NORTH DAKOTA GAME AND FISH DEPARTMENT

FINAL REPORT

Grassland Bird and Invertebrate Distribution and Response to Fire Management within the Grand Forks County Saline Prairie Focus Area

Project T-41-R

April 1, 2014 – December 31, 2017

Terry Steinwand
Director

Submitted by
Greg Link
Chief, Conservation and Communications Division

March 2018

State Wildlife Grant Final Report - 2017

Project Title: Grassland bird and arthropod distribution and response to fire management within the Grand Forks County saline prairie focus area

Species of Conservation Priority (SoCP)
Level I: Marbled Godwit, Wilson's Phalarope, Grasshopper Sparrow, Nelson's Sparrow, Yellow Rail, American Bittern, Sprague's Pipit

Level II: Willet, Upland Sandpiper, Sharp-tailed Grouse, Greater Prairie-Chicken, Sedge Wren*, Le Conte's Sparrow, Bobolink, Western Meadowlark, Loggerhead Shrike, Canvasback, Northern Pintail, Short-eared owl

*Note list revised to 2015 updated list, not included in 2015 list

Contact Information:

Principal Investigator: Kathryn Yurkonis
Title: Associate Professor
Organization: University of North Dakota (UND) Biology Department
Address: 10 Cornell St., Stop 9019, Grand Forks, ND 58201
Phone/Fax: 701-777-4676
Email:Kathryn.Yurkonis@email.und.edu (corresponding PI)
Key Collaborators: Brett Goodwin, Dean – School of Environmental and Natural Resources Sciences Fleming College; Chris Merkord, Assistant Professor – Minnesota State University Moorhead

Activity Period: April 1, 2014 – December 31, 2017

Date of Report: February 20, 2018

Location:
Grand Forks County Prairie Project area (Figure 1, next page) located from ND Highway 15 northward to the Walsh County line between County Road 2 and U.S. interstate 29 in Grand Forks, County ND. Specific, intensively studied sites will include UND's Oakville Prairie (T. 151N R.52W Sec. 16.; T. 151N R52W Sec. 9 NW 1/4 and T. 151N R52W Sec. 9 SW 1/4) and the ND Game and Fish (NDGF) Crawford Oakville Prairie WMA (T. 151N R52W Sec. 9 SE 1/4), hereafter collectively referred to as Oakville Prairie.

Final Summary

In 2017 we completed the fourth and final project field season (under the current funding) with surveys of bird, arthropod, and plant community composition across the Grand Forks Prairie Project Area (GFPPA) and intensive sampling of these communities at the UND-NDGF Oakville Prairie. Over the project period, we worked with Badger Creek Wildfire to burn six management units at Oakville Prairie and we now have a mosaic within the site of areas at differing stages in their recovery from fire. Through additional collaborations with NDGF, the crew also successfully applied fire to two other NDGF managed ¼ section units in the Prairie Project Area. This is a substantial achievement given that none of the UND or NDGF public lands had seen fire management in the previous decades. As noted below the avian community and avian species of conservation priority are responding to this change in landscape heterogeneity. A majority of the avian SoCP were observed over the project period, with notable increases in Prairie Chickens, Sedge wrens, and Bobolinks on Oakville Prairie. We disseminated preliminary findings through two completed MS theses and through multiple local, regional, and national outlets. At this point we have one MS and one PhD student building on facets of this work as the Grand Forks Prairie Project efforts continue at a minimal level through a Regional Conservation Partnership Project with NRCS. The following summarizes the effort and data collected in relation to the project objectives.

Executive Summary of Project Accomplishments

Proposed Objective	**Accomplished**	**Data Generated**
Bird abundance and distribution across grazed, hayed, and idle sites with an intensive survey of birds at Oakville.	2014-7: 5 Grazed, 3 Hayed, and 10 Idle sites surveyed in the GFPPA. 37 points surveyed at Oakville	Grassland bird species list for the GFPPA and Oakville (4 yrs data) Site-based occurrence of grassland dependent bird species (4 yrs) Oakville pre/post-fire bird abundances (4 yrs)
Arthropod diversity, abundance, and distribution across the GFPPA and Oakville.	2014-16: Sweep net collections at GFPPA sites. Sweep net, sticky trap, and pitfall trap collections at 37 Oakville points. 2016-2017: Focused pollinator surveys in GFPPA sites.	Dried arthropod biomass from GFPPA sites (3 yrs) Diversity and abundance of litter, mid-story, and canopy arthropods at Oakville (3 yrs)
Vegetation data for the GFPPA and Oakville.	2014-2017: Structural and functional group composition at GFPPA sites. 2014-2017: Species composition survey at 229	Woody encroachment in GFPPA sites. Plant structure and composition for GFPPA sites. Species cover inventory for Oakville points.

	Oakville points.	
Introduce fire to Oakville	Six (2 in 2014, 1 in 2015, 1 in 2016, 2 in 2017) Oakville management units burned.	Estimate of litter consumption and percentage of unit burned (4 burned units).
Conservation awareness	2014: Presented results at ND Chapter Meeting of The Wildlife Society and through interactions with Grand Forks County Prairie Partners 2015: Oakville Prairie Dedication day, one MS thesis completed 2016: One MS thesis completed, Presented results at ND TWS meeting Totals: 11 presentations; 9 undergraduate student assistants; 5 graduate students; 8 outreach events; 8 news articles – details at end of document	2014: Three posters presented on: Plant diversity along a salinity gradient, Bird abundance relative to local factors, and Reintroduction of fire to OPC. 2015: MS thesis completed on Bird distributions and response to fire management in the GFPPA 2016: MS thesis completed on Vegetation distribution at Oakville Prairie, presented posters on: Pollinator responses to land management, ND fire weather

Need

The Grand Forks County Prairie Project Area (GFPPA) consists of a nearly contiguous grassland in an agricultural matrix west of the city of Grand Forks (Figure 1). This area was historically relatively undisturbed due to the localized upwelling of saline ground water, and, as such, contains the largest concentration of remaining grassland within the Red River Valley. However, this land cover is rapidly changing with urban encroachment from Grand Forks and the introduction of drain tile as a salinity mitigation strategy. While a considerable portion of grassland remains in public (state, federal, county, and university) holdings, these areas have only sporadically been managed with fire and grazing practices, and **a coordinated, multi-stakeholder management effort is needed if we are to continue to expect these and private pasture lands to meet the needs of state SoCP**.

