The Potential Function of Ranggawulung'S Urban Forest, Subang, West Java, Indonesia As a Bird Habitat

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ABSTRACT

Ranggawulung's urban forest (RUF) is protected area located in Subang, West Java, Indonesia with latitude 6°34'30"-35'0"S and 107°44'15"-45'0"E. Human activity in RUF was caused decreased vegetation cover, habitat fragmentation and also declined community composition and diversity of bird species. The aim of this study was to determine diversity of bird and their habitat in vegetation of RUF. Diversity of vegetation was assessed in the plot with the size of 20x20 m, and the assessment for bird diversity used the point transect method with a radius of 50 m in a distance between point count of 100 m. It was recorded 42 species of tree belonging to 19 families with a diversity index of Shannon Wiener of 3.03 whereas there were 34 species of birds belonging to 19 families with diversity index of Shannon-Wiener is 2.95. The vegetation used for bird activity was Paraserianthes falcataria, Tectona grandis, and Bambusa spp. Birds were divided from four guild type which were guild of feeding, nesting, origin and habitat. The higher guild of feeding were insectivores (50%) whereas the canopies (56%) were the dominantly nesting place. Most of birds were not the immigrant's birds (85%) and their habitat were mostly in forest (85%).

Keyword: Diversity of birds, Habitat, Ranggawulung's urban forest,

INTRODUCTION

Ranggawulung urban forest (RUF) is located at the edge of town (suburban), between natural landscape (Gede Pangrango National Park) and the city of Subang. Urban forest is dominated by natural vegetation. The urban forest provides enormous benefits to the surrounding people including aesthetic, hydrology, climatology, ecology, protection, hygienic, and education (Nazaruddin, 1996). Thus, the existence and continuity of RUF should be maintained.

One of ecological function of RUF is living place or habitat for many species of animal including birds. The vegetation of RUF and birds have mutual interaction which was used for nesting, feeding, and protection area for population of bird. The role of birds to vegetation itself is as seed disperser, pollinator and pest control. This was stated by Alikodra (1990) that there was positive correlation between bird composition and vegetation.

Vegetation coverage at RUF decreased in 2015 compared to 2012 which was approximately 42% (Centre for Environmental Studies 2012). Land area which is not covered with vegetation increased which was due to human activities, such as illegal logging and land clearing for farming and plantation. The human activities mostly caused habitat fragmentation (Forman, 1995) and decreasing of community composition and species diversity (Primack et al. 1998), such as the bird diversity..

Bird is a sensitive species to environmental changes (Mason et al. 2007). Cody (1981) stated that the bird community composition reflected the dynamics of population change interspecific and symptoms. The structure of bird community in a location wass directly related to the condition and availability of resources. The community of birds nesting in the tree canopy was able to describe the condition of vegetation in the area. Trophic condition was also able to reflect the aspects of the ecosystem function. It can be seen in the presence of an insect-eating bird community was determined by availability of insects as a food source (O'connell et al. 2000).

The study of diversity bird in RUF was very limited which only had been conducted in 2012 by Centre for Environmental Studies UIN Syarif Hidayatullah Jakarta. That study was showed moderate diversity index of birds in RUF at 2012 (H'=2.69) (Centre for Environmental Studies, 2012).Therefore, it is very important to study bird in RUF. This study was aimed to analyze diversity of bird and also to assess the

relation of vegetation and bird diversity in RUF as bird habitat.

MATERIALS AND METHODS

The research was conducted in October-November 2015 at Ranggawulung's urban forest, Subang, West Java, Indonesia, located in 6°34'30"-35'0" S and 107°44'15 "-45'0" E, with elevation of 500 meter above sea level (Figure 1).

