

# *Plants harbor diverse microbiomes*

- Phylogenetically and ecologically diverse
- Occur in all plants and in all plant communities
- Shape plant health, productivity, and resilience
- Inhabit tissues such as roots and leaves





**Seeds: vital propagules for most plant species**

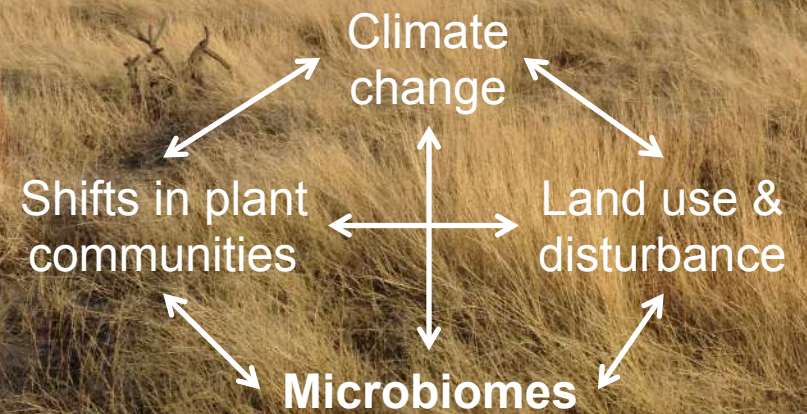
**Seed microbiomes: vital to plant establishment**

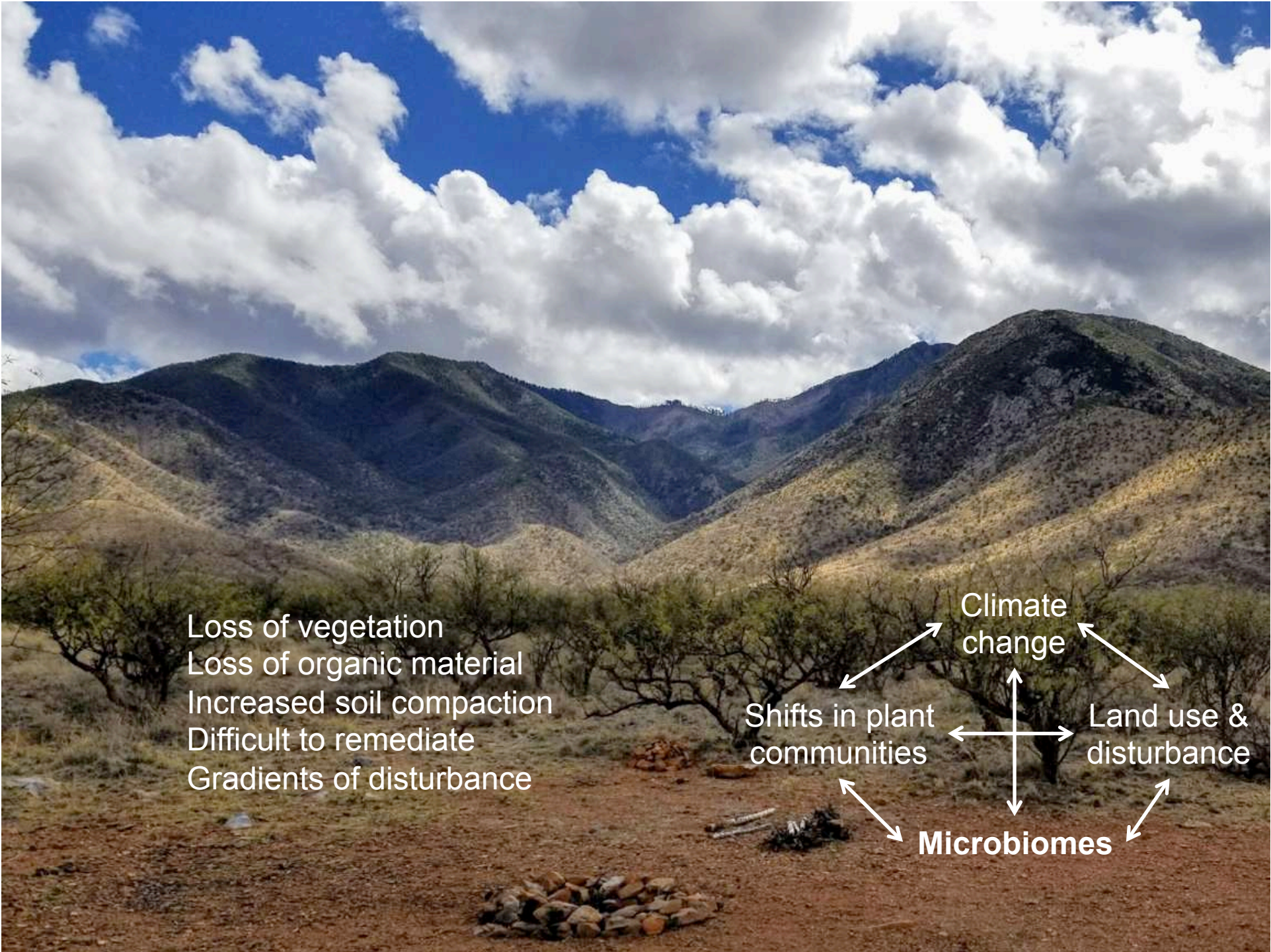
**Seed-microbe interactions: subject to strong selective pressure**

