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Ponding infiltration stages in a burned Mediterranean soil

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The repeated fire incidence in the Mediterranean area increases runoff rates on forested slopes. A key process in runoff generation is water infiltration rate and capacity. This process will help us to partially determine the interaction between soil-water regimes and runoff behaviour in different parts of the affected slope.

This study was carried out at the Experimental Station of "La Concordia" (Valencia, Spain). The station is located on a calcareous hillside oriented SSE of the slope and composed of nine erosion plots (4 x 20 m). The soil type is classified as Rendzic Leptosol and supports Mediterranean shrubland vegetation, which is disposed in a patchy mosaic pattern. In June 1995, a set of experimental fires with different intensity levels was carried out on six plots out of nine. Three plots were burnt with high intensity and the other three were burnt with moderate intensity, whereas the remaining plots were left unaltered to be used as control. In summer of 2003, experimental fires were conducted on the same plots aiming to make possible the study of the effects of repeated fire on water infiltration. These fires reached medium-low intensity.

The infiltration rate and capacity were measured, with a water pressure head of -2.0 cm, after 2, 5 and 20 minutes, by means of a ponding mini-disk infiltrometer (MDI). The infiltration rate was calculated according to Green and Ampts' model. Soil water infiltration was analysed to assess the effects of vegetation cover (under canopy, UC) and bare soil (BS), before and after the experimental fires of 2003. Soil properties like soil organic matter (SOM), pF curves, soil water content (SWC), water retention capacity (WRC) and percentage of rock fragments on the soil surface were calculated

for the different sites and fire treatments.

The low fire impact on UC and BS environment encouraged a decline in water infiltration. After fire, a decrease of water infiltration rate after 2 minutes on UC site was observed, from 43 to 25 mm h^{-1} (40%), a reduction from 30 to 21 mm h^{-1} (30%) after 5 minutes and from 20 to 15 mm h^{-1} (20%) after 20 minutes. On the other hand, on BS sites a slight fire effect by a lower decrease in water infiltration was observed, from 60 to 47 mm h^{-1} (21%), from 41 to 34 mm h^{-1} (17%) after 2, 5 minutes, respectively, and a slight increased from 22 to 23 mm h^{-1} (5%) at 20 minutes.

The differences in water infiltration rates at 2, 5 and 20 minutes, between burned plots UC and BS were statistically non significant before and after the fire, even though the differences between UC and BS infiltration rates after 2 minutes, were of **17 mm h^{-1}** before fire and **22 mm h^{-1}** after fire. Differences between UC and BS infiltration rates after 5 minutes confirmed an increase of **11 mm h^{-1}** before fire and **13 mm h^{-1}** after it. While, increases in soil wetness occurred when infiltration rates were measured after 20 minutes, where the differences were of **2 mm h^{-1}** before fire and **7 mm h^{-1}** after, showing a more homogeneous water infiltration when soil was moist. On the control soil, statistically significant differences between UC and BS infiltration rate after 2 and 5 minutes were obtained, but not in the infiltration rate measured at 20 minutes.

In this case, a repeated low fire impact on the soil surface could produce a decline in water infiltration, mainly under plant cover. On bare soil, the lack of burned vegetation, less SOM and higher rock fragment content, promotes a higher ponding water infiltration rate, before and after fire perturbation.