

**Declining Population Trends of the Lesser Prairie-Chicken in the Southern Great Plains**

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GEOG 445: Biogeography

Dr. Laura Moley

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For our course Biogeography (GEOG 455), groups were tasked with researching a topic related to biology, ecology, or geography. Many of our group members were interested in endangered and at-risk species, particularly birds. To select a species that would be both interesting and engaging to the audience, we utilized several library resources to do background research on potential topics. Namely, we used the Kansas State University Research Guide Library Database where we accessed the site *Birds of the World* by Cornell University. In order to narrow our options, we utilized different searching techniques, including filtering for location. It was important to our group that we focus on a bird species native to Kansas. We selected the lesser prairie-chicken (*Tympanuchus pallidicinctus*) as our focal species due to its status as Vulnerable under the IUCN Red List of Endangered Species. We chose the lesser prairie-chicken because we wanted to cover an animal that lived relatively near Manhattan, and lesser prairie-chickens are an important indicator of the health of the native grasslands they inhabit. We centered our project around the reasons behind lesser prairie-chicken decline and the conservation steps that are being taken to help recover their populations.

In order to find information on the causes of prairie-chicken decline, we utilized several different research strategies. Each group member used different search engines and databases to find a wide array of sources. This method worked well and yielded a variety of sources that pertained to our project. For example, in our search for studies relating to prairie-chicken genetic drift, we utilized K-State's library database to access *ProQuest Central*, which yielded a study by Kelly Corman (2011) called, "Conservation and landscape genetics of Texas lesser prairie-chicken: Population structure and differentiation, genetic variability, and effective size." This study contained valuable information on the genetic makeup of different prairie-chicken populations and how habitat fragmentation can lead to a loss of genetic variability. This source

helped to further our understanding of the threats facing prairie-chickens and led us to ask deeper questions such as how prairie-chickens are affected by inbreeding and hybridization.

Throughout the research phase of our project, we relied heavily on a variety of library research tools. When selecting a database or search engine, we were very deliberate in using sites that would produce accurate information. After searching the K-State Library Database for reputable sources, we decided to use two search engines: *Google Scholar* and *ProQuest Central*. These search engines lead us to a variety of peer-reviewed studies relating to the prairie-chicken and proved to be essential to the success of our project. Both search engines were invaluable, as it can be difficult to determine if a source is trustworthy or not. However, these databases helped us sort out unreliable research and focus on genuine sources. In addition to *Google Scholar* and *ProQuest Central*, we also utilized various government websites, including the *National Oceanic and Atmospheric Administration* (NOAA), the *U.S. Fish and Wildlife Service*, and the *Natural Resources Conservation Service* (NRCS). We also used a few specific databases that could only be accessed through the K-State Library Database page. Those databases were the *Wiley Online Library Database*, the *JSTOR Biological Sciences Collection*, and the *BioOne Digital Library*. These sites gave us a lot of valuable background information on lesser prairie-chickens and the conservation programs that are in place to protect them. To keep track of all the sources we found, we created a shared Microsoft Excel file where we organized our findings based on where they were from and what information they provided.

In general, finding information and recent research on lesser prairie-chickens was a bit of a challenge. Due to anthropogenic forces, these birds have been fragmented into several small populations. Therefore, little research has been conducted on them compared to other, more widespread species. In order to find reputable information, we turned to sources that we knew

would contain information about this species. Cornell University's website *All About Birds* was very useful in providing us with an abundance of background information, and the aforementioned government websites contained information on programs that are centered around prairie-chicken conservation. Finding studies relating to prairie-chicken decline was slightly more challenging. Initially, on *Google Scholar* and *ProQuest Central*, we searched for papers about lesser prairie-chickens. However, it soon became apparent that this was ineffective. Many of the papers we found either mentioned prairie-chickens in passing or were studies that did not apply to our project goals. In order to narrow our search, we had to alter our filtering methods. To do this, we utilized background information from the *All About Birds* website, which stated that lesser prairie-chickens are at risk due to habitat loss and inbreeding. This information helped us to better exploit the filter function on our search engines, leading us to other, more useful studies. This change proved to be very effective, and we found a variety of papers describing how habitat loss and inbreeding led to the decline of the lesser prairie-chicken.

