

Species diversity of birds in different habitats at Kasetsart University, Bang Khen Campus

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Abstract

Birds are one of the most diverse vertebrates and can be found in a wide range of habitats. Each species of bird has adaptation abilities to fit with the different environments. Therefore, the diversity of birds in each area could be used to indicate habitat quality. This study thus aimed to investigate the biodiversity of birds that utilize the area in Kasetsart University, Bangkok campus, Bangkok, from February 2023 to May 2023. The line transect method was used for studying four different routes. Each route contained 1.0 km in length. Herein, a total of 3982 individuals, 61 species belonging to 31 families and 12 orders of birds were found. The Shannon diversity index (H') of the campus could be calculated as $H'=3.06$. The abundant species are resident birds, which are highly adaptive to fit in with the human community, such as *Passer montanus*, *Columba livia*, and *Geopelia striata*. According to the habitat utilization, the Cumulative Garden (Agricultural Museum) shows the highest bird diversity index ($H'=3.00$). Rice School (RS) and Faculty of Fisheries (FF), the agricultural activity areas, showed the most similarity in bird species. The predictors such as tree cover, level of human disturbance and water cover were discussed for the aspects of habitat utilization as well.

Keywords

bird diversity, habitat use, urban environment, Kasetsart University

Introduction

Birds can be found worldwide in all environments and play a significant role in the ecosystem such as controlling pests, being pollinators and spreading plant seeds. They are related, either directly or indirectly, to the fitness of several other species (King Mongkut

Memorial Park of Science and Technology Waghor, 2012). According to their capacity to quickly and directly respond to modification in their habitat, birds are known as good indicators of environmental change (Wongthirawat, 2009).

Kasetsart University, Bang Khen Campus is located at northern Bangkok which is part of the central plains, an area that used to be rich in resources and biodiversity in the past (Times Higher Education, 2023). Nowadays, increasing urbanization has affected the landscape composition of cities, directly impacting the composition of bird communities. From the perspective of a biodiversity-friendly city, university campuses can play a key role as important urban green spaces for biodiversity in several cities including Bangkok metropolis. According to urbanization, some area on campus was modified for educational activities. Therefore, increasing construction and a gradually decrease of green areas, affecting directly to the quality habitat of birds. Many bird surveys have been carried out at Kasetsart University the last decade, most in unpublished documents. Duangkhae (2022) documented a list of species of birds at Kasetsart University from 1980 to 2022, which included 231 species. Recently, Chanthatho (2020) provided information on the bird diversity at Kasetsart University specifically on the diversity, density and monthly occurrence.

Herein, we provide a checklist of birds at Kasetsart University, Bang Khen Campus, from February to May 2023, along with their relative abundance and conservation status. The result of this study can be the baseline for data collection for monitoring bird populations and exploring habitat utilization on the campus for long-term planning.

Materials and Methods

Study area

Kasetsart University's Bang Khen Campus is situated in the Chatuchak District of northern Bangkok, covering approximately 846 rai (135.4 hectares). The campus comprises an inner and outer zone. The inner zone is designated for educational purposes and consists of buildings, canteens, and other areas for human activities. The outer zone is home to various government offices, such as the Department of Fisheries, Department of Forestry, and Department of Agriculture. The Habitat feature of the campus consists of several gardens, drains and ponds. The campus roads are lined with trees such as *Peltophorum pterocarpum*, *Lagerstroemia loudonii*, *Ficus benjamina*, and *Dolichandrone serrulata*. The campus is surrounded by Phahonyothin Road, Vibhavadi Rangsit Road, Ngam Wong Wan Road, Green Line BTS, and SRT Red Line. As a result, the university is like a greenery surrounded by busy streets and public transit systems.

Four transect lines, approximately one km in length, were selected for recording bird diversity. Each route starts from the Department of Zoology to the target area which was differences in utilization (Figure 1). Characteristics of the surveying route is shown in Table 1.

