Community trends in forest bird abundance within northeastern National Parks

National Park Service
Inventory and Monitoring Program
Northeast Temperate Network

Northeast Temperate I&M Network

National Park Service
U.S. Department of the Interior

- Coordinate annual monitoring of natural resources in 13 parks
- Data used for evaluating status and trends in key attributes of natural resources
  - Forest Health
  - Breeding landbirds
  - Water quality and quantity, etc
- For advising park management decisions
- Data and products publicly available on our website

http://go.nps.gov/netn

Park forest condition and threats

Park forests are unique across the northeast region:

- Highest level of protection
- More complex older-forest structure than surrounding matrix forests (Miller et al. 2016)
- Greater tree diversity than surrounding matrix forests (Miller et al. 2018)

Key forest health issues

- Invasive plants and pests
- Deer overabundance
- Lacking and/or suboptimal regeneration

Landbird monitoring program

- Background of bird monitoring program
- Review results from recent trend analysis

Faccio et al. 2015

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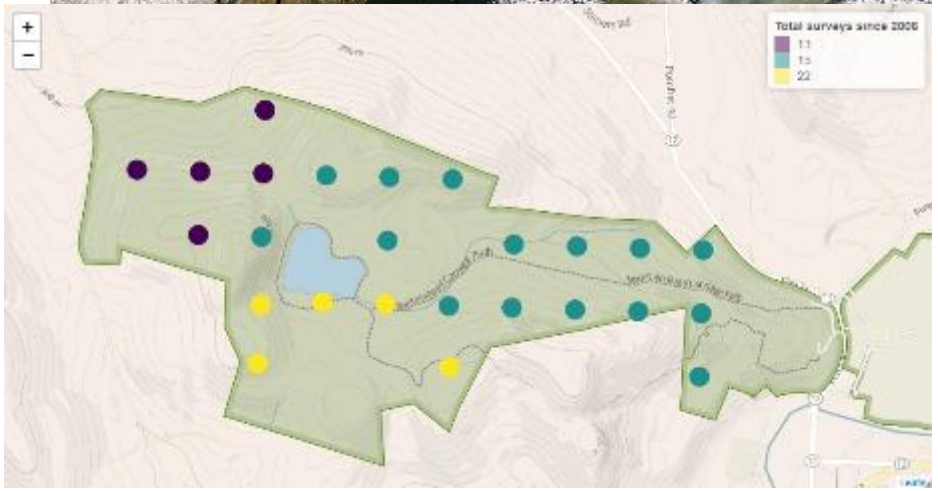
Landbird monitoring program

Objectives:

- Estimate trends in abundance of species breeding in park forests and grasslands

Sampling Design for forest birds:

- Annual point count monitoring since 2006
- ~240 permanent point count sites ME - NJ
- Number of sites per park is proportional to forest area with sites separated by 250m
- Each site co-located with forest monitoring plot
- Volunteer-based data collection



Sampling design in Woodstock, VT showing visits per site since 2006

Landbird monitoring volunteers

Steve Faccio

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Tom Sharp
Cailin O'Connor Fitzpatrick

THANK YOU!

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James Restivo
Scott Stoner
Jude Griffin
Brian Olsen
Christine Guarino

Community trends in forest bird abundance

Questions we addressed:

What are the trends in forest bird richness and abundance at the site, park, and network-scale?

What are the effects of local forest structure on bird abundance at the park and network scale?

In collaboration with:

MICHIGAN STATE UNIVERSITY

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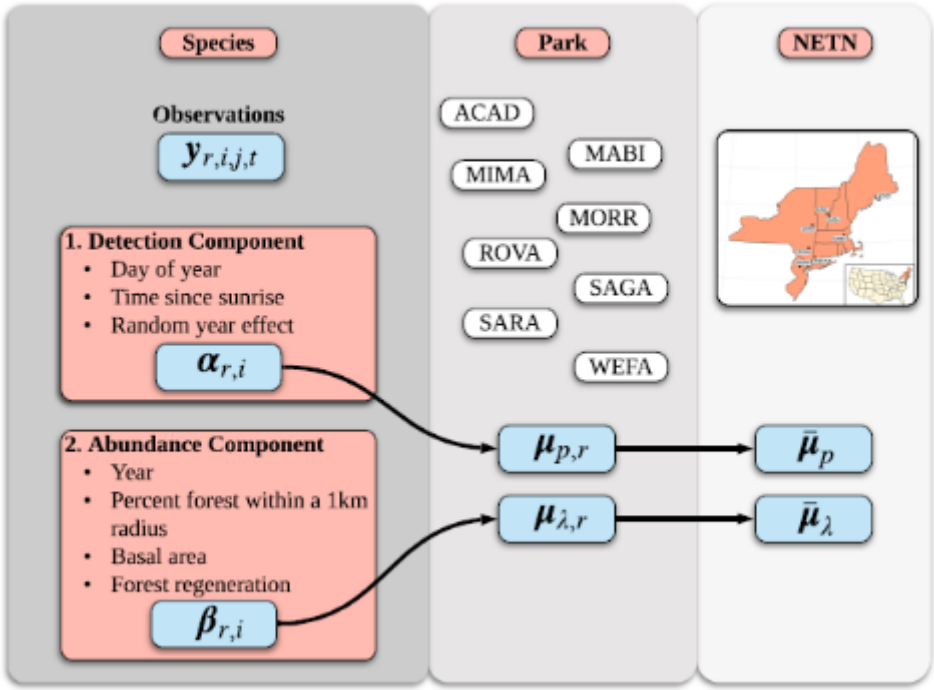
Community trends in forest bird abundance

Modeling approach:

- Multi-species, multi-regional removal model to estimate annual abundance at each forested site in 8 parks

- Accounted for imperfect detection using time period of first observation to estimate the product of availability and detectability
  - Covariates: time since sunset and day of year

- Evaluated effects of local forest structure on abundance:
  - % forest cover within 1km radius of site
  - Regeneration density from co-located forest plot
  - Basal area from co-located forest plot



Park Name	Code	Forested Area (Ha)	Years Sampled (Year Established)	Points/Year Mean (sd)
Acadia	ACAD	8178	13 (2007)	35.8 (9.6)
Saratoga	SARA	687	12 (2007)	13.3 (6.5)
Morristown	MORR	626	14 (2006)	20.6 (6.4)
Roosevelt-Vanderbilt	ROVA	338	14 (2007)	24.4 (6.1)
Minute Man	MIMA	234	14 (2006)	21.5 (3.0)
Marsh-Billings-Rockefeller	MABI	196	14 (2006)	23.6 (2.3)
Saint-Gaudens	SAGA	48	12 (2006)	7.9 (0.3)
Weir Farm	WEFA	18	11 (2006)	5 (0)

Summary

Park	Observed Species	Average Species Abundance (birds/point)	Species Abundance Range (birds/point)
ACAD	69	0.11	[0.0021, 1.43]
MABI	58	0.20	[0.0030, 2.95]
MIMA	60	0.22	[0.0033, 1.46]
MORR	57	0.22	[0.0035, 1.31]
ROVA	63	0.15	[0.0029, 0.83]
SAGA	49	0.21	[0.011, 1.79]
SARA	71	0.20	[0.0063, 1.44]
WEFA	45	0.18	[0.018, 1.16]
NETN	106	0.17	[0.0021, 2.95]

