Semi-automatic fuel break monitoring with Sentinel-2 imagery

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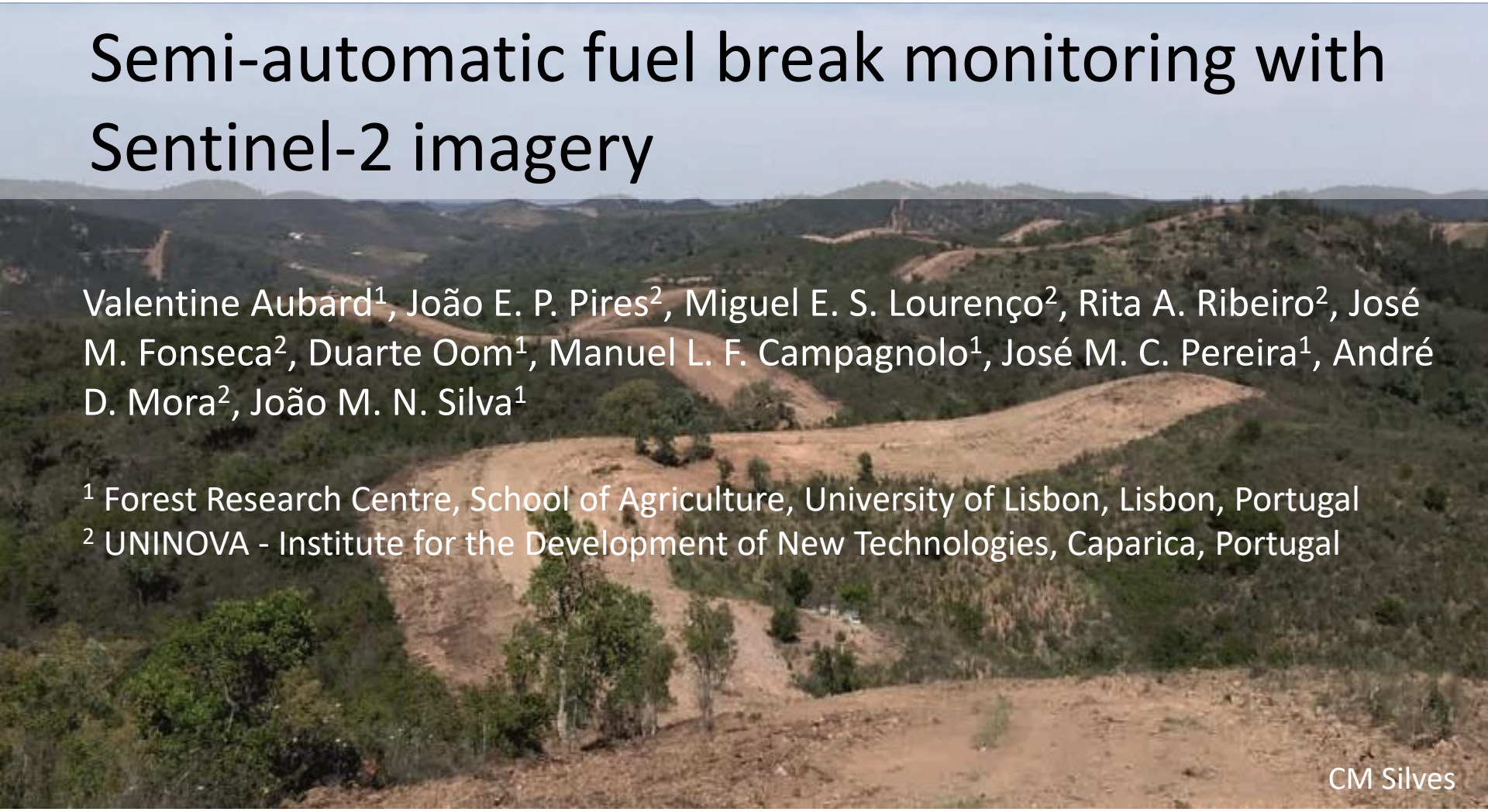

CM Silves

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The Portuguese primary fuel break network

- Interconnected linear strips - 125m width
- 1 600 km already installed
- 11 125 km planned
- Large area for monitoring

