Multi-scale occupancy models provide insights to landscape conservation needs for the Lesser Prairie-Chicken

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Threats to the species

- Conversion of grassland to agriculture
  - CRP or native prairie
- Encroachment of woody species
- Industrial development
- Prolongued drought
Basic Biology

- High productivity
  - 12-14 eggs in clutch
    - regional variation
- Moderate survival
  - 35-60% Annual
- Landscape species
  - 5-10,000 ha
- Evolved largely treeless landscapes
LEPC range-wide monitoring

- Occupancy complements abundance estimates range-wide monitoring
- Spatio-temporal changes in distribution
- A straight-forward framework for habitat relationship modelling
Objectives

1. Estimate LEPC occupancy at multiple spatial scales

2. Exploratory analysis: effects of habitat and conservation practices on LEPC occupancy

3. Provide a few insights to more recent multi-year occupancy modelling
Range-wide study area 2015

Spatially balanced sample of 15 km x 15 km grid cells ($N = 283$)

- **Shortgrass/CRP mosaic**
  $N = 73$

- **Sand sagebrush prairie**
  $N = 55$

- **Mixed grass prairie**
  $N = 78$

- **Shinnery oak prairie**
  $N = 77$
Modified range-wide design

- 15 km
- 7.5 km
- 225 km²
- 56 km²
Modified range-wide design

1. Front seat observers
2. Back seat observers

7.5 km
Multi-scale occupancy

Large-scale occupancy of grid cells \((\psi)\)

Small-scale occupancy of transects \((\theta)\), when the grid cell is occupied

Detection of observers \((p)\), when the transect and grid cell are occupied

Hagen et al., 2016, Condor
Pavlacky et al., 2012, J. Wildlife Manage., Vol. 76
Preliminary hypotheses

• Mean patch size of native vegetation (km²)
  – Playa Lakes Joint Venture land cover database

• Major road density (km⁻¹)
  – Tiger/line road database

• Conservation Reserve Program land cover (%)
  – Farm Service Agency common land unit database

• Prescribed grazing land cover (%)
  – Natural Resources Conservation Service spatial database
Range-wide detection

Habitat region - observer

- SOPR - front
- SSPR - back
- SSPR - front
- MGPR - front
- MGPR - back
- SGPR - front
- SGPR - back

Detection (p)

Front seat observers
Back seat observers
## Range-wide occupancy

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<thead>
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<th>Parameter</th>
<th>Est.</th>
<th>CV</th>
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<td>$\psi(.)$</td>
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<td>$\theta($Shortgrass$)$</td>
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<td>$\theta($Shinnery oak$)$</td>
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Large-scale occupancy

Mean patch size of native vegetation (km²)

Prescribed grazing land cover (%)
Small-scale occupancy

CRP land cover (%)

Small-scale occupancy (θ)

Habitat regions

Shinnery oak
Sand sagebrush
Mixed grass
Shortgrass - CRP
Exploratory conclusions

- Patch size and prescribed grazing improved habitat condition at the large scale.
- CRP augmented the patch size of native vegetation at the small scale.

Mean patch size = 0.6 km²

CRP = 6%  CRP < 1%
CRP = 22%  CRP = 20%
Future directions

- Multi-scale occupancy is a promising state variable for range-wide monitoring
- Temporal analysis to predict LEPC responses to habitat and conservation practices
Acknowledgements

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- Michael Houts

[Logos of WAFWA, Pheasants Forever, and USDA Natural Resources Conservation Service]