## EFFECTS OF PATCH-BURN GRAZING ON THE NESTING SUCCESS OF GRASSLAND BIRDS 2016-2017

A report to the Missouri Department of Conservation in partial fulfillment of Cooperative Agreement #311, Amendment 3

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**SUMMARY.** In 2016, the Missouri River Bird Observatory (MRBO) conducted a pilot season of nest-searching and monitoring to examine the effects of patch-burn grazing (PBG) on the nesting success of grassland birds. The second year of this project took place in 2017, and it is slated to continue in 2018. The goal of the study is to measure nest survival within four different management treatments (patch-burn grazed [PBG], burned ungrazed [BU], unburned grazed [UBG], and unburned ungrazed [UBUG]). In 2016, observers located and monitored nests within PBG study sites at Taberville Prairie Conservation Area and kept continuous records of the status of nests from 25 May to 31 July. In 2017, nest-searching and monitoring was conducted at Wah'Kon-Tah Prairie from 14 May to 30 July.

Nest data were analyzed in R-Studio via a logistic exposure analysis to determine full-cycle nest survival rates. Sample size to date has allowed analyses on Dickcissel in 2016 and the target species guild and all species combined in 2016 and 2017. In 2016 at Taberville, the PBG treatment had the highest percentage of full cycle nest survival, which agrees with numerous studies on patch-burn grazing and its successful use as a management tool. In 2017 at Wah'Kon-Tah, the highest nest survival rate was documented on the UBUG area, followed by the BU treatment. Future nest-monitoring on the PBG study areas should allow further elucidation on these trends.

**INTRODUCTION**. PBG is a widely accepted management tool that is utilized to produce a diversity of vegetative structure, thus increasing both nesting and foraging habitat for a variety of grassland-obligate species (Churchwell et al. 2008, Coppedge et al. 2008, Hovick et al. 2011). To manage for grassland-obligate bird species in the <1% of native prairie remaining in Missouri, a comprehensive management toolbox includes the use of prescribed fire and moderate grazing. The long-term effects of PBG on grassland bird nesting success in Missouri is an important topic for investigation.

The Missouri Department of Conservation's (MDC) Resource Science Division (RSD) has initiated a 15-year study examining the effects of patch-burn grazing on prairie ecosystems, with particular focus on plant communities and vegetative structure. Study areas include Diamond Grove, Kickapoo, Providence, Wah'Kon-Tah, Taberville and Hi Lonesome Prairies. MRBO has initiated a parallel study to investigate the effects of PBG treatment on grassland bird nesting success. The Taberville Prairie PBG unit was the first site selected for our examination of nest productivity. Due to a grazing rest period at Taberville in 2017, the study focused effort this year on Wah'Kon-Tah prairie where grazing was still active. Target species included Eastern Meadowlark (*Sturnella magna*), Dickcissel (*Spiza americana*), Field Sparrow (*Spizella pusilla*), Henslow's Sparrow (*Ammodramus henslowii*), Grasshopper Sparrow (*Ammodramus savannarum*), and Bell's Vireo (*Vireo bellii*), though all nests found are recorded and monitored regardless of species.

**2017 STUDY AREA.** Wah'Kon-Tah Prairie (Fig. 1) is a 3,030-acre parcel located in the Upper Osage Grasslands Priority Geography and is characterized largely by native prairie (2,700 acres). Other components include warm season grass plantings and wooded areas. The 292-acre PBG study area falls on the northeastern side of Wah'Kon-Tah. The grazing treatment unit is 153.9 acres, of which 37 acres were burned on March 15<sup>th</sup>, 2017. The control (ungrazed) unit is 138.4 acres, of which 54 acres received prescribed fire on March 15<sup>th</sup>, 2017.

