



Environmental
& Statistical
Consultants

Prairie Grouse and Sage Grouse and Response to Wind Energy Development

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Background

- Wind energy development is a new form of anthropogenic disturbance to sage-grouse and prairie grouse (indirect vs direct)
- Few peer-reviewed studies exist documenting potential impacts to greater sage-grouse, prairie chickens, and sharp-tailed grouse



Background – Potential Concerns

- Direct habitat loss
- Displacement
- Reduced fitness
- Reduced Connectivity

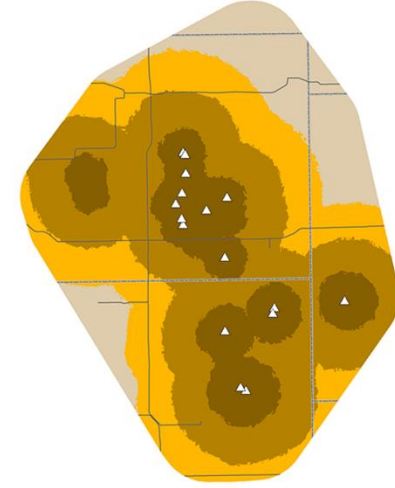
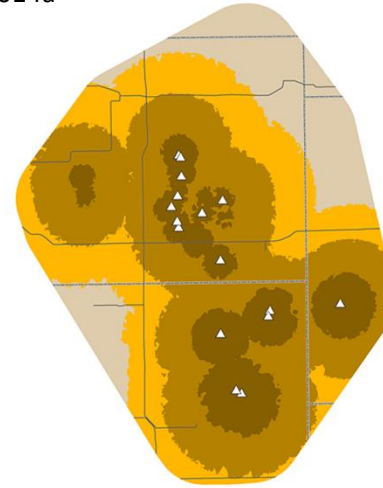


Winder et al. 2014a

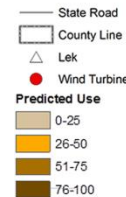
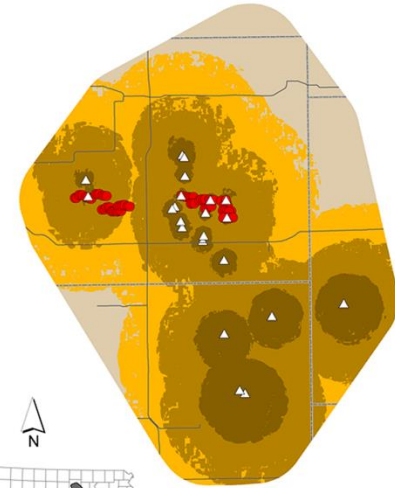
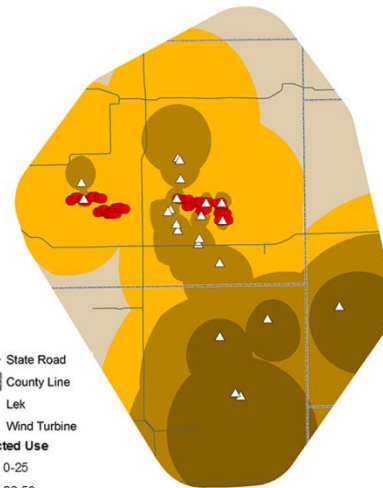
Breeding

Nonbreeding

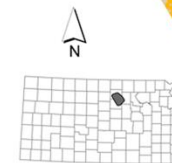
Pre-construction



Post-construction



0 5 10 20 Kilometers



Background – Study Locations

- Meridian Way North Central Kansas
 - Greater Prairie-Chicken
 - McNew et al. 2014
 - Winder et al. 2014a
 - Winder et al. 2014b
 - Winder et al. 2015
 - Four Wind Projects in Idaho near Idaho Falls
 - Columbia Sharp-tailed Grouse
 - Proett 2017
- Ainsworth Sandhills of Nebraska
 - Greater Prairie-Chicken
 - Harrison 2015
 - Smith et al. 2017
- Seven Mile Hill South central Wyoming
 - Greater Sage-Grouse
 - LeBeau et al. 2012
 - LeBeau et al. 2014
 - LeBeau et al. 2017a
 - LeBeau et al. 2017b

