Comparative Analysis of Microbial Functional Diversity Between Rhizosphere and Bulk Soil Across Three Ecological Zones: Lowland, Riparian, and Sedge Habitats

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Introduction

- Functional diversity of microbial communities in wetlands is essential in nutrient cycling and overall ecosystem dynamics
- The rhizosphere, the soil zone adjacent to plant roots, has a unique microbial community compared to bulk soil
- This research explores the functional diversity in microbial communities across rhizosphere and bulk soil in three vegetation types, enhancing the comprehension of wetland microbial ecosystems

Methods

- Three wetland vegetation types: sedge (J. acutus), riparian, and lowland (Typha-dominated) were studied
- Random bulk soil (8) or rhizosphere (5) samples/vegetation type

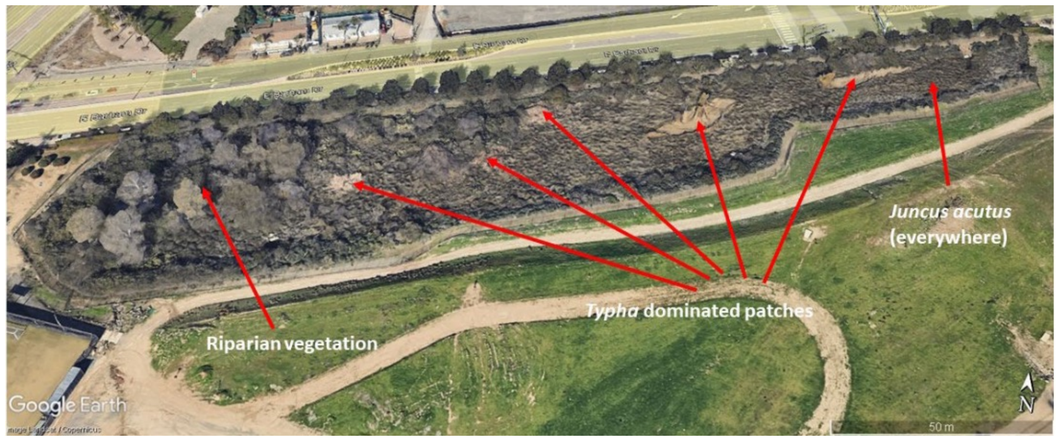
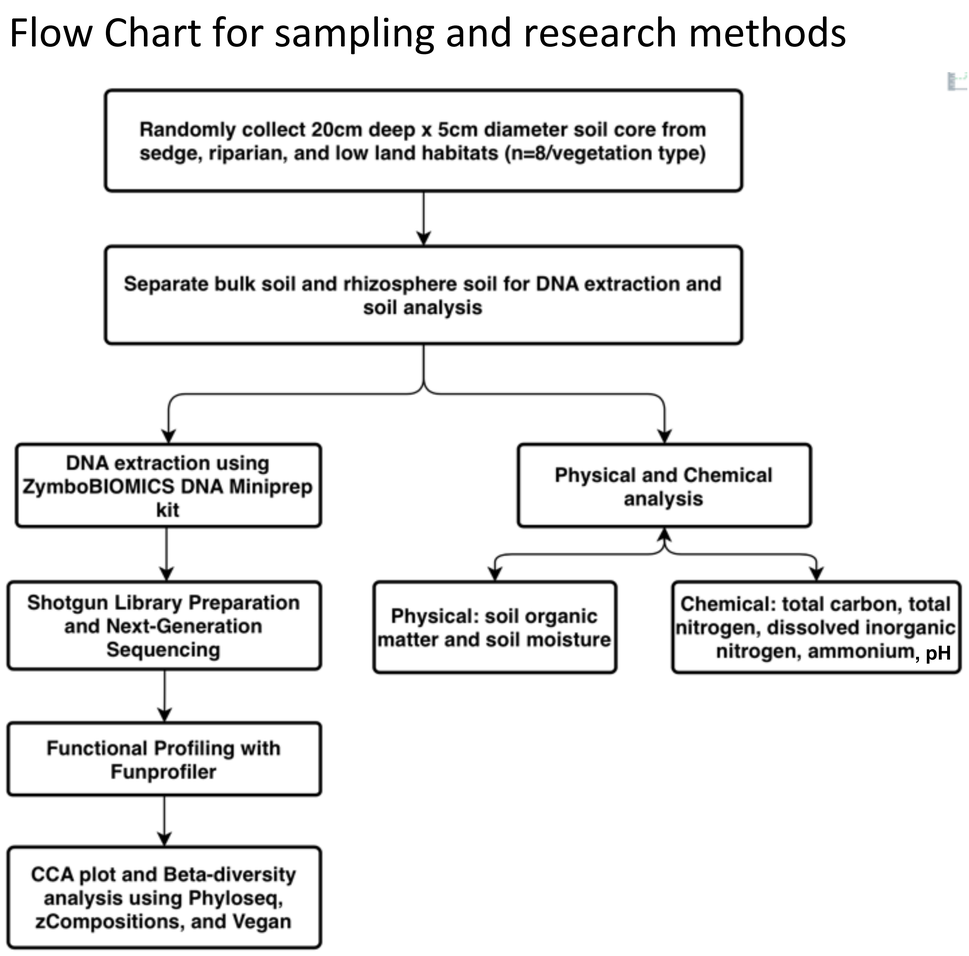


