Assessing and managing the risk of water quality contamination after wildfires

an example approach for Portugal

João Pedro NUNES, Joana PARENTE, Akli BENALI, Luis DIAS
joao.carvalhonunes@wur.nl

FRISCO
Managing fire-induced risks of water quality contamination

Sharing is encouraged

Project partners:

University of Lisbon

University of Aveiro

Águas de Portugal

Wageningen University

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Fires and water contamination

Fires often increase the risk of water supply contamination

Risks are difficult to manage:

- Limited knowledge of drivers
- Poor assessment of mitigation options
- Hard to transfer knowledge between climate regions

Today:

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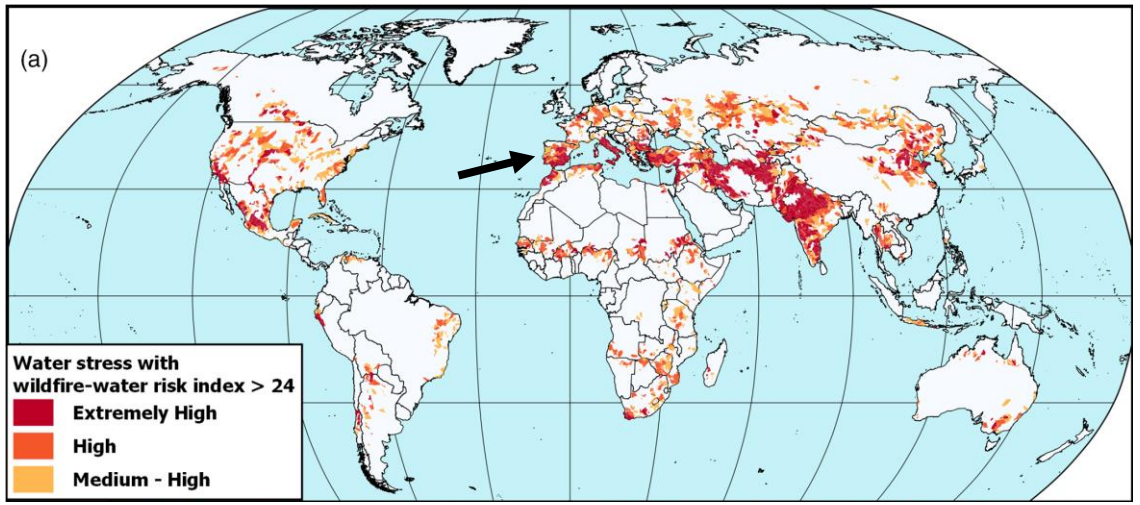
Managing fire-induced risks of water quality contamination

Scientists' warning on extreme wildfire risks to water supply

Robinne et al. (2021): https://doi.org/10.1002/hyp.14086



Assessing contamination risk

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Fire-prone watershed

Which tools are needed to assess and map post-fire water contamination risk?

Nunes et al. (2018): https://doi.org/10.1002/hyp.11434

Wildfire
- Cover reduction
- Changes to soil properties

Ash – contaminants
- Highly mobile
- Recovery: 2+ years

Mobilization
- Enhanced runoff and erosion
- Connectivity with streams

Water contamination
- Turbidity: ashes, fine sediments
- Toxic compounds: metals, O.M.
- Eutrophication induced by nutrients

Where is ash generated? | **Where is ash mobilized?** | **Which water bodies are at risk?**

JP Nunes et al.: risk of water quality contamination after wildfires (joao.carvalhonunes@wur.nl)

