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Extent and severity of water repellency in northwestern Spanish soils

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Occurrence of soil water repellency has been reported worldwide from different climatic conditions, soil types, and vegetation covers. The climatic features of NW Spain, with a high annual precipitation but warm, dry summers; the prevalence of soils with a coarse texture and a high organic matter content; the predominantly forest land use; and the high incidence of forest fires all favour the development of water repellency in its soils. Notwithstanding its widespread occurrence, water repellency has scarcely been studied in soils of the Spanish temperate-humid region.

The aim of this work was to examine the distribution and severity of water repellency in soils of different texture in the Spanish humid region as a function of land use and management. The study was conducted at 34 locations and included various geological materials in order to encompass as wide as possible a range of soil textures. At each location, samples of soil under different land uses (maize crop, grassland, *Pinus pinaster* forest and *Eucalyptus globulus* forest) were collected from the surface layer (0-5 cm); an overall 133 samples were examined. In addition, *P. pinaster* and *E. globulus* forest soil samples were collected at four different depths (0-5, 5-10, 10-20 and 20-40 cm) at 10 of the previous locations. Water repellency was determined by using the water drop penetration time (WDPT) test on field-moist samples (actual WDPT) collected during the summer in order to obtain the maximum repellency to be expected to occur, which was compared with the values for samples dried at 105 ºC (potential WDPT).

Based on the results, the prevailing vegetation and land use dictate the development and severity of surface water repellency in the studied soils. The *E. globulus* forest soil samples were found to be the most water repellent, followed by the *P. pinaster* forest

samples (73% and 64%, respectively, with actual WDPT $>$ 6h); on the other hand, 79% of the field-moist samples from soils under maize and 71% of those under grass were non-repellent. The influence of vegetation on water repellency was found to be related to the type and content of soil organic matter. Thus, the actual water repellency was positively correlated with the organic carbon content (r = 0.66, $p < 0.01$), and with the C/N ratio (r = 0.43, $p < 0.01$). Each type of vegetation resulted in significant differences in surface water repellency between soils on granite or quartz-rich schists (with sandy-loam-texture) and those on schists containing biotite, gabbros and amphibolites (with loam or silt-loam texture); repellency was higher in the samples with coarser textures. The severity of water repellency decreased with increasing soil depth, which is associated with the reduced amounts of organic carbon, the decrease being more marked in the finer textured soils than in the coarser ones and also in the pine forest soils than in the eucalyptus forest soils. The water repellency of most of the samples dried at 105 ºC was similar to that of the field-moist samples collected during the dry period (r = 0.89, $p < 0.01$).

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