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Factors affecting runoff and soil detachment in micro-plots under different climatic conditions (South of Spain)

Jose Damian Ruiz Sinoga, Juan Francisco Martinez Murillo, and Miguel Angel Gabarron Galeote
University of Malaga, Geography, Physical Geography, Malaga, Spain (sinoga@uma.es)

In Mediterranean hillslopes, different controlling factors have been described for runoff generation and soil detachment at patch scale. Some of them are biotic: e.g., plants, soil organic matter content, microorganism activity. And others are abiotic: e.g., micro-topography, slope gradient, crusts, rock fragment cover and disposition, and soil moisture. The climate used to be the principle factor that defines either the predominance of the biotics or abiotics. The aim of the study is to assess the controlling factor variability of runoff and soil detachment at patch scale. The objectives were next: to measure the runoff generation and the soil detachment in micro-plots under different climatic Mediterranean conditions, and to analyze how their controlling factors varied according to that climate variation.
Three experimental sites were selected in South of Spain. Topography, geology and land use were similar (mountainous topography, metamorphic rocks and Mediterranean scrubland affected by grazing), though Mediterranean climatic conditions different: Gaucín site (GA), humid regime (1000 mm y-1); Almogía site (AL), dry regime (510 mm y-1); and Gérgal site (GE), semiarid regime (240 mm y-1). A set of closed micro-plots (1.3 m2) were installed in these sites following the next criterions: slope exposure, position in the hillslope (top and bottom) and location of the plants within the micro-plots. In GA and AL, 8 micro-plots were installed in north and southfacing exposure; in every exposure, four of them at the top of the hillslope and 4 at the bottom; and in every hillslope position, 2 micro-plots with plants in the upper part and other 2 in the outlet of the micro-plot. In GE, the same procedure was followed but only micro-plots were installed in southfacing exposure. The micro-plots were equipped with a collector for runoff and sediments. A meteorological station was installed in every field site. The sampling period was prolonged from February 2008 to December 2009.
Despite of being the driest site, GE registered more runoff and soil detachment due to the low soil infiltration capacity. Oppositely, the runoff and soil detachment was lesser in AL. The analyses indicated that rainfalls (volume and intensity), plant distance to collector and rock fragment cover were the most influential factors in the runoff generation and soil detachment at the three field sites. Likewise, in the case of GA and AL, the exposure also influenced the hydrological response of the micro-plots being less active those located in northfacing. In general, no significant relations were found related to slope gradient and vegetal cover. In GA, the key factors were the presence of moss, the area of crusting and the plant distance to the collector. In AL, the rock fragment disposition in the top of the soil surface and the litter implicated a decreasing in runoff and soil detachment. And in GE, the distance of the plant to the collector was the only one factor found significant, though a negative trend were observed in runoff and soil detachment when rock fragment cover on top increased. In summary, taken into account the results, the position of the plant within the micro-plot greatly determines the runoff and soil detachment at a detail scale and under different climatic conditions. According to this, we can point two issues out: the methodological implication that implies to set a sufficient number of replicas functioning during a representative period of time, and the importance of the patchy vegetation pattern on the hydrological and erosive functioning of scrubland Mediterranean environments.