

Breeding bird populations from forest to suburbia after thirty-seven years

Resident generalists thrive as migratory forest-interior species disappear

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THE RAPID PACE OF urbanization in the United States during the post-World War II period has wrought profound ecological alterations with resultant modification of birdlife. Few places have witnessed greater and more rapid changes during this period than the countryside around Washington, D.C., and particularly Fairfax County, Virginia, across the Potomac River from the District of Columbia. To better appraise the extent of such transformations in our nation's birdlife numerical studies of breeding bird populations before and after urbanization in a given area are essential.

Fortunately, circumstances have permitted such a comparative study in a mature eastern deciduous forest in 1942 and again 37 years later in the same locality after it had become a well-established residential community. The area studied is immediately south of Lake Barcroft in Fairfax County, Virginia, 8 miles southwest of the White House in Washington, D.C., and 3 miles south of Falls Church, Virginia. Situated near the eastern edge of the Piedmont Plateau, the 95-acre (38.5 hectares) study area ranges from 220 to 360 feet (67 to 110 meters) above sea-level. It extends roughly from near the south shore of Lake Barcroft, formerly the reservoir of the Alexandria, Virginia Water Company, southward to near Columbia Pike (Virginia Route 244). The area was originally bounded by less mature growths chiefly of Scrub Pine (*Pinus virginiana*), Tulip-tree (*Liriodendron tulipifera*) and Black Locust (*Robinia pseudo-acacia*). Today it is continuous with residential development in all directions. Two small streams of fairly constant flow, now largely confined to underground pipes, traverse the area creating a rolling topography.

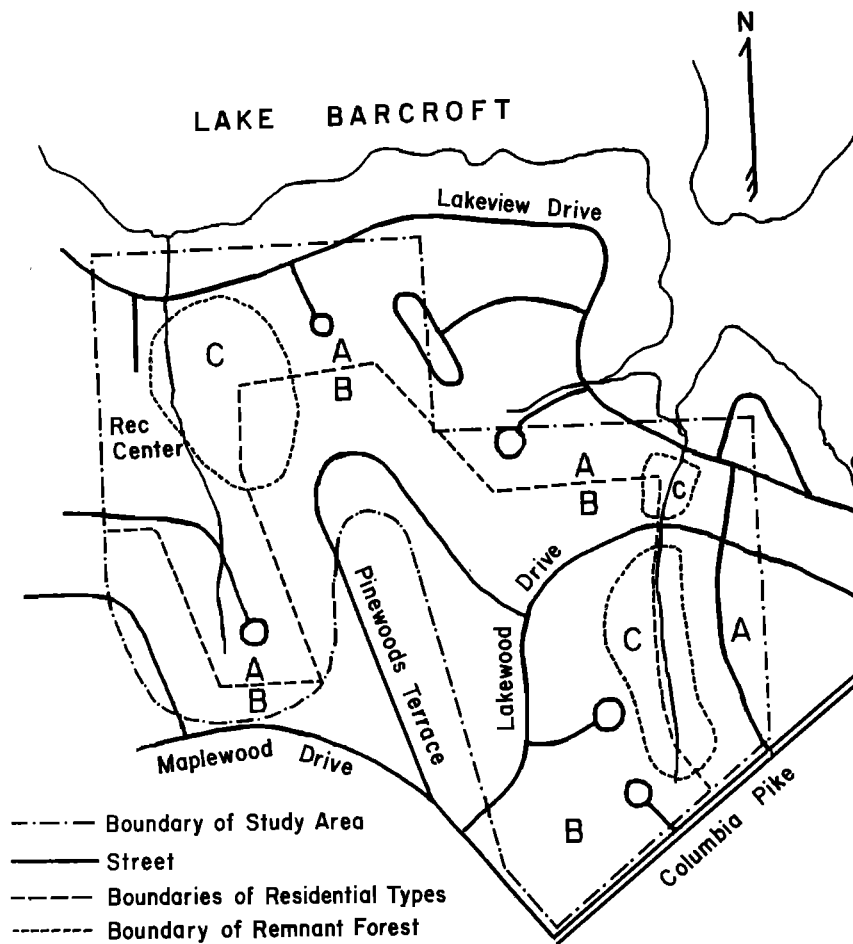
IN 1942, THE FOREST incorporated in the area was quite mature but showed signs of having been selectively lumbered many years previously. Some of the old stumps that were not completely decomposed were immense. Many of the standing trees, particularly White Oaks (*Quercus alba*), were large also. The relative abundance of trees 12 inches (30 cm) or over in diameter at breast height, counted along transects within the study area, was Tulip-tree, 41%; White Oak, 25%; Red Oak (*Q. rubra*), 11%; hickory (sp.), 11%; Chestnut Oak (*Q. prinus*), 7%; others including Black Oak (*Q. velutina*), Scrub Pine, Pitch Pine (*P. rigida*) and Black Cherry (*Prunus serotina*), 5%. Other trees encountered along the transects, but under 12 inches in diameter were Sour Gum, Sycamore, Hornbeam, Ironwood, Black Locust, Black Walnut, Beech, Red Maple and Chinquapin. The Chestnut Oak, White Oak and hickories were most common on the drier ridge tops, while the sycamores were chiefly in stream bottoms. Tulip-trees and Red Oaks occupied the slopes. The most common shrubs were Spicebush and Flowering Dogwood, but Pink Azalea, Mountain Laurel, Maple-leaf Viburnum, American Holly and blueberry (sp.) occurred scatteringly. The ground-cover was predominantly Japanese Honeysuckle and Poison Ivy. Names of trees and shrubs are from Petrides (1958).

