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Relationship between bird species diversity and tree composition in Coban Talun waterfall area, Batu, East Java

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A B S T R A C T

Birds and trees are interrelated and can therefore be used as bioindicators of environmental quality. Trees provide food and shelter for various bird species, while birds assist in tree pollination. The relationship between bird species diversity and tree composition in the Coban Talun tourist area has not been specifically studied, therefore this study aims to assess the environmental quality in the Coban Talun tourist area through an analysis of the relationship between bird species diversity and tree composition. The method used to observe tree composition was inventory, while the point count and line transect methods were used to observe birds. The data analysis used was Spearman's rank correlation test to analyze the relationship and influence between plant diversity and the number of bird species and individuals. Based on the analysis results, it was found that station 1 (pine forest) was dominated by the Yellow-crested Bulbul (*Pycnonotus aurigaster*), which took advantage of the presence of fruit trees, while station 2 (fields) was dominated by the Linchi Swiftlet (*Collocalia linchi*), which adapted to open areas. Bird diversity increased in areas with higher tree diversity, indicating a positive relationship between vegetation composition and bird abundance. This correlation confirms that tree structure and diversity play an important role in providing habitat, food, and activity space for birds, so that the relationship between these two components can be used as an indicator of environmental quality.

Keywords: Bird; tree; Coban Talun; diversity; correlation

1. INTRODUCTION

Indonesia is one of the countries with the highest levels of biodiversity in the world. This biodiversity includes various types of plants and animals spread across the entire territory of Indonesia. Indonesia ranks fourth in the world in terms of plant diversity, with around 38,000 plant species. Plant diversity is clearly evident in the abundant forests throughout Indonesia. As autotrophic organisms, plants can produce organic matter for their own needs and play a crucial role in the food chain, especially for other organisms (Nugroho, 2015).

Plants play an important role for all living things. Plants provide food, energy, and metabolic support for various organisms, including birds (Ariyanto, Probosari and Nurmiyati, 2016). In addition, plants also serve as habitats for other organisms that are food sources for birds, such as caterpillars (Saputri *et al.*, 2022). Every organism has a reciprocal relationship, such as the symbiotic relationship between birds and trees. Some trees benefit from the pollination process aided by birds, while birds themselves need trees for nesting and obtaining fruits and seeds as a food source (Wattimena, 2023).

Birds are one component of biodiversity, along with plants, that provide various important benefits for human life (Mainase & Sinery, 2019). Birds play a crucial role in maintaining the balance between forest ecosystems and the environment (Mariyappan *et al.*, 2023). One of the main roles of birds is as seed dispersers (Fatimah & Muhammad, 2023). Many bird species consume fruits and seeds (Daryatmo & Widiarso, 2016), then disperse them to various locations through their droppings. This process allows plants to spread beyond their parent trees, thereby supporting forest regeneration and maintaining biodiversity (Rumanasari & Katili, 2017).

Birds and trees have a reciprocal relationship. This is because trees provide food and shelter for various bird species (Siti & Kamal, 2022). The more diverse the composition of trees in an area, the more diverse the bird species within it. Bird conservation can be maintained by conserving species, preceded by various studies or research on these animals, including their diversity, population, habitat, and the environment that affects them (Mainase & Sinery, 2016). Bird species in the Coban Talun area, Batu, East Java, play an important functional role in the ecosystem and are often considered a good indicator of biodiversity (Rudini & Ihsan, 2016). The Coban

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Talun area is a natural tourist destination with pine forests, waterfalls, and rapid ecotourism development. However, intensive tourism activities such as the construction of tourist facilities, an increase in the number of visitors, and changes in land use around the forest area have the potential to pose ecological threats in the form of habitat fragmentation, a decline in the quality of natural vegetation, and disturbance to wildlife, especially birds. This tourism pressure can affect the behavior, distribution, and abundance of bird species, which ultimately reflects the condition of the area's ecosystem. In addition, this area is located in a transition zone between protected forest and tourism utilization areas (Novita & Novarino, 2025).

