# THE FIRE PROJECT: A MULTIDISCIPLINARY APPROACH TO PROVIDE INNOVATIVE PROBABILISTIC SCENARIOS OF SHALLOW LANDSLIDES OVER BURNED AREAS

*Ferrarotti M.*[1,2], *Marmoni G.M.*[1], *Fiorucci M.*[3], *Esposito C.*[1], *Berardi D.*[4], *Galuppi M.*[4], *Salvi F.*[5], *Lombardi M.*[4], *Lei A.*[5], *Martino S.*[1]

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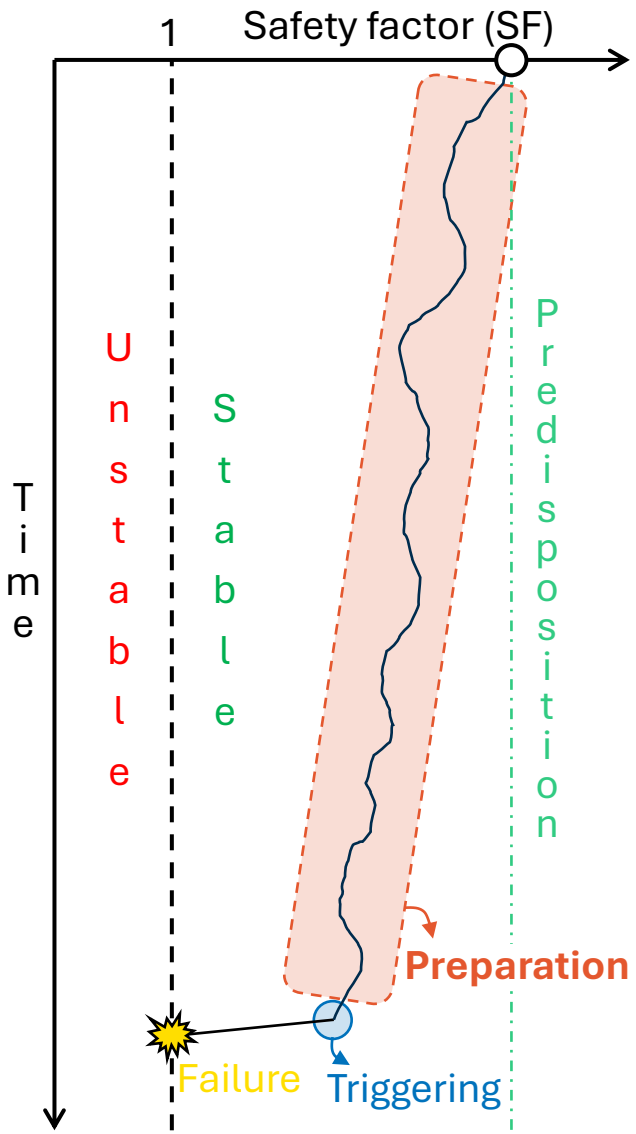
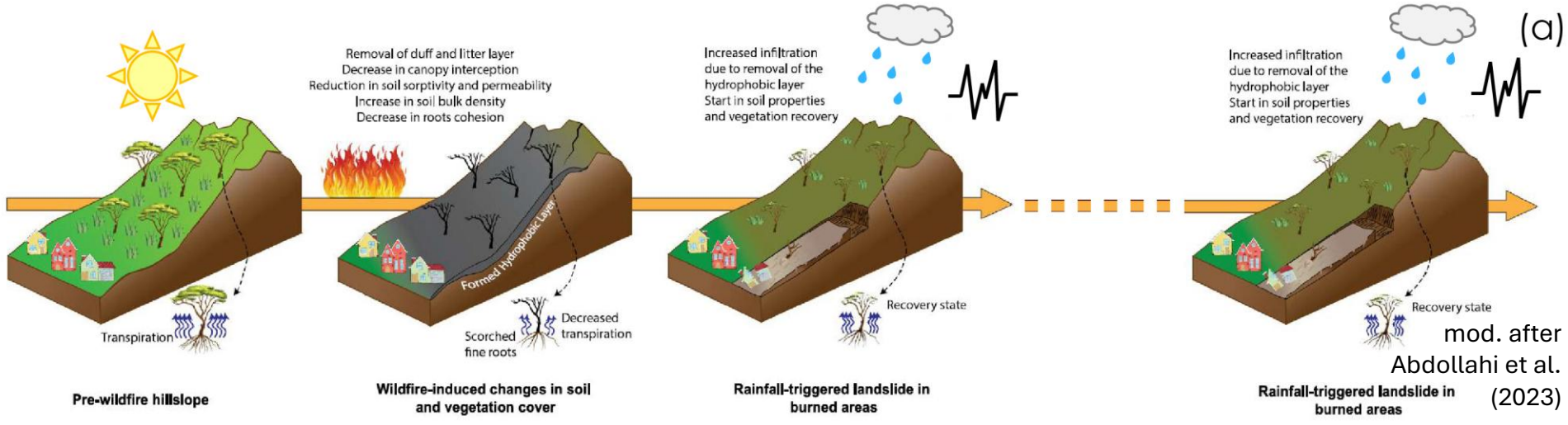
*Session NH7.1 – Spatial and Temporal Dynamics of Wildfires: Models, Theory, and Reality*

