Effects of Heavy Winter Patch Grazing and Wildfire on Small Mammals

Kaitlyn Cihoski[UG], Eric Michel, and Lan Xu*
Department of Natural Resource Management , South Dakota State University, Brookings, SD 57006

Introduction

- Fire and grazing maintain structural and compositional heterogeneity of grassland ecosystems.
- Contemporary management practices focus on maximizing livestock production through fire suppression and uniform use of plant communities, which promotes homogeneity and reducte biodiversity.
- Many landowners and managers exhibit aversion to fire due to concerns of safety and forage losses.
- Alternative non-pyric heavy Winter Patch Grazing is being studied for creating heterogeneity.
- Small mammals are sensitive indicators of habitat structure and are the most abundant group of mammal taxa in the Great Plains.
- They are important indicators of biodiversity through their direct and indirect influence on biota.

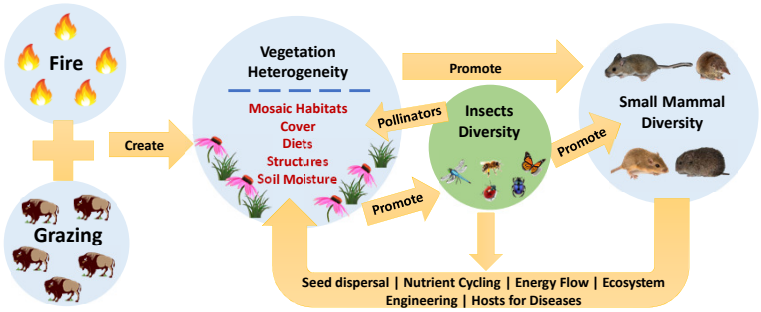

Fig. 1. Schematic of the relationship between fire, grazing, and small mammals.

Objectives

- Assess the effects of winter-patch grazing (WPG), wildfire burn patch grazing (PBG), and continuous season-long grazing (CG) on species richness, abundance, and diversity of small mammal communities.

Hypothesis

- We hypothesize WPG and PBG management strategies create heterogeneous conditions compared to uniform continuous grazing. We further hypothesize such mosaic habitats created by WPG and PBG would likely have a greater variety and abundance of small mammal communities than CG management.

Study Area

- Cottonwood Range & Livestock Research Station, South Dakota (Lat. 43° 55'08'' N, Long. 101° 52'58'' W).
- Climate: Continental and semiarid; hot summers & cold winters.
  - Annual mean precipitation: 419mm
  - Annual mean temperature: 8°C (Jan.= -14°C, Jul. = 32°C)
- Northern mixed-grass prairie, clayey to loamy soil.
- Vegetation: dominant species include *Pascopyrum smithii* (western wheatgrass), *Bouteloua gracilis* (blue grama), and *Bouteloua dactyloides* (buffalograss), and some forbs.
- Land use: continuous season-long livestock grazing.
- Wildfire burned part of each pasture (PBG) in October 2016.
- Other portions of pastures intensively grazed by cattle to reduce standing dead forage in fall 2016-2017.

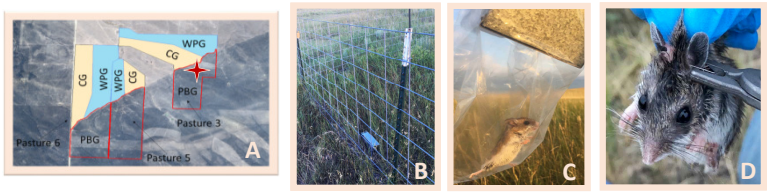

Fig. 2. A = Study design with treatments, B = Sherman live placement, C = Deer mouse released from trap into plastic gallon bag, D = Ear tag a deer mouse

Methods

- Randomized Complete Block Design with 3 treatments (WPG, PBG, CG) and 3 blocks (Pasture 3, 5, 6) (Fig. 2A).
- We trapped biweekly consecutive 3 nights for eight weeks (July-August 2018). Total 495 trap-nights.
- Five Sherman live traps (76-mm X 89-mm X 229-mm) were placed in each of three enclosures (5-m X 5-m) per treatment one block at a night with a mixture of peanut butter and rolled oats for bait (Fig. 1B).
- Traps were setup shortly before sunset (8:30 PM) and checked at dawn (5:00 AM) next day.
- Each capture was handled in a safe and sanitary manner by following IACUC protocol (Fig. 1C).
- Ear tags were placed for each first-time capture for future recapture identification (Fig. 1D).
- Recorded site location, weather, ID species, date of each capture, then released each capture.
- Vegetation structures were studied by concurrent vegetation sampling project.
- Catch Effort Index: Individuals would be expected to be captured over 100 trap night was calculated for each treatment by using the equation = # of captures X 100)/(# of trap nights - (# of sprung traps/2))[7].
- One-way ANOVA with significance P < 0.1.