1) Route 1 to the Agricultural Museum (AM). The road was less transportation, shady with trees and some ornament shrubs. AM is dense and covered with medium-sized size trees. The natural pond is provided as a water resource for this area.

2) Route 2 to the Thai Commemorative Garden (TCG). This route was the main transportation route from Paholyathin Road to the educational zone. The garden's environment is quite similar to the first route, but this place has fewer trees and larger water sources.

3) Route 3 to Rice School (RS). The road to Rice School was surrounded by the educational zone of campus and moderate transportation. The target area is the demonstration rice field for learning. The rice field is near the government building. However, this place is quite isolated from drains and small roads. The rice field is covered with a few large trees and a medium-sized pond. This habitat has changed over the years.

4) Route 4 to the Faculty of Fisheries (FF). The Faculty of Fisheries was separated from other buildings in the educational zone. This place is an open habitat surrounded by small trees and shrubs. Most of the areas have been modified to be aquaculture areas. This route passes through a group of buildings with trees growing along the path.



Figure 1. The study area A). Agricultural Museum (AM), B). Thai Commemorative Garden (TCG), C). Rice School (RS) this habitat has changed frequently and D). Faculty of Fisheries (FF).

Data collection and analysis

The study was conducted between February and May 2023 using the line transect method. All individuals encountered during the observation period were documented, including their species and number of individuals. The diversity indices used in the present study were Shannon-Wiener species diversity index (H') and Pielou's evenness index (J). In addition, analyses of relative abundance were described and species composition among habitat diversity using Sørensen's similarity coefficient.

Data recording starts at 7.00 am to 9.00 am by exploring one route per day and will cover four routes in a month. The birds along the transect line were observed using 8X42 magnification binoculars and identified to the species level. The field of view was estimated by eye about 50 m from the line. The scientific name and migration status followed BCST, 2022. The global conservation status of each species follows the International Union for Conservation of Nature red list (IUCN, 2023). The conservation status of Thailand follows the Office of Natural Resources and Environmental Policy, and Planning (ONEP, 2023).

Results and Discussion

Bird diversity

The study period from February 2023 to May 2023 covered the spring migration period for many bird species, 3983 individuals, 61 species belonging to 31 families, and 12 orders were recorded (Table 2). Both resident and migrant birds are found at the campus (Figures 2 and 3). Order Passeriformes is dominant, with 18 families and 36 species. The most dominant species were the Eurasian Tree Sparrow, Rock Pigeon, and Zebra Dove, respectively. Even though this study was conducted for a short period, the number of bird species found was similar to the record reported by eBird (Hotspot: Kasetsart University, Bang Khen Campus) as 63 species (eBird, 2024). Some species that were not found in this study according to their activity and occurrence, such as the Brahminy Kite (*Haliastur indus*), Blue-and-white Flycatcher (*Cyanoptila cyanomelana*), and some nocturnal species like Collared Scops-Owl (*Otus lettia*).

When compared to the 83 species reported throughout the year (eBird, 2024), this study shows lower diversity due to the exclusion of the winter period when winter visitors (such as, warblers and flycatchers) come over. However, the diversity is still considered to be not much different. It is apparent that even though the study period was short, the line transects covered the habitat used by the birds, making it representative of that time period.

Of the 61 birds surveyed, most of them are resident birds. Forty-six species of resident birds live in Thailand throughout the year and have breeding grounds in Thailand. For example: Little Cormorant, Black-crowned Night Heron, Pink-necked Green Pigeon, Coppersmith Barbet, Asian Palm Swift, Common Iora, Streak-eared Bulbul, Common Tailorbird, Oriental Magpie Robin. Fourteen of migratory birds were found during the study period as well. For example, Peregrine Falcon, Barn Swallow, Forest Wagtail, Hair-crested Drongo and Black-winged Cuckooshrike.

Table 1. Characteristics of the surveying route, number of individual and diversity indices of campus.

