Population Distribution, Density and Habitat Preferences of the Cerulean Warbler, *Setophaga cerulea*, in the Delaware Water Gap National Recreation Area

Shannon Curley & Terry Master

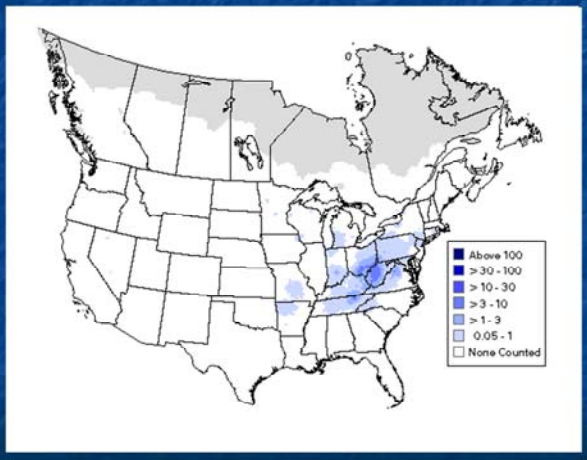
http://wordpress.com/2008/10/dendroica-cerulea-002.jpg

Goals of this Study

- Preliminary studies indicated relatively high densities in portions of the Delaware Water Gap National Recreation Area (DEWA) (T. Master unpublished data, 2006)
- Determine if there is a definite breeding Cerulean Warbler population within DEWA
- Investigate distributions & estimate population density to serve as a baseline for future projects
- Examine habitat preference within DEWA

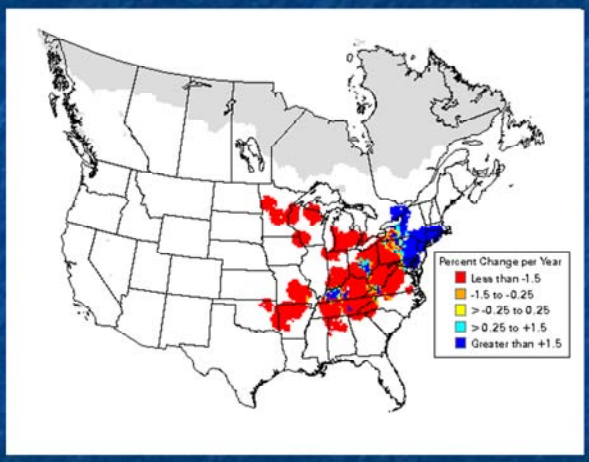
Photo credit Terry Master

BBS Summer Distribution Map 1994 - 2003



http://www.mbr-pwrc.usgs.gov/bbs/htm03/ra2003_blue/ra06580.htm

BBS Trend Map, 1966 - 2003



http://www.mbr-pwrc.usgs.gov/bbs/htm03/trn2003/tr06580.htm

METHODS

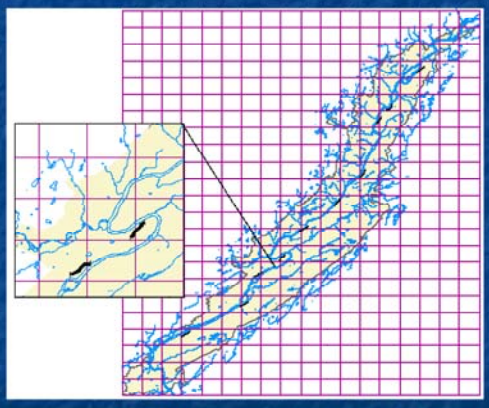
Study Site - DEWA

- Established 1965
- 68,714 acres
- Middle Delaware River
- Pennsylvania/ New Jersey border
- Protects 40 miles of the Delaware River
  - Nat' l. Wild & Scenic River
  - longest non-dammed major river in east
  - cleanest large river in the east

