Projeto cofinanciado pelo Fundo Europeu de Desenvolvimento Regional (FEDER) a través do INTERREG V-A Espanha-Portugal (POCTEP) 2014 – 2020

Medidas inovadoras de recuperação preventiva em áreas queimadas (0701_TERRAMATER_1_E)

TERRAMATER project: A tool for post-fire rehabilitation and restoration of soils

[1]Macías, F., [1]Antelo, J, [2]Verdes, P.V., [3]Figueiredo, T., [3]Fonseca, F., [4]Hernandez, Z., [5]Valente, T., [5]Barroso, A., [5]Henriques, R., [6]Carvalho, M., [6]Fernandes, M.J., [6]Teixeira, S., [6]Delerue-Matos, C. and [7]Macías-García, F.

[1]CRETUS. Department of Soil Science and Agricultural Chemistry. Universidade de Santiago de Compostela. Spain

[2]Department of Applied Physics. Universidade de Santiago de Compostela. Spain

[3]Centro de Investigação de Montanha (CIMO), Instituto Politécnico de Bragança. Portugal

[4]Mountains of Research Collaborative Laboratory (MORE). Portugal

[5]Instituto de Ciências da Terra. Universidade do Minho. Portugal

[6]REQUIMTE/LAQV, Instituto Superior de Engenharia Do Porto. Politécnico Do Porto. Portugal

[7]Recursos y Valorización Ambiental, S.L. Spain

Contact Information:

info@terramaterpoctep.eu www.terramaterpoctep.eu

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TERRAMATER
preuvención y recuperación de áreas quemadas

Funded by **Interreg VA Spain-Portugal (POCTEP) Programme**
Promotes cross-border cooperation projects with the support of the European Union

Period**: 2018 – 2022**

Budget: 1.106.805,29 € (Funding: **830.103,96 €**)

Partners: **USC** (Spain), **Uminho** (Portugal), **ISEP** (Portugal), **IPB** (Portugal), **RVA** (Spain)

USC UNIVERSIDADE DE SANTIAGO DE COMPOSTELA

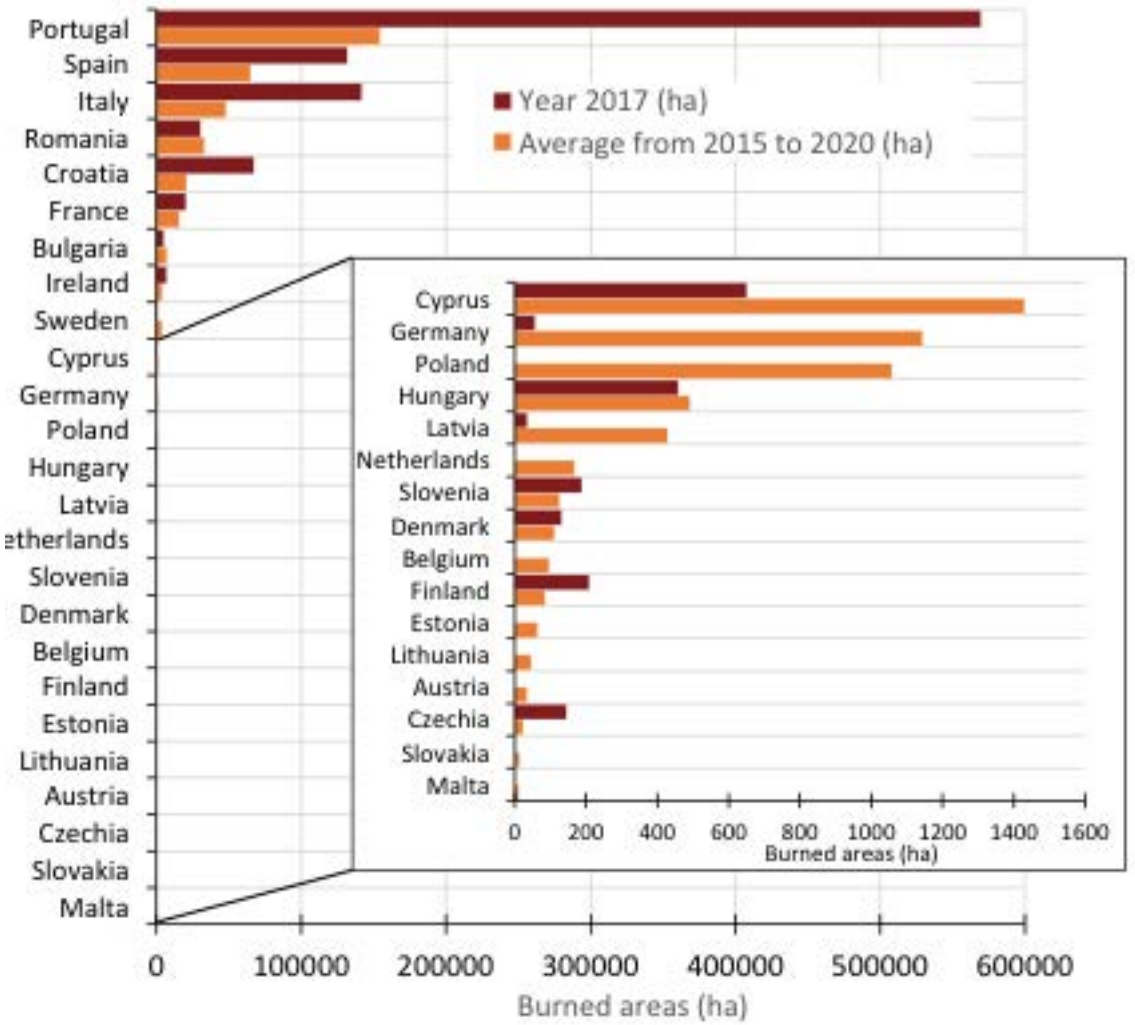
Universidade do Minho

isep Instituto Superior de Engenharia do Porto

RVA

ipb INSTITUTO POLITÉCNICO DE BRAGANÇA

Contact Information: info@terramaterpoctep.eu


Year 2017 (ha)
Average from 2015 to 2020 (ha)
Portugal
Spain
Italy
Romania
Croatia
France
Bulgaria
Ireland
Sweden
Cyprus
Germany
Poland
Hungary
Latvia
Netherlands
Slovenia
Denmark
Belgium
Finland
Estonia
Lithuania
Austria
Czechia
Slovakia
Malta
0
100000
200000
300000
400000
500000
600000
Burned areas (ha)
Cyprus
Germany
Poland
Hungary
Latvia
Netherlands
Slovenia
Denmark
Belgium
Finland
Estonia
Lithuania
Austria
Czechia
Slovakia
Malta
0
200
400
600
800
1000
1200
1400
1600
Burned areas (ha)


