Green Spaces in WPU Main Campus: Refugia for Endemic and Conservation-Priority Birds and Mammals

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ABSTRACT

This study explores the ecological role of the green spaces within the Western Philippines University (WPU) Main Campus as refugia for endemic and conservation-priority birds and mammals amid increasing anthropogenic pressures on the surrounding landscape. Specifically, it evaluates the bird and mammal assemblages utilizing these green spaces, with emphasis on species diversity and the presence of endemic and conservation-priority species. Wildlife surveys employed transect counts, mist netting, cage trapping, visual encounter surveys, and opportunistic observations. Data collection was conducted from August 2022 to September 2025. Ecological analyses included species richness, relative abundance, Shannon-Wiener diversity index, Pielou's evenness index, frequency, and averages. The survey recorded 119 bird and mammal species, including 21 endemic species, 10 endemic subspecies, and 30 conservation-priority species. These findings demonstrate that the green spaces within the WPU Main Campus support high wildlife diversity, including endemic, migratory, and conservation-priority species, emphasizing their role in both local and broader biodiversity conservation. The campus green spaces also supported 27 species of migratory birds, highlighting its role as a staging and overwintering habitat along the East Asian–Australasian Flyway. Consequently, conserving these areas is essential for sustaining wildlife populations in human-dominated landscapes. It is recommended that WPU strengthen policies for the expansion and enhancement of green spaces through sustainable landscaping practices, such as the use of native flora, reduced pesticide application, and the installation of wildlife-friendly structures. Other institutions are likewise encouraged to establish and maintain green spaces to support biodiversity conservation.

Keywords: biodiversity, ecosystem function, habitat loss, landscape ecology

INTRODUCTION

Habitat loss, driven largely by human activities, is one of the most critical threats to global wildlife diversity. It occurs when natural environments are cleared, degraded, or fragmented due to urbanization, agriculture, industrial development, and infrastructure expansion. This process drastically reduces suitable wildlife habitats and disrupts the ecological balance and connectivity of ecosystems (Hefty and Koprowski 2021; Lwankomezi and Kaganga 2024). In areas severely affected by habitat loss, the remaining fragments of vegetation play a crucial role in supporting extant wildlife populations. These landscape patches function as refugia, providing food, shelter, and breeding sites that help sustain biodiversity within human-dominated landscapes (Galo et al. 2017). Such vegetated fragments, particularly those found in developed and urban environments, are commonly referred to as green spaces. Apart from their role in supporting wildlife, green spaces perform other essential ecosystem functions and provide a wide range of goods and services to local communities. Their vegetation helps cool surrounding environments, improve air quality, and enhance water quality (Ramaiah and Avtar 2019; U.S. Environmental Protection Agency 2021), while also offering aesthetic and recreational benefits that contribute to improved quality of life and human well-being (Jabbar et al. 2021).

Academic institutions located in urban and settlement areas usually have vast natural spaces sprawling among the patches of their building facilities. Unlike other urban spaces that experience significant degradation due to human activity and development, green spaces within educational campuses are typically safeguarded from intensive anthropogenic pressures. In some academic institutions, green spaces host ecologically diverse habitats that serve as critical refugia for native flora and fauna, many of which are endemic and conservation priority species (Sanilorente et al. 2023).

Academic institutions often integrate green spaces into their campus design to promote environmental sustainability. These efforts help conserve ecologically important areas and mitigate the impacts of urbanization on local biodiversity. In academic settings, these spaces typically experience less degradation than other urban landscapes due to institutional policies aimed at preserving them. Additionally, they often receive active management and preservation efforts, which help maintain their ecological integrity and minimize human disturbance.

Research has shown that green spaces in universities tend to provide more stable environments for wildlife compared to other community parks or areas that experience higher levels of human activity, construction, and pollution (Ong et al. 1999; Obana and Buot 2025). The relatively low levels of degradation and disturbance in these spaces make them more effective at supporting endemic and conservation priority species that are particularly sensitive to habitat loss.

