

Habitat use by birds in Ranggawulung's Urban Forest, Subang, West Java, Indonesia

Lily Surayya Eka Putri^{1*}, Dasumiati¹, Walid Rumbat¹, Achmad Jaelani¹, Fahri Fahrudin¹, Laksmana Putra Leuvinadrie², Eka Adhi Mulyono²

¹(Department of Biology, Faculty of Science and Technology, State Islamic University Syarif Hidayatullah Jakarta)

²(PT. Pertamina EP Field Subang)

Abstract: Ranggawulung's urban forest (RUF) is a 80 ha mountain forest and a protected area (in-situ conservation area) located in Subang, West Java, Indonesia which is as shelter for birds. This study aimed to determine bird diversity and their habitat in vegetation of RUF in relation to land fragmentation. Diversity of bird used the point transect method with a radius of 50 m in a distance between point count of 100 m which was observed for one week. The vegetation was also assessed in between in the plot with the size of 20x20 m. It was recorded 34 species of birds belonging to 19 families with diversity index of Shannon-Wiener is 2.95. The recorded birds were divided from four guild type which were guild of feeding, nesting, origin and habitat. The higher guild of feeding was insectivores (50%) whereas the canopies (56%) were the dominantly nesting place. Most of birds were not the immigrant's birds (85%) and their habitat was mostly in forest (85%). The vegetation used for bird activity was *Paraserianthes falcataria*, *Tectona grandis*, and *Bambusa spp.* which was the dominant vegetation in RUF.

Keywords: Birds diversity, Guilds, Habitat, Ranggawulung's Urban Forest

I. Introduction

Indonesia is one of the most important places in the world for biodiversity including bird biodiversity. Java is a large island with a fourth-high number of endemic birds after Papua, Sumatera and Borneo as many as 498 species [1]. Many birds are threatened with extinction by forest habitat loss, both historical and ongoing, and also trapping and trade. Urban parks may be capable supporting some of the endemic/threatened and forest specialized bird species present on Java, therefore, the Urban Parks may be of conservation significance.

Ranggawulung urban forest (RUF) is one of the urban forest in Subang, West Java which located at the edge of town (suburban), between natural landscape (Gede Pangrango National Park) and the city of Subang, with latitude 6°34'30"-35°0'S and 107°44'15"-45°0'E and elevation of 500 m above sea level. This urban forest has an area of 80 Ha which is dominated by natural vegetation. The urban forest provides enormous benefits to the surrounding people including aesthetic, hydrology, climatology, ecology, protection, hygienic, and education. One of ecological function of RUF is as habitat for many species of animal including birds. The vegetation of RUF and birds has 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 [2] that there was positive correlation between bird composition and vegetation.

The existence of biodiversity in RUF need to be managed and protected. One of government oil company, PT. Pertamina field Subang had conducted conservation program in the area of RUF since 2012 through planting program of fruit, woody plants and medicinal plants. It was reported that there are 25 birds species belonging to 15 families detected in RUF whereas the diversity index for vegetation was in moderate level ($H' = 2.43$) [3]. To monitor the conservation program doing by PT. Pertamina field Subang, this study of bird diversity in RUF was very important and it is also an ease detection and efficient in time [4,5].

The purpose of this study is to discover the structure of bird community especially its species diversity and habitat structure in RUF. The result of this study can support the biodiversity conservation effort in RUF and maintain the existence from anthropogenic activities.

II. Materials And Methods

The research was conducted in October-November 2015 at Ranggawulung's urban forest, Subang, West Java, Indonesia (Fig. 1). The bird data were obtained by using the distance sampling point count method from 06:00-13:00 am [6,7]. It was established 40 point count stations that were at least 100 m apart throughout the area. Each point count station was surveyed 5 times for 10 minutes at each point count station. Birds were recorded and counted at certain point based on visual and bird voice [8].

The bird species identification used the bird field guide in Sumatera, Jawa, Bali and Kalimantan [9]. The IUCN red data book [10] was used to obtain the status of birds, including the Government Regulation of

Republic Indonesia no. 7 year 1999 on the preservation of plants and animals [11], and trade status based on CITES categories [12].

