**RESEARCH PURPOSE AND OBJECTIVES**

"Climate and weather are key drivers for wildfires, with droughts and heat waves increasing wildfire risk." (Doerr 2013)

The goal of this research at the Pan-European scale is to:

- Test the link between wildfire extent and meteorological drought
- Determine the relative effect of drought indices
- Identify regional differences in wildfire occurrence across Europe.

These objectives are addressed by modeling monthly wildfire burned area using all possible combinations of meteorological drought indices at the subnational level while controlling for seasonal fire patterns.

**DATA**

The European Forest Fire Information System (EFFIS) has compiled monthly wildfire extent statistics at the national and subnational scale (NUTS 1:2.3) for 22 countries within Europe as part of the European Fire Database. This data forms the basis for the wildfire analysis.

**MONTHLY EUROPEAN WILDFIRE MODEL**

- All analysis is based on monthly wildfire extent derived by calculating percent burned based on forested area from the CORINE land use database:
  \[
  \text{Area Burned} \% = \frac{\text{Area Burned} \text{[ha]}}{\text{Forested Area} \text{[ha]}} \times 100
  \]

- This accounts for inflammable area (water and urban).

- Because this measure of fire is a proportion of total flammable area, wildfire extent is modeled using logistic regression (logit function):
  \[
  \text{logit} \left( \frac{\text{Area Burned} \%}{1 - \text{Area Burned} \%} \right) = \beta_0 + \beta_1 \text{SPI} + \beta_2 \text{SPEI} + \epsilon
  \]

where logit is the logit transform, (logit(x)) is a spline curve that approximates the seasonal pattern of wildfire, SPI or SPEI value for the n month accumulation period, and ε is a linear regression coefficient.

- Separate models were fit for each NUTS2 region and the best model was determined using a 5 year cross-validation based on the R2SE and AIC.

- Variables considered include:
  - Biomass burning (Burned Biomass Index)
  - Climate (SPI, SPEI)
  - Land use (Forest, Arable, Urban, Wetlands, Water)
  - Biogeographic Regions

- The model includes area burned as the dependent variable and includes the following predictor variables:
  - SPI (Precipitation Index divided by potential evapotranspiration)
  - SPEI (Semi-Arid Evapotranspiration Index)

**SEASONAL WILDFIRE PATTERNS**

The seasonal (monthly) component of wildfires is relatively consistent across regions defined by latitude:

- 40°N-
  - The Mediterranean region tends to have a single, pronounced peak in wildfire activity between July and August
  - 40°-50°N:
    - Central Europe is characterized by two distinct peaks in fire activity, in early spring (March) and again in late summer (August)
    - 50°N-
      - Northernmost regions of Europe tend to have a much flatter curve with little change in the likelihood between April and August

There is relatively little difference in seasonal wildfire pattern longitudinally (west to east).

**GOODNESS OF FIT**

- The model for Portugal has the following summary statistics:
  - Adjusted coefficient 0.35
  - R2SE = 0.63
  - Only predictors 1 and 3 included

**CONCLUSIONS**

- Seasonal wildfires, independent of drought, follow consistent patterns across Europe.
- There is relatively little difference in seasonal wildfire pattern longitudinally (west to east).

**REFERENCES / ACKNOWLEDGEMENTS**


