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First application of the WEPP model to predict runoff and erosion risk in fire-affected volcanic areas in Europe

Jonay Neris (1), Peter R. Robichaud (2), William J. Elliot (2), Stefan H. Doerr (1), Jesús S. Notario del Pino (3), and Marcos Lado (4)

(1) Geography Department, Swansea University, Swansea, United Kingdom, (2) US Department of Agriculture, Forest Service, Rocky Mountain Research Station, Moscow ID, USA, (3) Departamento de Biología Animal y Edafología y Geología, Universidad de La Laguna, La Laguna, Spain, (4) Departamento de Ciencias de la Navegación y de la Tierra, Universidade da Coruña, A Coruña, Spain

Abstract
An estimated that 15% of the world's population lives in volcanic areas. Recent catastrophic erosion events following wildfires in volcanic terrain have highlighted the geomorphological instability of this soil type under disturbed conditions and steep slopes. Predicting the hydrological and erosional response of this soils in the post-fire period is the first step to design and develop adequate actions to minimize risks in the post-fire period. In this work we apply, for the first time, the Water Erosion Prediction Project model for predicting erosion and runoff events in fire-affected volcanic soils in Europe. Two areas affected by wildfires in 2015 were selected in Tenerife (Spain) representative of different fire behaviour (downhill surface fire with long residence time vs uphill crown fire with short residence time), severity (moderate soil burn severity vs light soil burn severity) and climatic conditions (average annual precipitation of 750 and 210 mm respectively). The actual erosion processes were monitored in the field using silt fences. Rainfall and rill simulations were conducted to determine hydrologic, interrill and rill erosion parameters. The soils were sampled and key properties used as model input, evaluated. During the first 18 months after the fire 7 storms produced runoff and erosion in the selected areas. Sediment delivery reached 5.4 and 2.5 Mg ha-1 respectively in the first rainfall event monitored after the fire, figures comparable to those reported for fire-affected areas of the western USA with similar climatic conditions but lower than those showed by wetter environments. The validation of the WEPP model using field data showed reasonable estimates of hillslope sediment delivery in the post-fire period and, therefore, it is suggested that this model can support land managers in volcanic areas in Europe in predicting post-fire hydrological and erosional risks and designing suitable mitigation treatments.