Geophysical Research Abstracts
Vol. 21, EGU2019-3076, 2019
EGU General Assembly 2019

How thresholds of rainfall intensity determine the impact of post-fire erosion at catchment level in North-central Portugal

Steven van der Wilk (1), Jantiene Baartman (1), and Joao Pedro Nunes (2)

(1) Soil Physics and Land Management group, Wageningen University, Wageningen, the Netherlands, (2) CE3C Centre for Ecology, Evolution and Environmental Changes, Lisbon University, Lisbon, Portugal

Wildfires are a frequent and natural phenomenon in the European Mediterranean region. However, due to the increased frequency and size of wildfires in the past decades, they are nowadays considered to be the main factor to cause land cover changes in the north-central region of Portugal. Wildfires impact the hydrological and sedimentological responses of a catchment as well as ecosystem services. Understanding the effects of wildfires and subsequent land cover changes on runoff and erosion, is essential to decide optimal management practices and the allocation of land uses. This study uses a physically and process-based rainfall-runoff model (LISEM) to assess the impact of a wildfire followed by three different land management scenarios (mulching, ploughing, non-ploughing) in the Macieira de Alcôba catchment in North-central Portugal. A total of seven natural rainfall-runoff events were modelled and the model performed better for discharge (average NSE = 0.67, R^2= 0.75 for calibration and NSE = 0.72, R^2= 0.80 for validation events) than for sediment yield (average NSE = 0.27, R^2= 0.48 for calibration and NSE = -2.5, R^2= 0.55 for validation). The modelled scenarios showed that peak rainfall intensity was the main attributor to discharge and sediment yield changes measured locally and at the outlet of the catchment. Although increased erosion and discharge values were measured for all events in the burnt area, only the rainfall event with the highest peak intensity of 96 mm/h showed an impact at catchment level (i.e. increased discharge and sediment yield at the outlet). This rainfall intensity threshold was further assessed using 12 design rainfall events with a return period of 0.2, 0.5, 1, 1.5, 2, 2.5, 5, 10, 20, 50, 100, 500 and 1000 years with peak rainfall intensity ranging from 58.8 to 306.9 mm/h. These events support the peak intensity threshold and suggest that for small events (return period $<\sim$0.5 years) the impact of the burnt area is relatively small at the catchment level because eroded sediment is deposited within the catchment and does not reach the outlet. Medium events (return period between $\sim$1 and $\sim$10 years) show a significant impact at the catchment level as eroded sediment from the burnt area reaches the outlet while erosion in the rest of the catchment is relatively small. Finally, heavy storms (greater than 20 years return period) cause significant erosion in the entire catchment, weakening the relative impact of the burnt area. Thus, local post-fire management is most effective to reduce erosion caused by events with a 1 and 10 return period. These dynamics can be further explored by spatially analyzing specific erosion and sediment values within various land cover zones in the catchment. These insights can help forest managers to decide where to focus their soil and water conservation efforts effectively.