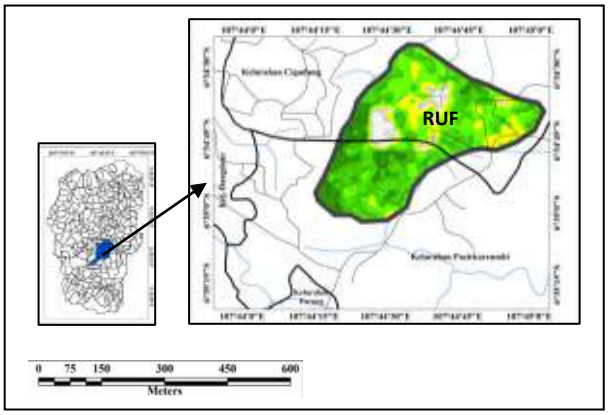

Figure 1. Map of Subang showing RUF as Study Site

The method used in birds data collection was point transect with a radius of 50 m. Observation was conducted in 100 m line transect and recorded for 10-15 minutes each point every morning between 06:00-10:00 am with 5 repetition. Visual and sound of birds were the way in collecting data directly and indirectly ways. Identification of bird species used the book of MacKinnon et al. (2010). Then, the birds were grouped based on their guilds (feeding, migration status, laying nest and primary habitat), and protection status. The feeding guild was divided into into five types which were the seed eaters, fruit eaters, nectar eaters, predators and insect eaters. The migration status consisted of migrating and permanent birds. The laying nest was differed into laying in canopy, shrub, mountain side, land or as parasite. For their main habitat, it was divided into forest, city and water. The status of birds was classified using IUCN Red Data Book and the laws of the Republic of Indonesia, Government Regulation No. 7 of 1999 on the preservation of plants and animals.

Analysis of vegetation in RUF was carried out on the level of tree vegetation. The sampling of vegetation were in 42 plots with the size of 20x20 m put randomly. Parameters of vegetation measured were species name (local and scientific name), number of individuals of each species to calculate the density, rod diameter to determine the basal area and to calculate the volume of a tree, total height, and stratification.

Each type of plants that were used by the birds was identified and determined the value of the function of the vegetation. Identification of tree used the book of Backer and Brink (1965) and Priyadi et al. (2010). Function of vegetation was determined by the proportion of the use of vegetation by all birds and presented in graphical form. The data obtained described the role of vegetation for bird life.

RESULTSANDDISCUSSION

Diversity of Trees in RUF

Based on the analysis of the level of tree vegetation in RUF, it was found 42 trees species belonging to 19 families with high species diversity (H'=3.03) (Table 1). The family of Fabaceae was dominantly found among trees in RUF. There were eight types of trees that have higher INP value up to 10%, which were Mangifera indica (mango), Paraserianthes falcataria (jeungjing), Gmelina arborea (Jabon), Lagerstroemia speciosa (bungur), Swietenia mahagoni (mahogany), Arthrocarpus integra (jackfruit), Pinus merkusii (pine), and Maesopsis eminii (sobsi). These species dominated the vegetation in RUF and also had high economic value, especially for wood utilization.

High diversity of tree was encouraging potential of RUF as bird habitat. The diversity of tree will affect birds diversity that utilize the habitat. According to Wiens (1989) the structure of the vegetation is one of the key factors that affected bird species richness at the local level. The types of trees in RUF generally were plants that bloom annually, so that it supported RUF to be habitat of birds as birds used pollen, seeds, and fruit as their feed (Putri 2015).

Based on the type and form of vegetation, RUF has a variety of habitats for birds such as forests, plantations, and open areas / shrubs. It makes RUF potentially supports various types of wildlife including many species of birds. Forest is a habitat for a variety of bird species to find resources for survival, such as food sources, reproduction, as well as space for rest and shelter shield (Kuswanda, 2010). Plantation was a habitat to find food, and trees were often used by some birds to nest (Rahayuningsih et al. 2007).

Diversity of bird species in RUF

Diversity Index of bird in RUF was 2.95 categorized in moderate condition. The diversity index was influenced by habitat or vegetation. The vegetation with a variety of different types of trees with different shapes could be a factor leading to high diversity of birds (Welty 1982; Kuswanda 2010). Bird evenness index was high (0.84) which the birds were spread

evenly in RUF and there was not bird species dominates (dominance index value = 0.07).

