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Bird community in urban residential area: Which species sustained after five elapse years?

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Abstract. Birds are able to sustain almost everywhere, including in urban residential areas where habitat components were limited. Some birds may survive, while others might not. The objective of the research was to identify bird species which still sustained in an urban area, after 5 years elapsed time. The study site was Sentul City (West Java), a large residential area that arranged into clusters of different housing and tree planting arrangement. Birds were sampled in 2012 and 2017 within 5 housing clusters and boulevard, using a point count method. There were 42 bird species found in 2012 and 35 species in 2017, and thus there were a decrease of 7 species (16%). Eurasian Tree sparrow, Sooty-headed Bulbul, and Scarlet-headed Flower pecker were the most abundant birds. Two new species were recorder in 2017. About 60% of bird species were sustained as exploiters and adapters in the study sites, including tree sparrows, bulbuls (sooty-headed), flowerpeckers and sunbirds, and munias. The semi-natural cluster within the residential area harbour avoiders that preferred shrubby old-growth habitat such as babblers, cuckoos, and nightjars.

Keywords: Bogor, housing complex, housing clusters, Sentul City, urban birds

1. Introduction

Cities worldwide are the most heterogeneous landscapes, resulting from highly fragmented environments, and create a mosaic of patches of land use types of various sizes [1, 2]. Cities in Indonesia is no exception. Unfortunately, scientific research related to the impact of urban fragmentation on urban biodiversity in Indonesia is lacking.

In Indonesian cities, most cities were dominated by residential areas, although the average figure is unavailable. With the current movement toward green development, residential areas in cities have been designed and managed toward more environmental-friendly areas. The typical important activity by the developer of residential areas is providing environmental-friendly habitat by planting trees and creating/maintaining green open spaces.

Trees along the road and among housing, planted in the backyards, as well as parks and other green open spaces in the residential areas provide good habitat for urban wildlife, including birds. Some research on urban bird diversity have been conducted in big Indonesian cities in Java, e.g. Jakarta [3], Bandung [4], and Semarang [5]. However, there has been no research on temporal basis, and thus there has been no information about the species that are able to sustain in residential areas after some period of time.



In order to understand how bird community responds to urban development and fragmentation in residential areas after a period of time, a field research in Sentul City residential area was conducted. During the last five years, the residential area in Sentul City has been rapidly developed. Several housing clusters, apartment complex, and malls were and have been built, eliminating areas that might have been served as bird habitat in previous years. The objective of this research was to reveal the bird community in Sentul City in 2012 and again in 2017, in particular to find out which species were able to sustain in the residential areas and which ones were lost or extirpated.

2. Methods

2.1. Description of the study site

The study area was Sentul City residential area, located in the periphery of the City of Bogor, West Java. The whole complex occupied an area of around 2,400 ha, consists of 13 housing complexes (covers most area), malls, hospital, amusement park, mosques and churches, hotels, offices, apartment, market, house-shop complex, convention centre, schooling, bus terminal, and 18-hole golf course. The whole area basically is a landscape of mosaic small patches for birds.

Six sites were selected as study area, consisted of five housing clusters (representing different housing age and house size) and the main boulevard. The housing clusters were Northridge, Bukit Golf Hijau-Mediterrania I, Venesia-Pasadena-Sakura, Bali Cluster, and Cluster Argenia Cluster. Trees, palm, and shrubs (mostly are indigenous species, some are non-local) have been planted mainly along the main road (boulevard) and between houses within clusters, except for Northridge Cluster.

The Northridge is very spacious, has big houses on large-sized land. There are many unbuilt areas in between houses, and this cluster overall resembles semi-natural area. There is also a small lake in this cluster. Bukit Golf Hijau-Mediterrania I was built about 20 years ago, consists of large to medium sized houses. Mature raintree *Samanea saman* characterized this cluster and creates heavy shading along the major roads. Venesia-Pasadena-Sakura have medium to small houses, and located in the valley, surrounded by some open spaces. Bali Cluster (Tapaks iring, Legian, Besakih, Udayana) has small houses, mostly town-house style. Argenia Cluster is relatively new cluster of medium-sized houses, built approximately 9 years ago. Trees planted in this cluster are almost reach their maturity.

2.2. Field method

Birds within each cluster and along the boulevard were observed by using the standard point count method [6] in 2012, and again in 2017. In each cluster, 10 random points (radius 25 m) were established to sample the bird communities. Duration of field observations varied, and the observations were ended when there was no additional new species, which took between 4 to 10 days for each cluster. Nomenclature and species identification follows [7].

Duration for bird observation in each point was 10 mins, after a 2-min. wait. Data recorded were species name and its number. Each point was replicated at least three times in different days, to ensure a representative result. Observation was conducted twice a day, in the morning (05:30-9:00 am) and in the afternoon (3:30-6:00 pm). Diurnal bird survey was not conducted in heavy claudy days, rainy days or when thick mist occurred. Nocturnal birds were intermittently surveyed and identified mostly from their calls.

