

EFFECT OF DEVELOPMENT ON BIRD SPECIES COMPOSITION OF TWO URBAN FORESTED WETLANDS IN STATEN ISLAND, NEW YORK

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Abstract.—Urban development often results in removal, fragmentation and degradation of woodland habitat. A 2-yr breeding bird census was conducted at two urban, forested wetlands in Staten Island, Richmond County, New York, to evaluate the influence of development on bird species composition. Bird species composition at the Richmond Creek site, a habitat fragment surrounded by development, was dominated by non-forest, urban-resident and human-attracted species. The Latourette Park site, located within a wooded parcel in the Staten Island Greenbelt, supported significantly more forest-interior and human-intolerant species. The two sites did not differ significantly in the number of migrant or resident bird species. The study indicates that forest islands in New York City can provide nesting habitat for area-sensitive bird species, but development that encroaches upon or degrades these habitats promotes the urbanization of the forest bird community.

EFFECTO DEL DESARROLLO URBANO EN LA COMPOSICIÓN DE ESPECIES DE AVES DE DOS ANEGADOS FORESTADOS URBANOS EN STATEN ISLAND, NEW YORK

Sinopsis.—El desarrollo urbano a menudo resulta en la remoción, fragmentación y degradación de habitats forestados. Por dos años se condujeron censos de aves en dos anegados forestados urbanos del Condado de Richmond en Staten Island, New York, para evaluar la influencia del desarrollo en la composición de especies de aves. La composición de aves en un habitat fragmentado, rodeado por desarrollo urbano en Richmond, fue dominado por aves típicas de lugares no forestados, residentes de áreas urbanas y aves atraídas por actividades de humanos. Una localidad del Parque Latourette, localizado en una parcela forestada de Staten Island, albergó un número significativamente mayor de aves usuales del interior de bosques y de poca tolerancia hacia el humano. Las dos localidades estudiadas no difieren significativamente en lo referente a especies residentes o migratorias. El estudio indica que las "islas de bosques" en la ciudad de New York pueden proveer de habitat de anidamiento para especies de aves sensitivas, pero el desarrollo que usurpa estas áreas o degrada el habitat promueve la urbanización de la comunidad de aves de bosques.

Numerous studies have shown that forest bird populations in suburban and developing areas of eastern North America have exhibited declines in neotropical-migrant and forest-interior species. These declines result, in part, from the loss of forest area as well as fragmentation and isolation of remaining forests (Ambuel and Temple 1982, 1983; Askins and Philbrick 1987; MacClintock et al. 1977; Whitcomb 1977; Wilcove 1988). Loss of forest habitat is particularly acute in urban areas where the percent of forest area is already much reduced and where remaining forest habitats are fragmented by residential and commercial developments. As urban sprawl increases, forested areas such as parks, greenbelts and wetlands become increasingly important as habitat islands for forest bird species (Adams and Dove 1989, Tilghman 1987). These natural areas are also

subject to increased disturbance from human activities and encroaching development.

This study focused on breeding bird populations in two forested wetlands in Staten Island, Richmond County, New York, New York. The study sites were chosen to include a relatively undisturbed area in a large city park and a site surrounded by residential development. The purpose of the study was to document and compare avian use of these two areas and to identify the extent to which adjacent development may affect the species composition of breeding birds. The results are discussed in terms of Staten Island biogeography.

METHODS

Study areas.—Bird species were monitored in two 7-ha plots. The Latourette Park plot is located within the Staten Island Greenbelt, a 1000-ha natural area managed by the New York City Department of Parks and Recreation. The study area is in a deciduous swamp dominated by red maple, *Acer rubrum*, spice bush, *Lindera benzoin*, jewelweed, *Impatiens capensis* and skunk cabbage, *Symplocarpus foetidus*. A multi-branched stream flows through the wetland. The study area is a rectangular plot 200 m wide and 350 m long. The plot is bounded by wetland to the north, upland woods of oak, *Quercus* spp. and red maple to the east and by a public golf course to the west and south. The plot boundary varies between 5 and 50 m from the forest/golf course edge. Approximately 1 ha of upland forest is included within the plot. The nearest residential development is located 400 m to the north.

