POST-FIRE SOIL WATER REPELLENCY: AN INDICATOR OF SOIL TEMPERATURE REACHED DURING BURNING?


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Knowledge of the soil temperature (T) reached during a wildfire is of crucial importance in evaluating post-fire soil physical properties, fertility and seedbed status, which in turn affect short and medium term erosion susceptibility of burnt slopes. With the exception of instrumented prescribed fires, soil temperatures are notoriously difficult to monitor/estimate and are often based on somewhat subjective post-fire observations with a large margin of error using indicative factors such as ash colour and degree of ground fuel consumption.

Through studies carried out mainly in the western USA, it has long been recognised that wildfires in some vegetation communities can induce or enhance water repellency if soils are heated to T < 250°C, or destroy repellency for soil T 300-400°C. Soils under fire-prone Australian eucalypt forests tend to be naturally water repellent if dry or moderately moist, also when long-unburnt. Based on these characteristics, this study aims to (i) quantify the destruction temperature for water repellency in three soils from locations in Victoria and New South Wales in Australia under typically fire-prone eucalypt species (Eucalyptus siberi, E. ovata and E. baxteri) and (ii) examine whether the presence or absence of water repellency after a wildfire can be utilised as a semi-quantitative post-hoc indicator of critical soil temperature.

Water repellency is shown to increase in all soils during heating, but is abruptly eliminated at 260 < T < 340°C. Destruction temperature varies somewhat between
samples, but is lowest for 40-minute heating (260-280°C) and highest for 5-minute heating (310-340°C). Results suggest that post-fire water repellency may be used as a convenient indicator of whether a relatively narrow soil temperature threshold has been exceeded within repellency-prone environments. A field evaluation protocol is suggested and discussed also in the light of potential shortcomings of the current USDA/NRCS protocol used in the USA to determine fire intensity and associated erosion risk.