Xures (Galicia), 2017


Lousa (Portugal), 2017

OBJECTIVES

Recovery of the environmental and productive functions of burnt areas (Galicia and North of Portugal); reducing soil losses due to erosion and increasing soil resilience to new episodes of wildfire

Improvement of ecological conditions in the recovered area and reduce the threat of contamination of neighboring forest systems and aqueous systems

ACTIONS

Evaluate the post-fire ecological conditions and the biogeochemical processes associated to soil remediation and to improve soil quality

Create an early alert system and define a set of procedures to define critical risk areas (remote sensor network)

Application of tailored soil amendments (technosols) to increase the content of organic matter, improve soil quality and soil protection against wildfires

Creation of a manual for soil management and soil remediation, which may be used as basis for future cross-border normative and cooperation

STUDY AREAS – Galicia-North Portugal border

- ✓ **South Galicia**: Ponteareas and Serra do Xures. **Wildfires 2020 & 2021**
- ✓ **North East Portugal**: Valença and Monçao. **Wildfires 2017 & 2018**
- ✓ **North West Portugal**: Aveleda (Bragança). **Prescribed fires, 2016 & 2021**


Aveleda (Bragança)

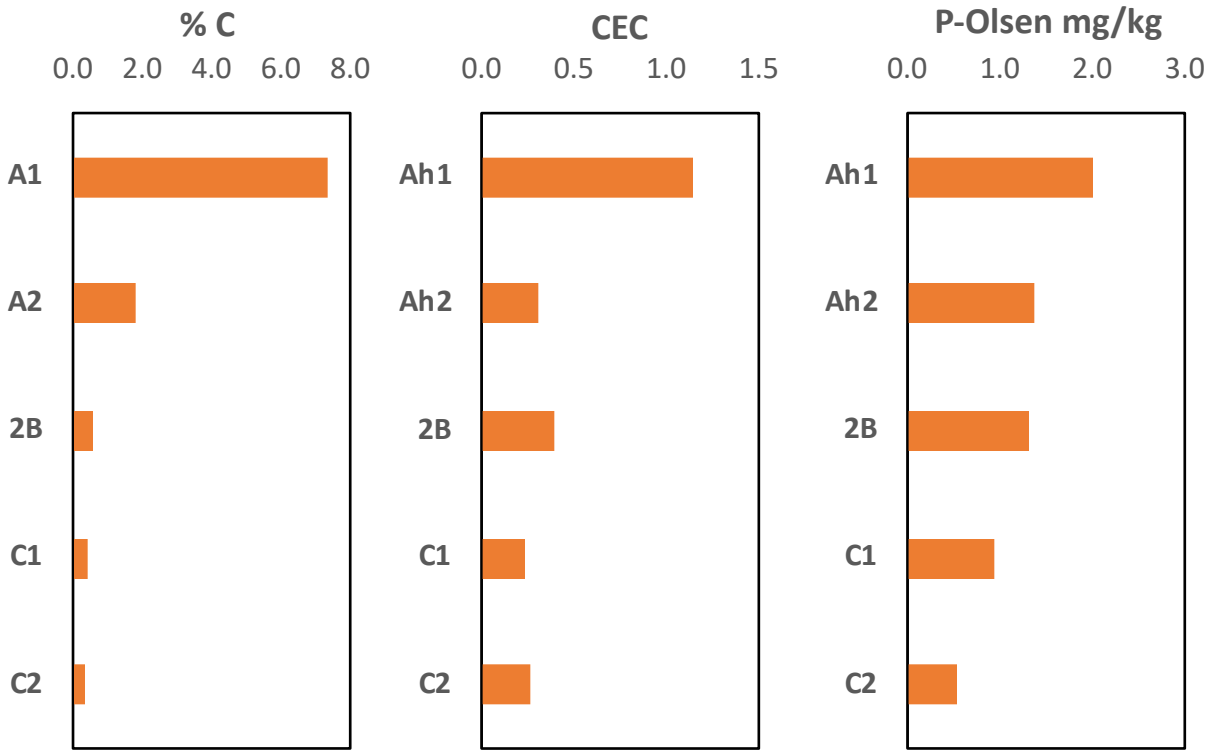

Sanfins (Valença)

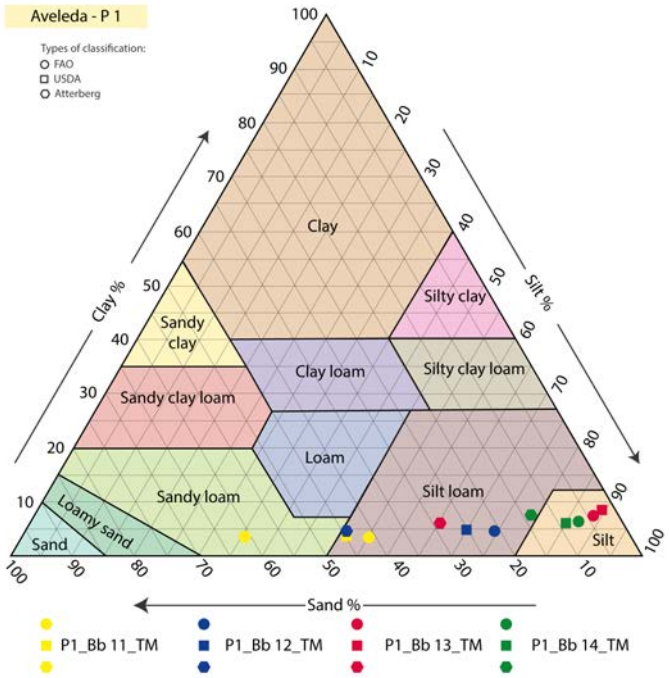

Xures (Lobios, Galicia)


Aveleda (Bragança)

Wildfire & Prescribed fire – Lab analysis

- ✓ **Chemical characterization (USC, ISEP):** pH, EC, C & C_{org}, N, P-total & P-Olsen, CEC…
- ✓ **Mineralogy, texture (Uminho)**
- ✓ **PAH (ISEP):** 17 PAHs (16 of which are considered as prioritary pollutants because they are more toxic, mutagenic, and carcinogenic),





