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Combining Landsat TM multispectral satellite imagery and different modelling approaches for mapping post-fire erosion changes in a Mediterranean site

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South European countries are naturally vulnerable to wildfires. Their natural resources such as soil, vegetation and water may be severely affected by wildfires, causing an imminent environmental deterioration due to the complex interdependence among biophysical components. Soil surface water erosion is a natural process essential for soil formation that is affected by such interdependences. Accelerated erosion due to wildfires, constitutes a major restrictive factor for ecosystem sustainability.
In 2007, South European countries were severely affected by wildfires, with more than 500,000 hectares of land burnt in that year alone, well above the average of the last 30 years. The present work examines the changes in spatial variability of soil erosion rates as a result of a wildfire event that took place in Greece in 2007, one of the most devastating years in terms of wildfire hazards. Regional estimates of soil erosion rates before and after the fire outbreak were derived from the Revised Universal Soil Loss Equation (RUSLE, Renard et al. 1991) and the Pan-European Soil Erosion Risk Assessment model (PESERA, Kirkby, 1999; Kirkby et al., 2000). Inputs for both models included climatic, land-use, soil type, topography and land use management data. Where appropriate, both models were also fed with input data derived from the analysis of LANDSAT TM satellite imagery available in our study area, acquired before and shortly after the fire suppression.
Our study was compiled and performed in a GIS environment. In overall, the loss of vegetation from the fire outbreak caused a substantial increase of soil erosion rates in the affected area, particularly towards the steep slopes. Both tested models were compared to each other and noticeable differences were observed in the soil erosion predictions before and after the fire event. These are attributed to the different parameterization requirements of the 2 models. This quantification of sediment supply through the river network provides also important insights regarding both the present-day sedimentation processes in the study area as well as the potential flooding hazard. Our work underpins that valuable contribution of remote sensing technology, combined with modeling approaches for depicting the spatial distribution of changes in erosion rates after the wildfire.

KEYWORDS: erosion risk, RUSLE, PESERA, wildland fires, LANDSAT TM, remote sensing, Geographical Information Systems, Greece.