# Influence of wildfires on landslides



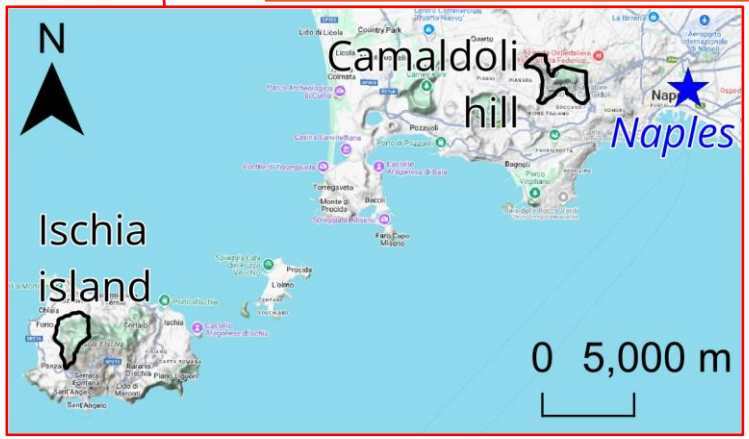

mod. after Abdollahi et al. (2023)


Di Napoli et al. (2020)

# Characterisation of soil covers

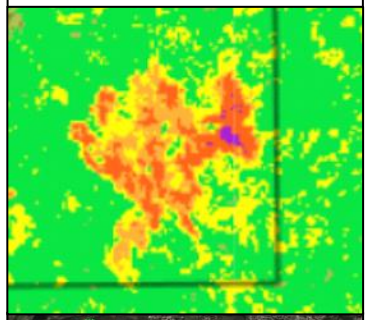


Camaldoli, 19-21th June 2024

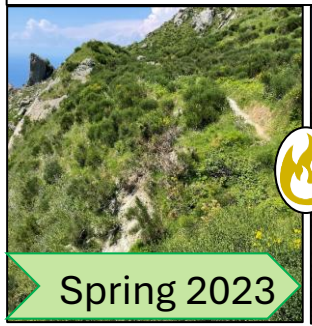



Soil sampling and laboratory tests

Wildfire characteristics through RS



Field campaigns during different seasons, pre- and post-fire



Spring 2023

Summer 2023

Winter 2024

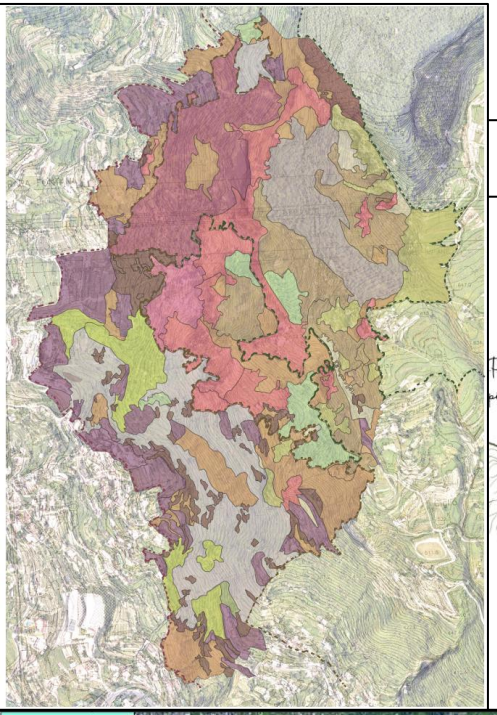
Spring 2024

Ischia, 27-28th August 2023

In situ tests and observations

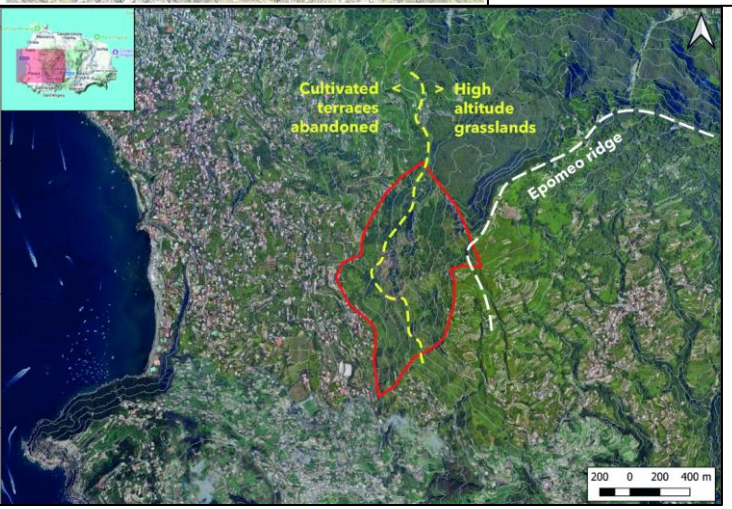
# Vegetational associations and wildfire propagation