Habitat characteristics	Garden		Rice field	Aquaculture area
	AM	TCG	RS	FF
Human disturbance	++	+++	+	++
Transportation on the route	+	+++	++	+
Habitat heterogeneity	Heterogeneous	Heterogeneous	Homogeneous	Homogeneous
Size of habitat	48,788 m ²	30,843 m ²	15,428 m ²	43,990 m ²
Water resource	~ 7,660 m ²	~ 10,565 m ²	~ 4,020 m ²	~ 10,000 m ²
Number of individuals	977	860	1181	965
Number of species	40	35	44	38
Diversity index (H')	3.00	2.78	2.91	2.82
Evenness index (J)	0.80	0.78	0.76	0.77

The Diversity Index is a tool for measuring diversity, which considers both richness and evenness. The number of individuals, species richness, Shannon-Wiener Diversity Index (H') and Pielou's evenness index (J) are shown in Table 1. Diversity Index (H') of campus was calculated to be 3.06. Among the different areas on the campus (Figure 4), the Agricultural Museum showed the highest species diversity index ($H'=3.00$), followed by the Rice School ($H'=2.91$) and the Faculty of Fisheries ($H'=2.82$). Conversely, the Thai Commemorative Garden had the lowest species diversity index ($H'=2.78$).

The diversity of birds is impacted by human disturbances and habitat heterogeneities (Pena, 2023). Route 1 (AM) had the highest species diversity index as green spaces offered birds, like fruit trees, water sources, and trees to rest. Moreover, this place had low human disruptions, making it a suitable habitat for many species, followed by the FF and RS, respectively. The degree of disturbance in those environments was quite similar. However, habitat homogeneities indicated less bird diversity in those two habitats compared to the AM. Route 2 (TCG) showed the lowest diversity. Although it is composed of high habitat heterogeneities. However, it showed the highest level of disturbance due to human activities within the area and transportation surrounding.

The Shannon-Wiener diversity index combines species richness and evenness index reflex heterogeneity information across the study area (Peet, 1974). Route 1 presented a moderate species richness (40) and the evenness index of 0.81 represents good species distribution in the area. In contrast, RS showed the highest species richness (45) but lowest evenness index of 0.76. This result was characterized the area by the dominance of some species in a community, or a wider variety of birds compared to other areas (Table 2). However, this pattern is characteristic of some open areas, where a few abundant bird species dominate, resulting in lower species evenness (Bezzel, 1985).

Conservation status

Most of the bird species that inhabit the campus have been categorized under the conservation status of LC. However, one species, the Plain-backed Sparrow, has been designated as Near Threatened for local conservation status by ONEP (2023). While, the Asian Golden Weaver was threatened on a global scale as Near Threatened (IUCN, 2023). Those two species were widely dispersed in the open grassland of mainland SE Asia. They feed mostly on grain and seeds and are commonly observed in the paddle field. However, their number was continually decreasing corresponding to habitat loss and also direct capture for bird trade (Angkaew, 2023).

The Java Sparrow is native to Java, Bali, and Bawean in Indonesia. It was brought into Thailand to be kept as a caged bird, and some of them managed to escape. As a result, they can now survive in the wild and were frequently found in certain areas of Bangkok, Nonthaburi, and Pathum Thani, including the neighborhood around Kasetsart University (Sophonrat, 2019). The Java Sparrow has been popular as a caged bird in Asia for several centuries. It was introduced into China and Japan, as well as the United States, Puerto Rico, Jamaica, and Christmas Island off the coast of Western Australia (eBird, 2024). However, the natural population of this species has significantly declined due to the loss of natural habitat and trapping as an agricultural pest in some areas. Consequently, the Java Sparrow is now classified as endangered on the IUCN Red List of Threatened Species, with fewer than 10,000 individuals remaining (IUCN, 2023).



Figure 2. Some migrant birds utilize green space on campus. A, Brown Shrike; B, Black-winged Cuckooshrike; C, Forest Wagtail; D, Barn Swallow.



Figure 3. The common bird species found at Kasetsart University. A, Scaly-breasted Munia; B, Little Egret; C, Common Myna; D, Asian Openbill; E, White-rumped Munia; F, White-vented Myna.