Previous studies have shown that bird distribution and abundance are highly dependent on forest habitat characteristics at various spatial scales, both at the stand and landscape levels (Mitchell *et al.*, 2006). Research by Hartoyo et al. (2019) in the traditional agroforestry area of Meru Betiri National Park found that tree species such as Artocarpus heterophyllus are important activity points for birds, especially at heights of 4–20 meters above ground level. Meanwhile, research by (Pradana, 2024) in the Gunung Balak Protection Forest, East Lampung, showed that changes in vegetation structure, including tree regeneration and dominance, have a direct impact on bird species diversity. Similar results were found in nature tourism areas, such as a study Nature et al. (2020) in the Telaga Warna Nature Tourism Area, Bogor, which showed that birds more often utilize the canopy and habitat edges, indicating the importance of vertical structure and vegetation complexity for bird activity.

In general, these various studies confirm that the more complex and diverse the vegetation structure with dense tree cover, complete stratification, and high tree species composition, the greater the diversity and abundance of birds. Saputri et al. (2022) reinforces these findings through research in agroforestry areas in East Java, which shows a strong relationship between vegetation structure and bird abundance. However, to date, studies specifically examining the relationship between bird species diversity and tree composition in tourist areas such as Coban Talun are still very limited. Therefore, this study was conducted to assess the environmental quality of the Coban Talun tourist area by analyzing the relationship between bird species diversity and tree composition as indicators of forest ecosystem balance under pressure from tourist activities.

2. MATERIAL AND METHODS

2.1 Study area

Data collection was conducted on August 3, 2024 in the Coban Talun tourist area, covering protected forests, pine forests, and agricultural land. Observations were made in the morning at 05.00 a.m. -09.00 a.m. Western Indonesian Time, divided into four counting points with a distance of 200 meters between each counting point. The observation lasted for 120 minutes, with 80 minutes for observation, consisting of 20 minutes at each counting point and 40 minutes to walk to the next counting point. The observation location was divided into 2 stations, namely station 1 (pine forest) and station 2 (field) with a transect length of 200 meters for tree data collection.

2.2 Tools and materials

Binoculars for observing birds both near and far, writing instruments, a camera for documenting (taking photos of birds) during research, a series of field guides on birds in the Greater Sunda Islands, Sumatra, Kalimantan, Java, and Bali (2024). As well as using the Merlin Bird app to identify birds based on their sounds and documentation results. And the PlantNet app to identify trees.

2.3 Observation method

The method of collecting tree composition data was carried out using a 200-meter line transect with a width of 5 meters on both sides of the line transect at each station, followed by an inventory, which involved recording the tree species found at station 1 and station 2.namely recording the types of trees located at station 1 and station 2. The observation parameters used were counting the number of individuals for each plant species, then collecting bird observation data using the point count and line transect methods. The point count method is where the observer stands at a predetermined location then records all birds seen or heard, while the line transect method is a method of observing wildlife and plants by making a straight path lengthwise. This method was chosen because the research location is open and has high visibility. The parameters measured were bird species and the number of individuals of each bird species.

