



GRASSLAND BIRD SURVEYS AND
NEST-MONITORING IN MDC PATCH-BURN
GRAZE STUDY UNITS 2015-2018

REPORT TO THE MISSOURI DEPARTMENT OF CONSERVATION
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Patch-burn grazing (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 populations and nesting success in Missouri is an important topic for investigation.

In conjunction with the MDC Resource Science Division's (RSD) 15 year patch-burn grazing (PBG) study, the Missouri River Bird Observatory (MRBO) has initiated a parallel study to investigate the effects of PBG treatment on grassland bird densities and nesting success. Study areas include Diamond Grove, Kickapoo, Providence, Wah'Kon-Tah, Taberville, and Hi Lonesome Prairies. Target grassland breeding species include Eastern Meadowlark (*Sturnella magna*), Dickcissel (*Spiza americana*), Field Sparrow (*Spizella pusilla*), Henslow's Sparrow (*Ammodramus henslowii*), Grasshopper Sparrow (*Ammodramus savannarum*), Northern Bobwhite (*Colinus virginianus*), Bell's Vireo (*Vireo bellii*), Loggerhead Shrike (*Lanius ludovicianus*), and Greater Prairie-Chicken (*Tympanuchus cupido*). However, all species detected during surveys are recorded and all species' nests that are found are monitored.



Format of this report

This report presents the results of 2015-2018 transect surveys on PBG study units. Data were combined across years to analyze and present grassland bird densities in grazed and ungrazed units.

Nest-monitoring results are provided in detail for 2018. Where appropriate for comparison purposes, relevant 2016-2017 data are also included.

More detailed descriptions of survey and nest-monitoring methodology are available in previous years' reports or upon request. Densities of grassland obligate species on all MDC properties surveyed in 2018 can be accessed in MRBO's comprehensive report (Duke and Ripper 2018).

Project Summary

- ✦ MRBO surveyors located and monitored 200 nests during the 2019 breeding season, bringing the 2016-2018 sample size to 408 nests, 334 of which are grassland target species
- ✦ Nest monitoring data to date suggest that Dickcissel, Bell's Vireo, and target species as a guild have the highest rate of nest survival in PBG units, followed by the unburned, ungrazed units.
- ✦ Nest success rates of Dickcissel, Eastern Meadowlark and Henslow's Sparrow documented on Taberville Prairie are similar to rates found by other studies such as Young (2017) and Winter (1999) in southwestern Missouri and Hovick and Miller (2016) in southern Iowa. Predation was the primary cause of nest failure in these studies as well as in MRBO's study.
- ✦ Survey data from 2015-2018 on all of the MDC's PBG units indicate that there is some preference for (e.g. higher density in) grazed units by Dickcissel, Eastern Meadowlark, Field Sparrow and Northern Bobwhite. Taken as a guild, Missouri's grassland obligates do not display clear differences in density between grazed and ungrazed units.

GRASSLAND BIRD DENSITY ON PBG UNITS

The PBG study units are surveyed using the standardized line-transect design that is employed throughout MRBO's surveys of public grasslands throughout Missouri. However, while other grassland survey sites are visited once each breeding season, PBG study units are surveyed twice in order to bolster sample sizes for further analysis.

Line-transect surveys were conducted on the PBG units within the months of May and June. Bird detections were marked with spatially explicit data using ArcGIS Collector and with this information density estimates of grassland-obligate species were made using the program Distance. Density estimates were calculated if the sample size was ≥ 10 for a unit. Combined density estimates of all grassland obligates from 2015 to 2018 show that there is no significant trend in preference for grazed versus ungrazed units (Table 1). However, with the exception of Grasshopper Sparrow for which sample sizes are generally too small to make inferences, individual species show fairly clear patterns of preference for grazed or ungrazed units (Tables 2 through 7).

