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Exploration Of Bird Species Diversity In Sanggabuana Area, Citalaksana, Karawang, West Java

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Abstract

Mount Sanggabuana has a high potential as a conservation site for Java's decreasing biodiversity. However not many research reports have been found that discuss birds in the area. The purpose of this paper is to determine the diversity of bird species in the Sanggabuana Area, Cintalaksana, Tegalwaru, Karawang, West Java. The research was conducted on 15-17 August 2024 using the *point count* method. Based on the results of observations, 26 bird species from 16 families were recorded and there are five bird species protected according to the Minister of Environment and Forestry Regulation No. 20 of 2018, one of which is Wreathed hornbill *(Rhyticeros undulatus*). The diversity of bird species in the Sanggabuana area is classified in the medium category, details of the H' value in the primary forest (Jalur Hutan) of 2.54 and in the secondary forest (Jalur Curug) of 2.55. The dominating bird species in the primary forest habitat is Flame-fronted barbet (*Psilopogon armillaris*) while in the secondary forest is Sooty-headed bulbul (*Pycnonotus aurigaster*). Diversity of birds in the study area are representative of a fragmented habitats consisting of primary and secondary forests. Mount Sanggabuana require further research and conservation actions to preserve its biodiversity.

Keyword: Birds, Diversity, Habitat, Sanggabuana

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INTRODUCTION

Indonesia has abundant natural resources, making it one of the mega biodiversity countries. Indonesia is inhabited by 25% of fish, 16% of herpetofaunas, 15% of insect, 12% of mammal, and 10% of flowering plant species in the world (Noberio *et al*., 2015).. As of 2024, Indonesia holds more than 1768 species of birds, which is 17% of world's diversity of birds (Billerman *et al*., 2022; Noberio *et al*., 2015). The level of bird diversity in Indonesia is very high and ranks fourth in terms of bird diversity in the world (Iswandaru *et al*., 2020).

Birds are one of the most important components of forest ecosystems. Ecologically, birds play an important role in the natural regeneration of forests, such as seed dispersers, pollinators, and pest controllers (Saibi *et al*., 2019). Birds in this way also act as environmental bioindicators, as forests with a high diversity of birds means it's likely a healthy one (Saefullah *et al*., 2015). Birds require several conditions to survive, including suitable resources and habitats with minimal disturbances, both man-made and natural such as deforestation, illegal hunting, and natural disaster (Kamal *et al*.,

2017). Bird diversity is influenced by abiotic and biotic factors, which often influences the availability of food, nesting sites, and predation (Sumbaluwu *et al.*, 2014).

One of the regions in West Java still harbouring rich bird diversity is Mount Sanggabuana area located in Karawang Regency, West Java Province. Among Sanggabuana's bird diversity are migrant raptor species, such as Chinese sparrowhark (*Accipiter soloensis*), and Japanese sparrowhawk (*Accipiter gularis*) (Kiara, 2021). However, even Mount Sanggabuana is facing increasing man-made disturbance. Karawang Regency is known as an industrial city with rapid economic growth every year, accompanied by infrastructure development in various fields, including agriculture as well as tourism (Widiatmaka *et al.*, 2013). Rapid economic and population growth would causes increasingly encroachment of agriculture fields and residents to wild bird habitats (Cody, 1991). Moreover, Mekarbuana Village, one of the villages located near Mount Sanggabuana forests, has immense potential as a tourist area. Religious tourism and ecotourism may increase development of land (Habibie Nur, 2021). According to Cody (1981), regions experiencing land use changes caused by large-scale development impacts, will cause environmental imbalances. Thus, it is important the diversity of birds in Mount Sanggabuana to be fully known so that necessary conservation actions, such as turning the area into a national park can be undertaken. Data of bird diversity in Mount Sanggabuana has never been published and thus the purpose of this research is to reveal preliminary species diversity of avifauna in Mount Sanggabuana forests.

METHOD

Time and Place

This research was carried out on 15 – 17 August 2024. The location of this research was in Sanggabuana, Cintalaksana, Tegalwaru, Karawang, West Java.

