Wyoming's Sage-grouse Core Area Strategy: Is it Effective?

Jeffrey L. Beck
Dept Ecosystem Science & Management
University of Wyoming
Laramie, WY

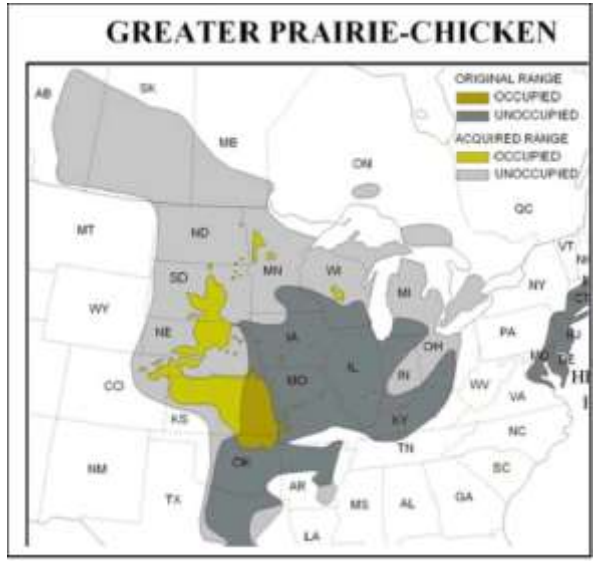
Greater Prairie Chicken

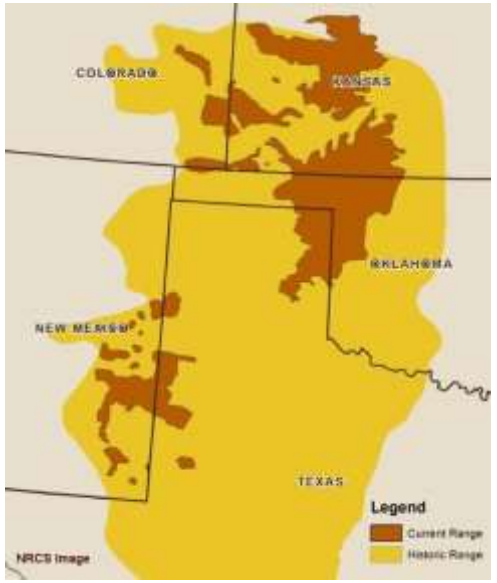
Lesser Prairie Chicken

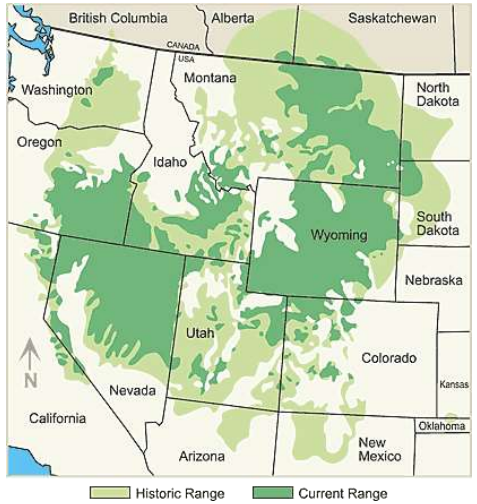
Sharp-tailed Grouse

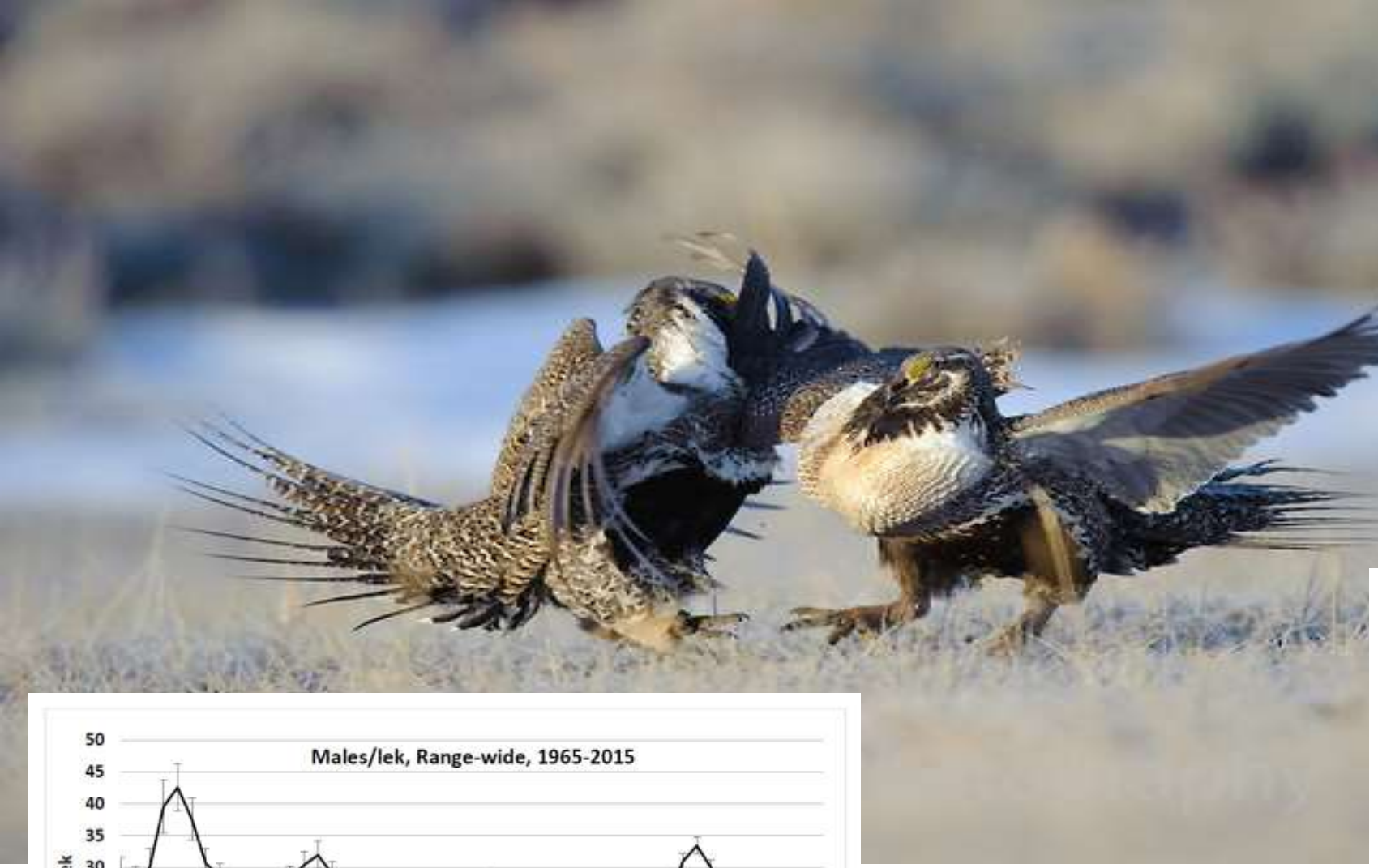
Greater Sage-grouse

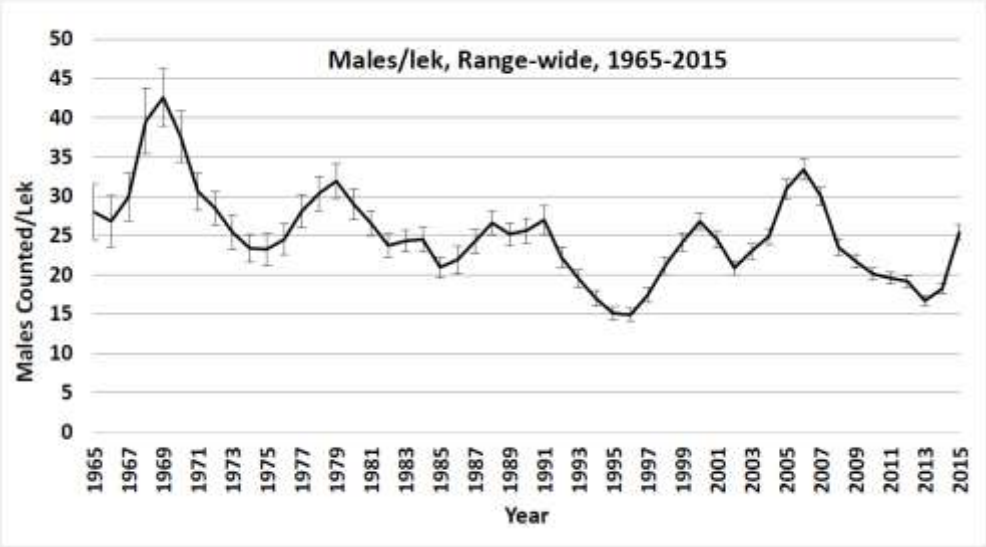
Gunnison Sage-grouse

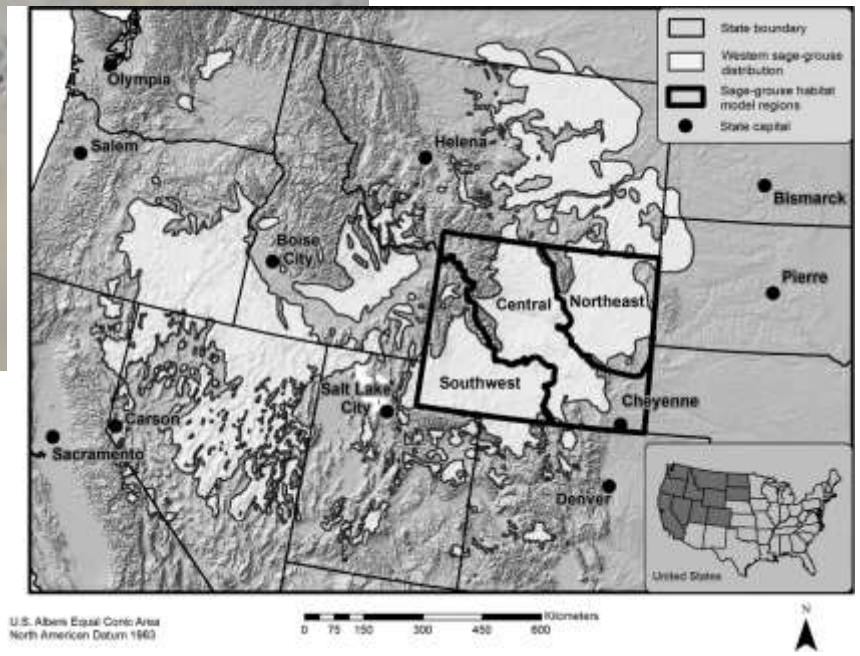












Fedy et al. (2014) – *Wildlife Monographs*

WYOMING'S SAGE-GROUSE BY THE NUMBERS

77% Wyoming has about 62 million acres. Of this, about 48 million (77 percent) was historic range for sage-grouse

24 percent of the state has been designated as "core" habitat for sage-grouse

24%

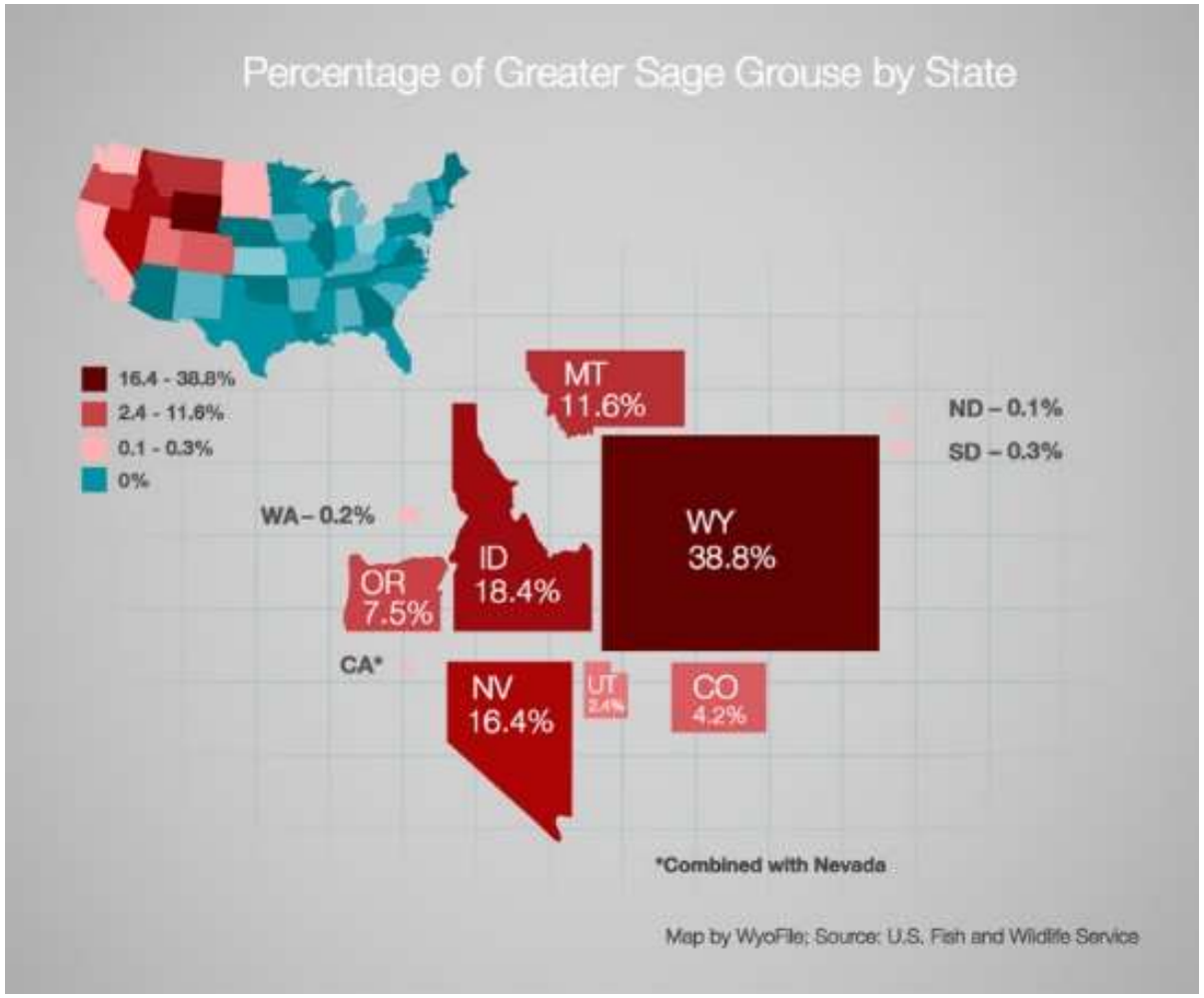
90 percent (43 million acres) of historic habitat in Wyoming is still occupied as compared to 56 percent of range-wide habitat

90%

82 percent of Wyoming's breeding population of sage-grouse displayed on leks in core areas at implementation in 2008

82%

Wyoming habitats are generally more intact/continuous than in other states with sage-grouse populations



Sagebrush Obligates

From Gamo et al. (2013) – *The Wildlife Professional*

Outline

I. **Wyoming's Sage-grouse Core Area Strategy**
II. Effectiveness in conserving breeding habitat
III. Effectiveness in conserving winter habitat
IV. Sage-grouse as an umbrella species
V. Conclusions

