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

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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
Previous Research

Observed 83% reduction in collisions when fences were marked

Used vinyl markers with reflective tape

Previous Research

Collision risk influenced by:

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

Previous Research

Risk map based upon:
1) Topography
2) Proximity to leks

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
Study Area

Sublette County, Wyoming
- Area of high sage-grouse density
- Evidence of collisions
- Relatively easy public access
- Cooperative landowners
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
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)
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
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
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
Analysis (cont’d)

• Detection (p) Covariates
  • Visit effects
  • Survey effects
  • Observer effects
  • “Trap” effects
  • Cloud Cover
  • Snow Cover
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
Multiscale Occupancy

\[ \psi \]

\[ \theta \]

\[ \rho \]

Lek

White

Reflective

Flysafe

Control

Visit 1  Visit 2

Visit 1  Visit 2

Visit 1  Visit 2

Visit 1  Visit 2
Results

- 64 confirmed collisions
  - 2014 = 15
  - 2015 = 49
- 50 of 64 collisions on top wire
- 96 likely/possible collisions removed
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
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: $\beta = 0.03, SE = 0.01$
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%
Results - Small-scale Occupancy: Risk decreases away from leks

$\beta = -1.11,\ SE = 0.24$
Results - Small-scale Occupancy: Risk increases with fence exposure

\[ \beta = 0.03 \]

\[ SE = 0.01 \]
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
Results - Small-scale Occupancy Collision risk map

- No evidence that collision risk is different between high- and medium-risk areas
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)
Full Technical Report Available

Rocky Mountain Avian Data Center -> Reports -> 2016

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Questions?

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