Observed species richness per site at Minute Man NHP Concord, MA since 2006

Image: COL

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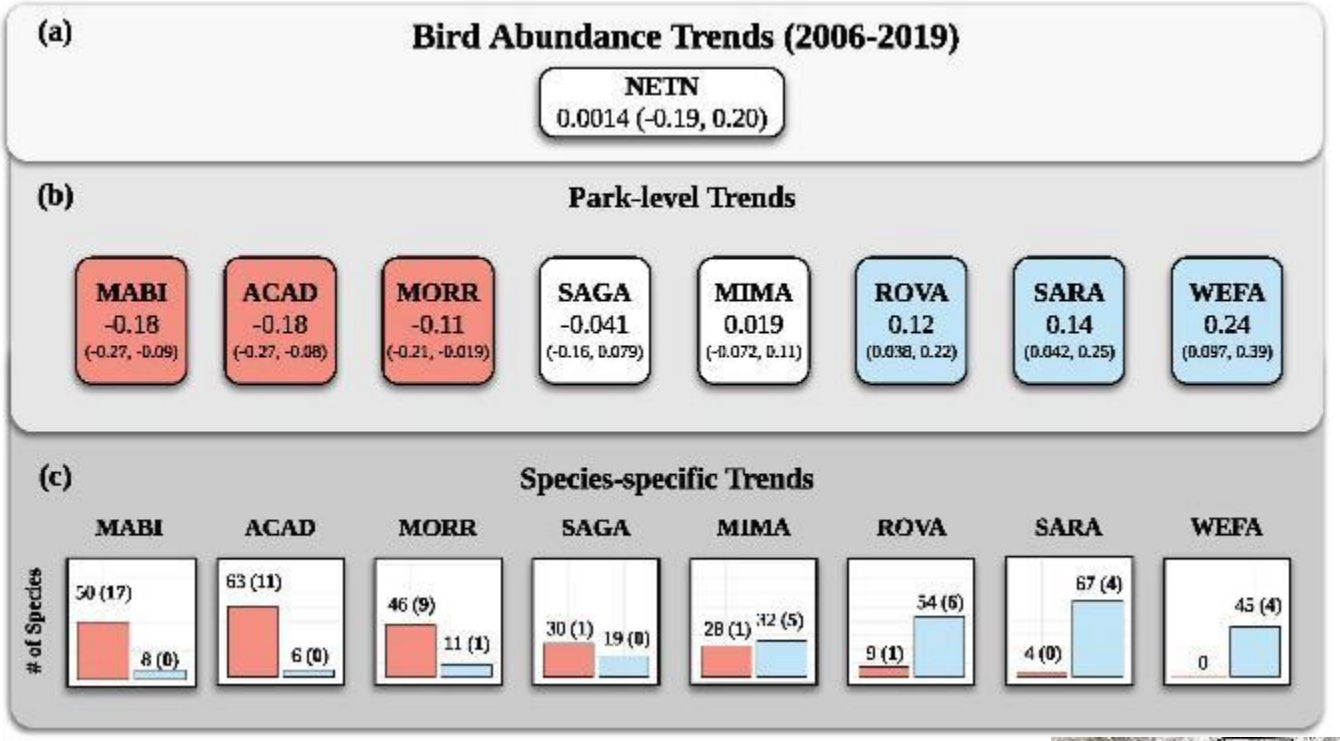
Community trends in forest bird abundance



- Network-scale abundance is stable, but geographical variation in trends is evident; no clear geographical pattern
- Significant declines and increases of forest birds in 3 parks; two parks with stable trends
- Trends in richness mirror abundance