In this regard, the green spaces on the Western Philippines University (WPU) Main Campus, which feature diverse ecological characteristics and habitat types, have strong potential to function as refugia for endangered and conservation-priority species that are becoming increasingly rare in surrounding areas due to ongoing anthropogenic pressures. However, studies on the extent to which these green spaces support wildlife diversity, particularly endemic and conservation-priority species, remain limited. Hence, this study was conducted to explore how the green spaces within the WPU Main Campus contribute to biodiversity conservation, focusing specifically on their role as habitats for wildlife species. Specifically, it aims to determine the wildlife assemblages utilizing these green spaces by assessing species richness, abundance, Shannon–Wiener diversity index, and Pielou's evenness. Additionally, the study evaluates the presence of endemic and conservation-priority species among birds, mammals, amphibians, and reptiles.

METHODS

Time and Place of the Study

The study was conducted at the Western Philippines University (WPU) Main Campus in Aborlan, Palawan, over a three-year period from August 2022 to September 2025.

Research Design

This study employed a descriptive-longitudinal survey design to assess the wildlife biodiversity in the green spaces of WPU across wet and dry seasons over a three-year period. The design integrates a combination of both quantitative and qualitative approaches through standardized and opportunistic field sampling methods to provide a comprehensive assessment of species composition and distribution.

Field data were collected using multiple complementary techniques, including standard transect walks, visual encounter surveys (VES), mist netting, cage trapping, and opportunistic data observation such as spotlighting and audio surveys were also employed to confirm the presence of secretive, skulking and cryptic species. Incidental records of captured, road killed, and photo documented wildlife in the vicinity were also noted.

Sampling was conducted during both the wet and dry seasons over a period of three years to capture temporal variations in species occurrence, abundance, and activity patterns. This repeated seasonal sampling allowed for the analysis of biodiversity trends and potential seasonal influences on wildlife distribution.

Data Collection

The study used two1-kilometer transect lines, strategically laid across the WPU main campus, passing through different green spaces identified for this study. The transect lines served as references for observing birds and mammals. The purpose of this method was to observe and document species occurrence, distribution, and abundance across the campus.

The wildlife survey was conducted along the established transect routes. During the transect walk survey, all birds and mammals detected using visual and auditory cues were identified, photo-documented, and recorded. Audio recordings of ambient noise in selected habitats along the transects were also made to verify the presence of vocal wildlife species (Schaub et al. 2011).

The transect walk survey during the day was conducted in the morning between 0600H and 1000H, and in the afternoon between 1500H and 1800H. Another transect count was conducted at night to observe nocturnal species. This was carried out in the evening between 1800H and 2100H (Barton et al. 2010).

Active searching for wildlife and signs of their presence, such as feathers, nests, roosting areas, droppings, quills, burrows, and tracks, was also conducted in different habitat types along the transect routes (Veith et al. 2004). This method was employed because it is effective in detecting shy, skulking, and cryptic or well-camouflaged species that may not be easily observed through conventional transect walk surveys.

Opportunistic observations were also made throughout the study. These observations were recorded whenever the researcher encountered bird and mammal species outside the survey period or just outside the designated survey area. This informal method provided valuable data on the presence of species that were not the primary focus of the formal surveys (Tulloch et al. 2013).

Data Analysis

The data were analyzed using descriptive biological statistics, including species richness, relative abundance, Shannon-Wiener diversity index (Shannon 1948), and Pielou's evenness index, frequency, and averages. The level of endemism of birds and mammals were based on existing literatures, while their conservation status was determined using the Red List of Threatened Species by the International Union for the Conservation of Nature (IUCN), and PCSD Resolution No. 15-521 by the Palawan Council for Sustainable Development (PCSD).

