Impacts of Patch-Burn Grazing and Winter-Patch Grazing on Arthropod Community Heterogeneity

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Introduction

- Historically, the Northern Great Plains evolved to thrive under periodic fire and substantial grazing pressures.
- Contemporary management practices focused on maximizing livestock production and fire suppression have resulted in more homogeneous plant communities.
- Arthropods are an important component of grassland systems and food webs.
- Arthropod community heterogeneity depends greatly on plant community heterogeneity.

Objectives

The objective of this study was to evaluate and compare the impact of patch-burn grazing and winter-patch grazing on arthropod community order richness, abundance, and diversity.

Hypothesis

We hypothesized that patch-burn grazing (PBG) and winter-patch grazing (WPG) will have different impacts on arthropod community compared to continuous season-long grazing (CG) in: • Abundance • Order Richness • Diversity

Study Area

The location for this study was the Cottonwood Range and Livestock Research Station in western South Dakota (Lat. 43° 55'08" N, Long. 101° 52'58" W). The site is home to northern mixed-grass prairie vegetation and is mainly used for cattle grazing. Predominant soils are clayey and loamy. Wildfire burned part of each pasture in October 2016.

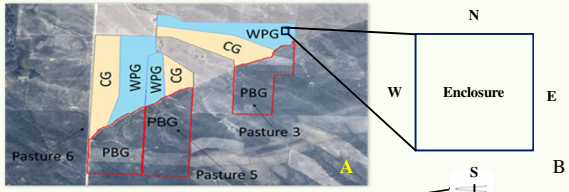

Fig.1. Study design setup and execution

Methods

- Randomized Complete Block Design with 3 treatments (WPG, PBG, CG), 3 replicates (Pasture 3, 5, 6) for each treatment and 3 enclosures within each replicate (Fig.1A)
- Four samples were taken from each enclosure in each pasture radiating out from the starting location of the enclosure in cardinal directions along 50-m transect (Fig.1B)
- Samples were taken with a sweep net that was swung through the tops of the foliage in 180 degree swipes (Fig.1C) and 70 swipes made along each transect (Fig.1D)
- Each sample was transferred to a gallon labeled bag and stored in the freeze until sorting.
- Two sampling events occurred from early June to early August in 2018 two years post disturbance (PBG and WPG)
- Arthropods were sorted to taxonomic order.
- One-way ANOVA with significance $P < 0.05$

Results

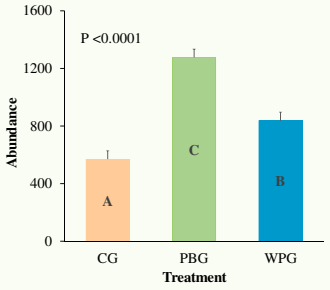

Fig.2. Total Arthropod abundance in CG, PBG, and WPG treatments

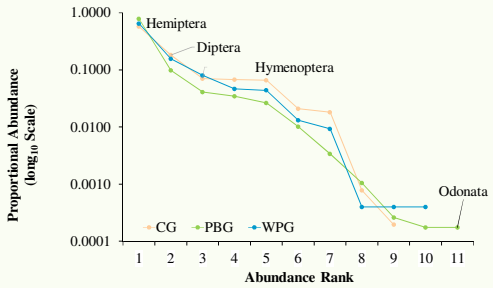

Fig.4. Rank-abundance curves for Arthropod orders in CG, PBG, and WPG treatments

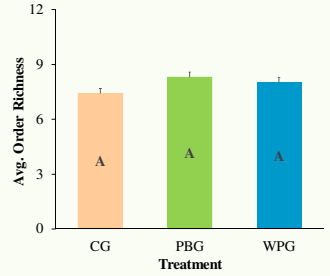

Fig.3. Average Arthropod order richness in CG, PBG, and WPG treatments

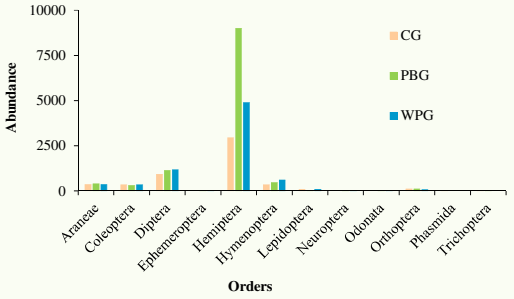

Fig.5. Arthropod community composition based on orders for CG, PBG, and WPG

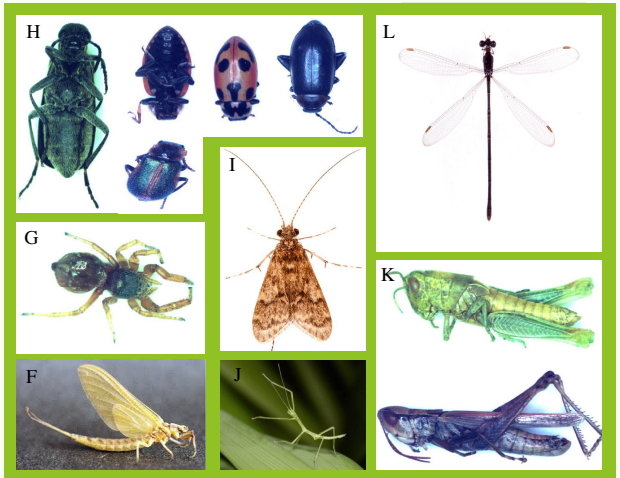

Fig. 6. (A) Hemiptera, (B) Diptera, (C) Hymenoptera, (D) Lepidoptera, (E) Neuroptera, (F) Ephemeroptera, (G) Araneae, (H) Coleoptera, (I) Trichoptera, (J) Phasmida, (K) Orthoptera, (L) Odonata

Results

- Sampling resulted in a total of 24,141 arthropods representing 12 orders (Fig. 6) across CG (5,122 arthropods, 9 orders), PBG (11,482 arthropods, 11 orders), and WPG (7,537 arthropods, 10 orders) treatments (Fig. 5).
- PBP and WPG significantly increased arthropods abundance compared to CG by 2.24 to 1.47 times, respectively (Fig. 2).
- No statistically significant difference was found in order richness among the 3 treatments, however, fewer orders were captured in CG treatments than in PBG or WPG treatments (Fig.3).
- Three orders (Ephemeroptera, Neuropetera and Odonata) were only found in WPG and PBG treatments (Fig.5), while the order Phasmida was found only in CG treatment.
- Hemiptera, Diptera, and Hymenoptera were consistently the three most abundant orders in each treatment(Fig. 5) and made up 90% of abundance.(Fig.4)
- Rank-abundance curves appeared PBG and WPG have increased biodiversity compared to CG treatment (Fig. 4)

Discussion

- Results demonstrate that patch-burn grazing and winter-patch grazing has significantly positive impact on arthropods abundance.
- Patch-burn grazing and winter-patch grazing appears to harbor, on average, more orders (i.e. order richness).
- Patch-burn grazing may be preferable over CG for maintaining abundant and diverse Arthropod communities.
- WPG may serve as a better non-pyric management tool for enhancing ecosystem structure and services via food web diversity and pollination.

References

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