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Water repellency and soil moisture variations under *Rosmarinus officinalis* in a burned soil

E. Gimeno-García (1), J.A. Pascual-Aguilar (1), and J. Llovet (2)

(1) Centro de Investigaciones sobre Desertificación-CIDE (CSIC, UVEG, GV), Camí de la Marjal, s/n, 46470, Valencia, Spain (eugenia.gimeno@uv.es/Fax:+34 961270967), (2) Fundación Centro de Estudios Ambientales del Mediterráneo (CEAM). Universittat d'Alacant. Departament d'Ecologia. Campus de Sant Vicent del Raspeig - Ap.99. 03080, Alacant, Spain(juan.llovet@ua.es / Fax:+34 965909825)

Mediterranean semi-arid landscapes are characterised by the patchiness of the vegetation cover, in which variations in the distribution pattern of soil water repellency (SWR) can be of major importance for their hydrological and geomorphological effects in burned areas, and also for their ecological implications concerning to the re-establishment of their plant cover. Within a broader research framework, the present work studies the influence of *Rosmarinus officinalis* vegetated patches on SWR in burned and unburned soils and its relationship with the field soil moisture content (SMC). The results presented here are the first step analysing the spatial pattern of sink and source runoff areas in a burned hillslope.

The study area is located in the municipality of Les Useres, 40 km from Castellón city (E Spain), where a wildfire occurred in August 2007. We selected a burned SSE facing hillslope, located at 570 m a.s.l., with 12° slope angle, in which it was possible to identify the presence of two unique shrub species: *Quercus coccifera* L. and *Rosmarinus officinalis* L., which were distributed in a patchy mosaic. Twenty microsites with burned *R. officinalis* and eight at the nearest unburned area were selected. At the burned microsites, it was possible to distinguish three concentric zones (I, II and III) around the stumps showing differences on their soil surface appearance, which indicate a gradient of fire severity. Those differences were considered for soil sampling (1 sample per zone at each microsite, n= 84, form the first 2 cm of the mineral A horizon) and field soil moisture measurements determined by means of the moisture meter HH2 with ThetaProbe sensor type ML2x (5 measurements per zone at each microsite, n= 420), which were taken one day after the first rainfall event after fire, when 11 mm were registered in the study area.

Results showed that the largest repellency persistence (measured by means of the Water Drop Penetration Time test, WDPT) was found close to the burned R. officinalis stumps, where all soil samples showed water repellency, with mean WDPT of 68 seconds. Generally, we observed a sharp hydrophobic/hydrophilic boundary between the zones I (stump) and II (intermediate). Soil samples from bare soil (zone III) were entirely wettable. At control microsites, SWR was present only in one of the unburned *R. officinalis* samples. On the basis that unburned microsites are representative of the pre-fire conditions at the burned ones, these results imply that fire caused a significant increase in SWR occurrence at the soil surface.

Field SMC showed statistically significant differences between the three zones. Both control and burned microsites showed the same trend, with an increasing gradient towards the outer zone. Furthermore, burned microsites showed larger differences in SMC between zone I and zone III (18% and 27%, respectively) than the unburned ones. It could be explained because at burned stumps, the largest persistence of water repellency and the highest SOM content might decrease the wettability of aggregates, slowing their rates of wetting, which might not occur at all during the rainstorms. In fact, there was obtained a significant and negative Pearson's correlation coefficients between SMC and WDPT, and between SMC and SOM at burned microsites. However, no correlation between field SMC and WDPT was found from control microsites. Moreover, at the burned microsites, the partial correlation analysis with SOM as control variable revealed that SMC and WDPT were influenced by the SOM. In addition, it is necessary to consider the existence of root channels with the development of preferential flow

pathways, which could enhance deeper water infiltration in the stump areas.

These results provide evidences of the importance of microsite soil surface properties on SMC variability on semiarid burned slopes. The existence of SWR and lowest SMC detected at burned stumps opposite to the highest SMC after rainfall and the absence of SWR in burned bare soil zones could be key factors for the differences in overland flow and erosional response of burned areas characterised by the patchiness of the vegetation cover.