

Science Informs Managing Working Lands for Lesser Prairie-Chickens

CEAP Wildlife Component – Charlie Rewa

Kansas State University studies – David Haukos

Q&A



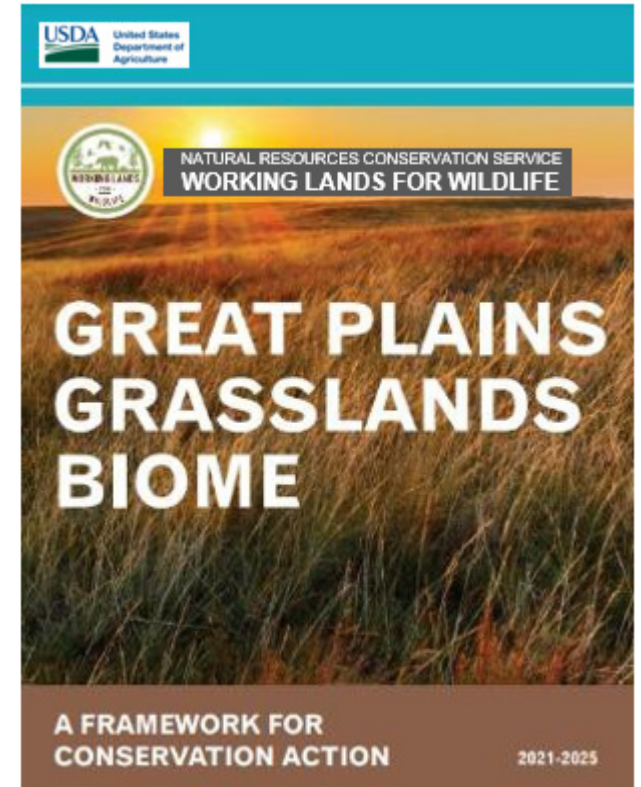
NRCS Outcomes Webinar June 23, 2022



Conservation Effects Assessment Project (CEAP)

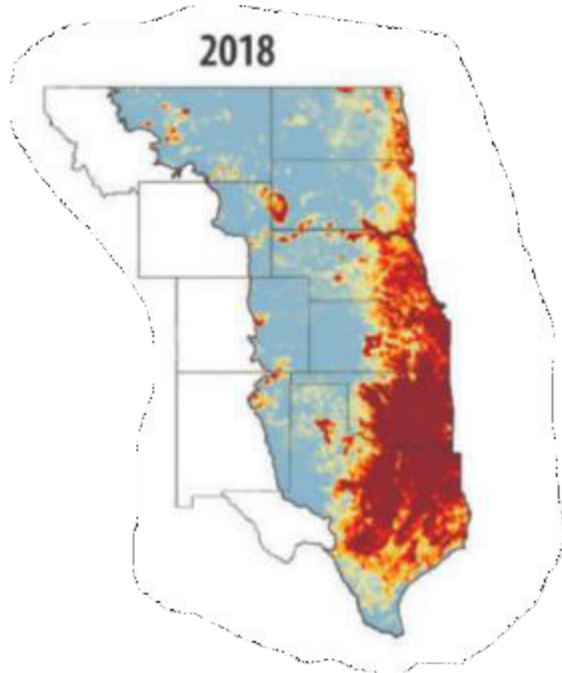
Wildlife Component

- Document F&W outcomes and inform delivery
- Collaborates across NRCS to identify assessment priorities
- Relies on cooperative partnerships with fish and wildlife science community
- Assess outcomes of NRCS Working Lands for Wildlife, including Lesser Prairie-chicken
- Science tied to ***Great Plains Grasslands Biome: A Framework for Conservation Action***

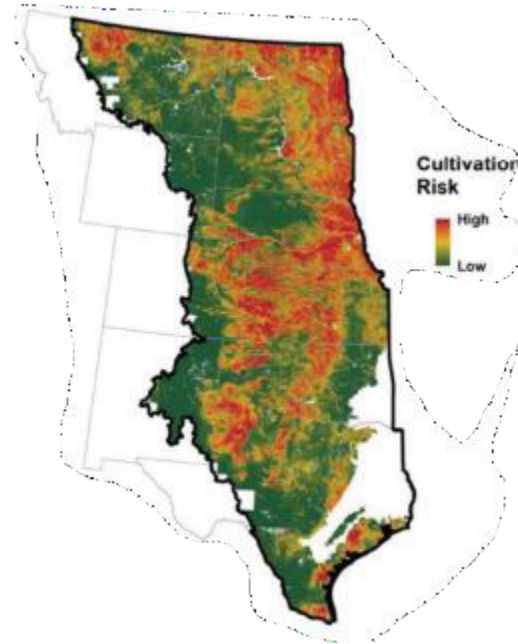


Framework vision: *Wildlife Conservation Through Sustainable Ranching*

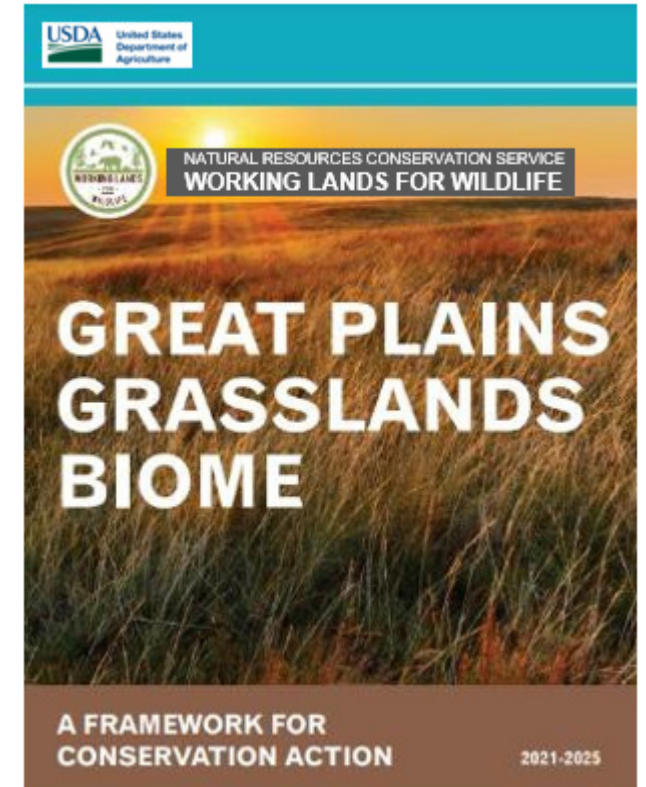
- Strategic, targeted delivery of Farm Bill conservation programs to address threats at scales that matter



Woodland Expansion



Land Use Conversion





**Science Informs Managing Working Lands
for Lesser Prairie-Chickens**

David Haukos
Kansas Cooperative Fish and Wildlife Research Unit
Kansas State University, Division of Biology

Photo credit: Jonathan Lautenbach

Iconic Species of the Southwestern Great Plains

Range includes mid-grass prairie, short-grass prairie, sand sagebrush prairie, and sand shinnery oak prairie

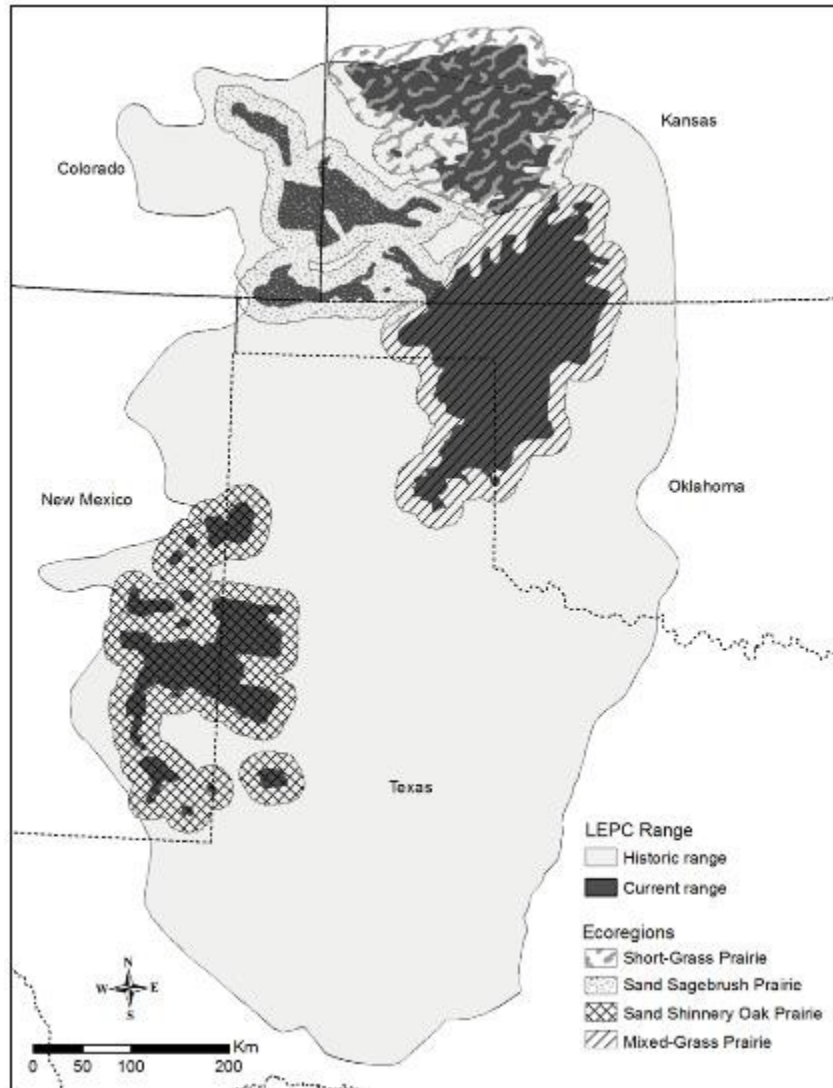
Needs large prairie landscapes to persist – size for a sustainable population is uncertain

Range is characterized by an extreme environment and climate – frequent intense drought, wide temperature range

Grazing is the dominant land use in occupied areas

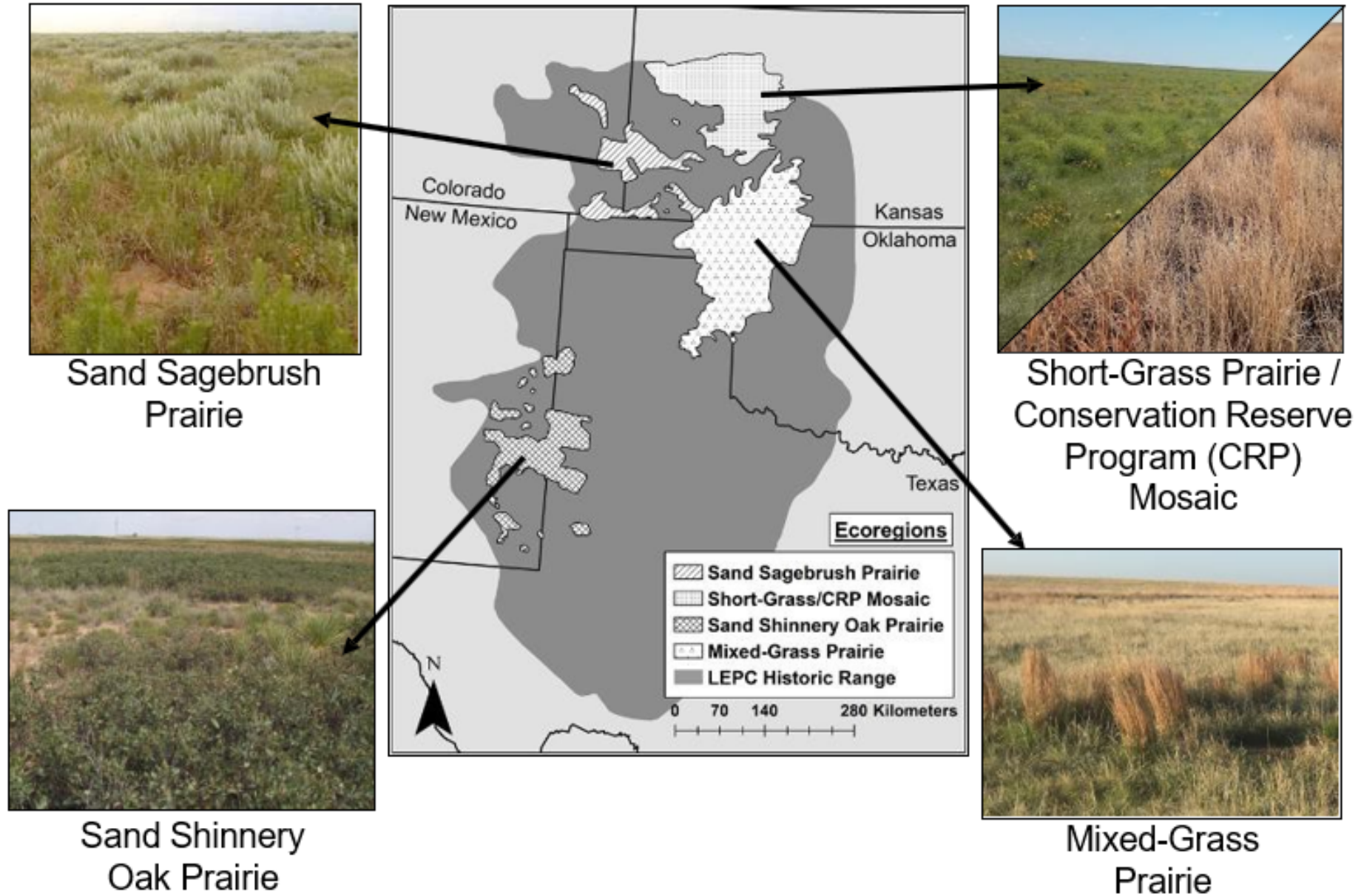


Lesser prairie-chicken historical and current occupied range

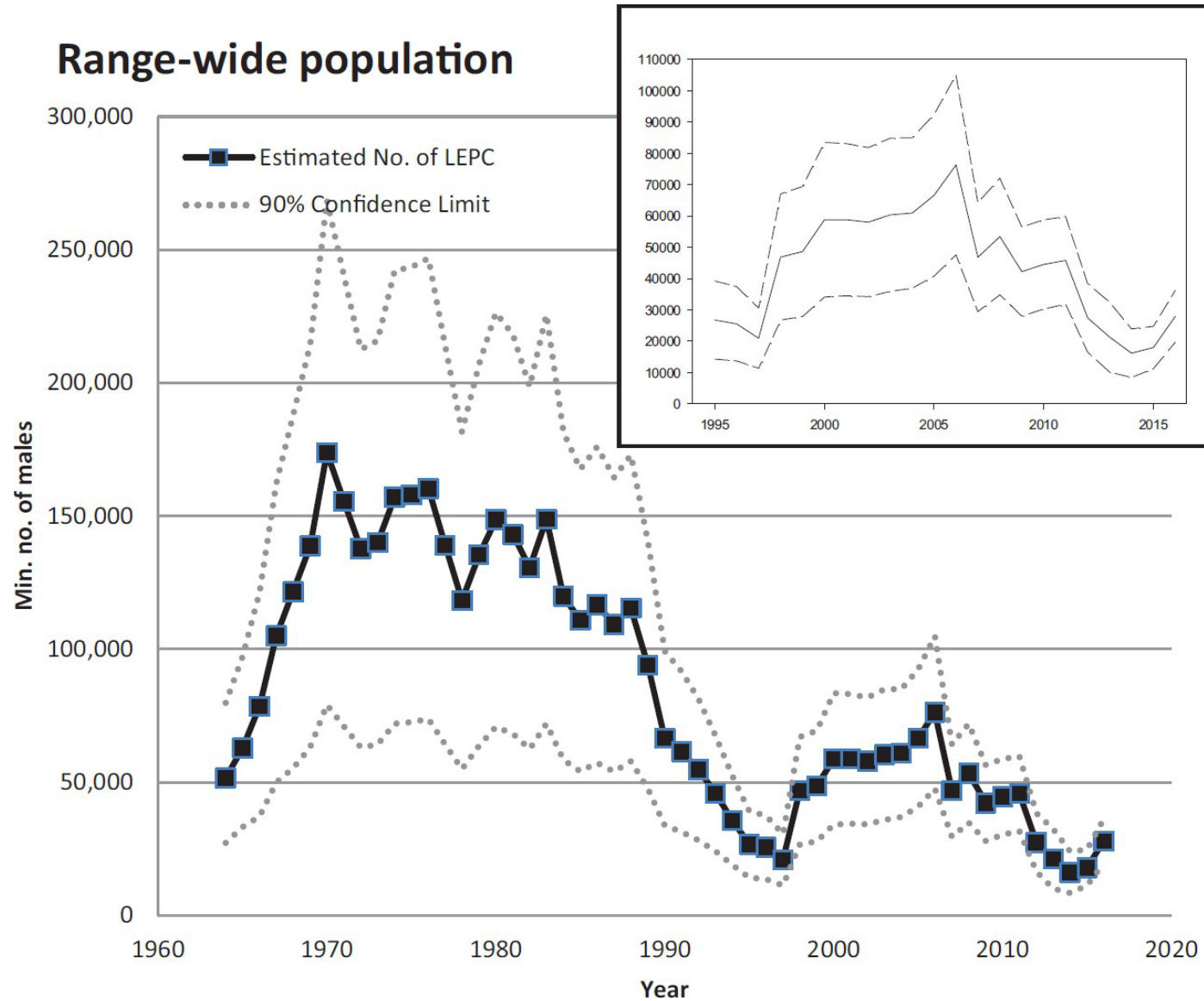


- *McDonald et al.* defined occupied lesser prairie-chicken range as 4 ecoregions
- ~2/3 of extant lesser prairie-chicken range in Kansas
- >90% of extant lesser prairie-chickens in Kansas
- Each has unique landscapes and different threats to lesser prairie-chicken populations