RESULTS

Bird and Mammal Assemblage

The wildlife surveys conducted in the green spaces of the WPU Main Campus during both wet and dry seasons from 2022 to 2025 recorded 1,308 individuals belonging to 119 species from 62 families (Table 1). Avifauna exhibited higher species richness and abundance, comprising 929 individuals from 103 species distributed across 40 families. In contrast, mammals were represented by 379 individuals comprising 16 species distributed across 12 families (Table 2).

The green spaces of the WPU Main Campus in Aborlan, Palawan supported a high level of bird and mammal diversity from 2022 to 2025, as reflected in both seasonal and overall survey results. A total of 119 species were recorded across the entire study period, with species richness notably higher during the wet season (113 species) compared to the dry season (72 species). Similarly, abundance also followed the same pattern, among the total of 1,308 individual wildlife encounters, the wet season had greater proportion (779 individuals) than the dry season (529 individuals).

Seasonal diversity analysis further highlights the ecological importance of the campus green spaces. The Shannon–Wiener Diversity Index (H') was higher in the wet season (H' = 4.73) compared to the dry season (H' = 4.27), indicating greater species diversity during periods of higher moisture availability. The overall diversity index (H' = 4.78) still reflects a highly diverse community, suggesting that the campus consistently supports a

Table 1. Families, common names, scientific names, endemism and conservation status of birds and mammals recorded in the green spaces of WPU Main Campus, Aborlan, Palawan from 2022 to 2025 (**Legend:** *R – Resident Species, R* – Resident with Palawan Endemic Subspecies, PHES – Philippine Endemic Species, PHES* – Palawan Endemic Species, M – Migratory, NoE – Not Evaluated, LC – Least Concern, NT – Near Threatened, V – Vulnerable, E – Endangered, CE – Critically Endangered*.

Family	Common Name	Scientific Name	Endemism	IUCN	PCSD 15-521
Avifauna					
Accipitridae	Crested Serpent-Eagle	*Spilornis cheela palawanensis*	R*	LC	E
Accipitridae	Crested Goshawk	*Accipiter trivirgatus palawanus*	R*	LC	E
Accipitridae	White-Bellied Sea Eagle	*Haliaeetus leucogaster*	R	LC	E
Aegithinidae	Common Iora	*Aegithina tiphia*	R	LC	LC
Alcedinidae	Oriental Dwarf Kingfisher	*Ceryx erithaca*	R	LC	LC
Alcidinidae	Blue-Eared Kingfisher	*Alcedo meninting*	R	LC	LC
Alcedinidae	Common Kingfisher	*Alcedo atthis*	M	LC	LC
Alcidinidae	Stork-Billed Kingfisher	*Pelargopsis capensis*	R	LC	LC
Anatidae	Wandering Whistling Duck	*Dendrocygna arcuata*	R	LC	LC
Ardeidae	Intermediate Egret	*Egretta intermedia*	M	LC	LC
Ardeidae	Eastern Cattle Egret	*Bubulcus coromandus*	M	LC	LC
Ardeidae	Little Egret	*Egretta garzetta*	M	LC	LC
Ardeidae	Great Egret	*Ardea alba*	M	LC	LC
Ardeidae	Striated Heron	*Butorides striata*	R	LC	LC
Ardeidae	Cinnamon Bittern	*Ixobrychus cinnamomeus*	R	LC	LC
Ardeidae	Black Crowned Night Heron	*Nycticorax nycticorax*	R	LC	LC
Ardeidae	Rufous Night Heron	*Nycticorax caledonicus*	R	LC	LC
Ardeidae	Grey Heron	*Ardea cinerea*	M	LC	LC
Ardeidae	Purple Heron	*Ardea purpurea manilensis*	R	LC	LC
Artamidae	White-Breasted Woodswallow	*Artamus leucorynchus leucorynchus*	R	LC	LC
Caprimulgidae	Large-Tailed Nightjar	*Caprimulgus macrurus*	R	LC	LC
Campephagidae	Pied Thriller	*Lalage nigra nigra*	R	LC	LC

