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Linking spatio-temporal data to the Fire Weather Index to estimate the probability of wildfire in the Mediterranean

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The Canadian Fire Weather Index (FWI), which is widely used in many local and international fire danger systems as an indicator of the likelihood of wildfire, accounts for the influence of weather conditions on wildfire occurrence. However, wildfire occurrence in the Mediterranean region is strongly influenced by human intervention (through accident and arson), supported by favoring weather conditions. It seems therefore appropriate to combine the influence of the weather, as represented through the FWI, with parameters representing human presence as well as topographic characteristics, in order to improve the accuracy of predictions on fire occurrence for an effective wildfire warning system.

In a previous study, we investigated the expressiveness of the FWI for predicting wildfire occurrence in the Mediterranean using Poisson regression and Bayesian networks. That study was based on data from the Mediterranean island of Rhodes. The spatial reference of the models was the municipality level, at which data was available. It was found that the FWI can serve as an indicator, but with the investigated model and the available data, the expressiveness of the FWI was found to be limited. Therefore, in the present study we use a model with increased spatial resolution combined with additional anthropogenic factors, as well as additional data, to investigate whether an improved prediction can be achieved. To facilitate the higher resolution and automated analysis of a larger amount of spatial data, a geodatabase is linked to a Bayesian network.

The analysis is based on a 1km by 1km raster. Weather data for each cell are obtained by spatial interpolation, and the FWI is computed daily for each cell. A Bayesian network model is then learned, which enables predicting the rate of wildfires for any cell based on the FWI as well as parameters describing the population and road density, land use and elevation. Fire and weather data from the island of Cyprus in the years 2006-2009 are used for learning the models. Data from 2010 are used to validate the model.