



# The Clifton Institute

## Potential Master's Research Projects at the Clifton Institute, 2021-2022

### About the Clifton Institute's Research Program

Clifton Institute staff, interns, and collaborators do ecological research to better understand the causes of decline in native plants and animals and to identify land management practices to support declining species. All of our research projects produce actionable recommendations that inform land managers and conservation practitioners. We inform land owners and agencies of our results through [site visits](#), workshops, public programs at the institute, and print and digital communications.

### Call for Master's Students 2021-2022

We are currently seeking involvement from Master's students in projects in two of our [research themes](#): conservation and restoration of Piedmont prairies, and mitigating the effects of urbanization on biodiversity.

### Research Theme 1: Conservation and Restoration of Piedmont Prairies

#### Introduction

At the time of European settlement, prairies, savannas, and open woodlands were extensive in the Piedmont of eastern North America. These open habitats were maintained by fires started from lightning strikes and by Native Americans, which burned every 2-6 years, as well as grazing by bison and elk, and seasonal drought. Many grasslands have now turned into forests because of fire suppression and the extirpation of large mammals. Urban development, invasion by non-native pasture grasses, overgrazing, and hay cutting are also replacing or degrading the remaining native grasslands. Non-native fields tend to have greatly reduced diversity of plants and animals compared to native meadows. The Clifton Institute is working to restore native grasslands for the benefit of the native plants and animals, both on our 900-acre property and across northern Virginia.

#### Project 1: Grassland Restoration Experiment

The Clifton Institute has a 110-acre field that was used as cattle pasture until March 2018. Our goal is to convert this pasture, which is dominated by non-native grasses, to a native grassland, which will benefit native plants and animals. After consultation with the Natural Resources Conservation Service (NRCS) and local landowners who have carried out grassland restoration projects, we chose four methods for establishing native plants and two methods for managing the fields. In the first establishment method, we sprayed herbicide once to kill non-native grasses and let the natives recover from seeds that were already in the soil naturally. In the second, we used the more expensive method that NRCS prefers: spraying herbicide three times to kill all the plants, and then plant seeds of native plants. We also tried an organic alternative: repeated plowing to turn under non-native plants, followed by planting native seeds. Finally, we have a control plot where no establishment method was used. Native plant establishment was completed in June of 2021. We are also comparing the effectiveness of two methods to maintain the grasslands: prescribed fire and mowing. We use prescribed fire to manage grasslands because native species are adapted to fire, while some non-native plants are harmed by it. Mowing is more easily done by most landowners so we are evaluating how native plants and animals are affected by mowing. By combining these establishment and management methods, we have created eight experimental treatments that are being implemented across the grassland. We have also joined forces with Virginia Working Landscapes and the Oak Spring Garden Foundation to replicate the experiment at two additional sites.

We are studying how native plants and animals are responding to the eight experimental treatments, and determining which treatments are the most effective and the most economical. We have already collected data on



# The Clifton Institute

the birds, plants, butterflies, and insects overall found in the experimental plots before we started the restoration treatments. We also analyzed baseline soil chemistry and soil microbes. We will repeat these surveys in the spring, summer, and fall of 2022, and we are excited to learn which treatments were most effective at restoring plants, animals, and soil. Jordan Coscia, Ph.D. student in the [Restoration Ecology Lab](#) at Virginia Tech is collecting and analyzing the plant data for her dissertation. We are looking for a Master's student to help with this project, especially with insects or soil.



This figure shows the treatments in the Clifton Institute's 110-acre grassland restoration experiment.

## Project 2: Animals of Remnant Piedmont Prairies

Some sites, like the fields in our restoration experiment, need a lot of active management to return them to something like their native state. However, there are many small remnants of native Piedmont prairies scattered around northern Virginia. In the summer of 2020, we studied the plants of 38 such prairies in our region. We found that these habitats are among the most diverse native plant communities in the entire state, and that they are home to several rare or threatened plant species. Furthermore, these prairies are acutely threatened by urbanization, herbicide spraying, and invasive plants. However, we were pleasantly surprised to find that powerline clearings are providing an important refuge for native grassland plants. It turns out that some of the highest quality Piedmont prairies found in North Carolina and Georgia are also in powerline clearings.

We now have a good idea about what plants found in northern Piedmont prairies (and we aim to publish our results by the end of 2022), but the animals living in these sites are poorly known. The presence of rare bumblebees and declining grassland birds in degraded non-native pastures in our region indicates that interesting animals are probably be hiding out in these little-studied high-quality grasslands. A Master's student could survey the insects or birds in these remnants to improve our understanding of the status and conservation value of these habitats. There are also interesting ecological questions to be answered. For example, are there more diverse insect communities at sites with more diverse plants? Is there a minimum remnant size that can support different species



# The Clifton Institute

of birds? How do powerlines and roadsides serve as corridors to connect diverse grasslands that are otherwise surrounded by urban areas or agricultural land?

We are working closely with power companies, government agencies, and private landowners to improve management of these special grasslands. Results from this project will be used to advance our management recommendations. Furthermore, while we value native plants for their own sake, we will be able to attract more attention from the public if we also knew that these remnants were good habitat for pollinators and birds.

## **Research Theme 2: Mitigating the Effects of Urbanization on Biodiversity**

### Introduction

The Clifton Institute is located just west of the expanding suburban sprawl that surrounds Washington, D.C., and exurban development in rural counties in our region is intensifying rapidly. Smaller forest patches, more roads, increased coverage of pavement, and associated pollution all have profound effects on plants and animals in our area. We are studying the effects of urbanization on species of conservation concern to identify which species are most vulnerable and to find ways to mitigate the negative effects of development.

### Project 3: Can we improve the design of porch lights to reduce the number of insects they kill?

There are several factors that have been implicated in the decline of insects, including pesticides, invasive species, and habitat loss. One underappreciated factor is the [high mortality rate of insects at lights that are left on overnight](#). Even in rural areas, homeowners and businesses often leave lights on all night, and billions of insects likely die as a result. We are looking for a student to help us set up a porch light experiment in the summer of 2022. We will compare the number and diversity of insects that attracted to different kinds of bulbs (e.g., LED, incandescent, different color temperatures), lights that are motion-sensing versus constant, and different kinds of fixtures. We will identify ways to minimize mortality from lights and inform landowners and the general public of our results.