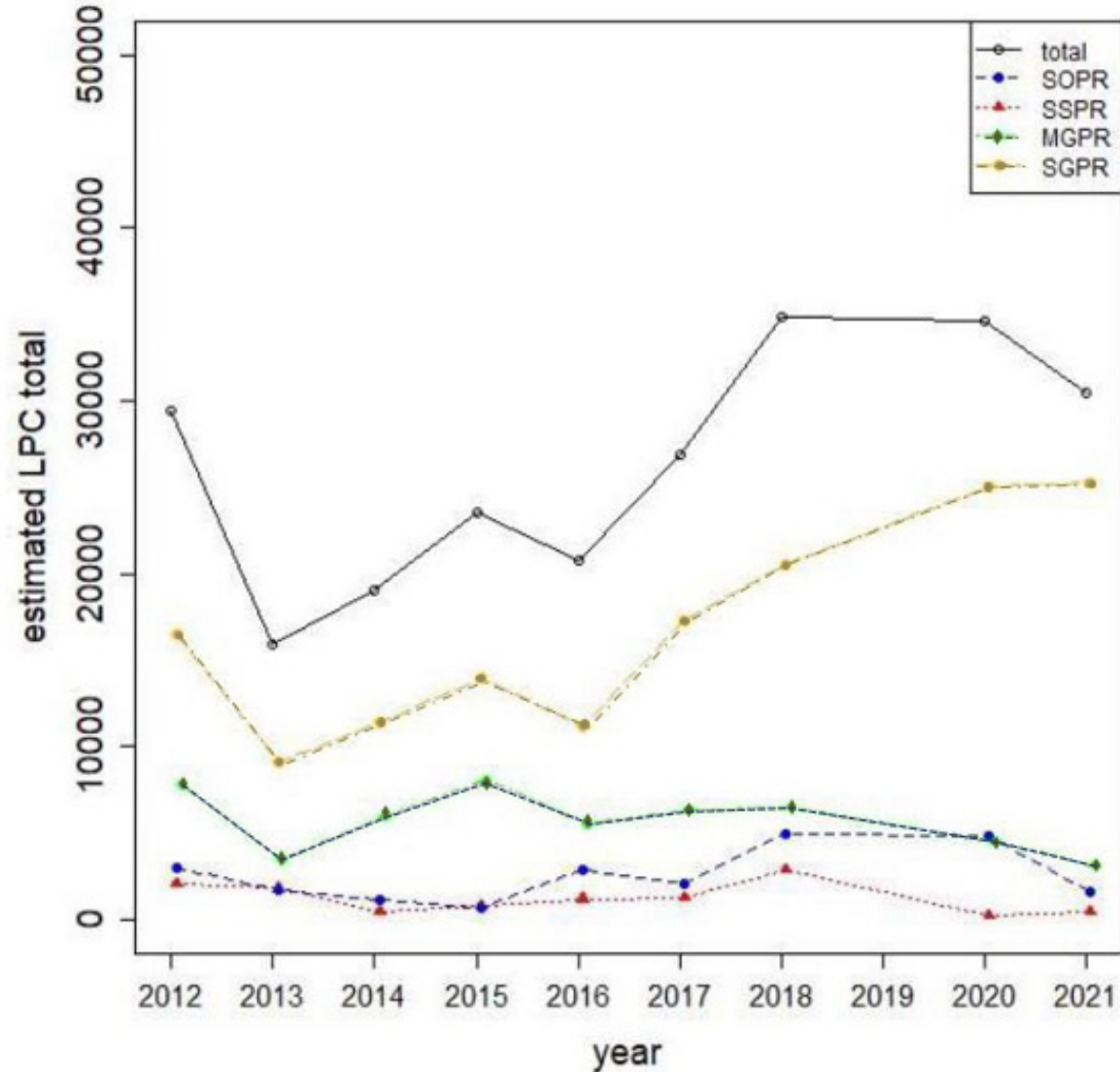
Lesser Prairie-Chicken Distribution



Lesser prairie-chicken population trends



Lesser prairie-chicken estimated population trends based on aerial surveys 2012-2021



Total = Entire population

SOPR = Sand Shinnery Oak
Prairie Ecoregion

SSPR = Sand Sagebrush Prairie
Ecoregion

MGPR = Mixed-Grass Prairie
Ecoregion

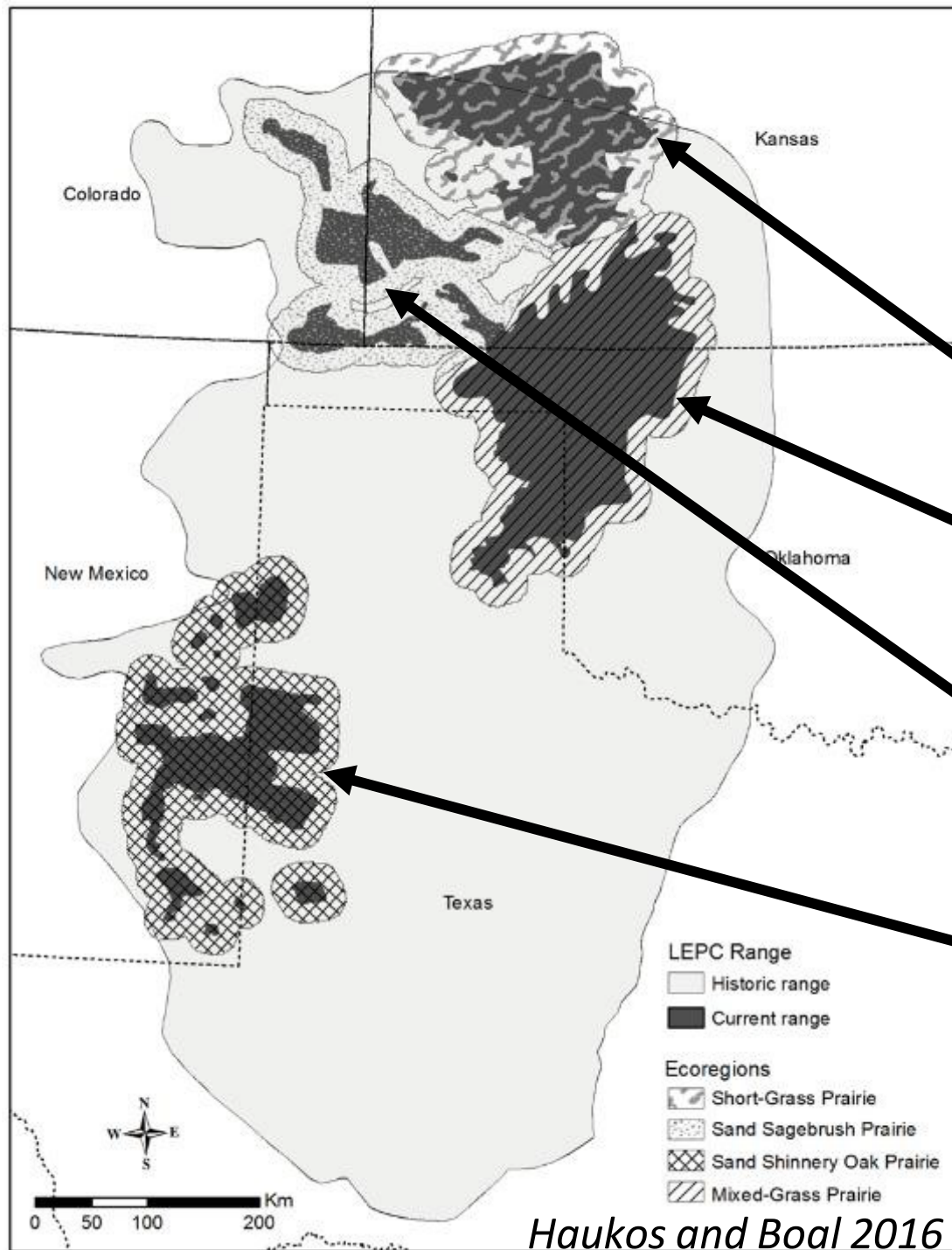
SGPR = Short-Grass Prairie/
CRP Mosaic Ecoregion

Hypotheses for the population decline

- Loss and fragmentation of lesser prairie-chicken grassland habitats
- Anthropomorphic structures leading to avoidance or increased mortality
- Climate including increased frequency and intensity of drought and increasing temperature
- Reduced food quality
- Disease
- Hybridization
- Increasing predators

Hypotheses for the population decline

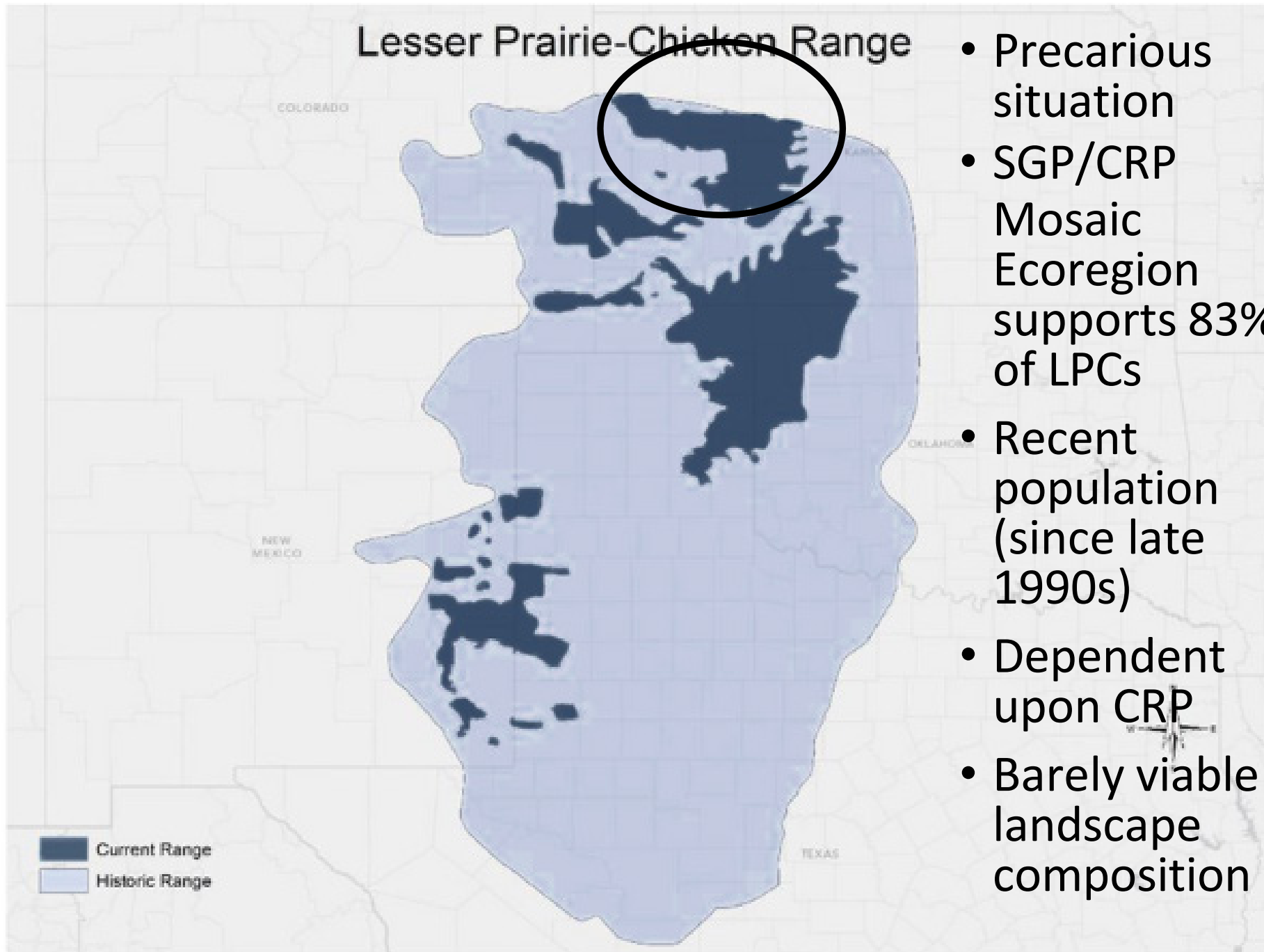
- Reduced habitat quality (e.g., vegetation structure and composition) through mismanagement or loss of ecological drivers resulting in reduced simultaneous availability of needed habitat types
- Loss of landscape- and patch-scale vegetation heterogeneity
- Loss of fire in the eastern portion of the range
- Invasive trees
- Unmanaged, continuous intensive grazing throughout the species range, particularly detrimental in the western, semi-arid portion of the species range



- 2021 population estimate using aerial survey
- Short-Grass Prairie/CRP Mosaic
25,318 (15,092, 36,329)
- Mid-Grass Prairie
3,132 (1,688, 4,877)
- Sand Sagebrush Prairie
440 (55, 963)
- Sand Shinnery Oak Prairie Ecoregion
1,571 (630, 2,678)

Total point estimate
30,461; ~90% in Kansas

Lesser Prairie-Chicken Range



- Precarious situation
- SGP/CRP Mosaic Ecoregion supports 83% of LPCs
- Recent population (since late 1990s)
- Dependent upon CRP
- Barely viable landscape composition

Lesser Prairie-Chicken Populations Occur on Private Lands

Greater than 99% of lesser prairie-chickens occur on private land

- Combination of working lands, CRP, and energy production

Comanche and Cimarron National Grasslands

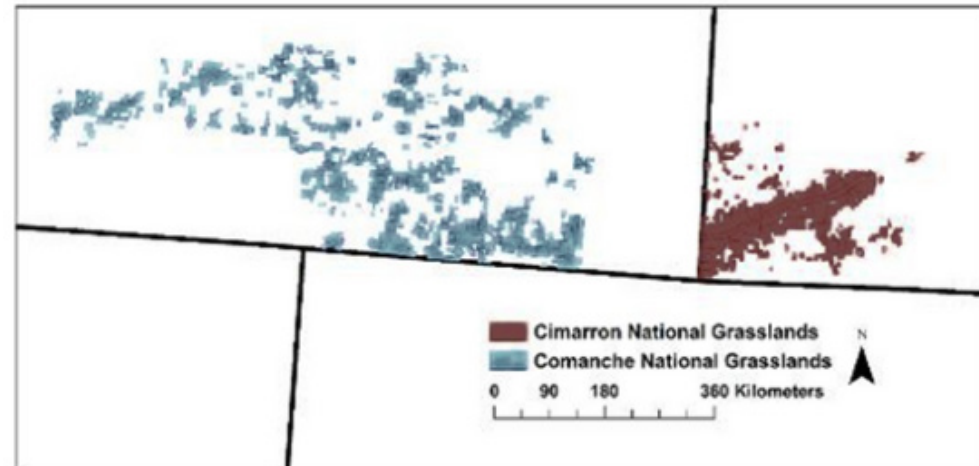
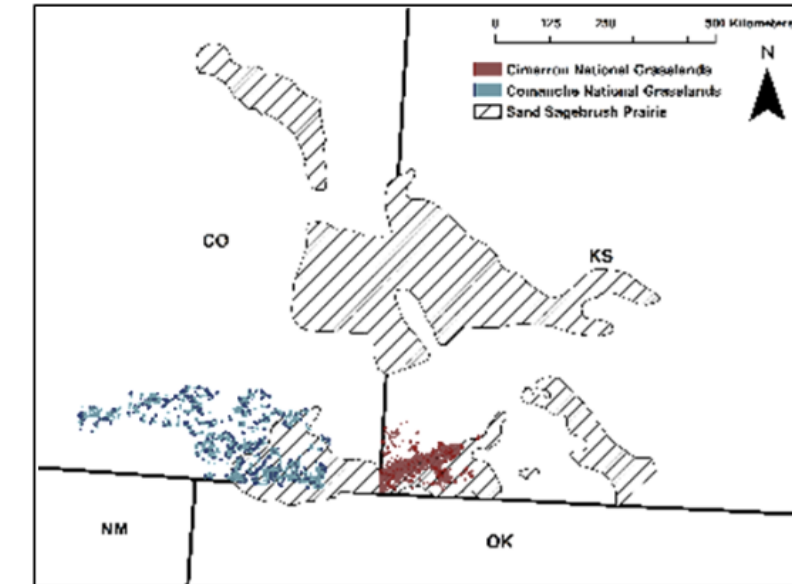
- Provides ~224,000 ha of Sand Sagebrush habitat

Unfortunately, populations declined on the National Grasslands

- In part due to long term drought and extreme winter weather events including hail
- Locally extirpated since 2016



Location of public land in Sand Sagebrush Prairie Ecoregion



Iconic Species of the Southwestern Great Plains

The key to understanding lesser prairie-chicken population demography and occupancy is that a variety of habitat types are needed for populations to persist.

