Urban Ecology, 9 (1986) 399—412
Elsevier Science Publishers B.V., Amsterdam — Printed in The Netherlands

AVIAN GUILD STRUCTURE AND HABITAT ASSOCIATIONS IN SUBURBAN BIRD COMMUNITIES

RICHARD M. DeGRAAF[1] and JAMES M. WENTWORTH[2]
[1] *Northeastern Forest Experiment Station, USDA Forest Service, University of Massachusetts, Amherst, MA 01003 (U.S.A.)*
[2] *School of Forest Resources, University of Georgia, Athens, GA 30602 (U.S.A.)*
(Accepted 24 April 1985)

ABSTRACT

DeGraaf, R.M. and Wentworth, J.M., 1986. Avian guild structure and habitat associations in suburban bird communities. *Urban Ecol.*, 9: 399—412.

Breeding bird communities were compared in three suburbs: a 70-year-old area of large houses along streets shaded by mature trees (MT), primarily oaks (*Quercus*) and elms (*Ulmus*); a 15-year-old area built upon open agricultural land with young maple (*Acer*) street trees (YT); and a 15-year-old area on which houses were built in small clearings within a second-growth oak-pine (*Quercus—Pinus*) woodland (OP). Bird censuses each year for 5 years revealed that YT supported the lowest total avian density of the three suburbs; OP supported the greatest variety and total density of insectivores, and the lowest number of ground-gleaning omnivores; and MT supported the highest total avian density, comprised primarily of ground-foraging seed eaters and omnivores. Among nesting guilds, OP contained the fewest ground/herb nesters, and MT the most. Also, OP had the fewest shrub nesters, and MT the most. Tree cavity and twig nesters were significantly more numerous in OP, and tree branch nesters fewer in YT than in either OP or MT. Analyses of habitat structure revealed that shrub maturity is more important than numbers of shrubs, and that planted trees, no matter how mature or abundant, do not replace natural forest stands as habitat for most insectivorous species.

INTRODUCTION

Suburbs have replaced former forest and agricultural land in many regions. Birdlife in the suburbs, in many respects quite different than that of more rural environments, still provides a rich recreational and biological resource. Birds are ideal wild inhabitants of residential areas because they are colorful and they add song and movement to our environs while posing few nuisance problems.

Most studies of the birdlife or urban and/or suburban habitats imply a comparison with rural or natural habitats and tend to group urban or suburban habitats into one habitat type. But suburbs are not alike. They vary greatly in housing density, architectural style, and the amount and kinds of vegetation that they contain.

0304-4009/86/$03.50

The avifaunas of several North American and European cities have been described, and the general effects of urbanization on birds have been reported. Urban areas tend to have very high densities of a relatively few species (Erz, 1966; Lancaster and Rees, 1979; Jones, 1981); ground-nesting or native cavity-nesting species are usually absent (Geis, 1974; DeGraaf, 1978). In North America, the breeding populations of insectivorous neotropical migratory species decline with urbanization (Walcott, 1974), and starlings (*Sturnus vulgaris*), house sparrows (*Passer domesticus*) and rock doves (*Columba livia*) dominate city avifaunas. Indeed, such seed eaters and ground foraging omnivores seem to fare well in cities everywhere (Emlen, 1974). In sum, urban and rural or 'natural' bird habitats have been compared and dramatic differences shown.

Suburbs generally represent a middle habitat condition between natural and urban environs, and have great potential for containing quite varied bird communities. Our purpose is to describe several types of suburbs in terms of relative habitat values for birds.

We discuss the breeding bird communities in three kinds of suburbs that are typical of those found in southern New England and elsewhere in the northeastern United States. Bird communities are described in functional terms — guilds — which are groups of species that use environmental resources in similar ways. We will discuss the three types of suburbs in terms of their habitat differences for avian foraging and nesting guilds. Such information is useful in order to design residential areas that are more interesting for their residents.

STUDY AREAS

Three types of suburban neighborhoods were selected in Amherst (pop. 25 000), a university town in western Massachusetts. Each area was visually homogeneous; all were comprised of single-family dwellings on lots of 0.5—1.0 ha.

The oldest area was built about 70 years ago on open land, and now consists of large houses along streets shaded by mature trees (MT). Lawns are of moderate size; mature trees and shrubs characterize the landscape (Fig. 1). Street trees are large, and include pin oak (*Quercus palustris*), American elm (*Ulmus americana*) and sugar maple (*Acer saccharum*).