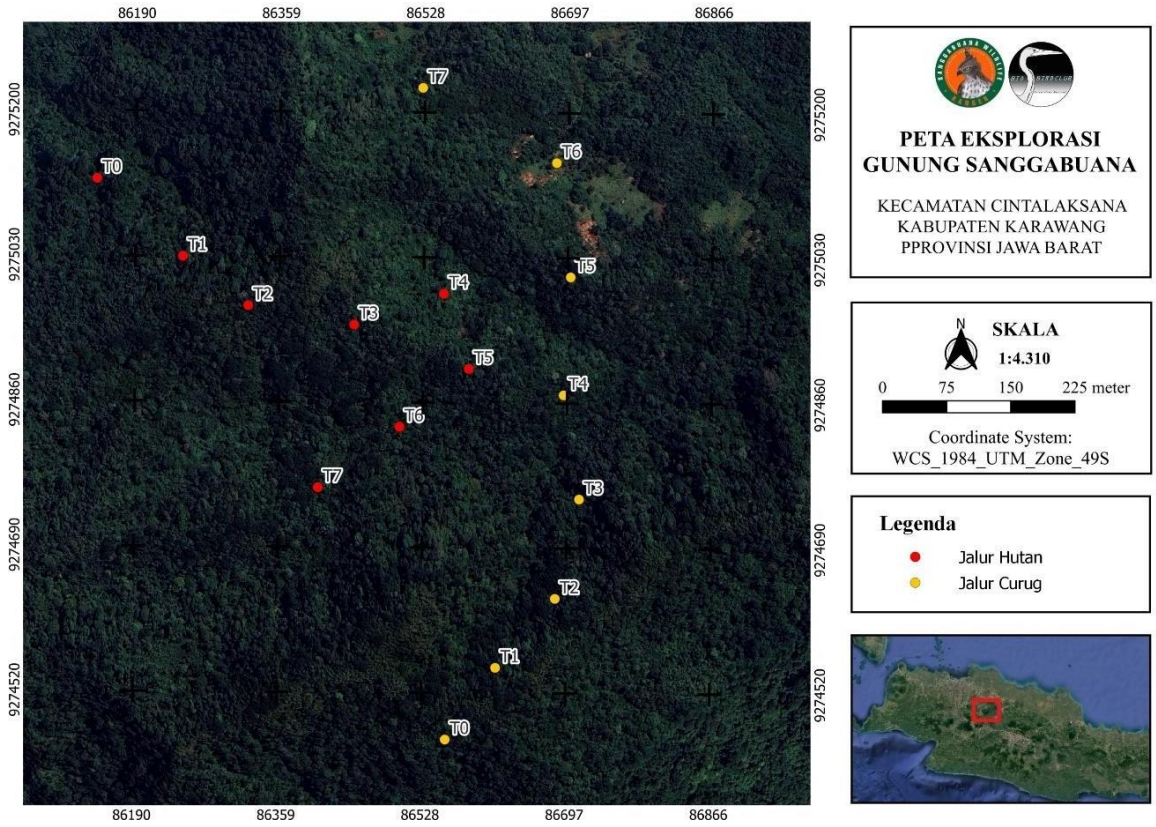


Figure 1. Map of Research Location

Research Instrument

The equipment used in this research was binoculars, digital cameras, writing tools, books for taking notes, watches, data tabulation, counters, and the field identification book "Panduan Lapangan Burung-Burung di Indonesia: Sunda Besar" (Birds of Indonesia Field Guide: Greater Sunda) (Taufiqurrahman *et al*., 2022)

Ways of working

Observations were made in the morning and evening, spanning 2 days. Observation time was carried out in the morning at 07.00 - 11.00 WIB and in the afternoon at 14.00 - 17.00 WIB. Bird observations are carried out using the point count observation method on predetermined routes (Jalur Hutan and Jalur Curug). Data collection is carried out at observation points along the route with an interval distance of 100 meters per point. At each point, observation of birds was carried out for 15 minutes with an observation radius of 50 meters. The observation data collected is the type of bird found either visually or directly seeing it or through sound (vocals), the number of individual birds, data on tree use by birds, canopy use by birds, and point coordinates.

Data analysis:

1. Dominance Index

The Dominance Index (D) ranges from 0 to 1, where the greater the dominance index value, it indicates that there is one or more species that dominates the proportion of individuals in the community, with a larger population than other birds, and vice versa. The equation is as the following ((Odum, 1993):

$$D = \Sigma \left(\frac{Ni}{N}\right)^2$$

2. Similarity Index

The similarity index is used to determine the similarities in the composition of bird species found in two types of habitats. The Similarity Index (IS) can be calculated using the formula (Magurran, 1988):

$$IS = \frac{2C}{A+B} X\ 100\%$$

Description:
IS = Type Similarity Index
A = Number of bird species that are only found in community A
B = Number of bird species that are only found in community B
C = Number of bird species found in communities A and B

3. Species Diversity Index

Used to determine the level of diversity of bird species. The calculation of the species diversity index value is determined by the Shannon-Wiener index (Magurran, 1988) with the following equation:

$$H' = -\Sigma pi\ lnpi$$

$$pi = \frac{ni}{N}$$

Information:
H' = Species Diversity Index
Pi = Proportion of important values of type i
ln = Natural Logarithm
ni = Number of individuals in type 1
N = Number of individuals of all species

The H value can be used to determine the level of diversity (Magurran, 1988), namely:
H value ≤ 1.5 = Low diversity
H value 1.5-3.5 = Medium diversity
H value > 3.5 = High diversity

Hutchinson test was used to compare the diversity between the two types of habitats. This test is used to determine whether or not there are differences in bird diversity index between (bird types). In the Hutchinson test using the "t" test the value with a 95% chance (α = 0.05) is as follows:

$$Var\ H' = \frac{\frac{\Sigma pi\ (lnpi)2\ -\ (\Sigma pilnpi)2}{N}}{N} - \frac{S-1}{2N}$$

$$thit = \frac{H'1 - H'2}{\sqrt{var\ H'1 + var\ H'2}}$$

The degree of freedom can be calculated as follows:

$$db = \frac{(var\ H'1 + var\ H'2)^2}{\frac{(var\ H'1)^2}{N1} + \frac{(var\ H'2)^2}{N2}}$$

Information:
Var = Difference in species diversity between regions (variance)
S = Number of species discovered

Hypothesis rejection criteria:
Thit < t0.05(db), then H1 = H2, so the conclusion is to accept H0, there is no difference.
Thit > t0.05(db), then H1 ≠ H2, so the conclusion rejects H0, there is a difference.

