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Bird community in Taman Kehati Universitas Negeri Semarang, Indonesia

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ABSTRACT

This research was to analyze the bird community in Taman Kehati Universitas Negeri Semarang (Unnes) in relation with species richness, species diversity and evenness. The data were collected by point count method. Bird observation was conducted from 06.00 to 12.00 hours, when their activities was at its peak. The distances between each point count were 150 meters with viewing radius of 20 meters from each point. The study revealed that there were 24 bird species belongs to 19 families and 8 orders. Three of these birds species were protected by Indonesian legal codes, one species was categorized as NT (Nearly Threatened) by IUCN 2014 (International Union for Conservation of Nature) and one of them was enlisted in CITES (Convention on International Trade of wild fauna and flora). The diversity index (H') of the bird species was 2.95, species richness index (D_{mg}) was 5.66 and evenness index (E) was 0.93.

Keywords: Taman Kehati Unnes, bird community, species diversity, conservation

Mathematics Subject Classification: 15A04, 15A99

Journal of Economic Literature (JEL) Classification : Q57, Q51, Q52, Q53

1. INTRODUCTION

Taman Kehati Unnes, is a biodiversity garden located in Gunung Ledek Semarang, was established by Indonesia Ministry of Environment in 2008. It has area of 64 hectares with 15 hectares from the total amount is given for conservation of 51 endemics plants species of Central Java (Rahayuningsih et al., 2010). In its development, the concept of Taman Kehati is need to be evaluated as it is supposed to include not only collecting of plants species, but also being an area to natural resources reservation which is functioning as in-situ and ex-situ conservation. It is especially for the plants that needs the help of pollinator and seed-cracker animals to help them pollinates. Taman Kehati Unnes should be going through redesign, since the condition of the area are susceptible to landslides and also it is need to supports existed flora and fauna data. Research or monitoring, especially for the flora and fauna in the park, has to be done. Some landscape exhibit high richness in biological diversity whereas others show an impoverished flora and fauna (Joshi et al 2012) .

The study of bird community is an effort to manage the potential of biodiversity in Taman Kehati. It is because the birds could become an indicator of biodiversity, environmental quality changes, and the stipulation of conservation area. In context to developing plan as conservation university, the

biodiversity data such as t a variety of fauna is also needed to determine the policy direction of managing the park and the priority of doing conservation around the campus. The Result of this research is expected to know the diversity and habitat of the birds and find out the steps that has to be done as the effort of biodiversity conservation especially in Taman Kehati Unnes.

2. METHODS

The research was conducted in Taman Kehati Unnes, in Sekaran Village of Gunungpati Sub-district (Figure 1). It was done between May and November 2013. Birds were observed by Nikon 8 x 30 binocular and Nikon 20 x 60 monocular. Indirectly records method was also done by birds voices. It were recorded in its location by Global Positioning System (GPS) Garmyn e-trex 12 channel, compass, camera, and identified by the guidebook of bird (Mackinnon et al 2010).



Figure 1. Research location in Taman Kehati Unnes

Observation was done between 6 am and 12 PM when birds's activities are high (Catry et al., 2000; Wang & Deborah 2002; Koh et al., 2002; Chettri et al., 2005). We divided the study location at five transects in the area of the Taman Kehati (Figure 2). The entire birds datas is taken by point count method. In this method, observer stops at a point and counts every detected bird for a certain time. we stand at one place, it is possible to count all the birds seen and heard. At its simplest such a method was repeated over several places so as to record bird species present in the area (Bibby et al., 2000; Dapke et al 2015). Radius observation at every point is determined based on the vegetation type and ability of the observer (20 meters), while the duration at every point count is 10 minutes with recess time on the first 1-2 minutes. Distance among points in this observation is 150 meters to

reduce the recounting of same individual birds species (Javed and Rahul 2000). The total point count in this study divide into 5 transect and were 10 point/transect. Birds that flew overhead but did not land in the sites were not recorded. The scientific and local names of bird species are based on Mackinnon et al (2010) and Sukmantoro et al., (2007).

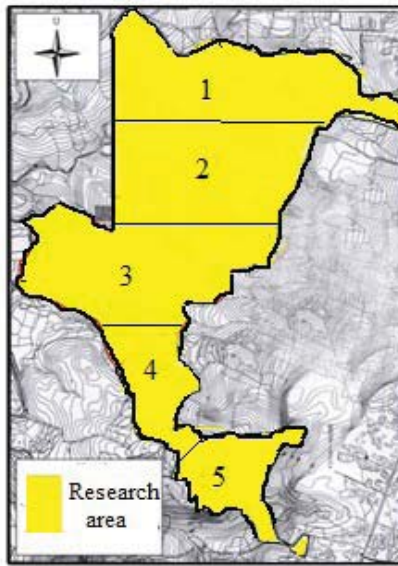


Figure 2. Research area and transect (1-5)

The conservation status of birds are recorded based on IUCN criteria (2014), government regulation status, and trade status (Soehartono & Mardiasuti 2003).

