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Contribution of human, climate and biophysical drivers to the spatial distribution of wildfires in a French Mediterranean area: where do wildfires start and spread?

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Understanding the contribution of biophysical and human drivers to the spatial distribution of fires at regional scale has many ecological and economical implications in a context of on-going global changes. However these fire drivers often interact in complex ways, such that disentangling and assessing the relative contribution of human vs. biophysical factors remains a major challenge. Indeed, the identification of biophysical conditions that promote fires are confused by the inherent stochasticity in fire occurrences and fire spread on the one hand and, by the influence of human factors –through both fire ignition and suppression - on the other. Moreover, different factors may drive fire ignition and fire spread, in such a way that the areas with the highest density of ignitions may not coincide with those where large fires occur.
In the present study, we investigated the drivers of fires ignition and spread in a Mediterranean area of southern France. We used a 17 years fire database (the PROMETHEE database from 1989-2006) combined with a set of 8 explanatory variables describing the spatial pattern in ignitions, vegetation and fire weather. We first isolated the weather conditions affecting the fire occurrence and their spread using a statistical model of the weather/fuel water status for each fire event.. The results of these statistical models were used to map the fire weather in terms of average number of days with suitable conditions for burning. Then, we used Boosted regression trees (BRT) models to assess the relative importance of the different variables on the distribution of wildfire with different sizes and to assess the relationship between each variables and fire occurrence and spread probabilities.
We found that human activities explained up to 50 % of the spatial distribution of fire ignitions (SDI). The distribution of large fire was chiefly explained by fuel characteristics (about 40%). Surprisingly, the weather indices explained only 20 % of the SDI and its contribution does no vary according to the size of considered fire events. These results suggest that changes in fuel characteristics and human settlements/ activities, rather than weather conditions are the most likely to modify the future distribution of fires in this Mediterranean area. These conclusions provide useful information on the scenarios that could arise from the interaction of changes in climate and land cover for the Mediterranean area in the near future.