POPULATION TRENDS OF LAND BIRDS ON EAST FOUNDATION RANCHES: AN ANALYSIS OF TEN YEARS OF DATA

A Thesis

by

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ABSTRACT

Population Trends of Land Birds on East Foundation Ranches: An Analysis of Ten Years of Data

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Bird surveys have been conducted on East Foundation properties in South Texas annually from 2010 to 2020 to document species occurrence, richness, and abundance. Both breeding and non-breeding bird surveys have been conducted on San Antonio Viejo, El Sauz, and Santa Rosa properties. Non-breeding surveys were conducted from August–April through the use of transect surveys. During May and June, breeding bird point count surveys were conducted. The East Foundation properties have a unique mix of avian species and vast diversity of landscape types due to their varying locations. Large ranches in South Texas, such as the ranches owned by the East Foundation, help preserve large continuous tracts of land that are critical to the survival of birds during migration. Many private landowners understand the value of documenting trends and managing for non-game birds on their property; however, few long-term bird studies exist from the ranchlands of South Texas. Long-term data sets of 10 years or longer are relatively rare, yet such data can provide unique insights into population dynamics and processes.

Two-hundred and twenty-three species were documented on the East Foundation ranches throughout the study period. However, only 52 of these species were detected frequently enough to establish population trends.

DEDICATION

For Dad who sparked my interest in the outdoors and nature from the very beginning.

For Mom who spent 20+ years answering all my weird wildlife questions.

For Chi and Kathleen. Thank you for all your support despite having no idea what I was talking about for the last few years.

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CHAPTER I.

LITERATURE REVIEW

Grassland and aridland birds are at a critical point concerning the sustainability of their populations. Wild bird populations are under threat from a multitude of factors related to climate change, habitat fragmentation, invasive species, and human-caused disturbances. This has led to a crisis in not only grassland birds in North America, but all bird communities globally (Rosenberg et al. 2019). Organizations with large relatively unfragmented landholdings, like the East Foundation properties in South Texas, provide wildlife scientists with a unique opportunity to study population trends on a scale that is not typically available elsewhere. In the following chapter, I have provided a review of the literature illustrating how these factors impact bird populations.

The Importance of Long-Term Studies

Short-term studies have become the norm in ornithology. Studies of 1 to 3 years have become typical (Wiens 2016). However, it is rare that the same amount of information can be gathered in a three-year study versus a study that lasts an entire decade. Typically, this is due to the duration of a graduate student's project, which lasts anywhere from 2 to 4 years. In this study, instead of ending after one student graduated, observations have continued from student to student for twelve years, which resulted in a long-term set of data. Long-term data sets allow for insight into population dynamics and processes that only become visible when data is compiled over many generations of animals. Short-term studies of less than 5 years may lead to misleading results, especially when observing population dynamics. For example, many intermediate scale phenomena, such as population dynamics, require 5 to 10 years to thoroughly investigate (Wiens 2016).

This chapter follows the guidelines of the Bulletin of the Texas Ornithological Society

Monitoring

The goal of most monitoring projects is to make inferences about an ecological state, that can then be analyzed to inform management or conservation decisions (Nichols and Williams 2006). Nichols and Williams (2006) argued that monitoring should not be viewed as a stand-alone activity, but rather as a component of a larger process of either conservation-oriented science or management. Monitoring data should not be gathered with the hope that it should prove to be useful for conservation later. Monitoring is more effective if it focuses on gathering vital information for conservation purposes. Targeted monitoring is defined by its integration into conservation practice, with monitoring design and implementation based on a priori hypotheses and associated models of system responses to management (Nichols and Williams 2006).

Impacts of Climate Change on Bird Populations

The impact of climate on bird populations has long been a source of interest for ornithologists. However, the issue of climate change has only just started to be addressed. According to University of California-Davis Science and Climate website, climate change refers to the significant changes in global temperature, precipitation, wind patterns, and other measures of climate that occur over several decades or longer (University of California-Davis 2018). A substantial body of evidence suggests that climate change has influenced the conditions of bird foraging sites, breeding times, and migration patterns (Franks et al. 2017; McKechnie et al. 2012; Both et al. 2010). Changing weather patterns, thought to be due to climate change, have caused an increasing number of extreme weather events including extended periods of freezing temperatures and drought, which can be detrimental to bird populations (Conradie et al. 2019; Albright et al. 2017).

