SOUTHERN ROCKIES
Landscape Conservation Cooperative

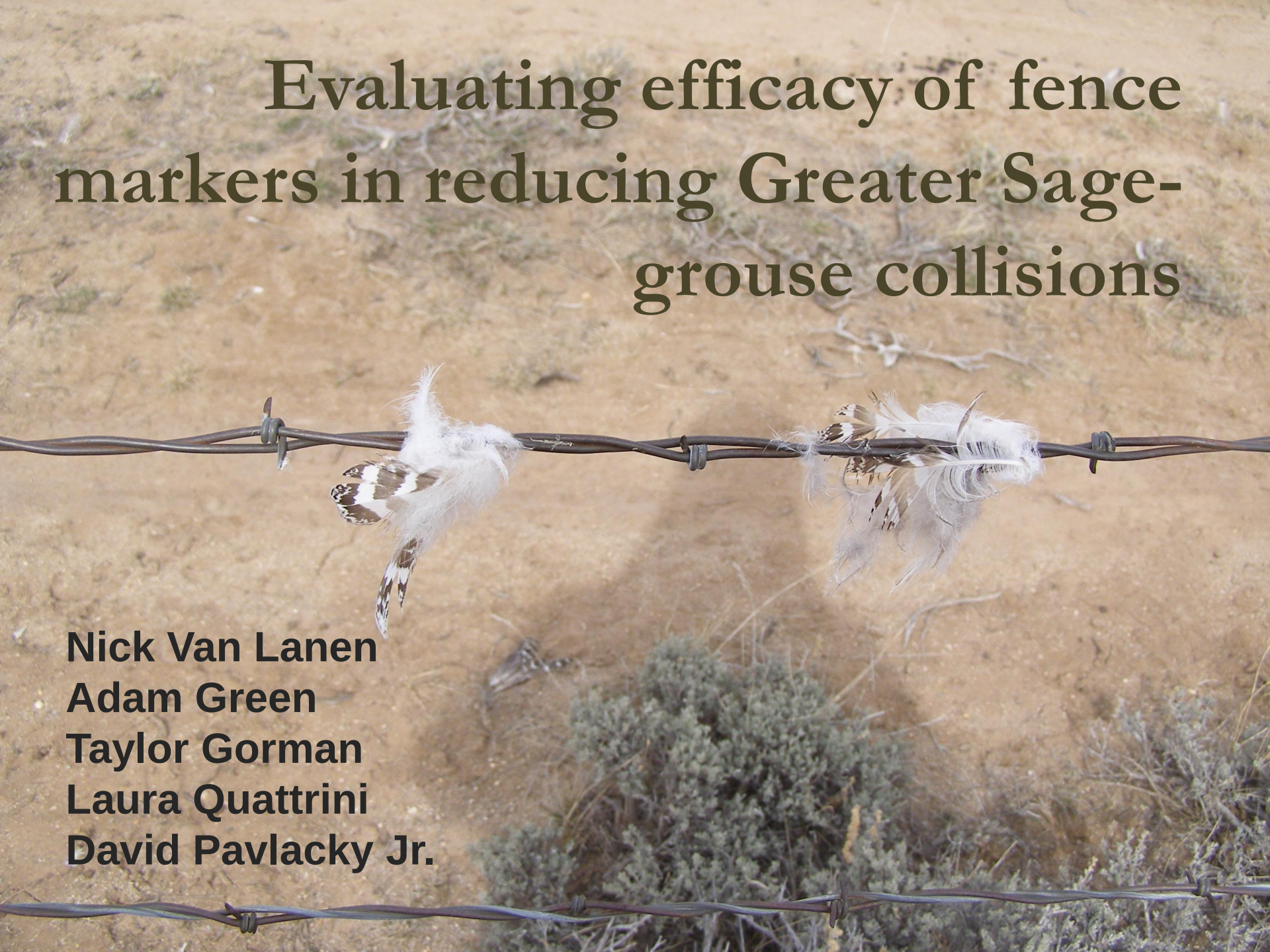
Evaluating Efficacy of Fence Markers in Reducing Greater Sage-grouse Collisions

NICK VAN LANEN

Bird Conservancy of the Rockies

Co-authors: David C. Pavlacky Jr., Taylor R. Gorman, Adam W. Green, and Laura A. Quattrini – Bird Conservancy of the Rockies

Evaluating efficacy of fence markers in reducing Greater Sage-grouse collisions



Nick Van Lanen
Adam Green
Taylor Gorman
Laura Quattrini
David Pavlacky Jr.

Conservation Problem

- Sage-grouse populations are likely in decline
- Evidence Sage-grouse collide with fences
  - Stevens et al. 2012
  - Christianson 2009
- Some evidence marking may reduce collisions

Wildlife Society Bulletin 36(2):297–303; 2012; DOI: 10.1002/wsb.142

Original Article

Greater Sage-Grouse and Fences: Does Marking Reduce Collisions?

BRYAN S. STEVENS,[1] *Departments of Fish and Wildlife Resources and Statistics, P.O. Box 441136, University of Idaho, Moscow, ID 83844, USA*
KERRY P. REESE, *Department of Fish and Wildlife Resources, P.O. Box 441136, University of Idaho, Moscow, ID 83844, USA*
JOHN W. CONNELLY, *Idaho Department of Fish and Game, 1345 Barton Road, Pocatello, ID 83204, USA*
DAVID D. MUSIL, *Idaho Department of Fish and Game, 324 South 417 E Suite 1, Jerome, ID 83338, USA*

ABSTRACT Collision with infrastructure such as fences is widespread and common for many species of grouse. Greater sage-grouse (*Centrocercus urophasianus*) fence-collision has been documented and fence-marking methods have been recommended for mitigating prairie-grouse collision in rangeland habitats. We tested a marking method in greater sage-grouse breeding habitat and modeled collision as a function of fence marking and control covariates, in Idaho (USA) in 2010. Our results suggested collision risk decreased with fence marking, increased with lek-count indices of local abundance, and decreased with increasing distance from lek. We found an approximate 83% reduction in collision rates at marked fences relative to unmarked fences. Our results also suggested marking may not be necessary on all fences, and mitigation should focus on areas with locally abundant grouse populations and fence segments <2 km from known leks. Nonetheless, collision still occurred at marked fences <500 m from large leks and moving or removing fences may be necessary in some areas if management is to eliminate collision. © 2012 The Wildlife Society.