***Most seed-associated microbes are recruited from soil***

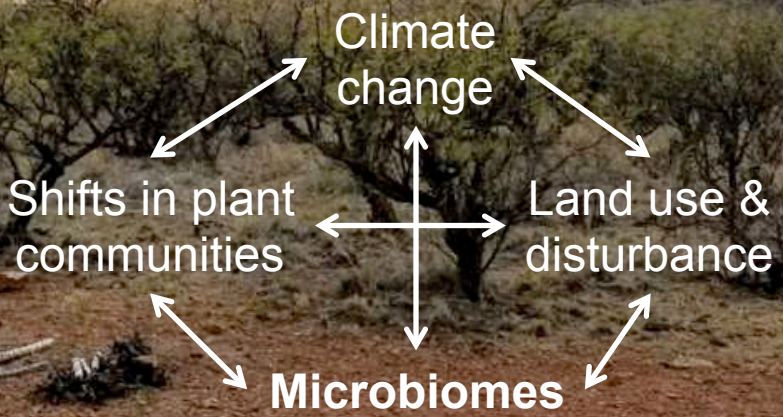
# Distributions and importance of soilborne microbes for seeds at the Santa Rita Experimental Range

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Loss of vegetation  
Loss of organic material  
Increased soil compaction  
Difficult to remediate  
Gradients of disturbance





***How does disturbance influence recruitment of soil microbes to seeds of a restoration plant?***

# *Field experiment*



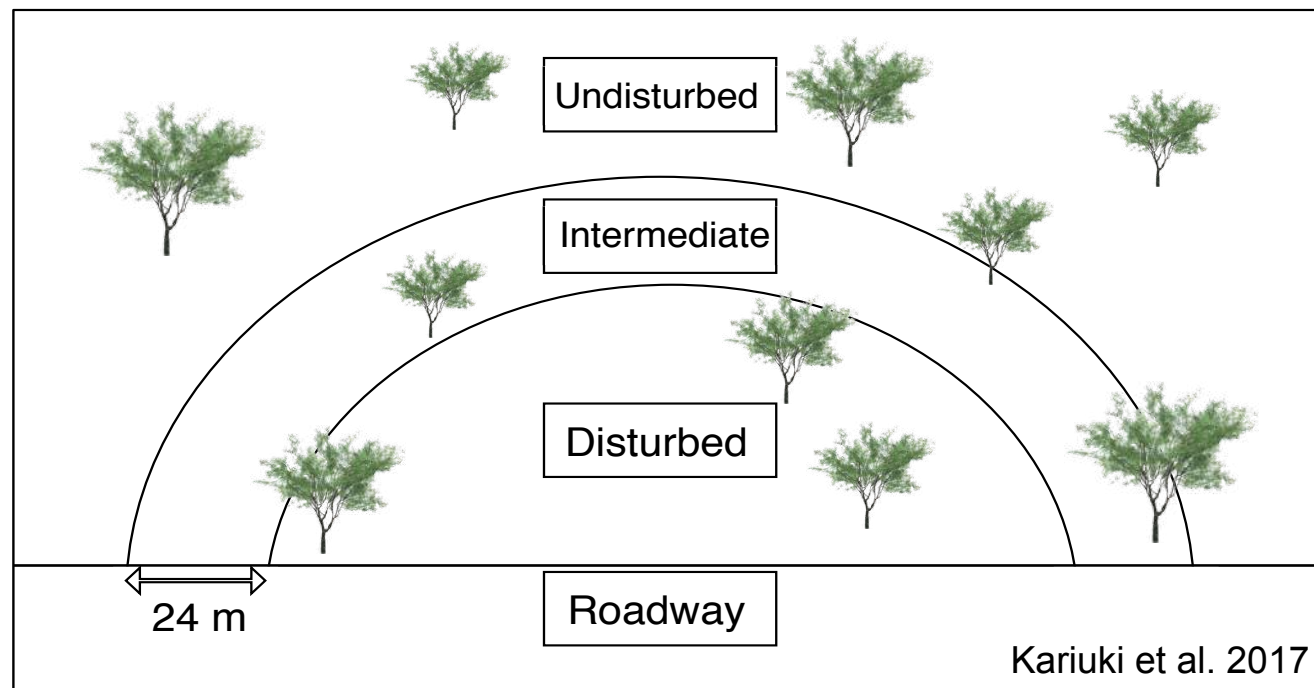
# *Field experiment*

- 50  $\mu\text{m}$  mesh bags permeable to soil and microbes
- 10 seeds/bag
- Buried 5 cm below soil surface
- Left in place for 10 days
- 2 plots per zone per campground (18 plots total)