Based on the occurrence of the birds in the clusters, birds were categorization as 'exploiters' and 'adapters', and 'avoiders', followed the definitions by [8] and [9] for the birds' response to urbanization. Modified to the study area, urban exploiters were defined as species that are most successful (i.e. widespread, can be found in 5 to 6 sites) in the residential area being studied. Urban adapters were species that commonly found (i.e. found in 2 to 4 sites), while urban avoiders were those that can be found in a semi-wild habitat (i.e. tend to avoid urban environment), in this case was the Northridge Cluster. Exploiters and adapters were considered as sustained in the residential areas.

Bird species found in 2017 for each category were compared with those of 2012 to find out about the species that still sustained between the two periods. Newly recorded bird(s) in 2017 was identified, and so do the lost or extirpated species.

3. Results

A total of 43 bird species was recorded in all sites (data of 2012 and 2017 combined) (Table 1). There were 35 bird species in 2017, slightly lower than bird species found in 2012, which was 42 species. In 2017, two new species were recorded in the Northridge Cluster (semi-natural area), namely Black-crowned Night Heron and White-headed Munia.

Omitting the aerial foragers that might not be resident to the study area, the seven most common species, in decreasing order of abundance in 2012 and 2017 observations (combined), were: Eurasian Tree sparrow (*Passer montanus*), Sooty-headed Bulbul (*Pycnonotus aurigaster*), Scarlet-headed Flowerpecker (*Dicaeum trochileum*), Javan Munia (*Lonchura leucogastroides*), Olive-backed Sunbird (*Nectarinia jugularis*), Fluvous-breasted Woodpeker (*Dendrocopos macei*), and Common Tailorbird (*Orthotomus sutorius*). These species can be categorized as exploiters of residential areas in the study sites.

About 60.4% of the bird species were able to sustain in the residential areas, mostly insectivores, and nectarivores, and granivores (seed-eaters). Surprisingly, some piscivores (fish eaters) and bark borers were also part of the sustained species. In contrast, avoider species that might not sustain in the residential areas were generally raptor and other forest-dependent species (e.g. babbler, green pigeon).

Comparing between clusters, in both years Northridge Cluster had the highest number of bird species, followed by Bukit Golf Hijau, Argenia, Bali and Venesia. Along the main boulevard were also provide a good habitat for birds, comparable with other clusters. Except for the Venesia-Pasadena-Sakura, the species number in all study sites was decreasing. Even with the existence of the semi-natural habitat, Sentul City has been losing 7 bird species in the past five years, although one new species was recorded in of the Northridge Cluster.

Table 1. Presence (1) and absence (0) of birds in 2012 and 2017, organized based on their response to urbanization; bold – not found in 2017, underlined – new record in 2017; sequence and nomenclature follows [7]

Response to Urbanization	Common Name	Latin Name	2012	2017
Exploiters	Spotted Dove	<i>Streptopelia chinensis</i>	1	1
	Cave Swiftlet	<i>Collocalia linchi</i>	1	1
	Fulvous-breasted Woodpecker	<i>Dendrocopos macei</i>	1	1
	Pacific Swallow	<i>Hirundo tahitica</i>	1	1
	Striated Swallow	<i>Hirundo striolata</i>	1	1
	Sooty-headed Bulbul	<i>Pycnonotus aurigaster</i>	1	1
	Common Tailorbird	<i>Orthotomus sutorius</i>	1	1
	Olive-backed Sunbird	<i>Nectarinia jugularis</i>	1	1
	Scarlet-headed Flowerpecker	<i>Dicaeum trochileum</i>	1	1
	Eurasian Tree Sparrow	<i>Passer montanus</i>	1	1
	Javan Munia	<i>Lonchura leucogastroides</i>	1	1
	Scaly-breasted Munia	<i>Lonchura punctulata</i>	1	1
Adapters	Rusty-breasted Cuckoo	<i>Cacomantis merulinus</i>	1	1
	Plaintive Cuckoo	<i>Centropus bengalensis</i>	1	1
	Lesser Coucal	<i>Alcedo meninting</i>	1	1