A growing body of evidence identifies temperature as the main driver of phenological responses (Cohen et al. 2018; Usui et al. 2017). The impact of climate change on temperature may also be responsible for shifting the distribution of species. As the climate changes, the timing of seasonal activities of some organisms has been changing in response (Brown et al. 2016; Thackeray et al 2016; McKechnie et al. 2012), and a lack of synchronicity between the hatching and peak prey abundance can cause negative impacts on populations (Kwon et al. 2019). If a chick hatches after peak food abundance it is likely that its growth rate would be less than that of an individual that hatched at peak food abundance, leading to a less fit individual (McKinney et al. 2012). Long-distance migrants are hypothesized to be at the greatest risk from this asynchrony (Ockendon et al. 2013; Franks et al 2017). Despite the advancement of laying dates, long-distance migrants may still be missing peak food abundance (Franks et al. 2017). While it appears that this asynchrony has an impact, the magnitude of the impact on the population dynamics of birds is unclear (Dunn and Møller 2014; Pearce-Higgins and Green 2014).

According to the National Audubon Society's 2019 report, Survival by Degrees, there are 389 species of birds on the brink of extinction. Furthermore, shrinking and shifting geographic ranges could put more than half of the species in North America at risk (National Audubon Society 2019). This loss of range occurs without any subsequent range expansion for 126 species. The Central Flyway, which stretches from the Rocky Mountains to the Western Gulf Coast, encompasses more than half of the continental United States landmass, and over 400 species of birds are estimated to use this migratory route (Johnsgard 2012). Of these species over 200 hundred are considered highly or moderately vulnerable this means that these birds may lose more than half of their current range (National Audubon Society 2019). Texas has 28 species that

are highly vulnerable and 48 that are moderately vulnerable. In South Texas, drought and urbanization are the biggest threats, and a changing climate is exacerbating these effects (Miller et al. 2018; Lipschutz 2016). In Texas, the Eared Grebe (Podiceps nigricollis) and Horned Grebe (Podiceps auratus) lost 100% of their summer range and lost 33% and 46% of their winter range, respectively. Species like Wild Turkey (Meleagris gallapavo), Osprey (Pandion haliaetus), Black Vulture (Coragyps atratus), Sandhill Crane (Grus canadensis), and Golden-Fronted Woodpecker (Melanerpes aurifrons) are common species in South Texas that are potentially at risk of becoming threatened due to the effects of urbanization and drought (National Audubon Society 2018).

Human-Caused Disturbance

With the increasing population growth of the United States, urbanization has increased drastically. It is expected that by 2030 urban land cover will triple what it was in 2000 leading to the potential loss of threatened habitat (Seto et al. 2012). While urban areas can support a high density of birds, the surrounding areas with wild, native vegetation usually contain higher levels of diversity and species richness (Emlen 1974; Lancaster and Rees 1979). Retaining native vegetation in urban areas is vital for maintaining biodiversity, and the introduction of native plants into previously disturbed sites has a positive effect on the number and diversity of native bird species (Swab et al 2017). Beninde et al. (2015) determined that these patches of vegetation needed to be >50 ha to retain threatened and urban-sensitive species.

Fragmentation of natural landscapes is often detrimental to biodiversity because it involves the removal, reduction, and isolation of native vegetation (Smith et al. 2011). Relevant habitat fragmentation threats for bird populations include increased competition with competitive or predatory exotics, (Grimm et al. 2008), heightened disturbance from human activity (Pena et

al. 2017; Mc Donald, Marcotullio, and Güneralp 2013), and restricted dispersal corridors (Hong et al. 2012). Since it is unlikely that habitat fragmentation will decrease, managers must figure out how to maintain wildlife on the fragmented landscapes (Mc Donald, Marcotullio, and Güneralp 2013).