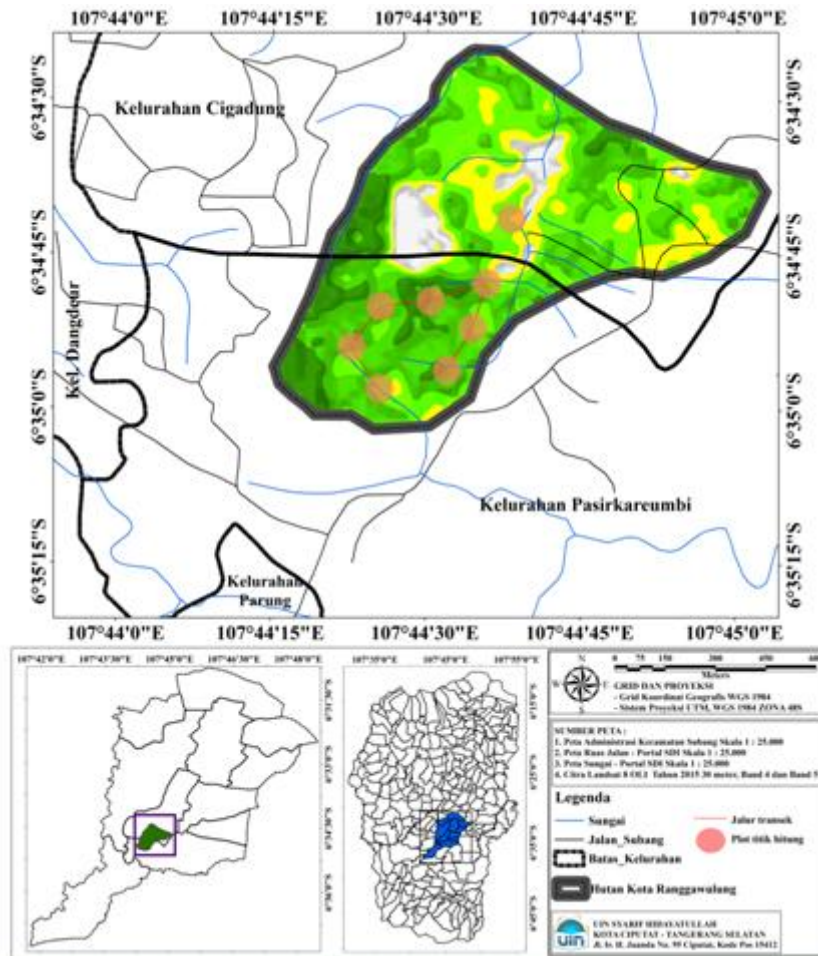


Figure 1: Map of Subang showing RUF as study site

The value of bird species diversity is determined using Shannon-Wiener index [13], which is:

$$H' = - \sum_{i=1}^S p_i \times \ln p_i$$

p_i = bird species no- i / the total number of bird

The Shannon index of Equitability or Evenness is used to determine the abundance proportion of bird species in each habitat type [13], as follows:

$$E = H' / \ln s$$

s = the number of species

Dominant bird in study site is determined using the dominance index [14] and the formula is:

$$D_i = \frac{N_i}{N} \times 100\%$$

D_i = dominance index; N_i = number individu of species; N = total individu

Criteria:

$D_i = 0 - 2\%$ no dominant species

Di = 2 – 5 % subdominant species

Di = >5% dominant species

Each bird species was differed into three guilds which are feeding, migratory and habitat. Feeding guild was categorized into seed eaters, fruit eaters, nectar eaters, predators and insect eaters. The residence status was consisted of migrating and permanent birds. Habitat guild was categorized into forest, urban and wetland. Every species could only had one guild.

The vegetation data is species of plants that birds present. Identification of plants used the plant field guide of Java by Backer and Van Den Brink [15] (1965).

III. Results And Discussion

3.1. Diversity of bird species in RUF

A total of 34 bird species and 19 families were observed in RUF (Table 1). The most commonly found were *Cuculidae*, *Accipitridae*, and *Ploceidae*. *Cuculidae* and *Ploceidae* had better adaptation than others due to suitability of habitat and food availability. Availability of food is the main factors for the presence of birds in a habitat [16], besides nesting, foraging and resting [17].

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.