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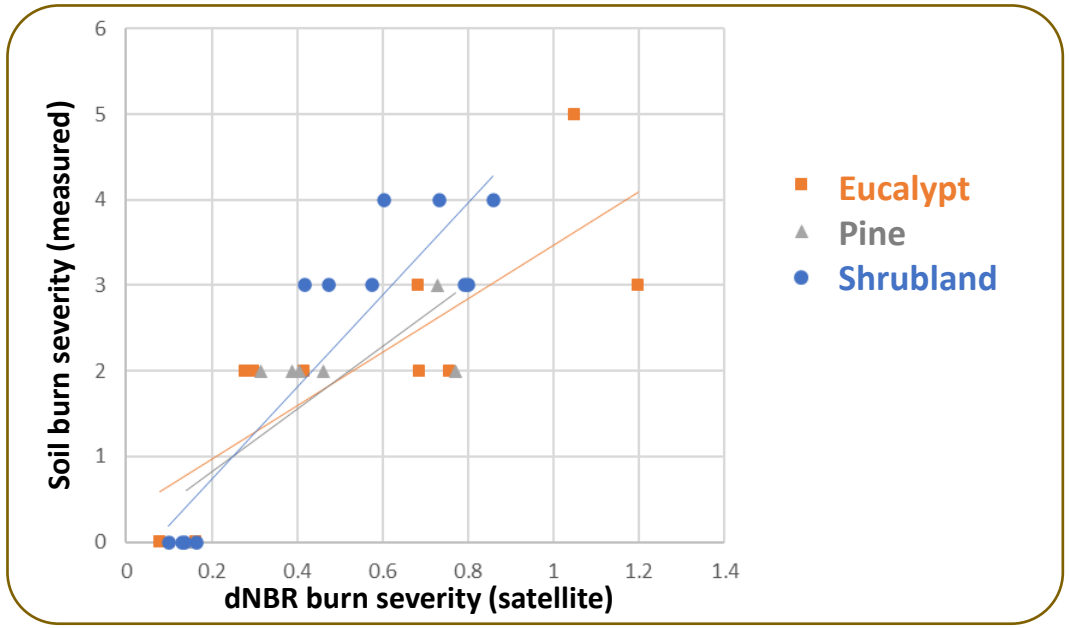
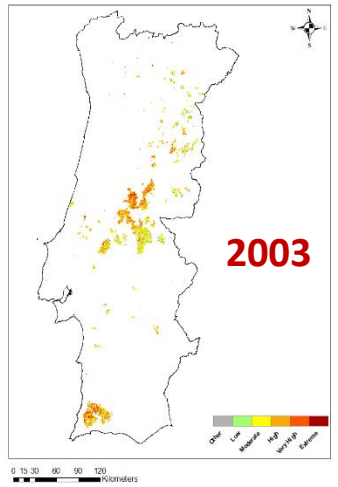
Where is ash generated?

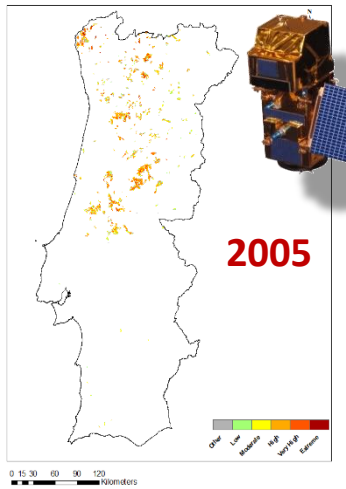
Map burn severity with remote sensing

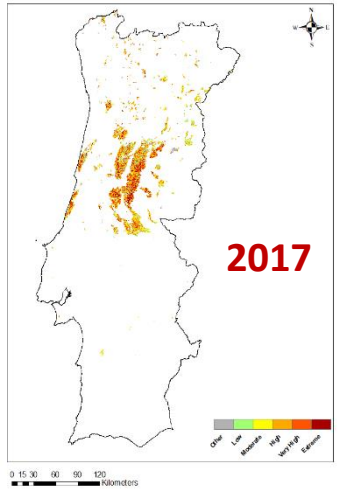
- Fast risk assessment
- dNBR: delta Normalized Burn Severity
- Field validation and index improvement



