Rapid Bacterial and Fungal Successional Dynamics in First Year after Chaparral Wildfire

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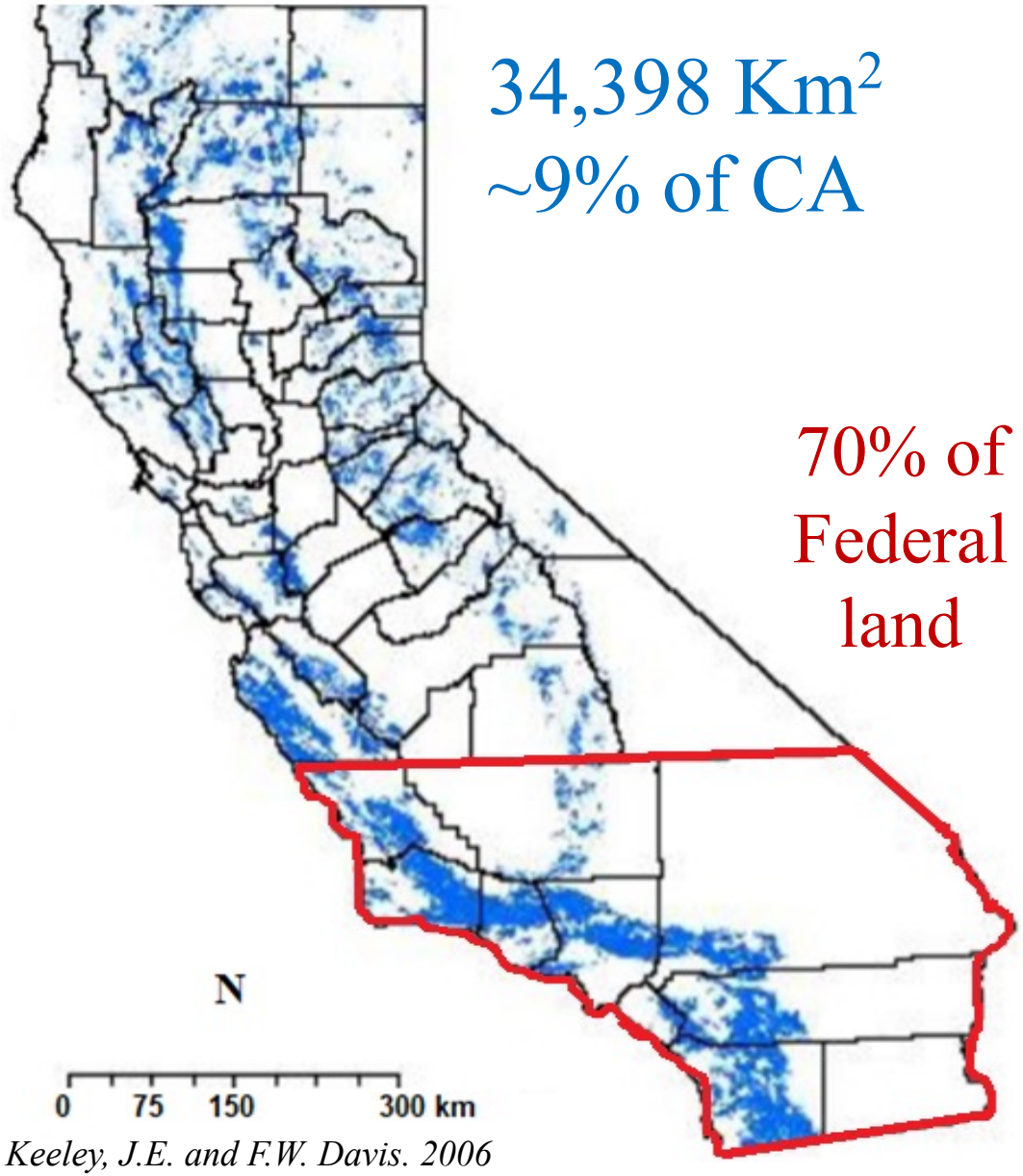
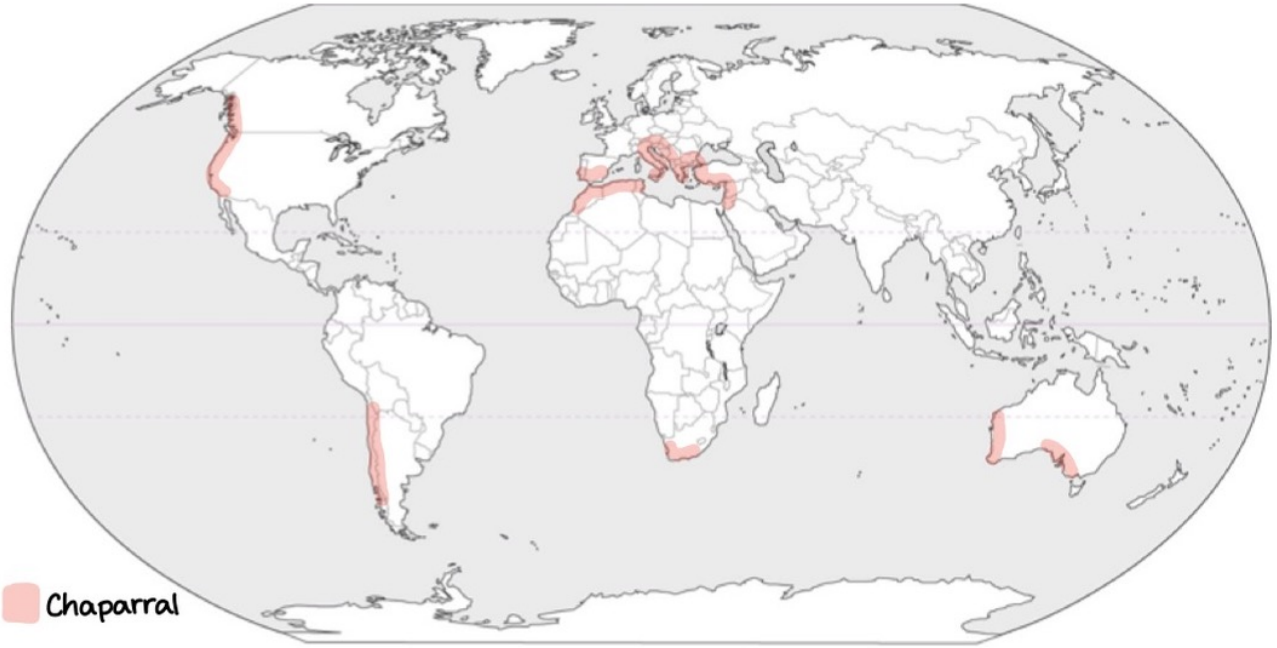
Chaparral is a Mediterranean shrubland adapted to wildfires