Grassland tracts within the Grand Forks Prairie Project Area (GFPPA) have either been idle for decades or managed with moderate grazing (cattle, bison) and haying practices. Fire is occasionally used on public and private lands to promote forage production and, in conjunction with chemical and mechanical means, to control woody plant encroachment (Russian Olive, Snowberry). Unfortunately, these efforts have not been implemented systematically or consistently and, as a result, the landscape lacks the breadth of habitat types that would maximize grassland arthropod and bird diversity (Fuhlendorf et al. 2006).

Objectives

Our goal was to monitor and implement management to enhance habitat for SoCP within the North Dakota Saline Prairie Focus Area. This effort was conducted at two spatial scales over three (2014-2016 so far) growing seasons. We conducted a high-resolution site-specific study on Oakville Prairie and a concurrent broader-scale survey on public and private lands within the GFPPA. We addressed conservation problems identified in the ND Comprehensive Wildlife Conservation Strategy (CWCS) with the following objectives (see also Table 1):

1. Conduct annual grassland bird, arthropod, and vegetation surveys across the GFPPA (including state, federal, private grasslands), with stratification across grazed, hayed, and idle lands.

2. Implement a replicated fire regime with a four-year return interval to reverse habitat degradation on Oakville Prairie.

3. Determine how the abundance of grassland bird species and the composition of the grassland bird, arthropod, and plant communities change with grazing status and time since burning.

4. Increase regional conservation awareness by co-hosting annual, spring workshops and fall field tours to engage with local landowners and citizens regarding the value of regional public and private lands for supporting SoCP.

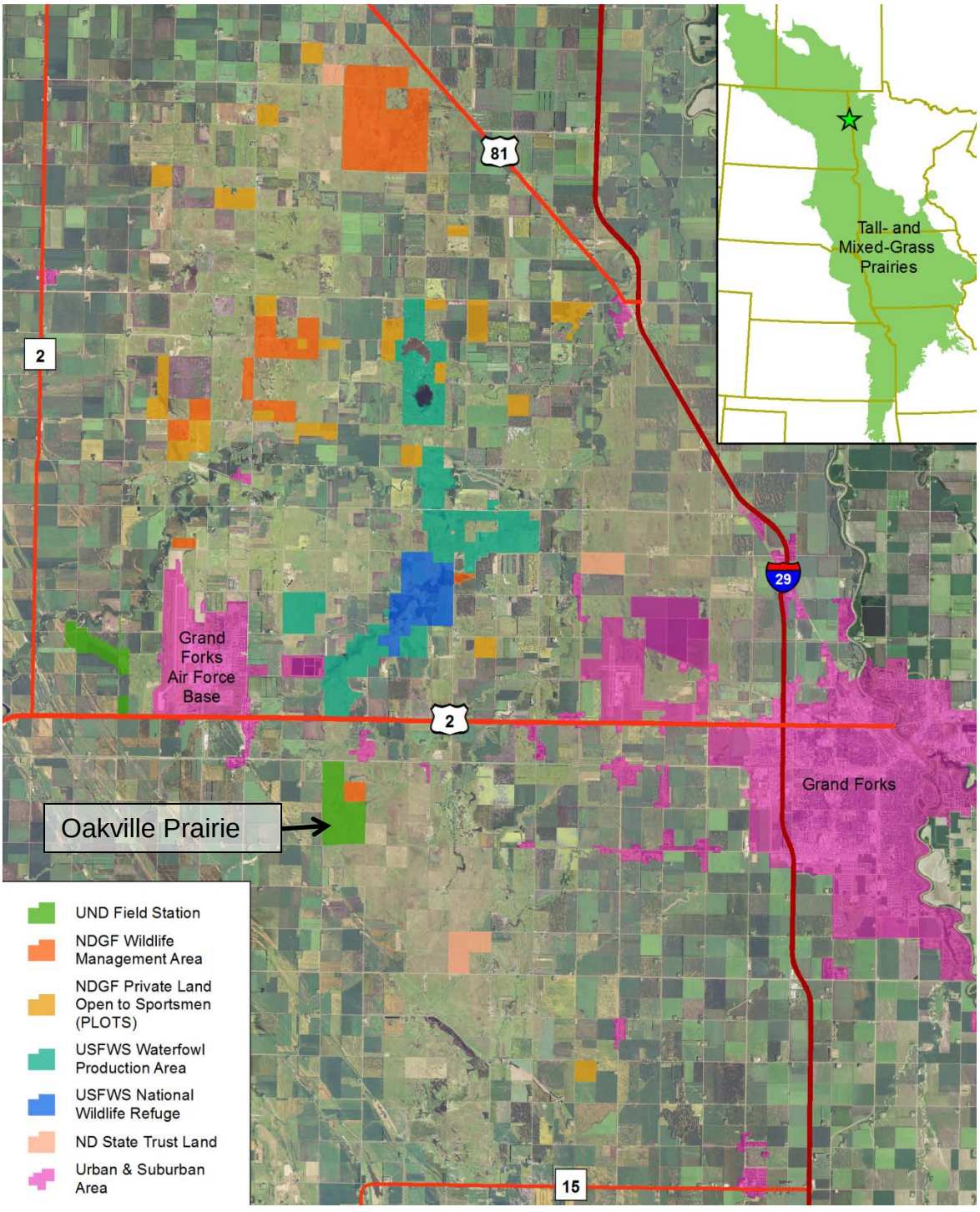

Figure 1 The Grand Forks County Prairie Project Area encompasses a nearly 10 x 30 mile grassland area immediately west of the city of Grand Forks. The nearly contiguous grassland area is located within an agricultural matrix and nearly 10,000 acres are managed within state and federal holdings. We will intensively sample the UND Oakville Prairie/NDGF Crawford Oakville Prairie Wildlife Management Area complex (labeled Oakville Prairie).