Tables 1 - 8: Density of birds on patch-burned graze and ungrazed units on Conservation Areas.

n = total number of observations during transect surveys. D = estimated density in birds/acre generated by Program Distance based on pooled data from all survey years and locations. Density calculated only if n >10 for a property. CV = coefficient of variance.

 indicates treatment unit where density was higher, but not significantly
 indicates treatment unit where density was significantly higher (alpha <0.05).

Note: of all PBG study units, only Hi-Lonesome was actively grazed in 2018.

All Grassland Obligates

	2015-2018 Grazed			2015-2018 Ungrazed		
	n	D	CV	n	D	CV
Diamond Grove	525	1.179	0.09	1006	1.199	0.06
Hi-Lonesome	556	0.892	0.15	473	0.738	0.15
Providence (Grazed)/Kickapoo (Ungrazed)	565	1.444	0.16	440	1.160	0.13
Providence (Ungrazed 2018 Only)				182	1.439	0.09
Taberville	552	1.999	0.13	547	1.442	0.12
Wah'Kon-Tah	321	1.094	0.09	774	1.363	0.06
All Properties	2519	1.242	0.07	3422	1.167	0.05



Bell's Vireo

	2015-2018 Grazed			2015-2018 Ungrazed		
	n	D	CV	n	D	CV
Diamond Grove	11	0.028	0.33	32	0.048	0.27
Hi-Lonesome	50	0.091	0.18	51	0.099	0.18
Providence (Grazed)/Kickapoo (Ungrazed)	44	0.127	0.19	8	-	-
Providence (Ungrazed 2018 Only)				19	0.188	0.30
Taberville	42	0.172	0.33	63	0.208	0.34
Wah'Kon-Tah	40	0.154	0.14	115	0.254	0.11
All Properties	187	0.104	0.13	288	0.123	0.13



Dickcissel

	2015-2018 Grazed			2015-2018 Ungrazed		
	n	D	CV	n	D	CV
Diamond Grove	269	0.648	0.13	508	0.642	0.06
Hi-Lonesome	140	0.241	0.18	137	0.227	0.19
Providence (Grazed)/Kickapoo (Ungrazed)	352	0.964	0.19	303	0.847	0.14
Providence (Ungrazed 2018 Only)				115	0.965	0.13
Taberville	253	0.982	0.14	236	0.659	0.07
Wah'Kon-Tah	55	0.201	0.19	200	0.373	0.15
All Properties	1069	0.565	0.11	1499	0.542	0.07

Eastern Meadowlark



	2015-2018 Grazed			2015-2018 Ungrazed		
	n	D	CV	n	D	CV
Diamond Grove	127	0.253	0.08	224	0.209	0.08
Hi-Lonesome	104	0.148	0.17	83	0.102	0.17
Providence (Grazed)/Kickapoo (Ungrazed)	76	0.173	0.18	47	0.097	0.20
Providence (Ungrazed 2018 Only)				18	0.112	0.15
Taberville	99	0.318	0.11	72	0.149	0.10
Wah'Kon-Tah	50	0.151	0.20	116	0.160	0.08
All Properties	456	0.200	0.08	560	0.150	0.07



Field Sparrow

	2015-2018 Grazed			2015-2018 Ungrazed		
	n	D	CV	n	D	CV
Diamond Grove	2	-	-	8	-	-
Hi-Lonesome	54	0.099	0.26	37	0.030	0.40
Providence (Grazed)/Kickapoo (Ungrazed)	17	0.050	0.35	22	0.030	0.41
Providence (Ungrazed 2018 Only)				4	-	-
Taberville	32	0.132	0.31	31	0.043	0.36
Wah'Kon-Tah	31	0.121	0.35	48	0.044	0.34
All Properties	136	0.077	0.19	150	0.026	0.30

