

The Effects of Vole Herbivory on Vegetation in Northern Illinois Tallgrass Prairie

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Study Site

- Restored Tallgrass Prairie and Savanna
- Located within the College of Dupage Natural Areas in Northern IL
- 7.3 hectares
- Adjacent to ponds and wetlands





Meadow Voles



*Microtus
pennsylvanicus*



Prairie Voles



*Microtus
ochrogaster*

Experimental Design

- Established in 2003
- 12, 2x2- meter plots, ca. 10-m spacing
- 6 plots allow vole access
- 6 plots exclude voles
 - Fencing 0.6 m high
 - Extends 0.3 m below ground





Grasses





Forbs



Given that the composition of vegetation is dependent on vole herbivory, we predict that the abundance and heights of forbs will exceed grasses in plots without vole access because forbs are more palatable and preferred by the voles.





<20cm

20-39.9

40-59.9

60-79.9

80-99.9

>100cm



25%




Weather _____

[illegible]

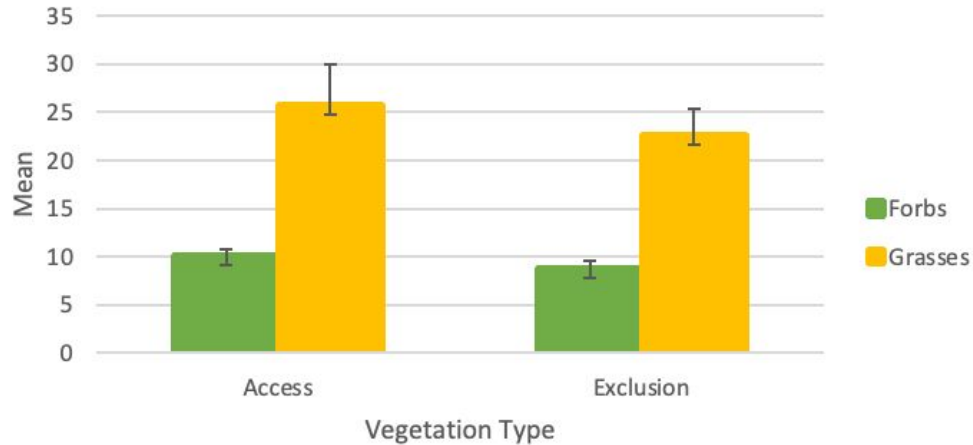
Statistical Analyses & Results





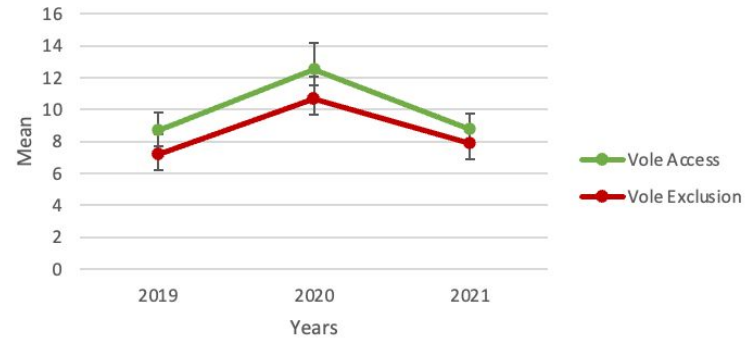
Graphs

Forbs and Grasses Abundance of 3 years in Access and Exclusion Plots

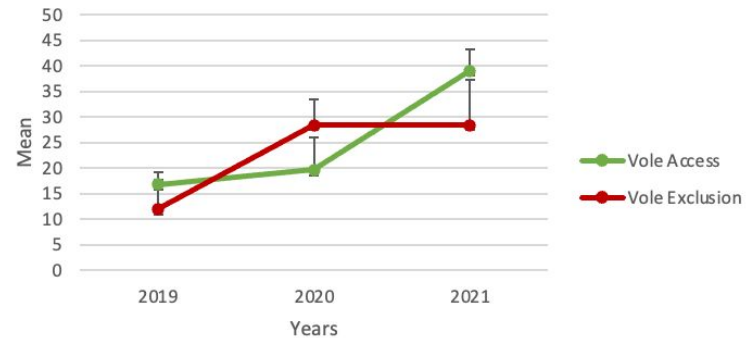


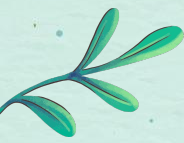
T-Test Assuming Unequal Variances:
 $t = 1.50$, $df = 324$, $p = 0.1358$
Significance was determined at $\alpha = 0.05$