The second area was a relatively new suburb built in the mid-1960's on open land from which an old apple orchard had been cleared (Fig. 2). The landscape is quite open and exposed; lawns occupy most of the lots, and shrubs and trees are small (YT). The few tall trees are fast-growing varieties, such as silver maple (*A. saccharinum*) and Lombardy poplar (*Populus italica*). Street trees, still small, are primarily Norway maple (*Acer platanoides*).

The third area was also built in the mid-1960's, but differed greatly from YT in that houses were built in a second-growth oak-pine woodland (OP).

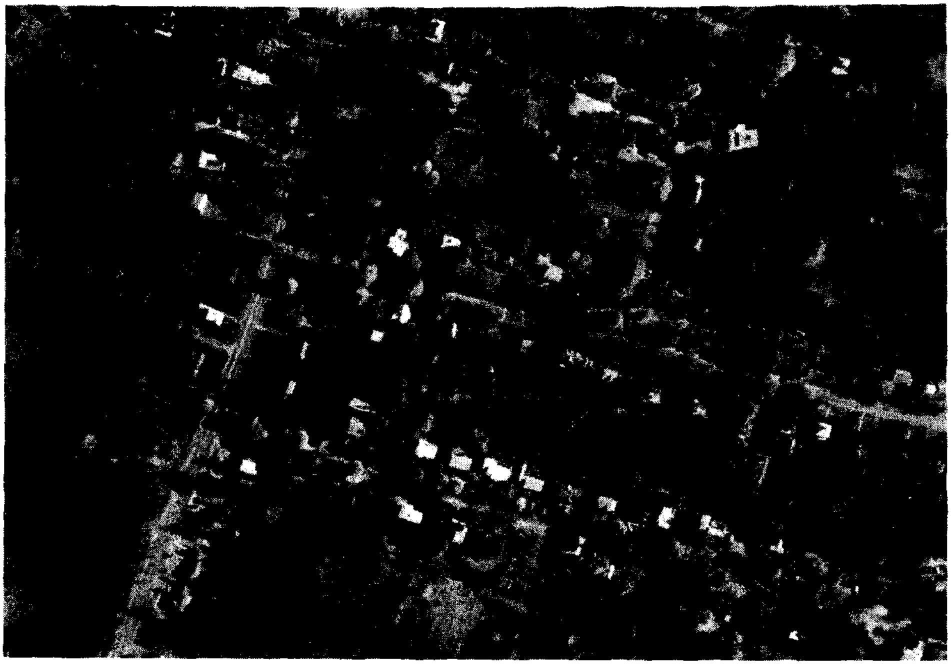

Fig. 1. Aerial view of study area MT — Amherst, MA (scale = 1:4800).

Fig. 2. Aerial view of study area YT — Amherst, MA (scale = 1:4800).

Fig. 3. Aerial view of study area OP — Amherst, MA (scale = 1:4800).

Dominant tree species are red oak (*Q. rubrum*), black oak (*Q. velutina*), red maple (*A. rubrum*), and white pine (*Pinus strobus*). Small clearings were made for the houses; lawns are small and landscaping typically involves foundation plantings. The general appearance is one of houses in a park-like, uneven-aged forest, with forest litter and small lawns comprising the ground cover (Fig. 3).

METHODS

Birds were counted during each June from 1975 to 1979. Twenty contiguous 1-ha plots, centered along streets, were established in each suburb. Ten counts (one per day) of singing males were made on each plot by walking a 100-m street transect in 3 min. Start times and locations were randomized and counts were conducted between 05:30—08:30 EDT on clear, calm mornings. Plots were delineated on large-scale (1:4800) aerial photographs that were carried during counts for use in determining bird locations.

Vegetation measurements included the diameter breast height (d.b.h.), total height, and height to crown of all deciduous and coniferous trees, height of coniferous and deciduous shrubs, and the areas of lawn and herbaceous growth on each 1-ha plot. Tree heights were measured with an altimeter; heights to the bottoms of tree crowns and of shrubs were measured with a range pole. Number of dwellings and distance from plot centers to the edge of the nearest woodlot at least 0.5 ha in size were measured on aerial photographs (scale = 1:4800). Values for 22 habitat components were derived from these field measurements. Values were calculated for deciduous and coniferous tree and shrub densities, numbers of tree and shrub species, and coniferous:deciduous ratios for trees and shrubs.

