

A habitat model predicting Cerulean Warbler (*Dendroica cerulea*) distribution in Central America during Spring migration



Tiffany Beachy  
FWF Seminar  
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A brief glimpse at Cerulean Warblers...



- Nearctic Neotropical migrants
- Breed in eastern North America
- Canopy nesters and foragers
- Appear to prefer structurally diverse canopy with interspersed light gaps

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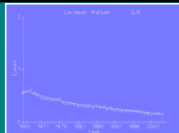
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Status



- The range-wide population of the Cerulean Warbler has been declining steadily for the last several decades
- Petitioned to be listed as a Threatened Species in 2001
- Declared 'not warranted' to be listed on 12/5/06

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### Conservation efforts

- Proposed factors contributing to decline on all parts of their range: *fragmentation and loss of habitat*
- Cerulean Warbler Technical Group formed in 2001
- El Grupo Cerúleo

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## Objective



– To predict suitable stop-over habitat for the Cerulean Warbler in Central America by developing a Mahalanobis distance ( $D^2$ ) habitat model for the region

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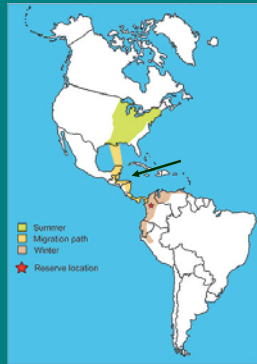
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## Study Area



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## Field Methods

- Surveys for Cerulean Warbler presence:
  - 2004 – Belize
  - 2005 – Guatemala and Honduras
  - 2006 – Guatemala and Honduras
- Validation of model:
  - April 2007 – Chiapas, Mexico, Guatemala, and Honduras

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## Methods: Acquire variables

1. Elevation (USGS – EROS)
2. Average solar exposure (Hermann 1996)
3. Mean temp. for April (Hijmans et al. 2005)
4. Mean precip. for April (Hijmans et al. 2005)
5. Precip. for the wettest quarter (Hijmans et al. 2005)
6. Temp. for the driest quarter (Hijmans et al. 2005)
7. Tree cover (Hansen et al. 2006)

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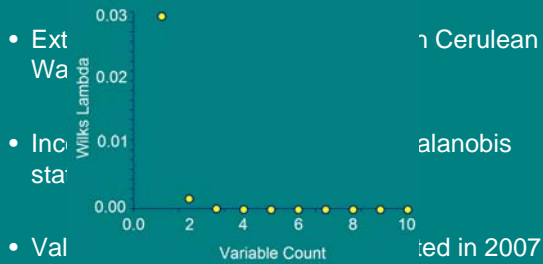
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## Model Development

- Conduct PCA with a PVA to determine the best 2 of 19 available bioclimatic variables




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## Results

**Table 1:** Summary statistics for explanatory variables used to model Cerulean Warbler habitat in Central America.

Variable	Cerulean Warbler locations			Study Area	
	Mean	SE	Range	Mean	Range
Average solar exposure (day/yr)	168.8	2.2	115 - 199	157.7	85 - 221
Elevation (m)	542.4	29	103 - 1169	1736	0 - 4189
Mean temperature for April (°C)	24.9	1.5	22.3 - 27.7	18.3	4.6 - 30.4
Mean precipitation for April (mm)	73.3	1.4	42 - 95	149	2 - 297
Precipitation for the wettest quarter (mm)	979.8	26	578 - 1473	1289	279 - 2453
Temperature for the driest quarter (°C)	23.6	2	19.4 - 26.7	16.6	3 - 28.7
Tree canopy cover (%)	69.9	8.2	34 - 76	37.7	0 - 76

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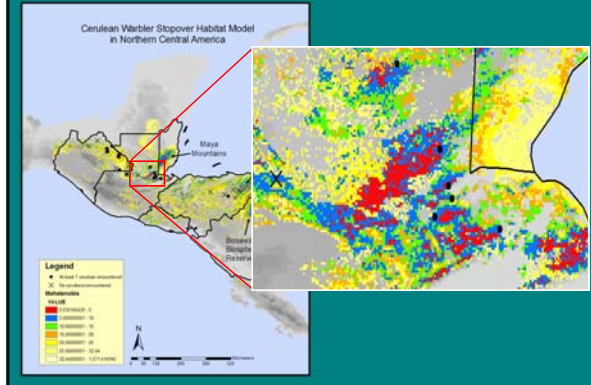
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## Results




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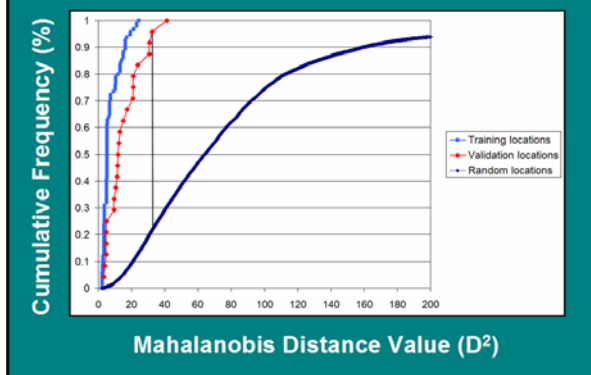
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## Model Validation




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## Model Validation

Table 2: Results from logistic regression analysis

# present	# absent	Coefficient	P	Rescaled R <sup>2</sup>
24	60	-0.0415	0.093	0.0697

Sensitivity: 95.8%  
(proportion of correctly predicted presences)

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## Discussion

- Model adequately predicts Cerulean Warbler presence in Central America during spring migration
- Continued monitoring needed to further validate the model
- Future directions:
  - Collect absence dataset to assess specificity
  - Compare D<sup>2</sup> model with other algorithms

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## Discussion

- Support current conservation efforts and enable long-term independent monitoring



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## Management Implications

- Use model to locate priority areas for conservation action



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## Management Implications

- Know what management recommendations to suggest to landowners



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## Acknowledgements

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  - C. Thatcher, L. Bulluck, J. Giocomo, W. Seaver, F. van Manen, J. Murrow, D. Varble, and P. Hamel for their assistance during the development of this project
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Muchas gracias!  
¿Preguntas?



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