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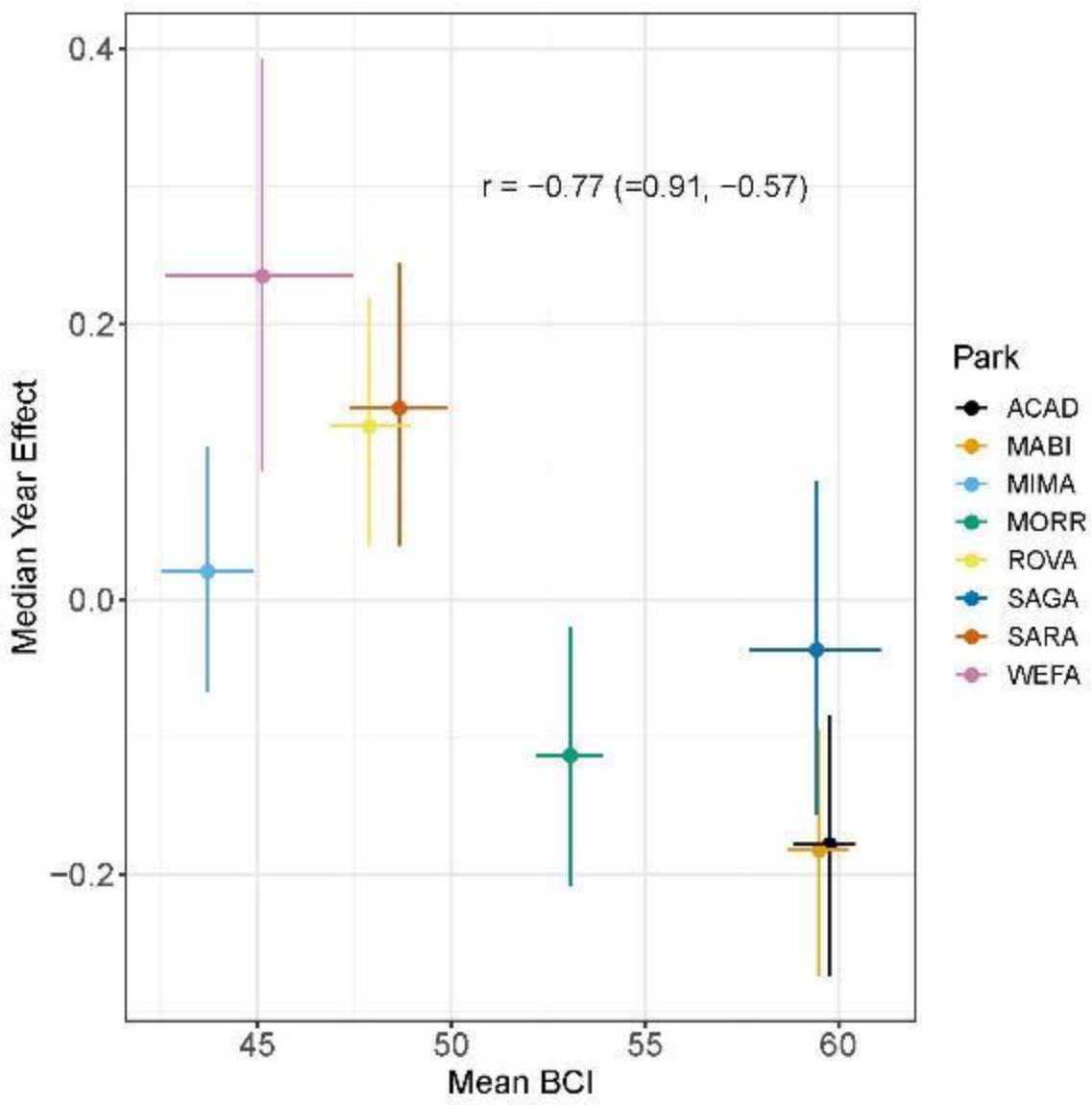
Community trends by guild



- Trends in guild-level abundance consistent within a park
- Park-scale trend in abundance inversely related to Bird Community index (BCI) (O'Connell et al. 2001)

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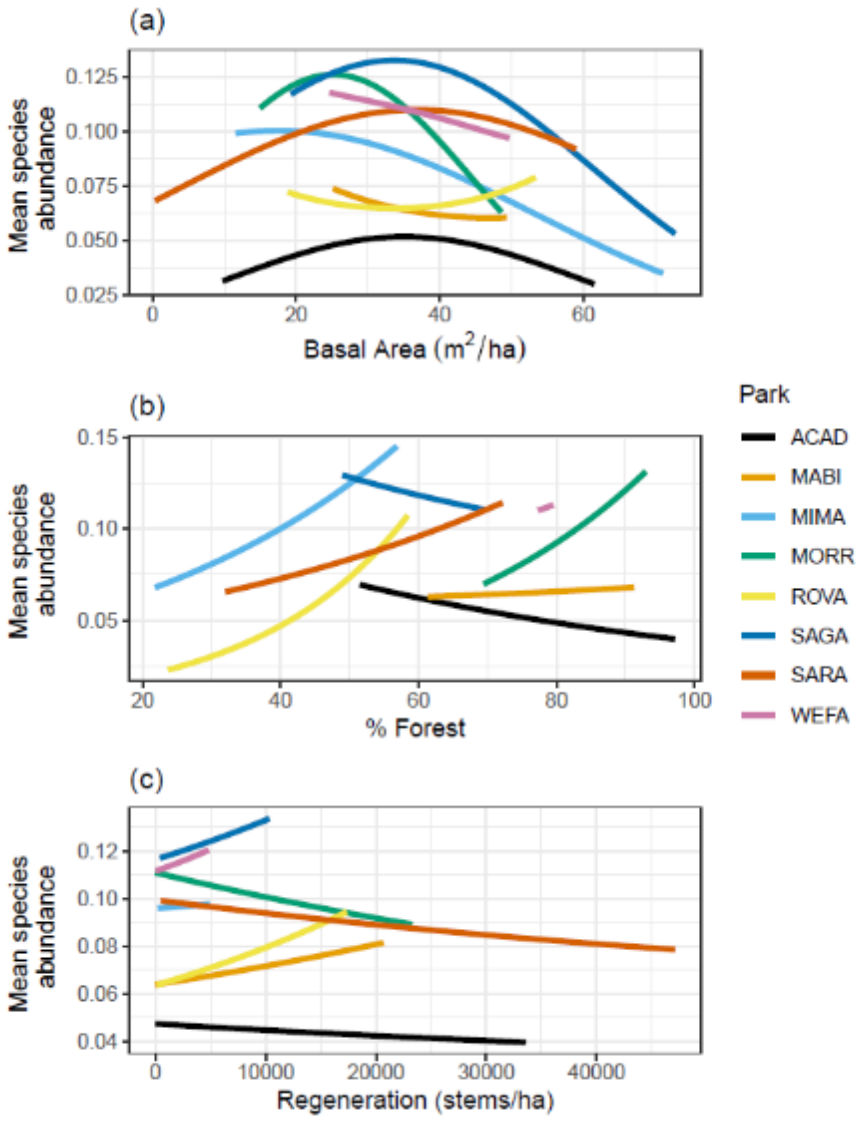
Effects of forest structure on abundance