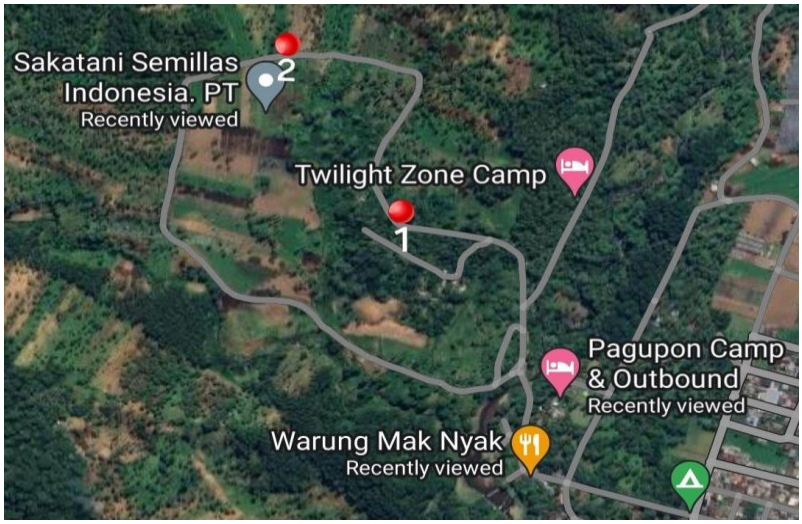

Figure 1. Observation location station 1: pine forest, station 2: fields in the Coban Talun tourist area, Batu, East Java.

2.4 Data analysis

The data analysis used was Spearman's rank correlation test to analyze the relationship and influence between plant diversity and the number of bird species and individuals.

3. Results and Discussion

3.1 Results

Observations made at station 1, located in a pine forest, showed 21 plant species from 17 different families. The most abundant plant species were pine and mahogany trees. Meanwhile, at station 2, located in a plantation, 14 plant species from 11 different families were found.

Table 1. Plant species at station 1 and station 2 in the Coban Talun area, Batu, East Java

No.	Station	Scientific Name	Local Name	Family	Number of Individuals
1.		*Artocarpus heterophyllus*	Nangka	Moraceae	2
2.		*Dimocarpus longan*	Kelengkeng	Sapindaceae	2
3.		*Eucalyptus globulus*	Pohon Gum Biru	Myrtaceae	21
4.		*Ficus callosa*	Pohon Pangsot atau Ilat-ilatan	Moraceae	2
5.		*Helianthus tuberosus*	Bunga matahari berbonggol	Asteraceae	1
6.		*Mallotus barbatus*	Pohon Balik Angin	Euphorbiaceae	1
7.		*Persea americana*	Alpukat	Lauraceae	1
8.	1	*Pinus merkusii*	Pohon Pinus	Pinaceae	120
9.		*Psidium guajava*	Jambu Batu	Myrtaceae	1
10.		*Sechium edule*	Labu Siam	Cucurbitaceae	1
11.		*Swietenia mahagoni*	Mahoni	Meliaceae	20
12.		*Tectona grandis*	Pohon Jati	Lamiaceae	2
13.		*Terminalia catappa*	Ketapang	Combretaceae	2
14.		*Toona ciliata*	Pohon Suren Kapar	Meliaceae	2
15.		*Trema orientalis*	Mengkirai	Cannabaceae	1
16.		*Lantana camara*	Tembelekan Atau Tahi Ayam	Verbenaceae	2

17.		*Calliandra tetragona*	Kalliandra	Fabaceae	2
18.		*Musa Paradisiaca*	Pisang	Musaceae	3
19.		*Durio zubethinus Murr*	Durian	Malvaceae	2
20.		*Bambusa vulgaris*	Bambu	Poaceae	6
21.		*Ficus benjamina*	Beringin	Moraceae	1
1.	2	*Acacia podalyriifolia*	Akasia Mutiara	Fabaceae	30
2.		*Citrus sinensis*	Jeruk Peras	Rutaceae	5
3.		*Coffea arabica*	Kopi	Rubiaceae	2
4.		*Hydrangea macrophylla*	Bunga Hortensia atau bunga bokor	Hydrangeaceae	25
5.		*Ipomoea triloba*	Ubi Jalar Hutan	Convolvulaceae	5
6.		*Lantana camara*	Tembelekan atau tahi ayam	Verbenaceae	5
7.		*Leucaena leucocephala*	Lamtoro	Fabaceae	4
8.		*Persea americana*	Alpukat	Lauraceae	2
9.		*Pinus merkusii*	Pohon Pinus	Pinaceae	50
10.		*Pinus pinaster* Aiton	Pohon Pinus Pinaster	Pinaceae	100
11.		*Toona ciliata*	Pohon Suren Kapar	Meliaceae	20
12.		*Mallotus barbatus*	Pohon Balik Angin	Euphorbiaceae	2
13.		*Psidium guajava*	Jambu Batu	Myrtaceae	1
14.		*Tamarindus indica*	Pohon Asam Jawa	Fabaceae	1