Real estate development began in the area around 1950 when use of the reservoir by the water company was discontinued. Today the habitat, besides detached homes along paved streets, is a mixed assortment of trees, shrubbery and lawns characteristic of suburban residential areas. The individual house lots vary considerably in size but average

about 0.5 acres (0.2 hectares) throughout.

However, the study area is about equally divided between sections characterized by lots with relatively more lawn and lesser amounts of trees and shrubbery (Area B, Fig. 1), and sections with relatively more woody vegetation, particularly of larger trees remaining from the original forest (Area A, Fig. 1). The large original trees make up a substantial part of the present landscaping and are in approximately the same proportion of species as in 1942, judging from the sample counts of large trees visible from the streets. Of the original understorey, some Mountain Laurel and Flowering Dogwood has been retained. Three discontinuous, small and considerably disturbed remnants of the original forest totaling about 10 acres (4 hectares), still survive, chiefly along the streams (Fig. 1). These have suffered from cutting and windfall of large trees and reduction of undergrowth and ground-cover by trampling and erosion. Other vegetation at present includes a large variety of evergreen and deciduous ornamental trees and shrubs. On the whole the present cultivated undergrowth is much more evergreen in character and has more berry-bearing varieties now than in the 1942 forest. Vegetation throughout is changing little at present. New development in 1979 was minimal with only two houses under construction in Section A during the census period.

THE FIRST BREEDING bird population count on our study area was made on 17 trips from March 26 to July 16, inclusive, 1942, by the senior author and Allen J. Duvall (Aldrich 1942). The second study was conducted on 8 trips from May 5 to June 12, inclusive, 1979, by the present authors. Breeding territories of



A = Less lawn, more wooded
 B = More lawn, less wooded
 C = Remnant Forest

1 inch (25mm) = 533 feet (162 meters)
 Size of Total Area 95 acres (38.4 hectares)

Figure 1. Lake Barcroft Study Area in 1979

birds in both 1942 and 1979 were estimated by the "Williams spot-mapping method" (Williams 1936; Kendeligh 1944) which has been employed in annual breeding bird censuses reported in *Audubon Field Notes* and its successor *American Birds*. Numbers of breeding territories for each species estimated in both 1942 and 1979 are shown in Table 1. A value of 0.5 was given to a territory in which half or more of the recorded observations were outside the boundaries of the study area, but the totals in the table have been rounded to the next highest whole numbers.