Avian communities here are decribed in terms of their species compositions and guild structures. Guilds are functional groups of species with similar habitat use patterns (Salt, 1953; Root, 1967; Holmes et al., 1979). For this analysis, we used a three-digit foraging classification similar to Willson's (1974) classification: Primary Food Habit is described as (1) seed eater, (2) frugivore, (3) insectivore, (4) omnivore, (5) carnivore; Foraging Substrate is described as (1) bark, (2) ground, (3) lower foliage/branch, (4) upper foliage/branch, (5) air, (6) water; Foraging Behavior is described as (1) bark excavator, (2) gleaner, (3) forager, (4) sallier, (5) screener, (6) hover-gleaner, (7) wader, (8) hawker. Thus, a three-digit code describes a species major food-foraging substrate and feeding behavior.

TABLE I

Ranked means of habitat values in three subdivisions

Habitat Variable	MT	YT	OP	Significance[a]
Deciduous tree DBH (TDDIAM)	1	3	2	**
Deciduous tree height (TDHT)	1	2	1	**
Deciduous tree height to crown (TDHTC)	2	3	1	**
No. deciduous trees (TDNUM)	2	3	1	**
Coniferous tree (DBH (TCDIAM)	1	3	2	**
Coniferous tree height (TCHT)	1	2	1	**
Coniferous tree height to crown (TCHTC)	2	3	1	**
No. coniferous trees (TCNUM)	2	3	1	**
Deciduous shrub height (SDHT)	—[b]	—	—	—
No. deciduous shrubs (SDNUM)	1	3	2	**
Coniferous shrub height (SCHT)	—	—	—	—
No. coniferous shrubs (SCNUM)	1	3	2	**
Coniferous:deciduous tree ratio (TCDRATI)	—	—	—	—
Coniferous:deciduous shrub ratio (SCDRATI)	2	1, 2	1	*
Area of 'weedy' growth (AHERB)	1	2	2	**
Area of lawn (AMOW)	2	1	3	**
No. dwellings (NHOMES)	—	—	—	—
Woodlot distance (WOODLOT)	1	2	3	**
No. tree species (NSPT)	1	2	3	**
No. shrub species (NSPS)	1	2	1	**
Total number of trees (TTNUM)	2	3	1	**
Total number of shrubs (RSNUM)	1	2	1	**

[a] Significance levels: (Duncan's new multiple range test) *, $P \leqslant 0.05$; **, $P \leqslant 0.01$.
[b] Blank lines indicate no significant differences among suburbs.

We also used a six-category nesting guild classification: (1) ground/herb, (2) shrub, (3) tree twig, (4) tree branch, (5) tree cavity/crevice, (6) building.

RESULTS

We found 64 bird species in the breeding season over all three subdivisions. Species numbers were virtually identical in each: MT and OP each contained 48 species, and YT contained 47. But the avian habitats of the three suburbs were structurally different and their avifaunas varied greatly.

Habitat structure. YT had the lowest values for all measured tree and shrub variables, the smallest area of herbaceous or 'weedy' growth, and the largest area of mowed lawn (Table I). By contrast, the most wooded suburb, OP, contained the highest values for tree density, mean height to tree crown, density of coniferous shrubs, and shrub species richness, and the lowest area of mowed lawn. Not surprisingly, it also had the lowest mean distance from plot centers to the nearest woodlot. MT contained the largest trees, both deciduous and coniferous, the greatest tree species richness, and the greatest area of herbaceous or weedy growth. MT was intermediate in terms of both tree density and area of mowed lawn.

TABLE II

Mean densities of breeding birds in three subdivisions — Amherst, MA, 1975—79

Species	Guild		Breeding density (pairs per 40 ha)[a]			Significance[b]
	Foraging	Nesting	MT	YT	OP	
Green-backed Heron	567	2		0.04		
Ring-necked Pheasant	432	1	0.04			
Mourning Dove	123	4	12.16a	3.96c	8.32b	**
Yellow-billed Cuckoo	332	4	0.04	0.12	0.04	
Ruby-throated Hummingbird	436	4	0.08		0.04	
Downy Woodpecker	312	5	0.68b	0.24b	1.84a	**
Hairy Woodpecker	312	5	0.24b		0.96a	*
Northern Flicker	322	5	1.00a	0.16b	1.12a	**
Pileated Woodpecker	312	5			0.36a	*
Eastern Wood-Pewee	354	4	0.08b	0.12b	3.32a	**
Least Flycatcher	354	4		0.04		
Eastern Phoebe	354	6	0.20b	0.12b	2.60a	**
Great Crested Flycatcher	354	5	b	0.12b	4.08a	**
Eastern Kingbird	354	3	0.12b	0.72a	0.12b	*
Tree Swallow	355	5	0.16ab	0.48a	b	
Barn Swallow	355	6	b	0.68a	b	*
Blue Jay	423	4	21.08b	3.72c	26.16a	**
American Crow	423	4	1.24a	0.32b	0.76ab	
Black-capped Chickadee	332	5	5.32b	0.88c	12.08a	**

