

# COA Mini Grant Application Form

**Applicant Name:** Robert Clark

**Address (City, State, Zip Code):**

Great Hollow Nature Preserve & Ecological Research Center

225 State Route 37

New Fairfield CT 06812

**Amount of Funding Requested:**

\$1000.00

**Project Title:**

How does food quality for insectivorous songbirds vary among native and non-native plants in Connecticut forests?

**Brief Description of Project:** Many species of Connecticut birds rely heavily on arthropods as food for both themselves and their offspring, which in turn means that they can be impacted by how the local plant community shapes arthropod numbers and quality. However, invasive shrubs have become abundant in the U.S.'s forested landscapes, reshaping plant communities and potentially altering the resources available to birds along the way. However, despite the potential impact of invasive shrubs on songbirds, there is relatively little data comparing the indirect food quality of multiple native and non-native plants for birds in Connecticut forests. In this project we are quantifying the abundance of arthropod prey available to birds and attempting to assess the difference in nutritional quality (protein content) between native and non-native understory wood plants at Great Hollow Nature Preserve (New Fairfield, CT). We expect that non-native shrub species like Japanese barberry, Eurasian honeysuckles, autumn olive, and burning bush would have less food available compared to native understory trees like musclewood, striped maple, shadbush, and witch-hazel. However, our preliminary results suggest that not all invasive shrubs are equally poor food sources for arthropod prey. In 2021 we did a bird exclusion experiment to compare which arthropods were taken from native and non-native shrubs by songbirds. Surprisingly, some invasive shrubs like honeysuckle have equivalent biomass of arthropods and insectivorous birds remove prey at similar rates compared to natives. However, some non-native plants, like barberry, have fewer insect prey available and experience apparently lower foraging effort by insectivorous birds. The next step in this project is to quantify the protein content of the arthropod prey we collected from native and non-native shrubs.

**Specific Goals and Objectives of Project:** We will determine the 'worst offenders' in terms of insectivorous bird food provided by invasive plants. This information will allow land managers to target their resources for invasive plant control towards the worst species and have the greatest conservation impact for birds in Connecticut forests..

- Quantify total arthropod abundance on native and native shrubs (ten species)
- Quantify the total biomass of arthropods removed by birds via a selective barrier (exclusion netting)
- Statistically model bird foraging intensity across the ten focal species of plants
- Determine if nutritional quality per unit biomass is lower on non-native plants compared to natives

The impact of non-native shrubs on wildlife is a central concern for invasive species management in Connecticut and the surrounding region. Currently it is assumed that removing all non-native species should be a priority, but there could be evidence that we should target a narrower range of exceptionally poor hosts first.

### **Deliverables:**

- The first ranked list of food quality for ten species of native and non-native shrubs for insectivorous birds (for Connecticut forests and other regions that have been invaded by these plant species)
- Publication on the degree to which forest songbirds forage for insect prey on native vs. non-native plants.
- Information for the general public on what native understory trees (of the six studied) provide the highest quality 'bird food'
- Recommendations for management of non-native plants, including a priority list due to poor food availability and/or quality for insectivorous wildlife.

### **Budget for Funding:**

#### *Protein Content Assay*

C:N Ratio Analysis (Arthropods) .....	\$8/sample
	x 120 trees
	<b>\$960</b>
Lab consumables.....	<b>\$40</b>
Total costs .....	<b>\$1000</b>

#### *Funding Sources*

Connecticut Ornithological Association Mini Grant (Requested here).....\$1000

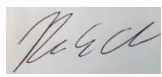
### **Timeline for Completing Project, including date of final report:**

- Summer 2021: Field surveys of insects and bird exclusion experiment (Completed in August)
- Preparation of samples to be sent for C/N Ratio analysis (Jan 2022)
- Isotope analysis of samples at Cornell University (Feb-March 2022)
- Statistical modeling of bird exclusion effects on native and non-native plants (March 2022)
- Data on nutritional quality among host plants use in scientific manuscript (May 2022)
- December 23 2022: Final report submitted
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### **Person Responsible for Project Completion (name/phone/email):**

Robert Clark, Ph.D (860-518-1954) [rclark@greathollow.org](mailto:rclark@greathollow.org)

Print Name / Phone / Email



Signature

Research Scientist

Title

1/13/2022

Date

Email this application to: [coa-minigrants@googlegroups.com](mailto:coa-minigrants@googlegroups.com)

or

Mail to: Connecticut Ornithological Association  
314 Unquowa Road  
Fairfield CT 06824  
Attn: Mini-grant Committee

### **Detailed Project Description**

#### **Project Significance:**

The spread of invasive species is among the most devastating impacts humans can have on the environment. Invasive species are particularly abundant in disturbed environments in proximity to high human population density. In the fragmented Connecticut forests this especially true, where invasive shrubs can dominate forest understories. Non-native plants displace native shrubs, removing important food sources for wildlife that originally depended on those native plant species. Effective forest habitat management prioritizes removal of monocultures of invasive plants in an attempt to reestablish the resources available to wildlife, especially migratory songbirds. However, in Connecticut forests, there are hundreds of invasive plant species that have become widespread. A handful of these species are particularly abundant, including Japanese Barberry, Asiatic honeysuckles, Burning bush, and Autumn olive. The outlined project will focus on these four focal species and compare them to native understory trees and samplings common in many Connecticut forests: Striped maple, Witch-hazel, American beech (saplings), Black birch (saplings), Musclewood, and Shadbush. By quantifying the food quantity and food quality, we can provide recommendations on which understory invasive shrubs are the ‘worst offenders’ of these four, and also reveal which common native species provide superior food availability to birds in place of exotic species. This information will focus management efforts to swap poor species for superior species, helping to improve the prey availability for our migratory songbirds that arrive in Connecticut forests each year.

#### **Background:**

Not all host plants provide the same amount of food resources to insect herbivores, and the quality of host plants cascades up food webs impacting insectivores like migratory songbirds. Non-native shrubs are often poor quality for insect herbivores, significantly reducing the

abundance of available food for other animals that depend on insects like caterpillars. Consequently, effective wildlife conservation requires an understanding of how food resources impact on local fauna. For migratory songbirds, it has been long-established that temperate forests provide a rich source of insect prey critical for nestling development. Forest trees and shrubs support a high density and diversity of foliage-feeding insects, which are a high-quality resource high in lipid and protein content. However, despite the importance of this interaction for wildlife, relatively few studies have directly documented the insect fauna and their macronutrient composition among native hosts. The majority of historical work has examined the impact of forest structure and tree species composition, but not documented the trophic link mediated by insect communities.

### **Methods:**

Using a paired predator exclusion and control treatment approach, we have already surveyed 120 trees, 3 times, among 10 species at Great Hollow's forests. In spring 2021, we placed 60 nets over our ten focal plant species and collected arthropods from these branches and nearby controls with no manipulation. All branches were sampled during the peak abundance of foliage-feeding arthropods and the associated invertebrate community (e.g. spiders) from late May to early July. Insects were collected *via* branch beating and crawling or sessile arthropods were collected directly into vials. All insects have been frozen at -20c for later nutritional analysis. In total, we have collected over 70,000 arthropods and processed them. Preliminary analyses of arthropod abundance and biomass is already complete, and the C/N content remains the last step in our methods to complete this experiment. The completed experiment will provide data for a scientific manuscript and public bulletins on invasive species management.