



Effects of wildfire on mercury mobilisation

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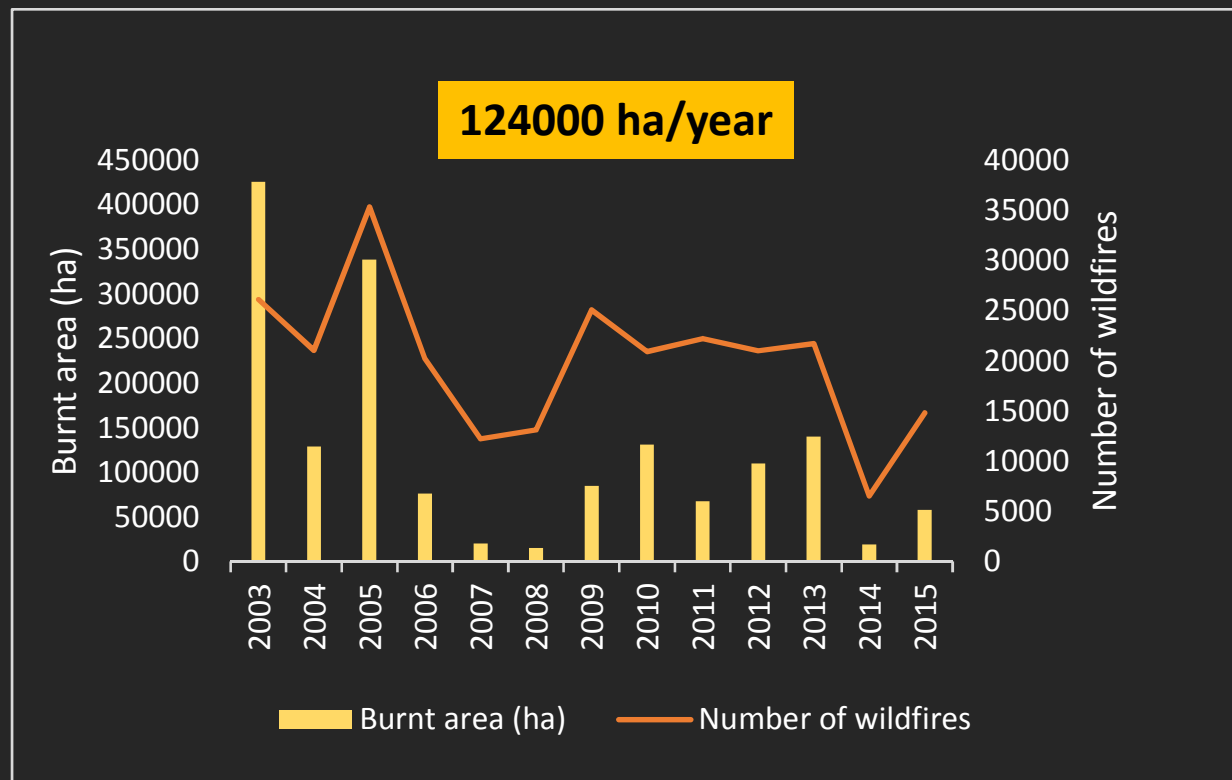
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Impacts of Wildfires:

- Forest fires are particularly problematic in Portugal:

Occurring with high frequency

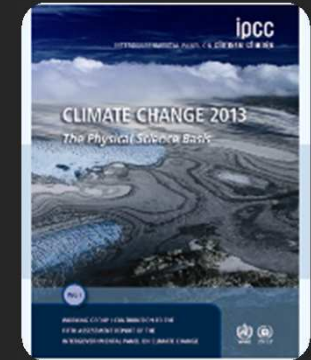
Affecting large areas



Impacts of Wildfires:



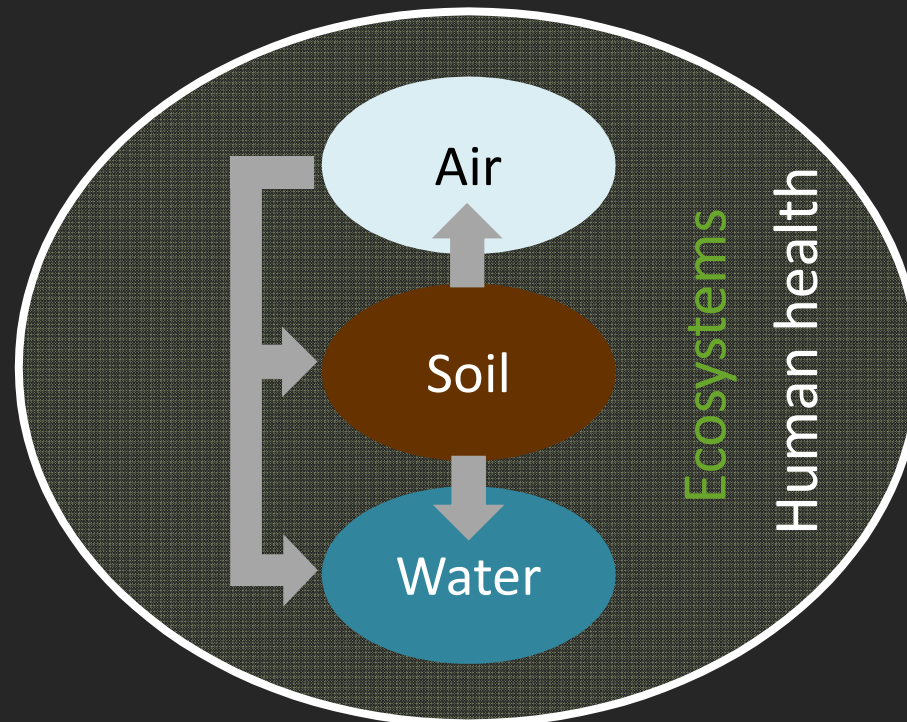
According the Intergovernmental Panel on Climate Change, future scenarios for Southern Europe point towards a **worsening of the present-day situation**, with conditions becoming warmer, drier and, thus, more propitious to forest fires.



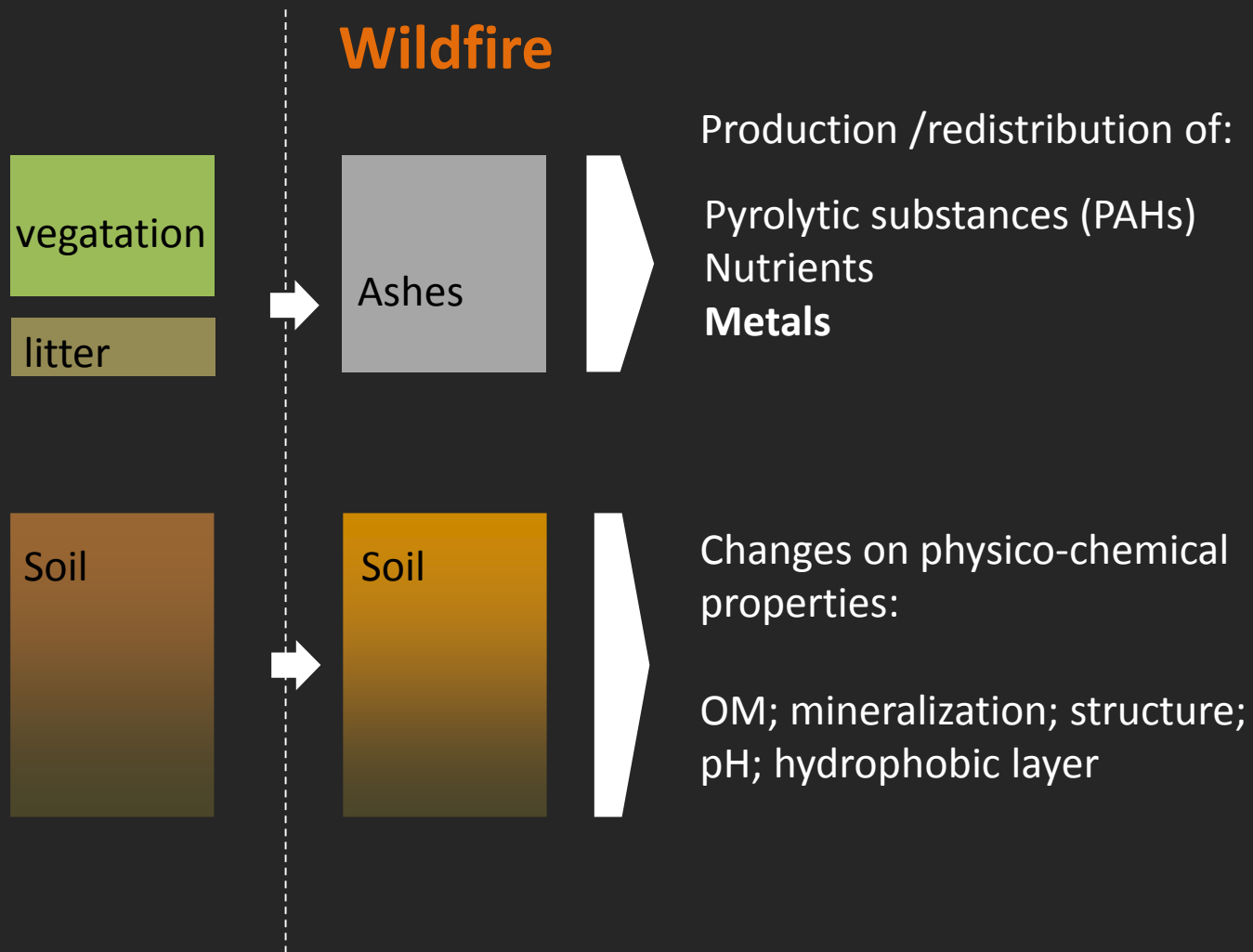
Impacts of Wildfires:

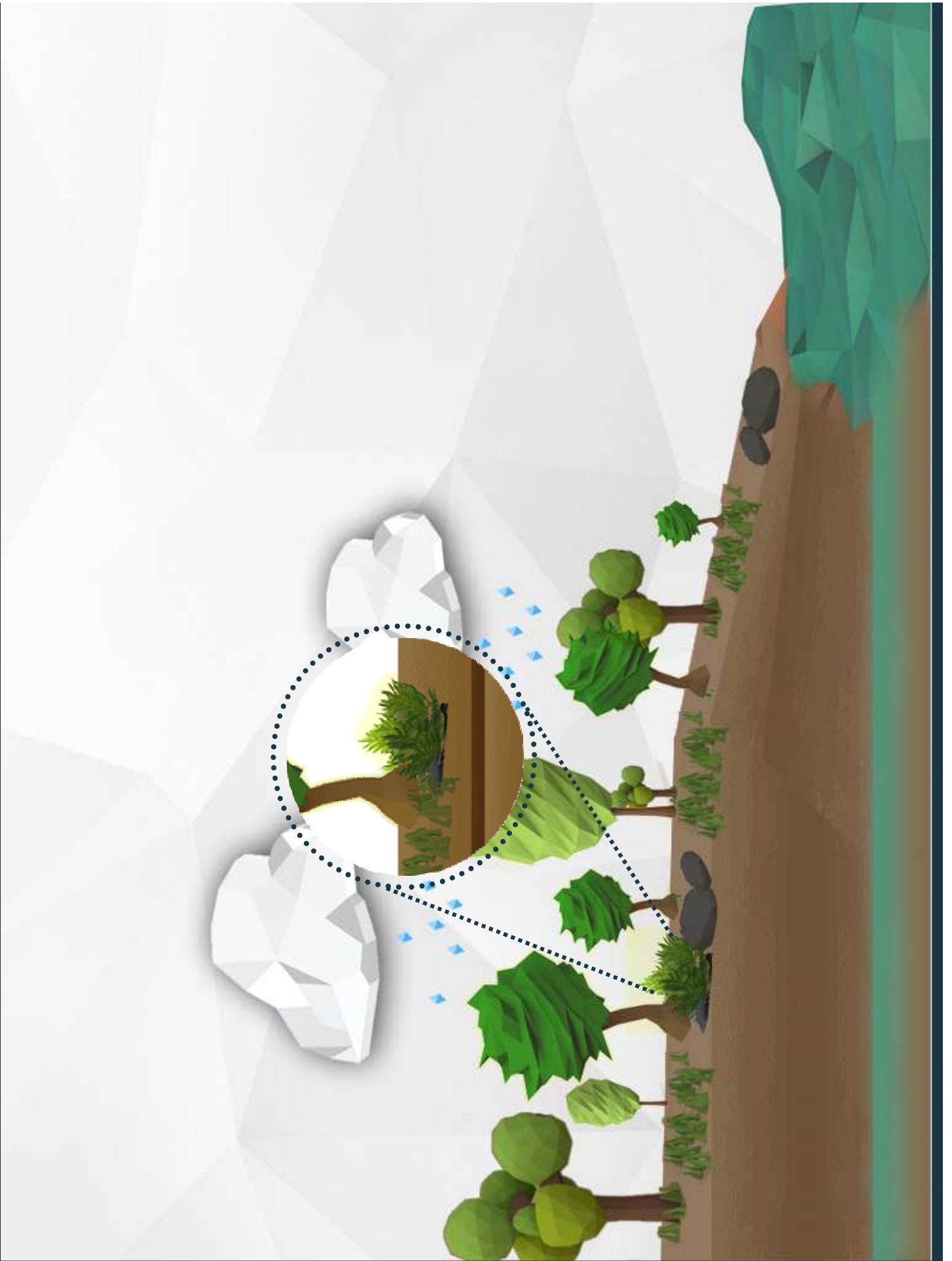
- Important environmental problem

adverse and diversified effects on different compartments (soil, air, surface and groundwater) and their dependent ecosystems



