Forest fires impact on the presence and levels of Polycyclic Aromatic Hydrocarbons and its behavior in soils

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INVESTIGATION

CIGRAC

International Conference on Contaminated Land Management and Rehabilitation

May 11th to 14th, 2021
Lisbon

TERRAMATER Project

Recovery of the environmental and productive functions of the burnt areas, reducing soil losses due to erosion and increasing its resilience to new episodes of fire.

The improvement of ecological conditions in the recovered areas also aims to reduce the threat of contaminations in the neighboring forest masses.

This will be achieved by remedying the soil in burnt areas by applying corrective amendments prepared “a la carte”; that is, according to the in-depth and local knowledge of post-fire ecological conditions and biogeochemical processes associated with the recovery and improvement of the quality of the affected soils

MAIN OBJECTIVES

TERRAMATER Project

EXPECTED RESULTS:

Creation of an early warning system

Design of procedures for the definition of critical fire risk areas, based on a network of sensors and the development of drying curves (soil and vegetation)

Application of soil amendments, previously formulated and tested, will lead to an increase in organic matter, promoting the protection and improvement of soil quality, which will result in an opportunity for ecological restoration of burnt areas and a consequent reduction in gas emissions with greenhouse effect.

It is hoped that the manuals produced during the project will serve, both in Portugal and in Spain, as a common basis for normative documentation in the field of cross-border cooperation on the issue of forest fires.

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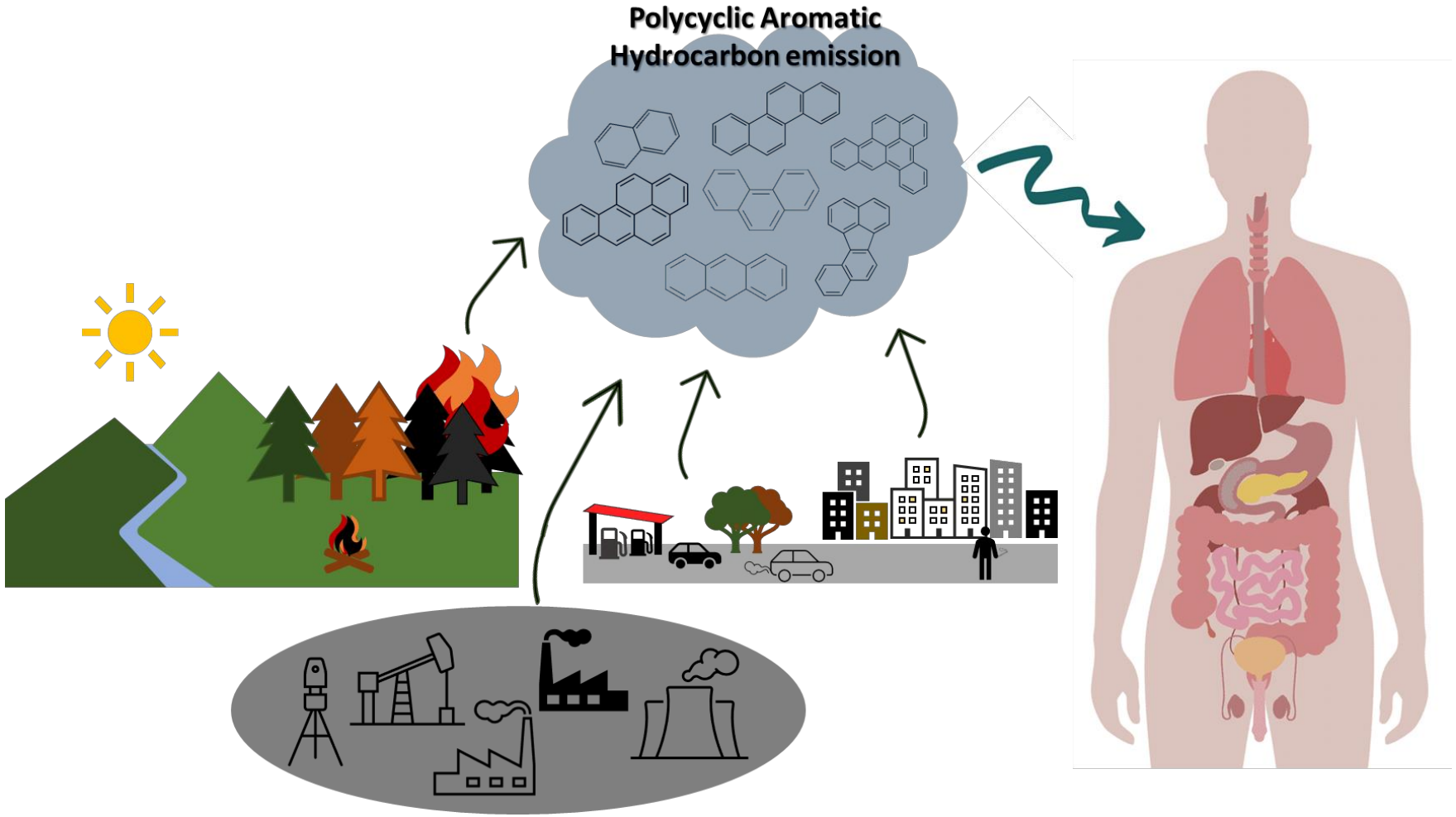
Introduction



