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A Preliminary Assessment of Bird Communities and Their Conservation Status in Two Grand Forest Parks (Tahura) of Lamandau, Central Kalimantan

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Abstract

In 2023, the Environment and Forestry Service (DLHK) of Lamandau Regency, Central Kalimantan, designated two forest areas, Tahura Bukit Selajaan and Tahura Bukit Benyawai, as Grand Forest Parks (Tahura) to strengthen biodiversity conservation and management efforts. This preliminary study aimed to inventory bird species, analyze species composition and community structure, and identify protected and endangered species in both areas. The research employed line transect and point count methods, supported by camera traps to enhance detection. A total of 92 bird species were recorded, including 21 protected and 9 endangered species. The Sørensen Similarity Index (>75%) indicated a high degree of similarity in bird communities between the sites, suggesting comparable habitat conditions. Key species such as the Bornean Bristlehead, Helmeted Hornbill, Rhinoceros Hornbill, and Great Argus highlight significant avitourism potential. These findings provide a crucial baseline for sustainable conservation planning. However, ongoing anthropogenic pressures threaten habitat quality. Strategies such as public awareness programs, regular monitoring and patrols, and the development of conservation based alternative livelihoods are essential to ensure long term ecological integrity and sustainable management of the Tahura areas.

Keyword: biodiversity, birds, community structure, protected species, tahura.

INTRODUCTION

Birds are a group of wildlife species found across various habitats and play a crucial role in ecosystem functioning. In addition to serving as indicators of a healthy environment, birds play essential roles in ecological processes such as pollination, seed dispersal, and insect population control (Nugroho et al., 2015). Their presence is highly influenced by the habitat's carrying capacity, including the availability of food sources, breeding grounds, and shelter (Hidayat et al., 2017).

In 2023, the Environment and Forestry Service (DLHK) of Lamandau Regency, Central Kalimantan, oversaw the designation of two forest areas as Grand Forest Parks (Tahura): Tahura Bukit Selajaan and Tahura Bukit Benyawai. This designation was formalized through the Decree of the Minister of Environment and Forestry Number

670/MENLHK/SETJEN/PLA.2/6/2023 concerning the Change of Primary Forest Functions, which reclassified approximately 1,821 hectares as the conservation area of Tahura Bukit Selajaan and approximately 2,439 hectares as Tahura Bukit Benyawai. This change in reclassification strengthens efforts to protect and manage biodiversity in Lamandau Regency, especially considering that both areas were previously designated as production forests.

Upgrading an area's status to a Tahura plays a strategic role in providing optimal protection for various flora and fauna, including bird species. As of 2025, Indonesia recorded 1,835 bird species, of which 542 are endemic and 557 are protected by law (Burung Indonesia, 2025; MoEF, 2018). Indonesia's remarkable bird diversity is a source of national pride, but it also includes many species that are endangered. Human activities such as hunting, land conversion, and other anthropogenic pressures pose serious threats to the sustainability of bird populations in the wild even within conservation areas. These pressures may also trigger human–wildlife conflict (Gagarin et al., 2022; Hadi et al., 2023).

Protecting forests as primary habitats is essential for ensuring the survival of various species, including birds. One strategic approach to supporting conservation efforts is the continuous collection of bird species data. This activity not only generates valuable scientific information for the management of conservation areas but also helps raise public awareness about the importance of preserving birds in the wild (Aditya et al., 2019). Accurate biodiversity monitoring and assessment are vital for informing effective wildlife management. Biodiversity inventories are fundamental to understanding patterns of species richness, diversity, and community composition across different locations, habitat types, and forest conditions (Tobler et al., 2008).

Based on this context, this preliminary study aims to inventory bird species, describe species composition and community structure across the two Tahura areas, and identify protected and endangered species. Given the recent change in status of both areas to conservation zones, the findings of this study are expected to serve as a reference for formulating effective policies for the sustainable management of biodiversity in both Tahura.

METHOD

Study Area

Observations were conducted from 2023 to 2024 in the Tahura Bukit Selajaan and Tahura Bukit Benyawai areas, located in Lamandau Regency, Central Kalimantan (Fig. 1). Tahura Bukit Selajaan is situated approximately 55 kilometers from the regency capital, while Tahura Bukit Benyawai is located about 45 kilometers away. Both areas are characterized by mixed dipterocarp forest types.

Data Collection

Data collection in this study employed two main methods: the line transect method and the point sampling method, both supported by camera traps to enhance bird detection. **Line Transect Method**: Bird surveys were conducted in the morning between 06:00 and 11:00 WIB using the line transect method, following the guidelines of Bibby et al., (2000). Each transect was approximately 1 km in length, with the transect width adjusted according to field conditions. Observers paused for five minutes upon detecting birds to allow for accurate identification. For each observed species, the local name, scientific name, and location were recorded. Additionally, photographs were taken to support species identification and for documentation purposes. Point Sampling Method with Camera Traps: A total of eight camera traps were deployed-four in each Tahura-strategically placed based on terrestrial bird habitat features and a predetermined grid layout. This approach was aimed at capturing elusive and ground-dwelling bird species that are difficult to observe directly. According to Murphy et al., (2017) camera traps have proven effective in monitoring the distribution and occupancy trends of terrestrial birds in tropical rainforests.

Photographs obtained from the camera traps were reviewed to identify bird presence. Data from the images were compiled into Excel spreadsheets for analysis. The process of converting image data into tabular form was facilitated by the PIE (Picture Information Extraction) application, which grouped images by bird species. Each photo file was then renamed using a standardized format that included the camera trap station code, bird species name, date and time of capture, and a sequential file number.

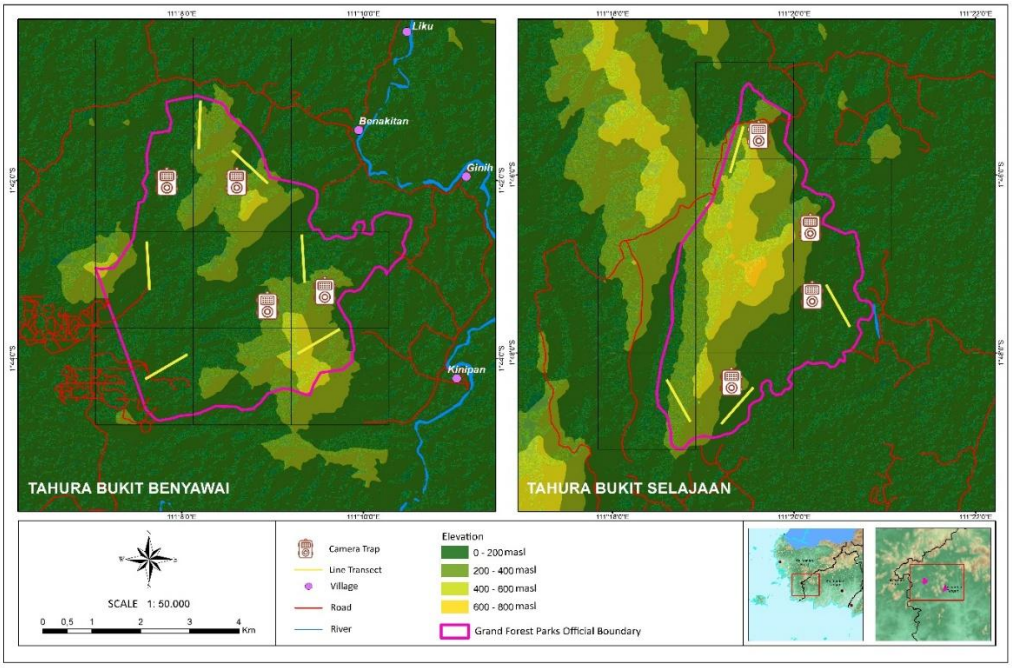

Figure 1. Map of the study sites in the Lamandau Forest Parks, showing line transects (yellow lines) and camera trap locations (camera trap icons).

Data Analysis

Bird Composition and Communities

Birds recorded through direct observation and camera trap deployment were identified using the field guide Birds of the Indonesian Archipelago: Greater Sundas and Wallacea (Eaton et al., 2021), with taxonomic names referenced from the IUCN (2025). Bird species data from each site were compiled to determine the species composition at each location. The species composition data were then used to calculate the Sørensen Similarity Index (Magurran, 2004), which measures the degree of similarity in bird communities between the two sites. According to the Sørensen Index classification, similarity values fall into five categories: Very Low (0–20%), Low (21–40%), Medium (41–60%), High (61–80%), and Very High (81–100%). A higher index value indicates a greater level of similarity in bird community composition between the two locations.

Conservation Status

We report the conservation status of each species based on the latest Red List assessment by the International Union for Conservation of Nature (IUCN). Throughout, species were assigned to one of five categories: Critically Endangered (CR), Endangered (EN), Vulnerable (VU), Near Threatened (NT), and Least Concern (LC) (IUCN, 2025). We further assign CITES (Convention on International Trade in Endangered Species of Fauna and Flora) appendices I (species threatened with extinction and trade is only permitted in exceptional circumstances with permits), II (not necessarily threatened with extinction and trade is closely controlled allowing commercial trade), and III (protected species in at least one country and countries have the right to make unilateral changes in trade policy) (CITES, 2022). In addition, we assign protection status under the National Protected Species List of Indonesia under the Regulation of the Ministry of Environment and Forestry of Indonesia NO. P.92/MENLHK/SETJEN/KUM. 1/8/2018 (MoEF, 2018).

RESULT

Based on observations conducted between 2023 and 2024, a total of 92 bird species from 40 families were recorded in the Tahura Bukit Selajaan and Tahura Bukit Benyawai areas. Among these, the families with the highest number of species were Cuculidae, Bucerotidae, and Pycnonotidae. The Cuculidae family had the highest representation with 9 species, followed by Bucerotidae and Pycnonotidae, each with 6 species (Fig. 2). The number of bird species recorded in Tahura Bukit Selajaan was higher than in Tahura Bukit Benyawai. The Sørensen Similarity Index between the two locations was 0.757, indicating a relatively high level of similarity in bird community composition (Table 1).

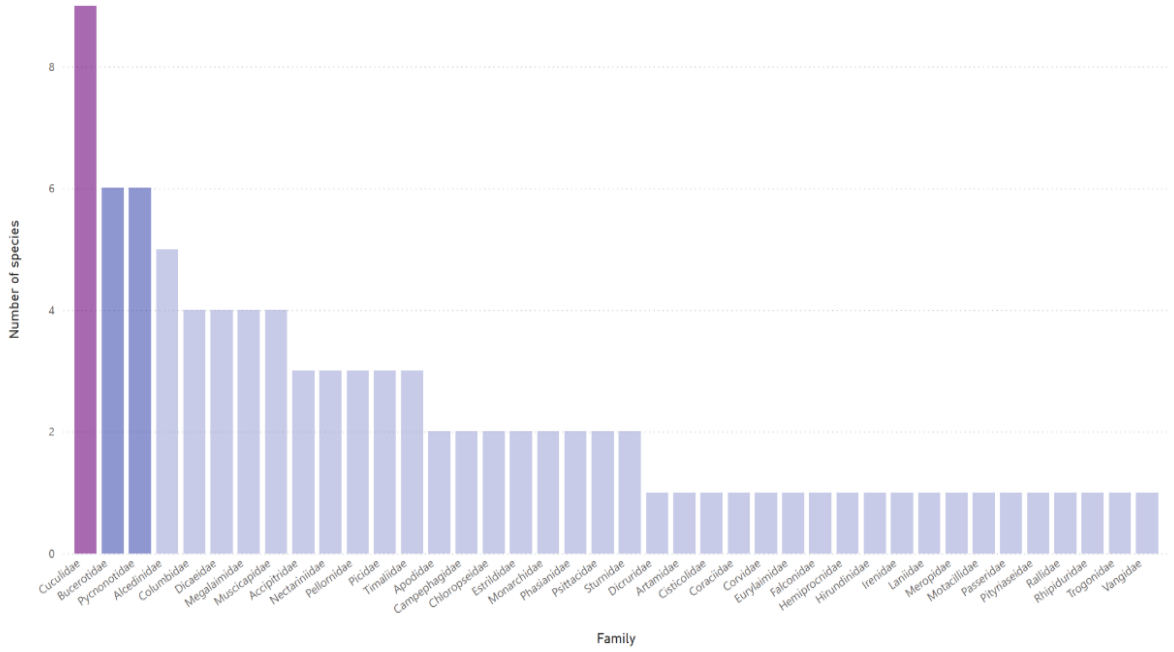

Figure 2. Number of species among families

Table 1. Comparison of Species Composition and Sørensen Similarity Index

Location	No. of family	No. of Species	Number of the same species between locations	Indeks Similaritas Sørensen
Bukit Selajaan	38	86	56	0,757
Bukit Benyawai	34	62		

Based on the IUCN Red List, nine bird species detected in both Tahura areas are categorized as endangered. One species, the helmeted hornbill (*Rhinoplax vigil*), is classified as critically endangered; one species, the greater green leafbird (*Chloropsis sonnerati*), is classified as endangered; and seven other species are classified as vulnerable (Table 2, Fig. 31). Of these nine threatened species, seven are listed on the Indonesian National List of Protected Species, and two are not. Overall, the Tahura areas are home to 21 legally protected bird species in Indonesia, with 20 species found in the Bukit Selajaan Tahura and 16 species in the Bukit Benyawa Tahura. In the context of international protection, one species is listed in CITES Appendix I, and 13 others in CITES Appendix II. Details of the conservation status for each species in each Tahura area are presented in Table 2.

Table 2. Conservation Status of Bird Species in the Tahura Bukit Selajaan and Tahura Bukit Benyawai Areas

Conservation Status \ Location		Tahura Bukit Selajaan		Tahura Bukit Benyawai	
		No. of Species	Species	No. of Species	Species
Protected by Indonesian Government Law		20	• Changeable Hawk-eagle • Wallace's Hawk-eagle • Crested Serpent-eagle • Bushy-crested Hornbill • Oriental Pied Hornbill • Black Hornbill • Rhinoceros Hornbill • Helmeted Hornbill • Wreathed Hornbill • Lesser Green Leafbird • Greater Green Leafbird • Black-thighed Falconet • Yellow-crowned Barbet • Crimson Sunbird • Great Argus • Blue-crowned Hanging-parrot • Blue-rumped Parrot • Sunda Pied Fantail • Common Hill Myna • Scarlet-rumped Trogon	16	• Changeable Hawk-eagle • Crested Serpent-eagle • Black Hornbill • Rhinoceros Hornbill • Helmeted Hornbill • Wreathed Hornbill • Greater Green Leafbird • Black-thighed Falconet • Yellow-crowned Barbet • Red-crowned Barbet • Crimson Sunbird • Great Argus • Blue-crowned Hanging-parrot • Blue-rumped Parrot • Sunda Pied Fantail • Common Hill Myna
IUCN	Critically Endangered	1	• Helmeted Hornbill	1	• Helmeted Hornbill
	Endangered	1	• Greater Green Leafbird	1	• Greater Green Leafbird
	Vulnerable	7	• Wallace's Hawk-eagle • Black Hornbill • Rhinoceros Hornbill • Wreathed Hornbill • Great Argus • Bornean Crested Fireback • Bornean Bristlehead	4	• Black Hornbill • Rhinoceros Hornbill • Wreathed Hornbill • Great Argus
CITES	Appendiks I	1	• Helmeted Hornbill	1	• Helmeted Hornbill

Appendiks II	13	• Changeable Hawk-eagle • Wallace's Hawk-eagle • Crested Serpent-eagle • Bushy-crested Hornbill • Oriental Pied Hornbill • Black Hornbill • Rhinoceros Hornbill • Wreathed Hornbill • Black-thighed Falconet • Great Argus • Blue-crowned Hanging-parrot • Blue-rumped Parrot • Common Hill Myna	10	• Changeable Hawk-eagle • Crested Serpent-eagle • Black Hornbill • Rhinoceros Hornbill • Wreathed Hornbill • Black-thighed Falconet • Great Argus • Blue-crowned Hanging-parrot • Blue-rumped Parrot • Common Hill Myna

DISCUSSION

Based on research conducted in both Tahura areas, habitat conditions remain supportive of various bird groups, particularly species that depend on intact forest ecosystems. The dominance of the Cuculidae (insectivores), Pycnonotidae (insect and fruit eaters), and Bucerotidae (fruit eaters) families reflects the continued ecological functionality of the area as a habitat for forest specialists. This pattern suggests good habitat representation, as insectivorous and frugivorous birds are typically sensitive to habitat degradation and are indicative of healthy forest interiors. Frugivores play a key role in seed dispersal, while insectivores help regulate arthropod herbivore populations, thus contributing to ecosystem stability (Van Bael et al., 2003; Markl et al., 2012; Glass & Arcilla, 2024). The presence of insectivorous birds, in particular, serves as an important ecological indicator; declines in their populations may lead to surges in pest insects that can damage crops (Rafik et al., 2023).

Tahura Bukit Selajaan, which maintains relatively pristine natural forest cover and minimal human disturbance, recorded a higher number of bird species than Tahura Bukit Benyawai. In contrast, although Bukit Benyawai encompasses a larger area, it is subjected to greater anthropogenic pressure. Surrounded by five villages and adjacent to oil palm plantations, it faces threats such as forest encroachment, land clearing for agriculture, and wildlife hunting. Although hunting also occurs in Bukit Selajaan, it is observed at a lower intensity. These human activities contribute to habitat degradation and may reduce bird diversity. Birds require suitable, undisturbed habitats for survival and reproduction (Ontario et al., 1990). Habitat loss due to forest encroachment leads to a reduction in food sources, shelter, and breeding grounds, which in turn causes population declines, behavioral changes, and increased competition among species (Gunawan, 2005).

To address these challenges, effective conservation strategies and governance are urgently needed in disturbed areas. Active protection plays a critical role in mitigating threats such as land-use change, human disturbance, and climate change (Maxwell et al., 2019; Tesfaw et al., 2018), thereby enhancing the long-term effectiveness of biodiversity conservation in protected areas (Maxwell et al., 2020).

Figure 3. Bird species categorized as Vulnerable according to the IUCN Red List, documented in the Tahura Bukit Selajaan and Tahura Bukit Benyawai areas; A. Rhinoceros Hornbill, B. Bornean Bristlehead, C. Bornean Crested Fireback, D. Great Argus

Although species richness is higher in Tahura Bukit Selajaan, the Sørensen Similarity Index reveals that more than 75% of bird species in Bukit Benyawai are also present in Selajaan, indicating a high level of similarity in bird community structure. This similarity is likely due to the shared dominance of lowland mixed dipterocarp forest in both locations, which provides relatively comparable habitat conditions despite local variations in species composition.

The conservation categories based on the IUCN Red List highlight the need for serious attention to the nine bird species identified as endangered in this study. These findings underscore the importance of implementing sustainable conservation efforts in both areas, particularly in safeguarding endangered species and their habitats. According to Gagarin et al., (2022), one example of a conservation area that supports threatened bird species is the Pocut Meurah Intan Grand Forest Park (Tahura) in Aceh Province. This area is characterized by diverse vegetation, including tree species that serve as important food sources and nesting sites for birds. Similarly, the forest cover in Tahura Bukit Selajaan and Tahura Bukit Benyawai provides critical habitat for various bird species. The presence of fruit trees from the Myrtaceae and Moraceae families supports frugivorous birds, while large trees offer nesting sites for species such as hornbills. As noted by Dewi et al., (2007), trees provide essential resources for birds, including food, shelter, and breeding sites factors that are crucial for their survival. A more structurally diverse habitat, reflected in plant species richness and vegetation complexity, typically supports a higher diversity of fauna. Thus, maintaining forest integrity and plant diversity is key to preserving avian biodiversity in these protected areas.

The presence of protected and threatened bird species highlights the need for strong synergy between national conservation policies and site-level management to ensure effective protection. According to Praptiwi et al., (2019), areas with a high concentration of such species require integrated environmental management strategies, including public education initiatives that raise awareness of the negative impacts of unsustainable practices and foster positive changes in public attitudes. Developing alternative livelihoods such as agritourism or nature-based tourism is also essential to reduce pressures like poaching (Wicaksono et al., 2021). Birdwatching, or more specifically avitourism, is recognized as a sustainable and expanding sub-sector of the nature-based tourism industry, with a primary focus on bird observation (Li, Zhu, & Yang, 2013; Steven, Morrison, & Castley, 2015). Charismatic and endemic species such as the Bornean Bristlehead, Helmeted Hornbill, Rhinoceros Hornbill, and Great Argus serve as flagship attractions for international birdwatchers, reinforcing the potential for ecotourism development based on biodiversity conservation.

CONCLUSION

Both Grand Forest Parks (Tahura Bukit Selajaan and Tahura Bukit Benyawai), have been habitat to support a total of 92 bird species, including frugivorous and insectivorous birds that play essential roles in maintaining ecosystem functions. Despite Bukit Benyawai experiencing higher levels of anthropogenic pressure, the Sørensen Similarity Index indicates a high level of similarity in bird communities (>75%), suggesting that both sites maintain comparable habitat conditions. The presence of protected and endangered species highlights the urgent need for sustainable conservation efforts, including habitat protection, cross-sectoral collaboration, and the promotion of community-based approaches such as avitourism. It is recommended that the Lamandau Regency Government integrate conservation initiatives into regional policy development

to ensure the long-term sustainability of Tahura management. Additionally, stronger promotional and awareness efforts are needed to enhance the visibility and conservation value of these areas.

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REFERENCES

Aditya, Nugroho GD, Jauhar MF, Sunarto (2019). Keanekaragaman Burung Diurnal dan Potensi Burung Sebagai Objek Daya Tarik Avitourism di Taman Nasional Gunung Merbabu, Jawa Tengah. PROS SEM NAS MASY BIODIV INDON Vol. 5 No. 1. Halaman 362-368. DOI: 10.13057/psnmbi/m050139.

Bibby, C., Jones, M., Marsden, S. J *et al*. (2000). *Teknik-teknik Ekspedisi Lapangan: Survei Burung*. Birdlife International Indonesia Programme, Bogor.

Burung Indonesia. 2025. *Status Burung di Indonesia 2025. https://burung.org/informasi-burung/status-burung-di-indonesia-2025 diakses pada 28 Mei 2025*

CITES Secretariat & UNEP-WCMC (2022). *A Guide to Using the CITES Trade Database* Version 9. Geneva, Switzerland, and Cambridge, UK.

Dewi, R. S., Mulyani, Y., & Santosa, Y. 2007. *Keanekaragaman Jenis Burung Di Beberapa Tipe Habitat Taman Nasional Gunung Ciremai*. Departemen Konservasi Sumberdaya Hutan dan Ekowisata, Fakultas Kehutanan IPB Bogor.

Eaton, J. A., van Balen, B., Bricle, N. W. & Rheindt, F. E. 2021. *Birds of Indonesian Archipelago. Greater Sundas and Wallacea*. Lynx Edicions. Barcelona.

Gagarin, Y., Pd, M., Khairil, M. S., & Supriatno, M. S. (2022). Burung Besar Aceh: Penetapan habitat penting burung. PUSTAKA AKSARA,Surabaya

Glass, A., & Arcilla, N. (2024). The Effects of Disturbance Intensity on Tropical Forest Bird Communities and Vegetation Structure after Two Decades of Recovery. *Birds*, *5*(3), 388-403.

Gunawan, H., & Mukhtar, A. S. (2005). Pengaruh Perambahan terhadap Vegetasi dan Satwa Liar di Taman Nasional Rawa Aopa Watumohai, Provinsi Sulawesi Tenggara. *Jurnal Penelitian Sosial dan Ekonomi Kehutanan*, *2*(5), 449-459.

Hadi N, Ainy NS, Sjahfirdi L, Mujadid I. 2023. Prinsip 6R Konservasi dan Perlindungan Keanekaragaman Hayati: Menahan Laju Kepunahan dan Ancaman Utama Hidupan Liar di Indonesia. JGG-Jurnal *Green Growth* dan Manajemen Lingkungan. Vol. 13 No.1 DOI: doi.org/10.21009/jgg.131.04

Hidayat, R., & Rifanjani, S. (2017). Studi Keanekaragaman Jenis Burung Diurnal di Hutan Sebadal Taman Nasional Gunung Palung Kabupaten Kayong Utara. *Jurnal Hutan Lestari*, *5*(3).

IUCN. (2025). *The IUCN Red List of Threatened Species*.Version 2025-1. www.iucnredlist.org

Li, F., Zhu, Q., & Yang, Z. J. T. E. (2013). Birding Tourism Development in Sichuan, China. *19*(2), 257-273.

Maggurran A E 2004 Measuring Biological Diversity. USA: Blackwell Publishing Company.

Markl, J. S., Schleuning, M., Forget, P. M., Jordano, P., Lambert, J. E., Traveset, A., ... & Böhning-Gaese, K. (2012). Meta-analysis of the Effects of Human Disturbance on Seed Dispersal by Animals. *Conservation biology*, *26*(6), 1072-1081.

Maxwell, S. L., Fuller, R. A., Brooks, T. M., & Watson, J. E. M. (2019). *The ravages of guns, nets and bulldozers.* Nature, 536(7615), 143–145. https://doi.org/10.1038/536143a

Maxwell, S. L., Rhodes, J. R., Runge, C. A., McDonald-Madden, E., Grantham, H. S., McBride, M. F., ... Watson, J. E. M. (2020). *Area-based conservation in the twenty-first century.* Nature, 586(7828), 217–227. https://doi.org/10.1038/s41586-020-2773-z

Ministry of Environment & Forestry (MoEF) (2018). National Protected Species List (NOMOR P.20/MENLHK/SETJEN/KUM.1/6/2018). Republic of Indonesia, Jakarta: 6–24.

Murphy, A. J., Farris, Z. J., Karpanty, S., Kelly, M. J., Miles, K. A., Ratelolahy, F., Rahariniaina, R. P., & Golden, C. D. (2017). Using Camera Traps to Examine Distribution and Occupancy Trends of Ground-dwelling Rainforest Birds in north-eastern Madagascar. *Bird Conservation International*, 27(3), 266–280. https://doi.org/10.1017/S0959270917000074

Nugroho AS, Anis T, Ulfah M. 2015. Analisis Keanekaragaman Jenis Tumbuhan Berbuah di Hutan lindung Surokonto, Kendal, Jawa Tengah dan Potensinya Sebagai Kawasan Konservasi Burung. PROS. SEM NAS MASY. B INDON. Vol 1, No.3, Hal 472-276.

Ontario J, Hernowo JB, Haryanto, Ekarelawan. 1990. Bird Habitat development patterns in residential areas, especially in urban areas. Media Konservasi 3 (1): 15-28. [Indonesian]

Praptiwi, R. A., Saab, R., Setia, T. M., Wicaksono, G., Wulandari, P., & Sugardjito, J. (2019). Bird Diversity in Transition one of Taka Bonerate, Kepulauan Selayar Biosphere Reserve, Indonesia. *Biodiversitas Journal of Biological Diversity*, 20(3), 819-823.

Rafik, M., Widiya, Y., Az Zahra, I., Ramdhani, H. A., Rifdah, A., Nazulfah, I., Amelia, L., Kholifah, N., Humairoh, M., Oktaviani, H. D., Pratama, T. L., Lestari, T. Y., Magdalena, Komariah, S., Saraswati, D. A., Elisabeth, F., Basyuni, M., Haryandi, Y., Dewi, N. A. 2023. Inventarisasi Avifauna di Kawasan Ekowisata Desa Malasari Taman Nasional Gunung Halimun Salak. Bioma. 25 (1), 38-48.

Steven, R., Morrison, C., & Castley, J. G. J. J. o. S. T. (2015). Birdwatching and Avitourism: a global review of research into its participant markets, distribution and impacts, highlighting future research priorities to inform sustainable avitourism management. *23*(8-9), 1257-1276.

Tesfaw, A. T., Sileshi, G. W., Derero, A., & Granström, A. (2018). *Impacts of Human Disturbance on Biodiversity and Ecosystem Services in Tropical Forests of*

Ethiopia. Forest Ecology and Management, 429, 1–11. https://doi.org/10.1016/j.foreco.2018.06.004

Tobler, M.W., S.E. Carrillo-Percastegui, R. Leite Pitman *et al*. (2008). An Evaluation of Camera traps for Inventorying large-and medium-sized terrestrial rainforest mammals. *Animal Conservation*, 11(3): 169–178.

Van Bael, S. A., Brawn, J. D., & Robinson, S. K. (2003). Birds Defend Trees from Herbivores in a Neotropical Forest Canopy. *Proceedings of the National Academy of Sciences*, *100*(14), 8304-8307.

Wicaksono, G., Rifqi, M. A., Tobing, I. S., & Atmoko, S. S. U. (2021). Diversity and Threat Hunting of the Birds in the Labian-Leboyan Corridor West Kalimantan. *Journal of Tropical Biodiversity*, *1*(3), 179-185.