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Diversity of Birds recorded around Ang Luang in University of Phayao, Thailand

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This study aimed to survey bird species and assessed bird diversity at Ang Luang, University of Phayao, located in Mae Ka, Mueang Phayao District, Phayao Province. The research was conducted between November 2022 and February 2023, with surveys taking place twice daily morning sessions from 7:30 a.m. to 9:30 a.m. and evening sessions from 4:00 p.m. to 6:00 p.m. across six survey stations over a 12-week period. A total of 522 bird individuals belonging to 19 families and 34 species were observed, though 8 individuals could not be identified. The most common bird families were Columbidae and Muscicapidae, each with four species, followed by Cuculidae and Pycnonotidae, each with three species. The most abundant bird species were Common Myna, Sooty-headed Bulbul, and White-vented Myna. Of the 34 identified species, 22 were residents, 6 were migratory, and 6 were both resident and migratory species. None of the species were listed as reserved wild animals of Thailand, but 32 out of the 34 species were on Thailand's protected species list. All species were classified as least concern by the IUCN, with one species listed in CITES Appendices II. The bird diversity index at Ang Luang was 2.69, with an evenness index of 0.72. Species were categorized by relative abundance, revealing 2 abundant species, 4 common species, 7 moderately common species, 14 uncommon species, and 15 rare species. Similarity index analysis indicated that the survey points with the most similar bird populations were Points 1 and 2, while Points 4 and 6 were the least similar. The study area was divided into two types of land use: waterside public spaces, which included Points 1, 2, 3, and 6, and deciduous dipterocarp forests, which included Points 4 and 5. The average temperature was 24.58 ± 3.28°C in the morning and 28.37 ± 1.24°C in the evening. Relative humidity averaged 61.30 ± 8.15% in the morning and 47.95 ± 2.92% in the evening. Light intensity was 10,676.17 ± 7,695.37 lx in the morning and 2,746.21 ± 1,650.41 lx in the evening. The findings from this study are valuable for informing the management of the university's natural areas and the conservation of biodiversity. Additionally, the data can contribute to the development of ecotourism and educational initiatives related to birds at the university.

Keywords: Bird Diversity, Ang Luang, University of Phayao.

Introduction

The birds are vertebrate and warm-blooded creatures that have the characteristics of two wings for simple flying use and they have been widely accepted that birds evolved from theropods (Prum, 2008). In the current period, birds have been discovered by scientists at approximately 11,140 species all over the world (Pozio, 2005; Xiao et al., 2017) such as freshwater ecosystems (Barocas et al., 2021), marine ecosystems (Singh et al., 2021), and roughly 1,098 species have been found in Thailand's landscapes (Singh, Griaud, & Collins, 2021), particularly the forests, where resident birds and migratory birds can be discovered (Faaborg et al., 2010). Furthermore, the bird is the only unit of the ecosystems that is tremendously significant to improving the environmental biodiversity (Hamilton, 2005), involving bird abundance in forests (Morrison, 1992). because birds have had an evolution vastly, including behaviour, a duty of the ecosystem, and habitational diversities. (Schweizer & Liu, 2018) In terms of consumption, some birds consume plants which consist of seeds or fruits, as good food, and there is an essential role in spreading seeds all over the place. Likewise, the species of birds that consume nectar from flowers could be hybridized pollens to generate new flowers, and some species, as predators prey on other creatures such as insects and fish, including huge creatures and other birds.

Therefore, it is dramatically essential, as the only role in controlling the high population density of prey. In terms of birds as scavengers, they have a role in consuming prey, and some birds, have been eaten by other creatures. In addition, birds flying have rapid mobility and are likely to commute somewhere easily and swiftly, especially tough places so the birds are excellent pioneers. Each species resides in different habitats such as the fields, the forests, the sea, the coasts, and the hills, including agricultural areas, local communities, urban areas, extremely dry areas or deserts, and frozen areas. Some species reside in several areas whereas others live in limited areas. Hence, an important index of the habitational abundance of the birds can be investigated (Donnelly & Marzluff, 2006; Martin, 1980). University of Phayao is colonized in Mae Ka subdistrict, Mueang Phayao district, Phayao province, where it covers all spaces of approximately 5,158 rai, which is half of a dry dipterocarp forest and a large reservoir (Ang Luang). Ang Luang is a water storage for producing tap water and exhibiting a view of the university, involving other far buildings.

This reservoir is a huge freshwater ecosystem that has habitats for various creatures, particularly diverse birds. From the paragraph described before, University of Phayao is in a dry dipterocarp forest, which has changed into a beneficial area for human activities. In the past periods, there has been no research on bird diversity in this area. Therefore, all authors were interested in studying the diversity of birds recorded around Ang Luang at University of Phayao and the impact of change in using the benefits from the population density of birds. In addition, the data would be generated to be information bases or databases related to the diversity of birds in the area, which provides interested citizens associated with the diversity of birds in this location, plans to conserve abundance, and develops this space into shared space and studying environments for students, personnel, and the general public.

Materials and Methods

Materials

A Canon camera (EOS-700D version), a binocular (Olympus 10x50), the Garmin GPS, a hygro-thermometer (Union version), a lux meter (Tenmars version), and A Bird Book of Thailand.

Exploration

Study Areas

Select significant points that can be set up in all 6 positions at Ang Luang and dry dipterocarp forests which are around the water resource, around this area equal to roughly 2,050 meters, with each position being approximately 342 meters apart. Moreover, these places are forecasted that find several birds in each point such as Station 1 (N 19 01.668, E 099 53.787), Station 2 (N 19 01.592, E 099 53.983), Station 3 (N 19 01.419, E 099 53.939), Station 4 (N 19 01.329, E 099 53.871), Station 5 (N 19 01.365, E 099 53.728), Station 6 (N 19 01.527, E 099 53.753). All areas would be categorized as mainly two study areas, where dry dipterocarp forests have been altered as footpaths. Nevertheless, that area still preserves abundance in forests: Station 4 and 5. In parts 1, 2, 3, and 6 zones, these areas are the shared spaces, which are around the edges of the water resource.

