

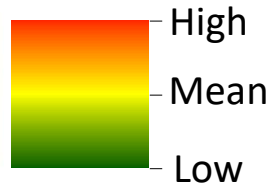
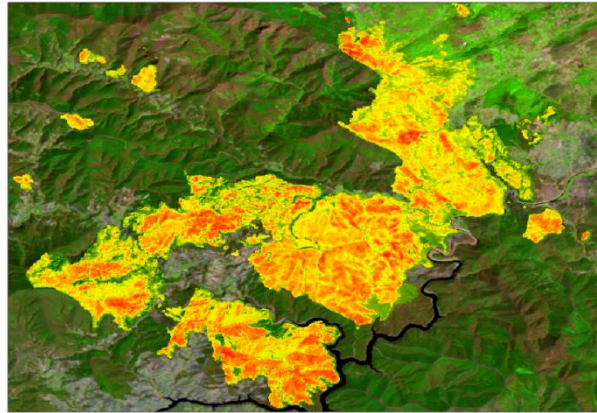


Fire severity and fire-weather conditions are increasing in West-Central Spain

Quintero, N.; Viedma, O.; and Moreno, J.M.

Highlights

- During the last 33 years, **fire severity (RBR metrics) increased**, and the **fire-weather conditions tended to be warmer and drier**.
- There was **more** area burned at **high severity** and **less** area burned at **low severity**.
- **Fire activity decreased** but large fires did not show any trend and **small fires tended to be larger**.
- Fire burned **more shrublands** at the expense of forested and agroforestry areas.
- **Summer weather conditions** variables were **strong explanatory and predictor** variables of fire severity.
- **Hot and dry** weather conditions during **summer** were **related** to **high fire severity** and **cooler** and **wet seasons related** to **low fire severity**.



Fire severity index:
Relativized burnt ratio (RBR)

