

**EFFECTS OF WIND POWER ON THE DEMOGRAPHY AND POPULATION  
GENETICS OF THE GREATER PRAIRIE-CHICKEN**

**QUARTERLY REPORT**

**Submitted by:**

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**Presented to:**

**National Wind Coordinating Council  
Kansas Department of Wildlife and Parks**

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# **EFFECTS OF WIND POWER ON THE DEMOGRAPHY AND POPULATION GENETICS OF THE GREATER PRAIRIE-CHICKEN**

NREL Technical Monitor: Karin Sinclair  
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Quarterly Report  
Reporting Period: 1<sup>st</sup> Quarter 2009  
Date: 1 May 2009

## **EXECUTIVE SUMMARY**

*Field.*— Our efforts during this quarter were field-based and focused on conducting lek attendance surveys, capturing and marking greater prairie-chickens, and gathering location data on radio-marked hens. As of 25 April 2009, 197 lek surveys have been conducted at 16 leks at Unit 3. The mean number of prairie-chickens attending leks did not differ between impact and reference areas. Trapping via walk-in traps and drop nets occurred during 3 March - 25 April, resulting in 164 captures of 132 prairie-chickens (85 males, 47 females). Radio-transmitters were fitted to 45 new females, and 17 females radio-marked in 2008 remain on-air and active. We will continue to capture prairie-chickens until females stop visiting leks and we have banded > 80% of the males on each lek.

*Laboratory.*— Laboratory activities during the first quarter of 2009 have focused on the hiring and training of new field staff to aid in the capture of prairie-chickens and acquisition of additional DNA samples. Trapping activities are still underway, but are expected to be completed sometime within the next two weeks. To date in 2009 we have collected blood samples from 166 individuals (114 from Unit 3 and 52 from Unit 2). We have just begun to acquire genetic data for these samples; so far we have completed DNA extractions of only 96 individuals. No PCR amplification has been completed yet. Thus, estimates of genetic diversity, effective population size, inbreeding and genetic connectivity between demes remain unchanged since the annual report.

*Administration and Reporting.*— In March 2009, six new seasonal field staff were added to aid in trapping and nest monitoring of prairie-chickens. One individual left the project after one week, thus our current staff is at six full-time field staff and one fulltime undergraduate lab technician. So far in 2009 vehicle maintenance costs have been

higher than anticipated. In addition to general service, four vehicles have required new brakes, two have required tires, and one has required wheel alignment. Consequently, thus far in 2009 we have spent approximately \$4,200 to maintain our fleet of five trucks and four ATV's. Fuel costs also remain a major expenditure; in March we spent approximately \$2,400 in fuel.

Prior to the start of field activities, all landowners, with the exception of Unit 3 impact landowners, were contacted concerning field activities that were going to take place on their properties in 2009. At the request of Horizon Energy, Unit 3 impact landowners were not contacted directly, but were instead contacted by Horizon Energy personnel. Due to an oversight, one impact landowner was not contacted before trapping commenced on his property. A similar incident occurred last year as well. These incidents have led to a new understanding between K-State research staff and Horizon Energy staff - *K-State prairie-chicken project staff will now be responsible for contacting all landowners about research activities taking place on their properties.*

## **FIELD BASED HYPOTHESES**

**Hypothesis I) Lek Attendance:** *Lek attendance on impact sites is not affected by wind-power development.*

### *Accomplishments Since Last Quarter*

Leks were identified by field surveys at both the reference and impact areas at all three study units. The total number of males, females, and prairie-chickens of unknown sex was recorded, as well as the weather conditions (e.g., estimated temperature, wind speed, cloud cover) and time and date of observation. Birds were flushed from untrapped leks between 0600 and 0930. On trapped leks, we recorded the maximum number of prairie-chickens observed at the lek.

We located 16 leks during the quarter at Unit 3, including 3 new leks at the impact site. As of 25 April, 197 lek surveys have been conducted at these leks during 2008. The mean ( $\pm$ SD) number of total prairie-chickens attending leks (including new leks) during this time period was  $13.1 \pm 6.2$  and was similar between the impact ( $13.4 \pm 7.9$ ) and reference areas ( $12.9 \pm 5.0$ ). Two of the 3 new leks are located  $< 300$  m from

the nearest wind turbine. However, one lek identified in the impact area prior to construction (currently < 100 m from the nearest turbine) was not attended in 2009, and another lek impact lek < 10 m from the nearest turbine had significantly reduced attendance this year (consistently 4 males) when compared to previous years ( $8.2 \pm 2.5$  males in 2007 and 2008). Therefore, it is unclear whether lek attendance was impacted by wind power development in the first year of post-construction monitoring.

