Breeding Bird Survey for Spring 2012

Grande Prairie Wind Energy Project, Holt County, Nebraska

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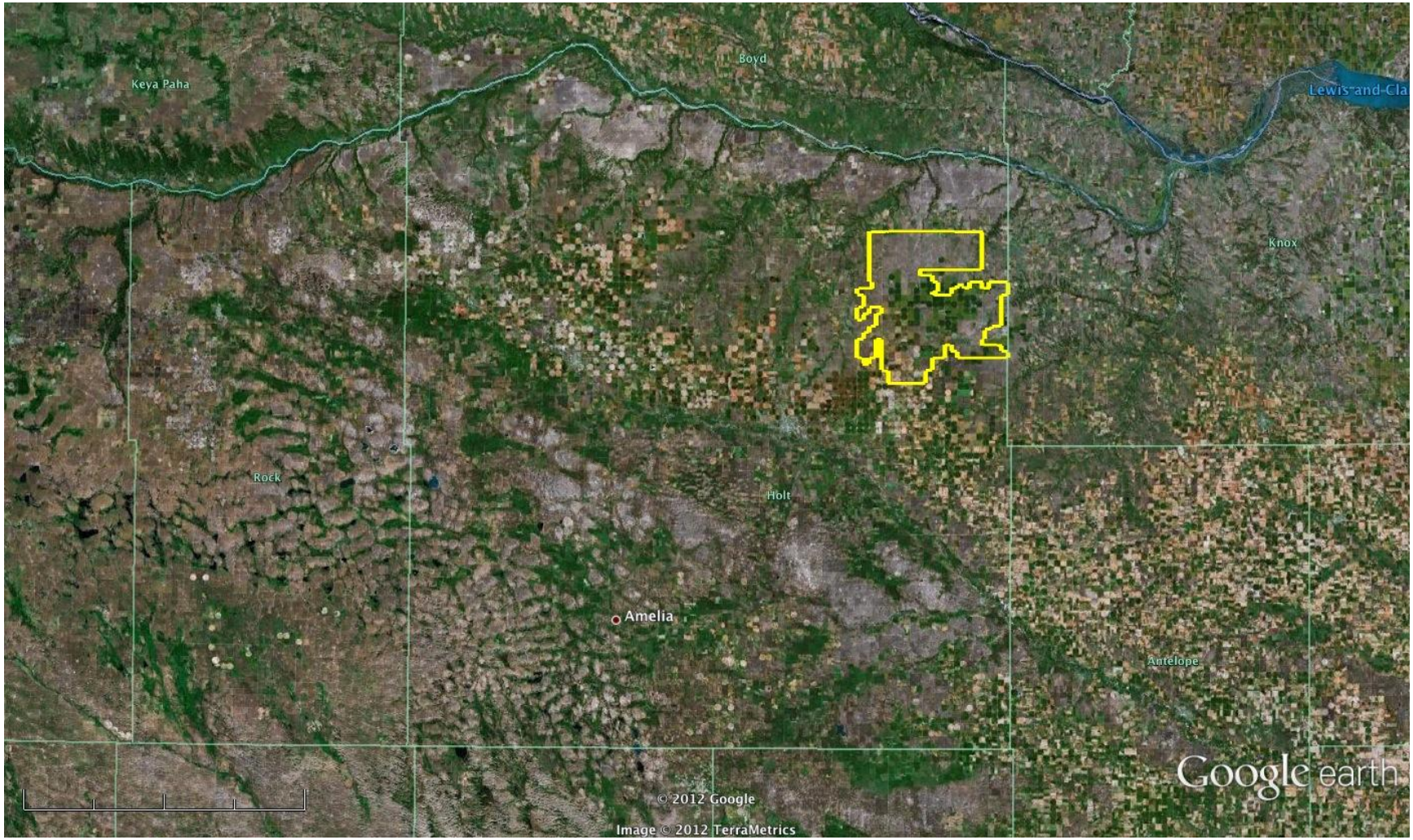
Figure 1-1. Location of Grande Prairie Wind Energy Project (yellow polygon) in Holt County, Nebraska.



1 INTRODUCTION

The Nebraska Game and Parks Commission (NGPC) has issued draft voluntary guidelines (NGPC 2012) for evaluating the risk of impacts of wind energy facilities on Nebraska's birds. Among various recommended studies is a Breeding Bird Survey (hereafter the Survey). As stated in the guidelines (page 16), the purpose of the Survey is to quantify breeding bird abundance or density in a project area.

This report provides results of a pre-construction Survey conducted during 4-11 June 2012 at the site of the Grande Prairie Wind Energy Project (hereafter the Project), located in Holt County (Figure 1-1). Biologists from Olsson Associates in Mullen, Nebraska, collected the data, which was analyzed by Curry & Kerlinger, LLC, for the client, Midwest Wind Energy.