The Shannon - Wiener's diversity index (H')

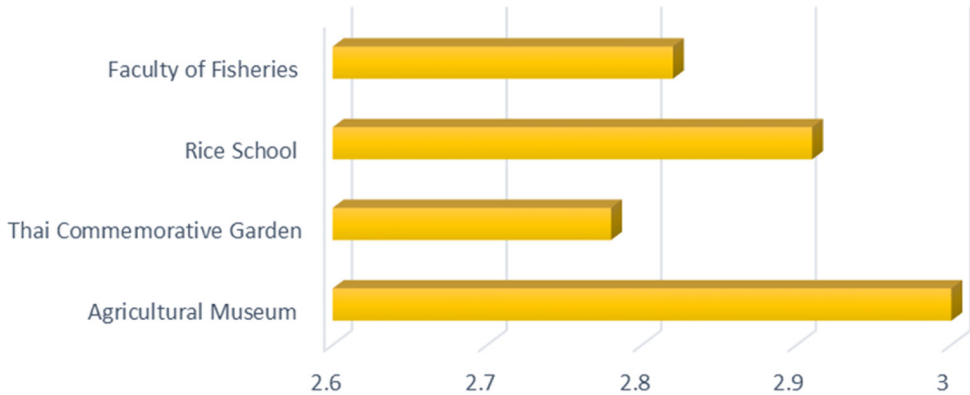


Figure 4. Shows the Shannon-Wiener's diversity index (H') in each study route.

Habitat utilization and similarity index

The transition from paddle fields to cities has challenges for urban birds. While they lose their original habitats, some adaptable species can access new resources. More than 25 species of birds found on campus can adapt to urban environment such as, Columbidae (Dove and Pigeon), Cuculidae (Cuckoo), Ptyctonotidae (Bulbul), Corvidae (Crow), etc. Most of them had a diverse diet and adapted well to urban life. For example, Pigeon can lay eggs on the roof when there are not enough trees around. Steak-eared bulbul still finds fruit from trees planted in the campus. Olive-backed sunbirds can eat nectar, while kingfishers and herons can hunt for fish in water resources. Moreover, most of them can also use spaces in the campus for nesting.

Theoretically, species diversity increases with the complexity of habitat (St. Pierre, 2014; Gumede, 2022; Xu, 2022). AM and TCG are classified as garden habitats with a high heterogeneity of plants. Those two routes were utilized by many bird species both resident and migrant birds. However, the highest diversity at AM ($H' = 3.00$) and lowest at TCG ($H' = 2.78$). It is possible that human disruptions may be the majority because that impacts the diversity of birds. Many studies have investigated the impacts of human activities on birds, such as changes in the community structure (Francis *et al.*, 2009), noise disturbance changes foraging behavior of birds in highly urbanized areas (Ortega, 2012), increase in physiological stress and heightened vigilance (Frid and Dill, 2002). Even though bird species may not recognize humans as natural predators, their avoidance of human disturbance can impact habitat selection for sensitive species, especially when disturbances occur over the long-term.

Table 2. Checklist of Avifauna at Kasetsart University, Bangkok campus from February to May 2023.