Campephagidae	Ashy Minivet	*Pericrocotus divaricatus*	M	LC	LC
Charadriidae	Pacific Golden Plover	*Pluvialis fulva*	M	LC	LC
Charadriidae	Little Ringed Plover	*Charadrius dubius*	M	LC	LC
Charadriidae	Greater Sand Plover	*Anarhynchus leschenaultii*	M	LC	LC
Charadriidae	Kentish Plover	*Charadrius alexandrinus*	M	NT	LC
Cisticolidae	Rufous-Tailed Tailorbird	*Orthotomus sericeus*	R	LC	LC
Cisticolidae	Zitting Cisticola	*Cisticola juncidis nigrostriatus*	R	LC	LC
Columbidae	Spotted Neck Dove	*Spilopelia chinensis*	R	LC	LC
Columbidae	Zebra Dove	*Geopelia striata*	R	LC	LC
Columbidae	Pink-Necked Green Pigeon	*Treron vernans*	R	LC	LC
Columbidae	Black-Chinned Fruit Dove	*Ptilinopus leclancheri*	R*	LC	V
Columbidae	Common Emerald-Dove	*Chalcophaps indica*	R	LC	LC
Columbidae	Reddish Cuckoo-Dove	*Macropygia tenuirostris*	R	LC	LC
Corvidae	Palawan Crow	*Corvus pusillus*	PHES*	LC	LC
Cuculidae	Chestnut-Breasted Malkoha	*Phaenicophaeus curvirostris*	R	LC	LC
Cuculidae	Square-Tailed Drongo-Cuckoo	*Surniculus lugubris brachyurus*	R	LC	LC
Cuculidae	Plaintive Cuckoo	*Cacomantis merulinus*	R	LC	LC
Cuculidae	Sunda Brush Cuckoo	*Cacomantis sepulcralis*	R	LC	LC
Cuculidae	Asian Koel	*Eudynamys scolopaceus*	R	LC	LC
Cuculidae	Greater Coucal	*Centropus sinensis*	R	LC	LC
Cuculidae	Lesser Coucal	*Centropus bengalensis javanensis*	R	LC	LC
Dicaeidae	Pygmy Flowerpecker	*Dicaeum pygmaeum palawanorum*	R*	LC	LC
Dicaeidae	Palawan Flowerpecker	*Prionochilus plateni*	PHES*	LC	V
Dicruridae	Hair-Crested Drongo	*Dicrurus hottentottus palawanensis*	R*	LC	LC
Dicruridae	Ashy Drongo	*Dicrurus leucophaeus leocophaeus*	R	LC	LC
Estrildidae	Chestnut Munia	*Lonchura atricapilla*	R	LC	LC
Estrildidae	Scaly-Breasted Munia	*Lonchura punctulata cabanisi*	R	LC	LC
Estrildidae	White-Bellied Munia	*Lonchura leucogastra palawana*	R	LC	LC
Hirundinidae	Barn Swallow	*Hirundo rustica*	M	LC	LC
Laniidae	Brown Shrike	*Lanius cristatus*	M	LC	LC
Laridae	Whiskered Tern	*Chlidonias hybrida*	M	LC	LC
Locustellidae	Striated Grassbird	*Megalurus palustris forbesi*	R	LC	LC
Monarchidae	Blue-Paradise Flycatcher	*Terpsiphone cyanescens*	PHES*	NT	V
Monarchidae	Black-Naped Monarch	*Hypothymis azurea azurea*	R	LC	LC
Motacillidae	Paddy Field Pipit	*Anthus rufulus lugubris*	R	LC	LC
Motacillidae	Grey Wagtail	*Motacilla cinerea*	M	LC	LC
Motacillidae	Yellow Wagtail	*Motacilla flava*	M	LC	LC
Motacillidae	Forest Wagtail	*Dendronanthus indicus*	M	LC	LC
Muscicapidae	White-Vented Shama	*Copsychus niger*	PHES*	LC	V
Muscicapidae	Palawan Blue Flycatcher	*Cyornis lemprieri*	PHES*	NT	V
Muscicapidae	Mangrove Blue Flycatcher	*Cyornis rufigastra*	R	LC	LC
Muscicapidae	Grey-Streaked Flycatcher	*Muscicapa griseisticta*	M	LC	LC
Nectariniidae	Pale Spiderhunter	*Arachnothera dilutior*	PHES*	LC	V
Nectariniidae	Palawan Sunbird	*Cinnyris aurora*	PHES*	LC	LC
Nectariniidae	Brown-Throated Sunbird	*Anthreptes malacensis paraguae*	R*	LC	LC
Nectariniidae	Purple-Throated Sunbird	*Leptocoma sperata*	R	LC	LC
Passeridae	Eurasian Tree Sparrow	*Passer montanus*	R	LC	LC
Pellorneidae	Ashy-Headed Babbler	*Malacocincla cinereiceps*	PHES*	LC	V