4. Abundance, Frequency and Importance Value Index (INP)

Abundance shows the number of individuals of certain species that are members of a community. Relative abundance is calculated by dividing the abundance of a species by the abundance of all species. Abundance and relative abundance values (Balen, 1984) can be calculated as follows:

$$K = \frac{Number\ of\ individuals\ in\ each\ habiatt}{Total\ number\ of\ individual}$$

$$KR = \frac{Abundance\ (K) of\ species\ i}{Total\ abundance\ of\ all\ species}$$

Frequency is a quantity that expresses the rate of species encounter in a community. Relative frequency is obtained from the comparison between the frequency of one type and the frequency of all types. The frequency and relative frequency values (Balen, 1984) can be calculated as follows:

$$F = \frac{Number\ of\ points\ containing\ i}{Total\ number\ of\ points}$$

$$FR = \frac{Frequency\ of\ individuals\ of\ a\ species}{Sum\ of\ frequencies\ of\ all\ species}\ x\ 100\%$$

To see which bird species that dominate a habitat, it is necessary to calculate the Importance Value Index (INP) according to Fachrul (2012) which can be calculated as follows:

$$INP = KR + FR$$

Information:
FR = Relative frequency
KR = Relative abundance

Information:
FR = Relative frequency KR = Relative abundance

5. Evenness Index

The evenness of bird species in a community can be calculated using the Species Evenness Index formula according to (Fachrul, 2012) with the following formula :

$$E = \frac{H'}{\ln(S)} X\ 100\%$$

Information :
E = Evenness index
H'= Shannon-wiener diversity index
S = Number of types found

If the species evenness index value is close to 1, it indicates that the distribution of individual bird species in a community is becoming more evenly distributed and if the evenness index value is close to 0, it indicates that there are one or more bird species whose individuals will be found more often than other species (Fachrul, 2012).

RESULT

A. Bird Species Composition and Conservation Status

During the two-day observations in the Cikoleangkak Trail area, a total of 26 bird species were recorded in 16 families (Table 1).

Table 1. List of bird species found during the observation period

No	Family	Scientific Name	Indonesian Name
1	Apodidae	*Collocalia linchi*	Walet linchi
		Cypsiurus balasiensis	Walet palem asia
2	Accipitridae	*Spilornis cheela*	Elang-ular bido
		Pernis ptilorhynchus	Sikep madu asia
3	Alcedinidae	*Todiramphus chloris*	Cekakak sungai
4	Aegithinidae	*Aegithina tiphia*	Cipoh kacat
5	Bucerotidae	*Rhyticeros undulatus*	Julang emas
6	Cuculidae	*Zanclostomus javanicus*	Kadembang
7	Cisticolidae	*Orthotomus sepium*	Cinenen jawa
		Orthotomus ruficeps	Cinenen kelabu
8	Columbidae	*Chalcophaps indica*	Delimukan zamrud
9	Dicaeidae	*Dicaeum trochileum*	Cabai jawa
		Dicaeum trigonostigma	Cabai bunga-api
		Dicaeum minullum	Cabai polos
10	Megalaimidae	*Psilopogon australis*	Takur tenggeret
		Psilopogon armillaris	Takur tohtor
		Psilopogon javensis	Takur tulung - tumpuk
11	Pycononotidae	*Pycnonotus aurigaster*	Cucak kutilang
		Pycnonotus goiavier	Merbah cerukcuk
		Pycnonotus simplex	Merbah corok - corok
12	Picidae	*Picoides moluccensis*	Caladi tilik
13	Cettidae	*Horornis flavolivaceus*	Ceret gunung
14	Nectariniidae	*Aethopyga eximia*	Burung-madu gunung
		Arachnothera affinis	Pijantung gunung
15	Campephagidae	*Pericricitus flammeus*	Sepah hutan

16	Hemiprocnidae	*Hemiprocne longipennis*	Tepekong jambu

Table 2. Comparison of Birds Found in Primary Forests, Secondary Forest, and Both Area

Habitat	Number of Species
Primary Forest	**21**
Secondary Forest	**19**
Both Area	**14**

As seen in Table 2, examples of bird species found in both habitats include the Cave swiftlet *(Collocalia linchi)*, Asian palm swift (*Cypsiurus balasiensis*), Crested serpent-eagle (*Spilornis cheela*), Collared kingfisher (*Todiramphus chloris*), Wreathed hornbill *(Rhyticeros undulatus)*, Ashy tailorbird (*Orthotomus ruficeps*), Scarlet-headed flowerpecker (*Dicaeum trochileum)*, Orange-bellied flowerpecker (*Dicaeum trigonostigma)*, and Plain flowerpecker (*Dicaeum minullum*). There are a greater number of individuals in the secondary forest habitat compared to the primary forest habitat.