Table 1. Diversity of Trees in RUF

Local Name	Families	Scientific Name	Σ Ind	IVI (%)	H'
Mangga	Anacardiaceae	Mangifer aindica	13	14,60	3,03
Jambu Mede	Anacardiaceae	Anacardium occidentale	2	4,23	
RengasManuk	Anacardiaceae	Gluta wallichii	2	4,44	
Lame	Apocynaceae	Alstonia scholaris	3	6,08	
Kawung	Arecaceae	Arenga pinnata	1	5,13	
Sawit	Arecaceae	Elaeis oleifera	1	6,87	
Karet	Euphorbiaceae	Havea brasiliensis	3	7,00	
Jeungjing	Fabaceae	Paraserianthes falcataria	11	13,98	
Jengkol	Fabaceae	Archidendron pauciflorum	6	9,32	
Angsana	Fabaceae	Pterocarpus indicus	3	5,24	
Foris	Fabaceae	Acacia auriculiformis	3	6,51	
Jalatra	Fabaceae	Gliricidia maculata	2	3,46	
Pete	Fabaceae	Parkia speciosa	2	4,29	
Akasia	Fabaceae	Acacia mangium	1	5,13	
Asam	Fabaceae	Tamarindus indica	1	5,59	
Peundeuy	Fabaceae	Parkia javanica	1	7,38	
Trembesi	Fabaceae	Albizia saman	1	2,71	
Melinjo	Gnetaceae	Gnetum gnemon	1	3,52	
Jabon	Lamiaceae	Gmelina arborea	19	18,11	
Jati	Lamiaceae	Tectona grandis	5	8,62	
Alpukat	Lauraceae	Persea americana	1	3,70	
Bungur	Lythraceae	Lagerstroemia speciosa	13	12,00	
RanduKapuk	Malvaceae	Ceiba pentandra	6	7,67	
Drowak	Malvaceae	Grewia acuminata	3	5,67	
Duren	Malvaceae	Durio zibethinus	2	4,45	
Tisuk	Malvaceae	Hibiscus macrophyllus	1	3,11	
Mahoni	Meliaceae	Swietenia mahagoni	16	14,59	
Kecapi	Meliaceae	Sandoricum koetjape	4	5,34	
Mahoni Uganda	Meliaceae	Swietenia macrophyla	3	4,93	
Nangka	Moraceae	Arthrocarpus integra	14	14,19	
Kluwih	Moraceae	Artocarpus camansi	2	4,95	
Kondang	Moraceae	Ficus variegata	1	2,75	
Teureup	Moraceae	Artocarpus elasticus	1	2,77	
Tin	Moraceae	Ficus carica	1	2,86	
JambuBiji	Myrtaceae	Psidium guajava	2	3,52	
JambuKopo	Myrtaceae	Syzygium littorale	2	3,48	
Pinus	Pinaceae	Pinus merkusii	45	28,60	
Sobsi	Rhamnaceae	Maesopsis eminii	24	19,92	
Rambutan	Sapindaceae	Nephelium lappaceum	1	3,39	
Tanjung	Sapotaceae	Mimusops elengi	2	3,73	
Ki Bonteng	Stemonuraceae	Platea latifolia	2	2,77	
Laban	Verbenaceae	Vitex pubescens	1	3,41	

Note: *IVI: importance value index; H': diversity index (Shannon wiener index)*

According to Fachrul (2007), the dominance index was less than 0.5 meaning no dominance species.

Bird species found in RUF was 34 species belonging to 19 families. The most commonly found were Cuculidae and Acciptiridae with four species, followed by Ploceidae with three bird species (Table 2). The types of families Cuculidae and Ploceidae were able to adapt better than others due to suitability of habitat and food availability. Availability of feed was one of the main factors for the presence of birds in a habitat or area (Wiens et al.1992). Habitats were used as nesting, foraging and resting for these types of birds (Rahayuningsih et al. 2007).

Among the bird species found, there were raptors, such as Accipiter gularis, Accipiter soloensis and Pernis ptilorhycus. These predatory birds were migrating through RUF during their annual migration. Raptors used RUF as their habitat for resting and feeding, so it caused enhancement of bird diversity. The types of raptors were discovered in RUF including protected bird species.

Bird protection status can be seen from the IUCN and the Indonesian Government Regulation No. 7 of

1999 on the preservation of plants and animals. Based on the IUCN red list, all of the birds found in RUF were classified in least concern or have a low risk for