Lek

Nest

Brood

Winter

Vegetation structure and composition for each life-history stage must be available –
landscape heterogeneity



Management Dilemma

- How to create, restore, and enhance landscapes to provide the necessary habitat types needed by lesser prairie-chicken on private working landscapes
- In particular, how to provide the necessary landscape heterogeneity (i.e., necessary habitat types) at a scale large enough for a positive response by a lesser prairie-chicken population
- Finally, how to increase populations to objective levels and facilitate colonization of either previously occupied habitat or enhanced/restored habitat

Lesser Prairie-Chicken Occupy Space Based on A Hierarchical Decision Process

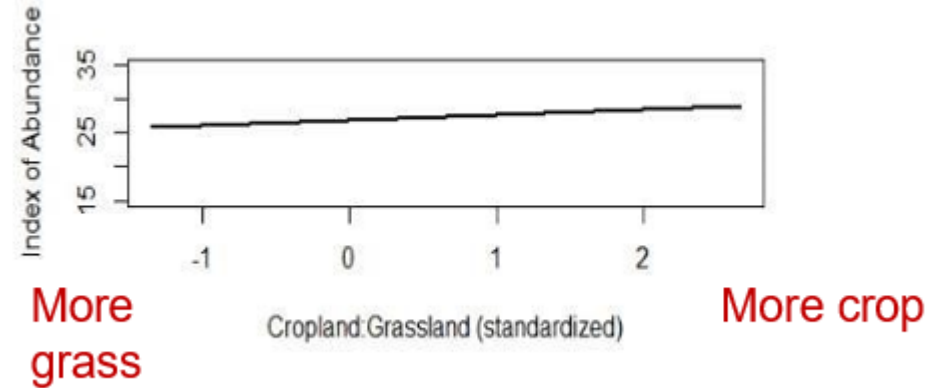
- **Initial Decision is based on amount of grassland on a landscape**
- **Not all of the grassland needs to be potentially usable by lesser prairie-chickens, just present (e.g., short-grass prairie) but needed habitat types within the grassland landscape need to be readily available**
- **Patch selection based on vegetation composition and structure**

How Much Grassland is Needed?

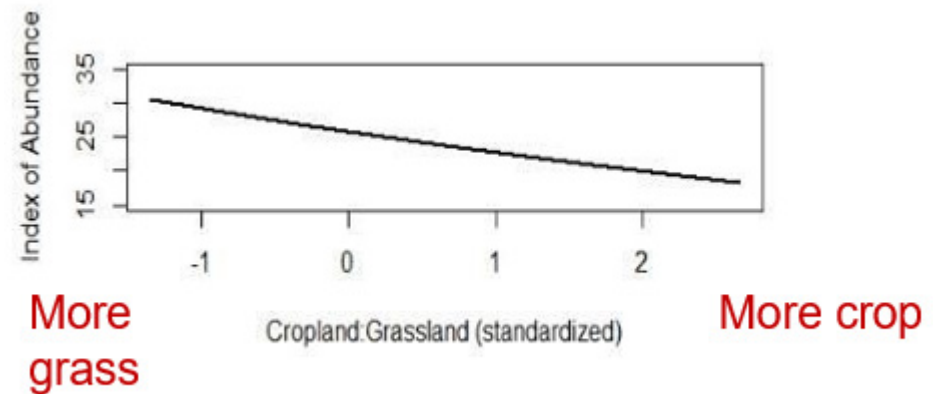
- Crawford and Bolen (1976) stated that lesser prairie-chickens will disappear from the landscape with less than 63% prairie.
- There has not been any evidence to cast doubt on this estimate.
- Sullins et al. (2019) - Predicted probability of use was greatest in 5-km radius landscapes that were 77% grassland.
- However, this question is much more complicated

Interaction of Land Cover and Climate

- Abundance during years without extreme drought

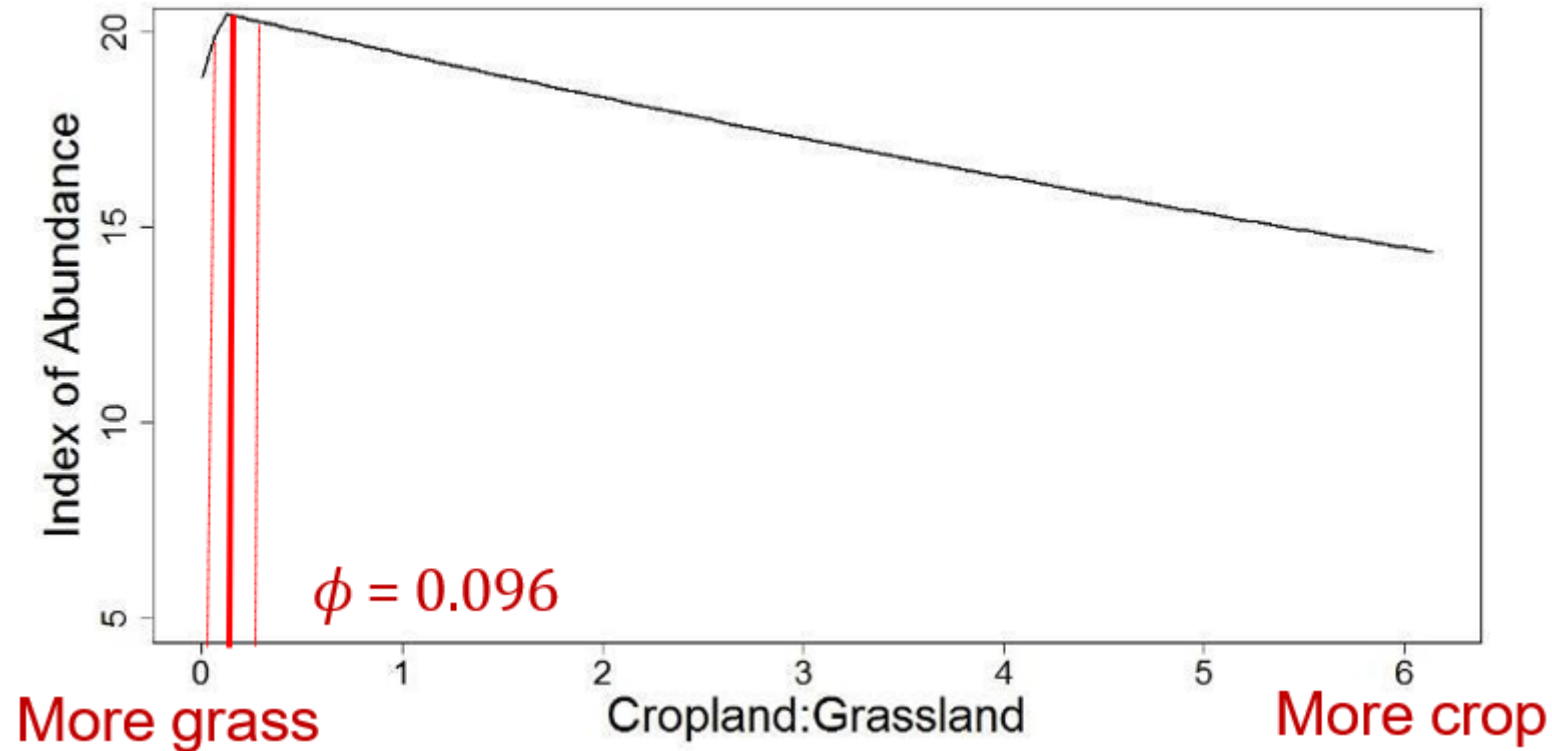


- Abundance during years with extreme drought



Ross et al. 2016, *Global Eco. and Con.*

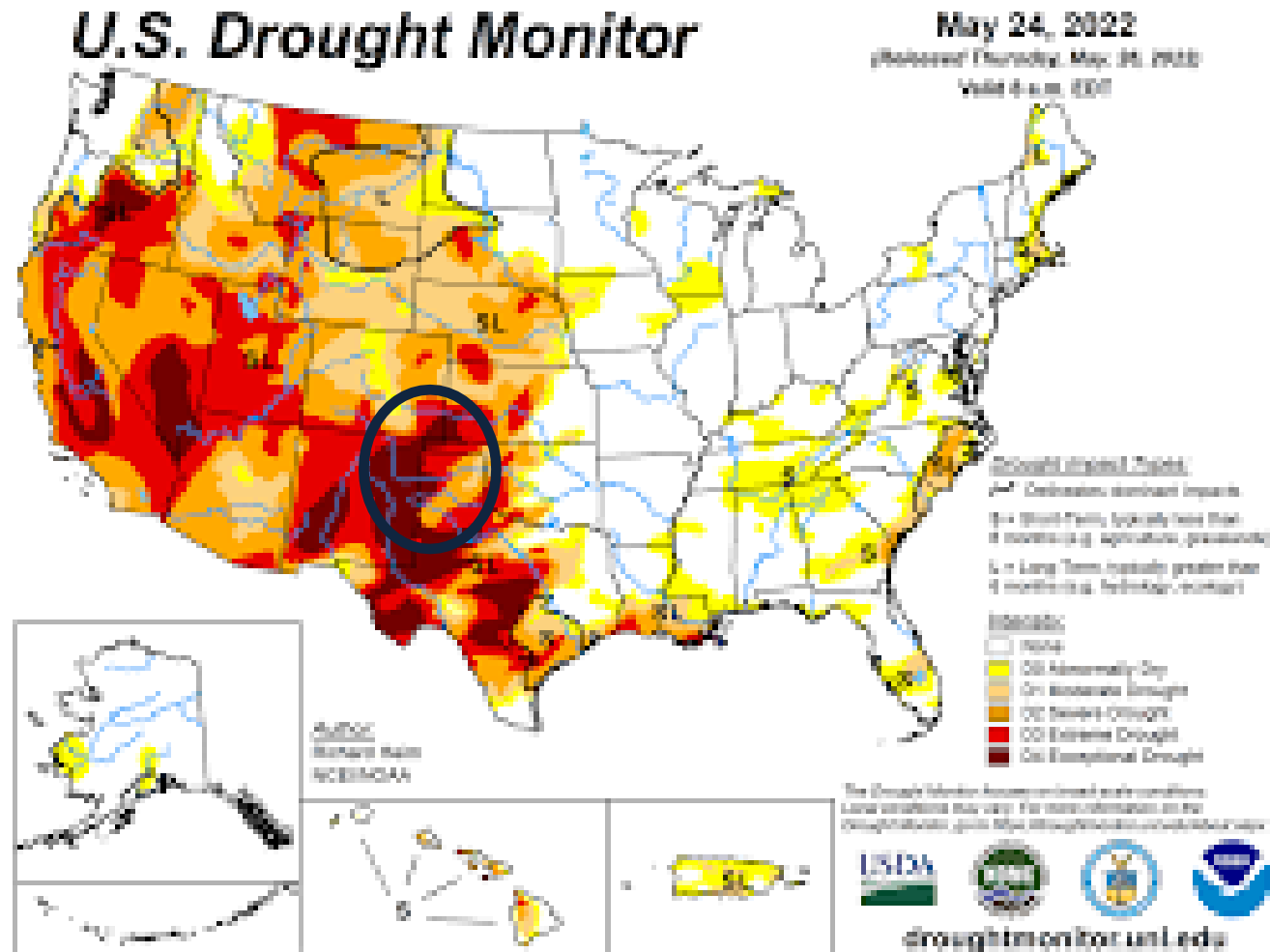
Resilience of Populations to Extreme Drought



Ross et al. 2016, *Global Eco. and Con.*

Ability to persist through extreme drought maximized at about 90% grassland

Current Palmer Drought Severity (PDSI) Index Drought Conditions



Lesser Prairie-Chicken Legal Status

Federal Listing

1996: Petitioned for listing

2014: Listed as threatened

2015: Decision vacated by court ruling

2016: Delisted

2021: New proposed listing

- threatened (KS, CO, OK, part of TX)
- endangered (NM and part of TX)

State Protections

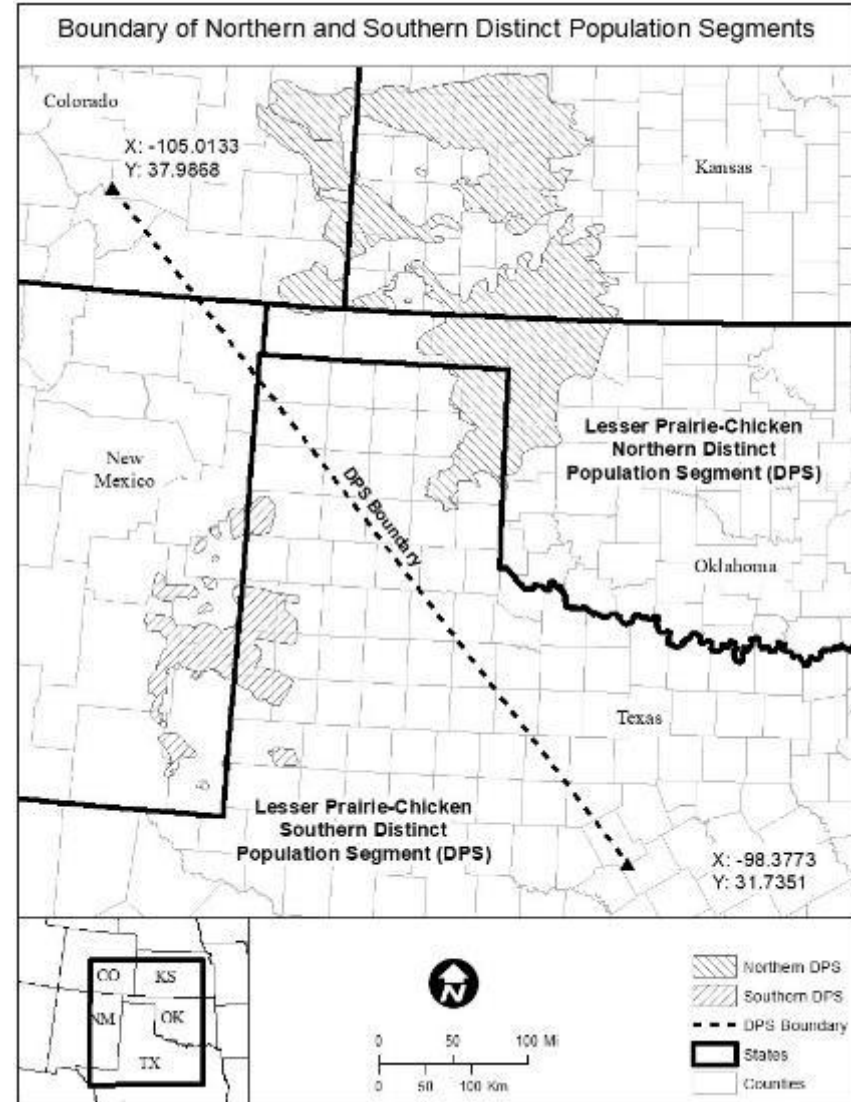
CO - Currently Threatened

KS - Not Listed

NM - Greatest Conservation Need

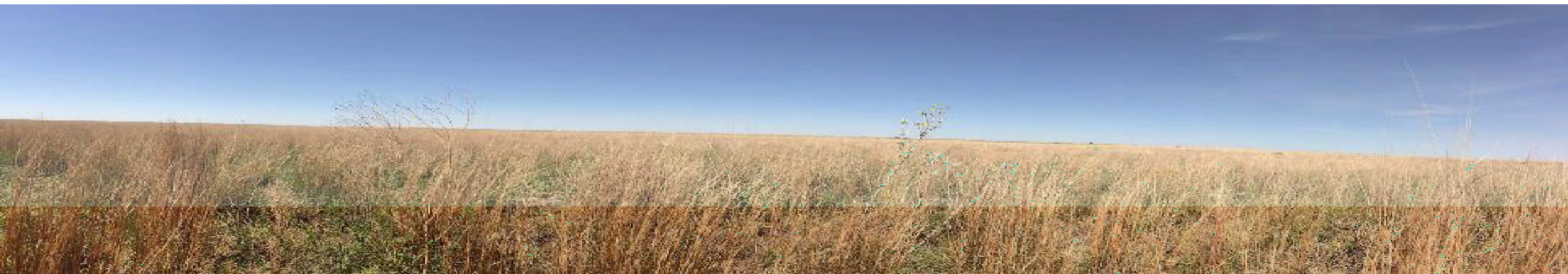
OK – Not Listed

TX – Not Listed



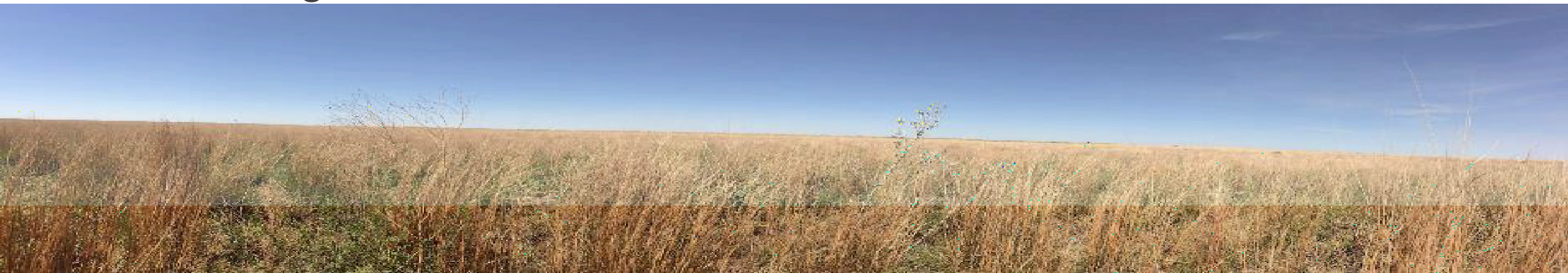
Conservation Status

- Lesser prairie-chicken populations are greatly constrained from using broad grassland landscapes in which they evolved
- Achieving pre-European settlement conditions not achievable
- Removing the risk of local extinction will require:
 - Conservation of remaining large grassland areas
 - Improving the habitat quality of those areas
 - Use of widespread conservation approaches that are feasible on privately owned land



Use Grazing and Fire to Create Vegetation Heterogeneity

- Most grazing practices are designed for uniformed grazing distribution using smaller pastures, increased stocking rates, and reduced grazing periods
- Patch-burn grazing redistributes cattle on the landscape creating heterogeneity benefiting wildlife
- Prescribed fire is rarely used in semi-arid portion of lesser prairie-chicken range





Evaluation of heterogeneity-based grazing management strategies on vegetation structure, habitat selection, and nest and adult survival

Kraft, J. D., D. A. Haukos, M. R. Bain, M. B. Rice, S. G. Robinson, D. S. Sullins, C. A. Hagen, J. Pitman, J. Lautenbach, R. Plumb, and J. Lautenbach. 2021. Using grazing to manage herbaceous structure for a heterogeneity-dependent bird. *Journal of Wildlife Management* 85:354–368.

