A Data Analysis of the Short-term Responses in Plant Coverage Following Prescribed Burns at The Litzsinger Road Ecology Center Restored Prairie Sites

Internship Research Project

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Abstract

The report looks to use plant monitoring data collected at a continuously managed restored prairie site to evaluate the possible effects of using prescribed burn in a suburban restored prairie over short-term periods of time. Monitoring data was collected from two different prairie plots over the course of a year in which a prescribed burn was not administered and then collected again three years later following a prescribed winter burn. Data related to plants representing a significant importance in the ecological health of the prairie was extracted from the monitoring data and subjected to a statistical analysis to determine if there was a correlation between the change in mean coverage between monitoring cycles and the prescribed burns. Statistically significant differences were found in *Apocynum cannabinum*, *Impatiens capensis,* and in the genus *Rubus.* In many cases, these differences may be attributed to factors other than the presence of prescribed burns, including, but not limited to; climate, edge effects and inconsistences or error in data collection.

Key Words;

Prescribed Burns, Plant Monitoring, Prairie Restoration

Introduction

Controlled burns are an important tool in prairie management. Prescribed burns emulate the natural wildfire burn cycles that occurred in historic prairies and mimic the burns administered by Native American tribes. These fires aided in controlling what plant species were best able to colonize and thrive in these highly disturbed ecosystems, such as grasses and forbs. Today, prescribed burns also provide a method for controlling the introduction and spread of nonnative and invasive species that are not as well adapted to fire disturbances.

While fire provides a useful tool for restoration management, not all prairie systems are the same. Plot size, hydrological regime, soil type, the presence/absence of grazers and climate are additional factors that play into what management techniques are most suitable for each site. Sites that are often under drought conditions and sites located in coastal wetland prairies represent areas where prescribed fire management would be less ideal compared with other management techniques, such as spot treatments with herbicides, introduction of natural herbivores, or mowing. This highlights the importance of studying how prescribed burns affect different sites' flora and fauna over both the short term and long term to ensure management techniques are being properly utilized.

Site

Data analyzed in this study came from the Litzsinger Road Ecology Center's North and South prairie plots. Of the thirty-four acre property, both the six acre North Prairie and the four acre South Prairie areas that were sewn with native seeds in 1989-1990 have had prescribed winter burns on an alternating cycle when conditions for burning have been favorable. Both

prairies are wet-mesic to mesic tall-grass prairies located in a suburban area. Due to the small size of the plots and the high abundance of ornamental plants, invasive species control has been found to be the majority focus for restoration management efforts at the site. An urban water-way - Deer Creek - also runs through the property, increasing the access of alien flora to the property. Along with fire, herbicide treatments, physical removal and mowing have all been used on the property to manage invasive plants and aggressive native plants.

Tools and methods

Plant monitoring was done by recording what plants occur within two feet by two feet quadrants located on transects through the two prairies. Each plant is identified down to species or the next highest level of classification possible. Each species also receives plot coverage, e.g., how much area of the plot is taken up by the plant. Coverage numbers are scaled between one and five ratings. One represents up to 1% of the plot; two is 1% to 5% of the plot; three is 5% to 25% of the plot; four is 25% to 50% of the plot; and a rating of five is anything that covers more than 50% of the quadrant plot. The data is collected in the field before being transferred into a spreadsheet along with the previous year's data. For this research project, the mean coverage was calculated for several plant species in a year in which a burn did not occur and a year in which the prairie was burned. For the North Prairie monitoring data from 2010 and 2013 was used; for the South Prairie data from 2011 and 2014 was used.

The plant species used to look at the effects of burns where plants that met one of several criteria. These criteria dictated that they must be a conscious plant that is readily identifiable by the data collector; the plants must be representative of an important plant group; the species must be actively managed for or against; or the plant species must be of particular research interest by

the managing administrator. The plants selected from the monitoring data for this report were as listed: *Andropogon gerardii, Apocynum cannabinum, Carex shortiana, Desmodium sp, Geum canadense, Impatiens capensis, Monarda fistulosa, Penstemon digitalis, Pycnanthemum sp, Rubus sp, Rudbeckia subtomentosa,Solidaga altissima,*and *Veroniacastrum virginicum.* The mean coverage for each plant was then subjected to a pairwise t-test to determine if the change in mean coverage was significantly different enough to suggest a possible correlation with the prairie burns. The test was two tailed with an alpha value of 0.05. If the p-value for a plant is below the alpha value then the change in mean coverage is significant.

Results

Of 13 plant groups used in this report only three had p-values low enough to be considered significant: *Apocynum cannabinum, Impatiens capensis,* and *Rubus sp.* Of the three, only *Rubus sp* showed significant values in both the north and south prairies. *Veroniacastrum virginicum* did not have enough occurrences in the south prairie for analysis to be conducted. All the pairwise t-tests can be found in tables 1- 13.

