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An analysis of wildfire frequency and burned area relationships with human pressure and climate gradients in the context of fire regime

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Understanding fire regime is a crucial step towards achieving a better knowledge of the wildfire phenomenon. This study proposes a method for the analysis of fire regime based on multidimensional scatterplots (MDS). MDS are a visual approach that allows direct comparison among several variables and fire regime features so that we are able to unravel spatial patterns and relationships within the region of analysis. Our analysis is conducted in Spain, one of the most fire-affected areas within the Mediterranean region. Specifically, the Spanish territory has been split into three regions – Northwest, Hinterland and Mediterranean – considered as representative fire regime zones according to MAGRAMA (Spanish Ministry of Agriculture, Environment and Food). The main goal is to identify key relationships between fire frequency and burnt area, two of the most common fire regime features, with socioeconomic activity and climate. In this way we will be able to better characterize fire activity within each fire region.

Fire data along the period 1974-2010 was retrieved from the General Statistics Forest Fires database (EGIF). Specifically, fire frequency and burnt area size was examined for each region and fire season (summer and winter). Socioeconomic activity was defined in terms of human pressure on wildlands, i.e. the presence and intensity of anthropogenic activity near wildland or forest areas. Human pressure was built from GIS spatial information about land use (wildland-agriculture and wildland-urban interface) and demographic potential. Climate variables (average maximum temperature and annual precipitation) were extracted from MOTEDAS (Monthly Temperature Dataset of Spain) and MOPREDAS (Monthly Precipitation Dataset of Spain) datasets and later reclassified into ten categories. All these data were resampled to fit the 10x10 Km grid used as spatial reference for fire data.

Climate and socioeconomic variables were then explored by means of MDS to find the extent to which fire frequency and burnt areas are controlled by either environmental, human, or both factors. Results reveal a noticeable link between fire frequency and human activity, especially in the Northwest area during winter. On the other hand, in the Hinterland and Mediterranean regions, human and climate factors ‘work’ together in terms of their relationship with fire activity, being the concurrence of high human pressure and favourable climate conditions the main driver. In turn, burned area shows a similar behaviour except in the Hinterland region, were fire-affected area depends mostly on climate factors. Overall, we can conclude that the visual analysis of multidimensional scatterplots has proved to be a powerful tool that facilitates characterization and investigation of fire regimes.