Results – Study Features

116 female lesser prairie-chickens were radio tagged

7,018 nonbreeding locations

Grazing pressure 0-2.31 Animal Unit Month (AUM)/ha

Forage use 0-77%

Stocking density 0-0.96 AUM/ha

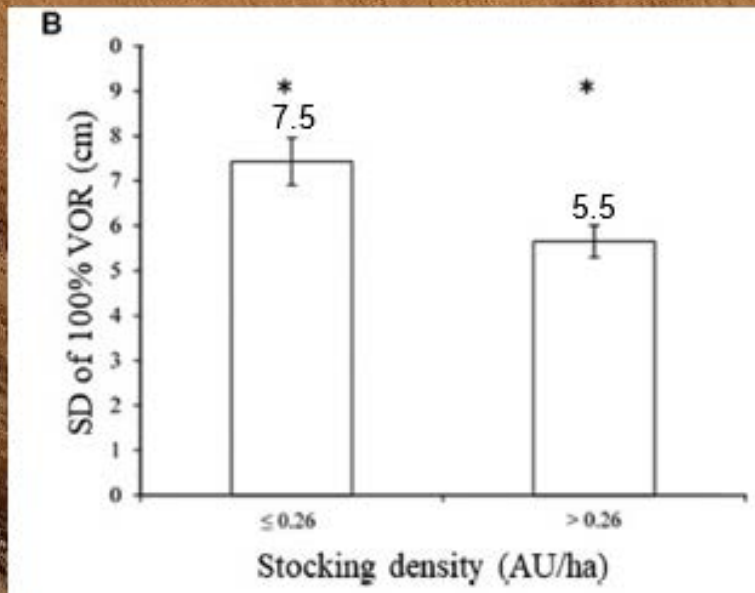
Pasture area 33-739 ha

**Growing season deferment (time when no grazing occurs)
0-100%**

Results

As stocking density decreased, vegetation density became more variable (heterogeneous)

Pastures were most heterogeneous when stocking density was <0.26 AU/ha



Results

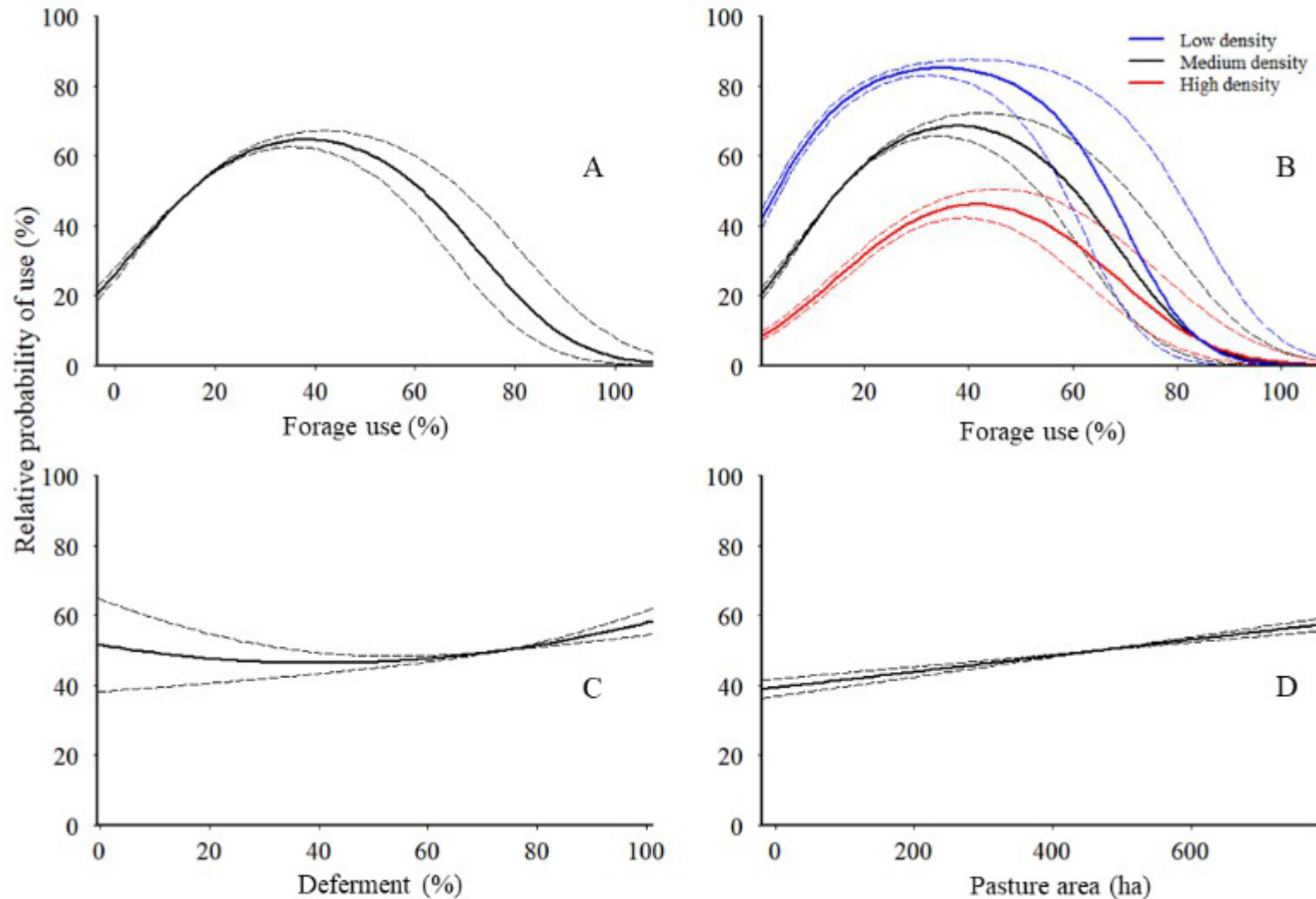
Relative probability of use by nonbreeding lesser prairie-chickens

Was greatest around 40% forage use;

Declined as stocking density increased from low (0.06 AUM/ha) to medium (0.13 AUM/ha) to high (0.56 AUM/ha);

Was lowest at 40-60% deferment; and Linear increase with pasture area

Relative probability of use by lesser prairie-chickens under a range of forage use values, forage use values by stocking density, grazing deferment, and pasture area

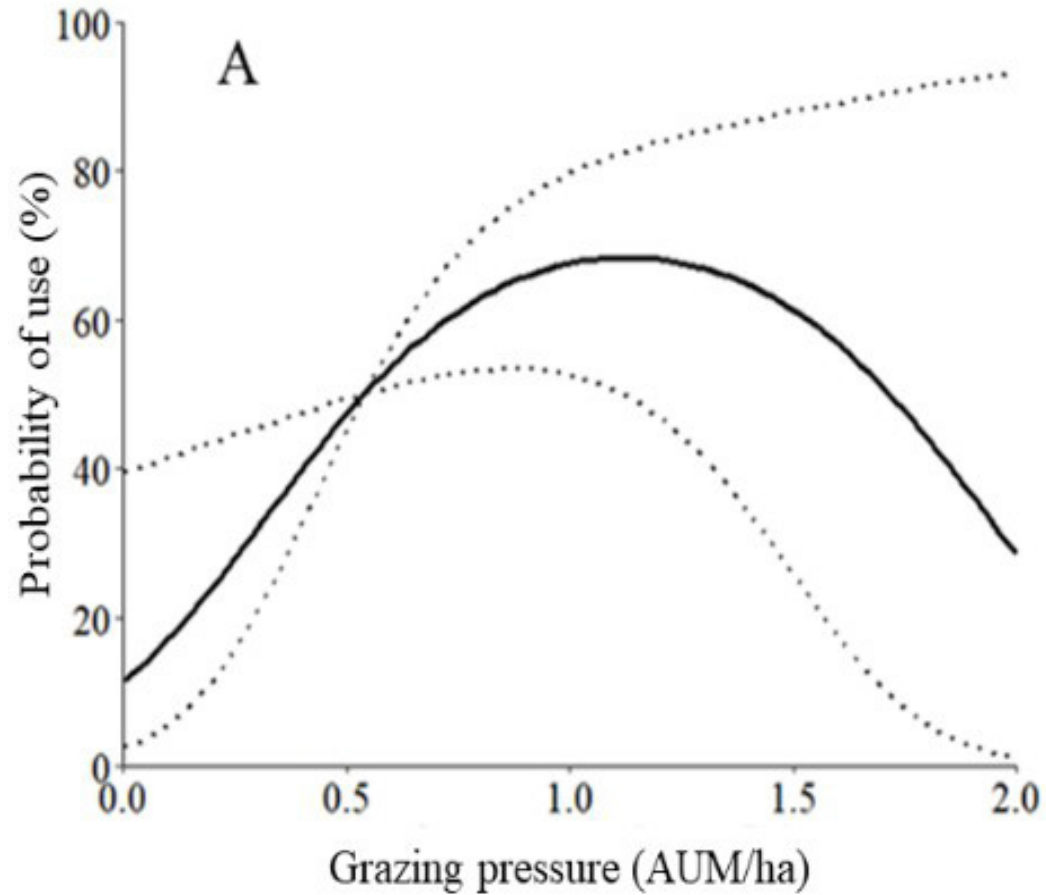


Results

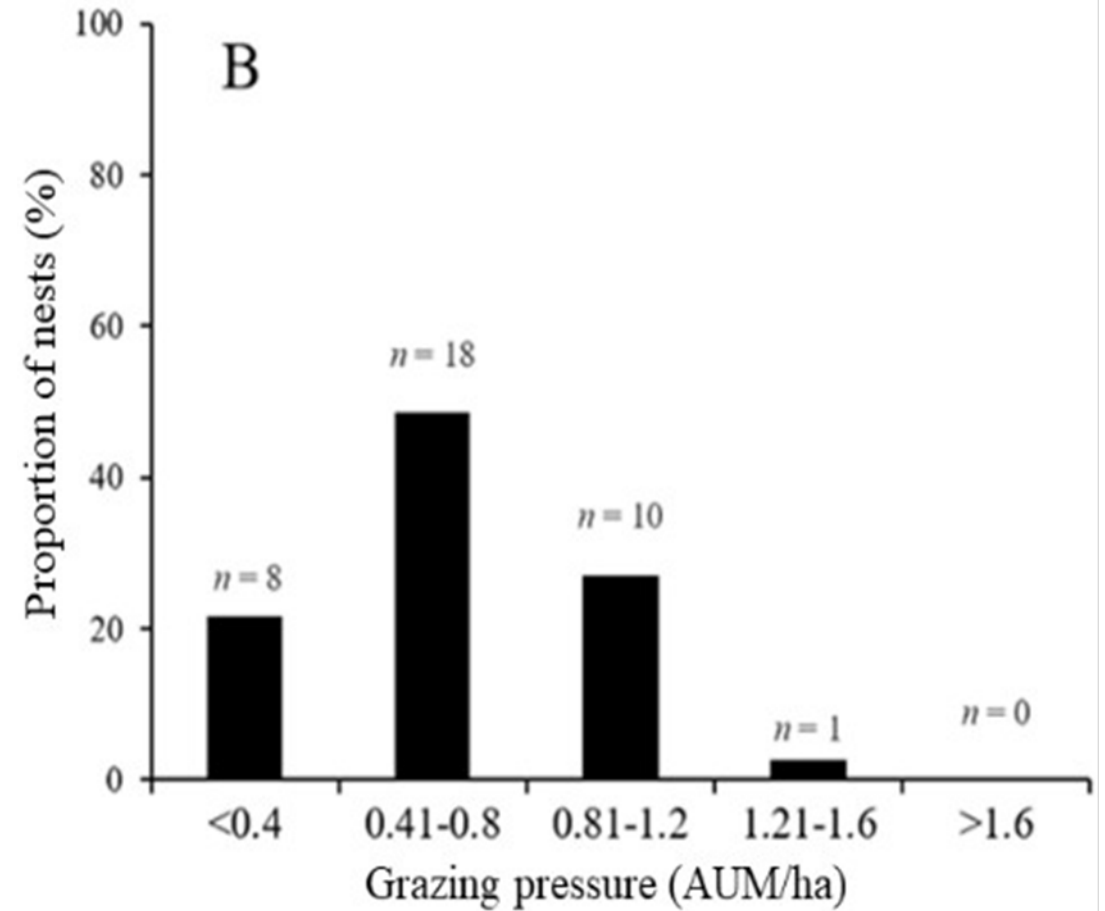
Relative probability of nest site placement was affected by grazing pressure and maximized at 1.0-1.2 AUM/ha

Essentially no nests when grazing pressure was >1.2 AUM/ha (70% located at <0.8 AUM/ha)

Probably of use by lesser prairie-chicken based on a range of grazing pressure values



Proportion of nests based on categories of grazing pressure values



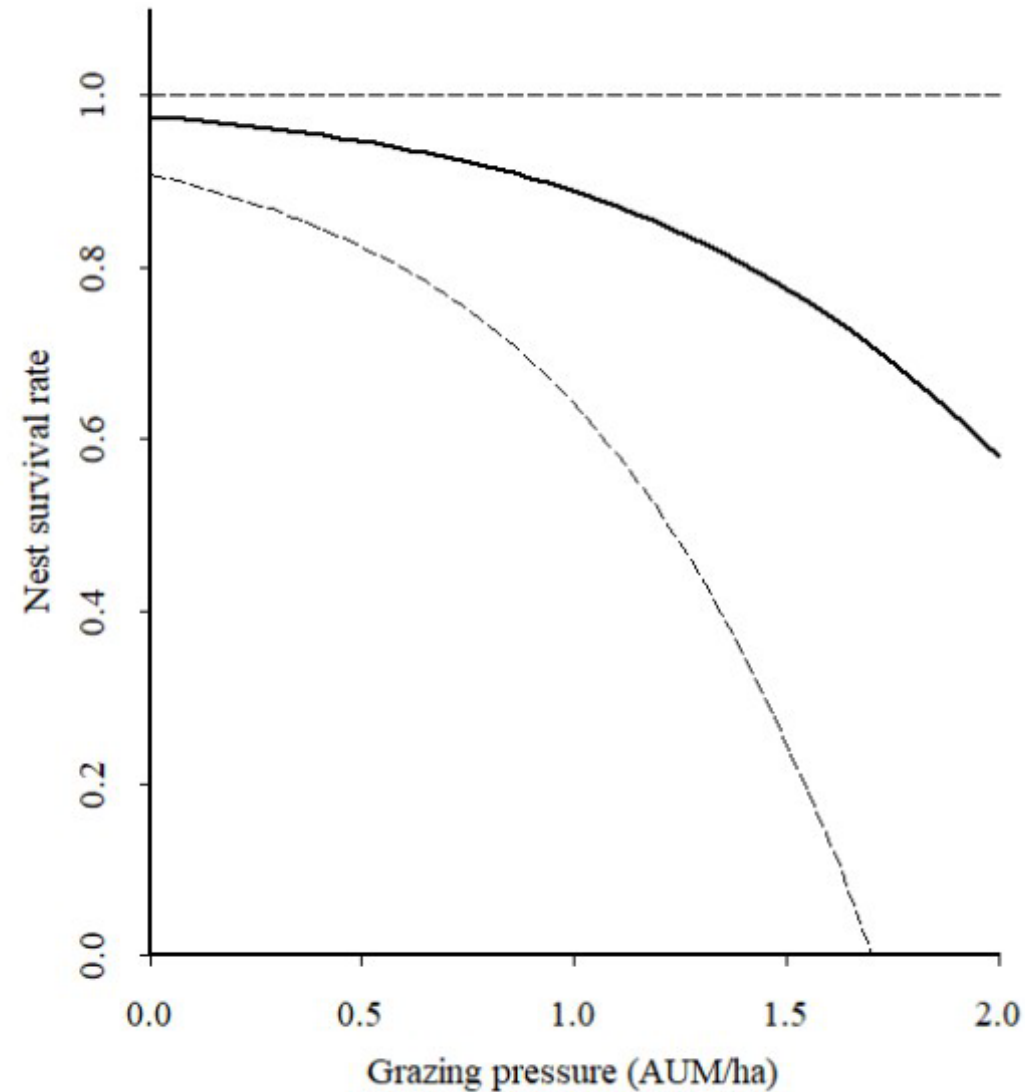
Results

Annual adult survival was 0.317 and not influenced by grazing measures

Nest success = 50.1%

Negative relationship between grazing pressure and daily nest survival

Relationship between lesser prairie-chicken daily nest survival rate and grazing pressure



Conclusions

Lesser prairie-chickens respond positively to light to moderate grazing disturbances in semi-arid environments

Greatest use when forage use <50% and stocking densities <0.26 AU/ha

Pastures in our study sites with >60% forage use did not support lesser prairie-chickens

Increasing pasture size develops a gradient of light to heavy grazing that creates a gradient of vegetation structure and associated patch heterogeneity