2 METHODS

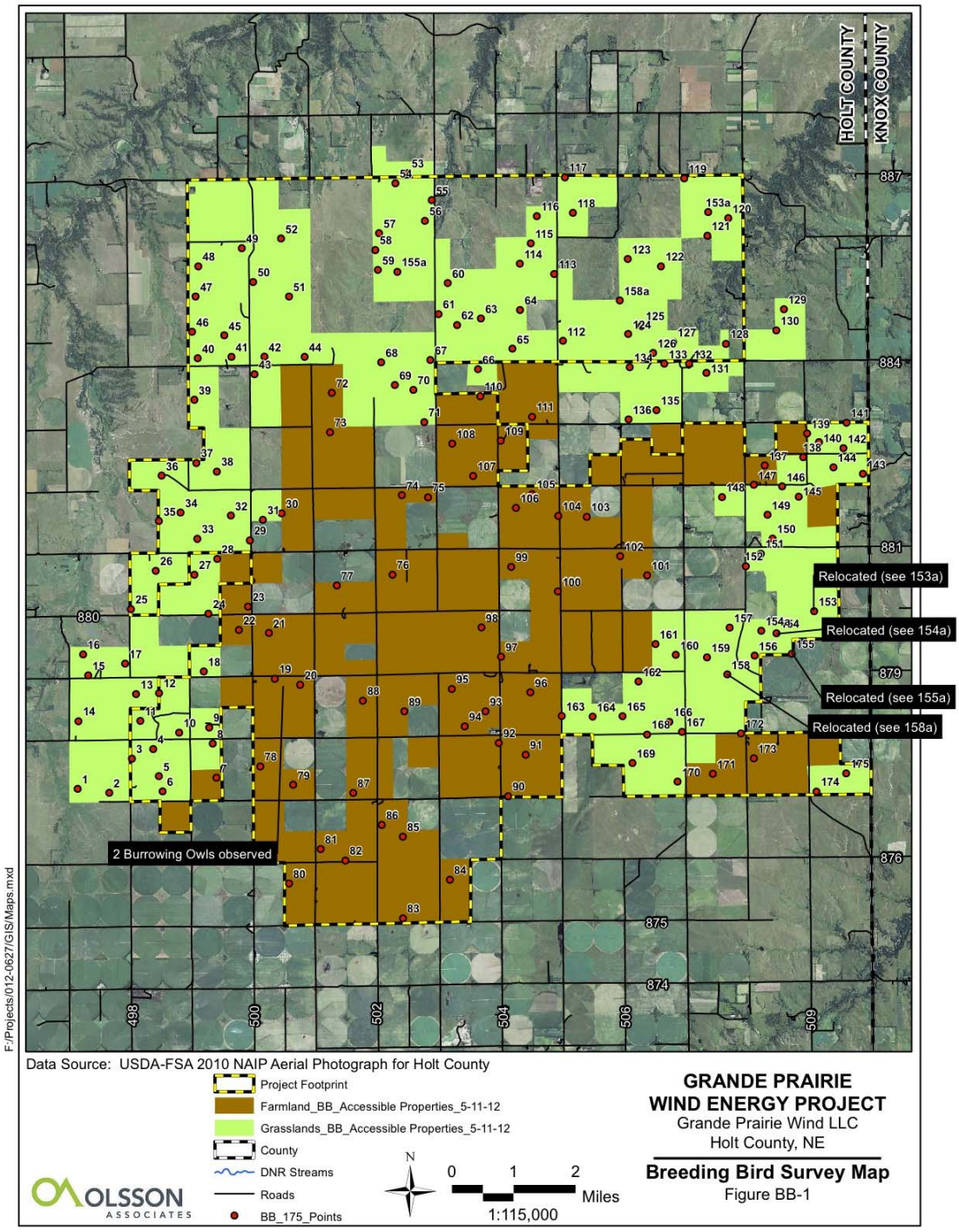
2.1 Field Methods

Prior to fieldwork, Olsson Associates submitted the Survey protocol to Joel Jorgensen of NPGC, who found the methods satisfactory (e-mail of 24 April 2012 to Tim Andersen of Olsson Associates). Distance sampling at point counts (Buckland et al. 2001, 2004) was used to generate density estimates of birds inhabiting the study site's grassland and farmland habitats. Farmland was largely defined by the presence of center-pivot irrigation systems, which indicated areas most suitable for cropland agriculture. Nonetheless, small grassland parcels were distributed throughout farmland (*fide* Tim Andersen). Grasslands on accessible (i.e., leased) properties (green areas in Figure 2-1) measured 115.8 km^2, and farmland (brown areas) measured 103.8 km^2.

The Spatial Analyst module of ArcGIS was used to distribute 175 point-count locations randomly within the study area, with more points assigned to grasslands because they were more likely to harbor species of conservation concern (Tier I and Tier II species in the Wildlife Action Plan for Nebraska; see Schneider et al. 2011). Thus, 125 point counts were located in grasslands for a density of 1.1 point counts per km^2, and 50 were located in farmland for a density of 0.5 point counts per km^2. Point count coordinates and habitat classifications may be found in Appendix A.

Each observation point was given an identification number determined prior to fieldwork. Identification numbers were assigned based on geographic position and proximity to other points, so that the observer could move efficiently from point to point in sequence and conduct the Survey at a quick pace.

Figure 2-1. Study site with point count locations in farmland and grassland



Following NGPC (2012) guidelines, the Survey was conducted during the first half of June during mornings (one half-hour before sunrise to 10:30) and evenings (17:00 to sunset). NPGC (2012) guidelines stipulated that no more than 50% of point counts could be conducted during evenings. The number of point counts that could be sampled in a day was estimated at 25, but this rate was expected to vary mainly by the time required to move between point count locations. Each point-count location was accessed either on foot or by motor vehicle such as an ATV. When point counts were reached by motor vehicle, the observer waited at least one minute to allow birds to acclimate before the point count commenced. Point counts were not conducted when there was precipitation, winds exceeding 24 kph (15 mph), or visibility less than 0.8 km (0.5 miles).

On each sampling day, the first point count to be sampled was randomly selected, and thereafter the plots were sampled in sequential order based on the identification number of each observation point. Each point count was surveyed for 5 minutes, during which time all birds seen or heard were recorded and the radial distance between a bird or a cluster of birds and the observer was measured with the aid of a laser rangefinder.

For each bird observation, the following data were recorded:

- A unique identification number
- Radial distance from the observer (in meters)
- Direction from the observer (using the eight cardinal directions)
- Cluster size (number of individuals)
- Species

Other data recorded included the date, start and stop times of the point count, habitat type, and weather observations including temperature, wind speed, wind direction, cloud cover, and precipitation.

Special attention was given to species listed as Tier I or Tier II in the Wildlife Action Plan for Nebraska (Schneider et al. 2011). If any were seen outside of point count periods or while moving between point counts, they were recorded. Incidental observations of nests would have been recorded if any had been found.