Low severity

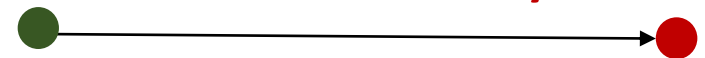


Wet conditions

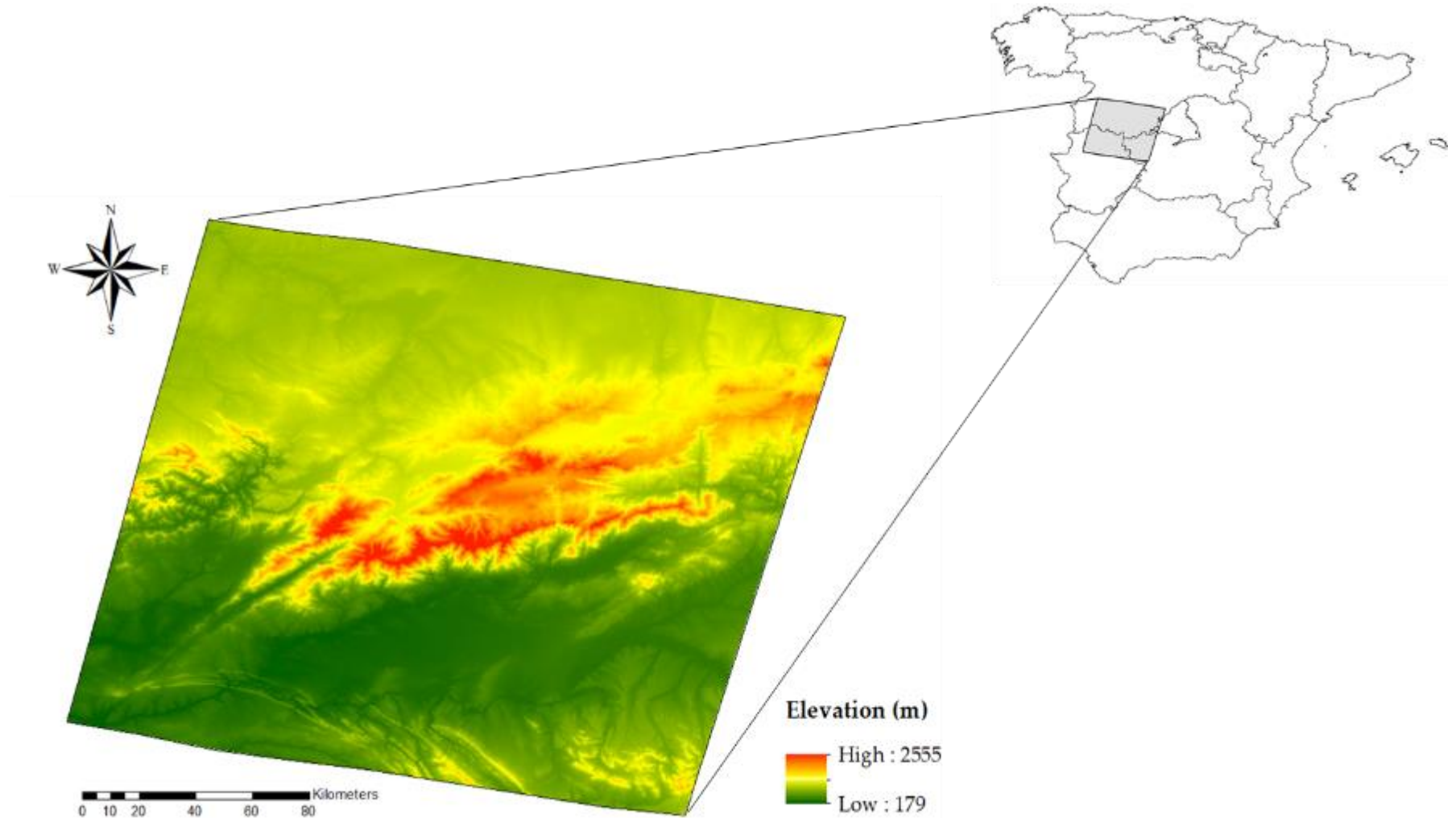