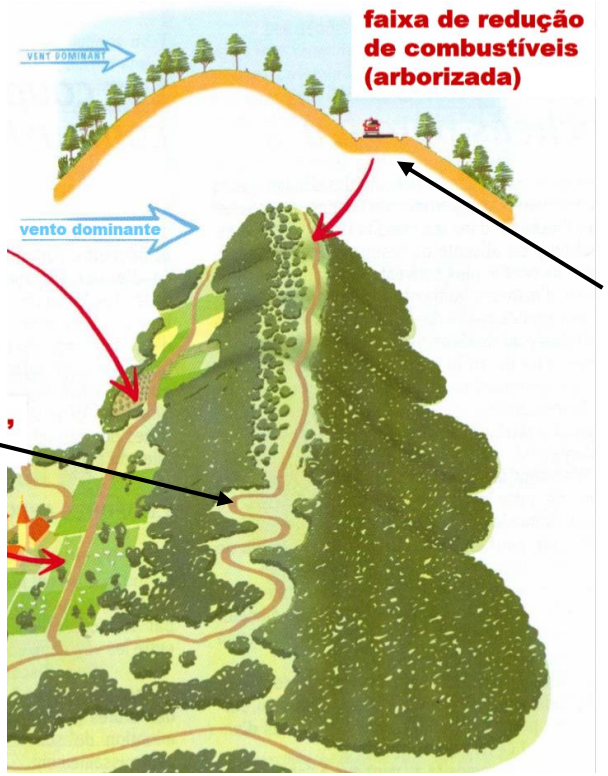
125 m

Portuguese fuel break network

Remove fuel

Reduce fuel amount

The goal of primary fuel breaks is to reduce the risk of fire propagation and help fire fighting



Road

Direct fire fighting

A fuel break is only effective if it is maintained.

The FuelMon project

Remote Fuel Break Monitoring for Forest Fire Protection

Motivation

Country wide monitoring of fuel breaks: the Portuguese Forest Service is not able to perform field monitoring of the status of fuel breaks

Challenge

Mapping fuel treatment and biomass accumulation in the Portuguese primary fuel break network

Scientific objectives

- Exploring new satellite data with high spatial and temporal resolution (Sentinel-2)
- Comparing alternative semi-automatic image classification approaches to map fuel treatments

Only using 10m Sentinel-2 bands

Preprocessing

Cloud and cloud shadow masking

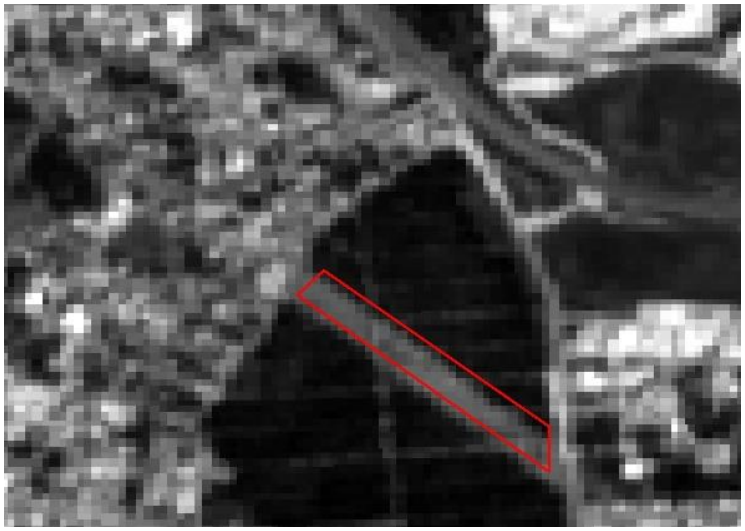
- Cloud masking with Sen2Cor algorithm for Sentinel-2 level-1C images
- Now: using the Level-2A and the cloud and cloud shadow masks provided