TABLE II *(continued)*

Species	Guild		Breeding density (pairs per 40 ha)[a]			Significance[b]
	Foraging	Nesting	MT	YT	OP	
Tufted Titmouse	332	5	0.60b	0.08b	3.80a	**
Red-breasted Nuthatch	312	5	0.52a	b	0.32ab	
White-breasted Nuthatch	312	5	0.88b	0.23b	5.92a	**
Brown Creeper	312	5	0.08			
House Wren	332	5	14.44a	2.96b	6.76b	**
Winter Wren	332	5	0.04			
Blue-gray Gnatcatcher	342	4			0.04	
Swainson's Thrush	322	3	0.08			
Hermit Thrush	322	1			0.08	
Wood Thrush	423	4	3.12b	0.16c	8.28a	**
American Robin	423	4	50.44a	18.36c	38.24b	**
Gray Catbird	423	2	12.04a	2.88b	4.12b	**
Northern Mockingbird	423	2	0.84b	9.08a	0.12b	**
Brown Thrasher	423	2	0.12	0.16	0.04	
Cedar Waxwing	243	3	0.06	0.08	0.20	
European Starling	423	6	41.44a	28.64b	13.60c	**
Solitary Vireo	342	3		0.12		
Warbling Vireo	342	3			0.08	
Red-eyed Vireo	332	3	1.32b	0.36b	3.96a	**
Blue-winged Warbler	332	1	0.28	0.04		
Yellow Warbler	332	2	0.48	0.64		
Yellow-rumped Warbler	332	1			0.08	
Blackpoll Warbler	332	4	0.20a	b	0.08ab	*
Black-and-white Warbler	312	1			0.96a	**
American Redstart	332	3	0.24	0.04	0.24	
Ovenbird	322	1			0.24	
Common Yellowthroat	332	1	0.88b	2.12a	b	**
Scarlet Tanager	342	3	0.36b	0.16b	1.28a	**
Cardinal	423	2	14.28a	1.68b	0.56b	**
Rose-breasted Grosbeak	433	3	0.20	0.04	0.16	
Indigo Bunting	332	1		0.12	0.12	
Rufous-sided Towhee	423	1	0.04b	b	0.68a	**
Chipping Sparrow	423	2	2.00b	7.64a	4.88ab	**
Field Sparrow	423	1	0.04			
Song Sparrow	423	1	8.96	12.76	0.24	**
Swamp Sparrow	322	1	0.04	0.04		
Red-winged Blackbird	423	2	b	1.52ab	0.84a	*
Eastern Meadowlark	322	1		0.08		
Common Grackle	423	4	8.20b	23.44a	7.16b	**
Brown-headed Cowbird	123	4	0.20	0.20	0.28	
Northern Oriole	443	3	1.08b	1.44b	9.36a	**
Purple Finch	423	3		0.04		
House Finch	423	3	4.16a	2.04b	0.04c	**
American Goldfinch	423	2	1.60	1.80	0.76	
House Sparrow	123	6	14.52a	7.32b	5.40b	*

[a] Values followed by different letters are significantly different ($P < 0.05$).
[b] Significance levels (analysis of variance): *, $P < 0.05$; **, $P < 0.001$.

Foraging guilds. Each of the suburbs supported twelve foraging guilds and had nearly identical species richness values: MT and OP contained 48 species; YT 47 species, but the avifaunas were quite different (Table II.) The densities of nine of the twelve foraging guilds differed significantly among the three suburban habitats (Fig. 4). These differences reflect differences in the habitat structure of each suburb.