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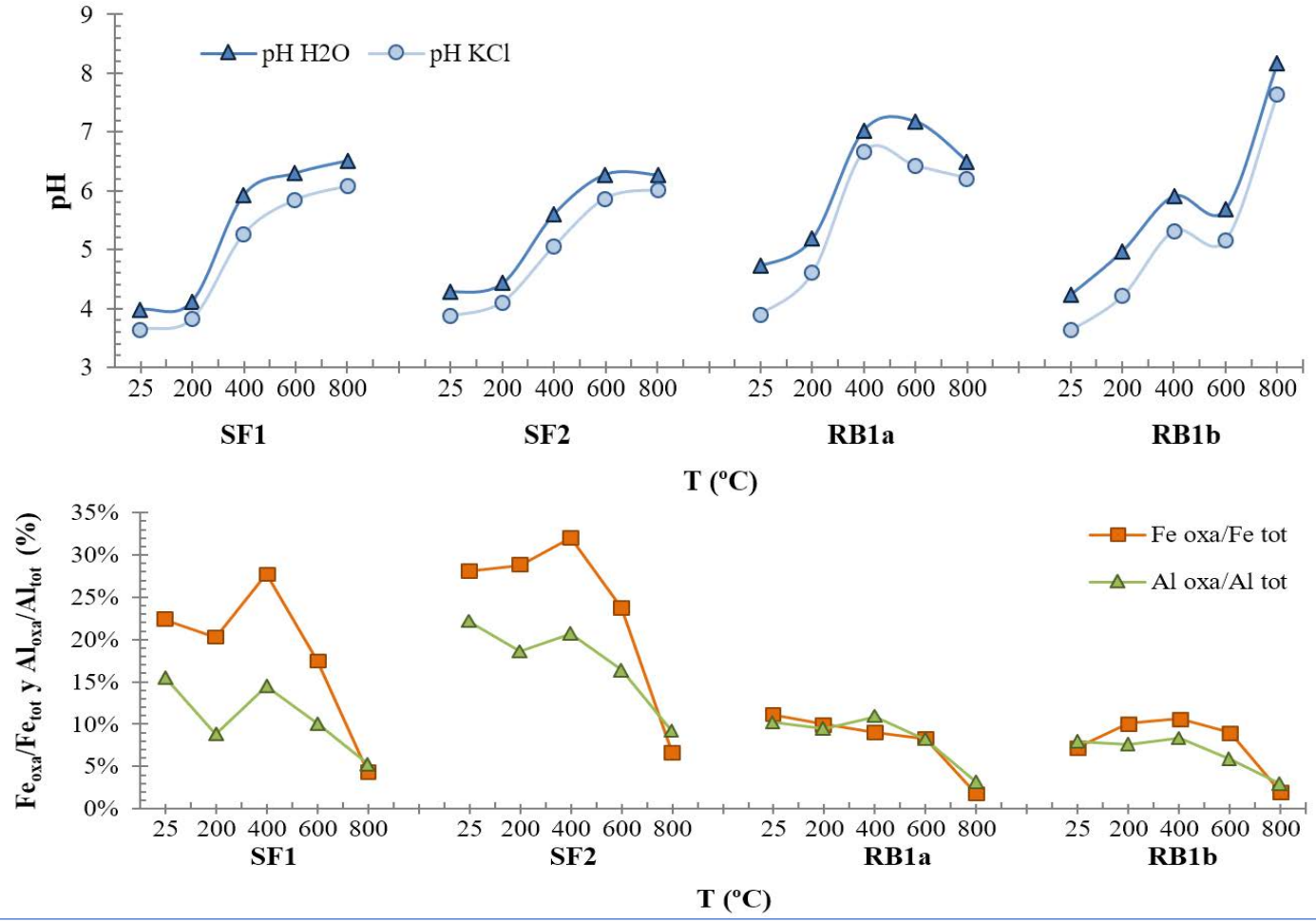
Wildfire & Prescribed fire – Lab analysis

- ✓ **Chemical characterization (USC, ISEP):** pH, EC, C & C_{org}, N, P-total & P-Olsen, CEC…
- ✓ **Intensity effects** (200 to 800ºC). Top soil (0-5 cm)



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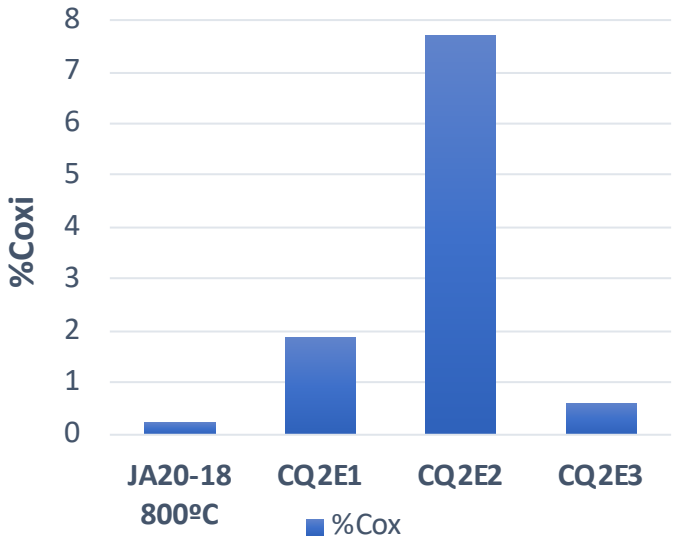
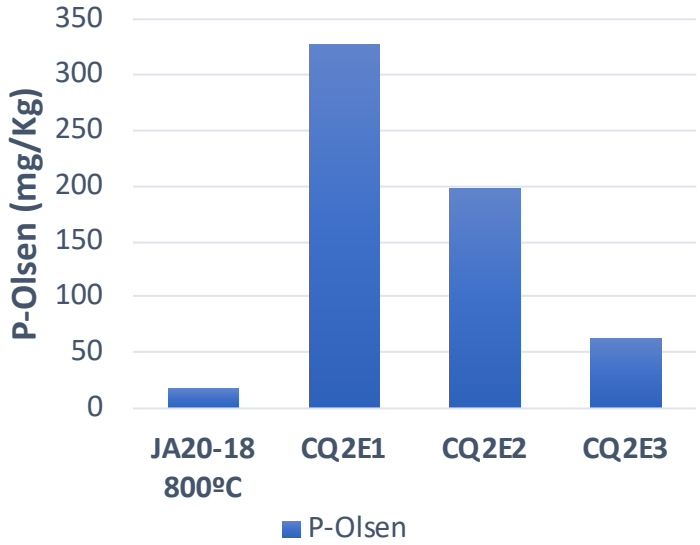
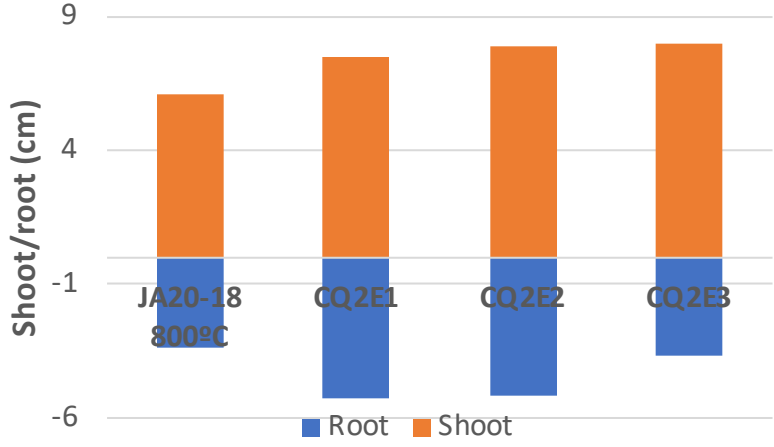
Wildfire & Prescribed fire – Lab analysis