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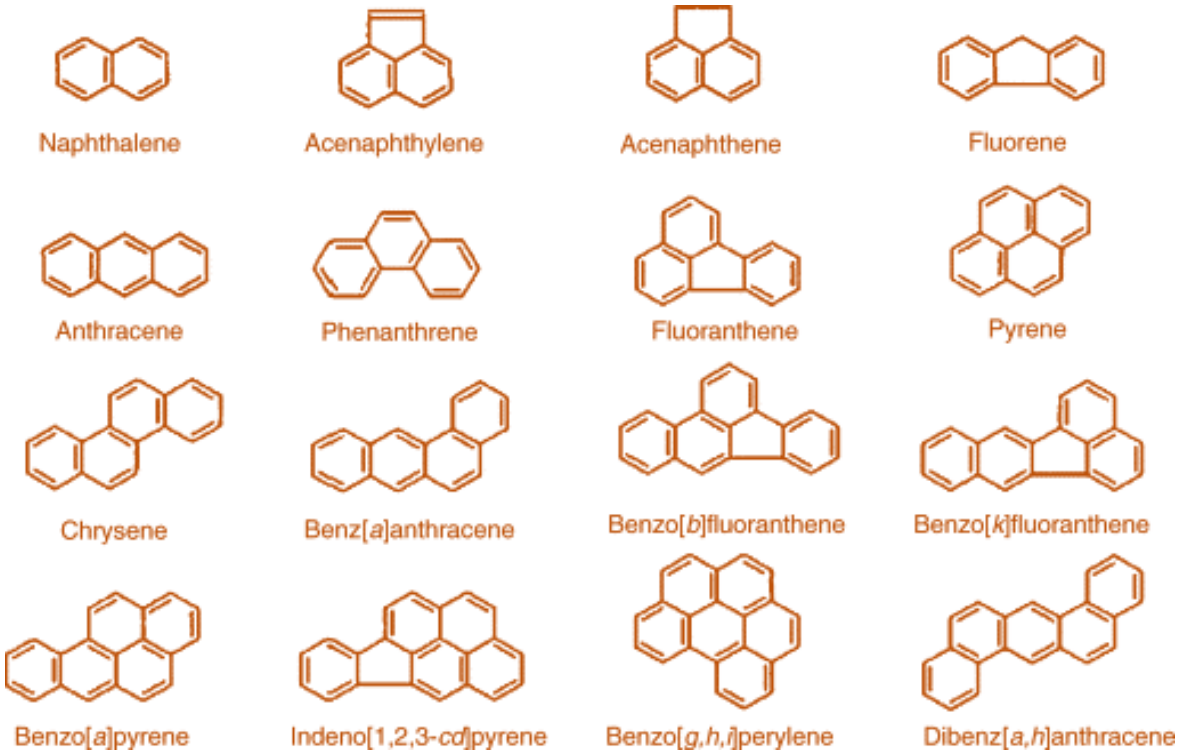
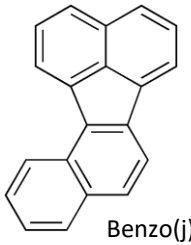
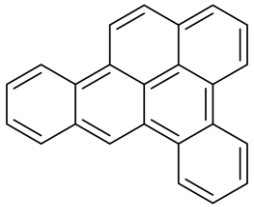
Objectives