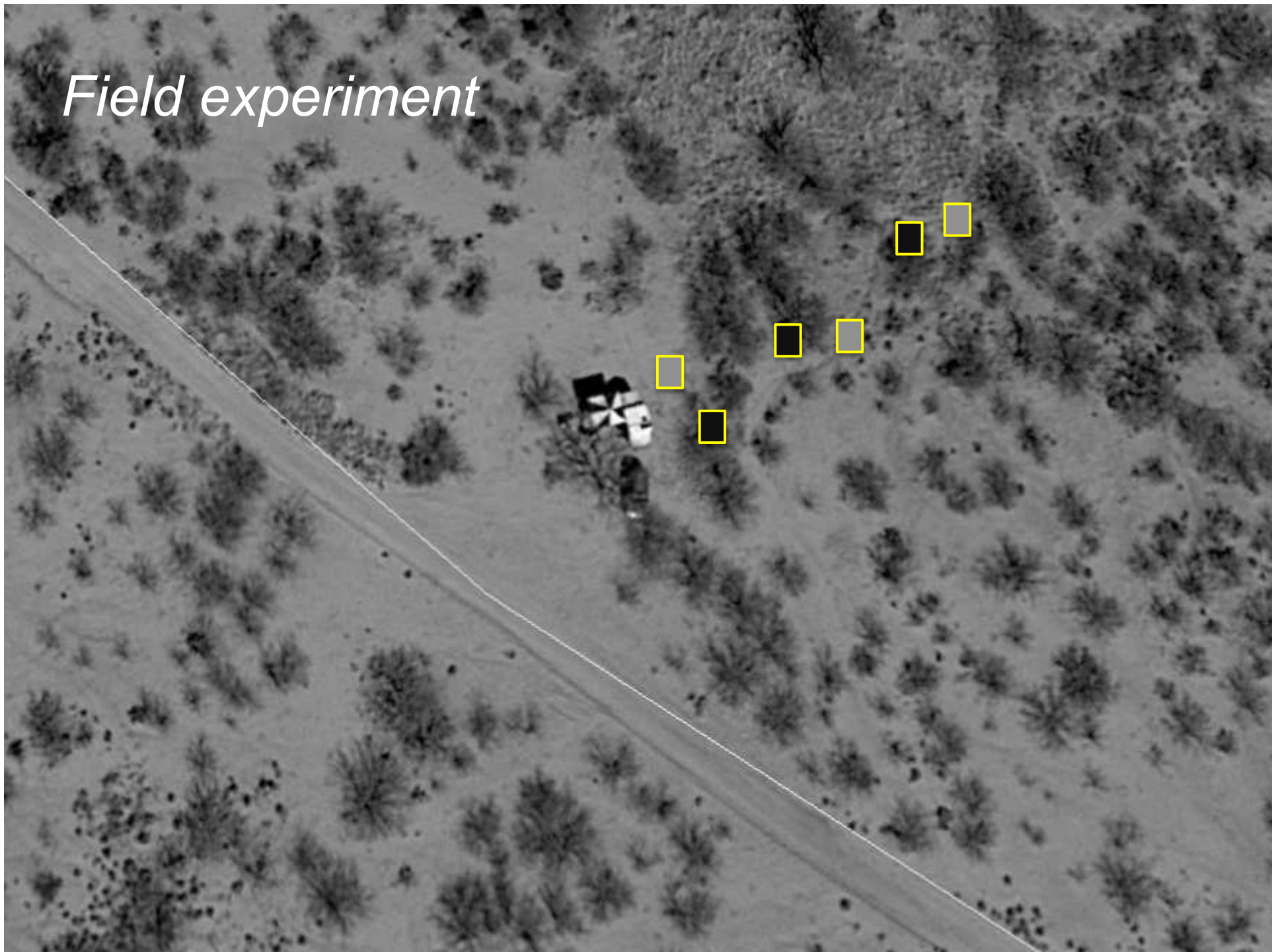
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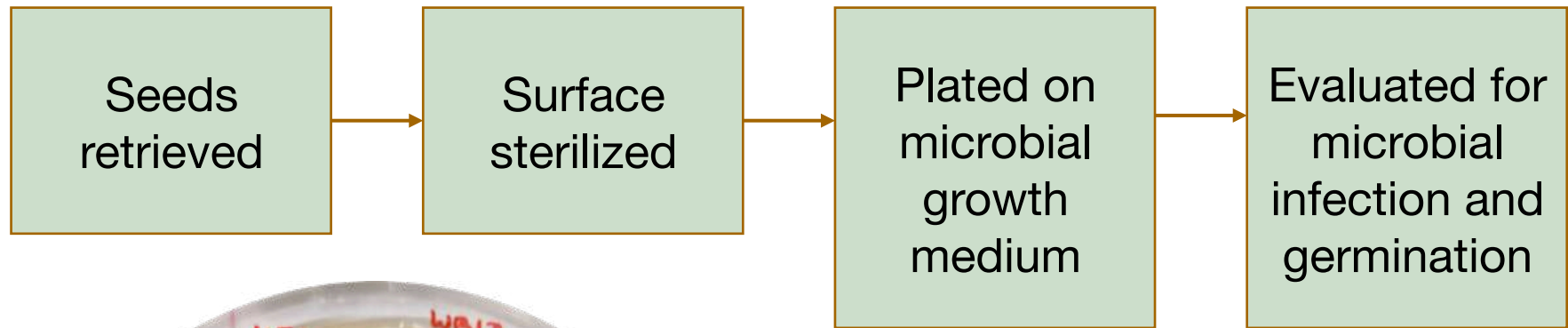




