What is the relative importance of biotic vs. abiotic determinants of temporal occupancy for avian species in North America?
Sara Snell and Allen Hurlbert

Introduction

- Do biotic or abiotic variables explain more variation in the distribution and abundance of species within their range?
- Does temporal occupancy provide greater insight than abundance for analysis of species distributions?
- Hypotheses: Focal species occurrence will decrease as competitor abundance increases
- Species occupancy will decrease further from their optimal environmental conditions

Temporal occupancy (how often a species occupies a given site over time) is related to, but different from abundance

Methods

- We examined 63 focal species using Breeding Bird Survey (BBS) data for North America
- Criteria for focal species selection:
  - Occupied 30-70% of the sites within their range over 10 year period
  - Present at > 20 routes
- Competitor species selected by similarity in geographic range, body size, and habitat preference
- Scaled competitor abundance and environmental optimum compared to focal species temporal occupancy using generalized linear models and variance partitioning

Example Focal Species: Red-breasted Nuthatch

Results

- As competitor abundance increases, focal species occupancy decreases
- Focal occupancy peaks at threshold
- Focal occupancy peaks at optimum (centroid)

Amount of variance explained for each species sorted from greatest to least effect of the environment.

Family migration class, and diet guild included below color-coded by category.

Conclusions

- Occupancy decreased as competitor abundance increased and as vegetation and elevation deviated from species range optimum. However, no single variable (abiotic or biotic) predicted occupancy for focal species most successfully overall.
- Unexplained variance could be a result of biotic interactions that were not considered in analysis.
- Future directions: identify additional biotic interactions that may determine occupancy such as facilitation, predation, and parasitism
- Acquire more detailed data on species breeding habitat for analysis using previous studies.
- Incorporate forest structure in analysis of environment.

Acknowledgements and Sources


Image citations: cristinasbirdsomeblog.blogspot.com, www.pinterest.com, maineboats.com, c: ||| 1:1 line for occupancy vs. abundance GLM

Family
A: Aegithalidae
B: Buntingidae
C: Certhiidae
D: Certhiiformes
E: Emberizidae
F: Fringillidae
G: Grallinidae
H: Hirundinidae
I: Icteridae
J: Jynx
K: Kestridae
L: Laniidae
M: Mimidae
N: Nuthatchidae
O: Ochthocephalidae
P: Parulidae
Q: Quiscalidae
R: Regulidae
S: Saccornithidae
T: Trogleridae
U: Turdidae
V: Vireonidae

Migratory Class
A: Arctic breeder
B: Breeder
C: Breeder
D: Non-breeder
E: Migrant
F: Resident
G: Short distance migrant
H: Short distance breeder
I: Short distance non-breeder
J: Short distance non-breeder
K: Short distance non-breeder
L: Short distance non-breeder
M: Short distance non-breeder
N: Short distance non-breeder
O: Short distance non-breeder
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W: Short distance non-breeder
X: Short distance non-breeder
Y: Short distance non-breeder
Z: Short distance non-breeder

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Diet
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