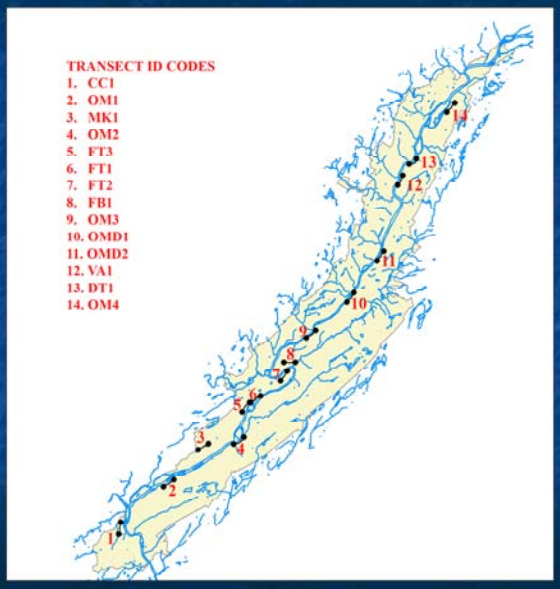
www.worldfromtheweb.com/Parks/Delaware/Delaware.html

METHODS
Transects

- GIS map of DEWA gridded into 2 km^2 blocks.
- Stratified random sample
  - riparian forest, blocks including river
  - low areas of disturbance
  - mature forests
- 10/14 blocks randomly chosen
  - 10 transects 2009
  - 14 transects 2010



Transect Locations within DEWA

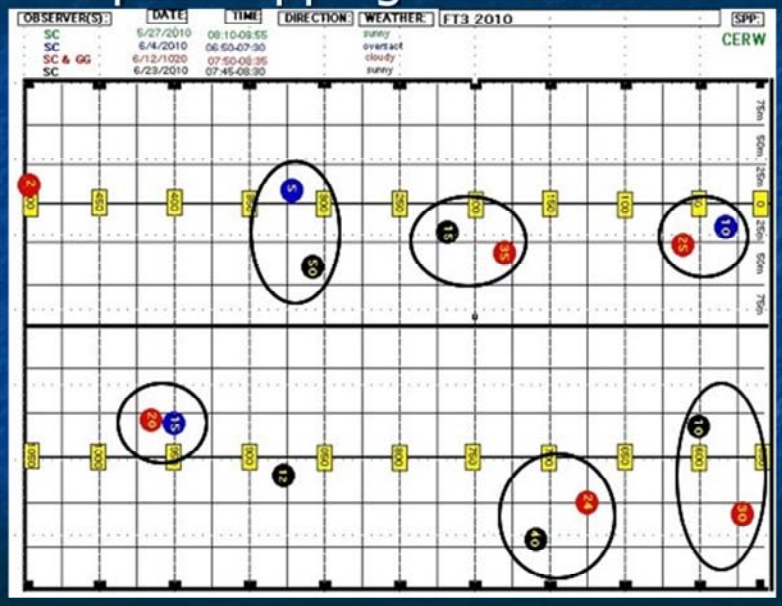


METHODS

Transects

- Surveys conducted from 05:30 – 08:00 am from late May – late June, 2009 - 2010
- Each transect was traversed 3 times in 2009 and 4 times in 2010
- During each survey, warblers seen or heard were recorded
- Time, directionality, distance from transect center line and cue type were recorded
- Territories were declared and GPS-marked when Cerulean Warblers were recorded in the same area on at least 2 separate days

Spot Mapping of Territories



METHODS

Ad hoc Roadside Surveys for Population Distrubution

- Roadside surveys were conducted to supplement transect distribution data from 15 May – 30 June, 2009 – 2010
- Hours variable
- Recorded and GPS-marked location when Cerulean Warblers were heard or seen
- Returned to these sites on separate days to confirm registrations
- Territories were confirmed when birds were recorded 3 or more times at the location on non-consecutive days