- **Improving georeferentiation**

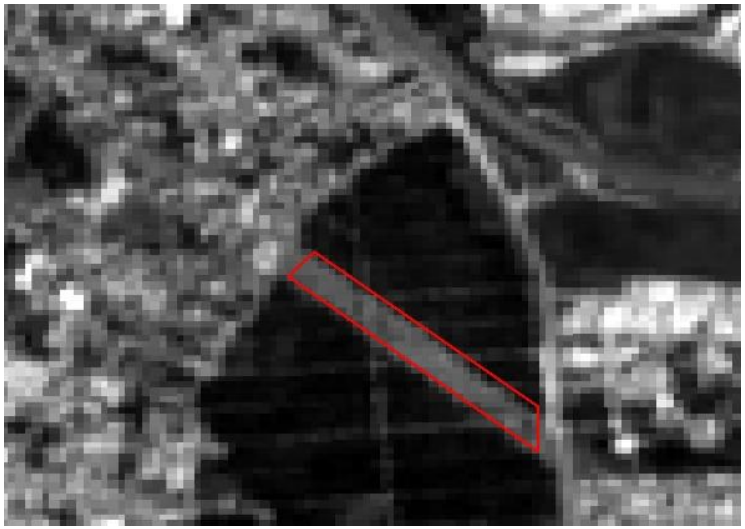
The maximum difference detected is 15 meters = 1.5 pixel for 10-m bands.

The correction technique implies the *Fast-Fourier Transformation* and the correlations between images. (Guizar-Sicairos et al., 2008; Python code available).