#### *Goals For Next Quarter*

We will continue to conduct lek surveys during the upcoming quarter. A complete lek attendance analysis will be conducted to fully evaluate the effects of study areas and wind power construction on lek attendance. Greater prairie-chicken response to wind power development will be estimated in two ways. First, the maximum number of males attending each lek will be used to calculate an average maximum number of males at reference and impact areas. As per BACI design (see below), the difference among the estimates between reference and impact areas will be compared for flushes occurring before, during, and after development using an ANOVA. In addition, we will use regression procedures (PROC GLM, SAS Institute) to model lek attendance as function of the distance of the lek from the nearest anthropogenic feature, including wind-associated structures.

**Hypothesis II) Avoidance of anthropogenic structures: *Prairie-chickens do not avoid wind-towers and/or other anthropogenic features on impact sites.***

#### *Accomplishments Since Last Quarter*

Wind power development was completed at the Unit 3 impact site during Fall 2008. Effort this quarter was focused on capturing and radio-marking females at reference and impact sites and monitoring females to quantify post-construction habitat selection and space use. Radio-marked prairie-chickens were located  $\geq 3$  times/week from project trucks, an ATV, or on foot using portable radio receivers and handheld 3-element Yagi antennas. Bird locations are estimated from  $\geq 2$  triangulation bearings using a maximum-likelihood estimator in program LOCATE III or flush locations were recorded with a GPS.

Trapping via walk-in traps and drop nets was conducted during 3 March – 25 April at Unit 3, resulting in 164 captures of 132 prairie-chickens (85 males, 47 females).

Radio-transmitters were fitted to 45 new females (26 impact, 19 reference). In addition, 17 hens fitted with transmitters in 2008 are currently being monitored at Unit 3. We collected 1,122 locations of 62 females at Unit 3 (28 impact, 34 reference) during the quarter.

*Goals For Next Quarter*

We will continue monitoring radio-marked prairie-chickens at reference and impact areas.

**Hypothesis III) Impacts on Fecundity Rates: *Wind development will not reduce nest success or chick survival.***

*Accomplishments Since Last Quarter*

Efforts this quarter focused on 1) hiring and training 6 research technicians, 2) capturing and radio-marking female prairie-chickens at all sites, and 3) intensive monitoring of radio-marked prairie-chickens to locate nests. Capture and handling of prairie-chickens occurred as described in our research proposal beginning 3 March. Captured females were fitted with necklace-style radio-transmitters. Radio-marked hens were located by triangulation or homing  $\geq 3$  times/week from project trucks, an ATV, or on foot. When females localize in an area and their estimated location does not change for 3 successive days, we will use portable radio receivers and handheld Yagi antennas to locate and flush the bird so that the eggs can be counted and nest location recorded with a GPS unit.

During 3 March – 25 April, 2009, 132 prairie-chickens were captured 164 times. Forty-five females have been fitted with radio-transmitters, and 17 females radio-marked in 2008 continue to be monitored. Two nests have been documented at the time of this report; one nest has already been depredated.

*Goals For Next Quarter*

Effort in the upcoming quarter will be focused on capturing and monitoring prairie-chickens at reference and impact sites, following our existing field protocols. Females will be monitored  $>4$  times per week to assess nesting status. Nests will be identified and monitored remotely until hatch or fail. Nest survival will be estimated as

described in the 2008 annual report. Vegetation structure will be quantified at each nest site within 3 days of hatching or failure as described in 2008 annual report.

Chicks will be captured by hand within 3 days of hatch by homing in and flushing the brood hen. Captured chicks will be measured and individually marked with numbered Monel metal tags clipped onto the patagium of the leading edge of the wing. Processed chicks will be placed in a second cloth sack. Initial brood size will be considered the number of chicks that were known to hatch based on nest observations. Systematic flush counts will be used to estimate pre-fledge (0-14 days) and post-fledge (14-60 days) survival. Because broods will not be observed daily, we will use the nest survival model type in Program MARK to evaluate daily brood survival probabilities. Covariates will include hen age, a forb:grass cover index, VOR, and average home range distance to closest anthropogenic feature.

**Hypothesis IV) Impacts on Breeding Habitat: *Placement of wind-towers and related structures does not impact the habitat use of breeding greater prairie-chickens.***

*Accomplishments Since Last Quarter*

Radio-marked prairie-chickens were located  $\geq 3$  times/week from project trucks, an ATV, or on foot using portable radio receivers and handheld 3-element yagi antennas. Bird locations are estimated from  $\geq 2$  triangulation bearings using a maximum-likelihood estimator in program LOCATE III or flush locations were recorded with a GPS. Data collection was ongoing at the time of this report.

*Goals For Next Quarter*

We will continue to estimate the locations of radio-marked prairie-chickens  $\geq 3$  times per week. These data will be uploaded to a GIS and home ranges will be estimated using a spatial tools package. Females will be monitored regularly to assess nesting status. Nest locations will be identified as described in the previous annual report.