In the end, we used a vast assortment of library research tools to aid us in our search for reputable sources. The K-State Library Database was incredibly useful in leading us to helpful search engines such as *Google Scholar* and *ProQuest Central*. Our clear goals for our project helped us to develop a robust research strategy that included finding background information, identifying useful sources, and applying the information we learned to our project. And by using well-developed searching techniques, we ensured that we would find the information necessary for our project. The variety of library research tools at our disposal were vital to our success, and the strategies we developed to utilize these resources will prove invaluable as we continue with our undergraduate studies at Kansas State University.

# Declining Population Trends of the Lesser Prairie-Chicken in the Southern Great Plains

Presented by: Maddie Willson, Natalie Miller, Mikaela Jackson, and Kenzie Davis

## Specific Research Topic:

The decline of the lesser prairie-chicken

## Geographic Location:

Southern Great Plains

## Time Frame:

1989 - Present Day



Source: "Prairie Chicken" by Dan Wundrock, public domain, via Wikimedia Commons.



Source: "Lesser Prairie Chicken (Tympanuchus pallidicinctus) (20163767618)" by Ron Knight, CC BY 2.0, via Wikimedia Commons.

# Table of Contents

Background Information.....	3
Lesser Prairie-Chicken Description.....	3
Lesser Prairie-Chicken Habitat.....	4
Lesser Prairie-Chicken Lifestyle.....	5
Importance.....	6
Habitat Degradation.....	7
Agriculture/Fragmentation.....	7
Fires/Woody Encroachment.....	8
Wind Energy.....	9
Oil and Gas Production.....	10
Loss of Genetic Variability.....	11
Habitat Fragmentation.....	11
Habitat Loss.....	12
Genetic Drift/Inbreeding.....	13
Hybridization.....	14
Conservation.....	15
Population.....	16
Conclusion.....	17
Bibliography.....	18

# Background Information

- The lesser prairie-chicken (*Tympanuchus pallidicinctus*) is a medium-sized, pale gray-brown grouse, similar in size to a crow.
- Order: Galliformes
- Family: Phasianidae
- It has barred brown and white plumage, rounded body and tail, small head and bill, and broad, rounded wings.
- Males have elongated pinnae, bright yellow combs above the eyes, and dull red esophageal air sacs on the sides of their necks.
- Females and juveniles have a pale throat and eye line, and have shorter pinnae (Center for Biological Diversity).

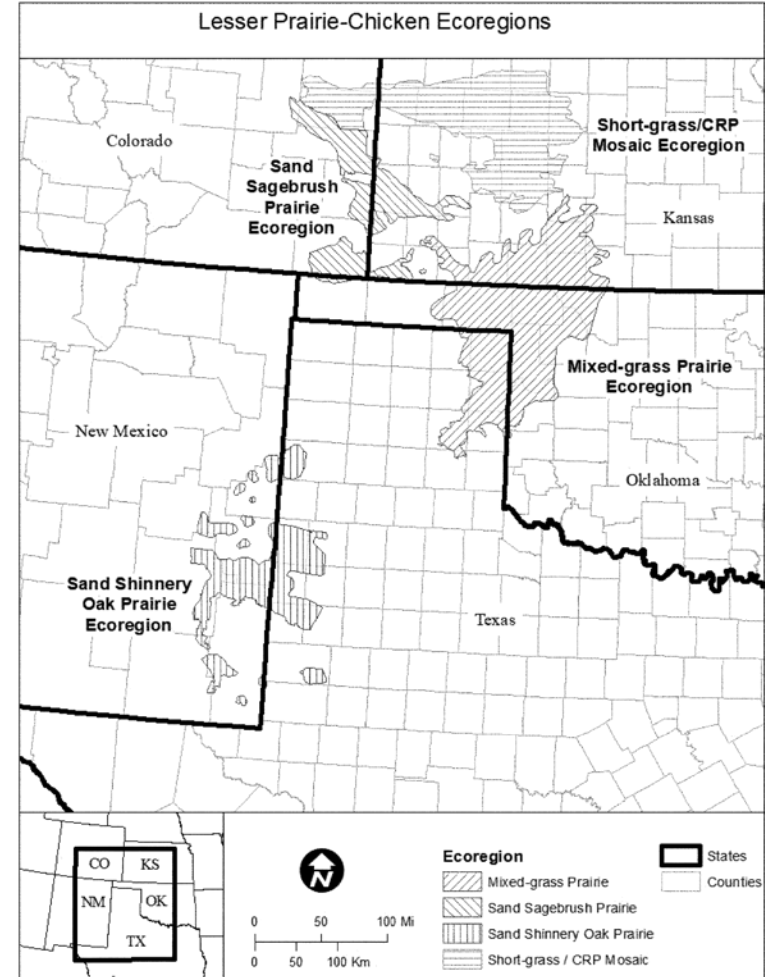
Source: "Lesser Prairie-Chicken" by Alex Eberts, CC BY 2.0, via Macaulay Library.



