Cerulean Warbler Breeding Habitat Characteristics

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Regional Variation on Common Themes

• Tract Size / Area Sensitivity
  – Varies regionally

• Bimodal Site Types

• Variety of Tree Species Regionally,
  – May be more restricted locally

• Big Trees

• Tall Trees

• Heterogeneous canopy structure
Habitat Associations of Cerulean Warblers

Scale Description

- Regional, physiographic forest type, topographic, edaphic, successional stage, stocking
- Tree species and nest vicinity, and nest microsite
- Home range/microsite
- Stand
- Landscape
- Regional
- Rangewide
Breeding Distribution is Dynamic within the Range

Data of Jennifer Baldy, Univ. of Memphis Thesis, 2005
Forest Managers in the Central Hardwoods are the Primary Stewards of Cerulean Warbler Breeding Habitat
Landscape-scale Relationships

• Largely forested landscapes
  – eg. Cumberland Mountains, TN- 85% forested

and/or

• Large forest patch size
  – 700 ha- MD (Robbins et al 1992)
  – 1600 ha- Miss. Alluvial Valley (Hamel)

• Regional variation in sensitivity
Tract Size Utilization

Number of Sites

Tract Size, ha

R3 Midwest
R4 Southeast
R5 Northeast

10 30 61 142 304 607 1417 3036
Forest Cover in Landscape
(Bosworth 2003)

$R^2 = 0.52, \quad P = 0.05$
Preliminary data from 2004-05 suggest that density and nest survival rates may be lower in forests adjacent to recent clearcut compared to more forested landscapes.

Bakermans and Rodewald, in progress
(Check back in the summer)
Habitat Relationships: Landscapes

• Area sensitivity
  – 1,780 ac (Robbins et al 1992)
  – 4,000 ac in MAV (Hamel)

• Regional variation in sensitivity

• Edge avoidance varies
Forest type

• Eyre (1980) lists 49 Eastern forest cover types

• Cerulean Warblers have been confirmed to nest in nominate tree species of 33

• Forest cover type use is selective within a locality

• Forest cover type use varies across localities
Tree species use

- Basswood
- American Beech
- Black Walnut
- Black Locust
- Elm
- Ash
- Cottonwood
- Yellow-poplar
- Sycamore
- Hickories
- Maples
- Oaks

Percent of States
Cerulean Warbler on Desha Site
Tree Availability vs Use

Proportion of Stems

Tree Species

ACNE  CELA  FRPE  LIST  PLOC  PODE  ULAM

Used
Available
Topographic situations

Number of Sites

Site Type

- Dry Slopes and Ridgetops
- Other Uplands
- Mesic Uplands and Coves
- Bottomland Sites
- Swamps and Lake Margins

Number of Sites

<table>
<thead>
<tr>
<th>Site Type</th>
<th>R3 Midwest</th>
<th>R4 Southeast</th>
<th>R5 Northeast</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dry Slopes and Ridgetops</td>
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<tr>
<td>Other Uplands</td>
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</tr>
<tr>
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</tr>
<tr>
<td>Swamps and Lake Margins</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Legend:
- R3 Midwest
- R4 Southeast
- R5 Northeast
Elevation and aspect

Important Cerulean Warbler Areas

Cumberland Mountains, Tennessee Site

- Random Points
- Territories
- Nest Sites
Slope position
(Weakland, Wood, Bosworth)

Mean CER

Territory density

Abundance

- bottom
- mid-slope
- ridge

A
B
AB
A
B
B
Edge Effects?

- Reduced density (Wood et al.) and possibly reduced productivity in areas adjacent to hard edges.
- Effective distance unknown
  - Needs to be documented for different forest management types
- Importance of canopy gaps?
  - Canopy heterogeneity vs. canopy gaps
Use of edge types
(Weakland and Wood 2005)

<table>
<thead>
<tr>
<th>Edge Type</th>
<th>Use</th>
<th>Available</th>
</tr>
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<tbody>
<tr>
<td>Natural gap</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Partly open-canopy road</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Open-canopy road</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mine</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Available (Weakland and Wood 2005)
Edge vs. Gaps

- Territories included canopy gaps / trails
- did not appear to avoid open-canopy edges
- did not use powerline edges
Successional stage

- Cerulean Warblers occur in areas dominated by sawtimber sized trees

- Dominant trees may be
  - Shade Intolerant, pioneer species
  - Shade Tolerant, later successional species

- But they are always big trees
Stand Stocking

• Relates tree number and tree size to available light and growing space in a predictable way

• Foresters understand this concept implicitly

• Ornithologists generally do not

• Conservationists often miss the point that tree growth means that habitats are in continuous change
Stocking of Cerulean Warbler Study Sites in Allegheny Hardwoods, Pennsylvania

The diagram illustrates the relationship between trees per acre, basal area per acre (sq. ft./acre), and percent stocking for Cerulean Warbler study sites in Allegheny Hardwoods, Pennsylvania. The quadrants are labeled as A-line, B-line, C-line, and the graph includes shaded areas indicating the presence (blue) and absence (orange) of Cerulean Warblers.
Stocking of Cerulean Warbler Study Sites in Southern Ohio