Order/Family	Scientific name	Common name	Status				Route			RA
			1	2	3	AM	TCG	RS	FF	
Suliformes										
Phalacrocoracidae	<i>Microcarbo niger</i>	Little Cormorant	R	LC	LC	-	1	-	-	+
Pelecaniformes										
Ardeidae	<i>Ardeola speciosa</i>	Javan Pond Heron	R	LC	LC	-	-	10	1	+++
	<i>Ardeola bacchus</i>	Chinese Pond Heron	N	LC	LC	2	1	4	4	++
	<i>Ardea intermedia</i>	Intermediate Egret	N	LC	LC	-	-	2	-	+
	<i>Egretta garzetta</i>	Little Egret	R	LC	LC	-	1	1	9	+++
	<i>Butorides striata</i>	Striated Heron	N	LC	LC	-	1	-	-	+
	<i>Nycticorax nycticorax</i>	Black-crowned Night Heron	R	LC	LC	5	-	-	-	++
Ciconiiformes										
Ciconiidae	<i>Anastomus oscitans</i>	Asian Openbill	R	LC	LC	7	11	3	5	+++
Falconiformes										
Falconidae	<i>Falco peregrinus</i>	Peregrine Falcon	N	LC	LC	-	-	-	1	+
Columbiformes										
Columbidae	<i>Treron vernans</i>	Pink-necked Green Pigeon	R	LC	LC	11	15	48	32	+++
Columbidae (cont.)										
	<i>Columba livia</i>	Rock Pigeon	R	LC	LC	101	136	114	123	+++
	<i>Streptopelia tranquebarica</i>	Red Collared Dove	R	LC	LC	7	4	1	6	+++
	<i>Spilopelia chinensis</i>	Eastern Spotted Dove	R	LC	LC	22	18	14	17	+++
	<i>Geopelia striata</i>	Zebra Dove	R	LC	LC	76	50	96	99	+++
Cuculiformes										
Cuculidae	<i>Cacomantis merulinus</i>	Plaintive Cuckoo	R	LC	LC	5	1	1	1	+++

Table 2. Checklist of Avifauna at Kasetsart University, Bangkhen campus from February to May 2023. (continuous)

Order/Family	Scientific name	Common name	Status				Route			RA
			1	2	3	AM	TCG	RS	FF	
	<i>Eudynamys scolopaceus</i>	Asian Koel	R	LC	LC	13	13	6	4	+++
	<i>Centropus sinensis</i>	Greater Coucal	R	LC	LC	-	-	6	-	+++
Coraciiformes										
Alcedinidae	<i>Pelargopsis capensis</i>	Stork-billed Kingfisher	R	LC	LC	3	1	-	-	++
Meropidae	<i>Merops philippinus</i>	Blue-tailed Bee-eater	R	LC	LC	11	-	8	1	+++
Coraciidae	<i>Coracias affinis</i>	Indochinese Roller	R	LC	LC	2	-	1	-	++
Piciformes										
Megalaimidae	<i>Psilopogon haemacephalus</i>	Coppersmith Barbet	R	LC	LC	56	69	52	78	+++
Caprimulgi- formes										
Apodidae	<i>Cypsiurus balasiensis</i>	Asian Palm Swift	R	LC	LC	69	129	30	87	+++
	<i>Apus nipalensis</i>	House Swift	R	LC	LC	1	13	8	2	+++
Passeriformes										
Hirundinidae	<i>Hirundo rustica</i>	Barn Swallow	N	LC	LC	-	-	-	36	
Motacillidae	<i>Dendronanthus indicus</i>	Forest Wagtail	N	LC	LC	1	-	-	-	+
Campephagi- dae	<i>Pericrocotus cinnamomeus</i>	Small Minivet	R	LC	LC	-	17	23	16	+++
	<i>Lalage melaschistos</i>	Black-winged Cuckooshrike	N	LC	LC	-	-	2	-	+
Aegithinidae	<i>Aegithina tiphia</i>	Common Iora	R	LC	LC	6	-	-	4	+++
Pycnonotidae	<i>Pycnonotus goiavier</i>	Yellow-vented Bulbul	R	LC	LC	5	9	6	3	+++
	<i>Pycnonotus conradi</i>	Streak-eared Bulbul	R	LC	LC	46	66	42	38	+++
Dicruridae	<i>Dicrurus leucophaeus</i>	Ashy Drongo	N	LC	LC	3	-	1	3	+
Dicruridae (cont.)	<i>Dicrurus macrocercus</i>	Black Drongo	R	LC	LC	4	-	-	-	+
	<i>Dicrurus hottentottus</i>	Hair-crested Drongo	N	LC	LC	5	-	-	-	+