Abundance generally:

- ↑ at mid-levels of basal area, ↑ with local forest cover, ↑ with regeneration
- local forest cover more prominent effect compared to other variables considered
- little variability in the effects of the covariates across guilds

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Trend comparisons in VT – By Guild

Category	Guild Name	Trend direction (no. species) VT FBMP 1989 - 2013	NETN MABI 2006 - 2019
Breeding	Single-brooded	**Decline (58)**	**Decline (44)**
Insectivore Foraging	Aerial Insectivores	**Decline (11)**	**Decline (4)**
	Bark-probers	Decline (11)	**Decline (9)**
	Ground Gleaners	**Increase (5)**	Decline (5)
	High Canopy	**Increase (14)**	**Decline (5)**
	Low Canopy	**Decline (20)**	**Decline (10**
Migratory Strategy	Neotropical	**Decline (33)**	Decline (22)
	Residents	Decline (10)	**Decline (20)**
	Short-distance	**Decline (17)**	**Decline (15)**
Nest Location	Canopy Nesters	**Decline (28)**	**Decline (24)**
	Ground Nesters	**Decline (14)**	**Decline (13)**
	Shrub Nesters	Decline (19)	**Decline (8)**

- Guild designations from O'Connell et al. (1998, 2001)
- VT FBMP trends from Faccio et al. 2017. Status of VT Forest Birds
- **Boldface** and highlighted cells indicate trend is statistically significant from 0 ($\alpha < 0.05$).

Trend comparisons in VT – By Species

Direction of trend by percentage of species evaluated (no. species)

Program	Increase	Decline
VT BBS (1989 -2013)	65% (22)	35% (12)
VT FBMP (1989 - 2013)	35% (12)	65% (22)
NETN - MABI (2006 - 2019)	13% (4)	91% (29)

VT FBMP

- 7 of 12 species stat. significant ↑
- 11 of 22 species stat. significant ↓

NETN – MABI

- 0 of 4 species stat. significant ↑
- 14 of 29 species stat. significant ↓

Similar stat. significant trends between VT FBMP and NETN MABI:

- **Decline:**
  - Blackburnian warbler, Common Yellowthroat, Eastern Wood-Pewee, Rose-breasted Grosbeak
- **Increase:**
  - Pileated woodpecker

Many species stable or ↑ across VT FBMP are declining at MABI:
- AMRO, BRCR, BTNW, HAWO, HETH, MODO, OVEN, REVI, WOTH, YBSA

VT FBMP and VT BBS trends from Faccio et al. 2017. Status of VT Forest Birds

Conclusions

- Long term commitment of partners and volunteer support has made this work possible

- While network-level trends are stable, parks supporting a greater number of forest specialist species are declining faster in abundance (ACAD, MABI, MORR) than parks harboring more generalist species.

  WHY?

- Further work is planned to evaluate the underlying mechanisms driving these patterns and compare with other programs.

- Integrating acoustic monitoring into the program to enhance data quality and better estimate rare or difficult to detect species

THANKS!

Questions or data requests?

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www.nps.gov/im/netn/breeding-landbirds.htm

Integrating acoustic recording with point count monitoring

Can we use acoustic recorders:

- to improve occupancy and abundance estimates? How so?
- to improve data quality (QC of volunteer birders)?