- ✓ **Intensity effects** (200 to 800ºC). Top soil (0-5 cm)
- ✓ **Application of soil amendments:** technosol, compost, biochar







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Prescribed Fire

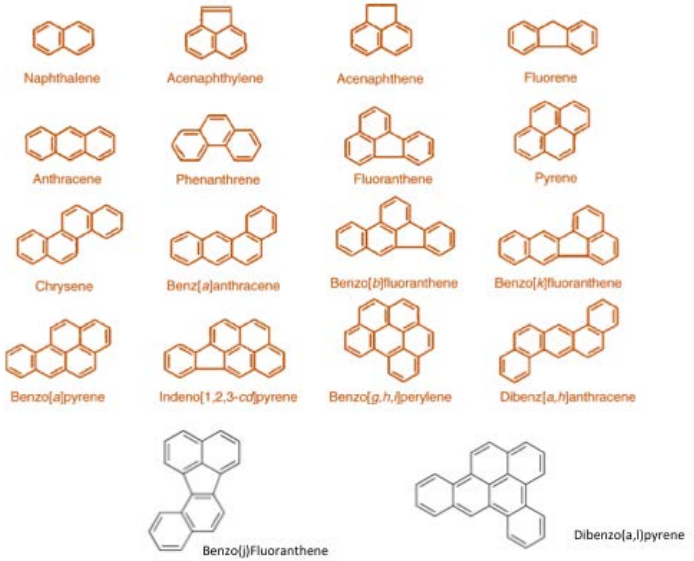
- ✓ **North West Portugal**: Aveleda (Bragança). **Prescribed fires, 2016 & 2021**
- ✓ Samples collected before the fire (January 2020 & January 2021)
- ✓ Samples collected immediately after the fire – March 2021
- ✓ **Chemical characterization, texture, PAHs, vegetation biomass, UAV**
- ✓ **Application of Technosol – July 2021**

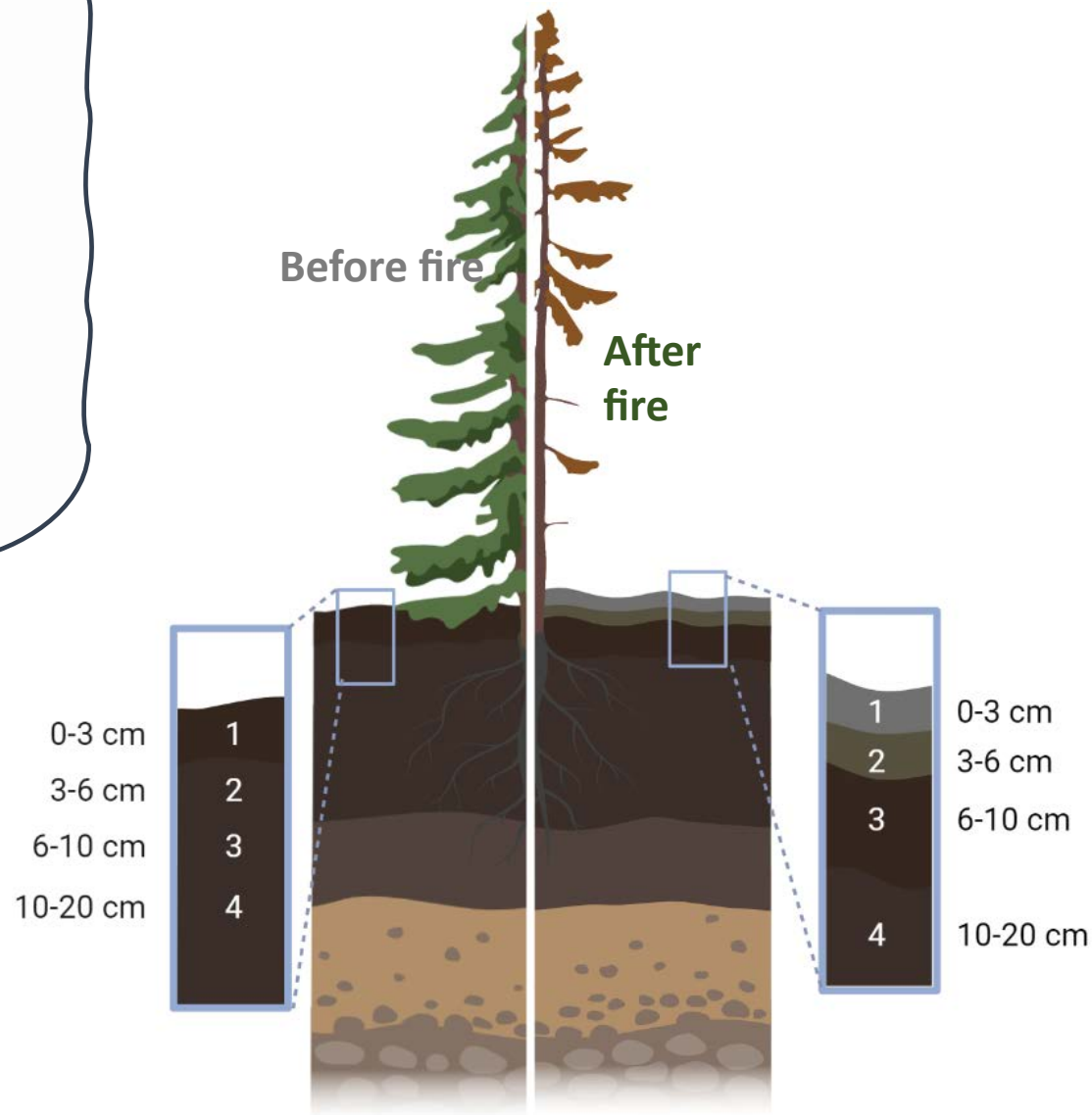
✓ **Forest fires impact on the presence and levels of Polycyclic Aromatic Hydrocarbons (PAHs)and its behaviour in soils**