High severity



Dry conditions



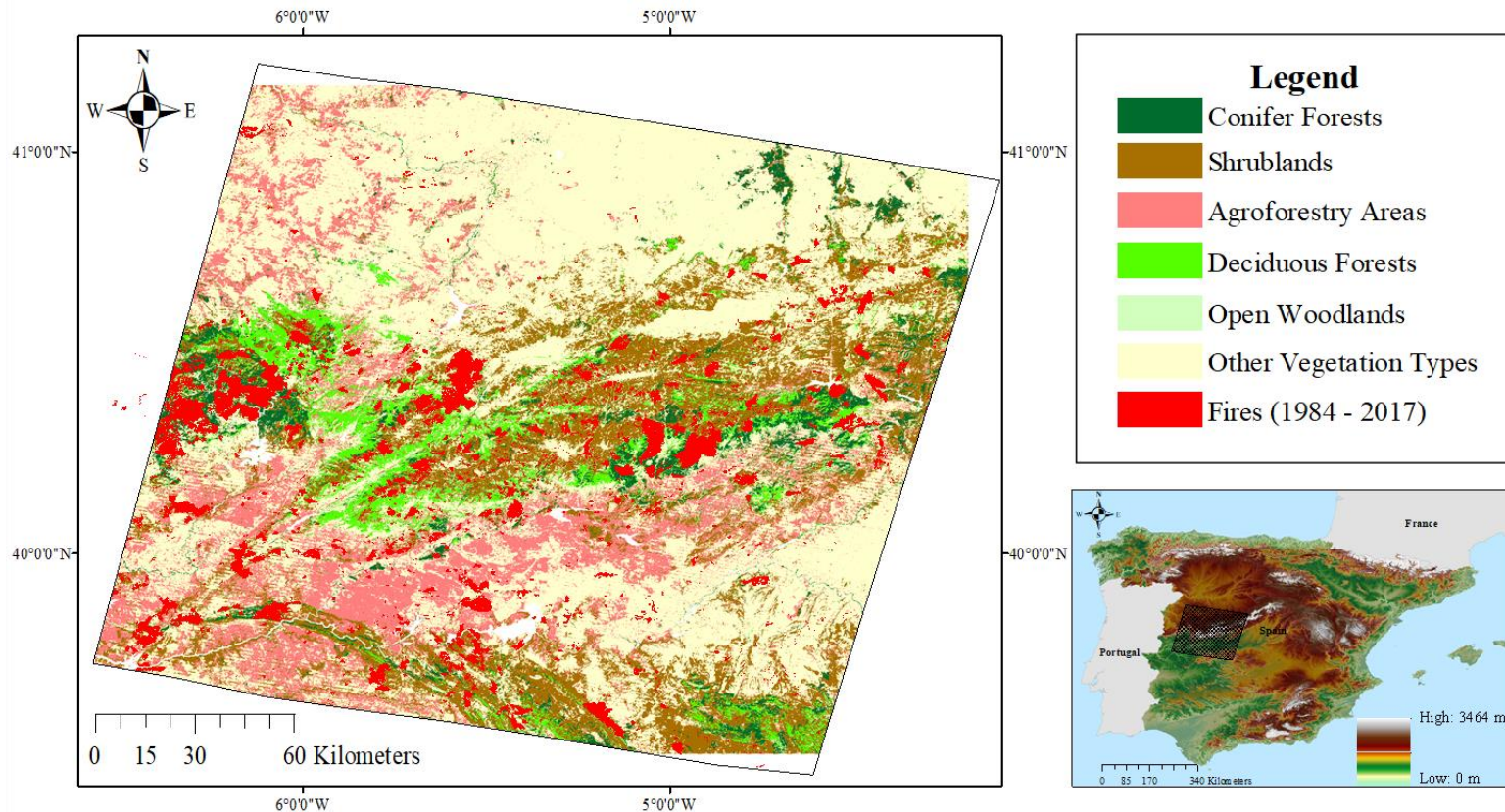
Representative area of Mediterranean landscape