Results

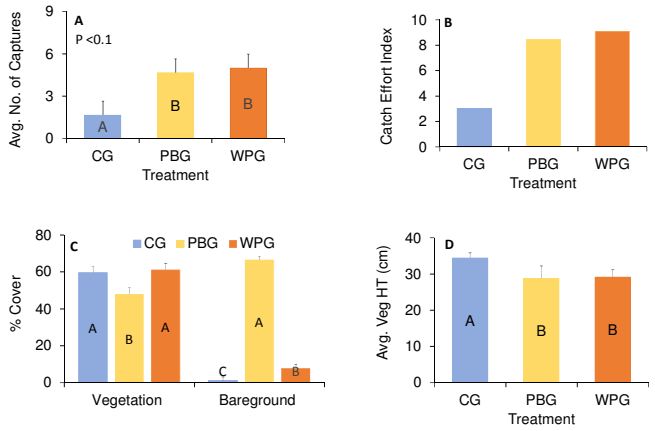

Fig. 3. A = Number of capture among the treatments, B = Catch Effort Index, C = Vegetation and Bare Ground Cover, D = Vegetation Height (cm).

- Total 34 captures with 27 individuals and 7 recaptures belonging to only one species deer mice (*Peromyscus maniculatus*)
- WPG and PBG significantly increased no. of captures compared to CG. Average captures were 5, 4.7 and 1.7 in WPG, PBG and CG, respectively (Fig. 3A)
- Catch Effort Index were 1.01, 8.48, and 9.09 in CG, PBG, and WGP, respectively (Fig. 3B).
- Vegetation cover was significantly lower in PBG compared to CG and WPG (Fig. 3C).
- Bare ground cover was significantly different among three treatments. PBG had the highest bare ground cover followed by WPG. CG had the lease bare ground cover (Fig. 3C).
- Average vegetation height was significantly taller in CG than PBG and WPG sites and no difference between PBG and WPG (Fig. 3D).

Discussion

- Results show that winter-patch grazing and patch-burn grazing promote habitat heterogeneity by altering vegetation height, vegetation cover, bare ground cover, removal of standing dead, and reducing litter.
- Such heterogeneous conditions positively impacted small mammal community, possibly due to improving their movement, thermal condition, food sources, and protection from predators.
- Winter-patch grazing and patch-burn grazing appear to attract more generalist species, such as deer mice.
- Our results supported the previous reports that deer mice have a strong positive response to fire and their abundance was not or was minimally affected by grazing compared to other small mammal species.
- Our results suggest that winter-patch grazing may serve as an alternative non-pyric management tool to promote small mammal community.
- This study was only conducted in one year (2-year post disturbances) and 495 trap nights. More trap nights per site, trap season, and areas will be recommended for the future study. Characteristics (e.g. size, weight, sex) of each capture may also be determined.

References

1 Cao, D, LY Shuai, XP Xin, YL Song, and ZG Zeng. 2016. Effects of Cattle Grazing on Small Mammal Communities in the Hulunber Meadow Steppe. Peerj 4.
2 Hayward, B, EJ Heske, and C. W. Painter. 1997. Effects of Livestock Grazing on Small Mammals at a Desert Cienaga. J. Wild. Mgmt. 61:123–129.
3 Johnston, AN and R.G. Anthony. 2008. Small-Mammal Microhabitat Associations and Response to Grazing in Oregon. J. Wild. Mgmt. 72:8:1736-1746.
4 Kirchner, BN., NS Green, DA Sergeant, JN Mink, and KT Wilkins. 2011. Responses of Small Mammals and Vegetation to a Prescribed Burn in a Tallgrass Blackland Prairie. The Amidl. Nat. 166:112–125.
5 Matlack, RS, DW Kaufman, and GA Kaufman. 2001. Influence of Grazing by Bison and Cattle on Deer Mice in Burned Tallgrass Prairie. The Amidl. Nat. 146:361–368.
6 Matlack, RS, DW Kaufman, and GA Kaufman. 2008. Influence of Woody Vegetation on Small Mammals in Tallgrass Prairie The Amidl. Nat. 160:7–19.
7 Nelson, L and FW Clark. 1973. Correction for sprung traps in catch/effort calculations of trapping results. J. Mammalogy 54:295–298.
8 Wywialowski, A. P. 1987. Habitat structure and predators: choices and consequences for rodent habitat specialists and generalists. Oecologia 72:39–45.

Acknowledgements

This research was funded by the U.S. Department of Agriculture AFRI (Grant Number 2017-67020-26511) and NCR-SARE (Grant Number 2015-38640-23781), through a grant awarded to South Dakota State University and the Griffith Undergraduate Research Award of South Dakota State University. Special thanks to Luke Zilverberg, Josh Harvey, Alyssa Vachino, and Jake Comer for their help in the field.

Kaitlyn.Cihoski@jacks.sdstate.edu
*Lan.xu@sdstate.edu (605-688-4564)
Eric.Michel@sdstate.edu

South Dakota State University
Department of Natural Resource Management