The lowest total avian density of the three subdivisions occurred in YT. YT supported the highest density of insectivorous air screeners, comprised of barn and tree swallows, significantly ($P < 0.05$) more than OP. YT con-

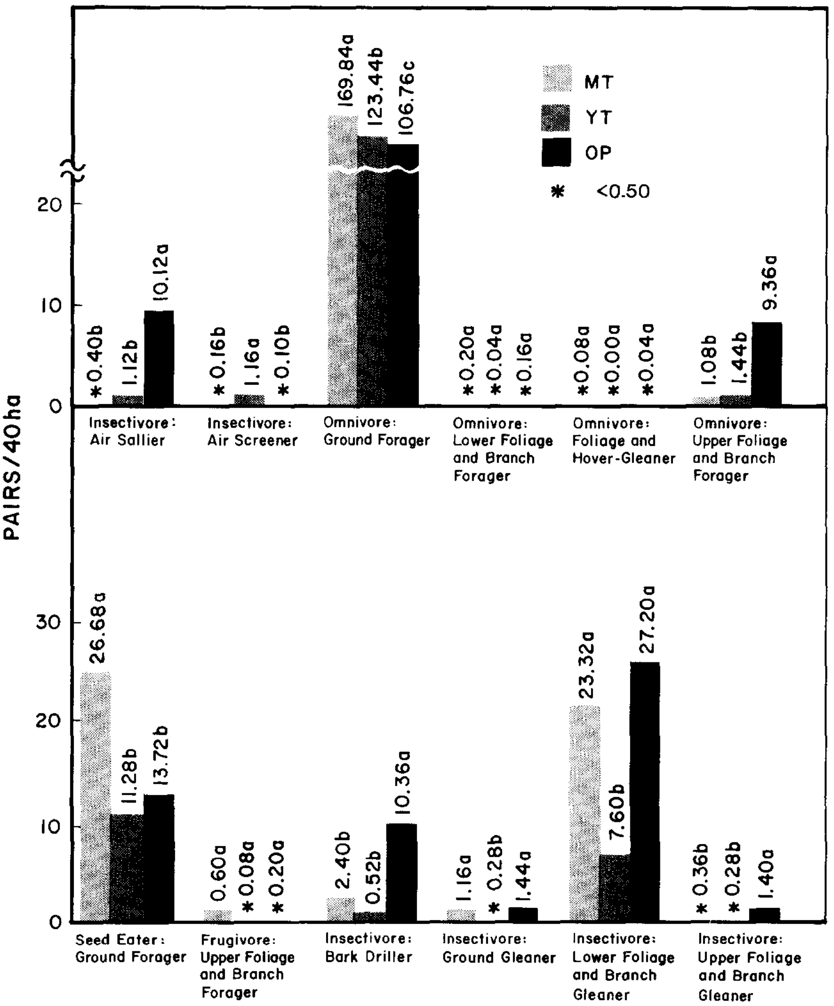

Fig. 4. Foraging guild composition in three suburb types. Values followed by different letters differ at the 0.05 level. Values too small to be illustrated are indicated by an asterisk.

tained the fewest insectivorous ground gleaners and lower foliage branch gleaners (Table II).

MT supported the highest total avian density of the three suburbs. Significantly greater ($P < 0.01$) numbers of seed eating and omnivorous ground foragers occurred there. Species accounting for these differences included mourning dove and house sparrow among seed eaters, and American robin, European starling, gray catbird, and cardinal among omnivores (Table II).

Intermediate in total avian density, OP supported the greatest number of insectivores: bark drillers, ground gleaners, upper foliage/branch gleaners, and air salliers. Insectivores occurred at a total density of 50.52 breeding pairs per 40 ha, or 35% of the total avian density. This is more than 5 times than of YT, and almost 2 times that of MT.