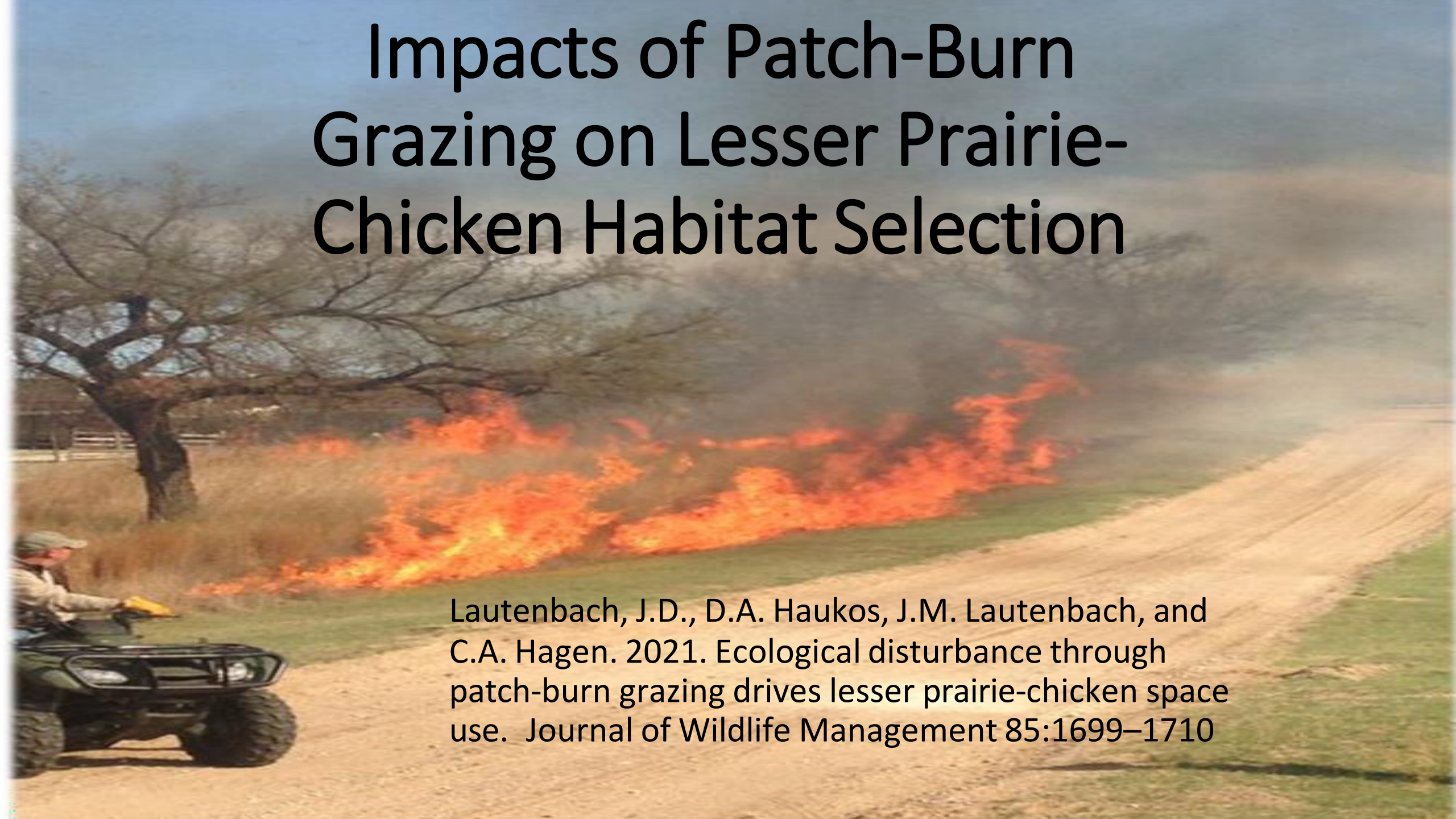
Conclusions

Nest-site selection more sensitive to grazing pressure, with sharp decrease in probability of use when forage use is >20%

Effect of deferment is site-specific and depends on existing structure and production potential

It is possible to use grazing management to promote vegetation and patch heterogeneity to meet the basic resource needs of lesser prairie-chickens, but requires commitment by land managers.

Impacts of Patch-Burn Grazing on Lesser Prairie- Chicken Habitat Selection

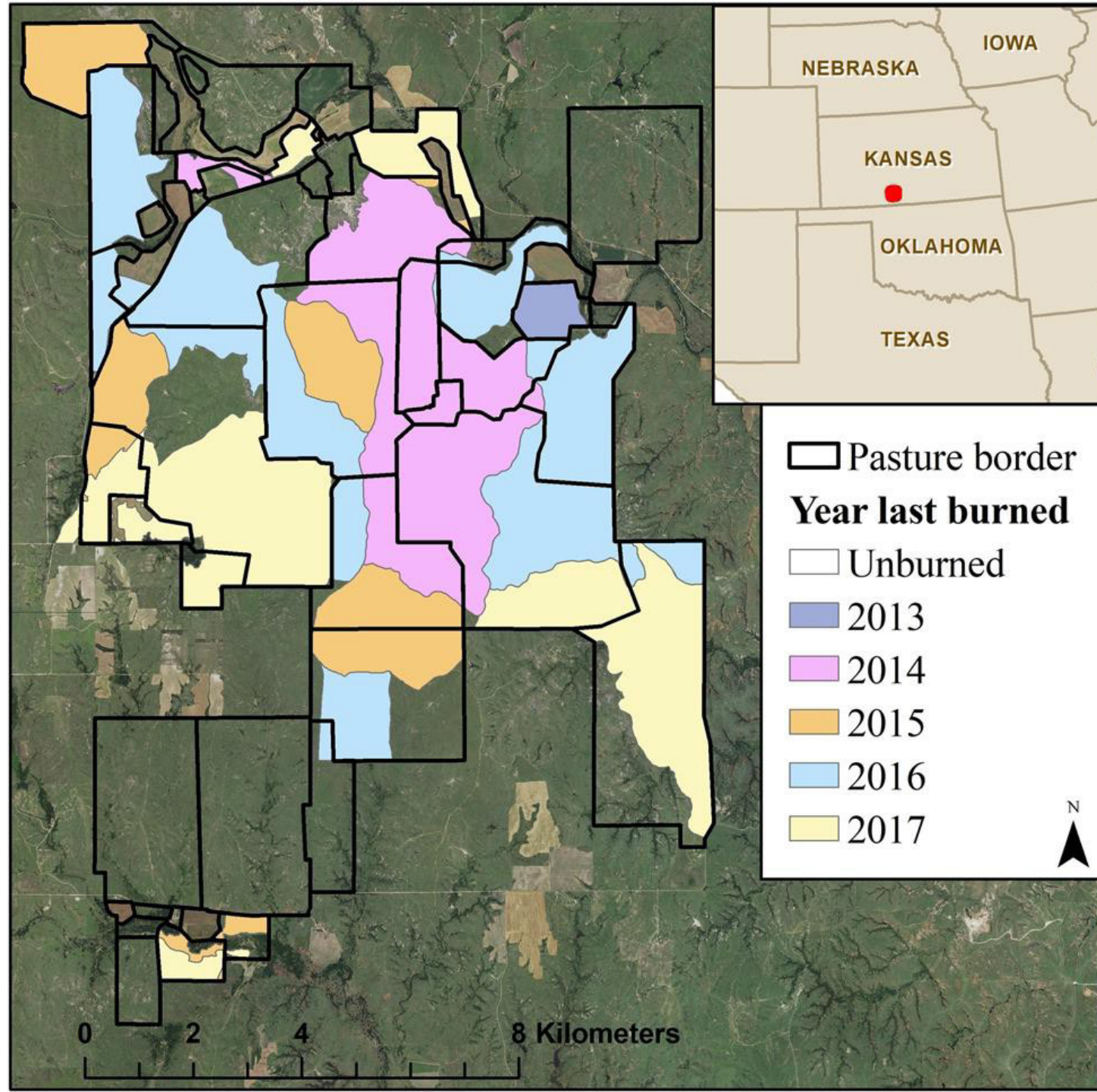
A photograph showing a controlled fire burning in a field. The fire is a long, irregular strip of orange and yellow flames moving across a green field. In the foreground, a person wearing a hat and a light-colored shirt is sitting in a dark-colored utility vehicle, looking towards the fire. The background features a large, leafless tree on the left and a dirt road or path on the right. The sky is a clear, pale blue.

Lautenbach, J.D., D.A. Haukos, J.M. Lautenbach, and C.A. Hagen. 2021. Ecological disturbance through patch-burn grazing drives lesser prairie-chicken space use. *Journal of Wildlife Management* 85:1699–1710

Prescribed Fire

- How does prescribed fire impact lesser prairie-chickens?
 - Nest selection?
 - Habitat?
 - Space use?
- Is there a way to use prescribed fire to control tree encroachment and benefit lesser prairie-chickens
 - Utilize multiple habitat types during different life stages
 - Patch-burn grazing







Nest Locations

Time	Available	Used	# Nests
Year of Fire	0.18	0.00	0
1 Year Post Fire	0.09	0.07	4
2 Years Post Fire	0.04	0.05	3
3 Years Post Fire	0.01	0.00	0
≥ 4 years Post Fire	0.69	0.88	49

Results

- Lesser prairie-chickens select a variety of time-since-fire patches during the year
 - Selected 1- and 2-year post-fire patches during lekking
 - ≥ 4 -year post-fire patches during the nesting season
 - Year-of-fire and 1-year post-fire patches during post-nesting and nonbreeding seasons.
- Nest in >2 years post-fire, with greater visual obstruction
- Post-breeding lesser prairie-chickens select year-of-fire, 1-year post-fire, and 2-years post-fire patches



Management Implications

- Because lesser prairie-chickens selected all available time-since-fire patches during their life history, patch-burn grazing may be a viable management tool to restore and maintain lesser prairie-chicken habitat on the landscape
- Prescribed fire in a patch-burn grazing mosaic can be used to help prevent future eastern red cedar encroachment



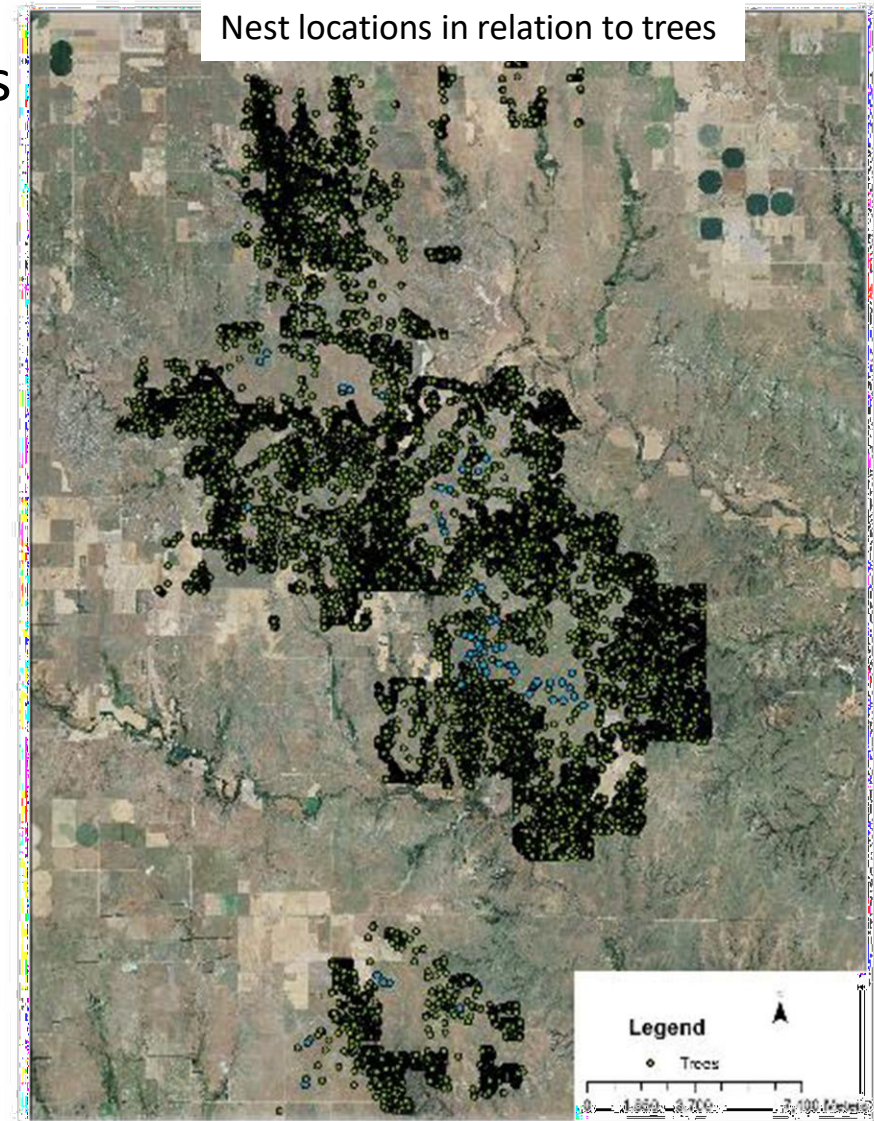
Tree Encroachment

- Loss of fire has allowed trees to establish in grasslands
 - Prairie can convert to closed canopy forest in ≈ 30 years
- Trees (e.g., eastern red cedar) alter grassland communities in eastern range of the lesser prairie-chicken.
- Lesser prairie-chickens perceive structures, including trees, on the landscape as potential predation risk



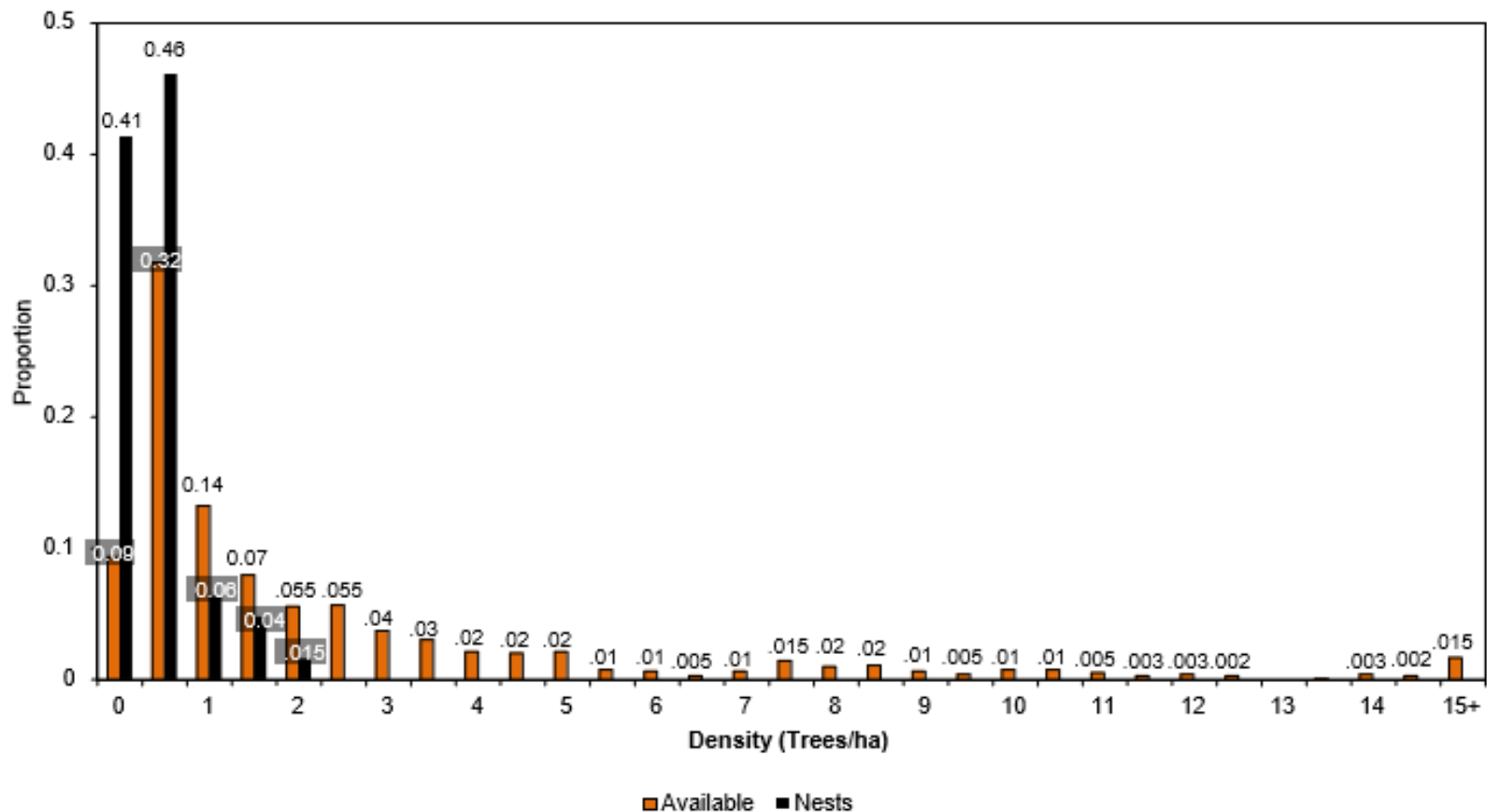
Lautenbach, J.M., R.T. Plumb, S.G. Robinson, D.A. Haukos, J.C. Pitman, and C.A. Hagen. 2017. Lesser prairie-chicken avoidance of trees in a grassland landscape. *Rangeland Ecology & Management* 70:78-86.