Source: "Lesser Prairie-Chicken" by Zach Millen, CC BY 2.0, via Macaulay Library.

# Background Information

- Lesser prairie-chickens live in two distinct areas of the southern Great Plains in shortgrass prairies, where shinnery oak, sand sagebrush, and bluestem grasses are most common (U.S. Fish and Wildlife Service, 2022, p. 72674; The Cornell Lab of Ornithology).
- They need large areas of intact native grasslands, often over 20,000 acres (Center for Biological Diversity).
- Their original range stretched across vast quantities of the southern Great Plains, through Kansas, Colorado, Oklahoma, New Mexico, and Texas (The Cornell Lab of Ornithology).
- Due to sharp population declines, lesser prairie-chickens inhabit only a fraction of their original range.
- They can only be found in small pockets stretched across the five states (U.S. Fish and Wildlife Service, 2022, p. 72674).
- Main reasons for their decline: habitat loss from overgrazing, agriculture, oil and gas extraction, fire, woody encroachment, wind farms, and loss of genetic diversity. (Center for Biological Diversity).



Source: U.S. Fish and Wildlife Service.



# Background Information

- Lesser prairie-chickens eat insects, leaves, seeds, buds, and cultivated grain. They peck the ground and visually search for food, similar to chickens (The Cornell Lab of Ornithology).
- Females usually build their nests in shinnery oak copses, in tall bunchgrass or sand sagebrush grasslands. The nesting area is typically rich with insects that young birds eat.
- Lesser prairie-chickens are most well-known for their breeding habits.
- Males gather in early spring on small leks, where they perform complex “booming” displays. They extend their yellow eye combs, raise their pinnaes, point their tail up, stamp their feet, click and fan their tail feathers, shake their wings, and inflate their red esophageal air sacs to create loud booming and cackling noises. They fight with other males to defend small patches of territory and perform “flutter-jumping” to catch females’ attention (The Cornell Lab of Ornithology).



Source: “Lesser Prairie Chickens” by Larry Lamsa, CC BY 2.0, via Flickr.



Source: “Lesser Prairie Chicken Fight” by Larry Lamsa, CC BY 2.0, via Flickr.

# Why is this important?

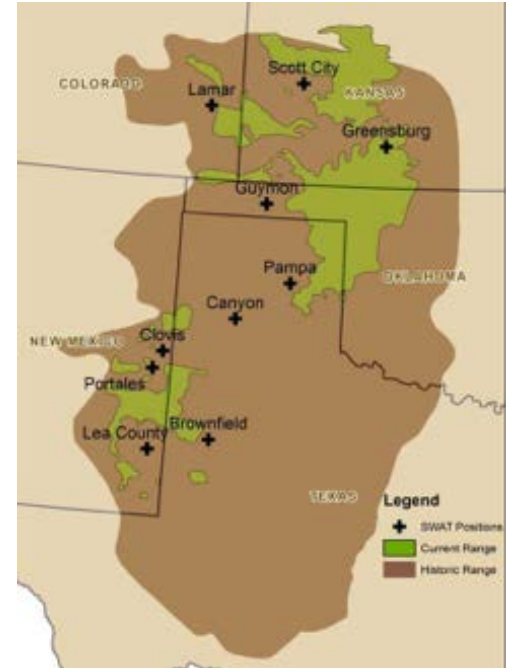
- What was the main contributor to the decline of the lesser prairie-chicken?
- Researchers studied the amount of male lesser prairie-chickens at lek grounds from 1965 - 2016, and found that populations remained consistently above 100,000 males until 1989 (U.S. Fish and Wildlife Service, 2022, p. 72674).
- An aerial survey from 2012 - 2022 that studied males and females found that only 32,000 remained over a period of five years (U.S. Fish and Wildlife Service, 2022, p. 72674).
- Due to loss of habitat, their historical range has diminished by 90% (Maestas, 2022).
- In 2022, the Northern DPS of the lesser prairie-chicken was listed as threatened, while the Southern DPS of the lesser prairie-chicken was listed as endangered (Maestas, 2022).
- The U.S. Fish and Wildlife Service is attempting to work with farmers and landowners to set up areas of critical habitat to allow lesser prairie-chickens to flourish again.
- However, lawmakers and energy producers have condemned these measures, stating that the conservation of a wide range of habitat necessary for lesser prairie-chickens would harm farmers, ranchers, and energy producers (Kite, 2022).
- Lesser prairie-chickens are an important bioindicator of the health of native grasslands due to the fact that they need such large areas of habitat to survive.
- The declining population of the lesser prairie-chicken represents the poor health of native grasslands and prairies as a whole.



