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Can vegetative ash be water repellent?

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In most of the literature, ash is referred to as a highly wettable material (e.g. Cerdà and Doerr, 2008; Etiegni and Campbell, 1991; Woods and Balfour 2010). However, the contrary was suggested in few articles, albeit with no further quantification (Gabet and Sternberg, 2008; Khanna et al., 1996; Stark, 1977). To clarify this question, water repellency measurements on ash using the Water Drop Penetration Times (WDPT) method were performed on ash from Mediterranean ecosystems and it was found to be water repellent (Bodí et al. 2011). Water repellency on ash from different wildfires ranged from 40 to 10 % occurrence with samples being extreme repellent (lasting more than 3600 s to penetrate). Part of the ash produced in the laboratory was also water repellent. After that, other ash samples had been found water repellent in wildfires in Colorado (unpublished results), Portugal (Gonzalez-Pelayo, 2009), or in prescribed fires in Australia (Bodí et al. 2011b; Petter Nyman, personnal communication). All the samples exhibiting water repellent properties had in common that were combusted at low temperatures, yielding in general ash with dark colour and contents of organic carbon of more than 18 % (Bodí et al. 2011a), although these properties were not exactly proportional to its water repellency occurrence or persistence. In addition, the species studied in Bodí et al. (2011) had been found to produce different levels of WR repellency, being ash from Pinus halepensis more repellent than that from Quercus coccifera and Rosmarins officinalis. Ash from Eucaliptus radiata had been found also very water repellent, as Pinus halepensis (unpublished data). The reasons of the existance of water repellent ash are that the charred residue produced by fire (an also contained in the ash) can contain aromatic compounds that have a lower free energy than water and therefore behave as hydrophobic materials with reduced solubility (Almendros et al., 1992 and Knicker, 2007). Specifically, studies of FT-IR spectroscopy in the WR ash reported in Bodí et al (2011) have been done, resulting that the more persistent water repellency coincided with higher levels of aliphatic, aromatic and carboxylic groups (Pavel Dlapa et al., under revision). The existence of water repellent ash indicate that i) after low severity fires, ash can be responsible in some occasions of the soil water repellency and ii) ash water repellency can be one of the ash properties that controls the variable hydrological response of ash covering the soil.
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