Grasshopper Sparrow



	2015-2018 Grazed			2015-2018 Ungrazed		
	n	D	CV	n	D	CV
Diamond Grove	43	0.094	0.20	78	0.105	0.24
Hi-Lonesome	30	0.047	0.37	3	-	-
Providence (Grazed)/Kickapoo (Ungrazed)	8	-	-	16	0.048	0.42
Providence (Ungrazed 2018 Only)				0	-	-
Taberville	2	-	-	1	-	-
Wah'Kon-Tah	20	0.067	0.38	31	0.062	0.33
All Properties	103	0.050	0.19	129	0.049	0.21

Henslow's Sparrow



	2015-2018 Grazed			2015-2018 Ungrazed		
	n	D	CV	n	D	CV
Diamond Grove	60	0.158	0.24	130	0.184	0.20
Hi-Lonesome	107	0.202	0.22	80	0.148	0.29
Providence (Grazed)/Kickapoo (Ungrazed)	28	0.084	0.37	40	0.125	0.35
Providence (Ungrazed 2018 Only)				19	0.178	0.38
Taberville	96	0.408	0.20	129	0.404	0.21
Wah'Kon-Tah	109	0.436	0.18	207	0.432	0.11
All Properties	400	0.231	0.12	605	0.245	0.10



Northern Bobwhite

	2015-2018 Grazed			2015-2018 Ungrazed		
	n	D	CV	n	D	CV
Diamond Grove	12	0.018	0.35	24	0.019	0.031
Hi-Lonesome	56	0.061	0.24	64	0.067	0.24
Providence (Grazed)/Kickapoo (Ungrazed)	39	0.068	0.15	3	-	-
Providence (Ungrazed 2018 Only)				7	-	-
Taberville	28	0.069	0.24	14	0.025	0.37
Wah'Kon-Tah	16	0.037	0.30	57	0.068	0.17
All Properties	151	0.050	0.13	169	0.039	0.15



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



Figure 1. Taberville Prairie and the PBG study units: grazed (yellow) and ungrazed (blue).



Since 2016, MRBO has been conducting a nest-monitoring study on the Taberville (2016 and 2018) and Wah'Kon-Tah (2017) Prairies PBG units. The goal of the study is to measure nest survival within four different management treatments (patch-burn grazed [PBG], patch-burned ungrazed [PBUG], unburned grazed [UBG], and unburned ungrazed [UBUG]).

2018 Study Area Characteristics. Taberville Prairie (Figure 1) is a 1,360-acre remnant prairie 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, crop fields, prairie restoration, woodlots, and old fields. The PBG study area falls on the eastern side of the property.

In 2018, unlike the previous two breeding seasons, the PBG unit had just two management types. PBUG and UBUG. Grazing did not occur within the treatment area for the entirety of 2018. Additionally, the control unit did not receive a prescribed burn that is typically a third of the entire unit. Some haying occurred in the control unit to act somewhat as a substitute and there was minor

brush-hogging in both the treatment and control units. The treatment unit could be divided into two designation, PBUG and UBUG. The patch-burned area was about 63 acres and this area received a late summer burn on 14 September 2017. The UBUG unit in the treatment area was about 136 acres. The control unit was about 195 acres and did not get burned in the 2018 fiscal year and so was classified as UBUG.

2018 Methods. MRBO observers conducted nest searches at Taberville Prairie Conservation Area from the end of May until mid-July, 2016 and at Wah'Kon-Tah Prairie from mid-May until the end of July in 2017. In 2018, nest-searching went on from late-May until late-July at Taberville Conservation Area. We note that four observers were employed on the project in 2016, two in 2017, and three in 2018.

Observers tried to spend equal time nest-searching in the treatment and control units, with the number of searchers in each unit varying per day to ensure search times were equal. 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. One change in searching methodology for this year was that of implementing the rope-dragging technique. For this method, searchers held opposite ends of a rope that had cans dangling from portions of the rope and walked along the prairie while the rope dragged across the tops of the vegetation and the cans clanking against each other. This created disturbances that were very likely to cause any ground-nesting bird to flush from their nest when walking near them.

Nests were documented as successful (fledging at least one young) or failed. 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.