2.2 Analytical Methods

The program DISTANCE 6.0 (Thomas et al. 2010) was used to calculate density and abundance of birds recorded in point counts. Field data was first filtered and plotted by species and stratum to locate evidence of distance heaping and outliers. This was done for all species pooled, the five most numerous species, and each individual species for both strata (grassland and farmland) combined as well as for each stratum. We truncated data by removing approximately 10% of the greatest distance observations for each analysis (Buckland et al. 2001) and chose an appropriate grouping of the truncated data to facilitate model fitting.

For each analysis one of five models was used to fit the radial detection function: half-normal using a Hermite polynomial expansion, half-normal with cosine expansion, hazard-rate with cosine expansion, uniform with simple polynomial expansion, and uniform with cosine expansion. From the five models fit to each filtered data set DISTANCE chose the model with the lowest AIC (Akaike's Information Criterion) value, a common metric for model selection which takes into account both model fit and model complexity in order to determine a more parsimonious model (Buckland et al. 2001). Lowest AIC models were further assessed using the Chi-Squared goodness of fit test and visual inspection of the proposed detection function against plotted data.

Once a model was chosen DISTANCE calculated estimates of density and abundance for each filtered data set along with standard error, coefficient of variation, and 95% confidence interval for the estimate. Note that for certain species and stratum combinations there were insufficient data to properly fit a detection function. Densities are reported in the text with the standard error in birds per km^2 (1 km^2 = 100 ha). The coefficient of variation (CV) is the standard error (SE) divided by the density estimate, reported as a percent. NPGC guidelines called for the CV not to exceed 10% for overall density or 20% for the five most numerous species.

3 RESULTS

Heather Darrow, Assistant Scientist for Olsson Associates, conducted the Survey on 8 days, from 4 to 11 June 2012. Her qualifications are provided in Appendix B. She sampled 21.9 ± 2.5 point counts each day. Sixty-four (35%) of the 175 point counts were sampled during evening hours (17:00 to sunset).

There were safety concerns with respect to accessing points 153, 154, 155, and 158 in the southeastern portion of the study area. As a result, Darrow relocated them to areas with similar habitat and land use. In addition, points 30, 139, 163, and 172 were found to fall between areas classified as grassland and farmland, but they were processed as farmland points given that they partially sampled cropland.

The Survey recorded a total of 56 species of which 51 were recorded in point counts and another five were recorded only outside of point counts (Table 3-1). Included in the total were six species listed as Tier I or Tier II in Nebraska's Wildlife Action Plan (Schneider et al. 2011). The Tier I species were Greater Prairie-Chicken, Burrowing Owl, Loggerhead Shrike, and Henslow's Sparrow. The Tier II species were Swainson's Hawk and Wilson's Snipe. Greater Prairie-Chicken, Wilson's Snipe, Loggerhead Shrike, and Henslow's Sparrow were recorded in point counts, but Swainson's Hawk and Burrowing Owl were not.

With respect to point counts and density estimates, a total of 1,585 individuals of 51 identified species (Table 3-2) were recorded during a total of 875 minutes (14.6 hours) of observations at the 175 point counts. When calculated in DISTANCE, the overall density estimate within the study area (grassland and farmland combined) was 346.3 ± 6.7 birds/km^2 (CV = 1.9%).

Table 3-1. Species recorded during Survey

Species	Tier[1]	Number recorded in point counts	Recorded outside of point counts
Canada Goose		26	
Mallard		3	
Northern Bobwhite		8	
Ring-necked Pheasant		16	
Greater Prairie-Chicken	I	9	
Great Blue Heron			+
Wild Turkey		4	
Turkey Vulture		2	
Northern Harrier			+
Swainson's Hawk	II		+
Red-tailed Hawk		3	
American Kestrel			+
Killdeer		15	
Upland Sandpiper		72	
Wilson's Snipe	II	1	
European Collared-Dove		3	
Mourning Dove		82	
Burrowing Owl	I		
Common Nighthawk		16	
Red-headed Woodpecker		7	
Hairy Woodpecker		2	
Northern Flicker		10	
Eastern Wood-Pewee		3	
Great-crested Flycatcher		1	
Eastern Kingbird		9	
Loggerhead Shrike	I	1	
Blue Jay		1	
American Crow		32	
Horned Lark		52	
Barn Swallow		22	
Black-capped Chickadee		1	
Eastern Bluebird		2	
American Robin		60	
Gray Catbird		1	
Brown Thrasher		11	
Yellow Warbler		12	
Common Yellowthroat		3	
Chipping Sparrow		3	
Field Sparrow		30	
Vesper Sparrow		1	
Lark Sparrow		15	
Grasshopper Sparrow		151	
Henslow's Sparrow	I	1	
Scarlet Tanager			+
Blue Grosbeak		1	
Indigo Bunting		3	
Dickcissel		163	

Bobolink	21
Red-winged Blackbird	50
Eastern Meadowlark	2
Western Meadowlark	465
Common Grackle	23
Brown-headed Cowbird	108
Orchard Oriole	23
Baltimore Oriole	7
American Goldfinch	2
56 species	

[1] Nebraska species of conservation concern listed in Schneider et al. 2011.