Table 1. Procedures, data, and schedule associated with each study objective. UND students and faculty partnered with several agencies to conduct these studies.

Objective	Procedure	Data generated	Schedule	Partners
1 – Fill bird, arthropod, and habitat data gaps in the GFPPA	Habitat and bird SoCP occurrence on sites in the region.	Bird, arthropod, vegetation (including woody plant) occurrence at permanent points	Annually collected (yrs 1-4)	USFWS, NDGF, Private landowners
2,3 – Introduce a regular fire regime to Oakville	Burn ~ ¼ of the site on a four-year return interval	Bird, arthropod, vegetation (including woody plant) occurrence at permanent points	Year 1: Baseline data collection; Phased burning Years 2-4	NDGF, Badger Creek Wildfire
4 – Conservation awareness	Workshop, field tour	Workshop, tour summaries of stakeholder input	Annual Spring workshop and Fall field tour	NRCS, GFCSCD, Grand Forks Prairie Partners

Preliminary Results

1. Conduct annual grassland bird, arthropod, and vegetation surveys across the Grand Forks Prairie Project Area (GFPPA), with stratification across grazed, hayed, and idle habitats.

Summary: We collected data over four growing seasons on bird, arthropod, and vegetation composition in the GFPPA that has served as the basis for two completed MS theses. We have recorded 69 species of birds and 20 of the 48 ND bird SoCP. Most frequently SoCP species include Nelson's Sparrow, Marbled Godwit, Grasshopper Sparrow, Wilson's Phalarope, Bobolink, Western Meadowlark, Sedge Wren and LeConte's Sparrow. Occurrences of Nelson's Sparrow, Marbled Godwit, Bobolink, Prairie Chicken, and Sedge Wren increased since 2014 on Oakville Prairie.

Methods

Study Area

GFPPA grassland sites (Figure 2), including public, private and Oakville Prairie lands, were surveyed for their bird, plant and arthropod communities 2014 -2016. Hayed sites (n=2) (mowed annually in late July) were Wildlife Management Areas (WMAs) managed by the North Dakota Game and Fish Department. Grazed sites (2014: n=4, 2015-7: n=5) were actively grazed during the survey seasons with stocking densities ranging from 0.2-0.6 head/ha. Idle sites (2014: n=11, 2015-17: n=9) were not actively managed with haying, grazing, or burning and were all enrolled in the Conservation Reserve Program (CRP) administered by the Natural Resources Conservation Service (NRCS).

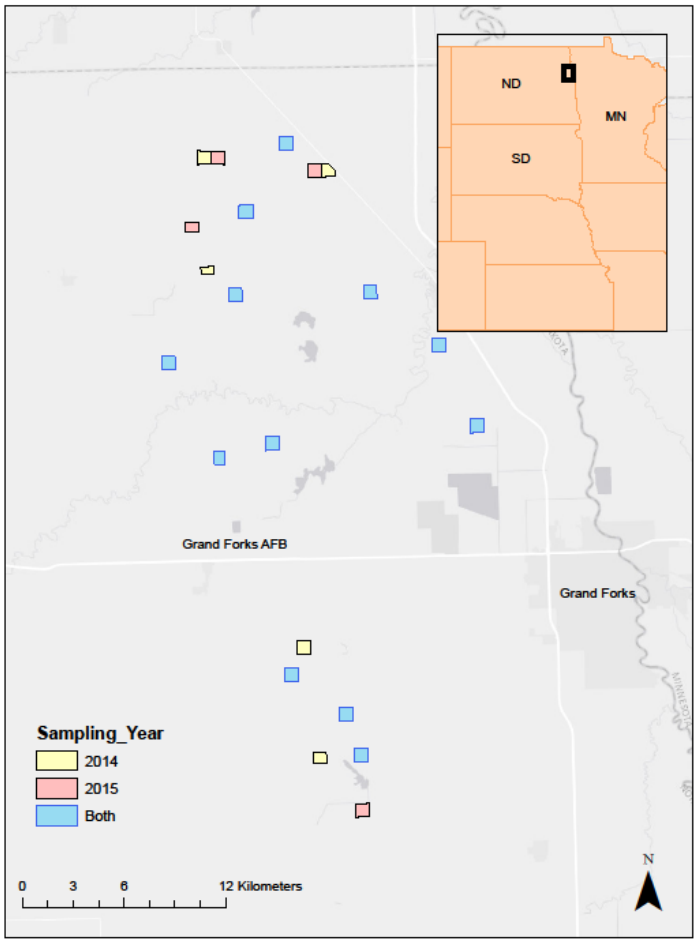

Figure 2. Map of sampling locations in the GFPPA. Colored polygons represent the sites sampled, with colors denoting the years sampled. Dark grey polygons represent water features, and light grey polygons city limits.

Bird Survey

Bird survey points (hereafter, bird points) were randomly placed on each site positioned ≥150 m from site edges and spaced ≥225 m apart. Most sites were ~1/4 section in area and five bird points were typically located in these sites. In 2014 a number of bird points fell in wetter, cattail dominated areas. These were shifted to more upland habitat for 2015 - 7. Oakville Prairie was sampled more intensively (37 bird points were positioned ≥ 200 m apart). In this site, bird points were randomly selected from permanent vegetation sample locations (Figure 3).

