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The Interactive Effects of Fire and Recreation on Golden Eagles

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Introduction

Sagebrush steppe ecosystems are vulnerable to several threats

- Wildfire
  - Alters habitat
  - Changes wildlife distributions [3, 9]
- Recreation
  - Alters animal behavior [4, 8]
  - Destroys habitat [2]

Individual threats affect wildlife

Methods

Study Site
- 22 historical eagle territories along the Owyhee Front of Idaho
- Popular site for outdoor recreation
- In 2015, the Soda fire burned through 14 territories, 8 remained unburned

Study Design
We leveraged data collected in 2017 with similar pre-fire data from 2013-2014 on recreation and eagle reproduction. We also compared burned and unburned sites with varying levels of recreation disturbance.

Data Collection
- Monitored Recreation volumes with trail cameras
- Surveyed territory occupancy
- Monitored nests for productivity

We answered questions using GLMMs:

1. Does fire affect recreation volume?
   - No effect of fire on recreation volumes

2. Is occupancy, egg-laying or productivity predicted by:
   - Period = before/after burn
   - Burn extent = % burned area per territory
   - OHV = average Off Highway Vehicle use
   - PED = average early season pedestrian use
   - Random effects: territory, year

No effects on nest productivity

Evidence that OHVs affect occupancy

- Pedestrians negatively affect egg-laying

Research Objectives
- Monitor the effects of wildfire on outdoor recreation
- Determine if there are interactive or additive effects of fire and recreation on Golden Eagle territory occupancy, egg laying, and production of young

Results

Golden Eagles:

- Apex predators of the sage-steppe
- Rely on healthy shrub habitat to support prey [1]
- Fire negatively affects nest success [5]
- Recreation negatively affects occupancy and egg-laying [6, 7]

How do recreation and wildfire synergistically affect eagles?
1. Recreation may not change after fire, causing additive negative effects
2. Recreation may decrease after fire, relieving eagles of disturbance

Table 1. AICc table showing candidate model used to explain the probability of Golden Eagle territory occupancy

<table>
<thead>
<tr>
<th>R, Data, AICc, Wt</th>
<th>5, 0.50, 0.46</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept only</td>
<td>4, 0.90, 0.76</td>
</tr>
<tr>
<td>OHV</td>
<td>5, 2.61, 0.88</td>
</tr>
<tr>
<td>OHV, Period</td>
<td>6, 5.24, 0.97</td>
</tr>
</tbody>
</table>

Figure 1. The probability of eagle territory occupancy predicted by average OHV use per trail per day. Shading indicates 95% confidence intervals.

Figure 2. The probability eagles will lay eggs in occupied territories predicted by average early season pedestrian use per trail per day. Shading indicates 95% confidence intervals.

Table 2. AICc table showing candidate model used to explain the probability that Golden Eagles will lay eggs

<table>
<thead>
<tr>
<th>R, Data, AICc, Wt</th>
<th>5, 0.00, 0.35</th>
</tr>
</thead>
<tbody>
<tr>
<td>PED</td>
<td>4, 1.00, 0.35</td>
</tr>
<tr>
<td>Intercept only</td>
<td>5, 1.23, 0.25</td>
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<tr>
<td>OHV, Period</td>
<td>5, 2.35, 0.15</td>
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<tr>
<td>OHV, Period, Burn extent</td>
<td>6, 4.13, 0.06</td>
</tr>
</tbody>
</table>

Conclusions

- Fire did not affect recreation volumes, which has not been documented in the sage-steppe
- Even after a large scale fire, recreation, continues to be a major threat to eagles
  - This is important for managing sensitive species in the sage-steppe
  - Data from 2018 may reveal additional trends

Thanks!

Field and technical support:
- Ben Dudek, Teague Scott, Casey Pozzanghara, Mike Kochert and Bryce Robinson

Future Research

- How do fire and recreation affect eagle diet?