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Modeling soil erosion in burnt areas

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Wildfires can cause significant changes to hydrological and soil erosion processes, through the destruction of vegetation cover and changes to soil properties. Modeling soil erosion in burnt areas is still a challenge, since most erosion models are built for agricultural fields and usually present a poor performance when applied to burnt areas. An important fact behind the poor performance is that important processes, such as the onset and destruction of soil water repellence or the transport of litter and ash, are not well represented in most models.

Project EROSFIRE aims to develop a soil erosion model to be applied in burnt hillslopes. For this purpose, the project collected data on six burnt hillslopes in central Portugal. Measurements included weekly runoff and sediment collection and bi-weekly transects detailing vegetation cover, ash cover and soil water repellence on different points along the hillslope. At the same time, rainfall simulation experiments were conducted near the test hillslopes to assess runoff generation under high intensity rainfall conditions. Finally, erosion features were mapped in a larger area offering a qualitative map of soil erosion.

This communication will present the data collected in this project, and the insights used for model development. The Morgan-Morgan-Finney erosion model was applied without modifications to the slope-scale datasets and other similar data collected on previous projects; while annual model results had a reasonable agreement with measurements, model performance for seasonal results were poor. A modification on the model to take into account seasonal changes in soil water repellence yielded significantly better results. When applied to other slopes in the region, the modified model results did not agree well with observations, especially since it does not take into account the impacts of post-fire management practices – especially terracing, when not properly implemented – on increasing the conditions for runoff concentration and sediment loss. Finally, the communication will revise the insights gained from this modeling exercise and suggest improvements to the modified MMF model to better represent soil erosion processes in burnt hillslopes.