KEY WORDS avian collision, *Centrocercus urophasianus*, collision mitigation, fence management, greater sage-grouse, Idaho, infrastructure marking, prairie-grouse.

Bird Conservancy of the Rockies

Previous Research

Observed 83% reduction in collisions when fences were marked

Used vinyl markers with reflective tape

Greater sagegrouse and fences: Does marking reduce collisions? - 142_ft... http://onlinelibrary.wiley.com/store/10.1002/wsb.142/asset/142_ft

Wildlife Society Bulletin 36(2):297–303; 2012; DOI: 10.1002/wsb.142

Original Article

Greater Sage-Grouse and Fences: Does Marking Reduce Collisions?

BRYAN S. STEVENS,[1] *Departments of Fish and Wildlife Resources and Statistics, P.O. Box 441136, University of Idaho, Moscow, ID 83844, USA*
KERRY P. REESE, *Department of Fish and Wildlife Resources, P.O. Box 441136, University of Idaho, Moscow, ID 83844, USA*
JOHN W. CONNELLY, *Idaho Department of Fish and Game, 1345 Barton Road, Pocatello, ID 83204, USA*
DAVID D. MUSIL, *Idaho Department of Fish and Game, 324 South 417 E Suite 1, Jerome, ID 83338, USA*

ABSTRACT Collision with infrastructure such as fences is widespread and common for many species of grouse. Greater sage-grouse (*Centrocercus urophasianus*) fence-collision has been documented and fence-marking methods have been recommended for mitigating prairie-grouse collision in rangeland habitats. We tested a marking method in greater sage-grouse breeding habitat and modeled collision as a function of fence marking and control covariates, in Idaho (USA) in 2010. Our results suggested collision risk decreased with fence marking, increased with lek-count indices of local abundance, and decreased with increasing distance from lek. We found an approximate 83% reduction in collision rates at marked fences relative to unmarked fences. Our results also suggested marking may not be necessary on all fences, and mitigation should focus on areas with locally abundant grouse populations and fence segments <2 km from known leks. Nonetheless, collision still occurred at marked fences <500 m from large leks and moving or removing fences may be necessary in some areas if management is to eliminate collision. © 2012 The Wildlife Society.

KEY WORDS avian collision, *Centrocercus urophasianus*, collision mitigation, fence management, greater sage-grouse, Idaho, infrastructure marking, prairie-grouse.

Stevens, B.S., K.P. Reese, J.W. Connelly, and D.D. Musil. 2012. Greater sage-grouse and fences: does marking reduce collisions? Wildlife Society Bulletin, 36(2): 297-303.

Bird Conservancy of the Rockies

Previous Research

Collision risk influenced by:

- Post type
- Width of fence panel (>4m between posts)
- Region
- Fence density
- Distance to leks
- Topography

Management and Conservation

Multi-Scale Assessment of Greater Sage-Grouse Fence Collision as a Function of Site and Broad Scale Factors

BRYAN S. STEVENS,[1] *Department of Fish and Wildlife Resources and Department of Statistics, P.O. Box 441136, University of Idaho, Moscow, ID 83844, USA*

JOHN W. CONNELLY, *Idaho Department of Fish and Game, 1345 Barton Road, Pocatello, ID 83204, USA*

KERRY P. REESE, *Department of Fish and Wildlife Resources, P.O. Box 441136, University of Idaho, Moscow, ID 83844, USA*

ABSTRACT Previous research in Europe and North America suggested grouse are susceptible to collision with infrastructure, and anecdotal observation suggested greater sage-grouse (*Centrocercus urophasianus*) fence collision in breeding habitats may be prevalent. However, no previous research systematically studied greater sage-grouse fence collision in any portion of their range. We used data from probability-based sampling of fences in greater sage-grouse breeding habitats of southern Idaho, USA, to model factors associated with collision at microsite and broad spatial scales. Site-scale modeling suggested collision may be influenced by technical attributes of fences, with collisions common at fence segments absent wooden fence posts and with segment widths >4 m. Broad-scale modeling suggested relative probability of collision was influenced by region, a terrain ruggedness index (TRI), and fence density per square km. Conditional on those factors, collision counts were also influenced by distance to nearest active sage-grouse lek. Our models provide a conceptual framework for prioritizing sage-grouse breeding habitats for collision mitigation such as fence marking or moving, and suggest mitigation in breeding habitats should start in areas with moderate-high fence densities (>1 km/km^2) within 2 km of active leks. However, TRI attenuated other covariate effects, and mean TRI/km^2 >10 m nearly eliminated sage-grouse collision. Thus, our data suggested mitigation should focus on sites with flat to gently rolling terrain. Moreover, site-scale modeling suggested constructing fences with larger and more conspicuous wooden fence posts and segment widths <4 m may reduce collision.

KEY WORDS avian collision, *Centrocercus urophasianus*, fence management, greater sage-grouse, Idaho, infrastructure collision, modeling collision risk.

Stevens, B.S., J.W. Connelly, and K.P. Reese. 2012. Multi-scale assessment of greater sage-grouse fence collision as a function of site and broad scale factors. The Journal of Wildlife Management, 76(7): 1370-1380.

Bird Conservancy of the Rockies

Previous Research

Risk map based upon:

1) Topography

2) Proximity to leks

Tools and Technology

Mapping Sage-Grouse Fence-Collision Risk: Spatially Explicit Models for Targeting Conservation Implementation

BRYAN S. STEVENS,[1,2] *Departments of Fish and Wildlife Sciences and Statistical Sciences, University of Idaho, P.O. Box 441136, Moscow, ID 83844, USA*

DAVID E. NAUGLE, *Wildlife Biology Program, University of Montana, Missoula, MT 59812, USA*

BRIAN DENNIS, *Departments of Fish and Wildlife Sciences and Statistical Sciences, University of Idaho, P.O. Box 441136, Moscow, ID 83844, USA*

JOHN W. CONNELLY, *Idaho Department of Fish and Game, 1345 Barton Road, Pocatello, ID 83204, USA*

TIM GRIFFITHS, *United States Department of Agriculture, Natural Resources Conservation Service, 10 E Babcock Street, Bozeman, MT 59718, USA*

KERRY P. REESE, *Department of Fish and Wildlife Sciences, University of Idaho, P.O. Box 441136, Moscow, ID 83844, USA*