*Field experiment*



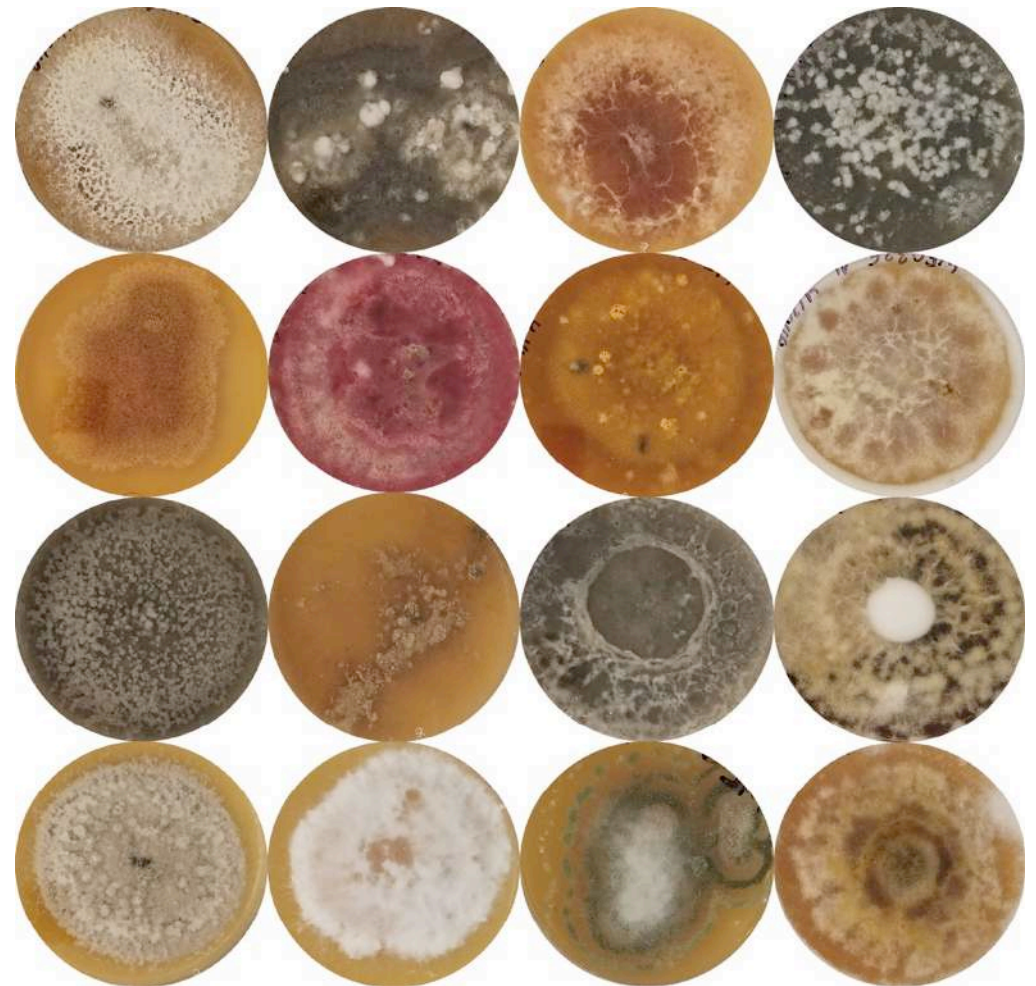
# *Microbial isolation and germination trials*