Rope-dragging to find nests at Taberville Prairie.

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. Logistic Exposure analysis provides daily, weekly and full-cycle nest survival rates.

Results. In 2018, MRBO observers spent 211 hours in the control unit and 223 hours in the treatment unit during the period of 22 May to 26 July. In the control unit, 85 nests were found and monitored. In the treatment unit, 115 nests were found and monitored. 59 additional nests were found but were determined to be inactive and therefore were excluded from further analyses.

Assigning these nests their management type for this year resulted in 57 nests in the PBUG unit and 143 nests in the UBUG unit (Table 8). Of the total 200 nests monitored, 155 were target species' nests and 53 of these 155 nests were successful in producing at least one fledgling. Of the 102 nests that did not succeed, 88 failed due to predation or abandonment, 10 were still active at the end of the field season and four nests had fates that could not be determined (Table 9).

Sample size to date has been sufficient ($n > 50$ per treatment) to allow analyses on the target species guild and all species combined in 2016-2018 (Table 10). In 2016 and 2018, Dickcissel sample size was large enough to run analysis and Bell's Vireo sample size was suitable when all years' nests were combined (Table 10).

In 2018, for all species' nests combined and for Dickcissel nests, survival rate was higher in the UBUG unit. Grassland obligates as a guild had higher survival rates in the PBUG unit. Survival analyses were also conducted on 2016-2018 combined nest data across all treatment units and both target species and all species had higher survival rates in the PBG unit (Figure 2). When the 2016 through 2018 data were combined, both Bell's Vireo and Dickcissel nests had the highest survival in PBG units (Figure 3).

Though there were no new data for any grazed unit in 2018, the PBG and UBG results from previous years show that Taberville Prairie had higher survival rates than Wah'Kon-Tah in both of the treatment areas. The PBG unit at Taberville in 2016 had the highest survival rate of Dickcissel, target species, and all species' nests than all other units by year. Wah'Kon-Tah PBUG and UBUG units had higher survival rates for target species and all species' nests than both years' PBUG and UBUG units at Taberville.

DISCUSSION. The 2018 season was unlike the 2016 and 2017 seasons in that the treatment unit, which had previously had cattle present during the breeding season, was not grazed at all. Another unusual component to this year's study was that the control unit did not have a third of its area burned like the past two years' study area. Therefore, this translated to a disproportionate amount of nest-searching effort in the UBUG category compared to PBUG. Despite the much smaller area that comprised the PBUG category this year, compared to the UBUG unit, the density of nests found was much greater. 57 nests, 53 of which were target species, were found in the 63-acre PBUG area compared to 143 nests, 102 of which were target species, found in the 331-acre UBUG area.

While both the PBUG and UBUG areas had 46 Dickcissel nests this year, the survival rate was lower than Dickcissels in the PBUG area. Similar to the 2016 season, Taberville had many more Dickcissel nests relative to all other species present. This contributed disproportionately to the target species and all species analyses, more so for the PBUG unit than the UBUG unit.

The second highest number of target species' nests found during the 2018 season was Bell's Vireo. MRBO searchers found more Bell's Vireo nests than 2016 and 2017 years combined. This speaks to the abundant shrubby and woody vegetation at Taberville that was not controlled by fire or grazers this season. The treatment area was not grazed in 2017 either and this further exacerbated lush vegetative growth. This thick vegetation is also apparent through MRBO's line-transect surveys that were conducted this year, in which only one Grasshopper Sparrow was detected and was likely nesting outside of the study area.

It is important to note that parts of the UBUG unit were brush-hogged in December 2017 and another portion was hayed in July 2017. The hayed portion had two nests: one Eastern Meadowlark and one Henslow's Sparrow, both of which failed. The brush-hogged areas had three nests: two Bell's Vireo nests and one Dickcissel nest, of which one Bell's Vireo nest was successful.