Based on the obtained data, the Similarity Index (IS) for the Cikoleangkak trail is 35%, indicating a difference in species similarity values. This can be seen in the types of vegetation present in both habitats, which are relatively similar.

B. Conservation Status of Birds

Based on the conservation status created by IUCN (International Union for Conservation of Nature and Natural Resources), the bird species in the Sanggabuana region fall into two conservation categories: Least Concern and Vulnerable. Based on the results obtained, the most bird species in the Sanggabuana region falls into Least Concern (LC) category, indicating that these bird species have a low risk of extinction and their numbers are still considered abundant. Only one species categorized Vulnerable; the Wreathed hornbill.

Among the bird species found, there are five species protected by Government Regulation No. 20 of 2018 on Environmental and Forestry, namely Crested-serpent eagle, Wreathed hornbill, Flame-fronted barbet (*Psilopogon armillaris*), Oriental honey-buzzard (*Pernis ptilorhynchus*), and Black banded-barbet (*Psilopogon javensis*). The full list of the species' conservation and protection statuses can be seen in Table 3.

Table 3. Conservation Status of Birds According to IUCN, CITES, and Government Regulation No. 20 of 2018.

No	Family	Scientific Name	Indonesian Name	IUCN	CITES	PP KLHK No. 20 Thn 2018
1	Apodidae	*Collocalia linchi*	Walet Linchi	LC	-	-
		Cypsiurus balasiensis	Walet palem asia	LC	-	-
2	Accipitridae	*Spilornis cheela*	Elang-ular bido	LC	Appendiks II	√

		Pernis ptilorhynchus	Sikep madu asia	LC	Appendiks II	√
3	Alcedinidae	*Todiramphus chloris*	Cekakak sungai	LC	-	-
4	Aegithinidae	*Aegithina tiphia*	Cipoh kacat	LC	-	-
5	Bucerotidae	*Rhyticeros undulatus*	Julang emas	VU	Appendiks II	√
6	Cuculidae	*Zanclostomus javanicus*	Kadalan kembang	LC	-	-
7	Cisticolidae	*Orthotomus sepium*	Cinenen jawa	LC	-	-
		Orthotomus ruficeps	Cinenen kelabu	LC	-	-
8	Columbidae	*Chalcophaps indica*	Delimukan zamrud	LC	-	-
9	Dicaeidae	*Dicaeum trochileum*	Cabai jawa	LC	-	-
		Dicaeum trigonostigma	Cabai bunga-api	LC	-	-
		Dicaeum minullum	Cabai polos	LC	-	-
10	Megalaimidae	*Psilopogon australis*	Takur tenggeret	LC	-	-
		Psilopogon armillaris	Takur tohtor	LC	-	-
		Psilopogon javensis	Takur tulung-tumpuk	LC	-	-
11	Pycononotidae	*Pycnonotus aurigaster*	Cucak kutilang	LC	-	-
		Pycnonotus goiavier	Merbah cerucuk	LC	-	-
		Pycnonotus simplex	**Merbah coro**k - corok	LC	-	-
12	Picidae	*Picoides moluccensis*	Caladi tilik	LC	-	-
13	Cettidae	*Horornis flavolivaceus*	**Ceret** gunung	LC	-	-
14	Nectariniidae	*Aethopyga eximia*	**Burung-**madu gunung	LC	-	-
		Arachnothera affinis	Pijantung gunung	LC	-	-
15	Campephagidae	*Pericricitus flammeus*	Sepah hutan	LC	-	-
16	Hemiprocnidae	*Hemiprocne longipennis*	Tepekong jambul	LC	-	-

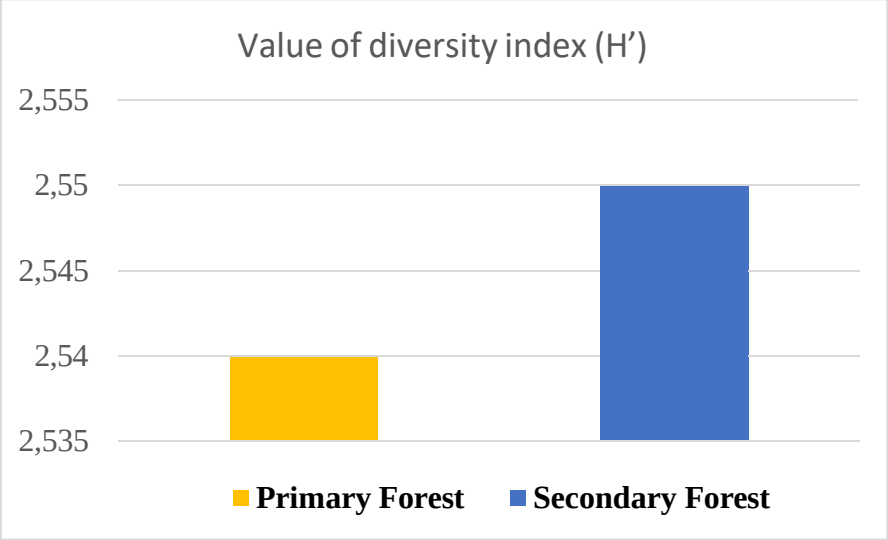
Other conservation efforts are also conducted to protect and utilize the diversity of animal species through the CITES Appendix mechanism. CITES (Conservation

