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The role of vegetation patches and antecedent soil moisture conditions in runoff and erosion connectivity in a 4-times burnt pine stand.

Taco Regensburg (1), Oscar González-Pelayo (2), Martinho Martins (2), Mohammedreza Hosseini (1), Saskia Keesstra (1), and Jan Jacob Keizer (2)

(1) Wageningen University, Soil Physics and Land Management, Wageningen, The Netherlands (taco.regensburg@wur.nl), (2) CESAM, University of Aveiro, Environment & Planning Department, Aveiro, Portugal

As part of the EU-FP7 project CASCADE, which addresses tipping-points in land degradation of Mediterranean ecosystems, the degradation drivers of repeated wildfires and post-fire drought spell are being studied in maritime pine stands in north-central Portugal. Preliminary results indicated that overland flow and sediment losses were markedly higher at 4–times burnt sites than at one-time burnt sites and, at the same time, that they were markedly higher at recently burnt than long-unburnt sites. These results, however, concerned micro-plots where post-fire recovery was mainly due to seeders and, as a consequence, rather reduced during the study period of the first two years following the wildfire ("inter-patches"). In the framework of COST Action ES1306 (Connecting European Connectivity Research), the present follow-up study aimed at assessing how the overland flow and erosion generated at such inter-patches would be "handled" by downslope vegetation patches and, in particular, patches where the main shrub species in the study area, Pterospartum tridentatum, had re-sprouted. More specifically, this study wanted to assess: (i) how the sink function of these vegetation patches was influenced by potential flow length or the length of the upslope inter-patch; and (ii) how it varied through time and, in particular, with antecedent soil moisture content. The study site is a south-west facing slope in an area that had burnt, with moderate severity, in early September 2012 and three more times before that since 1975 (as of when burnt area maps are available). By the time of the 2012-fire, it was covered by a sparse maritime pine stand that was roughly 7-years old. During October 2014, the study site was instrumented with a total of 12 bounded runoff plots, equally divided over the three slope sections (upper, middle and lower). At each slope section, four types of plots were laid out using square plots of 50 cm x 50 cm as basic building blocks. They were: (i) single inter-patch (50 cm x 50 cm); (ii) double inter-patch (50 cm x 100 cm); (iii) vegetation patch plus single upslope inter-patch (50 cm x 100 cm); (iv) vegetation patch plus double upslope inter-patch (50 cm x 150 cm). This experimental design was envisaged to address the following hypotheses: (i) runoff and erosion connectivity increase with increasing length of up-slope inter-patches; (ii) vegetation patches act as effective sinks of run-on and transported sediments from upslope inter-patches; (iii) the sink function of the vegetation patches is related to the influence of the shrubs on antecedent soil moisture conditions. The latter hypothesis is tested by means of replicate but unbounded plots next to the above-mentioned 150 cm-long bounded, being instrumented with EC-5 soil moisture sensors to automatically record topsoil moisture contents in a vegetation patch and upslope inter-patches. The very first results are pointing towards a confirmation of the first two of the above-mentioned hypotheses.