# *Microbial isolation and germination trials*

Permanent collection  
DNA barcoding  
Data sharing

Taxonomic identification  
Inoculation experiments  
Regional comparisons



# *Results*



# Results

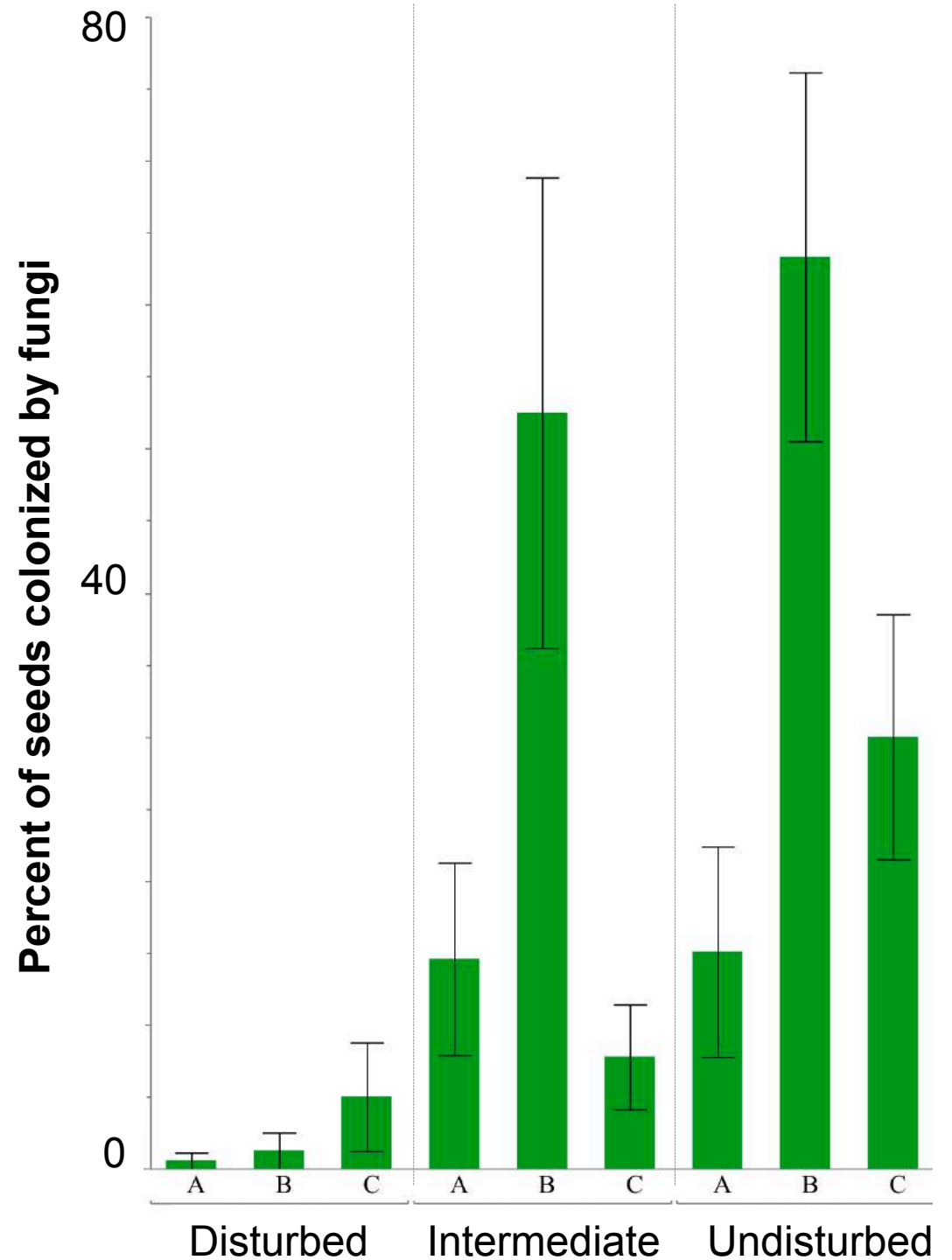
## Colonization of seeds

**Disturbance\*\***

Mesquite

Disturbance x mesquite

Soil chemistry (PC1)