International on Trade of Endangered Species of Flora and Fauna) is an international agreement among countries regulating the trade of plant and animal species (in this case, birds) and their components on a global scale. The purpose of this international agreement is to ensure that international trade in birds will not threaten the sustainability of the traded bird species and will not pose a threat to conservation efforts (Nainggolan *et al*., 2019). Examples of bird species included in CITES Appendix II are the Crested serpent-eagle, Wreathed hornbill, and Oriental honey-buzzard (*Pernis ptilorynchus*).

C. Biodiversity Index

Biodiversity index shows the level of diversity that the bird community in each habitat type has. For the primary forest habitat type, an H' value of 2.54 was obtained, while for the secondary habitat type, an H' value of 2.55 was obtained.

Figure 2. Bird Species Diversity Index Values in Sanggabuana for Two Types of Forest Habitats



According to Magurran (1988), the bird species diversity in the Sanggabuana region falls into the moderate category due to the H' value range of 1.5 - 3.5. The highest number of bird species is found in the secondary forest habitat type.

D. Dominance, Uniformity, and Important Values Index (INP)

The dominance index is used to describe how much one species dominate over others in a habitat (Mawazin & Subiakto, 2013). Meanwhile, the INP value represents which species has the greater proportion of population in a community (Hamidun & Baderan, 2013). The INP value is a more comprehensive parameter that considers relative density, frequency, and species dominance within the community (Nurjaman *et al*., 2017). The higher the INP value, the greater the role of that species in the community. Therefore, a species with high dominance does not necessarily have a high INP value, and vice versa.

Table 4. Dominance in Secondary Forest Habitat Type

No	Scientific Name	Indonesian Name	D	INP (%)
1	*Pycnonotus aurigaster*	Cucak kutilang	0.031	27.64
2	*Psilopogon armillaris*	Takur tohtor	0.018	23.23

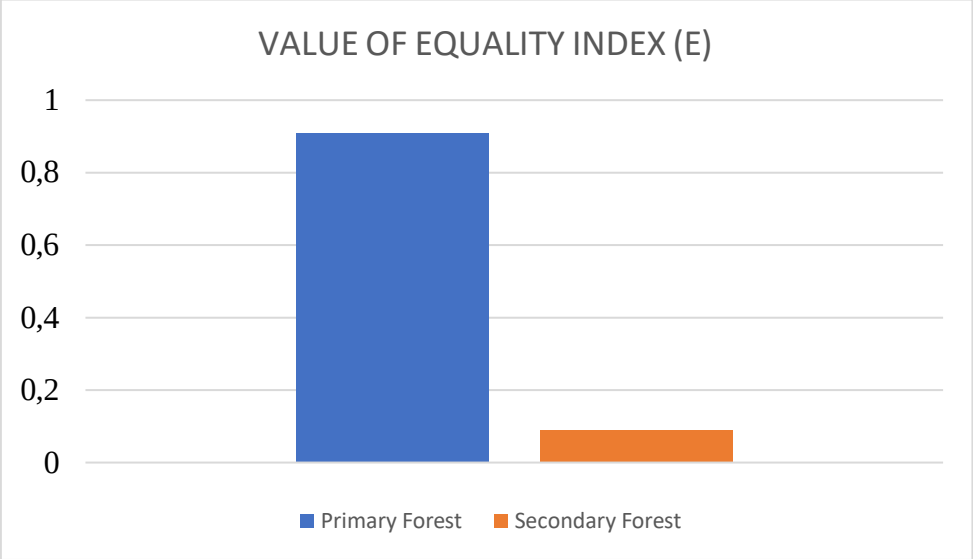
3	*Todiramphus chloris*	Cekakak sungai	0.014	21.76
4	*Dicaeum trigonostigma*	Cabai bunga api	0.014	19.26
5	*Hemiprocne longipennis*	Tepekong jambul	0.008	18.82
6	*Collocalia linchi*	Walet linchi	0.003	13.38
7	*Orthotomus sepium*	Cinenen jawa	0.002	11.91
8	*Dicaeum trochileum*	Cabai jawa	0.002	9.41
9	*Psilopogon javensis*	Takur tulung-tumpuk	0.002	9.41
10	*Orthotomus ruf Cinenen kelabu*	0.001	7.94	
11	*Psilopogon australis*	Takur tenggeret	0.001	7.94
12	*Pycnonotus goiavier*	Merbah cerucuk	0.001	5.44
13	*Dicaeum minullum*	Cabai polos	0.0002	3.97
14	*Picoides moluccensis*	Caladi tilik	0.0002	3.97
15	*Spilornis cheela*	Elang-ular bido	0.0002	3.97
16	*Rhyticeros undulatus*	Julang emas	0.0002	3.97
17	*Zanclostomus javanicus*	Kadalan kembang	0.0002	3.97
18	*Pernis ptilorhynchus*	Sikep madu asia	0.0002	3.97
			0.097	200

