Effects of Vegetation Structure and Microclimate on Southwestern Willow Flycatcher Nest Predation
Why study predation?

- Leading cause of nest failure for open-cup nesting passerines (Martin 1992, Driscoll 2005)
- Strong selective pressure on choice of nest site (Martin and Roper 1988, Li and Martin 1991)
  - Nest-site choice may lead to enhanced reproductive success, which is one factor that determines population size
  - Maintaining viable population size critical for conservation of endangered species
Vegetation structure

- Higher canopy height (Murphy 1983)
- Greater concealment (Filliater et al 1994, Budnik et al 2002)

* In studies that find no effect of structure on success, microclimate of nest site is often cited as a potential factor (e.g. Bisson and Stutchbury 2000, Martin 1998, Prather et al. 2002)
Microclimate

• Temperature extremes impact reproductive output (Rauter et al. 2002)
• Higher mid-day temperatures correlated with nest placement (Lloyd and Martin 2004, Walsberg 1981)
• However, very few studies have attempted to link microclimate and predation
  – Predation reduced by roost selection based on microclimate (Hiller and Guthery 2005)
Studies with SWCA

- Study sites along Virgin, Muddy and Colorado Rivers and Pahranagat Valley
- Data collected 2003-2006
Methods

• Vegetation measurements (5)
  – Nest height, canopy height, canopy cover, ground cover, concealment

• Microclimate (4)
  – Diurnal maximum and minimum temperature and humidity
Patterns of depredation

<table>
<thead>
<tr>
<th></th>
<th>FLEDGE</th>
<th>DEPREDATED</th>
<th># NESTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>MESQ</td>
<td>61.2 (30)</td>
<td>38.8 (19)</td>
<td>49</td>
</tr>
<tr>
<td>PAHR</td>
<td>76.8 (43)</td>
<td>23.2 (13)</td>
<td>56</td>
</tr>
<tr>
<td>TOPO</td>
<td>51.3 (38)</td>
<td>48.7 (40)</td>
<td>78</td>
</tr>
<tr>
<td>TOTAL</td>
<td>61.7 (111)</td>
<td>38.3 (72)</td>
<td>183</td>
</tr>
</tbody>
</table>

* Table shows percent fledged/depredated (# nests)
** Nest fate differs by site
  (Pearson Chi-square = 10.8; p=0.004)
### Results of univariate logistic regression (numbers in bold are significant; p<0.05)

- **Microclimate around the nest is the most important factor driving predation**
- **Vegetation structure does not affect predation**

<table>
<thead>
<tr>
<th></th>
<th>MESQ Fledged (n=30)</th>
<th>MESQ Depredated (n=19)</th>
<th>PAHR Fledged (n=41)</th>
<th>PAHR Depredated (n=12)</th>
<th>TOPO Fledged (n=38)</th>
<th>TOPO Depredated (n=40)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nest height</td>
<td>Mean (SE)</td>
<td>2.1 (0.1)</td>
<td>2.0 (0.1)</td>
<td>3.4 (0.2)</td>
<td>3.1 (0.5)</td>
<td>3.6 (0.2)</td>
</tr>
<tr>
<td>Canopy height</td>
<td>Mean (SE)</td>
<td>4.9 (0.1)</td>
<td>5.1 (0.2)</td>
<td>17.1 (0.9)</td>
<td>15.1 (2.3)</td>
<td>92.5 (1.4)</td>
</tr>
<tr>
<td>Ground cover</td>
<td>Mean (SE)</td>
<td>18.0 (3.4)</td>
<td>11.0 (2.9)</td>
<td>31.3 (4.3)</td>
<td>27.8 (7.3)</td>
<td>15.8 (2.5)</td>
</tr>
<tr>
<td>Canopy closure</td>
<td>Mean (SE)</td>
<td>92.4 (1.1)</td>
<td>94.8 (1.2)</td>
<td>93.0 (1.6)</td>
<td>92.4 (2.4)</td>
<td>1.4 (0.2)</td>
</tr>
<tr>
<td>Concealment</td>
<td>Mean (SE)</td>
<td>1.4 (0.2)</td>
<td>1.7 (0.1)</td>
<td>2.0 (0.2)</td>
<td>2.3 (0.3)</td>
<td>1.4 (0.2)</td>
</tr>
<tr>
<td>Maximum temp</td>
<td>Mean (SE)</td>
<td>41.4 (1.0)</td>
<td>42.1 (1.2)</td>
<td>37.1 (0.5)</td>
<td>38.2 (1.2)</td>
<td>41.7 (0.6)</td>
</tr>
<tr>
<td>Minimum temp</td>
<td>Mean (SE)</td>
<td>15.5 (0.4)</td>
<td>14.4 (0.9)</td>
<td>13.3 (0.3)</td>
<td>10.2 (0.6)</td>
<td>17.9 (0.5)</td>
</tr>
<tr>
<td>Maximum humidity</td>
<td>Mean (SE)</td>
<td>97.0 (0.7)</td>
<td>93.3 (2.0)</td>
<td>88.6 (1.7)</td>
<td>78.7 (4.2)</td>
<td>95.3 (0.8)</td>
</tr>
<tr>
<td>Minimum humidity</td>
<td>Mean (SE)</td>
<td>17.5 (1.8)</td>
<td>14.0 (1.9)</td>
<td>14.5 (1.0)</td>
<td>10.0 (0.7)</td>
<td>22.0 (1.3)</td>
</tr>
</tbody>
</table>
• Higher temperature = higher chance success
• Higher humidity = higher chance success
• Results from one site; others exhibit same pattern
Why is microclimate so important?

- First study to demonstrate this link
  - But, we are still missing data on female behavior at the nest!
- Behavior can be documented with nest cameras, iButtons, etc.
Implications of this study for habitat restoration

**GOAL:** Create and conserve habitat, work toward recovery of T&E species, and reduce likelihood of additional species being listed.

Accomplish this by **restoration of sites** along LCR where:

1. Microclimate is optimized
2. Reproductive rate (productivity and fecundity) is maximized
3. Predation rate is minimized

* Results may apply to all cup nesting passerines
Acknowledgments

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