Brachypodium invasion in California may be facilitated by rhizosphere microbes

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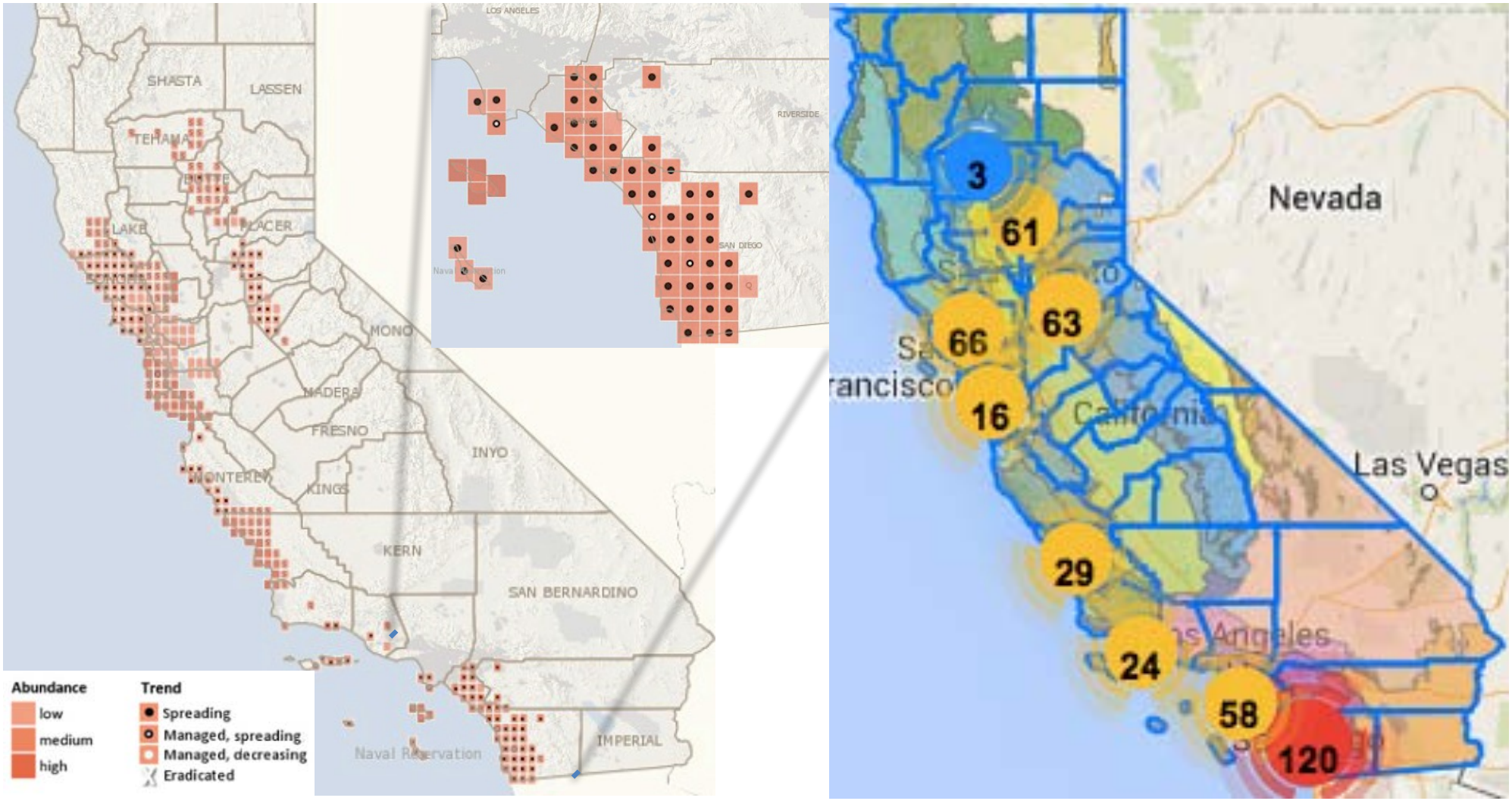
Brachypodium “distachyon” considered invasive in CA



Brachypodium “distachyon” densities

San Diego County, CA, USA

Zaragoza, Spain

Brachypodium “distachyon” is really 3 species

B. distachyon B. staceii B. hybridum

Catalan et al. 2012

Drivers of Invasion

- Enemy release
- Exploitation of naïve community
- Mutualists co-invade

Drivers of Invasion

- Enemy release
- Exploitation of naïve community
- Mutualists co-invade
- Some combination of these and other factors

Objective

- To better understand what is driving invasion by *Brachypodium* annual spp., in CA by investigating their microbiome in their native range
  - May lead to better understanding of past invasion by *Bromus* annual spp.
  - Assist with preventing or controlling invasions