In our current study we have recorded 29 species breeding in the old study area, now chiefly residential landscape. The

number of species in the 1942 forest was 23. The main difference in the birdlife in the two periods is not so much total numbers of species and individual territories, although these are considerable, as it is in the species that have been lost, as well as those gained; and the comparative numbers of those species which were present in both periods. Gone completely as nesters are the formerly abundant Red-eyed Vireo, Ovenbird and Scarlet Tanager, while the previously very common Wood Thrush was represented in 1979 by only two territories. The places of the more numerous forest species of 1942 are now taken by Blue Jays, Mockingbirds, Starlings, Cardinals and Song Sparrows. Also numerous now



Figure 2. Habitat types in Lake Barcroft study area. a. Residential type A.



b. Residential type B.



c. Remnant forest. Photos/J. W. Aldrich

are Gray Catbirds, American Robins and House Sparrows which were totally absent in the area in 1942. Other typical forest birds formerly present and now lacking are Acadian Flycatcher, Eastern Wood Pewee, Yellow-throated Vireo, Worm-eating Warbler, Hooded Warbler, and Louisiana Waterthrush. Species that were approximately equally common in 1979 and 1942 are Yellow-billed Cuckoo, Red-bellied Woodpecker, White-breasted Nuthatch and Carolina Wren.

SURPRISING WAS THE total lack of breeding of the predominant deciduous forest nesters such as the Eastern Wood Pewee, Red-eyed Vireo, Ovenbird,

Hooded Warbler and Scarlet Tanager. Evidently the few small, discontinuous and considerably disturbed remnants of original forest, together with the more heavily wooded house lots were inadequate to support even a single pair of the more specialized forest species. It should be noted in this connection, however, that Briggs and Criswell (1979) have shown a marked decline in the Washington, D.C. region in all deciduous forest breeding species that migrate to the tropics, while permanent resident species have remained constant or have increased. We have found that a decline in the more common tropical migrants breeding in the Eastern Deciduous Forest of Maryland, Virginia and the District of Columbia is indicated by comparison of breeding bird censuses published in *Audubon Field Notes* and *American Birds* before 1951 and after 1971. Those data show an overall decrease in the more common tropical migrants of about 26% and particularly in the case of the Acadian Flycatcher, Yellow-throated Vireo, Red-eyed Vireo, Ovenbird and Hooded Warbler. On the other hand those data show an increase in the Wood Thrush and Scarlet Tanager and no change in the Eastern Wood Pewee and American Redstart. An apparent overall decline in the tropical migrants, in part, may be responsible for the failure of those same species, so common in 1942, to breed in the more heavily wooded sections at Lake Barcroft in 1979. However, the fact that a few Eastern Wood Pewees, Red-eyed Vireos and Scarlet Tanagers did appear in the area in 1979 but failed to stay and breed makes it appear that environmental changes in the area and surrounding region were primarily responsible for lack of breeding there. It is becoming more and more apparent that not only is a certain type of habitat necessary for the breeding of certain species but that there is a minimum size of isolated areas of such habitat that will support even one pair of that species (MacClintock *et al.* 1977). This principle is being investigated more intensively by others (Chandler Robbins, pers. comm.).

A review of breeding bird population censuses of suburban residential areas which were conducted in the eastern United States and southeastern Canada published in *American Birds* from 1971 to 1979 inclusive, shows a remarkable similarity in the more common species. Among the 11 most common species in 13 censuses of breeding birds in suburban residential habitats, 9 were the

Table 1. Breeding Birds of Deciduous Forest Compared with Suburban Residential Habitats at Lake Barcroft, Fairfax County, Virginia in a 95-acre (38.4 hectare) Study Area