Fig. 1. An image of the CSUSM wetland in 2022, sourced from Google Earth. The red arrows indicate the various vegetation types selected for sampling



Results and Discussion

Bulk Soil

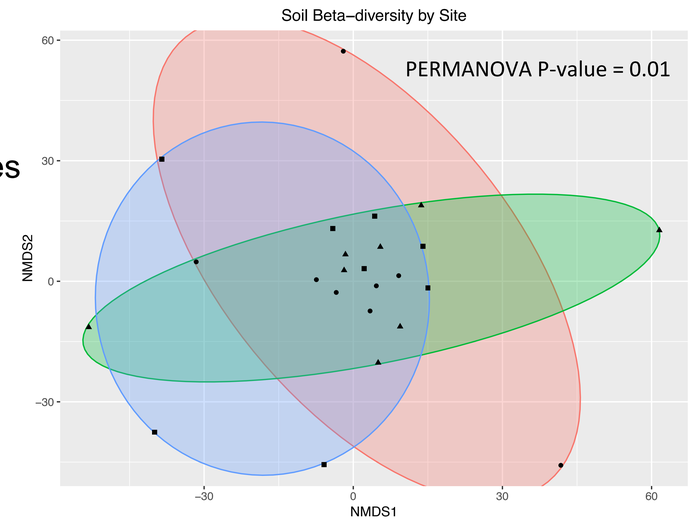


Figure 2. Bulk soil Beta-diversity comparing the differences between soil functional profiles present by sites. Sites represent: L: lowland, S: sedge, and R: riparian

Rhizosphere

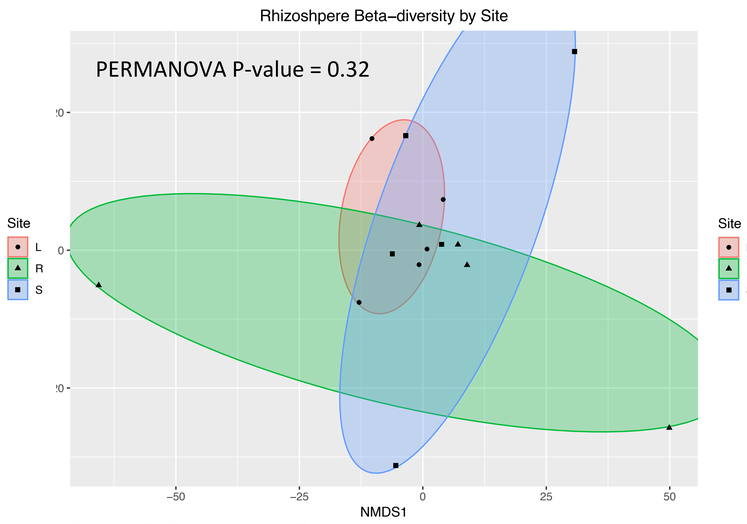


Figure 3. Rhizosphere Beta-diversity comparing the differences between soil functional profiles present by sites. Sites represent: L: lowland, S: sedge, and R: riparian