Energy Development in Wyoming

Economic Impact

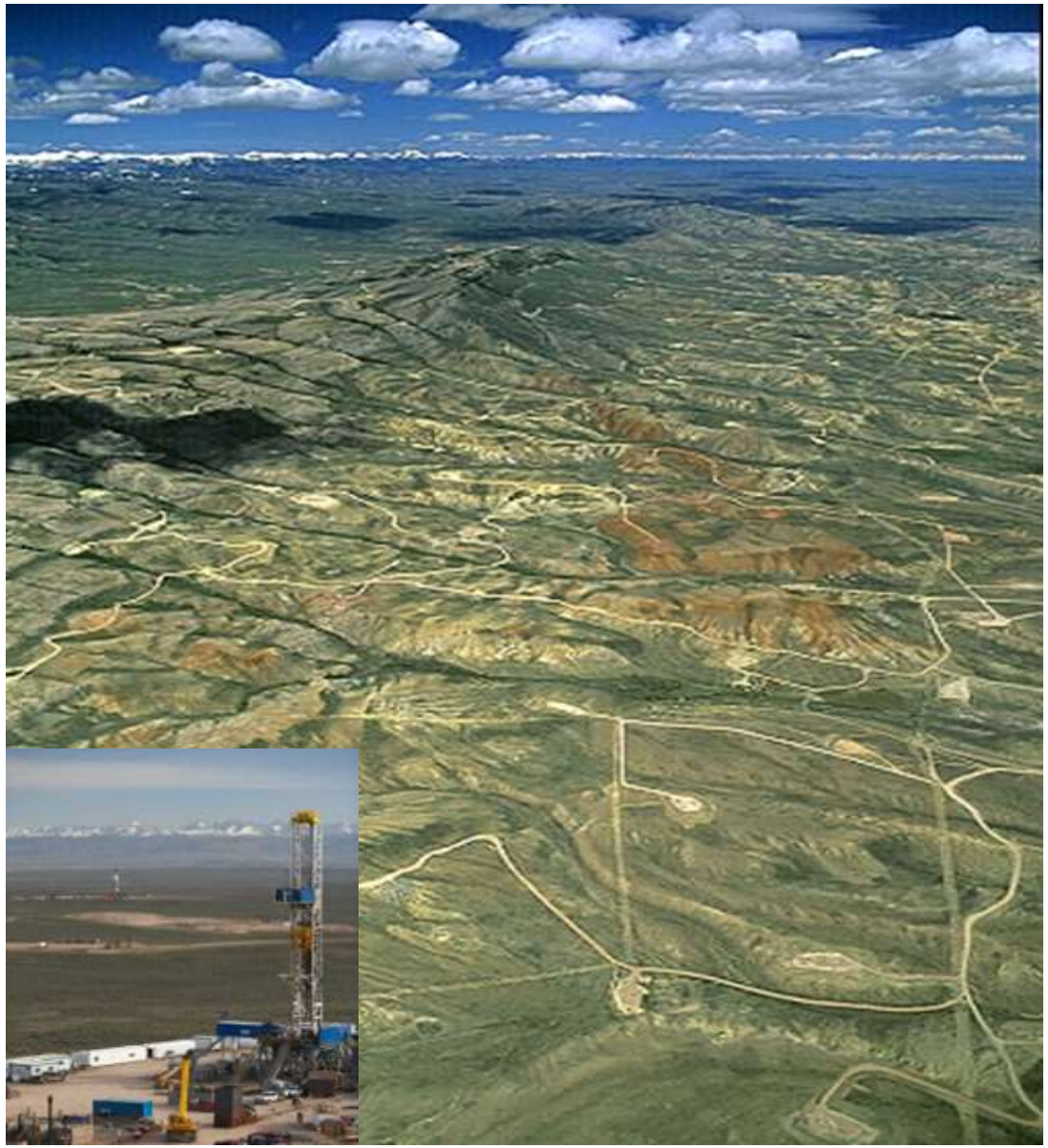
- Total valuation in 2011 = **$15.6 billion for oil, coal and natural gas** (CREG 2012)
- 9.9% of Wyoming's jobs
- 15–24% of Wyoming's GDP/year

Production Ranking (second leading state)

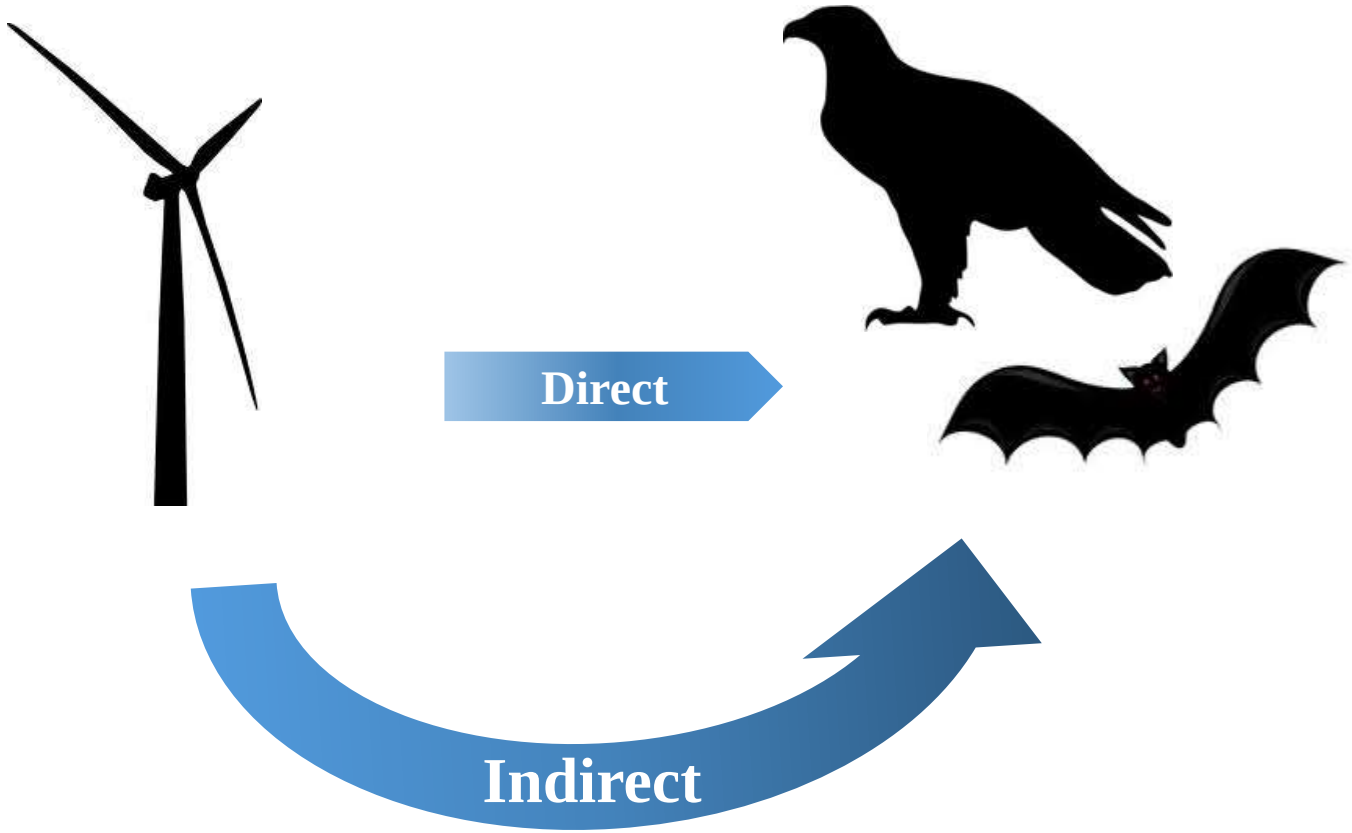
- #1 in U.S. coal and uranium, production and exports of British Thermal Units
- #3 in U.S. natural gas production
- #8 in U.S. oil production
- #11 in U.S. in installed wind energy capacity

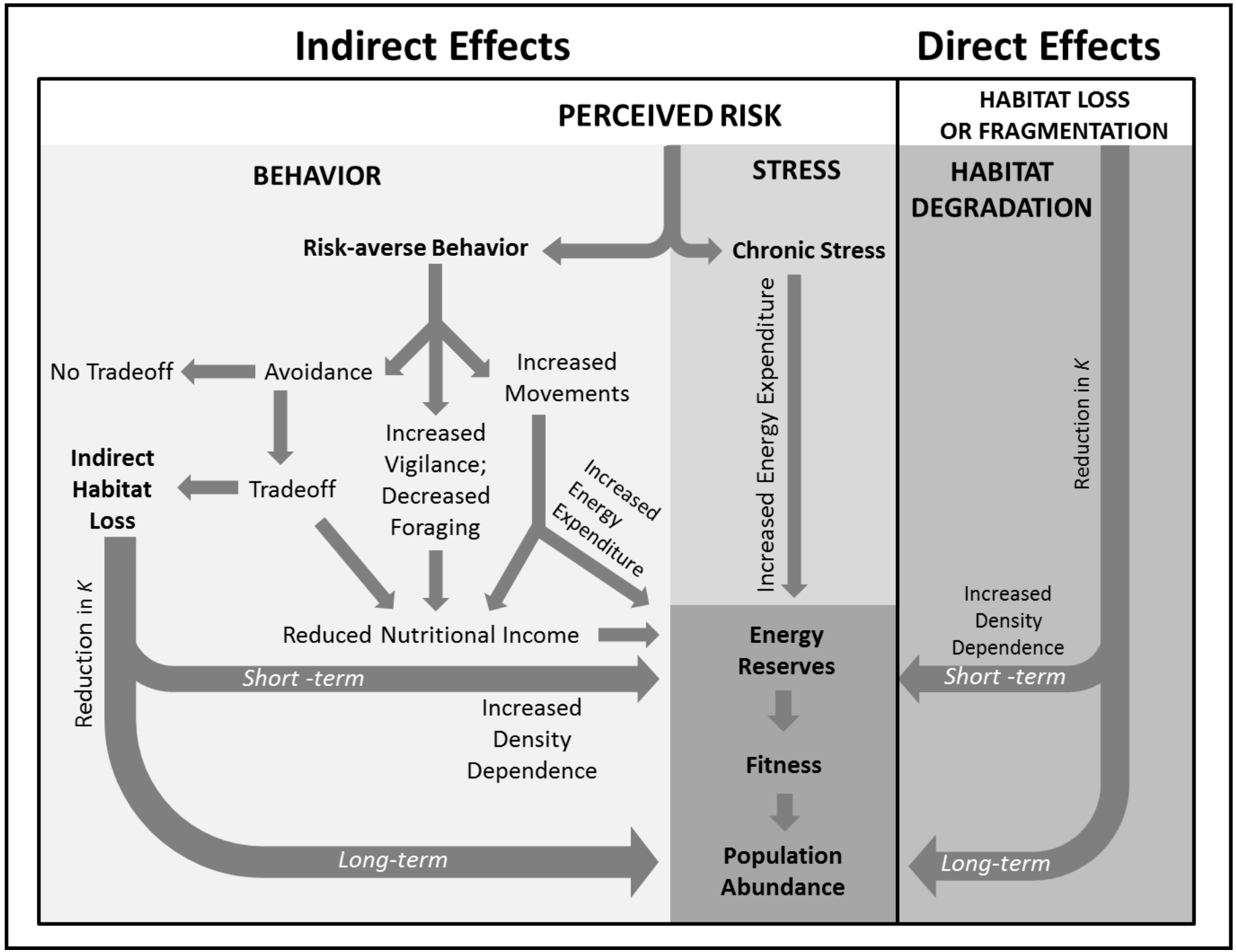
Environmental Impact

- Oil and gas field project boundaries encompass 19% of surface area of Wyoming
- Could directly or indirectly affect up to 21% (96 million ha) of the 5 major ecosystems (grassland, boreal forest, shrubland, temperate forest, and wetland) in western North America (Copeland et al. 2011)

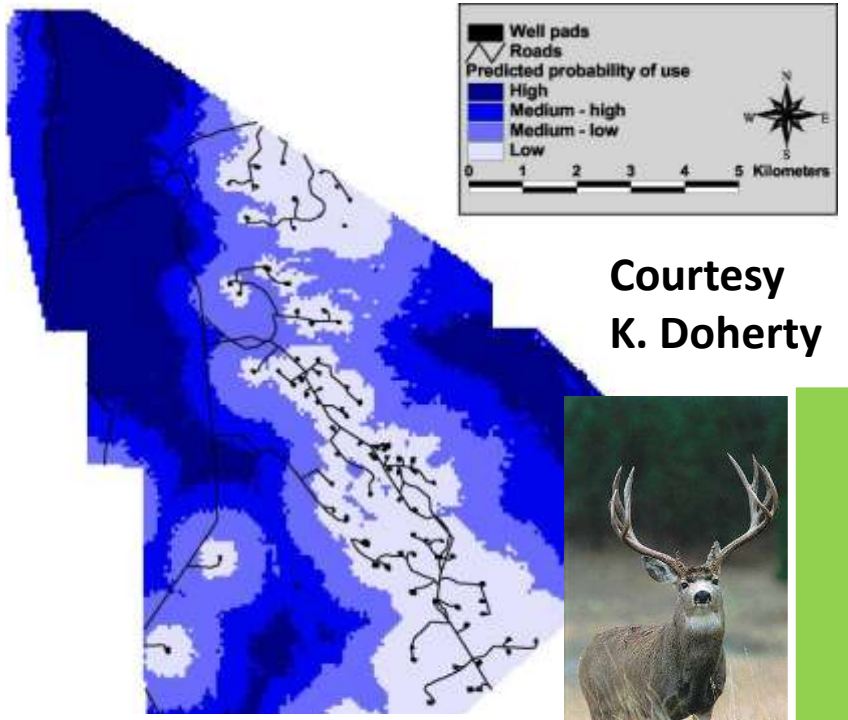


Potential Impacts to Wildlife





Dwinnell (2017)



Courtesy
K. Doherty

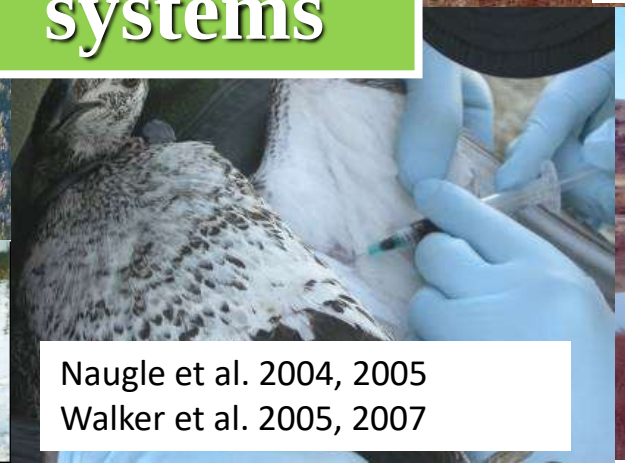
Ingelfinger and Anderson 2004
Bayne et al. 2008;Gilbert & Chalfoun 2011

Sawyer et al. 2006 JWM

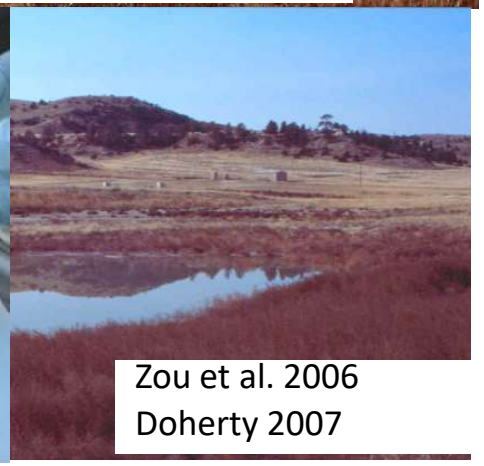
Impacts occur across differing taxa and systems