<i>Deciduous Forest</i> 1942	1942 Breeding Territories	<i>Territories</i> per 100a/100 ha	<i>Suburban</i> <i>Residential</i> 1979	1979 Breeding Territories	<i>Territories</i> per 100a/100 ha
Red-eyed Vireo	42	44/111	Cardinal	38	40/100
Ovenbird	36	38/95	Mockingbird	20	21/53
Wood Thrush	31	33/82	Song Sparrow	20	21/53
Scarlet Tanager	15	16/39	Blue Jay	18	19/47
Hooded Warbler	12	13/32	Starling	17	18/45
Acadian Flycatcher	6	6/16	Gray Catbird	17	18/45
Eastern Wood Pewee	6	6/16	American Robin	16	17/42
Red-bellied Woodpecker	5	5/13	House Sparrow	16	17/42
Blue Jay	5	5/13	Mourning Dove	15	16/39
Cardinal	5	5/13	Carolina Chickadee	13	14/34
Great Crested Flycatcher	4	4/11	Tufted Titmouse	11	12/29
Downy Woodpecker	3	3/8	Downy Woodpecker	7	7/18
Tufted Titmouse	3	3/8	Common Grackle	7	7/18
Common Crow	2	2/5	Common Crow	6	6/16
White-breasted Nuthatch	2	2/5	Brown-headed Cowbird	6	6/16
Carolina Wren	2	2/5	Common Flicker	5	5/13
Worm-eating Warbler	2	2/5	Red-bellied Woodpecker	5	5/13
Red-tailed Hawk	1	1/3	Barn Swallow	4	4/11
Yellow-billed Cuckoo	1	1/3	Chimney Swift	3	3/8
Mourning Dove	1	1/3	White-breasted Nuthatch	3	3/8
Yellow-throated Vireo	1	1/3	House Finch	3	3/8
Louisiana Waterthrush	1	1/3	Great Crested Flycatcher	2	2/5
Rufous-sided Towhee	1	1/3	House Wren	2	2/5
			Carolina Wren	2	2/5
			Wood Thrush	2	2/5
			American Redstart	2	2/5
			Rock Dove	1	1/3
			Yellow-billed Cuckoo	1	1/3
			Hairy Woodpecker	1	1/3
Total 23 species	187	195/492	Total 29 species	263	277/692

leading species at Lake Barcroft. The comparative abundance of those species is shown in Table 3. Although the species' occurrence was similar in the two lists, the relative abundance varied considerably. The larger numbers of Mockingbirds and Cardinals in the Lake Barcroft census reflected the relatively more southern location of that area, while the lesser abundance of the American Robin, House Sparrow and Common Grackle, and total absence of the Chipping Sparrow, probably was the result of the relatively more wooded character of the Lake Barcroft environment than the average for residential areas covered by the reported censuses.

One of the most characteristic suburban birds of the eastern United States now is the Mockingbird which has been expanding its range rapidly in the past 50 years. Although second in abundance, together with the Song Sparrow, in our Lake Barcroft area in 1979, the species was almost unknown in the Washington, D.C. region before the turn of the century (Coues and Prentiss 1862, 1883), and the Mockingbird did not begin to increase there until around 1905 (Cook 1929).

OUR STUDY AREA IS comprised of two different types of properties — one with less wooded lots, with relatively more lawn area and another type with more heavily wooded surroundings. These two habitats, shown as Sections B and A (Figs. 1 and 2) occur in about equal amounts in the study area (52% in Section B and 48% in Section A). A recreation area of about 4 acres with swimming pools and tennis courts is included in Section A. A tendency toward partial separation of the breeding territories of bird species into these two types of habitat is indicated in Table 2. The totals in Table 2 are slightly different in some species from the totals in Table 1, because full value is given in Table 2 to territories which overlap the study area boundaries, whereas in Table 1 the territories are given a value of only 0.5 if at least half of the records are outside. Rock Doves, Mockingbirds, American Robins, Starlings, House Sparrows, and House Finches seem relatively more numerous in the communities with more lawn and less woody vegetation, as do possibly the Common Flicker and House Wren. The Carolina Wren and Common Grackle seem to occur in equal abun-

Table 2. Abundance of Birds by Residential Types

[All territories are given full unit value even though they overlap the boundaries of the study area.]