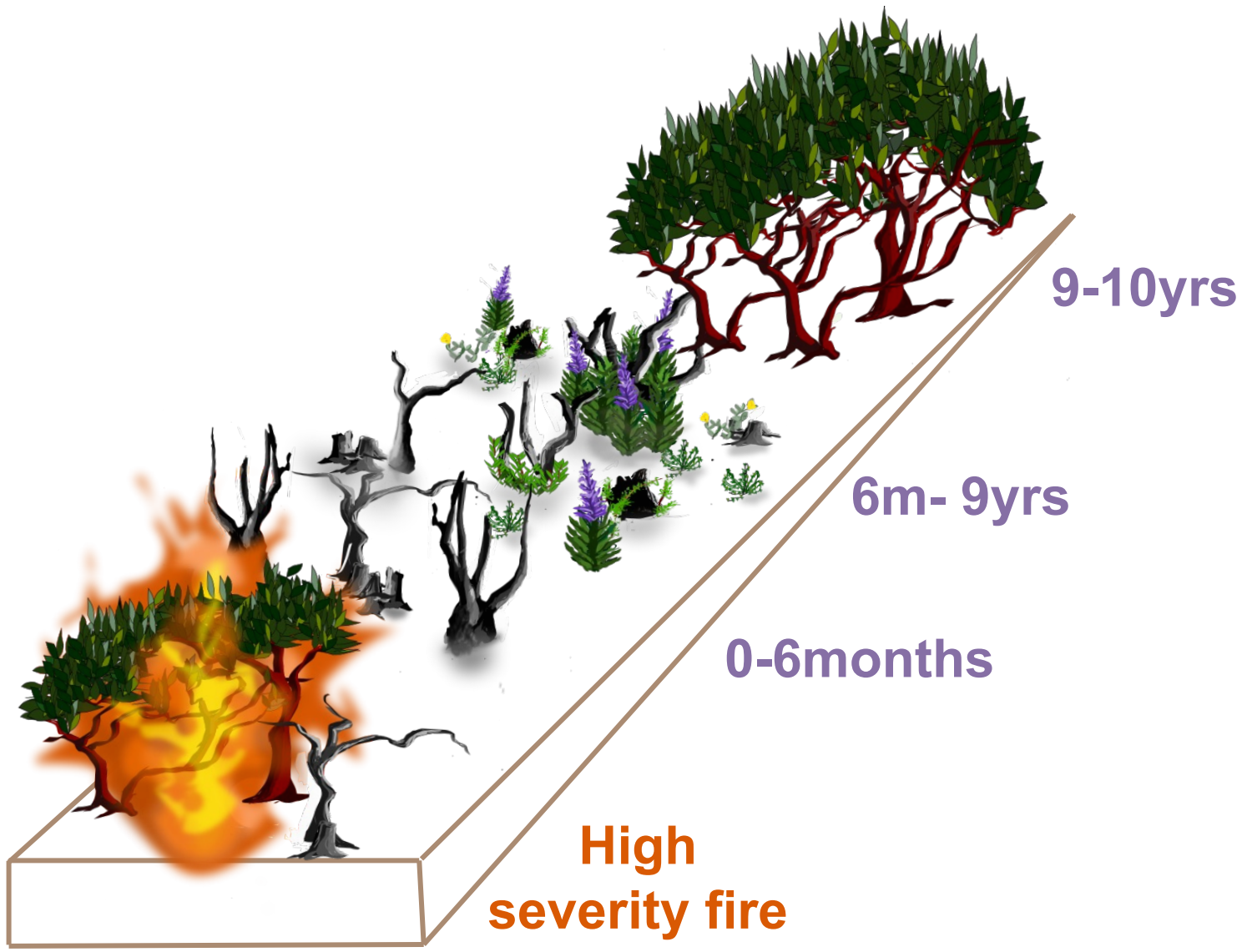
34,398 Km^2
~9% of CA

70% of Federal land

Keeley, J.E. and F.W. Davis. 2006

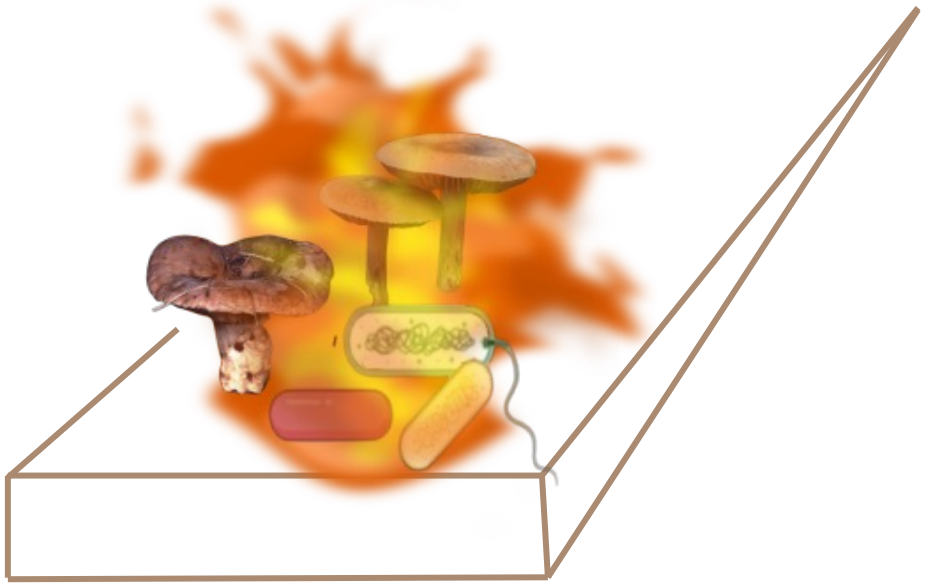


Secondary succession (change over time) is well understood in Chaparral vegetation but unknown for bacteria or fungi

