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Wildfire-ash: Relationships between colour, water repellency and organic carbon content

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During a forest fire, a layer of vegetative ash is often deposited over soil surface. The amount of ash deposited as well as its physical and chemical properties are highly variable. These parameters are influenced particularly by vegetation type and fire severity, resulting in a differing ash colour. This ash remains over the soil until it is redistributed by water or wind erosion or incorporated into the soil profile. Throughout that time, the ash layer can affect the runoff, infiltration and erosion rates. However, up to now, its effects on soil hydrology are still controversial. In some studies ash is reported to be highly hydrophilic, aiding infiltration, in others, ash is argued to reduce infiltration by clogging soil pores. No studies to date have focussed on the potential water repellency of ash. The aim of this work was to assess the water repellency of different ash types and their possible relationship with the total organic carbon and colour.

Ash samples were collected from 5 different wildfires in the Mediterranean region (n=48). These samples were taken almost immediately after the fire and before any rain (except for one site). Water repellency (WDPT test), total organic carbon (TOC) and colour (Munsell colour chart) were measured in laboratory in all ash samples.

The results obtained show that 33% of the ash samples exhibited water repellent properties (WDPT > 5 s), with half of those having WDPTs > 300 s. Carbon content varied from 8 to 37%. There was no strong relationship between water repellency and TOC although all samples with more than 20% of TOC were water repellent. Colour was found not to be a good indicator of either the carbon content or the water repellency; however, there is a general tendency for darker ash to be more water repellent and to containing more organic carbon. These findings demonstrate that the previous held notion of ash being hydrophilic is not always correct. For certain vegetation types and combustion scenarios, particularly black ash may contribute to fire-induced or enhanced soil water repellency at the surface and perhaps also when incorporated into the soil.