

Soil Health as Affected by Land Management

Grace Johnson¹ and Dr. Barbara Bellows²

¹Dillard University, ²Tarleton State University



Introduction

- The beneficial effects of grazing are largely determined by how and where the grazing is used in a human-controlled grazing system (Ericson, 2009).
- Maintaining and improving soil quality is crucial if agricultural production and environmental quality are to be sustained for future generations (Carter & Johansen, 2004).
- Knowing the characteristics of soil health can benefit not only the vegetation that grows there but the arthropods who live there (Morrow et al 2016).
- Soil samples were analyzed to determine the differences in critical soil health characteristics among grazed, recently ungrazed, and long-term ungrazed areas.



Figure 1: The Grazing Experiment



Figure 2: The ungrazed land (The Cathedral)

Goals and Objectives

- This research provides baseline soil health assessments for the grazing experiment and comparisons with a long-term ungrazed area on a similar soil.
- This research will become the baseline of a long-term assessment and set the values for farmers and agricultural managers.

Methods

- Soil assessments were conducted on the Timberlake grazing study site. This study site is laid out in a statistical design with 3 reps and 3 main treatments: open to grazing by deer and cattle, low fence that restricts cattle grazing but will allow deer grazing, and high fence that restricts both cattle and deer grazing.
- Chemical and physical analyses included: aggregate stability, permanganate oxidizable carbon, glomalin, β -glucosidase, hot and cold water extractions for easily available organic matter, gas flux analyses of CO₂, and total carbon and nitrogen.
- Soil samples were taken at the grazing site on June 6th and 13th. The ungrazed area was sampled on July 11th.



Figure 3: Aggregate stability machine

- Majority of analyses were dependent on aggregate stability by producing the 2mm and 0.053mm sieved collections of soil.
- Aggregate stability indicates the soil's ability to resist disintegration due to wind and water erosion.

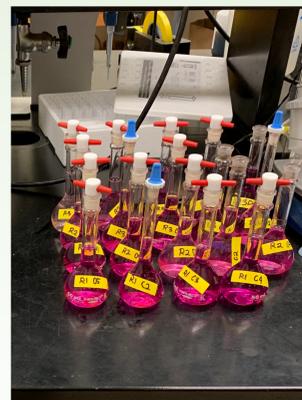


Figure 4: Permanganate analyses

- Permanganate oxidizable organic matter analyses determined easily available organic matter.
- Glomalin acts as a glue holding together soil particles and enhances soil health and soil remediation (Reyna & Wall 2014).
- A Gaset gas flux analyzer was used to determine microbial activity.



Figure 5: Gas flux assessments

Results

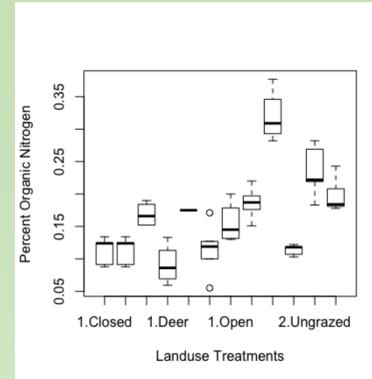


Figure 6:

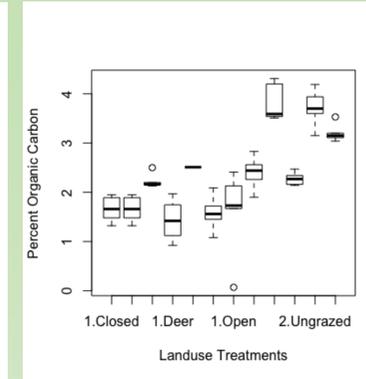


Figure 7:

Both carbon and nitrogen indicate differences in soil organic matter. The rep 3 open area resembles much of the ungrazed site due to the recent uprooting of an old tree.

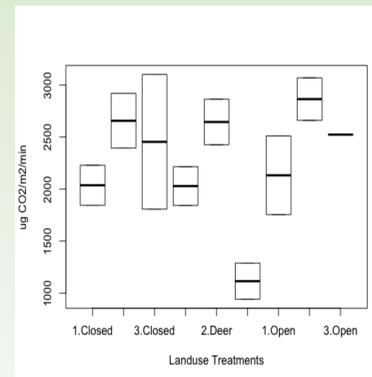


Figure 8: CO₂ flux represents soil microbial activity.

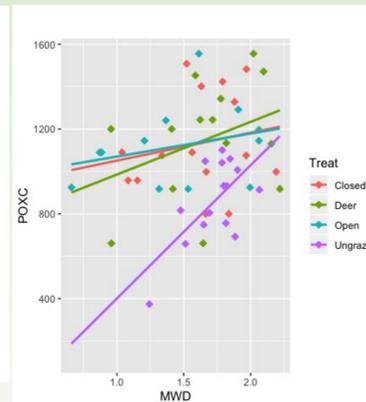


Figure 9: Less landuse impact is associated with indicators of soil health.

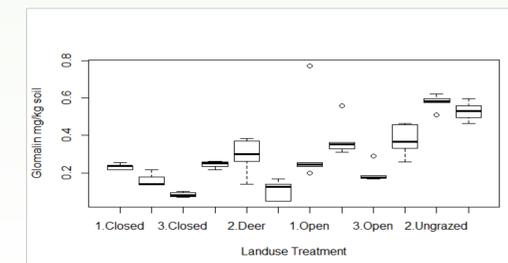


Figure 10: Glomalin is a protein associated with mycorrhizae and an early indicator of soil health.

Conclusion

- The lack of significant differences among treatments in the grazing experiment was due to confounding factors such as shade and uprooted trees.
- Total organic carbon, total organic nitrogen, and glomalin appeared to be the most effective early indicators of soil health.
- A combination of POXC and aggregate MWD may potentially be an early indicator of soil health.
- Soil health assessments can help land managers monitor the impact of their practices on the environment.

References

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