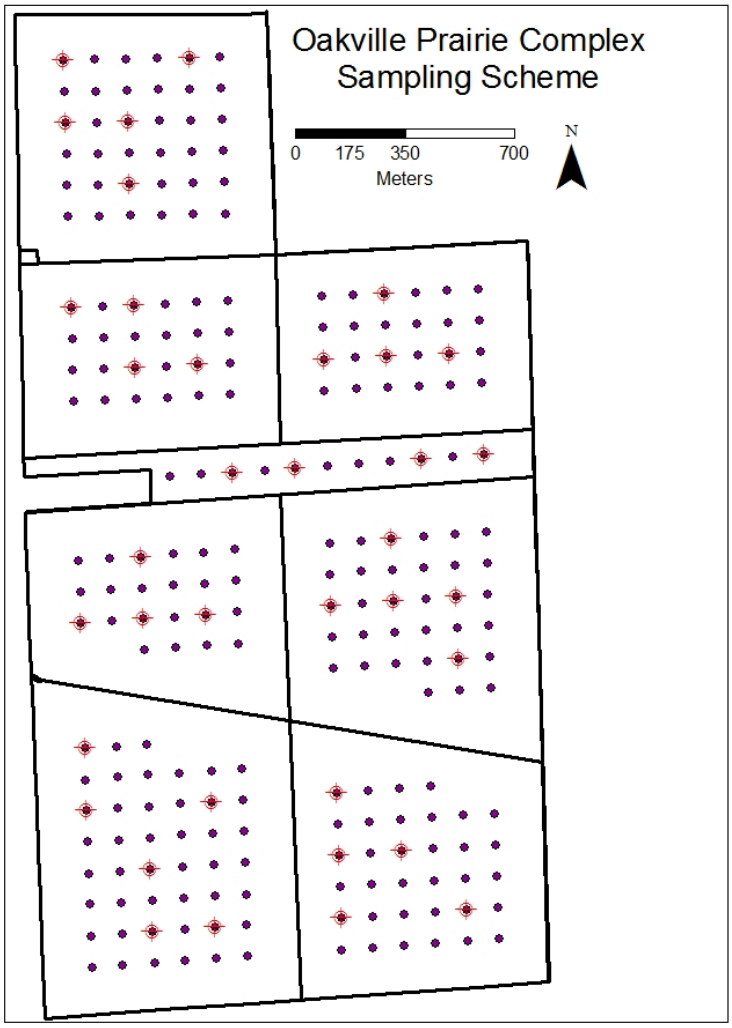

Figure 3. Sample point locations within Oakville Prairie. Vegetation survey locations are represented by purple points. Arthropod and bird survey locations are highlighted with red cross-hares. Lines roughly delineate site management unit boundaries. Actual unit boundaries and associated firebreak lines varied according to site moisture conditions.

GFPPA and Oakville bird points were surveyed June-July. Three sites were surveyed per morning, starting at local sunrise (as det. by the U.S. Naval Observatory for Grand Forks, ND) and continuing until no later than 10 AM. Bird points were not surveyed during high wind (>35 km/h), rain, or low visibility (i.e., foggy; Winter et al. 2006) conditions. Most bird points were surveyed 3 times during the breeding season and visits to each site were roughly 10 days apart. The site visit order was rotated during the three visits to ensure an early (sunrise-0700), mid (0700-0830), and late (0830-1000) morning visit for each site.

Wind speed and temperature were recorded at each bird survey point. After a 2 minute cool-down birds were counted for 5 minutes. All birds heard or seen within a 100 m radius from bird points were recorded, noting sex (m or f) and type of detection (song, call, or visual). A bird was considered to be using the survey location if it was observed on the ground, perched in

vegetation, or singing/calling from a concealed location in vegetation within a 100 m radius of the bird point. All birds flying over and any birds observed outside the detection radius were excluded from subsequent analyses.

Vegetation Survey

Vegetation structure and composition was measured for all bird points early July in each year, since vegetation measurements from later in the breeding season are better indicators of bird abundance (Winter and Faaborg 1999). Five vegetation plots were placed within 100 m of each bird point to quantify habitat structure and composition. The first plot was placed in the center of the bird point location and four satellite points were placed a random distance between 15 m and 100 m from the central point in each cardinal direction.

Aerial percent cover was estimated to the nearest percent for every plant species within a 0.5 × 2 m survey plot centered on the designated plot coordinates. Percent bare ground visible within the plot was estimated to the nearest percent. Visual obstruction was measured in 2.5 cm increments of height in the center of the plot, from each cardinal direction following Robel et al. (1970) and Vermeire and Gillen (2001). Measurements of live vegetation height (cm) and litter depth (cm) followed Winter et al. (2004).The distance to the nearest tree or shrub within 100 m of the bird point was recorded (Impulse laser rangefinder; Laser Technology Inc., Centennial, CO). The number of shrubs (< 1 m tall) and trees (≥ 1 m tall) within 100 m of the central plot were counted.

At Oakville a site-wide vegetation survey was performed at each of 229 sample locations in late July 2014 -2017. Aerial percent cover was estimated for each plant species in two 0.5 × 2 m survey plots at each sample location. These data were used to determine species and functional group richness and functional group cover (cool season grasses, warm season grasses, graminoids, forbs, legumes, and woody) for each plot. Visual obstruction, live vegetation height, and litter depth were recorded as described above.

Arthropod Survey

Mid-story arthropods were sampled via sweep net at the center of each GFPPA bird point in late June-early July annually. Sweep net sampling was conducted under weather conditions as described above for bird surveys. The surveyor walked a 10 m North-South transect centered on the bird survey point, sweeping a canvas net through the standing vegetation once every meter for a total of 10 sweeps. This transect was repeated three times, with arthropods transferred to a gallon zip top bag, labeled, and stored on ice. The same procedure was used for a second transect at the same point, oriented East-West. Arthropods were stored in a -20^{o}C freezer until processing to separate arthropods from vegetation. Arthropods from North-South and East-West transects were combined, dried in an oven for 72 hours at 60**°**C and weighed (nearest 0.0001 g).

At Oakville liter, mid-story, and canopy dwelling arthropods were surveyed in mid-June and mid-July annually at each of the bird sample points. Pitfall traps were placed in the center of each of the sample point borders and left in place for three days. Following removal, pitfall trap specimens were stored in 70% ethanol. Two-way sticky traps were placed above canopy in the center of the east and west sample point borders with trap faces parallel to the border to sample canopy arthropods. Upon removal, sticky traps were covered with wax paper and

stored in a -20^{o}C freezer to await identification. Sweep net sampling was performed as described above the day following removal of pitfall and sticky traps. These specimens were similarly stored in 70% ethanol. Arthropod specimens were identified to family and then assigned to morphospecies.