Table 2. Checklist of Avifauna at Kasetsart University, Bangkok campus from February to May 2023. (continuous)

Order/Family	Scientific name	Common name	Status				Route			RA
			1	2	3	AM	TCG	RS	FF	
Piciformes										
Oriolidae	<i>Oriolus chinensis</i>	Black-naped Oriole	N	LC	LC	10	7	4	4	+++
Corvidae	<i>Corvus leuallantii</i>	Eastern Jungle Crow	R	LC	LC	9	19	12	12	+++
Cisticolidae	<i>Prinia inornata</i>	Plain Prinia	R	LC	LC	-	-	7	5	+++
	<i>Orthotomus sutorius</i>	Common Tailorbird	R	LC	LC	2	-	1	-	+++
Muscicapidae	<i>Copsychus saularis</i>	Oriental Magpie Robin	R	LC	LC	62	53	31	46	+++
	<i>Muscicapa sibirica</i>	Dark-sided Flycatcher	N	LC	LC	-	2	-	-	+
	<i>Muscicapa dauurica</i>	Asian Brown Flycatcher	N	LC	LC	2	2	-	-	++
	<i>Ficedula albicilla</i>	Taiga Flycatcher	N	LC	LC	-	2	-	-	++
Rhipiduridae	<i>Rhipidura javanica</i>	Malaysian Pied Fantail	R	LC	LC	24	15	8	25	+++
Laniidae	<i>Lanius cristatus</i>	Brown Shrike	N	LC	LC	-	-	1	-	+
Sturnidae	<i>Gracupica floweri</i>	Siamese Pied Starling	R	LC	LC	5	1	1	-	+++
	<i>Gracupica nigricollis</i>	Black-collared Starling	R	LC	LC	15	5	9	6	+++
	<i>Acridotheres tristis</i>	Common Myna	R	LC	LC	76	32	58	28	+++
	<i>Acridotheres grandis</i>	White-vented Myna	R	LC	LC	83	12	28	26	+++
Nectariniidae	<i>Anthreptes malacensis</i>	Brown-throated Sunbird	R	LC	LC	1	-	-	-	+
	<i>Cinnyris jugularis</i>	Olive-backed Sunbird	R	LC	LC	21	16	10	17	+++
Dicaeidae	<i>Dicaeum minullum</i>	Plain Flowerpecker	R	LC	LC	-	-	-	1	+
	<i>Dicaeum cruentatum</i>	Scarlet-backed Flowerpecker	R	LC	LC	8	-	6	12	+++
Passeridae	<i>Passer montanus</i>	Eurasian Tree Sparrow	R	LC	LC	138	109	206	189	+++
	<i>Passer domesticus</i>	House Sparrow	R	LC	LC	23	18	37	6	+++
	<i>Passer flaveolus</i>	Plain-backed Sparrow	R	LC	NT	-	-	-	1	+
Ploceidae	<i>Ploceus hypoxanthus</i>	Asian Golden Weaver	R	NT	LC	-	-	1	-	+

Order/Family	Scientific name	Common name	Status				Route			RA
			1	2	3	AM	TCG	RS	FF	
	<i>Ploceus philippinus</i>	Baya Weaver	R	LC	LC	-	-	5	-	++
Estrildidae	<i>Padda oryzivora</i>	Java Sparrow	R	EN	EN	-	-	52	2	+++
	<i>Lonchura striata</i>	White-rumped Munia	R	LC	LC	31	-	19	-	+++
Estrildidae (cont.)	<i>Lonchura punctulata</i>	Scaly-breasted Munia	R	LC	LC	3	8	189	8	+++
Anseriformes										
Anatidae	<i>Dendrocygna javanica</i>	Lesser Whistling Duck	R	LC	LC	-	-	1	-	+
Buceroti- formes										
Upupidae	<i>Upupa epops</i>	Eurasian Hoopoe	R	LC	LC	-	1	-	-	+