Fig. 1: A map of the current and historical range of the lesser prairie chicken from 1989 to present day. Source: Author's map (Data: USFWS)

# Habitat Degradation-Agriculture/Fragmentation

- “Large-scale declines of grassland ecosystems in the conterminous United States have led to substantial loss and fragmentation of lesser prairie-chicken habitat and decreased their range and population numbers by 85%,” (Verheijen et al., 2021).
- “Previous estimates of breeding season space use are largely limited to one of the four currently occupied ecoregions, and extrinsic drivers of breeding space use, such as landscape fragmentation, and vegetation structure and composition, can show large spatial variation,” (Verheijen et al., 2021).
- Their breeding season space is a crucial component to lesser prairie-chicken conservation, it can affect their local carrying capacity and their population dynamics, (Verheijen et al., 2021).
- Habitat needs vary among lekking/prelaying, nesting, and post-breeding stages of their breeding season, space used by female lesser prairie-chickens during this time remains unclear.



Source: Wildlife Conservation 101

# Habitat Degradation-Fires/Woody Encroachment

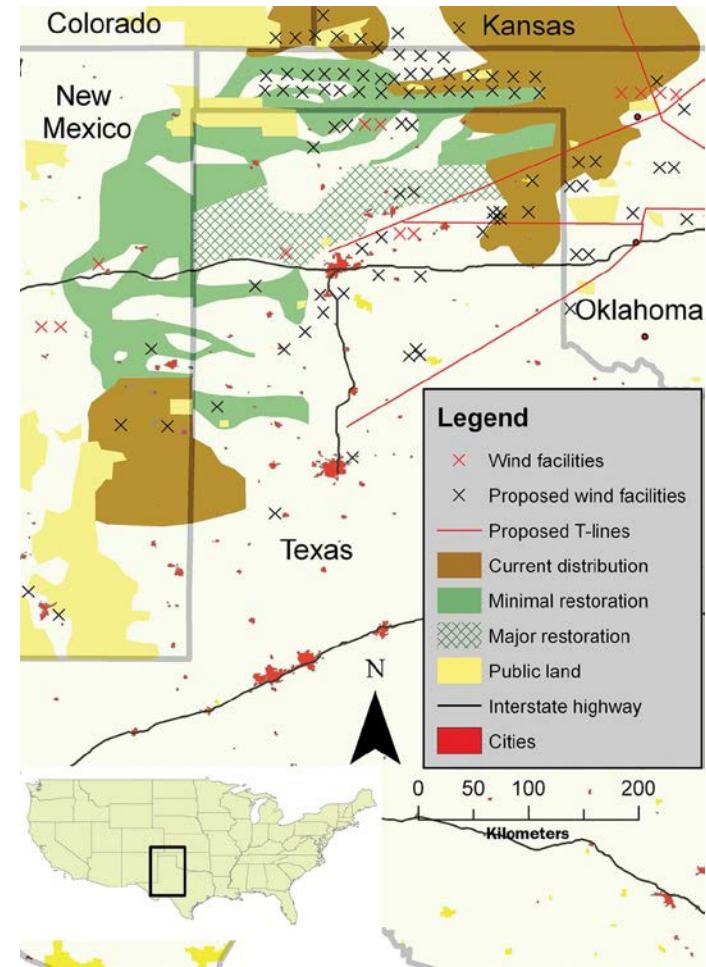
- Across the western Great Plains in North America, natural fire has been removed from grassland ecosystems, decreasing vegetation heterogeneity and allowing woody encroachment, (Lautenbach et al., 2021).
- “The loss of fire has implications for grassland species requiring diverse vegetation patches and structure or patches that have limited occurrence in the absence of fire,” (Lautenbach et al., 2021).
- They require heterogeneous grasslands throughout its life history and fire has been removed from much of its occupied range.
- “Patch-burn grazing is a management strategy that reestablishes the fire grazing interaction to a grassland system, increasing heterogeneity in vegetation structure and composition. Patch burn-grazing may be a viable management tool to restore lesser prairie-chicken habitats,” (Lautenbach et al., 2021).