Bergquist et al. 2007

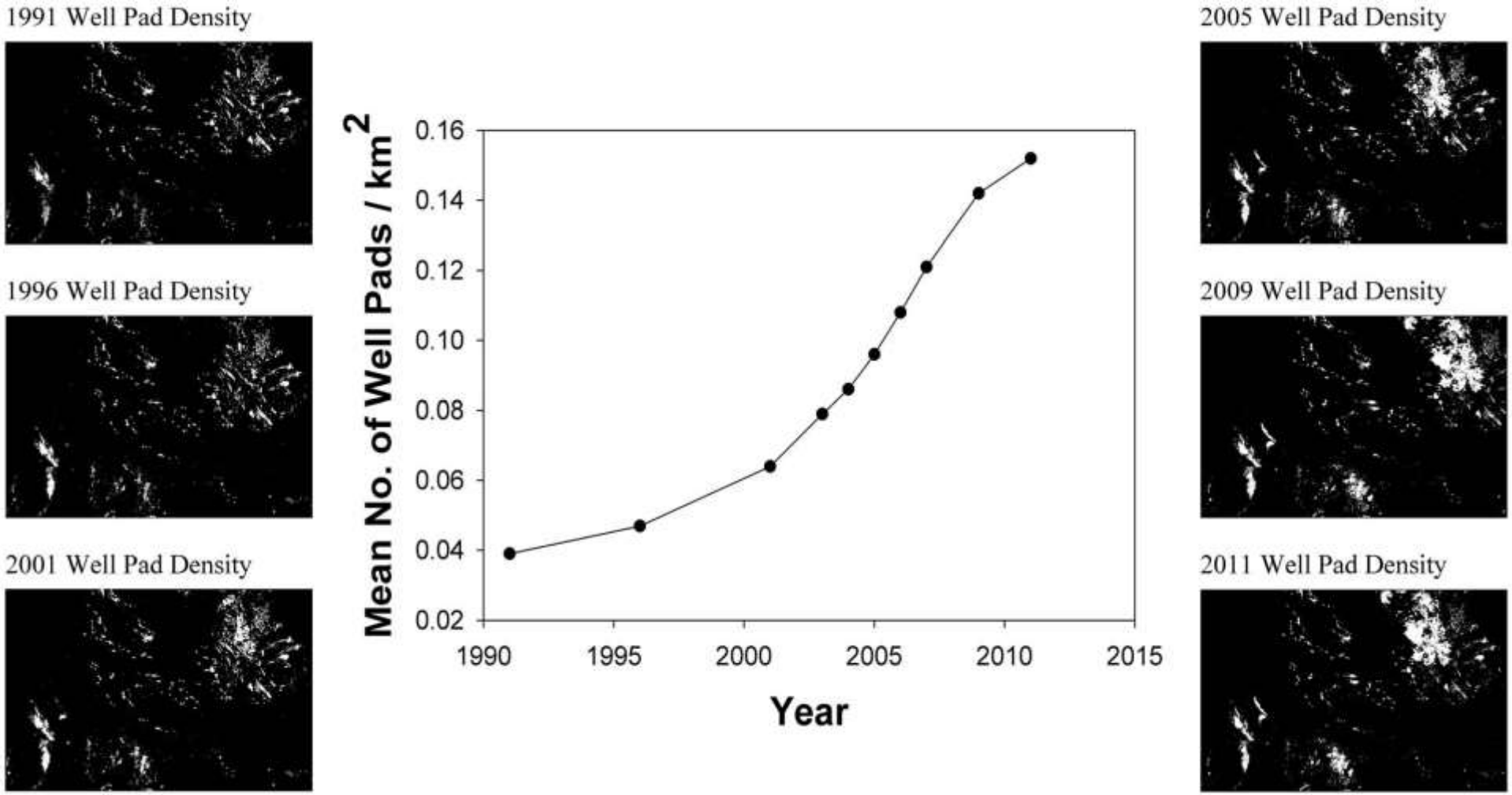
Sorensen et al. 2008 JWM



Naugle et al. 2004, 2005
Walker et al. 2005, 2007



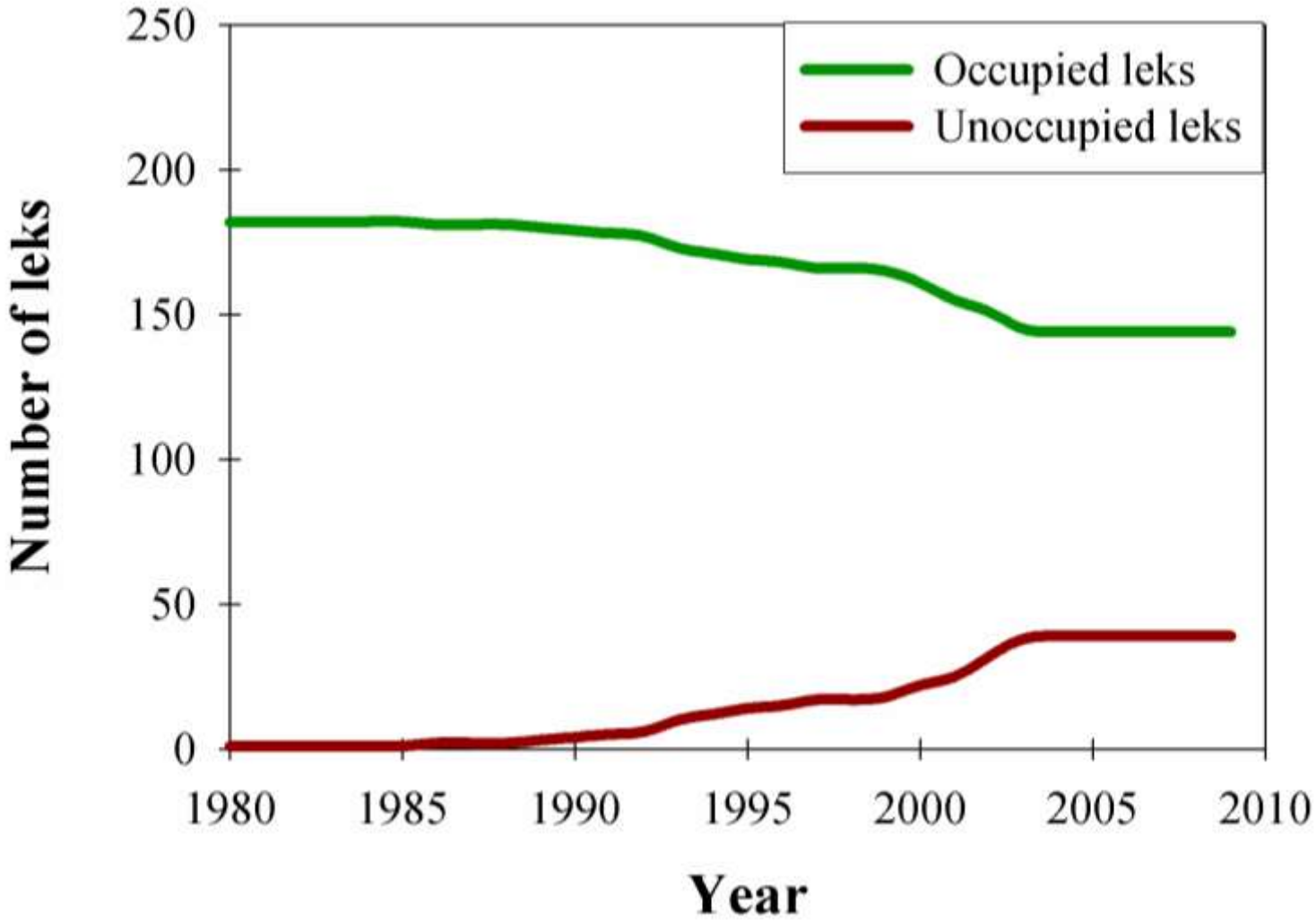
Zou et al. 2006
Doherty 2007



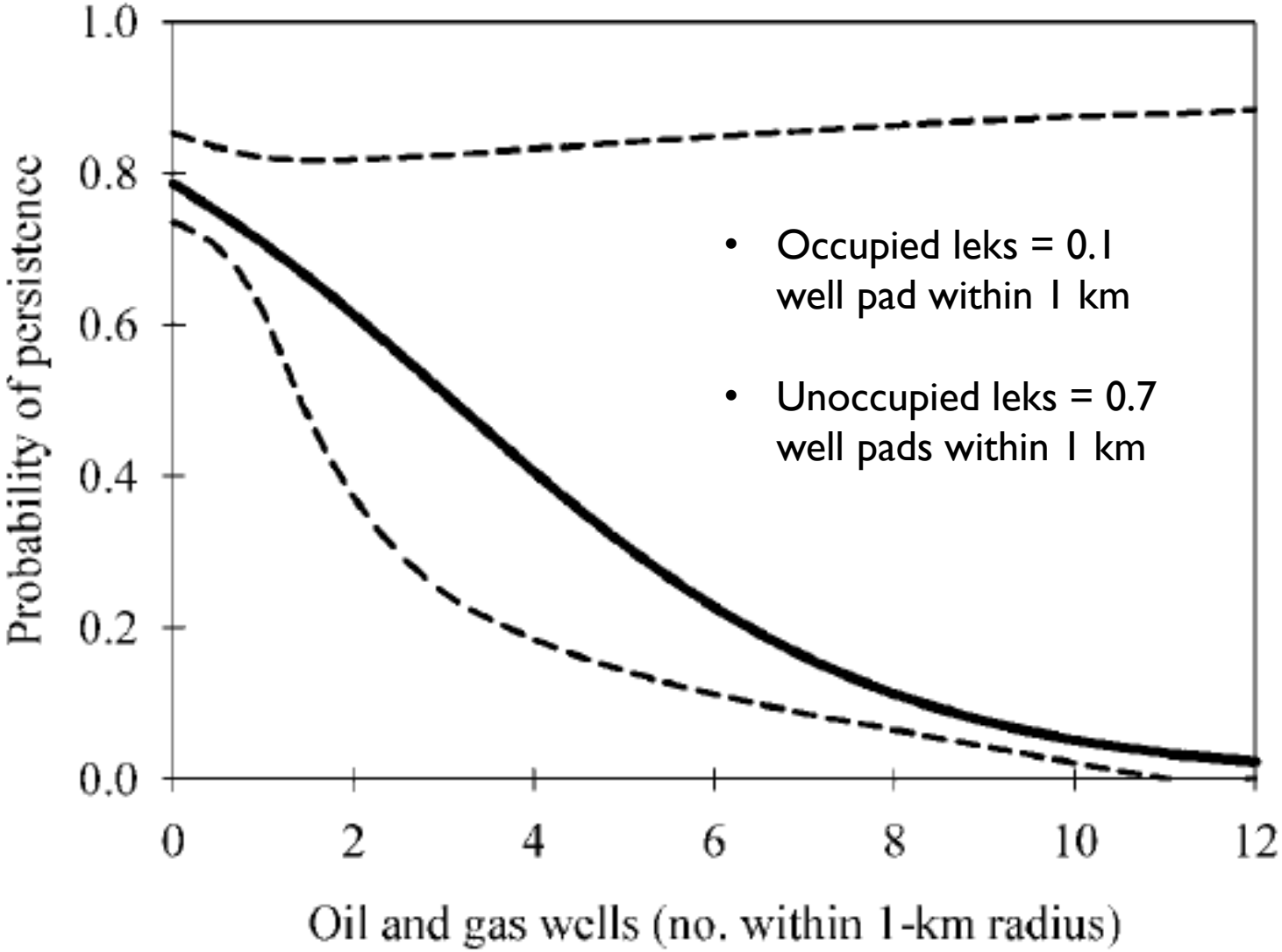
- 39,885 oil and gas wells 1991–2011
- 3.6-fold increase in wells
- Associated with a 24% decline in male sage-grouse attending leks

