Lesser Prairie-Chicken Avoidance Thresholds for Anthropogenic Structures in New Mexico and Oklahoma

Authors: A. Barnard, C.M. Curry, H. Dang, M.A. Patten

# Abstract

This project will support the effort to understand the ecology and demography of this declining species  
(basic research) and to use findings to shape management decisions (applied research) through in-depth  
analyses of an extensive, multi-year (1999–2014) telemetry study to assess how the Lesser PrairieChicken responds to human modification of its habitat, a study that will entail assessment of vital rates,  
movements, and avoidance behavior at a variety of spatial and temporal scales.

Keywords: grassland, conservation, Bayesian, anthropogenic disturbance

# Introduction

Successful, long-term conservation of the Lesser Prairie-Chicken (*Tympanuchus pallidicinctus*), a nonmigratory grouse endemic to mixed- and shortgrass prairies of the south-central United States, requires an in-depth understanding of the species’ ecological needs, including how it responds to anthropogenic disturbance and land use changes.

Anthropogenic disturbances affect grassland birds such as this grouse both directly and indirectly. Grazing (), noise pollution (Blickley et al. 2012*a*, *b*), mortality by collision (Wolfe et al. 2007), habitat alteration (Woodward et al. 2001), and habitat fragmentation (Crawford and Bolen 1976). Additionally, prairie-chickens avoid anthropogenic features such as power lines, roads, highways, and buildings (Pruett et al. 2009, Hagen et al. 2011) and site their nests farther from such features such that much otherwise appropriate habitat can be lost through anthropogenic structures (Pitman et al. 2005) even without changes in vegetation

In this paper we address a key open question of at what distance prairie-chickens avoid anthropogenic structures, assessing avoidance behavior at a variety of spatial and temporal scales.. Lesser Prairie-Chickens home range use avoids both highways and power lines (Pruett et al. 2009). The avoidance of structures is not always due to the anthropogenic disturbance itself—prairie-chickens avoid trees as well (Lautenbach et al. 2017) and taller cover near leks (Anderson 1969). Past work on avoidance has considered linear avoidance patterns and determined that habitat use is non-random in the presence of human structures. Understanding thresholds at which these avoidance behaviors cease will be crucial to the refinement of conservation and management plans for the species, from guidelines to how site energy-related structure to how best to manage land to facilitate dispersal.

We will quantify specific thresholds, as well as estimates of uncertainty, for avoidance behavior with respect to anthropogenic features in the habitat, such as power lines, wind turbines, roads, oil pumps, and buildings. Avoidance will be assessed for: a) lek placement, b) nest placement, c) home range size and shape, and d) seasonal movement patterns. Finally, we will quantify resilience, in the sense of whether, under what conditions, and how long after a disturbance avoidance behavior is reduced (i.e., the threshold shrinks). , a study that will entail assessment of avoidance behavior at a variety of spatial and temporal scales.

# Methods

## Tracking data

We used tracking data and in-depth analyses of an extensive,15-year (1999–2014) telemetry study to assess how the Lesser Prairie-Chicken responds to human modification of its habitat.

We computed kernel density estimates for individual home range size and shape and to plot all documented lek and nest locations for the mixed-grass ecoregion.

Tracking data was triangulated using XYZ method (HENRY WRITES THIS SECTION).

## Land use data

Data from this long-term study will be supplemented by data from other studies or surveys as well as by remotely sensed and similar data for land use. **Age of features needed to quantify bird behavior since disturbance.**

**GIS layers to acquire: power lines, wind turbines, roads, oil pumps, and buildings**

## Estimation thresholds

Threshold distances will be estimated with software SiZer (Sonderegger et al. 2009, Front. Ecol. Environ. 7:190–195), results of which will be wed to specially designed Bayesian analyses to obtain estimates not only of the parameter of interest from SiZer, such as avoidance distance, but also of statistically meaningful measures of uncertainty. This approach allowed us to assess types of avoidance beyond simple linear assumptions (Powell et al. 2017, Wildl. Biol. wlb-00245).

## Study area

Data are from mixed grass prairie habitats of Beaver, Harper, Ellis, and Woods Counties in northwestern Oklahoma, a region of chiefly privately owned lands dominated by a mix of perennial grasses and low shrubs that tend to be burned regularly, that have been heavily invaded by Eastern Red Cedar (Juniperusvirginianus), and that are used extensively for cattle grazing and energy development.

# Results

# Discussion

# Acknowledgements

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