The value of bird species richness was analyzed by Margalef's Diversity Index (DMg) (Magurran, 1988) :

$$D_{Mg} = (S-1) / \ln N$$

S = the number of species record and N= the total number of individual summed over all S species)

The Shannon-Wiener index was used to determine the value of bird species diversity (Magurran 1988), which is:

$$H' = \sum_{i=1}^s pi \log pi$$

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

The Shannon index of Equitability or Evenness, referred in Magurran (1988) was used to determine the abundance proportion of bird species in each habitat type and land landscape. They are as follows:

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

S = the number of species

3. RESULTS

This study showed that a total of 24 bird species belonging to 19 families and 8 orders were reported in Taman Kehati Unnes. Three of these birds species were protected by Indonesian legal codes, Crested Serpent Eagle (*Spilornis cheela*), Javan Kingfisher (*Halcyon cyanoventris*) and Olive-backed Sunbird (*Cynnyris jugularis*) Government law No 5/ 1990, Government Regulation No 7/ 1999, and Government Regulation No 8/ 1999, one species Asian Golden Weaver (*Ploceus hypoxanthus*) was categorized as NT (*Nearly Threatened*) by IUCN (International Union for Conservation of Nature) and one of them (*Spilornis cheela*) was enlisted in CITES (Convention on International Trade of wild fauna and flora) Appendix II (Table 1).

Table 1. Birds species recorded in Taman Kehati Unnes between May to November 2013

Order	Family	Scientific name	English name	Protection status
Accipitriformes	Accipitridae	<i>Spilornis cheela</i>	Crested Serpent Eagle	CI (II), AB
Apodiformes	Apodidae	<i>Collocalia linchi</i>	Cave Swiftlet	
	Hirudinae	<i>Hirundo tahitica</i>	Pacific Swallow	
Charadriiformes			Kurrichane	
	Turcinidae	<i>Turmix sylvatica</i>	Buttonquail	
Columbiformes	Columbidae	<i>Geopelia striata</i>	Zebra Dove	
		<i>Streptopelia chinensis</i>	Island Collared Dove	
Coraciiformes	Alcedinidae	<i>Halcyon cyanoventris</i>	Javan Kingfisher	AB, EJ
Cuculiformes	Cuculidae	<i>Cacomantis merulinus</i>	Plaintive Cuckoo	
		<i>Centropus bengalensis</i>	Lesser Coucal	
Galliformes	Phasianidae	<i>Gallus varius</i>	Green Junglefowl	
Passeriformes	Aegithinidae	<i>Aegithina tiphia</i>	Common IoraC	
	Campephagidae	<i>Pericocrotus cinnamomeus</i>	Small Minivet	
	Cisticolidae	<i>Prinia familiaris</i>	Bar-winged Prinia	
	Corvidae	<i>Corvus enca</i>	Slender-billed Crow	
			Scarlet-headed Flowerpecker	
	Dicaeidae	<i>Dicaeum trochileum</i>	Flowerpecker	
	Estrildidae	<i>Lonchura leucosgatroides</i>	Javan Munia	
		<i>Lonchura maja</i>	White Headed Munia	
		<i>Lonchura punctulata</i>	Scaly Breasted Munia	
	Nectariniidae	<i>Cinnyris jugularis</i>	Olive-backed Sunbird	AB
			Eurasian Tree Sparrow	
	Passeridae	<i>Passer montanus</i>	Sparrow	
	Ploceidae	<i>Ploceus hypoxanthus</i>	Asian Golden Weaver	IUCN (NT)
	Pycnonotidae	<i>Pycnonotus aurigaster</i>	Sooty-headed Bulbul	
	Sylviidae	<i>Orthotomus ruficeps</i>	Ashy Tailorbird	
		<i>Orthotomus sutorius</i>	Common Tailorbird	

- A : Protected by Government Law No 5/1990
- B : Protected by Government Regulation No 7 1999
- CI (II) : CITES (Convention on International Trade of wild fauna and flora) Appendix II
- IUCN (NT) : International Union for Conservation of Nature : NT : Near Threatened

The existence of *Ploceus hypoxanthus* in Taman Kehati Unnes suggest that this study area is one of its favorable habitats. *Ploceus hypoxanthus* was considered as NT by the IUCN 2014 that lived in group or colony in shrubs and reeds, also in swamps or in opened area.

