The use of non-native plants by nesting birds in the Red Clay Valley: an experiment

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Introduction

Birds are in trouble (Rosenberg et al. 2019). Many families are in strong decline because of multiple threats, of which the most pervasive is the loss, fragmentation, or degradation of their habitat. There are many factors which lead to their habitat becoming degraded including pollution, disturbance by humans or their pets or livestock, and the accidental or deliberate spread of non-native plants. Non-native plants are problematic because they support fewer arthropods such as caterpillars which form a large part of the diet of nestling songbirds as well as migrating insectivores like warblers, vireos and thrushes (Tallamy 2017).

The Mid-Atlantic is rife with non-native plants. Some escaped after being used as packaging for imported goods while others were deliberately introduced as ornamentals or yard borders because of their attractive flowers or berries [Oriental bittersweet vine (*Celastrus orbiculatus*), Japanese honeysuckle vine (*Lonicera japonica*), porcelain berry vine (*Ampelopsis glandulosa*), burning bush (*Euonymous alatus*) and Japanese barberry (*Berberis thunbergia*), privet (*Ligustrum* sp.)]. Some were introduced for erosion control [multiflora rose (*Rosa multiflora*), olives (*Elaeagnus* sp.)], or somewhat ironically, for their wildlife value (multiflora rose, olives). The berries of these plants are consumed by birds and other animals which then pass out the seeds, spreading non-native plants throughout our yards, city parks, state parks and countryside. For further details of the history of these species see the USDA's Invasive Species information center at https://www.invasivespeciesinfo.gov. Many local and statewide conservation agencies, state parks and private citizens are addressing these threats by removing these plants.

Nevertheless, some birds readily build their nests in non-native plants, as has been documented in several observational studies (e.g. Heckscher 2004, Schlossberg and King 2010). However, few studies have examined the consequences of the widespread removal of non-native plants for nesting birds (though see Rodewald et al. 2015 for a single-species removal experiment). We tested this by removing the majority of non-native plants from some plots at a site in the Red Clay Valley and comparing the use of these plots by nesting birds in comparison with neighboring plots where no removal occurred. We also collected data on which plants birds used for nests in these plots as well as elsewhere at the study site and two other sites in the Red Clay Valley.

Methods

Our experiment was carried out during the summer of 2020 at Bucktoe Creek Preserve, a private 300-acre nature preserve near Kennett Square, Pennsylvania comprised of two large meadows surrounded by woodland dominated by deciduous trees and shrubs. During the preceding two winters one of us (IS) removed almost all the non-native shrubs and bushes from 10 study plots spread throughout the woods. The area of the plots was approximately 5,500 m2 (mean ± standard deviation 5,680 ± 679 m2; = 0.57 hectares, 1.4 acres) and were either square, rectangular or trapezoidal in shape. Non-native bushes, shrubs and vines were removed by cutting away the branches using a hedge trimmer or loppers until the main trunk or stem was exposed. The trunk or stem was cut close to the ground using loppers or a handsaw then a small dab of Aquaneat herbicide (a 54% solution of glyphosate, mixed with a surfactant and tracking dye) was applied to the cut stump. Most of the non-native plants that were removed were multiflora rose, bush honeysuckle (*Lonicera maackii*) and Oriental bittersweet, though we also removed some burning bush, privet, Japanese barberry and Japanese honeysuckle. There are several other non-native plants which emerge at Bucktoe during the late summer (Japanese hops (*Humulus japonicus*), mile-a-minute weed (*Persicaria perfoliate*) and porcelain berry) but these are not present in the winter and could not be controlled. Adjacent to each of the 10 cleared plots were 10 control plots in which no non-native plants were removed. A mowed walking trail or deer trail separated each pair of cleared/control plots. Each of the control plots was approximately the same area and shape as the cleared plot with which it was being compared and was as far as possible an ecological equivalent with respect to the species, size and density of the trees present, and whether it was along a creek or on a hilltop.

One of us (IS) searched each plot for nests approximately once every 12 days (mean ± SD = 12.6 ± 9.6 days). Most nests were found by slowly scanning suitable vegetation, especially in areas where the parents' behavior alerted us to the presence of a nest (especially the distinctive 'mupping' call adult Gray Catbirds give near their nest or young). We identified the plant(s) each nest was constructed in and noted whether it was a native or non-native species.

