Land Management Changes and its Effects on Soil Microbial Communities

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Introduction

- Land management techniques are always changing to improve soil health, increase crop production, improve conservation measures
- Benefits of healthy soils include less susceptibility to erosion, higher crop yields, increased microbial diversity
- Diverse microbial ecology improves soil structure, nutrient availability, and helps facilitate air and water movement in the soil
- A higher ratio of soil predator to prey can indicate an active community
- Interaction between protozoa and bacteria aids in releasing nutrients back into the soil
- Diversity of gram positive and gram negative communities can indicate certain conditions in the soil
- Therefore, soil microbial communities can be used to indicate the health of soil under different land management uses
- This study compares three different land management techniques, how they affect soil microbial communities, and in turn how the microbial communities affect soil properties and soil health

Methods

- Study conducted in Dawson County near Glendive, Montana
- The first site has been under the Conservation Reserve Program (CRP) for over thirty years
- The second site was converted to no-till production agriculture in the fall of 2015.
- The third site was converted to no-till agriculture in the fall of 2014 and treated in a similar manner but was also grazed by livestock
- Starter fertilizer (N, P, K) was applied to both no-till management sites in April of 2016.
- Soil samples were collected in the spring and fall of 2016 and 2017 and tested for Phospholipid Fatty Acid (PFLA) levels at soil depth increments of 0-5cm, 5-15cm and 15-30cm

Conclusion

- Total bacterial biomass is trending downward with depth as is expected and increasing overall in the no-till management sites during growing seasons.
- The Diversity Index is trending downward with depth as is expected and changes are noted among the management sites.
- Variations of microbial biomass in 2017 could be a result of drought conditions.
- We expect increasing changes to the total soil microbial biomass, shifts in our microbial communities and an increase in diversity in response to land use and management changes.

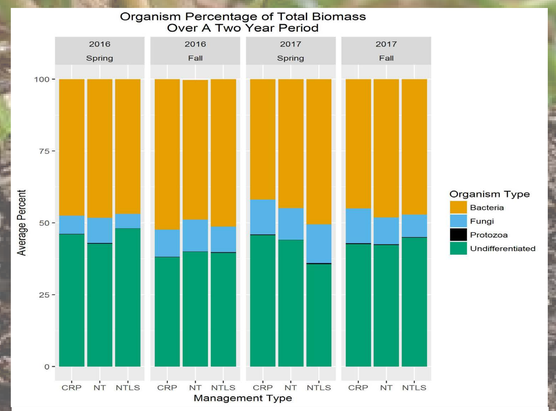

Figure 1. Percentages of the type of microbial biomass which make up the overall total biomass at each management site over a two year period.

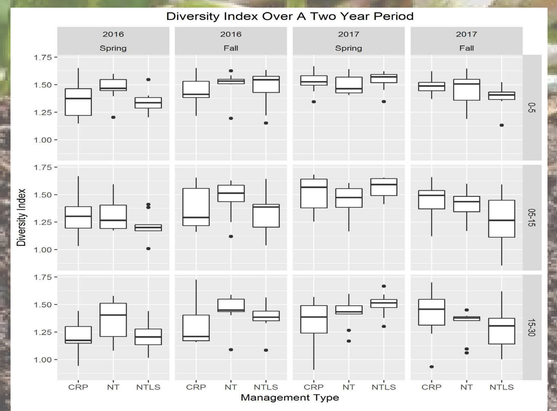

Figure 2. Diversity Index trends with depth and land management.

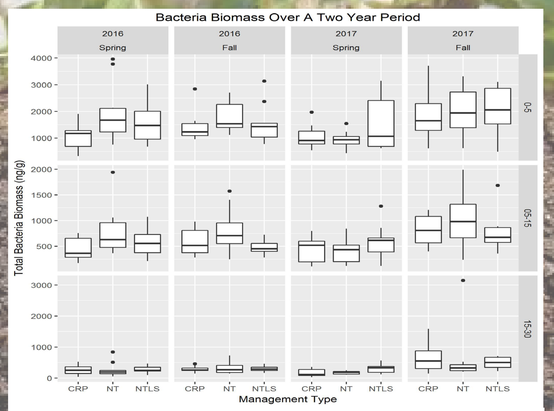

Figure 3. Bacteria Biomass trends with depth and land management.