Gregory and Beck (2014) – *PLoS ONE*

Bighorn Basin Lek Persistence

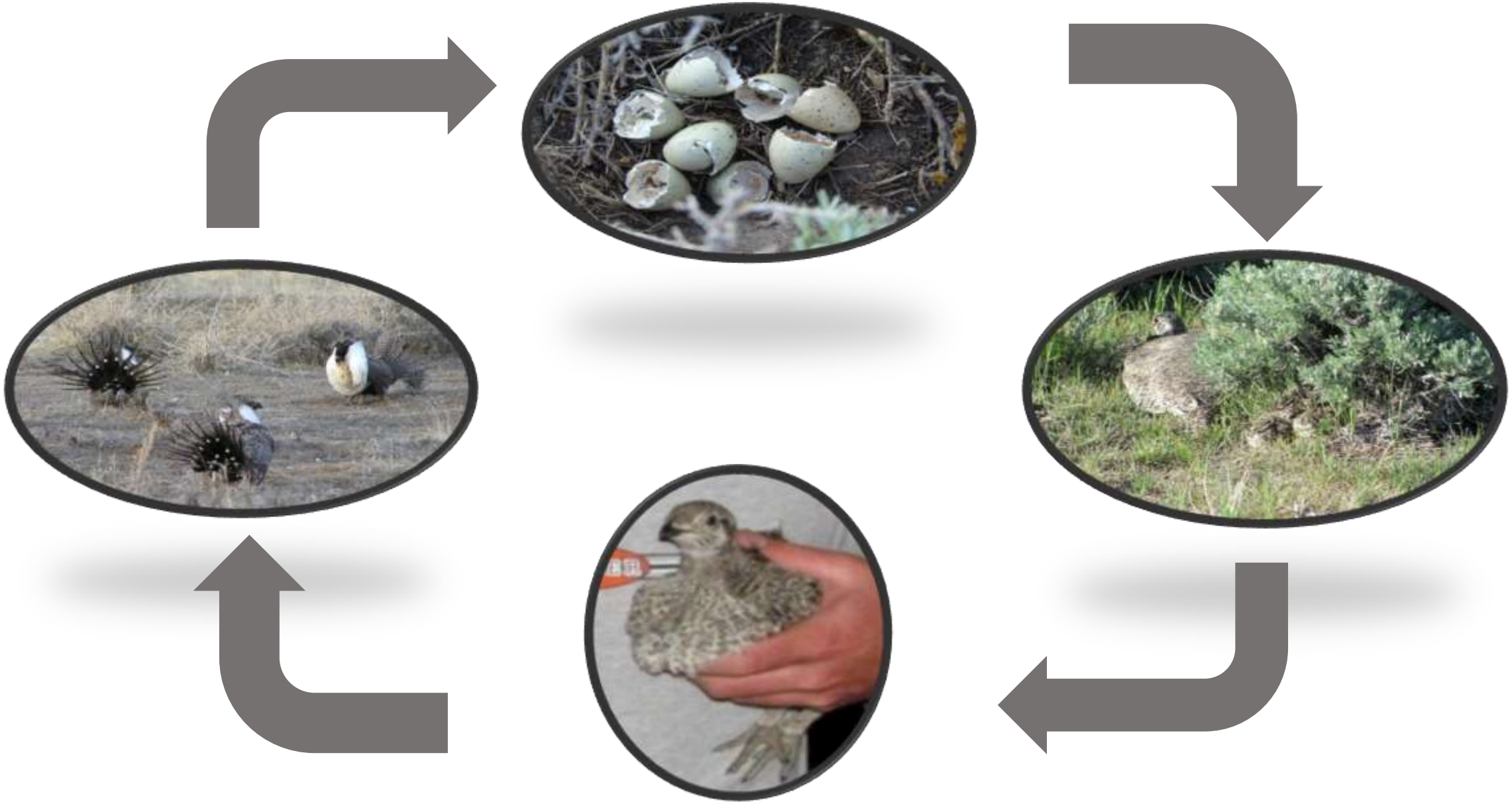


Hess and Beck (2012) - JWM

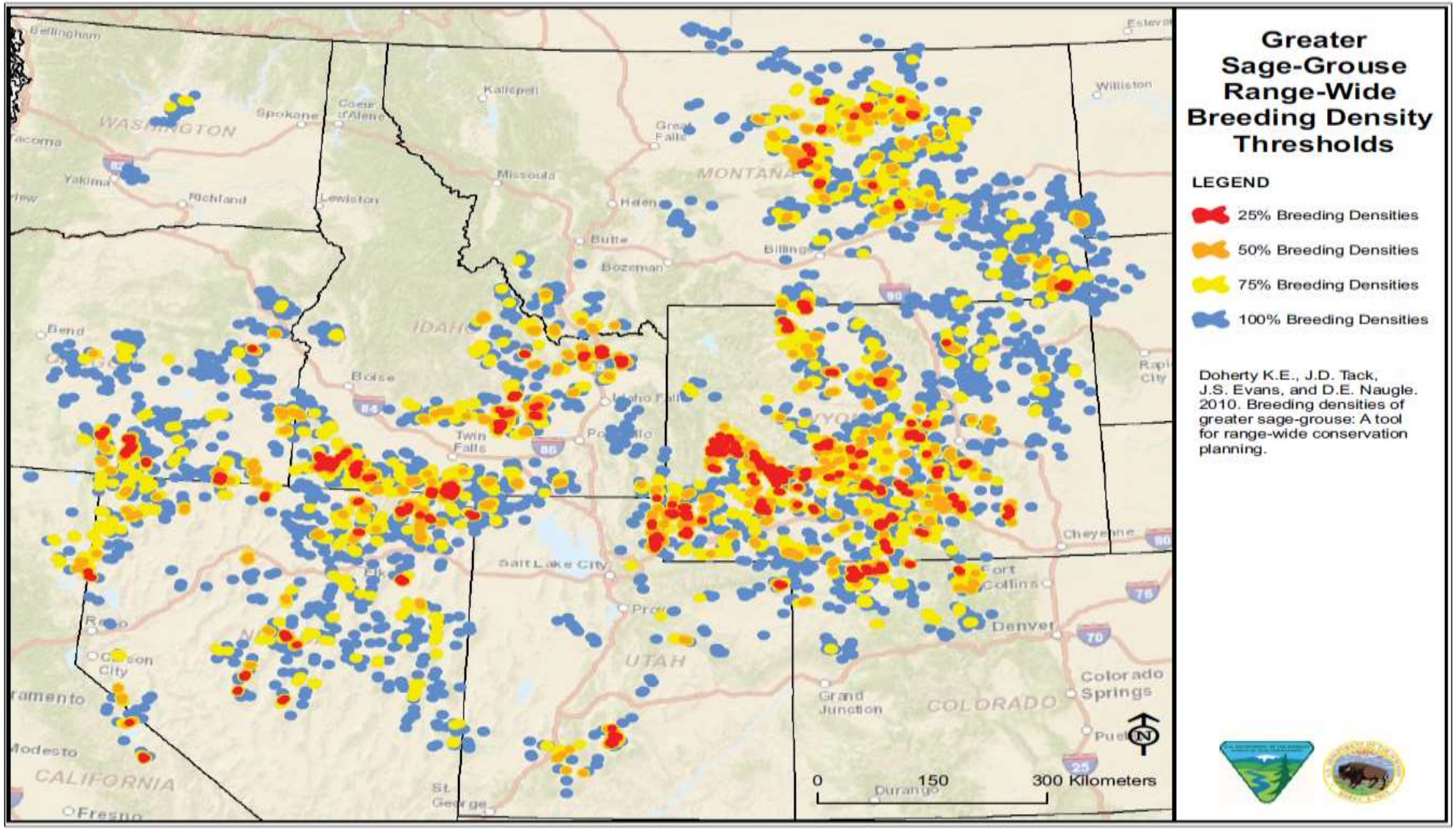


Hess and Beck (2012) – JWM

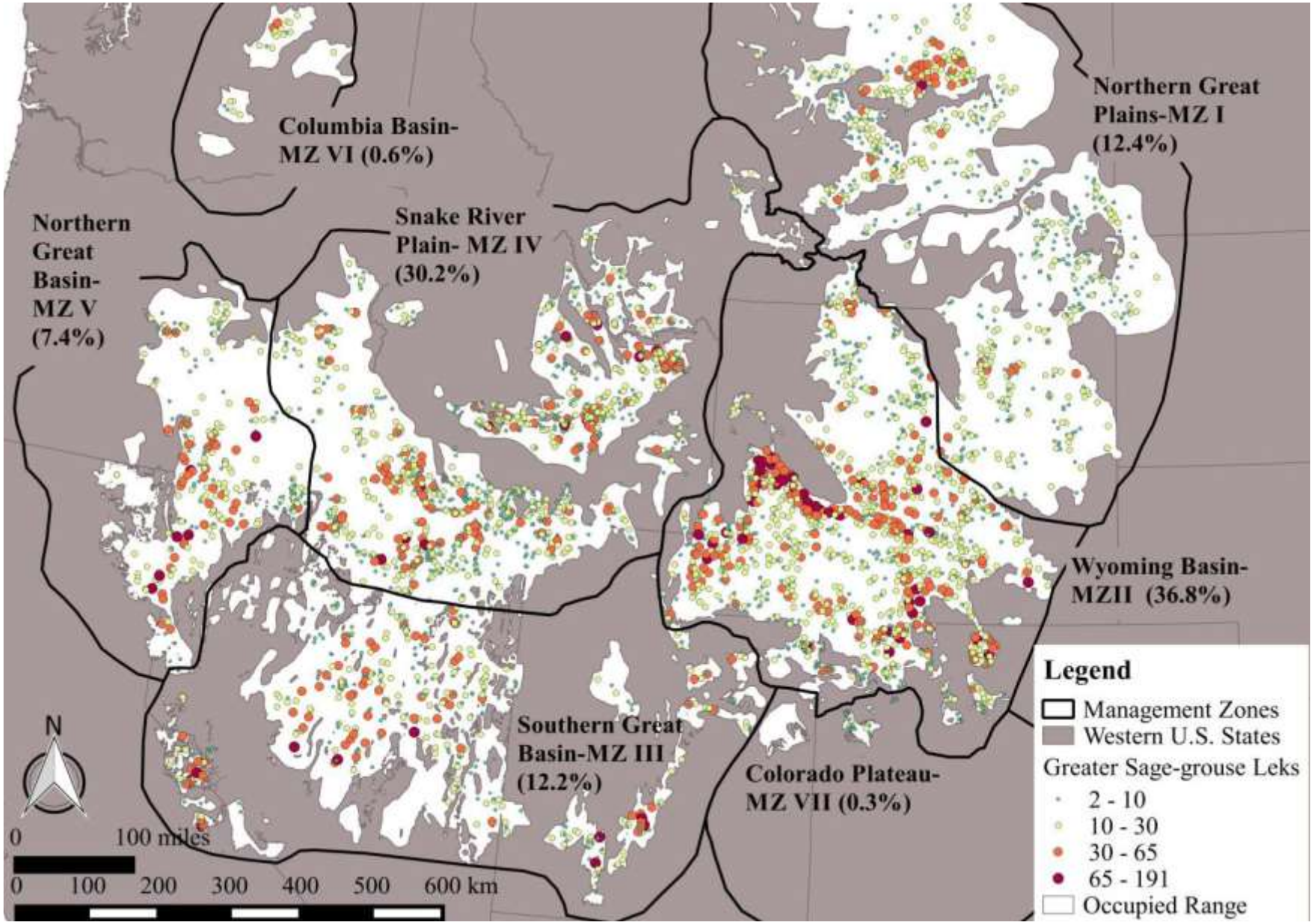
Sage-Grouse Populations



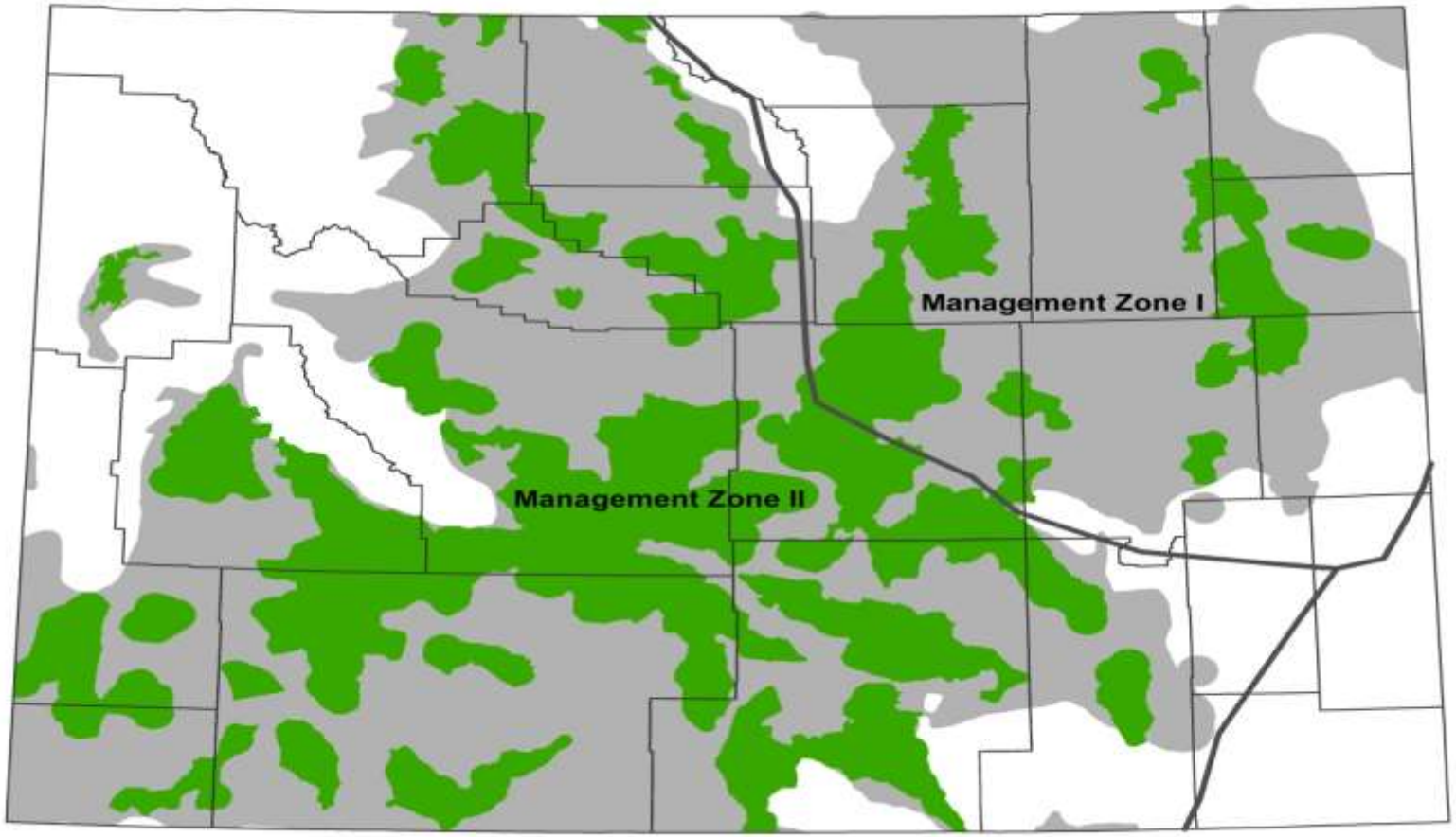
Breeding Densities



Percentage of Range-wide Lek Count (2010–2014; Doherty et al. 2015)



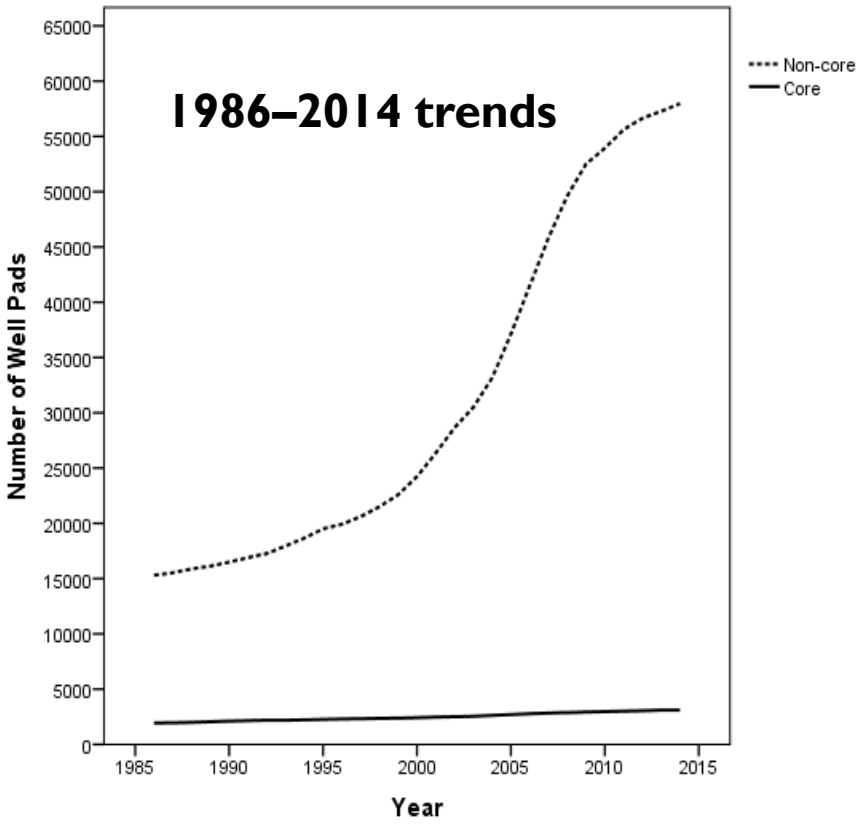
Wyoming Sage-grouse Executive Order (2008)

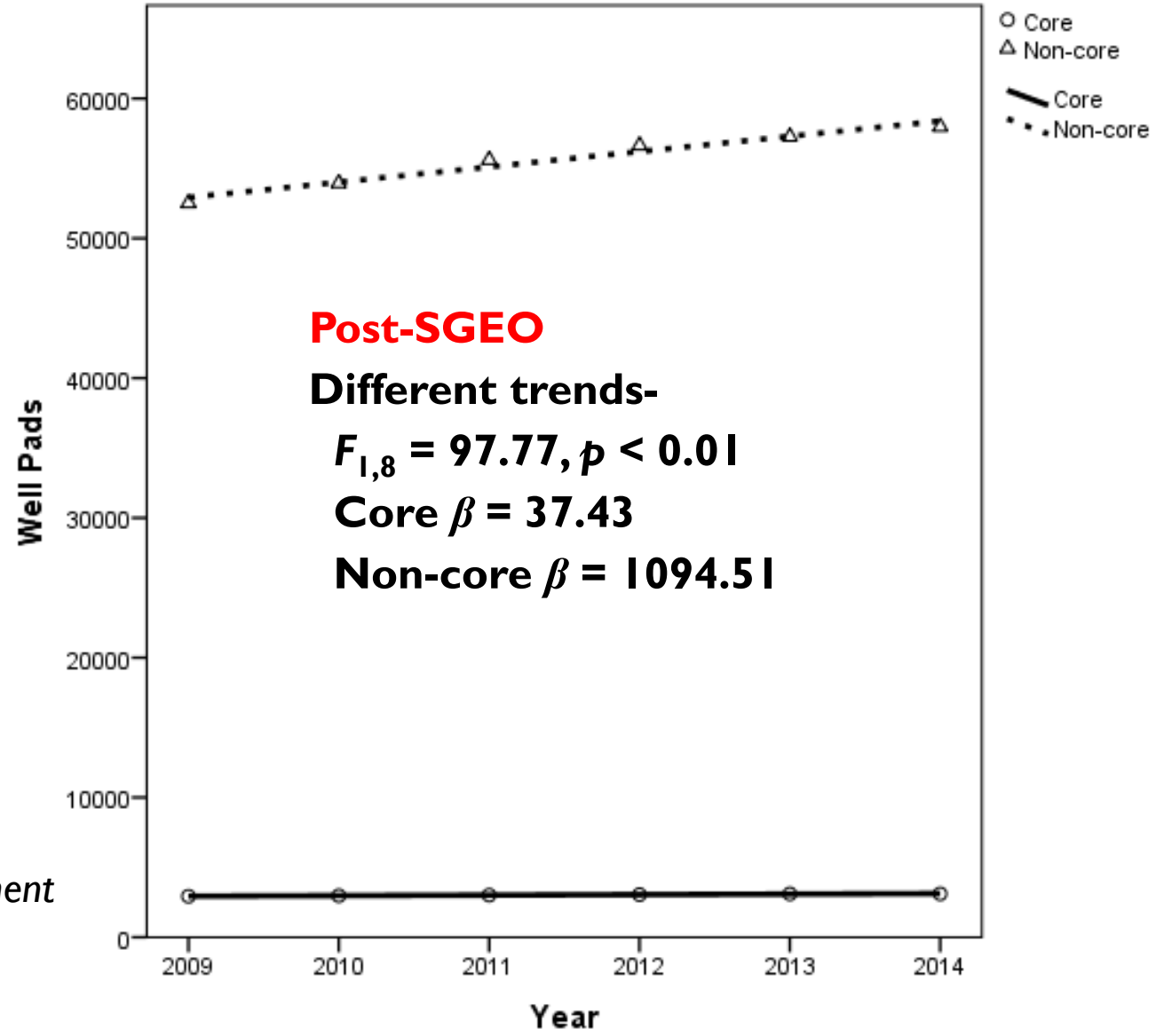


Primary Regulations Limiting Disturbance

- Seasonal timing stipulations
- 5% surface disturbance
- No more than 1 disturbance/640 acres
- 0.6 mi no surface occupancy from lek perimeter