**METHODS.** Nest searching and monitoring methodology did not differ between years. MRBO observers conducted nest searches at Taberville Prairie Conservation Area from the end of May until mid-July, 2016 and at Wah'Kon-Tah from mid-May until the end of July. Four observers were employed on the project in 2016 and two in 2017. Observers spent equal time nest-searching in the grazed and ungrazed units, with the number of searchers in each unit varying per day to ensure search times were equal. Searching began at sunrise and concluded by 12:00 pm to minimize disturbance to nesting birds during the hottest portion of the day. Each unit was traversed by foot and observers focused on cues such as flushing adults, short flights, chipping adults, or adults with food or nesting material. Upon flushing a

bird, observers immediately searched the area for a maximum of ten minutes to minimize disturbance. If the nest was not found during that time period, observers knelt in a concealed location to watch for returning parents. If the nest was not found, the location of likely nesting areas was mapped using Collector for ArcGIS and observers returned later in the day or in following days to continue observation.

Observations including date, species, method of discovery, nest stage, and observer name were recorded electronically. Nests were also marked visually by adhering a small piece of black electrical tape to tall vegetation in a triangular perimeter. Target species nests, with the exception of Eastern Meadowlark, were revisited every two days to check status. Non-target species nests and Eastern Meadowlark, a species susceptible to disruption, were revisited every three to five days. Nest observations tracked include: number of eggs and/or nestlings, presence of Brown-headed Cowbird eggs or nestlings, ultimate nest fate, and behavioral observations of interest (e.g. flushing off nest, chipping, food in mouth). Extreme precaution was taken to avoid trampling vegetation or using the same path to and from nests in order to reduce cues to potential nest predators.

Observers continued recording observational data on every visit until the nest was deemed either successful (at least one nestling fledged) or failed. A



Figure 1. Wah'Kon-Tah Prairie and the PBG study units: grazed (yellow) and ungrazed (blue).

nest was deemed successful if the following were observed in conjunction with appropriate age of nestlings: a fledging event, an empty nest with vocal adults and/or fledglings present, or a nest cup empty other than fecal matter (fecal matter is removed continually from the nest by parents until the time of fledging). Nests were deemed failed if the nest was empty and/or disrupted before the appropriate fledging age or if the nest fledged only Brown-headed Cowbird young. Observers attempted to determine the cause of nest failure, classified as predation (mammalian or reptile) or other (e.g. weather damage, human disturbance or other cause) based on the state of the failed nest.

**DATA ANALYSIS.** R-Studio with packages library(lme4) and library(MASS) was employed to perform a Logistic Exposure analysis using PBG treatments units as covariates (Shaffer 2004). Required attribute data consisted of nest ID, date observed, date found, stage of nest (building, incubating, or nestling), status of the nest ('1' when the nest was active or fledged and '0' if the nest failed), the intervals between each day the nest was checked, and the nest's management sub-unit.

### **RESULTS:**

In 2016, MRBO observers spent a total of 360 hours in each unit and found 143 nests in the grazed (n = 77) and ungrazed (n = 56) study areas (Table 1). An additional 51 nests were deemed inactive (i.e., nesting had concluded before the study commenced) and were excluded from further analyses. Of the 143 active nests located in 2016, 120 were nests of target species (Table 3). Of the total active target-species nest sample, 45 were successful in producing at least one fledgling, 66 failed due to predation (mainly snakes, which can be inferred by the lack of damage to nest cup), 21 failed for other reasons, three were abandoned before completion, four were still active at the end of the field season, and four fates were unknown. Target species nest success varied widely between study units (Table 3).

In 2017, observers spent a total of 190 hours in each unit found 122 nests in the grazed (n = 45) and ungrazed (n = 77) study areas (Table 2). An additional 16 nests that were located were deemed inactive. The 2017 nest sample included 59 target species nests (Table 4), of which 41 failed due to predation or other causes. Just 15 nests were successful. The fate could not be accurately determined for three nests (Table 4).

Logistic Exposure analysis provided the daily, weekly and full cycle nest survival rates for Dickcissel in 2016 and all species and the target guild in both 2016 and 2017 (Table 5-7, Figures 2-3). Overall, nest survival at Taberville Prairie (Table 5, Figure 2) was higher in all treatment units than at Wah'Kon-Tah Prairie (Table 6, Figure 3). This trend, coupled with the larger sample size for Taberville, produced combined results that more closely reflect the results at Taberville, with highest nest survival in the PBG unit followed by the UBUG unit.