- Determination of the levels of eighteen PAHs, including the 16 - EPA priority congeners and Dibenzo(a,l)pyrene (DB(a,l)P) and Benzo(j)Fluoranthenein topsoil collected in two fire-prone forest areas, and some background areas located in Portugal and Spain.
- The relationship between the occurrence of fires and the concentration of PAH were studied, as well as the transport of these compounds to surrounding areas.





Benzo(j)Fluoranthene



Dibenzo(a,l)pyrene

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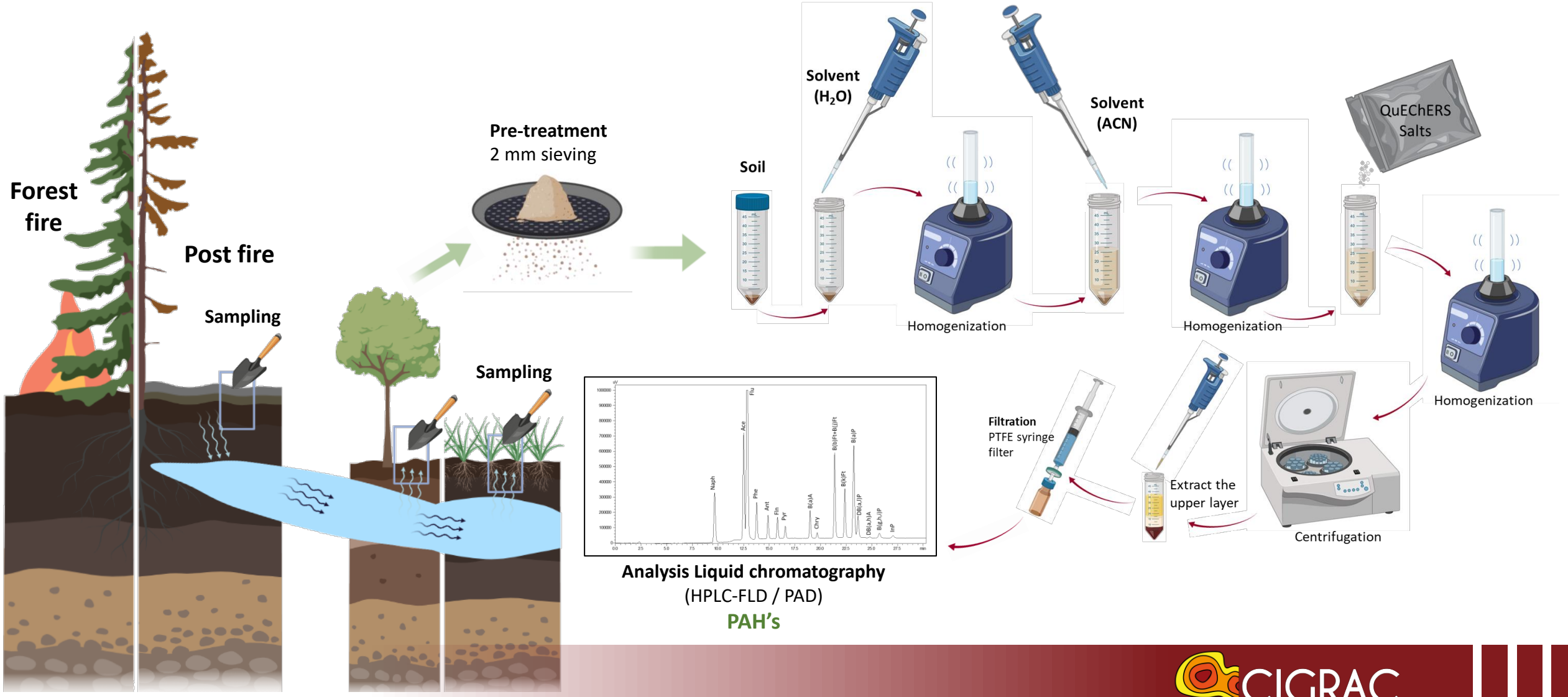
Method