Cerulean Warbler Density
- > 2 / 25 acres
- < 2 / 25 acres
- Absent

Trees per acre

Basal area per acre (sq. ft./acre)

Percent Stocking

Quadratic Mean Diameter

A-line

B-line

C-line
Spatial distribution within stands

Meeman Shelby Forest SP & WMA, TN

From Barg et al., Journal of Animal Ecology 2005 74:139–149, Fig. 1
Cerulean Warbler use of trees in Mississippi Alluvial Valley sites,
N=3690 used, >200,000 available
Boxelder in the MAV, from SOFIA, 2002

- top
- top25
- Mean ht
- Crown base
- bottom25
- bottom
- CERWnest
Habitat Relationships: Forest stand structure

Meeman Shelby Forest Grid Point XV

- Suppressed
- Intermediate
- Codominant
- Dominant
- Unknown
- Total

Foliage Volume in pct

Cerulean Warbler Nesting Habitat, from 25 m
Vertical Vegetation Structure at Nests varies with Location

Queen’s University Biological Station, Ontario, Canada, 1999
Frozen Head State Natural Area, Tennessee, USA, 1999
Chickasaw National Wildlife Refuge, Tennessee, USA, 2001

Vertical Vegetation Structure at Nests varies with Location

Nest sites
Nest site

Photo by Heinz Meng
Figure 2: Mean nest site characteristics of 49 Cerulean Warbler nests, Cumberland Mountains, Tennessee, 1996-1998.
### Cerulean Warbler Nest Trees in the LMAV

<table>
<thead>
<tr>
<th></th>
<th>Chickasaw</th>
<th>Desha</th>
<th>Meeman</th>
<th>Total</th>
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<tbody>
<tr>
<td>Nests</td>
<td>19</td>
<td>19</td>
<td>28</td>
<td>66</td>
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<tr>
<td>Tree Species</td>
<td>8</td>
<td>4</td>
<td>9</td>
<td>14</td>
</tr>
<tr>
<td>Tree Height, m</td>
<td>29 +/- 1.7</td>
<td>28 +/- 2</td>
<td>31 +/- 1.4</td>
<td>30 +/- 1</td>
</tr>
<tr>
<td>Nest Height, m</td>
<td>18 +/- 1.2</td>
<td>17 +/- 1.2</td>
<td>20 +/- 1.3</td>
<td>19 +/- 0.74</td>
</tr>
<tr>
<td>Tree DBH, cm</td>
<td>58 +/- 6</td>
<td>55 +/- 5</td>
<td>46 +/- 3</td>
<td>52 +/- 2.6</td>
</tr>
<tr>
<td>Nest from Bole, m</td>
<td>6.2 +/- 0.8</td>
<td>3.5 +/- 0.5</td>
<td>3.4 +/- 0.3</td>
<td>4.2 +/- 0.35</td>
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<tr>
<td>Crown Radius Test</td>
<td>Open grown</td>
<td>No data</td>
<td>Open grown</td>
<td></td>
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</tbody>
</table>
Cerulean Warbler Nest Trees, Mississippi

Relative Ht, %

Median
25 %ile
75 %ile

Tree Diameter, cm
Broadcast Arena may be common denominator in male habitat selection
General Habitat Relationships

- Large tracts of mature deciduous forest
- Ridge tops, floodplain and mesic cove forests.
- Common denominator = emergent, structurally diverse canopy
Suggestions

• Common features of habitats reflect the birds’ biology
• Regional variations reflect external limiting factors, e.g., parasitism and predation
• Preliminary Finding, Cerulean Warblers in the LMAV occur in very productive sites
• Effect of climate change should not be overlooked
Generalizations are difficult because so much is context dependent...
More on habitats during migration and nonbreeding residency periods later
Stocking of Study Grids
Mississippi Alluvial Valley
Bottomland Hardwoods
Stocking at Cerulean Warbler Nest Sites

Same Study Sites In Mississippi Alluvial Valley Bottomland Hardwoods
Stocking of Cerulean Warbler Study Sites in Mississippi Alluvial Valley

Quadratic Mean Diameter

Basal Area ft² per acre

Trees per acre

Stocking percent

20%
40%
60%
80%
100%
120%

16
14
13
12
10
8

81
121
161
201
241

CHK nests
DES Nests
MEE Nests

“B”-line

CHK
MEE
DES

 CHK
 MEE
 DES
 CHK nests
 DES Nests
 MEE Nests
Stocking of Cerulean Warbler Study Sites in Southern Indiana

Cerulean Warbler
- Present
- Random points
- Pairs

Trees per acre

Basal area per acre (sq. ft./acre)

Percent Stocking

Quadratic Mean Diameter

A-line

B-line

C-line

110%
100%
90%
80%
70%
60%
50%
40%
30%
20%
100%
Stocking of Cerulean Warbler Study Sites in Eastern Tennessee

Study Site
- Royal Blue WMA
- Sundquist WMA
Cerulean Warblers in Southern Ohio, 2004-2005

![Graph showing the relationship between Stocking Percent and Territories/25 acres. The x-axis represents Stocking Percent, ranging from 0 to 100, and the y-axis represents Territories/25 acres, ranging from 0 to 8. The graph includes a trend line and several data points.]