Table 3-2. Overall densities of species recorded in 2012 Survey

Species	Number of Individuals	Density	Standard Error	Percent Coefficient of Variation	95% Confidence Interval Low	95% Confidence Interval High
All Species	1585	346.3	6.7	1.9%	333.4	359.6
Five most numerous species	969	227.6	5.1	2.3%	217.8	238.0
Western Meadowlark	465	100.6	3.3	3.3%	94.3	107.4
Dickcissel	163	33.0	2.3	6.9%	28.8	37.7
Grasshopper Sparrow	151	53.4	3.7	6.9%	46.5	61.2
Brown-headed Cowbird	108	43.4	6.8	15.7%	31.9	59.1
Mourning Dove	82	7.3	0.7	9.0%	6.1	8.7
Upland Sandpiper	72	11.4	4.0	35.5%	5.7	22.8
American Robin	60	9.3	1.0	10.5%	7.6	11.5
Horned Lark	52	7.6	0.7	8.9%	6.4	9.1
Red-winged Blackbird	50	15.5	3.0	19.4%	10.5	22.8
American Crow	32	1.2	0.3	22.2%	0.7	2.0
Field Sparrow	30	6.0	0.7	11.5%	4.7	7.5
Canada Goose	26	0.1	0.0	0.6%	0.1	0.1
Common Grackle	23	5.7	1.6	27.6%	3.2	10.0
Orchard Oriole	23	6.4	0.7	10.4%	5.2	8.0
Barn Swallow	22	20.7	3.8	18.4%	13.9	30.7
Bobolink	21	4.5	0.8	17.3%	3.1	6.4
Common Nighthawk	16	2.4	0.6	25.2%	1.4	4.2
Ring-necked Pheasant	16	1.8	0.0	0.6%	1.8	1.8
Killdeer	15	1.8	0.1	7.2%	1.5	2.1
Lark Sparrow	15	24.1	20.3	84.3%	4.7	122.6
Unidentified bird	14	6.3	1.6	25.7%	3.6	10.8
Yellow Warbler	12	2.2	0.0	0.7%	2.2	2.2
Brown Thrasher	11	2.9	0.6	21.3%	1.8	4.5
Northern Flicker	10	1.1	0.1	11.1%	0.9	1.5

Eastern Kingbird	9	8.5	3.9	46.3%	3.1	23.5
Greater Prairie-Chicken (Tier I)	9	1.0	0.0	1.0%	1.0	1.0
Northern Bobwhite	8	0.9	0.0	0.9%	0.9	0.9
Baltimore Oriole	7	1.2	0.0	0.6%	1.1	1.2
Red-headed Woodpecker	7	1.2	0.2	14.3%	0.8	1.7
Wild Turkey	4	<<1.0				
Chipping Sparrow	3	<<1.0				
Common Yellowthroat	3	<<1.0				
Eastern Wood-Pewee	3	<<1.0				
European Collared-Dove	3	<<1.0				
Indigo Bunting	3	<<1.0				
Mallard	3	<<1.0				
Red-tailed Hawk	3	<<1.0				
American Goldfinch	2	<<1.0				
Eastern Bluebird	2	<<1.0				
Eastern Meadowlark	2	<<1.0				
Hairy Woodpecker	2	<<1.0				
Turkey Vulture	2	<<1.0				
Unidentified duck	2	<<1.0				
Unidentified sparrow	2	<<1.0				
Unidentified woodpecker	2	<<1.0				
Black-capped Chickadee	1	<<1.0				
Blue Grosbeak	1	<<1.0				
Blue Jay	1	<<1.0				
Wilson’s Snipe (Tier II)	1	<<1.0				
Great-crested Flycatcher	1	<<1.0				
Gray Catbird	1	<<1.0				
Henslow's Sparrow (Tier I)	1	<<1.0				
Loggerhead Shrike (Tier I)	1	<<1.0				
Vesper Sparrow	1	<<1.0				

In terms of number of individuals seen or heard (Table 3-2), the five most numerous species were Western Meadowlark, Dickcissel, Grasshopper Sparrow, Brown-headed Cowbird, and Mourning Dove. Their combined overall density was 227.6 ± 5.1 birds/km^2 (CV = 2.3%). Note that Grasshopper Sparrow and Brown-headed Cowbird were calculated to have greater densities than Dickcissel (Table 1), even though fewer individuals were seen or heard. The reason for this has to do with detection probabilities, which distance sampling takes into account.

Table 3-3 compares density estimates for grassland and farmland for all species and the five most numerous species overall. Avian density in grassland was estimated to be about 12% greater than that in areas classified as farmland. Nonetheless, some species that were relatively abundant in grassland were much less abundant in farmland. A notable example was Grasshopper Sparrow, which was over ten times more abundant in grassland than in farmland.

Table 3-3. Density comparison by habitat strata

	Grassland		Farmland	
Species	**Density ± SE (birds/km^2)**	**CV**	**Density ± SE (birds/km^2)**	**CV**
All species	398.1 ± 8.4	2.1%	353.1 ± 13.4	3.8%
Five most numerous species	315.3 ± 11.3	3.6%	116.5 ± 7.3	6.2%
Western Meadowlark	136.4 ± 9.9	7.3%	52.9 ± 9.6	18.1%
Dickcissel	44.9 ± 2.2	4.8%	35.5 ± 3.5	9.9%
Grasshopper Sparrow	94.9 ± 13.2	13.9%	8.3 ± 0.3	4.1%
Brown-headed Cowbird	35.4 ± 7.6	21.6%	44.0 ± 10.0	22.8%
Mourning Dove	7.7 ± 0.4	4.7%	5.6 ± 0.6	10.3%

As noted above, three Tier I and one Tier II species recorded in point counts. The Tier-I Greater Prairie-Chicken was the most abundant of the special-concern species recorded in point counts. Its overall density was estimated at 1.0 ± 0.01 birds/km^2. Wilson's Snipe (Tier II), Loggerhead Shrike (Tier I), and Henslow's Sparrow (Tier I) were less abundant, with estimated overall densities below 1 bird/km^2 (Table 3-2).

4 DISCUSSION

Our estimates of avian densities are similar to those reported by Kempema (2007), who studied the effects of grazing systems on avian abundance in Nebraska's Sandhills. The Grande Prairie site is located just east of the Sandhills region, which begins in western Holt County. According to Sharpe et al. (2001), Grande Prairie is located in the Loess Mixed Grass Prairie vegetation zone.

Kempema used distance sampling along transects to generate her density estimates. The four grazing systems she studied were employed on private rangeland and classified as

long-duration, medium-duration, short-duration, and Sandhills (Kempema 2007, page 112). Table 4.1 compares the ranges reported by Kempema for twelve species that were also recorded in our study. Note that, in most cases, the estimates were similar, but they were much greater at the Grande Prairie site for Upland Sandpiper, Field Sparrow, Red-winged Blackbird, and Western Meadowlark, and much less for Vesper Sparrow. Some of these differences may be explained by the presence of cultivated land use at the Grande Prairie site.