Exploration of Birds in Ang Luang.

Numerous birds were explored by using the Fixed-point counting method, which is a repeated data collection, and gathering samples in 2 hours. To elaborate, the birds were surveyed at two times, such as 7.30 to 9.30 a.m., 4.00 to 6.00 p.m., once a week, and all 12 weeks. In exploring several birds, they were observed by taking photos with A Canon camera (EOS-700D version) and observing physical structures, such as beak, wing, feather, and behaviour characteristics, with a binocular. After that, recorded bird species would be compared and categorized by using a bird book in Thailand and going online to many international websites, including the physical database of birds, preservation criteria of IUCN, CITES, and Wild Animal Reservation and Protection of Thailand by data analysis of physical structures, such as beak, wing, feather, and behaviour characteristics, involving habitats (arid, wetland, riparian, forest, freshwater ecosystem), microhabitats. Furthermore, exploring physical factors of all 6 locations measured temperature and relative humidity by using a hydro-thermometer and light intensity with a lux meter.

Data Analysis

Firstly, information associated with birds was investigated with the species diversity index of birds according to the Shannon-wiener Index: H' in 6 locations (Shannon, 1948). To elaborate, an index that represents the diversity of living things in a data set.

$$H' = \sum_{i=1}^{s} (P_i \ln P_i)$$

H' = Shannon index of species diversity
s = number of species
P_i = the proportion of the total number of individuals occurring in species I.

Secondly, the number of birds in Ang Luang and 6 locations was verified evenness Index (J') by Pielou's evenness index, which is an index that shows the uniformity of species in a survey area, and it consists of ranges from 0 to 1, with a value of 1 meaning that living things found in that area are the number of individuals is the same in all species.

$$J' = \frac{H'}{H'_{max}} = \frac{H'}{Ln(s)}$$

H' = species diversity index of Shannon-wiener
H'_{max} = In(s) = species diversity under maximum
s = number of species
J' = Evenness index

Thirdly, the number of birds in Ang Luang and 6 locations was measured in the Relative Abundance (RA) of Pettingill which is a value that represents the number of species in an area, and it can be used to calculate the rarity of species in an area.

$$Relative\ abundance = \frac{The\ number\ of\ finding}{The\ number\ of\ survey} \times 100$$

Abundant: A = 90-100%
Common: C = 65-89%
Moderately Common: MC = 31-64%
Uncommon: UC = 10-30%
Rare: R = 1-9%

Finally, racking on the Index of similarity by using Sørensen in 1948 (Rahman et al., 2019; Wolda, 1981). To elaborate, it is an index that shows the similarity of two databases in ecology, it can be used to find the similarity of organisms in two data, especially between survey points and between survey periods, etc., and it has values from 0-1, by the value is near 1 that mean that the more similar two data.

$$Q_s = \frac{2c}{a+b}$$

c = bird species was found in both a and b points
a = the number of birds in a point
b = the number of birds in b point
Qs = Index of similarity

Results

Birds Found in Ang Luang

In this study, from November 22, 2022, to February 6, 2023, for 12 weeks, it was illustrated that all bird species were categorized into 514 numbers, 19 families, and 34 species and could not identify approximately 8 species, which found Columbidae and Muscicapidae the most, 4 species per family.

Table 1: A List of Bird Species was surveyed in Ang Luang, University of Phayao.

Family & Common Name	Scientific Name	Total	Status	IUCN	Protected Wild Animals
Columbidae					
Spotted Dove	*Streptopelia Chinensis*	14	Resident Bird	Least Concern	
Oriental Turtle Dove	*Streptopelia Orientalis*	26	Resident Bird	Least Concern	P
Red Collared Dove	*Streptopelia Tranquebarica*	6	Resident Bird	Least Concern	P
Rock Pigeon	*Columba Livia*	2	Resident Bird	Least Concern	
Cuculidae					
Green-billed Malkoha	*Rhopodytes Tristis*	3	Resident Bird	Least Concern	P
Greater Coucal	*Centropus Sinensis*	2	Resident Bird	Least Concern	P
Asian Koel	*Eudynamys Scolopaceas*	1	Resident And Migratory Bird	Least Concern	P
Rallidae					
White-breasted Waterhen	*Amauornis Phoenicurus*	3	Resident And Migratory Bird	Least Concern	P
Ardeidae					
Chinese Pind Heron	*Ardeola Bacchus*	35	Migratory Bird	Least Concern	P
Alcedinidae					
White-throated Kingfisher	*Halcyon Smyrensis*	4	Resident Bird	Least Concern	P
Megalaimidae					
Coppersmith Barbet	*Megalaima Haemacephala*	5	Resident Bird	Least Concern	P
Lineated Barbet	*Megalaima Lineata*	2	Resident Bird	Least Concern	P
Artamidae					
Ashy Woodswallow	*Artamus Fuscus*	1	Resident Bird	Least Concern	P
Dicruridae					
Black Drongo	*Dicrurus Macrocercus*	6	Resident And Migratory Bird	Least Concern	P
Ashy Drongo	*Dicrurus Leucophaeus*	2	Resident And Migratory Bird	Least Concern	P
Laniidae					
Brown Shrike	*Lanius Cristatus*	12	Migratory Bird	Least Concern	P
Corvidae					
Eurasian Jay	*Garrulus Glandarius*	5	Resident Bird	Least Concern	P
Cisticolidae					
Common Tailorbird	*Orthotomus Sutorius*	1	Resident Bird	Least Concern	P
Hirundinidae					
Striated Swallow	*Cecropis Striolata*	1	Resident And Migratory Bird	Least Concern	P
Barn Swallow	*Hirundo Rustica*	15	Resident And Migratory Bird	Least Concern	P
Pycnonotidae					
Sooty-Headed Bulbul	*Pycnonotus Aurigaster*	90	Resident Bird	Least Concern	P
Streak-Eared Bulbul	*Pycnonotus Blanfondi*	1	Resident Bird	Least Concern	P
Black-Crested Bulbul	*Pycnonotus Flaviventris*	1	Resident Bird	Least Concern	P
Phylloscopidae					
Dusky Warbler	*Phylloscopus Fuscatus*	31	Migratory Bird	Least Concern	P
Sturnidae					
Common Myna	*Acridotheres Ttristis*	130	Resident Bird	Least Concern	P
White-Vented Myna	*Acridotheres Grandis*	55	Resident Bird	Least Concern	P
Estrildidae					
Scaly-Breasted Munia	*Lonchura Punctulata*	7	Resident Bird	Least Concern	P
Motacillidae					
White Wagtail	*Motacilla Alba*	11	Migratory Bird	Least Concern	P
Richard's Pipit	*Anthus Richardi*	4	Migratory Bird	Least Concern	P
Muscicapidae					
Oriental Magpie Robin	*Copsychus Saularis*	6	Resident Bird	Least Concern	P
White-Rumped Shama*	*Copsychus Malabaricus*	7	Resident Bird	Least Concern	P
Grey Bush Chat	*Saxicolla Ferreaus*	6	Resident And Migratory Bird	Least Concern	P
Asian Brown Flycatcher	*Muscicapa Dauurica*	3	Resident And Migratory Bird	Least Concern	P
Nectariniidae					
Purple Sunbird	*Cinnris Asiatica*	12	Resident Bird	Least Concern	P