Based on the IUCN red list, all of the birds found in RUF were classified in least concern or have a low risk for extinction globally. Under Indonesian Government Regulation No. 7 year 1999, the birds protected by law were *Accipiter gularis*, *Accipiter soloensis*, *Pernis ptilorhycus*, *Spilornis cheela*, *Halcyon cyanoventris*, *Todiramphus chloris*, *Anthreptes malacensis*, and *Nectarinia jugularis*. Regarding the CITES categories [12], none of birds found in RUF was listed in the Appendix I, II, or III.

The bird Diversity Index (H') 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 [18,19]. Bird evenness index was high (0.84) which the birds were spread evenly in RUF and there was no bird species that dominates (dominance index value = 0.07). According to Fachrul [20], the dominance index was less than 0.5 meaning no dominance species.

3.2. Habitat disturbance in RUF

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 variety of bird species to find resources for survival, such as food sources, reproduction, as well as space for resting and shelter shield [19]. Plantation is a habitat to find food, and trees were often used by some birds to nest [17].

During the study, we found some of the threats to the bird conservation in the RUF and some are exploiting the high human activity in the region. The activity is land clearing for plantations, poaching, mining and tourism. These activities will directly affect the diversity of species of birds. According to Ontario *et al* [21] high human activity in the use of land resources and biological resources have resulted in a decrease in the diversity of bird species.

The reduced availability of vegetated areas which are essential components of bird habitat have resulted in some species of birds lose habitat. The loss of some species and disruption of ecosystem balance is the impact that would occur when the RUF was not able to maintain the condition of forests due to high human activity. Human development can have several negative effects on birds in remnant forest areas, including but not limited to: concentration of natural and exotic predators and parasites; increased competition with exotic and human-associated bird species, removal of resources and disruption of behavior and movement by human activities [22]. It was proved that 42% decreasing vegetation coverage in RUF occurred in 2015 compared to 2012, although total species of plants increased [23]. On contrary, plant diversity index increases from 2.43 at 2012 becoming 3.64 at 2015. It means that birds were found more on canopy of plants. In this study, it was found 56% birds on the canopy of plants and dominantly on *Paraserianthes falcataria*, *Tectona grandis*, and *Bambusa* spp.

3.3. Birds Guild Diversity 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 to biodiversity [24].

Table 1: Species of birds in RUF and the guild

Species	Family	Relative Abundance	Freq*	Diet	Residence status	Habitat	IUCN
<i>Pernis ptilorhycus</i>	Accipitridae	3%	40%	M	MIG	FOR	LC
<i>Spilornis cheela</i>	Accipitridae	1%	40%	M	MIG	FOR	LC
<i>Accipiter gularis</i>	Accipitridae	2%	40%	M	MIG	FOR	LC
<i>Accipiter soloensis</i>	Accipitridae	2%	20%	M	MIG	FOR	LC
<i>Amauornis phoenicurus</i>	Rallidae	0%	20%	I	RES	W	LC
<i>Glareola maldivarum</i>	Glareolidae	17%	80%	I	MIG	FOR	LC
<i>Treron vernans</i>	Columbidae	1%	40%	F	RES	FOR	LC
<i>Streptopelia chinensis</i>	Columbidae	2%	100%	S	RES	FOR	LC
<i>Cacomantis merulinus</i>	Cuculidae	0%	20%	I	RES	FOR	LC
<i>Chrysococcyx basalis</i>	Cuculidae	0%	20%	I	MIG	FOR	LC
<i>Phaenicophaeus curvirostris</i>	Cuculidae	1%	20%	I	RES	FOR	LC
<i>Centropus bengalensis</i>	Cuculidae	1%	40%	M	RES	FOR	LC
<i>Caprimulgus macrurus</i>	Caprimulgidae	1%	40%	I	RES	FOR	LC
<i>Collocalia linchi</i>	Apodidae	9%	100%	I	RES	U	LC
<i>Apus affinis</i>	Apodidae	4%	60%	I	RES	U	LC
<i>Halcyon cyanoventris</i>	Alcedinidae	4%	100%	I	RES	FOR	LC
<i>Todirhamphus chloris</i>	Alcedinidae	2%	100%	I	RES	FOR	LC
<i>Merops philippinus</i>	Meropidae	3%	40%	I	RES	FOR	LC
<i>Hirundo tahitica</i>	Hirundinidae	1%	40%	I	RES	U	LC
<i>Hemipus hirundinaecus</i>	Campephagidae	0%	20%	I	RES	FOR	LC
<i>Aegithina tiphia</i>	Chloropseidae	1%	40%	I	RES	FOR	LC
<i>Pycnonotus atriceps</i>	Pycnonotidae	6%	100%	F	RES	FOR	LC
<i>Pycnonotus aurigaster</i>	Pycnonotidae	2%	100%	F	RES	FOR	LC
<i>Dicrurus annectans</i>	Dicruridae	0%	20%	I	RES	FOR	LC
<i>Orthotomus sepium</i>	Silviidae	9%	100%	I	RES	FOR	LC
<i>Prinia familiaris</i>	Silviidae	0%	20%	I	RES	FOR	LC
<i>Artamus leucorhynchus</i>	Artamidae	1%	40%	I	RES	FOR	LC
<i>Anthreptes malacensis</i>	Nectarinidae	0%	20%	N	RES	FOR	LC
<i>Nectarinia jugularis</i>	Nectarinidae	8%	100%	N	RES	FOR	LC
<i>Dicaeum trigonostigma</i>	Meliphagidae	1%	40%	F	RES	FOR	LC
<i>Dicaeum trochileum</i>	Meliphagidae	8%	100%	F	RES	FOR	LC
<i>Passer montanus</i>	Ploceidae	1%	80%	S	RES	U	LC
<i>Lonchura punctulata</i>	Ploceidae	5%	100%	S	RES	FOR	LC
<i>Lonchura leucogastroides</i>	Ploceidae	1%	40%	S	RES	FOR	LC