Location of the study area in West-Central Spain.

METHODS

We determined the temporal trends of several fire weather conditions variables, fire activity and fire severity and the relationship of the latter two to fire-weather conditions in West-Central Spain for a 33-yr period (from 1985 to 2017). The fire severity data were calculated for the whole area and for each land-use/land cover type, using the relativized burnt ratio (RBR).





INPUTS

Fire weather conditions
(TerraClimate)

- Maximum temperature
- Precipitation
- Water deficit

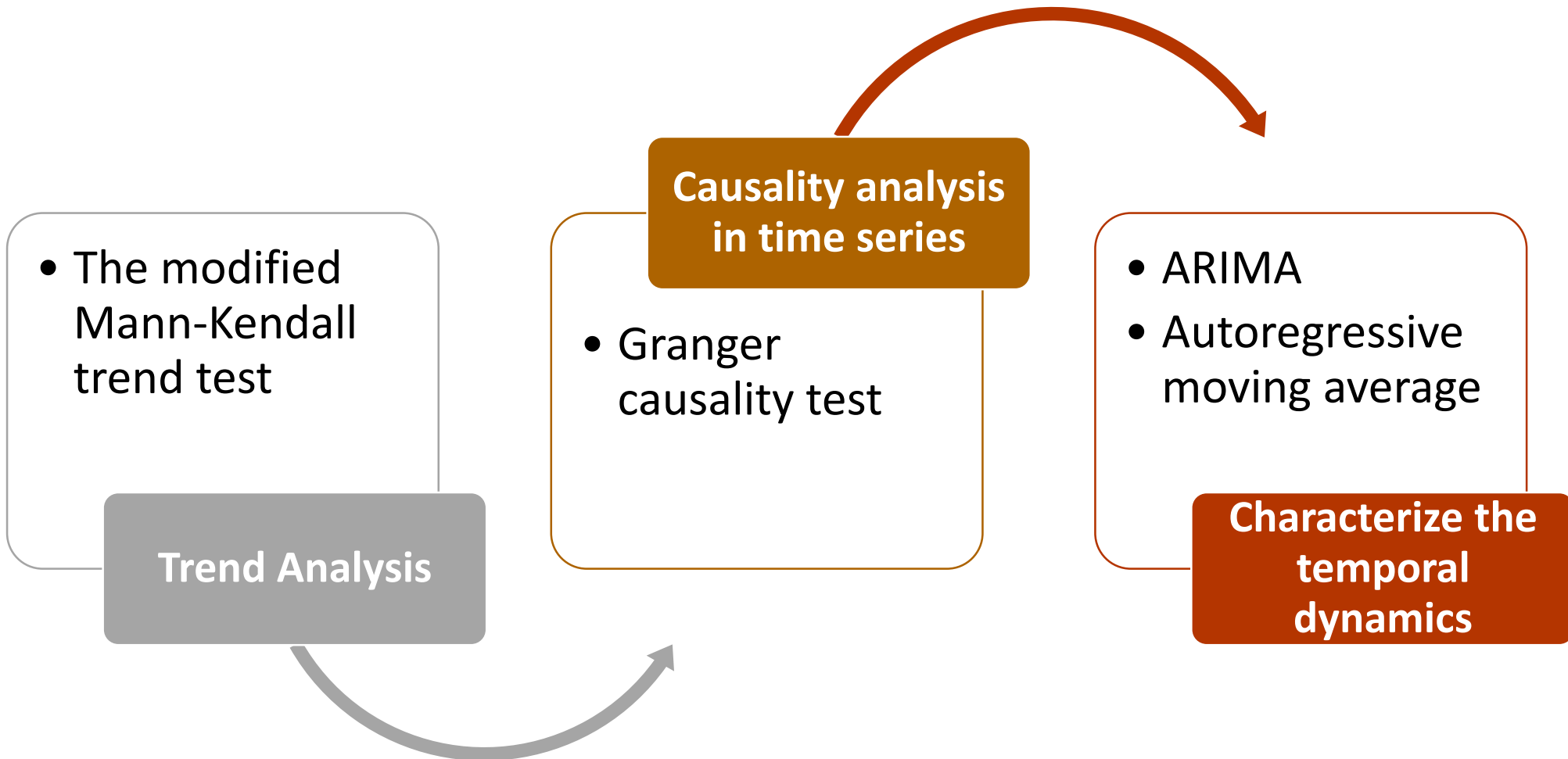
Fire activity

- Number of fires
- Fire size (Gini)
- Fire size P5 (percentile)
- Fire size P90 (percentile)
- Total burned area

Fire severity
(Landsat – RBR)

- Mean severity (RBR)
- RBR P5 (percentile)
- RBR P90 (percentile)
- Low severity burned area (%)
- High severity burned area (%)

