

ECOSYSTEM SERVICES PROVIDED BY CAVITY-NESTING BIRDS

KINLOCH FARM



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Collaboration between Virginia
Working Landscapes, the University
of Maryland Department of
Entomology, & the Smithsonian's
Center for Conservation Genomics

Project Background

Nest boxes can provide important habitat for cavity-nesting birds while also offering potential benefits to agricultural systems through the suppression of pest insects and rodents. Species such as Eastern Bluebirds, Tree Swallows, and Barn Owls readily use nest boxes in working landscapes. While nest boxes are widely used for bird conservation, their effectiveness in reducing pest populations remains uncertain. For my PhD dissertation research, I am investigating the interactions between cavity-nesting birds and insect and rodent pests. I plan to quantify the diversity of prey consumed by nest-box birds and determine how pest populations are affected by the presence of nest boxes.



Field Summary 2025

2025 was a successful field season! With the help of two great interns, Maya Roopnarine and Jay Campos, and VWL staff Nick Garnhart, we monitored 173 Bluebird nest boxes across 8 livestock and produce farms. 79% of nest boxes were occupied by breeding Eastern Bluebirds or Tree Swallows. I collected fecal samples to characterize the diets of these birds, as well as insect samples to compare their diets to the surrounding insect community. I also began deploying GPS tags on Eastern Bluebirds and Barn Owls as the next stage of my study to learn how habitat use relates to diet. See summary below of samples collected this year:

Number of boxes with fecal samples per species:

- Eastern Bluebird: 82
- Tree Swallow: 34

Number of individuals sampled per species:

- Eastern Bluebird: 404
- Tree Swallow: 183

Number of Insect Samples:

- Malaise traps: 40
- Sweep net: 50



Preliminary Lab Results

I am currently analyzing fecal and insect samples at the Center for Conservation Genomics at the National Zoo to characterize what the Bluebirds and Tree Swallows on your farms are eating in comparison to the surrounding insect community. So far, the results show that Bluebirds are eating a diverse array of arthropods including beetles, ants, and moths, while Tree Swallows are specializing on flies. The arthropods collected from sweep net samples (collected directly from vegetation) are mostly spiders, true bugs, grasshoppers, bees, and wasps. The insects collected via Malaise traps (to passively collect flying insects) are characterized primarily by flies, moths, and beetles. I hope to have more samples sequenced before the start of the next field season.

Tree Swallow Diets

13 ASVs were assigned to an arthropod order. Of those, 100% were classified as **Diptera**.



Diptera
(Flies)

100%

Eastern Bluebird Diets

76 ASVs were assigned to an arthropod order. Of those, **Lepidoptera**, **Hymenoptera**, and **Coleoptera** were the most common.



Lepidoptera
(Moths and Butterflies)

27%



Hymenoptera
(Ants, Bees, and Wasps)

27%



Coleoptera
(Beetles)

24%



Diptera
(Flies)

9%



Miscellaneous Arthropods
(Worms, Crickets, Isopods, etc)

<5% each

Preliminary Tracking Results

This summer, we successfully deployed GPS tags on Eastern Bluebirds and Barn Owls. The resulting data have provided valuable insights into their movement patterns while nesting on your farms. These tags are attached temporarily, and once the battery has expired, I recapture the bird to remove the tag and retrieve the data. I collected GPS data from 17 Bluebirds this year and learned that these individuals typically stay within 75 m (246 ft) of the nest box. The average farthest distance observed from the nest box was 331 m (1,085 ft or 0.2 miles). We also collected over 10,000 locations from Barn Owls but tagged too few individuals to calculate summary statistics on average area used. I have also collected diet samples from tagged individuals (fecal samples from Bluebirds and pellets from Owls) to determine how the birds' diets vary with their habitat use.

Additionally, as a collaboration with the Smithsonian Migratory Bird Center, I deployed two types of tags on Bluebirds at the end of the breeding season, which the birds will carry through the winter to track their nonbreeding movements. Although Bluebirds are present in Virginia during the winter, it's unclear whether these are the same birds that bred here. I plan to recapture the tagged birds when the birds return to breed in the spring, which will help us learn where our birds spent the winter.



RESULTS FROM YOUR PROPERTY

Kinloch by the Numbers:

- Percent of nest boxes occupied: 79%
- Number of fecal samples from Bluebirds: 75
- Number of Bluebirds tracked: 3
- Number of fecal samples from Tree Swallows: 41
- Number of insect community samples: 9
- Number of bird species detected: 40



The map above shows a male bluebird tracked by a GPS tag every 10 minutes during the day and every 6 hours at night. The white dot is the location of the nest box, the yellow dots are locations collected during the day, and the blue dots are locations collected at night. The yellow lines connect subsequent locations but are not necessarily movement paths that the bird used.



Common Yellowthroat

BIRD LIST

American Crow	Gray Catbird
American Goldfinch	Great Blue Heron
American Kestrel	Great Crested Flycatcher
American Robin	Indigo Bunting
Baltimore Oriole	Mourning Dove
Barn Swallow	Northern Cardinal
Blue Grosbeak	Northern Mockingbird
Blue Jay	Northern Rough-winged Swallow
Carolina Wren	Orchard Oriole
Common Yellowthroat	Red-bellied Woodpecker
Downy Woodpecker	Red-headed Woodpecker
Eastern Bluebird	Red-tailed Hawk
Eastern Kingbird	Red-winged Blackbird
Eastern Meadowlark	Ruby-throated Hummingbird
Eastern Phoebe	Song Sparrow
Eastern Towhee	Tree Swallow
Eastern Wood-Pewee	Tufted Titmouse
European Starling	Turkey Vulture
Field Sparrow	Yellow-billed Cuckoo
Grasshopper Sparrow	Yellow-breasted Chat



Song Sparrow

Plans for 2026

- Attach more GPS tags to Eastern Bluebirds, Tree Swallows, and Barn Owls
- Recover migration tags from Eastern Bluebirds when birds return to breed
- Continue fecal sampling and insect collections
- Analyze fecal and insect samples using DNA metabarcoding at the Smithsonian's Center for Conservation Genomics
- Add nest boxes to one produce farm and collect fecal and insect samples
- Onboard and train two new interns with the help of VWL staff Nick Garnhart to make this all possible!