Fire severity atlas 2000-2020







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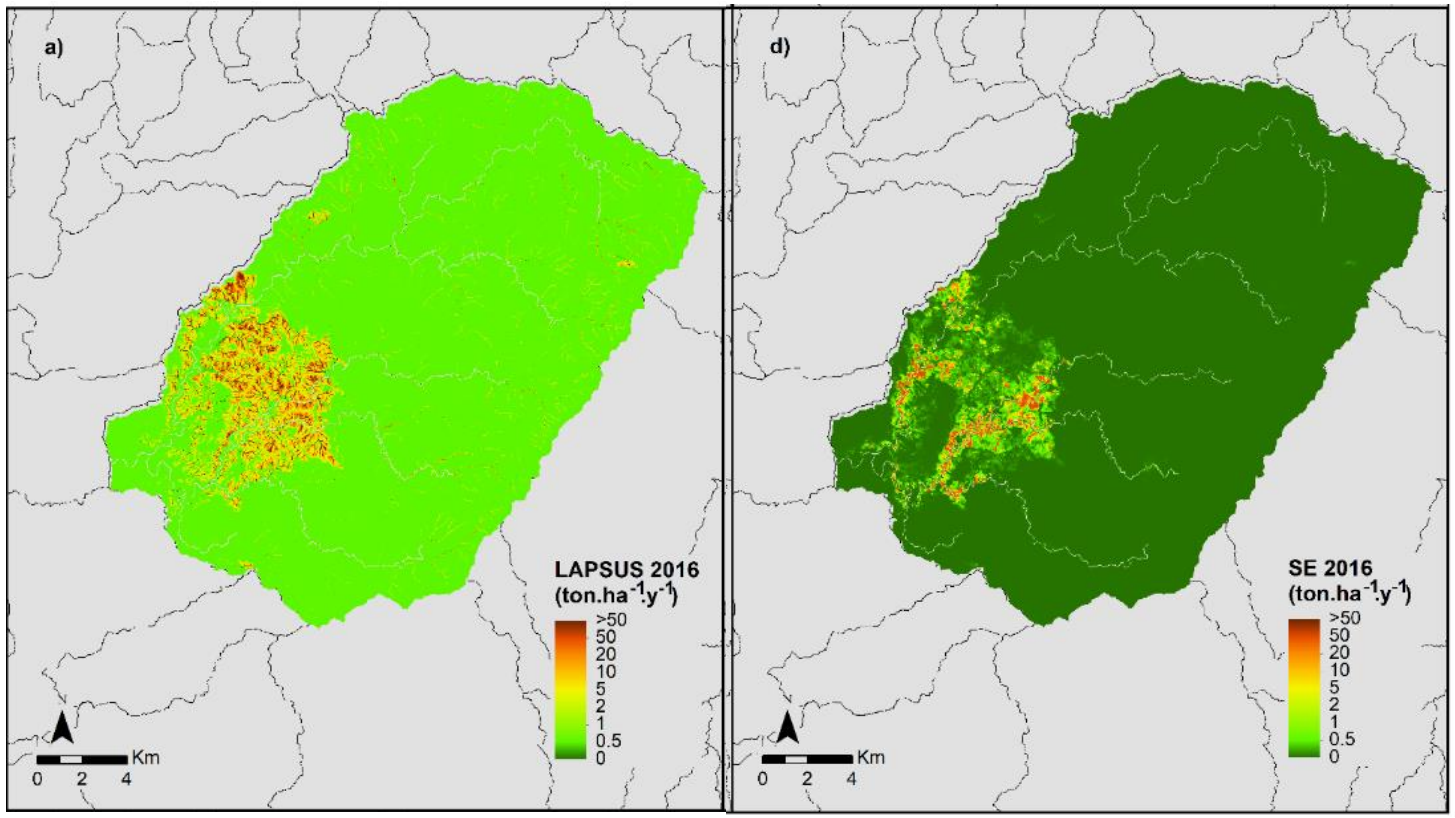
Where is ash mobilized?

- Map erosion hotspots
  - Fast risk assessment
  - Map hotspots for intervention
  - Satellite imagery + topography

Validated using numerical (erosion) modelling

Parente et al. (2023):
https://doi.org/10.1071/WF22145

LAPSUS erosion model | **RUSLE + Connectivity Index**



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Which water bodies are at risk?

