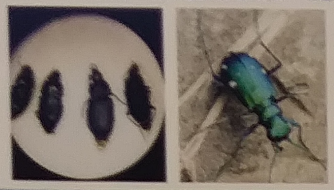
Ground beetle community structure and function in restored tallgrass prairie



Melissa S. Nelson, Nicholas A. Barber, Holly P. Jones
Department of Biological Sciences, Northern Illinois University

Objective Investigate how prairie restoration and management (bison grazing and prescribed fire) impact ground beetle communities and how their functional roles are influenced by restoration activities.

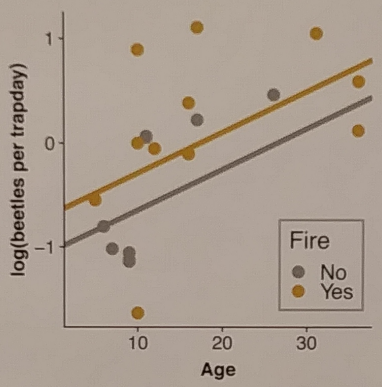
Background

- Restoration of natural areas typically focuses on reestablishing plant communities[1,2,3,4]; less is known about how organisms in higher trophic levels recover and what functional roles these recovering organisms play.
- Ground beetles (family Carabidae) vary widely in their life history traits, making them ideal for learning more about consumers' roles during succession[5].
- Understanding how restoration age, prescribed fire, and bison presence impact ground beetle communities, and thus how these impacts influence predation by ground beetles, can help land managers make predictions of how ground beetles influence restoration outcomes.

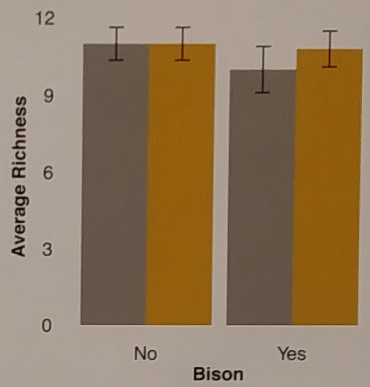
Study Site & Methods

- 20 sites varying in age, bison presence, and fire history were selected for ground beetle collection via pitfall trapping at Nachusa Grasslands.
- Ground beetle species were identified and density and species richness were calculated.
- A seed predation experiment was conducted in July to estimate the number of seeds consumed by ground beetles.
- An arthropod predation experiment was conducted in both July and September to estimate the average proportion of waxworms consumed by ground beetles.

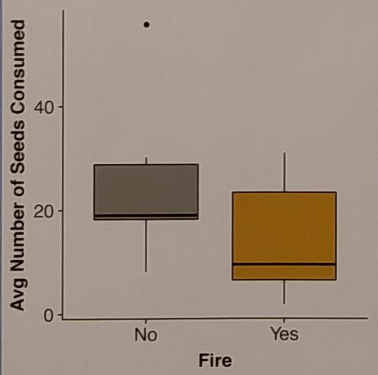
Findings



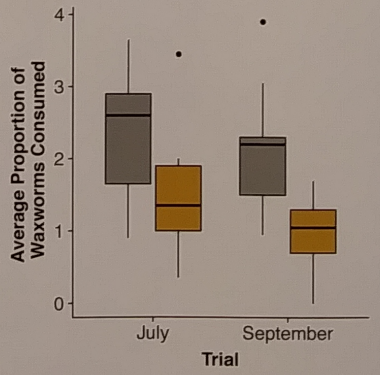
- Older sites have greater beetle density, and there tend to be more beetles in years that a site is burned.



- Species richness was unaffected by age, fire, and bison.



- Prescribed fire reduces seed predation rates.



- Prescribed fire reduces waxworm predation rates.

Conclusions

- Older sites contain more ground beetles but are nearly equivalent to younger sites in number of ground beetle species.
- The use of prescribed fire as a management tool has a greater impact on ground beetle communities than previously expected.
- Seed predators and waxworm predators are similarly affected by fire, with increased predation at unburned sites. Since fire is an intense management strategy that removes dead plant material, it could make mobility more difficult and risky in burned sites[6]. Less mobilization means less opportunities to find food.
- Further studies will focus on additional life history traits of ground beetles and interactions amongst restoration age, bison, and fire.

Acknowledgments
The Nature Conservancy, Nachusa Grasslands staff and crew, especially Bill Kleiman; Barber lab and Jones lab members. Supported by Friends of Nachusa Grasslands and Prairie Biotic Research.

Literature Cited

[1]Hobbs, R.J. & D.A. Norton (1996) Restor Ecol 4:93–110.
[2]WallisDeVries et al. (2002 Biol Conserv 104:265–273.
[3]Van Andel, J. & J. Aronson (2012) Restoration ecology: the new frontier. Wiley, New York.
[4]McAlpine et al. (2016) Front Ecol Environ 14:37–45.
[5]Gerisch et al (2012) Oikos 121:508–515.
[6]Lundgren et al (2006) Renewable Ag and Food System 21:227-237.