“Snag” in 2009 Research

Blakeslee man arrested, suspected in multiple car break-ins

Photo 1 of 1 | Zoom Photo +

Brian Scott Schutz, Jr., suspected of multiple car break-ins

Contributed

October 09, 2009

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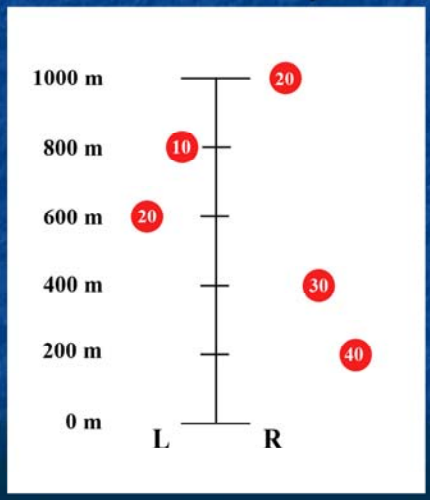
METHODS

Habitat Analysis

- Modified version of the Bbird vegetation analysis protocols using 11.3m radius plot
- Plot Selection
  - 5 “random” plots per transect
  - placed randomly within 200 m intervals along the transect
  - coin flip determined left or right side of transect line
  - random number table used to determine the distance of plot from transect center line (10, 20, 30 and 40 m)

METHODS

Habitat Analysis

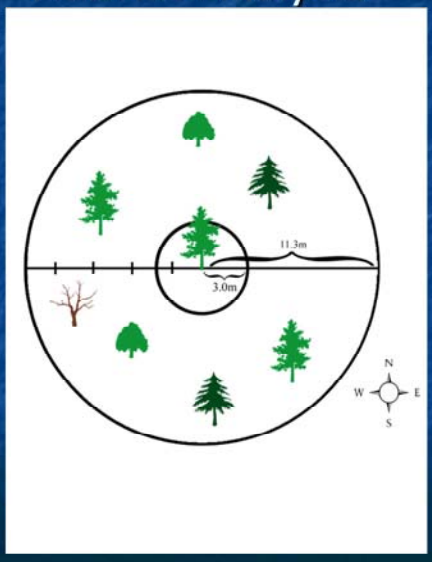


METHODS

Habitat Variables

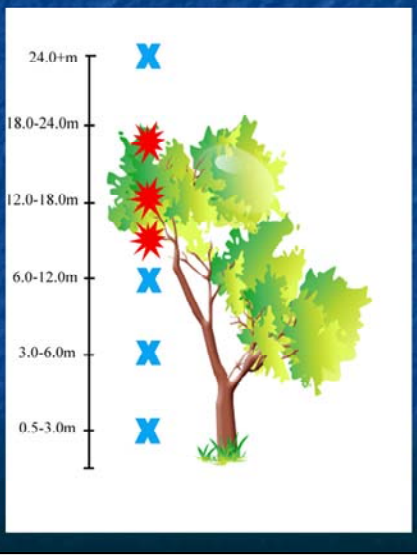
- Tree species within plots, frequency of these species & DBHs
- Ecological Importance values based on tree relative frequency, density and dominance values
- Canopy coverage
- Shrub % coverage