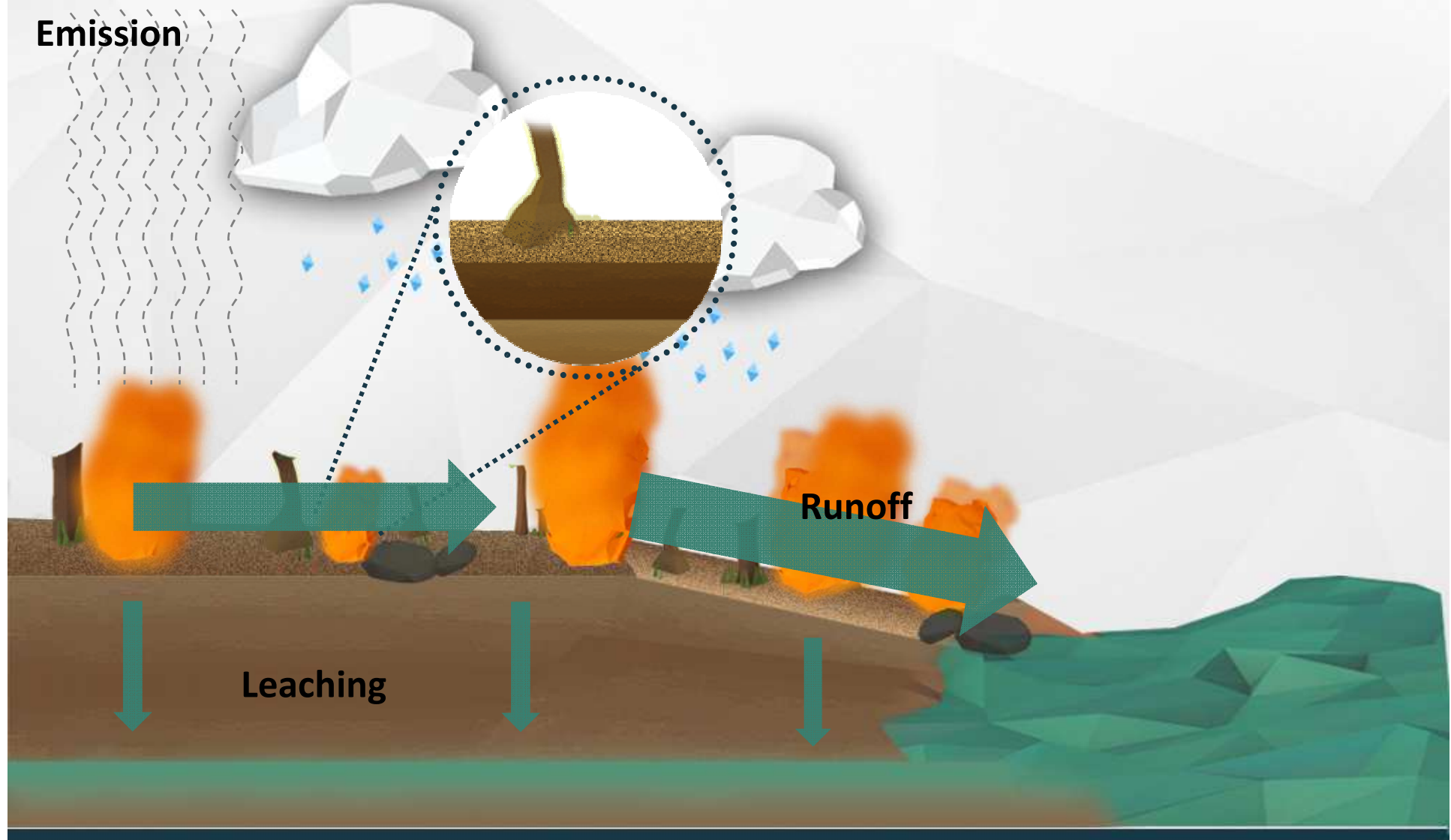
Impacts of Wildfires:





Wildfires:

Diffuse source of contamination to air, soil and water



Metals

V, Cr, Mn, Co, Ni, Cu, Zn, As, Mo, Cd, Hg, Pb

Directive 2008/105/EC 2008- Priority substances directive

USEPA- Priority pollutants



Risk to:

- ecosystems
- human health

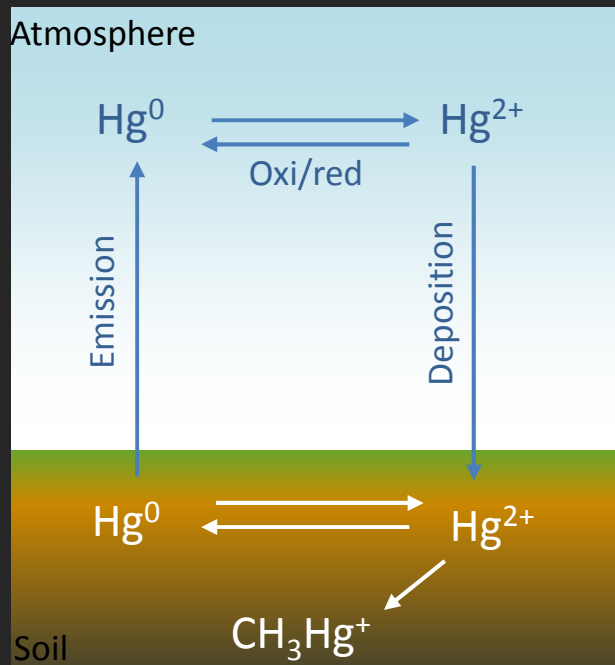
Hg



High volatile
High toxic > bioaccumulation>biomagnification



Mercury is a naturally occurring element that is found in air, water and soil:



Mercury is considered by WHO
as one of the **top ten**
chemicals or groups of
chemicals of major public
health concern.

Current gaps:

Few studies have reported the wildfire effects on the Hg cycle, particularly in what concerns the terrestrial compartment.

Main aim:

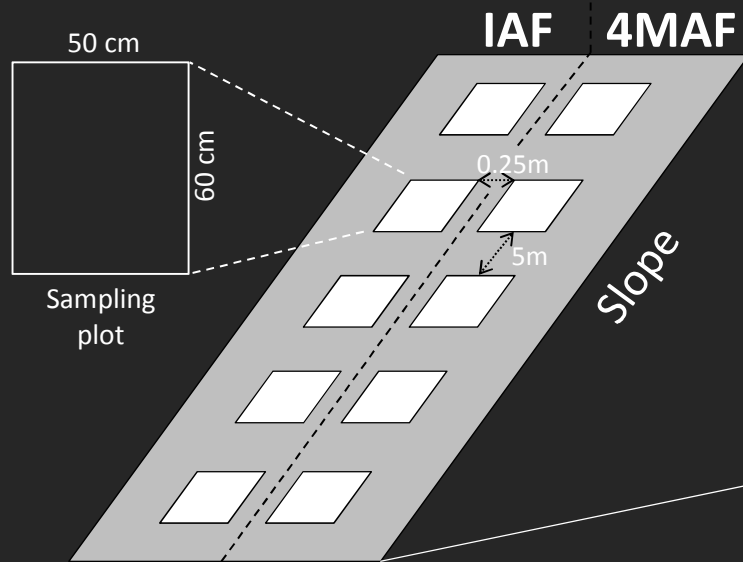
Clarify the impacts of wildfire on mercury redistribution in soils and ashes

Levels of Hg in two forest plantations

Impact of post fire rainfall on Hg mobilization and losses

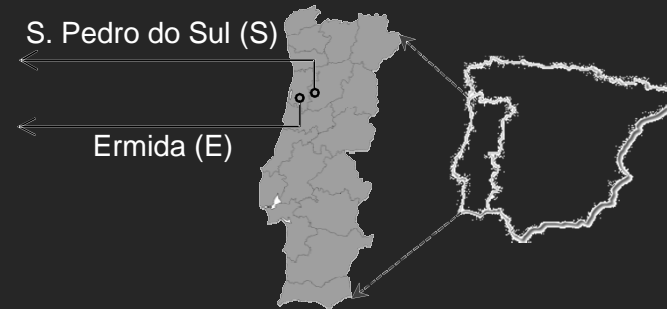
Effects of fire severity

Material and methods:



FIRECNUTS

PTDC/AGR-CFL/104559/2008



Summer 2010

Fire severity:

Ermida: moderate severity MS 🔥

S. Pedro do Sul: high severity HS 🔥

Soils and ashes were collected at:

- two sampling occasions: IAF and 4MAF (after rainfall events)
- 6 burnt hillslopes in Ermida [3 in eucalypt forest (E1, E2, E3) and 3 pine forest (P1, P2, P3)] and 1 non-burnt eucalypt forest (NBE).
- 4 burnt hillslopes in S. Pedro do Sul [1 eucalypt forest (E1) and 3 pine forest (P1, P2, P3)].

