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Post-fire infiltration modeling – some soil physical considerations

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Wildfires can change watershed hydrologic processes and increase the risks for soil erosion, flooding and debris flow after a fire. While fire-induced changes to the soil have significant effects on infiltration and runoff, the physical mechanisms remain unclear. A growing body of research suggests these mechanisms include soil water repellency (SWR) and the alteration of soil structure. The objective of this study was to relate SWR, soil structure, soil moisture to infiltration using a process-based, soil physics approach to better model infiltration into fire-affected soil. The ultimate goal is to improve the prediction of post-fire runoff with process-based hydrology models. Our research shows the effects of SWR and soil structure on infiltration can be captured by the soil hydraulic parameters of sorptivity and hydraulic conductivity, respectively. SWR reduces sorptivity and controls the early stage of infiltration during a storm. Changes in soil structure affect hydraulic conductivity and later stages of infiltration. Additionally, results show SWR can have an effect on unsaturated hydraulic conductivity but does not significantly affect saturated hydraulic conductivity. The study also highlights the important role soil water content plays for post-fire infiltration since both sorptivity and unsaturated hydraulic conductivity are functions of soil water content.