The composition of nesting birds this season was consistent with Taberville in 2016. This year, searchers found more nests of almost all target species suggesting the new technique of rope-dragging that was used this year will be beneficial to obtaining a larger sample size of target species necessary for further analyses. However, nesting success on average was lower this season than in 2016. If for the 2019 season the nest-monitoring project returns to Wah'Kon-Tah, it will be interesting to see if similar results occur on that PBUG study site.

Table 8. Nests found in each of the 2018 Taberville treatment units

	PBUG	UBUG	Total
American Goldfinch		3	3
Bell's Vireo	3	31	34
Brown Thrasher	2	1	3
Common Yellowthroat		2	2
Dickcissel	46	46	92
Eastern Kingbird		1	1
Eastern Meadowlark	1	6	7
Eastern Towhee		3	3
Field Sparrow	3	11	14
Gray Catbird		7	7
Henslow's Sparrow		7	7
Indigo Bunting		1	1
Mourning Dove	1	11	12
Northern Bobwhite		1	1
Northern Cardinal		1	1
Red-winged Blackbird		2	2
Wild Turkey		1	1
Yellow-breasted Chat	1	8	9
Total	57	143	200



Dickcissel nestlings.

Table 9. Fate of target species nests in 2018 Taberville treatment units

Target Species	PBUG				UBUG			
	Failed	Successful	Unknown	Active	Failed	Successful	Unknown	Active
Bell's Vireo	1	2			17	13	1	
Dickcissel	26	14	1	5	28	12	1	5
Eastern Meadowlark		1			3	3		
Field Sparrow		3			9	1	1	
Henslow's Sparrow					4	3		
Northern Bobwhite						1		
Total	27	20	1	5	61	33	3	5



Table 10. Nest survival for all species, the grassland obligate target guild, and Dickcissel in 2016-2018

Treatment Unit	Species/Group	2016		2017		2018	
		Full Cycle	SE	Full Cycle	SE	Full Cycle	SE
PBG	Dickcissel	52.4%	0.096				
	Target Guild	42.5%	0.075	5.1%	0.021		
	All Species	38.2%	0.060	14.7%	0.046		
PBUG	Dickcissel	19.4%	0.038			13.4%	0.025
	Target Guild	19.4%	0.038	23.8%	0.050	22.1%	0.037
	All Species	18.6%	0.036	23.9%	0.033	19.7%	0.031
UBG	Dickcissel	9.7%	0.025				
	Target Guild	13.8%	0.023	12.1%	0.031		
	All Species	19.7%	0.030	15.7%	0.031		
UBUG	Dickcissel	53.4%	0.126			17.7%	0.027
	Target Guild	28.1%	0.056	33.4%	0.081	21.7%	0.022
	All Species	26.0%	0.048	33.4%	0.081	22.1%	0.019