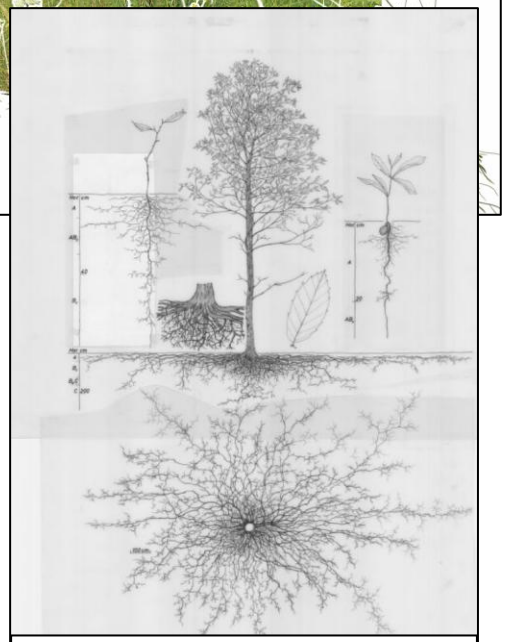




Courtesy of Salvi F. & Lei A.

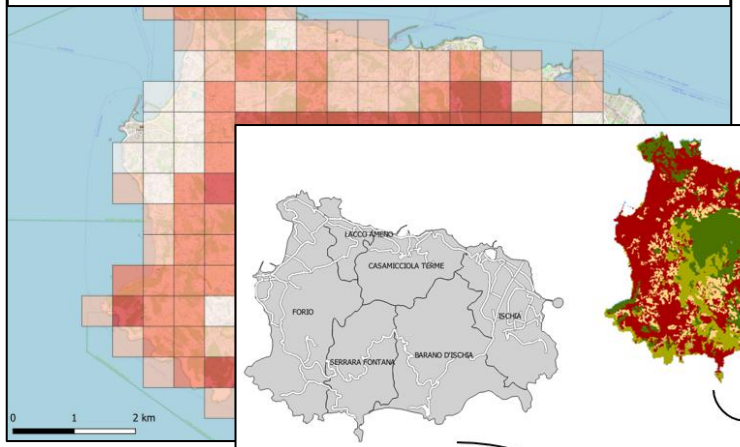
## Vegetational association map

Roots profile

## Wildfire hazard map

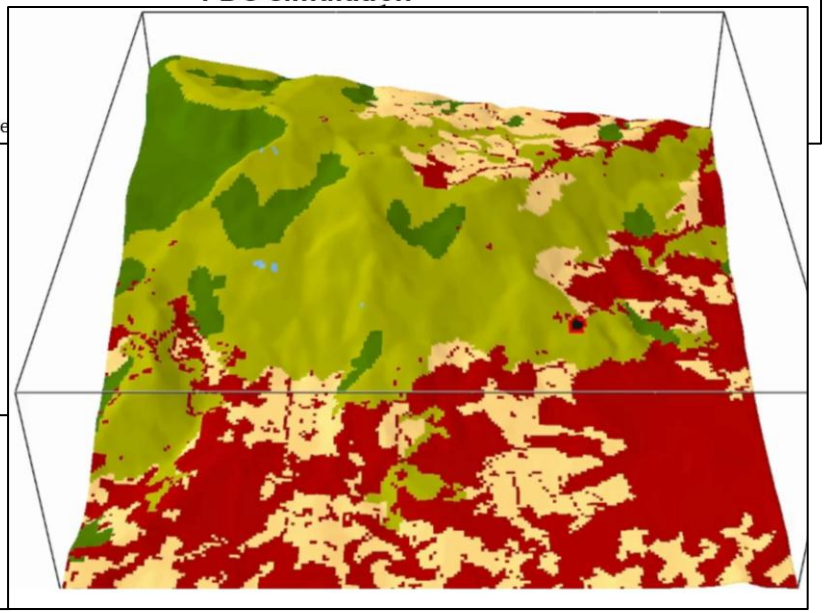



Courtesy of Galuppi M., Berardi D. & Lombardi M.