ABSTRACT Recent research suggested greater sage-grouse (*Centrocercus urophasianus*; hereafter, sage-grouse) fence collision may be widespread, and fence-marking methods have been developed for reducing prairie-grouse collision in sagebrush-steppe habitats. However, research also suggested sage-grouse collision was highly variable, and managers implementing mitigation desire targeting tools to prioritize mitigation efforts as a function of risk. We fit collision-risk models using widely available covariates to a sage-grouse fence-collision data set from Idaho, USA, and developed spatially explicit versions of the top model for all known sage-grouse breeding habitats (i.e., within 3 km of leks) in 10 of 11 western states where sage-grouse are found. Our models prioritize breeding habitats for mitigation as a function of terrain ruggedness and distance to nearest lek, and suggest that a relatively small proportion of the total landscape (6–14%) in each state would result in >1 collision over a lekking season. Managers can use resulting models to prioritize fence-marking by focusing efforts on high risk landscapes. Moreover, our models provide a spatially explicit tool to efficiently target conservation investments, and exemplify the way that researchers and managers can work together to turn scientific understanding into effective conservation solutions. © 2013 The Wildlife Society.

KEY WORDS avian collision, *Centrocercus urophasianus*, collision mitigation, fence collision, fence markers, infrastructure marking, sage grouse.

Stevens, B.S., D.E. Naugle, J.W. Connelly, T. Griffiths, and K.P. Reese. 2013. Mapping sage-grouse fence-collision risk: spatially explicit models for targeting conservation implementation. Wildlife Society Bulletin, 37(2): 409-415.

