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Short-term effects of prescribed fire for pasture management on soil water repellency in the Central Pyrenees (NE-Spain)

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The decrease of livestock grazing during the last decades in the Central Pyrenees has led to a regression of grasslands in favour of shrublands, mainly composed by Echinospartum horridum. Prescribed burning might be a suitable tool for the control of this species that limits pastures development and therefore, the reclamation of grasslands; although, its effects on soil properties are still uncertain [1].

Controlled burnings are usually performed in spring or autumn, when soil moisture is high and temperature low, being easier to control and also reducing its effects on soil properties. However, burning during the wet seasons can increase the risk of soil erosion as the vegetation cover is partially destroyed. In this sense, soil water repellency (SWR) plays an important role reducing the infiltration rates and, thus, increasing runoff and soil erosion [2]. Then, it is of special interest to study parameters that influence SWR such as soil moisture, soil organic carbon (SOC) content and soil biological activity [3].

The aim of this work is, to analyse the effects of controlled burning on SWR as well as some of the influencing factors on this parameter. To achieve this, soil sampling was carried out in two prescribed fire events that took place in the Central Pyrenees: Tella (April, 2015) and Buisán (November, 2015). Temperature was simultaneously recorded during the fire via thermocouples placed at the surface level and at 1 cm, 2 cm and 3 cm depth. In each event, topsoil was scrapped and sampled from 0-1 cm, 1-2 cm and 2-3 cm depth in each sampling point (3 for Tella and 4 for Buisán) just before and immediately after burning. We analysed SWR persistence (Water Drop Penetration Time, WDPT) and intensity (Ethanol Percentage Test, EPT) as well as total C and N, microbial C, β-glucosidase activity, soil moisture and pH.

Temperature measurements indicated a higher fire intensity in Tella than in Buisán burning. Surface unburned samples presented extreme SWR values for Tella (2726 s) and strong values for Buisán (191 s) according to the WDPT test, significantly decreasing with depth. Preliminary results showed that burning affected SWR, significantly reducing WDPT down to 3 cm in Tella (from extreme to strong) and 2 cm depth in Buisán (from strong to slight). EPT results indicated a significant decrease in SWR intensity down to 2 cm in Tella and 1 cm in Buisán with burning. On the other hand, no differences were observed regarding soil moisture between burned and unburned samples, although a trend to decreasing was observed with fire. Further analyses will allow us to explain and support in detail the variations observed in SWR with prescribed burning.

[1] Shakesby, R.A. et al. (2015). Impacts of prescribed fire on soil loss and soil quality: An assessment based on an experimentally-burned catchment in central Portugal. Catena 128: 278-293.
[2] Bodí, M.B. et al. (2013). Spatial and temporal variations of water repellency and probability of its occurrence in calcareous Mediterranean rangeland soils affected by fire. Catena 108: 14-25.
[3] Jordán, A. et al. (2013). Soil water repellency: Origin, assessment and geomorphological consequences. Catena 108: 1-5.