## Wildfire propagation model input



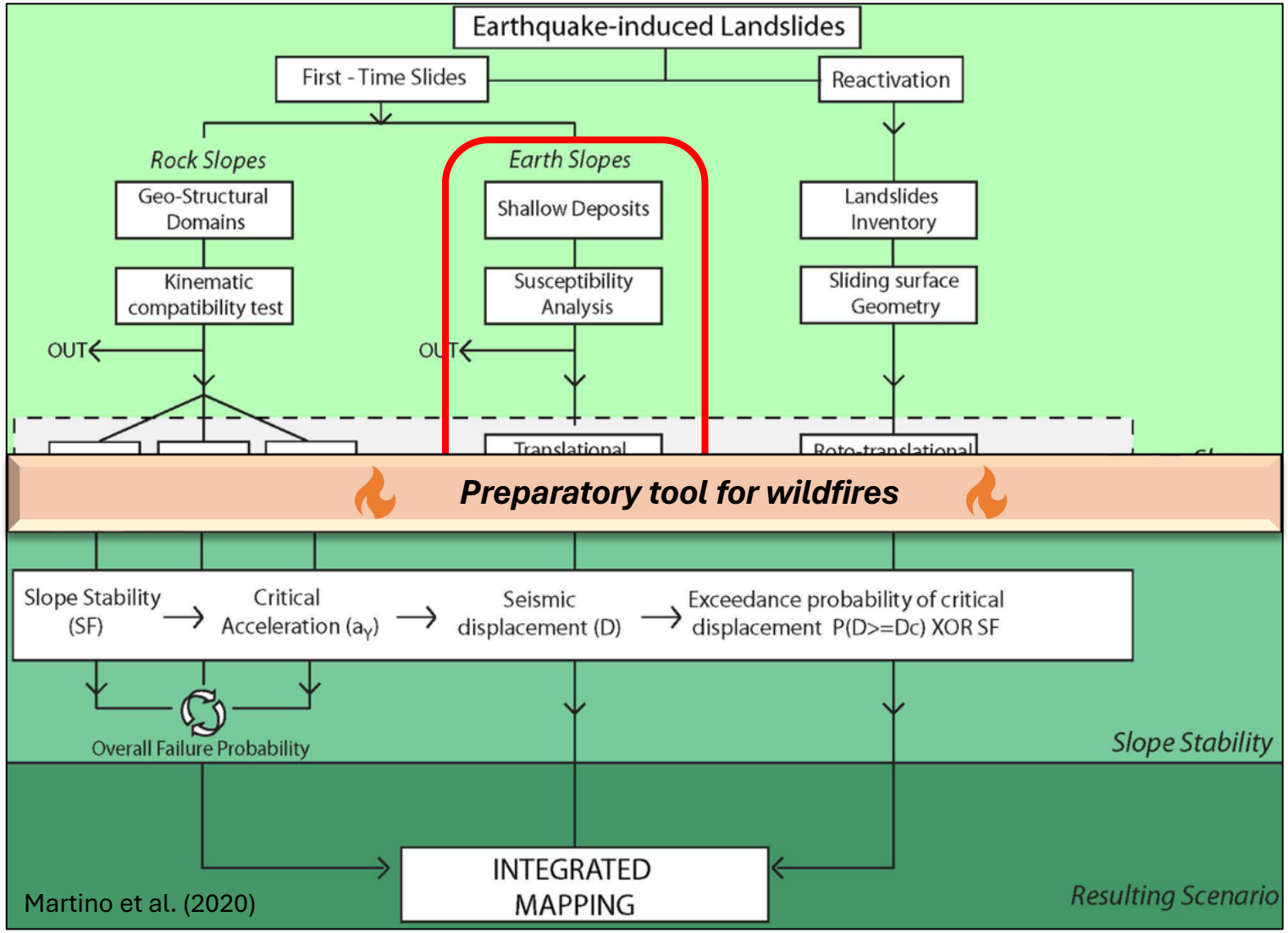

## Wildfire propagation simulation



# The PARSIFAL approach

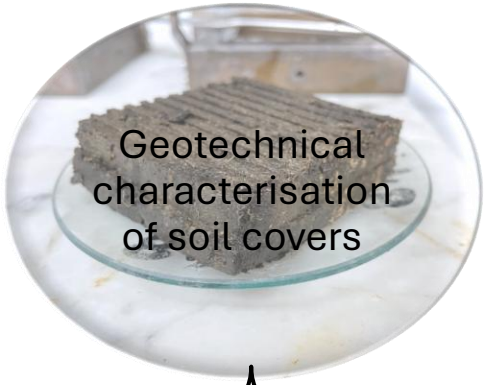
*Probabilistic **A**pproach to p**R**ovide **S**cenarios of earthquake-**I**nduced slope **FA**i**L**ures*

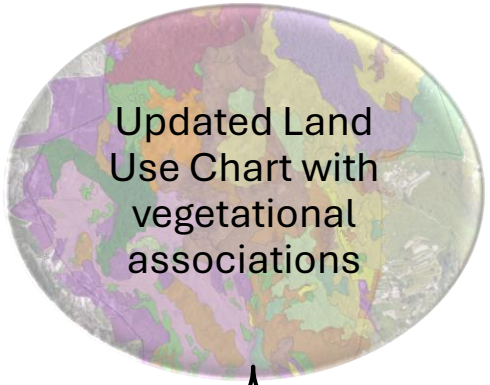
- From local to basin-size areas;
- **Susceptibility** and **stability analyses** for **earth slides** (activation and re-activation), **rockslides** and **topples**;
- Maps illustrating the **probability of exceedance** of pre-defined seismic displacement thresholds, for **different hydraulic conditions** and **hazard-related seismic actions**.

