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Wet-dry cycles effect on ash water repellency. A laboratory experiment.

Paulo Pereira (1), Artemi Cerdà (2), Marc Oliva (3), Jorge Mataix (4), and Antonio Jordán (5)

(1) Environmental Management Centre, Mykolas Romeris University, Vilnius, Lithuania (paulo@mruni.eu), (2) Departament de Geografia, Universitat de Valencia, Blasco Ibàñez, 28, 46010-Valencia, Spain, (3) Centro de Estudos Geográficos / IGOT, Universidade de Lisboa Edifício FLUL, Alameda da Universidade, 1600-214 - Lisboa, (4) Environmental Soil Science Group, Department of Agrochemistry and Environment, Miguel Hernández University, Avda. de la Universidad s/n, Elche, Alicante, Spain, (5) MED_Soil Research Group, University of Sevilla, C/Profesor García González, s/n. 41012, Sevilla, Spain

In the immediate period after the fire, the ash layer has a strong influence on soil hydrological processes, as runoff, infiltration and erosion. Ash is very dynamic in the space and time. Until the first rainfall periods, ash is (re)distributed by the wind. After it can cover the soil surface, infiltrate or transported to other areas by water transport (Pereira et al., 2013a, b). This will have strong implications on nutrient redistribution and vegetation recovery. Ash layer may affect soil water repellency in different ways, depending on fire severity, soil properties and vegetation. Ash produced at low temperatures after low-severity burning is usually hydrophobic (Bodi et al., 2011, 2012).
Wet-dry cycles have implications on ash physical and chemical properties, changing their effects in space and time. The aim of this study is to analyse the effects of fire temperature and severity on ash water repellency. Pinus sylvestris needles were collected in a Lithuania forest in Dzukija National Park (53º 54' N and 24º 22' E), transported to laboratory and washed with deionized water to remove soil particles and other residues. Needle samples were dried during 24 hours and exposed to different temperatures: 200, 300, 400 and 500 ºC, during 2 hours. Ash colour was analysed according to the Munsell Soil Color charts. Ash was black (10 YR 2/1) at 200 ºC, very dark grey (10YR 3/1) at 300 ºC, gray (10YR 5/1) at 400 ºC and light gray (10YR 7/1) at 500 ºC. Ten samples of ash released after each treatment were placed in plastic dishes (50 mm in diameter) in an amount enough to form a 5 mm thick layer, and ash water repellency was measured according to the Water Drop Penetration Test. Later, ash was carefully wetted with 15 ml of deionized water and placed in an oven during 4 days (96 hours), as in Bodí et al. (2012). This procedure was repeated 5 times in order to observe the effects of wet-dry cycles in ash water repellency. The results showed significant differences among wet-dry cycles (Chi Sqr = 184.13 $p < 0.001$) and among temperatures, immediately after treatments (Kruskal-Wallis test: H = 13.64, $p<0.01$) and after first wet-dry cycle (Kruskal-Wallis test: H =13.85 $p<0.01$). In the second (Kruskal-Wallis test: =5.80, $p > 0.05$), third (Kruskal-Wallis test: H =3.07, $p>0.05$), fourth (Kruskal-Wallis test: H=0.75, $p>0.05$) and fifth (Kruskal-Wallis test: H =0.199, $p<0.05$) wet-dry cycles, ash water repellency did not show significant differences. After wetting, ash water repellency decreased substantially in the first cycle. These results suggest that wet-dry cycles have important impacts in the reduction of ash water repellency. Nevertheless, this reduction at least in the first cycle is different according to the temperature/severity. Black ash (200 ºC) water repellency was significantly higher than the other temperatures/severities. Further research will be carried out using burned soils and different species.

References

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