Little Africa in Prairie Grassland Montana

Abstract

In recent years, one invasive grass species made an appearance in grassland habitats of Montana. It is currently uncertain of how Northern Africa grass (*Ventenata dubia*) arrived in Northwestern Montana resulting in the displacement other invasive species and especially native species. This impact could have negative effects on native plant diversity, and management needs to understand potential impacts, especially going into the future. I conducted a field study to investigate *V. dubia* abundance and effects on native composition along transects at six potholes both manmade and natural, on the National Bison Range, and Waterfowl Production Areas (WPA). The objective was to determine if *V. dubia* had impacted vegetation communities, and if this impact differed across sites and if it was modified by distance from pothole, cardinal direction, and soil moisture. Results showed that distance from pothole and cardinal direction had no impact on *V. dubia* relative abundance, and that relative abundance of *V. dubia* had no impact on plant diversity. However, *V. dubia* did have a significant impact on soil moisture.

Introduction

Prairie grassland in Montana, around National Bison Range, was covered in 2,000 meters depth lake over 12,000 years ago. The dam broke over time as water carved the landscape leaving marks on hills and the bottom valley that are still seen today (Montana Natural History Center). Prairie potholes were formed as a result of these events, and these habitats are a common feature of the National Bison Range and surrounding Waterfowl Protection Areas (WPA). Potholes are a lifeline for vegetation, fish, and wildlife, and vegetation communities may change based on their proximity to potholes. Unfortunately, invasive plant species have invaded grasslands and they may have an important impact on the composition and diversity of native plant communities. As an example, the extoic grass Soft Brome (*Bromus hordeaceus*), and forb Canada thistle (*Cirsium arvense*) can outcompete native species for moisture and nutrients.

A new competitive invasive grass species is becoming known in Montana. In recent years, Northern Africa grass or wired grass (*Ventenata dubia*) has moved in to the prairie valley, yet no one knows how quickly it spread. An annual grass, this species is visible in yellow panicle-like inflorescences and grows in various patches from small to large. This species is able to establish in moist soils and spread further into drier areas. This grass can produce up to 50 seeds per plant, and the seeds easily attach to wandering animals that unknowingly disperse the plant. It is considered a fire hazard since it dries out earlier in the season than native grasses. Consider non forage for all wildlife and domestic cattle. Because *V. dubia* can establish on both moist and dry soils, and certain slope aspects may favor their expansion, I set out to determine if

distance from potholes and cardinal direction around potholes affected *V. dubia abundance*. It is also established that this invader is a superior competitor to native plants, so another objective was to investigate effects on vegetation diversity and soil moisture. Six sites containing natural potholes were studied. Five sites were located on WPAs within the proximity of the NBR, and one site was located on the NBR.

Hypothesis

1. What is proximity between Northern Africa grass *Ventenata dubia* and the distant water bodies?
2. How is *Ventenata dubia* compete with other vegetation species on moisture?

Objectives

1. Determine effect of distance from pothole and cardinal direction on *V. dubia* abundance.

2. Quantify vegetation diversity at each site and examine if *V. dubia* density is negatively correlated with diversity.

3. Determine if sites with higher abundance of *V. dubia* have lower soil moisture.

Methods

In each site one pothole was selected. Care was taken to control for the size of the potholes, so that similar sized potholes were taken into consideration. At each pothole, a 50 m transect was established in each of the four cardinal directions. Importantly, at some sites, the length of the transect on at least one side of the pothole was obstructed by a fence or road, so for some sites, only 3 transects were established. At each transect, a 1 m -2 frame was placed next to the transect at the water's edge, 10 m, 20, 30, 40 and 50 m away from the pothole. At each plot, percent coverage of plants and grass species was estimated. Then, a soil sample (~ 10 g) was taken from each plot and later weighed, dried at 60°C overnight, and then reweighed to determine percent soil moisture.

Consider this revision for your stats section:

"The statistical program SYSTAT 10.2 (SYSTAT Software, San Jose, CA) was used to analyze the relationship between soil moisture, site, distance from pothole, on *V. dubia* abundance. ANOVA and regression was used to determine these relationships. Regression showed that *V. dubia* had a significant impact on soil moisture."