Remark

Status 1 = Seasonal status (BCST, 2022)
(R resident or presumed resident, N non-breeding visitor.)
2 = Global Threat (IUCN, 2023)
3 = National Threat (ONEP, 2023)
(EN endangered; NT near-threatened; LC Least Concern)

RA = Relative abundance

Heterogeneity of habitat increases bird abundance (Tu *et al.*, 2020). As a result of this study, open areas (RS and FF) contain a higher diversity of birds than garden habitats (AM and TCG). Though, there was little difference between the bird’s diversity in different habitat types, ranging from 0.76 to 0.81 (Table 3). In terms of variation of bird communities in different Habitat, RS and the FF are the most similar in bird species composition (Table 3) due to those two places being more similar land scape structure. Those two areas being open areas with shallow water resources. The surrounding by trees, which provide as foraging and resting site for birds. The plants in the area are usually monocots, grasses, and rice. As a result, the farmland bird and wader species commonly utilize this kind habitat. The most abundance birds found in these habitat types such as Plain Prinia, Blue-tailed Bee-eater, Scaly-breasted Munia, Eurasian Tree Sparrow, Java Sparrow, Javan Pond Heron, Little Egret and Asian Openbill.

Many factors such as migration, breeding, food availability, and changes in vegetation can influence the habitat utilization of birds. (Harisha and Hosetti, 2009). The dissimilarity in the number of birds between garden habitat (TCG) and rice field (RS) could be explained by habitat homogeneity and resource availability. The species composition of TCG and RS differ more due to the difference in land use patterns, with TCG was a dense plant garden, whereas RS was an open area. The rice field may have higher food availability for granivores and wader. While aerial insectivores and insectivores were the dominant groups in all habitat types, especially in garden habitats. This result same as several studies that linked habitat and habitat selection of birds especially among open area and plantation (Tu *et al.*, 2020; Ramlah *et al.*, 2021; Lin *et al.*, 2023; Mugatha *et al.*, 2024) Interestingly, most migratory birds were found only in the RS (Table 2). This is why the area has the highest species richness and shows that the species composition is different from the other areas.

Table 3. Sørensen's similarity coefficient among four routes

	AM	TCG	RS	FF
AM				
TCG	0.743			
RS	0.75	0.707		
FF	0.741	0.746	0.8	

Summary

The diversity of birds that utilize the area in Kasetsart University, Bangkok campus, Bangkok, from February 2023 to May 2023 was 61 species. Fourteen species were migratory birds while the rest were resident birds. The majority of the bird species were classified under the conservation status of LC, however, three species were found to be under threatened categories NT and EN. At least 25 bird species can adapt well to urban environments. Habitat used and distribution of birds, showed the highest species richness and lowest evenness index in Rice field. The study indicated that both land use type and human disturbance played significant roles in affecting bird diversity. This study revealed the same number of bird species as reported by eBird in the same period, even only four months. The line transects clearly covered the habitat that the birds used, indicating that even with the short study period, it was representative of the study area. A longer observation period is recommended to provide a more accurate number of birds on campus all year round.

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References

- Angkaew, R., D. Ngoprasert, L.A. Powell, W. Limparungpatthanakij, P.D. Round and G.A. Gale. 2023. Variation in avian responses to rice intensification in the central plains of Thailand guides conservation opportunities. **Biological Conservation** 286: 100307.
- Bird Conservation Society of Thailand (BCST). 2022. **Checklist_ThaiBirds_2022**. Downloaded from <https://www.bcst.or.th/report-archives/> on 3 December 2023.
- Bezzel, E. 1985. Birdlife in intensively used rural and urban environments. **Ornis Fennica** 62: 90–95.
- Chanthatho, S. 2020. **Diversity of birds at Kasetsart University, Bang Khen Campus**. Department of Zoology, Faculty of Sciences, Kasetsart University, Bangkok.
- Duangkae, P. 2022. **80 years 80 birds Kasetsart University**. Faculty of Forestry, Kasetsart University, Bangkok.
- eBird. 2024. **eBird: An online database of bird distribution and abundance [web application]**. eBird, Cornell Lab of Ornithology, Ithaca, New York. Downloaded from <http://www.ebird.org> on 17 May 2024.
- Francis, C.D., C.P. Ortega and A. Cruz. 2009. Noise pollution changes avian communities and species interactions. **Current Biology** 19(16): 1415-9.
- Frid, A. and L. Dill. 2002. Human-caused disturbance stimulates a form of predation risk. **Conservation Ecology** 6: 11–26.