- 17 PAHs (16 of which are considered as prioritary pollutants because they are more toxic, mutagenic, and carcinogenic), were analyzed in the 4 layers of the 11 plots under study.

Before the fire

- Only Fluoranthene (Fln) presented values above the quantification limit (LQ) in the 1st layer of plot 3 (0,006172 µg/g).





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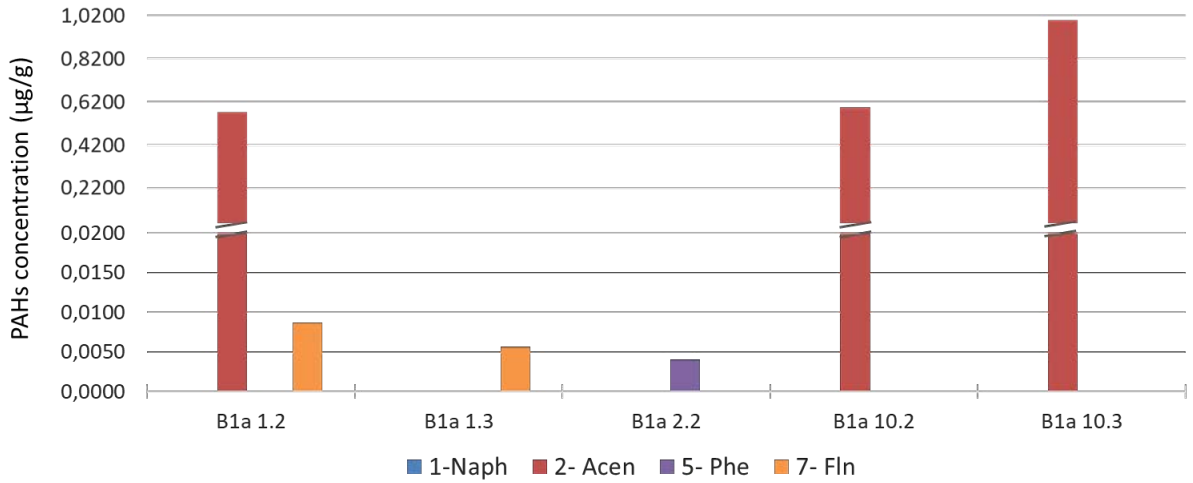
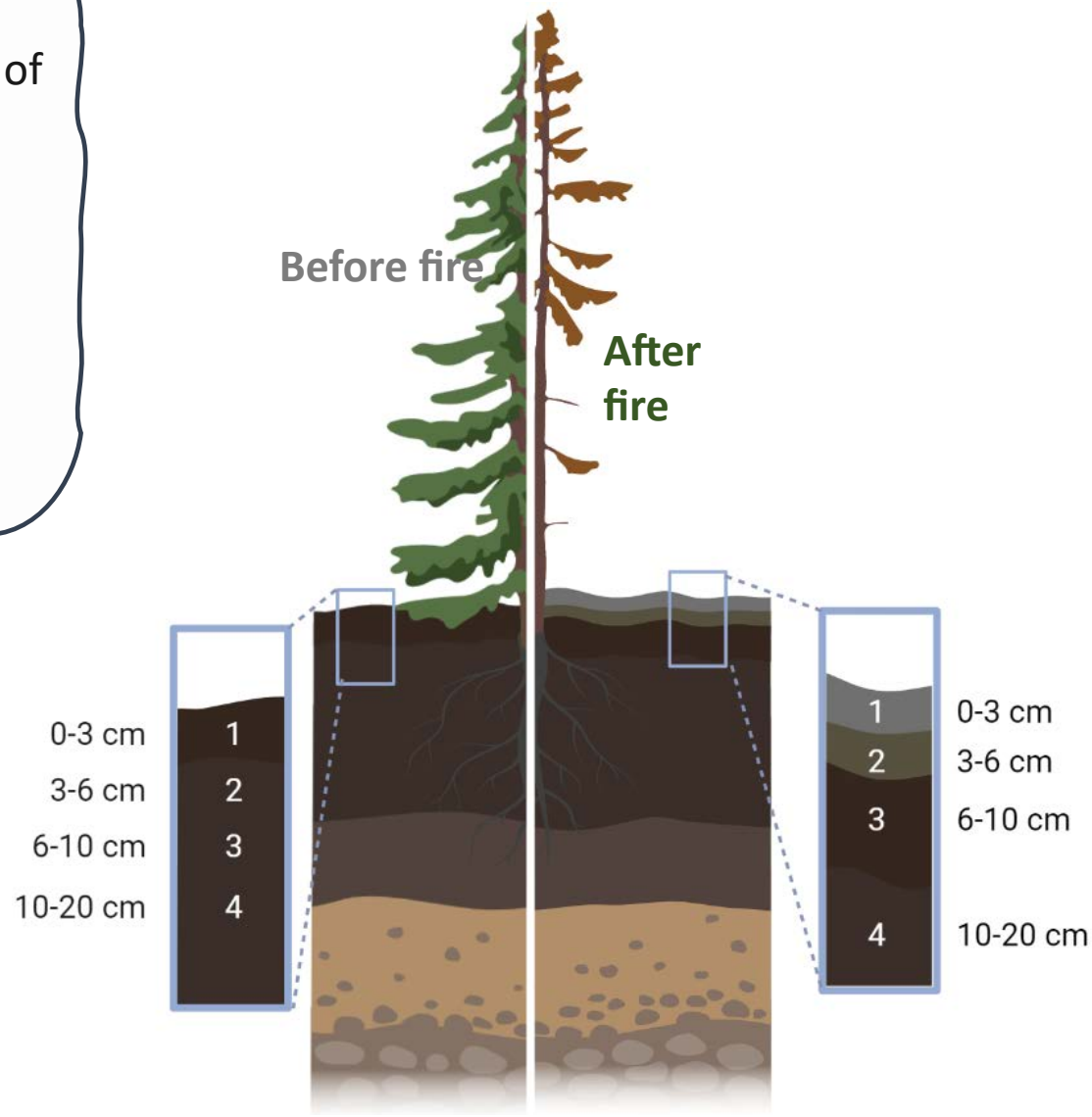
After the fire