We attempted to revisit nests to determine their fate although given competing work commitments this was not common. Nests were categorized as having failed if the eggs disappeared before their expected hatch date or if the nestlings were lost before the middle of their nesting period. Nests were categorized as successful if the nestlings survived until the middle of their nestling period or if fledglings were seen close to the nest. This measure was used to compensate for the infrequency of our nest visits even though it may have overestimated the number of nests that succeeded if the nestlings were lost close to fledgling.

We included both occupied and empty nests in our analysis, since even nests that were empty when they were discovered represented a nesting decision and could have been occupied but the contents depredated before the nest was found. Some nests in the same general area may have represented re-nesting or even second broods by the same pair, but we were unable to control for this as we did not capture and mark the adults.

In additional to our experimental plots, we also collected data on nesting substrate by searching for nests throughout the rest of Bucktoe Creek Preserve as well as deciduous woodland in two other sites: Ashland Nature Center in Hockessin, Delaware and Coverdale Farm Preserve in Greenville, Delaware.

Results

Nesting within study plots

We found 43 nests in the study plots. There were significantly more nests in the control plots than in the cleared plots (mean ± SD = 3.9 + 1.4 vs 0.4 + 07) (Wilcoxon signed rank test Z = 2.8, P < 0.01, Figure 1). There was at least 1 nest in all 10 control plots yet only 3 of the 10 cleared plots contained nests (see Table 1).

Nesting substrate

In addition to the 41 study plot nests, we found 97 nests elsewhere at Bucktoe and at Ashland and Coverdale. The majority of these 138 nests were Gray Catbirds.

75 out of 83 Gray Catbird nests (90%) were built in non-native plants, and 73 of them (88%) were built in multiflora rose (either rose stems overlaying a tree or a free-standing rose bush). Of the 8 Gray Catbird nests built in a native plant, 2 were in free-standing cluster of greenbrier (*Smilax herbacea*), 2 were in an arrowwood

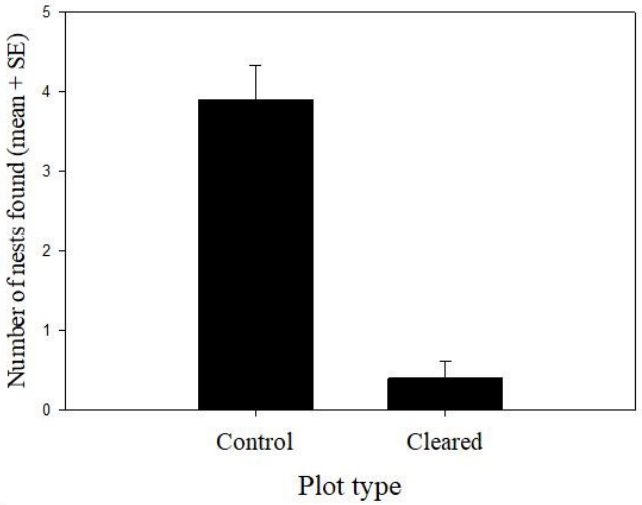

Figure 1. Number of nests found in 10 woodland control plots and 10 adjacent plots from which most non-native plants had been cleared.

Table 1. Nests found in 10 woodland plots where non-native shrubs and bushes had been cleared and in 10 control plots where no plants had been cleared.

Plot Pair	Nests in cleared plot	Nests in control plot
1	0	3 (3 GRCA)
2	0	6 (1 BRTH, 3 GRCA, 1 NOCA, 1 WOTH)
3	1 (EATO[1])	5 (4 GRCA, 1 NOCA)
4	0	4 (3 GRCA, 1 WOTH)
5	2 (2 NOCA[2])	4 (4 GRCA)
6	0	3 (3 GRCA)
7	0	3 (1 GRCA, 1 NOCA, 1 WOTH)
8	1 (1 SOSP[1])	3 (1 CAWR, 2 GRCA)
9	0	2 (1 GRCA, 1 WOTH)
10	0	6 (5 GRCA, 1 WOTH)

BRTH = Brown Thrasher, CARW = Carolina Wren, EATO = Eastern Towhee, GRCA = Gray Catbird, NOCA = Northern Cardinal, SOSP = Song Sparrow, WOTH = Wood Thrush

[1] One Eastern Towhee and one Song Sparrow nest were assumed to be present within patches of dense vegetation because one or both parents jumped up and gave alarm calls from the same location on at least two successive visits, though we could not find the nests.

