What is fire behavior?

Wildfire behavior is broadly defined as the way a fire ignites, develops, and spreads through the landscape.

What data are necessary to characterize fire behavior?

First, it is necessary to reproduce the observed **fire progression**, i.e. where and when the fire burned in the landscape.

Several data sources can be used and combined to reconstruct the progression of a wildfire, such as: photos, videos, field information (e.g. interviews), satellite data etc [1].

Fire progression is typically presented using **isochrones**.

Field photos
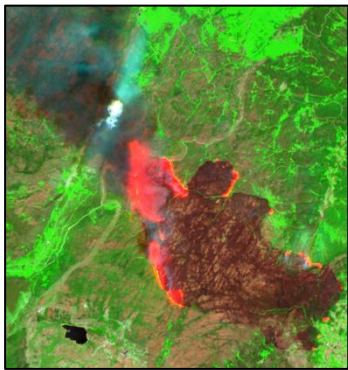
source: FEPC

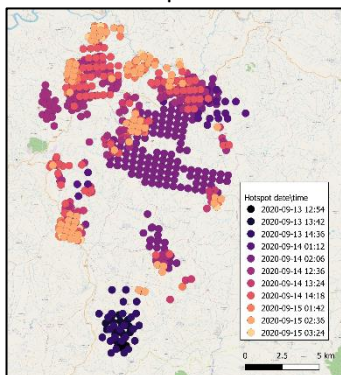Airborne photos (visible)

source: UEPS

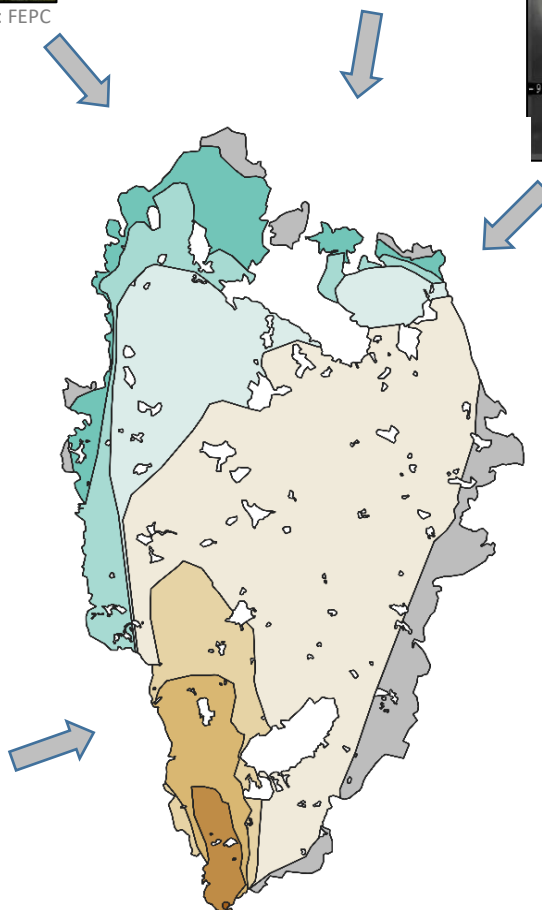Airborne photos (thermal)

source: ANEPC

Satellite imagery
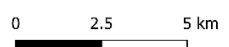
source: Sentinel-2

Satellite "hotspots"
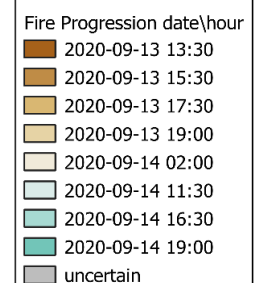
source: VIIRS

Reconstructed fire progression
Proença-a-Nova (Portugal), 09/2020 (PT-FireSprd, [1])