General Summary – Direct Habitat Loss



General Summary - Displacement

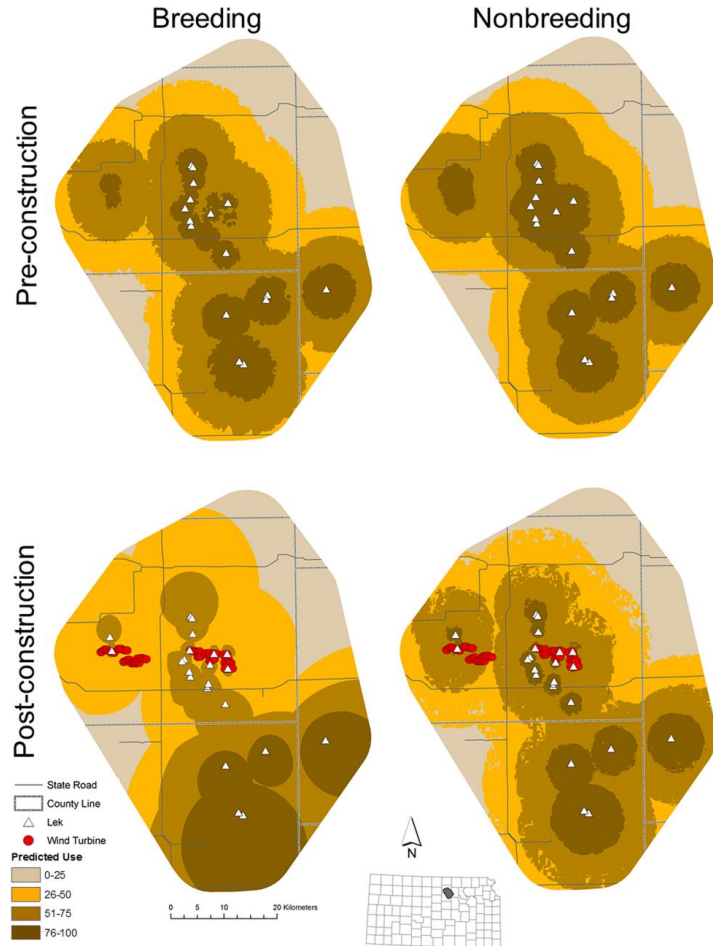
- Nest Site Selection
 - Greater Prairie-Chicken
 - No effect (KS; McNew et al. 2014)
 - No effect (NE; Harrison 2015)
 - Columbian Sharp-tailed Grouse
 - No effect (ID; Proett 2017)
 - Greater Sage-Grouse
 - No effect (WY; LeBeau et al. 2017)

