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Scale relationships in the hydrological and erosional response to fire in a Mediterranean terraced landscape

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Abandoned agricultural terraces are a widespread component of European Mediterranean landscapes. Terraces can be considered as hydrological cells that greatly control the distribution of water and soils at the slope and catchment scales. However, after decades of abandonment, these systems tend to collapse, loosing the hydrological control provided by the terraces. In addition, forest fire risk increases after land abandonment as fields are usually colonised by fire prone plant communities. Therefore, soil degradation processes in these landscapes can be enhanced by the combined effect of terrace collapsing and fire. In this work, we asked about the post-fire hydrological and erosional behaviour of Mediterranean terraced landscapes, and about the role played by the two major functional units involved, i.e. terrace and catchment. The study area is located on the south-facing slopes of the Xortà mountain range draining to the Guadalest reservoir (Alacant province, E Spain). Climate is dry Mediterranean, with mean annual precipitation of 658 mm and mean annual temperature of 15.6 ºC. Lithology corresponds to miocenic marls with some levels of limestones, being *Calcaric Cambisol* the dominant soil type. Slopes are structured in agricultural terraces of different abandonment ages. The oldest abandoned terraces are nowadays covered by *Pinus halepensis* forest that spontaneously colonised the abandoned fields. The area was affected by a wildfire in August 1998. We studied runoff and sediment production over the first seven post-fire years at plot and catchment scales. We installed a gauge station at the outlet of a terraced catchment (2.1 ha). The catchment was mostly covered by pine forest and was completely affected by the fire. We also installed three closed erosion plots (about 80 m^2 in size) in the burned pine forest area. Every plot included the whole terrace structure (cropped strip and wall). Rainfall data was obtained from the Guadalest reservoir weather station, which recorded 5 min rainfall accumulations. Rainfall amount and intensity thresholds for runoff production were smaller at

the plot scale and, as a consequence, runoff and sediment events were more frequent at the plot than at the catchment scale. At the plot scale, we registered 56 productive rainfall events, while the burned catchment only produced 31 and 25 runoff and sediment events, respectively. Both scales showed good relationships between runoff and sediment productions and the rainfall AI_{30} index (the product of total rainfall amount and maximum 30-min intensity). Runoff amount decreased with the increase in scale, resulting in higher total runoff production at the plot scale (150 mm) than at the catchment scale (35 mm). On the contrary, total sediment production was lower in the erosion plots (2.8 Mg ha^{-1}) than in the catchment (4.6 Mg ha^{-1}). We attributed the increase in sediment yield with the increase in scale to the higher potential for runoff concentration and erosivity, and for rill erosion at the catchment scale. However, potential for runoff infiltration at the catchment scale is higher than at the plot scale and would explain the lower runoff rates observed in the catchment as compared to the plot data.