**DISCUSSION.** Data resulting from 2016-2017 nest-monitoring indicate that differences may occur in target species nesting success across study units. While different trends in nest success by unit were observed at Wah'Kon-Tah as compared to Taberville, the wide disparity in sample size (59 target species nests at Wah'Kon-Tah versus 120 at Taberville) may have had a significant effect on logistic exposure analyses. Combined data to date suggest that target species are most successful in the PBG and UBUG units, followed by the BU and UBG units.

Dickcissels were abundant at Taberville in 2016 and the initial data from that year suggest that Dickcissels experience the highest nest survival rate in PBG and UBUG units. The high sample size of Dickcissel nests (n = 82) had a disproportionate contribution to the target guild and all species analyses. Nest sample sizes of other target species were inadequate to undergo Logistic Exposure analyses; current raw data from both 2016 and 2017 do not suggest any particular trend in nesting success linked to grazing management.

Higher sample sizes for species within the target guild can be expected with the addition of future data. In both years completed to date, nests were located in approximate proportion to target species' abundance on the study area, as compared to results from two rounds of all-species line-transect surveys performed on the PBG study units during the breeding season (Ripper and Duke 2017 and Ripper et al. 2017). For example, Dickcissels were relatively non-abundant on Wah'Kon-Tah in 2017 while Grasshopper Sparrows were virtually non-existent at Taberville in 2016.

As grazing resumes at Taberville Prairie in 2018, the nest-monitoring study will return to that site. We anticipate that Taberville and Wah'Kon-Tah PBG units will be monitored on a rotating basis in future years. These sites provide a unique opportunity for amassing a robust dataset for examining the nest survival of grassland birds in response to PBG management. In addition generating comparative nest success measures for PBG study units, future analyses will include nest distance to woody edges and vegetative structure as covariates.

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### LITERATURE CITED

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## Nests located by PBG Unit, 2016-2017

### Taberville 2016

 

 Table 1. Number of active nests of all species located on Taberville Prairie Conservation

 Area patch-burn graze study areas.

 BU: Burned, ungrazed; PBG: patch-burned, grazed;

 UBG: unburned, grazed; UBUG: unburned, ungrazed. Target species denoted by **bold** type.

	BU	PBG	UBG	UBUG	Total
Bell's Vireo		2	6	4	12
Brown Thrasher		4	6		10
Common Yellowthroat		1		1	2
Dickcissel	28	22	22	10	82
Eastern Kingbird				1	1
Eastern Meadowlark			5		5
Eastern Towhee				1	1
Field Sparrow		4	9	5	18
Grey Catbird		1			1
Grasshopper Sparrow			1		1
Henslow's Sparrow				2	2
Mourning Dove		1	2	1	4
Orchard Oriole	1				1
Red-winged Blackbird		1		1	2
Unknown Spp.				1	1
Total	29	36	51	27	143



Wah'Kon-Tah 2017 Table 2. Number of active nests of all species located on Wah'Kon-Tah Prairie patch-burn graze study areas in 2017. BU: Burned, ungrazed; PBG: patch-burned, grazed; UBG: unburned, grazed; UBUG: unburned, ungrazed. Target species denoted by **bold** type.

Species	BU	PBG	UBG	UBUG	Total
American Goldfinch	1		2	2	5
Ammodramus spp.			1		1
Bell's Vireo	1	1	8	8	18
Blue Grosbeak	1		2	1	4
Brown Thrasher	1	4		2	7
Common Grackle	1				1
Dickcissel	16		2	5	23
Eastern Kingbird	1		1		2
Eastern Towhee				1	1
Field Sparrow	2	6	2	3	13
Gray Catbird	13		5	3	21
Grasshopper Sparrow			2		2
Henslow's Sparrow			5		5
Indigo Bunting			1		1
Mourning Dove		1			1
Northern Cardinal	1				1
Northern Mockingbird	1				1
Orchard Oriole	1		1		2
Red-winged Blackbird	9		1		10
Yellow-breasted Chat	1			2	3
Total	50	12	33	27	122



### Taberville 2016

 Table 3. Nest fate for target species nests found within Taberville Prairie Conservation Area patch-burn graze study areas.