Statewide Trend in Well Pads





Gamo and Beck (2017) – *Environmental Management*

Outline

I. Wyoming's Sage-grouse Core Area Strategy
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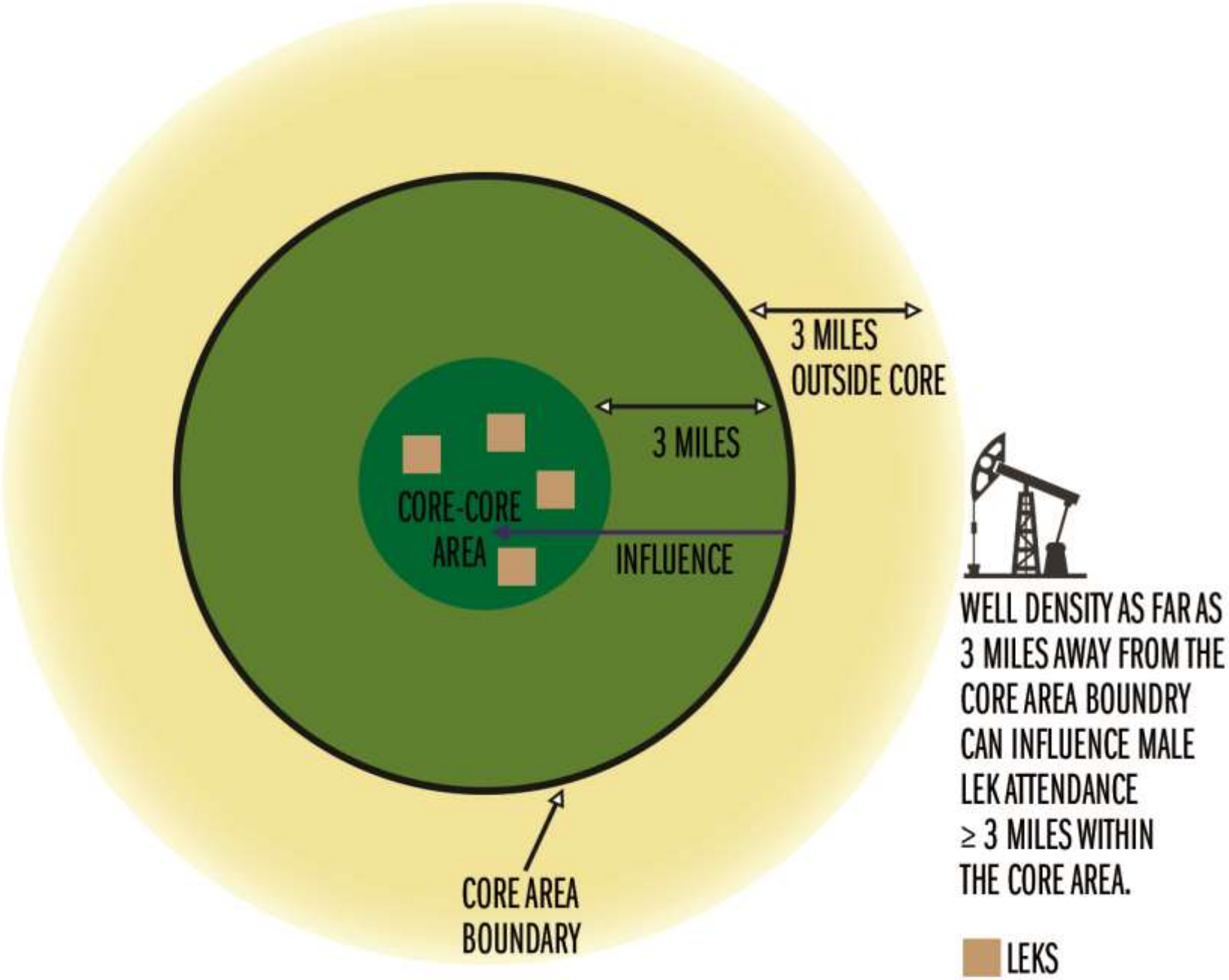
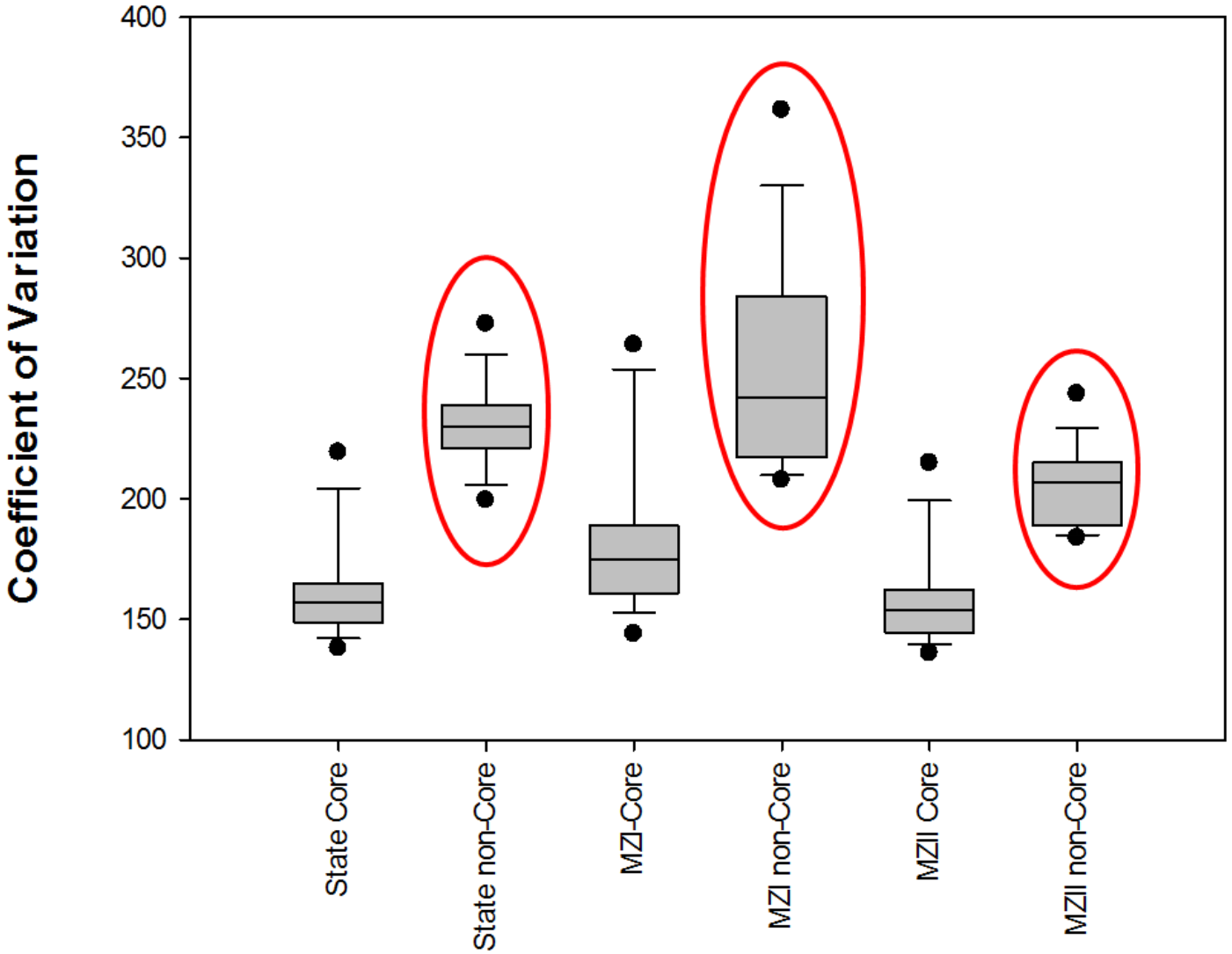
Oil and gas development density outside the Core Area is negatively impacting lek attendance inside the Core Area



Spence et al. (2017) – *PLOS ONE*

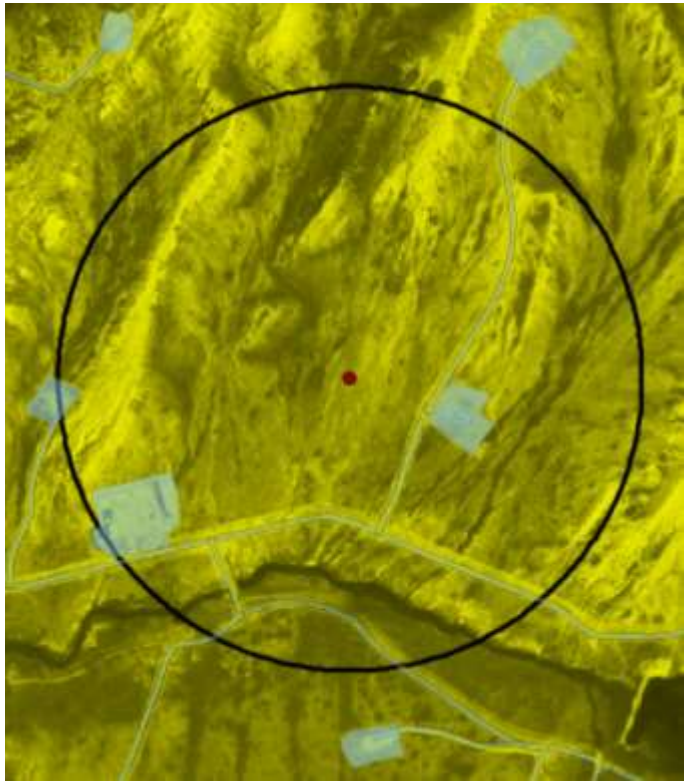
Median and Range in CVs in Male Lek Attendance in Wyoming (1997–2014)

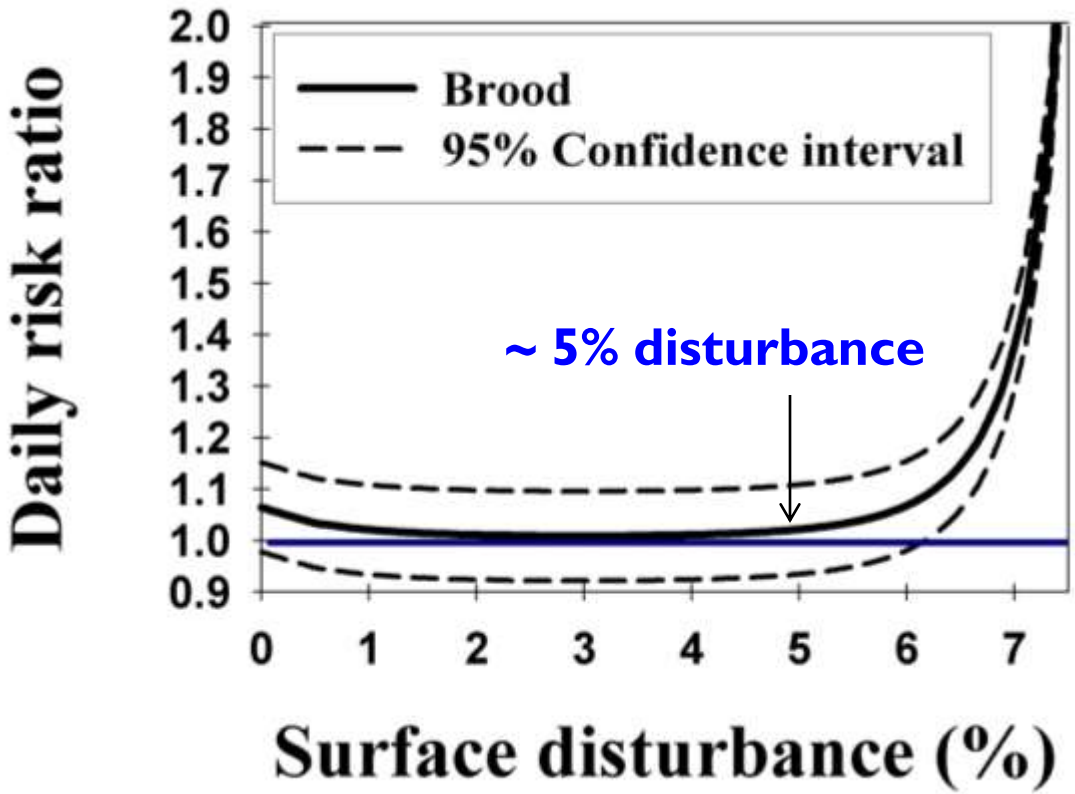


Populations that exhibit smaller CVs are more stable and resilient to changing environmental conditions (Harrison 1979). Data from Gamo and Beck (2017) – *Environmental Management*

Anthropogenic Disturbance and Brood Risk

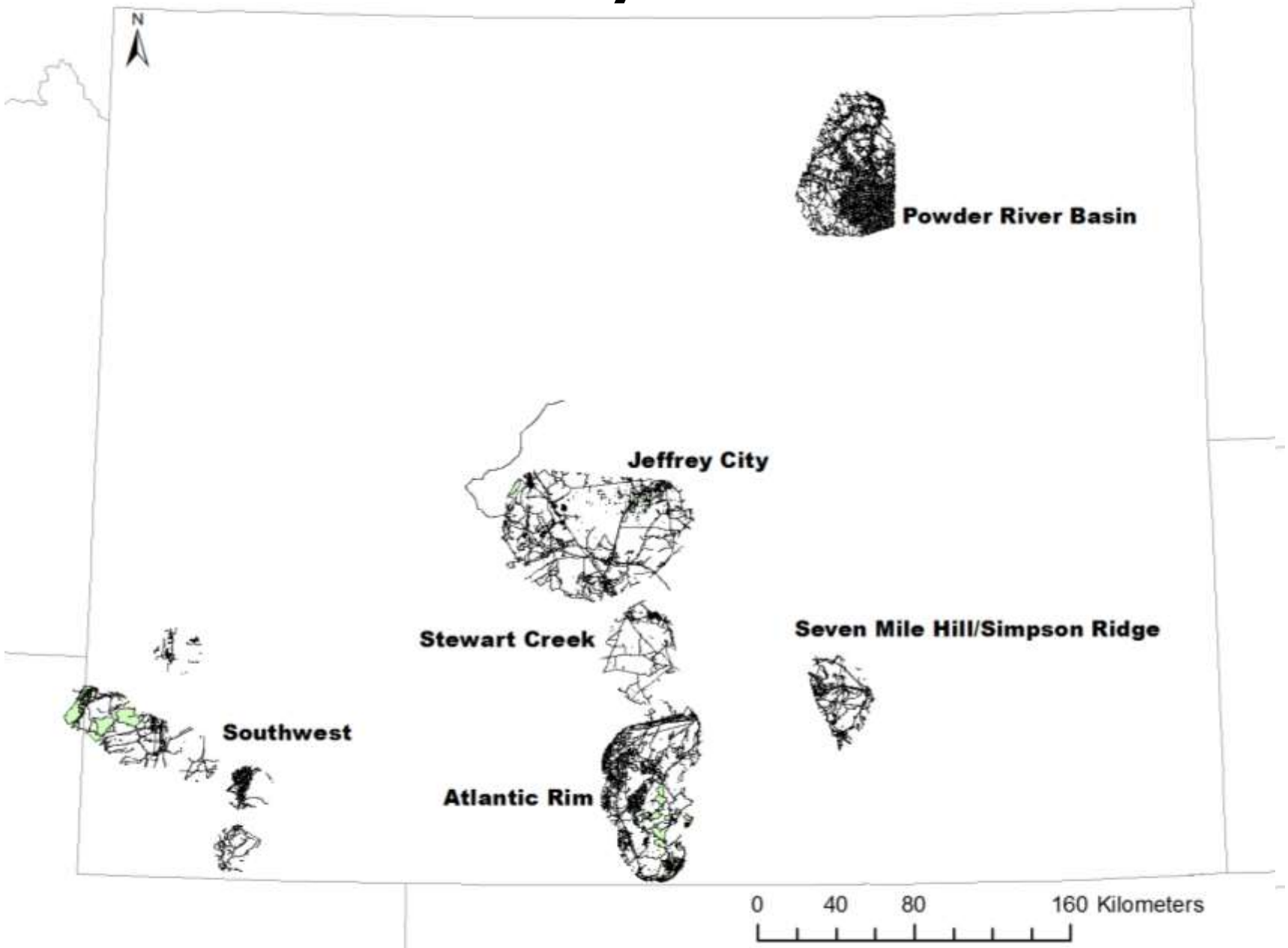
0.564 km radii (1.0 km^2)