Soil Survey

At Oakville soil moisture (% volume wet content at 20 cm depth) was measured twice per month from early July to mid-August annually beginning once standing water was no longer visible. Soil cores (20 mL) were collected 2 m north of the center of each sample location in mid-August. Soil cores were air dried and used to estimate soil texture (% sand, silt, clay) following Jasrotia (2008), and pH and electrical conductivity (EC; a measure of salinity) were measured following protocols developed by Dr. Brian Darby at UND (Darby unpublished).

Results

Bird Survey

Sixty-nine bird species were observed across the GFPPA study (Table 2, next page). Of the ND SoCP, Nelson's Sparrow, Grasshopper Sparrow, Bobolink, Western Meadowlark, Sedge Wren and Le Conte's Sparrow were most frequently encountered. We will be incorporating 2016 and 2017 data into analyses reported on in 2015 to determine factors associated with bird species detection in the GFPPA.

Arthropod Abundance and Vegetation Structure and Composition

With collection of 2014-2017 data we will be assessing management effects on the number of woody plants, grass cover, and VOR across the survey sites to supplement previous analysis contained within the completed J. Cole and B. Deal theses.

Oakville Prairie Vegetation

To-date 237 plant species have been recorded across the Oakville Prairie survey points. In 2016 Prairie cordgrass, foxtail barley, smooth brome, and Kentucky bluegrass had the greatest average cover across the survey plots. Two current graduate students (one MS, one PhD) will be assessing 2014-2017 data as part of their graduate studies.

Table 2. Species recorded and occurrence counts across all sites and on Oakville Prairie 2014-2016. Shaded rows are species from the ND State SCoP list (level I = Dark shading, level II = light shading).

			2014		2015		2016		2017	
AOU Code	**Common Name**	**Scientific Name**	**All Sites**	**Oakville**	**All Sites**	**Oakville**	**All Sites**	**Oakville**	**All Sites**	**Oakville**
NESP	Nelson's Sparrow	*Ammodramus nelsoni*	21	3	29	3	36	15	33	9
GRSP	Grasshopper Sparrow	*Ammodramus savannarum*	33	1	48	2	31	4	51	24
WIPH	Wilson's Phalarope	*Phalaropus tricolor*	18	2	4	-	11	1	1	-
MAGO	Marbled Godwit	*Limosa fedoa*	22	-	26	7	98	61	26	7
YERA	Yellow Rail	*Coturnicops noveboracensis*	3	-	1	-	-	-	-	-
AMBI	American Bittern	*Botaurus lentiginosus*	7	-	-	-	1	-	-	-
SPPI	Sprague's Pipit	*Anthus spragueii*	-	-	-	-	-	-	1	1
BOBO	Bobolink	*Dolichonyx oryzivorus*	399	45	335	91	510	167	644	226
WEME	Western Meadowlark	*Sturnella neglecta*	293	35	292	79	310	42	151	48
SEWR	Sedge Wren	*Cistothorus platensis*	292	62	442	202	285	113	400	220
LCSP	Le Conte's Sparrow	*Ammodramus leconteii*	76	22	111	42	76	36	70	21
UPSA	Upland Sandpiper	*Bartramia longicauda*	14	-	16	3	1	-	1	1
STGR	Sharp-tailed Grouse	*Tympanuchus phasianellus*	1	-	10	-	29	3	5	4
GRPC	Greater Prairie-Chicken	*Tympanuchus cupido*	-	-	20	8	3	2	6	3
LOSH	Loggerhead Shrike	*Lanius ludovicianus*	1	-	1	-	-	-	-	-
CANV	Canvasback	*Aythya valisineria*	4	-	-	-	-	-	-	-
NOPI	Northern Pintail	*Anas acuta*	2	-	-	-	-	-	-	-
WILL	Willet	*Tringa semipalmata*	6	-	-	-	-	-	-	-
SEOW	Short-eared owl	*Asio flammeus*	-	-	-	-	-	-	2	-
SAVS	Savannah Sparrow	*Passerculus sandwichensis*	867	140	1206	366	1141	341	975	429
RWBL	Red-winged Blackbird	*Agelaius phoeniceus*	462	26	241	59	445	168	265	98
CCSP	Clay-colored Sparrow	*Spizella pallida*	345	86	380	226	241	133	84	46
COYE	Common Yellowthroat	*Geothlypis trichas*	214	53	234	112	272	139	172	78
SORA	Sora	*Porzana carolina*	90	4	9	3	43	2	11	1
BHCO	Brown-headed Cowbird	*Molothrus ater*	56	6	99	34	164	45	81	31
WISN	Wilson's Snipe	*Gallinago delicata*	49	8	20	4	9	1	3	-
MAWR	Marsh Wren	*Cistothorus palustris*	44	1	43	12	39	1	64	16
EAKI	Eastern Kingbird	*Tyrannus tyrannus*	29	10	47	20	33	18	42	21
SOSP	Song Sparrow	*Melospiza melodia*	16	6	17	16	7	3	2	1
COGR	Common Grackle	*Quiscalus quiscula*	14	5	9	8	28	11	25	12
AMGO	American Goldfinch	*Spinus tristis*	2	1	24	12	47	17	26	17
NOHA	Northern Harrier	*Circus cyaneus*	2	1	6	2	29	10	19	6
KILL	Killdeer	*Charadrius vociferus*	12	-	35	23	52	2	33	4