Table 4.1. Density comparison (birds/km^2) with those estimated by Kempema (2007) for the Nebraska Sandhills

Species	Sandhills range[1]	Overall, this study
Killdeer	0.2 - 1.5	1.8
Upland Sandpiper	5.2 - 5.7	11.4
Mourning Dove	3.7 - 6.8	7.3
Common Nighthawk	1.9 - 3.4	2.4
Horned Lark	4.9 - 7.1	7.6
Field Sparrow	0 - 3.8	6.0
Vesper Sparrow	1.5 - 3.6	<<1.0
Lark Sparrow	12.6 - 24.2	24.1
Grasshopper Sparrow	57.0 - 114.6	53.4
Red-winged Blackbird	0.3 - 2.2	15.5
Western Meadowlark	29.1 - 42.0	100.6
Brown-headed Cowbird	6.2 - 33.4	43.4

[1] Range reported for four grazing system (long-duration, medium-duration, short-duration, and Sandhills) on private rangeland in the Nebraska Sandhills, 2002-2004 (Kempema 2007, page 112).

This study will be repeated post-construction.

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Appendix A. Point count coordinates and habitat classifications

Point_ID	Notes	Habitat	LAT_DD	LONG_DD	LAT_D_M_S	LONG_D_M_S
1		Grassland	42.54096424	-98.55685109	42□ 32' 27.471" N	98□ 33' 24.664" W
2		Grassland	42.54000797	-98.5468736	42□ 32' 24.029" N	98□ 32' 48.745" W
3		Grassland	42.54795626	-98.53965169	42□ 32' 52.643" N	98□ 32' 22.746" W
4		Grassland	42.55016953	-98.53288589	42□ 33' 0.610" N	98□ 31' 58.389" W
5		Grassland	42.54380847	-98.53113297	42□ 32' 37.710" N	98□ 31' 52.079" W
6		Grassland	42.54025078	-98.52996344	42□ 32' 24.903" N	98□ 31' 47.868" W
7		Farmland	42.54337152	-98.5128457	42□ 32' 36.137" N	98□ 30' 46.245" W
8		Grassland	42.55134772	-98.5139673	42□ 33' 4.852" N	98□ 30' 50.282" W
9		Grassland	42.5551027	-98.51508986	42□ 33' 18.370" N	98□ 30' 54.323" W
10		Grassland	42.55398144	-98.52461456	42□ 33' 14.333" N	98□ 31' 28.612" W
11		Grassland	42.55674138	-98.53689413	42□ 33' 24.269" N	98□ 32' 12.819" W
12		Grassland	42.56324723	-98.53089972	42□ 33' 47.690" N	98□ 31' 51.239" W
13		Grassland	42.56301206	-98.53818483	42□ 33' 46.843" N	98□ 32' 17.465" W
14		Grassland	42.55675064	-98.55650189	42□ 33' 24.302" N	98□ 33' 23.407" W
15		Grassland	42.56745637	-98.55334956	42□ 34' 2.843" N	98□ 33' 12.058" W
16		Grassland	42.57234487	-98.55492543	42□ 34' 20.442" N	98□ 33' 17.732" W
17		Grassland	42.57014867	-98.54163515	42□ 34' 12.535" N	98□ 32' 29.887" W
18		Grassland	42.56818174	-98.51669475	42□ 34' 5.454" N	98□ 31' 0.101" W
19		Farmland	42.56638609	-98.49418792	42□ 33' 58.990" N	98□ 29' 39.077" W
20		Farmland	42.56493503	-98.4861259	42□ 33' 53.766" N	98□ 29' 10.053" W
21		Farmland	42.5771263	-98.49598129	42□ 34' 37.655" N	98□ 29' 45.533" W
22		Farmland	42.57783614	-98.50548847	42□ 34' 40.210" N	98□ 30' 19.758" W
23		Farmland	42.58326551	-98.50251385	42□ 34' 59.756" N	98□ 30' 9.050" W
24		Grassland	42.5816831	-98.51509453	42□ 34' 54.059" N	98□ 30' 54.340" W
25		Grassland	42.5828483	-98.53969705	42□ 34' 58.254" N	98□ 32' 22.909" W
26		Grassland	42.59178315	-98.53173527	42□ 35' 30.419" N	98□ 31' 54.247" W

