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Identifying the controls of wildfire activity in Namibia using multivariate statistics

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Despite large areas of Namibia being unaffected by fires due to aridity, substantial burning in the northern and north-eastern parts of the country is observed every year. Within the fire-affected regions, a strong spatial and inter-annual variability characterizes the dry-season fire situation. In order to understand these patterns, it appears critical to identify the causative factors behind fire occurrence and to examine their interactions in detail. Furthermore, most studies dealing with causative factor examination focus either on the local or the regional scale. However, these scales seem to be inappropriate from a management perspective, as fire-related strategic action plans are most often set up nationwide.

Here, we will present an examination of the fire regimes of Namibia based on a dataset conducted by Le Roux (2011). A decade-spanning fire record (1994-2003) derived from NOAA's Advanced Very High Resolution Radiometer (AVHRR) imagery was used to generate four fire regime metrics (Burned Area, Fire Season Length, Month of Peak Fire Season, and Fire Return Period) and quantitative information on vegetation and phenology derived from Normalized Difference Vegetation Index (NDVI) time series. Further variables contained by this dataset are related to climate, biodiversity, and human activities.

Le Roux (2011) analyzed the correlations between the fire metrics mentioned above and the predictor variables. We hypothesize that linear correlations (as estimated by correlation coefficients) simplify the interactions between response and predictor variables. For instance, moderate population densities could induce the highest number of fires, whereas the complete absence of humans lacks one major source of ignition. Around highly populated areas, in contrary, fuels are usually reduced and space is more fragmented – thus, the initiation and spread of a potential fire could as well be inhibited.

From a total of over 40 explanatory variables, we will initially use data mining techniques to select a conceivable set of variables by their explanatory value and to remove redundancy. We will then apply two multivariate statistical methods suitable to a large variety of data types and frequently used for (non-linear) causative factor identification: Non-metric Multidimensional Scaling (NMDS) and Regression Trees. The assumed value of these analyses is i) to determine the most important predictor variables of fire activity in Namibia, ii) to decipher their complex interactions in driving fire variability in Namibia, and iii) to compare the performance of two state-of-the-art statistical methods.

References:

Le Roux, J. (2011): The effect of land use practices on the spatial and temporal characteristics of savanna fires in Namibia. Doctoral thesis at the University of Erlangen-Nuremberg/Germany – 155 pages.