- Captured and marked 58 females
- Monitored 63 Nests
- Average distance to tree
 - Nest: 292.7 m \pm 19.7 SE
 - Random: 172.0 m \pm 20.9 SE



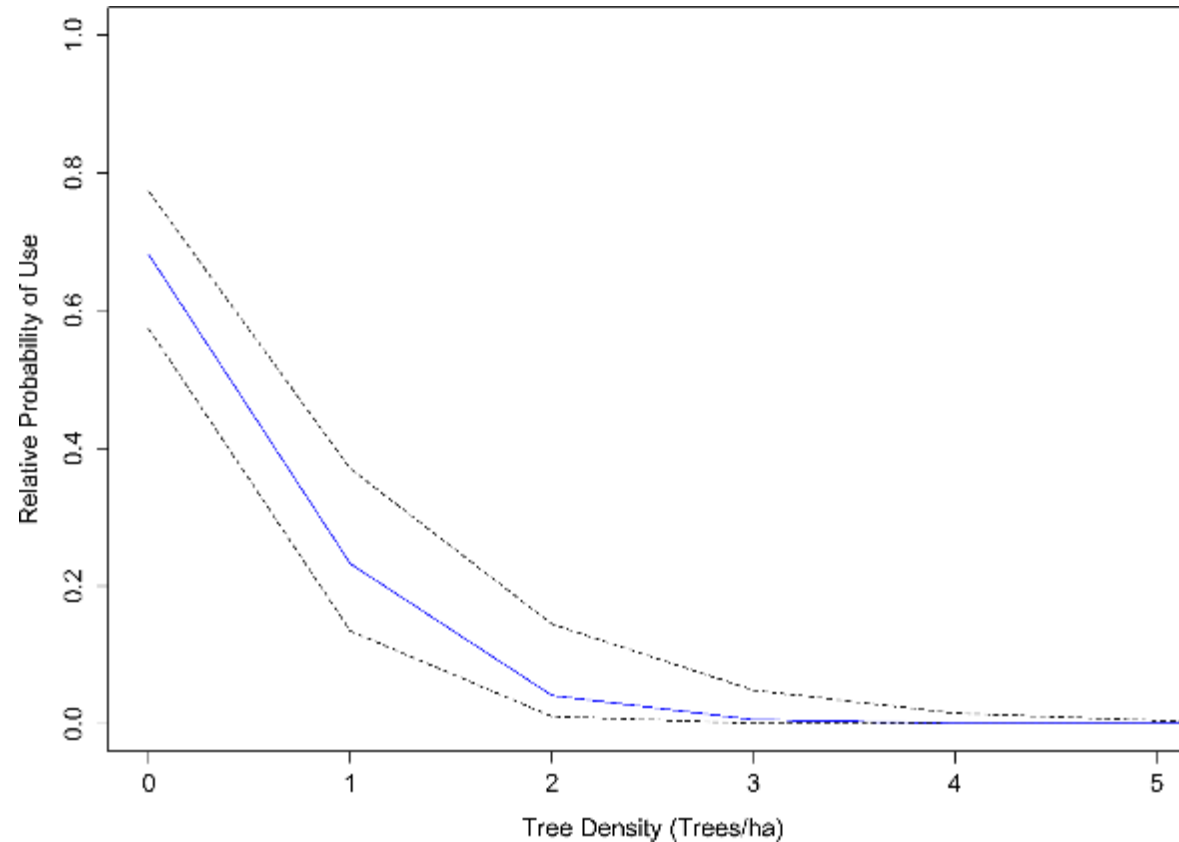
Nest Site Selection- Trees

Proportion of lesser prairie-chicken nests in relationship to proportion of tree densities



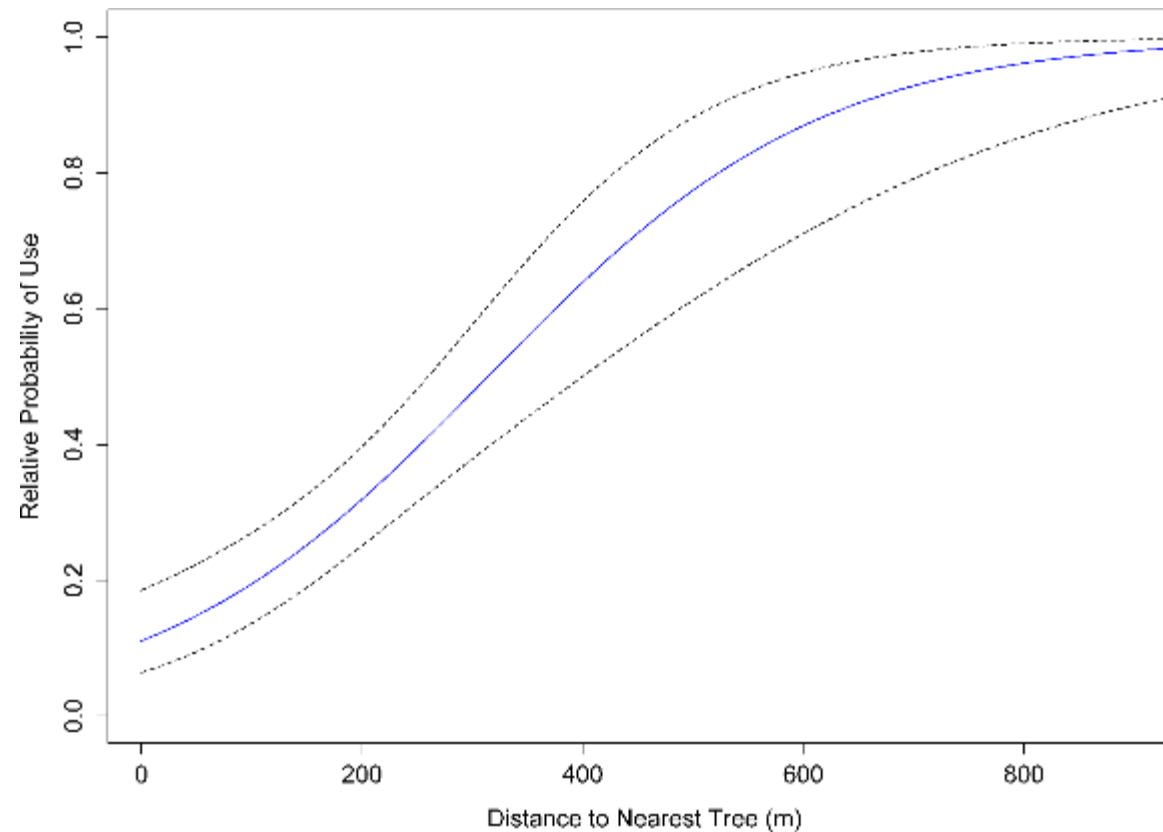
Nest Site Selection- Trees


Probability of use by lesser prairie-chickens in relationship to tree densities



Nest Site Selection- Trees

Relative probability of use by lesser prairie-chickens in relationship to distance to nearest tree



The background of the slide is a composite image. It features a central, semi-transparent white rectangular box containing text. The background behind the box is a dark, textured aerial photograph of a landscape, possibly a grassland or prairie, showing various shades of brown, green, and grey. The overall composition is framed by a dark border on the left and right sides, and a lighter, hazy border at the top and bottom.

**Selection and demographic
consequences of Conservation
Reserve Program grasslands for
lesser prairie-chickens**



Background

- Converted several million acres of cropland back to grassland in the Great Plains
 - > 700,000 ha of CRP grasslands in LEPC range
- Predicted benefits for lesser prairie-chickens:
 - Utility of CRP increase nesting and nonbreeding habitat
 - Increase spatial heterogeneity in some areas
 - Increased grassland composition to surpass extinction threshold
- Value of CRP varies throughout lesser prairie-chicken range following a precipitation gradient

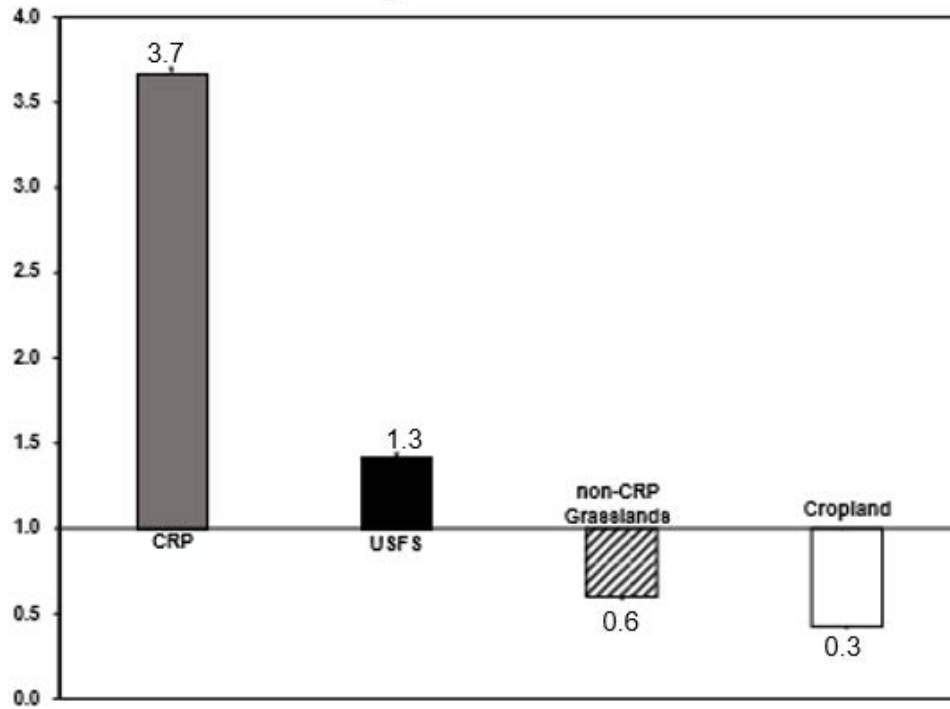


Background

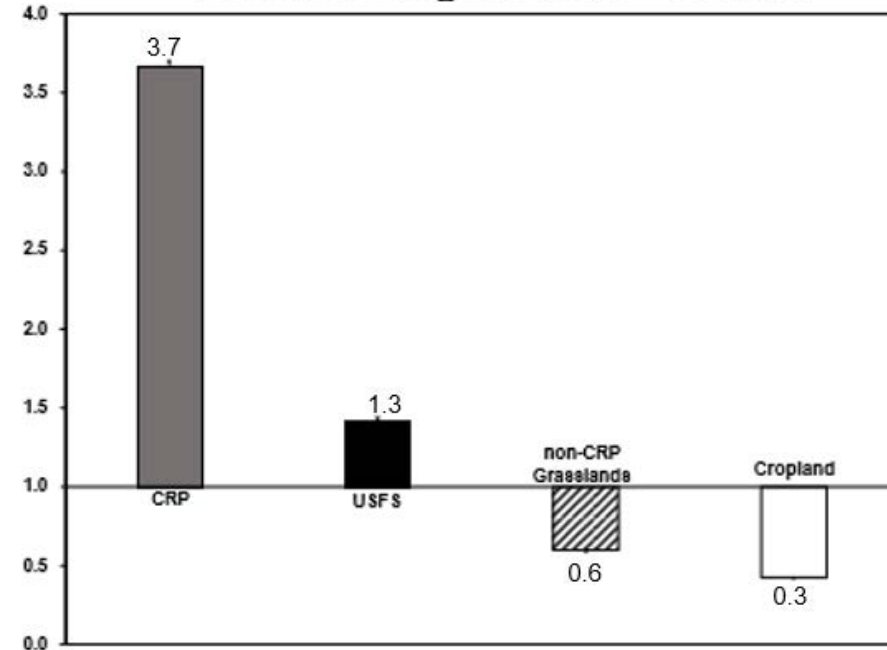
- Lesser prairie-chickens have adapted to CRP throughout their range.
- Persistence of many populations is dependent upon CRP.
- Sullins, D.S., J.D. Kraft, D.A. Haukos, S.G. Robinson, J. Reitz, R.T. Plumb, J.M. Lautenbach, J.D. Lautenbach, B.K. Sandercock, and C.A. Hagen. 2018. Selection and demographic consequences of Conservation Reserve Program grasslands for lesser prairie-chickens. *Journal of Wildlife Management* 82:1617-1632.
- Even birds released in a novel landscape select for CRP

Cover Type Selection by Translocated Lesser Prairie-Chickens Based on Selection Ratios

Breeding Season – Overall

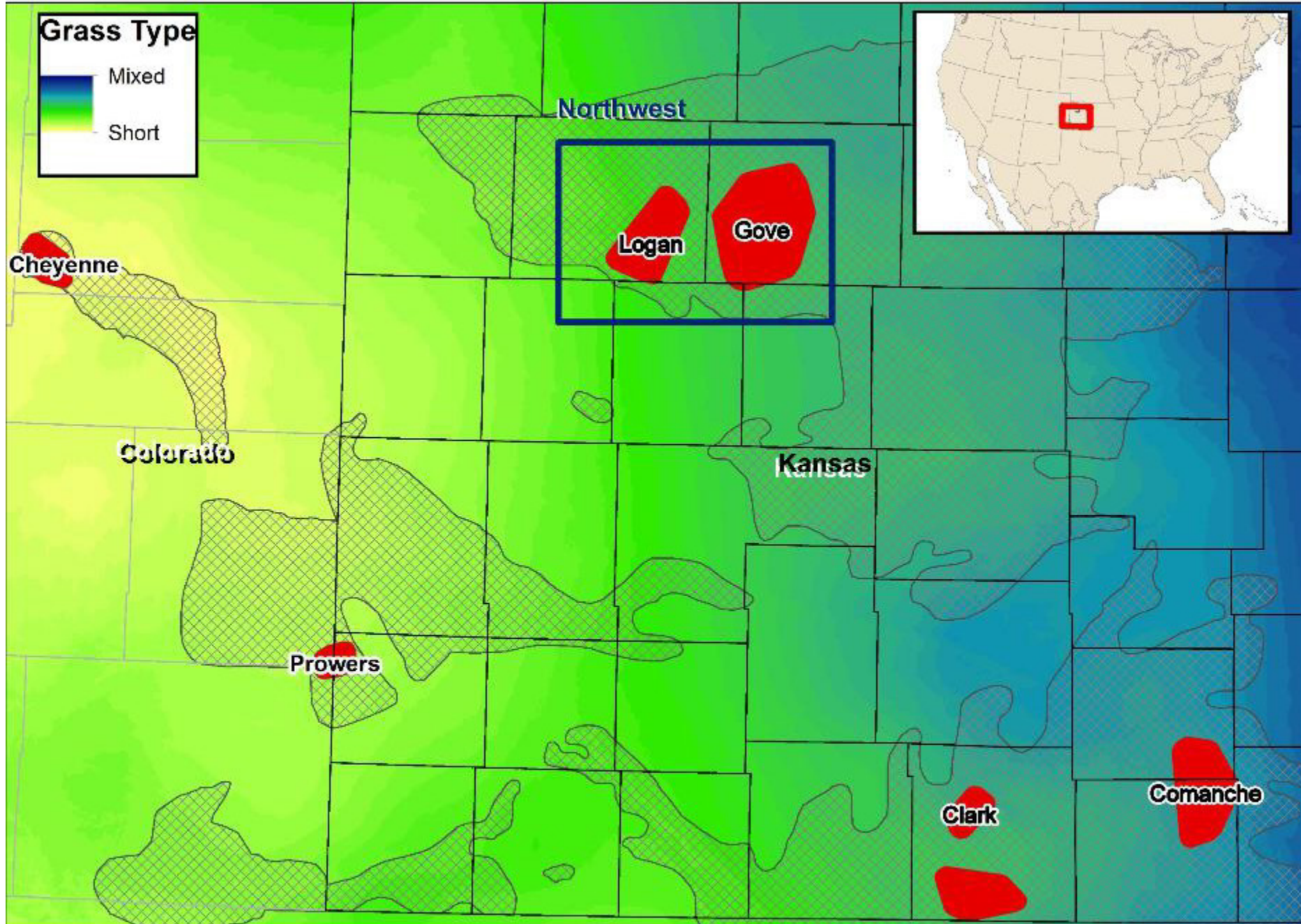


Nonbreeding Season – Overall

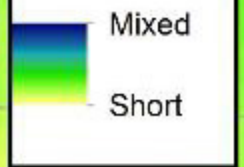


Similar to percent cover type, selection changes little between breeding seasons

Selecting for CRP and avoiding cropland and non-CRP private working grassland



Grass Type



Northwest

Cheyenne

Logan

Gove

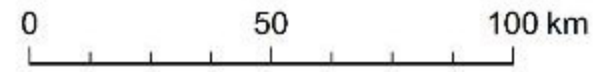
Colorado

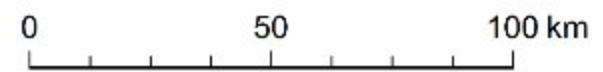
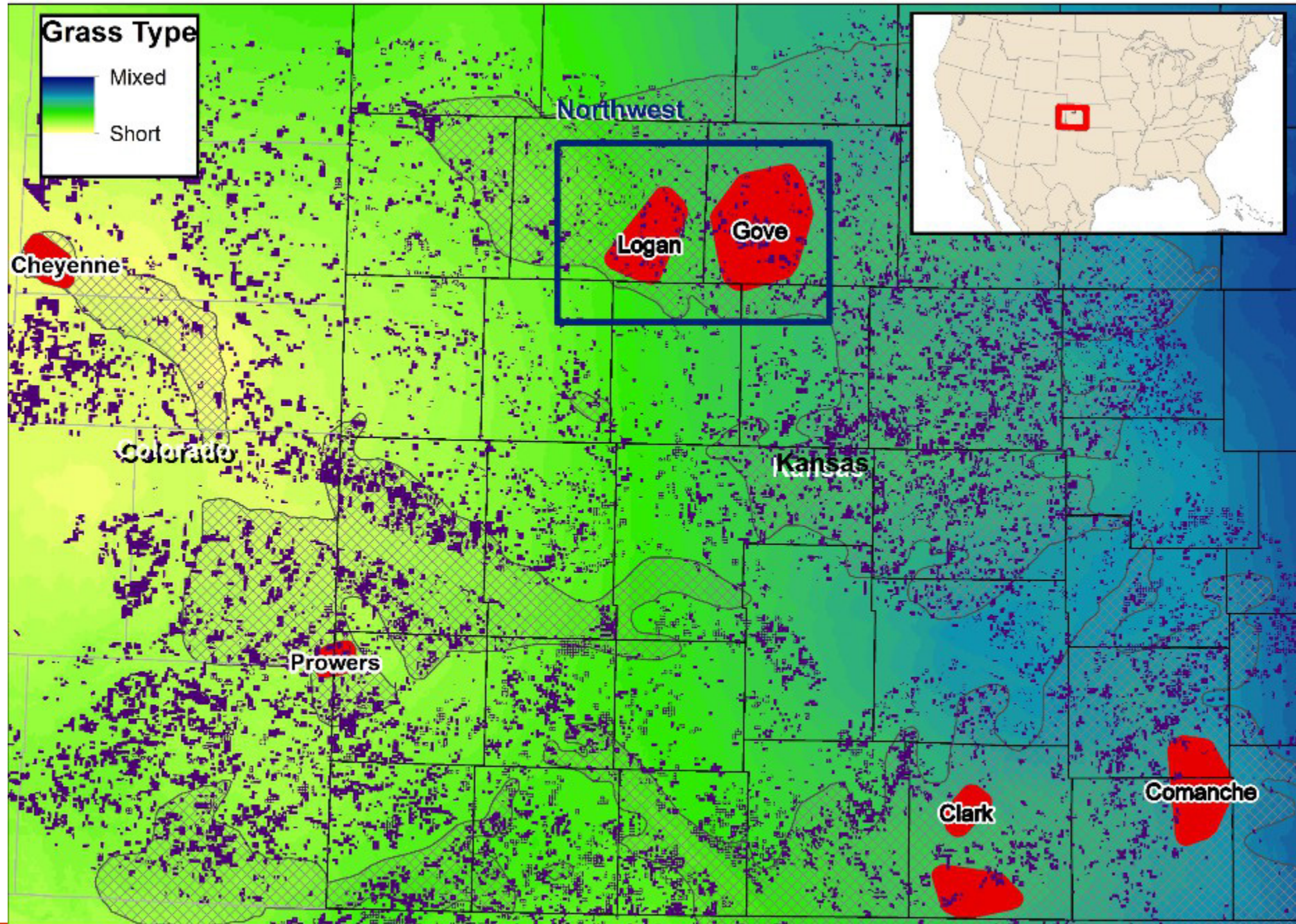
Kansas