27	Grassland	42.59079404	-98.51946698	42° 35' 26.859" N	98° 31' 10.081" W
28	Grassland	42.59447299	-98.51221793	42° 35' 40.103" N	98° 30' 43.985" W
29	Grassland	42.59874739	-98.50187824	42° 35' 55.491" N	98° 30' 6.762" W
30	Grassland/Farmland	42.60502111	-98.49172497	42° 36' 18.076" N	98° 29' 30.210" W
31	Grassland	42.60353051	-98.49763732	42° 36' 12.710" N	98° 29' 51.494" W
32	Grassland	42.60457587	-98.50783786	42° 36' 16.473" N	98° 30' 28.216" W
33	Grassland	42.59918933	-98.51852046	42° 35' 57.082" N	98° 31' 6.674" W
34	Grassland	42.6053107	-98.5237538	42° 36' 19.119" N	98° 31' 25.514" W
35	Grassland	42.60337562	-98.53064589	42° 36' 12.152" N	98° 31' 50.325" W
36	Grassland	42.61401455	-98.52974919	42° 36' 50.452" N	98° 31' 47.097" W
37	Grassland	42.61688182	-98.51866051	42° 37' 0.775" N	98° 31' 7.178" W
38	Grassland	42.61486234	-98.51217732	42° 36' 53.504" N	98° 30' 43.838" W
39	Grassland	42.63167117	-98.51917014	42° 37' 54.016" N	98° 31' 9.013" W
40	Grassland	42.64135497	-98.51805921	42° 38' 28.878" N	98° 31' 5.013" W
41	Grassland	42.64164819	-98.50733039	42° 38' 29.933" N	98° 30' 26.389" W
42	Grassland	42.64163412	-98.49686476	42° 38' 29.883" N	98° 29' 48.713" W
43	Grassland	42.63751209	-98.50003204	42° 38' 15.044" N	98° 30' 0.115" W
44	Grassland	42.64152012	-98.48406462	42° 38' 29.472" N	98° 29' 2.633" W
45	Grassland	42.64666175	-98.50957371	42° 38' 47.982" N	98° 30' 34.465" W
46	Grassland	42.64754092	-98.51980552	42° 38' 51.147" N	98° 31' 11.300" W
47	Grassland	42.65579059	-98.51859728	42° 39' 20.846" N	98° 31' 6.950" W
48	Grassland	42.66280772	-98.51770739	42° 39' 46.108" N	98° 31' 3.747" W
49	Grassland	42.66695227	-98.50383699	42° 40' 1.028" N	98° 30' 13.813" W
50	Grassland	42.65907925	-98.50029828	42° 39' 32.685" N	98° 30' 1.074" W
51	Grassland	42.65563378	-98.48894777	42° 39' 20.282" N	98° 29' 20.212" W
52	Grassland	42.66919442	-98.49133786	42° 40' 9.100" N	98° 29' 28.816" W
53	Grassland	42.68426514	-98.45117223	42° 41' 3.355" N	98° 27' 4.220" W
54	Grassland	42.68192205	-98.45495211	42° 40' 54.919" N	98° 27' 17.828" W
55	Grassland	42.67794698	-98.4434473	42° 40' 40.609" N	98° 26' 36.410" W
56	Grassland	42.67311161	-98.4456201	42° 40' 23.202" N	98° 26' 44.232" W

57	Grassland	42.67029948	-98.46022256	42° 40' 13.078" N	98° 27' 36.801" W
58	Grassland	42.66638382	-98.46146756	42° 39' 58.982" N	98° 27' 41.283" W
59	Grassland	42.6617498	-98.46066438	42° 39' 42.299" N	98° 27' 38.392" W
60	Grassland	42.65854653	-98.43849159	42° 39' 30.768" N	98° 26' 18.570" W
61	Grassland	42.65128345	-98.44149057	42° 39' 4.620" N	98° 26' 29.366" W
62	Grassland	42.64873312	-98.43566347	42° 38' 55.439" N	98° 26' 8.388" W
63	Grassland	42.65021845	-98.42807204	42° 39' 0.786" N	98° 25' 41.059" W
64	Grassland	42.65212891	-98.41556216	42° 39' 7.664" N	98° 24' 56.024" W
65	Grassland	42.64312906	-98.41808523	42° 38' 35.265" N	98° 25' 5.107" W
66	Grassland	42.63837347	-98.42906622	42° 38' 18.144" N	98° 25' 44.638" W
67	Grassland	42.64061876	-98.44417322	42° 38' 26.228" N	98° 26' 39.024" W
68	Grassland	42.640133	-98.45979863	42° 38' 24.479" N	98° 27' 35.275" W
69	Grassland	42.63482265	-98.45550093	42° 38' 5.362" N	98° 27' 19.803" W
70	Grassland	42.63362478	-98.44968001	42° 38' 1.049" N	98° 26' 58.848" W
71	Grassland	42.62611887	-98.44624592	42° 37' 34.028" N	98° 26' 46.485" W
72	Farmland	42.63306641	-98.47556247	42° 37' 59.039" N	98° 28' 32.025" W
73	Farmland	42.62386765	-98.47616702	42° 37' 25.924" N	98° 28' 34.201" W
74	Farmland	42.60909938	-98.45349752	42° 36' 32.758" N	98° 27' 12.591" W
75	Farmland	42.60854887	-98.445226	42° 36' 30.776" N	98° 26' 42.814" W
76	Farmland	42.59055444	-98.45667849	42° 35' 25.996" N	98° 27' 24.043" W
77	Farmland	42.58809702	-98.4743206	42° 35' 17.149" N	98° 28' 27.554" W
78	Farmland	42.54592921	-98.4989516	42° 32' 45.345" N	98° 29' 56.226" W
79	Farmland	42.54164258	-98.48854143	42° 32' 29.913" N	98° 29' 18.749" W
80	Farmland	42.51858985	-98.49005728	42° 31' 6.923" N	98° 29' 24.206" W
81	Farmland	42.52656846	-98.48000087	42° 31' 35.646" N	98° 28' 48.003" W
82	Farmland	42.52387642	-98.47214919	42° 31' 25.955" N	98° 28' 19.737" W
83	Farmland	42.51026871	-98.45400718	42° 30' 36.967" N	98° 27' 14.426" W
84	Farmland	42.51920337	-98.43908097	42° 31' 9.132" N	98° 26' 20.691" W
85	Farmland	42.52933166	-98.45391339	42° 31' 45.594" N	98° 27' 14.088" W
86	Farmland	42.53212922	-98.4605909	42° 31' 55.665" N	98° 27' 38.127" W