	Black-nest Swiftlet	<i>Collocalia maximus</i>	1	1
	Blue-eared Kingfisher	<i>Halcyon cyanoventris</i>	1	1
	Javan Kingfisher	<i>Dendrocopos macei</i>	1	1
	<u>Little Swift</u>	<i>Apus affinis</i>	0	1
	Small Minivet	<i>Pericrocotus cinnamomeus</i>	1	1
	Common Iora	<i>Aegithina tiphia</i>	1	1
	<u>Yellow-vented Bulbul</u>	<i>Pycnonotus goiavier</i>	0	1
	Great Tit	<i>Parus major</i>	1	0
	Black-capped Babbler	<i>Pellorneum capistratum</i>	1	0
	Golden-bellied Gerygone	<i>Gerygone sulphurea</i>	1	1
	Olive-backed Tailorbird	<i>Orthotomus sepium</i>	1	1
	<u>Bar-winged Prinia</u>	<i>Prinia familiaris</i>	0	1
	Long-tailed Shrike	<i>Lanius schach</i>	1	1
	Oriental White-eye	<i>Zosterops palpebrosus</i>	1	1
Avoiders	<u>Black-crowned Night-heron</u>	<i>Nycticorax nycticorax</i>	0	1
	Spotted Kestrel	<i>Falco moluccensis</i>	1	0
	White-breasted Waterhen	<i>Amaurornis phoenicurus</i>	1	1
	Pink-necked Green Pigeon	<i>Treron vernans</i>	1	0
	Rock Pigeon^f	<i>Columba livia</i>	1	0
	Zebra Dove	<i>Geopelia striata</i>	1	1
	Banded Bay Cuckoo	<i>Cacomantis sonneratii</i>	1	0
	Asian Drongo-Cuckoo	<i>Surniculus lugubris</i>	1	0
	Collared Scopsowl	<i>Otus lempiji</i>	1	1
	Large-tailed Nightjar	<i>Caprimulgus macrurus</i>	1	1
	Collared Kingfisher	<i>Todiramphus chloris</i>	1	0
	Asian House-martin	<i>Delichon dasypus</i>	1	0
	Pied Triller	<i>Lalage nigra</i>	1	0
	Horsfield's Babbler	<i>Malacocincla sepiarium</i>	1	0
	Chestnut-capped Babbler	<i>Timalia pileata</i>	1	1
	Common Pipit	<i>Anthus novaeseelandiae</i>	1	0
	White-breasted Wood-swallow	<i>Artamus leucorhynchus</i>	0	1
	Little Spiderhunter	<i>Arachnothera longirostra</i>	1	0
	White-headed Munia	<i>Lonchura maja</i>	0	1
	Total number of species		42	35

Table 2. Number of bird species in each cluster in Sentul City residential areas in 2012 and 2017

	North- ridge	BGH ¹	Venesia ²	Bali ³	Argenia	Boule- vard	Sentul City
Number of species; 2012	33	23	14	16	17	21	42
Number of species; 2017	27	15	17	13	12	16	35

Number of new species	3	0	6	1	3	4	2
Decreased in species number [%]	11	8	3	7	5	11	7 [16.7%]

¹Bukit Golf Hijau-Mediterrania I; ²Venesia-Pasadena-Sakura; ³Bali Cluster consists of Tapaksiring, Legian, Besakih, Udayana; f feral species

4. Discussion

Comparing with other research in other urban areas (e.g. [3, 4, 5]), bird community found in Sentul City residential areas were resembled to other cities in Java. Bird species in the studied clusters and boulevard showed dynamic changes, in which some species were lost and others were newly established. As predicted by the theory of island biogeography [10], over a long time period, there would be a turnover in bird community, including in urban bird community as also reported in Bogor Botanical Garden [11], Singapore [12], and in the isolated island of Barro Colorado in Panama [13].

Despite the fact that the bird community was dynamic over the five-year period, some bird species were able to sustain in the residential areas. The mosaic heterogeneous patches in the residential areas still support birds that do not require specific habitat components. While some bird species require large habitat patches and forest-resembled habitat (e.g., thick canopy, dense shrub), small open patches may be sufficient for others.

Previous research [14] shown that urbanization typically leads to decrease in species number, an increase of biomass of abundant species, and a shift toward more generalist species. The habitat loss due to the rapid and vast development of Sentul City contributed to the decrease of the bird species and the loss of some non-adaptive species.

Remnants of semi-natural green open space in urban landscape, including in a residential area, have larger core areas that are not influenced by edge effect, such as higher anthropogenic disturbance and predation [15, 16, 17]. Therefore, in semi-natural area of Northridge will provide species with a more specific habitat requirement, as also reported by [16] in Madrid, Spain. Raptors, water-associated bird (waterhens, night-herons), birds that have brood parasites breeding strategy (cuckoos), birds that preferred bush-shrub habitat (babblers), and top canopy fruit eaters (green pigeons) were urban avoiders that can only be found in the semi-natural habitat of Northridge Cluster. These species may not sustain in the residential area if the semi-natural habitat is no longer available.

The loss of habitat due to the development of the residential areas of Sentul City can be compensated mainly by and fulfilling birds' habitat components. Some suggested activities are maintaining the semi-natural habitat as refuge area, intensifying planting of birds' food sources, and providing additional shrub layers in the existing parks/boulevard as new additional micro-habitat.

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