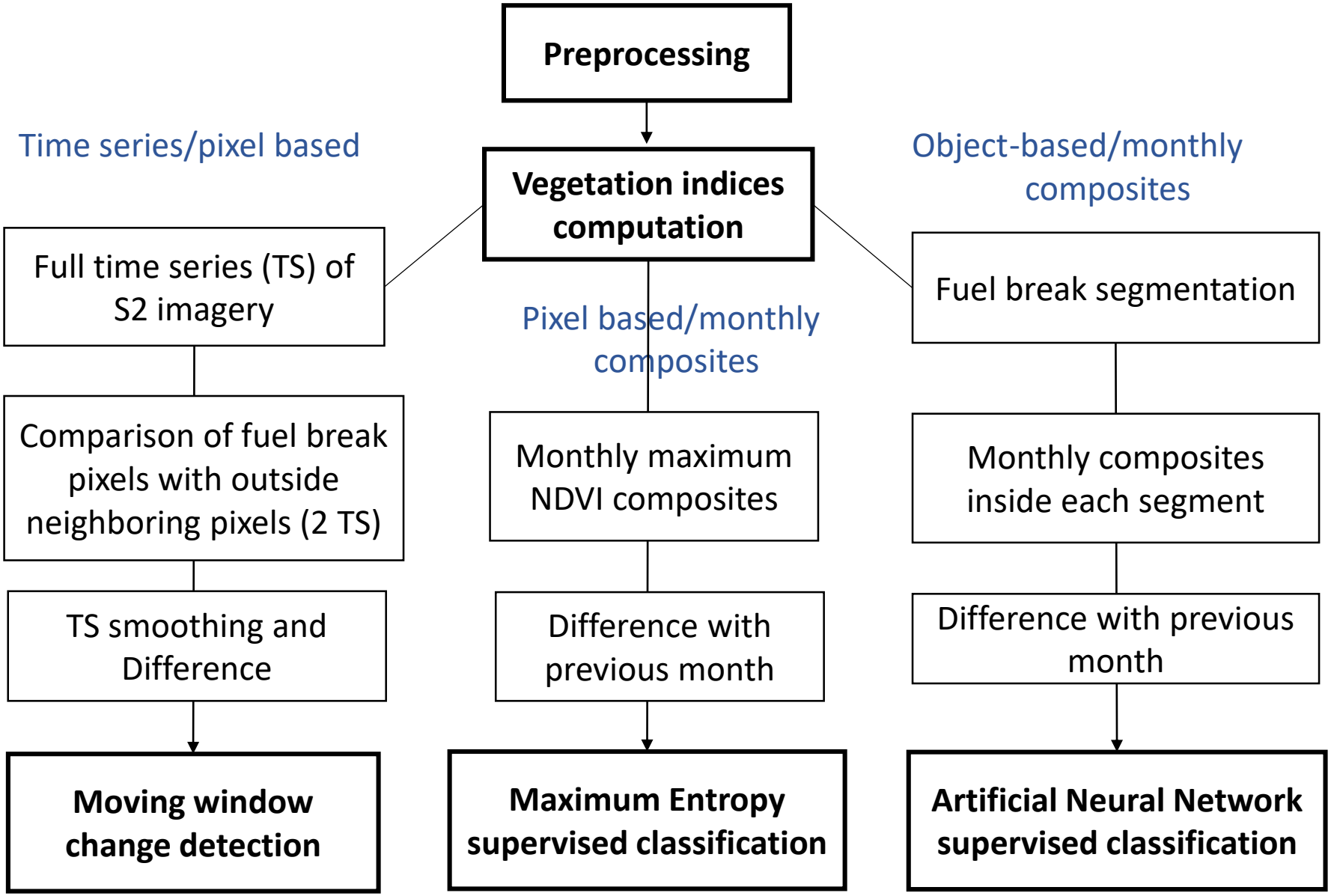
Band 4 (Red) – 10/05/2018



Band 4 (Red) – 15/05/2018

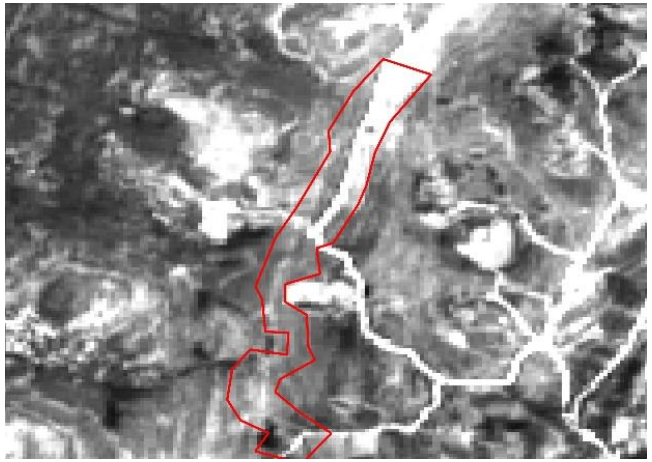


Three methodologies are being tested:

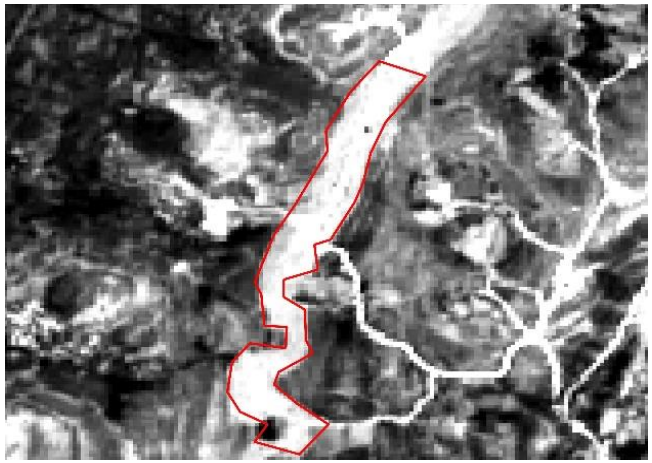


First results: Object-based classification (monthly composites)