Forbs Abundance in Vole Access vs. Vole Exclusion Plots

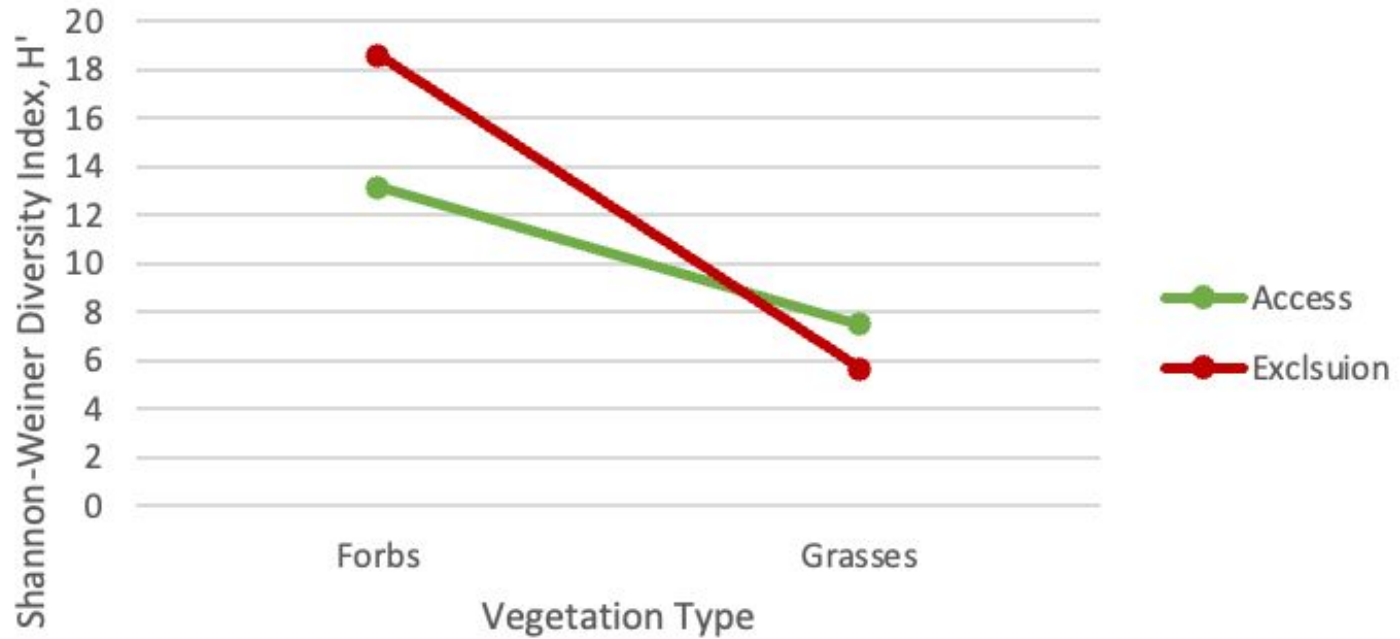


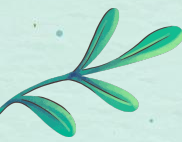
Grasses Abundance in Vole Access vs. Vole Exclusion Plots