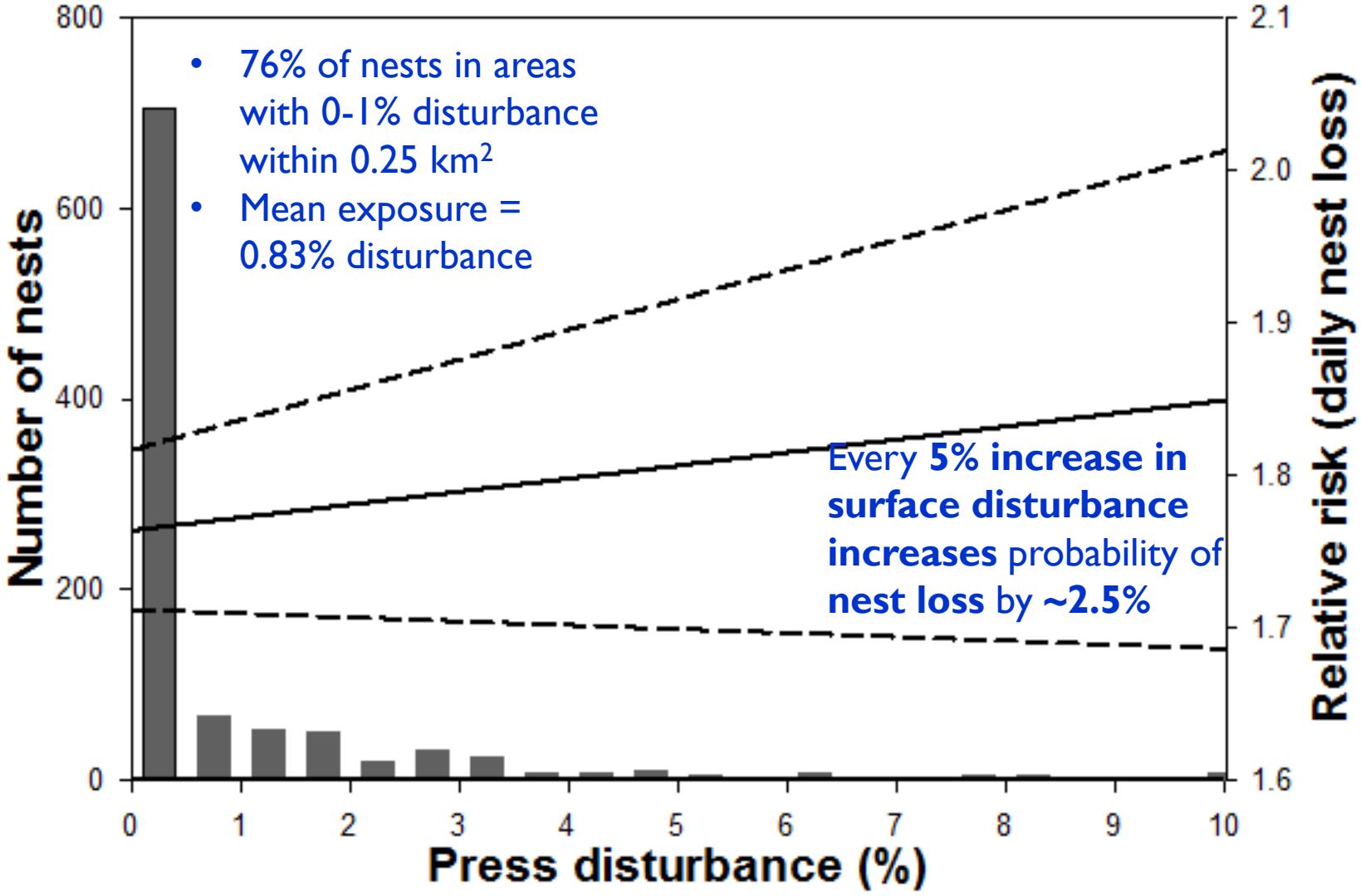


Kirol et al. (2015) – *Ecological Applications*

Study Areas


N
Powder River Basin
Jeffrey City
Stewart Creek
Seven Mile Hill/Simpson Ridge
Southwest
Atlantic Rim
0
40
80
160 Kilometers

Disturbance and Nest Survival



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Winter Habitat Protection (Wyoming SGEO)

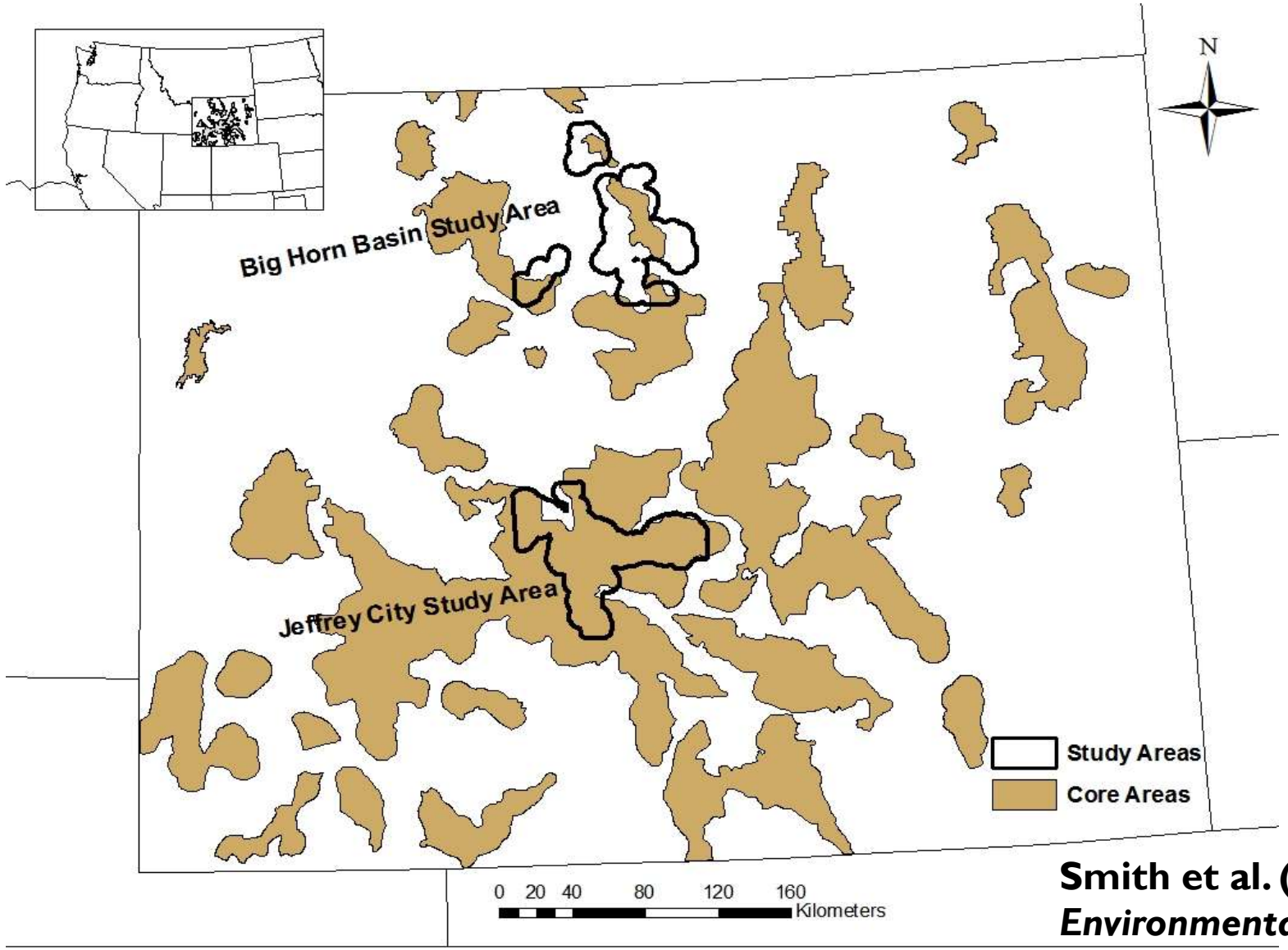
- Winter Concentration Areas (WCAs) – areas where large concentrations (≥ 50 birds) of Core Area sage-grouse congregate and persistently occupy from Dec 1 through Mar 14

- Non-Core Area & non-identified winter concentration area
  - No restrictions on disturbance

- Non-Core Area & **identified** winter concentration areas
  - Seasonal disturbance restrictions: 1 Dec to 14 Mar

- **Core Area** & **identified** winter concentration area
  - Seasonal disturbance restrictions: 1 Dec to 14 Mar
  - 5% surface disturbance cap

Resource Selection Study



Smith et al. (2016) –
Environmental Management

Results – Locations/Core Overlap

Big Horn Basin

- 38 females w/24,311 locations during 4 winters (2011–2015)
- Movement from fall to winter range = 8.2 ± 1.7 km (range: 0 to 80.3 km)
- Mean winter season
  - 26 Oct to 21 Mar
- Small Core Area
  - 56.7% (17/30) nests in Core
  - 63.0% of winter locations in Core
  - **17.6% wintered <u>outside</u> Core**

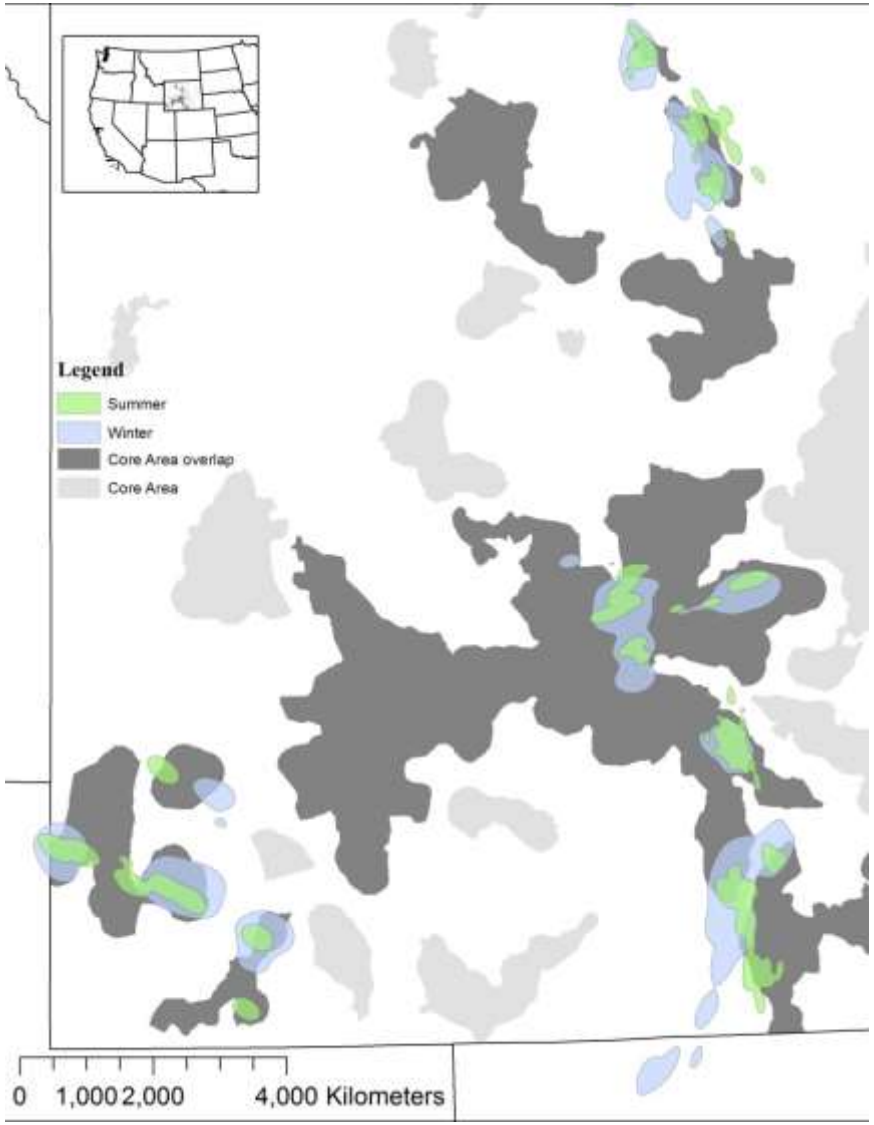
Jeffrey City

- 34 females w/19,689 locations during 3 winters (2012–2015)
- Movement from fall to winter range = 5.1 ± 1.3 km (range: 0 to 37.4 km)
- Mean winter season
  - 7 Oct to 21 Mar
- Large Core Area
  - 100% nests in Core
  - 97.6% of <u>winter</u> locations
  - 96.7% of <u>breeding</u> locations

Smith et al. (2016) –
Environmental Management

Demographic Study

- 585 sage-grouse
- Overlapped 8 Core Areas
- More overlap in larger Core Areas
- No differences between severe and mild winters



Dinkins et al. (2017) – *Ecosphere*

Winter and Core Area Overlap

Sage-grouse Core Area[a]		Bird use in Core Area (km^2)	Proportional overlap of bird use with Core Areas			
			Summer	Winter	Total	Summer : winter
Fontenelle	75%	136.08	0.62	0.39	0.48	1.59
Hyattville	75%	460.45	0.51	0.47	0.43	1.09
Greater South Pass	75%	2213.53	0.66	0.70	0.64	0.94
Sage	75%	966.83	0.89	0.74	0.76	1.20
Shell	75%	78.11	0.42	0.22	0.22	1.91
South Rawlins	75%	363.81	0.44	0.12	0.20	3.67
Uinta	75%	328.12	0.75	0.54	0.60	1.39
Washakie	75%	45.18	0.98	0.50	0.56	1.96
All Core Area	75%	4592.12	0.75	0.62	0.62	1.21
All Core Area	95%	8475.62	0.69	0.50	0.51	1.38

[a] Contour of the kernel densities used to calculate overlap are denoted as 75 or 95 %.

Dinkins et al. (2017) – *Ecosphere*

Demographic Comparisons

- Nesting success

- Brood success

- Annual hen survival
  - Core v. non-Core Areas
  - Seasonal differences
  - Annual resident v. leave winter area
  - Migratory v. non-migratory (≥10 km)
  - Age (yearling v. adult)
  - Weather
  - Interactions with season

Dinkins et al. (2017) – *Ecosphere*

Results

- 2008–2015
  - 21.7% had at least 1 location in non-Core Areas
  - 23.5% nests were outside of Core Areas
  - 26.8% of broods were outside of Core Areas at least once

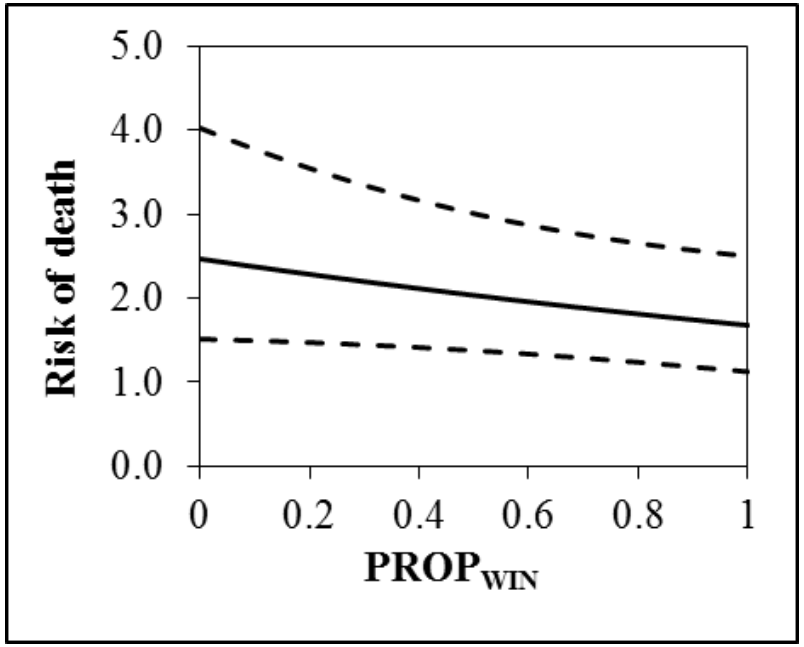
- 426 nests and 183 broods

- 155 sage-grouse mortalities
  - Breeding season (*n* = 84; April – July)
  - Fall (*n* = 36; August – November)
  - Winter (*n* = 35; December – March)