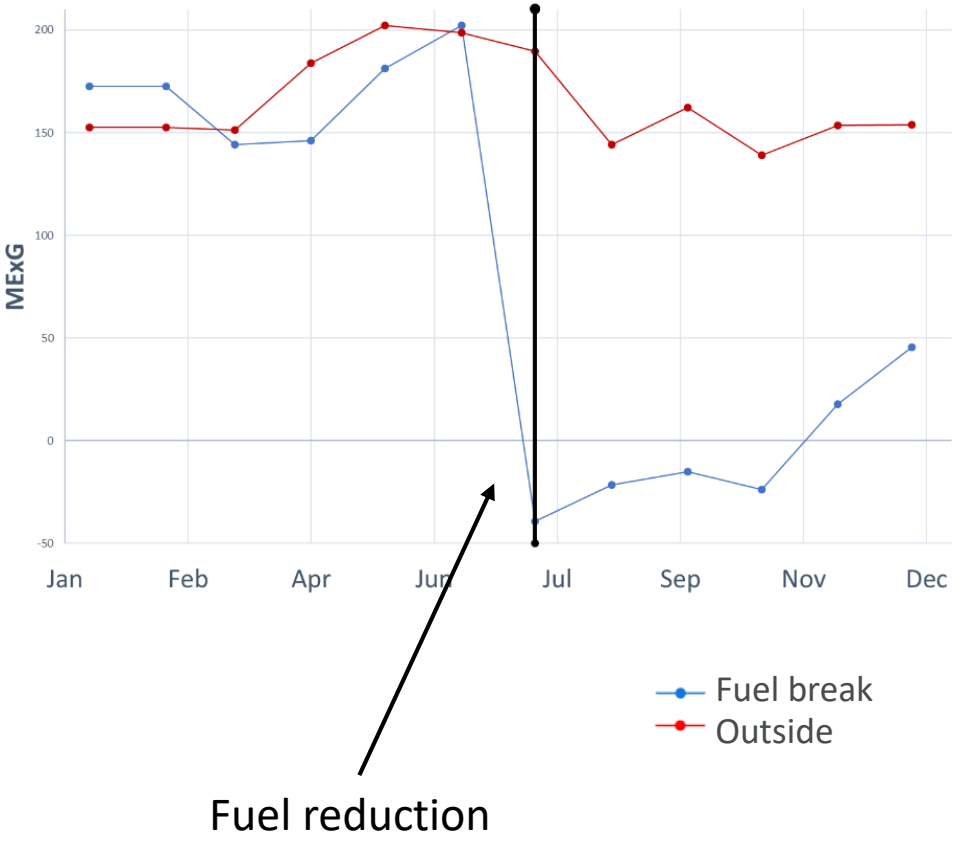
Segment before intervention (June)



Segment after intervention (July)



Temporal Evolution of the Modify Excess of Green (MExG) indice in 2017 with detected month of intervention

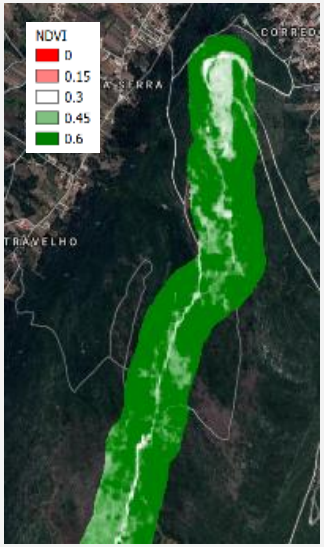


First results: Pixel-based classification (monthly composites)