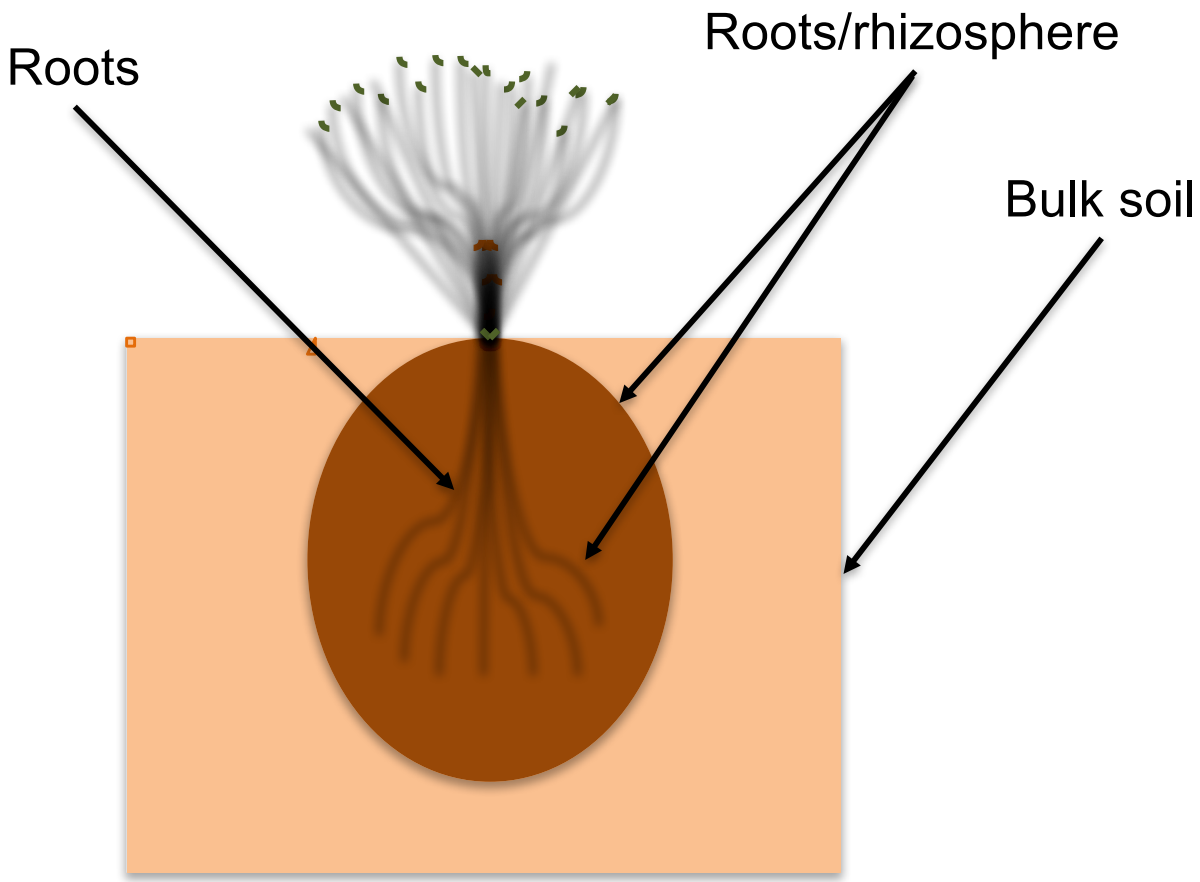
Hypotheses

- Grass root microbiomes are a subset selected from their surrounding rhizosphere communities, which in turn select from bulk soil communities
- Closely related genera differ in their root and rhizosphere microbial communities

Methods

- Collected *Brachypodium* spp. and co-occurring *Bromus* spp. in May 2014 and 2015
- For *Brachypodium* spp. we collected *B. distachyon* and *B. hybridum* (here reported together)
- For *Bromus* spp. we collected *B. rubens* and *B. madritensis* (here reported together)
- Collections were performed in Spain, within the native range, and Califonia, the invaded range for both genera