Table 1	Andropogon gerardii	
	North	**South**
T-statistic	-1.16	-1.7
P-value	0.24	0.102
Mean	3.19	2.67
Mean After	2.83	3.38
SD Before	1.13	0.984
SD After	1.07	1.12
N Before	23	12
N After	26	13

Table 2	Apocynum cannabinum	
	North	**South**
T-statistic	-3.31	0.12
P-value	0.002	0.9
Mean	1.5	1.53
Mean After	2.23	1.5
SD Before	0.611	0.516
SD After	0.815	0.548
N Before	19	15
N After	26	6

Table 3	Carex shortiana	
	North	South
T-statistic	-1.76	-1.99
P-value	0.09	0.111
Mean	2.44	2.33
Mean After	3.08	3.75
SD Before	0.726	0.577
SD After	0.954	1.26
N Before	9	3
N After	13	4

Table 4	Desmodium sp.	
	North	South
T-statistic	-1.43	-1.76
P-value	0.157	0.123
Mean	2.11	1.67
Mean After	2.53	2.61
SD Before	1.05	1.21
SD After	1.25	1.27
N Before	27	6
N After	36	36

Table 5	Geum canadense	
	North	South
T-statistic	-0.553	-1.12
P-value	0.595	0.269
Mean	1.6	2.19
Mean After	1.88	2.59
SD Before	0.894	0.981
SD After	0.835	1.06
N Before	5	16
N After	8	17

Table 6	Impatiens capensis	
	North	South
T-statistic	1.37	3.073
P-value	0.18	0.004
Mean	2.09	2.58
Mean After	1.75	1.89
SD Before	0.9	1.18
SD After	0.716	0.33
N Before	23	36
N After	20	9

Table 7	Monarda fistulosa	
	North	South
T-statistic	-0.29	-1.62
P-value	0.77	0.149
Mean	1.375	1.6
Mean After	1.5	2.5
SD Before	0.744	0.54
SD After	0.837	1.22
N Before	8	5
N After	6	6

Table 8	Penstemon digitalis	
	North	South
T-statistic	-1.13	-0.766
P-value	0.26	0.447
Mean	2.58	3.23
Mean After	2.81	3.43
SD Before	0.903	0.99
SD After	0.969	0.992
N Before	40	31
N After	42	23

Table 9	Pycnanthemum sp.	
	North	**South**
T-statistic	-0.311	-0.537
P-value	0.757	0.61
Mean	2.83	2.57
Mean After	2.97	3
SD Before	1.3	0.976
SD After	1.59	1.58
N Before	18	7
N After	29	5

Table 10	Rubus sp.	
	North	**South**
T-statistic	-4.23	-2.45
P-value	1.06x10-4	0.02
Mean	2.18	3.12
Mean After	3.3	3.94
SD Before	0.907	0.993
SD After	0.988	0.929
N Before	22	17
N After	30	16

Table 11	Rudbeckia subtomentosa	
	North	**South**
T-statistic	-0.085	-0.78
P-value	0.932	0.439
Mean	3.88	3.96
Mean After	3.9	4.22
SD Before	0.983	1.24
SD After	1.08	1.04
N Before	52	25
N After	51	23

Table 12	Solidago altissima	
	North	**South**
T-statistic	1.08	0.427
P-value	0.287	0.672
Mean	2.48	3.13
Mean After	2.19	3
SD Before	1.05	0.968
SD After	0.849	1.03
N Before	25	23
N After	26	20

Table 13	veronicastrum virginicum	
	North	**South**
T-statistic	1.05	
P-value	0.307	
Mean	3.43	
Mean After	2.79	
SD Before	1.13	
SD After	1.63	
N Before	7	1
N After	14	3

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Discussion

Based on the results from the pairwise t-test, 10 of the plant groups used in this report had p-values that rejected the null hypothesis that the presence of prescribed burns did not affect the percentage of quadrant coverage in either prairie. The unaffected plants were *Andropogon gerardii, Carex shortiana, Desmodium sp, Geum canadense, Monarda fistulosa, Penstemon digitalis, pycnanthemum sp, Rudbeckia subtomentosa, Solidago altissima,* and *Veronicastrum virginicum. Apocynum cannabinum* showed a significant change in the North prairie only; the mean coverage increased following the prescribed burn. *Impatiens capensis* also showed a significant change in only one prairie, the south prairie; in this instance the mean coverage decreased and the plant occurred in 27 fewer quadrants than in the previous years. The present plants in the genus *Rubus* represent the only group of plants that showed significant changes in both prairies, with the mean coverage increasing in both following the prescribed burns. *Veronicastrum virginicum* did not have a significant change in the North prairie and occurred at too few quadrants in the south prairie for an analysis to be conducted. Several other plants other than *Veronicastrum virginicum* occurred with noticeably fewer plots in the South Prairie than in the North Prairie, namely *Carex shortiana* and plants in the genus *Pycnathemum*. This difference is likely due to the North prairie being classified as a wet-mesic prairie while the South Prairie tends to be drier.

Other factors could drive coverage change within the study area, such as changes in climate, the time of the year when the burn occurred and differences in the identification skills of the data collector. Some plants that were not selected to be used in this study because they did not occur within enough quadrants to be analyzed, such as rose mallow *Hibiscus lasicarpus,* may

have been significantly affected by the burns. This type of site exclusion could also explain the differences in quadrant occurrences for plants used in the study.

Conclusion

Based on the results from this study, prescribed burns in the North and South Prairie management areas did not cause significant changes in plant coverage over a short time period; with the exception of plants in the genus *Rubus*, and possible for the species *Apocynum cannabinum* and *Impatiens capensis*. Further analysis needs to be conducted to determine the long term effects of the prescribed burns.