The Richmond Creek plot is located approximately 1200 m south of the Latourette Park site and is connected to the Greenbelt via a wooded stream corridor. The study area is deciduous swamp dominated by red maple, black willow, *Salix nigra*, spice bush, arrowwood, *Viburnum dentatum* and jewelweed. The wetland is bordered along its length by residential development and is dissected at several locations by paved roads 5–6 m in width. The roads divide the study area into several rectangles varying from 100 to 200 m wide and totalling 750 m long. Water impounded by road construction has developed into a small (0.4 ha) emergent marsh of cattail, *Typha latifolia* and arrow arum, *Peltandra virginica*. Several houses and yards are included in the plot. Destruction of wetland vegetation has occurred from human activities including construction, filling, power line maintenance, dumping and discharge of septic wastes. Invasive species such as *Phragmites communis*, Japanese knotweed, *Polygonum cuspidatum*, Japanese honeysuckle, *Lonicera japonica*, poison ivy, *Rhus radicans*, multiflora rose, *Rosa multiflora* and greenbrier, *Smilax rotundifolia* dominate the disturbed areas.

These two sites were chosen for comparison because of their similar geographical location, similar vegetative characteristics and the common origin of their streams. I have assumed for the purposes of comparison that, prior to the existing development and alteration of the wetland, the Richmond Creek site was similar to the Latourette Park site and that

this comparison is essentially a before and after development scenario (see Emlen 1974).

Census methods.—Bird species nesting in each plot were identified using the spot mapping method (Wakeley 1987). Censuses were conducted in 1989 and 1990 between 8 May and 29 June and between 0510 and 0845 hours. The number of territorial males or breeding pairs was determined for all species. Each species was classified according to three variables (resident status, habitat preference and tolerance for association with humans). Each variable has three or four categories defined as follows. (1) Status: permanent resident, neotropical migrant or short-distance migrant. (2) Habitat: forest interior, forest edge or non-forest. (3) Human association: (a) Urban: Species commonly found in urban, residential developments and associated with human residences for food and nest sites. Urban-residential areas are defined as city blocks, with individual homes having yards with grass, shrubbery and street trees. (b) Attracted: Species that inhabit wooded, urban, residential areas and are attracted to these areas of human residence for food, nest materials, etc. (c) Tolerant: Species nesting in suitable habitat in the vicinity of human residence but not attracted to it because of the presence of people. (d) Intolerant: Species, usually forest-interior or area-sensitive, infrequently found nesting in association with urban developments.

Species were classified by a combination of personal observations and reference to other studies (Ambuel and Temple 1982, Askins and Philbrick 1987, Galli et al. 1976, Robbins et al. 1989, Whitcomb et al. 1981). Species were assigned to the human association category according to their highest tolerance for human presence. The number of species in each category was tallied for both sites. The species composition (or number of species in each category) was compared between sites using a *G* test for goodness of fit (Sokal and Rohlf 1981) for each of the three variables.

RESULTS

Results of the 2-yr census are summarized in Table 1, which lists the species, classification and location for all breeding birds. Eight of the 30 breeding species were found nesting at both sites.

Considering both years together, 19 breeding species were detected at the Latourette Park site (Table 1). In both years, Gray Catbird, *Dumetella carolinensis* was the most numerous breeding species followed by House Wren, *Troglodytes aedon*, Tufted Titmouse, *Parus bicolor* and Red-eyed Vireo, *Vireo olivaceus*. A majority (95%) of the 19 species were associated with either the forest interior or the forest edge. Five species (27%) were neotropical migrants. Nine species (47%) were considered intolerant of human presence.

A total of 19 breeding species was observed at the Richmond Creek site also. In both years, Red-winged Blackbird, *Agelaius phoeniceus*, Gray Catbird and European Starling, *Sturnus vulgaris* were the most numerous breeding species. Only 58% of the species were associated with either the forest interior or the forest edge. The remaining 42% were non-forest

TABLE 1. Classification of species nesting at Latourette Park and Richmond Creek.