MALL	Mallard	*Anas platyrhynchos*	11	-	17	7	54	16	20	9
SWSP	Swamp Sparrow	*Melospiza georgiana*	7	-	16	8	12	3	1	-
MODO	Mourning Dove	*Zenaida macroura*	6	-	26	9	19	5	29	9
BRBL	Brewer's Blackbird	*Euphagus cyanocephalus*	3	-	58	48	14	-	6	1
BRTH	Brown Thrasher	*Toxostoma rufum*	1	-	5	2	2	-	1	1
YHBL	Yellow-headed Blackbird	*Xanthocephalus xanthocephalus*	37	-	10	-	10	-	3	1
NSHO	Northern Shoveler	*Anas clypeata*	3	-	4	-	5	-	1	-
ROPI	Rock Pigeon	*Columba livia*	3	-	-	-	2	2	8	1
YEWA	Yellow Warbler	*Setophaga petechia*	1	-	-	-	4	2	1	1
WEKI	Western Kingbird	*Tyrannus verticalis*	1	-	-	-	1	-	1	1
BWTE	Blue-winged Teal	*Anas discors*	5	-	-	-	1	-	2	-
DOWO	Downy Woodpecker	*Picoides pubescens*	1	-	-	-	-	-	-	-
ALFL	Alder Flycatcher	*Empidonax alnorum*	3	-	-	-	-	-	-	-
WIFL	Willow Flycatcher	*Empidonax traillii*	-	-	20	12	11	5	13	5
AMRO	American Robin	*Turdus migratorius*	-	-	17	12	2	1	1	-
AMCR	American Crow	*Corvus brachyrhynchos*	-	-	6	-	1	1	-	-
BARS	Barn Swallow	*Hirundo rustica*	-	-	4	-	48	8	26	5
NOFL	Northern Flicker	*Colaptes auratus*	-	-	3	1	-	1	3	-
BBMA	Black-billed Magpie	*Pica hudsonia*	-	-	5	5	-	-	-	-
CEDW	Cedar Waxwing	*Bombycilla cedrorum*	-	-	1	1	-	-	-	-
CORA	Common Raven	*Corvus corax*	-	-	1	1	-	-	-	-
GRCA	Gray Catbird	*Dumetella carolinensis*	-	-	1	1	-	-	-	-
RTHA	Red-tailed Hawk	*Buteo jamaicensis*	-	-	1	-	4	-	9	-
CLSW	Cliff Swallow	*Petrochelidon pyrrhonota*	-	-	12	-	-	-	-	-
SACR	Sandhill Crane	*Grus canadensis*	-	-	2	-	-	-	2	-
GHOW	Great Horned Owl	*Bubo virginianus*	-	-	1	-	-	-	-	-
NOMO	Northern Mockingbird	*Mimus polyglottos*	-	-	1	-	-	-	-	-
PIWO	Pileated Woodpecker	*Dryocopus pileatus*	-	-	3	-	-	-	-	-
YBSA	Yellow-bellied Sapsucker	*Sphyrapicus varius*	-	-	1	-	-	-	-	-
GADW	Gadwall	*Anas strepera*	-	-	-	-	8	3	1	-
TRES	Tree Swallow	*Tachycineta bicolor*	-	-	-	-	18	3	14	2
CANG	Canada Goose	*Branta canadensis*	-	-	-	-	7	-	101	10
DCCO	Double-crested Cormorant	*Phalacrocorax auritus*	-	-	-	-	1	-	-	-
EAPH	Eastern Phoebe	*Sayornis phoebe*	-	-	-	-	1	-	-	-
HERG	Herring Gull	*Larus argentatus*	-	-	-	-	1	-	-	-
GBHE	Great Blue Heron	*Ardea herodias*	-	-	-	-	1	-	3	-
EUCD	Eurasian Collared-Dove	*Streptopelia decaocto*	-	-	-	-	-	-	26	4
SBDO	Short-billed dowitcher	*Limnodromus griseus*	-	-	-	-	-	-	2	-

2. Implement a replicated fire regime (with a private contractor) with a four-year return interval beginning fall 2014 to reverse habitat degradation on Oakville Prairie.

We contracted with Badger Creek Wildfire and successfully implemented fall burning management on six Oakville management units as of spring 2018. Extensive preparation and planning efforts included establishing firebreaks, engaging with regional stakeholders (Fig. 4), and preparing personnel and equipment. In 2015 weather conditions limited us to completing a successful burn on unit "B" shown below. The 2016 weather conditions limited us to completing a successful burn on unit "G" in Figure 4. In 2017 units "D" and "E" were burned. BCW also burned two additional NDGF managed units in the GFPPA as part of this collaborative effort.

3. Determine how the abundance of grassland bird species and the composition of the grassland bird, arthropod, and plant communities change with grazing status and time since burning (pre-burn, post-burn, 1yr since burn).

Preliminary analyses are described in detail in Cole (2016) and analysis of the four year data set will occur within a forthcoming MS thesis and PhD dissertation. All presentations which included discussion of the project and preliminary findings are listed at the end of this document.

4. Increase regional conservation awareness by co-hosting annual, spring workshops and fall field tours to engage with local landowners and citizens regarding the value of regional public and private lands for supporting SoCP

PI Yurkonis participated in the spring 2014-2017 Grand Forks County Soil Health Workshops and continues to work with the Grand Forks NRCS office and the Grand Forks County Soil Conservation District on outreach programming (8 outreach events listed below). In October 2015 we held a dedication ceremony at Oakville with over 100 attendees including land-owners, conservation personnel, government officials, students, and university administrators. Outreach efforts will continue 2018-2022 in part through a Regional Conservation Partnership Project with the regional NRCS office.