Note: This table did not gather unknown birds for all 8 species. P = Bird species are protected wild animals on the Wild Animal Reservation and Protection Act, 2019. * = Bird species are on the list of CITES Appendices. Source: Protected wild animals: https://www4.fisheries.go.th/local/file_document/20180730183909_1_file.pdf, Reserved wild animals: https://library.parliament.go.th/th/radioscript/rr2565-sep2, IUCN Red List: https://www.iucnredlist.org/, CITES Appendices: https://cites.org/eng/app/appendices.php

Moreover, the birds were discovered as second families, such as Cuculidae and Pycnonotidae, with 3 species per family, and the most common birds in the top 5 were Common Myna (*Acridotheres tristis*), all 130 birds; Sooty-headed Bulbul (*Pycnonotus aurigaster*), totalling 90 birds; White-vented Myna (*Acridotheres grandis*), of about 55 birds; Chinese Pond Heron (*Ardeola bacchus*); and Dusky Warbler (*Phylloscopus fuscatus*), all 31 birds Table 1. (Selvatti et al., 2015). Furthermore, each area discovered migratory birds of all 6 species, Resident and migratory birds added 28 species. Then, when the number of bird species was identified according to rarity, it was revealed that 21 species were seen the most considerably, and 10 species were seen frequently. One species was not seen frequently in this place, including one species that was seen at the same as the Resident, which was found to be a rare bird whereas it was still a migratory bird that was seen quite frequently, and one species was a bird that was found quite a lot in Ang Luang. Nevertheless, it would be seen somewhere or in some areas. By recording all bird species, this data did not discover birds that were on the list of protected wild animals according to "Wild Animal Reservation and Protection Act, 2019" showed that two species were definitely and accurately identified among all 34 species that were not on the list of protected wild animals, such as Rock Dove (*Columba livia*), and Spotted Dove (*Streptopelia chinensis*). Moreover, in terms of threatened species according to the IUCN Red List, using classification rules version 3.1, illustrated that 34 species were the least concerned group. Also, one species was discovered on the list of CITES Appendices II, which was White-rumped Shama (*Copsychus malabaricus*).

Species Diversity Index and Evenness Index of Birds in Ang Luang

The species diversity index results of the Shannon Index in Ang Luang were 2.69, and the consequences of all 6 stations were 2.17, 2.44, 2.46, 2.55, 1.23, and 2.11, respectively Figure 1. In terms of the evenness index consequences, Ang Luang was 0.72, and each location was 0.74, 0.78, 0.82, 0.84, 0.69, and 0.80, respectively Figure 1.

Relative Abundance of Birds in Ang Luang

In this analysis, Ang Luang found the relative abundance of 5 levels as 2 species in the abundant level, 4 species in the common level, 7 species in the moderately common level, 14 species in the uncommon level, and 15 species in the rare level Table 2. The birds with the abundant level were found in 2 species: Sooty-Headed Bulbuls at 100% relative abundance, and Common Mynas at 91.67% relative abundance. As for birds with the common level were found 4 species: Spotted Doves, Brown Shrikes, Dusky Warblers, and White-Vented Mynas Table 3. When we classified relative abundance levels according to each location, we found that 6 stations did not see birds at the abundant or common level. Likewise, at the moderately common level, Station 1 revealed 3 species: Common Mynas (RA = 59.09%), Sooty-Headed Bulbuls (RA = 45.45%), and Dusky Warblers (RA = 40.91%). Station 2 discovered 3 species: Common Mynas (RA = 59.09%), Sooty-Headed Bulbuls, and Purple Sunbirds (RA = 31.82%). Station 3 illustrated 2 species of birds, such as common mynas and Dusky Warblers (RA = 36.36%) and Station 4 found 3 species of birds in this area as Sooty-Headed Bulbuls (RA = 40.91%), dusky warblers (RA = 36.36%), and White-Rumped Shamas (RA = 31.82%) whereas Station 5 has no birds at the moderately common level. Finally, Station 6 discovered 2 species of birds, such as Chinese Pind Herons (RA = 40.91), and Sooty-Headed Bulbuls (RA = 31.82) Table 4.