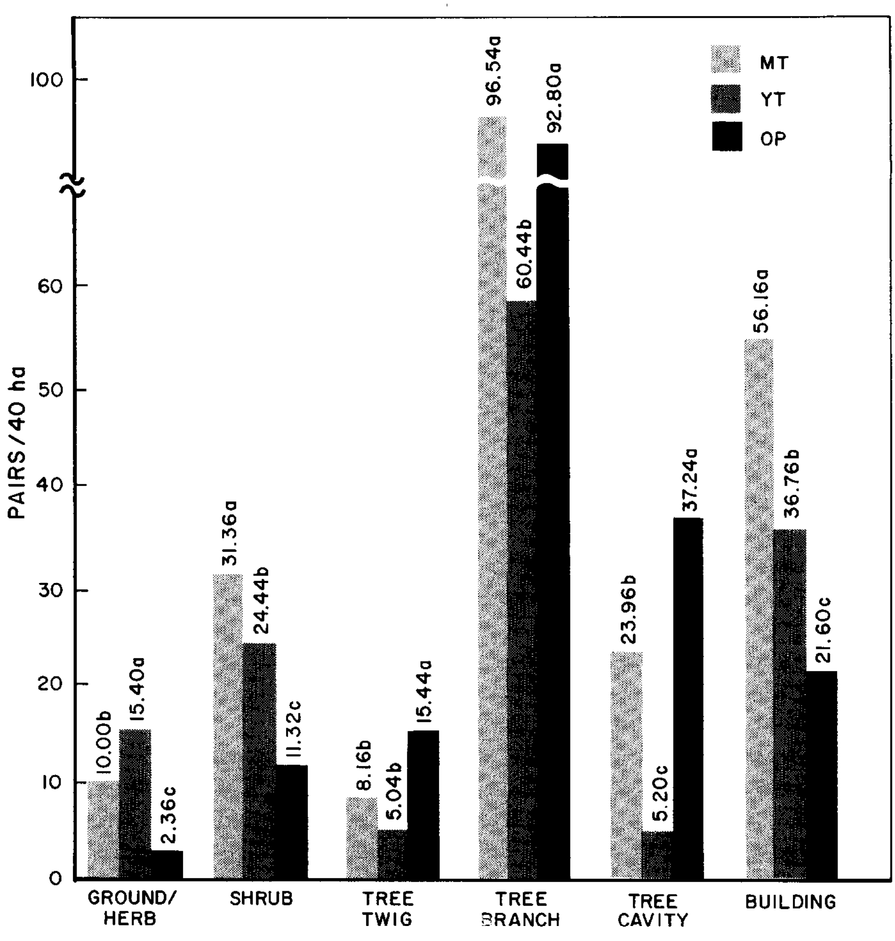

Fig. 5. Nesting guild composition in three suburb types.

Nesting guilds. Significant ($P < 0.01$) differences in the distributions of all six nesting guilds occurred among the suburban habitats. Ground/herb nesters differed among all habitats, with OP having the fewest and YT the most. Shrub nesters and those nesting on buildings likewise differed among all three habitats; in both situations, OP supported the fewest and MT the most. Tree cavity nesters also differed among all habitats; YT supported the fewest and OP the most. Twig nesters were more numerous ($P < 0.01$) in OP than in either MT or YT, and branch nesters fewer ($P < 0.01$) in YT than in either OP or MT (Fig. 5).

Guild/habitat associations. When avian foraging and nesting guild distributions were considered in terms of habitat structure, several general patterns emerged. Insectivores (except air screeners) were strongly associated with measures of tree cover and showed affinity for woodlots (i.e. were negatively correlated with distance to the nearest woodlot). Seed eaters and omnivorous ground foragers were strongly associated with the area of herbaceous growth and with large shade trees; but seed eaters avoided woodlots, i.e. were positively correlated with distance to the nearest woodlot (Table III).

Ground/herb nesters were negatively correlated with most tree variables and positively correlated with area of weed growth and area of mowed lawn. Shrub nesters showed a strong negative correlation with the density of coniferous shrubs but were positively correlated with coniferous shrub height, suggesting that the maturity and development of shrubs were more important than the number of shrubs present. Shrub nesters were also negatively correlated with the height to crown of trees, indicating a possible affinity for lower tree branches by members of this guild, or that they used the lower portion of a vertical foliage continuum. The tree twig, tree branch, and tree cavity guilds all displayed similar habitat associations, showing a strong positive affinity for all measures of tree canopy development. In addition, all three were negatively correlated with lawn area (Table III). Finally, building nesters, which were not associated with housing density, were associated with large open-grown trees (low height to crown) and lawn area particularly. Species that commonly nest on buildings were here associated with ornate older homes. Such houses are characteristic of MT, and provide many nest sites. So, architectural style seems to determine avian nesting more than mere number of buildings.

Suburbs can have very different avifaunas. A quite wooded habitat is necessary for insectivores; large shade or street trees will not suffice. Thus, OP had a large proportion of insectivores; MT, which had larger trees, did not. Also, twig and cavity nesters were significantly more abundant in the wooded (OP) suburb habitat. The open habitat of YT supported significantly more ground/herb nesters than either of the other habitats, as well as more air screeners among foraging guilds. The expansive lawns and large trees of MT supported significantly more seed eaters and omnivorous ground foragers, and more shrub, tree branch, and building nesters.