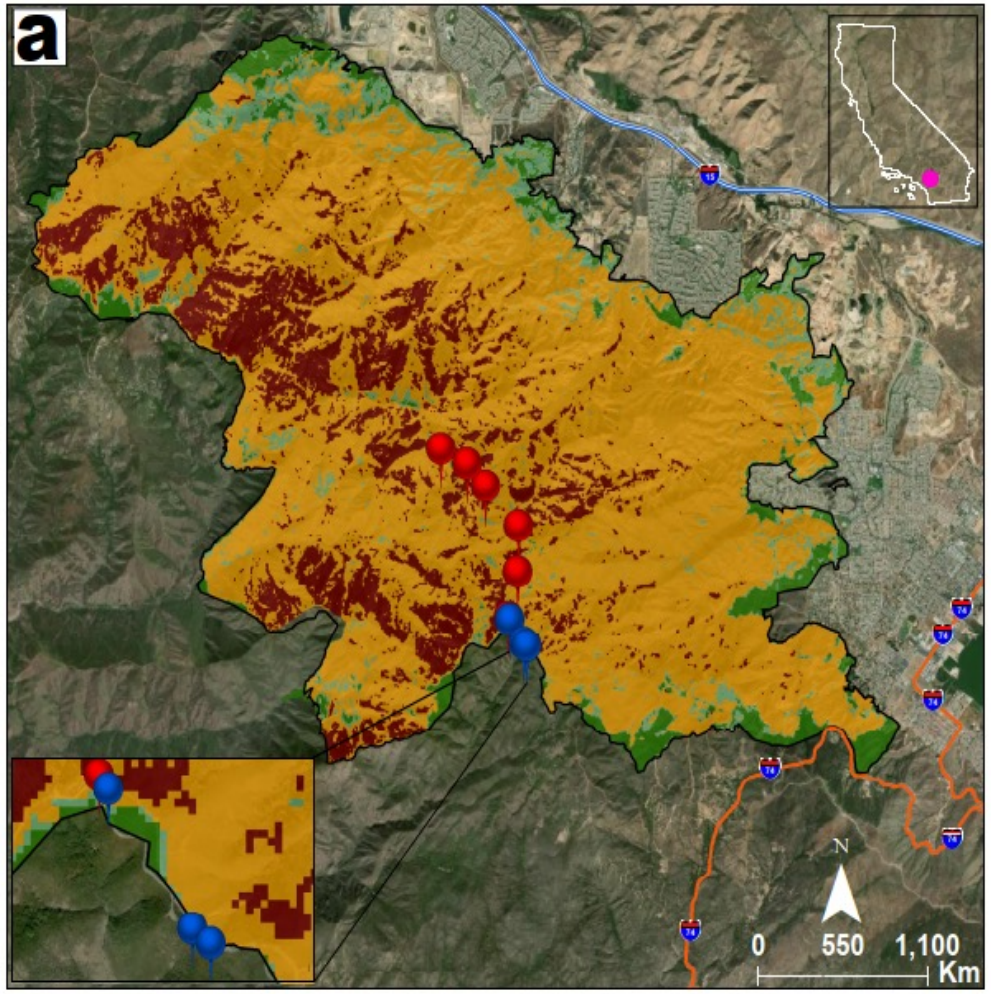


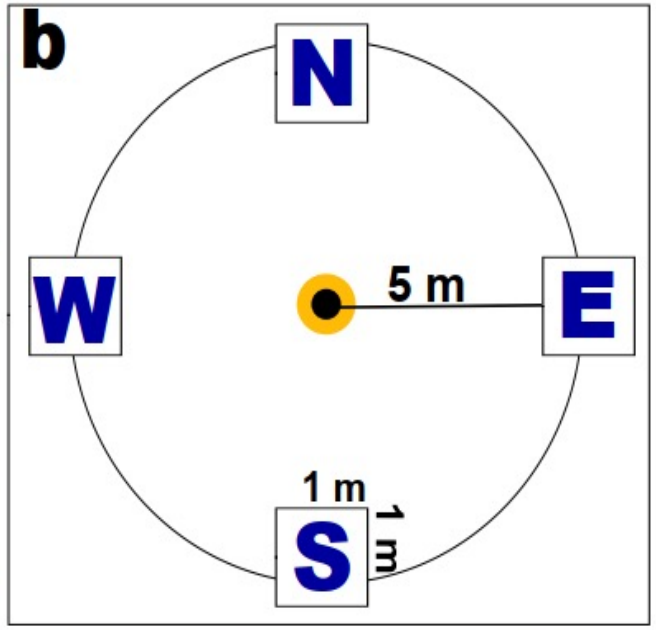
Importance of Microbes

- Drive nutrient cycling
- Stabilize soils
- Plant regeneration (mycorrhizal fungi)



Experimental Design: 2018 Holy Fire





Sampled 9 time points ranging from 2.5 weeks to 1-year post-fire.

16S

ITS2

Metagenomes

Soil Burn Severity
- High
- Moderate
- Low
- Unburned/Very low

Sampling Plots
- Burned
- Unburned

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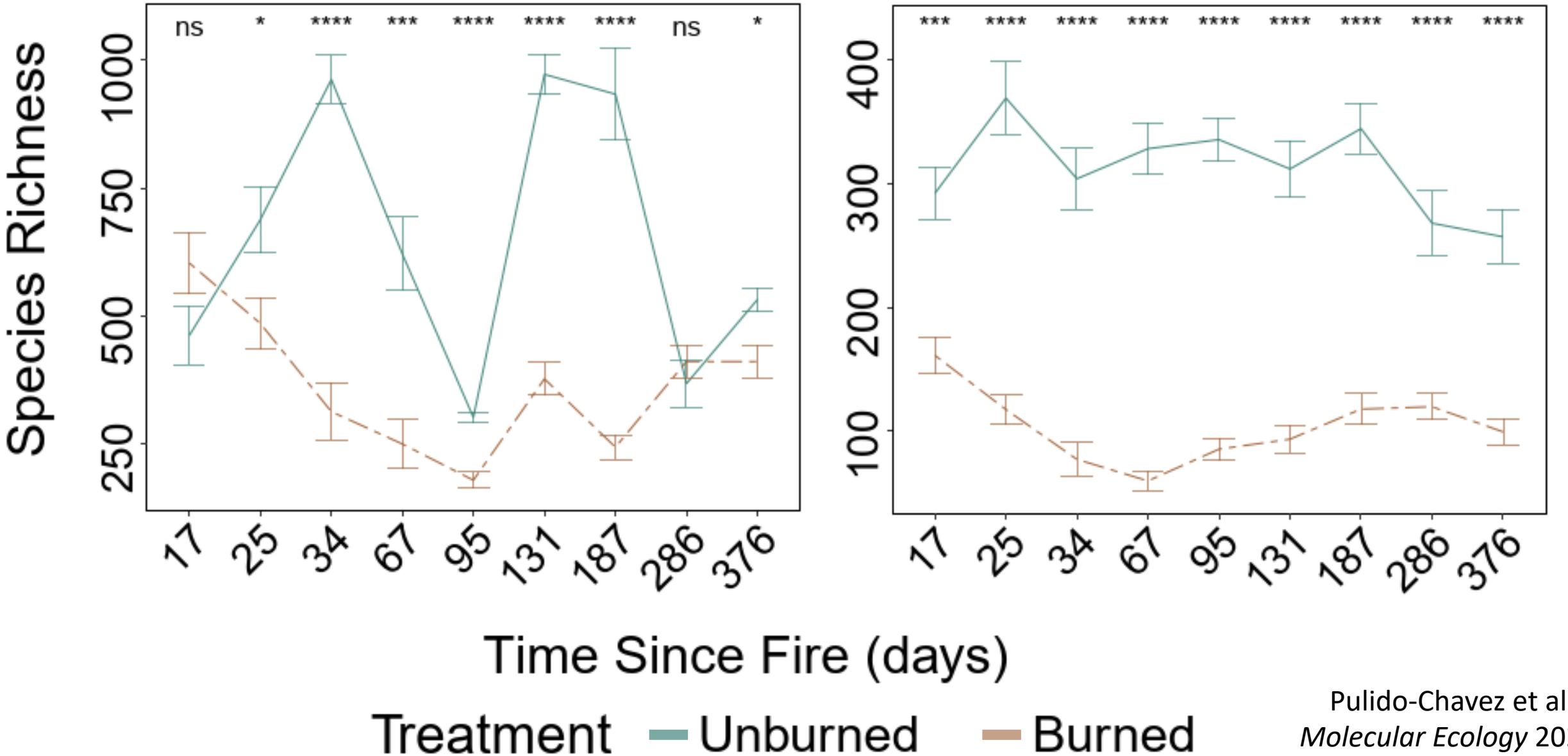
Fire reduced bacterial richness by 46 % and fungal by 68 %