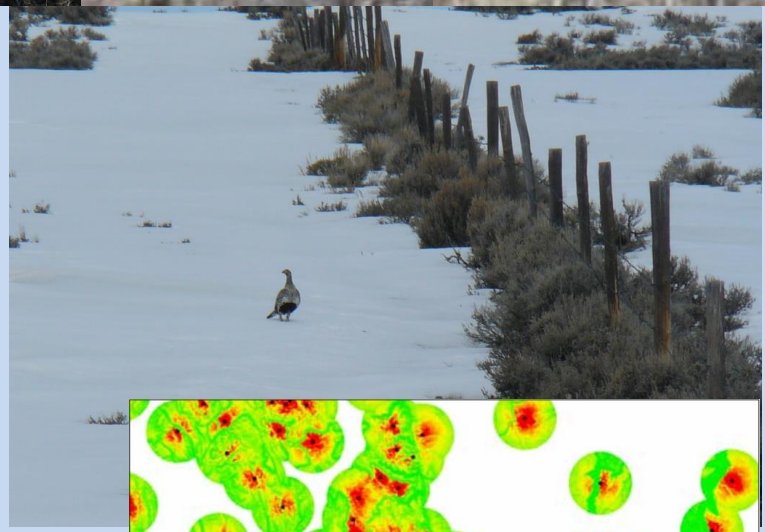
Bird Conservancy of the Rockies

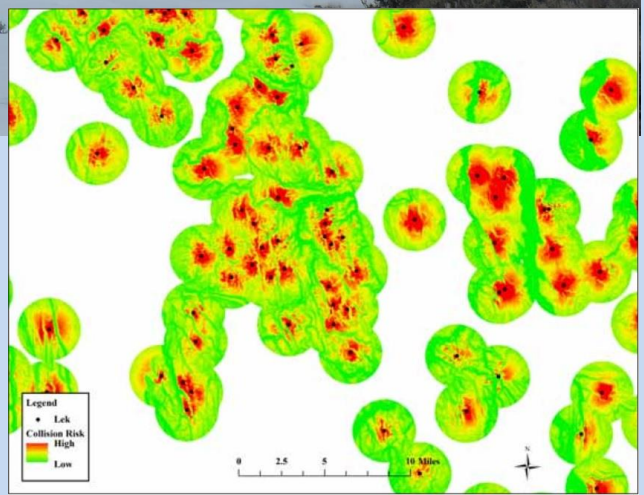
Our Research Objectives

1) Evaluate effectiveness of different types of fence markers

2) Investigate local and landscape-scale factors impacting collision risk

3) Validate collision risk model





Bird Conservancy of the Rockies

Study Area

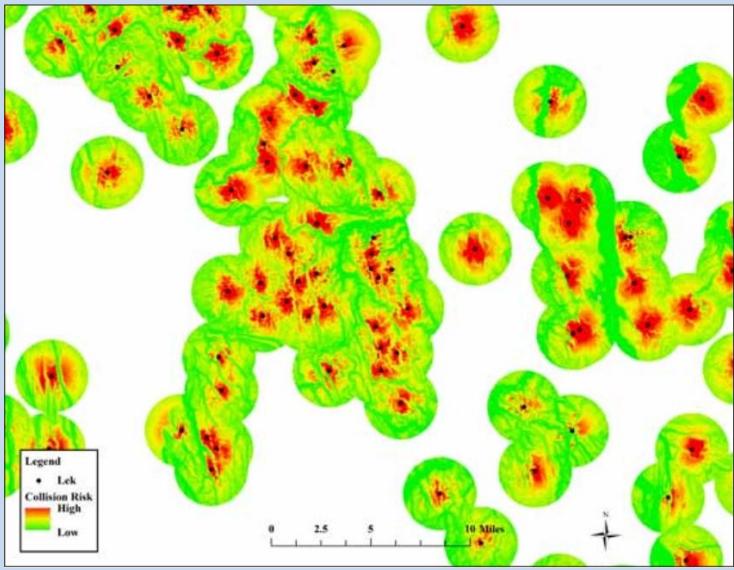
Sublette County, Wyoming

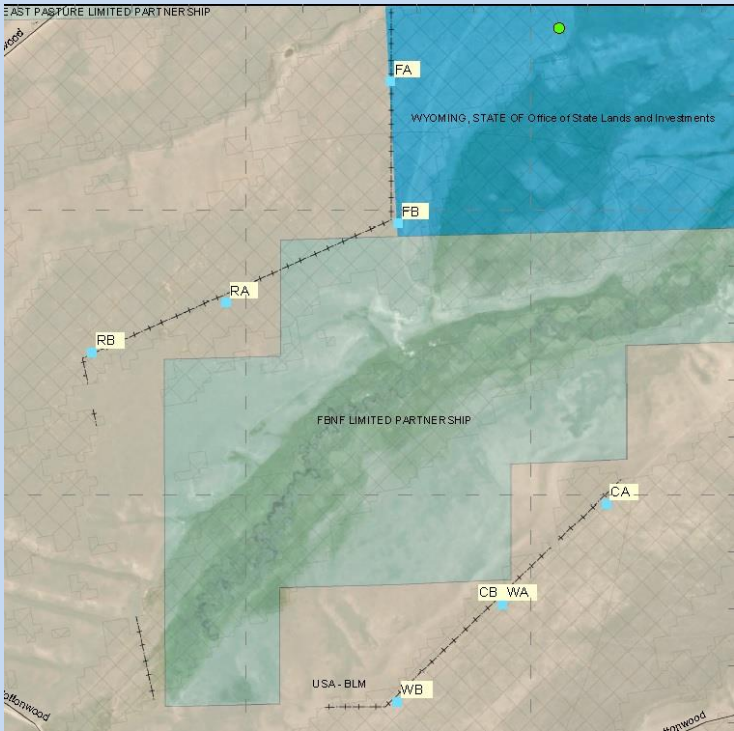
- Area of high sage-grouse density
- Evidence of collisions
- Relatively easy public access
- Cooperative landowners

Bird Conservancy of the Rockies

Study Design

- Fence layer from Pinedale BLM
- Selected 26 leks in Sublette County
  - Minimum 2km of fencing in high & medium risk areas w/in 3km radius of lek
- Randomly assigned treatments to 500m stretches of fencing





Bird Conservancy of the Rockies

Methods

- Installed markers in October of 2013 and March of 2014
  - 3 marker types and unmarked “control” stretches
  - Placed markers on top wire
  - ~ 2 - 3’ apart

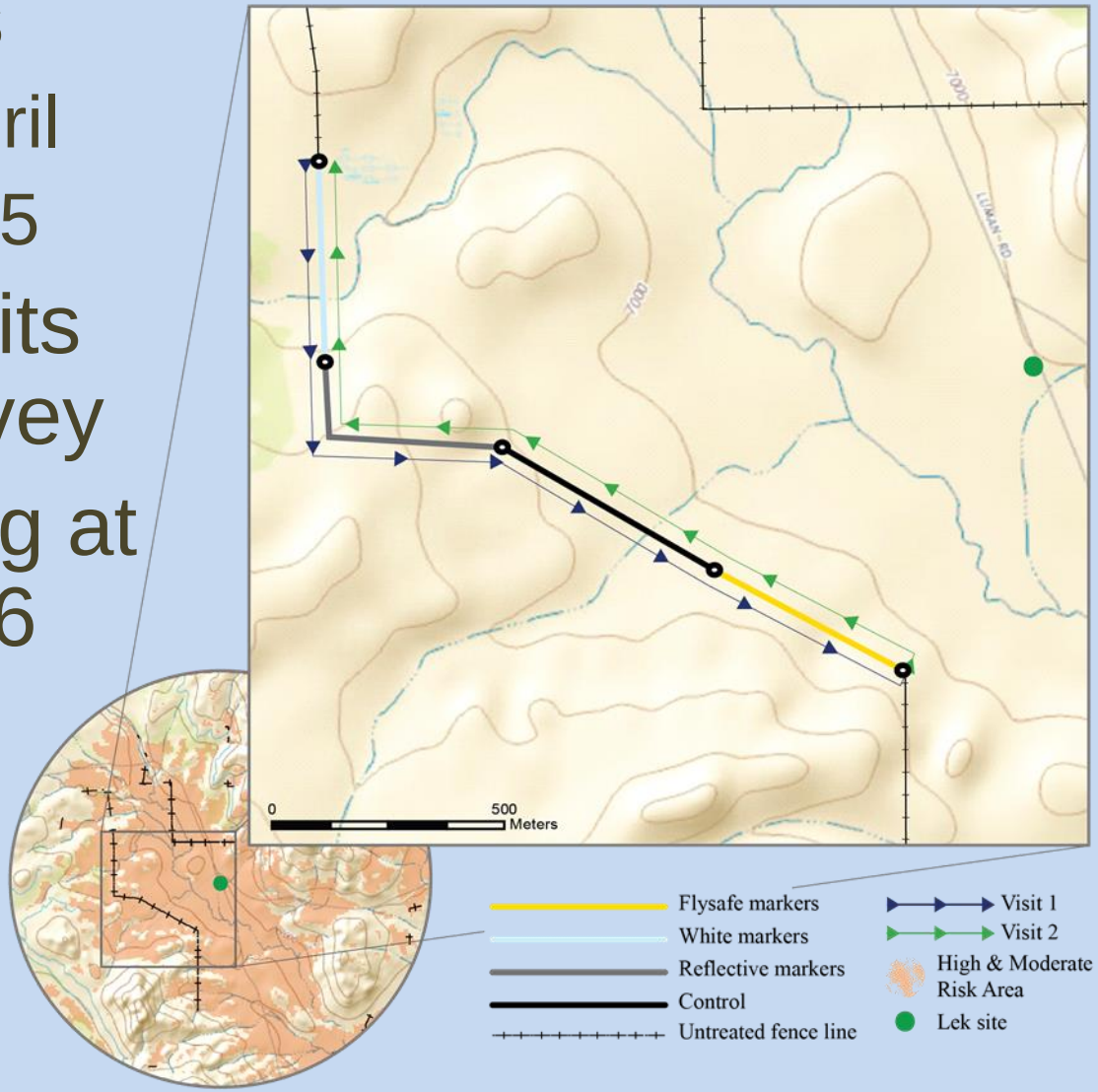
Methods (cont'd)

- Covariate collection
  - Took measurements at 6 points along each fence segment (100m apart)
    - Vegetation height
    - Fence height
  - Lek information provided by WYGF
  - Collision risk map (Stevens et al. 2012)

Bird Conservancy of the Rockies

Methods (cont'd)

- Walking surveys
  - March and April
  - 2014 and 2015
- Conducted 2 visits during each survey
- Surveyed fencing at each site ~ 5 to 6 times/year



Bird Conservancy of the Rockies

Methods (cont'd)

- Only included "confirmed" strikes in analyses (*n* = 64)
  - Feathers had to be stuck in fence
  - Removed possible predation, preening, or perching events