- It was found that there was a release of PAHs after the occurrence of controlled fire.
- Acenaphthylene (Acen) is the PAH that appears in the highest concentration, followed by Naphthalene (Naph).
- The heaviest PAHs are the least detected.
- The highest values of HAPs are found on the surface.

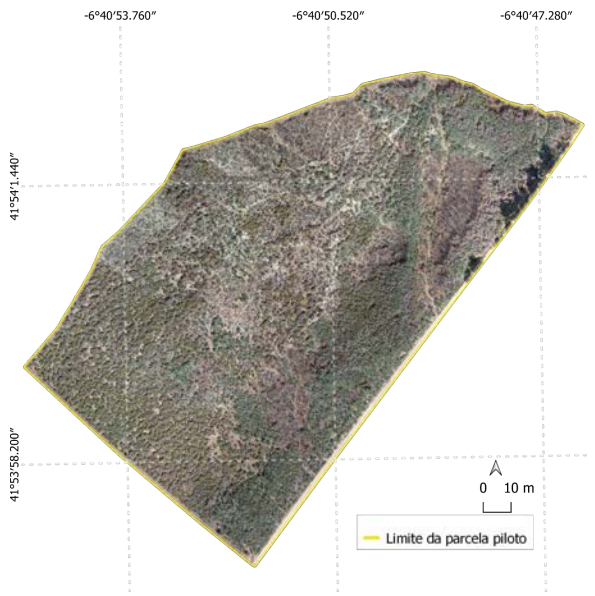


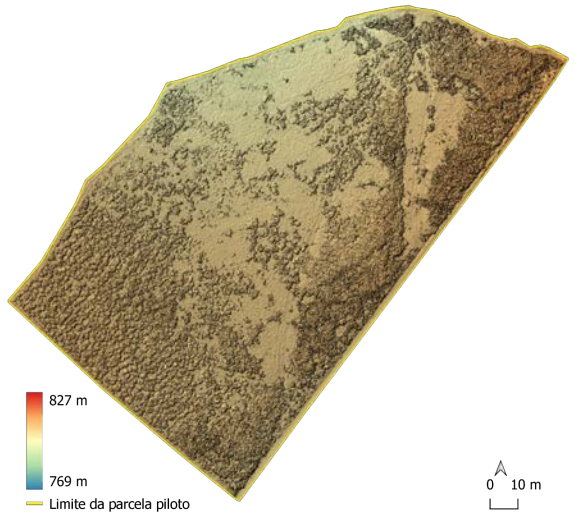


Prescribed fire – UAV

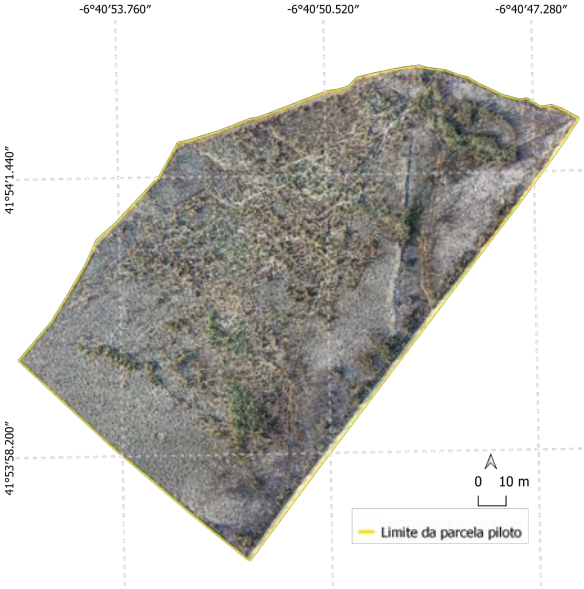
- Photogrammetric survey using Unmanned Aerial Vehicles (UAV) - Dji Phantom 4RTK
- Biomass Volume
- Geochemical Maps