Picidae	Spot-Throated Flameback	*Dinopium everetti*	PHES*	NT	V
Picidae	White-Bellied Woodpecker	*Dryocopus javensis*	R*	LC	V
Picidae	Red-Headed Flameback	*Chrysocolaptes erythrocephalus*	PHES*	E	E
Picidae	Great Slaty Woodpecker	*Mulleripicus pulverulentus*	R	V	V
Pittidae	Hooded Pitta	*Pitta sordida*	R	LC	LC
Podargidae	Palawan Frogmouth	*Batrachostomus chaseni*	PHES*	NA	V
Psittaculidae	Blue-Naped Parrot	*Tanygnathus lucionensis salvadorii*	R	NT	CE
Psittaculidae	Blue-Headed Raquet Tail	*Prioniturus platenae*	PHES*	V	E
Psittaculidae	Red Vented Cockatoo	*Cacatua haematuropygia*	PHES	CE	CE
Pycnonotidae	Palawan Bulbul	*Alophoixus frater*	PHES*	LC	V
Pycnonotidae	Ashy-Fronted Bulbul	*Pycnonotus cinereifrons*	PHES*	LC	LC
Pycnonotidae	Black-Headed Bulbul	*Pycnonotus atriceps*	R	LC	LC
Rallidae	White-Browed Crake	*Amaurornis cinerea*	R	LC	LC
Rallidae	Red-Legged Crake	*Rallina fasciata*	R	LC	LC
Rallidae	Buff-Banded Rail	*Hypotaenidia philippensis*	R	LC	LC
Rallidae	Common Moorhen	*Callinula chloropus*	R	LC	LC
Rallidae	Watercock	*Gallicrex cinerea*	R	LC	LC
Rallidae	White-Breasted Waterhen	*Amaurornis phoenicurus*	R	LC	LC
Recurvirostridae	Black-Winged Stilt	*Himantopus himantopus*	M	LC	LC
Rhipiduridae	Philippine Pied Fantail	*Rhipidura nigritorquis*	PHES	LC	LC
Rostratulidae	Greater Painted-Snipe	*Rostratula benghalensis*	R	LC	LC
Scolopacidae	Temminck's Stint	*Calidris temminckii*	M	LC	LC
Scolopacidae	Red-necked Stint	*Calidris ruficollis*	M	LC	LC
Scolopacidae	Common Sandpiper	*Actitis hypoleucos*	M	LC	LC
Scolopacidae	Wood Sandpiper	*Tringa glareola*	M	LC	LC
Scolopacidae	Pectoral Sandpiper	*Calidris melanotos*	M	LC	LC
Scolopacidae	Marsh Sandpiper	*Tringa stagnatilis*	M	LC	LC
Scolopacidae	Common Greenshank	*Tringa nebularia*	M	LC	LC
Scolopacidae	Common Redshank	*Tringa totanus*	M	NT	LC
Strigidae	Spotted Wood Owl	*Strix seloputo wiepkeni*	R*	LC	E
Sturnidae	Asian Glossy Starling	*Aplonis panayensis*	R	LC	LC
Timaliidae	Pin-Striped Tit-Babbler	*Mixornis gularis woodi*	R*	LC	LC
Turnicidae	Barred Buttonquail	*Turnix suscitator haynaldi*	R*	LC	LC
Mammal					
Pteropodidae	Common Short-Nosed Fruit Bat	*Cynopterus brachyotis*	R	LC	LC
Pteropodidae	Dagger-Toothed Flower Bat	*Macroglossus minimus*	R	LC	LC
Pteropodidae	Giant Flying Fox	*Pteropus vampyrus*	R	NT	E
Megadermatidae	Common Asian Ghost Bat	*Megaderma spasma*	R	LC	LC
Hipposideridae	Diadem Roundleaf Bat	*Hipposideros diadema*	R	LC	LC
Muridae	Malaysian Field Rat	*Rattus tiomanicus*	R	LC	LC
Muridae	Polynesian Rat	*Rattus exulans*	R	LC	LC
Muridae	Asian House Rat	*Rattus tanezumi*	R	LC	LC
Tupaiidae	Palawan Tree Shrew	*Tupaia palawanensis*	PHES*	LC	E
Sciuridae	Northern Tree Squirrel	*Sundasciurus juvencus*	PHES*	LC	V
Cercopithecidae	Long-Tailed Macaque	*Macaca fascicularis philippensis*	R	E	E
Mustilidae	Oriental small-Clawed Otter	*Aonyx cinereus*	PHES*	V	E
Viverridae	Common Palm Civet	*Paradoxurus hermaphroditus*	R	LC	LC
Hystricidae	Palawan Porcupine	*Hystrix pumila*	PHES*	V	E
Felidae	Leopard Cat	*Prionailurus bengalensis heaneyi*	R	LC	E
Mephitidae	Palawan Stink Badger	*Mydaus marchei*	PHES*	LC	V