Bird Conservancy of the Rockies

Analysis

- Multi-scale occupancy analysis
  - Local and landscape-scale factors affecting risk of collision
  - Used multiple “visits” within a survey to account for incomplete detection
  - Only included “new” collisions
- Placed covariates on detection, local occupancy (fence segment), and landscape occupancy (lek)
- Sequential model selection
  - p, Psi, Theta

Bird Conservancy of the Rockies

Analysis (cont'd)

- Detection (p) Covariates
  - Visit effects
  - Survey effects
  - Observer effects
  - "Trap" effects
  - Cloud Cover
  - Snow Cover

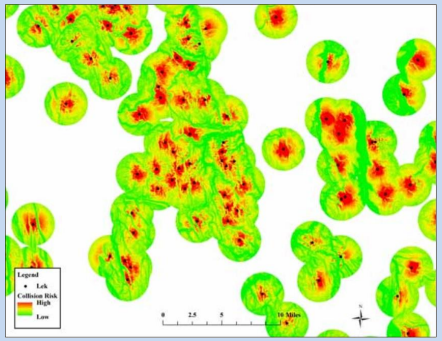
Bird Conservancy of the Rockies

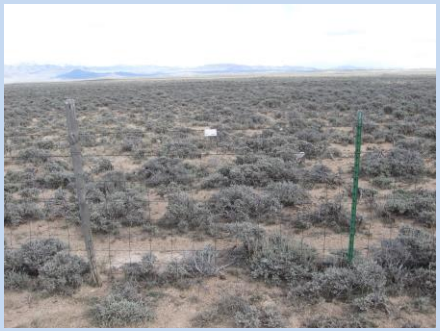
Analysis (cont'd)

- Large-scale Occupancy Covariates
  - Year
  - # of occupied leks within 4km of focal lek
  - Sum of lek counts within 4km of focal lek

Analysis (cont'd)

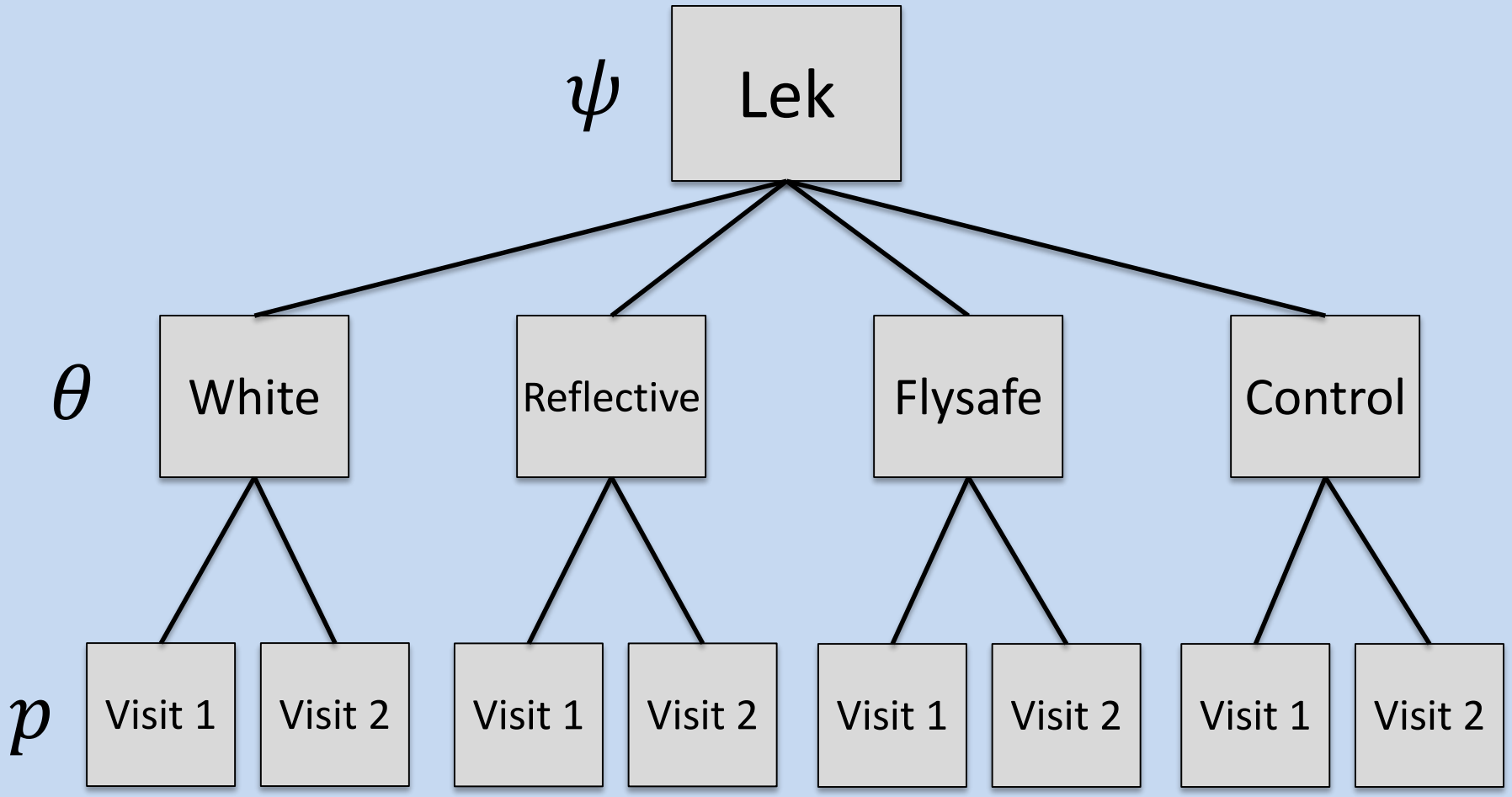
- Small-scale Occupancy Covariates
  - Year
  - Marker type
  - Marker vs. Control
  - Fence exposure angle
  - Distance of fence to nearest lek
  - Height of fence exposed
  - Proportion of fence in high risk area
  - Fence post type





Bird Conservancy of the Rockies

Multiscale Occupancy



Bird Conservancy of the Rockies

Results

- 64 confirmed collisions
  - 2014 = 15
  - 2015 = 49
- 50 of 64 collisions on top wire
- 96 likely/possible collisions removed

Bird Conservancy of the Rockies

Results

- Detection – constant
  - 0.935 (SE=0.026)
- Large-scale occupancy
  - 0.750 (SE=0.123)
  - Increased with sum of nearby lek counts
  - Higher in 2015
  - Null model was most supported