Note: M: Meat, I: insect; F: fruit, S: seed, N: nectar, MIG: migrant, R: resident, FOR: forest, U: urban, W: wetland, LC: least concerned, P: protected, NP: not protected, Freq: an encounter value per repetition

The guild insects-eater was the most dominant found in RUF (50%), while other types of feeding reached 15% were meat eaters and the fruit group (Table 1). This suggested that the availability of insects was quite high which affected the increased insectivorous birds were found in RUF.

The diversity of bird guild was divided into four groups of guild which were feeding, nests, residence status, and its main habitat. Based on the guild of feeding, there were five types: 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 1). This suggested that the availability of insects was quite high which affected the increased insectivorous birds were found in RUF. Moreover, decreasing vegetation in RUF had occurred as reported by Putri [23] which resulted in declined frugivorous birds found only 15% among others in this study. The frugivorous birds play an important role on vegetation recoveries since they help seed dispersal.

The availability of food resources determined the amount of the abundance of birds in an area or region [25]. The level of abundance in particular bird guild was also affected by the width of the niche they occupied [26]. 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 [24].

Most of forest birds are an insect eater and dominantly were found in bird communities living in Java forest as reported by [27,28]. Insect eaten by birds could be as an alternative food due to decline vegetation as sources of nectar, fruit and seed.

While, the resident birds were mostly found in RUF reached 85%. The migrant birds were found 15% in RUF including *Accipiter gularis*, *Accipiter soloensis*, *Pernis ptilorhycus*, *Chrysococcyx basalis* and *Glareola maldivarum*. According to Kukreti and Bhatt [29], the diversity and richness of species might be higher in the summer due to the migration season and breeding season of birds. The North Asian shorebird traveled from the northern hemisphere in winter season to the tropics area.

Most birds (85%) were found as forest bird. There were also urban or commensal bird (12%) including *Collocalia linchi*, *Apus affinis*, *Hirundo tahitica*, and *Passer montanus*. *Amauornis phoenicurus* was the only

water bird (3%) recorded in RUF. The existence of rice fields and some springs allowed these birds live in the RUF.

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. Response guild can produce an effective indicator of the habitat disturbance.

3.4. Vegetation use by Birds

The trees used by birds in RUF were 12 species (Fig. 2). The tree species widely used by birds were *Paraserianthes falcata*, *Tectona grandis* and *Bambusa* spp. 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. Fruit trees were found in RUF used for birds for food, mainly *Mangifera indica* and *Artocarpus camansi*.