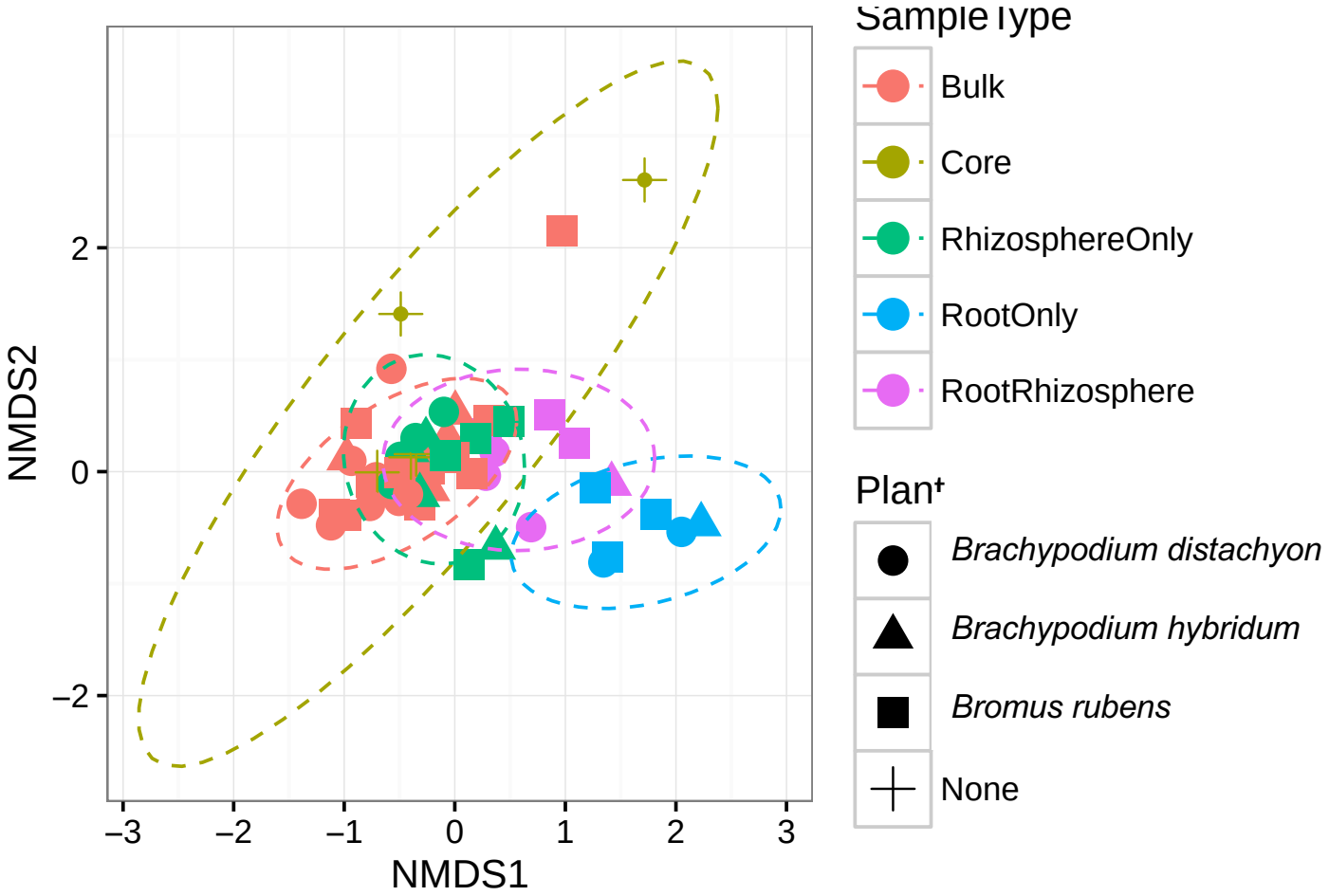
Plant sampling scheme



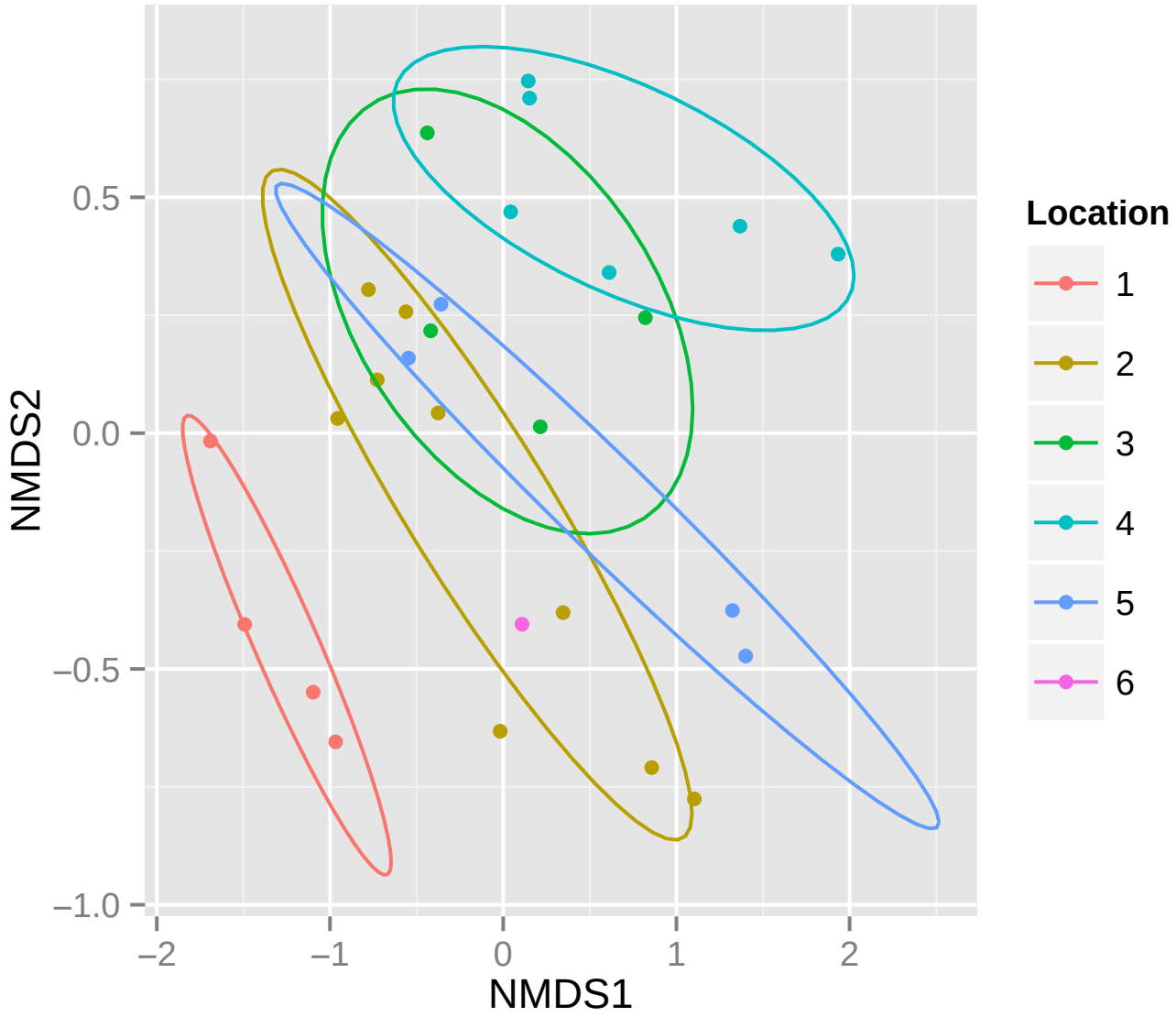
Molecular methods

- DNA extracted using MoBio PowerSoil kit