Observations made at station 1, located in a pine forest, showed 21 plant species from 17 different families. The most abundant plant species were pine trees and mahogany trees. Meanwhile, at station 2, located in a plantation, 13 plant species from 11 different families were found. The most commonly found plant species at this station were pine trees and *Pinus pinaster* Aiton. These plants are abundant at both stations because pine trees thrive in mountainous areas, where temperature and rainfall conditions are similar to those of a subtropical climate. According to (Rajagukguk and Basuki, 2022), pine trees can grow well even in poor, sandy, or rocky soil. Generally, their habitat is at an altitude of 200–1,800 meters above sea level (masl), but pine trees actually grow optimally at an altitude of 400–1,500 masl. The best conditions for pine growth are in areas with annual rainfall of 1,200–3,000 mm. In addition to climatic factors, the plant's adaptability also influences the fertility of pine trees.

Table 2. Bird species at station 1 and station 2 in the Coban Talun area, Batu, East Java

No.	Stasion	Scientific Name	Local Name	Family	Number of Individuals
1.	1	*Locustellan montis*	Ceret Jawa	Locustellidae	5
2.		*Pycnonotus goiavier*	Merbah Cerukcuk	Pycnonotidae	1
3.		*Pycnonotus aurigaster*	Cucak Kutilang	Pycnonotidae	8
4.		*Malacocincla sepiaria*	Pelanduk Semak	Pellorneidae	1
5.		*Spilopelia chinensis*	Tekukur Biasa	Columbidae	1
6.		*Hemipus hirundinaceus*	Jingjing Batu	Vangidae	5
7.		*Megalurus palustris*	Cica Koreng Jawa	Locustellidae	3
8.		*Cacomantis merulinus*	Wiwik Kelabu	Cuculidae	1
9.		*Phaenicophaeus curvirostris*	Kadalan Birah	Cuculidae	1
10.		*Dendrocopos analis*	Caladi Ulam	Picidae	1
11.		*Halcyon cyanoventris*	Cekakak Jawa	Alcedinidae	1
12.		*Todiramphus chloris*	Cekakak Sungai	Alcedinidae	1
13.		*Otus lempijji*	Celepuk Reban	Strigidae	1
14.		*Lalage nigra*	Kapasan Kemiri	Campephagidae	1
15.		*Cinnyris ornatus*	Madu Sriganti	Nectariniidae	1
16.		*Cyanoderma melanothorax*	Tepus Pipi Perak	Timaliidae	1

17		*Pericrocotus flammeus*	Sepah Hutan	Campephagidae	4
1.		*Macropygia ruficeps*	Uncal Kouran	Columbidae	2
2.		*Spilopelia chinensis*	Tekukur Biasa	Columbidae	1
3.		*Enicurus velatus*	Meninting Kecil	Muscicapidae	2
4.		*Brachypteryx leucophrys*	Cingcoang Coklat	Muscicapidae	1
5.		*Malacocincla sepiaria*	Pelanduk Semak	Pellorneidae	1
6.		*Todiramphus chloris*	Cekakak Sungai	Alcedinidae	1
7.		*Halcyon cyanoventris*	Cekakak Jawa	Alcedinidae	4
8.	2	*Prinia inornata*	Perenjak Padi	Cisticolidae	4
9.		*Orthotomus sepium*	Cinenen Jawa	Cisticolidae	1
10.		*Megalurus palustris*	Cica Koreng Jawa	Locustellidae	1
11.		*Locustella montis*	Ceret Jawa	Locustellidae	1
12.		*Lonchura punctulata*	Bondol Peking	Estrildidae	1
13.		*Collocalia linchi*	Walet Linci	Apodidae	10
14.		*Pericrocotus cinnamomeus*	Sepah Kecil	Campephagidae	5
15.		*Pycnonotus aurigaster*	Cucak Kutilang	Pycnonotidae	3