Bacteria

Fungi



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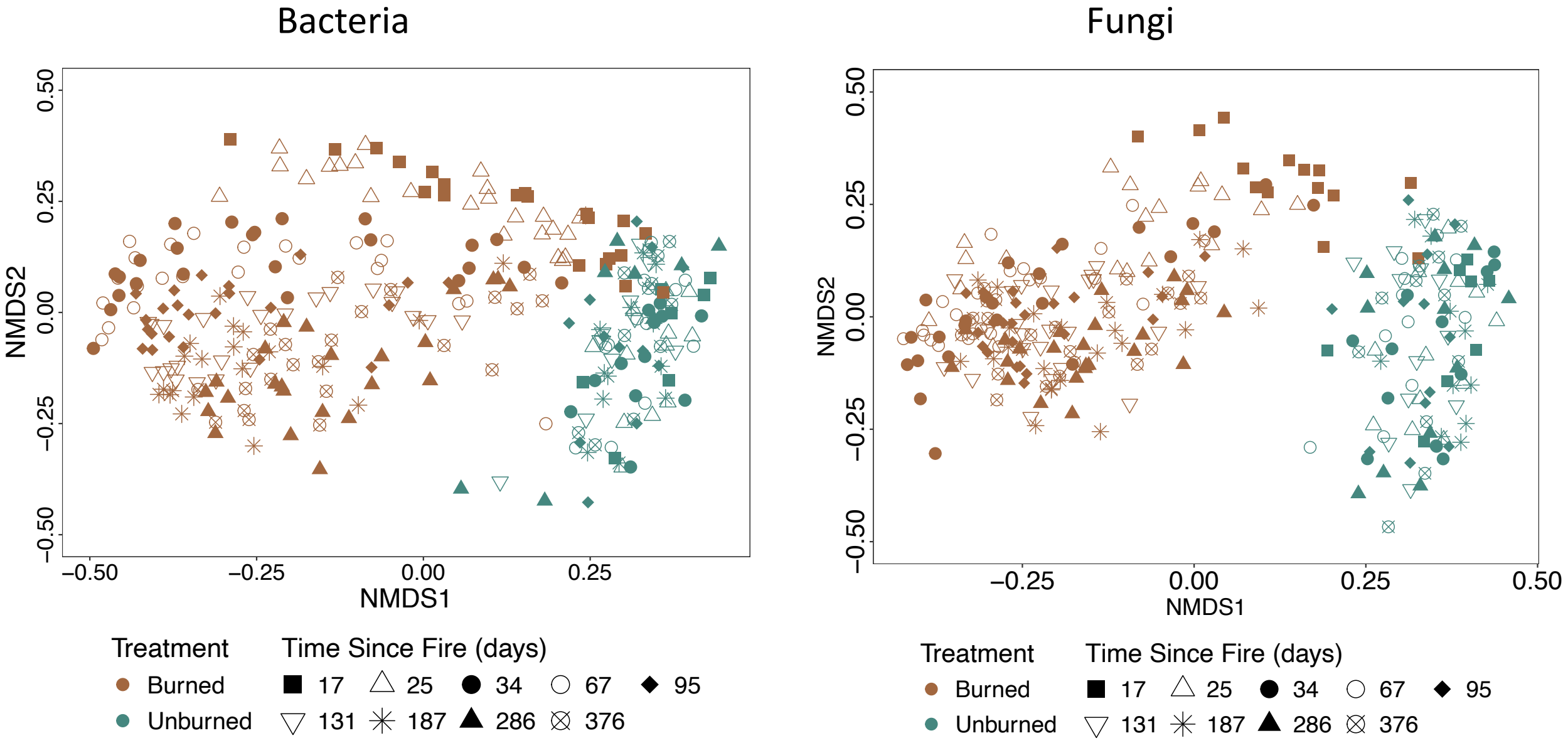
Fire altered bacterial and fungal composition