- PCR for V3 and V4 regions of 16S rRNA gene
- Sequenced via Illumina MiSeq
- Analyzed via QIIME and R

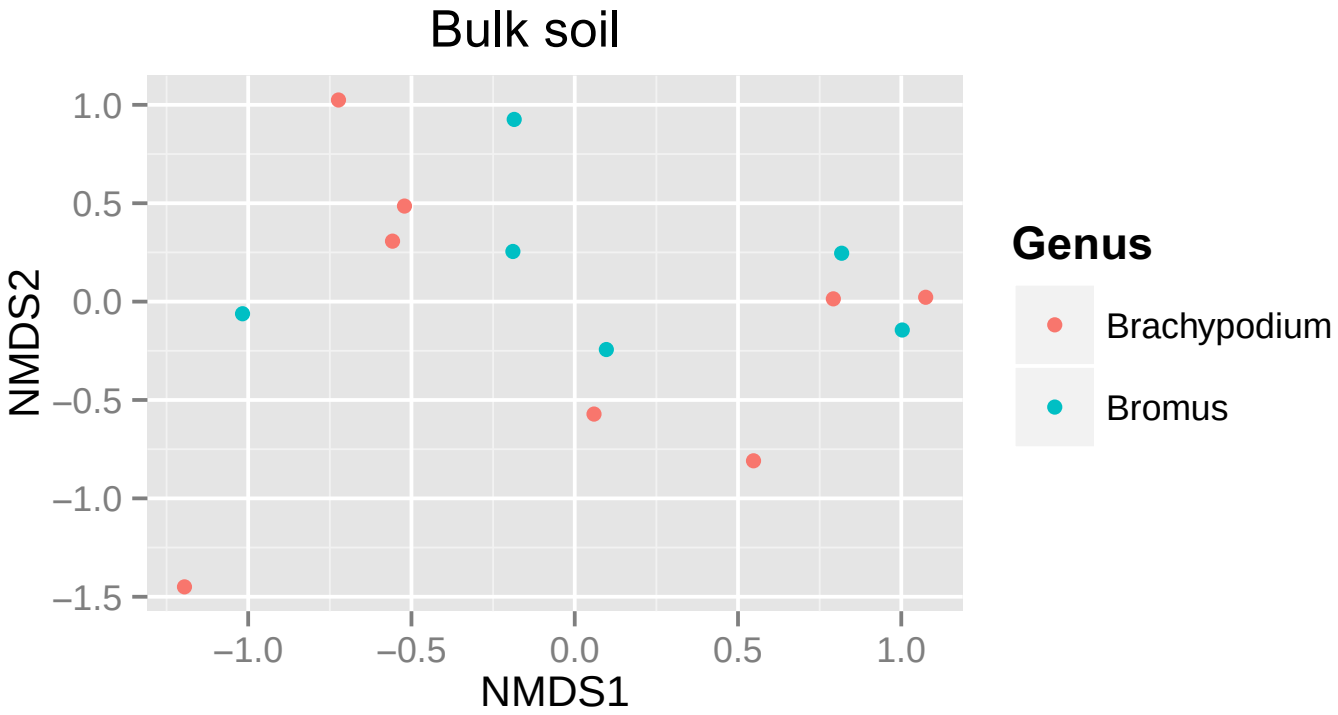
Results: By sample type across locations and years