Effect	Coefficient	Std Error	Std Coef	Tolerance	t	P(2 Tail)
CONSTANT	8.627	1.363	0.000	.	6.329	0.000
DISTANCE	-0.005	0.041	-0.029	1.000	-0.116	0.909

SYSTAT Regression test was in order to determine if *Ventenata dubia* was taking all moisture at

certain distant or if there was no effect. Results show there is effect in moisture by *Ventenata dubia* which means in certain plot distance the invasive grass is taking all moisture. This answers my hypothesis but there is question of how much will this effect plant communities in future

Results

The result has shown their high sufficient *V. dubia* present far away in distance from pond. At certain distant *V. dubia* can progress and tolerate in moisture conditions. High level of moisture near the pond will not allow *V. dubia* as seen on figure 1-1 but can host other vegetation that could tolerate.

On the second regression test, I did not include Harek because there no *V. dubia* presentjfat this site. The results shown with *V. dubia* present all sites there is sufficant loss of moisture at each ponds even at certain distant.

On shannon diversity test, there was no change on plant communties at all sites with ventenata dubia present. Although more test and study needs to be done.

Dependent Variable	plants_shan
N	123
Multiple R	0.765
Squared Multiple R	0.586

Discussion

This recent invasive grass needs to be monitored more closely with long term studies with different angles that determine future distribution in grassland areas. Aerial photographs should be taken yearly or seasonal to look effects on wildlife habitats with *Ventenata dubia*. Management can help prevent more spread and as mentioned before *Ventenata dubia* can be promote fire risking unnecessary fires in areas. Fire can suppress germination, yet no strong evidence can support this without further study. This non forage grass in prairie valley where many wildlife depends on certain forgeable vegetation to thrive on WPA sites that meant for conservation.

Acknowledgements

This study could not made possible without UNDERC-West program and Director Dr. Gary Belovsky and Assistant Director Dr. David Flagel. Many thanks for permission from Confederated Salish Kootenai Tribes, and National Bison Range. Thank you for allowing students for conducting research. Much special appreciation and big thanks to Kate Bailey for big help with lots of support on and off the field.

References

www.glaciallakemissoula.org/

National Wildlife Refuge System, “Waterfowl Production Areas”. https://www.fws.gov/refuges/about/wpas.html

Fryer, Janet L. 2017. Ventenata dubia. In: Fire Effects Information System, [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Missoula Fire Sciences Laboratory (Producer). Available: www.fs.fed.us/database/feis/plants/graminoid/vendub/all.html

Appendix

Figure. 1-1

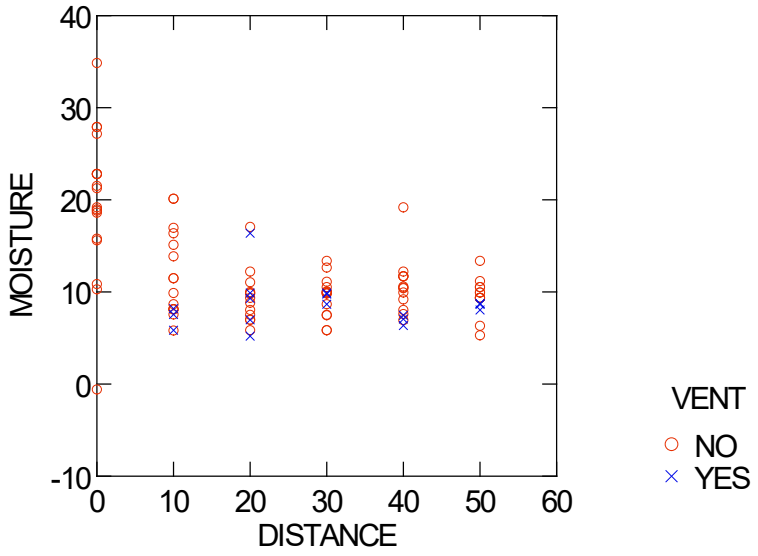

Figure. 1-2

Source	Sum-of-Squares	Df	Mean-Square	F-ratio
DISTANCE	765.534	1	765.534	26.876
POND$	30.016	4	7.504	0.263
POND$*DISTANCE	14.387	4	3.597	0.126
Error	2136.331	75	28.484	