Species	Status	Habitat	Human association	Nesting location
Mallard	permanent resident	non-forest	tolerant	Richmond Creek
Ring-necked Pheasant	permanent resident	non-forest	tolerant	Latourette Park
Mourning Dove	permanent resident	non-forest	attracted	Richmond Creek
Yellow-billed Cuckoo	neotropical migrant	forest edge	intolerant	Latourette Park
Downy Woodpecker	permanent resident	forest edge	tolerant	Latourette Park
Northern Flicker	permanent resident	forest edge	tolerant	both sites
Blue Jay	permanent resident	forest edge	attracted	both sites
American Crow	permanent resident	forest edge	attracted	Latourette Park
Black-capped Chickadee	permanent resident	forest edge	attracted	Latourette Park
Tufted Titmouse	permanent resident	forest edge	tolerant	both sites
House Wren	short-distance migrant	forest edge	tolerant	both sites
Veery	neotropical migrant	interior	intolerant	Latourette Park
Wood Thrush	neotropical migrant	interior	intolerant	both sites
American Robin	short-distance migrant	forest edge	attracted	Richmond Creek
Gray Catbird	short-distance migrant	forest edge	tolerant	both sites
Northern Mockingbird	permanent resident	non-forest	urban	Richmond Creek
Brown Thrasher	short-distance migrant	forest edge	intolerant	Latourette Park
European Starling	permanent resident	non-forest	urban	Richmond Creek
White-eyed Vireo	short-distance migrant	forest edge	intolerant	Latourette Park
Red-eyed Vireo	neotropical migrant	interior	intolerant	Latourette Park
Common Yellowthroat	short-distance migrant	forest edge	intolerant	both sites
Scarlet Tanager	neotropical migrant	interior	intolerant	Latourette Park
Northern Cardinal	permanent resident	forest edge	attracted	both sites
Rufous-sided Towhee	short-distance migrant	forest edge	intolerant	Latourette Park
Song Sparrow	permanent resident	non-forest	attracted	Richmond Creek
Red-winged Blackbird	short-distance migrant	non-forest	tolerant	Richmond Creek
Common Grackle	short-distance migrant	non-forest	attracted	Richmond Creek
Northern Oriole	neotropical migrant	forest edge	tolerant	Richmond Creek
House Finch	permanent resident	forest edge	urban	Richmond Creek
House Sparrow	permanent resident	non-forest	urban	Richmond Creek

species. Two species (10%) were neotropical migrants and two species (10%) were classified as intolerant of human presence.

Although the two study sites have the same number of breeding species, the species composition differs significantly with respect to the habitat ($G = 8.79$, $df = 2$, $P = 0.012$) and human association ($G = 13.36$, $df = 3$, $P = 0.004$) variables. Overall, the Latourette Park site supported a more typical forest community which was significantly less tolerant of human presence than the Richmond Creek bird community. The Richmond Creek site supported more non-forest species and more species attracted to or tolerant of human presence. The sites did not differ significantly with respect to the status variable ($G = 1.80$, $df = 2$, $P = 0.05$), probably because permanent residents comprised 42% of the species nesting at Latourette Park and, even though Richmond Creek supported only two neotropical migrants, 42% of all species nesting there were migrants.

DISCUSSION

In a study of Staten Island breeding birds, Siebenheller (1981) reported the extirpation of several forest species from the island including Black-and-white Warbler, *Mniotilta varia*, American Redstart, *Setophaga ruticilla* and Ovenbird, *Sierus aurocapillus*. Habitat loss and development were cited as probable causes for the loss of these species as breeding birds. Though they regularly occur on the island during migration, apparently habitat of sufficient size or quality for establishment of breeding territories does not exist within the remaining woodlands. Other species, such as Wood Thrush, *Hylocichla mustelina* and Red-eyed Vireo, have experienced declines. Since the publication of that report, residential development on Staten Island has proceeded apace.