Fire Progression date\hour
- 2020-09-13 13:30
- 2020-09-13 15:30
- 2020-09-13 17:30
- 2020-09-13 19:00
- 2020-09-14 02:00
- 2020-09-14 11:30
- 2020-09-14 16:30
- 2020-09-14 19:00
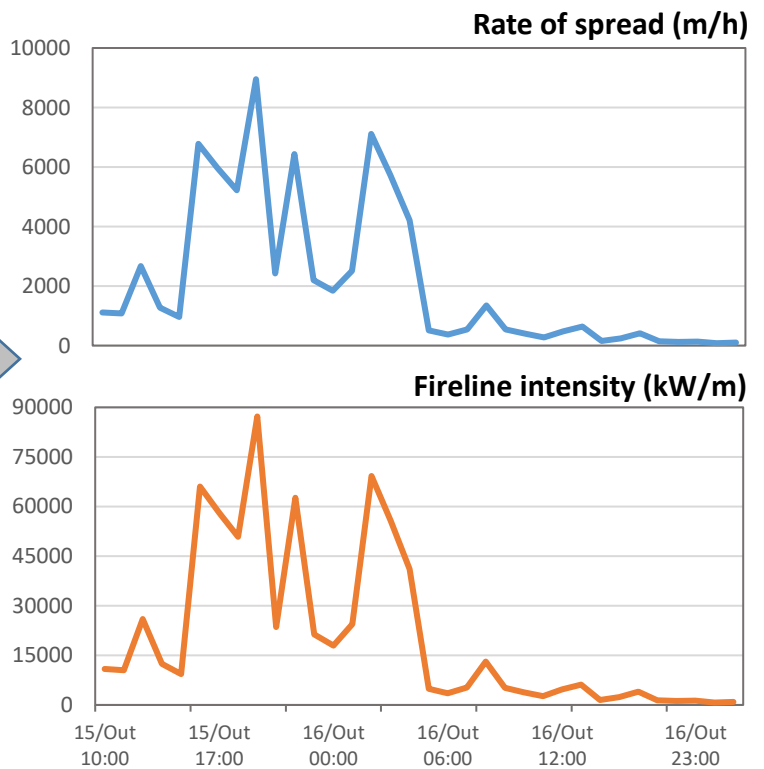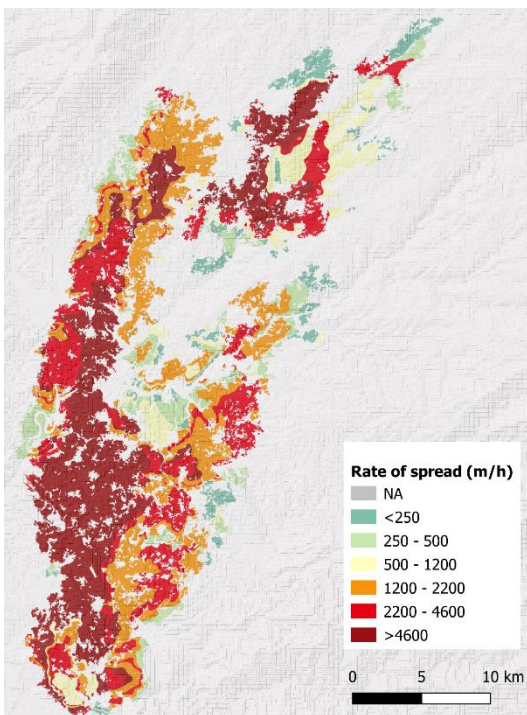- uncertain

0   2.5   5 km

What data are necessary to characterize fire behavior?

From fire isochrones, **key fire behavior descriptors** can be derived.

The **rate of spread** (m/s) [2], an indicator of how fast a fire progresses, is computed by dividing the distance between two isochrones by the time elapsed between both.

The **fireline intensity** (kW/m), a measure of the heat energy released from the burning fuels, is calculated by combining the *rate of spread* (m/s), the load of consumed ***fuel*** (kg/m^2) and its heat of combustion (KJ/kg) [3].

Rate of spread Lousã (Portugal), 10/2017 [1]

Rate of spread (m/h)
- NA
- <250
- 250 - 500
- 500 - 1200
- 1200 - 2200
- 2200 - 4600
- >4600

0   5   10 km

Rate of spread (m/h)

Fireline intensity (kW/m)

How will fire behavior data be used in NERO?

The complilation of a pan-European fire behavior dataset will be exploited to build knowledge and tools to better understand and predict the conditions that lead to the development of extreme fire behavior.

References

[1] Benali, et al. (2023). The portuguese large wildfire spread database (PT-FireSprd). Earth Syst. Sci. Data, 15, 3791–3818.

[2] Alexander, M. E. (1982). Calculating and interpreting forest fire intensities. Canadian Journal of Botany, 60(4), 349-357.

[3] Byram, G. M. (1959). Combustion of forest fuels. In Forest fire: control and use. Edited by K. P. Davis. McGraw-Hill, New York. pp. 61-89.