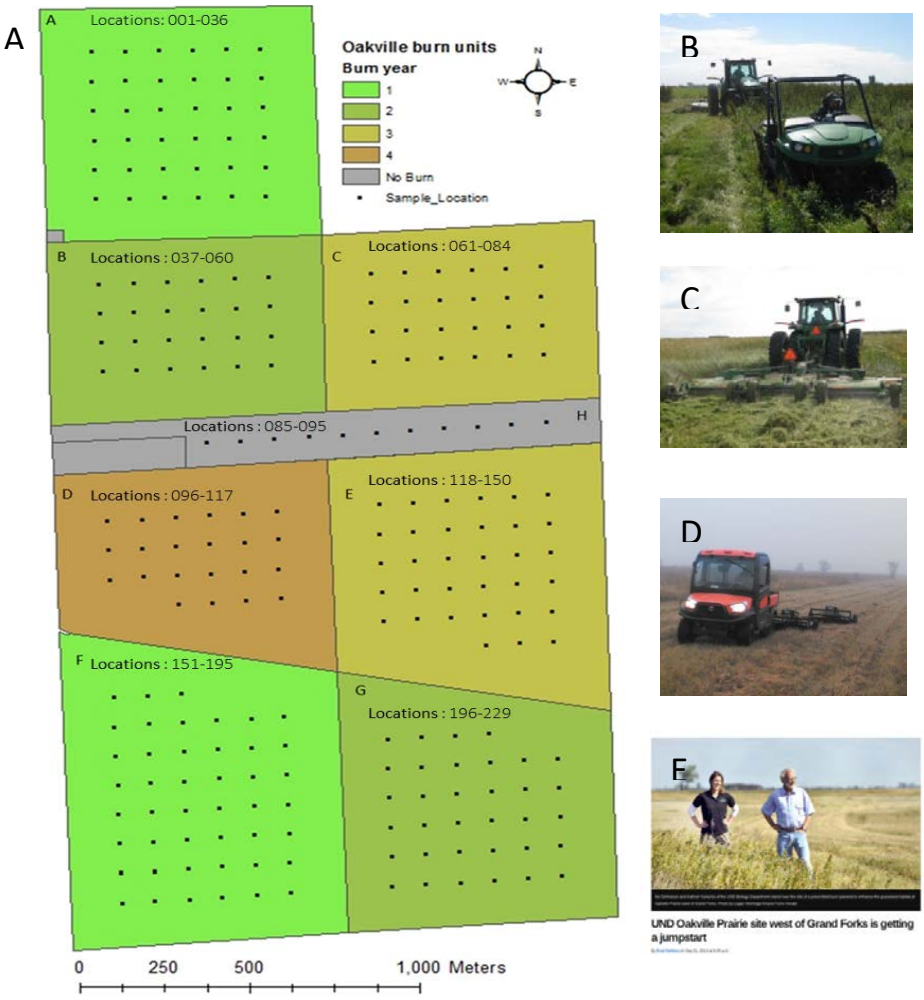

Figure 4 Seven management units (A) were delineated to be burned on a four-year return interval. We collaborated with a local landowner to mow 30ft firebreaks around each unit (B-C) that were finished by the Badger Creek Wildfire (BCWF) crew prior to burning (D). (E) Stakeholders were directly (local landowners and emergency personnel) and indirectly contacted (local media sources).

Details on Project Activities

Manuscripts in Prep

Cole, J.*, C. Merkord, K.A. Yurkonis, & B.J. Goodwin. *In prep*. Grassland bird response to grassland management in the Grand Forks Prairie Project Area. For submission to *Conservation Biology*

Deal, B.D.*, B.J. Goodwin, B.J. Darby, & **K.A. Yurkonis.** *In prep*. Plant and arthropod structure in response to grassland environmental gradients. For submission to *Journal of Vegetation Science*.

PI Oral Presentations

Yurkonis, K.A. May 2017. From genes to landscapes: Integrating research and demonstration to promote ecological resilience in ND. ND Range Research Exchange Meeting. Mandan, ND.

Yurkonis, K.A. Mar 2016. From individuals to landscapes: New Frontiers in Grassland Restoration. Grand Forks Audubon. Grand Forks, ND.

Yurkonis, K.A. Feb 2016. From individuals to landscapes: Investigating grassland diversity and invasion. North Dakota Introduced Cool-Season Grass Working Group. Jamestown, ND.

PI Poster presentations

Dillon, J., D.A. McGranahan, D. Toledo, **K.A. Yurkonis**, B.J. Goodwin. Feb 2017. Effects of climate change on prescribed fire seasons in the Northern Great Plains. ND Wildlife Society Meeting. Mandan, ND.

Yurkonis, K.A., J. Dillon, W. Brown, D. Brown, B.J. Goodwin. Aug 2016. Effects of climate change on prescribed fire seasons in the Northern Great Plains. Ecological Society of America 101st Annual Meeting. Ft. Lauderdale, FL.

Yurkonis, K.A., B.J. Darby, B.J. Goodwin & I.J. Schlosser. Aug 2015. Developing collaborative relationships to enhance field station management and use within the Northern Plains. Ecological Society of America 100th Annual Meeting. Baltimore, MD.

Brown, W.†, B.J. Darby, B. Deal, B.J. Goodwin, I.J. Schlosser & **K.A. Yurkonis**. Feb 2015. Implementation of a fire management plan on the joint UND-NDGF Oakville Prairie Wildlife Management Area. North Dakota Chapter of The Wildlife Society Annual Meeting. Mandan, ND.

Student Poster presentations

Anderson, R.*, A. Kennedy & **K.A. Yurkonis**. Feb 2017. Atmospheric conditions and their relationship to wildfire potential in the Northern Plains. ND Wildlife Society Conference. Mandan, ND.

Deal, B.W.*, B.J. Goodwin, B.J. Darby, **K.A. Yurkonis**. Nov 2015. Arthropod community patterns and associations along soil environmental gradients in a fine-scale northern grassland habitat. Entomological Society of America Annual Meeting. Minneapolis, MN.

Cole, J.S.*, **K.A. Yurkonis**, B.J. Goodwin, C.L. Merkord & B. Deal*. Feb 2015. Local habitat associations of five grassland bird species in Grand Forks County, ND. North Dakota Chapter of The Wildlife Society Annual Meeting. Mandan, ND.

Deal, B.*, **K.A. Yurkonis**, B.J. Goodwin, & B.J. Darby. Feb 2015. Plant species distribution and community pattern across environmental gradients in a northern grassland. North Dakota Chapter of The Wildlife Society Annual Meeting. Mandan, ND.

Awards

UND Center for Community Engagement Public Scholar Award, Yurkonis Fall 2015 Recipient. Nominated in recognition of work with the Grand Forks County Prairie Project.