General Summary - Displacement

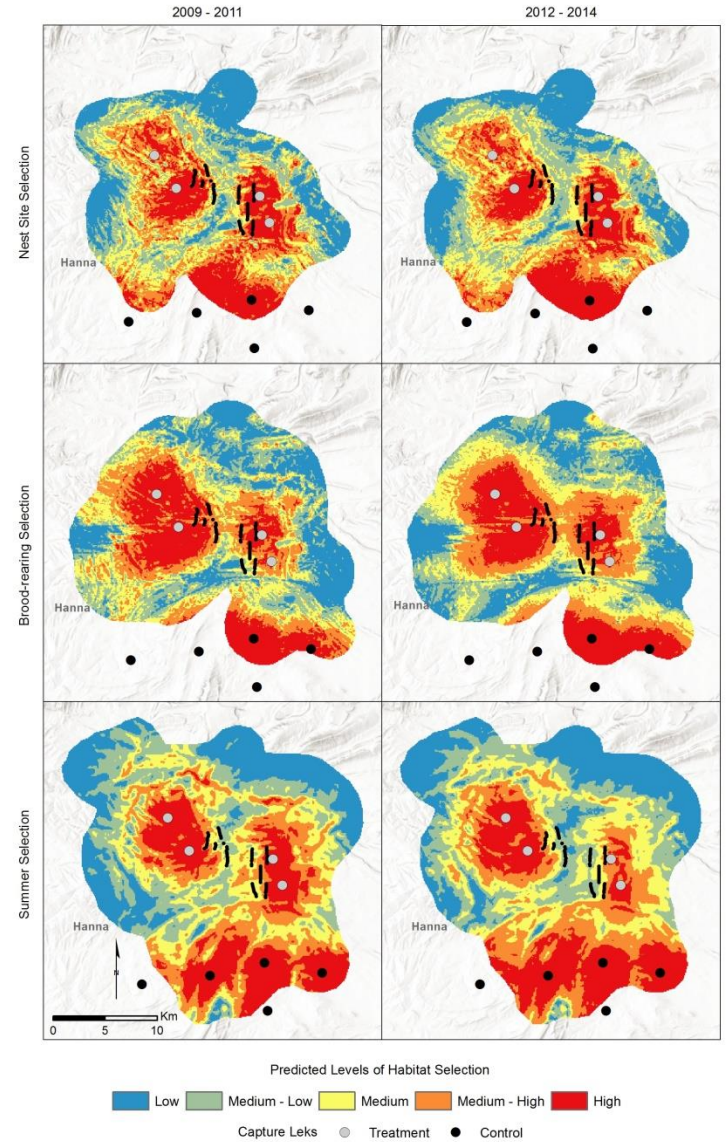
- Habitat Selection
 - Greater Prairie-Chicken
 - No effect (brood-rearing; NE; Harrison 2015)
 - Negative change in space use during breeding season (KS; Winder et al. 2014a)
 - Greater Sage-Grouse
 - Avoided habitat with higher density of turbines (brood-rearing and summer; WY; LeBeau et al. 2017a)

General Summary - Displacement

Winder et al. 2014a



LeBeau et al. 2017a



General Summary - Displacement

- Male Lek Attendance
 - Greater Prairie-Chicken
 - Lek abandonment was high within 8 km of turbines (Winder et al. 2015)
 - Probability of lek persistence depended on lek size and habitat type and not proximity to turbine (Winder et al. 2015)
 - Greater Sage-Grouse
 - No significant negative differences in males attending leks between a control area and the treatment area pre to post development ; WY; LeBeau et al. 2017b)



General Summary - Fitness

- Nest Survival
 - Greater Prairie-Chicken
 - No effect (KS; McNew et al. 2014)
 - No effect (NE; Harrison 2015)
 - Columbian Sharp-tailed Grouse
 - No effect (ID; Proett 2017)
 - Greater Sage-Grouse
 - No effect (WY; LeBeau et al. 2017a)



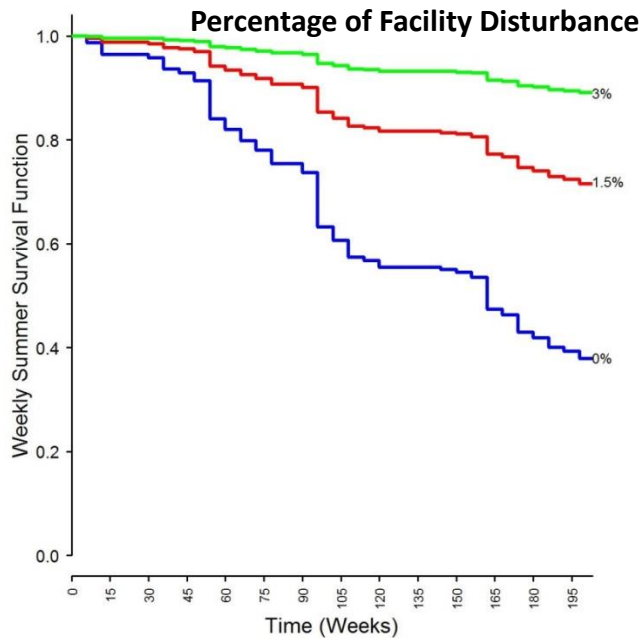
General Summary - Fitness

- Brood Survival
 - Greater Prairie-Chicken
 - No effect (NE; Harrison 2015)
 - Columbian Sharp-tailed Grouse
 - Negative effect in habitats with higher density of turbines (ID; Proett 2017)
 - Greater Sage-Grouse
 - No effect (WY; LeBeau et al. 2017a)

