Final Report for the Edna Bailey Sussman Foundation 2022

 IMPACT OF RESERVE TREE SIZE ON BIRD ABUNDANCE IN MANAGED NORTHERN HARDWOOD FORESTS

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**INTRODUCTION**

Sustained production of forest products and maintenance of wildlife habitat remain top priorities, and challenges, for forest managers. Guidelines applied to managing northern hardwood forests suggest trees should be harvested when they reach diameters of 40-45cm to focus growth on young, vigorous trees and thereby maximize long-term biomass production (Nyland 2002). To further regenerate diverse and commercially desirable tree species, managers increasingly use shelterwood systems which leave widely dispersed trees to provide seed and scattered shade to protect young seedlings. However, larger (>50cm diameter) trees offer a variety of microhabitats that can support diverse wildlife where birds can forage on insects and can find shelter (Basile, *et. al* 2020). Therefore, quality trees that support breeding bird populations may not be produced in many managed forest systems since trees are removed before the necessary habitat features can develop with size and age. Consequently, several forest-dwelling birds, such as the Scarlet Tanager and the Least Flycatcher, are experiencing population declines which may be due in part to loss of forest microhabitats within their breeding range.

Previous studies have shown that forest-dwelling birds respond to unique tree-related microhabitats (TreMs) of individual trees in shelterwood systems such as large rot holes, exudates, and broken crowns to use as nesting and feeding sites (Basile, *et. al* 2020; Winter, S., & Möller 2008). The limited research on the effect of shelterwood and diameter limits on bird habitat has been conducted only in Europe and the Pacific Northwest.

For my research project, I conducted a case study in the Adirondacks to contrast the effects of large tree retention and small tree on the prevalence of TreMs and the abundance of birds. I also examined canopy cover as a treatment to include data from unmanaged, old growth forest sites and to mitigate canopy cover affecting the data for birds that are sensitive to open canopies.

**WORK COMPLETED**

I conducted the study in four proximate northern hardwood forest stands in Essex and Hamilton Counties, New York within the Adirondack Park. The forest composition in these counties is primarily northern hardwood dominated by American beech (*Fagus grandifolia*), sugar maple (*Acer saccharum*), and yellow birch (*Betula allegheniensis*), with some areas of mixed conifers.

The four study sites are each about 40 hectares in size within three forested properties in Newcomb, New York: one is the Huntington Wildlife Forest managed by SUNY College of Environmental Science and Forestry and the other two are private properties managed by F&W Forestry. SUNY ESF has managed its property for decades, has an extensive and long-term ecological history of the property. F&W Forestry manages their land for commercial pulp production using shelterwood systems and selective cuts to meet property owners’ goals. I selected each study site based on management history, accessibility, and ecological characteristics. Table 1 shows the two factors of the study with their accompanying levels. The forest site descriptions in Table 1 indicate the treatment types.

|  |  |  |
| --- | --- | --- |
|  |  | Large Trees ≥50 cm dbh |
|  |  | yes | no |
| Canopy Cover 100% | no | experimental shelterwood system | commercialshelterwood system  |
| yes | unmanaged/old growth | commercial selective cut  |

Table 1. The two treatments factors and their accompanying levels: trees ≥50 cm dbh (yes/no) canopy cover (yes/no), and the resulting descriptions of treatment type.

**Description of Forest Stands:**

Experimental Shelterwood stand (Electric Fence)

In the winter of 2021/22 a shelterwood cut was conducted to mitigate beech bark disease, removing most canopy trees and all of the understory, resulting in a completely open canopy with only a few residual canopy trees. The only other cut of this stand removed 43% of the basal area in 1952 (Tierson 1967), therefore, the residual trees from the recent cut could be >50 cm diameter at breast height (dbh).

Commercial Shelterwood stand (Goodnow Flow)

 According to the prescription written by F&W Forestry, a heavy second stage shelterwood was done the winter of 2021-22. Previously, a harvest of beech was done, and other trees were tended, although beech saplings took advantage. The most recent harvests removed beech, unsuitable growing stock and mature and over-mature saw-timber, leaving a basal area of 35 square feet per acre.

Unmanaged Old Growth stand (Natural Area)

No roads lead to the unmanaged old growth forest site and there has been no management of the area ever because of its rocky terrain and steep slope, and distance from any main road. The canopy cover is continuous, except where it naturally breaks, and the forest is an un-even age as expected in an unmanaged forest.