Workshops attended

Grand Forks County Soil Conservation District Soil Health Workshop. Yurkonis Participant. Grand Forks, ND. Mar 2017

Grand Forks County Soil Conservation District Soil Health Workshop. Yurkonis Participant. Grand Forks, ND. Mar 2016

Introduced Cool-season Grass Workshop. Hosted by Cami Dixon. Yurkonis Invited participant and presenter. Jamestown, ND Feb 2016

Grand Forks County Soil Conservation District Soil Health Workshop. Yurkonis Participant. Grand Forks, ND. Mar 2015

State Wildlife Action Plan Summit. Goodwin, Yurkonis Participants in the workshop to revise the ND State Wildlife Action Plan. Bismarck, ND. Apr 2014

Grand Forks County Soil Conservation District Soil Health Workshop. Yurkonis Participant. Grand Forks, ND. Mar 2014

Nine undergraduate students

Public/Community outreach events

North Dakota Geographic Alliance Oakville Tour. June 2017. Yurkonis - One hour presentation on how to incorporate grassland education into the classroom for regional High School teachers.

NATURE Summer Camp. Jun 2017. Hosted four summer camp participants in the lab over a one-week period. Students assisted with data collection and field activities.

Wonder Years Daycare Oakville Prairie Tour. July 2017. Yurkonis - Conducted four, one hour prairie education events for approx. 60 school-age children.

Red River High School. May 2016. Yurkonis - Ecology presentation.

UND Oakville Prairie Field Day and Dedication Ceremony. Sept 2015. Co-organized the ceremony and dedication with Ike Schlosser.

Grand Forks Prairie Project. 2012-present. Yurkonis Coordinated UND's involvement in the Grand Forks Prairie Project Memorandum of Understanding. The MOU brings together Federal, State, Non-profit and Citizen agencies with the goal of better managing the grasslands of Grand Forks county, ND. Coordinated UND involvement in land-owner outreach meeting and field tour in 2013.

ND EPSCoR NATURE Summer Camp host laboratory. June 2013, 2014. Hosted tours of the Grassland Ecology Laboratory for summer camp participants.

Panelist for the "Networked Communities" UND Community Connect Forum sponsored by the UND Center for Community Engagement. Apr 2014. Yurkonis Discussed the Grand Forks County Prairie Project research and outreach efforts during the "Networked Partners Roundtable" event. Emerado, ND.

News coverage of project activities

"Montana crew burns portions of Oakville Prairie." Brad Dokken. 9/17/17. Grand Forks Herald. Grand Forks, ND

"North Dakota's Tallgrass Prairie: Rescuing a Disappearing Ecosystem with Prescribed Burns." Sandy Johnson. *The Wildlife Professional*. 10:3, 25-27.

"Celebration commemorates new WMA, Important Bird Area designation on Oakville, Fairfield prairies." Brad Dokken. 9/18/2015. *Grand Forks Herald*. Grand Forks, ND.

"Oakville Prairie west of Grand Forks gets reboot with burning." Brad Dokken. 6/28/2015. *Grand Forks Herald*. Grand Forks, ND.

"ND to study climate change impacts on wildlife" Patrick Springer. 6/14/15. *The Forum of Fargo-Moorhead*. Fargo, ND

"Prairie Reboot: UND Oakville Prairie Site west of Grand Forks is getting a jumpstart." Brad Dokken. 9/21/14. *Grand Forks Herald*. Grand Forks, ND

"Partnership focuses on soil health in Grand Forks County." Kristine Larson and Lorilie Atkinson. June 2014. In Marketing Committee ed. *NRCS Conservation Briefs Newsletter: Garden Edition*. North Dakota Natural Resources Conservation Service. Bismarck, ND.

"UND: Enbridge's proposed pipeline threatens prairie research." Anna Burleson. 3/1/2014. *Grand Forks Herald*. Grand Forks, ND.

Literature Cited

Cole, J. 2016. The effects of habitat management on grassland birds in the northern tallgrass Prairie. MS Thesis. University of North Dakota. 136 p.

Deal, B. 2016. Plant and arthropod associations with environmental gradients in a northern tallgrass prairie. MS Thesis. University of North Dakota. p.

Fiske, I. and R. Chandler. 2011. unmarked: An R package for fitting hierarchical models of wildlife occurrence and abundance. *Journal of Statistical Software*. 43:1–23.

Fuhlendorf, S.D., Harrell, W.C., Engle, D.M., Hamilton, R.G., Davis, C.A. & Leslie, D.M. (2006) Should heterogeneity be the basis for conservation? Grassland bird response to fire and grazing. Ecological Applications, 16, 1706-16

Jasrotia, P. 2008. Particle size analysis for soil texture determination (hydrometer method) [Internet]. East Lansing, MI: Kellogg Biological Field Station, Michigan State University. [cited 10 April 2014]. Available from: http://lter.kbs.msu.edu/protocols/108.

Oksanen, J., F.G Blanchet, R. Kindt, et al. 2016. Vegan: Community Ecology Package. R package version 2.3-4. https://CRAN.R-project.org/package=vegan.

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Seabloom, E.W. and A.G. van der Valk. 2003. Plant diversity, composition, and invasion of restored and natural prairie pothole wetlands: implications for restoration. *Wetlands*. 23(1): 1-12.

Seelig, B.D. 2000. Salinity and sodicity in North Dakota soils. NDSU Extension Service EB 57, North Dakota State University, Fargo, ND. 15 p.

Vermeire, L.T. and R.L. Gillen. 2001. Estimating herbage standing crop with visual obstruction in tallgrass prairie. *Journal of Rangeland Management.* 54(1): 57-60.

Winter, M. and J. Faaborg. 1999. Patterns of area sensitivity in grassland nesting birds. *Conservation Biology.* 13:1424–1436.

Winter, M., Johnson, D. H., Shaffer, J. A., Donovan, T. M., & Svedarsky, W. D. 2006. Patch size and landscape effects on density and nesting success of grassland birds. *Journal of Wildlife Management*. *70*(1):158-172.