Results: Locations differed within Spain



Results: Microbial communities by plant genus



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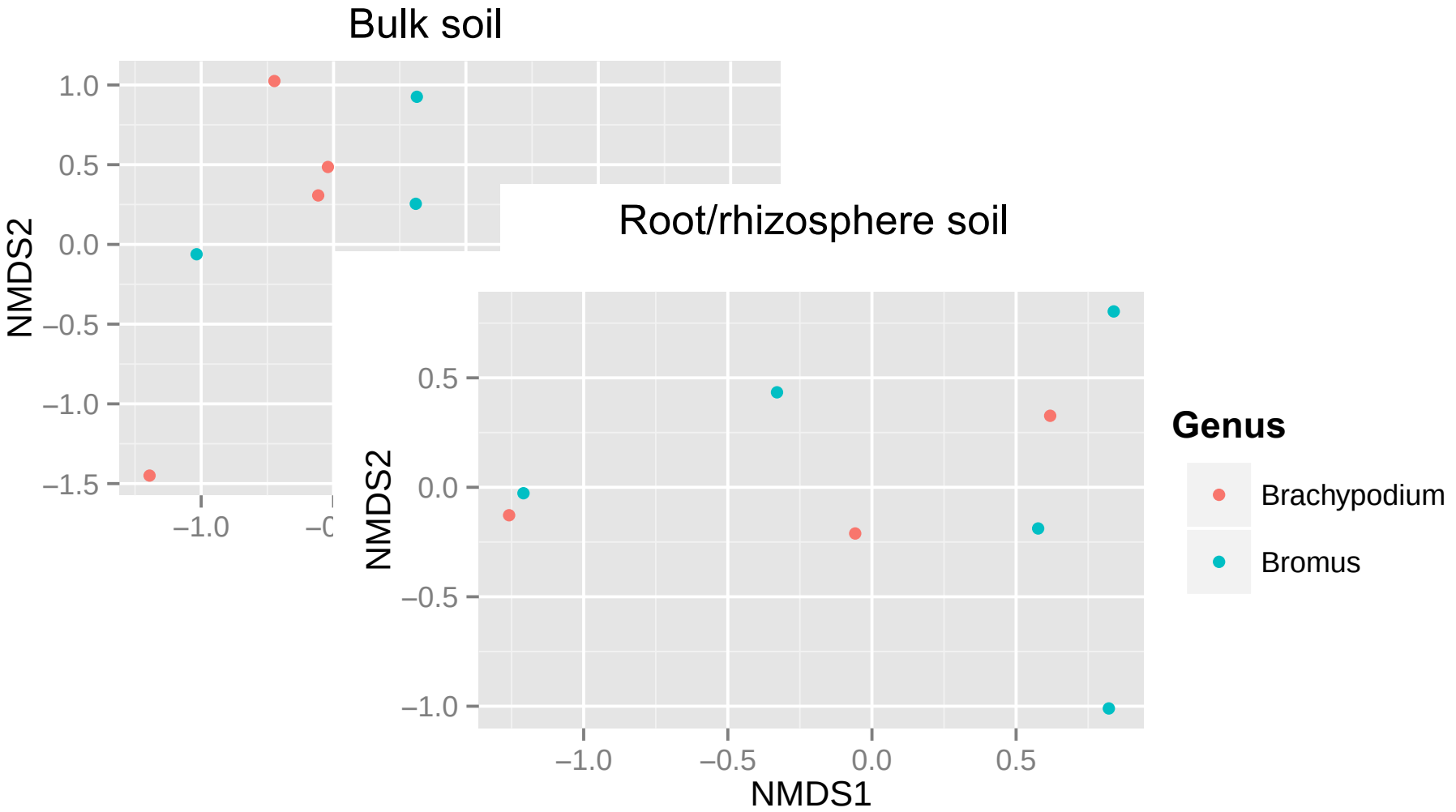