STATISTICAL ANALYSIS

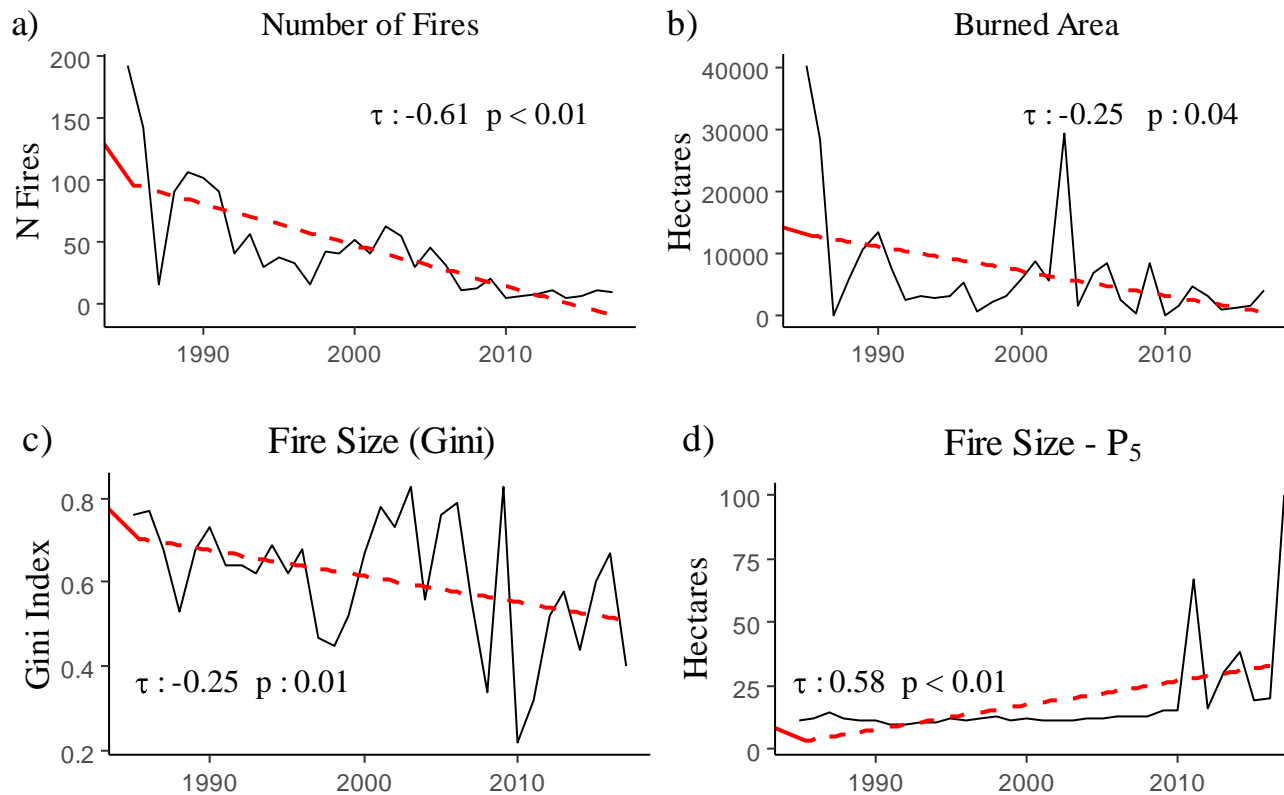


RESULTS

FIRE ACTIVITY TRENDS

- Decreasing fire activity: Number of fires and burned area decreased, while wildfires tended to be less diverse in size and small fires larger.

Fire Activity Trends (Whole area)

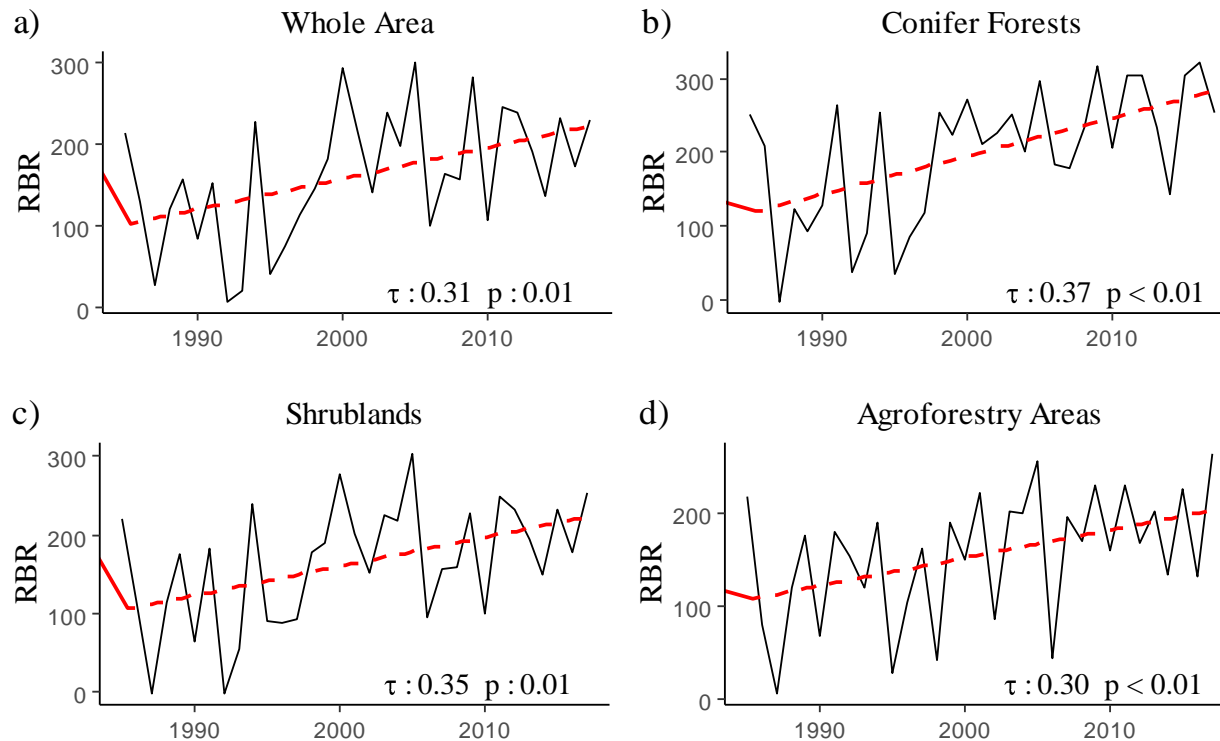


RESULTS

FIRE SEVERITY TRENDS

- Increasing fire severity: RBR values significantly increased over time (mean, P_5 , P_{90}). The percentage of burned area at low severity (RBR < 100) decreased. All LULC types tended to burn at higher fire severity over time.