Table 2. Species of Birds in RUF

Species	Family	Guild				Protection Status	
		Feed	Nest	Origin	Habitat	IUCN	Constitution of RI
Accipiter gularis	Accipitridae	M	CAN	MIG	FOR	LC	P
Accipiter soloensis	Accipitridae	M	CAN	MIG	FOR	LC	P
Pernis ptilorhycus	Accipitridae	M	CAN	MIG	FOR	LC	P
Spilornis cheela	Accipitridae	M	CAN	MIG	FOR	LC	P
Halcyon cyanoventris	Alcedinidae	I	MS	PER	FOR	LC	P
Todiramphus chloris	Alcedinidae	I	MS	PER	FOR	LC	P
Collocalia linchi	Apodidae	I	MS	PER	CI	LC	NP
Apus affinis	Apodidae	I	MS	PER	CI	LC	NP
Artamus leucorynchus	Artamidae	I	CAN	PER	FOR	LC	NP
Hemipus hirundinaecus	Campephagidae	I	CAN	PER	FOR	LC	NP
Caprimulgus macrurus	Caprimulgidae	I	L	PER	FOR	LC	NP
Aegithina tiphia	Chloropseidae	I	CAN	PER	FOR	LC	NP
Treron vernans	Columbidae	F	SH	PER	FOR	LC	NP
Streptopelia chinensis	Columbidae	S	SH	PER	FOR	LC	NP
Cacomantis merulinus	Cuculidae	I	PAR	PER	FOR	LC	NP
Phaenicophaeus curvirostris	Cuculidae	I	SH	PER	FOR	LC	NP
Centropus bengalensis	Cuculidae	M	SH	PER	FOR	LC	NP
Chrysococcyx basalis	Cuculidae	I	PAR	MIG	FOR	LC	NP
Dicrurus annectans	Dicruridae	I	CAN	PER	FOR	LC	NP
Glareola maldivarum	Glareolidae	I	L	MIG	FOR	LC	NP
Hirundo tahitica	Hirundinidae	I	MS	PER	CI	LC	NP
Dicaeum trigonostigma	Meliphagidae	F	CAN	PER	FOR	LC	NP
Dicaeum trochileum	Meliphagidae	F	CAN	PER	FOR	LC	NP
Merops philippinus	Meropidae	I	MS	PER	FOR	LC	NP
Anthreptes malacensis	Nectarinidae	N	CAN	PER	FOR	LC	P
Nectarinia jugularis	Nectarinidae	N	CAN	PER	FOR	LC	P
Lonchura punctulata	Ploceidae	S	CAN	PER	FOR	LC	NP
Lonchura leucogastroides	Ploceidae	S	CAN	PER	FOR	LC	NP
Passer montanus	Ploceidae	S	CAN	PER	CI	LC	NP
Pycnonotus atriceps	Pycnonotidae	F	CAN	PER	FOR	LC	NP
Pycnonotus aurigaster	Pycnonotidae	F	CAN	PER	FOR	LC	NP
Amaurornis phoenicurus	Rallidae	I	SH	PER	AQ	LC	NP
Orthotomus sepium	Silviidae	I	CAN	PER	FOR	LC	NP
Prinia familiaris	Silviidae	I	CAN	PER	FOR	LC	NP

Note: M: Meat, I: insect; F: fruit, S: seed, N: nectar, CAN: canopy, MS: mountain side, L: land, SH: shrub, PAR: parasite, MIG: migrant, PER: permanent, FOR: forest, CI: city, AQ: Aquati, LC: least concerned, P: protected, NP: not protected

extinction globally. Under Indonesian Government Regulation No. 7 of 1999, the birds protected by law were Accipiter gularis, Accipiter soloensis, Pernis ptilorhycus, Spilornis cheela, Halcyon cyanoventris, Todiramphus chloris, Anthreptes malacensis, and Nectarinia jugularis (Table 2).

Birds Guild Diversity of in RUF

Study on the composition of bird feed related to guild is very important which can see the carrying capacity of the habitat. In a large scale, study of bird guild in the region was not only as a study to monitor biodiversity but it could also predict the impact of habitat disturbance on biodiversity in the future (Grey et al. 2007).

The diversity of bird guild was divided into four groups of guild, feeding, nests, the origin of species, and its main habitat. Based on the guild of feeding, it was divided into five types which were the seed eaters, fruit eaters, nectar eaters, predators and insect eaters. Guild-eating insects was the most prominent in RUF (50%), while other types of feeding reached 15% were meat eaters and the fruit group (Table 2). This suggested that the availability of insects was quite high which affected the increased insectivorous birds were found in RUF.

The availability of food resources determined the amount of the abundance of birds in an area or region (Wong 1986). The level of abundance in particular bird guild was also affected by the width of the niche they occupied (Novarino et al. 2008). Besides that, disturbance of bird habitats also affected the abundance

of some type of guild which commonly occurred in frugivorous and insectivorous with declined abundance after disturbances (Grey et al. 2007).

Based on guild of laying nest, there were 6 categories which were in the canopy, shrubs, mountain side, land and parasites. The dominance of laying nest was in the tree canopy (56%) and mountain side (18%). (Table 2).

While, the resident birds were mostly found in RUF reached 85%. The resident birds occupied RUF throughout the year and the opposite occurred in migratory birds. The migratory birds found in RUF were Accipiter gularis, Accipiter soloensis, Pernis ptilorhycus, Chrysococcyx basalis and glareola maldivarum. Kind of migratory birds usually traveled from the northern hemisphere in winter season to the tropics area (www.burung.org). According to Kukreti and Bhatt (2014) and the diversity and richness of species might be higher in the summer due to the migration season and breeding season of birds.