Figure 2-1

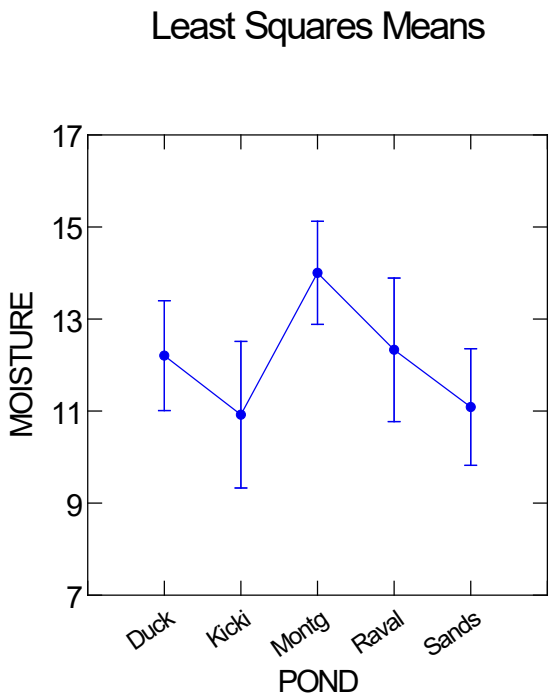

Figure 2-2

Analysis of Variance

Source	Type III SS	df	Mean Squares	F-ratio	p-value
Site$	6.944	5	1.389	13.732	0.000
Distance__m_	1.133	5	0.227	2.242	0.057
Site$*Distance__m_	2.694	25	0.108	1.066	0.398
Vantenata	0.015	1	0.015	0.151	0.699
Error	8.697	86	0.101		

Analysis of Variance					
Source	Type III SS	df	Mean Squares	F-ratio	p-value

Least Squares Means				
Factor	Level	LS Mean	Standard Error	N
Site$	Duck Haven	0.860	0.069	22.000
Site$	Herak	0.266	0.076	20.000
Site$	Klcking Hor	1.021	0.075	18.000
Site$	Montgomery	0.470	0.068	23.000
Site$	Ravalli	0.739	0.076	22.000
Site$	SandsMark	0.481	0.076	18.000

Figure 3-1 Shannon-wiener index

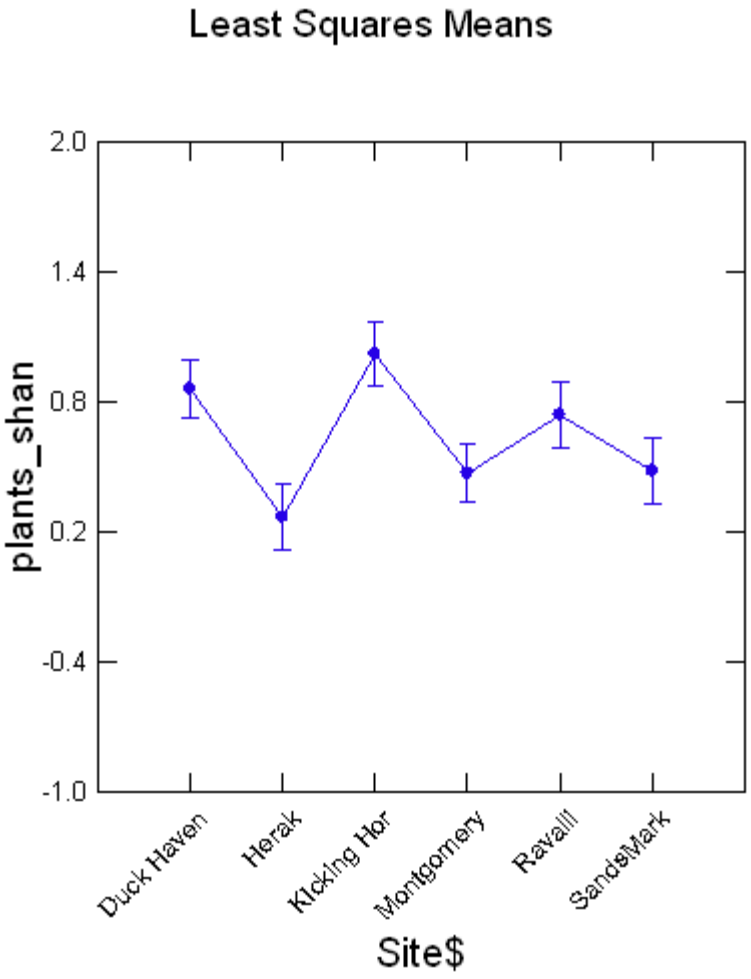

Figure 3-2 Plant Diversity is not effected by Ventenata Dubia