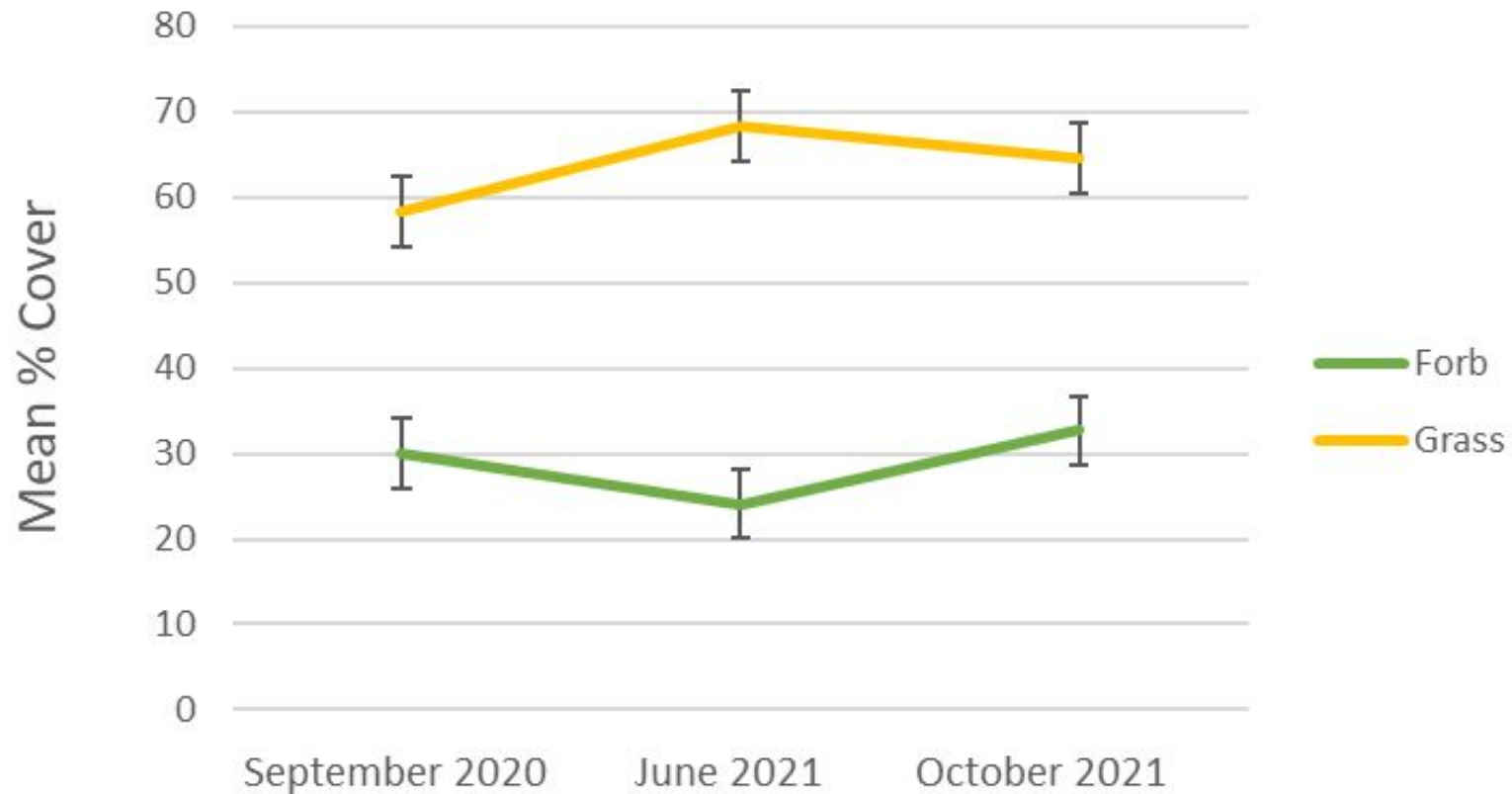


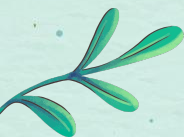
Diversity of Forbs and Grasses in Access and Exclusion Plots