- Gumede, S.T., D.A.E. Smith, S.P. Ngcobo, M. Sosibo, Y.C.E. Smith and C.T. Downs. 2022. The influence of forest characteristics on avian species richness and functional diversity in Southern Mistbelt Forests of South Africa. **Global Ecology and Conservation** 34: e02047.
- Harisha, M.N. and B.B. Hosetti. 2009. Diversity and distribution of Avifauna of Lakkavalli Range Forest, Bhadra Wildlife Sanctuary, Western Ghat, India. **Ecoprint** 16: 21–27.
- IUCN. 2023. **The IUCN Red List of Threatened Species Version 2023-1**. Downloaded from <https://www.iucnredlist.org> on 5 November 2023.
- Lin, D.L., M. Maron, T. Amano, A.Y. Chang and R.A. Fuller. 2023. Using empirical data analysis and expert opinion to identify farmland-associated bird species from their habitat associations. **Ibis** 165: 974–985.
- King Mongkut Memorial Park of Science and Technology Waghor. 2012. **Bird and Environment**. Downloaded from <http://www.waghor.go.th> on 3 December 2023.
- Mugatha, S.M., J.O. Ogotu, H.P. Piepho and J.M. Maitima. 2024. Bird species richness and diversity responses to land use change in the Lake Victoria Basin, Kenya. **Scientific reports** 14(1): 1711.
- Ortega, C.P. 2012. Effects of noise pollution on birds: a brief review of our knowledge. **Ornithological Monographs** 74: 6–22.
- Ramlah, S., Y. Santosa, N. Santoso and S.B. Rushayati. 2021. The variation of bird diversity in various oil palm land cover in North Mamuju, West Sulawesi, Indonesia. **Biodiversitas** 22(7): 3068–3074.
- The Office of Natural Resources and Environmental Policy and Planning. 2023. **Threatened animal species of Thailand**. Downloaded from <https://www.onep.go.th/open-data-reddatavertebrates/> on 14 November 2023.
- Peet, R.K. 1974. The measurement of species diversity. **Annual Review of Ecology, Evolution, and Systematics** 5: 285–307.
- Pena, J.C., O. Ovaskainen, I. MacGregor-Fors, C.P. Teixeira and M.C. Ribeiro. 2023. The relationships between urbanization and bird functional traits across the streetscape. **Landscape and Urban Planning** 232: 104685.
- Sophonrat, V., P.D. Round, T. Savini and G.A. Gale. 2019. Factors limiting the current distribution of the introduced Java sparrow (*Lonchura oryzivora*) in Bangkok, Thailand. **Raffles Bulletin of Zoology** 67: 448–458.
- St. Pierre, J.I., and K.E. Kovalenko. 2014. Effect of habitat complexity attributes on species richness. **Ecosphere** 5(2): 22.
- Times Higher Education. 2023. **About Kasetsart University**. Downloaded from <https://www.timeshighereducation.com/world-university-rankings/kasetsart-university> on 3 December 2023.
- Tu, H.M., M.W. Fan and J.C.J. Ko. 2020. Different habitat types affect bird richness and evenness. **Scientific Report** 10: 1221.
- Wongthirawat, S. 2009. **Using birds as ecological indicators**. Department of National Park, Wildlife and Plant Conservation.
- Xu, W., J. Yu, P. Huang, D. Zheng, Y. Lin, Z. Huang, Y. Zhao, J. Dong, Z. Zhu and W. Fu. 2022. Relationship between vegetation habitats and bird communities in urban mountain parks. **Animals** 12: 2470.