Associations between an invasive plant (Taeniatherum caput-medusae, Medusahead) and soil microbial communities

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The soil microbiome

The fungal and bacterial communities that exist in the soil

It’s BIG – near the root zone, 1 gram of soil has up to 10 billion microbes and 30k different microbe species.
The soil microbiome affects *just about everything*

- Stress tolerance in plants
- Foraging behavior
- Root growth
- Crop production
- Restoration success
- Water infiltration
- Nutrient cycling
- Insect invasion
- Litter decomposition
The soil microbiome affects plants

Beneficial microbes
- beneficial nutrients
- enhance root growth
- disease protection
- drought tolerance

Commensal microbes

Pathogenic microbes
- create a harmful environment
- cause infection

Pathogenic microbes cause infection, creating a harmful environment. Beneficial microbes enhance root growth, provide disease protection, and improve drought tolerance. Commensal microbes contribute to the environment, though their impact is less defined.

The presence of both beneficial and pathogenic microbes in the soil microbiome affects plant health.
Plants affect the soil microbiome
Why do plants become invasive?

**Plant-based factors**
- Faster growth rate
- More stress tolerant
- Higher seed production
- Rhizomatous growth

**Environmental-based factors**
- Stress increases
- Change in resources
- Disturbance
- Lack of predators
Why do plants become invasive?

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- Environmental factors

Soil microbiome
Invasive plants and the soil microbiome

Parepa et al. 2013 Ecosphere
Invasive plants and the soil microbiome

Batten et al. 2006 Biological Invasions
The soil microbiome and medusahead

Important for

Predicting invasion

Identifying management priorities

Develop management strategies
Our experiment

1. Does medusahead modify the soil microbiome?
Our experiment

1. Does medusahead modify the soil microbiome?
2. Does invasion intensity affect the relationship between medusahead and the soil microbiome?
Our experiment

1. Does medusahead modify the soil microbiome?
2. Does invasion intensity affect the relationship between medusahead and the soil microbiome?
3. How do soil microbial communities differ in areas where medusahead is successful vs. areas where medusahead is unsuccessful?
Results
Results

Bacteria

Fungi

Gornish et al. 2016 PLoS One
Results

Does medusahead modify the soil microbiome?

Gornish et al. 2016 *PLoS One*
Results

Does medusahead modify the soil microbiome? NO

Gornish et al. 2016 PLoS One
Results

Does medusahead modify the soil microbiome?  

NOT COMMUNITIES

Gornish et al. 2016 PLoS One
Results

Gornish et al. 2016 PLoS One

Does invasion intensity affect the relationship between medusahead and the soil microbiome?
Does invasion intensity affect the relationship between medusahead and the soil microbiome? 

NO
How do soil microbial communities differ in areas where medusahead is successful vs. areas where medusahead is unsuccessful?
Results

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How do soil microbial communities differ in areas where medusahead is successful vs. areas where medusahead is unsuccessful?

**They are completely different**
What does it all mean?
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Areas that have a history of medusahead invasion do not necessarily need to be treated differently than those that do not.
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In terms of soil-plant relationships, medusahead infestations of different intensities do not require different control approaches.
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In terms of soil-plant relationships, medusahead infestations of different intensities do not require different control approaches.

Medusahead might be excluded from oak habitat because of soil characteristics.
THANK YOU!

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