A Multi-Scale Analysis of Rusty Blackbird Habitat Selection and Nest Survival in Northeastern Industrial Forests

Shannon Buckley Luepold, Thomas Hodgman, Stacy McNulty, Jonathan Cohen and Carol Foss
Background:

- Regenerating clearcuts as “ecological traps”
- Predators and associated habitat variables unknown
- Hypothesized to be red squirrels, but no evidence

Powell et al. 2010, Condor
Objectives

• Examine the effect of different habitat features on habitat selection and nest survival at multiple spatial scales
• Identify predators of RUBL nests
• Explore the relationship between cone cycles, predator populations and nest predation
Study Areas

NH Study Area

ME Study Area

- RUBL Nest
Field Methods

- Cameras < 1 to 3 m from nests
- Habitat measurements
- Squirrel surveys
Home Range Scale Habitat Measurements

- Data on stand area, species composition, etc. from landowners
- Wetland data from National Wetland Inventory (NWI) Database
- Used ArcGIS v10 to determine percent cover of different forest and wetland types within 500-m radius of nests, distance to nearest road
Statistical Analyses

• **Nest Habitat Selection**
  – Logistic regression in R
  – 2 Spatial scales:
    • Nest Patch Scale (5 m)
    • Home Range Scale (500 m)

• **Nest Survival:**
  – Program MARK
  – 2 Spatial scales:
    • Nest Patch Scale (5 m)
    • Home Range Scale (500 m)

• **Comparison of Cone/Squirrel Abundance:**
  – Program R
    • Mann-Whitney $U$ Test
    • McNemar’s Test
Results: Nest Habitat Selection

- 72 nests total: ME (29) and NH (43), 2011-2012
- 63 nests in harvested areas, 9 in unharvested wetlands
## Results: Habitat Selection

### Nest Patch Scale

<table>
<thead>
<tr>
<th>Model*</th>
<th>K</th>
<th>$\Delta AIC_c$</th>
<th>$w_i$</th>
<th>L</th>
</tr>
</thead>
<tbody>
<tr>
<td>SFBAless10+Canopy+Site</td>
<td>3</td>
<td>0</td>
<td>0.63</td>
<td>1.00</td>
</tr>
<tr>
<td>SFBAless10+Canopy+Site+AlderStems</td>
<td>4</td>
<td>1.50</td>
<td>0.30</td>
<td>0.47</td>
</tr>
<tr>
<td>SFBAless10+Site</td>
<td>2</td>
<td>5.47</td>
<td>0.04</td>
<td>0.06</td>
</tr>
<tr>
<td>SFBAless10+Site+AlderStems</td>
<td>3</td>
<td>7.64</td>
<td>0.01</td>
<td>0.02</td>
</tr>
<tr>
<td>SFBAless10*Site</td>
<td>3</td>
<td>7.65</td>
<td>0.01</td>
<td>0.02</td>
</tr>
</tbody>
</table>

* $AIC_c$ value of top model = 29.44, n = 72

- SFBAless10: $\uparrow$ 5m$^2$/ha  $\uparrow$ 74±32%
- Canopy: $\uparrow$ 10%  $\downarrow$ 43±15%
## Results: Habitat Selection

### Home Range Scale

<table>
<thead>
<tr>
<th>Model</th>
<th>$K$</th>
<th>$\Delta \text{AIC}_c$</th>
<th>$w_i$</th>
<th>$L$</th>
</tr>
</thead>
<tbody>
<tr>
<td>YoungSoft+TotWet+Site</td>
<td>4</td>
<td>0</td>
<td>0.69</td>
<td>1.00</td>
</tr>
<tr>
<td>YoungSoft+PFO_PSS+Site</td>
<td>4</td>
<td>2.08</td>
<td>0.24</td>
<td>0.35</td>
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<tr>
<td>PoleSoft+TotWet</td>
<td>3</td>
<td>6.83</td>
<td>0.02</td>
<td>0.03</td>
</tr>
<tr>
<td>PoleSoft+TotWet+Site</td>
<td>4</td>
<td>7.70</td>
<td>0.01</td>
<td>0.02</td>
</tr>
<tr>
<td>PoleSoft+PFO_PSS</td>
<td>3</td>
<td>8.85</td>
<td>0.01</td>
<td>0.01</td>
</tr>
<tr>
<td>YoungSoft+TotWet</td>
<td>3</td>
<td>9.52</td>
<td>0.01</td>
<td>0.01</td>
</tr>
</tbody>
</table>

* $\text{AIC}_c$ of top model = 136.04, $n = 50$

YoungSoft: $\uparrow 10\% \rightarrow \uparrow 41\pm 15\%$

TotWet: $\uparrow 10\% \rightarrow \uparrow 114\pm 43\%$
Results: Nest Habitat Selection