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Sampling

Forgoselo Mountain

Sampling point	Fire Intensity	Observations
Soil 1		
Soil 2		
Soil 3		Water from burned areas accumulates here
Soil 4		Pasture area.
Soil 5		Receive some ashes from nearby burned bushes
Soil 6		Eucalyptus Forest. Burned and replanted this year.
Soil 7		

Portela do Homem

Sampling point	Fire Intensity	Observations
Soil 8		
Soil 9		Low fire risk zone
Soil 10		
Soil 11		Low fire risk zone

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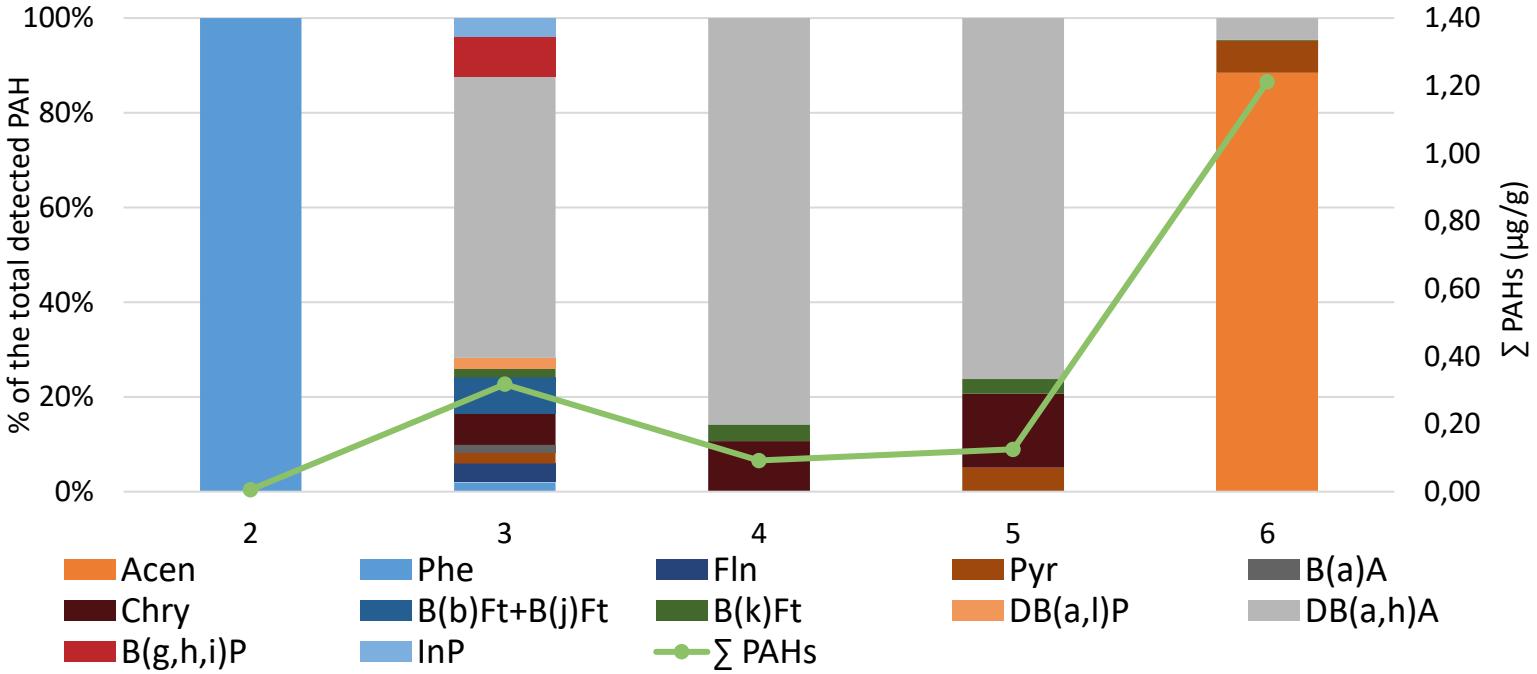
Results

Forgoselo Mountain



Sampling point	Fire Intensity	Observations
Soil 1		
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Soil 3		Water from burned areas accumulates here
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Soil 7		