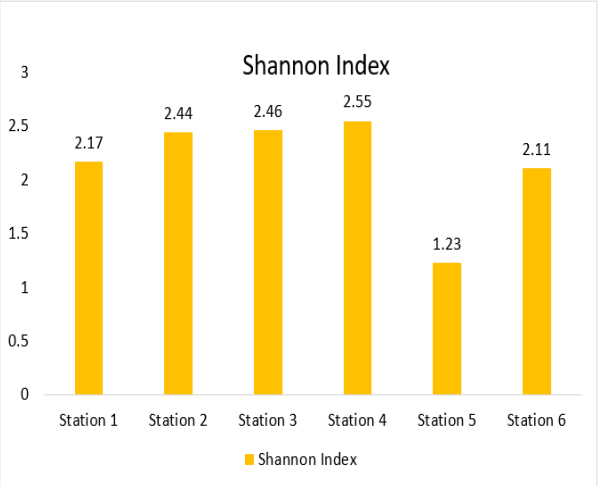

Figure 1: The Bar Chart of the Shannon-Wiener Index of Birds around Ang Luang at University of Phayao.

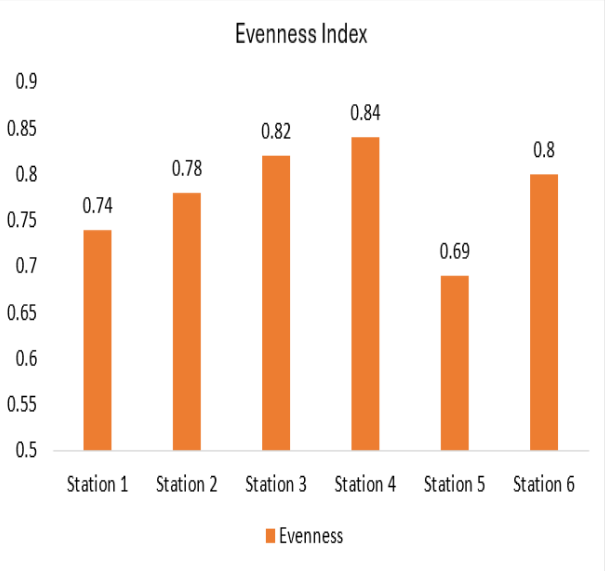

Figure 2: The Bar Chart of the Evenness Index of Birds around Ang Luang at University of Phayao.

Table 2: The Number of Bird Species discovered around Ang Luang according to Abundance Levels.

Relative Abundance	The Number of Species
Abundant: A	2
Common: C	4
Moderately Common: CM	7
Uncommon: UC	14
Rare: R	15

Table 3: The Relative Abundance of Birds around Ang Luang according to Abundance Levels.

Species of Birds	The number of Birds discovered at 6 Stations in the Morning/Evening (Individual)						RA (%)	RA levels
	Station 1	Station 2	Station 3	Station 4	Station 5	Station 6		
Spotted Dove	3/1	6	-/2	1/-		1/-	66.67	4
Oriental Turtle Dove	4/-	13	4/-	3/-		1/-	41.67	3
Red Collared Dove	2/1		1/-	1/-		1/-	41.67	3
Rock Pigeon						2/-	8.33	1
Green-Billed Malkoha	1/-			2/-			16.67	2
Greater Coucal			1/-	1/-			16.67	2
Asian Koel			-/1				8.33	1
White-Breasted Waterhen	1/-	1/-	-/1				25.00	2
Chinese Pind Heron	4/3	5/5	1/-			17/-	50.00	3
White-Throated Kingfisher	1/-	-/1				2/-	25.00	2
Coppersmith Barbet		2/3					16.67	2
Lineated Barbet			1/-	1/-			16.67	2
Ashy Woodswallow						1/-	8.33	1
Black Drongo	2/-	1/-	1/-	2/-			33.33	3
Ashy Drongo			1/-	1/-			16.67	2
Brown Shrike	1/-	1/-	1/1	2/-		6/-	50.00	4
Eurasian Jay				2/2	1/-		25.00	2
Common Tailorbird		1/-					8.33	1
Striated Swallow			1/-				8.33	1
Barn Swallow	7/-	8/-					16.67	2
Sooty-Headed Bulbul	13/7	8/5	6/6	13/7	11/4	8/2	100.00	5
Streak-Eared Bulbul	1/-						8.33	1
Black-Crested Bulbul				1/-			8.33	1
Dusky Warbler	6/3	3/2	5/3	6/2	1/-		75.00	4
Common Myna	42/6	31/12	8/9	3/2	6/-	11/1	91.67	5
White-Vented Myna	14/4	21/7	4/3		1/-	1/-	66.67	4
Scaly-Breasted Munia		2/-	2/3				25.00	2
White Wagtail	3/3	3/-				2/-	33.33	3
Richard's Pipit			-/3	1/-			16.67	2
Oriental Magpie Robin		1/1		1/-		3/-	25.00	2
White-Rumped Shama				2/5			16.67	2
Grey Bush Chat				1/3	2/-		25.00	2
Asian Brown Flycatcher	1/-	1/1	-/1	1/2			50.00	3
Purple Sunbird		4/5		2/-		1/-	33.33	3
Unknown A				1/-			8.33	1
Unknown B		1/-					8.33	1
Unknown C		1/-					8.33	1
Unknown D			1/-				8.33	1
Unknown E	1/-						8.33	1
Unknown F		1/-					8.33	1
Unknown G		1/-					8.33	1
Unknown H	1/-						8.33	1

Table 4: The Number of Bird Species discovered at each relative Abundance Level of 6 Stations.

Relative Abundance	The number of Bird Species					
	Station 1	Station 2	Station 3	Station 4	Station 5	Station 6
Abundant: A	0	0	0	0	0	0
Common: C	0	0	0	0	0	0
Moderately Common: CM	3	3	2	3	0	2
Uncommon: UC	5	6	4	3	2	2
Rare: R	11	14	14	15	4	10
Total	19	23	20	21	6	14

Index of Similarity

Table 5: Index of similarity of Bird Species.