# Results

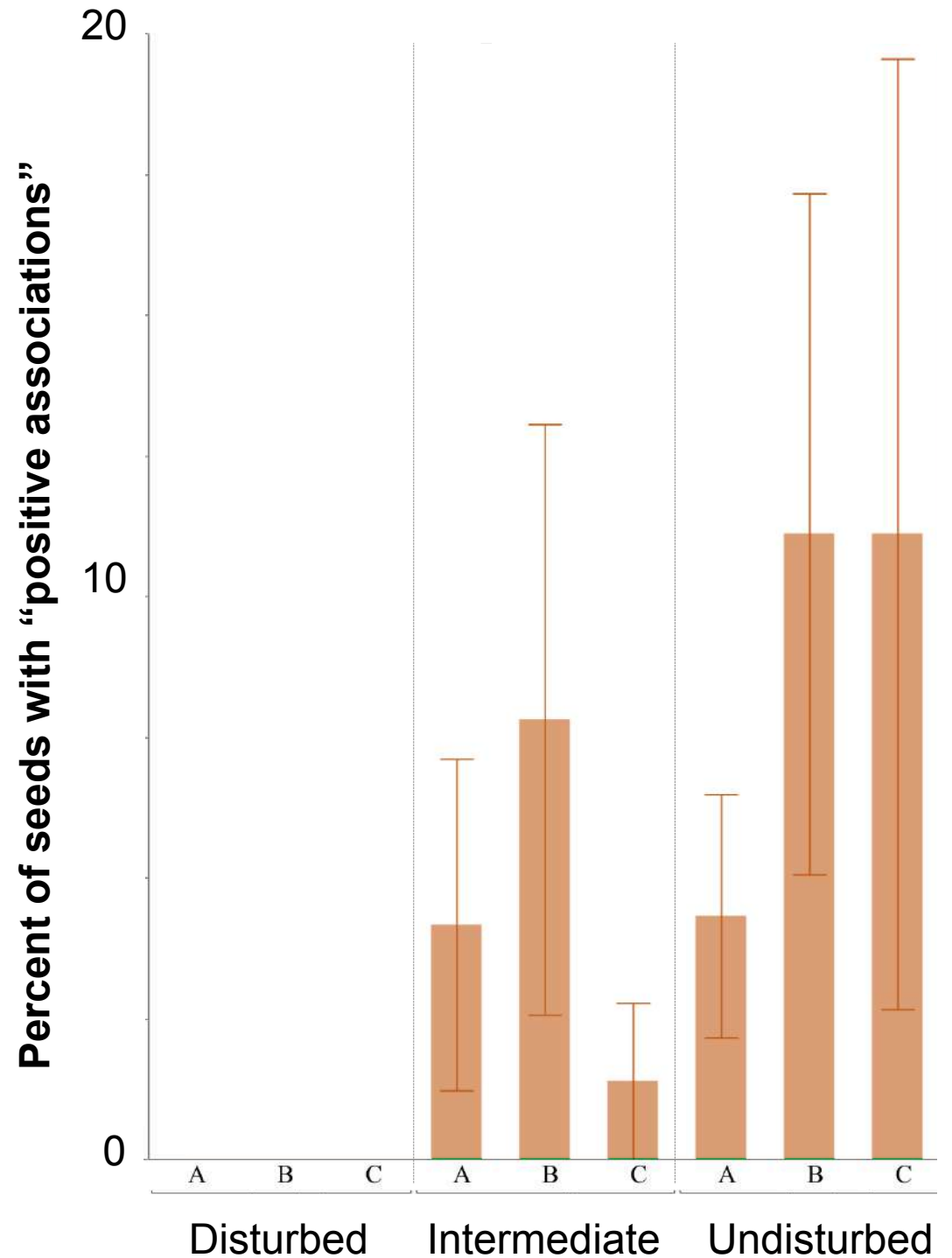
## Colonization + germination

### Disturbance\*\*

Mesquite

Disturbance x mesquite

Soil chemistry (PC1)



# Results

## Fungal species richness

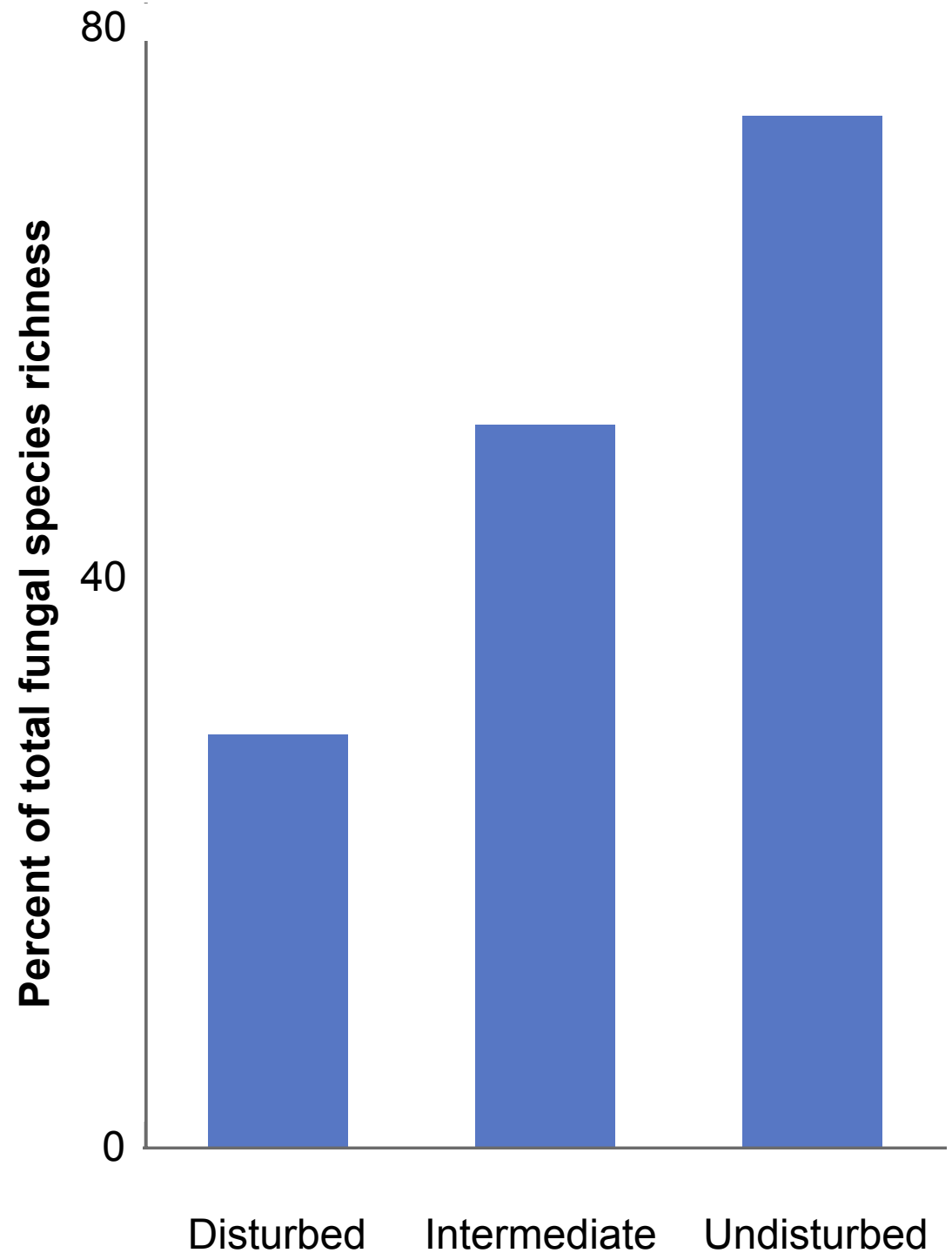
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**Disturbance\*\***

