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An experimental analysis of the mechanisms generating post-fire soil water repellency in a dry Eucalyptus forest in SE Australia

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Water repellency is a common occurrence in Australian forest soils and can affect water infiltration, surface runoff and soil erosion. Water repellency can be affected by fire, and researchers have identified two key mechanisms for this. Firstly, fire results in the volatilization of waxes and resins from the leaf litter on the forest floor, which can then condense on soil particles to potentially form a hydrophobic layer. Secondly, the removal of leaf litter by fire also results in higher evaporation rates and drier surface soils, also potentially altering soil water repellency. It is unclear which of these processes dominates in the generation and retention of post-fire water repellency under field conditions. This field study of post-fire water repellency was specifically designed to isolate these two post-fire water repellency generating processes, and determine the relative significance of each process to the total level of soil water repellency after a fire.

Forty experimental plots were established in a dry Eucalyptus forest in the highlands of Victoria Australia. Half the plots were established in unburnt areas, and half in an area subjected to a moderate to hot prescribed fire. Each 3m x 1m plot includes a control plot, a leaf- litter addition plot, and a plot with leaf litter completely removed. The experimental design specifically allows the water repellency effects of temperature and condensation of hydrophobic substances to be separated from the effect of litter removal and soil drying. A total of 1080 water repellence measurements were taken in spring 2009 (mid November) and summer 2010 (late March) using the molarity of ethanol droplet (MED) test. The measurements were taken at three depths 0cm, 2.5 cm and 5 cm. The MED measurements were converted to critical surface tension units for analysis. The results are currently being analysed.