 BU: Burned, ungrazed; PBG: patch-burned, grazed; UBG: unburned, grazed; UBUG: unburned, ungrazed.

	BU				UBUG				
	Failed:	Failed:		Unknown		Failed:	Failed:		Unknown
Target Species	Other	Predation	Successful	Fate	Active	Other	Predation	Successful	Fate
Bell's Vireo							3	1	
Dickcissel	6	14	7	1	1		4	5	
Eastern Meadowlark									
Field Sparrow						1	3	1	
Grasshopper Sparrow									
Henslow's Sparrow							2		
Total	6	14	7	1	1	1	12	7	

PBG							UBG			
Target Species	Active	Failed: Other	Failed: Predation	Successful	Unknown Fate	Failed: Other	Failed: Predation	Incomplete	Successful	
Bell's Vireo			1	1		5			1	
Dickcissel	2	2	5	11	2	1	14	2	5	
Eastern Meadowlark						2	2		1	
Field Sparrow			3	1		1	4	1	3	
Grasshopper Sparrow									1	
Henslow's Sparrow										
Total	2	2	9	13	2	9	20	3	11	

Wah'Kon-Tah 2017 Table 4. Nest fate for target species nests found within Wah'Kon-Tah Prairie patch-burn graze study areas. BU: Burned, ungrazed; PBG: patch-burned, grazed; UBG: unburned, grazed; UBUG: unburned, ungrazed.

	BU				UBUG			
	Failed:	Failed:		Unknown	Failed:	Failed:		Unknown
Target Species	Other	Predation	Successful	Fate	Other	Predation	Successful	Fate
Ammodramus Spp.		1						
Bell's Vireo	1				3	2	3	
Dickcissel	7	4	5			1	1	
Field Sparrow		1	1		1	1		1
Grasshopper Sparrow								
Henslow's Sparrow					3	1		1
Total	8	6	6		7	5	4	2

	PBG			UBG				
TT C	Failed:	Failed:	G (1	Unknown	Failed:	Failed:	G (1	Unknown
Target Species	Other	Predation	Successful	Fate	Other	Predation	Successful	Fate
Bell's Vireo			1		4		1	1
Dickcissel					2		2	
Field Sparrow	5	1				2		
Grasshopper Sparrow						1	1	
Henslow's Sparrow								
Total	5	1	1		6	3	4	1

## NEST SURVIVAL BY PBG UNIT, 2016-2017

Tables 5-7. Logistic Exposure function for target species nests found within Taberville and Wah'Kon-tah Prairies patch-burn graze study areas. Nest sample sizes were adequate (n > 50) to analyze nest survival for the target species guild and all species combined in both years, and for Dickcissel in 2016.

BU: Burned, ungrazed; PBG: patch-burned, grazed; UBG: unburned, grazed; UBUG: unburned, ungrazed.