87	Farmland	42.53962569	-98.4695446	42□ 32' 22.652" N	98□ 28' 10.361" W
88	Farmland	42.56114611	-98.46629191	42□ 33' 40.126" N	98□ 27' 58.651" W
89	Farmland	42.55864564	-98.45316944	42□ 33' 31.124" N	98□ 27' 11.410" W
90	Farmland	42.53861294	-98.42044246	42□ 32' 19.007" N	98□ 25' 13.593" W
91	Farmland	42.54829955	-98.4147735	42□ 32' 53.878" N	98□ 24' 53.185" W
92	Farmland	42.55107906	-98.423275	42□ 33' 3.885" N	98□ 25' 23.790" W
93	Farmland	42.55849613	-98.42742818	42□ 33' 30.586" N	98□ 25' 38.741" W
94	Farmland	42.55502857	-98.43403988	42□ 33' 18.103" N	98□ 26' 2.544" W
95	Farmland	42.56376326	-98.43805462	42□ 33' 49.548" N	98□ 26' 16.997" W
96	Farmland	42.562847	-98.41311699	42□ 33' 46.249" N	98□ 24' 47.221" W
97	Farmland	42.57118546	-98.4223608	42□ 34' 16.268" N	98□ 25' 20.499" W
98	Farmland	42.57810043	-98.42855119	42□ 34' 41.162" N	98□ 25' 42.784" W
99	Farmland	42.59219062	-98.41893694	42□ 35' 31.886" N	98□ 25' 8.173" W
100	Farmland	42.58636081	-98.40416957	42□ 35' 10.899" N	98□ 24' 15.010" W
101	Farmland	42.58999855	-98.37585713	42□ 35' 23.995" N	98□ 22' 33.086" W
102	Farmland	42.59450017	-98.38432861	42□ 35' 40.201" N	98□ 23' 3.583" W
103	Farmland	42.60373856	-98.39488574	42□ 36' 13.459" N	98□ 23' 41.589" W
104	Farmland	42.60399525	-98.40391488	42□ 36' 14.383" N	98□ 24' 14.094" W
105	Farmland	42.60910999	-98.41213781	42□ 36' 32.796" N	98□ 24' 43.696" W
106	Farmland	42.6059458	-98.4173128	42□ 36' 21.405" N	98□ 25' 2.326" W
107	Farmland	42.61348096	-98.43085257	42□ 36' 48.531" N	98□ 25' 51.069" W
108	Farmland	42.62105796	-98.43741659	42□ 37' 15.809" N	98□ 26' 14.700" W
109	Farmland	42.62165956	-98.4220053	42□ 37' 17.974" N	98□ 25' 19.219" W
110	Farmland	42.63208807	-98.42842585	42□ 37' 55.517" N	98□ 25' 42.333" W
111	Farmland	42.62720252	-98.41198547	42□ 37' 37.929" N	98□ 24' 43.148" W
112	Grassland	42.64486251	-98.40200386	42□ 38' 41.505" N	98□ 24' 7.214" W
113	Grassland	42.66048041	-98.40466631	42□ 39' 37.729" N	98□ 24' 16.799" W
114	Grassland	42.66297946	-98.4155393	42□ 39' 46.726" N	98□ 24' 55.941" W
115	Grassland	42.66767702	-98.41202769	42□ 40' 3.637" N	98□ 24' 43.300" W
116	Grassland	42.67400518	-98.41004903	42□ 40' 26.419" N	98□ 24' 36.176" W

117	Grassland	42.68304574	-98.40105973	42□ 40' 58.965" N	98□ 24' 3.815" W
118	Grassland	42.6747543	-98.39856634	42□ 40' 29.115" N	98□ 23' 54.839" W
119	Grassland	42.6825991	-98.36315809	42□ 40' 57.357" N	98□ 21' 47.369" W
120	Grassland	42.67324828	-98.34924457	42□ 40' 23.694" N	98□ 20' 57.280" W
121	Grassland	42.66913771	-98.35590987	42□ 40' 8.896" N	98□ 21' 21.276" W
122	Grassland	42.66211875	-98.37071794	42□ 39' 43.627" N	98□ 22' 14.585" W
123	Grassland	42.6638973	-98.38128265	42□ 39' 50.030" N	98□ 22' 52.618" W
124	Grassland	42.64635398	-98.38129797	42□ 38' 46.874" N	98□ 22' 52.673" W
125	Grassland	42.64820337	-98.37709672	42□ 38' 53.532" N	98□ 22' 37.548" W
126	Grassland	42.64189412	-98.37343264	42□ 38' 30.819" N	98□ 22' 24.357" W
127	Grassland	42.64443354	-98.36705008	42□ 38' 39.961" N	98□ 22' 1.380" W
128	Grassland	42.64388153	-98.35025987	42□ 38' 37.974" N	98□ 21' 0.936" W
129	Grassland	42.65184255	-98.33180727	42□ 39' 6.633" N	98□ 19' 54.506" W
130	Grassland	42.64693808	-98.33423375	42□ 38' 48.977" N	98□ 20' 3.242" W
131	Grassland	42.63715022	-98.35654477	42□ 38' 13.741" N	98□ 21' 23.561" W
132	Grassland	42.63930684	-98.36203051	42□ 38' 21.505" N	98□ 21' 43.310" W
133	Grassland	42.63934191	-98.36989423	42□ 38' 21.631" N	98□ 22' 11.619" W
134	Grassland	42.63858657	-98.38090855	42□ 38' 18.912" N	98□ 22' 51.271" W
135	Grassland	42.62851623	-98.37249631	42□ 37' 42.658" N	98□ 22' 20.987" W
136	Grassland	42.62641621	-98.38139792	42□ 37' 35.098" N	98□ 22' 53.033" W
137	Grassland	42.615419	-98.33827891	42□ 36' 55.508" N	98□ 20' 17.804" W
138	Grassland	42.61730204	-98.32605151	42□ 37' 2.287" N	98□ 19' 33.785" W
139	Grassland/Farmland	42.62282587	-98.32474934	42□ 37' 22.173" N	98□ 19' 29.098" W
140	Grassland	42.62080174	-98.32098128	42□ 37' 14.886" N	98□ 19' 15.533" W
141	Grassland	42.62524294	-98.31220549	42□ 37' 30.875" N	98□ 18' 43.940" W
142	Grassland	42.61929902	-98.31324485	42□ 37' 9.476" N	98□ 18' 47.681" W
143	Grassland	42.61327799	-98.30712744	42□ 36' 47.801" N	98□ 18' 25.659" W
144	Grassland	42.61484079	-98.3164739	42□ 36' 53.427" N	98□ 18' 59.306" W
145	Grassland	42.60807048	-98.32753291	42□ 36' 29.054" N	98□ 19' 39.118" W
146	Grassland	42.61049707	-98.33278888	42□ 36' 37.789" N	98□ 19' 58.040" W