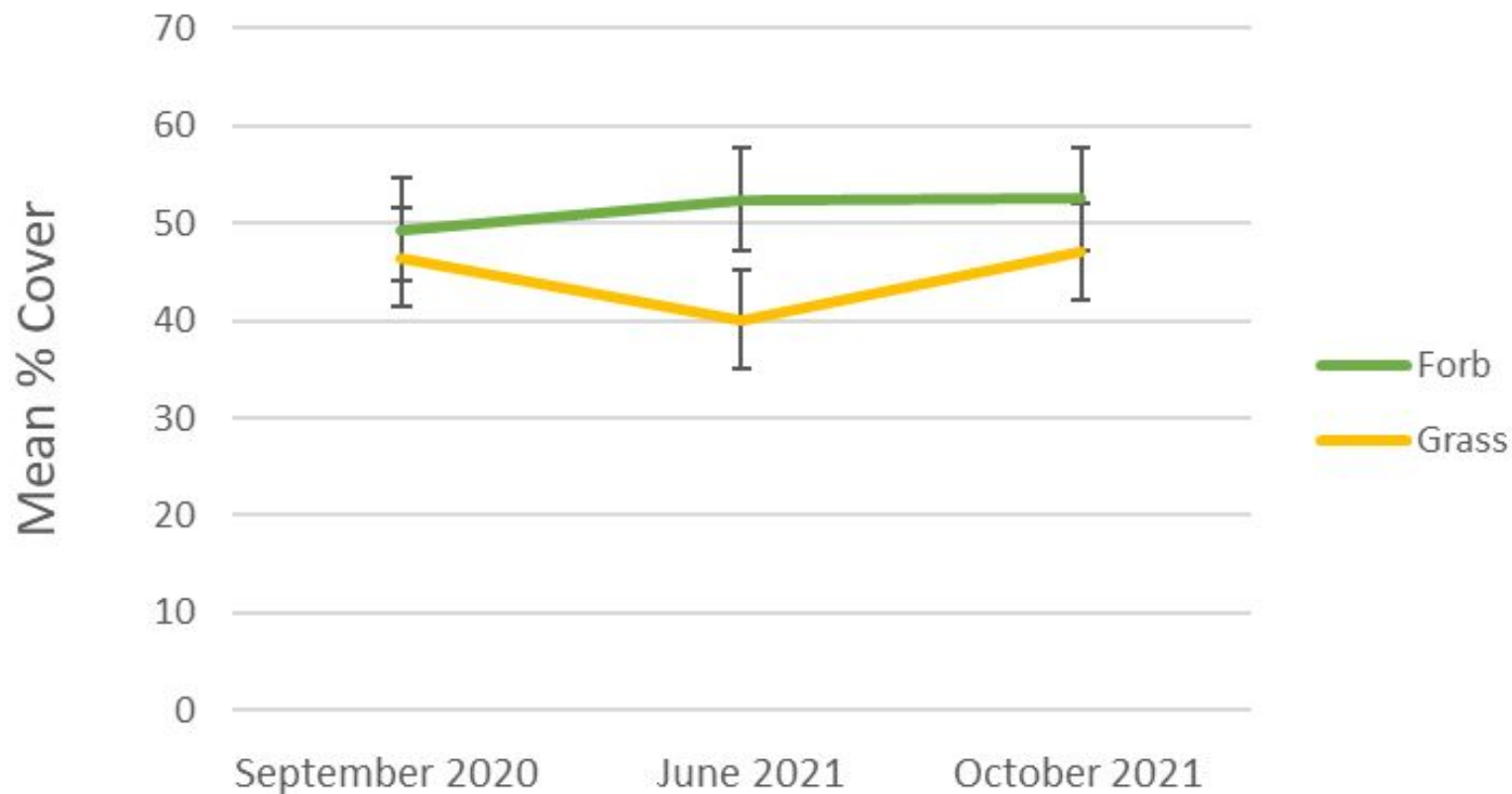


Grass vs. Forb Across Seasons of Access





Grass vs. Forb Across Seasons of Exclusion



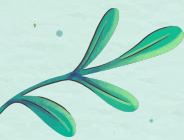
$$t = 3.36$$

$$df = 33$$

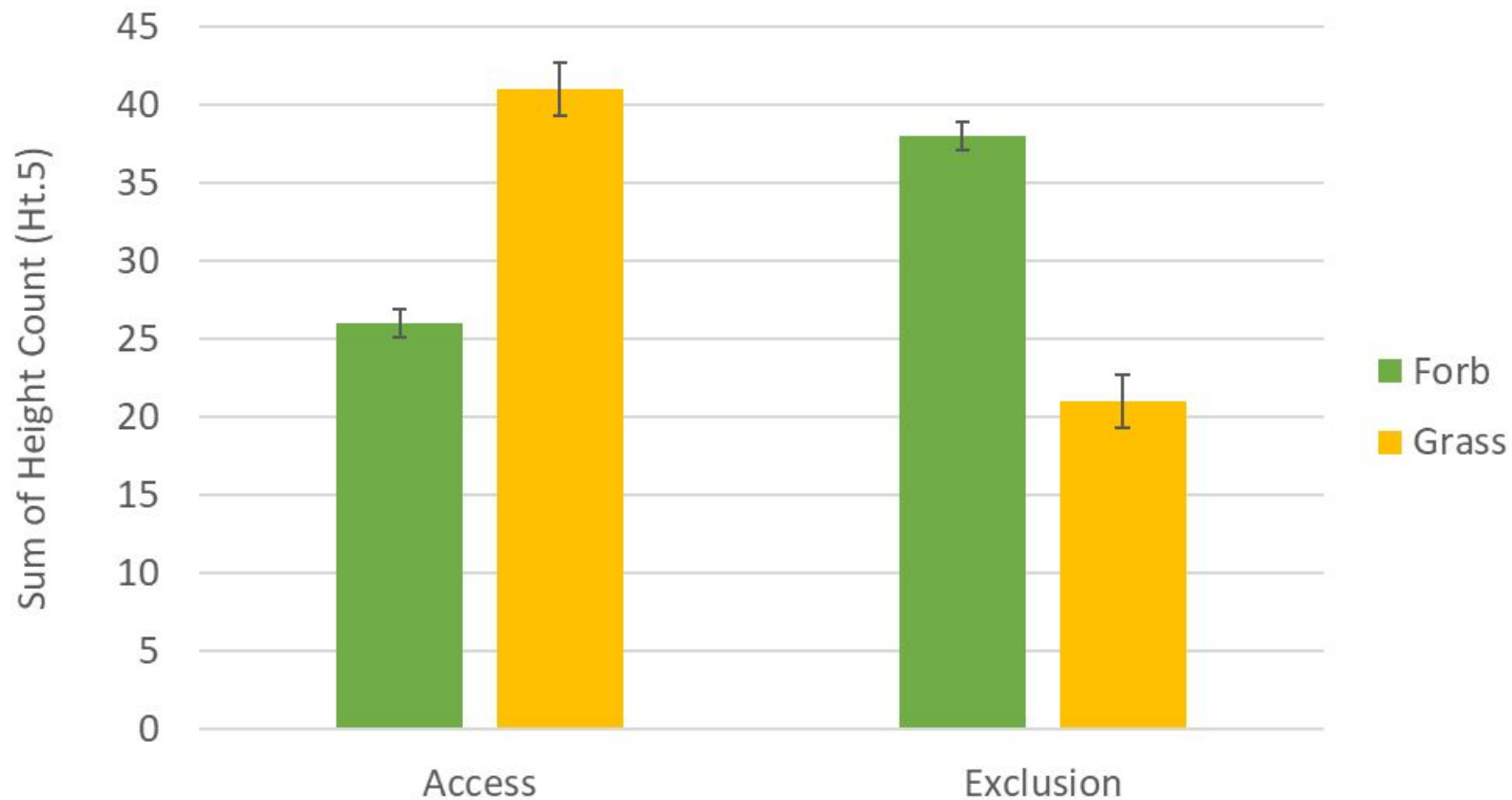
$$P = .002$$

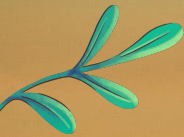
$$\alpha = .05$$