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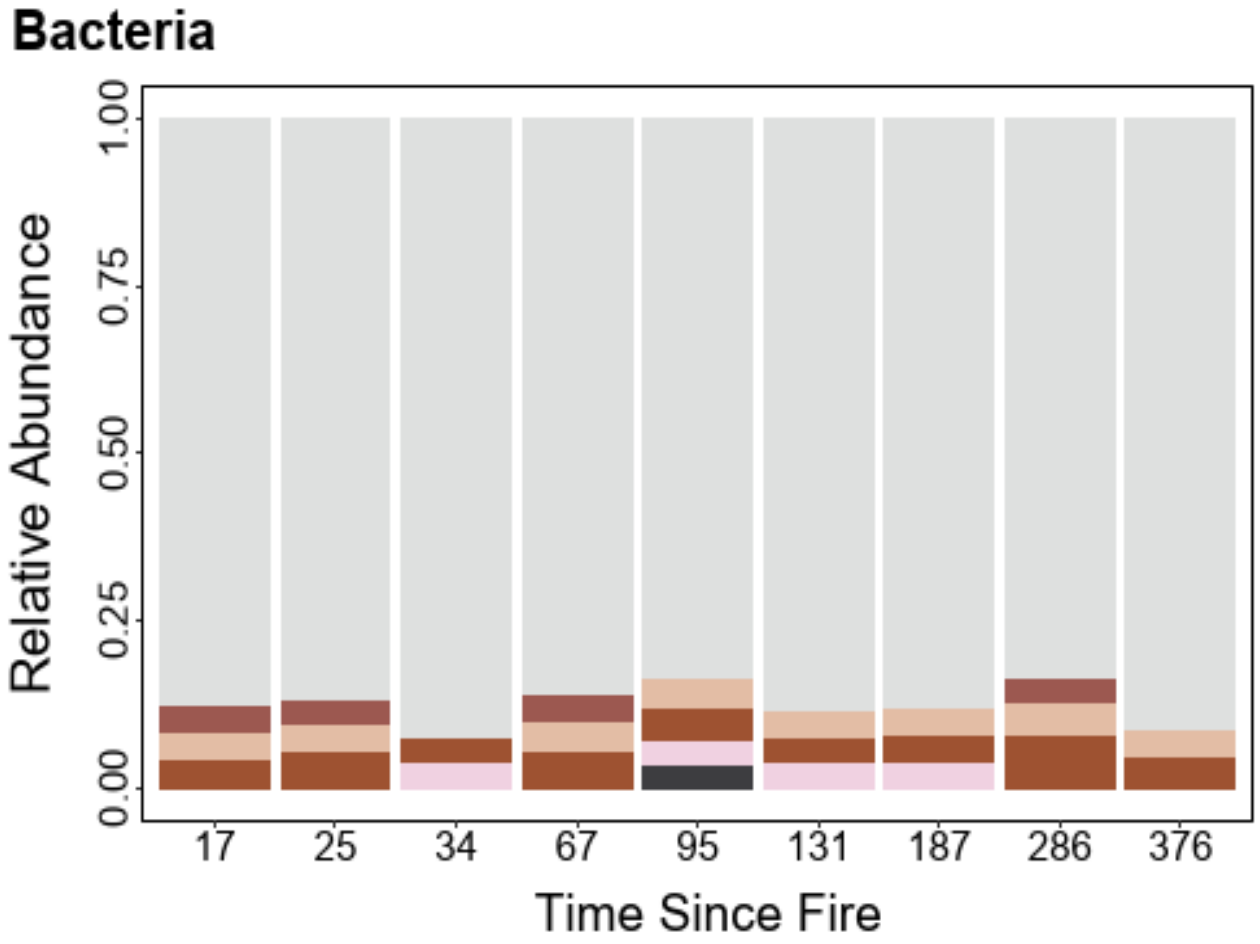
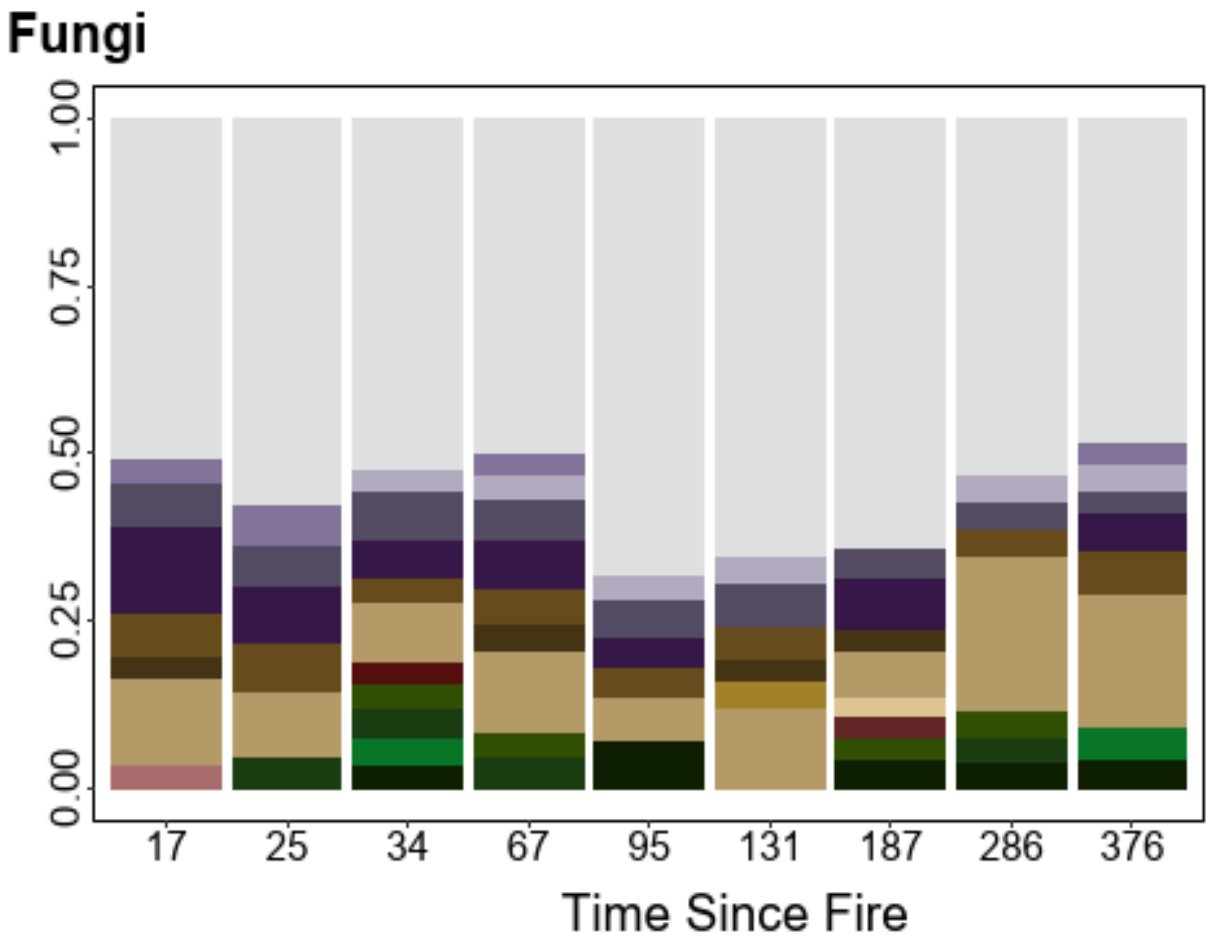
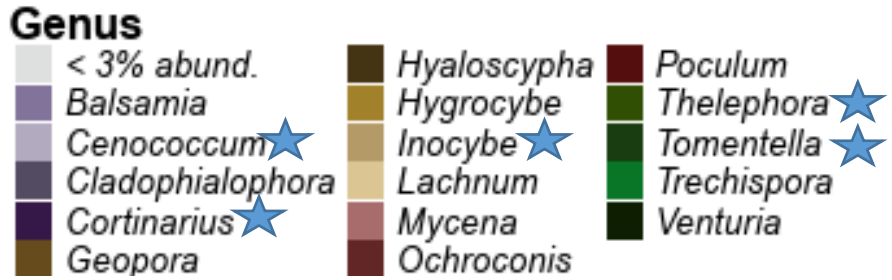
Unburned microbial communities show little to no dominance and low turnover







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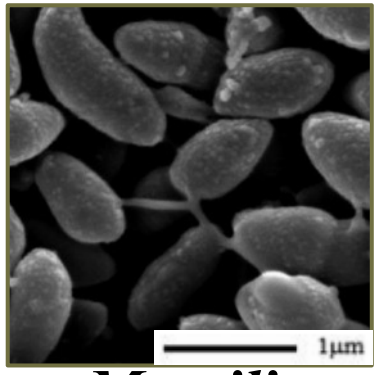
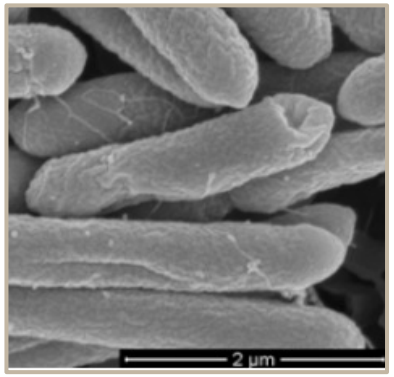
Burned communities dominated by a few pyrophilous bacteria