Table 2. Total number of families, species and individuals of different birds and mammals recorded in the green spaces of WPU Main Campus, Aborlan, Palawan from 2022 to 2025.

Taxonomic Level	Bird	Mammal	Total
Family	40	12	62
Species	103	16	119
Individuals	929	379	1308

Wide variety of species throughout the year. Finally, Pielou's Evenness Index (J') values were relatively high and comparable between seasons, with 0.88 in the wet season and 0.85 in the dry season, resulting in an overall evenness of 0.85 (Table 3).

Table 3. Seasonal trend in species richness, abundance, Shannon-Wiener Diversity Index, and Pielou's Evenness Index of birds and mammals recorded in the green spaces of WPU Main Campus, Aborlan, Palawan from 2022 to 2025.

Diversity Indicator	Wet Season	Dry Season	Over-all
Species Richness	113	72	119
Abundance	779	529	1308
Shannon-Wiener Diversity Index (H')	4.73	4.27	4.78
Pielou's Evenness Index (J')	0.88	0.85	0.84

From 2022 to 2025, wildlife diversity in the green spaces of the WPU Main Campus showed a slight declining trend in bird and mammal species richness, decreasing from 97 species in 2022–2023 to 92 species in 2024–2025. Abundance fluctuated moderately, with 444 individuals recorded in 2022–2023, decreasing to 429 in 2023–2024, and slightly increasing to 435 in 2024–2025 (Table 4).

Table 4. Temporal Trends in Species Richness, Abundance, Shannon–Wiener Diversity Index, and Pielou's Evenness Index of birds and mammals in the green spaces of WPU Main Campus, Aborlan, Palawan from 2022 to 2025.