laberville 2016									
		Nest S	burvival						
Species/Group	Daily	Weekly	Full Cycle	SE					
Dickcissel	97.0%	80.6%	52.4%	0.096					
Target Guild	96.0%	75.2%	42.5%	0.075					
All Species	95.5%	72.5%	38.2%	0.060					
Dickcissel	92.5%	57.8%	19.4%	0.038					
Target Guild	92.5%	57.8%	19.4%	0.038					
All Species	92.3%	57.0%	18.6%	0.036					
Dickcissel	89.5%	45.9%	9.7%	0.025					
Target Guild	91.0%	51.7%	13.8%	0.023					
All Species	92.5%	58.1%	19.7%	0.030					
Dickcissel	97.1%	81.1%	53.4%	0.126					
Target Guild	94.1%	65.5%	28.1%	0.056					
All Species	93.8%	63.9%	26.0%	0.048					
	I alSpecies/GroupDickcisselTarget GuildAll SpeciesDickcisselTarget GuildAll SpeciesDickcisselTarget GuildAll SpeciesDickcisselTarget GuildAll SpeciesDickcisselAll SpeciesDickcisselAll SpeciesDickcisselAll SpeciesDickcisselAll Species	Species/GroupDailyDickcissel97.0%Target Guild96.0%All Species95.5%Dickcissel92.5%Target Guild92.5%All Species92.3%Dickcissel89.5%Target Guild91.0%All Species92.5%Dickcissel89.5%Target Guild91.0%All Species92.5%Dickcissel97.1%Target Guild94.1%All Species93.8%	Taberville 2016           Nest S           Species/Group         Daily         Weekly           Dickcissel         97.0%         80.6%           Target Guild         96.0%         75.2%           All Species         95.5%         72.5%           Dickcissel         92.5%         57.8%           Target Guild         92.5%         57.8%           All Species         92.3%         57.0%           Dickcissel         89.5%         45.9%           Target Guild         91.0%         51.7%           All Species         92.5%         58.1%           Dickcissel         97.1%         81.1%           Target Guild         94.1%         65.5%           All Species         93.8%         63.9%	Taberville 2016Species/GroupDailyWeeklyFull CycleDickcissel97.0%80.6%52.4%Target Guild96.0%75.2%42.5%All Species95.5%72.5%38.2%Dickcissel92.5%57.8%19.4%Target Guild92.5%57.8%19.4%All Species92.3%57.0%18.6%Dickcissel92.3%57.0%18.6%Dickcissel92.5%58.1%19.7%Target Guild91.0%51.7%13.8%All Species92.5%58.1%19.7%Dickcissel97.1%81.1%53.4%Target Guild94.1%65.5%28.1%All Species93.8%63.9%26.0%					

# Taberville 2016

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## Wah'Kon-Tah 2017

				Nest S	urvival	
	Treatment Unit	<b>Species Group</b>	Daily	Weekly	Full Cycle	SE
	PBG	Target Guild	86.8%	37.2%	5.1%	0.021
đ		All Species	86.8%	52.7%	14.7%	0.046
	BU	Target Guild	93.4%	62.0%	23.8%	0.050
٨.		All Species	93.4%	62.0%	23.9%	0.033
	UBG	Target Guild	90.4%	49.5%	12.1%	0.031
		All Species	91.6%	53.9%	15.7%	0.031
V	UDUC	Target Guild	94.9%	69.4%	33.4%	0.081
	JBUG	All Species	94.9%	69.4%	33.4%	0.081

## Combined Results 2016-2017

			Nest Su	urvival	
Treatment Unit	<b>Species Group</b>	Daily	Weekly	Full Cycle	SE
DDC	Target Guild	94.7%	68.3%	31.9%	0.054
rbU	All Species	94.6%	68.1%	31.5%	0.045
DU	Target Guild	92.9%	59.7%	21.3%	0.030
Ы	All Species	93.0%	60.3%	21.9%	0.024
UDC	Target Guild	90.8%	51.1%	13.3%	0.019
UDG	All Species	92.2%	56.6%	18.1%	0.022
	Target Guild	94.4%	67.0%	30.1%	0.046
	All Species	94.2%	65.8%	28.5%	0.042

## Nest Survival by PBG Unit, 2016-2017

Figures 2 and 3. Relative survival of nests within Taberville and Wah'Kon-Tah Prairies patch-burn graze study areas. Nest sample sizes were adequate (n > 50) to analyze nest survival for the target species guild and all species combined in both years, and for Dickcissel in 2016. BU: Patch-burned, ungrazed; PBG: patch-burned, grazed; UBG: unburned, grazed; UBUG: unburned, ungrazed. Standard error represented by error bars. Red lines indicate average nest success of prairie birds suggested by Winters (1999) in southwest Missouri.