Material and Methods

- Soil
- Ash



Hg
levels



Pyrolysis atomic
absorption
spectrometry with
gold amalgamation



Results and discussion

Levels of Hg in
two forest
plantations



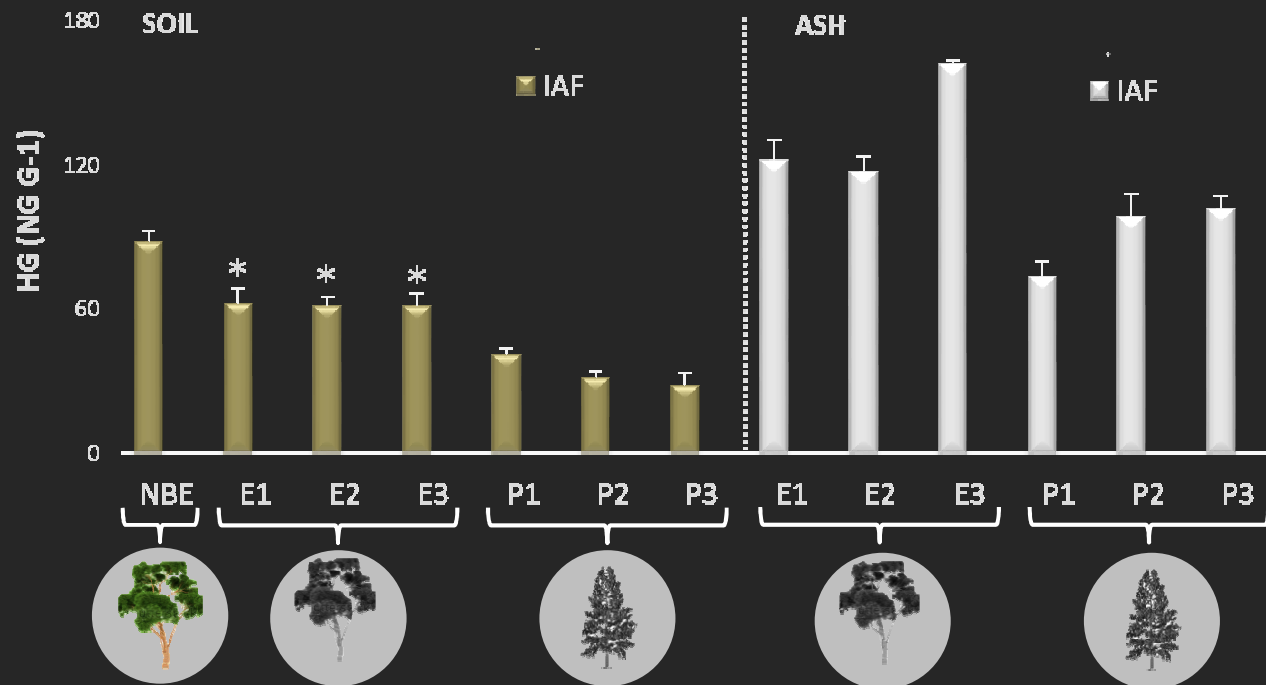
VS



Results and discussion

Levels of Hg in
two forest
plantations

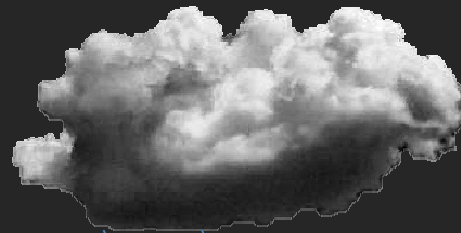
Mercury levels in eucalyptus (E) and pine (P) forest plantations



- Burnt sites (-30%) > Loss of 1 g Hg ha⁻¹ | **emission of Hg** Hg species volatilize at 100-300°
- Hg in ashes were twice the values found in soils
- Higher levels in soils and ashes from eucalypt | **Does eucalypt favour the Hg retention in soil/accumulate more Hg than pines?**