METHODS
Habitat Analysis

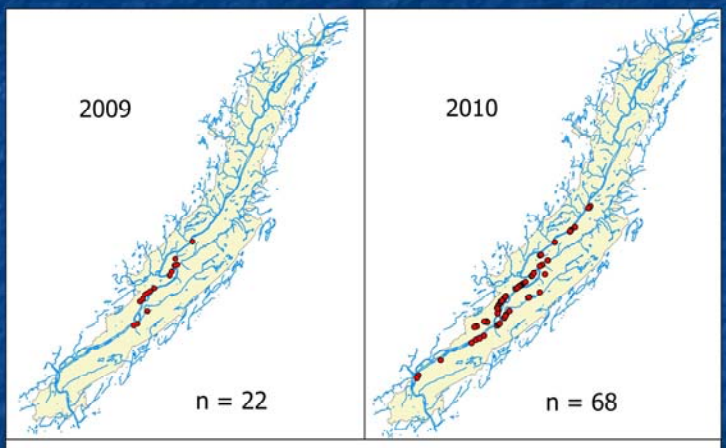


METHODS
Habitat Analysis

- Height intervals:
  - 24.0+ m
  - 18.0 - 24.0 m
  - 12.0 - 18.0 m
  - 6.0 - 12.0 m
  - 3.0 - 6.0 m
  - 0.5 - 3.0 m



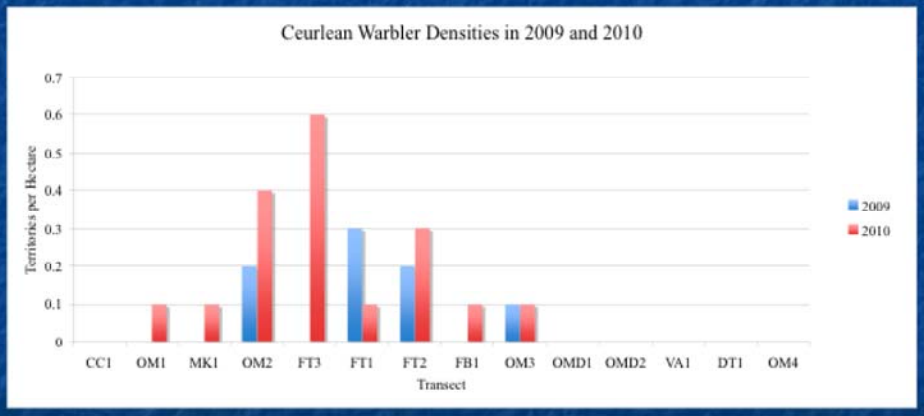
RESULTS
Distribution



Cerulean Warbler population distribution within DEWA in 2009 and 2010.

RESULTS

Individual Transect Density Estimates



RESULTS

Ecological Importance Values (IV)

- Calculated by adding relative density, dominance and frequency values
  - from DBHs and counts of all tree species from random and territory plots
- Was there a difference between tree species that occurred on random versus territory plots?
- Pearson's Chi-squared test:

  (X^2 = 187.2, df = 14, p = 0.004)

RESULTS

Tree Species Composition

- Which tree species contributed the most to these differences?
- Used a subdivided contingency table, removed trees that had the greatest % difference between random and territory plots until the original Chi-squared p-value was no longer significant

RESULTS
Tree Species Composition

- 5 tree species had the biggest influence on the initial Chi-squared test (occurred in higher than expected frequencies in territory plots)
  - Black Walnut
  - American Sycamore
  - Sugar Maple
  - Green Ash
  - Slippery Elm