The vegetation used by birds is mostly providing economic value including *Paraserianthes falcata*, *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

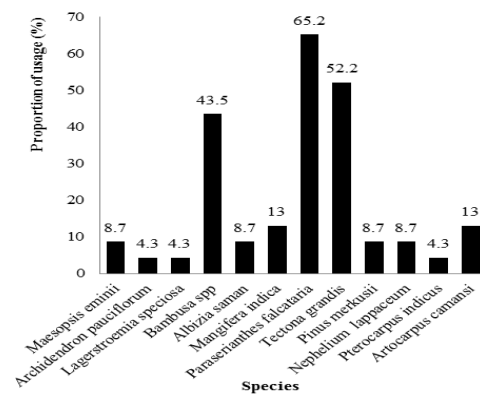


Figure 2: Vegetation used by birds in RUF

clear for plantations, poaching, mining, tourism and recreation. These directly affected the decline of bird diversity. Therefore, conservation program should be maintained sustainably both for plants and animals in RUF as there is significance relation between diversity of plants and bird. It was proved that an increase diversity of plants will enhance number of bird species (Table 2).

Table 2: C

Parameter	2012	2015
Diversity Index (H') of plants	2.43*	3.64**
Total Species of bird	25*	34
Total Family of bird	15*	19

*Centre for Environmental Studies [3]

**Putri [23]

IV. Conclusion

There were 34 bird species belonging to 19 families found in Ranggawulung's Urban Forest whereas 8 species are protected by law, *Accipiter gularis*, *Accipiter soloensis*, *Pernis ptilorhynchus*, *Spilornis cheela*, *Halcyon cyanoventris*, *Todiramphus chloris*, *Anthreptes malacensis*, and *Nectarinia jugularis*. Most of birds in RUF were categorized in resident bird which were dominantly insects eater and 88% of which were detected in forest guild.

The use of vegetation by bird in RUF was dominated by *Paraserianthes falcata*, *Tectona grandis* and *Bambusa* spp. The increase diversity of plants will affect the increase of bird species.

Therefore, conservation program in RUF should include the socialization of bird species that live in RUF along with their status. Prohibition of catch and hunt for protected bird is also enforced, and also

prohibition of cutting the trees. Contribution from all stakeholders including local people is needed to maintain the ecological function of RUF for long period of time.

Acknowledgements

The authors thank PT Pertamina EP Field Subang as the main sponsorship in financial support of this study. The authors also wish to thank LP2M, one of the Research and Community Services Institution in UIN, Syarif Hidayatullah Jakarta who supported in administrative works and the rangers of Ranggawulung's Urban forest giving useful information in this study.