Diversity Indicator	2022-2023	2023-2024	2024-2025
Species Richness	97	96	92
Abundance	444	429	435
Shannon-Wiener Diversity Index (H')	4.57	4.56	4.52
Pielou's Evenness Index (J')	0.87	0.87	0.87

Despite these changes, diversity remained relatively stable, as indicated by the Shannon–Wiener Index, which showed only a minimal decrease from 4.57 to 4.51 across the study period. Similarly, Pielou's Evenness Index remained consistently high (0.87), suggesting a fairly even distribution of individuals among species throughout the years.

Level of Endemism

A total of 119 bird and mammal species were recorded in the green spaces of WPU Main Campus from 2022 to 2025. Of these, 21 were endemic, including two Philippine endemic species, 19 Palawan endemic species, and 10 Palawan endemic subspecies (Table 5). Birds had the largest proportion of endemic taxa, with 26 of the 103 recorded species considered endemic at the species and subspecies levels. On the other hand, only five Palawan endemic species were recorded out of the total of 16 species.

Finally, it is worth noting that 27 species of birds are migratory and are present only during their overwintering season. The findings highlight the role of green spaces of WPU Main Campus as important habitats for both resident and overwintering migratory bird species. The results also emphasize the importance of this area as a staging and stopover site for migratory birds along the East Asian–Australasian Flyway.

Table 5. Number of endemic bird and mammal species recorded in the green spaces of WPU Main Campus, Aborlan, Palawan from 2022 to 2025.

Endemism	Number of Species		
	Bird	Mammal	Total
Philippine Endemic Species	2	0	2
Palawan Endemic Species	14	5	19
Palawan Endemic Subspecies	10	0	10
Resident Species	50	11	61
Migratory Species	27	0	27
Total	103	16	119

Conservation Status

In the context of this study, the conservation status presented was based on the highest priority status given by either IUCN or PCSD. Most bird and mammal species recorded in the WPU Main Campus green spaces

were classified as Least Concern (89 species), while 30 species were identified as conservation priorities, including 2 Critically Endangered, 12 Endangered, 14 Vulnerable, and two Near-Threatened species (Table 6). Birds accounted for the majority of conservation priority species, with 22 recorded species, while mammals were represented by eight conservation priority species.

Table 6. Number of conservation priority species of birds and mammals recorded in the green spaces of WPU Main Campus, Aborlan, Palawan from 2022 to 2025.

Conservation Status	Number of Species		
	Bird	Mammal	Total
Critically Endangered (CE)	2	0	2
Endangered (EN)	6	6	12
Vulnerable (VU)	12	2	14
Near-Threatened (NT)	2	0	2
Least Concern (LC)	81	8	89

DISCUSSION

Wildlife Assemblage

The results indicate that the green spaces of WPU Main Campus support a highly diverse wildlife assemblage, with 119 species recorded across multiple taxa. The dominance of birds in both richness and abundance reflects their ecological adaptability to diverse heterogeneous green spaces present in the campus landscape. The dominance of avifauna supports earlier observations that many bird species function as "exploiters" and "adapters," allowing them to thrive in human-modified environments (Conole, 2014). Although habitat disturbance at the landscape level negatively affects mammal assemblages (Casula et al. 2017), the relatively high abundance of mammals suggests that the habitat in the green spaces in the campus provides variety of resources and other vital life support processes to these species.

Seasonal patterns revealed higher species richness, abundance, and diversity during the wet season, while evenness remained consistently high, indicating a relatively balanced community structure across periods. This trend suggests that wetter conditions provide more favorable habitat resources such as increased food availability, vegetation cover, and shelter which support a wider range of species. Dry season affects the availability of resources that may cause decline in the population of many species by reducing population growth rate and viability (Brawn et al. 2017). The observed increase in wildlife records during the wet season is likely associated with ecological processes such as breeding cycles, heightened ecosystem productivity, and the arrival of migratory bird species overwintering in the wetlands of the WPU Main Campus. Notably, many migratory birds were recorded during the wet season surveys, substantially contributing to the higher observed diversity and species richness.

