

Abstract

A Rainfall Simulator Laboratory Approach to Determine the Impact of Ash Depth on Runoff Generation and Soil Losses [†]

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[†] Presented at TERRAenVISION 2019, Barcelona, 2–7 September 2019.

Published: 21 May 2020

Abstract: Ash cover the forest fire affected soil for some weeks or months and act as a key factor to determine the soil and water losses. Ash depth is researched here to determine how affect the soil detachment and the runoff generation. Seventy rainfall simulation experiments on paired 0.50 m² plots (five plots with 0, 1, 2, 3, 5, 10, 15- and 30-mm ash depth), and repeated one week later) under thunderstorms of 48 mmh⁻¹ for one hour were carried out under laboratory conditions. In the first experiment, after the bed of ash was applied, the results show that ash depth determines the runoff rates as they reduce the discharge from 23.1% to 13.9%. The sediment concentration increased from 23.8 till 38.3 g L⁻¹, and the total soil erosion from 22.9 till 27.6 Mg ha⁻¹ y⁻¹. In the second experiment after the bed of ash was applied, the results show that runoff discharge was higher and moved from 43.2% till 55.33%. The sediment concentration increased from 13.8 till 18.9 g L⁻¹ and the total soil erosion slightly increased from 33.9 till 47.6 Mg ha⁻¹ y⁻¹. This research confirms that the fresh ash beds contribute to reduce the runoff losses and as deeper is the ash bed lower is the runoff discharge. However, the ash bed also acts as a source of sediments and as deep is the ash bed the runoff sediment concentration is higher. The soil erosion increased with the depth of the ash bed. After the simulated thunderstorms, the soils shown a reduction in their capacity to hold water due to the crust formation and runoff was enhanced. Sediment concentration is reduced due to the ash compaction and the final soil erosion rates increased as a consequence of the larger runoff discharge. This research demonstrates the highly dynamic response of the ash after the fire due to the wetting and drying processes after the thunderstorms.

Keywords: fire; soil; ash; runoff; erosion; sediment

Acknowledgments: The research leading to these results has received funding from the European Union Seventh Framework Programme (FP7/2007-2013) under grant agreement No. 603498 (RE CARE project), POSTFIRE Project (CGL2013-47862-C2-1 and 2-R) and POSTFIRE_CARE Project (CGL2016-75178-C2-2-R) sponsored by the Spanish Ministry of Economy and Competitiveness and AEI/FEDER, UE. This abstract was written as a result of the collaboration that was initiated due to the COST ActionES1306: Connecting European

Connectivity research and the COST EU action COST Action “Fire in the Earth System: Science & Society” (FIRElinks) CA18135.



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