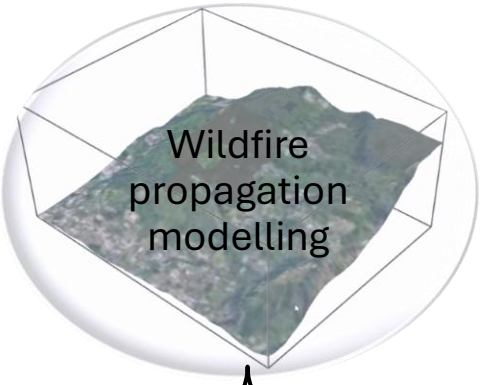


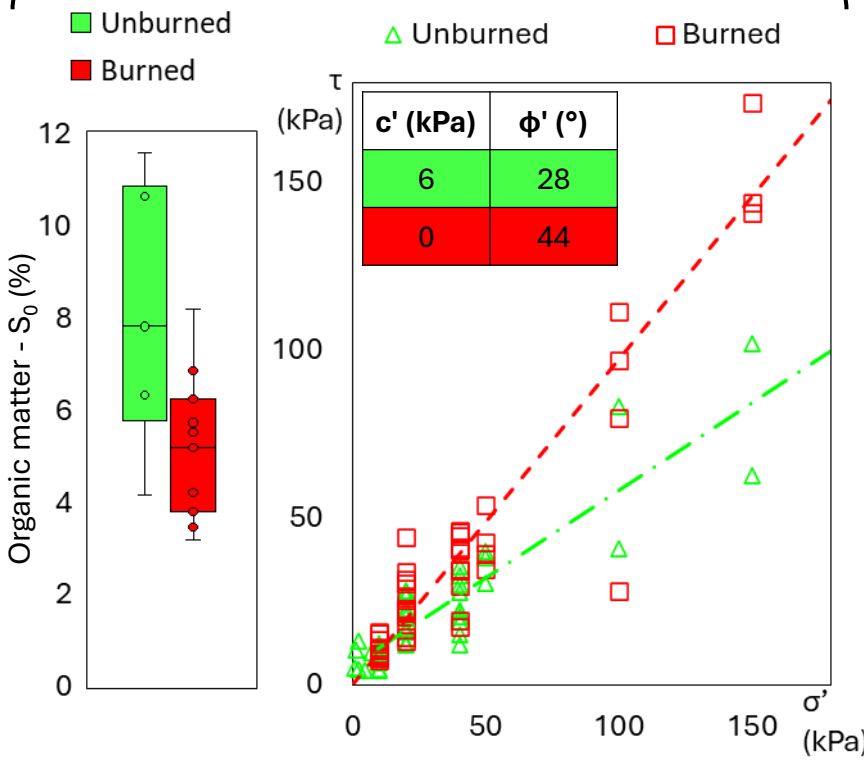
# Dataset construction for PARSIFAL application