TABLE III

Correlations (r) between habitat features and guild densities in suburban Amherst, MA, 1975–79[a]

Habitat variable	Foraging guild 123	243	311	322	332	342	354	355	423	433	436	443	567	Nesting guild 1	2	3	4	5	6
TDDIAM[b]	+	(+)		(+)	+				+								+	+	+
TDHT		+	+	+	+	+	+	−				+		−		+	+	+	+
TDHTC			+	+	+	+	+	(−)	(−)			+		−	−	+	+	+	−
TDNUM			+	+	+	+	+	(−)	−			+		−	−	+	+	+	−
TCDIAM	+	+	+	+	+	(+)		(−)	+		(+)			−		+	+	+	
TCHT		+	+	+	+	(+)	+	−			(+)	+		−		+	+	+	
TCHTC			(+)	+	+	+	+	(−)	−			+		−	−	+	+	+	−
TCNUM			(+)		+	+	+		(−)			(+)		−	(−)			+	
SDHT		+				(−)					(+)							(−)	
SDNUM	(+)			+	+				(+)								+	+	
SCHT		−	−			(−)	−				(−)				(+)				
SCNUM	(−)		+		+	+	+		(−)			+		−	−	+	+	+	−
TCDRATI									(+)										
SCDRATI	−	+					+		−		+				−				−
AHERB	(+)			(+)	(+)				(+)			(−)		(+)	+				(+)
AMOW			−	−	−	−	−	+	+			−		+	+	−	−	−	+
NHOMES		−							+		−						+		
WOODLOT	(+)	(+)	(−)			−	−		+		(+)	−		+	(−)		(−)	+	
NSPT	+		(−)			(+)	−		+		(+)	−		+	+	(−)			+
NSPS				(+)	+	(+)	+					+		−		+	+	+	
TTNUM			+	(+)	+	+	+	(−)	−			+		−	−	+	(+)	+	−
TSNUM			+	+	+	+	+					(+)		−	(−)	+	+	+	

[a] Correlations, (r) in () are significant at $P \leqslant 0.05$; all others significant at $P \leqslant 0.01$.
[b] See Table I for names of variables.

DISCUSSION

Suburbs vary in avian composition depending largely upon the degree to which they alter natural habitats. In forested or potentially forested regions, suburbanization generally results in a decline of insectivorous species. On the other hand, suburban development in deserts (Emlen, 1974) or in shrublands or steppes (Guthrie, 1974) generally results in an increase of such species because of the development and proliferation of artificially watered trees and shrubs. Within otherwise forested regions, suburban bird species numbers and evenness of distribution increase with foliage height diversity and total amount of vegetation, just as they do in 'natural' habitats, but only up to a point. Comparison of OP and MT, both of which were quite tree-covered — OP by remnant second-growth woodland, MT by mature specimen plantings — showed that MT supported significantly more shrub nesters than OP. There were no differences in numbers of branch nesters, but OP supported significantly greater numbers of cavity nesters. OP supported significantly greater numbers of all insectivorous guilds except air screeners. Thus, the suburb containing remnants of a closed, multi-layered forest canopy supports an avifauna quite different from one with larger trees, more shrubs, and greater tree and shrub species richness. Apparently, no matter how diverse, a planted habitat may not suffice as a replacement for forest insectivores. Edge species will probably continue to thrive in suburbs, but to attract many insectivorous migrant species (which have been used as measures of avifaunal quality (Walcott, 1974), native forest must be retained where possible.

REFERENCES

American Ornithologists' Union, 1983. Check-list of North American Birds (6th Edition). American Ornithologists' Union, Lawrence, KS, 877 pp.

DeGraaf, R.M., 1978. Avian communities and habitat associations in cities and suburbs. In: C.M. Kirkpatrick (Editor), Proc. Wildlife and People, February 1978, Purdue University, West Lafayette, IN, pp. 7—24.

Emlen, J.T., 1974. An urban bird community in Tucson, Arizona: derivation, structure, regulation. Condor, 76: 184—197.

Erz, W., 1966. Ecological principles in the urbanization of birds. In: Proc. 2nd Pan-African Ornitohological Congress, Pietermaritzburg, Natal, South Africa. Ostrich, Suppl. 6: 357—364.

Geis, A.D., 1974. Effects of urbanization and types of urban development on bird populations. In: J.H. Noyes and D.R. Progulske (Editors), Wildlife in an Urbanizing Environment. Plann. Resour. Dev. Ser. 28, Holdsworth Natural Resources Center, University of Massachusetts, Amherst, MA, pp. 97—105.

Guthrie, D.A., 1974. Suburban bird populations in southern California. Am. Midl. Nat., 92: 461—466.