Analysis: water quality 2000-2020

- 119 fire events in 66 reservoirs
- Change-point analysis

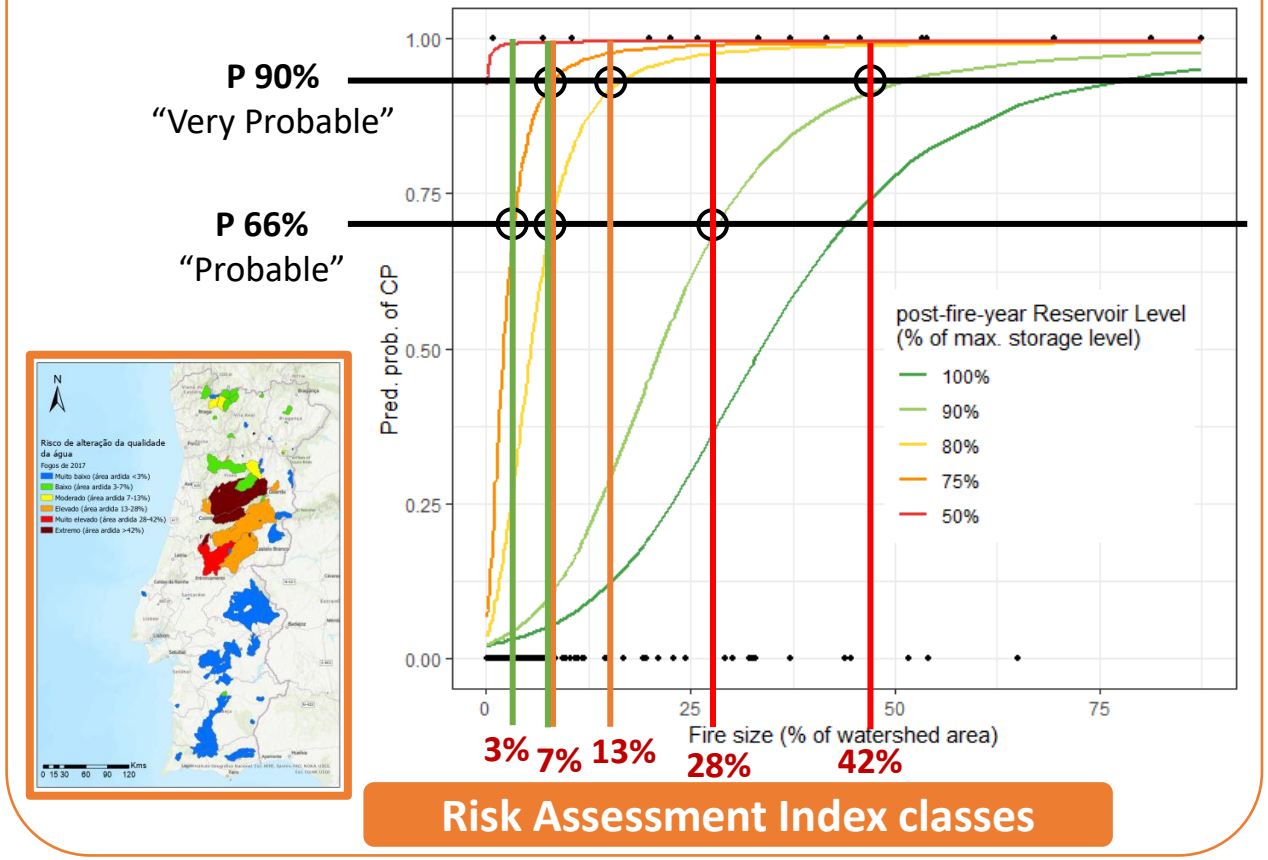
- Potential predictors: fire-related & weather-related

Main predictors for Sediments:

- Larger burnt area in watershed
- Lower reservoir water level after the fire (lower dilution capacity)