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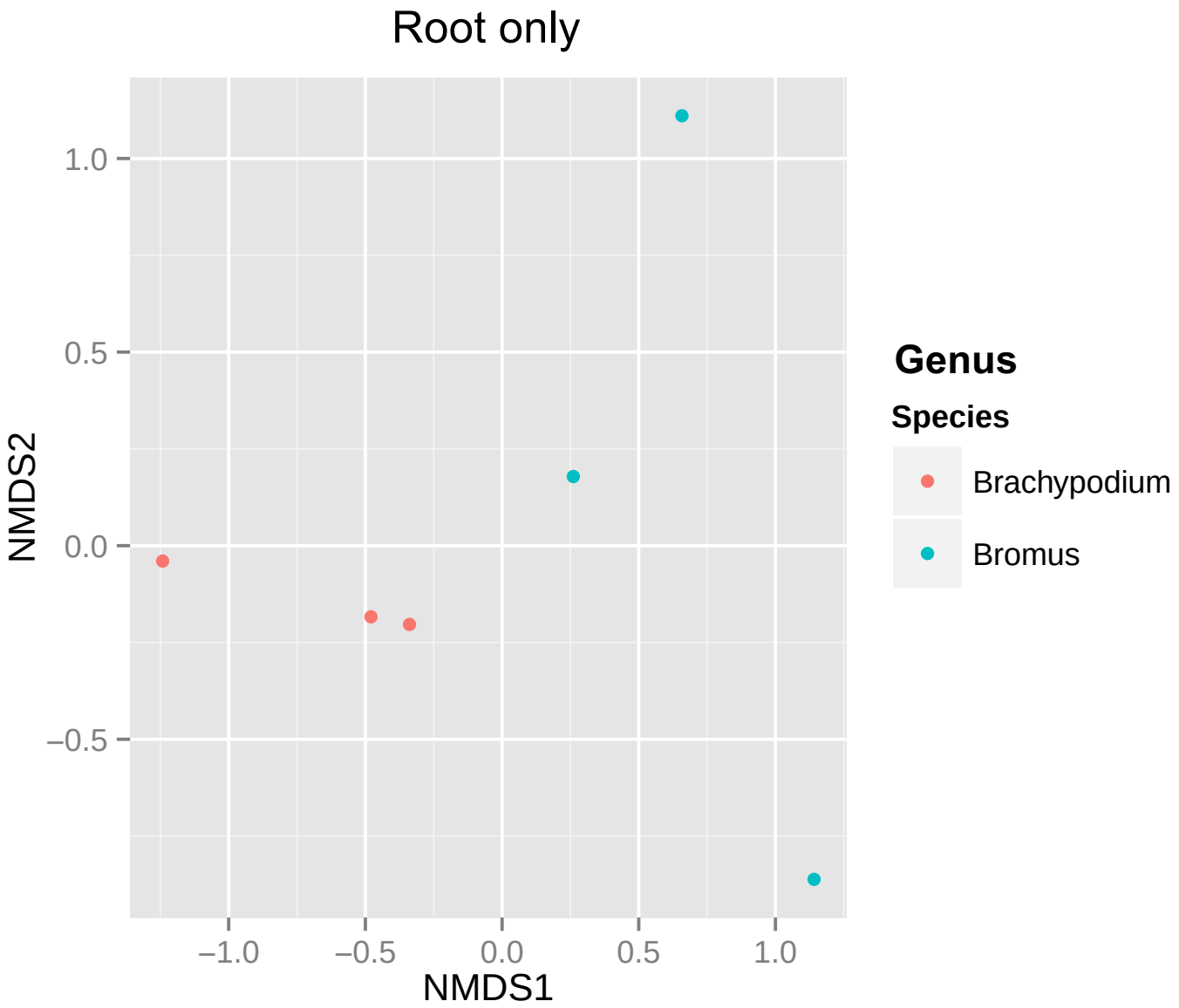
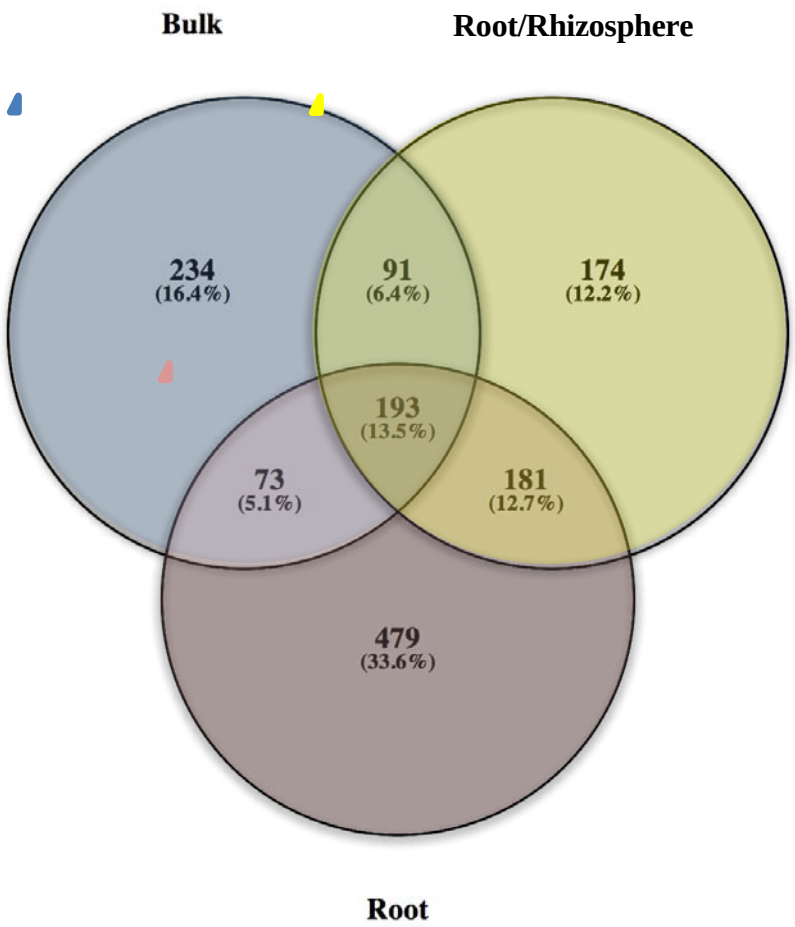
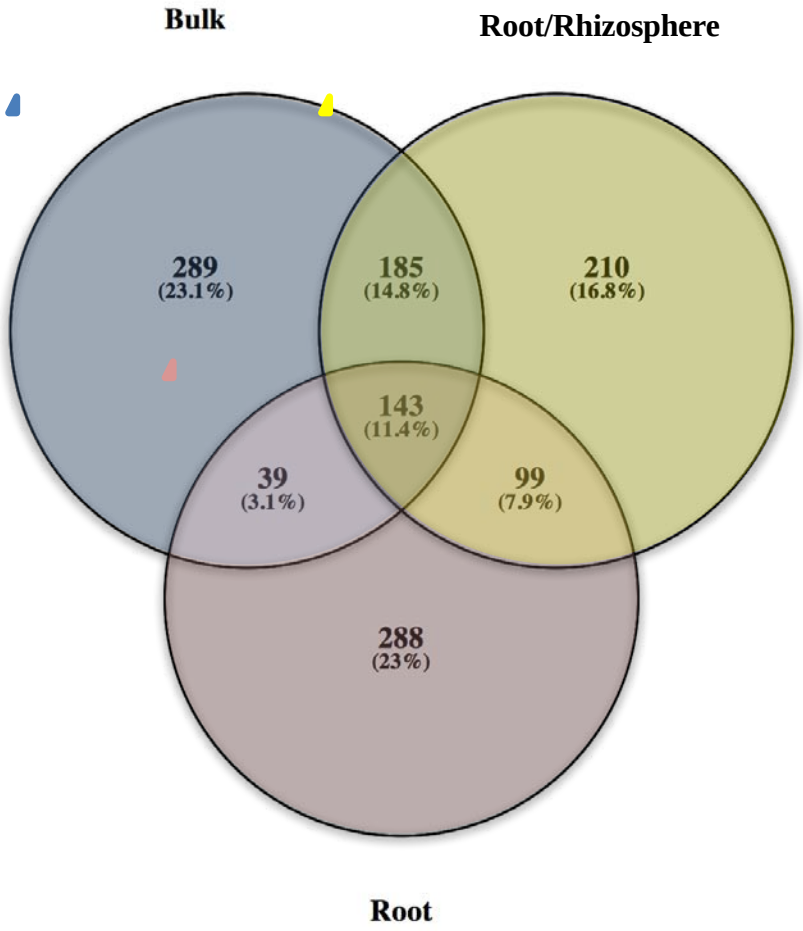


