Assessment of wildfires occurrence and performance of Canadian fire weather index in Central Portugal

Introduction

Wildfires represent the most important natural hazard in the Euro-Mediterranean (EU-MED) region, where a largest area of forested and shrubland (4,500 km^2) burn every year causing considerable economic and environmental damages and loss of life. Portugal has the highest ignition density and relative burnt area of all EU-MED countries. Between 2006 and 2017, Portugal has the highest average area burned annually of EU-MED (126,593 ha), being ahead of countries like Spain (99,323 ha) and Italy (86,452 ha) with much larger territorial areas.

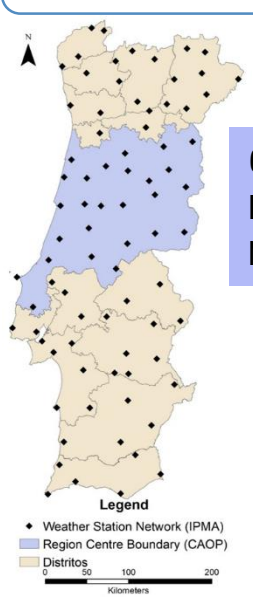
Meteorological variables alone or combined with vegetation and topographic data are frequently used to develop fire risk indexes. The Canadian Fire Weather Index System (FWI) is one of the most widely used in different parts of the globe. FWI is the official index for the operational fire danger forecasts used by the European Forest Fire Information System (EFFIS).

The aim of this study is to design an approach for establish a plausible relationship between FWI and the monthly average burned area (ABA) and average number of ignitions (ANI), supported by Geographic Information Systems (GIS).

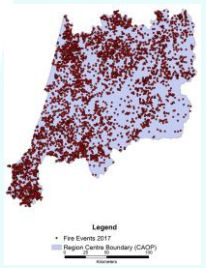
Study area and data

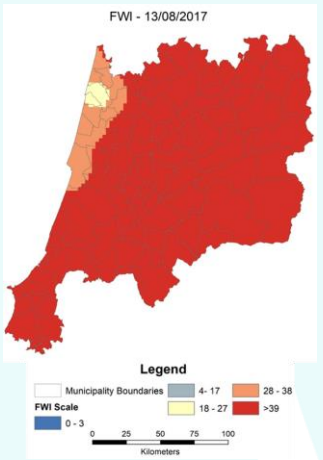
IPMA – Portuguese Institute for Sea and Atmosphere

SGIF – Nacional forest fire information system



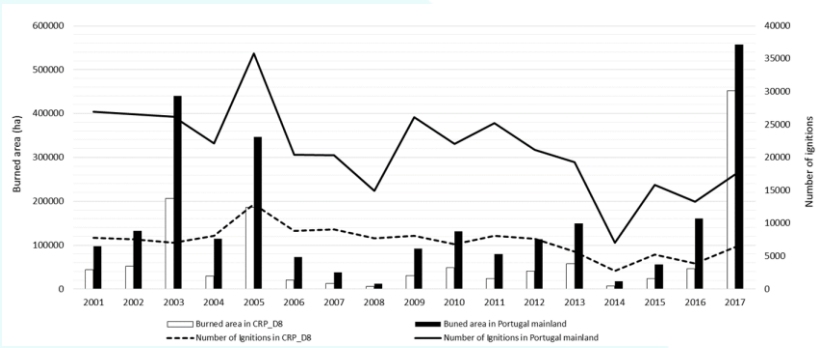
Central Portugal NUT II





FWI was calculated based on meteorological variables for the 12 UTC obtained in weather stations.

The spatial data of burned areas (vector format) and ignition database (date, duration, location).



Centre of Portugal encompasses eight districts, and it represents about 50% of the burned area in Portugal's mainland (2001-2017).

Data processing

Data base records retrieval

SGIF – Nacional forest fire information system

IPMA – Portuguese Institute for Sea and Atmosphere

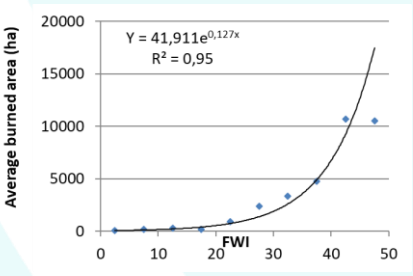
→ Data period 2001 to 2017

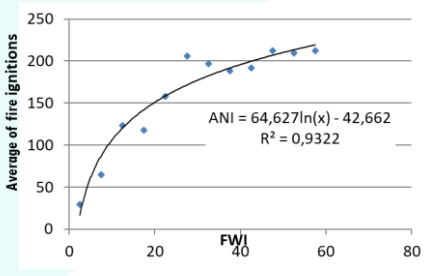
→ SGIF data selection and treatment

→ IDW Interpolation of FWI data

→ Predictive modeling

Results





- Exponential relationship between the variables (burned area and FWI), i.e. linear increases in the value of FWI translate into exponential increases in burned area value.
- The number of ignitions initially increases with the FWI value and then the ignitions number stabilize for FWI values greater than 32.5 (Very high and extreme values).

Final remarks

- FWI spatial distribution explains the majority of the variance of burned area and number of number of fire occurrences and the predicted equations have high R-squared.
- The equations were predicted for the critical period (June to October) and monthly for this period.
- This approach is important to develop and improve wildfires prevention policies and provides baseline information for predicting the burned area and number of fires occurrences under future climate scenarios.

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