

Assessing ecosystem restoration after fire: indicators of soil recovery in pine and chestnut forests in Mediterranean climate

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Introduction

Forest fires threatened the ecosystem health with consequences for soil properties and functionality.

The selection of **specific soil indicators** might contribute to better quantify the **soil degradation after fire** and monitoring the following **ecosystem recovery**.

Aims of this study were to evaluate soil enzymes, mycorrhizal colonization and stable isotopes as **indicators of post-fire soil health** and to evaluate the **natural regeneration ability** of Mediterranean forests.

Study area and data collection

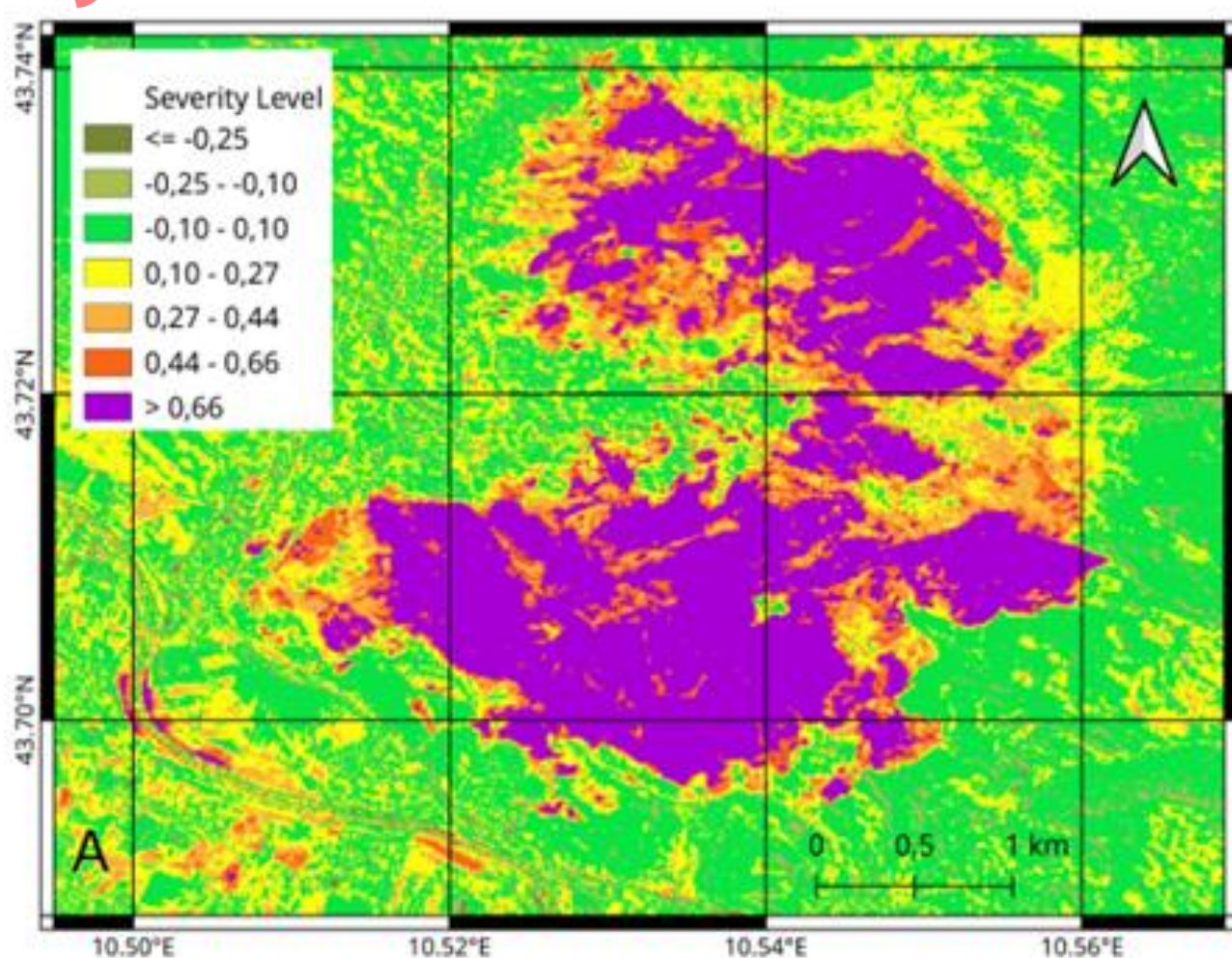


- Monte Pisano (Italy)
- Chestnut/pine forests
- Burned/unburned sites in 2018
- Soil sampling in 2020 and 2023

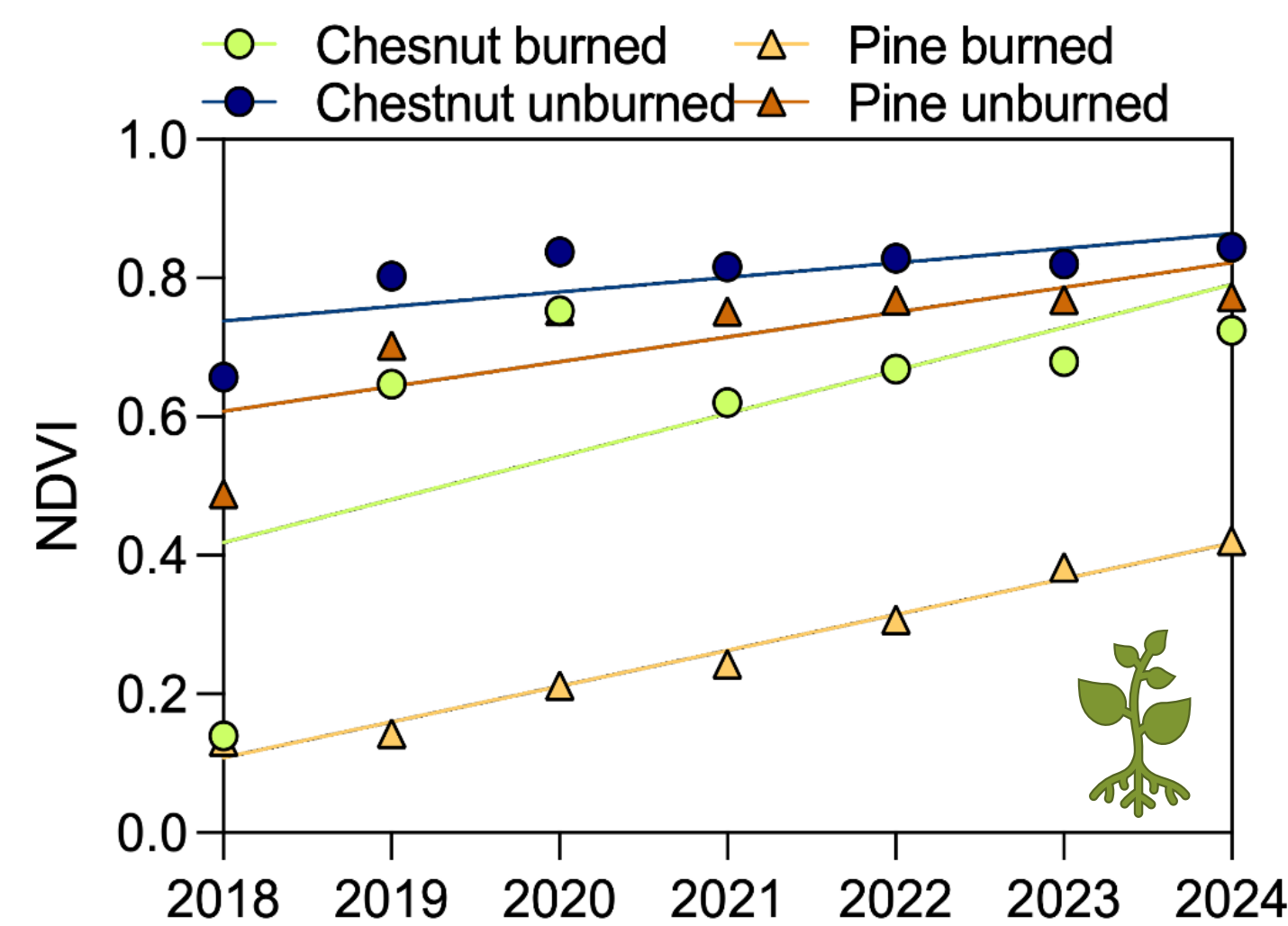
- Remote sensing monitoring
- Physical and chemical soil parameters
- Enzyme activities and stoichiometry
- Mycorrhizal abundance