Dinkins et al. (2017) – *Ecosphere*

Results

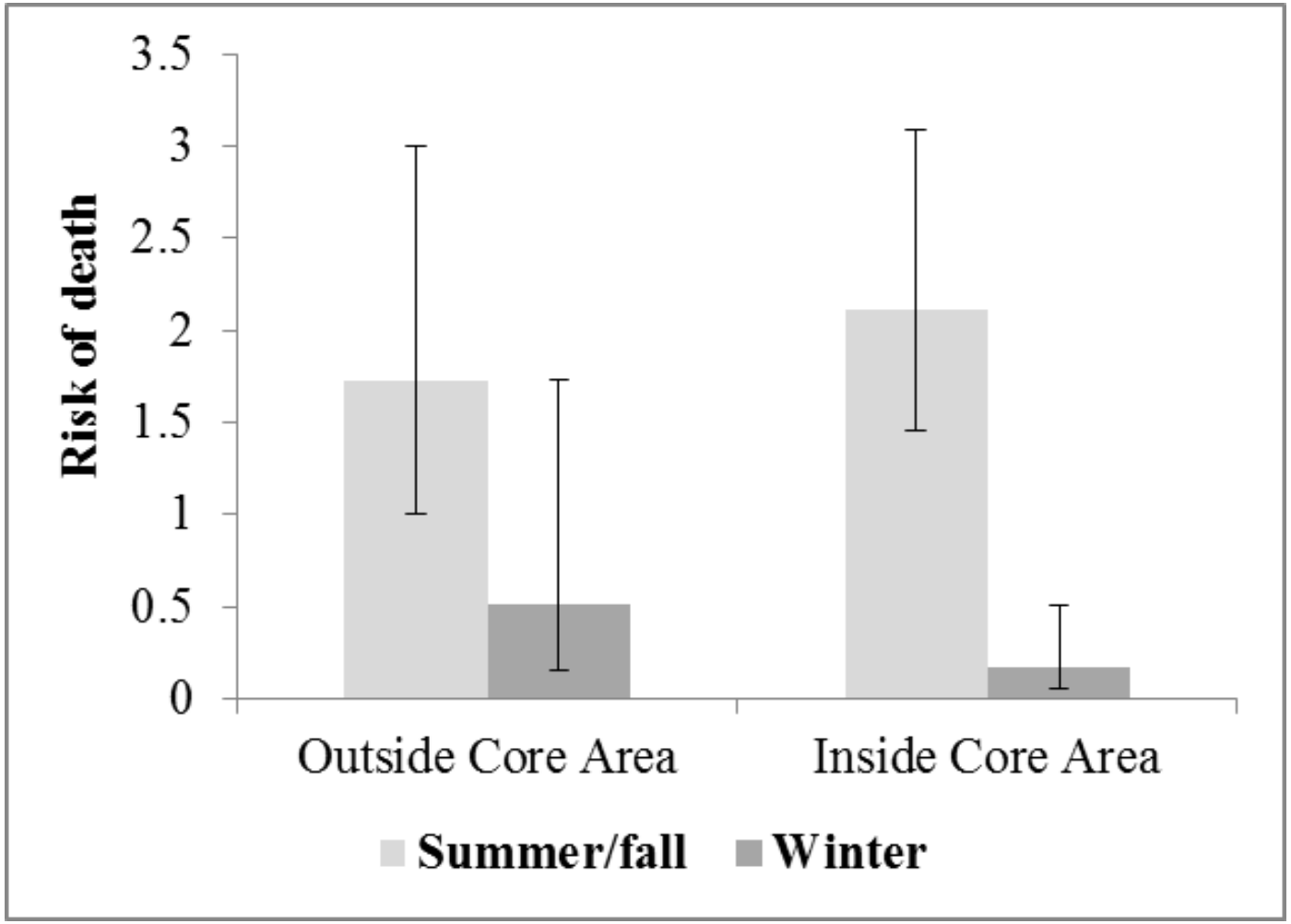
- Nest and brood success
  - No differences
- Annual Survival
  - Yearling > adult
  - Winter > summer & fall
  - Weather effects dependent on season



Dinkins et al. (2017) – *Ecosphere*

Annual Survival

- Core Area × winter



Dinkins et al. (2017) – *Ecosphere*

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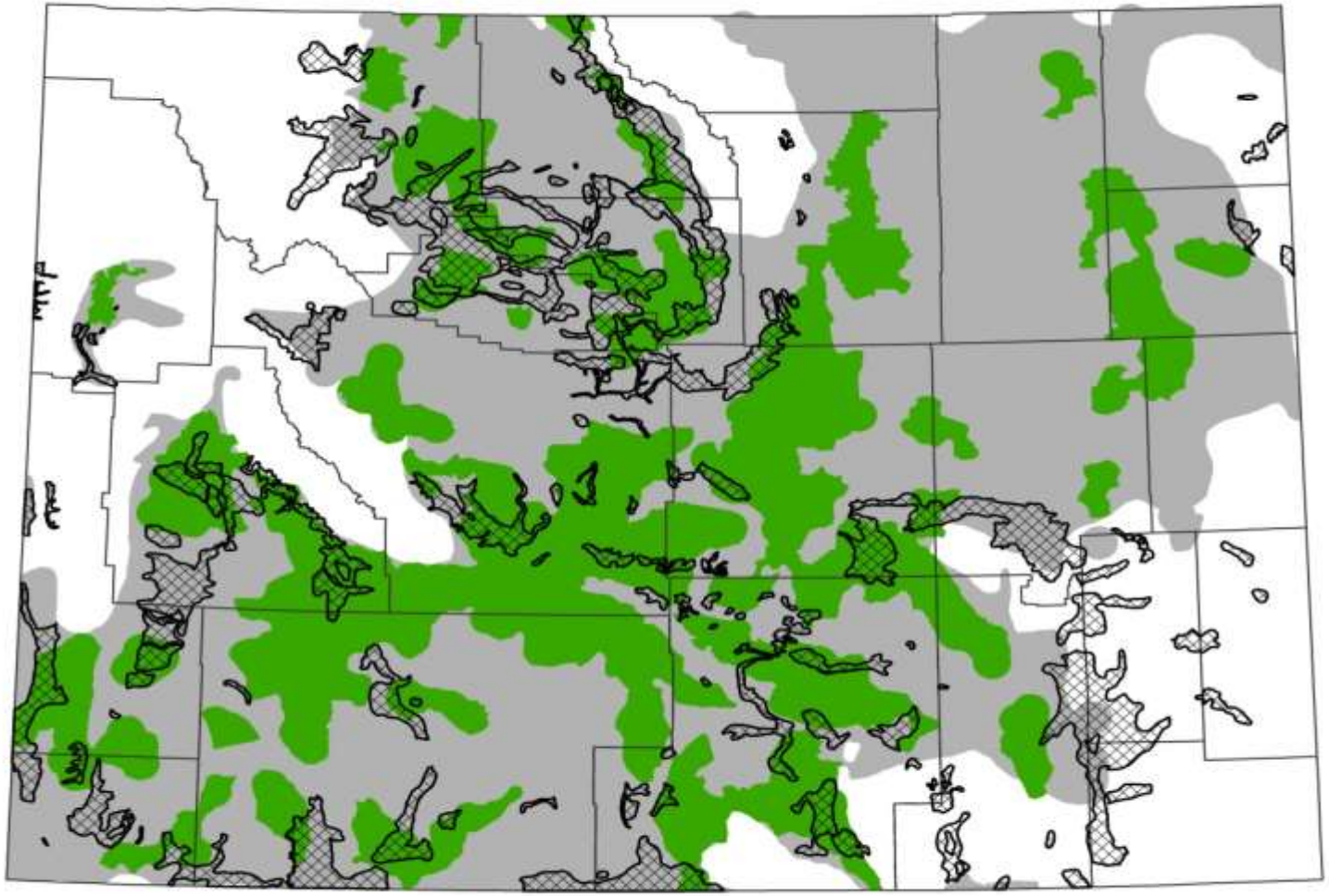
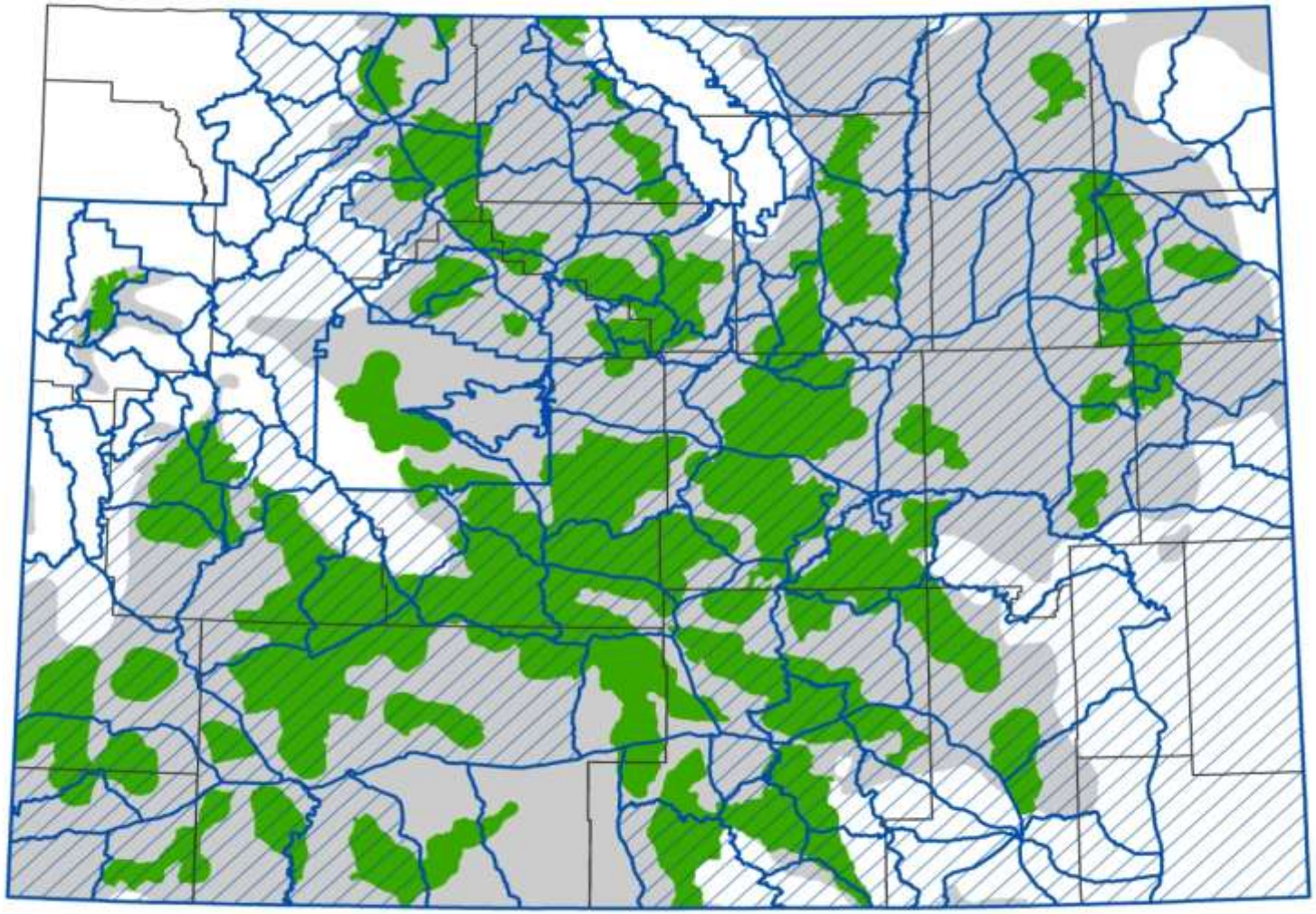
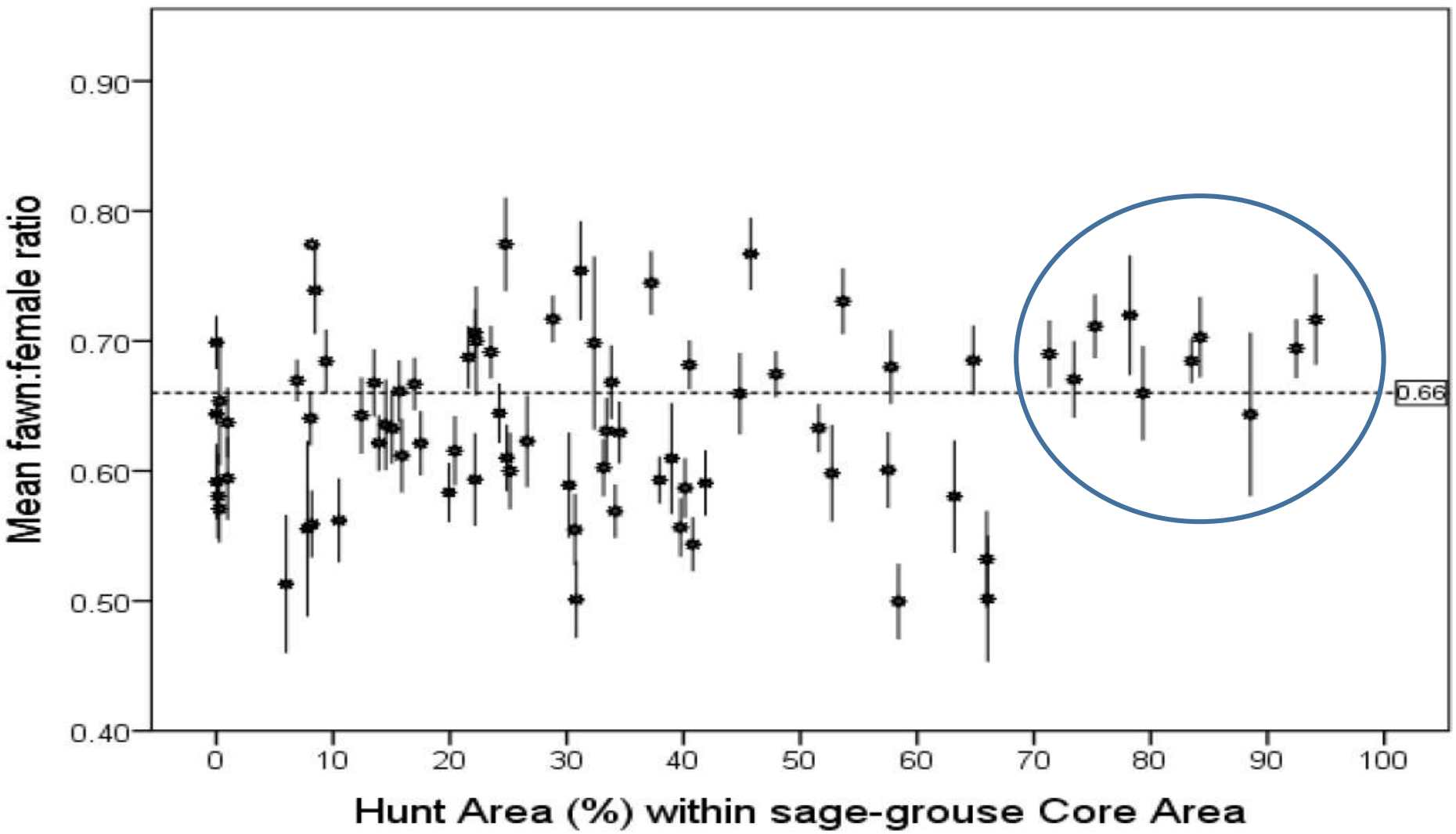
Mule Deer Crucial Winter Range and Sage-grouse Core Areas



Core Area overlaps 33% of state's mule deer crucial winter range

Mule Deer Hunt Areas and Sage-grouse Core Areas





Mean fawn:female ratios (± SE) for mule deer by the percentage Core Area overlap in 103 Hunt Areas, Wyoming, 1995–2013. The dashed horizontal line indicates a level (0.66) for fawn:female ratios above which populations are increasing.

Gamo and Beck (2017) – *REM*

V. Conclusions

1. **Core Area policy appears to limit energy development**

2. **Breeding habitat**
   1. Out boundary effects on male lek attendance extended to at least 3 miles
   2. Male lek attendance was more resilient in Core Areas
   3. Every 5% increase in disturbance increases nest loss probability ~2.5%
   4. Nesting microhabitat quality was similar between Core and non-Core (Dinkins et al. 2016 – PLOS ONE)

3. **Winter habitat**
   1. Winter timing stipulations and Core Area size are issues
   2. Females staying year-round in Core Areas have lower winter mortality

4. **Umbrella species effect**
   1. Fawn:female mule deer ratios enhanced when Core overlap ≥70%, suggesting positive productivity

Effectiveness of the SGEO (from Gamo and Beck 2017)

The effectiveness of the SGEO is dependent upon multiple factors:

- First, whether the lands encompassed by Core Area benefit sage-grouse
- Second, how well have the parameters been applied? This is particularly tenuous as the SGEO is a Governor's order, not a rule of legislated law
- Third, are the parameters, which are based on science, truly effective when applied at a landscape scale?

Research Support

devon

LINN Energy

bp

WRRC
Wyoming Reclamation & Restoration Center

National Wind Coordinating Collaborative

Horizon Wind Energy
An EDP Renewables Company

PACIFICORP
A MIDAMERICAN ENERGY HOLDINGS COMPANY

UNIVERSITY OF WYOMING AGRICULTURAL EXPERIMENT STATION
UW
www.uwyo.edu/uwexpstn

University of Wyoming Ecosystem Science & Management

Warren Resources

WEST Inc.

