Risk Validation Analysis:

USFWS Pacific Southwest Region Example of Eagle Take Permit Renewal/5 year Review Process Considerations

The U.S. Fish and Wildlife Service has not made any decisions regarding the Shiloh IV Wind Facility permit, and we do not currently have formal policy regarding the permit compliance, permit renewals, or the five year review process.
Shiloh IV Wind, LLC

• Eagle Take Permit Issued July 2014 (First Nationally)
• Permit Expires July 2019
• Permit Renewal Process is Similar to 5 year Reviews
Shiloh IV Location

Montezuma Hills Wind Resource Area (WRA)
Solano County, Northern California
Permit Renewal/5 Year Review Process

Step 1: Permit compliance risk validation
- was eagle take within authorized limits?

Step 2: Update risk prediction for next permit term.

Step 3: Compensatory mitigation:
- Mitigation Credits or Mitigation Owed?
## Authorized Take

<table>
<thead>
<tr>
<th>Predicted take over 5 years</th>
</tr>
</thead>
<tbody>
<tr>
<td>Preconstruction eagle use data</td>
</tr>
<tr>
<td>July 2014 Permit:</td>
</tr>
</tbody>
</table>
Post-construction Fatality Monitoring

Study Design:

Bird and Bat Fatality Monitoring

- 3 years, 50% turbines, searched weekly

Eagle Permit Fatality Monitoring

- 2 years, 100% turbines, searched monthly
Post-construction Fatality Monitoring

Dates:

Bird and Bat Fatality Monitoring
  • March 2013 - March 2016

Eagle Permit Fatality Monitoring
Post-construction Fatality Monitoring

Study Design:

<table>
<thead>
<tr>
<th>Study</th>
<th>number turbines searched</th>
<th>percent turbines searched</th>
<th>search frequency</th>
<th>search radius</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bird &amp; Bat</td>
<td>25</td>
<td>50%</td>
<td>weekly</td>
<td>105m</td>
</tr>
<tr>
<td>Eagle</td>
<td>50</td>
<td>100%</td>
<td>monthly</td>
<td>120m</td>
</tr>
</tbody>
</table>
Post-construction Fatality Monitoring

Bird & Bat Study
- 44% of project area searched
- Zero eagles found

Eagle Study
- 100% of project area searched
- Zero eagles found

Results

Photo: Patrick Kolar
Step 1: Risk Validation

Permit Compliance:
Were eagle impacts within authorized take limits?

Methods
- fatality monitoring data
- Evidence of Absence software (EoA) (Dalthorp et al. 2017)
Step 1: Risk Validation

Validate authorized eagle take not exceeded

Results: Evidence of Absence Multiple Year Model

Credibility level 0.5

Annual Mortality Estimates:

<table>
<thead>
<tr>
<th>Survey type/Year</th>
<th>Eagles found</th>
<th>Detection Probability</th>
<th>estimated mortality</th>
<th>median estimated mortality</th>
<th>95% CI</th>
<th>mean mortality rate</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bird &amp; Bat Year 1</td>
<td>0</td>
<td>0.36</td>
<td>0</td>
<td>0</td>
<td>[0, 4]</td>
<td>1.38</td>
<td>[0.0014, 6.9410]</td>
</tr>
<tr>
<td>Bird &amp; Bat Year 2</td>
<td>0</td>
<td>0.36</td>
<td>0</td>
<td>0</td>
<td>[0, 4]</td>
<td>1.38</td>
<td>[0.0014, 6.9410]</td>
</tr>
<tr>
<td>Bird &amp; Bat Year 3</td>
<td>0</td>
<td>0.36</td>
<td>0</td>
<td>0</td>
<td>[0, 4]</td>
<td>1.38</td>
<td>[0.0014, 6.9410]</td>
</tr>
<tr>
<td>Eagle Year 1</td>
<td>0</td>
<td>0.59</td>
<td>0</td>
<td>0</td>
<td>[0, 2]</td>
<td>0.88</td>
<td>[0.0009, 4.4840]</td>
</tr>
<tr>
<td>Eagle Year 2</td>
<td>0</td>
<td>0.59</td>
<td>0</td>
<td>0</td>
<td>[0, 2]</td>
<td>0.88</td>
<td>[0.0009, 4.4850]</td>
</tr>
</tbody>
</table>
Step 1: Risk Validation
Evidence Of Absence (EoA)