- Different factors driving selection at different spatial scales
  - Foraging requirements (wetlands) at home range scale
  - Nest safety (dense conifers) at nest patch scale
## Results: Nest Survival

### Nest Patch Scale:

<table>
<thead>
<tr>
<th>Model*</th>
<th>$K$</th>
<th>$\Delta AIC_c$</th>
<th>$w_i$</th>
<th>Dev</th>
</tr>
</thead>
<tbody>
<tr>
<td>BATotal</td>
<td>2</td>
<td>0</td>
<td>0.230</td>
<td>131.662</td>
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<tr>
<td>BATotal+Year</td>
<td>3</td>
<td>0.424</td>
<td>0.186</td>
<td>130.070</td>
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<tr>
<td>BATotal+Cut</td>
<td>3</td>
<td>1.263</td>
<td>0.123</td>
<td>131.430</td>
</tr>
<tr>
<td>BATotal+Site</td>
<td>3</td>
<td>1.784</td>
<td>0.094</td>
<td>129.996</td>
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<tr>
<td>BATotal+RESQ</td>
<td>3</td>
<td>1.937</td>
<td>0.087</td>
<td>131.584</td>
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<tr>
<td>BATotalxCut</td>
<td>4</td>
<td>2.371</td>
<td>0.070</td>
<td>130.000</td>
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<tr>
<td>Year</td>
<td>2</td>
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<td>0.029</td>
<td>135.837</td>
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<tr>
<td>AlderTree+Year</td>
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<td>4.548</td>
<td>0.024</td>
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<td>AlderTree+Site</td>
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<td>AlderTree</td>
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<tr>
<td>Null</td>
<td>1</td>
<td>5.864</td>
<td>0.012</td>
<td>139.537</td>
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</tbody>
</table>

* $AIC_c$ value of best model = 135.22, n = 65
Results: Effect of Total Basal Area

![Bar chart showing the comparison between successful and failed cases in terms of total basal area (m²/ha). The successful group has a higher basal area (n=44) compared to the failed group (n=21).]
<table>
<thead>
<tr>
<th>Model</th>
<th>K</th>
<th>ΔAIC_c</th>
<th>w_i</th>
<th>Dev</th>
</tr>
</thead>
<tbody>
<tr>
<td>RdDist+Yr+RdDistxYr</td>
<td>4</td>
<td>0</td>
<td>0.858</td>
<td>95.200</td>
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<tr>
<td>WetDist+Yr+WetDistxYr</td>
<td>4</td>
<td>6.864</td>
<td>0.028</td>
<td>102.064</td>
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<tr>
<td>Year</td>
<td>2</td>
<td>8.288</td>
<td>0.014</td>
<td>107.535</td>
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<tr>
<td>TotWet+Year</td>
<td>3</td>
<td>8.853</td>
<td>0.010</td>
<td>106.080</td>
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<tr>
<td>WetDist+Year</td>
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<td>9.068</td>
<td>0.009</td>
<td>106.295</td>
</tr>
<tr>
<td>TotWet</td>
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<td>9.743</td>
<td>0.007</td>
<td>108.990</td>
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<tr>
<td>YoungSoft+Year</td>
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<td>9.782</td>
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<tr>
<td>MatSoft+Year</td>
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<td>9.917</td>
<td>0.006</td>
<td>107.144</td>
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<tr>
<td>RdDist+Year</td>
<td>3</td>
<td>10.066</td>
<td>0.006</td>
<td>107.293</td>
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<tr>
<td>TotWet+Yr+TotWetxYr</td>
<td>4</td>
<td>10.091</td>
<td>0.006</td>
<td>105.291</td>
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<tr>
<td>Null</td>
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<td>10.137</td>
<td>0.005</td>
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</tbody>
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* AIC_c value of best model = 103.267, n = 50
Management Implications

- Roads
- Pre-commercial thinning?
Results: Nest Survival and Predators

• Monitored 29 nests with cameras

• 8 predation events documented, 4 predator species identified: white-tailed deer, sharp-shinned hawk, blue jay and red squirrel

• Red squirrels most frequent predator (4 predations), but only in 2012
Results: Cones, Squirrels and Nest Survival

- ME: $U = 605, P = 0.004$
- NH: $U = 1582, P < 0.001$

- McNemar’s Test, $P = 0.001$
Cyclical Patterns in Rusty Blackbirds

Savard et al. 2011, Ecoscience
Conclusions:

- Different habitat features important at different spatial scales - importance of landscape mosaic

- Relationship between RUBL ecology and timber harvesting complex

- Red squirrels important nest predators, but not every year - possible influence of masting/fluctuating predator populations
References:


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