Observations conducted at Station 1, located in a pine forest, revealed 17 bird species from 13 different families. The most abundant bird species is the Cucak Kutilang, while at Station 2, located in a plantation, 15 bird species from 10 different families were identified. The most commonly found bird species at this station is the Walet Linci, which is a bird species with high environmental mobility. Bird watching cannot be separated from the vegetation conditions that form their main habitat. Because vegetation conditions play a crucial role in shaping bird distribution and abundance, a Spearman correlation analysis was conducted at both stations to compare the relationship between trees and birds. The correlation results for Station 1 and Station 2 are presented in Table 3 and Table 4, respectively.

Table 3. Pearson correlation test results for station 1

			Tree	**Bird**
Speaarman's rho	Tree	Correlation coefficient	1.000	.061
		Sig. (2-tailed)		.817
		N	21	17
	Bird	Correlation coefficient	.061	1,000
		Sig. (2-tailed)	.817	
		N	17	17

Table 3 shows that the relationship between the number of trees and the number of birds has a coefficient of 0.061 with a significance value of 0.817, which means that the relationship between the two is very weak and not statistically significant; therefore, tree diversity at Station 1 does not affect the variation in the number of birds.

Table 4. Pearson correlation test results for station 2

			Tree	Bird
Speaarman's rho	Tree	Correlation coefficient	1.000	-.680
		Sig. (2-tailed)		.007
		N	14	14
	Bird	Correlation coefficient	-.680	1,000
		Sig. (2-tailed)	.007	
		N	14	15

Table 4 shows a correlation coefficient of –0.680 with a significance value of 0.007, indicating a strong and significant negative relationship between the number of trees and the number of birds. This suggests that at Station 2, an increase in the number of trees tends to be followed by a decrease in the number of birds, or vice versa.

3.2 DISCUSSION

Based on observations of bird diversity in the Coban Talun area from station 1 (pine forest), the dominant bird species is the Asian blue bird from the Pcynonotidae family. The large population of Asian Brown Bulbuls at station 1 is due to the availability of staple foods such as various types of fruit and insects. Asian Brown Bulbuls usually fly and perch to forage and rest. They forage in the morning and evening, but during the day they sleep in trees and seek shelter (Sidik & Ibrahim, 2022). The Yellow-breasted Bulbul (*Pycnonotus aurigaster*) dominated both stations because both observation areas were dominated by fruit-bearing plants, such as jackfruit (*Artocarpus heterophyllus*), longan (*Dimocarpus longan*), avocado (*Persea americana*), guava (*Psidium guajava*), chayote (*Sechium edule*), banana (*Musa paradisiaca),* coffee (*Coffea arabica*), and several vegetables that had begun to grow. These plants are a food source for bird species of the Pycnonotidae family, such as the Brown-eared Bulbul. The distribution of birds from the Pycnonotidae family is very wide, because the distribution of birds from this family depends on the fruit season, so that the number of trees and plants that produce fruits as mentioned above is directly proportional to the number of fruit-eating birds in this area (Surur & Purnamaningrum, 2020). The Pycnonotidae family is often found in habitats such as roadsides, parks, yards, shrubbery, and secondary forests (Ponpituk *et al.*, 2020).