Locations	(1)	(2)	(3)	(4)	(5)
Station 1	-				
Station 2	0.667	-			
Station 3	0.615	0.465	-		
Station 4	0.45	0.318	0.537	-	
Station 5	0.24	0.276	0.308	0.370	-
Station 6	0.545	0.595	0.471	0.229	0.3

This study analysed the index of similarity of bird species in Ang Luang and illustrated that Station 1 and 2 had the highest index of about 66.7% when compared to other locations. Nevertheless, Station 4 and 6 had the lowest similarity of approximately 22.9%. Table 5.

Physical Factors Data of Study Areas

The surveying illustrated that 6 areas are open spaces but these areas have shady large trees and were covered with grass and cover crops as weeds, such as Black-jack (*Bidens pilosa),* and Sensitive plants *(Mimosa pudica)*, involving all explored spaces have a height above sea level at 460 meters except Station 4, which is 525 meters. The first

station is covered with Malaysia Grass (*Axonopus* spp.) and has Foxtail palm (*Wodyetia bifurcata*); 4 trees, height of 6.75 meters, Black afara (*Terninalia ivorensis*); 2 trees, height of 9.5 meters, and Burmese sal (*Shorea siamensis*); one tree, height of 13 meters The second area has Blackwood (*Dalbergia cultrata*); 3 trees, and the average height is 17.5 meters. These trees are shady to explored points, including numerous flowers as well as garden trees,especially Snake plant (*Dracaena trifasciata*) and Dracaena loureiri Gagnep (*Dracaena loureiroi*). Station 3 is an open space with Purple Orchid Tree (*Bauhinia purpurea*), which has grown approximately 10 trees, heights of 7 meters. Moreover, there is Manila grass (*Polytrias indica*) for decoration as a beautiful view of the coffee shop. Station 4 is a dry dipterocarp forest, with a notable plant such as Blackwood, Burmese sal (*Shorea obtuse*), Dark red meranti (*Shorea siamensis*), which have a height of 7 meters. Station 5 is the edge of a dry dipterocarp forest, with a notable plant, particularly Burmese sal and Dark red meranti. Several kinds of plants have been invaded extremely due to landfilling around this area, including having a parking lot close to this point and enormous noise pollution.

The final location is Station 6, where there are viewpoints of Ang Luang and pavilions beside this location, it is an open area and has Paper Flower (*Bougainvillea* spp.) that are huge. In addition, the physical factors of all locations concluded the following in the mornings, which had an average temperature of roughly 24.58 ± 3.28 °C, and the average temperature the lowest was Station 1 around 19.55 ± 3.34 °C whereas the highest was Station 6 of about 30.43 ± 5.73 °C. In terms of the evenings, all locations had an average temperature of roughly 28.37 ± 1.24 degrees, and the highest temperature was Station 3 about 29.82 ± 2.96 °C whereas the lowest was Station 6 about 26.48 ± 1.91 °C. Furthermore, the investigation of relative humidity in the mornings revealed that the average of all areas was 61.30 ± 8.15% and the highest was 73.45 ± 9.90% at Station 1. On the paradoxical side, the lowest humidity was 48.18 ± 9.91% at Station 6. In parts of the evenings, the average of each location was 47.95 ± 2.92%, and the highest was 53.18 ± 12.64% at Station 6 whereas the lowest was 45.27 ± 11.81% at Station 3. Finally, the light intensity of 6 stations in the mornings was 10,676.17 ± 7,695.37 lx, and Station 6 had the highest average of 25,287.27 ± 6,873.44 lx, and the lowest was 2,827.73 ± 814.23 lx at Station 1. In terms of the evenings, the light intensity of the involved areas was 2,746.21 ± 1,650.41 lx, and a location that peak related to light intensity more than other areas as Station 1 about of 5,976.36 ± 2,435.84 lx, and plummet than other areas as Station 6 approximately 770 ± 549.63 lx.

Discussion

In surveying the diversity of birds in Ang Luang, University of Phayao illustrated numerous bird species that had lived to find food around this zone, which could unearth all birds solidly of 522 birds, 19 families, and 42 species. The 3 most frequently revealed birds were Common Myna, Sooty-headed Bulbul, and White-vented Myna when compared to the list that can be discovered on the Avibase website of Phayao province, which has all 567 species (Phayao Bird Checklist - Avibase - Bird Checklists of the World, n.d.). As results illustrated this area discovered all birds, approximately 7.41% of Phayao. At the same time, Rock pigeons were classified as having minimized relative abundance all over the area, although these two groups of birds were very abundant in urban zones. Station 2, 3, and 4 were points that had the most species diversity index results were 2.44, 2.46, and 2.55, respectively, and the evenness index was 0.78, 0.82, and 0.8, respectively. Moreover, Station 2, 4, and 3 were points that found the most bird species as 23, 21, and 20, respectively, and mostly were rare species because there are appropriate abundance and factors for living birds; for instance, huge trees around this zone can provide shade to that area and refuges. Furthermore, those stations have various tree species, whether a dry dipterocarp forest. In the case of Station 4 and nearby Station 3, the gardens were beautifully thrown, and in Station 2, or an agricultural centre, where there is high exuberance, this station found numerous birds. Whether it is a group of wild birds from the deciduous dipterocarp forest or birds in the open field from the agricultural centre.