In an attempt to reduce the human impacts on the earth, there have been calls to move to more renewable energy sources (United States Department of Energy 2021). Wind turbines seem like an excellent substitute for the use of fossil fuels to generate electricity. Although wind energy is a renewable resource, it still greatly impacts bird and bat populations directly, through collisions with turbines, and indirectly through disturbance (Arnett et al. 2016; Marques et al. 2014). Individual turbine characteristics can also influence the rate of mortalities. Turbine height, blade length, blade appearance, tip speed, and lighting seem to have the greatest influence on mortality (Kuvlesky et al. 2010). As the push for more renewable energy increases, and more wind farms are erected, these small numbers of bird deaths at wind farms can contribute to large cumulative mortality for migratory birds along their flyways. In 2003 there were approximately 17,500 operating wind turbines in the United States. Based on the average number of collisions per turbine calculated by the USDA Forest Service (2.11 birds/turbine/year), it was predicted that there would be 20,000 birds killed on average by wind turbines every year (Erikson et al. 2005). In 2015 there were roughly 49,000 wind turbines present across the United States, which led to an increase in bird deaths due to wind turbine collisions to approximately 500,000 birds per year. With the exponential increase in the production of wind energy, particularly along the Central Flyway of the Texas Gulf Coast, bird mortality is expected to rise to 1.4 million birds/year (Smallwood 2013). The small number of mortalities at each turbine may not seem significant immediately, however, when you multiply that by thousands of turbines across the United States

it can be detrimental to all bird populations, especially those that are already threatened or endangered. Multiple measures have been recommended to mitigate turbine collisions, such as using radar to forecast peak bird migration times when turbines should be turned off (Smallwood and Bell 2020, Van Doren and Horton 2018) and changing the colors of turbine blades to minimize "motion smear" (May et al. 2020).

Window collisions may cause up to 1 billion bird deaths per year. Like wind turbines, bird mortality from collisions with windows generally have small negative impacts at the local scale but compounded effects across the continental scale (Hager et al. 2017). Bird-window collisions are a function of building size and window area, urbanization, land cover, and lighting. Larger buildings tend to have higher mortalities overall, but what was unexpected was that large buildings in regions of low urbanization that were surrounded by open areas of landscaped vegetation had the highest bird-window collision mortalities (Hager et al. 2017). Increasing the native vegetation in an urban area, like mentioned in the previous paragraphs, may contribute to an increase in bird-window collisions. There is a potential tradeoff between providing additional habitat in urban areas and the native vegetation acting as an ecological sink.

Building lighting may also play a role in bird-window collisions as it acts as an attractant at night (Van Doren et al. 2017) In a study done at Texas A&M University-Kingsville it was noted that the building with the most frequent collisions was the Student Recreation Center. The Student Recreation Center had large windows, large lawns, and lights were kept on throughout the night, making it a hot spot for bird-window collisions (Slifka and Conkey 2018). Research is still being conducted on the best methods to mitigate these collisions. Currently, popular mitigation measures include anti-reflective materials on windows (Barton et al. 2017, and the National Audubon Society's Lights Out campaign (National Audubon Society 2020). There is

likely no “one size fits all” mitigation method. It will likely take a combination of methods to make a significant impact on mortalities from bird-window collisions (Martin 2011).

Another human impact that is typically overlooked is the feeding of wild birds. Feeding birds has long been a popular pastime in both the United States and the United Kingdom. In the United States, approximately 43% of households regularly feed birds (Martinson and Flashpoler 2003) while in the United Kingdom, the figure is closer to 75% (Cowie and Hinsely 1988). Even though food can be a limited resource and supplementary feeding can reduce starvation risk and potentially improve reproductive success (Newton 1998), it may not always have a positive outcome. Since large quantities of birds may gather at a feeding source at one time, it may be an easy way to spread disease. Additionally, if a large quantity of prey were present in one location there could be an increased predation risk around the feeding site (Robb et al. 2008). Potentially, feeders could also act as ecological traps by providing inaccurate information regarding the quality of the habitat (Robb et al. 2008)

Wildlife Habitat Manipulation in South Texas

The largest change over the last 150 years on the landscape of South Texas has been the encroachment of woody vegetation coupled with the loss of native grasses (Archer et al. 2017). Grasslands are one of the most rapidly changing landscapes, and the species that depend on those landscapes are threatened by these rapid changes (Correll et al. 2019). It is estimated that at least 74% of grassland bird species are in decline (Rosenberg et al. 2019). Widespread loss and degradation of grassland habitats on breeding grounds and continued use of certain toxic pesticides likely contributed to this decrease in grassland bird populations (Rosenberg et al. 2019). While it is widely assumed that the breeding ground degradation is what is causing the population decrease, degradation is taking place on the wintering grounds too. However, most