Table 5. Dominance in Primary Forest Habitat Type

No	Scientific Name	Indonesian Name	D	INP
1	*Psilopogon armillaris*	Takur tohtor	0.038	37.09
2	*Dicaeum trochileum*	Cabai bunga api	0.019	25.65
3	*Psilopogon javensis*	Takur tulung-tumpuk	0.012	22.87
4	*Psilopogon australis*	Takur tenggeret	0.007	17.15
5	*Todiramphus chloris*	Cekakak sungai	0.003	11.43
6	*Aegithina tiphia*	Cipoh kacat	0.003	11.43
7	*Pycnonotus aurigaster*	Cucak kutilang	0.003	11.43
8	*Pycnonotus simplex*	Merbah corok - corok	0.003	11.43
9	*Collocalia linchi*	Walet linchi	0.003	11.43
10	*Dicaeum minullum*	Cabai polos	0.001	5.71
11	*Chalcophaps indica*	Delimukan zamrud	0.001	5.71
12	*Spilornis cheela*	Elang-ular bido	0.001	5.71
13	*Rhyticeros undulatus*	Julang emas	0.001	5.71
14	*Pycnonotus goiavier*	Merbah cerukcuk	0.001	5.71
15	*Horornis flavolivaceus*	Ceret gunung	0.001	5.71
16	*Cypsiurus balasiensis*	Walet palem asia	0.001	5.71

On observations in the study area, a total of 26 bird species were obtained. The dominant bird species in the primary forest habitat is the Flame-fronted barbet (*Psilopogon* armillari) at 0.038, with an INP value of 37.09%. In the secondary forest habitat, the Sooty-headed bulbul *(Pycnonotus aurigaster)* is dominant at 0.031, with an INP value of 27.64%.

Figure 3. Bird Species Evenness Index Values in Sanggabuana for Two Types of Forest Habitat.



The evenness index is closely related to the diversity index and dominance index. The larger the evenness index value, the more evenly bird species are distributed (Sari *et al*., 2021). In the primary forest habitat type, an E value of 0.91 was obtained, while in the secondary forest habitat type, an E value of 0.09 was obtained. The evenness index ranges from 0 to 1. If the E value approaches 0, it means the evenness among species is low, and if the E value approaches 1, the distribution among species is relatively even (Fikriyanti *et al*., 2018).

E. **Feeding Guilds**

Feeding guilds is one of the parameters used to assess the structure of the bird community in the study area. Based on observation results, there are several types of feeding guilds similarity among birds in the Sanggabuana region. Information for the each of the species' diet were collected from Billerman et al., 2022. Full list of the feeding guilds of the species observed can be seen in Figure 4.

Figure 4. Bird Feeding Guilds in the Study Area for Two Types of Forest Habitat.