Mesquite

Disturbance x mesquite

Soil chemistry (PC1)



# Results

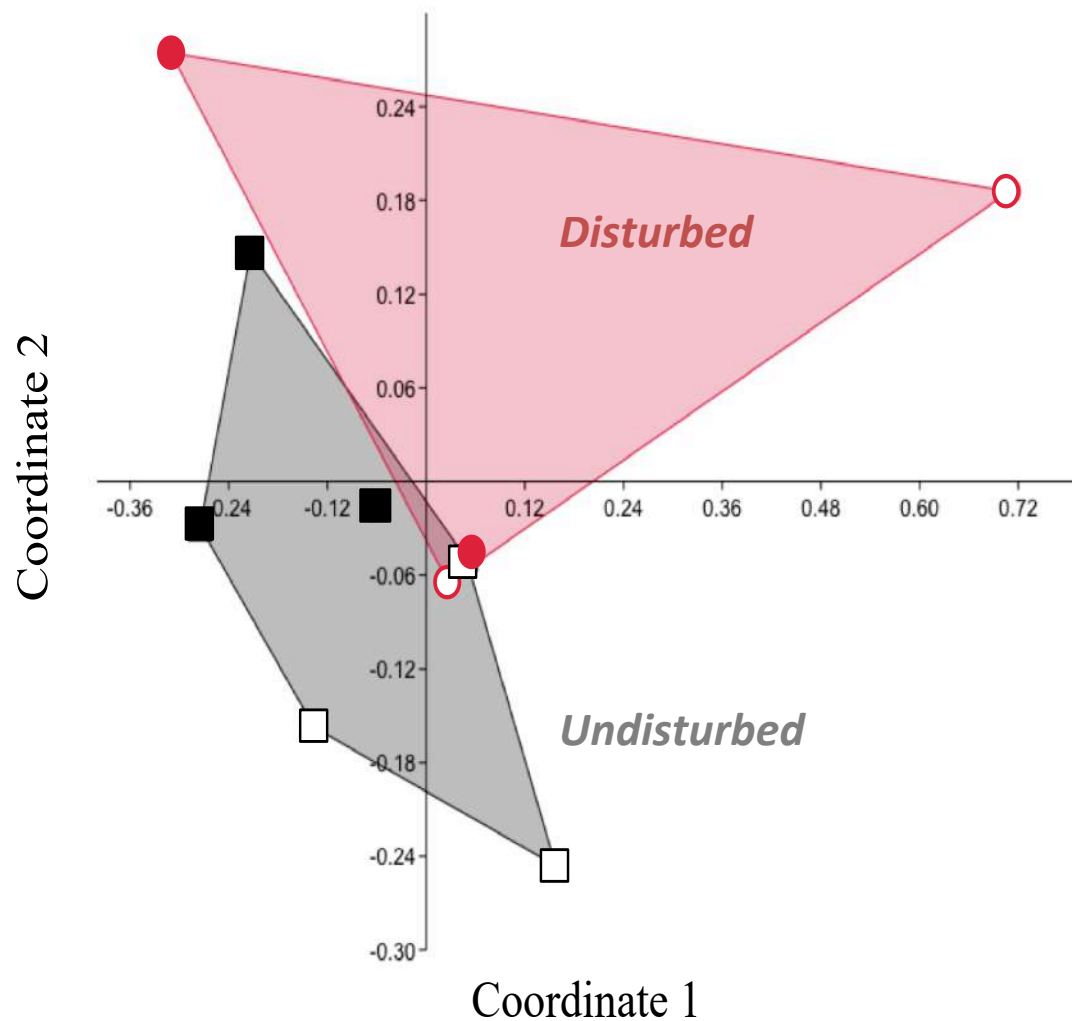
## Fungal community structure

**Disturbance\*\***

**Mesquite\***

Disturbance x mesquite

Soil chemistry (PC1)