Results: Core microbiome within Spain

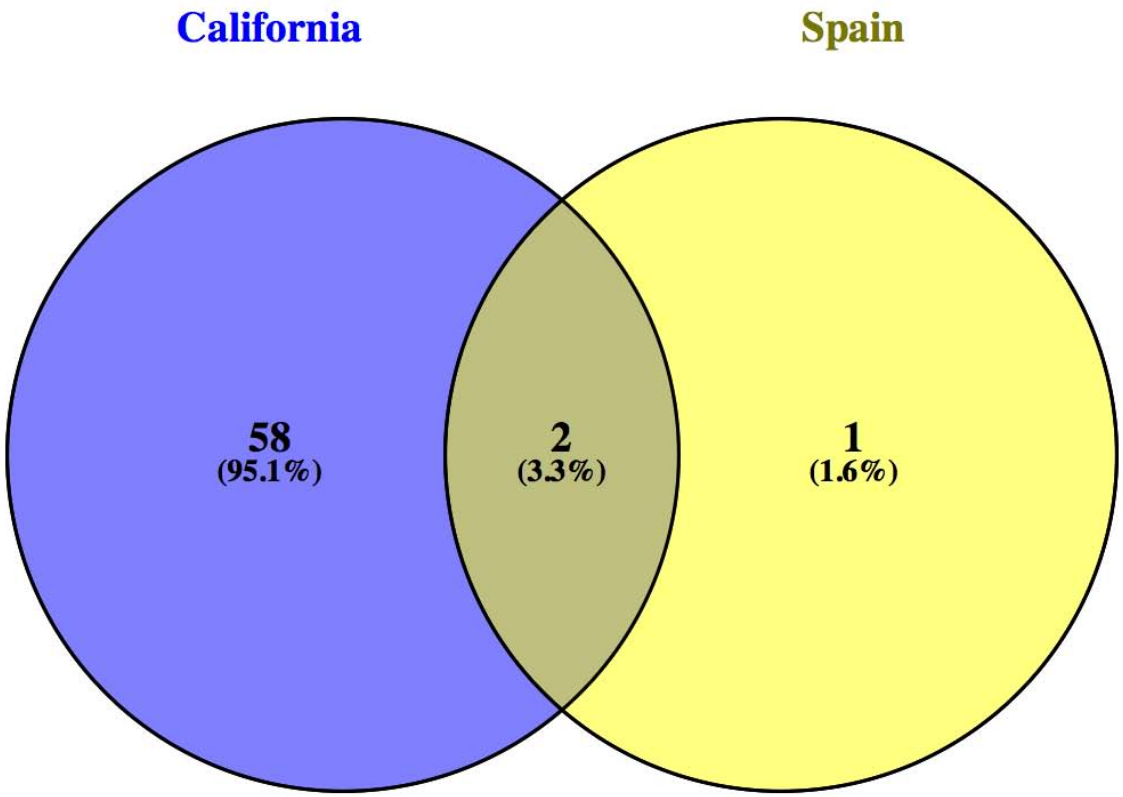
Brachypodium



Bromus



Core microbiome CA to Spain



Conclusions

- Invasive grass root endophyte communities are unique between plant genera, while nearby soil communities are not
- As the bacteria show little overlap between Spain and CA, we have an indication of the Enemy Release Hypothesis

Impact

- These data may lead to identification of beneficial or detrimental root endophytes
- May aid in the understanding of, and biocontrol for, these grasses in California.

Continuing research

- Additional collections were performed in 2015 & 2016
- Matched collections performed in Spain and California
- Roots completely separated from rhizosphere in all 2015/2016 samples
- In the process of sequencing these samples now.

Acknowledgements

Collaborators

- Ruben and others in the Catalan Lab at Escuela Politechnica de Huesca
- Edie and Mike Allen at UC Riverside

The Aronson Lab

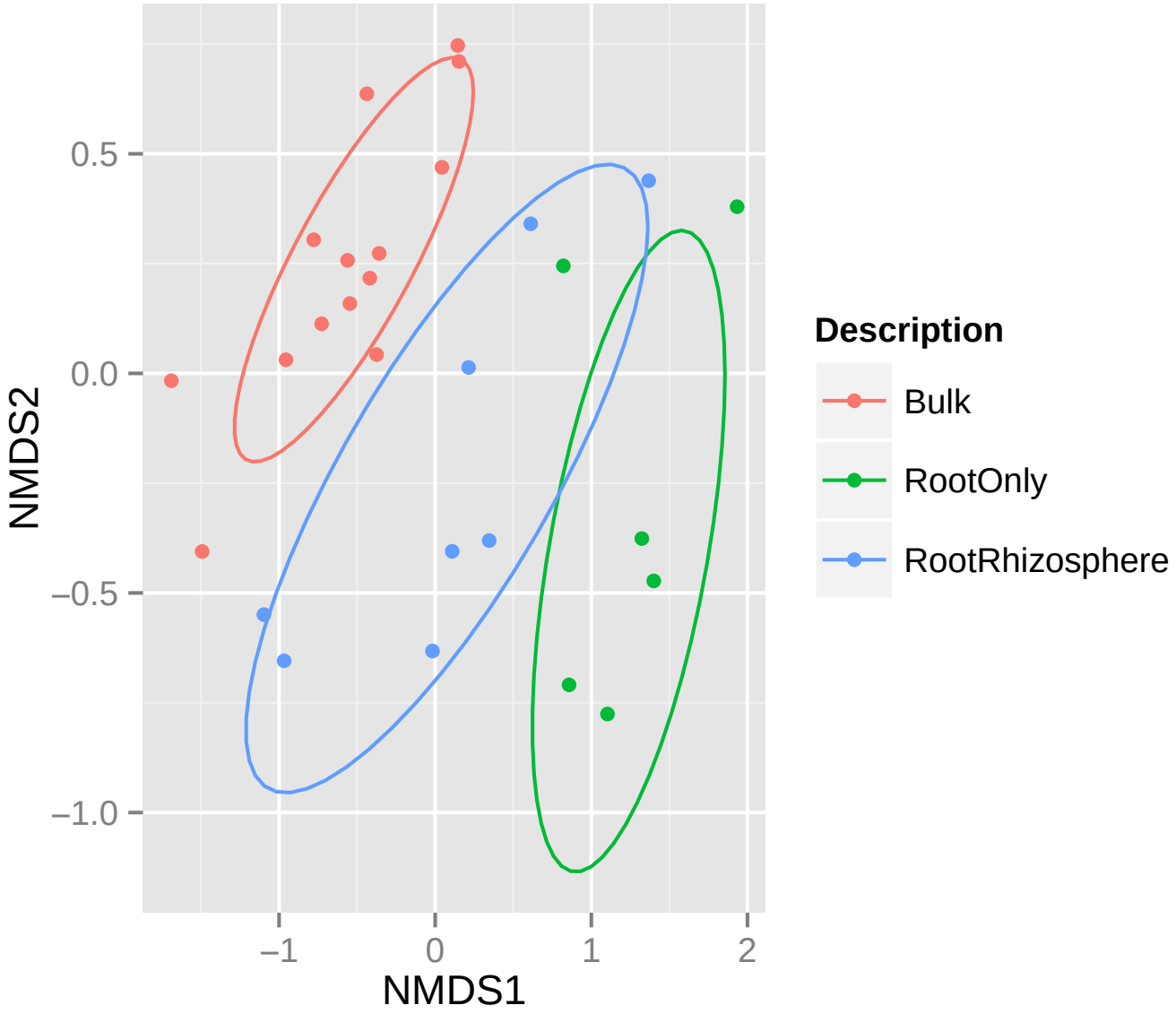
- Graduate student Brooke Pickett
- Undergraduate students Andres Rodriguez, Taryn Barsotti, and Samantha Chow

Funding Source

- USDA NIFA AFRI SEED grant


Questions?

Results – Spain 2014



Results: Overlapping species and years