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Bird population and bird hunting in the rural ecosystem of Cijambu, Sumedang, West Java, Indonesia

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Abstract. *Suroso, Iskandar J, Withaningsih S, Nurjaman D, Iskandar BS. 2023. Bird population and bird hunting in the rural ecosystem of Cijambu, Sumedang, West Java, Indonesia. Biodiversitas 24: 4470-4484.* Some rural West Java ecosystems have a high bird species diversity because they have forests, bamboo talun, mixed gardens, rice fields, and homegardens. Rapid population expansion, illicit bird shooting, forest degradation and conversion, and pesticide pollution have reduced rural bird species diversity. This study examined bird diversity in natural forests, coffee agroforestry, vegetable gardens, and bird hunting. Quantitative and qualitative research were used. The point count approach investigates bird species and populations, whereas detailed interviews with knowledgeable informants are used to study bird hunting. In natural forests, vegetable gardens, and coffee agroforestry, 67 species from 39 bird groups were found. The bird species diversity index in three habitats: vegetable garden (H'=2.59), coffee agroforestry (H'=2.97), and natural forest (H'=2.96). Based on the Sorensen Similarity Index, bird species in in vegetable garden and coffee agroforestry, vegetable garden and natural forest, and coffee agroforestry and natural forest had a similarity index of 31.03%, 22.22%, and 52.05%, respectively. These findings suggest that bird species may prefer coffee agroforestry over vegetable gardens. The coffee agroforestry system can generate complex vegetation canopy stratification with a multi-layered vegetation canopy, resembling natural forest stratification. Illegal hunting of bird species for trade is one of the causes of the decline in bird populations in rural ecosystems of West Java, including in Cijambu Village. The coffee agroforestry provides a habitat for rural birds.

Keywords: Bird hunting, bird population, bird species diversity, coffee agroforestry, rural ecosystem

INTRODUCTION

Initially, Java had a very high diversity of bird species. According to Hoogerwerf (1948), cited by Iskandar (2017), in Java, a total of 536 species and sub-species were recorded. Of the 536 species and sub-species, 410 species are resident birds. The rural area of West Java also has a variety of bird species, considering that the rural area has a variety of landscapes, including homegardens, mixed gardens, gardens, talun/bamboo gardens, rice fields, plantations, forests, and others that function as bird habitat in the rural ecosystem (Iskandar 2017).

Bird species in nature have several ecological, socio-economic, and cultural functions (Boesing et al. 2017; Iskandar et al. 2019, 2021; Mulyanto et al. 2020; Nurrofik et al. 2021; Hendrayana et al. 2022; Withaningsih et al. 2022). The ecological functions of birds, for example, are to assist in pollinating various plants, seed dispersal, control agricultural pests, and bioindicators to access environmental changes, including pesticide pollution and damage to forest vegetation. In comparison, the socio-economic and cultural functions are a source of animal protein for meat consumption, as pets in cages or cages, trading live bird species in bird markets, folk stories, and sources of inspiration for songs and myths of society (Iskandar et al. 2019; Mulyanto et al. 2020).

Ecologically, the diversity of bird species in nature is influenced by the diversity of bird habitats and vegetation in a bird's habitat. Generally, the more diverse the habitat in a location, the higher the diversity of bird species in that area (Boesing et al. 2017). Meanwhile, its relationship with plant vegetation shows that in plant vegetation habitats that are lush and have a layered vegetation canopy, such as forests, they have a high diversity of bird species (Imron et al. 2022). In contrast, open habitats, with monoculture plant vegetation and increasing management system intensity, have low bird species diversity (Jha et al. 2014; Hakim et al. 2020).

Various bird populations in rural West Java or other areas in Indonesia, even globally in temperate climates, have recently declined. Generally, human action (anthropogenic) factors, such as illegal bird hunting and bird trade, forest land conversion, forest fragmentation, habitat loss, and intensive use of pesticides, cause major disturbances to bird populations in nature (Moura et al. 2013; Ayat and Tata 2015; Barth et al. 2015; Iskandar et al.

2016; Mardiastuti et al. 2019; Taufiqurrahman et al. 2019; Vaccaro et al. 2019; Hakim et al. 2020; Marsden et al. 2023). Therefore, the decrease of bird species also results in a reduction of several ecological and socio-economic functions of bird culture for humans.

In many mountainous rural ecosystems of the Citarum watershed, West Java, their forest areas suffered a lot of damage due to many factors, including converting forest land into commercial vegetable gardens. As a result, it causes various environmental damage and disturbances, such as environmental pollution by pesticides, soil erosion, a decrease in the diversity of local plant species, and disturbance to bird populations. Since many forest areas have been intensively converted to vegetable gardens, ecologically bird diversity is lower because the complexity of heterogeneous strata of vegetation determines the distribution of resources in bird communities and influences bird diversity (Paker et al. 2014; Dinanti et al. 2018; Hadisusanto et al. 2022; Susanti et al. 2022).

Our study aimed to reveal the bird's diversity and populations in three bird habitat types: natural forest, coffee agroforestry, and vegetable gardens, in Cijambu Village, Sumedang, West Java. In general, studies on bird population in those three habitats of West Java have rarely undertaken by other scholars.

MATERIALS AND METHODS

This study was undertaken in Cijambu Village, Tanjungsari sub-district, Sumedang district, West Java province, from March to May 2022. Geographically, Cijambu is an upland village that lies off the east of Mount Manglayang, at coordinates 6^0 50' 38, 43" S; 107^0 47'34,67' E (Figure 1).

Cijambu Village is 1,000-1,700 meters above sea level (masl) and has a total area of about 1,365.75 ha. Land use type about 55.25 ha are devoted to settlement, and approximately 5.64 ha, 73.12 ha, 154.81 ha, and 1040.30 ha, to homegarden, paddy field, dryland/swidden cultivation, and forest, respectively, and other at 36.63 ha.

In 2021, the population of Cijambu Village was documented as 4,485 people, consisting of 2,332 males and 2,153 females, representing 1,600 households (Statistics of Cijambu Village 2021). The main livelihood of the Cijambu Village people is farmers. They cultivate agroecosystem crops, including home graden, mixed gardens, vegetable gardens, and paddy fields. In addition, some villagers cultivated food crops, such as rice, horticulture, and others. Additionally, they raised local poultry, lambs, and cows. The residents of Cijambu Village also work in a variety of different businesses, including rice mills, grocery stores, two-wheeled vehicle repair shops, tiny traditional food industries, trading, and companies in small village booths (warung desa) (Ihsan et al. 2023).

The village of Cijambu was chosen to be the location for the study of bird populations because the natural forest area in this village had been cultivated by rural people to farm a vegetable garden, then the Perhutani has been trying to replace the vegetable garden with a coffee agroforestry system. It hopes that the coffee agroforestry system can provide economic results for the income of the rural people. At the same time, the coffee agroforestry system can become a good appropriate for bird species habitats. Therefore, the study on bird populations in the vegetable garden systems, coffee agroforestry systems and natural forests of Cijambu Village has been considered important in this area.

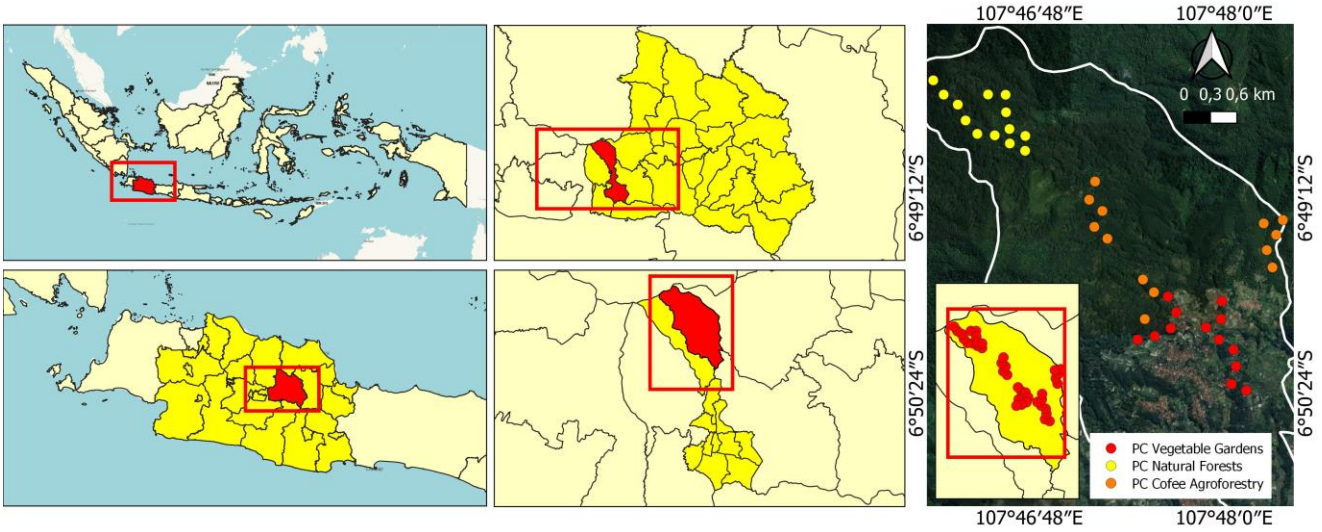

Figure 1. Location of the study site and point count sites of bird sampling in natural forest, coffee agroforestry, and vegetable garden, Cijambu Village, Tanjungsari sub-district, Sumedang District, West Java, Indonesia

Bird habitats

Various landscapes, including natural forests, plantation forests, coffee agroforests, vegetable gardens, homegardens, and paddy fields, are important as bird habitats of Cijambu Village. This study focused on the bird population in three bird habitats: natural forest, coffee agroforestry, and vegetable garden (Figure 2).

Natural forest

The natural forest has natural vegetation, including puspa (*Schima walchii* (DC) Korth), kihujan (*Engelhardia spicata* Lechen ex Blume), pasang (*Lithocarpus* spp.), and huru (*Litsea* spp.). The natural forest has uphill and undulating contours with an altitude between 1,300-1,400 masl, categorized in the lower mountain vegetation zone (sub-montana) (van Steenis 2010). The natural forest is located in the Perhutani forest area under the supervision of Perhutani KPH Sumedang, BKPH Manglayang Timur, and Resort Pemangkuan Hutan (RPH) in the Cijambu area. Local people around the forest call the natural forest 'rawa' (primary forest) to distinguish it from standing pine (*Pinus merkusii* Jungh et de Vriese) forests.

The structure of natural forest vegetation consists of 5 layers of canopy strata (Muhamad et al. 2013), namely the emergent tree layers (the canopy, the middle (midstory), and the understory), and the ground cover. The emergent tree layer consists of *Schima walichii* (DC) Korth, *Dacrycarpus imbricatus* (Blume) de Laub), and *Liquidambar excelsa* (Noronha) Oken. The canopy tree layer is predominantly composed by *Schima walichii* (DC) Korth, *Quercus* spp., and *Engelhardia spicata* Lechen ex Blume. The midle layers is predominantly constituted of Litsea spp., *Actinodaphn*e sp., *Schima walichii* (DC) Korth. Understorey layer is formed of *Ficus* spp., *Etlingera elatior* (Jack) R.M, and *Austroeupatorium inulaefolium* (Kunth) R.M. King & H. Rob. While the cover ground is constituted by *Molinera capitulata* and *Cyrtandra picta* Blume.

Coffee agroforestry

Coffee agroforestry is in the Perhutani forest area, dominated by pine trees (*Pinus merkusii*). Arabica coffee plants (*Coffea arabica* L) are generally planted under upright pine trees. Some areas under pine stands are also planted with Arabica coffee (*C. arabica*), avocado (*Persea americana* Mill), jackfruit (*Artocarpus heterophyllus* Lam), cabbage (*Brassica oleracea* L), and banana (*Musa x paradisiaca* L). Coffee agroforestry ranges from 1,200-1,300 m asl with uphill and hilly contours. Coffee agroforestry is in the Perhutani forest area under the supervision of Perhutani KPH Sumedang, BKPH Manglayang Timur, Resort Pemangkuan Hutan (RPH) Cijambu area, with an area of approximately 430.77 ha. Pine stands are still being actively tapped for sap by Perhutani.

The coffee agroforestry system in Cijmabu Village was introduced in 2016 with the PHBM (Community Collaborative Forest Management-*Pengelolaan Hutan Bersama Masyarakat*) program. The coffee agroforestry area has reached about 200 hectares. The vegetation structure in coffee agroforestry consists of 4 canopy strata: the upper, middle, and lower canopy layer and ground cover. The upper and lower canopy layers and ground cover generally predominate coffee agroforestry. The upper canopy is dominated by *P. merkusii*. Under the pine canopy layer, there is a middle layer filled with various plants, including *P. americana*, *Swietenia macrophylla* King and bamboo species (*Gigantochloa apus* (Schult.f.) Kurz ex Munro and *Schizostacyum blumei* Nees). Under the middle layer is the lower layer, which *C. arabica* dominates; other plants, such as *Musa x paradisiaca* L and *A. inulaefolium*. Under the lower layer, there is a soil cover layer occupied by natural vegetation, such as *Ageratina riparia* (Regel) King & H. Rob, *Impatiens platypetala* Lindl and grasses (Poaceae family), and cultivated plants of cabbage (*B. oleracea*; *Brassica juncea (*L.) Czern.) and *Capsicum annuum* L.

Figure 2. Three land use types: A. Natural forest, B. Coffee agroforestry, and C. Vegetable garden, as bird habitat of Cijambu Village, Sumedang, West Java, Indonesia

Vegetable garden

The contours of the vegetable garden are generally hilly, with altitudes ranging from 1,000-1,200 masl. Vegetable garden vegetation has a simpler stratification than coffee agroforestry and natural forest vegetation structures. Vegetable garden vegetation has 3 canopy stratifications, namely the middle canopy, the lower canopy, and the ground cover layer. The vegetable garden is predominantly by soil cover. The middle layer usually contains tree stands at the garden's edge, such as *Toona sureni* Merr. Beneath the lower layer contains *Musa x paradisiaca* L; Under the lower layer, there is a soil cover layer that is dominated by vegetables, such as *B. oleracea* and *Allium fistulosum* L and in some fields planted with *Nicotiana tabacum* L.

Procedures

Mixed methods of quantitative and qualitative were employed in this study. The quantitative method was carried out to collect bird population data, while the qualitative method focused on village people's bird hunting habits.

Bird population: Point counts (PCs)

The point counts (PCs) were randomly chosen in three land use types as the bird habitats: natural forest, coffee agroforestry, and vegetable garden, with 13 point counts for each habitat (Figure 2). At each selected point count in each habitat, the researchers recorded the species of birds seen and heard their voices carefully within a 50-100 meter radius for 15 minutes. Recording at each point count is done in the morning around 06.00-10.00 and in the afternoon around 15.00-18.00. If the weather is cloudy or rainy, data will not be collected on that day (Iskandar 2017) because the bird population is in bad weather or rain is not in normal conditions. For bird identification, the field guidebook on bird species written by Taufiqurrahman et al. (2022) and Iskandar and Iskandar (2022) were used.

Bird hunting: Interview with informants

Moreover, deep interviews were carried out with competent informants to obtain data on bird hunting in Cijambu Village, which was purposively selected (Alburquerquere et al. 2014). The number of informants in this study was 6 people, namely bird hunters, who used sap/mouse glue nets, rope traps, owl birds, and a domesticated bird that invites wild birds to come near bird middlemen in the village. As the first approach to ethnoornithological research, consent seeking, rapport building, and ethical considerations are important first steps. In our report on rapport-building methods to gain the trust of communities, it is important to visit all the households to explain to them (6 people) the importance of the work and its purpose to identify oneself as a researcher.

In semi-structured interviews, informants respond extensively to a series of general questions, some of which have been arranged in advance.

Data analysis

Based on bird population data collected by point count technique, dominance value, Diversity Index, Similarity Index, and Evenness Index or Equitability Index are analyzed.

Dominance-value

Therefore, to describe the bird species composition of a community of each habitat, namely natural forest, coffee agroforestry and vegetable garden, a community structure parameter is analyzed by a dominance index as follows:

$$Di = \frac{Ni}{N} . 100\ \% \text{ or } Di = 100.\ Pi$$

Where:
Di : Dominance value of bird species i;
Ni : Number of individuals belonging to bird species I;
N : Number of bird individuals in the community (the sum of all Ni)
pi : Proportion of bird individuals of the i-th species of all bird individuals of the community

The dominance value of birds can be distinguished from 3 dominance classes: 0-2 % non-dominant, 2-5 % sub-dominant, and over 5 % dominant.

Diversity index

The diversity index of bird species is important to analyze because there is a relationship between the stability of the bird community and assessing disturbances that occur in the bird community at the research site. The diversity index of bird species used uses the diversity index of Shannon-Weaver (Iskandar 2017) with the following formula:

$$H' = - \sum (ni/N) \ln (ni/N) \text{ or } H' = - \sum pi \ln pi;\ ni/N = pi$$

Where:
H' : Diversity index of Shannon;
pi : Proportion of the bird individuals of the i-th species of all bird individuals of the community;
Ni : Number of bird individuals of the i-th species in the community;
N : Number of bird individuals in the community (N is equal to the sum of all Ni)

Evenness index or the equitability index

The Evenness index is important to analyze, among other things, for the even distribution of individual birds belonging to a species in the community. The evenness index can be calculated using the following formula (Iskandar 2017):

$$E \text{ or } J = J' = H'/ \ln S$$

Where:
H' : the diversity index of Shannon
E or J : Evenness Index
S : the number of species

Similarity index

The bird species diversity index is used to compare the similarity of bird species that can be recorded in 3 habitats, natural forest, coffee agroforestry, and vegetable garden, in Cijambu Village. he similarity index from Sorensen was used to calculate the index of the bird species diversity in the 3 habitats with the following formula (Iskandar 2017):

$$ISs = \frac{2C}{A+B} \times 100\ \%$$

Where:

ISs : Similarity Index of Sorensen

A : Number of bird species recorded in natural forest

B : Number of bird species recorded in coffee agroforestry

C : Number of bird species recorded in both natural forest and coffee agroforestry

Dissimilarity Index = 100 % - ISs

The results of interview data with informants in qualitative data were analyzed in several stages, namely cross-checking, summarizing, and synthesizing from different sources to build a narrative count (Iskandar 2018). Cross-checking is validating data obtained from field observations and interviews with informants. Data that has been validated is summarized, synthesized, and narrated by descriptive analysis.

RESULTS AND DISCUSSION

Species richness

Based on the results of recording bird species using the point counts (PCs) technique in natural forest, coffee agroforestry, and vegetable garden habitats, a total of 39 point counts (PCs) can record 67 species representing 39 families, with a total of 481 individuals (Table 1, Table 2, and Figure 3).

Table 1. The number of species, genera, and families of birds recorded in three habitat types: natural forest, coffee agroforestry, and vegetable garden of Cijambu Village, Sumedang, West Java, Indonesia

Bird habitat	Species number	Genera number	Family number
Vegetable garden	24	21	20
Coffee agroforestry	34	32	24
Natural forest	39	36	26
Total	67	57	39

Figure 3. Some bird species of Cijambu Village, Sumedang, West Java, Indonesia. A. *Malacocincla sepiaria*; B. *Psilopogon haemacephalus*; C. *Cisticola juncidis*; D. *Hirundu javanica*; E. *Dendrocopos analis*; F. *Dicrurus leucophaeus*; G. *Cinnyris jugularis*; H. *Orthotomus sutorius*; I. *Cacomantis merulinus*

Table 2. Various birds and their dominant value were recorded in three habitat types: vegetable garden, coffee agroforestry, and natural forest of Cijambu Village, Sumedang, West Java, Indonesia

Family	Common name	Indonesian/ Vernacular name	Scientific name	Dominance value (Di)(%)		
				Vegetable garden	Coffee agroforestry	Natural forest
Accipitridae	Black eagle	Elang hitam	*Ictinaetus malaiensis* (Temminck 1822)	Opc	Opc	Opc
	Crested serpent eagle	Elang-ular bido	*Spilornis cheela* (Latham 1790)		Opc	
	Changeable hawk-eagle	Elang brontok	*Nisaetus cirrhatus* (Gmelin 1788)		Opc	
Alcedinidae	Javan kingfisher	Cekakak Jawa	*Halcyon cyanoventris* (Vieillot 1818)	6.82	1.57	
	Collared kingfisher	Cekakak sungai	*Todiramphus chloris* Boddaert 1783	1.52		
Apodidae	Cave swiftlet	Walet linchi	*Collocalia linchi* (Horsfield & Moore 1854)	Opc		
Artamidae	White-breasted woodswallow	Kekep babi	*Artamus leucoryn* (Linnaeus 1771)	Opc		
Campephagidae	Large cuckooshrike	Kepudang-sungu Jawa	*Coracina javensis* (Horsfield 1821)			0.45
		Kepudangsungu gunung	*Coracina larvata* (S. Müller 1843)		1.57	
	Pied triller	Kapasan kemiri	*Lalage nigra* (Forster 1781)	2.27		
	Sunda minivet	Sepah gunung	*Pericrocotus miniatus* (Temminck 1822)			21.43
Cisticolidae	Olive-backed tailorbird	Cinenen Jawa	*Orthotomus sepium* Horsfield 1821	6.06	1.57	0.45
Columbidae	Ruddy cuckoo-dove	Uncal buau	*Macropygia emiliana* Bonaparte 1854		0.79	0.89
	Eastern spotted dove	Tekukur biasa	*Spilopelia chinensis* (Scopoli 1786)	3.79	3.94	
	Pink-necked green-pigeon	Punai gading	*Treron vernans* (Linnaeus 1771)			2.68
Corvidae	Slender-billed crow	Gagak	*Corvus enca* (Horsfield 1822)		Opc	
Cuculidae	Plaintive cuckoo	Wiwik kelabu	*Cacomantis merulinus (Scopoli 1786)*	1.52		0.89
	Brush cuckoo	Wiwik belukar	*Cacomantis variolosus* (Vigors & Horsfield 1826)		0.79	
	Lesser coucal	Bubut alang-alang	*Centropus bengalensis* Gmelin 1788		2.36	
	Himalayan cuckoo	Kangkok himalaya	*Cuculus saturatus* Blyth 1843			1.34
	Chestnut-breasted malkoha	Kadalan birah	*Rhamphococcyx curvirostris* Shaw 1810		1.57	
Dicaeidae	Blood-breasted flowerpecker	Cabai gunung	*Dicaeum sanguinolentum* (Temminck 1829)			0.45
	Scarlet-headed flowerpecker	Cabai Jawa	*Dicaeum trochileum* (Sparrman 1789)	4.55		0.89
Dicruridae	Ashy drongo	Srigunting kelabu	*Dicrurus leucophaeus* Vieillot 1817		10.24	
Estrildidae	Javan munia	Bondol Jawa	*Lonchura leucogastroides* (Horsfield & Moore 1856)	21.97		
	Scaly-breasted munia	Bondol peking	*Lonchura punctulata (Linnaeus 1758)*	8.33		
Eurylaimidae	Javan broadbill	Sempur-hujan Jawa	*Eurylaimus javanicus* Horsfield 1821		5.51	0.45
Falconidae	Spotted kestrel	Alapalap sapi	*Falco moluccensis* (Bonaparte 1850)		0.79	
Hemiprocnidae	Grey-rumped treeswift	Tepekong jambul	*Hemiprocne longipennis* Rafinesque 1802	0.76		
Hirundinidae	Striated swallow	Layanglayang loreng	*Hirundo striolata* Temminck & Schlegel 1847	1.52		
Laniidae	Long-tailed shrike	Bentet kelabu	*Lanius schach* Linnaeus 1758	1.52	0.79	
Leiotrichidae	Javan fulvetta	Wergan Jawa	*Alcippe pyrrhoptera* (Bonaparte 1850)		11.81	16.52
Megalaimidae	Flame-fronted barbet	Takur tohtor	*Psilopogon armillaris* (Temminck 1821)			2.23
	Brown-throated barbet	Takur bututut	*Psilopogon corvinus* (Temminck 1831)			0.89
Monarchidae	Black-naped monarch	Kehicap ranting	*Hypothymis azurea* (Boddaert 1783)			0.45

Muscicapidae	Little pied flycatcher	Sikatan belang	*Ficedula westermanni* (Sharpe 1888)		0.79	3.57
	Javan whistling-thrush	Ciung batu kecil	*Myophonus glaucinus* (Temminck 1823)			0.45
Nectarinidae	White-flanked sunbird	Burung-madu gunung	*Aethopyga eximia* (Horsfield 1821)		1.57	1.79
	Little spiderhunter	Pijantung kecil	*Arachnothera longirostra* (Latham 1790)		0.79	2.68
	Olive-backed sunbird	Burungmadu sriganti	*Cinnyris jugularis* (Linnaeus 1766)	6.82		
Paridae	Great tit	Gelatik-batu kelabu	*Parus major Linnaeus 1758*			0.89
Pellorneidae	Horsfield's babbler	Pelanduk semak	*Malacocincla sepiaria* (Horsfield 1821)	0.76	0.79	0.45
	Temminck's babbler	Pelanduk bukit	*Trichastoma pyrrogenys* (Temmonck 1827)			0.45
Phasianide	Asian blue quail	Puyuh batu	*Synoicus chinensis* (Linnaeus 1766)	1.52		
Phylloscopidae	Javan warbler	Cikrak Jawa	*Phylloscopus grammiceps* (Strickland 1849)		0.79	4.91
	Mountain warbler	Cikrak daun	*Phylloscopus trivirgatus* Strickland 1849		3.94	5.36
Picidae	Orange-backed woodpecker	Pelatuk kundang	*Chrysocolaptes validus* (Temminck 1825)			0.45
	Freckle-breasted woodpecker	Caladi ulam	*Dendrocopos analis* (Bonaparte 1850)	0.76	3.94	0.45
	Sunda pygmy woodpecker	Caladi tilik	*Picoides moluccensis* (Gmelin 1788)	3.03	1.57	
Ploceidae	Eurasian tree sparrow	Burunggereja erasia	*Passer montanus* (Linnaeus 1758)	5.30		
Pnoepygidae	Pygmy cupwing	Berencet kerdil	*Pnoepyga pusilla* (Hodgson, 1845)			1.34
Pycnonotidae	Sooty-headed bulbul	Cucak kutilang	*Pycnonotus aurigaster* (Jardine & Selby 1837)	0.76	5.51	1.34
	Orange-spotted bulbul	Cucak gunung	*Pycnonotus bimaculatus* (Horsfield 1821)			2.68
	Yellow-vented bulbul	Merbah cerukcuk	*Pycnonotus goiavier* (Scopoli 1786)	17.42		
Rhipiduridae	Rufous-tailed fantail	Kipasan ekor merah	*Rhipidura phoenicura* Müller 1843			3.57
Scotocercidae	Yellow-bellied warbler	Cikrak bambu	*Abroscopus superciliaris* (Blyth 1859)			0.45
	Mountain tailorbird	Cinenen gunung	*Phyllergates cucullatus* (Temminck 1836)		2.36	3.57
Sittidae	Blue nuthatch	Munguk loreng	*Sitta azurea* Lesson 1830			1.79
	Velvet-fronted nuthatch	Munguk beledu	*Sitta frontalis* Swainson 1820		3.94	
Stenostiridae	Grey-headed canary flycatcher	Sikatan kepala-abu	*Culicicapa ceylonensis* (Swainson 1820)			0.89
Sylviidae	Common tailorbird	Cinenen pisang	*Orthotomus sutorius* (Pennant 1769)	3.03		
Timaliidae	Crescent-chested babbler	Tepus pipi perak	*Cyanoderma melanothorax* (Temminck 1823)		9.45	1.34
	Chestnut-capped babbler	Tepus gelagah	*Timalia pileata* Horsfield 1821		4.72	
Vangidae	Black-winged flycatcher-shrike	Jingjing batu	*Hemipus hirundinaceus* (Temminck 1822)		13.39	3.13
Vireonidae	Chestnut-fronted shrike-babbler	Ciu kunyit	*Pteruthius aenobarbus* (Temminck 1835)		1.57	1.34
	White-browed shrike-babbler	Ciu besar	*Pteruthius aeralatus* Blyth 1855		0.79	2.23
Zosteropidae	Sangkar white-eye	Burung kacamata pleci	*Zosterops melanurus* Hartlaub 1865		0.79	4.91
Total				100	100	100

Note: Opc: bird as out of point count

The natural forest has the highest number of species, with 39 species. They were of species found in coffee agroforestry was 34 species, and 27 in vegetable gardens. The natural forest has a complex vegetation structure with a multi-layered canopy, making it a good habitat for various bird species. There are more bird species in coffee agroforestry than in vegetable gardens, but less than in natural forests. This is because coffee agroforestry has a fairly complex vegetation structure compared to vegetable gardens, but the composition of the vegetation canopy is less complex than natural forest vegetation. In addition, because the coffee agroforestry location is close to the natural forest, which is 2-4 km away, it can become a corridor for forest bird species.

This result aligns with the results of various other studies that a bird prefers a habitat with a denser vegetation complex with layers of vegetation crowns, such as natural forest areas. This vegetation usually has a higher diversity of bird species compared to bird habitats where the vegetation is not complex, such as gardens, vegetables, and others (Jha et al. 2014; Ayat and Tata 2015; Barth et al. 2015; Boesing et al. 2017; Cerda et al. 2017; Dinanti et al. 2018; Taufiqurrahman et al. 2019; Hakim et al. 2020; Imran et al. 2022).

Based on 67 species from 39 families, most species are from the Cuculidae family, with 6 species, and Campephagidae, with 4 species. Members of the Cuculidae family have a distribution of species found in three habitats, thereby contributing to the number of species in the family. The Cuculidae family is widely distributed worldwide, with some birds being migrant species (Taufiqurrahman et al. 2022).

In general, members of the Campephagidae family are found in natural forests and coffee agroforests. Members of the species in the Campephagidae family generally inhabit forest areas (Taufiqurrahman et al. 2022).

Based on the feeding guild, it shows that the number of insectivore bird species is the number of dominant bird species in the three habitat types: natural forest, coffee agroforestry, and natural forest (Figure 4). The percentage of insectivorous bird species was 67.16%, and the percentage of frugivorous bird species was 10.45%. The high number of insectivore bird species indicates that the insect is predominant in the research area and is also suitable for the habitat of insectivore bird species because it has a high distribution and population of insects (Hakim et al. 2020). In the vegetable gardens, there were 14 species of birds belonging to the insectivore category (56 %) and were the most common type of feeding guild in the vegetable gardens. This is very beneficial for the vegetable garden system, considering that these birds can help control insect pests in vegetable gardens.

Bird richness recorded in Cijambu Village compared to that of other study results in some village areas of West Java, such as Karangwangi, Cianjur; upper Citarum watershed and Pangalengan, categorized to be high, but it was low compared to that of Cisokan and Panglangen (Table 3). Since the bird survey in Ciletuh and Cisokan has some bird habitats, namely natural forest and agroecosystem types, including paddy field, mixed garden, and homegarden, the bird richness is higher. Conversely, bird richness recorded in two villages of the upper Citarum Watershed is lower because the upper Citarum Watershed study location is dominated by monoculture commercial vegetable gardens with intensive management efforts, particularly in providing chemical pesticides to control insect pests. Indeed, according to Jha et al. (2014), animal diversity, including birds, is lower because of the low complexity of vegetation structure and increasing intensive management intensity.

Conservation status and endemic birds

Based on 67 species representing 39 bird families in Cijambu Village, it is recorded that 3 species of eagle (Family Accipitridae) and 1 species of alap alap (Family Falconidae) are protected by law in Indonesia based on Indonesian Government Regulations, Ministry of Environment and Forestry (Permen LHK P 106 /2018) namely the Crested Serpent Eagle which was observed in the vegetable garden, the Black Eagle which was observed in coffee agroforestry, and the changeable hawk-eagle which was observed in coffee agroforestry and natural forest, and the spotted kestrel which was observed in coffee agroforestry.

The three types of eagles were soaring, so they were not included in the point count records, while the spotted kestrel was perched on a pine tree. The rufous-tailed fantail and the brown-throated barbet are several other bird species protected by the Minister of Environment and Forestry regulations. According to the IUCN, 3 bird species also have endangered status, namely the Javan broadbill (near threatened), sangkar white-eye (vulnerable), and orange-spotted bulbul (near threatened). Meanwhile, 2 bird species are included in the Java endemic category, namely sangkar white-eye and Javan fulvetta, observed in natural forests and coffee agroforestry (Table 4).

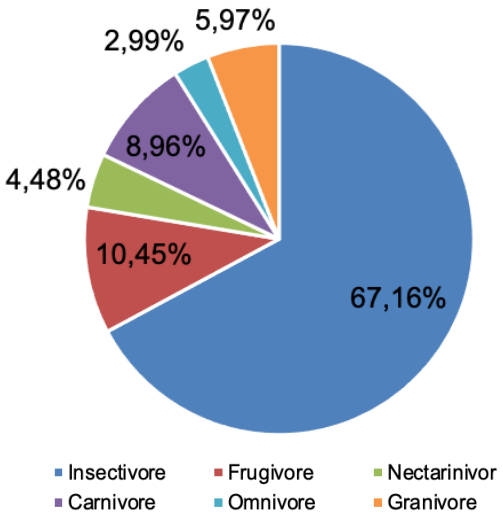

Figure 4. Various birds based on feeding guild recorded in 39 PCs of Cijambu Village, Sumedang, West Java, Indonesia

Table 3. Bird richness was recorded in Cijambu Village and some village areas of West Java, Indonesia

Habitat	Location	Method	Species number	Family number	Author
Natural forest, coffee agroforest, vegetable garden	Cijambu Village, Sumedang	Point count	67	39	*This research*
Mix garden, coastal, and forest	Karangwangi, Cianjur	Point count	40	21	Iskandar et al. (2016)
Cashcrop garden, talun (mix garden), homegarden	Two villages of upper Citarum Watershed	Point count	29	14	Hakim et al. (2020)
Remnant forest and agroecosystems in three villages	Ciletuh Geopark, Sukabumi	Transect	121	47	Iskandar et al. (2021)
Remnant forest, production forest, irrigated rice field, swidden cultivation, shrubs, mix garden/*talun*/ agroforest, settlement	Cisokan, Bandung	Transect	141	-	Husodo et. al. (2019)
Coffee agroforestry landscape	Pangalengan, Bandung	Point count	60	29	Withaningsih et al. (2020)

Table 4. Various birds are protected by Government Regulation, Ministry of Environment and Forestry (KLHK), Indonesia

Family	Common name	Scientific name	Permen LHK No. 106/2018	IUCN	Endemic
Accipitridae	Crested serpent eagle	*Spilornis cheela* (Latham, 1790)	Protected	Least concern	-
	Black eagle	*Ictinaetus malaiensis* (Temminck, 1822)	Protected	Least concern	-
	Changeable hawk-eagle	*Nisaetus cirrhatus* (Gmelin, 1788)	Protected	Least concern	-
Eurylaimidae	Javan broadbill	*Eurylaimus javanicus* Horsfield, 1821	-	Near threatened	-
Rhipiduridae	Rufous-tailed fantail	*Rhipidura phoenicura* Müller, 1843	Protected	Least concern	-
Zosteropidae	Sangkar white-eye	*Zosterops melanurus* Hartlaub, 1865	-	Vulnerable	Java, Bali
Pycnonotidae	Orange-spotted bulbul	*Pycnonotus bimaculatus* (Horsfield, 1821)	-	Near threatened	-
Leiotrichidae	Javan fulvetta	*Alcippe pyrrhoptera* (Bonaparte, 1850)	-	-	Java
Megalaimidae	Brown-throated barbet	*Psilopogon corvinus* (Temminck, 1831)	Protected	-	-
Falconidae	Spotted kestrel	*Falco moluccensis* (Bonaparte, 1850)	Protected	-	-

Based on the status of birds, it shows that although Cijambu Village is not a nature conservation area, some protected species of birds, based on the Decree of the Minister of Environment and Forestry of the Republic of Indonesia and several bird species are categorized as endangered according to the IUCN are found. Therefore, the conservation interest in bird species is carried out for birds in and outside nature conservation areas, including rural ecosystems.

Dominance value (Di)

Moreover, an analysis of bird abundance in three bird habitats, namely natural forest, coffee agroforestry, and vegetable garden, shows that in the vegetable garden habitat type, bird species with high abundance (dominant) include Javan munia (21.97%) and yellow-vented bulbul (17.42%) (Table 5). in the subdominant category including scarlet-headed flowerpecker (4.55%) and eastern spotted dove (3.79%). In the coffee agroforestry habitat type, the species with the highest abundance were black-winged flycatcher-shrike (13.39%) and Javan fulvetta (11.81%); the subdominant categories are chestnut-capped babbler (4.72%) and eastern spotted dove (3.94%). In the forest category, the species with the highest abundance were Sunda minivet (21.43%) and Javan fulvetta (16.52%). The subdominant categories are Javan warbler (4.91%) and sangkar white-eye (4.91%). Javan fulvetta was dominant in two: natural forest and coffee agroforestry, while the eastern spotted dove is subdominant in the vegetable garden and coffee agroforestry habitat types. Sangkar white-eye (*Zosterops melanurus*) was observed on the border of pine forest and natural forest, and it was reported that the population had decreased due to hunting activity (Eaton et al. 2015; Hakim et al. 2020).

Bird diversity, evenness index and similarity index

Based on the analysis of the bird diversity index, evenness index, and similarity index, it shows that the bird's diversity in coffee agroforestry and natural forest has relatively the same value, which is quite high, respectively (H'=2.97 and H'=2.96) (Table 6). This shows that the individual richness and evenness of bird species in natural forest habitats and evenness in coffee agroforestry are relatively the same, namely the influence of the vegetation structure in coffee agroforestry, which is quite dense and complex with multi-layered. On the other hand, the birds' diversity index in a vegetable garden was recorded low (H'=2.56) compared to the index of diversity of birds in the coffee agroforestry and natural forest. This is influenced by the vegetation structure in the vegetable garden, which is not complex, with only the lower canopy layer of less than 1 m dominated in the form of vegetable plant species. As a consequence, the bird diversity index and bird evenness are low. While the bird diversity index and evenness index are 2.97 and 0.87, respectively, in coffee agroforestry are also high, almost the same as in natural forests. Coffee

agroforestry has a vegetation structure similar to natural forests. In addition, the location's closeness between coffee agroforestry and natural forest makes agroforestry a corridor for natural forest species.

Based on the analysis of the Similarity Index of bird species in 3 bird habitats, namely natural forest, coffee agroforestry, and vegetable garden, the results show that the index of bird species diversity in the natural forest with coffee agroforestry has a high value (ISs = 52.05%) (Table 7). Meanwhile, the index of the similarity of bird species in natural forests and vegetable gardens is very low (ISs = 22.22%). These results indicate that the effect of vegetative canopy stratification in coffee agroforestry is almost similar to that of natural forest crown stratification, causing the bird species found in coffee agroforest to have many similarities to those found in natural forests. In other words, various birds in natural forests are also found in coffee agroforestry. In contrast, the vegetation structure of vegetable gardens is very different from that of natural forest vegetation. Consequently, the bird species in the vegetable garden differ greatly from those in the forests.

Table 5. Some bird species that have dominant and sub-dominant recorded in three habitat types, vegetable, coffee agroforestry, and natural forest of Cijambu Village, Sumedang, West Java, Indonesia

Common name	Scientific name	Family	Dominance value (Di)	Community composition
Vegetable garden				
Javan Munia	*Lonchura leucogastroides (*Horsfield & Moore 1856)	Estrildidae	21.97	Dominant
Yellow-vented bulbul	*Pycnonotus goiavier* (Scopoli 1786)	Pycnonotidae	17.42	Dominant
Scaly-breasted munia	*Lonchura punctulata (Linnaeus 1758)*	Estrildidae	8.33	Dominant
Javan kingfisher	*Halcyon cyanoventris* (Vieillot 1818)	Alcedinidae	6.82	Dominant
Olive-backed sunbird	*Cinnyris jugularis* (Linnaeus 1766)	Nectarinidae	6.82	Dominant
Olive-backed tailorbird	*Orthotomus sepium* Horsfield 1821	Cisticolidae	6.06	Dominant
Eurasian tree sparrow	*Passer montanus* (Linnaeus 1758)	Ploceidae	5.3	Dominant
Scarlet-headed flowerpecker	*Dicaeum trochileum* (Sparrman 1789)	Dicaeidae	4.55	Sub-dominant
Eastern spotted dove	*Spilopelia chinensis* (Scopoli 1786)	Columbidae	3.79	Sub-dominant
Sunda pygmy woodpecker	*Picoides moluccensis* (Gmelin 1788)	Picidae	3.03	Sub-dominant
Common tailorbird	*Orthotomus sutorius* (Pennant 1769)	Sylviidae	3.03	Sub-dominant
Pied triller	*Lalage nigra* (Forster 1781)	Campephagidae	2.27	Sub-dominant
Coffee agroforestry				
Black-winged flycatcher-shrike	*Hemipus hirundinaceus* (Temminck 1822)	Vangidae	13.39	Dominant
Javan fulvetta	*Alcippe pyrrhoptera* (Bonaparte 1850)	Leiotrichidae	11.81	Dominant
Ashy drongo	*Dicrurus leucophaeus* Vieillot 1817	Dicruridae	10.24	Dominant
Crescent-chested babbler	*Cyanoderma melanothorax* (Temminck 1823)	Timaliidae	9.45	Dominant
Javan broadbill	*Eurylaimus javanicus* Horsfield 1821	Eurylaimidae	5.51	Dominant
Sooty-headed bulbul	*Pycnonotus aurigaster* (Jardine & Selby 1837)	Pycnonotidae	5.51	Dominant
Chestnut-capped babbler	*Timalia pileata* Horsfield 1821	Timaliidae	4.72	Sub-dominant
Eastern spotted dove	*Spilopelia chinensis* (Scopoli 1786)	Columbidae	3.94	Sub-dominant
Mountain warbler	*Phylloscopus trivirgatus* Strickland 1849	Phylloscopidae	3.94	Sub-dominant
Freckle-breasted woodpecker	*Dendrocopos analis* (Bonaparte 1850)	Picidae	3.94	Sub-dominant
Velvet-fronted nuthatch	*Sitta frontalis* Swainson 1820	Sittidae	3.94	Sub-dominant
Lesser coucal	*Centropus bengalensis* Gmelin 1788	Cuculidae	2.36	Sub-dominant
Mountain tailorbird	*Phyllergates cucullatus* (Temminck 1836)	Scotocercidae	2.36	Sub-dominant
Natural forest				
Sunda minivet	*Pericrocotus miniatus* (Temminck 1822)	Campephagidae	21.43	Dominant
Javan fulvetta	*Alcippe pyrrhoptera* (Bonaparte 1850)	Leiotrichidae	16.52	Dominant
Mountain warbler	*Phylloscopus trivirgatus* Strickland 1849	Phylloscopidae	5.36	Dominant
Javan warbler	*Phylloscopus grammiceps* (Strickland 1849)	Phylloscopidae	4.91	Sub-dominant
Sangkar white-eye	*Zosterops melanurus* Hartlaub 1865	Zosteropidae	4.91	Sub-dominant
Little pied flycatcher	*Ficedula westermanni* (Sharpe 1888)	Muscicapidae	3.57	Sub-dominant
Rufous-tailed fantail	*Rhipidura phoenicura* Müller 1843	Rhipiduridae	3.57	Sub-dominant
Mountain tailorbird	*Phyllergates cucullatus* (Temminck 1836)	Scotocercidae	3.57	Sub-dominant
Black-winged flycatcher-shrike	*Hemipus hirundinaceus* (Temminck 1822)	Vangidae	3.13	Sub-dominant
Pink-necked green-pigeon	*Treron vernans* (Linnaeus 1771)	Columbidae	2.68	Sub-dominant
Little spiderhunter	*Arachnothera longirostra* (Latham 1790)	Nectarinidae	2.68	Sub-dominant
Orange-spotted bulbul	*Pycnonotus bimaculatus* (Horsfield 1821)	Pycnonotidae	2.68	Sub-dominant
Flame-fronted barbet	*Psilopogon armillaris* (Temminck 1821)	Megalaimidae	2.23	Sub-dominant
White-browed shrike-babbler	*Pteruthius aeralatus* Blyth 1855	Vireonidae	2.23	Sub-dominant

Table 6. Diversity index, and evenness Index of birds recorded in three habitat types: natural forest, coffee agroforestry, and vegetable garden of Cijambu Village, Sumedang, West Java, Indonesia

Land use/habitat	Individual number	Species number	Family number	Diversity Index (H')	Evenness Index (E)
Natural forest	234	39	26	2.96	0.81
Coffee agroforestry	124	34	24	2.97	0.81
Vegetable garden	133	24	20	2.56	0.83

Table 7. Similarity and disimilarity Index of birds recorded in three habitat-types: natural forest, coffee agroforestry, and vegetable garden of Cijambu Village, Sumedang, West Java, Indonesia

Bird habitat	Similarity Index (ISs) (%)	Disimilarity Index (IDs) (%)
Vegetable garden-Coffee agroforestry	31.03	68.97
Vegetable garden-Natural forest	22.22	77.78
Coffee agroforestry-Natural forest	52.05	47.95

Hunting and bird trade

Bird species poaching in many West Java rural areas is very common among village residents. Based on information from informants, the bird poaching practice has been carried out by village residents of Cijambu for a long time. For example, several informants have been hunting birds regularly since 2007. The locations for hunting bird species were in various areas in Cijambu Village, such as Mount Cijambu, Mount Pangparang, and Mount Kadaka.

Bird hunters usually go hunting birds with 2-3 other people. They usually go bird hunting early in the morning and return at 04.00 or 05.00 pm. However, if they hunt birds outside their village, such as in neighboring Sumedang districts, like the Subang area, they sometimes spend the night in the forest.

Hunters usually use a variety of techniques to hunt birds, such as using plant sap or rat glue (*ngalegeut),* using rope traps (*ngajiret),* using domesticated owls (*mikat),* using nets (*ngajaring*), and using rifles (*ngabedil*) (Figure 5). These techniques that the bird hunters of Cijambu Village use are generally similar to those used by bird hunters in Karangwangi Village, Cianjur District (Iskandar et al. 2016).

Regarding technique, bird hunters usually use jackfruit plants (*Artocarpus hetrophyllus* Lam), sultry teureup (*Artocarpus elasticus* Reinw. ex Blume), and mouse glue. Among the various adhesive devices, bird hunters generally use rat glue mixed with '*gemer* plants' (a type of vine plant) because the price is cheaper than sultry teureup sap. The function of the plant 'gemer' sap is as a mouse glue hardener. In this technique, hunters use an inviting bird, a domesticated bird, or a species similar to the target bird to be caught. In addition to using domesticated birds to invite birds to the place where the sap is installed, they also use the recording sounds of birds whose voices have been recorded on a Handphone. The domesticated bird is usually perched on a branch smeared with sap/a mixture of rat and *gemer* glue. Therefore, when a bird in nature approaches and steps on a branch smeared with glue and sap, it will get stuck on the sappy branch without being able to fly again.

Catching birds with wood sap (*ngaleugeut*) is more effective during the dry season because the glue attached to tree branches is more sticky. Meanwhile, the glue/sap is less sticky during the rainy season because it is exposed to rainwater. Another technique of domesticated bueuk/Sunda scops-owl (*Otus lempiji*) uses the owl to attract wild birds to perch on a branch smeared with sap or glue around it. Based on the ecological nature of birds, owls are raptors whose presence is not expected, thus inviting other birds to drive them away. When other birds try to approach the owls, they will inadvertently be exposed to the sap or glue that has been attached to the wood branches.

Catching birds using rope traps *(ngajiret*) technique usually uses a tool in the form of nylon thread positioned as a trap. Hunters use MP3, or recorded bird sounds from mobile phones to attract birds. When the bird approaches and hits the trap, the bird will be trapped. Apart from that, to invite wild birds into their nature, they are usually given bait in the form of earthworms, *ulat hongkong*, caterpillars, and insects (*laron* or *silaru)* (Figure 5). Furthermore, using the nets (*ngajaring)* technique is the main tool used in the net. The nets are stretched and helped to be erected with two bamboo or wooden poles 4 meters high. The net is placed in a place where birds often pass. The net height is about 3 meters. The remaining one-meter space provides space if a bird has been caught in the net. The nets are baited with moth insects (*laron* or *siraru)* to invite birds to the nets. In addition, illing birds by rifle (*ngabedil*) is fun and catches birds to be killed for consumption as animal protein. The birds that were shot with rifles included unchall birds (*Macropygia unchall*), kadanca (*Macropygia* sp), and sometimes hornbills (Fam. Bucerotidae). Of the various techniques used, the *ngajiret* and *ngalegeut* techniques are techniques that hunters in Cijambu Village often use. Hunters also know about the times of migratory birds such as the arrival of the mugimaki flycatcher, blue - and -white flycatcher, Siberian thrush (*Geokichla sibirica*), and Asian brown flycatcher (*Muscicapa daurica*). They call it a 'seasonal bird' that comes when the rainy season comes, and hunters usually catch these birds.

Figure 5. Various tools for bird hunting: A. Termite insect bait (*laron);* B. Bird net; C. Plant sap of (*getah gemer*); D. Mouse trap glue, E. Sunda scop-owl as a bird invites other kinds of birds in nature; F. Gun

The average daily catch ranges from 5 to 12 birds; the birds caught are then sold to the dealer/middlemen. From the middlemen, the birds are stored and acclimatized first, then sold to bird kiosks in the Sumedang, Rancaekek, Bandung, and Subang district areas of West Java.

After hunting, the hunters immediately sell the birds they catch directly to the dealer, who is also in Cijambu Village. For catches outside the village of Cijambu, such as in the Subang area, hunters sell directly to bird stalls in the Subang area; these birds are stored and cared for temporarily. If the bird is not wild anymore or tame, it is ready for sale (Figure 6). Based on the trading chain system, it can be inferred that hunting and trading birds can benefit many people in rural and urban areas. However, if birds' hunting has not been properly managed, it leads to material scarcity for the extinction of bird species in nature. This is because the rate of taking individual birds in nature is higher than the rate of regeneration of bird species.

Some of the birds that are often obtained from hunters, such as lesser shortwing (*Brachypterix erythrogyna*), velvet-fronted nuthatch and blue nuthatch (*Sitta frontalis* and *Sitta azurea*), Javan fulvetta (*Alcippe pyrrhoptera*), Sunda minivet and (*Pericrocotus miniatus*) (Table 8, Figure 7). Poachers do not target specific birds, so any bird they find is sold immediately. In general, hunters in Cijambu Village hunt in forest areas (both pine forest areas) and natural forests, so they are looking for forest birds. At the time of observation, the lesser shortwing was not recorded in the point count. One of them may result from hunting, which reduces its population.

The bird hunters in Cijambu Village hunt these types of birds because they do not have special skills, and it is difficult to find another job, so they go birding almost every day and have a day off on Fridays or when tired. Some hunters hunt birds to get additional income and do it when they are off working as farm laborers. During the pandemic, new hunters, such as sideline hunters, appeared to get income because their main income was affected by Coronavirus (Covid-19).

Moreover, the cases of bird poaching in Cijambu Village are common in other West Java villages (Iskandar et al. 2016, 2021; Hakim et al. 2020). Therefore, if cases of poaching of bird species in several rural areas in West Java or various rural areas of Indonesia, in general, are not handled by various related parties, it is really worrying for the survival of various bird species in rural areas.

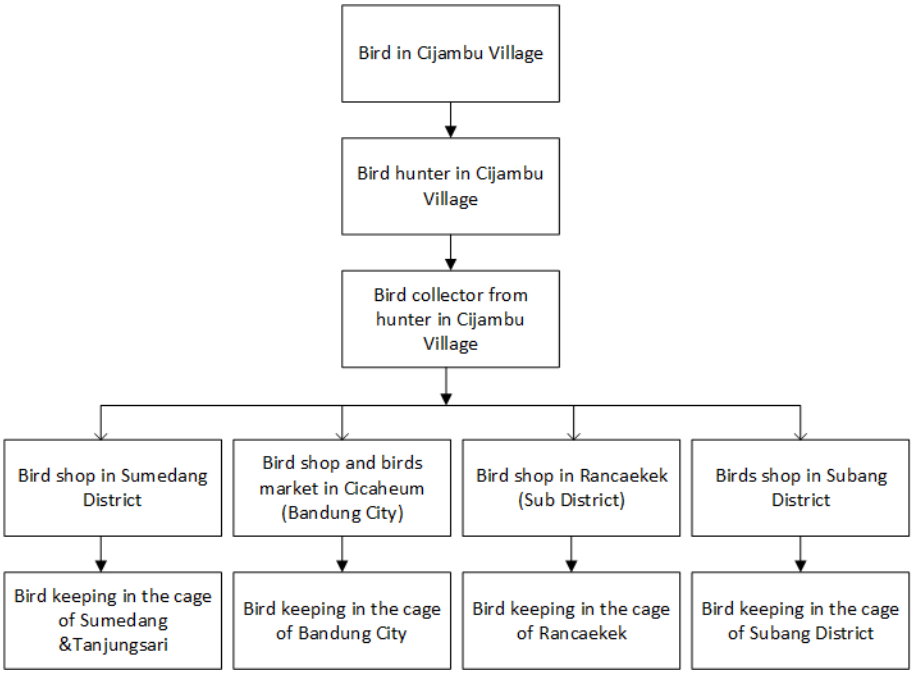

Figure 6. Trading chain of birds in Cijambu Village, Sumedang, West Java, Indonesia

Figure 7. Birds caught by hunters in Cijambu Village, Sumedang, West Java, Indonesia: A. Sunda minivet; B. Lesser shortwing

Table 8. Village bird hunters commonly catch various birds in Cijambu Village, Sumedang, West Java, Indonesia

Common name	Scientific name	Vernacular name	Hunting location	Selling price (IDR)
Velvet-fronted nuthatch	*Sitta frontalis* Swanson 1820	Paris. Rambatan	Forest	30,000-40,000
Blue nuthatch	*Sitta azurea* Lesson 1830	Kesper, rambatan,	Forest	30,000-35,000
Lesser shortwing	*Bracypterix erythrogyna* (Temmminck 1828)	Jongkangan, cingcoang cokelat	Forest	22,000-40,000
Sunda minivet	*Pericrocotus miniatus* (Temminck 1822)	Antenan	Forest	30,000-40,000
Spoted crocias	*Laniellus albobotatus*	Pentet matahari	Forest	65,000
Mountain warbler	*Phylloscopus trivirgatus* Strickland 1849	Arrow daun	Forest	10,000
Indigo flycatcher	*Eumyias indigo* (Horsfield 1821)	Anis biru	Forest	30,000-35,000
Little pied flycatcher	*Ficedula westermanni* (Sharpe 1888)	Arrow decu	Forest	10,000
Blue-and-white flycatcher	*Cyanoptila cyanomelana* (Temmminck 1829)	Sulingan laut	Forest	80,000-100,000
Crimson sunbird	*Aetophyga siparaja* (Raffles 1822	Sepah raja	Farm	15,000
Sangkar white-eye	*Zosterops melanurus*	Pleci	Forest edge	40,000-70,000
Javan fulvetta	*Alcippe pyrrhoptera* (Bonapate 1850)	Flamboyan	Forest	4,000-8,000
Javan gray-throated white-eye	*Heleia javanica*	Jempol	Forest	5,000
Great tit	*Parus major* Linnaeus 1758	Gelatik batu	Forest	35,000
Ashy drongo	*Dicrurus leucophaeus* Vieilllot 1817	Saeran abu	Forest	35,000-50,000
Mugimaki flycatcher	*Ficedula mugimaki* (Temminck 1836)	Arrow bintang	Forest	15,000

Note: 1 US $ = IDR 15,050.70 rupiah

In conclusion, the results revealed that 67 species representing 39 bird families were documented in three habitat types: natural forests, vegetable gardens, and coffee agroforestry. In general, although the diversity of bird species recorded in Cijambu Village seems to be high, only a few species are dominant and sub-dominant. Still, most bird species have a small number of individuals or are not dominant. The diversity index was based on the Shannon-Wiener Index in three habitats, namely vegetable garden habitat (H'=2.59), coffee agroforestry (H=2.97), and natural forest (H'=2.96). The similarity of bird species, based on the Sorensen Similarity Index, showed that the index on bird species in the habitat of coffee agroforestry and vegetable gardens (ISs = 31.03 %), coffee agroforestry and natural forest (ISs = 52.05 %), and forest nature with a vegetable garden (ISs = 22.22 %). Furthermore, based on the use of some indices on bird populations, it can be indicated that the program to construct damaged forests by converting them into coffee agroforestry is considered good for maintaining bird diversity. That is because coffee agroforestry is densely covered with vegetation with layers of vegetation canopy that closely resemble natural forest vegetation. It can be a good habitat for bird species compared to a commercial monoculture vegetable garden. Illegal hunting of bird species to be traded is the main factor causing the bird diversity in the ecosystem of Cijambu Village to decrease drastically. Therefore, stopping poaching should not only be based on formal rules, such as protecting various species of birds but also must pay attention to the villagers' socio-economic and cultural aspects, including poverty and adequate food availability in the rural ecosystem.

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