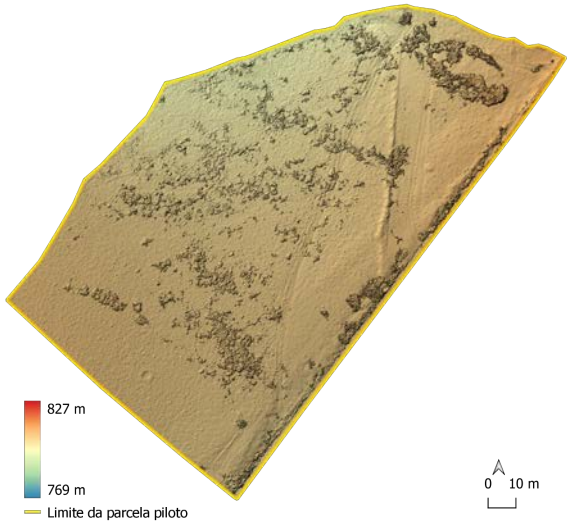
Before the prescribed fire





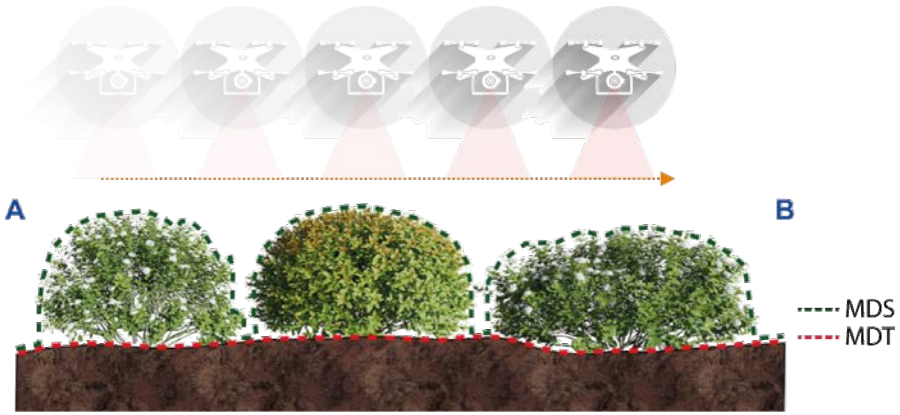
After the prescribed fire

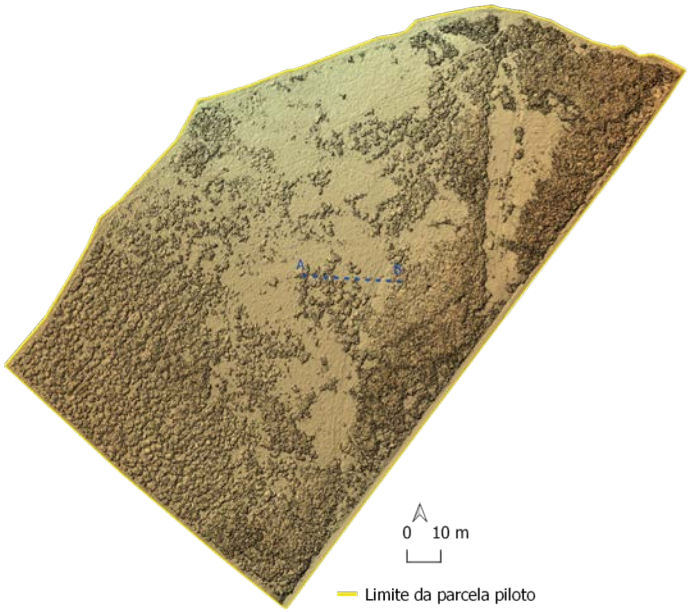




UAV – Biomass evolution

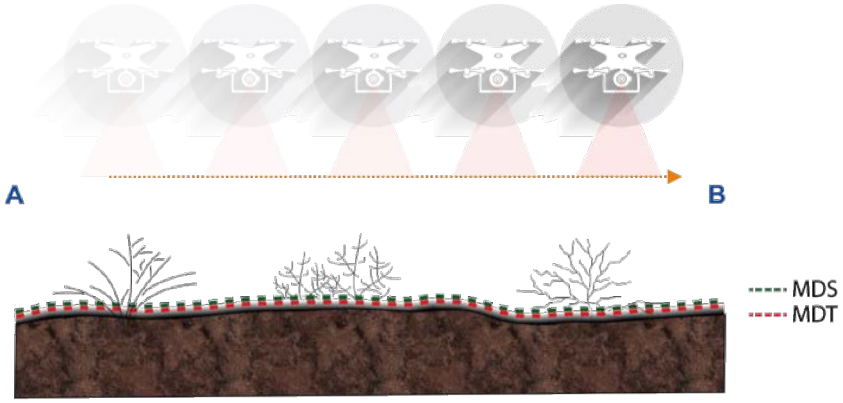
Before the prescribed fire

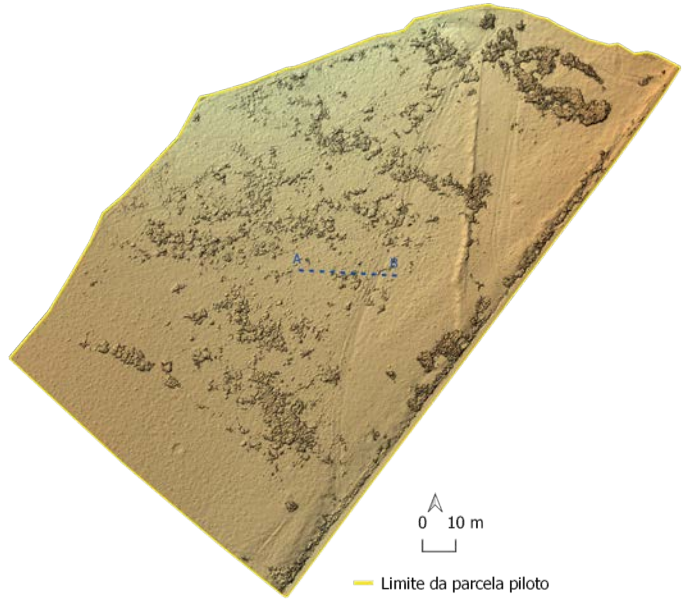




Prescribed fire - ICNF

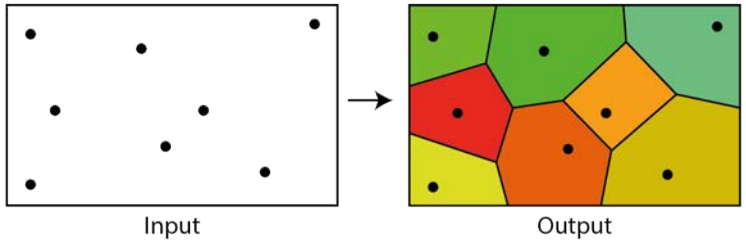
After the prescribed fire

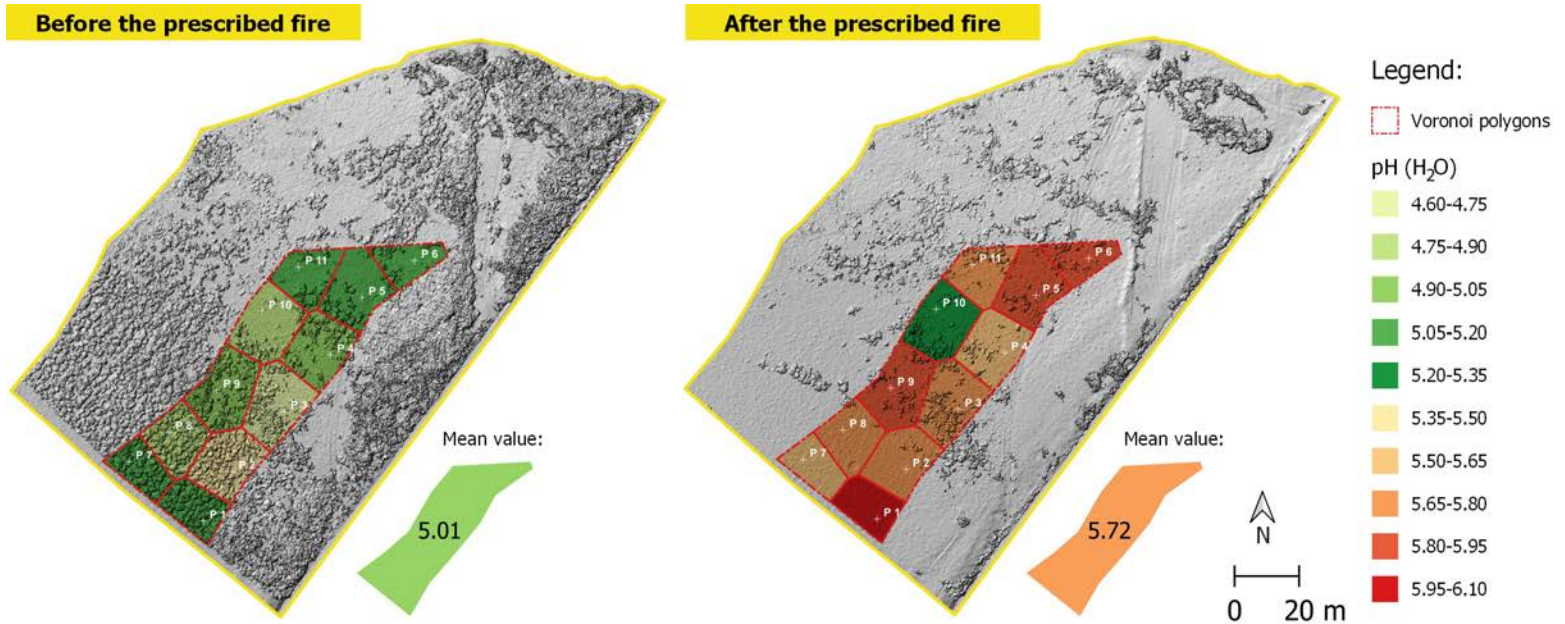


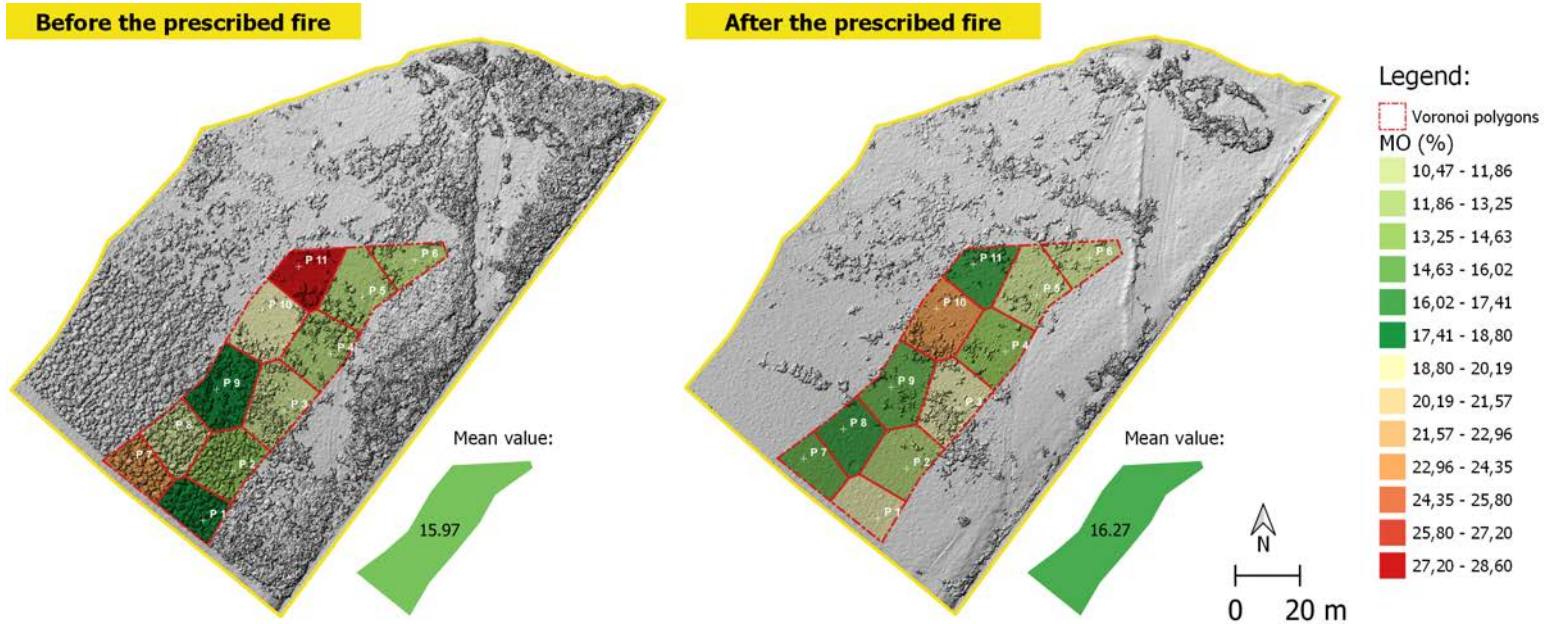


UAV – Geochemical Maps

- Geochemical maps were created using the Voronoi Polygons method to determine the influence area of each sampling point.







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Prescribed fire – Technosol Application

- ✓ **Application of soil amendment – Tailored technosol** (June 2021)
- ✓ 30-40 m^3 technosol, 500 m^2 plot, surface application (5-10 cm)
- ✓ Pre- and post-application UAV (1 flight/month)
- ✓ Chemical characterization (OC, nutrient content, texture, vegetation biomass…)

Summary

Objective TERRAMATER - Recovery of the environmental and productive functions of burnt areas (Galicia and North of Portugal); reducing soil losses due to erosion and **increasing soil resilience** to new episodes of wildfire

Actions TERRAMATER - Evaluate the **post-fire ecological conditions** and the biogeochemical processes associated to soil remediation. Application of **technosol as soil amendment to improve soil quality** and soil protection against wildfires

Results TERRAMATER – Study areas of soils affected by **wildfires or prescribed fires** (in Galicia and North Portugal). **Chemical characterization**, erosion plots, **biomass evaluation, geochemical maps**, PAHs

0701_TERRAMATER_1_E – Medidas Inovadoras de Recuperação Preventiva em Áreas de Queimadas, co-financed by the European Regional Development Fund (FEDER) through the Interreg V-A Spain-Portugal program (POCTEC) 2014-2020.