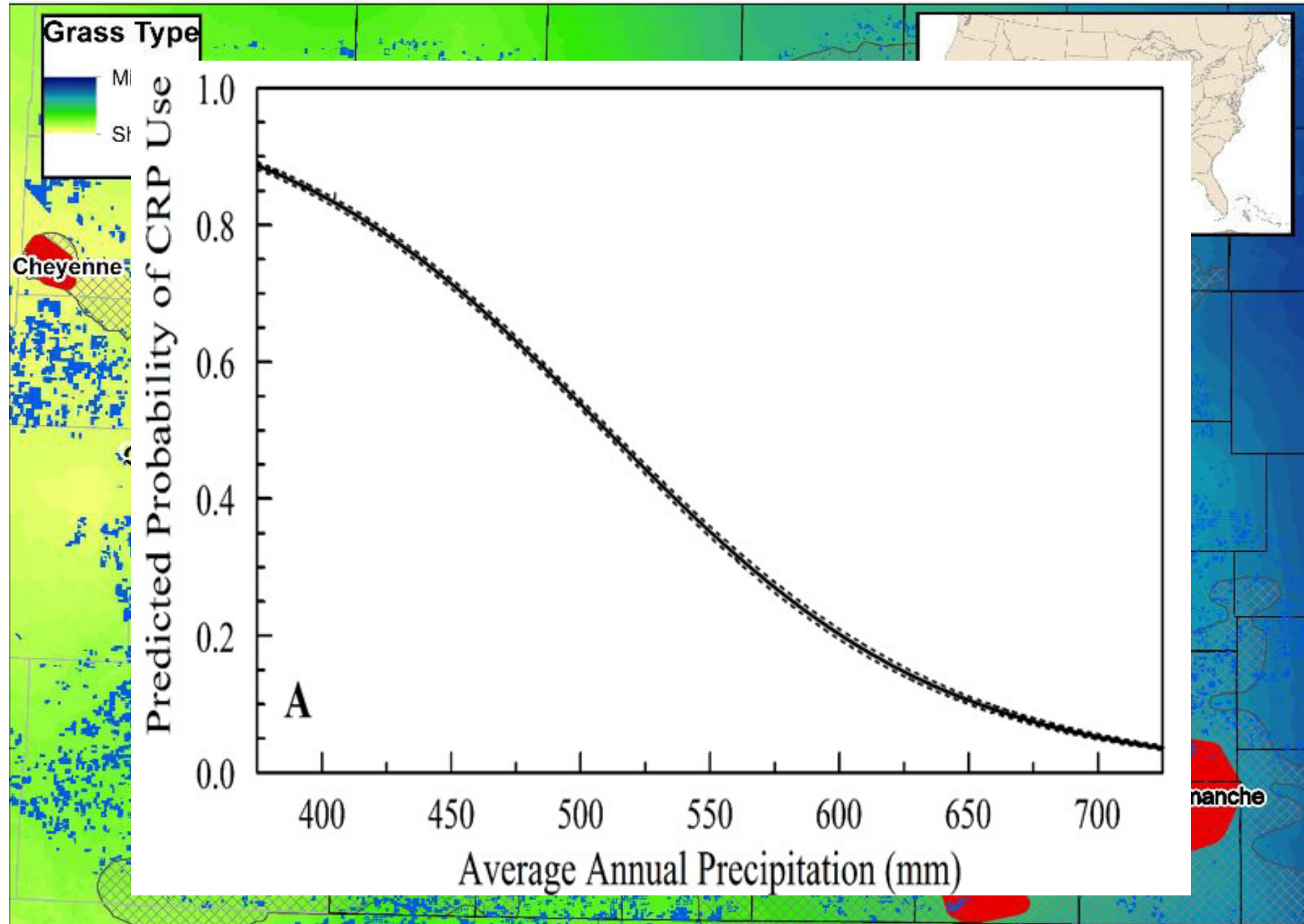
Prowers

Clark

Comanche







Habitat Availability

- Lesser prairie-chickens select landscapes (3,000ha) with $> 65\%$ grassland composition (Bohlen and Crawford 1976)
- Most likely to use CRP grasslands when local landscapes ($\sim 5,000$ ha) were $>70\%$ ($\sim 3,500$ ha) native prairie

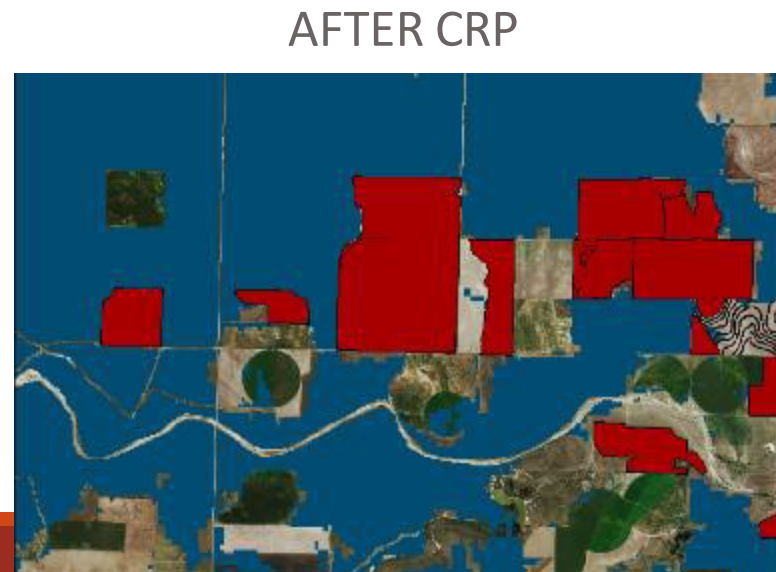
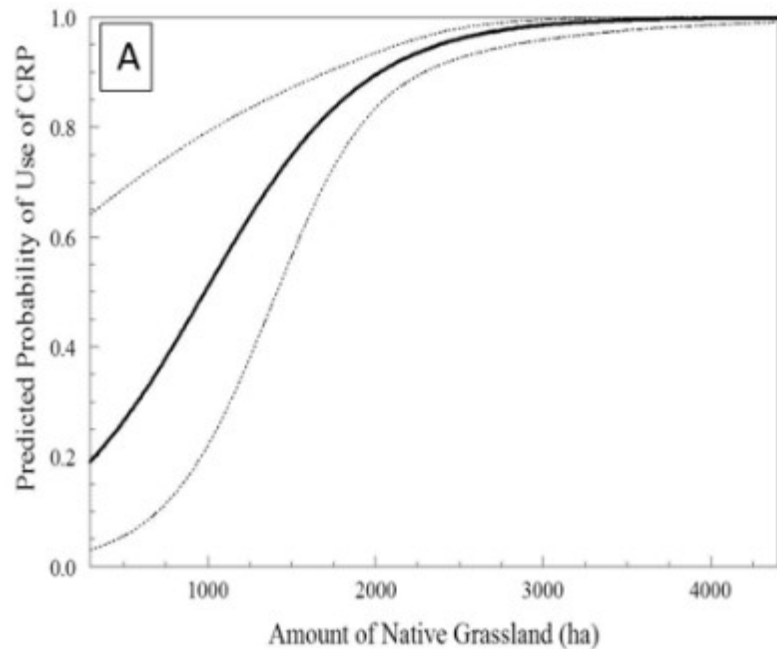
BEFORE CRP

AFTER CRP



Habitat Availability

- Lesser prairie-chickens select landscapes (3,000ha) with >65% grassland composition (Bohlen and Crawford 1976)
- Most likely to use CRP grasslands when local landscapes (~5,000 ha) were >70% (~3,500 ha) native prairie



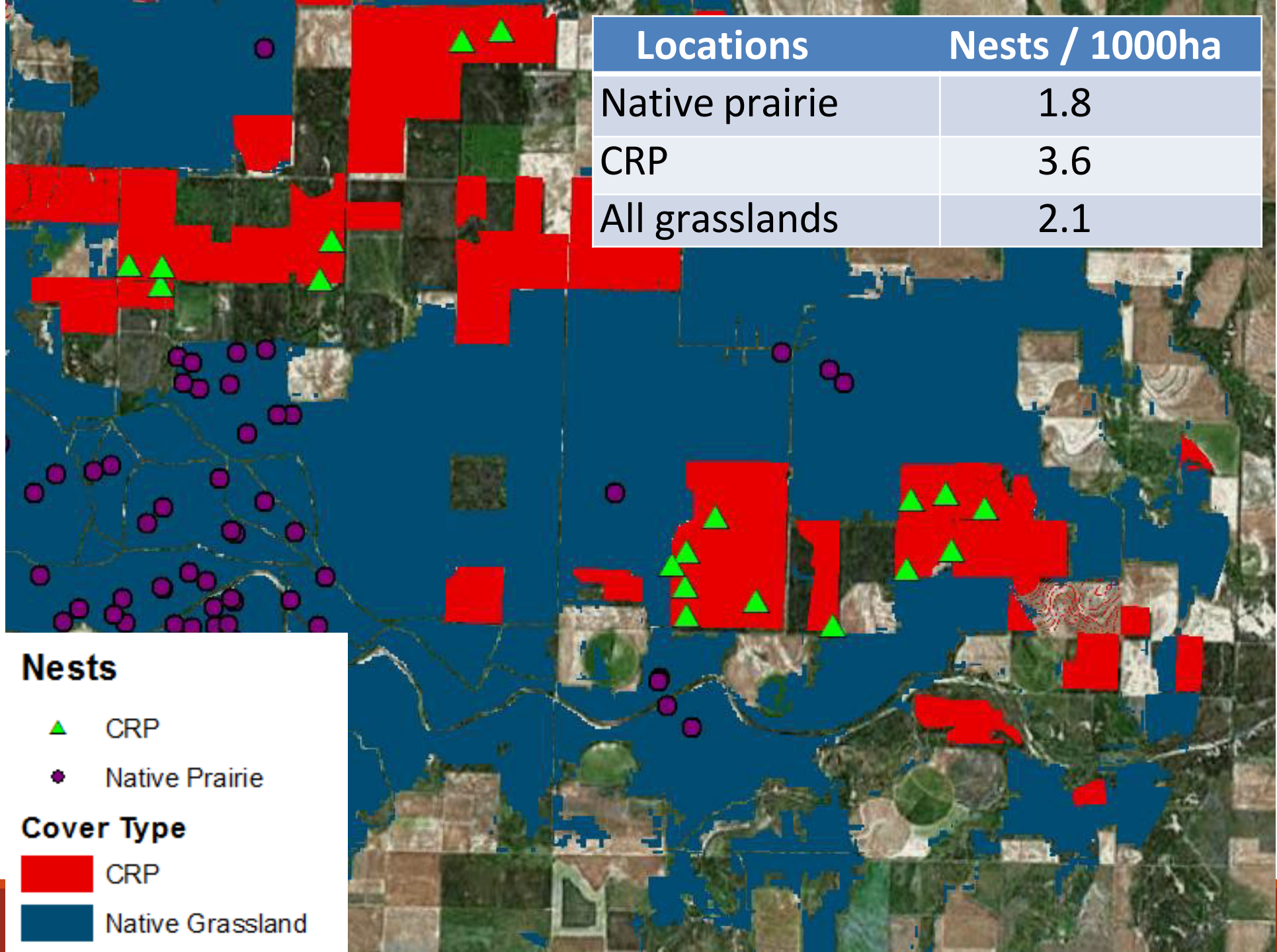
Habitat Quality: Individual Level Fitness

$$\frac{F_{sy} * S_j}{S_{sy}} \quad \frac{F_{asy} * S_j}{S_{asy}}$$

Landcover	λ	SD	95% CI
CRP	0.601	0.135	0.336 - 0.866
native working grassland	0.491	0.114	0.268 - 0.714

- CRP point estimate greater than native prairie





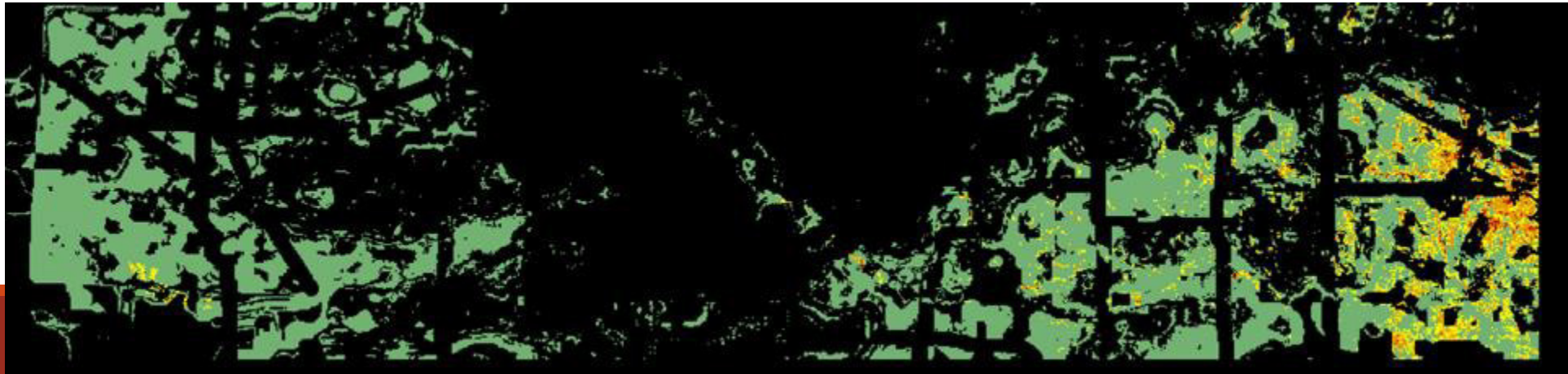
Conclusion

- Broad scale precipitation constraints on use of CRP
 - CRP was 7 times more likely to be used when annual average precipitation 55 cm compared to 70 cm
- Increased habitat availability
- Nest and adult survival not different from Native Prairie
- Improved habitat quality (population level)
 - Greater (2X) nest densities in CRP
- Habitat more reliably available
 - Provide refugia during periods of drought