Maximum NDVI composites

May
2017-05-01 to 2017-05-31

June
2017-06-01 to 2017-06-30



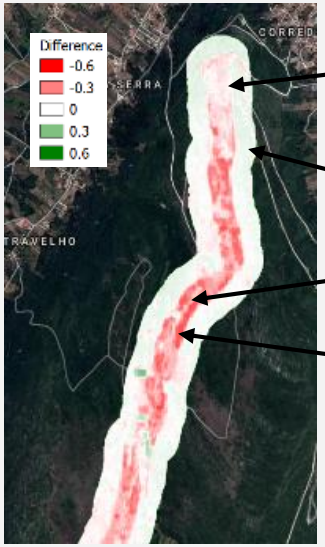
400 m

Fuel break + buffer of
100m on both sides

Difference

June - May

Maximum NDVI Difference



Already cut
before June

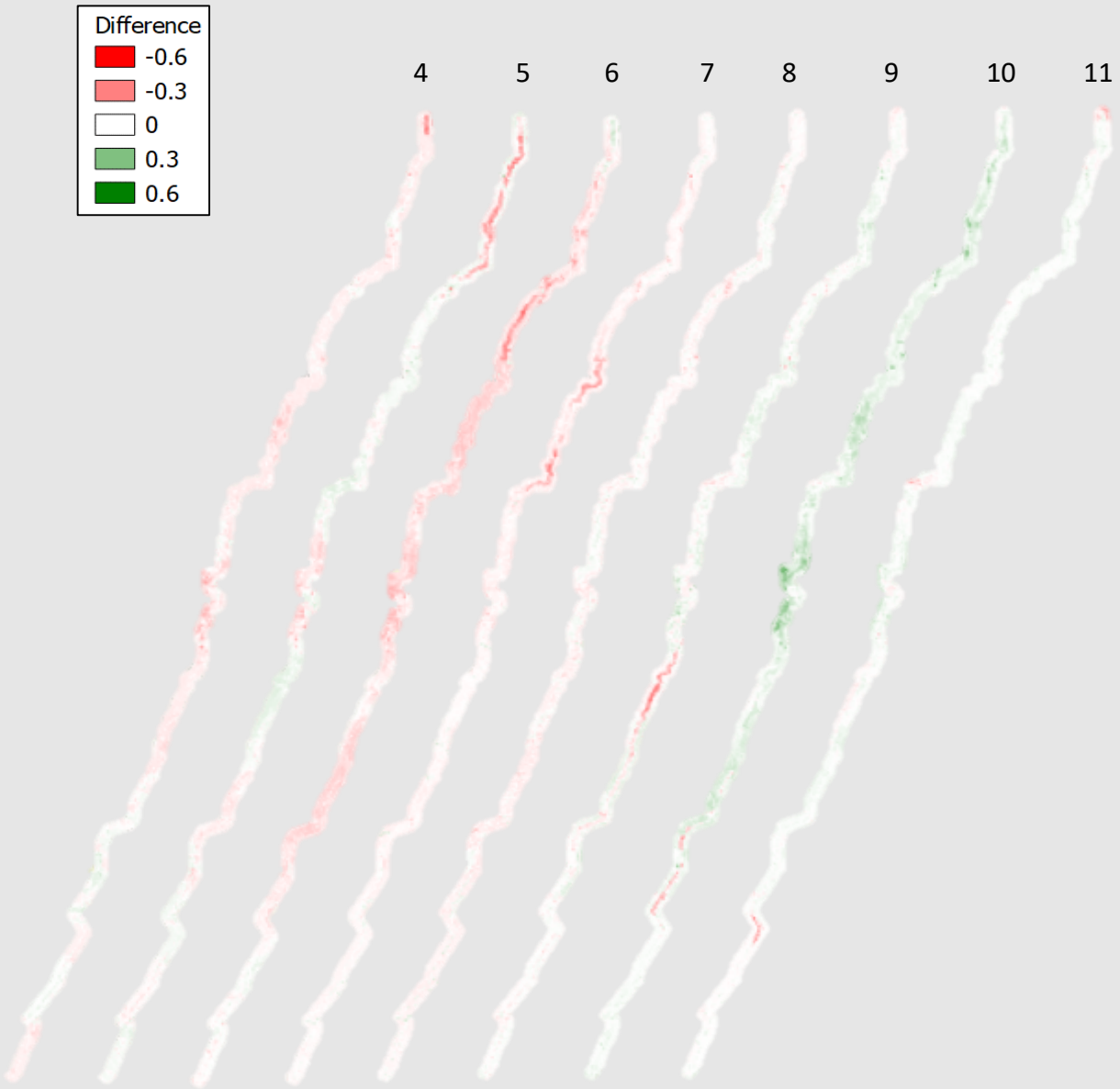
Buffer area,
not cut

Road (white)