Massilia

Copiotrophic

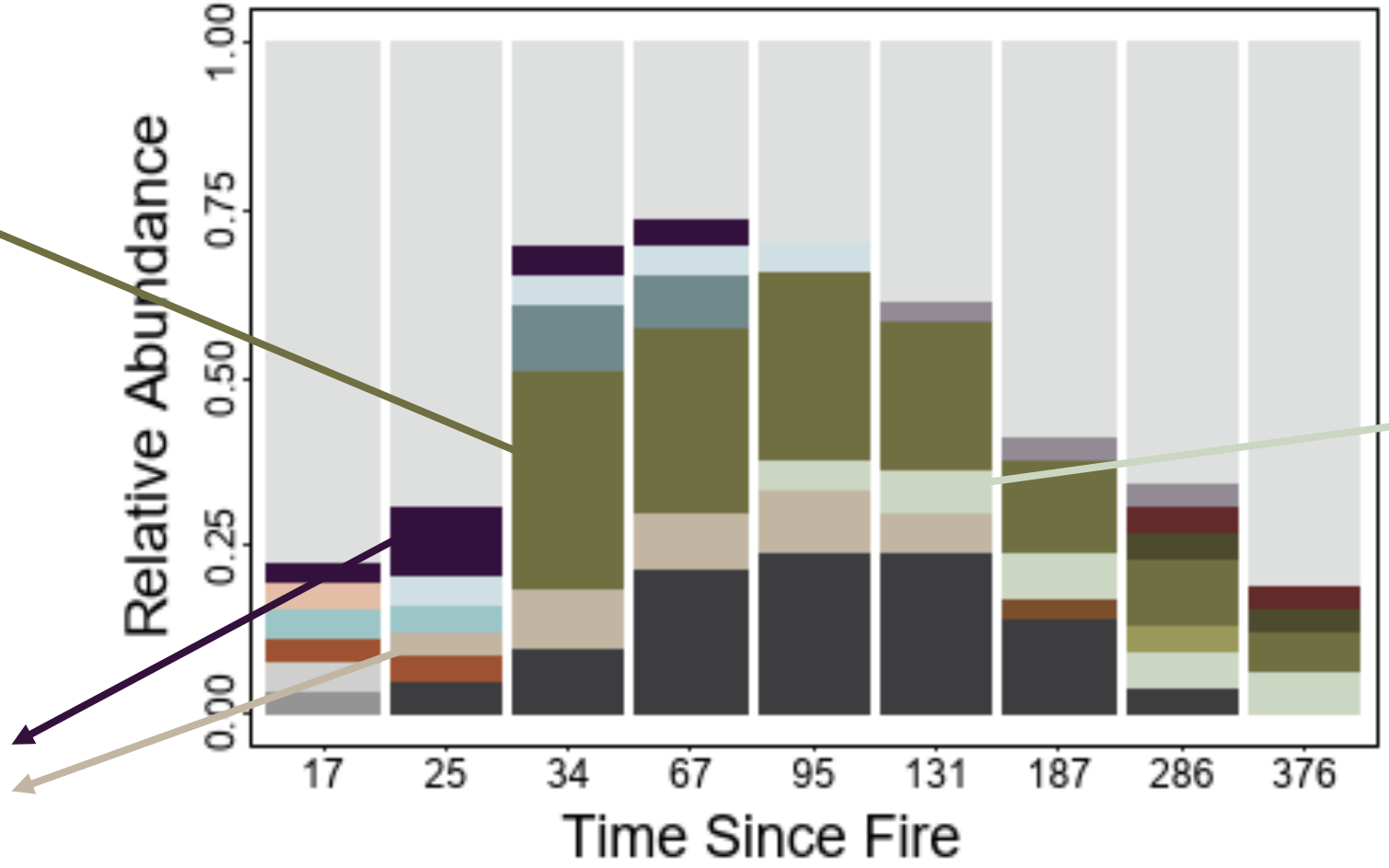
Fast growing

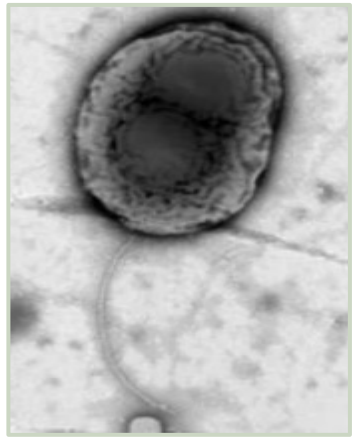


Paenibacillus & Bacillus

Heat-resistant

Endospores





Noviherbaspirillium

Degrade polyaromatic hydrocarbon, charcoal component

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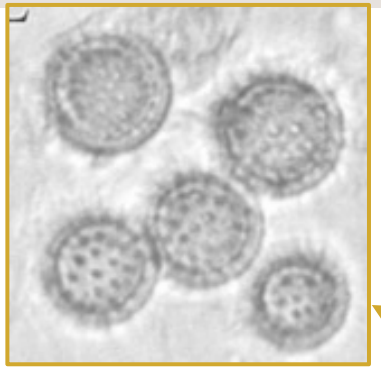
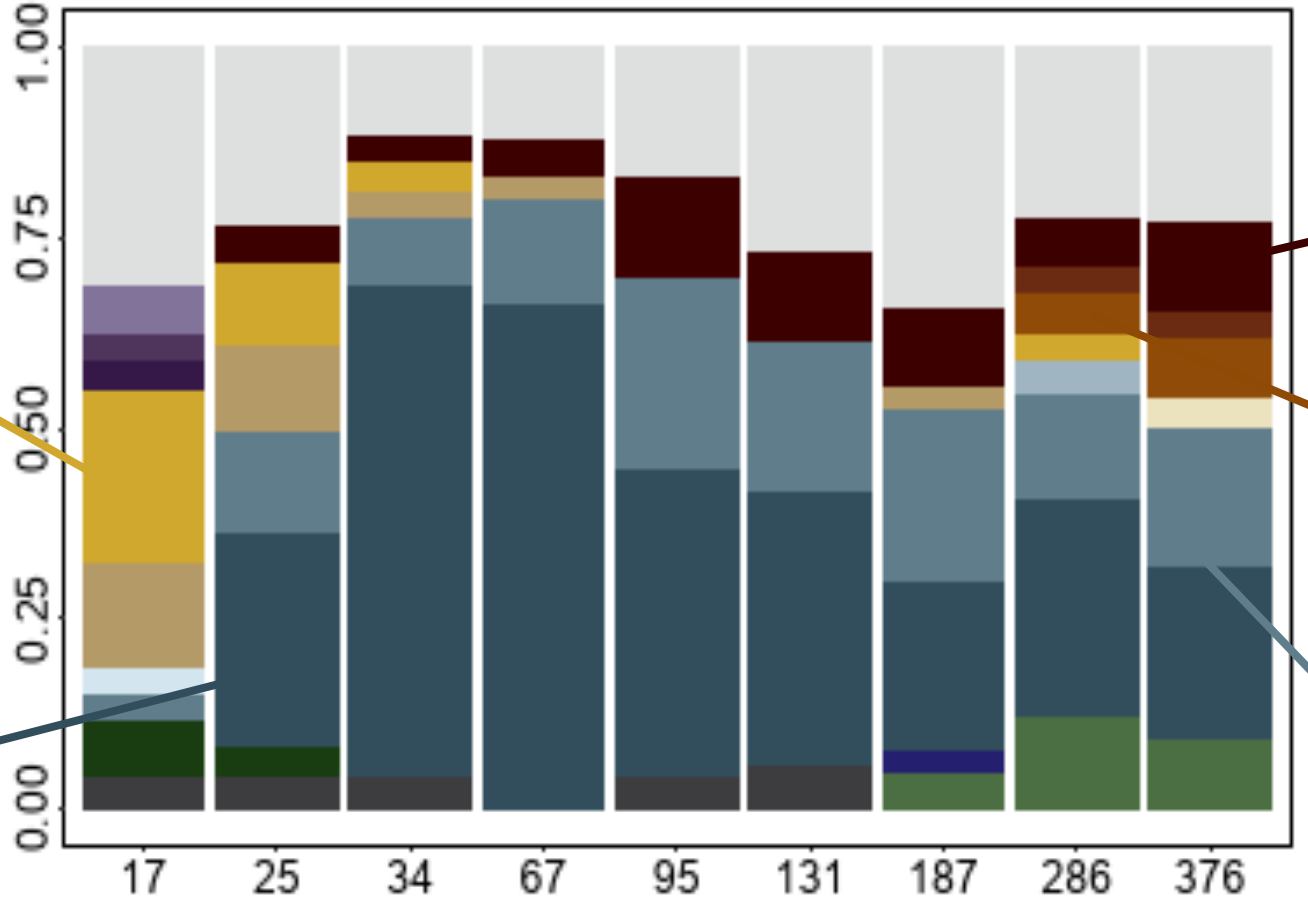
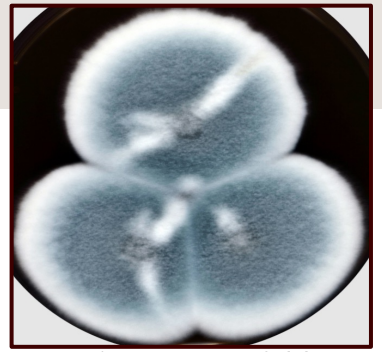
Burned communities dominated by a few pyrophilous fungi