147		Grassland	42.61091151	-98.34179514	42° 36' 39.281" N	98° 20' 30.463" W
148		Grassland	42.60810832	-98.35190294	42° 36' 29.190" N	98° 21' 6.851" W
149		Grassland	42.60390747	-98.33749846	42° 36' 14.067" N	98° 20' 14.994" W
150		Grassland	42.59829567	-98.33593729	42° 35' 53.864" N	98° 20' 9.374" W
151		Grassland	42.59480845	-98.33970682	42° 35' 41.310" N	98° 20' 22.945" W
152		Grassland	42.59192725	-98.34448633	42° 35' 30.938" N	98° 20' 40.151" W
153	Point relocated (see 153a)	Grassland	42.58130808	-98.32293415	42° 34' 52.709" N	98° 19' 22.563" W
154	Point relocated (see 154a)	Grassland	42.57620712	-98.3349665	42° 34' 34.346" N	98° 20' 5.879" W
155	Point relocated (see 155a)	Grassland	42.57137951	-98.3302053	42° 34' 16.966" N	98° 19' 48.739" W
156		Grassland	42.57102664	-98.34194465	42° 34' 15.696" N	98° 20' 31.001" W
157		Grassland	42.5776453	-98.34978804	42° 34' 39.523" N	98° 20' 59.237" W
158	Point relocated (see 158a)	Grassland	42.56669202	-98.35067475	42° 34' 0.091" N	98° 21' 2.429" W
159		Grassland	42.57069553	-98.35707535	42° 34' 14.504" N	98° 21' 25.471" W
160		Grassland	42.57135843	-98.36696448	42° 34' 16.890" N	98° 22' 1.072" W
161		Grassland	42.57391284	-98.37338503	42° 34' 26.086" N	98° 22' 24.186" W
162		Grassland	42.56519046	-98.37883945	42° 33' 54.686" N	98° 22' 43.822" W
163		Grassland/Farmland	42.55727082	-98.40324229	42° 33' 26.175" N	98° 24' 11.672" W
164		Grassland	42.55706991	-98.39346871	42° 33' 25.452" N	98° 23' 36.487" W
165		Grassland	42.55715256	-98.38399247	42° 33' 25.749" N	98° 23' 2.373" W
166		Grassland	42.55572585	-98.36915622	42° 33' 20.613" N	98° 22' 8.962" W
167		Grassland	42.55335438	-98.36516215	42° 33' 12.076" N	98° 21' 54.584" W
168		Grassland	42.5528083	-98.3762277	42° 33' 10.110" N	98° 22' 34.420" W
169		Grassland	42.54619561	-98.38096244	42° 32' 46.304" N	98° 22' 51.465" W
170		Grassland	42.54177887	-98.36670503	42° 32' 30.404" N	98° 22' 0.138" W
171		Farmland	42.54351679	-98.35547783	42° 32' 36.660" N	98° 21' 19.720" W
172		Grassland/Farmland	42.55291633	-98.34644171	42° 33' 10.499" N	98° 20' 47.190" W
173		Farmland	42.54706851	-98.342442	42° 32' 49.447" N	98° 20' 32.791" W
174		Grassland	42.53918659	-98.32263832	42° 32' 21.072" N	98° 19' 21.498" W
175		Grassland	42.54337225	-98.31320222	42° 32' 36.140" N	98° 18' 47.528" W
153a		Grassland	42.67468612	-98.35561157	42° 40' 28.870" N	98° 21' 20.202" W

154a	Grassland	42.57683287	-98.33979728	42□ 34' 36.598" N	98□ 20' 23.270" W
155a	Grassland	42.66123543	-98.45450721	42□ 39' 40.448" N	98□ 27' 16.226" W
158a	Grassland	42.65420814	-98.38387505	42□ 39' 15.149" N	98□ 23' 1.950" W

APPENDIX B. Qualifications of field biologists who conducted the 2012 Survey.

Tim Andersen
Senior Scientist
Bachelor of Arts, Biology, Environmental Studies; Dana College, 2001
Olsson Professional Experience, 2005 to Present
Total Professional Experience, 1999 to Present

Tim is an experienced field biologist and project manager with relevant project experience that emphasizes on biological assessments for avifauna and flora supporting renewable energy, land development, and transportation projects located in the Midwest. In support of wind energy development, floral assessments have included habitat surveys for rare and threatened and endangered species or vegetative communities, whooping crane stopover risk assessments, wetland delineations, grassland suitability surveys, and floristic quality assessments. Avian studies include breeding bird and avian use surveys using various methodologies including line transects, distance sampling, and point/plot counts. Additional avian studies include Migratory Bird Treaty Act nesting surveys, sharp-tailed grouse and greater prairie chicken lek surveys, and nesting raptor surveys. Tim is proficient in visual and aural bird identification for species prevalent in the Midwest. He is also an active member of the Nebraska Wind and Wildlife Working Group.

Heather Darrow
Assistant Scientist
Bachelor of Science, Biology; Beloit College, 2003
Olsson Professional Experience, 2011 to Present
Total Professional Experience, 2003 to Present

As a field biologist, Heather's experience includes a range of field surveys pertaining to threatened and endangered species, Migratory Bird Treaty Act, and Bald and Golden Eagle Protection Act. She has provided support for projects that have included wind energy development, oil/gas exploration and development, logging, U.S. Air Force, Army National Guard, and commercial infrastructure projects. Her background has included extensive avian surveys for projects involving lek counts for sharp-tailed grouse, greater prairie chickens and lesser prairie chickens, raptor nest surveys, fixed-point bird use surveys, spotted owl presence/absence, whooping crane monitoring, bald eagle winter roost surveys, and greater sage grouse brood counts. At her previous employ with Western EcoSystems Technology, Inc., Heather performed numerous point-count migration surveys and line-transect surveys for raptor species, and is well-versed in playback methods for attracting raptors and habitat and nest characterization. Heather provides statistical analysis and prepares a range of pre- and post-construction reports for wind energy development projects.