**Hypothesis V) Impacts on Survival: *Wind-power development does not increase mortality rates of greater prairie-chickens.***

*Accomplishments Since Last Quarter*

We monitored greater prairie-chickens remotely via radio-telemetry to assess survival at Units 2 and 3. During 1 January – 25 April, 2009, 92 female prairie-chickens were monitored. Six mortalities were documented. Five mortality events were the result of predation; one female mortality was capture-related.

#### *Goals For Next Quarter*

We will continue to focus our efforts on capturing and marking prairie-chickens at Unit 3. Our objective is to capture and equip >50 hens with radio-transmitters and band >80% of the males on each lek. Recaptures of marked birds will be recorded to estimate annual apparent survival via mark-recapture statistics. In an effort to increase our understanding of the potential for wind power development to impact the survival of prairie-chickens, we will conduct predator surveys at Units 2 and 3. We will establish 200 scent track stations. Scent track stations will be set at intervals of 200 m along 10 randomly chosen 1.6-km transects in both impact and reference areas of Unit 3. Scent stations will consist of a 1-square meter plot of sifted sand baited with a fatty acid plaster disk (Wildlife Services Supply Depot, Pocatello, Idaho). Each station will be checked daily for three consecutive days and number of visits by various potential prairie-chicken predators is recorded as an index of relative predator density, both within the research unit and between impact and reference portions of the unit.

## **LABORATORY BASED HYPOTHESES**

**Hypothesis I) Effects of anthropogenic disturbances associated with wind power development on breeding behavior: *There will be no change detected in the  $N_e/N$ , inter/intra group relatedness, or changes in rates of multiple paternity.***

#### *Quarter 1 Accomplishments*

Current estimates of  $N_e$  are unchanged as new genetic data for 2009 have not yet been included in the analysis. Currently, the effective population size for chickens across all three research units remains relatively high ( $N_e = 669.4 \pm 114$ ). Additionally to quantify changes to the breeding ecology as a result of wind power development we have begun conducting paternity analysis. Using a combination of exclusionary and probability methods we were able to assign paternity to 274 of 363 (75%) of the chicks

captured from 2006-2008. Of the 274 chicks that were assignable, only 214 (78% assignable, 59% of total), from 39 broods, were assignable with  $\geq 95\%$  confidence. Being able to confidently assign paternity to 59% of the chicks may seem rather low, but in 2009 we added samples from two previously un-trapped leks in Unit 2 and five previously un-trapped leks in Unit 3. Given female prairie-chicken selective breeding behavior and male prairie-chicken fidelity to leks, we anticipate the proportion of individuals we can confidently assign paternity to will increase with the addition of 2009 samples. Furthermore, an alternative hypothesis to the low level of assignment may have to do with the high skew in male reproductive success typically observed in prairie-chickens, such that closely related males may be fathering the majority of chicks and confounding paternity assessment confidence. This hypothesis has yet to be explored.

#### *Goals for Next Quarter*

During the next quarter we hope to complete the extraction and amplification of all adult Greater Prairie-chicken samples collected in 2009. Data from these samples will then be incorporated into data from previous years to recalculate  $N_e$  for each research unit independently, across all three research units, and within years within each research unit. Calculating  $N_e$  within years will allow us to look for changes to the  $N_e$  of the prairie-chicken populations inhabiting our three research units. Changes in  $N_e$  may reflect changes in the underlying population demography, which may be occurring as a result of changes to the landscape. Finally, we will conduct preliminary paternity analysis of all chick samples collected from 2006-2008, and begin extraction and PCR amplification of 2009 prairie-chicken, chick data. We will then calculate pairwise relatedness values between all putative fathers identified in our paternity analysis.

**Hypothesis II) Influence on Natal Dispersal: *There will be no differences detected in the dispersal patterns of prairie chickens pre and post wind-power development.***

#### *Quarter 1 Accomplishments*

We continue to document the location of all anthropogenic structures in Unit 3. Ground locations of anthropogenic structures have been collected using handheld GPS units and then uploaded into ESRI readable shapefiles for future analysis. Mapping will allow us to assess the impacts of all anthropogenic structures on gene flow, probability of

dispersal across barriers, demography, and space use of prairie-chickens in areas with and without wind power development.

*Goals for Next Quarter*

Compile location data for anthropogenic structures across Unit 3 into a single GIS data set. Conduct preliminary tests of genetic identity for all adult chickens captured in 2009 against chicks captured in 2007 or 2008. Calculate pairwise relatedness values within each year for all prairie-chickens captured in Unit 3 from 2007-2009. Finalize analysis of landscape permeability among the three research units to model the potential effects of anthropogenic disturbance on the genetic differentiation of populations across broad geographic regions.