Geminibasidium
Heat-resistant
and xerotolerant

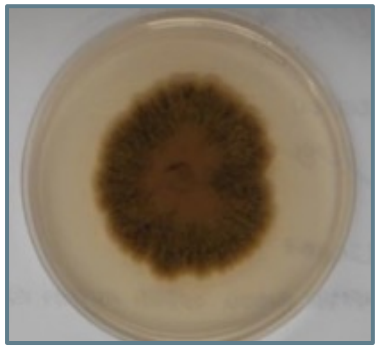
Pyronema
Heat-resistant
sclerotia





Aspergillus
Fast growing

Coprinellus
Decomposer



Penicillium
Fast growing

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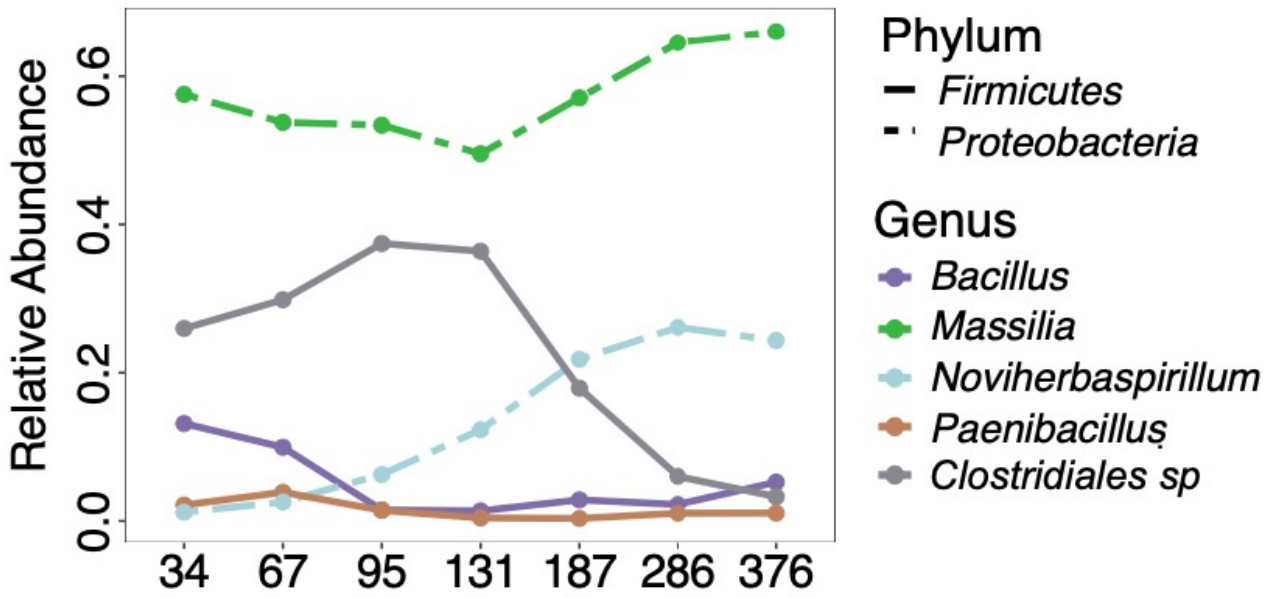
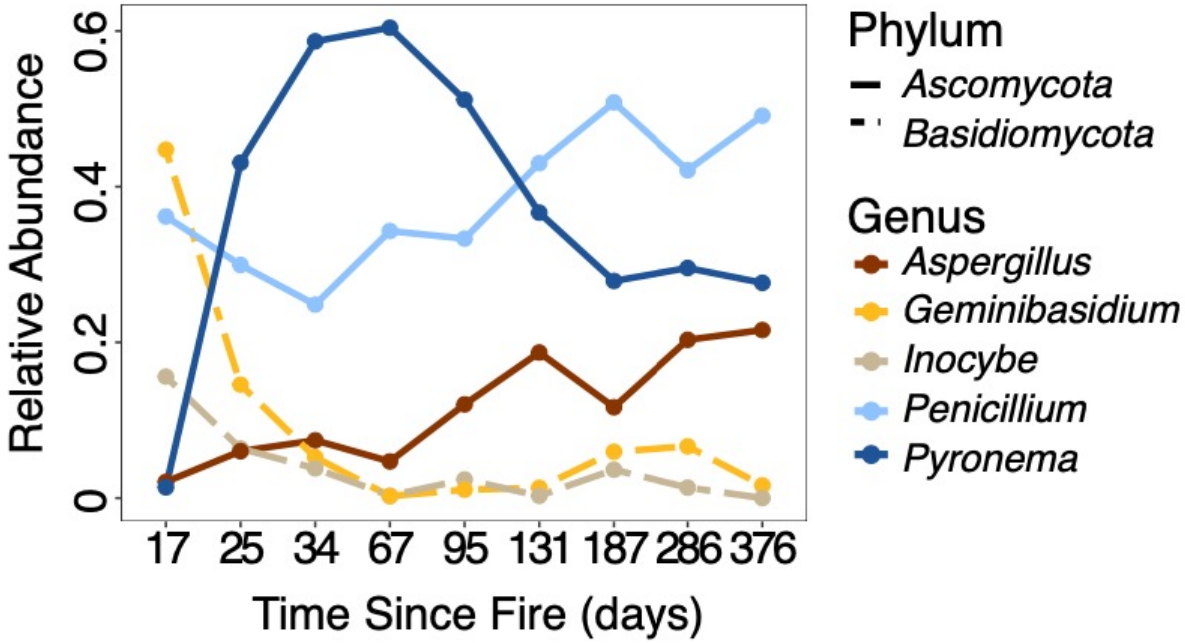
Burned communities dominated by a few pyrophilous microbes with distinct tradeoffs in abundance and traits