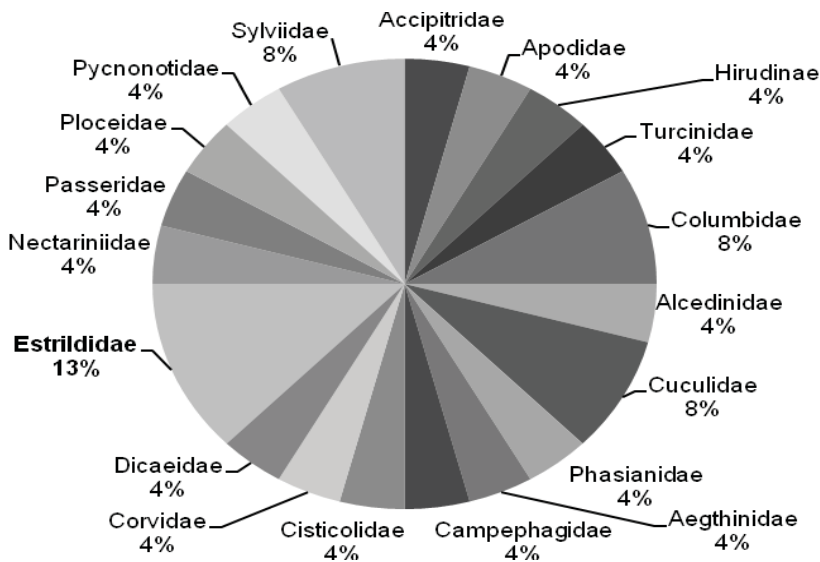
Birds diversity can be seen by various parameters. Those parameters, among others, are species richness, species diversity and evenness index values. The data analysis result of species diversity showed that Taman Kehati Unnes has species richness index (Dmg) of 5.66, and diversity index (H') of 2.95, while the evenness index (E) is considered high (0.93) (Table 2).

Table 2. The number of species, number of individual, species richness index, diversity index and evenness index of Taman Kehati Unnes

Number species (S)	24
Total number individual (N)	58
Spesies richness index(DMG)	5,66
Diversity index (H')	2,95
Eveness indekx (E')	0,93

The bird diversity in Taman Kehati is higher than in campus area of Unnes. Diversity index in Taman Kehati is lower than that of in Java, such as Gunung Halimun National Park, based on another research. Value of evenness index (E) was 0,92 showed that diversity index in Taman Kehati is quite high. It describes that the wealth of individuals of birds species in the park is almost well-balanced and no domination from another bird species.

From the 24 birds species which belongs to 19 families and 8 orders, the first three families with the overall highest number of taxa were Estrilididae (3 species; 13%), followed by Cuculidae and Sylviidae (2 species or 8%). Meanwhile, others 16 families consist of only one type of 4% (Figure 3). Estrilididae is a sparrow bird family that includes in the group of seed-eater bird, and belongs to a big troop when they seek for food (Mackinnon et al 2010). Three species from Estrilididae family, that was recorded in Taman Kehati Unnes were including *Lonchura leucogastroides*, *Lonchura maja*, and *Lonchura punctulata*.



According to the average percentage amount of individual per family, the largest percentage is dominated by Phasianidae (12%), and then Pycononotidae (10%), and Apodidae, Estrildidae (9%). While Turnicidae, Ploceidae, Hirudinae, Corvidae, and Campephagidae only represented 2% (1 individual) (Figure 4). Phasianidae family member which very common to be seen (total individual) is Green Junglefowl (*Gallus varius*).