Holmes, R.T., Bonney, R.E. and Pacala, S.W., 1979. Guild structure of the Hubbard Brook bird community: a multivariate approach. Ecology, 60: 512—520.

Jones, D.N., 1981. Temporal changes in the suburban avifauna of an inland city. Aust. Wildl. Res., 8: 109—119.

Lancaster, R.K. and Reese, W.E., 1979. Bird communities and the structure of urban habitats. Can. J. Zool., 57: 2358—2368.
Root, R.B., 1967. The niche exploitation pattern of the blue-gray gnatcatcher. Ecol. Monogr., 37: 317—350.
Salt, G.W., 1953. An ecologic analysis of three California avifaunas. Condor, 55: 258—273.
Walcott, C.F., 1974. Changes in bird life in Cambridge, Massachusetts from 1980 to 1964. Auk, 91: 151—160.
Willson, M.F., 1974. Avian community organization and habitat structure. Ecology, 55: 1017—1029.

APPENDIX I Scientific names of birds[a]

Green-backed Heron	*Butorides striatus*
Ring-necked Pheasant	*Phasianus colchicus*
Mourning Dove	*Zenaida macroura*
Yellow-billed Cuckoo	*Coccyzus americanus*
Ruby-throated Hummingbird	*Archilochus colubris*
Downy Woodpecker	*Picoides pubescens*
Hairy Woodpecker	*Picoides villosus*
Northern Flicker	*Colaptes auratus*
Pileated Woodpecker	*Dryocopus pileatus*
Eastern Wood-Pewee	*Contopus virens*
Least Flycatcher	*Empidonax minimus*
Eastern Phoebe	*Sayornis phoebe*
Great Crested Flycatcher	*Myiarchus crinitus*
Eastern Kingbird	*Tyrannus tyrannus*
Tree Swallow	*Tachycineta bicolor*
Barn Swallow	*Hirundo rustica*
Blue Jay	*Cyanocitta cristata*
American Crow	*Corvus brachyrhynchos*
Black-capped Chickadee	*Parus atricapillus*
Tufted Titmouse	*Parus bicolor*
Red-breasted Nuthatch	*Sitta canadensis*
White-breasted Nuthatch	*Sitta carolinensis*
Brown Creeper	*Certhia americana*
House Wren	*Troglodytes aedon*
Winter Wren	*Troglodytes troglodytes*
Blue-gray Gnatcatcher	*Polioptila caerulea*
Swainson's Thrush	*Catharus ustulatus*
Hermit Thrush	*Catharus guttatus*
Wood Thrush	*Hylocichla mustelina*
American Robin	*Turdus migratorius*
Gray Catbird	*Dumetella carolinensis*
Northern Mockingbird	*Mimus polyglottos*
Brown Thrasher	*Toxostoma rufum*
Cedar Waxwing	*Bombycilla cedrorum*
European Starling	*Sturnus vulgaris*
Solitary Vireo	*Vireo solitarius*
Warbling Vireo	*Vireo gilvus*
Red-eyed Vireo	*Vireo olivaceus*

Blue-winged Warbler	*Vermivora pinus*
Yellow Warbler	*Dendroica petechia*
Yellow-rumped Warbler	*Dendroica coronata*
Blackpoll Warbler	*Dendroica striata*
Black-and-white Warbler	*Mniotilta varia*
American Redstart	*Setophaga ruticilla*
Ovenbird	*Seiurus aurocapillus*
Common Yellowthroat	*Geothlypis trichas*
Scarlet Tanager	*Piranga olivacea*
Northern Cardinal	*Cardinalis cardinalis*
Rose-breasted Grosbeak	*Pheucticus ludovicianus*
Indigo Bunting	*Passerina cyanea*
Rufous-sided Towhee	*Pipilo erythrophthalmus*
Chipping Sparrow	*Spizella passerina*
Field Sparrow	*Spizella pusilla*
Song Sparrow	*Melospiza melodia*
Swamp Sparrow	*Melospiza georgiana*
Red-winged Blackbird	*Agelaius phoeniceus*
Eastern Meadowlark	*Sturnella magna*
Common Grackle	*Quiscalus quiscula*
Brown-headed Cowbird	*Molothrus ater*
Northern Oriole	*Icterus galbula*
Purple Finch	*Carpodacus purpureus*
House Finch	*Carpodacus mexicanus*
American Goldfinch	*Carduelis tristis*
House Sparrow	*Passer domesticus*

[a]After American Ornithologists' Union (1983).