Anadarko

PETRO-CANADA

MARATHON

UNIVERSITY OF WYOMING

BLM

NATIONAL SYSTEM OF PUBLIC LANDS

WYOMING GAME & FISH DEPARTMENT

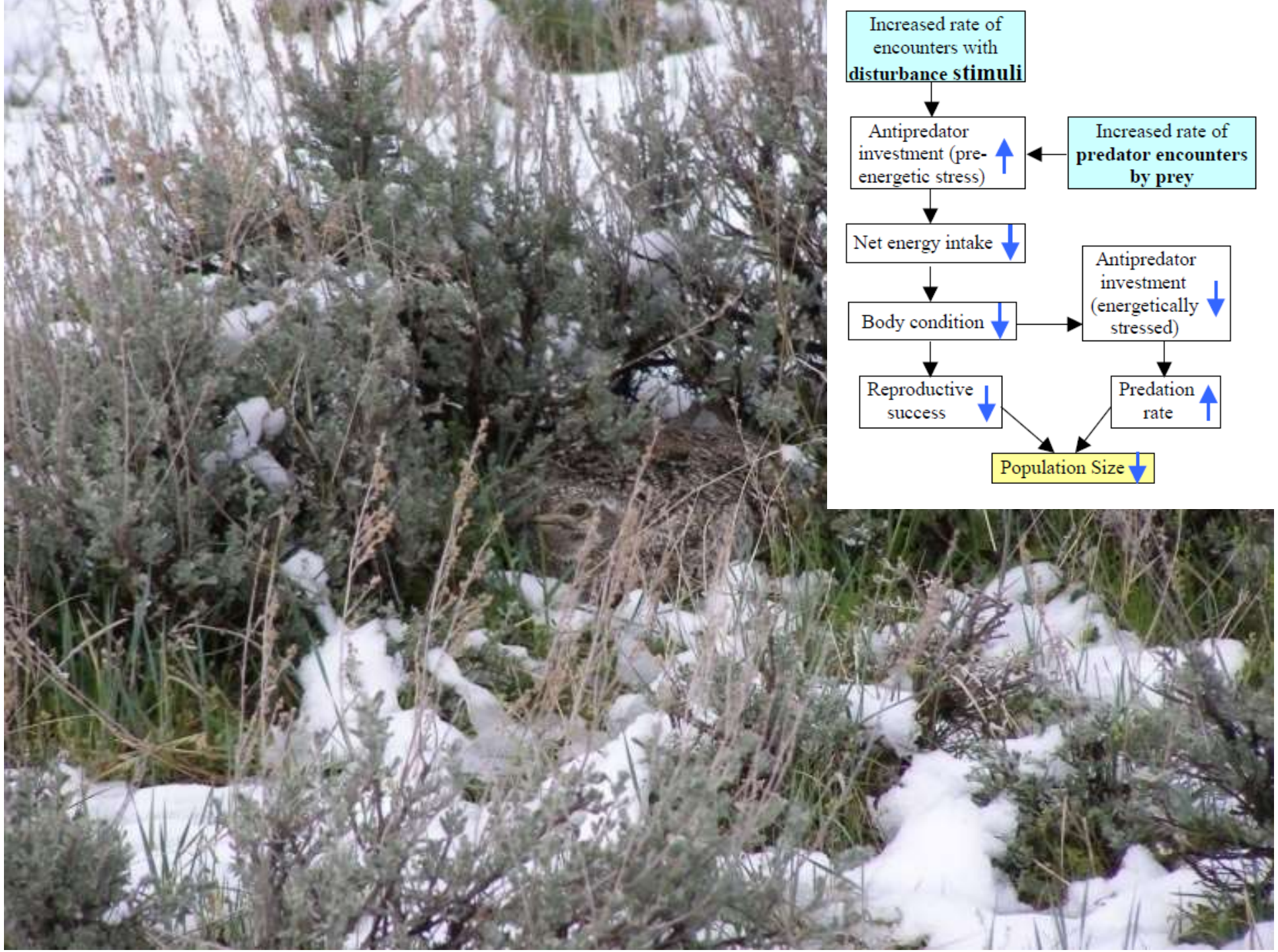
Samson Resources

Memorial Resource Development

School of Energy Resources

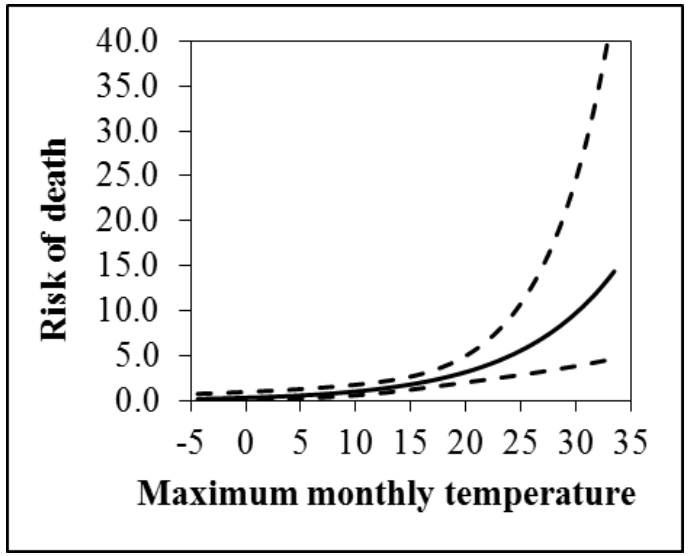
NORTHERN ARIZONA UNIVERSITY

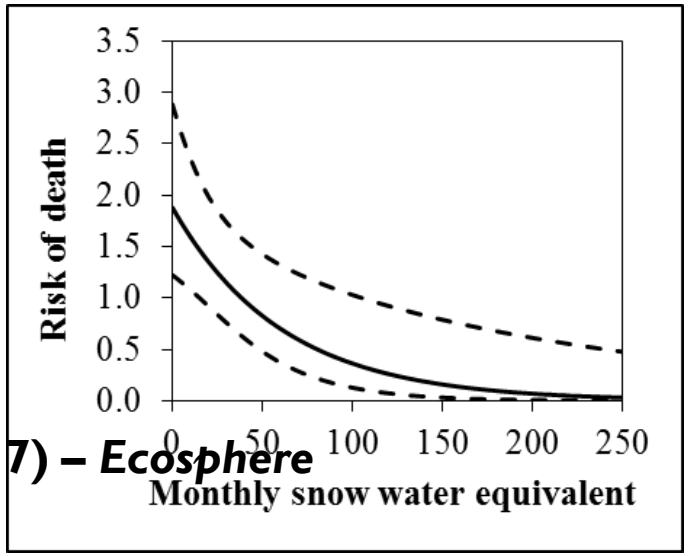
Questions?


Increased rate of encounters with disturbance stimuli
Antipredator investment (pre-energetic stress)
Increased rate of predator encounters by prey
Net energy intake
Antipredator investment (energetically stressed)
Body condition
Reproductive success
Predation rate
Population Size

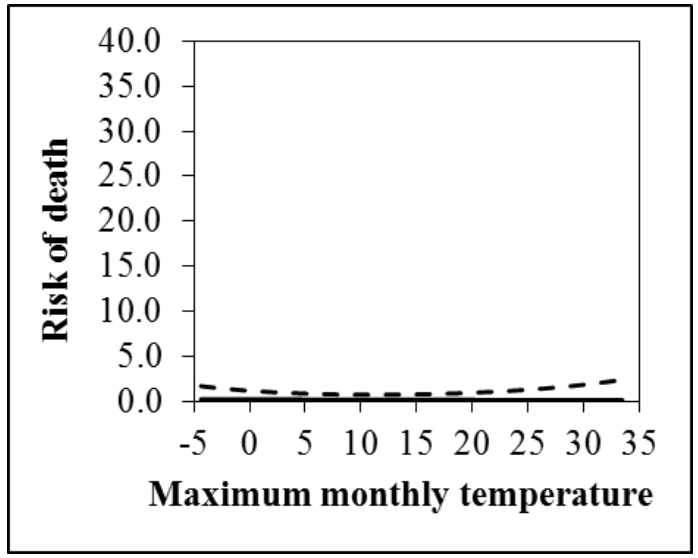
Annual Survival Results

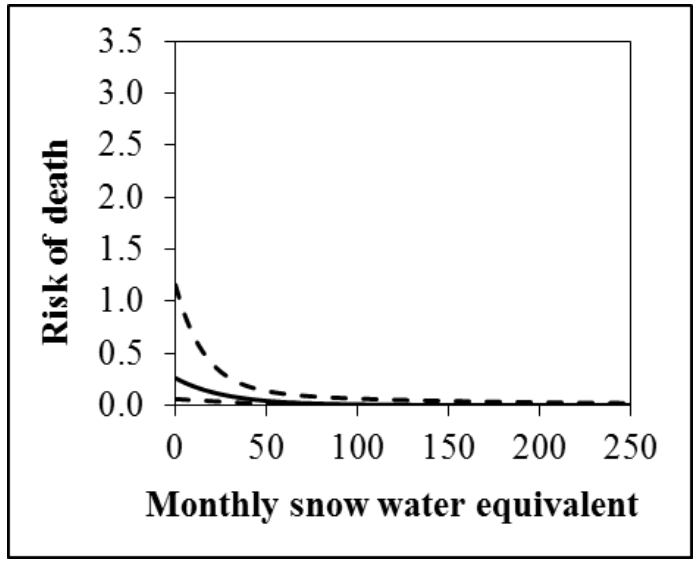
Summer





Winter

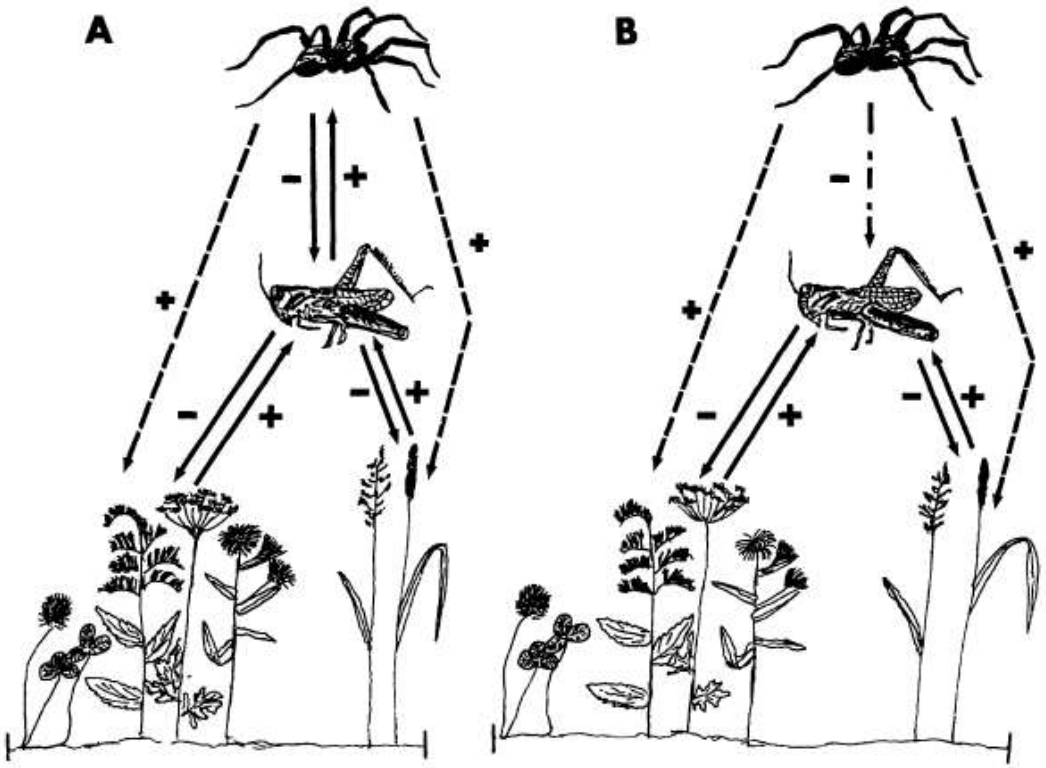




Dinkins et al. (2017) – *Ecosphere*

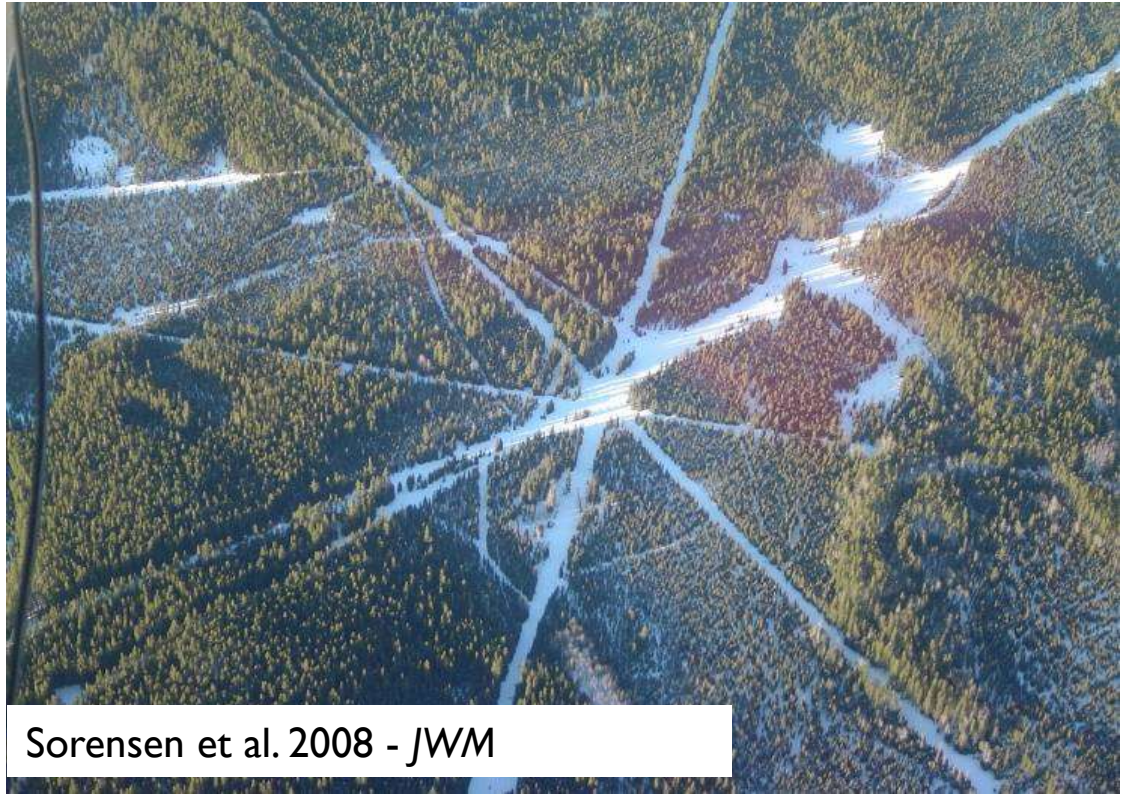
Wyoming Sage-grouse by the Numbers

- ~62 million acres in Wyoming; ~48 million acres historic range
- ~43 million acres occupied (90%) – compared to 56% rangewide
- 25% of the state is "Core" habitat
- 82% of Wyoming's sage-grouse population is in Core
- Wyoming has 26% of the current rangewide habitat occupied by 37% of the rangewide grouse population (Doherty et al. 2010).
- Wyoming habitats are generally more intact/continuous

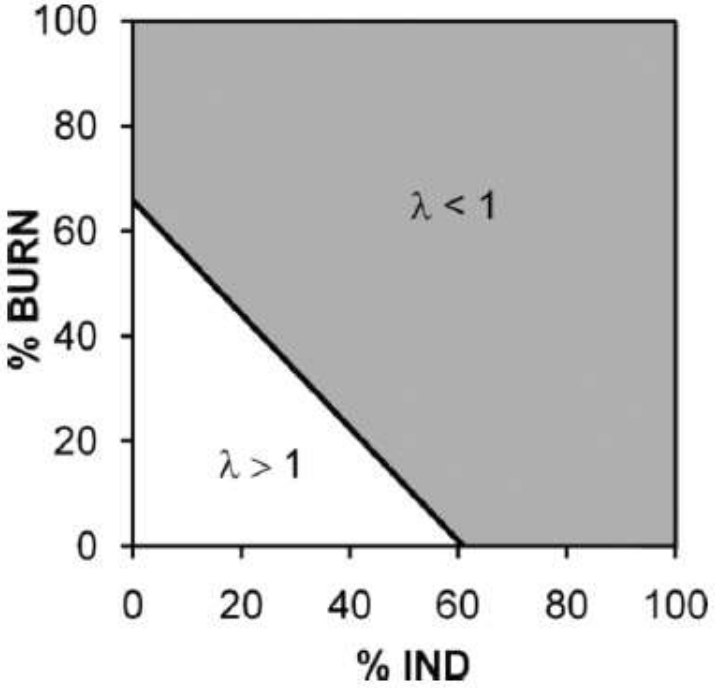


Pursued
Injury
Death

Foraging
Reproduction
Migrating



- Burned area (% BURN) in past 50 years within herd range and % caribou habitat within 250 m of industrial features (% IND) explained 96% of variation (R^2) in lambda (λ) for woodland caribou in 6 populations in northern Alberta, Canada, 1993–2001.



Oil and gas development density outside the Core Area is negatively impacting lek attendance inside the Core Area