Results and Discussion

Fire in September 2018



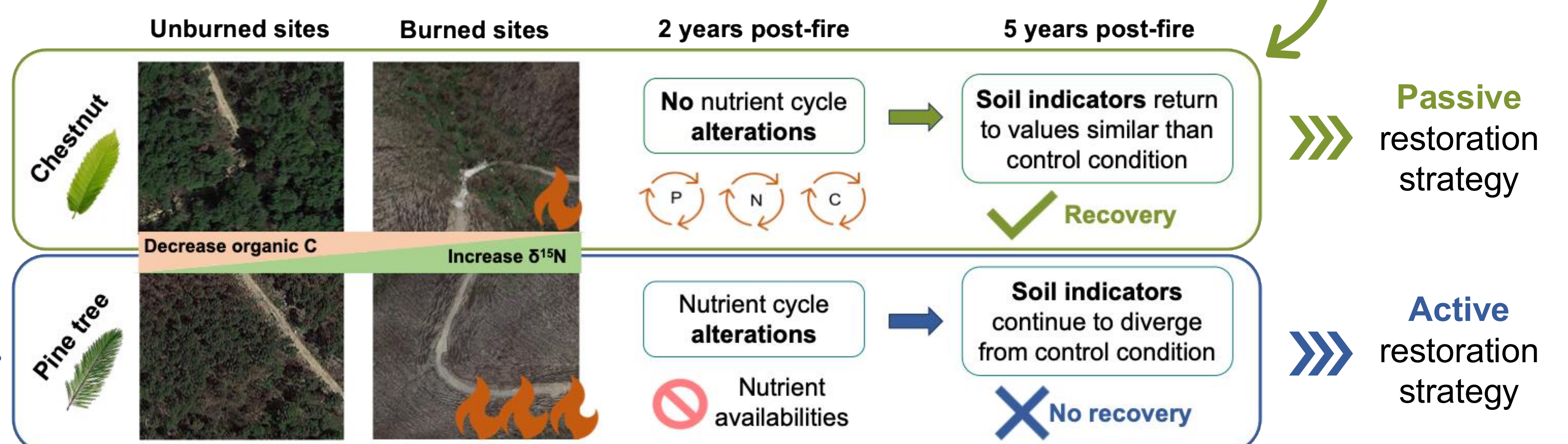
Post-fire recovery



Remote sensing highlighted a **higher fire impact and a slower vegetation recovery** in pine site compared to the chestnut forest

In **chestnut burned soil** the enzyme activities **did not reveal carbon and nutrient limitations**

In **pine burned soil** a ¹⁵N enrichment and higher soil enzyme activities indicated **changes in organic matter composition and limiting nutrient conditions**



Unlike chestnut site (sx), pine burned soil (dx) had a different **mycorrhizal colonization** than unburned site:

Arbuscular mycorrhiza	=	↓
Ectomycorrhiza	=	↑
Root biomass	=	↓

Conclusions Soil enzymes, stable nitrogen isotopes and mycorrhizal colonization, integrated with satellite data, were suitable indicators for monitoring the post-fire soil recovery. These indicators revealed different recovery rates in chestnut and pine forests. The combined monitoring of the indicators provided a comprehensive assessment of soil functional recovery after fire.

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