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# EXPERIMENTAL DESIGN TO MODEL INFILTRATION INTO AWATER REPELLENT SOIL USING A CRUST-TYPE INFILTRATION EQUATION

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The combustion of vegetation during forest fires can lead to the condensation of hydrophobic compounds on mineral matter near the soil surface. The resulting water repellent layer then inhibits water infiltration by altering soil hydraulic conductivity and the water content–soil matric suction relationship. This situation resembles that of a crust or seal capped soil, where a thin layer of reduced hydraulic conductivity overlays a more permeable soil. Although the physical processes leading to a surface seal or crusted layer are different from those of a water repellent layer, the infiltration modelling approach can theoretically be the same, as would be the case for all layered soils. The objective of this study was to test the use of a crust type infiltration equation ($IR=K_{wl}[(h_0-\psi+Z_{wl})/Z_{wl}]$; where IR=Infiltration rate (cm $h^{-1}$, $K_{wl}$=hydraulic conductivity of the water repellent layer (cm $h^{-1}$), $h_0$=depth of ponded water at surface (cm), $\psi$=sub-layer matric suction (-cm), $Z_{wl}$=thickness of the water repellent layer (cm)) for water repellent conditions. The study was carried out by applying simulated rainfall on a column of soil with the following dimensions: column diameter=13 cm, soil depth within the column=10 cm, and an underlying coarse sand layer for drainage=10 cm. Runoff from the surface of the column was collected in a beaker that was weighed continuously at 30 s intervals. Instantaneous infiltration was considered equal to the difference between the applied rainfall (about 40 mm $h^{-1}$) and runoff rates. The soil column was equipped with a tensiometer located near the centre of the column at a depth of 3 cm below the soil surface, and it measured soil matric suction at 30 s intervals. Before each simulation, a mass of oven dried pine needles was applied to the surface and burned in-situ. Different levels of water repellency were generated by varying the amount of pine needles burnt, and water drop penetration time (WDPT) measurements were carried out on all samples before rainfall application. Hence, a range of water repellent conditions was tested for which instantaneous infiltration and matric suction values were recorded. Water repellent layer depth was estimated using WDPT measurements at different depths on separate samples. These samples also served for aggregate stability samples. The infiltration model was then compared to measured values.

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