Bird diversity at station 2 (field) is dominated by swallows from the Apodidae family. This is because swallows are insectivorous birds that do not usually perch on trees and fly quickly. Swifts also have echolocation abilities that allow them to easily find food and habitats, such as plantations (Wiranata & Muttaqin, 2017). Bird habitats are generally found in areas with trees. Plants are useful as shelters (nests) and food sources for birds. The composition of plants found in the Coban Talun area has a major influence on bird diversity. Plants and birds have a reciprocal relationship. This is in line with the research by Saputri et al. (2022). which states that the more diverse the habitat structure (plant species diversity and vegetation structure), the higher the bird species diversity.

Both observation stations showed that most birds live and are active in trees. The birds observed were mostly found in the tree canopy, from the branches to the treetops. This was evident from the discovery of several nests in the branches and treetops, as well as the large number of birds perched and chirping in the branches. This indicates that birds use trees as a place to forage, carry out activities, chirp, and as a shelter from the weather and predators (Surur & Purnamaningrum, 2020). Most birds were seen perching on large, tall trees such as pine trees (*Pinus merkusii*), mahogany trees (*Swietenia magahoni*), and eucalyptus trees (*Eucalyptus globulus*).

The presence of bird and tree species in Coban Talun shows a close relationship with environmental conditions in the area, including the role of trees in providing habitat. The trees in Coban Talun provide habitat, shelter, and food sources for various bird species. Tree diversity supports habitat diversity, which enables bird species to survive (Karr & Roth, 1971). The influence of birds on the environment. Birds play an important role in ecosystems, including pollination and seed dispersal. For example, fruit-eating birds help disperse seeds that are important for plant regeneration, which ultimately supports flora diversity (Sutherland & Gill, 2005). They also serve as indicators of environmental quality. The composition of bird species and tree types can be indicators of environmental quality. Birds that are sensitive to environmental changes often indicate ecosystem health. Healthy trees reflect good soil and air quality, supporting the life of flora and fauna (Fischer & Lindenmayer, 2007).

The correlation between bird diversity, trees, and environmental quality is interrelated and mutually influential, namely tree diversity affects bird species diversity. The more tree species there are, the more habitats and food sources are available for birds. This increases bird species diversity (McGill *et al.*, 2007). Environmental quality affects bird and tree diversity. Factors such as soil quality, water availability, and pollution affect tree health and, in turn, the number and types of birds that can live in the area (Fischer & Lindenmayer, 2007). Bird species diversity plays a role in maintaining ecosystem balance, such as pest control, which is beneficial to tree health. Healthy trees provide the habitat and food necessary for birds, demonstrating a close reciprocal relationship between the two elements (Sutherland & Gill, 2005).

The diversity of bird species found in an area can indicate the diversity of bird habitats in that area. The more diverse the vegetation and tree composition in an area, the more diverse the birds that live there. This is reinforced by the opinion of (Ridwan, 2015), who argue that habitats with diverse vegetation types provide more food sources

for the animals that live in them, so that food choices, especially for birds, will be more varied. Animals tend to choose habitats that have abundant resources for their survival. Conversely, animals are rarely or never found in environments or habitats that are less favorable to them.

4. CONCLUSION

This study shows that the environmental quality in the Coban Talun tourist area is greatly influenced by the close relationship between bird diversity and tree composition. The dominance of certain species, such as the Cucak Kutilang in pine forests and the Walet Linchi in field areas, is influenced by the availability of food and vegetation structure that supports the behavior and ecological needs of each bird. The diversity of tree species, especially those that produce fruit or are large enough to be used as perches, provides suitable habitats for various bird species, thereby increasing the number and variety of species at each station. The reciprocal interaction between birds and trees—including the provision of food, shelter, seed dispersal, and the function of birds as indicators of environmental health—shows that the more diverse the vegetation available, the higher the diversity of birds that appear. Therefore, the positive relationship between vegetation structure and bird presence can reflect healthy ecosystem conditions, making analysis of these two components effective for assessing environmental quality in Coban Talun.