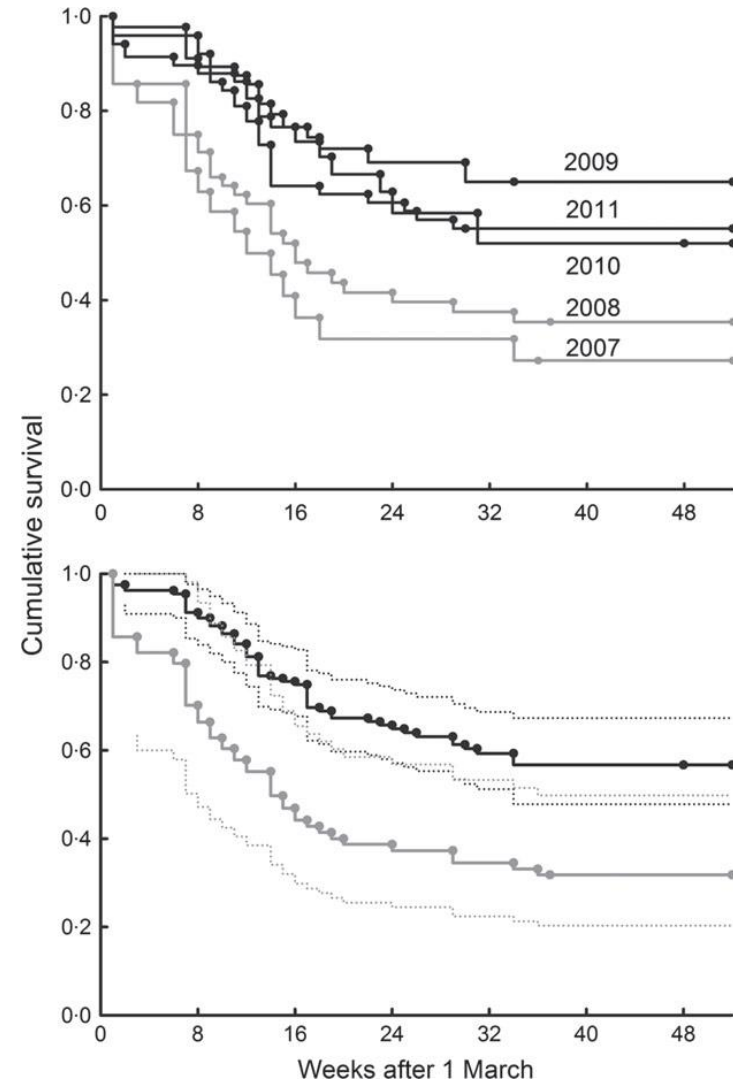


General Summary - Fitness

- Female Survival
 - Greater Prairie-Chicken
 - No effect (NE; Smith et al. 2017)
 - No negative effect (Winder et al. 2014b)
 - Greater Sage-Grouse
 - No negative effect (WY; LeBeau et al. 2017a)

