Inventory and Monitoring Program
Northeast Temperate Network

National Park Service
U.S. Department of the Interior

Forest Breeding Bird Monitoring in Northeastern National Parks

Brian R. Mitchell[1], Steve D. Faccio[2], and Adam J. Kozlowski[1]

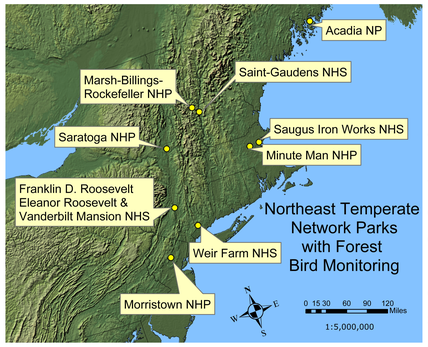
[1] National Park Service, Northeast Temperate Network, 54 Elm Street, Woodstock, VT 05091

[2] Vermont Center for Ecostudies, 20 Palmer Court, White River Junction, VT 05055

Introduction

The Northeast Temperate Network (NETN) of the National Park Service is tasked with monitoring a suite of representative indicators ("Vital Signs") of natural resource condition for a group of 13 parks.

Birds were chosen as one of the NETN Vital Signs because they are a reliable indicator of ecosystem integrity and they are a high profile taxonomic group. They are also easily detected and identified, and well-established survey methods are available.



NETN and the Vermont Center for Ecostudies (VCE) began monitoring forest birds in 11 of these parks in 2006, and we are pursuing multiple approaches to summarizing and analyzing our data. We are producing a guild-based Biological Integrity Scorecard, based on Croonquist and Brooks (1991) and O'Connell et al. (2000). In addition, we are analyzing our data using occupancy, distance, and removal models, in order to adjust for variability in the probability of detecting individuals and species. Ideally, abundance estimates generated using distance and removal models will strongly overlap. In this poster we present our Biological Integrity Scorecard as well as a comparison of removal and distance model results.

Blackburnian Warbler, photo by C. Eiseman

Field Methods

Each park contains one or more sites based on geography and habitat. Each site has 3 to 12 point count locations, separated by 250 meters. There will be 275 point count locations, ranging from 3 at Saugus Iron Works to 120 at Acadia. Each count location is visited by a volunteer birder at least once per year between late May and June; parks with fewer than 10 point count locations are visited multiple times. Volunteers record the species of each individual they detect, the time during the count when each individual is first detected, and the estimated distance to the individual (within 10 meters, 10 to 25 meters, 25 to 50 meters, and beyond 50 meters). The data is recorded on field cards and input into the USGS Point Count Database.

Cedar Waxwing, photo by C. Eiseman

Biological Integrity Scorecard

Our draft protocol (Faccio and Mitchell 2008) identifies 13 guilds of bird species that represent functional, compositional, and structural elements of forest ecological integrity. For each guild, we calculate the proportional species richness (number of guild members compared to the total species richness at a park). We then compare these richness values to ranges established by O'Connell et al. (2000) and Glennon and Porter (2005). In the table below, guild richness values based on data collected in 2007 for three parks are color-coded based on a comparison to the expected range for a forest with high biological integrity. **GREEN** text indicates a value within the expected range, **YELLOW** text indicates a value near the boundary, and **RED** text indicates a value outside of the expected range.

Integrity Element	Guild	ACAD	MABI	MIMA
Functional	Omnivore	0.29	0.30	0.44
	Bark Prober	0.12	0.16	0.13
	Ground Gleaner	0.07	0.08	0.05
	High Canopy Forager	0.07	0.08	0.05
	Low Canopy Forager	0.22	0.16	0.15
Compositional	Exotic Species	0.00	0.00	0.05
	Residents	0.32	0.28	0.41
	Single Brooded	0.54	0.54	0.41
	Nest Predators / Brood Parasite	0.07	0.06	0.08
Structural	Canopy Nester	0.34	0.34	0.26
	Shrub Nester	0.22	0.18	0.28
	Forest-ground Nester	0.12	0.12	0.05
	Interior Forest Obligate	0.41	0.38	0.18

ACAD = Acadia, MABI = Marsh-Billings-Rockefeller, MIMA = Minute Man

The scorecard for these parks supports our a priori expectations. Minute Man, a small park in fragmented and early succession habitat near Boston, has several red scores. The park has few forest obligate species, a high proportion of residents (few migrants), and many species that nest in shrub habitat. The other parks have less fragmentation, more late succession forest, and are farther from major population centers; their scores are all green or yellow.

