The Critical Role of Soil Microbiota to Sustainable Agriculture: Quantifying short-term microbial and vegetation feedback to intensive grazing

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Introduction

Debate over the best grazing management has remained volatile and inconclusive for decades. Many studies have examined long-term effects of grazing management on soil and vegetation parameters, but few have monitored effects of grazing on the soil microbiological community. This study will examine the immediate response of soil microbiota to grazing, and integrate the corresponding interactions with vegetation.

Methods

Soil microbiological analyses:
1. Soil microbial diversity — PCR amplification and sequencing of biomarker regions of bacteria and fungi.
2. Microbial functional diversity — extracellular enzyme assays.
3. Total microbial biomass — chloroform fumigation incubation.

Soil biogeochemical analyses:
1. pH & EC
2. Bulk density
3. Soil texture
4. Dissolved organic carbon & nitrogen
5. Total carbon & nitrogen
6. Soil organic matter

Vegetation regrowth and vigor (greenness):
1. Temporal changes in vegetation greenness — Ground-level Normalized Difference in Vegetation Index (NDVI) images that are taken with an NDVI camera mounted 1 m above the ground surface.

Experimental Design

• Laramie Agricultural Experiment Station (cool-season exotic grasses)
• Soil & vegetation data taken at four time points: 1 week before grazing (baseline data), 24 hours, 1 week, and 4 weeks after grazing.
• Twelve adjacent ½-acre pastures randomly assigned to one of three treatments in a randomized complete block design:
  - NDG (High-density, short-duration grazing)
  - LDG (Low-density, medium-duration grazing)
  - NO (No Grazing Control)

Discussion

HYPOTHESIS:
There is a immediate detectable soil microbial community response to high-intensity, short-duration grazing which will differ from low-intensity, medium-duration grazing and no grazing.

Management Impacts: This study will help to advise land managers to make management decisions aimed at promoting soil biological activity and vegetation growth. In addition, we are testing novel methods to determine effective monitoring methods that producers could implement (NDVI imagery and rising plate meter measurements).

Preliminary results indicate that the high-intensity, short-duration treatment has a faster vegetation recovery rate than the no grazing treatment. (p < 0.05)

Expected results will determine if there is a soil microbial response to grazing management over a short period of time.