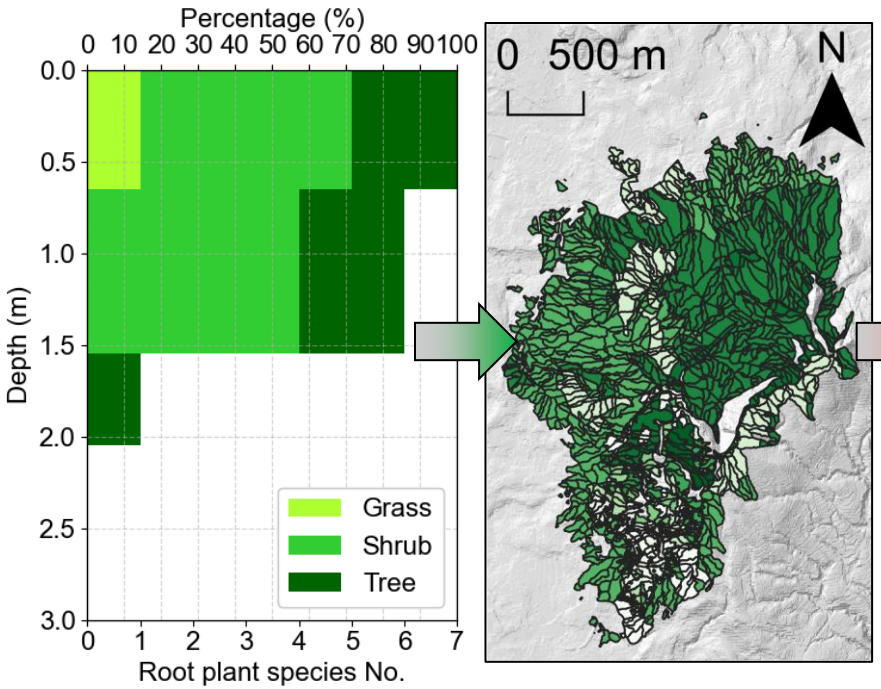




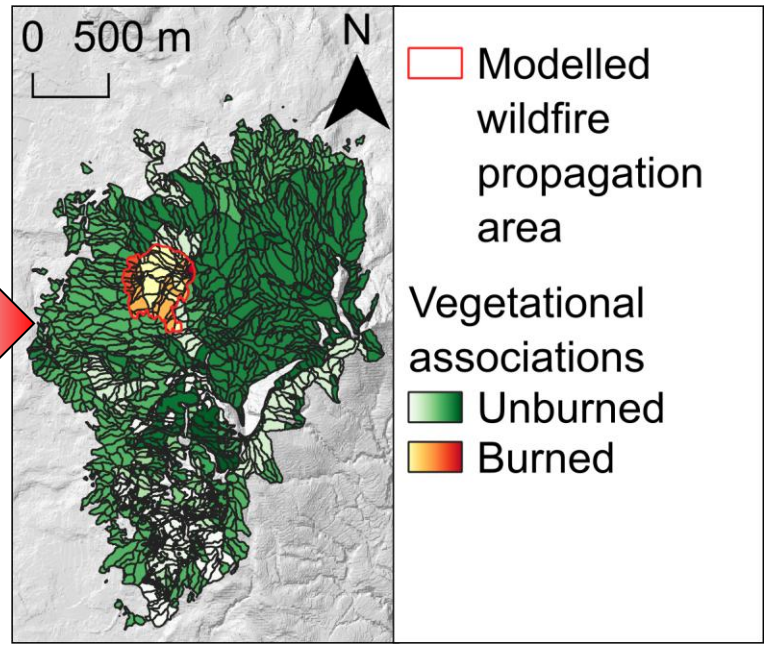



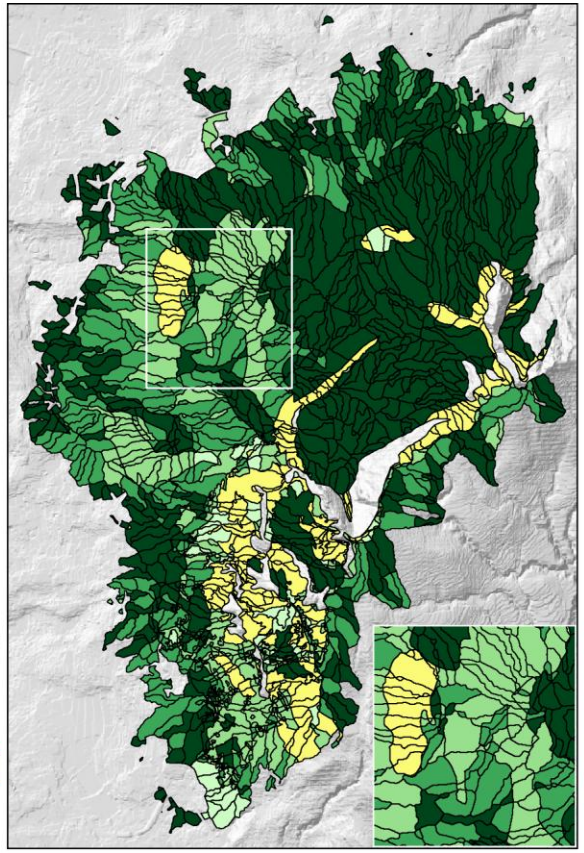


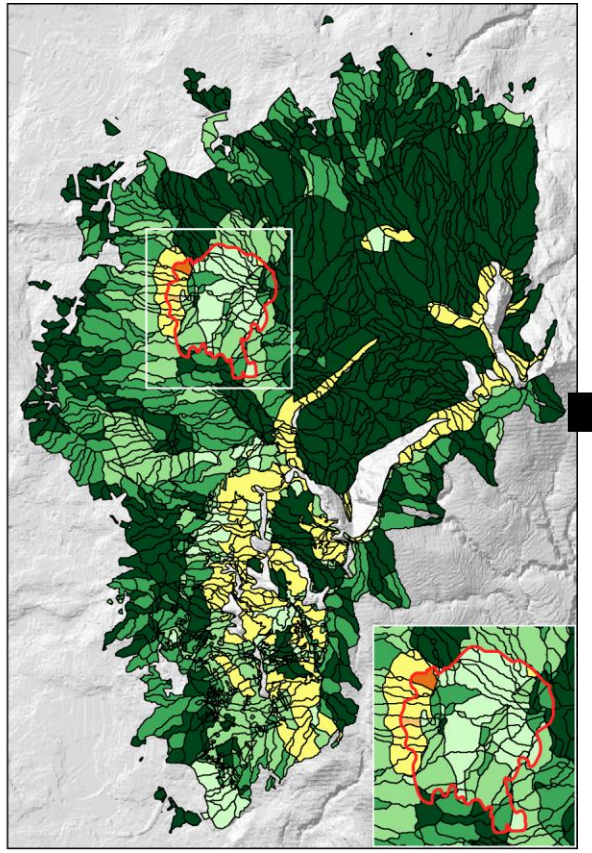


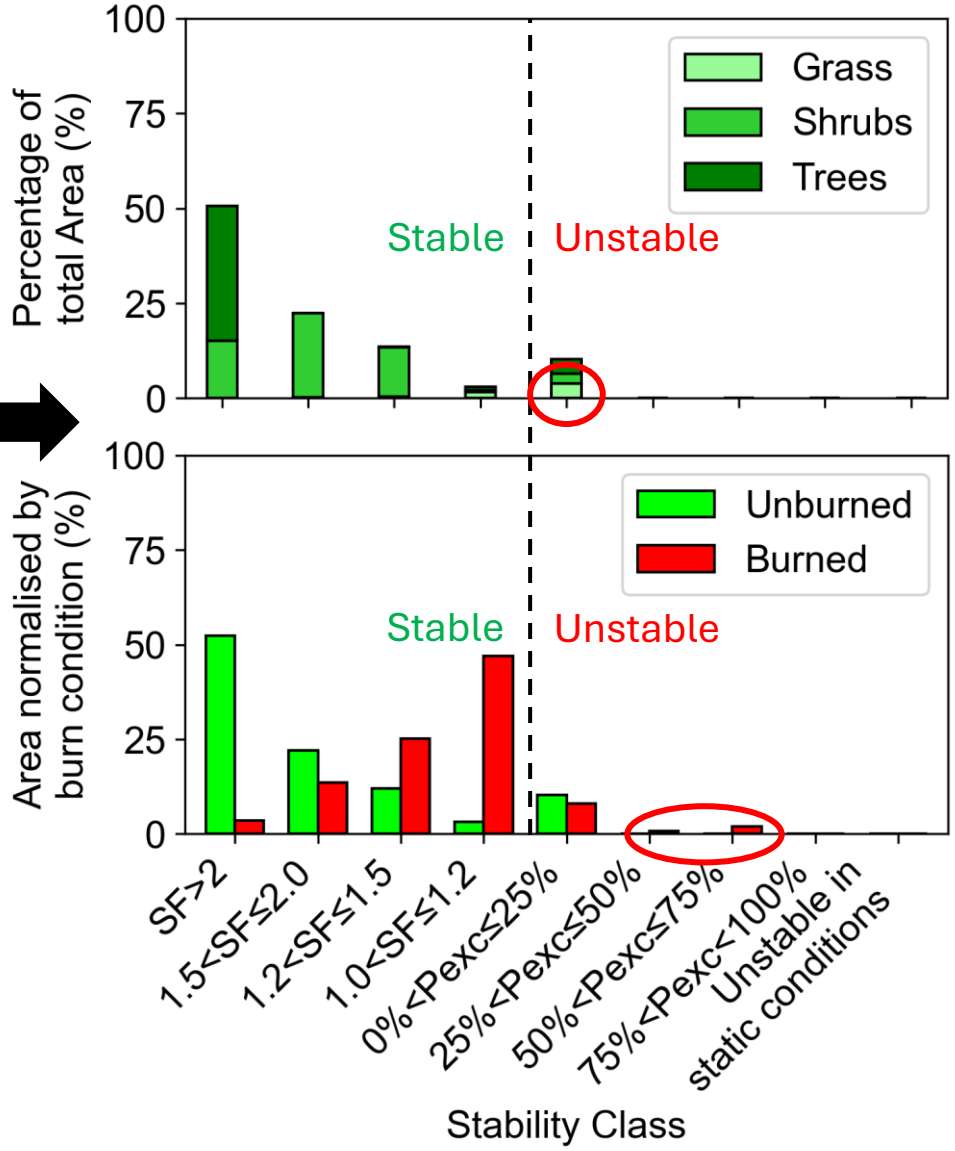


# Landslide scenarios

- Maximum saturation conditions (**rh = 0.66**)
- Seismic action for **RP = 475 y**
- Landslide depth: **h = 1 m**






Exceed. Probability of Critical Displacement (Pexc)
- 0% < Pexc ≤ 25%
- 25% < Pexc ≤ 50%
- 50% < Pexc ≤ 75%
- 75% < Pexc < 100%

Pseudostatic Safety Factor (SF)
- 1 ≤ SF ≤ 1.2
- 1.2 < SF ≤ 1.5
- 1.5 < SF ≤ 2
- SF > 2