[2] Including 1 NOCA nest in a small patch of multiflora rose bush that had been missed during clearing.

viburnum (*Viburnum dentatum*), 2 were in a spicebush (*Lindera benzoin*), 1 was in a box elder (*Acer negundo*) and 1 was in an oakleaf hydrangea (*Hydrangea quercifolia*).

15 out of 21 (70%) Northern Cardinal nests were built in non-native plants, and 12 of them (57%) were built in multiflora rose. 8 out of 12 robin nests were built in non-native plants, all of which were rose stems overlaying a tree. 8 out of 16 Wood Thrush nests were built in non-native plants, and 2 of them were built in multiflora rose stems overlaying a tree. We also found 3 Eastern Towhee nests of which 2 were in a non-native plant, and 3 Brown Thrasher nests of which 2 were built in a non-native plant.

Pooling species, 110/138 (=80%) of nests were built in a non-native plant (Table 2).

Nest success

0 of 3 gray catbird nests in native plants were considered to have succeeded, compared with 5 of 10 in non-native plants (Fisher's Exact Test = 0.23 P > 0.05). 2 of 4 Northern Cardinal nests in native plants were considered to have succeeded compared with 3 of 6 nests in non-native plants (Fisher's Exact Test = 1.0 P > 0.05).

Discussion

We conducted an experiment at Bucktoe Creek Preserve in the Red Clay Valley in which we removed most of the non-native bushes, shrubs and vines from 10 woodland plots and found that the number of nests built in those plots was significantly lower than the number of nests in 10 adjacent control plots where no plants were removed. We did not find any nests in most of the plots from which non-native plants had been removed, though we caution that we may have missed a small number of nests which are harder to find or access such as those placed in long grass or brambles by Common Yellowthroats or Song Sparrows.

This result is not particularly surprising: removal of shrubs and bushes will inevitably lead to a reduction in the number of birds which nest in shrubs and bushes, especially if these are the dominant form of vegetation. However, we believe that non-native plants need to be removed from an area before it can be restored with native shrubs and bushes, or else the new planting will likely be out competed and struggle or even die. The fact that Wood Thrushes still built 50% of their nests in a native tree (spicebush (*Lindera benzoin*) or blackhaw Viburnum (*Viburnum prunifolium*)) was encouraging however, as it suggests that they could benefit if their habitat were restored with these native trees.

We also searched for nests elsewhere in the Preserve and at two sites in northern Delaware. Most of the nests we found were built by Gray Catbirds. Almost all (90%) of the Gray Catbird nests were in a non-native plant, with a large majority of them (88%) located in multiflora rose.

Table 2. Nesting substrates of 4 bird species in the Red Clay Valley.

Nest substrate	Gray Catbird	Northern Cardinal	American Robin	Wood Thrush	Total
Native tree overlaid with multiflora rose	34	10	6	2	52
Free-standing multiflora rose	32	2	0	0	34
Free-standing native tree or bush	6	5	3	6	20
Non-native tree overlaid with multiflora rose	7	0	2	0	9
Native tree overlaid with Oriental bittersweet	2	1	0	2	5
Native tree overlaid with American Grape or greenbrier	0	1	1	2	4
Native tree overlaid with Japanese Honeysuckle	0	2	0	2	4
Free-standing non-native tree or bush	0	0	0	2	2
Free-standing greenbrier	2	0	0	0	2
Total	83	21	12	16	132

Approximately half of them were placed in rose stems growing over the branches of a shrub or tree, with the other half in a free-standing rose bush. Although our sample sizes were smaller for these species, most 50% of Northern Cardinal (n = 21) and American Robin (n = 12) nests were also placed in a tree overlaid with multiflora rose. We only found a handful of Brown Thrasher and Eastern Towhee nests (n = 3 each), but most were built in rose.