Source: Oklahoma Conservation

# Habitat Degradation-Wind Energy

- “A possible new threat to lesser prairie-chickens is the rapid development of wind-energy facilities throughout their habitat,” (Pruett et al., 2009).
- Wind-energy or wind power is mostly the use of wind turbines to generate power or electricity.
- Lesser prairie-chickens are found in states with the highest wind energy development.
- These facilities could serve as barriers to movement if they avoid the wind turbines, which will restrict their habitat, (Pruett et al., 2009).
- “Potential habitat connection do exist between Texas, Colorado, Kansas, and New Mexico, but almost all of this area is privately owned and would require habitat restoration,” (Pruett et al., 2009).
- Without a concerted effort, lesser prairie-chickens will likely disappear, and the land that they depend on.



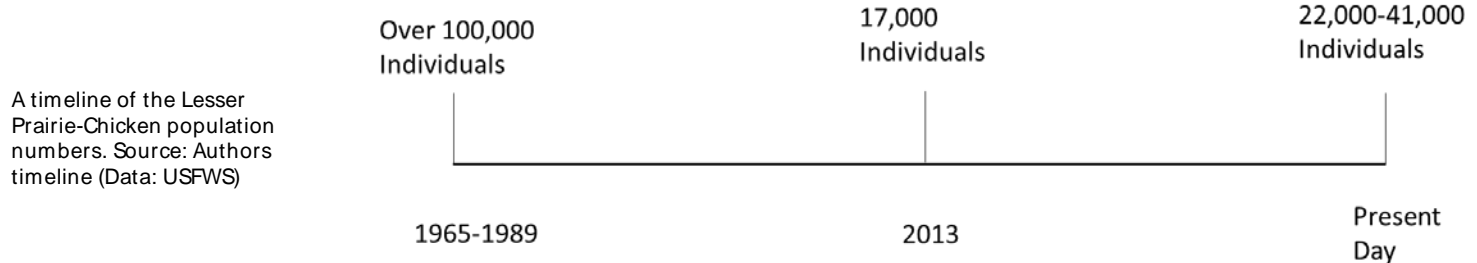
Source: BioScience

# Habitat Degradation-Oil and Gas Production

- As the oil and gas industry continues to expand in the Southwest, it has encountered the lesser prairie-chicken, (Campbell et al., 2015).
- “The species range includes Eastern New Mexico, Colorado, West and Northwest Texas (which are important areas for oil and gas production), Western Oklahoma, and Kansas,” (Campbell et al., 2015).
- “Given their preference for low-vegetation landscape, they avoid tall structures such as drilling equipment, telephone poles, and wind turbines. They are also low flying birds and may collide with relatively low obstructions,” (Campbell et al., 2015).
- “They tend to migrate or die off if more than 30% of the area has been disrupted, abandoning their lekking grounds when oil and gas activity is nearby,” (Campbell et al., 2015).