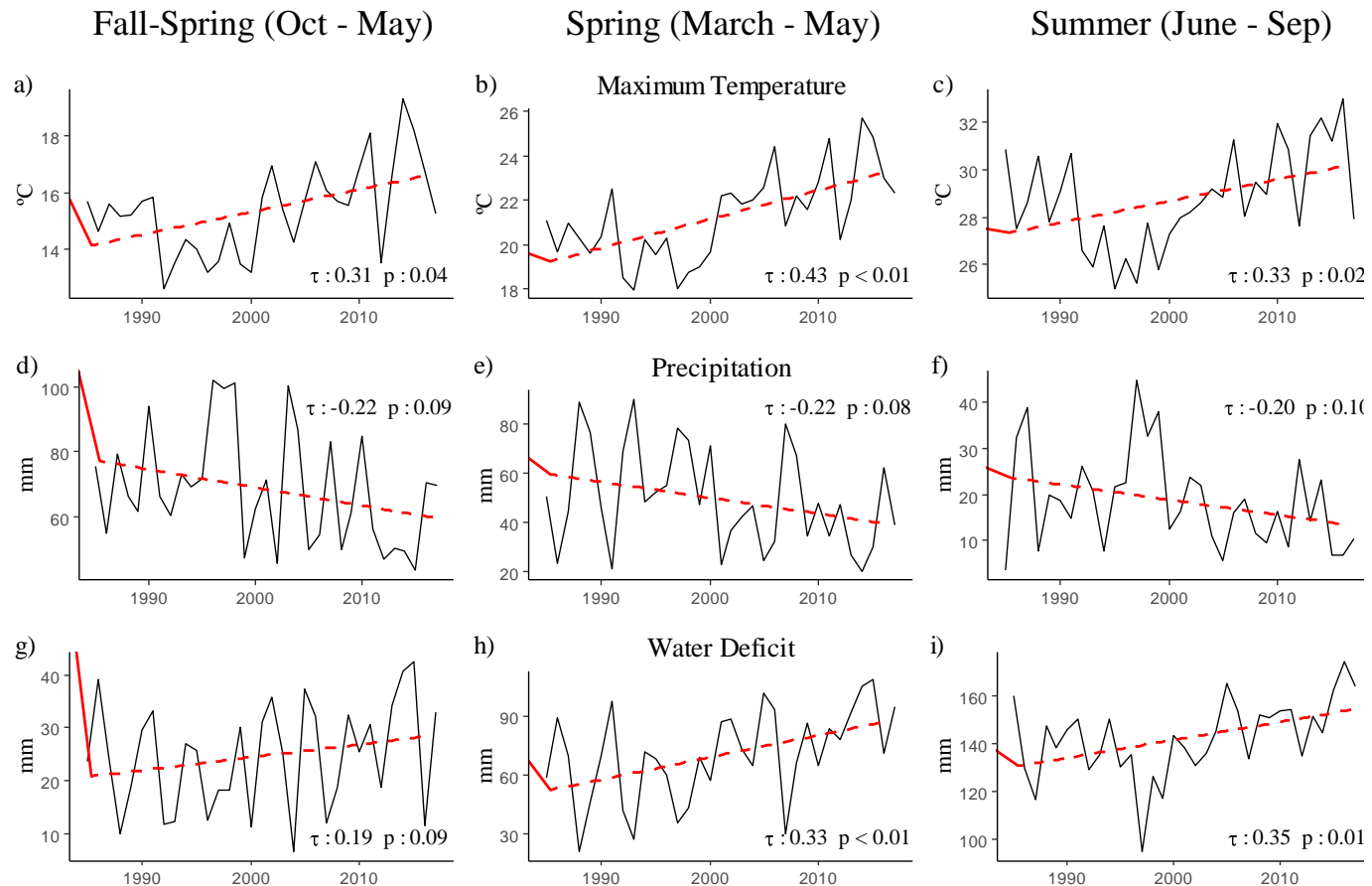
Mean Severity (RBR)