The immediate impact of development on Staten Island is the permanent removal of forest habitats and the substitution of residential and edge habitats (see also Aldrich and Coffin 1980). Development also reduces habitat value through incidental impacts such as erosion, sedimentation, pollution and deposition of debris which degrade adjacent wetland and forest habitats. At the Richmond Creek site, development has resulted in substantial fragmentation of the stream corridor by paved roads. The resulting mix of fragmented forest, disturbed areas and landscaped yards probably does not provide the quality of breeding habitat required by many forest species. For example, the Wood Thrush territory at Richmond Creek consisted of fragments of deciduous swamp and disturbed woods. Parts of the territory were separated by paved roads. Nesting success in such a fragmented, urban territory is not likely for this area-sensitive species (Andrle and Carroll 1988, Robbins et al. 1989).

At the same time, this habitat mix is attractive to species that tend to be more tolerant of disturbance to their nesting habitats. Red-winged Blackbird, not typically found in deciduous swamps, was the most abundant species at Richmond Creek. In 1990, four of the seven territorial males used the 0.4-ha emergent marsh. The other three used small patches

of *Phragmites* growing in disturbed areas adjacent to road margins and yards. Both the formation of the cattail marsh and the growth of *Phragmites* are attributable to the development adjacent to the wetland.

Interestingly, Gray Catbird held the same number of territories at both sites. Gray Catbirds apparently can tolerate the proximity of residential development when suitably dense shrub habitat exists. At Richmond Creek, Gray Catbird preferred areas of dense vegetation where wetland shrubs mixed with multiflora rose and greenbrier. In Latourette Park, this species preferred areas of dense understory and greenbrier in regenerating blowdowns or burned areas.

Edge effect.—Although the two study sites are the same size, they have different shapes. Due to its long, narrow shape, the Richmond Creek site has a higher ratio of edge to forest interior than the Latourette Park site. Thus, the high proportion (42%) of non-forest species at Richmond Creek may be partly an edge effect due to plot shape. This plot shape, however, is dictated by the development along the stream corridor. Fifty-five percent of the 18 non-forest and forest-edge species at Richmond Creek were urban residents or species attracted to human presence. At the Latourette Park site, which is affected by a golf course edge on two sides, only 27% of the 15 non-forest and forest-edge species were species attracted to human presence. There were no urban species at the Latourette Park site. The human-oriented nature of the edge at Richmond Creek attracts such species as American Robin, *Turdus migratorius*, Northern Mockingbird, *Mimus polyglottos* and European Starling, which are absent from the Latourette Park plot.

Biogeography.—The importance of forest size for the preservation and management of forest bird communities has been well documented (Ambuel and Temple 1982, 1983; Askins and Philbrick 1987; Galli et al. 1976; Tilghman 1987; Whitcomb 1977; Wilcove 1988). The Staten Island Greenbelt and contiguous, wooded outparcels represent the largest forest area on Staten Island. Results from the Latourette Park breeding bird census indicate that this forest is large enough to provide nesting habitat for some area-sensitive species such as Scarlet Tanager, *Piranga olivacea*, Wood Thrush, Veery, *Catharus fuscescens* and Red-eyed Vireo. The Greenbelt itself, however, is surrounded by development and represents an isolated forest on a true island. The nearest mainland forest of any size lies more than 50 km away in New York or New Jersey. The "island effects" on forest birds are therefore compounded and colonization rates from mainland forests are probably very low. The continued existence of the Veery and the Scarlet Tanager as breeding birds on Staten Island is considered tenuous (Siebenheller 1981). Further development adjacent to the Greenbelt may reduce the regional forest area to such an extent that these species are also extirpated.

The findings of this study confirm that, even in the New York City metropolitan area, large urban woodlands can provide nesting habitat for some of the neotropical-migrant species that have populations in decline. The results also suggest that development that encroaches upon and

degrades forest habitat promotes the proliferation of non-forest species and the urbanization of the forest bird community.

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