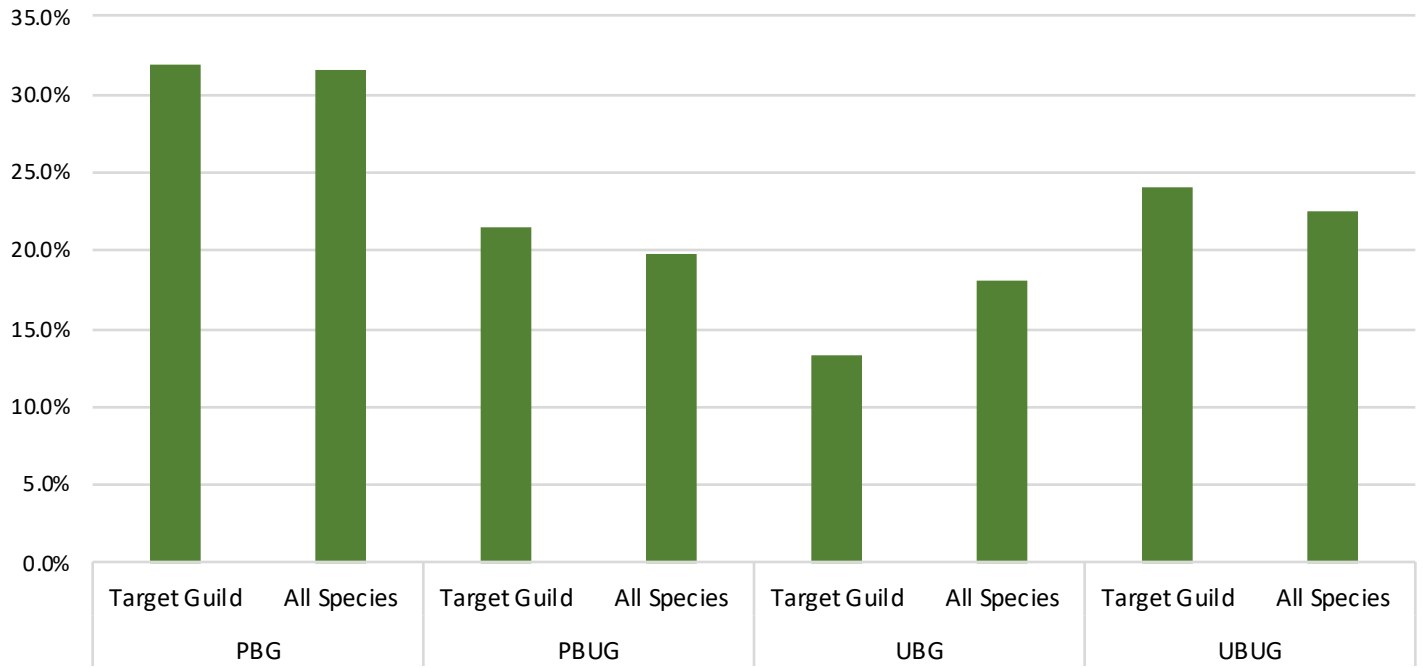


Figure 2. Full-cycle nest survival for all species and target species with data pooled from 2016-2018 at both Taberville and Wah’Kon-Tah Prairies. Due to the lack of grazing at Taberville Prairie in 2018, there were no data that fit into the PBG or UBG categories in that year.