Based on their main habitat, the birds were mostly found in forest (85%). There were also found city's bird (12%) including Collocalia linchi, Apus affinis, Hirundo tahitica, and Passer montanus while only Amaurornis phoenicurus (3%) living in water was found in RUF. It can be understand as forest provides all needs for bird's life including food and habitat.

Bird response to the guild can be used to measure the level of ecological damage or environmental interference. All kinds of birds in the guild provided the same responses to changes in the environment, so the birds can be used as indicators of environmental change, but it requires the right validation for the ecological character of each bird species which are complex and diverse (Catenburry 2000). Response guild can produce an effective indicator of the habitat disturbance (O'Connell et al. 2000).

Utilization of Vegetation by Birds

The trees found in RUF were 42 species belonging to 19 families which only 12 species were used by birds (Figure 2). The tree species widely used by birds were Paraserianthes falcataria and Tectona grandi. They had a dense canopy structure with a broad canopy cover, and also had many branches so that they became a very pleasant place for the activities of many species of birds. Some activities were generally performed on the vegetation were perched to look for foods. Moreover, the fruit of the trees planted were able to attract fruit-eating birds group (Savard et al. 2000). Therefore, fruit trees were also found in RUF used for birds for food, mainly Mangifera indica and Artocarpus camansi.

The vegetation used by birds is mostly provide economical value including Paraserianthes falcataria, Gmelina arborea, Lagerstroemia speciosa, Swietenia mahagoni and Pinus merkusii. Nevertheless, the existence of these plants triggered the exploitation through illegal logging by human being for wood. If the vegetation is damaged, then the diversity of wildlife including will decrease due to loss of habitat. During the study, there were several threats disrupting the bird's diversity in RUF, including tree logging for building materials, land clearing for plantations, poaching, mining, tourism and recreation. These

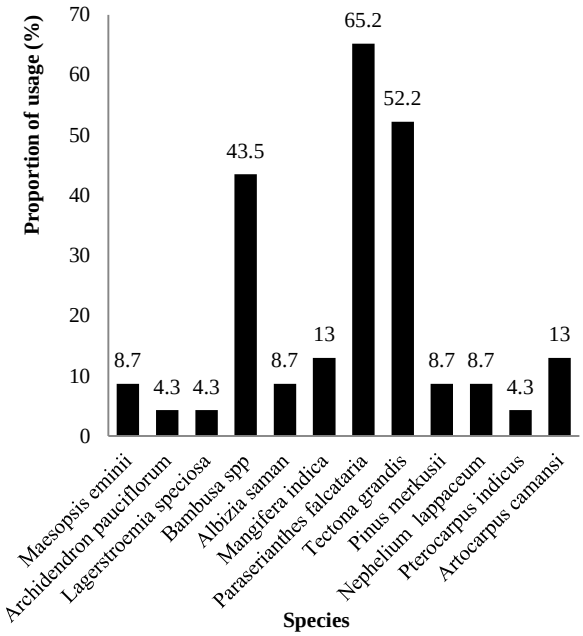

Figure 2. Vegetation used by Birds in RUF

directly affected the diversity of birds. According to the Ontario et al. (1990) high utilization of land and biological resources in the forest would have resulted in the decline of bird diversity.

The presence of birds in particular urban forests has an important role for the ecosystem. Therefore, the urban forest should be able to support bird life. Urban forest as supporting bird's life did not only serve as habitat but also as a preservative place. Jokimaki (1999) informed that 32% of birds tend to refuse occupying a small city park or forest (<0.75 ha) in urban area of northern Finland and level of the threats of nest by predators tend to be higher in smaller vegetation area. Fernández-Juricic and Jokimaki (2001) stated that in order to increase the diversity of birds in urban areas, especially in urban forest, it should provide a wide green space as their habitats.

CONCLUSION

Ranggawulung's urban forest had the potential function for birds habitat which was based on three aspects. Firstly, RUF has a high diversity of tree species diversity index of 3.07. Secondly, it was found 34 species of birds belonging to 19 families which had moderate diversity index 2.95. Thirdly, the birds used various types of trees in RUF for their activities, dominantly were Paraserianthes falcataria, Tectona grandis, and Bambusa spp. Therefore, it needs serious attention to conserve RUF which is started from the local government to prevent human interference in diversity exploitation of RUF. Other stakeholders are also important to sustain the biodiversity of RUF which had been conducted by PT. Pertamina EP field Subang since 2012 and continues until now through tree planting and educational program for local people. Contribution from all stakeholders will maintain the ecological function of RUF for long period of time.

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