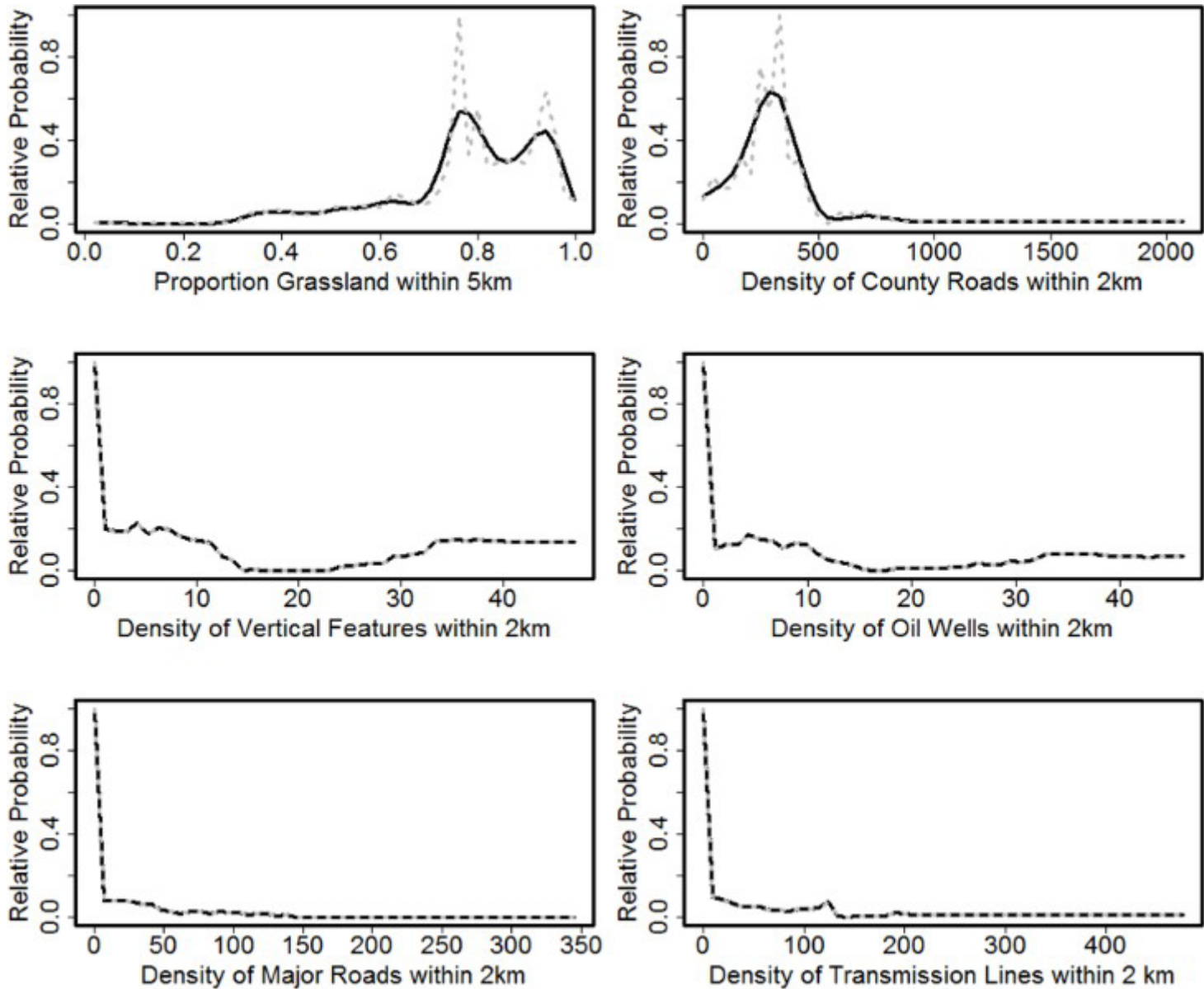


Distribution and Strategic Conservation of Lesser Prairie-Chickens in Kansas and Colorado

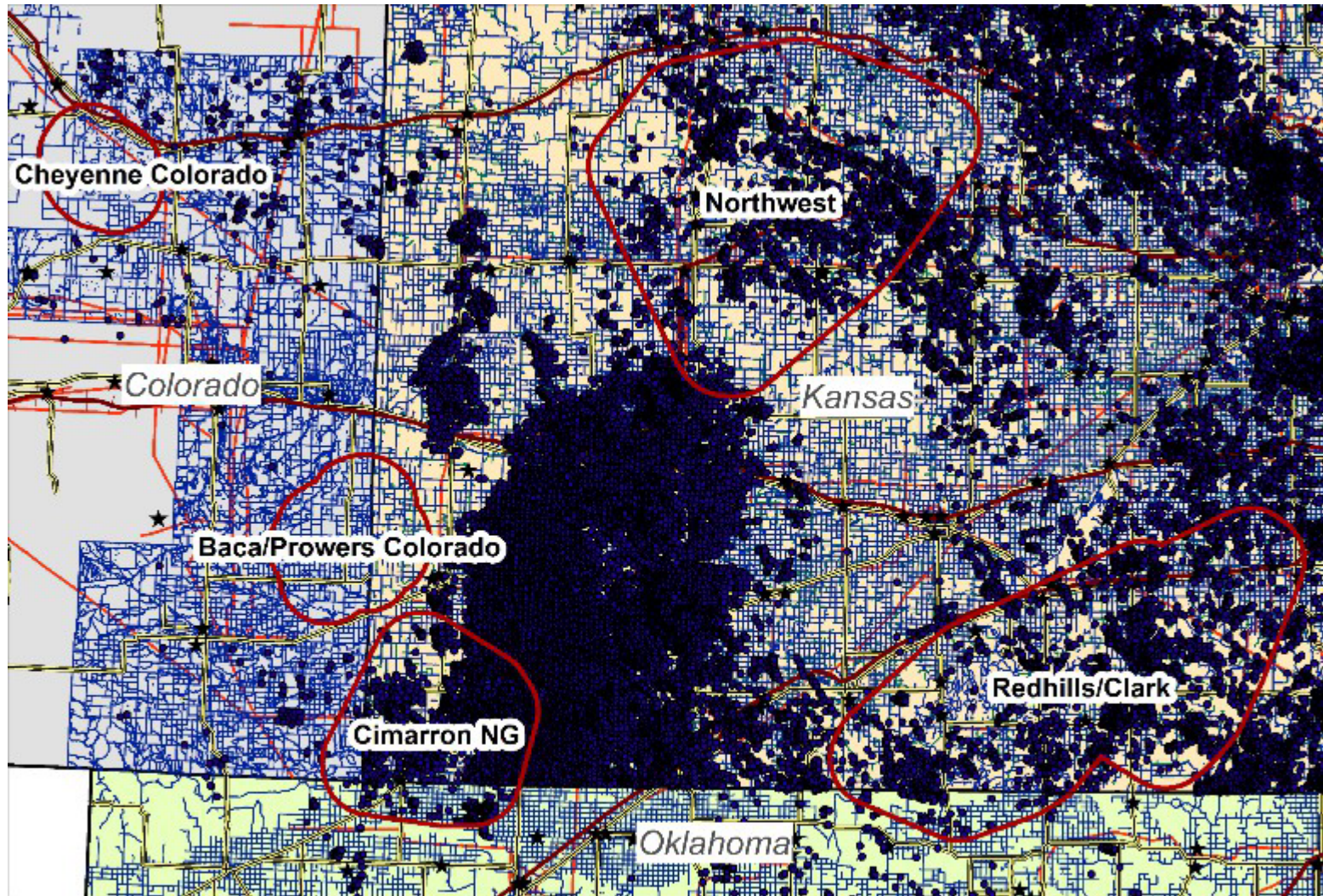
Sullins, D.S., D.A. Haukos, J.M. Lautenbach, J.D. Lautenbach, S.G. Robinson, M.B. Rice, B.K. Sandercock, J.D. Kraft, R.T. Plumb, J.H. Reitz, J.M.S. Hutchinson, and C.A. Hagen. 2019. Strategic regional conservation for lesser prairie-chickens among landscapes of varying anthropogenic influence. *Biological Conservation* 238 (2019) 108213



Relative probability of use by lesser prairie-chickens based on relationships with grassland and densities of roads, vertical features, oil wells, and transmission lines



Distribution of anthropogenic features in lesser prairie-chicken occupied range

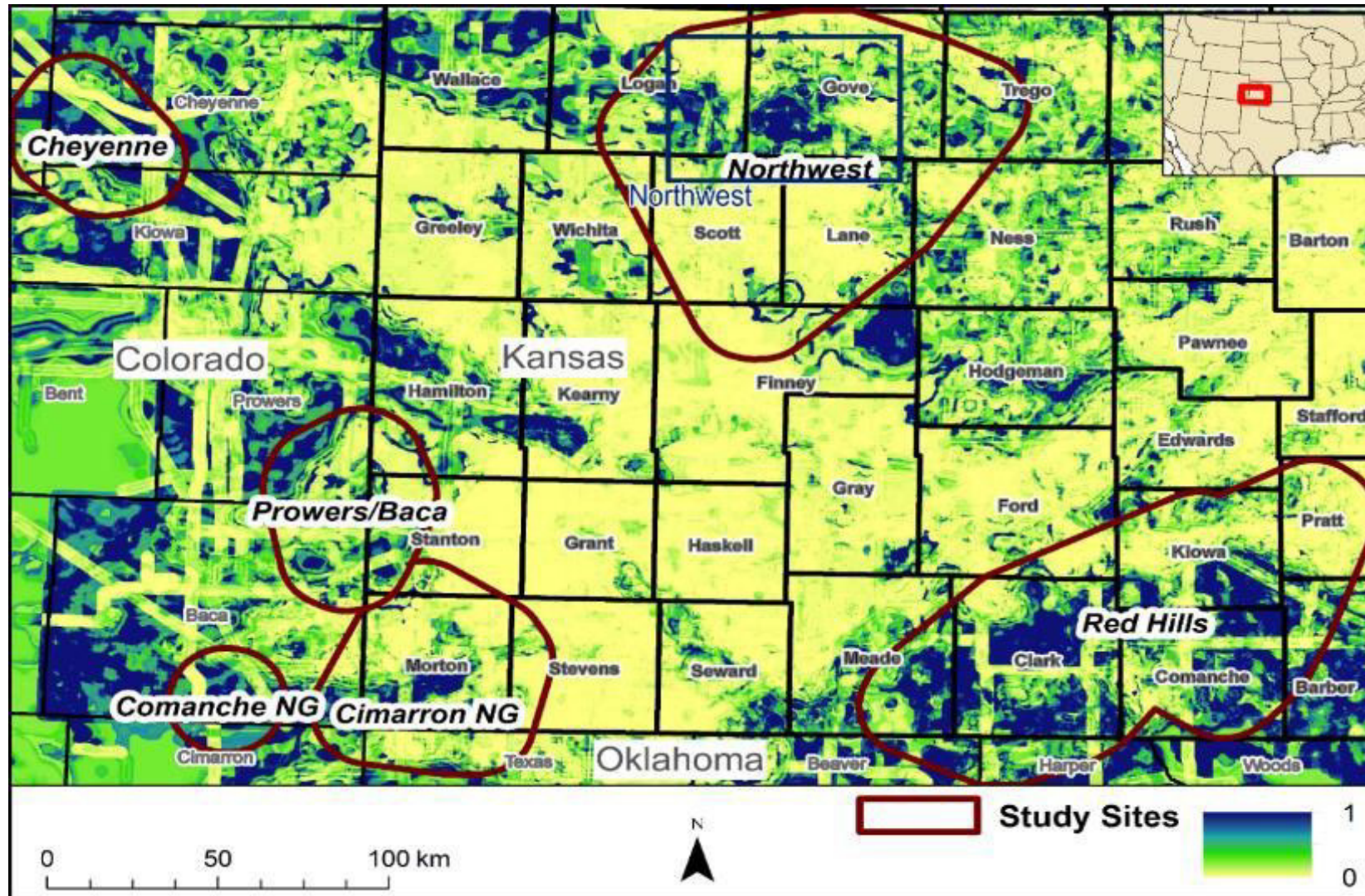


0 25 50 100 km

- Study sites
- Railroads
- Transmission lines
- Oil Wells
- Major roads
- KS distribution lines
- Cell towers
- County roads

Sullins et al. (2019)

Relative probability (0-1.0) of lesser prairie-chicken occurrence based on landscape features and a species distribution model



Based on our predictions, it appears lesser prairie-chickens at current population abundance are constrained to areas having >70% grassland within a 5-km radius (78.5 km²) and with minimal anthropogenic features (e.g., <10 vertical features in 12.6 km²).

The percentage of potential habitat (>0.6 predicted occurrence threshold) within the northern extent of presumed range of the lesser prairie-chicken in Kansas and Colorado is

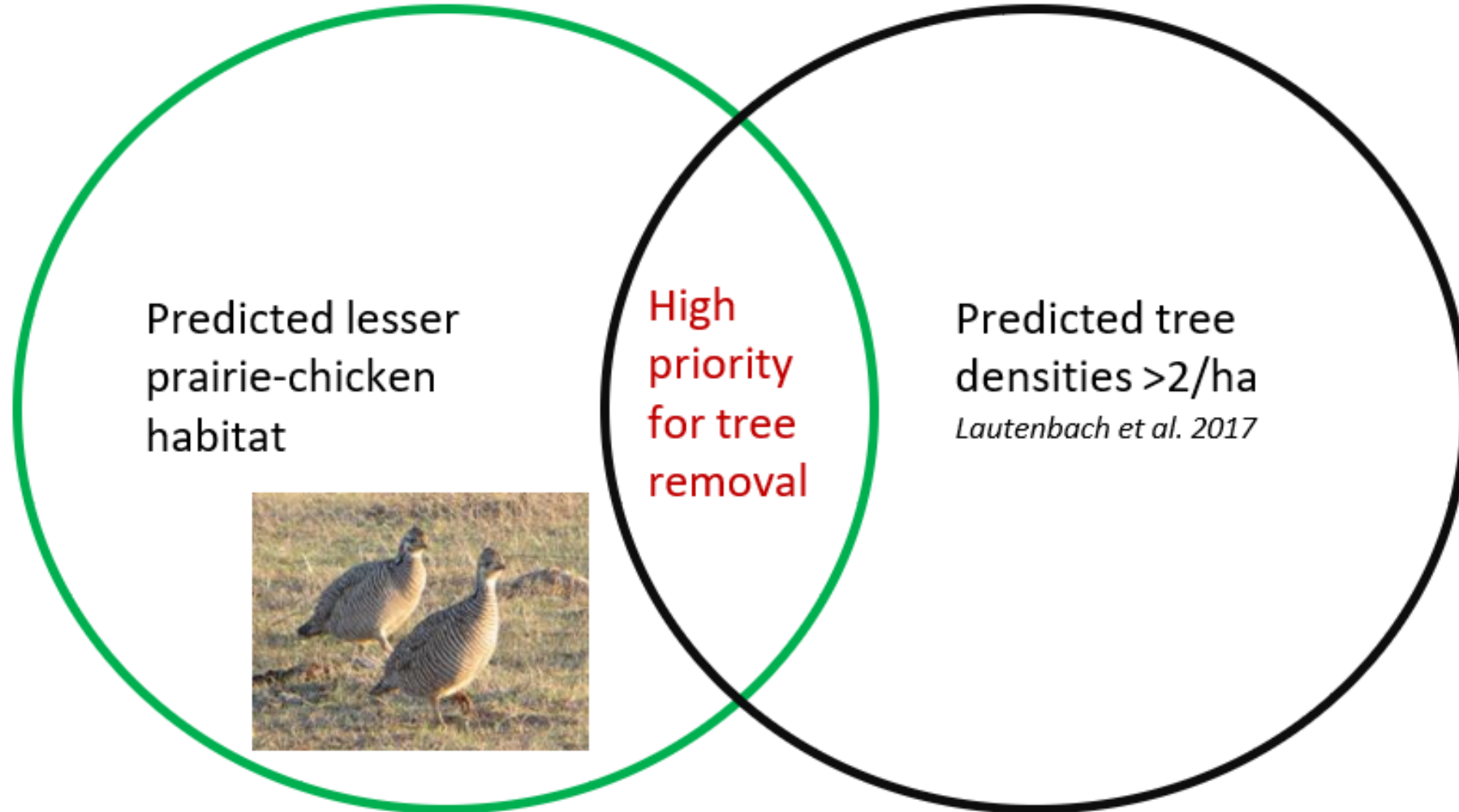
16% (3,099/14,790 km²) in the MGP Ecoregion,

9% (2,613/27,899 km²) in the SSP Ecoregion, and

8% (3,671/43,641 km²) in the SGP Ecoregion.



Strategic conservation: tree removal



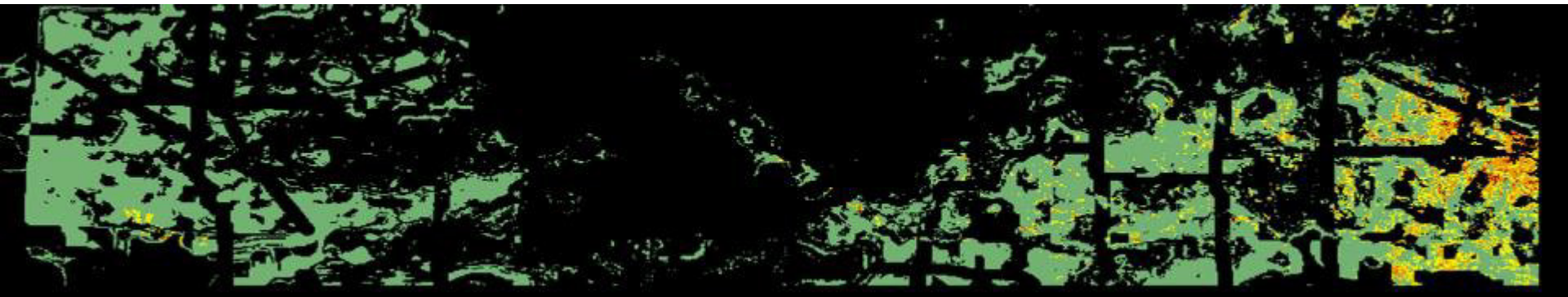
Strategic conservation: CRP enrollment



- Predicted habitat distribution
 - Anthropogenic feature densities
- Identified areas where CRP was most likely to be used
 - >60% native prairie within 4km radius
 - < 55 cm of Annual Average Precipitation
- Estimated the area of cropland falling within landscape and climate criteria

Conclusion

- Conserving large grassland landscapes (>70%) integral for the persistence of lesser prairie-chickens
 - Larger grassland areas are more resilient to drought
 - Need habitat in both ecoregions to resist negative stochastic events
- Anticipate that restoring potential habitat through tree removal and CRP sign up could increase populations by ~11%
 - Based on 19 birds/1000ha (5/mile²; Van Pelt et al. 2013)



Science to Solutions

Grazing Practices Foster



Science to Solutions

Patch-Burn Grazing Creates Habitat Diversity



Future Lesser Prairie-Chicken Research

- Use existing data to address novel ecological and conservation questions, including expanding investigation of theoretical relationships never before tested for prairie grouse.
- Development and use of movement models to evaluate and predict how lesser prairie-chickens move within home ranges, during dispersal, and following translocation.
- Determine additional thresholds for persistence of lesser prairie-chicken strategies.
- These results will inform development of corridors, provide insights on colonization of unoccupied habitat, response to landscape structure and composition, effects of management actions, and conservation status of populations of lesser prairie-chickens.

Thank you for supporting lesser prairie-chicken research at the Kansas Cooperative Fish and Wildlife Research Unit