Moreover, Purple Sunbirds are frequently seen at Station 2, and White-rumped Shama is found at only Station 4. Other studies mentioned that the distribution and the abundance of the population of birds are the main factors as the features of plants in that area (the complication of plant species, the diversity of trees, and the environmental factors) (Askins, Philbrick, & Sugeno, 1987). On the paradoxical side, Station 5, discovered the lowest number of about 6 species, 1.23 of the diversity index and 0.69 of the evenness index when compared to other zones because it has been severely interrupted by landfilling new lands inside the forest, and roughly 20 meters is parking for University of Phayao students, which has sound pollution from vehicles and talking sound, including air pollution in smoked form vehicles (Morrison, 1992). These things have generated special harshness in the evenings that students begin to back to dorms. From observation in the evenings, Station 5 could not record bird species except in week 12. However, Station 5 and Station 6 found birds meagrely because it may be about time factors, which start exploration at approximately 5:30 p.m. and 5:50 p.m., and it is sunset time. Moreover, the potential impact of environmental factors (e.g., temperature, humidity, light intensity) on bird diversity found that Station 5 and Station 6 were shady habitats that had an average temperature of roughly 28.7 °C, relative humidity of about 85.4%, and light intensity of around 190.54 Lux were recorded in the was shady habitats, resulting in appearing fewer birds because the temperature, humidity, light intensity factor impact the growth rate of trees, shrubs, and grasses, which based on resources such as food, nesting materials, and shelter, similar results with Perkins et al. (2000) demonstrated that in open habitats, a number of water hens, doves, pipits, quails, and jungle fowl had close relations with the grasses. This relation was due to the richness of seeds, insect larvae, and vegetation that were

induced by good weather.

Additionally, over observation, some weeks had strong storms and wind, such as weeks 4, 6, 9, and 12. When comparing the number of birds in the evenings of the same week illustrated that the number of birds was quite less than in weeks that had strong wind as weeks 9 and 12. Throughout the evening exploring birds was demonstrated at only one survey point, but whether the two events are truly related is not known. Likewise, in week 8 the evening found birds at much less even though that area did not have much wind during the exploration. However, other factors may impact possible events; for example, locations near explored points were damaged by wildfire. Ang Luang is a huge reservoir, that can attract birds that consume food in areas close to particular water resources. This research demonstrated 3 species, such as Chinese Pond Heron, White-throated Kingfisher, and White-breasted Water hen. However, throughout the research, those birds did not conduct behaviour associated with finding food for seeing authors. In contrast, the bird groups showed behaviour related to using benefits from a reservoir, that was swallows, could not categorize species. This bird cluster would appear in the evenings from about 4:30 p.m. onwards and would hover continuously on the water's surface. Furthermore, around 6:00 p.m., the observers could discover this bird cluster was hovering. After that, the observers research the information Barn Swallow (*Hirundo rustica*) in order to use it in comparison with other birds. The behaviour of the Barn Swallow was catching prey from the water's surface (Costanzo et al., 2018). The researchers assumed that those birds had similar behaviours to the Barn Swallow (see Figure 3).

When conducting this research results were compared to the study results in Kwan Phayao, where divided station all 7 features according to the characteristic locations. This result demonstrated that Kwan Phayao could discover all 79 species and 34 families, and this zone had almost twice as many birds as Ang Luang, which could fine the terrestrial birds together with other kinds of birds depending on each surveyed point. This was distinct from Ang Luang, which had only 3 types of birds that looked for diet in the water sources (Chinese Pond Heron, White-throated Kingfisher, and White-breasted Waterhen). When taking the community of birds in each station of Kwan Phayao compared with Ang Luang was found that the bird society had resemblance in 4 features of areas, such as plants emerging from the water, flooded grass forest, open zone above the water surface or grass, and a King Ngam Mueang Monument, where are open spaces that have embryophyte or aquatic plants to grow on areas considerably. Birds that were found in 4 locations, principally, were birds that looked for food in open areas, such as Common Myna, Baya Weaver, Paddyfield Pipit, Barn Swallow, Scaly-breasted Munia, Brown Shrike, and Asian Brown Flycatcher, all birds mentioned before, were species to discover at Ang Luang as well. When compared with the research on the population of birds in the natural forests at Doi Inthanon (Hvenegaard & Dearden, 1998), Mae Sa-Kog Ma Biosphere Reserve (Siri et al., 2019), and Khao Luang National Park (Round et al.,2006) illustrated that Ang Luang had the number of species less than 3 researches. From Doi Inthanon and Suthep-Pui, 237 species of birds were found, Mae Sa-Huai Khok Ma 65 species, and at Khiriwong Village, 123 species were found. Moreover, Ang Luang had dominant birds that were quite distinct. Remarkable birds from Mae Sa-Huai Khok Ma have The Grey-cheeked Fulvetta, Hill Blue Flycatcher, Puff-throated Bulbul, and Martens's Warbler. In parts of Khiriwong Village, Pycnonotidae and Nectariniidae were outstanding birds found in this place, and the species diversity showed that Ang Luang had a lower index than Mae Sa-Huai Khok Ma. Nevertheless, the species diversity of the 2 locations was utilized as a reference, which did not reckon this index.

Likewise, when analyzed with the other studies in urban areas of Thailand, such as waterbirds in the wetland of Bangpu, Thailand (Wanna, 2020), Suranaree University of Technology (SUT), Nakhon Ratchasima province (Naithani et al., 2018), Kasetsart University, Bangkok, Thailand (Chankhao et al., 2023), bird diversity in metropolitan area, Thailand (Chaiyarat, 2019), Koh Sichang, Chonburi province, and Yala municipality, southern Thailand demonstrated that Ang Luang had the population of bird species less than SUT and Koh Sichang, whereas more than Yala municipality. Ang Luang and SUT had the similarity of bird species approximately 24 species, Ang Luang and Koh Sichang had 17 species, and Ang Luang and Yala Municipality had 8 species. Also, analyzing the resemblance illustrated that the similarity was quite inferior whereas they had similar values when compared to the dominant birds of each area that had the difference (the 3 dominant birds in Ang Luang, such as Common Myna, Sooty-headed Bulbul, and White-vented Myna: SUT, such as House sparrow, Oriental Turtle Dove, and Zebre Dove: Koh Sichang, such as Rock Pigeon, Common Myna, and Yellow-vented Bulbul: Yala municipality, such as Eurasian tree sparrow, Common Myna, and Rock Pigeon). In terms of species diversity, Ang Luang had an index less than SUT but more than Koh Sichang and Yala municipality, because all research was at distinct times and unequal study periods, which resulted in different values. Furthermore, the distinct similarity index of between Ang Luang and other areas. This is probably due to the fact that both sites share non-similar features, including being manicured ornamental gardens, having shade from nearby tall trees, being close to the reservoir's banks, having a variety of plant species, and having regularly maintained plants.