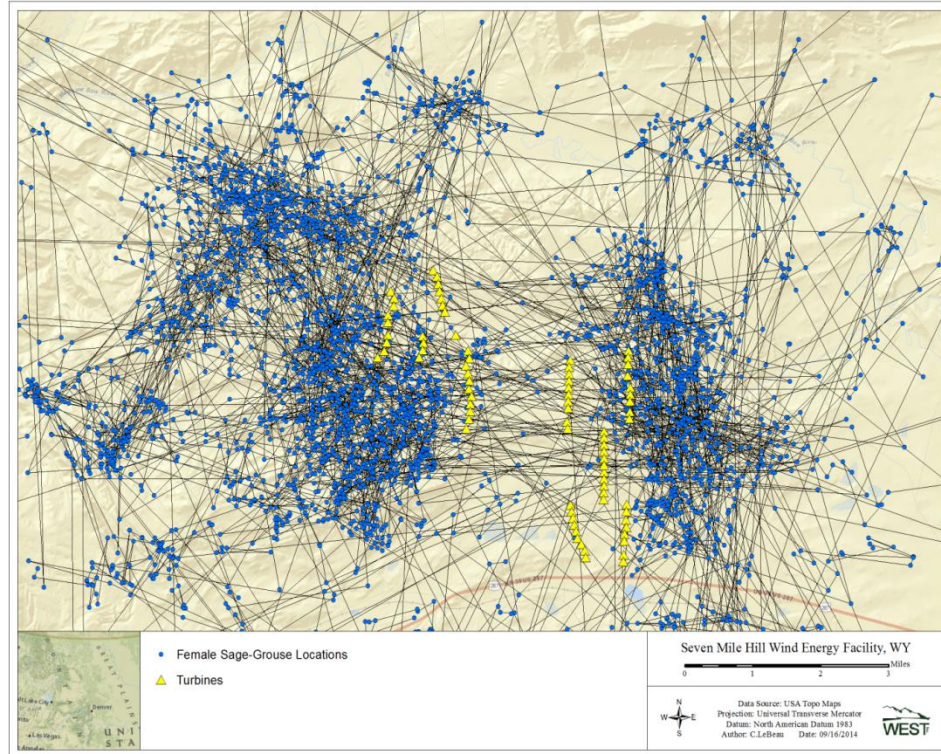
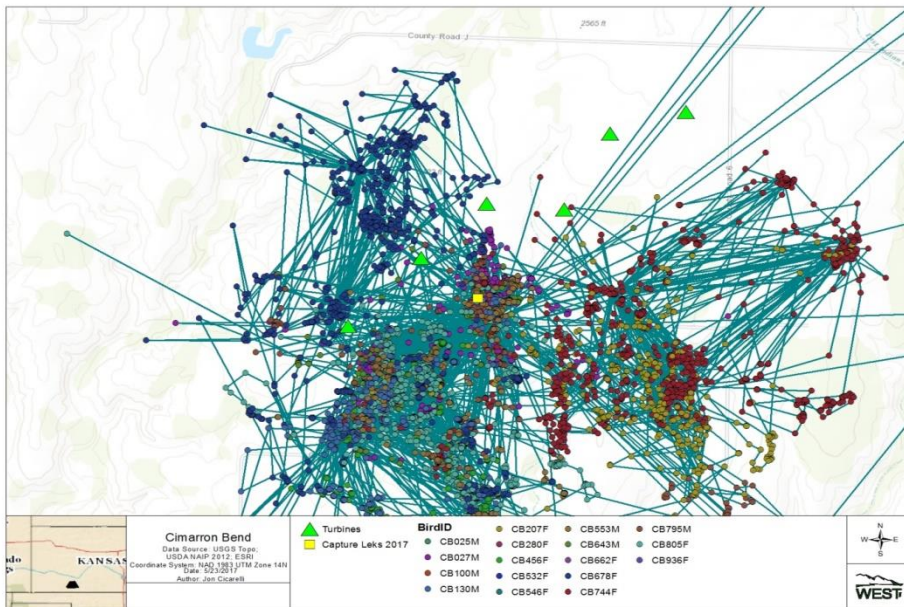


Winder et al. 2014b



Research Needs

- Multiple studies
 - 1 (GRSG), 1 (CSTG), 2 (GPCH)
- Connectivity between key habitats
- Research on responses of lesser prairie-chicken to wind energy development
 - Cimarron Bend



Cumulative Assessment

- Based on best available science

Parameter	Greater Sage-Grouse	Columbia Sharp-tailed Grouse	Greater Prairie-Chicken
Nest Survival	<i>No effect</i>	<i>No effect</i>	<i>No effect</i>
Brood Survival	<i>No effect</i>	<i>Negatively affected</i>	<i>No effect</i>
Annual female Survival	<i>Positively affected</i>	<i>Unknown</i>	<i>Positively affected/No effect</i>
Nest Site Selection	<i>No effect</i>	<i>No effect</i>	<i>No effect</i>
Brood selection	<i>Negatively affected</i>	<i>Unknown</i>	<i>Unknown</i>
Female breeding selection	<i>Negatively affected</i>	<i>Unknown</i>	<i>Negatively affected</i>
Changes in Males attending leks	<i>No effect</i>	<i>Unknown</i>	<i>No effect</i>

Research References

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- **Winder, V.L., A.J. Gregory, L.B. McNew, and B.K. Sandercock. 2015.** Responses of male greater prairie-chickens to wind energy development. *The Condor* 117



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