Bird Conservancy of the Rockies

Results - Small-scale occupancy

- Post type
  - Both: $\beta = 1.49$, $SE = 0.36$
- Distance to nearest lek: $\beta = -1.11$, $SE = 0.24$
- Marked: $\beta = -0.85$, $SE = 0.36$
- 2015: $\beta = 0.98$, $SE = 0.44$
- Fence exposure: $\beta = 0.03$, $SE = 0.01$

Bird Conservancy of the Rockies

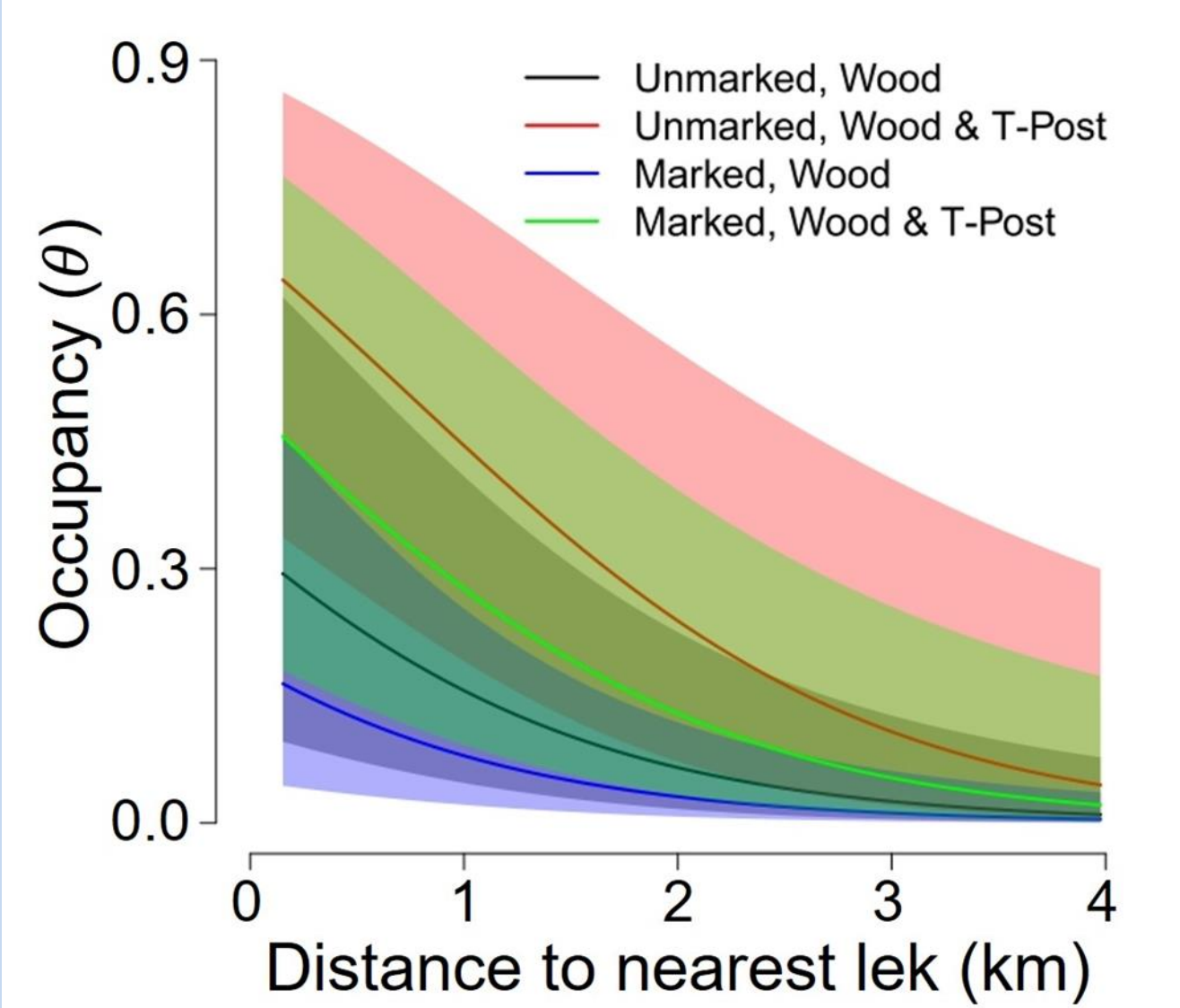
Results - Small-scale Occupancy Marker Effectiveness

- Markers collectively reduced collision risk
  - All: Decreased risk of collision by ~58%
  - White: Decreased risk of collision by ~58%
  - Reflective: Decreased risk of collision by ~63%
  - Flysafe: Decreased risk of collision by ~50%