NMDS – Bray Curtis  
Stress = 0.07  
ANOSIM P < 0.05



# Results

## Soil chemistry

Disturbance

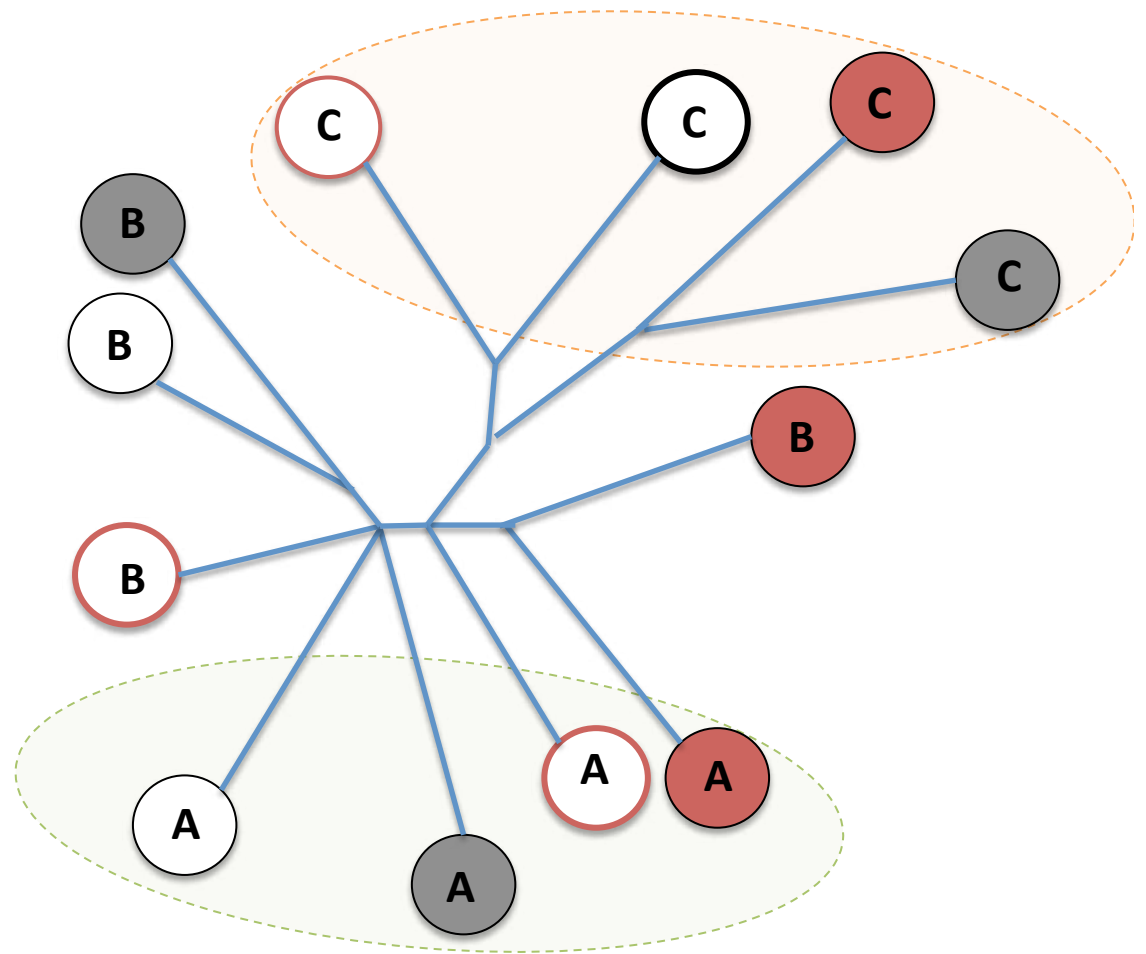
Mesquite

Disturbance x mesquite

*Disturbed*    *Undisturbed*

Filled = mesquite

Open = exposed



# *Conclusions*

## **1. As disturbance increased...**

- **fungi colonized seeds of a restoration plant less frequently**
- **infections of seeds were less frequently positive**
- **fungus species richness decreased**
- **fungus communities shifted markedly**

## **2. Such shifts likely reflect factors other than changes in soil chemistry**

- **soil compaction; loss of water-holding capacity and/or organic material?**



# *Ongoing work*

Native seeds for desirable remediation

Experiments to evaluate microbial effects on seedlings and mature plants

Evaluating microbiomes of Lehmann's lovegrass for potential impacts on native species



*Thank you*



**Ashton Leo**

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