During study periods, the authors were interested in one bird species that was Unknown A because they have structures not similar to other birds when we anatomized the features of birds in the guidebooks or the websites. After that, the authors have continuously searched since the day this bird was discovered. This bird species is small or moderate in size and has a body length of approximately 10-15 centimeters, including a slim body. Furthermore, other structures have short gray hair, completely black hair, and a long straight beak that seems to be an Olive-backed Sunbird. In parts of the behavior, they flap their wings periodically to maintain altitude while flying. Then, the

wings are closed and attached to the body and then swoops into the air. Therefore, the authors forecasted that Unknown A was Pycnonotidae. From the aforementioned results, the authors had biodiversity conservation and area management within the University of Phayao sustainably by meeting organizations and stakeholders by providing excellent knowledge associated with biodiversity conservation and establishing new criteria or policies in order to plummet noisy pollution from human activities and driving vehicles and new buildings within the university, including the information gathered in the study benefit planning area management and biodiversity conservation within the university by four recommendations in the future are 1) conduct studies in other areas of Phayao University, such as the school building area and forests in other areas. Ensure that the survey period is appropriately arranged and extended to obtain more comprehensive data. 2) study bird species and behaviours to create a database of bird species in Phayao University, which can contribute to conservation and bird-watching activities. This can raise awareness among personnel, students, and visitors. 3) investigate the relationship between bird species and topography, including physical and biological factors, in more detail., and 4) utilize the most up-to-date database to obtain information that reflects the current reality, including the current scientific names.

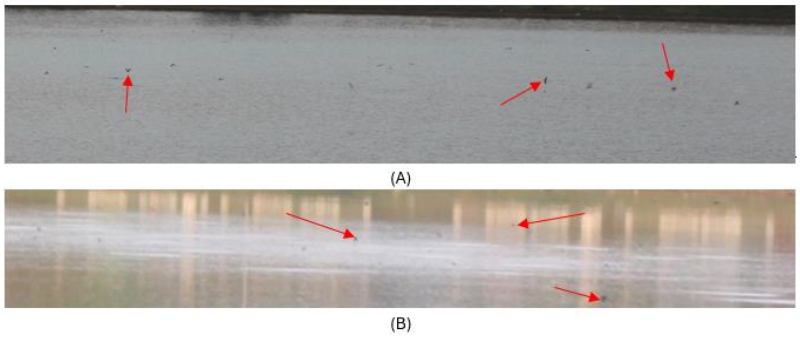

Figure 3: Swallow Swarms that unknown Type: (A) Week 5, and (B) Week 9.

Conclusion

The diversity study of birds around Ang Luang at University of Phayao displayed 514 birds, 19 families, and 34 species, which could identify bird species and could not categorize species of approximately 8 birds, 8 species. The totals of birds in this area are 522 birds, 42 species, which could discover the most 3 types, such as Common Myna, Sooty-headed Bulbul, and White-vented Myna. According to the season, around Ang Luang, resident birds were found of about all 22 species, migratory birds of approximately 6 species, and resident and migratory birds of 6 species, which families mostly discovered as Columbidae, Muscicapidae, Cuculidae, and Pycnonotidae. Furthermore, all 34 species are not protected wildlife whereas 32 species are on the list of reserved wild animals of Thailand, and all 34 species are the status threatened at the least concern according to the assessment of IUCN (Office of Natural Resources and Environmental Policy and Planning, 2017), and only one species is on the list of CITES In parts of the species diversity index (Shannon index: H'), birds at Ang Luang were 2.69, Station 4 was 2.55, and Station 5 was 1.23, which had the lowest index, and in terms of the evenness Index, Ang Luang had an index of 0.72, Station 4 was 0.84, which had the highest index, and Station 5 was 0.69, which was the lowest. Additionally, the relative abundance of birds found that all 42 species had 2 species at the abundant level as 2 species, such as Sooty-headed Bulbul, and Common Myna, and at the common level as Eastern Spotted Dove, Brown Shrike, Dusky Warbler, and White-vented Myna. The parts of the similarity index demonstrated that Station1 and 2 had the highest index of about 66.7%, and Station 4 and 6 had the lowest index of about 22.9%. Finally, the physical factors database of study areas around Ang Luang is appropriate for dwelling birds, which could distinguish 2 categories, such as the dry dipterocarp forest, and the decorative garden. The 2 types have huge trees to provide shade, simultaneously, these areas are open locations, where several species of plants are. Also, Station 5 and 6 have been interrupted by vehicles extremely as well.

Data Availability

The data that support the findings of this study are available on request from the corresponding author.

Conflicts of Interest

The authors declare that they have no conflicts of interest.

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References

Askins, R. A., Philbrick, M. J., & Sugeno, D. S. (1987). Relationship between the regional abundance of forest and the composition of forest bird communities. *Biological Conservation, 39*(2), 129-152. doi: https://doi.org/10.1016/0006-3207(87)90030-9

Barocas, A., Tobler, M. W., Valladares, N. A., Pardo, A. A., Macdonald, D. W., & Swaisgood, R. R. (2023). Protected areas maintain neotropical freshwater bird biodiversity in the face of human activity. *Ecological*

Indicators, *150*, 110256. doi: https://doi.org/10.1016/j.ecolind.2023.110256

Chaiyarat, R., Wutthithai, O., Punwong, P., & Taksintam, W. (2019). Relationships between urban parks and bird diversity in the Bangkok metropolitan area, Thailand. *Urban Ecosystems, 22*, 201-212. doi: https://doi.org/10.1007/s11252-018-0807-1

Chankhao, A., Meevanasukkul, P., Dumrongtawat, N., Bhumpakphan, N., Sukmasuang, R., Chimchome, V., et al. (2023). Correlation between resident birds and anthropogenic noise and particulate matter: A case study at Kasetsart University, Bangkok, Thailand. *Agriculture and Natural Resources, 57*(1), 11–20-11–20. doi: https://doi.org/10.34044/j.anres.2023.57.1.02

