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Environmental factors controlling post-fire sediment yield at the catchment scale in a Mediterranean fire-prone area

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Fire disturbance can produce changes in water and sediment fluxes that can cause dramatic impacts in terms of human life and property, ecological, and economical losses. Most field and modelling works have focused on factors affecting water erosion processes at the hillslope scale. However, the identification and weighting of the key factors controlling wildfire impact on soil erosion and sedimentation at the catchment and landscape scales is crucial to assess and predict vulnerability to wildfires, to develop management programs, and to proritize areas for remediation in case of fire. The main objective of this work was to determine the relative role of a wide range of environmental variables as factors influencing site vulnerability to wildfires. Based on the field assessment of post-fire sediments accumulated in check dams, we analyzed the effects of land use and physiographic factors on the post-fire sedimentological response at the catchment scale ($2.1 – 38.8$ km^2) in Eastern Spain, a Mediterranean fire-prone area. Eleven catchments were considered within the study area. Each catchment was defined as the total drainage basin flowing into a given check dam. In the last 20 years, three major wildfires occurred in the area, in July 1985, August 1990 and July 1994, wich cumulatively burned 10140 ha, almost 83 % of the whole area. Climate is dry-Mediterranean. Mean annual precipitation is 550 mm. Prior to the wildfires the area was covered by a Mediterranean common mosaic of pine forests, shrublands, cultivated fields, and abandoned fields. Abandoned and cultivated fields were located on narrow terraces. For each catchment, we estimated the total volume of stored sed-

iments by measuring sediment depth along cross sections in the dam sedimentation area. The analized post-fire sedimentation periods ranged between 3.5 and 12 years. The environmental control of wildfire impacts on sediment yield at watershed scale was analyzed using Partial Least Square (PLS) regression on 15 environmental variables describing land use, watershed morphometry and size, watershed topography, drainage system, and area burned. The most important environmental predictors of sediment yield were the percent of the watershed area on abandoned terraces and the percent of watershed area on marls. Topographic and shape factors also showed high influence on the PLS model. Watershed area, proportion of forest and shrubland, area burned, and hydrological parameters as drainage density and concentration time did not show any relevant influence on sediment yield. The implementation of suitable management and post-fire remediation strategies requires spatially explicit evaluation of site vulnerability to post-fire soil erosion and sedimentation. Our results provide information for mapping quantitatively and identifying vulnerable areas, using an approach that accounts for topography, geology, and land use at landscape scale. The results highlight the importance of land use type as key environmental variable. Specifically, the relative amount of abandoned terraces appeared as the most important control factor for sediment yield in the studied landscape. This fact points out the dynamic nature of the environmental control of post-fire sedimentation and the sensitivity of this type of Mediterranean landscape to land use change.