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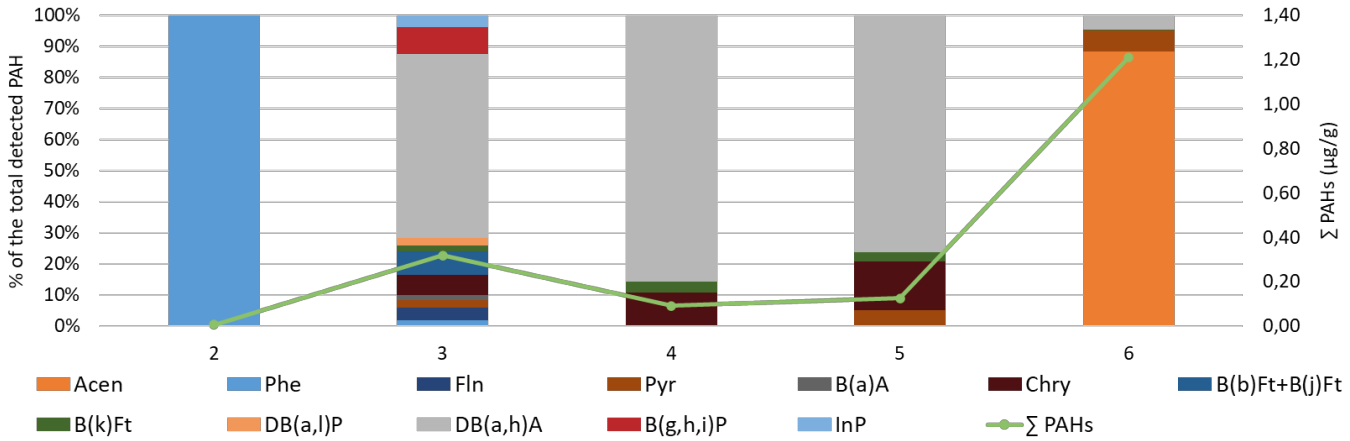
Results

FORGOSELO MOUNTAIN



- The most found compounds appear to be of higher molecular weight, which are the most lipophilic and those who are degraded with more difficulty.
- Soil 3 has the highest number of different PAH probably because it is in an area formed in a small depression where there is an upwelling of the small groundwater channel and receives water from adjacent burned areas (burned 2-3 years ago).
- Soil 6, which was the one that burned the most intensely, has the highest total PAH concentration value, due mainly to the presence of acenaphthene (Acen).

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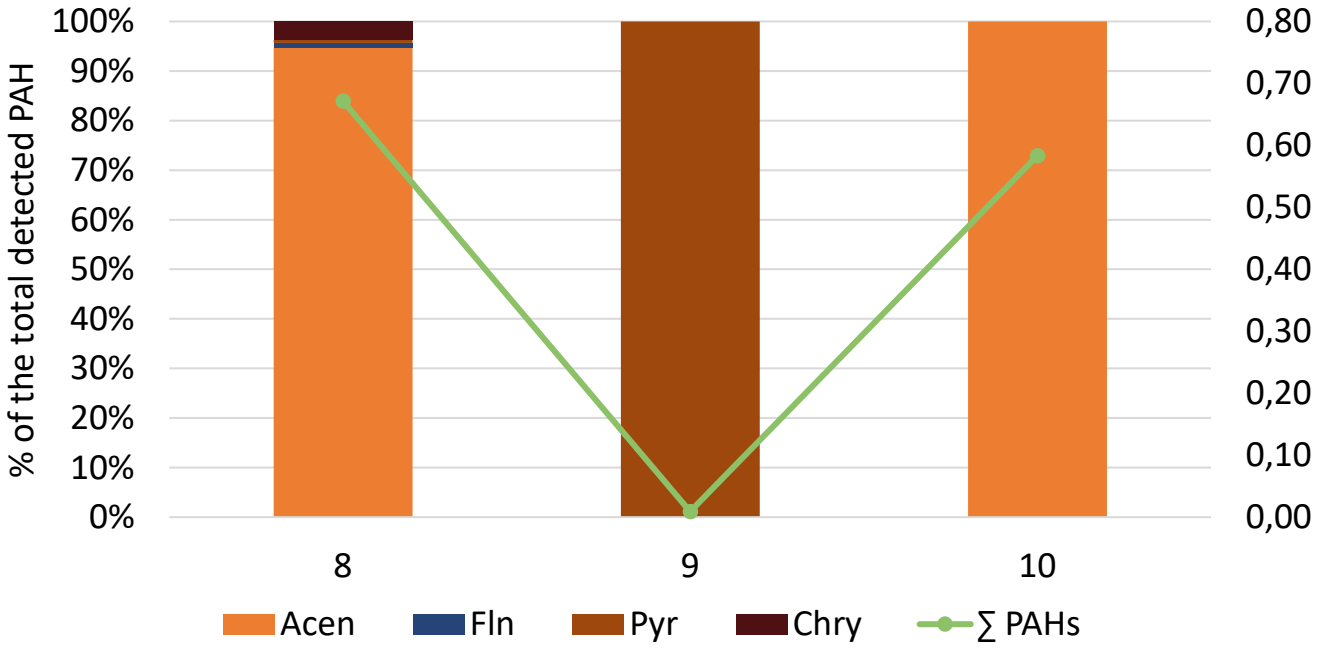
Results