	<i>Territories per 100a Area A (about 45.6a) More Wooded Lots</i>	<i>Territories per 100a Area B (about 49.4a) Less Wooded Lots</i>
Cardinal	22/48	17/34
Song Sparrow	11/24	10/20
Mockingbird	8/18	13/26
Starling	8/18	10/20
Blue Jay	11/24	7/14
Gray Catbird	12/26	5/10
American Robin	7/15	10/20
House Sparrow	7/15	10/20
Mourning Dove	10/22	7/14
Carolina Chickadee	8/18	5/10
Tufted Titmouse	7/15	5/10
Common Grackle	4/9	4/8
Downy Woodpecker	4/9	3/6
Brown-headed Cowbird	4/9	2/4
Red-bellied Woodpecker	4/9	1/2
Common Crow	4/9	3/6
Common Flicker	2/4	3/6
House Finch	0/0	3/6
Chimney Swift	2/4	1/2
Barn Swallow	3/7	1/2
Great Crested Flycatcher	2/4	0/0
White-breasted Nuthatch	3/7	0/0
Carolina Wren	1/2	1/2
Wood Thrush	2/4	0/0
House Wren	1/2	2/4
American Redstart	2/4	0/0
Yellow-billed Cuckoo	1/2	0/0
Hairy Woodpecker	1/2	0/0
Rock Dove	0/0	1/2
Totals	151/331	124/251

dance in both types. The remaining species seem to favor habitats with more trees and shrubbery. The considerable overlap in species occurring in the two types of real estate is probably because both incorporate portions of the remnant forest. A greater diversity of species in residential areas in which original trees were preserved was also noted by Geis (1976).

Possibly the most significant finding of the study was the relative number of species and total territories of all species in the mature natural forest compared with suburban residential habitats. There were actually six more species and 68 more territories of combined species in the 1979 suburban habitats than in the same area of natural deciduous forest habitat of 1942. The finding of a larger total breeding bird population after urbanization agrees with that of Geis (1974, 1975, 1976); Pitelka (1942); Graber and Graber (1963); Ertz (1966); Woolfenden and Rohwer (1969); Emlen (1974); and Huhtalo and Järvinen (1977); but the apparent increase in species diversity at Lake Barcroft is contrary to conclusions of the above authors except Pitelka (1942), who found an increase in diversity in a coastal California residential com-

munity compared with the depauperate population of surrounding grassland and sand dunes. The reason for the discrepancy between our finding of greater species diversity in the Lake Barcroft suburban residential area and that in most other similar areas studied may be that our present population is compared with that of a single, relatively uniform

Table 3. More Common Suburban Residential Breeding Birds in Southern Ontario, Massachusetts, New Jersey, District of Columbia, North Carolina, Ohio and Indiana¹ Compared with those at Lake Barcroft, Virginia²

	<i>American Birds Censuses</i>	<i>Lake Barcroft Census 1979</i>
House Sparrow	29 ³	15 ³
American Robin	18	15
Common Grackle	15	7
Starling	14	17
Mourning Dove	8	14
Cardinal	7	37
Song Sparrow	7	20
Blue Jay	4	17
Gray Catbird	4	16
Chipping Sparrow	4	0
Mockingbird	3	19
Totals	113	177

¹13 censuses in *American Birds* 1971 to 1979, ²1979 census in present study, ³Territories per 100 acres.

former deciduous forest type while all others appear to be compared with a diversity of natural habitats adjoining the urbanized areas. Furthermore, it is possible that an initial increase in diversity by suburbanization may be followed eventually by a decrease following further progress toward urbanization, with resultant decrease in diversity of vegetation.