References

- [1]. W. Sukmantoro, M. Irham, W. Novarino, F. Hasudungan, N. Kemp and M. Muchtar, *List of birds of Indonesia no. 2* (Indonesian Ornithologists' Union, Bogor, 2007).
- [2]. H.S. Alikodra, *Management of wild life* (Yayasan Penerbit Fakultas Kehutanan IPB, Bogor, 2002).
- [3]. Centre for Environmental Studies, *Report study of biodiversity and biological resources in Ranggawulung Urban Forest, Subang* (Centre for Environmental Studies UIN Syarif Hidayatullah Jakarta and PT. Pertamina EP Java Regian Field Subang, 2012).
- [4]. S. Dale, K. Mork, R. Solvang, A.J. Plumptre, Edge effect on the understorey bird community in a logged Forest Uganda, *Conservation Biology*, 14 (1), 2000, 265-276.
- [5]. K.C. Seto, E. Fleishman, J.P. Fay, and C.J. Betrus, Linking spatial patterns of bird and butterfly species richness with landsat TM derived NDVI, *International Journal Remote Sensing*, 25(20), 2004, 4309-4324.
- [6]. W. Young and M.F. Deborah, Consistency of mist netting and point counts in assessing land bird species richness and relative abundance during migration, *The Condor*, 104, 2001, 59-72.
- [7]. N. Chettri, C. Debes, S. Eklabya and J. Rodney, The relationship between bird communities and habitat: a study a tekking corridor in the Ikkin Himalaya. *Mountain Research and Development*, 25(3), 2005, 235-243.
- [8]. C. Bibby, J. Martin and M. Stuart, *Field expedition techniques of bird survey* (Indonesia: Birdlife International-Indonesia Programme, 2000).
- [9]. J. MacKinnon, K. Philips and B. Van Balen, *Field guide to the birds of Sumatra, Java, Bali and Borneo (including Sabah, Serawak and Brunei Darussalam)* (Centre of Research and Development in Biology, Bogor, 2010).
- [10]. International Union for Conservation of Nature (IUCN), *The IUCN Red List of Threatened Species*. Gland, Switzerland: International Union for Conservation of Nature (IUCN) (Retrieved from www.iucnredlist.org, 2012)
- [11]. Government regulation of Republic Indonesia no. 7 year 1999 on the preservation of plants and animals.
- [12]. CITES, *Convention on International Trade in Endangered species of Wild Fauna and Flora*. Appendices I, II and III. CITES and UNEP. Retrieved from <http://www.cites.org/eng/app/2012/E-2012-09-25.pdf>, 2012)
- [13]. A.E. Magurran, *Ecological Diversity and Its Measurement* (Princeton University Press, New Jersey, 1988)
- [14]. G.W.H. Helvoort, *Bird Population in The Rural Ecosystem of West Java* (Nature conservation Department, Netherlands, 1981).
- [15]. C.A. Backer, R.C.B. Van Den Brink Jr., *Flora of Java*. Vol II. (N.V.P Noordhoff-The Netherlands, Groningen, 1965).
- [16]. J.A. Wiens, N.C. Stenseth, B. Van Horne and R.A. Ims, Ecological mechanisms and landscape ecology, *Oikos*, 66, 1993, 369-80
- [17]. M. Rahayuningsih, A. Mardiasuti, L.B. Prasetyo, and Y.A. Mulyani, Bird community in Burung Island, Karimun Jawa National Park, Central Java, *Biodiversitas*, 8(3), 2007, 183-187.
- [18]. J.C. Welty, *The life of birds*. 3rd ed. (Saunders College Publishing. Philadelphia, 1982)
- [19]. W. Kuswanda, Influence of composition of plants against bird populations in Batang Gadis National Park, North Sumatra, *Journal of Forest Research and Nature Conservation*, 2(7), 2010, 193-213.
- [20]. M.F. Fachrul. *Sampling method for bioecology* (Jakarta (Bumi Aksara, 2007)
- [21]. J. Ontario, J.B. Hernowo, Haryanto and Ekarelawan. 1990. Habitat management of birds in settlement areas, with special emphasis in urban environment, *Media Konservasi*, 3(1), 1990, 15-28.
- [22]. J. Mason, C. Moorman, G. Hess and K. Sinclair, Designing suburban greenways to provide habitat for forest-breeding birds, *Landscape and Urban Planning*, 80, 2007, 153-164.
- [23]. L.S.E. Putri, Dasumiati, R. Fauziah, S. Bahri, A. Danial, H.F. Lubis, L.P. Leuvinadrie and E.A. Mulyono, Ranggawulung's Urban Forest, Subang District, Indonesia: Landuse Change and Values in Relation to Plant Community Structure, *International Journal of Applied Environmental Sciences*, 11(2), 2016, 599-611.
- [24]. M.A. Gray, S.L. Baldauf, P.J. Mayhew, and J.K. Hill, The response of avian feeding guilds to tropical forest disturbance, *Conservation Biology*, 21(1), 2007, 133-141.
- [25]. M. Wong, Trophic organization of understory birds in a Malaysian Dipterocarp Forest, *Auk*, 103, 1986, 100-116.
- [26]. W. Novarino, A. Mardiasuti, L.B. Prasetyo, R. Widjayakusuma, Y.A. Mulyani, H. Kobayashi, A. Salsabila, Jarulis, and M.N. Janra. Composition of guild and dan wide of niche of lower strata birds in Sipisang, West Sumatera, *Biota*, 13 (3), 2008, 155-162.
- [27]. N.S. Sodhi, L.P. Koh, D.M. Prawiradilaga, Darjono, I. Tinulele I, D. Putra and T.H.T. Tan, Land use and conservation value for forest birds in Central Sulawesi (Indonesia), *Biological Conservation*, 122, 2005, 547-558.
- [28]. R. Partasasmita, A. Mardiasuti, D.D. Solihin, R. Widjayakusuma, S.N. Priyono, K. Ueda, The frugivorous , *Biosfera*, 26(2), 2009, 90-99.
- [29]. M. Kukreti and D. Bhatt, Birds of lansdowne forest division and adjacent suburban landscapes, garhwal Himalayas, Uttarakhand, India: community structure and seasonal distribution, *Biodiversitas*, 1(15), 2014, 80-88.