PORTELA DO HOMEM



Sampling point	Fire Intensity	Observations
Soil 8	🔥🔥🔥	
Soil 9	🚫🔥	Low fire risk zone
Soil 10	🔥🔥🔥	
Soil 11	🚫🔥	Low fire risk zone

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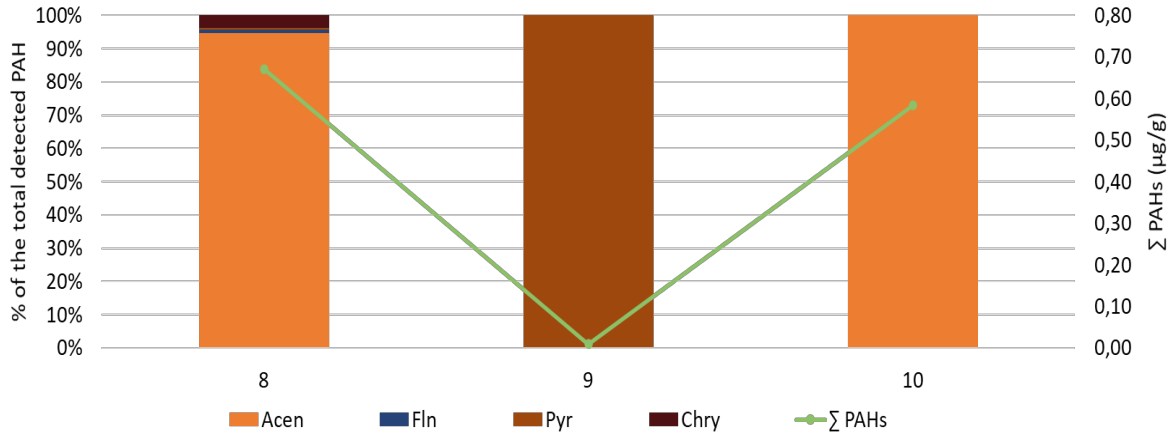
Results

PORTELA DO HOMEM



- Soil 8 and soil 10 are the ones with the highest PAH concentration values, with acenaphthene (Acen) being the compound that most contributes to this value.
- High molecular weight compounds are generally not detected in these soils.

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Conclusions

- Soil 3, that presented the highest number of different PAH, was taken from an area that, despite not having suffered fires, receives water from areas burnt 2 or 3 years ago. The results suggest that fire releases PAHs and that these substances move easily into the environment.
- The concentration of PAHs in soils that suffered combustion (soil 6, 8 and 10) is higher than the concentration of PAHs in soils that have not suffered combustion reaching, in the worst case, a total PAH content of about 1,28 µg/g in Forgoselo Mountain.
- The impact that these substances have on the soil is still relatively unknown compared to studies related to impact on water or air. Further research on this subject is therefore of utmost importance, especially considering about the possibility of transfer directly to food products or the possibility of PAHs becoming even more toxic products.

ACKNOWLEDGEMENTS

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