RESULTS

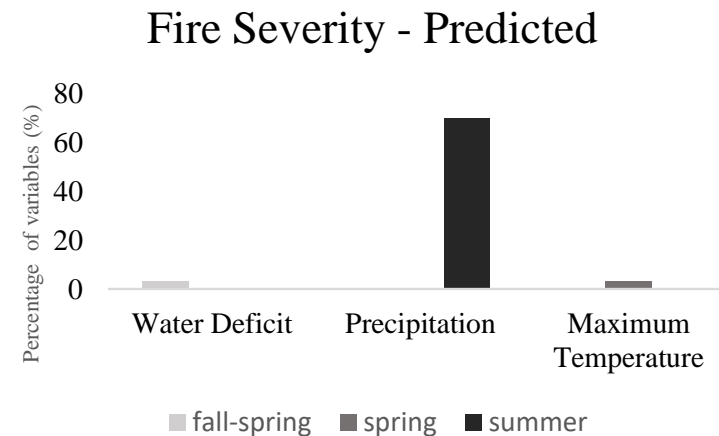
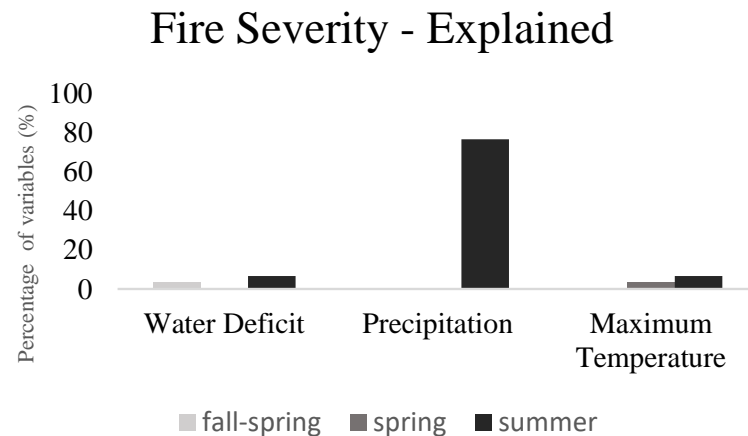
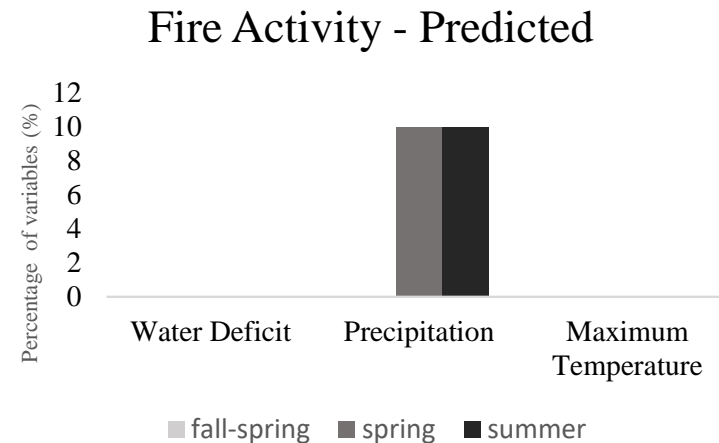
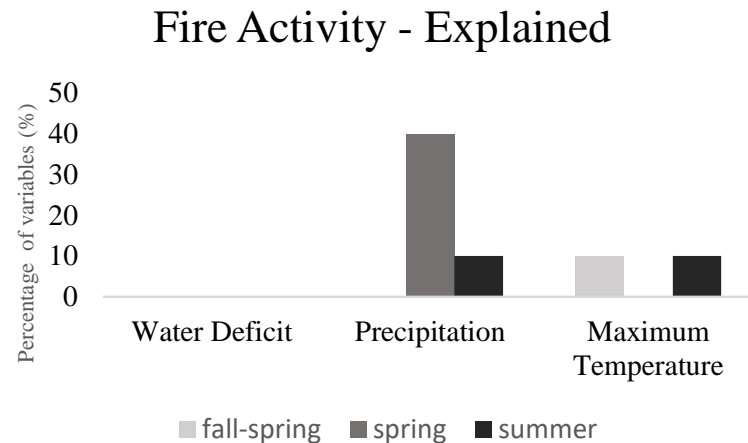
FIRE-WEATHER TRENDS

- Fires occurred in more severe fire-weather conditions through time: The decreasing fire activity and increasing fire severity occurs in zones with positive trends in maximum temperatures and drought conditions (lower precipitation and higher water deficit).