Several other studies have found that a large proportion of passerine nests are built in non-native vegetation, especially in thorny plants such as multiflora rose. For example, Johnson and Best (1980) found 30% of Gray Catbird nests in Iowa were in multiflora rose. Heckscher (2004) found that 84% of Veery nests in northern Delaware were in non-native vegetation, especially multiflora rose, and 55% of Veery nests in New York state were in non-native plants (Meyer et al. 2015). 43% of nests were placed in non-native woody vegetation in Massachusetts (Schlossberg and King 2010), and 64% of Northern Cardinal nests in Ohio were in non-native plants (mostly bush honeysuckle and multiflora rose) (Rodewald et al. 2009).

Why do so many birds nest in multiflora rose? We believe it is because it fulfills all three of the main criteria woodland birds likely use when selecting nest sites (see Table 3). It provides 1) structural support (either as a free-standing rose bush or when growing over a tree), 2) concealment against visually searching predators, and 3) protection against nest predators such as birds or mammals, which may be deterred by its dense thorns. Other common non-native shrubs and vines fulfill some of these criteria but not all.

Table 3. Nest selection criteria addressed by 4 common non-native plants.

Criterion	Multiflora rose	Bush honeysuckle	Japanese honeysuckle	Oriental bittersweet
Support	Yes	Yes	Yes[1]	Yes[1]
Concealment	Yes	Some	Yes	Some
Protection	Yes	No	No	No

[1]These vines only support nests when they are themselves supported by growing up a tree or bush.

By contrast, only 2 of the 16 Wood Thrush nests we found were in multiflora rose (2/16) and both were primarily supported by a tree fork or branch with only secondary support from a handful of rose stems. A large study of Wood Thrushes in Berks County, Pennsylvania, found only 1 out 127 nests were in multiflora rose (Hoover and Brittingham, 1998), with almost half of the nests being in spicebush. This suggests that rose removal would not significantly reduce nesting by Wood Thrushes provided the rest of the habitat was appropriate.

Nevertheless, we found little evidence that nests in non-native plants (primarily rose) were more likely to succeed than those in natives (8/16 vs 2/7 after pooling Gray Catbirds and Northern Cardinals) although our sample size was small. Meyer et al. (2015) highlighted the variation that exists within this topic with different studies reporting positive, negative or no effect of nesting in non-natives upon nesting success. However, the relationship between nesting success and nest substrate is complex and will vary between sites depending on the vegetation and type of predators present, since many animals prey upon nest contents (see Farnsworth and Simons 2000). For example, a nest in multiflora rose may be relatively safe from predators such as birds and mammals which are wary of being injured by the thorns but may be vulnerable to snakes who could easily climb up the dense network of low-growing stems and are probably not deterred by thorns.

In sum, we found that several of our most common woodland birds have clearly adapted to non-native plants for nesting, especially Gray Catbirds. Some of these species may even be becoming more common because of the spread of non-native plants and the greater proportion of edge habitat and mowed grass that has resulted from European colonization (Hess et al. 2000). Should one continue to remove non-native plants given that some birds are using them to build their nests? We would argue that one should, because these plants support very little food for birds and other wildlife (Tallamy 2017) and will aggressively out compete the native plants that do. Moreover, declining birds such as the Wood Thrush require bare patches of earth in which to search for invertebrates like earthworms, and these open patches of under story will gradually be covered by bushes such rose. Ideally, these cleared areas would then be restored with the appropriate native trees and shrubs to provide nest sites and support native invertebrates (Tallamy 2017, Kawahara et al. 2021). However, even if an area is not due to be replanted, removal of non-native plants is still advisable to reduce their spread through growth and seed dispersal.

The removal of non-native plants and subsequent habitat restoration can be a complex and prolonged process and the likelihood of its success depends upon the resources available. Depending on the size of the area, it requires a significant number of people to remove and continue to control non-native plants, a significant amount of funding to purchase native replacements, and people with the experience to plant and maintain them. However, given the prevalence of non-native plants in the Red Clay Valley and their known negative effects upon the

ecosystem, we believe it is a battle worth fighting. The birds would thank us.

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Appendix

Scientific names of birds mentioned in the text.

Brown Thrasher *Toxostoma rufum*

Carolina Wren *Thyrothorus ludovicianus*

Common Yellowthroat *Geothlypis trichas*

Eastern Towhee *Pipilo erythrophthalmus*

Gray Catbird *Dumatella carolinensis*

Northern Cardinal *Cardinalis cardinalis*

Song Sparrow *Melospiza melodia*

Veery *Catharus fuscescens*

Wood Thrush *Hylocichla mustelina*