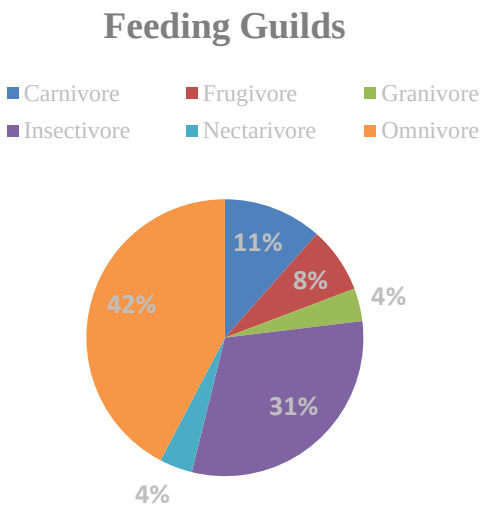


Table 6. Feeding Guilds for Birds Observed

No	Scientific Name	Indonesian Name	C	I	G	F	N	O
1	*Collocalia linchi*	Walet linchi		√				
	Cypsiurus balasiensis	Walet palem asia		√				
2	*Spilornis cheela*	Elang-ular bido	√					
	Pernis ptilorhynchus	Sikep madu asia	√					
3	*Todiramphus chloris*	Cekakak sungai	√					
4	*Aegithina tiphia*	Cipoh kacat		√				
5	*Rhyticeros undulatus*	Julang emas				√		
6	*Zanclostomus javanicus*	Kadalan kembang		√				
7	*Orthotomus sepium*	Cinenen jawa						√
	Orthotomus ruficeps	Cinenen kelabu						√
8	*Chalcophaps indica*	Delimukan zamrud			√			
9	*Dicaeum trochileum*	Cabai jawa						√
	Dicaeum trigonostigma	Cabai-bunga api						√
	Dicaeum minullum	Cabai polos						√
10	*Psilopogon australis*	Takur tenggeret				√		
	Psilopogon armillaris	Takur tohtor						√
	Psilopogon javensis	Takur tulung-tumpuk						√
11	*Pycnonotus aurigaster*	Cucak kutilang						√
	Pycnonotus goiavier	Merbah cerucuk						√
	Pycnonotus simplex	Merbah corok-corok						√
12	*Picoides moluccensis*	Caladi tilik		√				
13	*Horornis flavolivaceus*	Ceret gunung		√				
14	*Aethopyga eximia*	Burung-madu gunung					√	
	Arachnothera affinis	Pijantung gunung						√
15	*Pericricitus flammeus*	Sepah hutan		√				
16	*Hemiprocne longipennis*	Tepekong jambul		√				

Based on the grouping of food similarity, the bird community in study area is dominated by omnivorous birds at 42%, followed by insectivorous birds at 31% . The next order is carnivorous birds at 11%, granivorous, nectarivorous and frugivorous birds at 4%.

DISCUSSION

1. Ecological Significance of Bird Diversity in Sanggabuana

According to Fikriyanti et al. (2018), the number of bird species diversity in a place can have a reciprocal relationship with its ecosystem habitat. This is because bird habitat diversity is influenced by vegetation structure and food availability. Habitats with greater vegetation variety will have higher bird species diversity compared to habitats with limited vegetation types (Dewi et al., 2007).

The recorded species families in the study area underscore Mount Sanggabuana ecological importance as a transitional zone between lowland and montane ecosystems. The moderate Shannon diversity indices (H'=2.54–2.55) align with findings by Fikriyanti et al. (2018) in similar fragmented landscapes, suggesting intermediate disturbance effects. Notably, the higher species richness in secondary forests (19 species) compared to primary forests (21 species) challenges conventional assumptions but corroborates the "intermediate disturbance hypothesis" (Connell, 1978), where mixed habitats support both generalists (e.g., *P. aurigaster*) and specialists (e.g., *P. armillaris*). However, it must be noted that the higher observations recorded in secondary forests and plantations could

also due to the habitat types is more open than the closed primary forest and thus makes data collection easier compared to the primary forest area, which is filled with tall and dense trees (Sihotang et al., 2013).

2. Habitat Specialization and Conservation Implications

The low habitat similarity (35%) reflects niche partitioning, with:

a. Primary forests hosting canopy-dependent species like *Rhyticeros undulatus* (VU), consistent with Rifaie et al. (2021) who linked their decline to logging pressures.
b. Secondary forests favoring edge-adapted species such as *Collocalia linchi*, supported by Sihotang et al. (2013)'s findings on plantation vegetation attracting insectivores.

The dominance of *Psilopogon armillaris* (INP=37.09%) in primary forests signals its keystone role as a seed disperser, while *Pycnonotus aurigaster* (INP=27.64%) in secondary forests reflect anthropogenic adaptation—a pattern observed by Dewi et al. (2007) in Java's agroforests. *P. aurigaster* in particular have a high observation due to them being generalists that can be found in a variety of habitat types, including forests, paddy fields, river flows, and lowland areas up to an elevation of 1,291 meters above sea level (Riyadi *et al*., 2018).

For some species, the low occurrence could be due to the habitat not befitting as a nesting or foraging ground. Crested serpent-eagle while known as a generalist has a low INP value in the study area. This could be due to the observation route is still considered a valley route; eagle nests are generally found in lowland natural forests with flat topography and no valleys (Triliantho *et al.*, 2023).

Another notable observation in this study is those of Sunda bush warbler (*Horornis flavolicaeus*). They are commonly seen in higher altitudes of 1400 – 2700 meters. Thus, their presence in lower parts of Mount Sanggabuana is an exemption of their usual range (Limparungpatthanakij et al., 2022). Further observations required to verify the prescence of this species

3. Conservation Status and Anthropogenic Threats

Despite 92% of species being IUCN Least Concern, five are protected under Indonesian law (e.g., *Spilornis cheela*), mirroring global trends where legally protected species persist at low densities due to:

a. Habitat fragmentation: Detected in the rarity of cavity-nesters (*Picoides moluccensis*), as noted by Triliantho *et al*. (2023).
b. Illegal trade: CITES-listed species (*Rhyticeros undulatus*) showed low INP values (<5), echoing Nainggolan et al. (2019)'s warnings about unsustainable harvesting.

Songbirds and small doves are especially are vulnerable to hunters due to their attractive colors and the sparse vegetation along their routes, making encounters rare (Ekowati *et al*., 2016). This is seen in our observation of songbirds, particularly those that are sought by hunters; Ashy tailorbirds, Yellow-vented bulbuls and Common ioras.