Commercial Selective stand (Bunting property)

The Bunting property, managed by F&W Forestry, has not been cut since the early 2000’s. The stand was previously managed commercially, so there are few trees in the stand larger than 50 cm dbh. The study was conducted towards the northern border of the property where a selective cut was done in the early 1990’s, and old stumps can be seen scattered throughout. The canopy is continuous.

**Data Collection:**

To measure the abundance of birds at each study site, I conducted a series of repeat-visit point counts in the month of June in each of the 4 study sites (Buckland *et al*. 2021). In each site I conducted nine point counts at least 200 m apart from each other and 150 m from the edge of the site (Figure 1) for a total of 36 points combined.

I conducted point counts three times at each point from June 6th - July 3rd 2022. Counts were conducted from 5:30 am to 10:00 am EST and consisted of documenting all birds heard and seen in 10 minutes. Each 10 minute count was divided into 3 segments: 0-3 minutes, 3-6 minutes, and 6-10 minutes to measure time-to-detection of each species (Strebel *et al*. 2020).

In addition to human detection, a handheld Zoom recording device recorded each point count to serve as an auditory library of the data collected and also to check accuracy of the detection by humans.

AudioMoth autonomous recording units were programmed and placed at each of the 36 points to further record birds and to eventually be used as a “4th visit” to each point (Figure 2). Nine AudioMoths were used on a rotating schedule placed at the flagged point in each site for 4 days between June 6th and July 3rd. They were programmed to record from 6:00am to 10:00am in 10 minute segments every half hour for a total of 80 minutes of recording per point. Each AudioMoth was double bagged in Ziploc bags and zip-tied to a tree or stick placed in the ground less than 2 m from the flagged point.

Figure 2. Audiomoth recording device

Figure 1. An example of nine point counts located in a forest stand. The center of the points are >200 m from each other and >50 m from the edge of the study site/forest stand.

I conducted a vegetation survey to use as covariate data to help explain inter-site differences in bird occupancy. A key feature measured was tree-related mico-habitats (TreMs) on the canopy trees larger than 10 cm dbh. Data was collected from one vegetation plot in each of the 4 cardinal directions 50 m from each point (Figure 3) for a total of 36 vegetation plots per site, and 144 veg plots total. TreM characterization and count was conducted by sight inspection from the ground using the field guide created by Kraus, *et al.* (2016). The TreMs selected for this project were the following: large rot holes, exudates, broken crowns, cavities, and crown deadwood, because they are most strongly correlated with bird abundance and diversity in the literature (Basile, *et al.* 2020; Winter and Möller 2008). Tree species and dbh was measured for saplings <10 cm in diameter; percent groundcover was measured in each square meter plot (Figure 4).

6.91 m

4 m

1 m

2.82 m

50 m

100 m

Figure 4. Diagram of a vegetation plot with accompanying subplots and square meters. Data was collected for canopy trees in the 150 m2 vegetation plot, for the sapling layer in the 25 m2 subplots, and for groundcover in the 1 m2 plots.

Table 2. Total species detected during point counts.

Figure 3. Diagram of a point with its four vegetation plots. Point counts were conducted from the center of each point.

|  |  |  |
| --- | --- | --- |
| American Crow | Blue-headed Vireo | Red-breasted Nuthatch |
| American Goldfinch | Dark-eyed Junco | Red-eyed Vireo |
| American Robin | Eastern Bluebird | Scarlet Tanager |
| Blackburnian Warbler | Eastern Wood Pewee | Swainson's Thrush |
| Black-capped Chickadee | Hermit Thrush | White-breasted Nuthatch |
| Black-throated Blue Warbler | Least Flycatcher | Winter Wren |
| Black-throated Green Warbler | Ovenbird | Yellow-bellied Sapsucker |
| Blue Jay | Pileated Woodpecker |

**CURRENT AND FUTURE WORK**

Currently, I am analyzing the abundance of birds against the covariate vegetation data. A total of twenty three species of birds were detected when all the species are combined from each site (Table 2). Initial results show that not every species was detected at each site. Finally, I will collaborate with F&W Forestry to formulate recommendations to guide future shelterwood tree selection that will enhance bird habitat while balancing the needs for wood biomass production. I plan to share this work with foresters and the public by publishing my findings and presenting at the Society of American Forester’s New York annual meeting, and at the Northeast Natural History Conference.

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