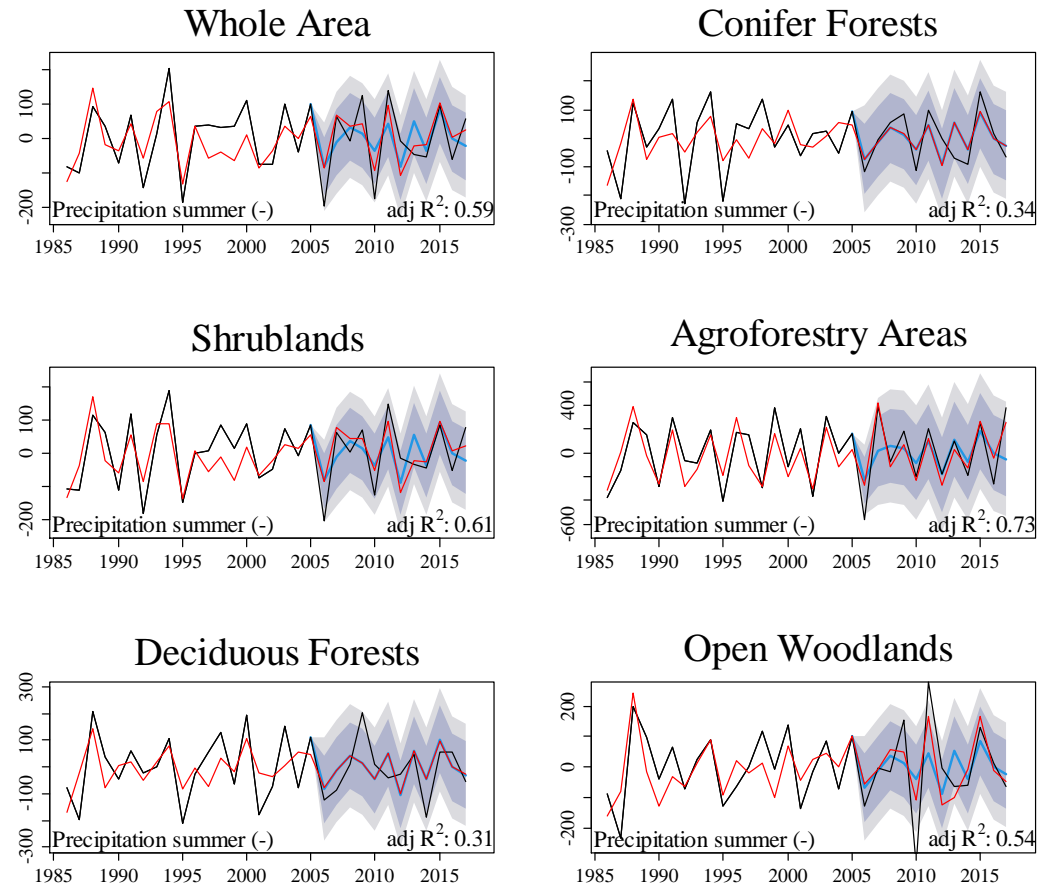
FIRE - CLIMATE EXPLANATORY AND FORECASTING MODELS

- Fire activity and severity were highly explained and predicted by fire-weather conditions: Summer and spring precipitation explained and predicted most of the fire severity and activity variables.



- Hot and dry summers are related to **high fire severity values and % of burned area at high severity (RBR >300)** while **cool and wet summers were related to low fire severity values and % of burned area at low severity (RBR < 100)**

Mean severity Forecast



In black, the stationary time series (1986 - 2017); in red, the ARMAX model for the time series (1986 - 2017) and in blue, the forecast for the last twelve years (2006 - 2017).

Conclusions

- In a large area in West-Central Spain a significant increasing trend in fire severity occurred during the last few decades: The RBR severity metrics (i.e., mean, P_5 and P_{90} RBR values) increased, and there was less area burned at low severity ($RBR < 100$) and more area burned at high severity ($RBR > 300$) mainly in agroforestry, shrublands and conifer forests.
- Fire-weather conditions tended to be warmer and drier: Over time, fires occurred in areas with higher temperatures and water deficit and less precipitation, especially in spring and summer.
- Fire weather conditions explained a high proportion of the variance in fire activity and fire severity: Precipitation and maximum temperature in summer were the most robust explanatory and forecasting variables of fire severity. Following them, water deficit was the next best one.



THANK YOU

