MSc thesis themes on Wildfires

Wildfires that spread under favourable conditions can become large and intense, and lead to severe consequences. Mediterranean countries have suitable fuel and climate conditions for the occurrence of large wildfires. The recent years of 2017 in Portugal and 2018 in Greece were unprecedented with very large extents of burnt area and large number of casualties. Contributing for a better understanding of wildfires is crucial to mitigate their negative impacts in the future years. Under this scope, we propose two different working themes focused on the study of large wildfires in mainland Portugal:

Theme 1: Where do wildfires stop?

Information on where wildfires stop spreading is important for the definition of both prevention and suppression strategies. For example, in a context of an on-going active wildfire, this information can be used to identify potential areas of efficient fire suppression in the next hours after ignition.

The work will consist in crossing the Portuguese fire atlas database, available since 1975, with other relevant variables, such as: time since last fire, fuel break network, land use, riparian vegetation areas, industrial forest stands, etc. The objective is to define the probability of a wildfire being suppressed when it reaches a given feature in the landscape. A thorough analysis will be made for a small set of case studies.

Theme 2: Defining priority fire occurrences using machine learning techniques

Large wildfires are typically concentrated in a small set of days that experience extreme climate conditions. In these days, it is common to observe multiple wildfires igniting in a very short period of time. Therefore it is extremely important to define which wildfires are priority and have a large potential of becoming large. This information can contribute for the definition of safer and more efficient suppression strategies.

The work will consist in developing a model using machine learning techniques (e.g. decision trees) to predict if a given ignition is likely to develop into a large wildfire (e.g. larger than 1000ha in the next 12 or 24h). Relevant information on the variables related with the spread of wildfires will be collected (e.g. wind speed, fire danger indices, fuels, etc). A machine learning model will be applied to the data to determine the probability of occurrence of a large wildfire based on the information collected at the time of the ignition. If possible, information regarding allocated fire suppression resources will also be used in the analysis.

Both works will have an important component of GIS work, and also some programming, therefore skills on these two areas will be valued. The work will be coordinated by Akli Benali & Ana Sá.