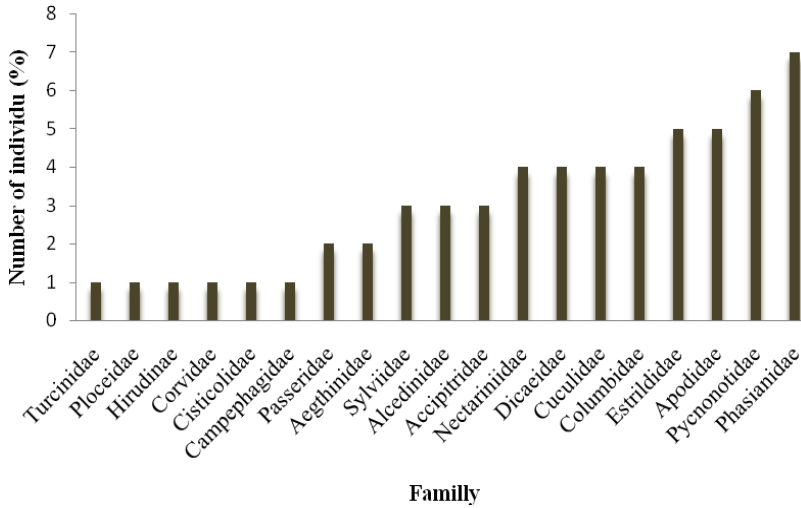


Figure 4. The average percentage of amount of individual per family

Presence of some birds species, including status of the protected and non-protected species in Taman Kehati Unnes, indicates that it is a good habitat for its birds species. Therefore, Taman Kehati is one of the remaining green opened space in Semarang City and must be protected and preserved. Protection towards the area is urgently required as the loss of habitat holds the key to the extinction of animals.

Analysis result on each observation transect indicates different bird species diversity on each transect. Third transect has the highest diversity index (2.58), while the fifth transect has the lowest diversity index (H=1.56; E=0.97). Generally, existed vegetation transect in that place is almost similar with the other fourth transect, but what makes it differents is the tight row of bamboos in the third transect (Table 3).

Table 3. The number of individuals, species richness index, diversity index, and evenness index on each transect in Taman Kehati Unnes

	Transect 1	Transect 2	Transect 3	Transect 4	Transect 5
Number of individuals (N)	13	5	18	16	6
Number of species (S)	13	5	14	12	5
Species richness index DMG	4.68	2.49	6.44	6.04	3,12
Diversity (H')	2.56	1.61	2,58	2,39	1,56
Evenness (E')	1	1	0,98	0,96	0,97

4. DISCUSSION AND CONCLUSION

From data analysis of species diversity in Taman Kehati Unnes, the diversity index (H') is 2,95. According to Magurran (2004) stated that Shannon's diversity index, which obtained from empirical data, usually falls between 1.5 and 3.5 and rarely surpasses 4. It is only when there are huge number of species in the sample that high values are produced. Difference sample sizes will also affect the Shannon diversity index. The bigger sample size and individual total will influence the index to be higher.

The bird diversity in Taman Kehati has the higher diversity index (H') than in Unnes campus was 2,5 (Rahayuningsih et al., 2007). Moreover, Wisnubudi (2004) reported that the diversity index value in Cikaniki, Curug, Cikupadeh, and Citalahab Gunung Halimun National Park (TNGH) was around 3,40-4,00. Meanwhile Prawiradilaga et al., (2002) stated that the diversity index value in Gunung Kendeng Gunung Halimun National Park was 3,53. Remegie & Gu (2008) stated that high evenness index showed a habitat with almost balanced or even rich of individual species. Meanwhile, low evenness index showed the tendency of certain domination species in a habitat. This suggests that the habitat conditions in the Taman Kehati has the availability of life resources such as food, shelter and breeding ground for the bird species in that area. Welty (1982) stated that habitat diversity will influence the bird diversity. The distribution of bird community is also affected by its habitat, and dynamically tends to show the relation between bird population and their habitat (Chettri et al., 2005). Alikodra (2002) mentioned that the high bird species diversity in particular region is supported by high habitat diversity. This is because the habitat has function as a place for feeding, drinking, resting, and breeding. So the high present number of wild animals is due to the availability of life needed in that habitat. Estrildidae was the most dominant families among the study sites, Estrilididae is almost found in every kinds of habitats such as forest, rice fields, farm, prairie, and in settlement. Taman Kehati Unnes has favorable condition for them as place to perch, to play, to seek for food, and even to build their nest at most of its vegetation is shrubs. The distribution of individual bird families in Taman Kehati was dominated by *Gallus varius*. *Gallus varius* prefers open area, prairie, forest edge, and hills. The condition of Taman Kehati was suitable for *Gallus varius* since it is placed in hills, in the edge of forest, and some places are open area and prairie. *Gallus varius* often have rest in the tree branches with height 1-4 meters. During their reproduction, *Gallus varius* made nest above the ground and layered with grass between bushes or shrubs (Mackinnon et al., 2010).

A total of 24 bird species belonging to 19 families and 8 orders were reported in the Taman Kehati Unnes. Three of those birds species were protected by Indonesian legal codes, one species was categorized as NT (*Nearly Threatened*) by IUCN (*International Union for Conservation of Nature*) and one of them were enlisted in CITES (*Convention on International Trade of wild fauna and flora*) Appendix II. It was noted that Estrildidae (13%) followed by Cuculidae and Sylviidae (8%) were the most dominant families among the study sites. The diversity index (H') of the bird species in Taman Kehati Unnes was 2.95, species richness index (D_{mg}) was 5.66, and evenness index (E) was 0.93.

5. ACKNOWLEDGMENT

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