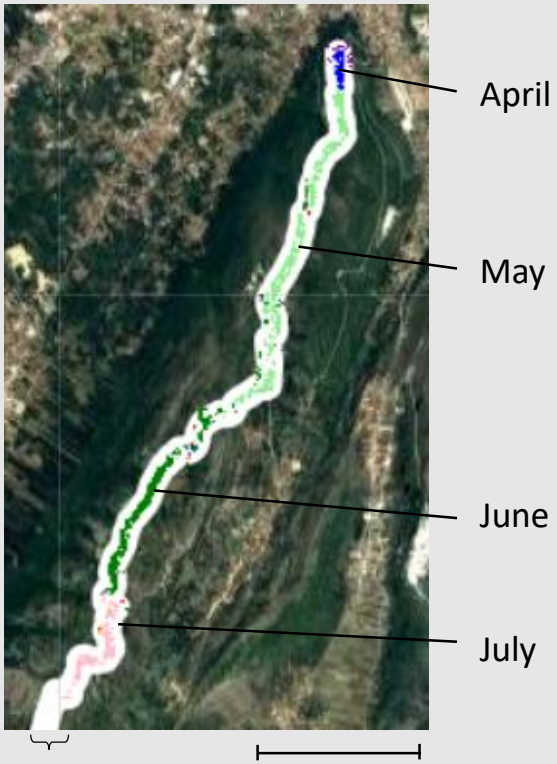
Cut in June 2017

Map of the area cleared in June

Month differences for 2017

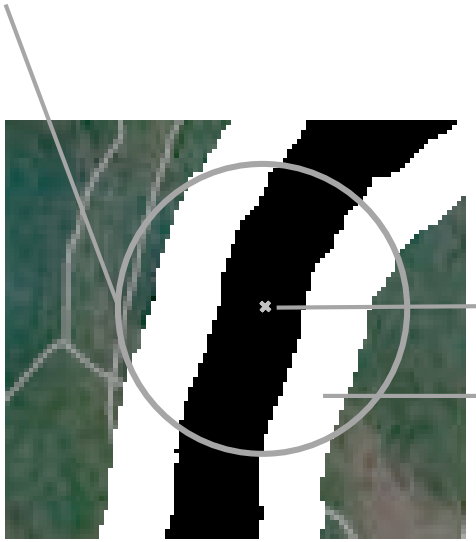


Monthly map of 2017 interventions in Serra de Aires e Candeeiros Natural Park



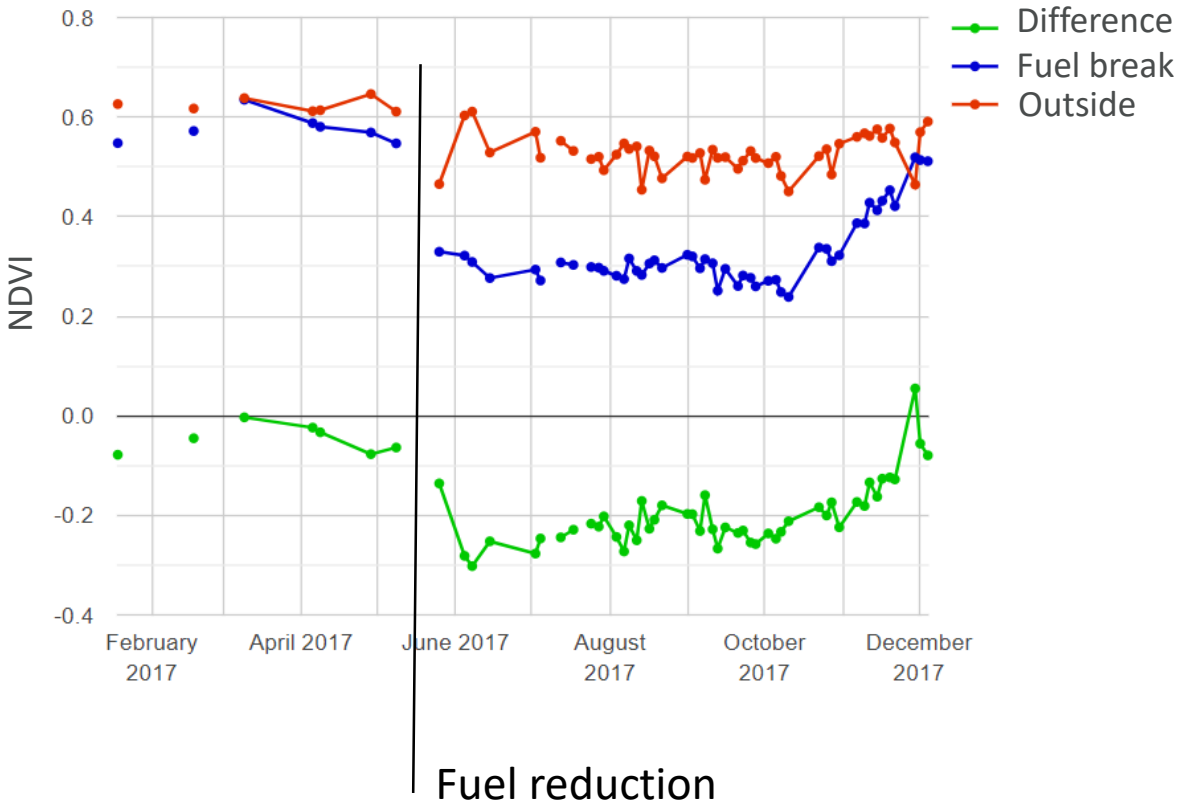
Fuel break + buffer of 100m on both sides