Prescence of large bodied birds such as eagles and hornbills indicate Mount Sanggabuana possess healthy ecosystems with large areas of forests. This is because large-bodied animals tend to require greater number of resources, especially home range and source of food (Terborgh & Winter, 1980). However large-bodied animals across all taxas tend to be more vulnerable to deforestation and habitat fragmentation (Raman & Mudappa, 2003). Hornbills found on disturbed habitats tend to exist in a lower population and desntiy, especially if there's a decrease of fruiting and nesting trees (Datta, 2008). This is especially severe in secondary forests or plantations (Ardiantiono, 1998). Thus

large-bodied birds of Mount Sanggabuana, especially hornbills may be vulnerable to encroaching development and thus require further conservationa actions.

4. Trophic Dynamics and Ecosystem Resilience

Feeding guild composition in a community is influenced by habitat type, vegetation structure, adaptation, and natural selection (Rofiq *et al*., 2021). The presence of prey is often one of the main factors that influence the presence of birds in a habitat (Hermawan *et al*., 2019). Based on the results in the diagram, it is found that in the Sanggabuana region, the dominant species of birds in the ecosystem are omnivorous birds, accounting for 42%, and the least numerous are granivorous, frugivorous and nectarivorous birds.

The guild composition (42% omnivores, 31% insectivores) reveals:

a. Prevalent of generalist species in fragmented or disturbed habitats as suggested by Barnagaud *et al*., (2011).
b. Bottom-up control: High arthropod biomass supports insectivores, validating Ramadhani et al. (2023)'s insect-bird linkage studies. While omnivores are the highest feeding guild type, all of the omnivorous species incorporate insects as major part of their diet. Bird species that feed on insects while feeding on other types of food include Cisticolidae, Megalaimidae, Nectarinidae. These families contribute the most species that make up the omnivore guilds.
c. Pollination gaps: Only 1 nectarivores species found (*Aethopyga eximia*) suggests phenological mismatches, a concern raised by Gunawan et al. (2022) in fragmented forests.

The abundant presence of insects attracts insectivorous birds, as birds are more frequently found in locations where food is available (Amna & Rifqiyati, 2014). Both omnivorous and purely insectivorous birds can be found in the study area, albeit the more prevalence of omnivorous birds suggests the type of ecosystems found in the study area favors more generalist birds like barbets (Megalamidae) rather than specialists such as woodpeckers (Picidae). Barnagaud *et a*l., (2011) highlight the phenomena where in disturbed habitats, generalist birds replaced specialist birds. This is most obvious in urban areas, where generalists like *P. aurigaster* can be found more often than more jungle-specialist bulbuls like Black-headed bulbul (*Microtasus melanocephalus*) (Fishpol & Tobias, 2023; Riyadi *et al*., 2018).

On the other hand, nectarivores birds have the least number of species, possibly due to not yet entering the flowering and fruiting season. According to Gunawan *et al*., (2022), the scarcity of nectarivores birds can be caused by the characteristics of that group, which tends to have a high dependence on locations with complex vegetation structure. Thus, it's possible the lack of high abundance of nectarivores suggests a disturbance even in the study area located in primary forests, perhaps due to hunting or fragmentation of habitats.

5. Climate Change and Future Vulnerabilities

The near-absence of nectarivores may reflect climate-induced shifts in flowering phenology, while the dominance of generalists signals biotic homogenization—a risk highlighted by Şekercioğlu et al. (2019) for tropical avian communities.

Management Recommendations

1. Further researches: Diversity survey in other areas of Mount Sanggabuana, habitat dependency and suitability of large-bodied birds.
2. Habitat corridors: Connect primary and secondary forests using native fruiting plants to aid frugivores like *Psilopogon* spp.
3. Community-based monitoring: Train locals to track CITES species using AI tools

(e.g., Merlin Bird ID).

4. Microhabitat restoration: Install artificial nests for cavity-dependent species (*Picoides moluccensis*).

Sanggabuana's avifauna exemplifies the delicate balance between ecological resilience and anthropogenic pressure. While its moderate diversity suggests current stability, the dominance of generalists and decline of specialists warrant proactive conservation to prevent future biodiversity erosion. This study reinforces the need for integrated landscape management in Indonesia's rapidly developing regions.

CONCLUSION

Based on the observations made, it can be concluded that:

1. Based on the results of observations, 26 bird species belonging to 16 families were recorded.
2. The diversity of bird species in the Sanggabuana area is classified in the medium category, details of the H' value in the primary forest (Jalur Hutan) of 2.54 and in the secondary forest (Jalur Curug) of 2.55.
3. The similarity index value (IS) for this forest habitat type is as high as 35%, indicating that the composition of birds differs between primary and secondary forests.
4. The evenness index value (E) for the secondary forest habitat is 0.884, while for the primary forest habitat, it is 0.917, showing that the distribution of individuals among bird species is relatively similar.
5. The dominant bird species in the secondary forest habitat is the Sooty headed-bulbul (*Pycnonotus aurigaster*), while in the primary forest habitat, it is the Flame-fronted barbet (*Psilopogon armillaris*).

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