Unstable in static conditions

# Outcomes and ongoing activities

Sharing is encouraged

- The effects of wildfires on slope stability are complex and a **multi-disciplinary approach**, like the one introduced in **FIRE Project**, is fundamental to identify at best the complex interactions between **wildfires**, **vegetation** and **soil covers**;
- The results from FIRE clearly demonstrate that wildfires can affect the stability conditions of a slope, in particular acting as a **preparatory process for shallow landslides**, also identifying a workflow to foresee the compounding hazard between wildfires and landslides;
- These outcomes are being implemented also in Spoke 2 of **PNRR – RETURN** Project on "Ground Instabilities"

Return

- Ongoing studies are aimed at trying to adopt **Machine Learning Emulators**, that are faster, flexible and more generalisable than physically based models that are used to train them, in collaboration with

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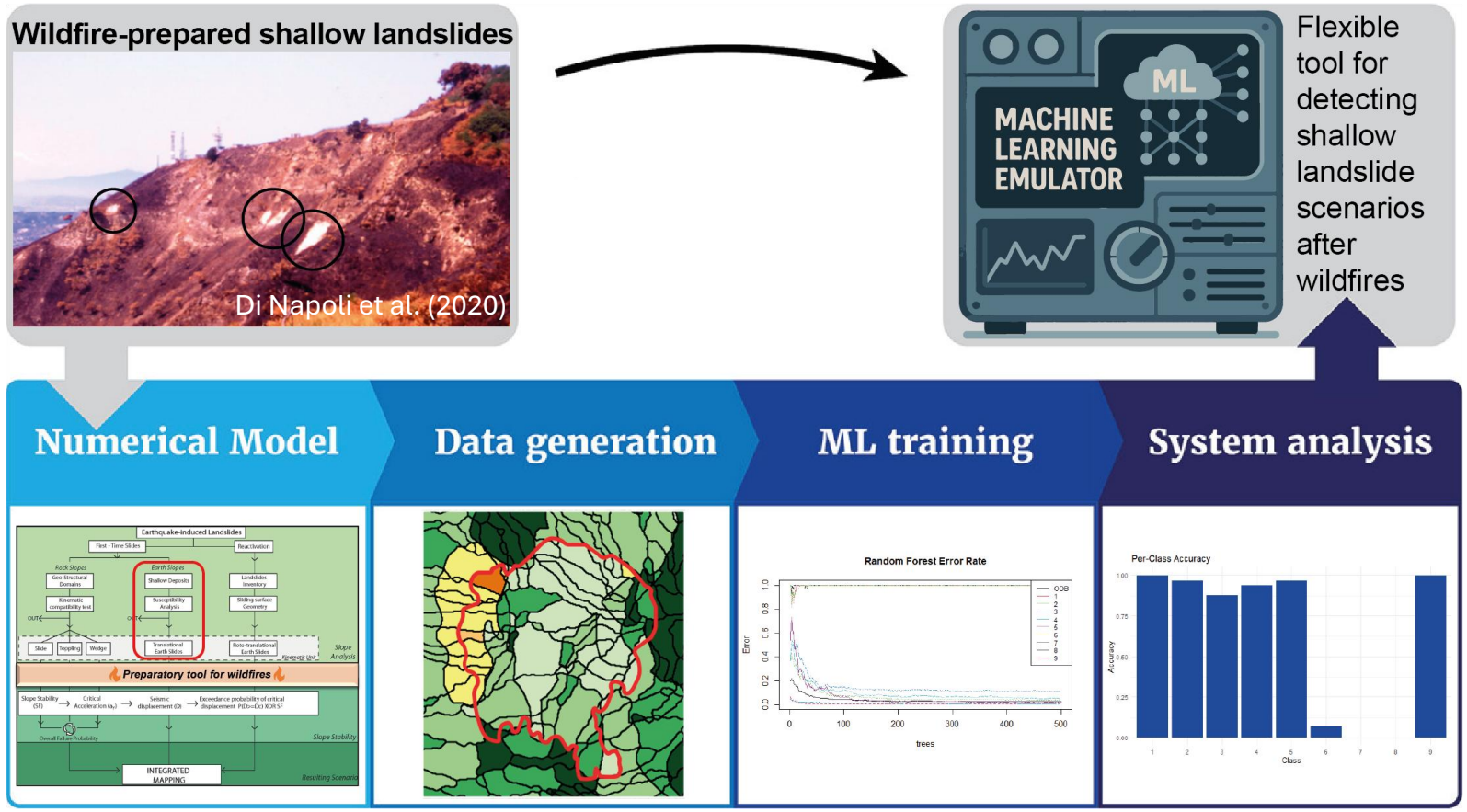


Pomarol Moya et al. (2025), mod.

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SPERI TOGETHER. TOMORROW.

# Time for questions

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