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Water repellency in Mediterranean burned soils. A comparison between field and laboratory data

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Soil water repellency (WR) is one of the properties most affected by combustion during a forest fire. Measurements of water repellency can be made directly in field or in soil samples under laboratory conditions. In other hand, previous laboratory findings have demonstrated that soil properties can be a key factor controlling the development of WR by burning, terra rossa being a type of soil with a low susceptibility to develop WR. One of the objectives of this research was to confirm laboratory findings under field conditions.

In summer 2008 WR was assessed in five areas recently affected by fires in MT. Carmel (NW Israel) and Alicante (SE Spain). The main difference between areas was the type of soil. Two of the soils were classified as Typic Xerorthents, another two as Lithic Rhodoxeralfs (terra rossa) and the other as a Calicixerept. In each one of the study areas WR was tested beneath *Pinus halepensis* in both burned and unburned (control) adjacent sites. WR tests were conducted under field conditions in triplicate using the water drop penetration time (WDPT) test in the top of the A horizon. A total of 300 field measurements were done. Soil samples from the first 0-2.5cm depth were also taken from the same places where WR was assessed for laboratory measurements.

In general terms, without distinguishing between areas, fire increased the frequency of occurrence of WR in affected soils. However, the magnitude of this effect is quite different depending on the studied area. The study sites with terra rossa soils showed the lowest WR values. Most of samples were wettable (<5 s), and the few samples classified as water repellent were in the lowest values of persistence (ranging in the 10-60 s classes of WDPT). These results are in agreement with those from our previous laboratory experiments (Arcenegui et al., 2007; Mataix-Solera et al., 2008). Organic matter and clay content together with the mineralogy of the clay fraction seem to be responsible for the different soil behaviour.

Although there is a correlation between field and laboratory WR data (r=0.671**), the comparison between field and laboratory measurements of WR shows differences, with higher values for the field data and in general terms higher differences for control (unburned samples) compared to burned ones. Since the soil water content was very low when the field measurement of WR was made, similar to air dried samples in laboratory, this factor is not suspected to being responsible. The observed differences could be explained however because the measurements in field are made over soil surface, while in laboratory the measurements are made in disturbed samples taken from topsoil to some depth (in our case from 0-2.5 cm). Taking into account that soil WR is a property that can vary with depth probably diminishing in parallel to soil organic matter content, the results seems to be logical. Moreover the disturbance of sample and the sieving can also be reasons for the observed differences.

Keywords: Water repellency, fire, burning, WDPT, terra rossa, hydrophobicity.

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