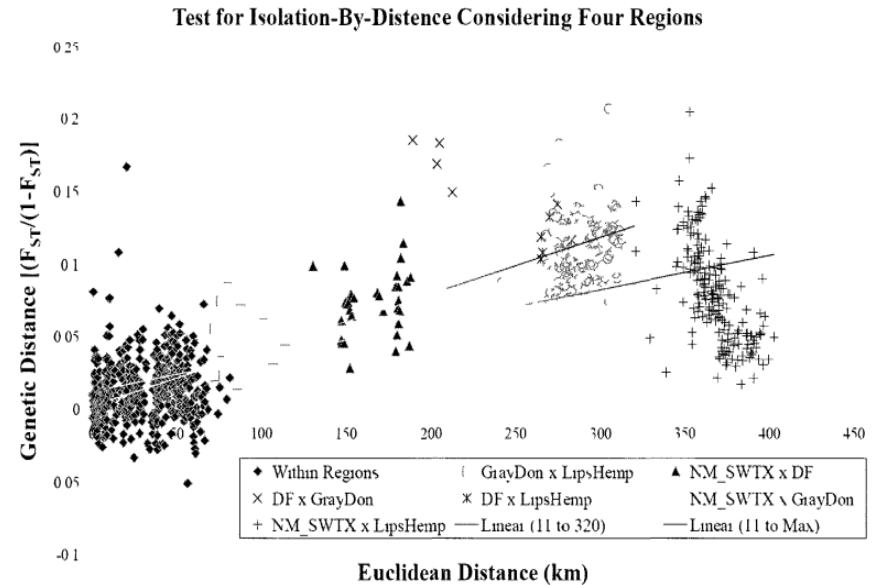


Source: Kansas State University



# Loss of Genetic Variability due to Habitat Fragmentation

- Habitat fragmentation separates populations, making it difficult for separate populations to access one another
- This can lead to a loss of genetic diversity as individuals are forced to interbreed, (Cormen, 2011).
- Studies have been done to determine the genetic diversity of lesser prairie-chicken populations. More specifically, researchers isolated nuclear microsatellites and mitochondrial DNA sequences to attempt to assess the genetic structure of different populations in order to determine their genetic variability and effective population size, (Cormen, 2011).
- Isolated populations are experiencing lower rates of genetic diversity at a rapid rate, (Cormen, 2011).
- Larger, connected populations are still exhibiting high genetic diversity, (Cormen, 2011).



Graph from Cormen, 2011. As geographic distance (km) increases so does genetic distance

# Loss of Genetic Variability due to Habitat Loss

- As less habitat becomes available due to habitat loss and degradation the amount of lek space decreases.
- A study investigated the genetic structure of lesser prairie-chickens in four closely spaced leks, (Bouzat and Johnson, 2004).
- The study found that closely spaced leks had higher degrees of homozygosity in microsatellite loci and mitochondrial DNA. This indicates a higher degree of inbreeding within these leks, (Bouzat and Johnson, 2004).
- Less lek space also leads to lowered dispersal rates and increased site-fidelity in male birds, leading to increased cases of inbreeding, (Bouzat and Johnson, 2004).

