Geophysical Research Abstracts
Vol. 17, EGU2015-14255-1, 2015
EGU General Assembly 2015

Can ash clog soil pores?

Cathelijne Stoof (1,2), Anouk Gevaert (2,3,4), Christine Baver (2), Bahareh Hassanpour (2), Veronica Morales (5), Wei Zhang (6), Deborah Martin (7), and Tammo Steenhuis (2)

(1) Wageningen University, Soil Geography and Landscape Group, Wageningen, the Netherlands, (2) Cornell University, Biological and Environmental Engineering, Ithaca NY, United States (cathelijne.stoof@wur.nl), (3) Hydrology and Quantitative Water Management Group, Wageningen University, The Netherlands, (4) Faculty of Earth and Life Sciences, Earth and Climate cluster, VU University, Amsterdam, The Netherlands, (5) Institute of Environmental Engineering, ETH Zürich, Zürich, Switzerland, (6) Department of Plant, Soil and Microbial Sciences, Michigan State University, East Lansing, MI, USA., (7) United States Geological Survey, Boulder, CO, USA.

Wildfire can greatly increase a landscape's vulnerability to flooding and erosion events, and ash is thought to play a large role in controlling runoff and erosion processes after wildfire. Although ash can store rainfall and thereby reduce runoff and erosion for a limited period after wildfires, it has also been hypothesized to clog soil pores and reduce infiltration. Several researchers have attributed the commonly observed increase in runoff and erosion after fire to the potential pore-clogging effect of ash. Evidence is however incomplete, as to date, research has solely focused on identifying the presence of ash in the soil, with the actual flow processes associated with the infiltration and pore-clogging of ash remaining a major unknown. In several laboratory experiments, we tested the hypothesis that ash causes pore clogging to the point that infiltration is hampered and ponding occurs. We first visualized and quantified pore-scale infiltration of water and ash in sand of a range of textures and at various infiltration rates, using a digital bright field microscope capturing both photo and video. While these visualization experiments confirm field and lab observation of ash washing into soil pores, we did not observe any clogging of pores, and have not been able to create conditions for which this does occur. Additional electrochemical analysis and measurement of saturated hydraulic conductivity indicate that pore clogging by ash is not plausible. Electrochemical analysis showed that ash and sand are both negatively charged, showing that attachment of ash to sand and any resulting clogging is unlikely. Ash also had quite high saturated conductivity, and systems where ash was mixed in or lying on top of sand had similarly high hydraulic conductivity. Based on these various experiments, we cannot confirm the hypothesis that pore clogging by ash contributes to the frequently observed increase in post-fire runoff, at least for the medium to coarse sands evaluated here. Infiltration reductions and increases in runoff in these systems are more likely caused by the hydrologic effects of the textural interface between ash and soil, or by other fire-induced changes such as vegetation removal, decrease in roughness, and changes in soil water repellency. This is important information for determining the desired focus of post-fire management activities.