Grass vs. Forb: How Treatment Affects Height



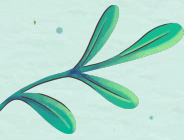


Discussion

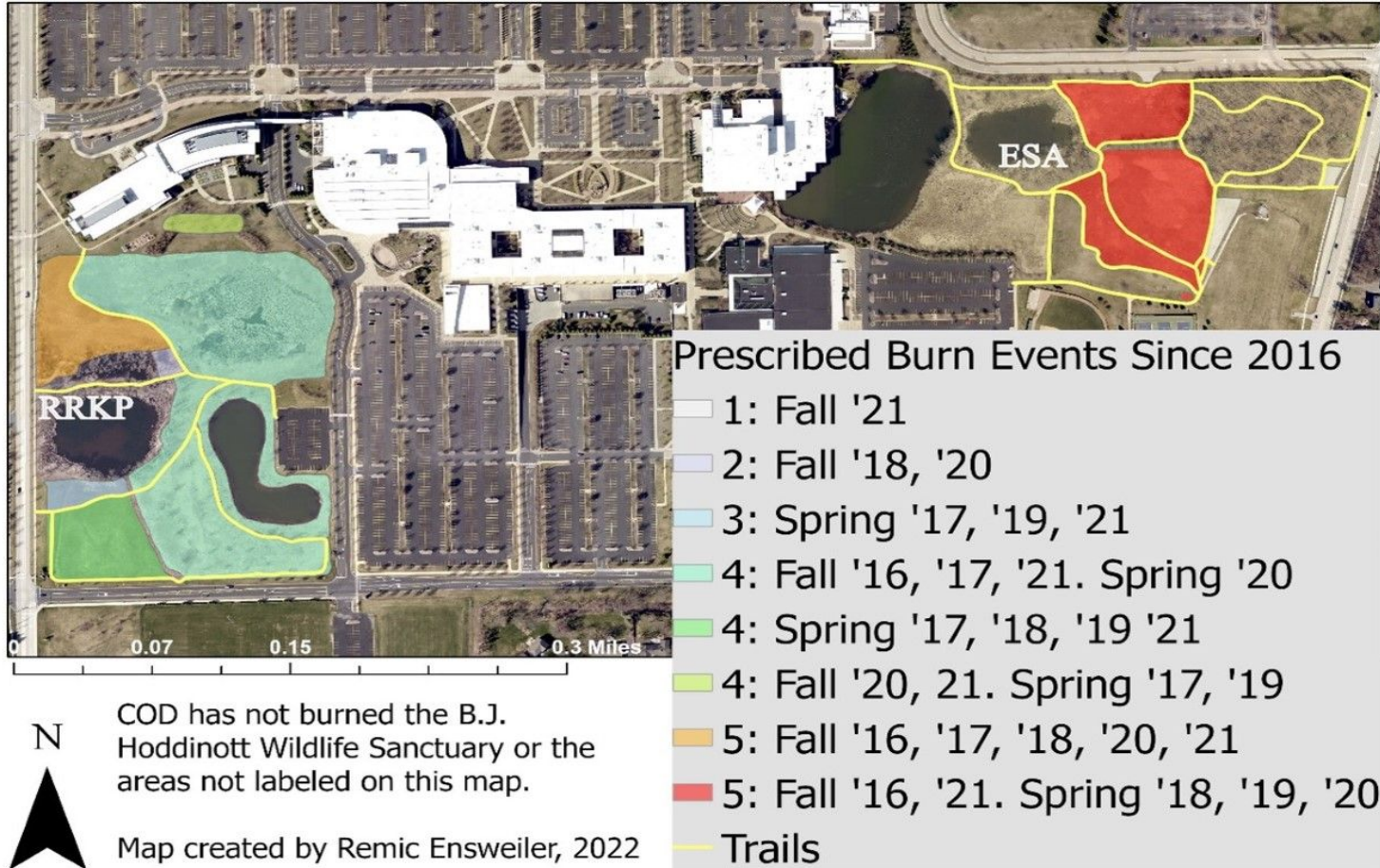


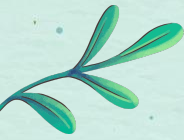


Discussion



COD Natural Areas Prescribed Burn Events Since 2016





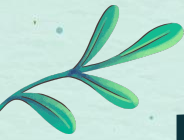
Conclusion

- Voles greatly influence composition of vegetation and prefer forbs over grasses
- Statistical analyses mostly **validate our hypothesis**
 - Abundance: Two-sample t-test
 - Percent Cover: Two-sample t-test
 - Heights: Chi-square test
- Consider **extraneous factors**
 - Climate change
 - Unintentional anthropogenic activity
 - Prescribed burning



