Varying levels of bird activity within a forest understory dominated by the invasive glossy buckthorn (*Rhamnus frangula)*

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Abstract

Our understanding of the ecological interactions among invasive plants and animals is still relatively limited. *Rhamnus frangula* is a common invasive shrub found across many landscapes in North America (Catling and Porebski 1994). The focus of our study was the influence of *R. frangula* on bird activity, something that has never previously been studied. We installed clay models of Lepidopteran larvae in *Acer rubrum* trees located "near" and "far" from *R. frangula*. We used a Chi-square test to determine whether a significant difference in bird activity occurred in sites "near" and "far" from *R. frangula.* No significant difference was found, however this does not necessarily mean that no difference is occurring. Differences in bird activity may have been undetectable due to the scale of this study. Further research using the basics of our design may show that bird activity is affected by *R. frangula.*

Introduction

Invasive plants have become a more prevalent portion of landscapes and subsequently research into their interactions in natural communities has become a popular focus in ecology. The small invasive tree *Rhamnus frangula*, glossy buckthorn, was first introduced to North America in the late 1800's and is now found across a wide variety of habitats including urban areas, fields, thick forests, and wetlands (Catling and Porebski 1994). *R. frangula*'s capacity to invade undisturbed areas such as poor fens has raised concern because it often replaces rare and/or endemic plants (Catling and Porebski 1994). Knowledge of the impacts that *R. frangula* may have on animals is currently limited.

Both the berries and leaves of *R. frangula* are used as a food source by generalist birds (Knight 2007). Because of this food relationship I would expect the activity of birds

to increase with greater numbers of *R. frangula*. However Knight (2007) suggests that the positive benefits birds receive from invasive buckthorn may not be outweighed by the loss of other food-plants from the area. Apfelbaum and Haney (1987) claim that bird species richness decreases with the establishment of *R. frangula* populations, yet there was no statistical support. If this is true, would levels of bird activity also be negatively affected by *R. frangula*?

We designed this study to answer questions about the effect of *R. frangula* on bird activity in forest communities. We postulated and tested two hypotheses (H_a, H_b) along with the null hypothesis (H_n). H_a: An increase in bird activity occurs in areas near *R. frangula* because it provides favorable food and protective coverage. H_b: A decrease in bird activity occurs in areas near *R. frangula* because other native food-plants have been replaced.

Methods

Study Site and Species: Schmeekle Reserve, located in Stevens Point, Wisconsin, is a 275-acre preserve located on the north side of the University of Wisconsin Stevens Point campus (Schmeekle Reserve 2006). The Chilla Woodlot, located on the western edge of the preserve, is a northern mesic forest whose cover story is comprised of Oak, Maple, and Pine (pers. obs.). We chose to conduct the study within the Chilla Woodlot because concentrations of *R. frangula* vary throughout the forest (pers. obs.).

Access to sunlight has been found to be a limiting factor impacting the distribution of *R. frangula*. In woodlands, the invasive is found on forest edges and portions of the landscape with light gaps in the canopy (Catling and Porebski 1994). This trend is consistent with the spatial distribution of *R. frangula* within the Chilla woodlot.

Experimental Design: We placed Lepidopteran models (n=66) at varying heights in *Acer rubrum* trees on September 21st, 2009. We left the models in the trees for four days in an attempt quantify relative avian predation rates in locations “near” and “far” from *R. frangula.*

The design of Lepidopteran models was based on general characteristics of larvae within this order. The models were approximately 5 x 1.5 cm, cylindrical in shape and made of soft green modeling clay. Impressions would be created when birds attempted to capture the models.

We chose *A. rubrum* trees in the field based upon ease of access to lower branches for model placement. Two models were placed within each tree and firmly attached using glue. Care was taken to not indent the models during installation. The distance (m) from the host tree to *R. frangula* was measured and grouped into two categories; near (<12 m) and far (>12 m). We determined these categories because the largest difference between data points occurred above and below 12 m. We also measured height from model to forest floor. After four days we collected and examined the models for the presence of avian beak marks.

Statistical Analysis: We ran a Chi-square test on the null hypothesis using Microsoft Excel. The Chi-square test was appropriate for this data set because only two categorical variables (near and far) and two outcomes (trees with attacks and trees without attacks) were being used. We used the chi-square analysis to determine whether there was a significant difference in bird activity among sites near and far from *R. frangula.*

Results

Trees located near *R. frangula* experienced a lower rate of predation than those far away from *R. frangula* (Table 1). However, according to the results of the Chi-square test, no significant difference was found therefore we cannot say that there is a difference in rates of bird activity among locations near and far from *R. frangula*.

Table 1. Summary of bird predation in *Acer rubrum* trees located at varying distances from *Rhamnus frangula.*

Distance to *R. frangula*	**Near(<12m)**	**Far(>12m)**
Relative Predation Rate (%)	31.25	50.00
Total Number of Replicates (n)	48	18
$\mathbf{X^2}$ (df = 1, n = 66) = **1.99**, p = 0.05, critical value = 3.84		

Discussion

The results of this study suggest that bird activity does not change with increasing densities of *R. frangula*. This lack of a difference came as a surprise. *R. frangula* has been found to dominate the landscapes that it has invaded, and in some cases constitutes 90% of the “green biomass” within that landscape (Catling and Porebski 1994). A drastic

change to the vegetative composition of a landscape should have some direct or indirect effect on birds. It is possible that we were unable to detect any effects on bird activity due to the small spatial scale in which we worked. The area in which we worked was smaller than a typical bird's territory. If looking for correlations between the bird activity and the presence of *R. frangula* it would be best to work on a scale that would include multiple bird territories mixed with unoccupied areas.

A change in the location of the study in combination with a larger spatial scale may produce different results. The Chilla Woodlot is intensively managed for the removal of *R. frangula* (pers. comm. Zach Grycan). Although *R. frangula* is not currently visible on certain portions of the landscape it likely was present there in the recent past. It would be better to choose a site similar to the Chilla woodlot that has no history of occupation by *R. frangula* as a control for future studies.

A smaller, although not significant, percentage of trees were attacked in the near category. If Apfelbaum and Haney's (1987) theory about decreases in bird diversity in regions inhabited by *R. frangula* is occurring then the bird population could be decreasing because groups of birds are abandoning these sites (Knight 2007). The birds are leaving because native browse is being replaced by *R. frangula* and the overall rate of bird activity is less. However this difference was not significant and I suggest that although diversity may be decreasing the number of birds is not.

The disappearance of certain bird species, as a result of buckthorn establishment, may be replaced through increases in the numbers of the remaining birds. The birds that are remaining are likely generalists who are not sensitive to changes in the understory. These bird's populations may increase as more space becomes available due to sensitive bird species leaving the habitat. So although diversity may be negatively affected by *R. frangula* the actual number of birds and their activity levels are not. This theory is supported by the results of our study. To further expand and support this theory it would be advantageous to survey and document the different bird species and census their populations in addition to measuring activity levels.

References

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