Permit Compliance Validation

Conservative Method:

- Validated take did not exceed 5 eagles over 5 years
- 2 Years Eagle Data + 1 Year of Bird & Bat Data
  - Used data collected during permit term
- 80th Credible Interval
Step 1: Risk Validation
Evidence Of Absence (EoA)

Permit Compliance Validation

In other words:

There is an 80% probability that the true number of fatalities was less than or equal to 2 eagles.
Step 1: Risk Validation
Evidence Of Absence (EoA)

Example of study design tradeoffs

Eagle Study Only
- 2 Years Data
- 80th Credible Interval

Bird & Bat Study Only
- 3 Years Data
- 80th Credible Interval

~10% chance take exceeded in permit year 5
~5% chance take exceeded in permit year 4,
~10% chance take exceeded in permit year 5
Step 2: Update Risk Prediction

Methods:

Update Shiloh IV take estimate

- Evidence of Absence output → Program R code script (DAPPER Stats 2017)
- “Expected value” output → Collision Risk Model

Results:

Updated Risk Prediction using

- Pre-construction eagle use data
- Post-construction eagle fatality data
### Step 2: Update Risk Prediction

#### Results

<table>
<thead>
<tr>
<th>Model Run</th>
<th>Data used</th>
<th>mean</th>
<th>SD</th>
<th>CI80</th>
<th>CI95</th>
</tr>
</thead>
<tbody>
<tr>
<td>Original Prediction</td>
<td>Preconstruction</td>
<td>0.61</td>
<td>0.41</td>
<td>0.89</td>
<td>1.4</td>
</tr>
<tr>
<td></td>
<td>Eagle use data</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Updated Prediction</td>
<td>Preconstruction</td>
<td>0.55</td>
<td>0.35</td>
<td>0.8</td>
<td>1.2</td>
</tr>
<tr>
<td></td>
<td>Eagle use data + fatality data</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Results:
Take authorized at 80% Credible Interval (CI)

Shiloh IV Eagle Permit:
0.89/year x 5 = 4.5 - Rounded up to 5 eagles over 5 years

Updated Risk Prediction:
0.80/year x 5 = 4 eagles over 5 years
Step 2: Update Risk Prediction

Pacific Southwest Region Options

Shiloh IV – First Eagle Take Permit Nationally
Eagle Use Data collected before ECP Guidance
- “unlimited distance” plots
- interpreted data conservatively
- 1-mile circular plot

Options....
Step 3: Compensatory Mitigation

Does Shiloh IV Wind, LLC get Mitigation Credits or is Mitigation Owed?
Shiloh IV 2014 Permit:

- Retrofitted 133 electric poles
- Mitigation location identified as high eagle use/risk area
Step 3: Compensatory Mitigation

Shiloh IV 2014 Eagle Take Permit Required
133 electric utility poles be retrofit

PG&E Retrofit 140 poles

All poles are not equal

Photos: Mike Best, Pacific Gas and Electric
Step 3: Compensatory Mitigation

Shiloh IV 2014 Eagle Take Permit

Project: Shiloh IV 2014 Compensatory Mitigation Package for the take of 5 golden eagles over 5 years at 1:1 ratio

<table>
<thead>
<tr>
<th>Type of retrofit</th>
<th>range poles needed</th>
<th># poles by type completed</th>
<th># poles by type needed</th>
</tr>
</thead>
<tbody>
<tr>
<td>10-year credit (plastic covers)</td>
<td>133</td>
<td>110</td>
<td>-46</td>
</tr>
<tr>
<td>30-year credit (reframe/rebuild)</td>
<td>58</td>
<td>30</td>
<td>0</td>
</tr>
</tbody>
</table>

Result: 46 Poles credited to next permit term
= more than 1 eagle mitigation credited to next permit term

Photos: Mike Best, Pacific Gas and Electric
Permit Renewal/5 Year Review Process
Take Home Message

Step 1: Permit compliance risk validation
- was eagle take within authorized limits?
  ➢ Yes

Step 2: Update risk prediction for next permit term.
  ➢ Yes, reduced by 1 eagle per 5 year term

Step 3: Compensatory mitigation:
  ➢ Mitigation Credited to next permit term for 2 or more golden eagles

Its an Adaptive Process!!
Acknowledgments

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Michael Azeka, EDF Renewables

Photo: Patrick Kolar
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Thank You!

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