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Analysis of soil water repellency under different eco-geomorphological conditions in Mediterranean environments (South of Spain)

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Soil water repellency (SWR) is a soil property that reduces its water affinity. Although it has been frequently related to wildfires, different studies in recent decades have shown that repellent soils are not rare, and they are widely spread around the world under various climatic, soil and vegetation conditions, on burned and unburned soils. The research described here was carried out in two Mediterranean rangelands containing similar Mediterranean tree and shrub species but differing in soil conditions. The aim of the study was to evaluate the effects of vegetal species, pH, soil organic matter (SOM), soil water content (SWC) and prescribed fire over SWR.
In June 2011, two samples from the first 5 cm of soil, one up and one downslope from plants, were collected under the dominant species of the two study areas (Nerja –NE– and Almogía –AL–), in a north-facing hillslope . In NE the selected species were Pinus halepensis (Ph), Cistus clusii (Cc), Rosmarinus officinalis (Ro), Thymus vulgaris (Tv) and Stipa tenacissima (St). In addition samples were collected in bare soil (Bs, at least 1.5m far away from the nearest shrub), under burned shrubs (Bsc) and in burned bare soil (Bbs). A controlled fire was conducted in April 2011. In AL the selected species were Quercus suber (Qs), Cistus monspeliensis (Cm) and Cistus albidus (Ca).
The results indicate: i) SWR is a common phenomenon in Mediterranean environments, in acid as well as in alkaline soils, but with a great variability in every study area depending on the vegetal species (Ro and Qs) were those more repellent to water; ii) OM seems to be a more influential factor over soil water repellency than acidity, which only was found a controlling factor for alkaline soils; iii climate and vegetation type, influencing SOM leading to hydrophobic conditions, are more key factors controlling SWR than bedrock characteristics; iv) SWC threshold for water repellency to be disappeared were not clearly stated independently of burn or unburned soils and vegetation type specie; and v) prescribed fire of low intensity only affected to SWC in bare soil which becomes slightly water repellent.