Results and discussion

Impact of post
fire rainfall on
Hg
mobilization
and losses

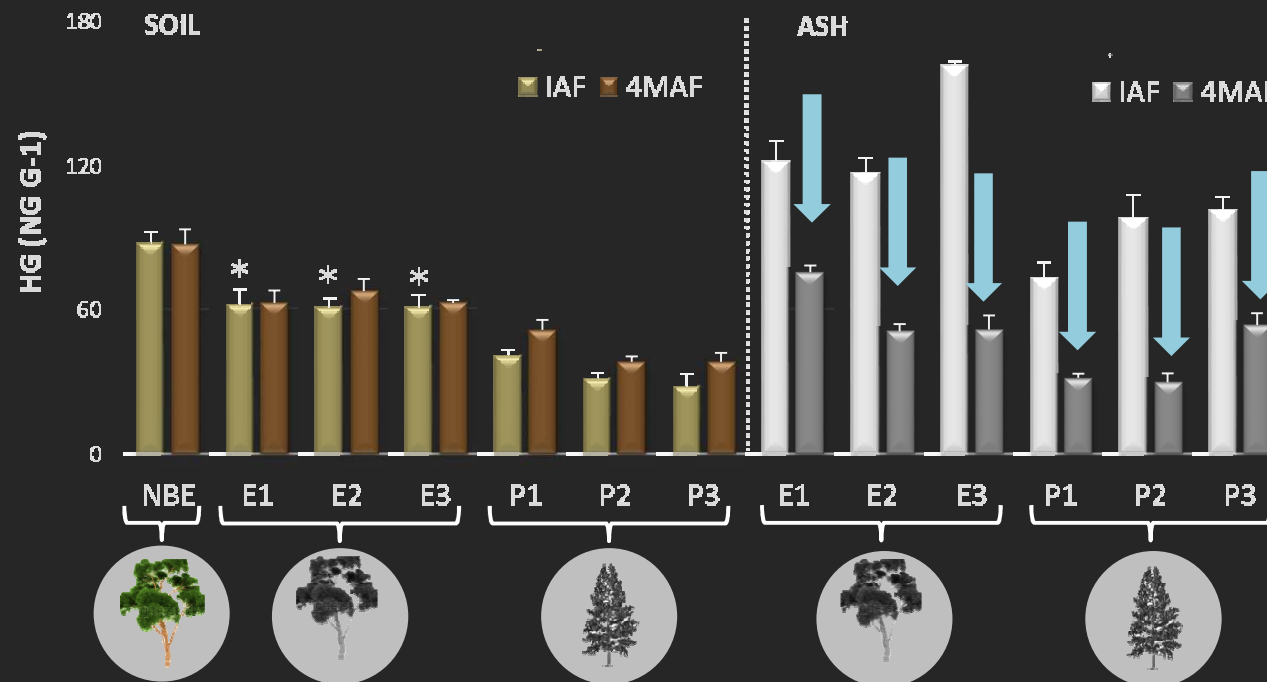


IAF ... 4MAF

Results and discussion

Impact of post
fire rainfall on Hg
mobilization and
losses

What happened after the first rainfall events?



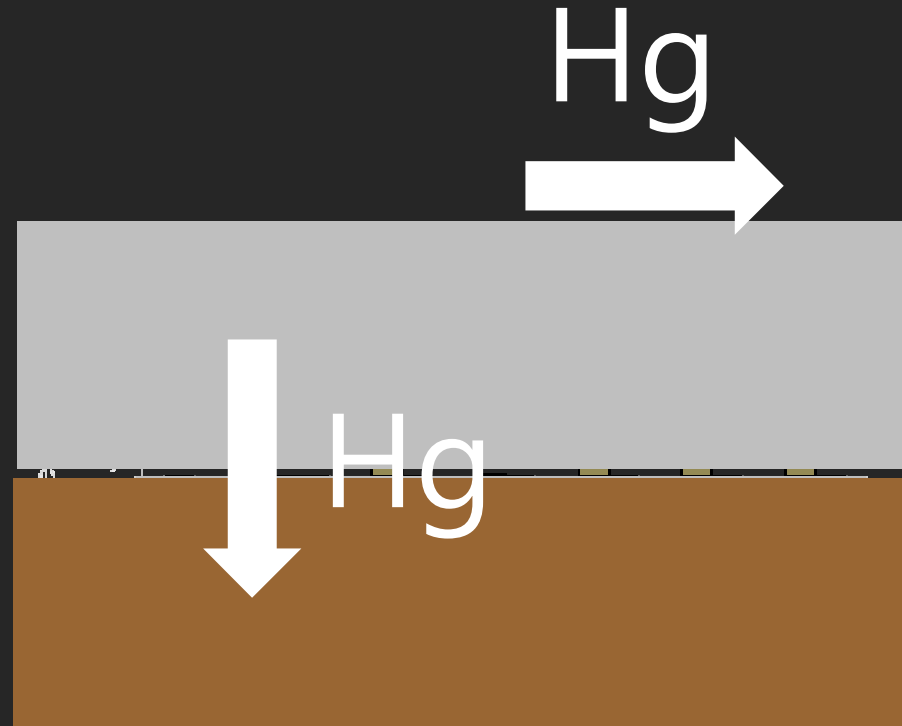
- Rainfall promoted Hg reduction in ashes (-30-60%) |

presumably runoff promoted the removal of particulate Hg or solubilised the forms attached to the organic matter in ashes

Results and discussion

Impact of post
fire rainfall on Hg
mobilization and
losses

Enrichment factors:

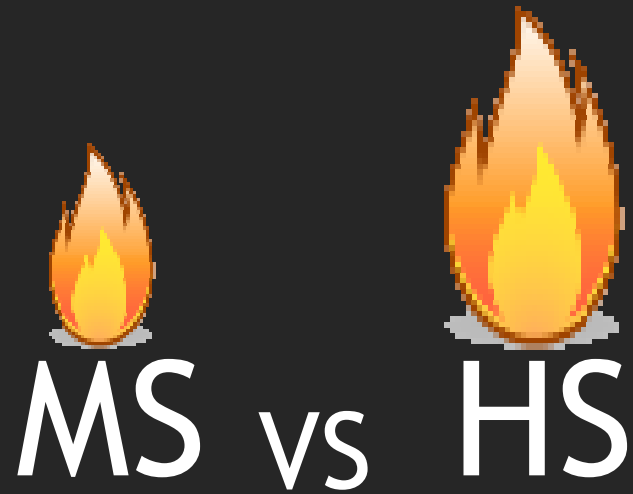


- Decrease of Hg in ashes (loss of 1.0 g Hg ha^{-1})
 - Increase of Hg in soils (gain of 0.5 g Hg ha^{-1})
- } Washout of ashes by runoff and leaching into underneath soils

0.5 g Hg ha^{-1} lost from ashes > what happened? **Lost by runoff?**

Results and discussion

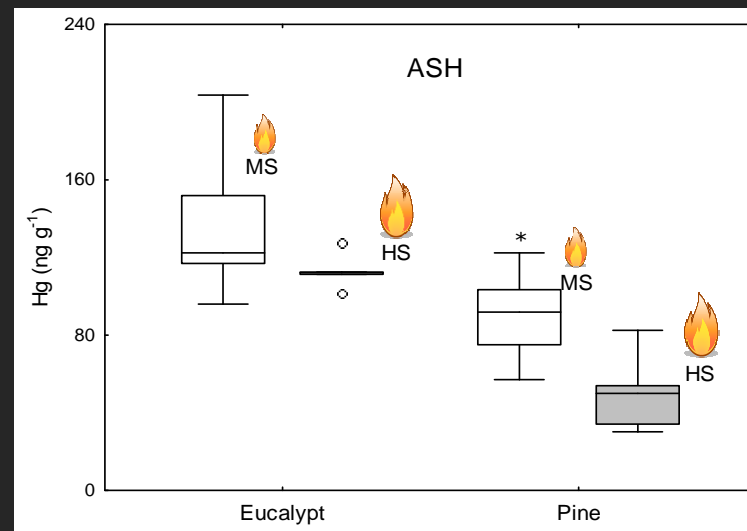
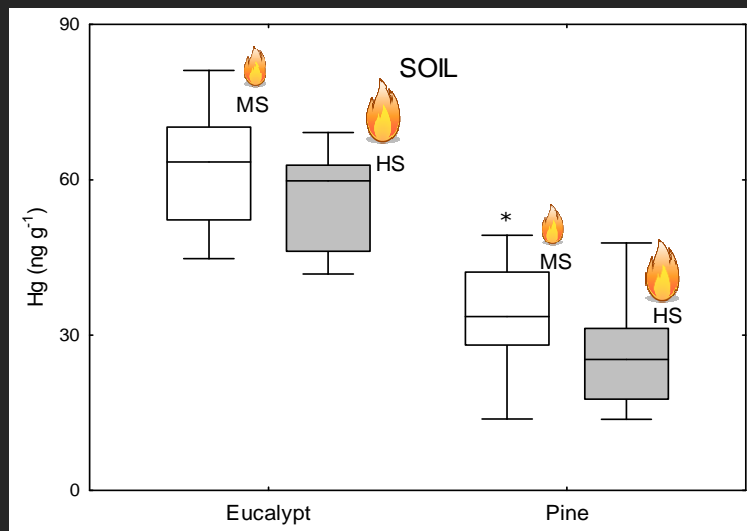
Effects of fire
severity



Results and discussion

Effects of fire
severity

Low severity vs High severity



Higher levels of Hg in soils and ashes from Ermida (moderate severity-MS) compared to S. Pedro do Sul (high severity-HS).

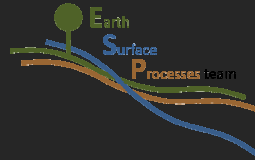
High fire severity was responsible for the lost of Hg from soils and ashes

Conclusions

- 30% of the Hg retained in eucalypt soils escaped during the wildfire, corresponding to a loss of 1.0-1.1 g Hg per hectare.
- Soils and ashes from eucalypt slopes were consistently enriched in Hg relatively to pine areas.
- The rainfall after the fire has a key role in the washed out of Hg from ashes deposited on the soil surface.
- Overall, this study brings a new insight on the importance of wildfire and subsequent rainfall in the mobilisation of Hg accumulated in the easily-erodible ashes, which poses a considerable contamination risk to downstream aquatic habitats, especially in eucalypt-dominated areas.

Acknowledgments

- To the ESP team



- To the project FIRECNUTS (PTDC/AGR-CFL/104559/2008)

- ..and to the institutions:



Thank
you for
your
attention



Impacts of Wildfires:

