Avian Diversity in Agricultural Landscapes of SP3 Pangea Area in Gorontalo Province

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Abstract. An agroecosystem cannot function without birds, which perform a variety of functions, including pollination, seed dispensing, nutrient deposition, scavenging, and predatory roles for rodents and insect agricultural landscapes support a wide range of habitats and a diverse population of avifauna. A new transmigration area called SP3 Pangea has been established in the province of Gorontalo. Therefore, the SP3 Pangea's agricultural landscapes do not support a great diversity of birds. The current study documented the abundance of avifauna in agricultural landscapes in SP3 Pangea from this perspective. In order to describe the variety and temporal fluctuation of the avifauna in the agricultural landscapes of Dusun SP3 Pangea, field surveys were carried out from December 2021 to February 2022. There were 13 different bird species in total. The IUCN Red List has one species that is classified as vulnerable. In the research area, it was regularly noted that some species had worldwide population patterns that were dropping. This underlines the fact that research locations are essential habitats for bird species with high conservation needs. Future studies on the management and conservation of existing bird species in agricultural settings are expected to use the findings of the current study as a starting point.

1 Introduction

Birds may be used as ecological indicators of an ecosystem's stability and integrity in terms of its structure and functions [1]. Over large geographical areas, the composition of bird communities varies depending on the available resources.

The presence of a distinctive bird assemblage in a landscape allows for forecasts of the ecological state and potential variations in ecosystem functioning [2]. Birds are an essential part of an agroecosystem and frequently perform a variety of functional activities, including pollination, seed dispensing, nutrient deposition, scavenging, and predatory roles for rodents and insect pests [3]. Birds are thought to be a useful indication of overall biodiversity in agricultural environments due to the wide range of ecological activities they perform. [1].

In agricultural environments, birds are recognized to serve a dual purpose as pests and biological pest controllers [4]. In agricultural landscapes, birds have a concentrated and relatively predictable source of food in the form of grains, seeds, fruits, green vegetation of crop plants, grasses, weeds, insects, and other arthropods [3]. Since most bird species in agricultural landscapes are insectivorous and can potentially control dangerous insects, this is advantageous to farmers [5]. Consequently, it is important to promote and protect these insectivorous birds in the agricultural landscape by using good management techniques [6]. Gorontalo, Indonesia, has a relatively low species diversity of pest birds and helpful birds, so information about the diversity of these birds is lacking.

As a result of extensive deforestation, intensive agriculture and its mechanization, and excessive pesticide and fertilizer use, the agroecosystem in Gorontalo, Indonesia, has seen tremendous changes over the past few decades. There has been a significant impact on the local bird population from all of these activities on the agroecosystems.

The community structure and species variety of birds in agroecosystems need to be studied in order to determine how altering agricultural practices and natural habitats will affect these birds [7]. In order to monitor ecosystem conditions and functions, the assessment of bird assemblages is of utmost importance [8]. Planning for conservation of birds without compromising the goal of intensive agricultural techniques will be made possible by knowledge of the species richness and community structure of birds [9]. In the province of Gorontalo, there is new transmigration area is called SP3 Pangea. The diversity of birds in the agricultural landscapes of the SP3 Pangea is therefore unknown. In this perspective, the current study made an effort to document the richness of the avifauna in the agricultural landscapes of SP3 Pangea.

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2 Material and method

2.1 Study area

The province of SP3 in Pangea Gorontalo served as the site of the current study. The area's agricultural operations depend on the river. The two rivers are mostly responsible for draining the area. Corn is the most important crop in agriculture. There are two seasons (tropical climate) in the research area; rainy season (October to February), and dry season (March to September). In the summer, the temperature can reach 35°C, but in the wet season, it can only reach 27°C.

2.2 Data Collection

The survey was conducted on December 2021 to January 2022. All birds within a 50 m radius of the observer were counted using point counts. Between 06.00 and 10.00 hours, points were visited, and within 20 minutes, all birds that seen were recorded. To measure and estimate distances, a digital rangefinder was utilized. Any observations that were longer than 50 m were not included in the analysis. Eight trips total were made to each site, which were made alternately. Birds were counted directly, aided by a camera and lens (100-400 mm). In addition to these regular surveys, opportunistic records of birds at other times were also included to document a comprehensive checklist. Field manuals were used to identify birds [10]. The following common and scientific names, together with the taxonomic rank (order and family), of documented species were allocated [11]. The International Union for Conservation of Nature (IUCN) evaluated the conservation status of many bird species. The Red List of the IUCN was used to compare the worldwide population trend of the species with its local status in the research area.

2.3 Data Analysis

By measuring the variety of bird species found within the study area, the diversity of species was assessed. The Shannon-Wiener index (H) was used to determine species diversity as follows:

$$H = -\sum_{i=1}^{S} pi \ln pi \quad (1)$$

Where S is the total number of species in the community, pi is the proportion of the entire sample that belongs to the ith species, and H is the index of species diversity

3 Results and discussion

During the study period, 13 different bird species were identified (Table 1). The diverse micro-habitats that seem to offer an abundance of food supplies can be used to confirm the robust bird assemblage in agricultural landscapes.

Table 1. List of bird species recorded from agricultural landscapes

Species	Total	H'	IUCN status
Aceros cassidix	2	0.11	VU
Ducula radiata	13	0.12	LC
Ptilinopus epius	6	0.2	LC
Coracias temminckii	21	0.15	LC
Actenoides monachus	22	0.05	LC
Ceyx fallax	5	0.05	LC
Meropogon forsteni	12	0.01	LC
Phaenicophaeus calyorhynchus	13	0.13	LC
Loriculus stigmatus	14	0.03	LC
Dicaeum celebicum	12	0.03	LC
Dicrurus montanus	25	0.21	LC
Scissirostrum dubium	5	0.02	LC
Penelopides exarhatus	6	0.13	LC

Based on the study conducted by the bird diversity index in the SP3 area overall is 1.24 and belongs to the middle category.

As can be observed from the data, there were a diversity of bird species within the study's geographic considerations. Variations in bird species may exist depending on factors including food availability, roosting and nesting locations, predation pressure, and disturbance [8]. The type of crops planted and the intensity of farming have an impact on the quantity and diversity of birds in agricultural areas.

The kind and quantity of food present in a given habitat has a major impact on the distribution and relative abundance of birds there. In terms of the research area's bird population's foraging behavior, the majority of bird species were insectivorous. Insectivores are the predominant feeding guild in agricultural environments, according to the study's findings [12]. The distinctive bird populations in agricultural settings in SP3 Pangea may vary in terms of their ecological functions, dietary preferences, and resource-use patterns. Given the abundance of insects in agricultural areas, the majority of bird species there are insectivorous. These insectivorous birds play a significant role in the biological management of several insect pests that thrive in horticulture, agriculture, and woodlands [13]. It is possible that the research area's avifauna may suffer greatly if chemical insecticides and pesticides are used carelessly in agricultural fields. In spite of this, it is essential to preserve these insectivorous bird species on agricultural lands by using the proper management techniques [6].

All of the recorded avifauna are categorized as least concern in IUCN status, and only one is vulnerable, that is *Aceros cassidix*. To determine a landscape's ecological significance, it is essential to record the species richness and composition of birds there. Species-specific functions and ecological services make it easier to prioritize the actions needed to conserve bird species and maintain the ecosystem services, which are still in need of support. The current study, in this context, is the first scientific account of the diversity and

assemblage of bird species in agricultural landscapes of SP3 Pangea.

4 Conclusion

It is clear from the present investigation that the agricultural landscapes of SP3 Pangea accommodate a wide variety of avifauna. For future studies on the conservation and management of extant bird species in agricultural environments, our findings on avian diversity can serve as a baseline. To support a comprehensive strategy to conservation and management methods for the sustainability of ecosystem services generated from birds, long-term monitoring of bird species should be continued in the research region. This monitoring should concentrate on seasonal abundance, habitat usage, nesting, and breeding ecology.

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References

1. S. Mekonen. Journal of Natural Sciences Research, **7**, 21 (2017)
2. Xu, Weizhen, F. Weicong, D. Jiaying, Y. Jiao, P. Huang, D. Zheng, Z. Chen, Z. Zhu, and G. Ding. China Diversity, **14**, 555 (2022)
3. Priya, D. Singh, V. Delu, K. Yodha, T. Dahiya, A. Kour, and N. Punia, The Pharma Innovation Journal, **11**, 7 (2022)
4. D. Garcia, M. Miñarro, and R. Martínez-Sastre. Agriculture, Ecosystems and Environment, **254** (2018)
5. D. J. Gonthier, R. S. Amber, S. Daniel, Karp, A. Lu, K. Garcia, G. Juarez, T. Chiba, S. Gennet, and C. Kremen. J Appl Ecol, **56** (2019)
6. C. S. Malhi. Environment and Ecology, **24**, 1 (2006)
7. A. Mallik, D. S. Chand, A. Singh, and S. P. Parida. Current Life Sciences, **1**, 2 (2015)
8. A. Hossain, and G. Aditya. Proc Zool Soc, **69**, 1 (2014)
9. K.G. Sundar, and S. Kittur. Biological Conservation, **168** (2013)
10. J. Schrader, C. Parsch, S. Moeljono, J. D. Kalor T. Hofmann, C. Weinrich, F. Mühlberger, C. Stinn, M. Mühlenberg, and C. Sattler. Forest and Society, **4**, 2 (2020)
11. J. Praveen, R. Jayapal, and A. Pittie. Indian BIRDS, **11**, 5&6 (2016)
12. M. Basile, I. Storch, and G. Mikusi´nskia. Ecological Indicators, **133** (2021).
13. J. D. Wilson, A. J. Morris, B. E. Arroyo, S. C. Clark, and R. B. Bradbury. Agriculture, Ecosystems and Environment, **75** (1999)