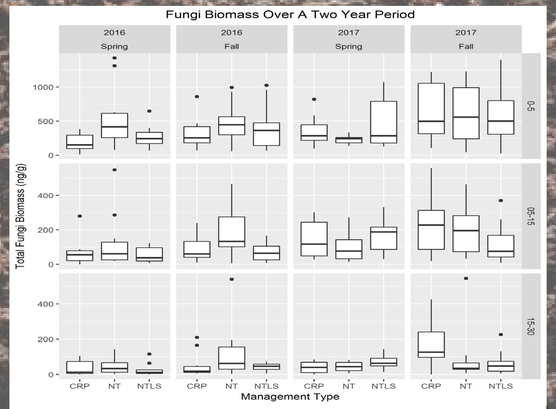

Figure 4. Fungi Biomass trends with depth and land management. Most changes are seen in the 0-5 cm.

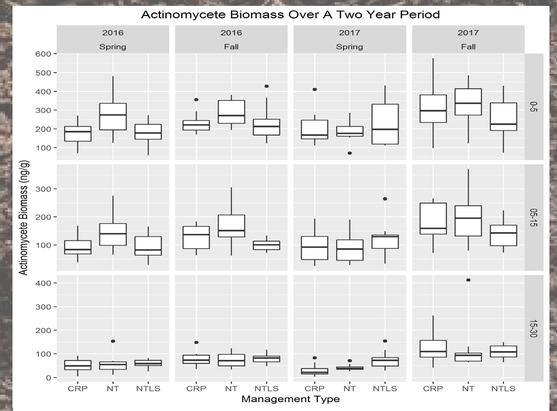

Figure 5. Actinomycete Biomass trends with depth.

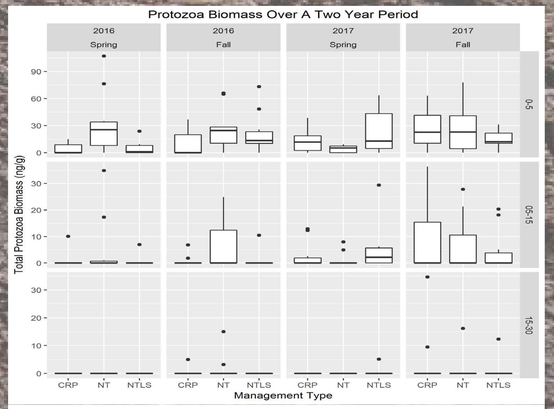

Figure 6. Most Protozoa Biomass trends with land management and is greatere in the 0-5 cm. Changes in the Fall 2017 in the 5-15 cm.

Figure 7. No Till site and data collector

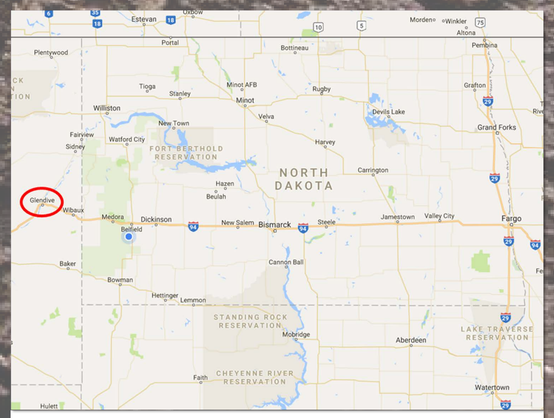

Figure 8. Location of the study area (red circle) and proximity to major North Dakota cities.

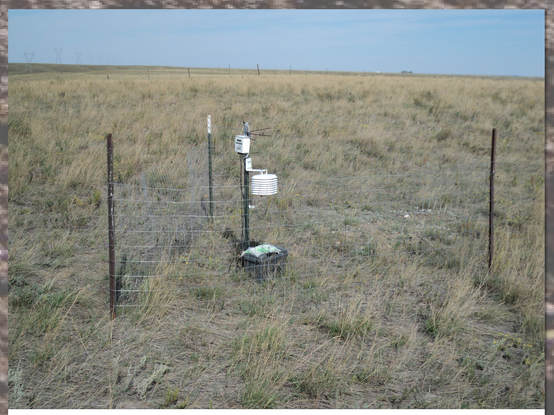

Figure 9. CRP site and data collector

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