Removal and Distance

Ovenbird, photo by C. Eiseman

Removal models (Farnsworth et al. 2002) estimate abundance based on the time individuals are first detected during a survey, while distance sampling (Buckland et al. 2001) estimates abundance based on the distance at which individuals are first detected. Although both methods depend on detection of the same individuals, the approaches are otherwise independent.

We explored the effect of two covariates - Bird Conservation Region (BCR) and whether counts occurred before or after June 15 (Date) - and used model selection (Burnham and Anderson 2002) to pick the best model of the four possible models. Distance models also tested among 5 different key functions and several expansions for the detection curve.

Species	Removal Model	Removal Weight	Distance Model	Distance Weight
BTNW	None	0.74	None, HRP	0.82
EAWP	None	0.73	BCR+Date, HNC	0.53
OVEN	BCR + Date	0.70	None, HNH	0.37
REVI	BCR	0.52	Date, HNC	0.48
WOTH	None	0.57	Date, HNC	0.60

BTNW = Black-throated Green Warbler, EAWP = Eastern Wood-Peewee, OVEN = Ovenbird, REVI = Red-eyed Vireo, WOTH = Wood Thrush
HNC = Half-Normal key function and Cosine expansion, HNH = Half-Normal and Hermite expansion, HRP = Hazard-rate and Polynomial expansion

We then compared the abundance estimates and 95% confidence intervals produced by the best models.

Species	Removal Model		Distance Model	
	Estimate	95% CI	Estimate	95% CI
BTNW	76	71 - 94	65	56 - 76
EAWP	76	59 - 138	76	47 - 121
OVEN	188	166 - 326	181	148 - 222
REVI	123	109 - 197	186	153 - 226
WOTH	94	87 - 113	100	78 - 129

The 95% confidence intervals strongly overlap in most cases, improving our confidence that we have accurately estimated the number of individuals in the vicinity of our point count locations.

Summary

The NETN bird monitoring program relies on volunteers (Citizen Scientists) to collect annual data on the presence and abundance of forest breeding birds at 11 national park units.

Data is summarized into a guild-based Biological Integrity Scorecard that successfully distinguishes between intact and impacted habitat, and that provides information that can be used for generating recommendations to park managers.

We investigated whether removal and distance models provided complementary abundance estimates, and we were pleased to see strong overlap in several of the 95% confidence intervals. Both modeling approaches will be used to adjust data for detection probability prior to testing for temporal trends in species abundance.

We will also explore occupancy models based on spatial replication within sites, and our trend analyses will incorporate explanatory variables from nearby long-term forest monitoring sites.

Gray Catbird, photo by C. Eiseman

References

Buckland, S. T., D. R. Anderson, K. P. Burnham, J. L. Laake, D. L. Borchers, and L. Thomas. 2001. Introduction to Distance Sampling: Estimating Abundance of Biological Populations. Oxford University Press, New York, New York.

Burnham, K. P., and D. R. Anderson. 2002. Model Selection and Multimodel Inference. 2nd edition. Springer, New York, New York.

Faccio, S. and B. R. Mitchell. 2008. Draft Northeast Temperate Network Landbird Monitoring Protocol. http://science.nature.nps.gov/im/units/NETN/monitor/monitor.cfm

Farnsworth, G. L., K. H. Pollock, J. D. Nichols, T. R. Simons, J. E. Hines, and J. R. Sauer. 2002. A removal model for estimating detection probabilities from point-count surveys. Auk 119:414-425.

Glennon, M. J. and W. F. Porter. 2005. Effects of land use management on biotic integrity: An investigation of bird communities. Biological Conservation 126: 499-511.

Red-eyed Vireo, photo by C. Eiseman

Croonquist, M. J., and R. P. Brooks. 1991. Use of avian and mammalian guilds as indicators of cumulative impacts in riparian-wetland areas. Environmental Management 15: 701-714.

O'Connell, T. J., L. E. Jackson and R. P. Brooks. 2000. Bird guilds as indicators of ecological condition in the central Appalachians. Ecological Application 10:1706-1721.