Costanzo, A., Romano, A., Ambrosini, R., Parolini, M., Rubolini, D., Caprioli, M., et al. (2018). Barn swallow antipredator behavior covaries with melanic coloration and predicts survival. *Behavioral Ecology, 29*(6), 1472-1480. doi: https://doi.org/10.1093/beheco/ary102

Donnelly, R., & Marzluff, J. M. (2006). Relative importance of habitat quantity, structure, and spatial pattern to birds in urbanizing environments. *Urban Ecosystems, 9*(2), 99-117. doi: https://doi.org/10.1007/s11252-006-7904-2

Faaborg, J., Holmes, R. T., Anders, A. D., Bildstein, K. L., Dugger, K. M., Gauthreaux Jr, S. A., et al. (2010). Conserving migratory land birds in the New World: Do we know enough? *Ecological applications, 20*(2), 398-418. doi: https://doi.org/10.1890/09-0397.1

Hamilton, A. J. (2005). Species diversity or biodiversity?. *Journal of environmental Management, 75*(1), 89-92. doi: https://doi.org/10.1016/j.jenvman.2004.11.012

Hvenegaard, G. T., & Dearden, P. (1998). Linking ecotourism and biodiversity conservation: A case study of Doi Inthanon National Park, Thailand. *Singapore Journal of Tropical Geography, 19*(2), 193-211. doi: https://doi.org/10.1111/j.1467-9493.1998.tb00259.x

Martin, T. E. (1980). Diversity and abundance of spring migratory birds using habitat islands on the Great Plains. *The Condor, 82*(4), 440-448. doi: https://doi.org/10.2307/1367571

Morrison, M. L. (1992). Bird abundance in forests managed for timber and wildlife resources. *Biological Conservation, 60*(2), 127-134. doi: https://doi.org/10.1016/0006-3207(92)91163-M

Naithani, A., Suwanwaree, P., & Nadolski, B. (2018). Bird Community Structure of Suranaree University of Technology Campus, Nakhon Ratchasima Province, Thailand. *Pakistan Journal of Zoology*, *50*(4), 1257-1265 doi: http://dx.doi.org/10.17582/journal.pjz/2018.50.4.1257.1265

Perkins, A. J., Whittingham, M. J., Bradbury, R. B., Wilson, J. D., Morris, A. J., & Barnett, P. R. (2000). Habitat characteristics affecting use of lowland agricultural grassland by birds in winter. *Biological Conservation, 95*(3), 279-294. doi: https://doi.org/10.1016/S0006-3207(00)00042-2

Pozio, E. (2005). The broad spectrum of Trichinella hosts: from cold-to warm-blooded animals. *Veterinary parasitology, 132*(1-2), 3-11. doi: https://doi.org/10.1016/j.vetpar.2005.05.024

Prum, R. O. (2008). Who's Your Daddy?. *Science*, *322* (5909), 1799-1800. doi: https://www.science.org/doi/10.1126/science.1168808

Rahman, I., Hart, R., Afzal, A., Iqbal, Z., Ijaz, F., Abd_Allah, E., et al. (2019). A new ethnobiological similarity index for the evaluation of novel use reports. *Applied Ecology & Environmental Research, 17*(2), 2765- 2777. doi: http://doi.org/10.15666/aeer/1702_27652777

Round, P. D., Gale, G. A., & Brockelman, W. Y. (2006). A comparison of bird communities in mixed fruit orchards and natural forest at Khao Luang, southern Thailand. *Biodiversity & Conservation*, *15*, 2873-2891. doi: https://doi.org/10.1007/s10531-005-2006-7

Schweizer, M., & Liu, Y. (2018). Avian Diversity and Distributions and Their Evolution Through Space and Time. In D. T. Tietze (Ed.), *Bird Species: How They Arise, Modify and Vanish* (pp. 129-145). Springer International Publishing. doi: https://doi.org/10.1007/978-3-319-91689-7_8

Selvatti, A. P., Gonzaga, L. P., & de Moraes Russo, C. A. (2015). A Paleogene origin for crown passerines and the diversification of the Oscines in the New World. *Molecular phylogenetics and evolution*, *88*, 1-15. doi: https://doi.org/10.1016/j.ympev.2015.03.018

Shannon, C. E. (1948). A mathematical theory of communication. *The Bell system technical journal, 27*(3), 379-423. doi: https://doi.org/10.1002/j.1538-7305.1948.tb01338.x

Singh, M., Griaud, C., & Collins, C. M. (2021). An evaluation of the effectiveness of protected areas in Thailand. *Ecological Indicators, 125*, 107536. doi: https://doi.org/10.1016/j.ecolind.2021.107536

Siri, S., Ponpituk, Y., Safoowong, M., Marod, D., & Duengkae, P. (2019). The natural forest gaps maintenance diversity of understory birds in Mae Sa-Kog Ma Biosphere Reserve, northern Thailand. *Biodiversitas Journal of Biological Diversity, 20*(1), 181-189. doi: https://doi.org/10.13057/biodiv/d200121

Wanna, C., Wasan, D., Pisarut, Y., & RUNGTIP, S. A. (2020). The diversity, population, ecology and conservation status of waterbirds in the wetland of Bangpu Nature Education Center, Thailand. *Biodiversitas Journal of Biological Diversity, 21*(8). 3910-3918. doi: https://doi.org/10.13057/biodiv/d210862

Wolda, H. (1981). Similarity indices, sample size and diversity. *Oecologia, 50*(3), 296-302. doi: https://doi.org/10.1007/BF00344966

Xiao, H., Hu, Y., Lang, Z., Fang, B., Guo, W., Zhang, Q., et al. (2017). How much do we know about the breeding biology of bird species in the world? *Journal of Avian Biology, 48*(4), 513-518. doi: https://doi.org/10.1111/jav.00934