Bacteria



Fungi



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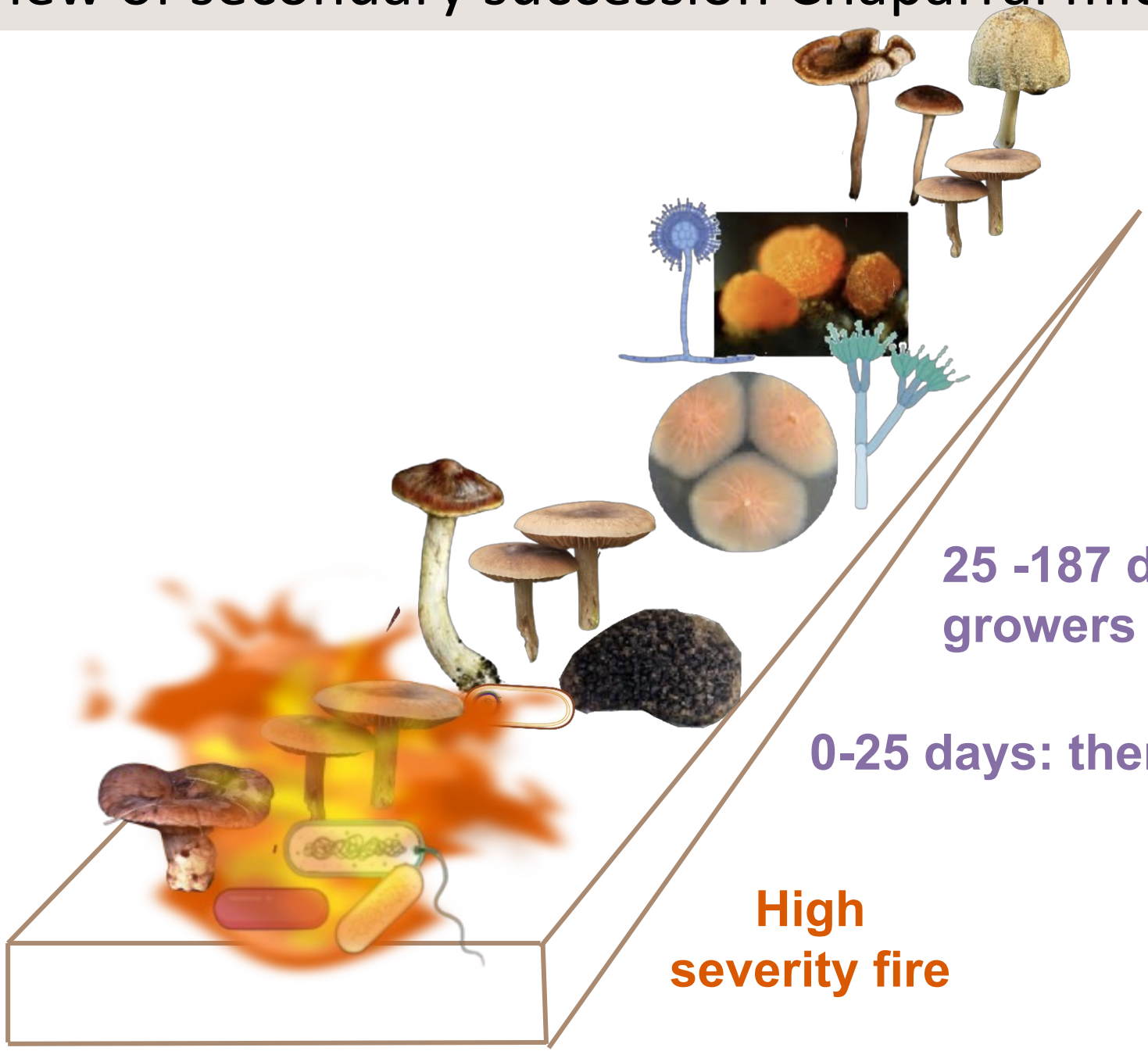
First detailed view of secondary succession Chaparral microbiomes



187 days-1 year
Resource
acquisition

25 -187 days: fast
growers

0-25 days: thermotolerators

High
severity fire

Summary

1. Wildfire significantly reduced bacterial & fungal richness

2. Burned bacterial and fungal communities experience rapid turnover rates likely driven by traits

3. Wildfire affected carbon and nitrogen cycling functions and increased aromatic degradation genes

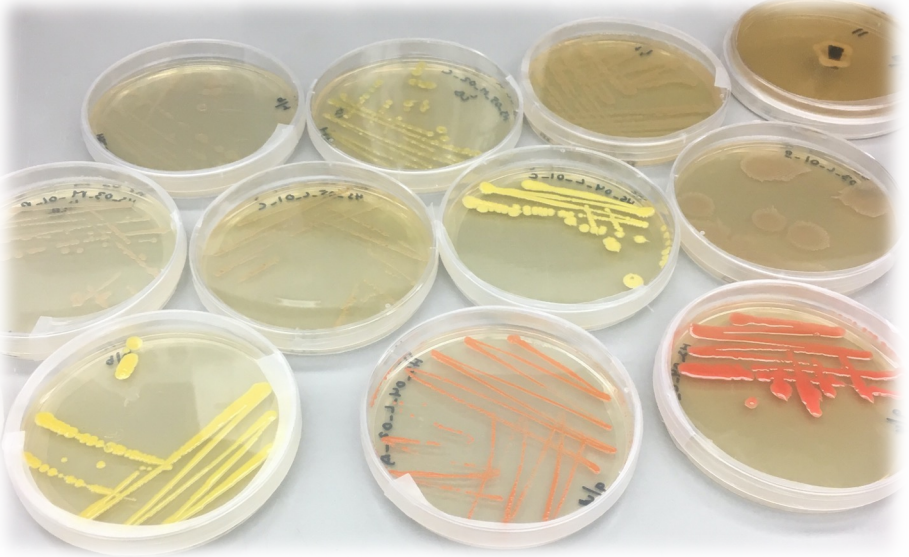
4. Certain pyrophilous microbes positively respond to fire

Bacteria: *Massilia, Bacillus, Paenibacillus, Noviherbaspirillium*

Fungi: *Geminibasidium, Pyronema, Penicillium, Aspergillus*

Next steps – biophysical assays & genomics

- Cultured >400 isolated of bacteria and fungi from burned soils
- Biophysical assays & genomics to assess traits of pyrophilous bacteria and fungi



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