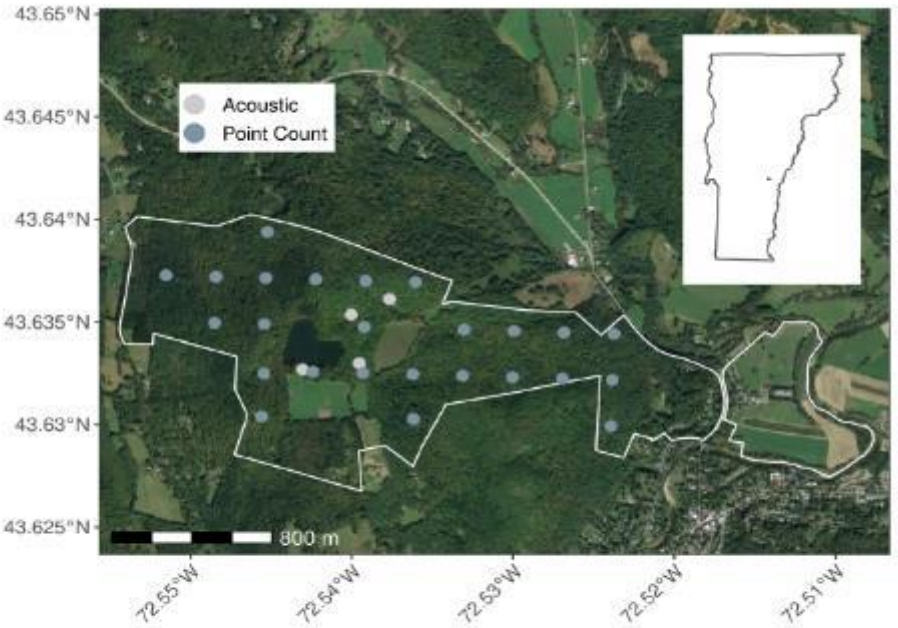
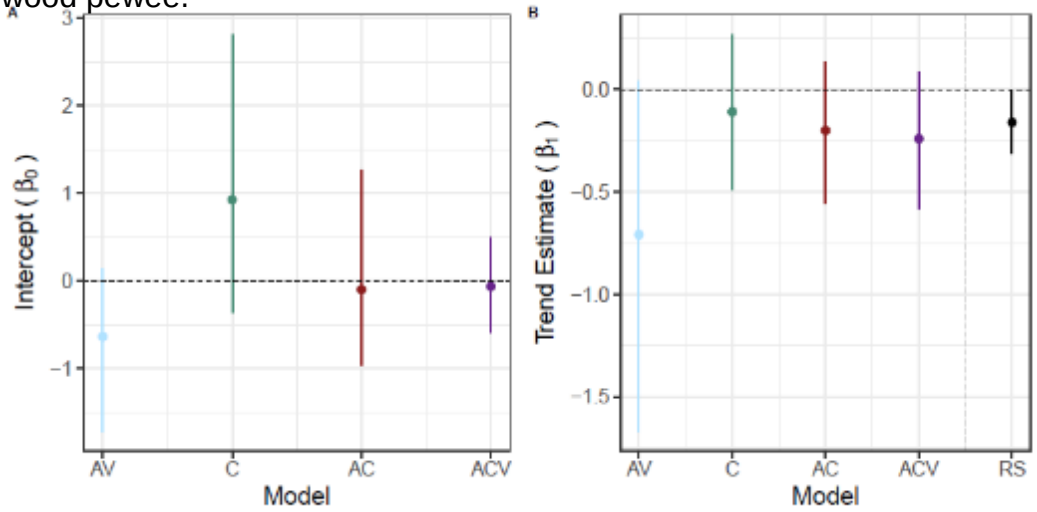


Figure 2: Locations of acoustic recorders and point counts in Marsh Billings Rockefeller (MABI) National Historic Park (bounded region) in Vermont, U.S.A. Inset map shows the location of MABI (black point) in Vermont.

Comparison of model performance for estimating abundance trends of eastern wood pewee.



- Model AV: uses acoustic (A) occupancy data from a clustering algorithm and a subset of manually validated (V) vocalizations.
- Model C: uses point count (C) data.
- Model AC: uses acoustic occupancy data from a clustering algorithm and point count data.
- Model AVC: uses acoustic occupancy data from a clustering algorithm, a subset of manually validated vocalizations, and point count data.