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REFERENCES

Ariyanto, J., Probosari, R.M. and Nurmiyati. 2016. Identifikasi Jenis dan Manfaat Pohon di Wilayah Kampus Utama Universitas Negeri Sebelas Maret. *Proceeding Biology Education Conference*, 13(1), pp. 711–716.

Daryatmo, J., and Widiarso, B.P. 2016. Manfaat Nutrisi Bagi Performa Burung Kicauan. *Jurnal Pengembangan Penyuluhan Pertanian*, 13(23), pp. 97–108. https://doi.org/10.36626/jppp.v13i23.102

Fatimah, I.N. and Muhammad, G.I. 2023. Studi Etno-Ornitologi Burung di Kawasan Kampus Universitas Sutomo Serang Banten Sebagai Bentuk Kearifan Lokal Masyarakat. *Journal of Sustainable Development Issues*, 2(1), pp. 65–83. Available at: https://scientium.co.id/journals/index.php/jsdi/article/view/468.

Fischer, J. and Lindenmayer, D.B. 2007. Landscape modification and habitat fragmentation: A synthesis. *Global Ecology and Biogeography*, 16(3), pp. 265–280. Available at: https://doi.org/10.1111/j.1466-8238.2007.00287.x.

Hartoyo, A.P. *et al.* 2019. Keanekaragaman Hayati Vegetasi pada Praktik Agroforestridan Kaitannya Terhadap Fungsi Ekosistem di Taman Nasional Meru Betiri, Jawa Timur. *Jurnal Hutan Tropis*, 7(2), pp. 145–157.

Karr, J.R. and Roth, R.R. 1971. Vegetation Structure and Avian Diversity in Several New World Areas. *The American Naturalist*, 105(945), pp. 423–435. Available at: https://doi.org/10.1086/282735.

Mainase, C., Warmetan, H.& Sinery, A.S. 2019. Keragaman Dan Kepadatan Populasi Spesies Burung Pada Kawasan Hutan Pendidikan Universitas Papua. *Jurnal Kehutanan Papuasia*, 2(1), pp. 10–16. Available at: https://doi.org/10.46703/jurnalpapuasia.vol2.iss1.40.

Mariyappan, M. *et al.* 2023. Ecological Role and Ecosystem Services of Birds: A Review. *International Journal of Environment and Climate Change*, 13(6), pp. 76–87. Available at: https://doi.org/10.9734/ijecc/2023/v13i61800.

McGill, B.J. *et al.* 2007. Species abundance distributions: Moving beyond single prediction theories to integration within an ecological framework. *Ecology Letters*, 10(10), pp. 995–1015. Available at: https://doi.org/10.1111/j.1461-0248.2007.01094.x.

Mitchell, M.S. *et al.* 2006. Relationships between avian richness and landscape structure at multiple scales using multiple landscapes. *Forest Ecology and Management*, 221(1–3), pp. 155–169. Available at: https://doi.org/10.1016/j.foreco.2005.09.023.

Nature, W. *et al.* 2020. Utilization of Tree Canopies by Avifauna in Two Types of Habitat in Telaga. *Indonesian Journal of Biotechnology and Biodiversity*, 4(2), pp. 62–70.

Novita, A., Mukhta, E. & Novarino, W. 2025. Bird Diversity and its Potential for Tourism Activities in Mandeh Mangrove', *Jurnal Biologi Tropis*, 25(1), pp. 1016–1022.

Nugroho, A.S. 2015. Analisis keanekaragaman jenis tumbuhan berbuah di hutan lindung Surokonto, Kendal, Jawa Tengah dan potensinya sebagai kawasan konservasi burung. *Proceding Biologi Education Conference*, 1, pp. 472–476. Available at: https://doi.org/10.13057/psnmbi/m010316.