CONSERVATIONISTS MIGHT be encouraged by the evidence of increase in total numbers of birds from urbanization to conclude that real estate developments are beneficial to wildlife and, in this respect, should not be considered undesirable replacements of native wild lands. Such a conclusion, of course, involves the relative values placed on different species. With current trends in land use, which are unlikely to change in the immediate future, we may expect to have more Blue Jays, Mockingbirds, Gray Catbirds, American Robins, Cardinals and Song Sparrows, as well as Starlings and House Sparrows, but it will be at the expense of Wood Thrushes, Red-eyed Vireos, Ovenbirds, Scarlet Tanagers and other birds characteristic of the deciduous forests of eastern North America. If we want both groups of species we must make certain that sufficiently large and undisturbed areas of the natural habitats are preserved to support the breeding of those specialized species that are dependent upon them. To do this we must know much more about critical amounts and geographical distribution of particular habitats that are required by individual species.

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References

ALDRICH, J. W. 1942. Report on the breeding bird population of an oak-tulip woodland in northeastern Virginia. Unpublished report in the files of the U.S. Fish and Wildlife Service, Washington, D.C.

BRIGGS, S. A. and J. W. CRISWELL. 1979. Gradual silencing of spring in Washington. Selective reduction in species of birds found in three woodland areas over the past thirty years. Audubon Naturalists Society — who we are, what we have done. Aug. 1979:9-26.

COUES, E. and D. W. PRENTISS. 1862. List of birds ascertained to inhabit the District of Columbia, with the times of arrival and departure of such as are non-residents and brief notices of habits, etc. 16th Ann. Rep.

Smithsonian Inst. 1861(1862):399-421.

COUES, E. and D. W. PRENTISS. 1883. Avifauna Columbiana: being a list of birds ascertained to inhabit the District of Columbia. *Bul. 26 U.S. Nat. Mus.* 133 pp.

COOKE, M. T. 1929. Birds of the Washington, D.C. region. *Proc. Biol. Soc. Wash.* 42: 1-80.

EMLEN, J. T. 1974. An urban bird community in Tucson, Arizona: deprivation, structure, regulation. *Condor* 76:184-197.

ERTZ, W. 1966. Ecological principles in the urbanization of birds. *Ostrich Suppl.* 6: 357-363.

GEIS, A. D. 1974. Effects of urbanization and type of urban development on bird populations. In *Wildlife in an urbanizing environment*. J. Noyes and D. Progulski, Eds. Univ. Mass. pp. 97-105.

_____. 1975. Urban planning and urban wildlife. A case study of a planned city near Washington, D.C. *Proc. Symposium at University of Guelph, May 26 to May 30, 1975*. Pub. Office of Continuing Education, U. of Guelph, Ontario.

_____. 1976. Bird populations in a new town. *Atl. Nat.* 31(4):141-146.

GRABER, R. R. and J. W. GRABER. 1963. A comparative study of bird populations in Illinois 1906-1909 and 1956-1958. *Bull. Ill. Nat. Hist. Surv.* 28:383-528.

HUHTALO, H. and O. JÄRVINEN. 1977. Quantitative composition of the urban bird community in Tornino, Northern Finland. *Bird Study* 24:179-185.

KENDEIGH, S. C. 1944. Measurement of bird populations. *Ecol. Monog.* 14:67-106.

MACCLINTOCK, L., R. F. WHITCOMB, and B. L. WHITCOMB. 1977. II. Evidence for the value of corridors and minimization of isolation in preservation of biotic diversity. *Am. Birds* 31:6-12.

PETRIDES, G. A. 1958. A field guide to the trees and shrubs. Boston, Houghton Mifflin Co. 431 pp.

PITELKA, F. A. 1942. High population of breeding birds within an artificial habitat. *Condor* 44:172-174.

WILLIAMS, A. B. 1936. The composition and dynamics of a beech-maple climax community. *Ecol. Monog.* 6:317-408.

WOOLFENDEN, G. E. and S. A. ROHWER. 1969. Breeding birds in a Florida suburb. *Bull. Florida State Mus.* 13:1-83.



White-breasted Nuthatch/drawing by James E. Coe.