First results: Time series approach (pixel based, full temporal resolution)

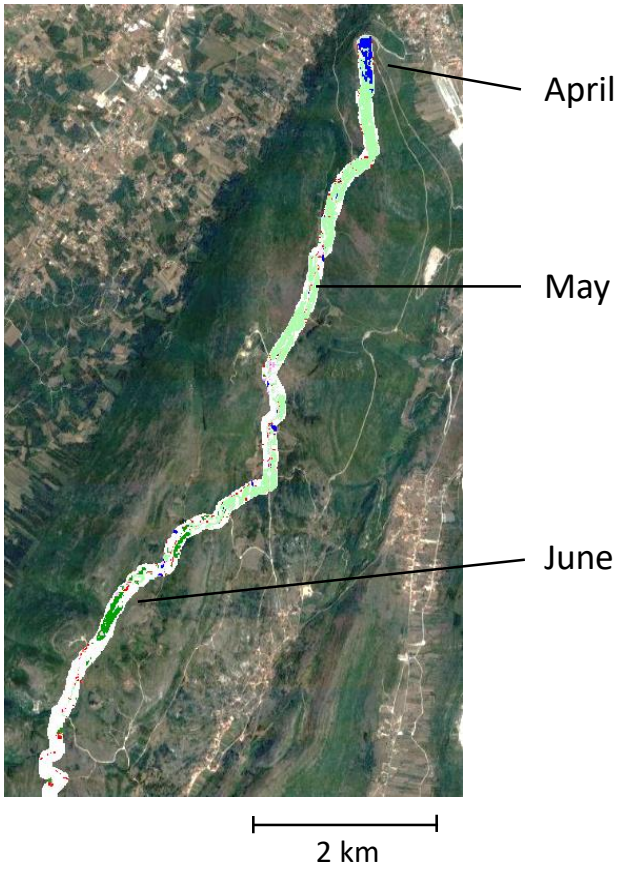


First results: Time series approach (pixel based, full temporal resolution)

NDVI time series of one pixel of the fuel break, the mean of its neighbors (outside) and their difference

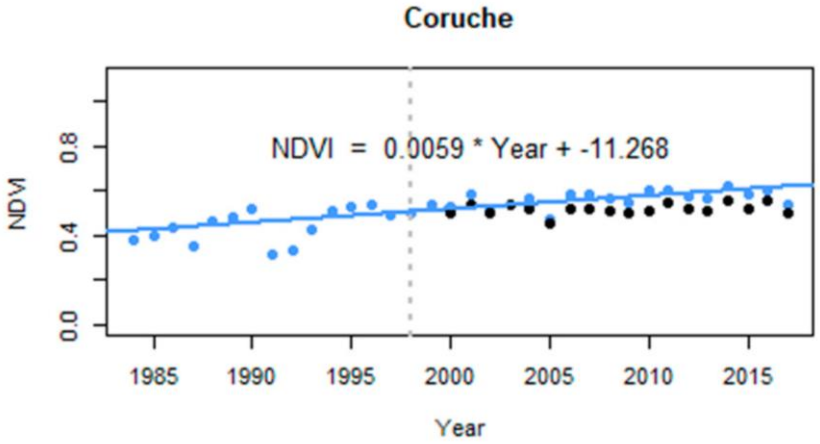


Interventions detected in 2017



Future Work:

Monitoring the biomass accumulation after an intervention inside the fuel break



Non-parametric techniques:
- Theil-Sen slope
- Mann-Kendall significance test

remote sensing

MDPI

Article

Long-Term Monitoring of Cork and Holm Oak Stands Productivity in Portugal with Landsat Imagery

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