Bird Conservancy of the Rockies

Results - Small-scale Occupancy: Risk decreases away from leks

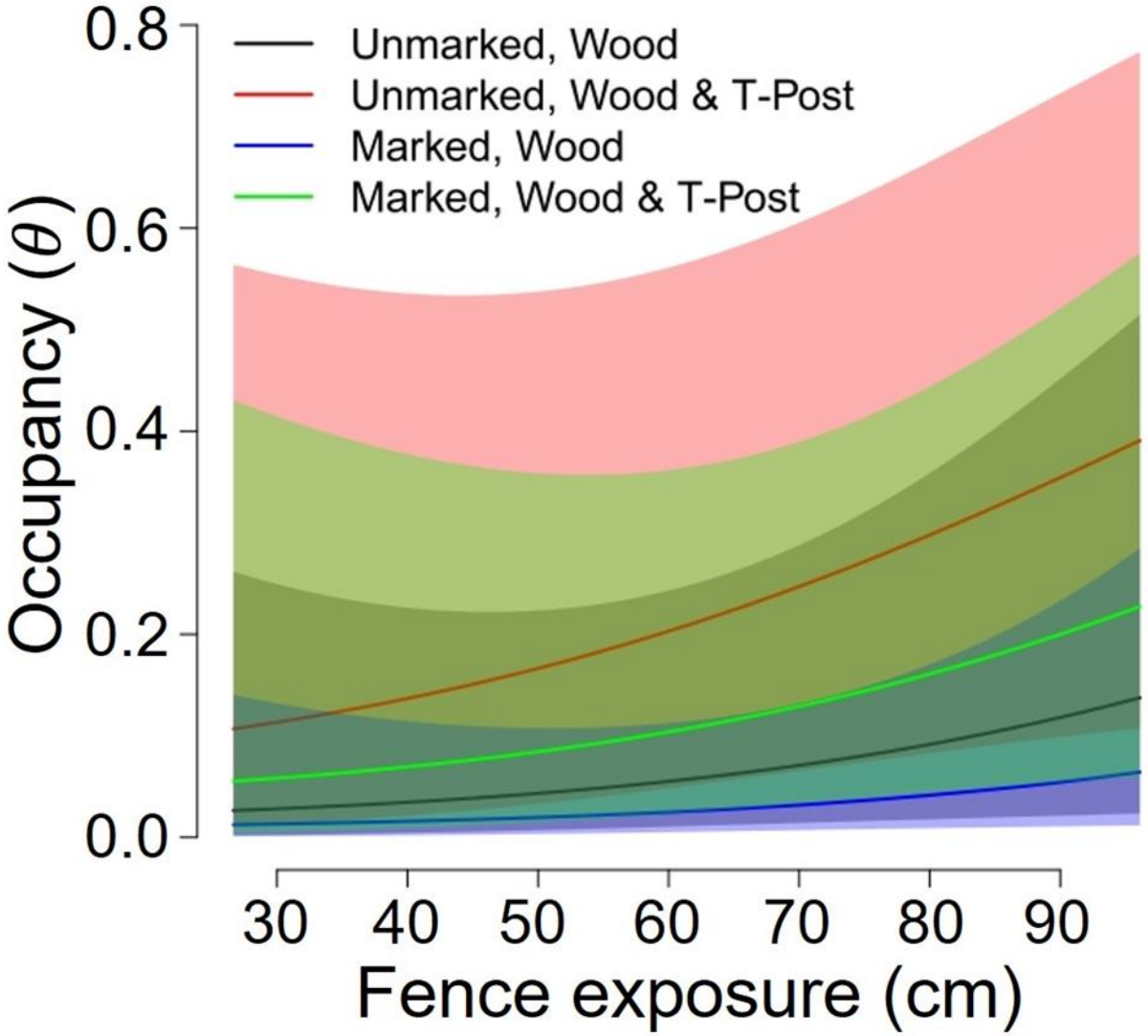
$\beta = -1.11,$
$SE = 0.24$



Bird Conservancy of the Rockies

Results - Small-scale Occupancy: Risk increases with fence exposure

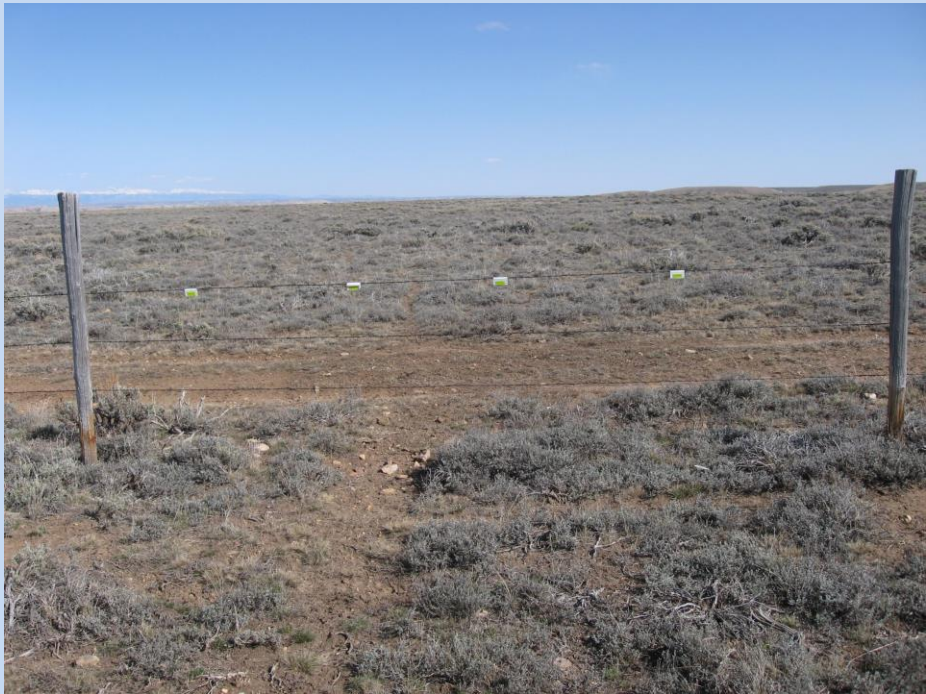
$\beta = 0.03$
$SE = 0.01$



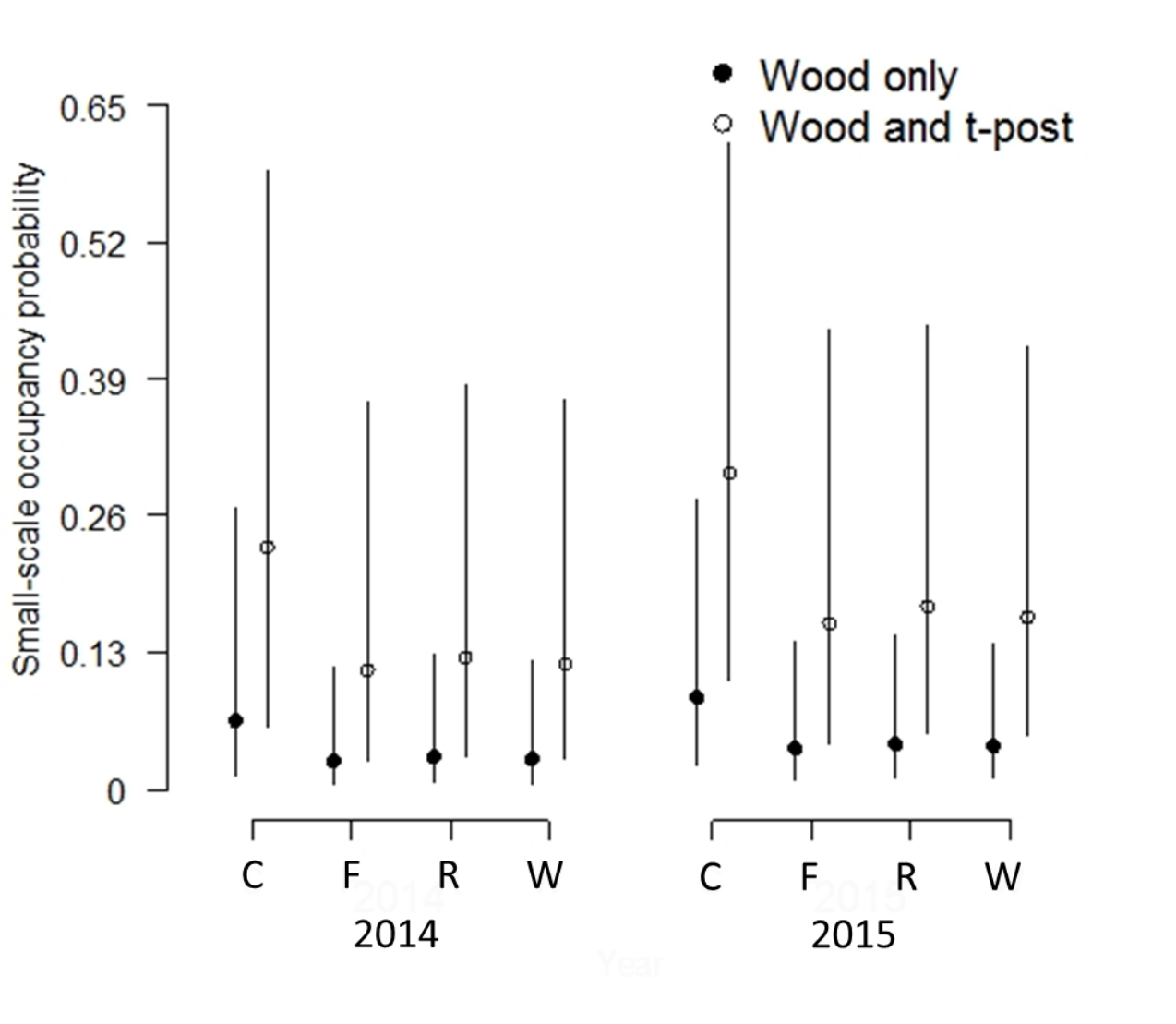
Bird Conservancy of the Rockies

Results - Small-scale Occupancy

- Amount of exposed fence affects collision risk
  - 15cm less exposed fence = 40% reduction in collision risk



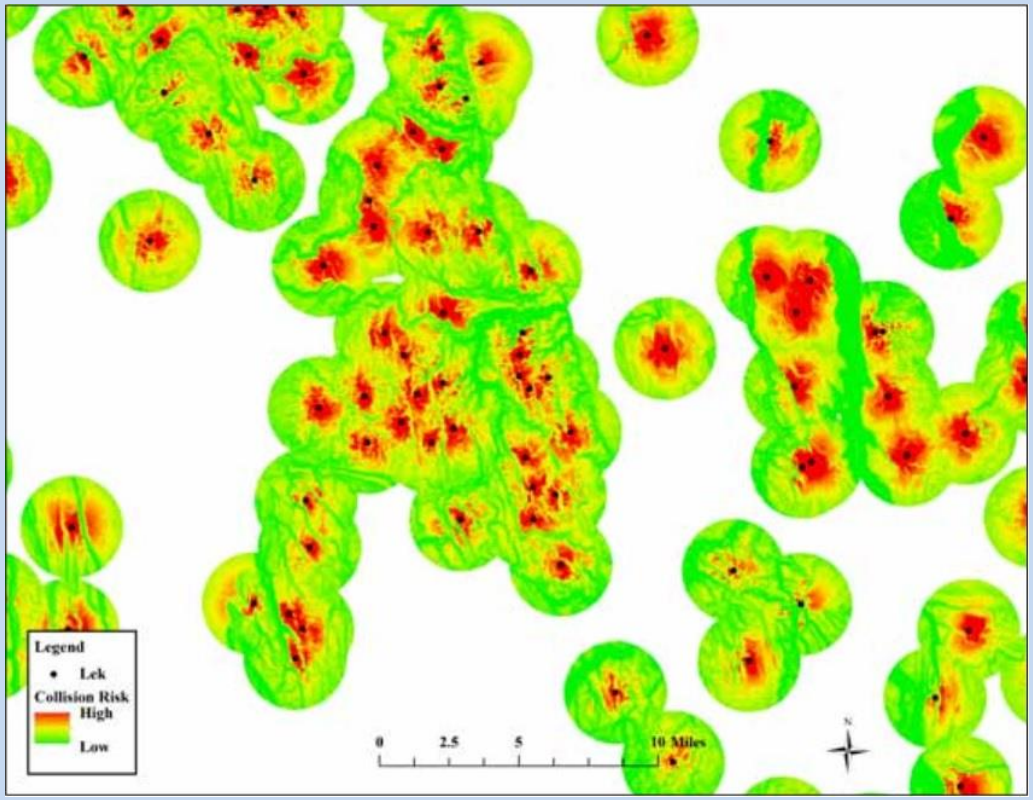
Results - Small-scale occupancy
Wood posts reduced collision risk



Bird Conservancy of the Rockies

Results - Small-scale Occupancy
Collision risk map

- No evidence that collision risk is different between high- and medium-risk areas



Bird Conservancy of the Rockies

Management Implications

- Markers did reduce collision
  - Use white PVC markers
    - Least expensive, easy to install
    - Almost as good as reflective
    - Better than Flysafe
- Mark fences near leks with high counts
- Mark/remove fences with T-posts
- Target marking efforts on fences with short vegetation by the fence
- Might not want to base marking efforts on collision risk map (high vs. medium risk)

Bird Conservancy of the Rockies

Full Technical Report Available

Rocky Mountain Avian Data Center ->

Reports -> 2016

http://rmbo.org/v3/Portals/5/Reports/CIG%20Fence%20Marking%20Technical%20Report_Final%20Report.pdf

Bird Conservancy of the Rockies

Acknowledgements

Funding provided by NRCS CIG grant
Jenny Berven
Brittany Woiderski
Dale Woolwine (BLM)
Tom Christianson (WYGF)
Tony Mong (WYGF)
Field Technicians
Bird Conservancy Staff

Bird Conservancy of the Rockies

Questions?

Nick Van Lanen, Biologist
Bird Conservancy of the Rockies
Nick.vanlanen@birdconservancy.org