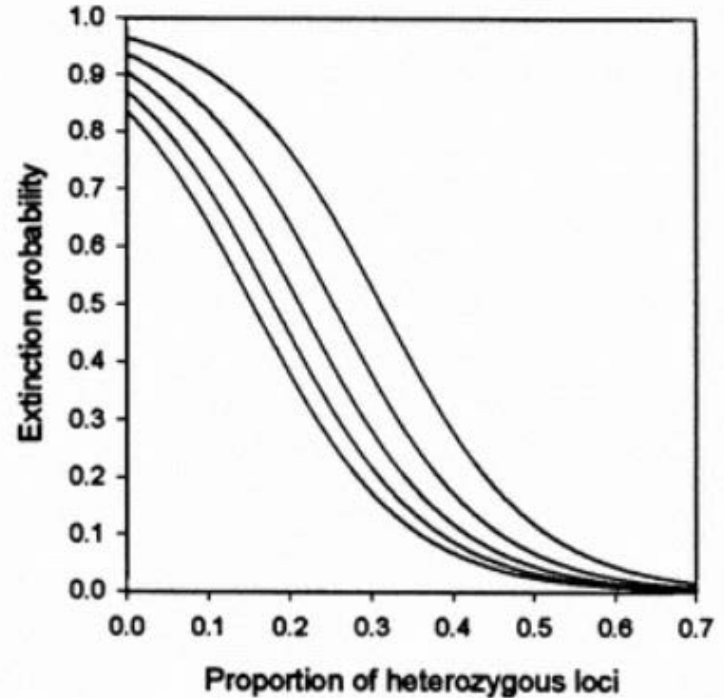


Source: USDA



# Negative Effects of Genetic Drift and Inbreeding

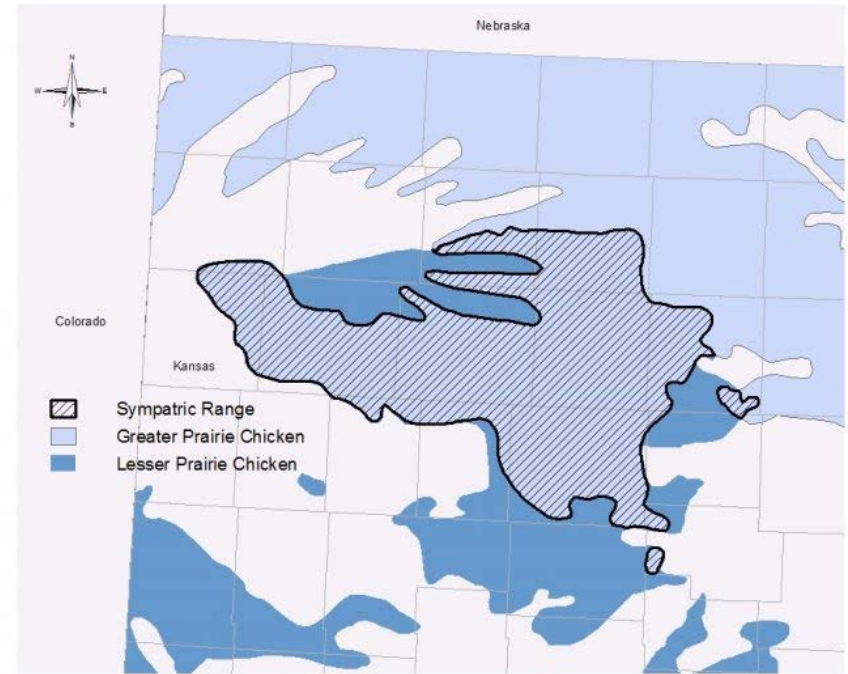
- High rates of inbreeding can lead to increases in homozygosity, which can be detrimental to populations, (Bouzat and Johnson, 2004).
- Increased homozygosity can lead to loss of fitness among individuals, which can be correlated with an increased risk of extinction, (Saccheri et al. 1998).
- Increased extinction risk due to a loss of genetic variability will only increase the rate of population loss and further the effects of habitat loss due to the decreased adaptability and fitness of the species, (Saccheri et al. 1998).



Source: Saccheri et al. 1998

# Hybridization

- As lesser prairie-chicken populations have declined conservation areas have been created in order to increase their numbers. In some cases this has led to expansions outside of their historical range. This has led to increased overlap between the lesser and greater prairie-chicken populations in western Kansas, (Oyler-McCance, 2016).
- A study found that at some sites contained birds with genes indicative of hybridization, (Oyler-McCance, 2016).
- Hybridization between these two species could complicate the listing of certain populations under the ESA, as hybrids are historically hard to list, especially if hybridization occurs due to anthropogenic factors, (National Oceanic and Atmospheric Administration).



Source: Oklahoma University

# Conservation

The most effective way to conserve the lesser prairie-chicken is through creating and restoring habitat through the use of:

- Prescribed burns
- Brush management
- Food plots
- Prescribed grazing
- Reintroduction of native plant species

(U.S. Department of Agriculture & Natural Resources Conservation Service, 2011)



*Lesser prairie-chicken habitat in a sand sagebrush mosaic found in Oklahoma.  
Photo by Steve Tully, NRCS.*

Source: NRCS

# Conservation

- Privately owned land and ranches hold the best hope for habitat restoration, (Nasman et al., 2022).
- 95% of current prairie-chicken populations live on privately owned land, (Nasman et al., 2022).
- “Based on aerial surveys, biologists estimate the lesser prairie-chicken numbers about 29,000, a 25 percent increase from 2014,” (Nasman et al., 2022).

# Conclusion

Habitat loss and degradation through fragmentation, woody encroachment, and loss of genetic diversity have taken a major toll on the Lesser Prairie-Chicken population. However, through habitat management and restoration the prairie-chicken population can be successfully expanded.



Source: NRCS

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