Ponpituk, Y. *et al.* 2020. Temporal variation in the population of bulbuls (Family Pycnonotidae) in lower montane forest , Northern Thailand. *Biodiversitas Journal of Biological Diversity*, 21(8), pp. 3644–3649. Available at: https://doi.org/10.13057/biodiv/d210829.

Pradana, Z.A. 2024. Keanekaragaman Burung pada Musim dan Struktur Vegetasi yang Berbeda di Kawasan Hutan Lindung Gunung Balak, Kabupaten Lampung Timur.

Rajagukguk, J.R. & Basuki, B. 2022. Sosialisasi Reboisasi Lahan Kompensasi Ijin Pakai Kawasan Hutan Mendukung Pembangunan Infrastruktur Ketenagalistrikan. *Jompa Abdi: Jurnal Pengabdian Masyarakat*, 1(1), pp. 1–10. Available at: https://doi.org/10.55784/jompaabdi.vol1.iss1.38.

Ridwan, M. 2015. Hubungan keanekaragaman burung dan komposisi pohon di Kampus Kentingan Universitas Sebelas Maret Surakarta, Jawa Tengah. *Prosiding Seminar Nasional Masyarakat Biodiversity Indonesia*, 1(3), pp. 660–666. Available at: https://doi.org/10.13057/psnmbi/m010346.

Rudini, Labiro, E. & Ihsan, M. 2016. Keanekaragaman Jenis Burung Pada Kawasan Hutan Lindung Kph Dampelas Tinombo Di Desa Sibualong. *Warta Rimba*, 4, pp. 69–75.

Rumanasari, R.D., Saroyo, S. & Katili, D.Y. 2017. Biodiversitas Burung pada Beberapa Tipe Habitat di Kampus Universitas Sam Ratulangi. *Jurnal Mipa*, 6(1), p. 43. Available at: https://doi.org/10.35799/jm.6.1.2017.16153.

Saputri, A.I. *et al.* 2022. Studi Korelasi Keanekaragaman Burung Dan Pohon Pada Lahan Agroforestri Blok Pemanfaatan Kphl Batutegi. *Jurnal Belantara*, 5(2), pp. 232–245. Available at: https://doi.org/10.29303/jbl.v5i1.854.

Sidik, A. & Ibrahim, M. 2022. Deskripsi Avifauna di Ruang Terbuka Hijau (Rth) Kota Gorontalo. *Jambura Edu Biosfer Journal*, 4(2), pp. 109–116. https://doi.org/10.34312/jebj.v4i2.10069

Siti, Z. & Samsul, K. 2022. Keanekaragaman Jenis Burung Di Hutan Kota Banda Aceh. *In Prosiding Seminar Nasional Biologi, Teknologi dan Kependidikan*, 10(1), pp. 25–42.

Surur, A., A'tourrohman, M. and Purnamaningrum, A. 2020. Hubungan Keanekaragaman Jenis Burung dan Komposisi Pohon di Kampus 2 UIN Walisongo Semarang. *Jambura Edu Biosfer Journal*, 2(2), pp. 57–64. https://doi.org/10.34312/jebj.v2i2.6895

Sutherland, W. J., & Gill, J.A. 2005. The Effects of Habitat Fragmentation on Bird Populations. *Journal of Applied Ecology*, 42(3), pp. 709–718.

Wattimena, C.M.A. 2023. Pendampingan Masyarakat Sebagai Upaya Konservasi Kawasan Pesisir Di Negeri Passo, Kota Ambon. *Maanu : Jurnal Pengabdian Kepada Masyarakat*, 1(1), pp. 46–52. Available at: https://doi.org/10.30598/maanuv1i1p46-52.

Wiranata, A., Unu Nitibaskara, T. and Muttaqin, Z. 2017. Keanekaragaman Jenis Burung di Hutan Kota Bumi Perkemahan dan Graha Wisata Cibubur. *Jurnal Nusa Sylva*, 17(2), pp. 71–79. https://doi.org/10.31938/jns.v17i2.204