. 243.

Post-fire soil burn assessments are typically conducted by Burned Area Emergency Response (BAER) teams after significant wildfires. These teams will recommend stabilization treatments for land, channels, roads, trails, and public safety. A critical