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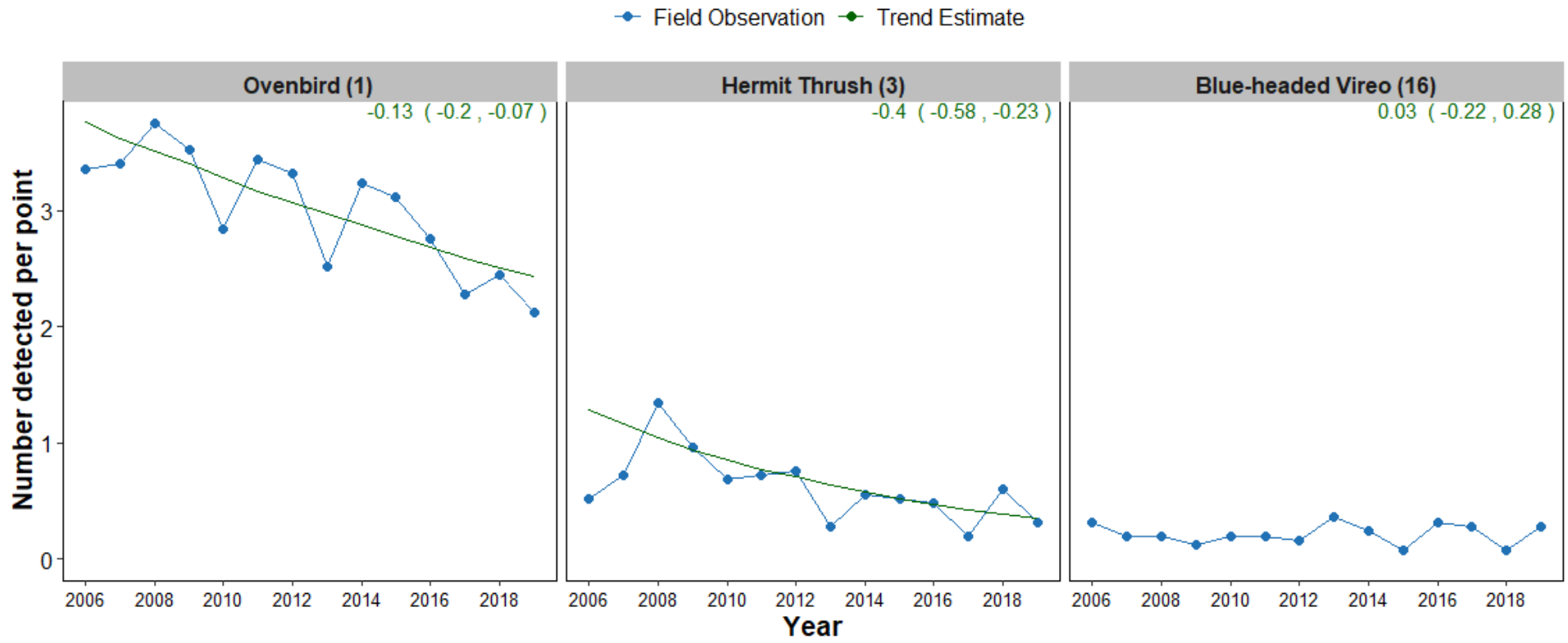
Guild

Biotic Integrity Element	Response Guild	Type	Number of Species
Functional	Omnivore	Generalist	34
Functional	Bark prober	Specialist	10
Functional	Ground gleaner	Specialist	7
Functional	Upper canopy forager	Specialist	11
Functional	Lower canopy forager	Specialist	20
Compositional	Exotic	Generalist	4
Compositional	Resident	Generalist	29
Compositional	Single-brooded	Specialist	65
Compositional	Nest predator/brood parasite	Generalist	7
Compositional	Temperate migrant	Generalist	26
Structural	Canopy nester	Specialist	31
Structural	Shrub nester	Generalist	20
Structural	Forest-ground nester	Specialist	14
Structural	Interior forest obligate	Specialist	29
Structural	Forest generalist	Generalist	25
Structural	Open-ground nester	Specialist	9

How did the model do?

Park-scale abundance: Marsh-Billings-Rockefeller NHP, Woodstock, VT)



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