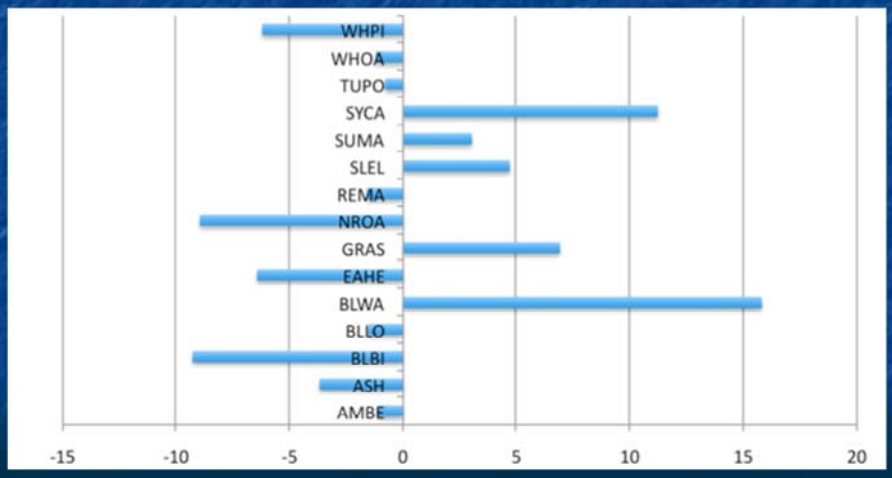
RESULTS

Preference and Avoidance Values

- Tree species composition differs in random vs. territory plots. Five trees had the highest influence over the p value, but varied in how strongly they were "preferred" or "avoided"
- Values calculated by subtracting random from territory IV values for each tree species

RESULTS

Preference and Avoidance Values

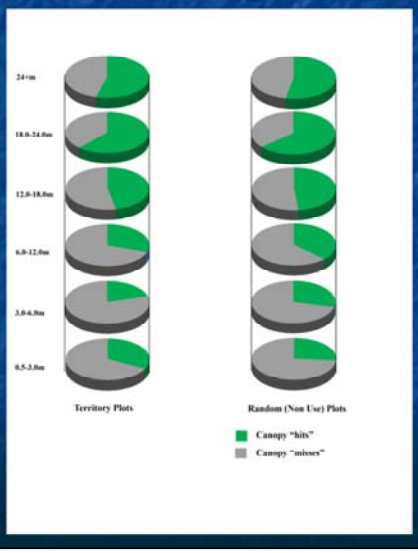


RESULTS

Foliage Height Diversity (Distribution)

- No significant difference in foliage distribution at any height interval between territory and random plots

  (p = 0.84)



RESULTS

Shrubs

- Mean shrub height in territory sites was 2.1 m versus 1.0 m in random plots
- Shrub height was significantly higher in territory plots ($p < 0.0001$)
- Estimated percent cover in random plots was 21.0% and 48.0% in territory plots

DISCUSSION

Distribution

- Confirmed a breeding population of Cerulean Warblers within DEWA
- Activity confined to the southern and especially central portions of DEWA
- Species noted for site fidelity
  - Colorado & Cuadros 2004, Jones et al. 2006, Moreno et al. 2006, Bakermans 2008
- Territories appeared to be concentrated

DISCUSSION

Density

- FT2, FT3, OM2 densities comparable to estimates from core breeding range and other areas (e.g., Ontario)
- Roadside surveys supplemented transects for distribution but could not be used in density estimates

DISCUSSION

Habitat Preference

- Most frequently occurring tree was black walnut
  - late leaf-out
  - Barg et al. (2006) – bitternut hickory preferred song post of Cerulean Warblers
    - less acoustic hindrance & increased vigilance over conspecifics
- New leaves more nutritious for Lepidopterans, may be selecting trees with greater food resources

DISCUSSION

Habitat Preference

- Avoidance of northern red oak also noted in West Virginia (George 2008)
- Explanation remains elusive
  - relatively high levels of tannins (Wood 2005)
    - may reduce biomass of Lepidopteran species
    - Tallamy (http://udel.edu/~dtallamy/host/) indicates high diversity of lepidopterans
  - leaves may provide difficult foraging substrate
    - other large-leaved tree species preferred however

DISCUSSION

Canopy Gaps

- Cerulean Warblers show a tolerance for internal canopy gaps (Weakland and Wood 2005)
  - Not indicated in DEWA foliage distribution survey, but other habitat features suggest the presence of gaps:
    - black walnut trees
    - gaps created by roads and Delaware River
    - Higher shrub layers in Cerulean Warbler habitat with greater coverage

Conservation Efforts & Future Research

- DEWA may be important as a northeastern breeding site and for examining a potentially expanding population
- Although population estimates as a whole remained low "hot-spots" within DEWA show relatively high densities
- Future studies – long-term distributional surveys/density estimates and measuring reproductive success in DEWA

Acknowledgements

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