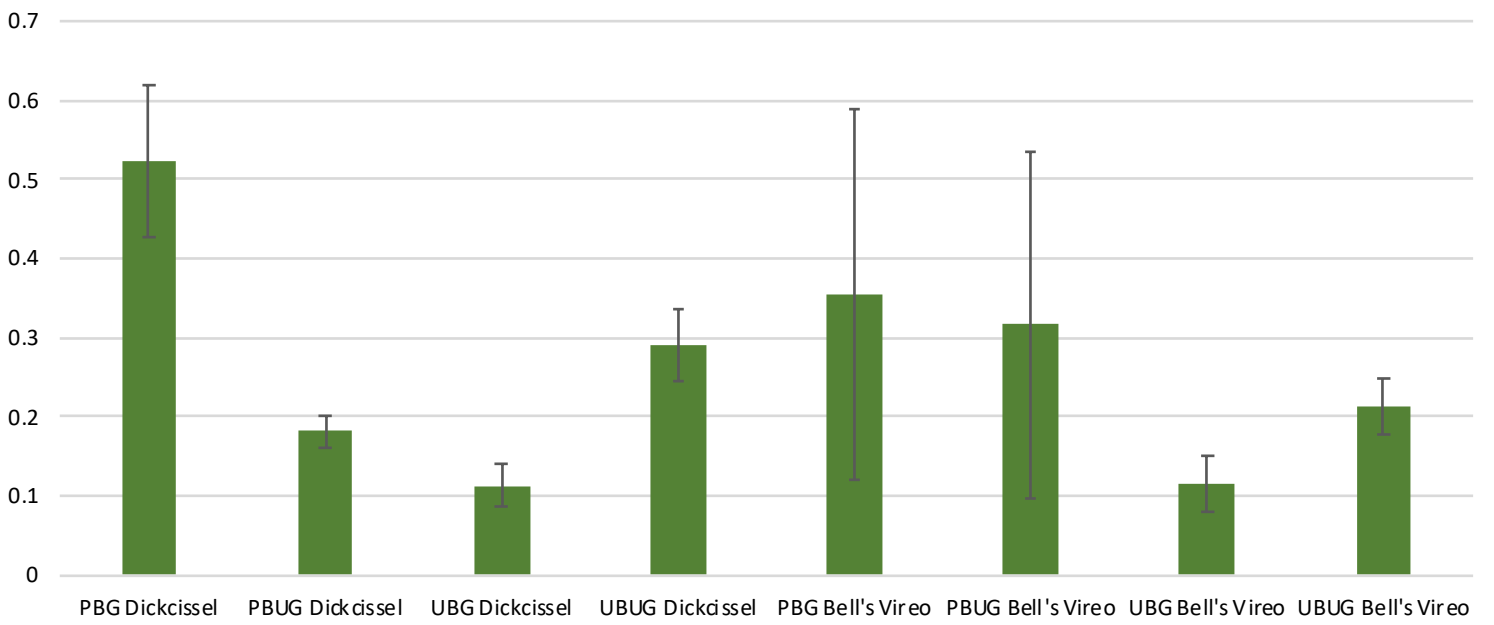


Figure 3. Full-cycle nest survival for all species and target species with data pooled from 2016-2018 at both Taberville and Wah’Kon-Tah Prairies. Due to the lack of grazing at Taberville Prairie in 2018, there were no data that fit into the PBG or UBG categories in that year.

Literature Cited

CHURCHWELL, R. T., C. A. DAVIS, S. D. FUHLENDORF, AND D. M. ENGLE. 2008. Effects of Patch-burn Management on Dickcissel Nest Success in a Tallgrass Prairie. *Journal of Wildlife Management* 72(7): 1596-1604.

COPPEDGE, B. R., S. D. FUHLENDORF, W. C. HARRELL, AND D. M. ENGLE. 2008. Avian Community Response to Vegetation and Structural Features in Grasslands Managed with Fire and Grazing. *Biological Conservation* 141: 1196-1203.

HOVICK, T.J AND J. R. MILLER. 2016. Patch-burn grazing moderates Eastern Meadowlark nest survival in Midwestern grasslands. *American Midland Naturalists* 176: 72-80.

HOVICK, T.J, J. R. MILLER, S. J. DINSMORE, D. M. ENGLE, D. M. DEBINSKI, AND S. D. FUHLENDORF. 2011. Effects of Fire and Grazing on Grasshopper Sparrow Nest Survival. *Journal of Wildlife Management* 9999: 1-9.

DUKE, E.C. AND D. RIPPER. 2018. Breeding bird surveys in Missouri's focal grassland landscapes 2013-2018. Missouri River Bird Observatory report to the Missouri Department of Conservation. 24pp.

SHAFFER, T. 2004. A unified approach to analyzing nest success. *The Auk* 121(2): 526-540.

WINTER, M. 1999. Nesting biology of Dickcissels and Henslow's Sparrows in Southwestern Missouri in prairie fragments. *Wilson Bulletin* 111(4): 515-527.

YOUNG, A.C. 2017. Seasonal fecundity and post-fledging survival and habitat selection of Henslow's Sparrow (*Ammodramus henslowii*). M.S. Thesis, University of Nebraska at Omaha. 117 pp.

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Photo credits

Front cover: Henslow's Sparrow by Andrew Reago & Chrissy McClaren

Bell's Vireo - page 3; Eastern Meadowlark - page 4: Dr. David Rintoul

All other photos taken by MRBO field staff.

Background this page: Eastern Meadowlark nestling

Back cover: Northern Bobwhite nest at Taberville Prairie