The Philippines is part of the East Asian–Australasian Flyway, a critical corridor for millions of waterbirds and terrestrial migratory species, providing stopover sites, feeding grounds, and wintering habitats along the route (Oracion et al. 2021). The occurrence of many migratory species in the WPU Main Campus during the wet season highlights its role as a seasonal stopover and overwintering site. Collectively, these findings underscore the importance of the wet season in sustaining both resident and migratory birds and mammals within the WPU Main Campus green spaces.

The higher species richness, abundance, and diversity during the wet season also highlights the influence of increased resource availability and favorable environmental conditions on wildlife activity. The consistently high evenness values across seasons indicate a relatively balanced community structure.

Temporal trends revealed a slight decline in species richness from 2022 to 2025, although diversity and evenness remained stable. This suggests that while some species may be affected by ongoing disturbances, overall community structure has been maintained. These findings underscore the importance of campus green spaces as refugia for birds and mammals, while also emphasizing the need for continued conservation efforts to sustain biodiversity over time.

Level of Endemism

A total of 119 bird and mammal species were recorded in the green spaces of the WPU Main Campus from 2022 to 2025, of which 31 (26%) are endemic to the Philippines and Palawan. The high level of endemism particularly the Palawan endemic species (19) and endemic subspecies (10) underscore the biogeographic significance of the WPU campus within the Palawan faunal region. Many of these endemic species are found only in limited biogeographic range, and nowhere else on the planet. Conserving these species is of utmost importance. Birds comprised the majority of endemic taxa, with 26 endemic species and subspecies recorded, while mammals also contributed notable endemic representation with five endemic taxa documented.

The concentration of endemic species recorded in the survey highlights the critical importance of conserving the campus green spaces, as these taxa are restricted in distribution and more vulnerable to habitat loss. In line with this, Gracia et al. (2021) emphasizes that identifying areas with high endemism is essential to focus and prioritize conservation efforts. Therefore, protecting these green spaces is crucial to ensure the sustainable existence of locally unique biodiversity and to support broader regional conservation initiatives.

The presence of 27 migratory bird species further emphasizes the role of the campus as a seasonal habitat for overwintering species, indicating its value beyond resident biodiversity. Sun et al. (2020) mentioned that conserving and protecting important nature reserves has positive effects on overwintering bird habitats.

Collectively, the coexistence of resident, endemic, and migratory species underscores the function of WPU green spaces as important refugia in a human-modified landscape, supporting both conservation-priority taxa and transient species.

Conservation Status

The assessment of conservation status indicates that most bird and mammal species recorded in the WPU Main Campus green spaces are classified as Least Concern, suggesting that the area continues to support relatively stable populations of non-threatened species. Although these Least Concern species are not currently at risk of extinction, Rey et al. (2024) mentioned that they remain equally important as threatened species, as they play vital roles in maintaining ecosystem functions and services such as pollination (Raju et al. 2005; Muchhala et al. 2009), seed dispersal (Mayta et al. 2025), and trophic regulation. Thus, their continued presence contributes significantly to ecosystem stability and resilience, reinforcing the importance of conserving green spaces not only for endangered taxa but for the broader ecological community.

Moreover, the presence of 30 conservation-priority species, including Critically Endangered, Endangered, Vulnerable, and Near-Threatened taxa, highlights the ecological significance of these habitats. Birds comprised most threatened species, reflecting their sensitivity to habitat changes and their reliance on diverse vegetation and habitat structures, while mammals also contributed notably to the threatened categories. Understanding local biodiversity, particularly the presence of endemic and threatened species in campus green spaces, is essential for developing effective institutional conservation strategies. Conservation actions undertaken today will determine the future sustainability of biodiversity (Kioumarsi et al. 2026). Taken together, these findings highlight the critical role of campus green spaces as refugia for both common and at-risk species, contributing significantly to local biodiversity conservation.

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