Literature Cited & Consulted

- Brady, M.J., Slade, N.A. 2001. Diversity of a Grassland Rodent Community at Varying Temporal Scales: The Role of Ecologically Dominant Species. *Journal of Mammalogy*. 82(4): 974-983.
- DeJaco, C.E., Batzli, G.O. 2013. Palatability of Plants to Small Mammals in Nonnative Grasslands of East-central Illinois. *Journal of Mammalogy*. 94(2):427-425. doi:10.1644/12-MAMM-A-157.1.
- Dickson, T.L., Hayes, B.A., Bragg, T.B. 2019. Effects of 34 Years of Experimentally Manipulated Burn Seasons and Frequencies on Prairie Plant Composition. *Rangeland Ecology and Management*. 72(1). doi:10.1016/j.rama.2018.07.014.
- Flory, S.L., & Clay, K. 2010. Non-native grass invasion suppresses forest succession. *Oecologia*. 164(4): 1029-1038.
- Getz L.L., & Carter, C.S. 1996. Prairie-vole partnerships. *American Scientist*. 84(1): 56-62.



Photographs Cited

Devaes J. 2010. Prairie Vole (*Microtus ochrogaster*).

<https://www.flickr.com/photos/habropoda/5019168557>.

Meadow Vole. 2015. <https://www.coniferousforest.com/meadow-vole.htm>.

Myers, J. 2020. *Meadow Vole*. Encyclopædia Britannica.

<https://www.britannica.com/animal/meadow-vole/images-videos#/media/1/371477/67470>

Castor, T. Prairie Vole. 2010. *Indiana Mammals: a Field Guide*. Indiana University Press

Anders, Barbara. *Forbs*.

Randa, Linda. *Grasses*.



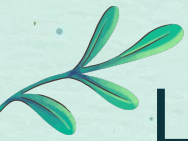
Literature Cited & Consulted

- HaBeck, C.W., Lindroth, R.L. 2013. Influence of Global Atmospheric Change on the Feeding Behavior and Growth Performance of a Mammalian Herbivore, *Microtus ochrogaster*. PLoS One. 8(8):1-10. doi:10.1371/journal.pone.0072717.
- Holt, J., Coventry, R. 1990. Nutrient Cycling in Australian Savannas. *Journal of Biogeography*. 17(4):427-432.
- Howe, H.F. 2008. Reversal of fortune: plant suppression and recovery after vole herbivory. *Oecologia*. 157(2): 279-286.
- Howe, H.F. 2011. Fire Season and Prairie Forb Richness in a 21-y Experiment. *Écoscience*. 18(2):317-328.
- Howe, H.F., & Brown, J.S. 2000. Early effects of rodent granivory on experimental forb communities. *Ecological Applications*. 10(3): 917-924.



Literature Cited & Consulted

- Kaufman, D.W., Bixler, S.H. 1995. Prairie Voles Impact Plants in Tallgrass Prairie. Proceedings of the Fourteenth North American Prairie Conference: Prairie Biodiversity, Kansas State University. 117-121.
- Mortensen, B., Danielson, B., Harpole, W.S., Alberti, J., Arnillas, C.A., Biederman, L., Borer, E.T., Cadotte, M.W., Dwyer, J.M., Hagenah, N., Hautier, Y., Peri, P.L., Seabloom, E.W. 2017. Herbivores safeguard plant diversity by reducing variability in dominance. *Journal of Ecology*. 106(01):101-112.
- Olff, H., Ritchie, M. 1998. Effects of Herbivores on Grassland Diversity. *Trends in Ecology and Evolution*. 13(7):261-265.
- Sullivan, A.T., Howe, H.F. 2011. Response of Two Prairie Forbs to Repeated Vole Herbivory. *Oecologia*. 165(4):1007-1015. doi:10.1007/s00442-010-.
- Thompson, D.Q. 1965. Food Preferences of the Meadow Vole (*Microtus pennsylvanicus*) in Relation to Habitat Affinities. *The American Midland Naturalist*. 74(1): 76-86



Literature Cited & Consulted

West, A.L., Zou, C.B., Stebler, E., Fuhlendorf, S.D., Allred, B. 2016. Pyric-herbivory and Hydrological Responses in Tallgrass Prairie. *Rangeland Ecology and Management*. 69(1). doi:10.1016/j.rama.2015.10.004.