Probability of significant changes in TSS concentration after fire

According to fire size and post-fire reservoir water storage



MSc Thesis Niels Nitzsche (2023): ULisbon

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Options for risk mitigation

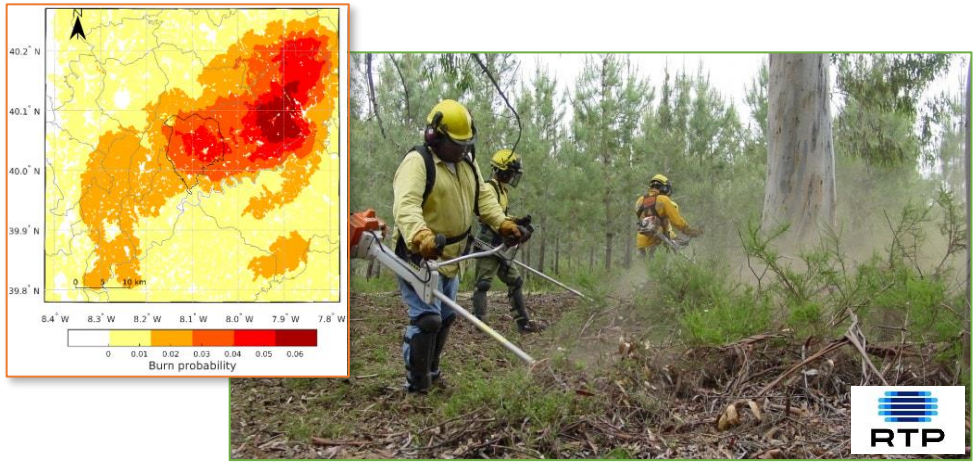
Fire risk reduction:
- Fuel management
- Fire breaks

Tool: probabilistic fire spread modelling

X

Emergency erosion control:
- Mulching, Barriers
- Riparian vegetation

Tools:
- Effectiveness: erosion modelling
- Efficacy: stakeholder interviews



Benali et al. (2021):
https://doi.org/10.3390/f12050522

Petratou et al. (2023):
https://doi.org/10.1007/s10980-023-01659-1

Final products

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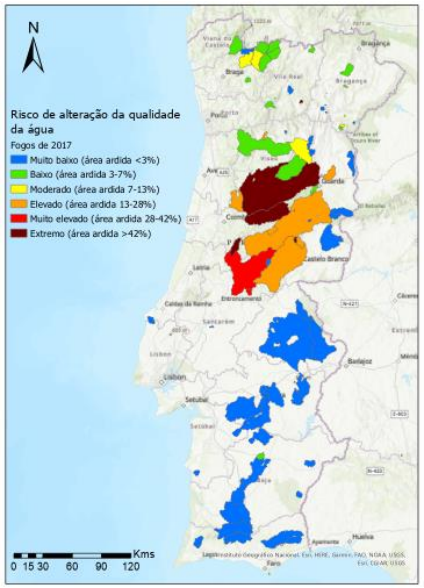
Risk Assessment

Where is ash generated?

Where is ash mobilized?

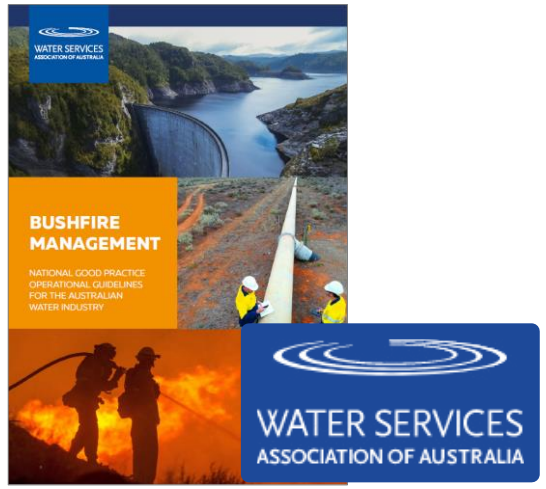
Which water bodies are at risk?



Online risk assessment index

Risk Mitigation

Risk mitigation handbook



https://www.wsaa.asn.au/publication/national-good-practice-operational-guidelines-bushfire-management-australian-water

Thank you for your attention!

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