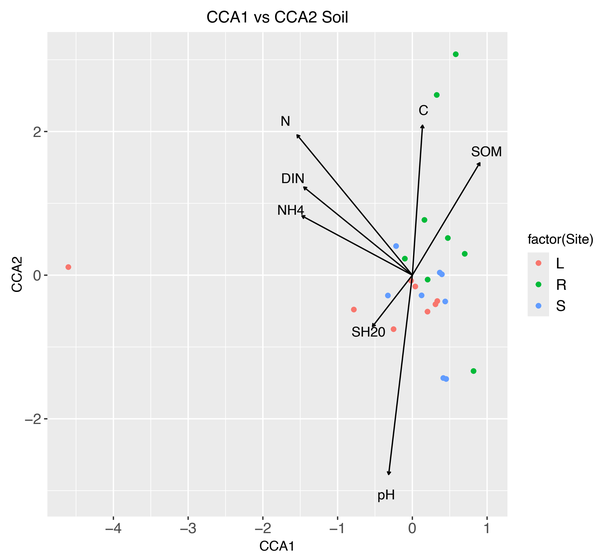


Figure 4. Bulk soil CCA plot displays environmental factors across sites: L, lowland, S, sedge, and R, riparian. Factors include: C (total carbon), N (total nitrogen), SOM (soil organic matter), DIN (dissolved inorganic nitrogen), SH_2O (soil moisture), NH_4 (ammonium), all log-transformed

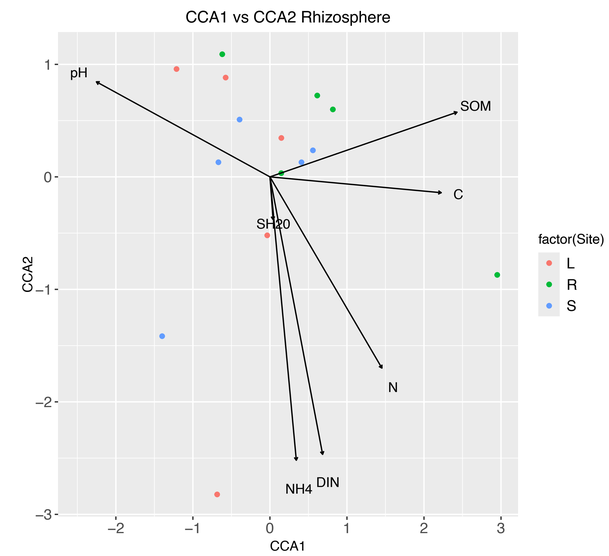


Figure 5. Rhizosphere CCA plot displays environmental factors across sites L, lowland, S, sedge, and R, riparian. Factors include: C (total carbon), N (total nitrogen), SOM (soil organic matter), DIN (dissolved inorganic nitrogen), SH_2O (soil moisture), NH_4 (ammonium), all log-transformed

Conclusions

- Bulk soil (P-value = 0.01) had significantly more functional diversity between sites compared to rhizosphere (P-value = 0.32). Indicating the diversity between root systems is distinct at the sites possibly due to the vegetation
- Riparian had the most dispersed functional diversity, likely due to the diversity of its vegetation
- Beta diversity in lowland was more dispersed in bulk soil compared to rhizosphere, suggesting greater functional diversity in lowland bulk soil
- Lowland rhizosphere displayed less dispersed functional diversity, likely due to the homologous vegetation
- Total carbon (C) and soil organic matter (SOM) most impacted the microbiome functional profiles for riparian site

Acknowledgements

This research was sponsored by a USDA-NIFA grant to Drs. George Vourlitis and Arun Sethuraman (2018-67032-27701).