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Contextualization and Assessing the Distribution Pattern of Bird Nest in Jahangirnagar University Campus

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Abstract: *Being aware of ecological processes in fast-growing urban areas is important for protecting biodiversity. Birds are useful indicators of how healthy and balanced an environment is. This study looks at where bird nests are found in different parts of Jahangirnagar University and tries to understand their nesting preferences. The research uses field surveys, photos, GPS mapping, and tools like GIS and NDVI to find key nesting areas. It also explores how vegetation, habitat types, and human activity affect where birds build nests. The results show that birds prefer quiet areas with thick vegetation, and that nest numbers vary between land and water habitats. This study provides useful information for future research and emphasizes the need to protect different types of habitats to support bird diversity in city areas.*

Keywords: Biodiversity, Bird Nests, Jahangirnagar University Birds, Habitat Preservation, Ecological Balance, Nesting Habits.

Introduction

Biodiversity, the variety of life on Earth, is fundamental to the health and stability of ecosystems. It includes the diversity of species, genetic variation within species, and the variety of ecosystems they create. Maintaining ecological balance and environmental health relies heavily on biodiversity. University campuses, with their varied environments, provide unique opportunities for studying biodiversity and implementing preservation initiatives. Jahangirnagar University Campus, known for its rich natural surroundings and diverse plant and animal life, serves as an ideal location for biodiversity research.

The campus's diverse habitats—vegetated lands, waterbodies, and open fields—support a wide range of species, making it a valuable site for biodiversity studies. This

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research systematically records and observes bird nests across Jahangirnagar University Campus. It aims to produce an annotated atlas of bird nests, offering detailed information on nest locations and associated bird species. This initiative enhances understanding of local biodiversity, promotes environmental awareness within the academic community, and supports conservation efforts.

The process involves identifying bird species associated with each nest and recording environmental factors influencing nest locations (Bibby et al., 2000). The research spans a specific period to capture seasonal variations in bird nesting patterns (Gill, 2007). The collected data is analyzed to map the distribution of bird nests, assess their abundance and diversity, and explore the relationship between nest diversity and overall biodiversity on the campus (Sutherland, 2006). The study culminates in an annotated atlas of bird nests, detailing nest types, locations, and associated bird species. It also provides recommendations for biodiversity conservation and habitat management (Newton, 2013).

Literature Review

Several studies have focused on avian biodiversity and nesting behavior within the Jahangirnagar University campus. Jahan et al. (2018) conducted an in-depth analysis of bird nesting patterns, identifying common nesting zones and behavioral traits of breeding species. Shoma (2022) examined the breeding ecology of the Asian pied starling, providing insights into reproductive behavior and nest site selection. Additionally, various undergraduate and MS-level theses from the Department of Zoology and Geography have documented bird species diversity, seasonal variation in sightings, and habitat relationships, although many lack detailed spatial mapping or integration of remote sensing tools.

While these studies have contributed to baseline knowledge, few have analyzed bird nest distribution using GIS or assessed vegetation influences through NDVI analysis. This study fills that gap by combining traditional field surveys with spatial tools to contextualize bird nesting patterns in relation to ecological and environmental variables. It also incorporates local bird names and photographic records, offering a more comprehensive and culturally grounded documentation.

Aim and Objectives of the Study

The study aims to provide a detailed understanding of the distribution, abundance,

and diversity of bird nests within the campus environment.
Its objectives include:

- Collecting and documenting data on bird nests,
- Contextualization of bird nests across the campus, and
- To assess the diversity of bird nests and overall biodiversity on the campus.

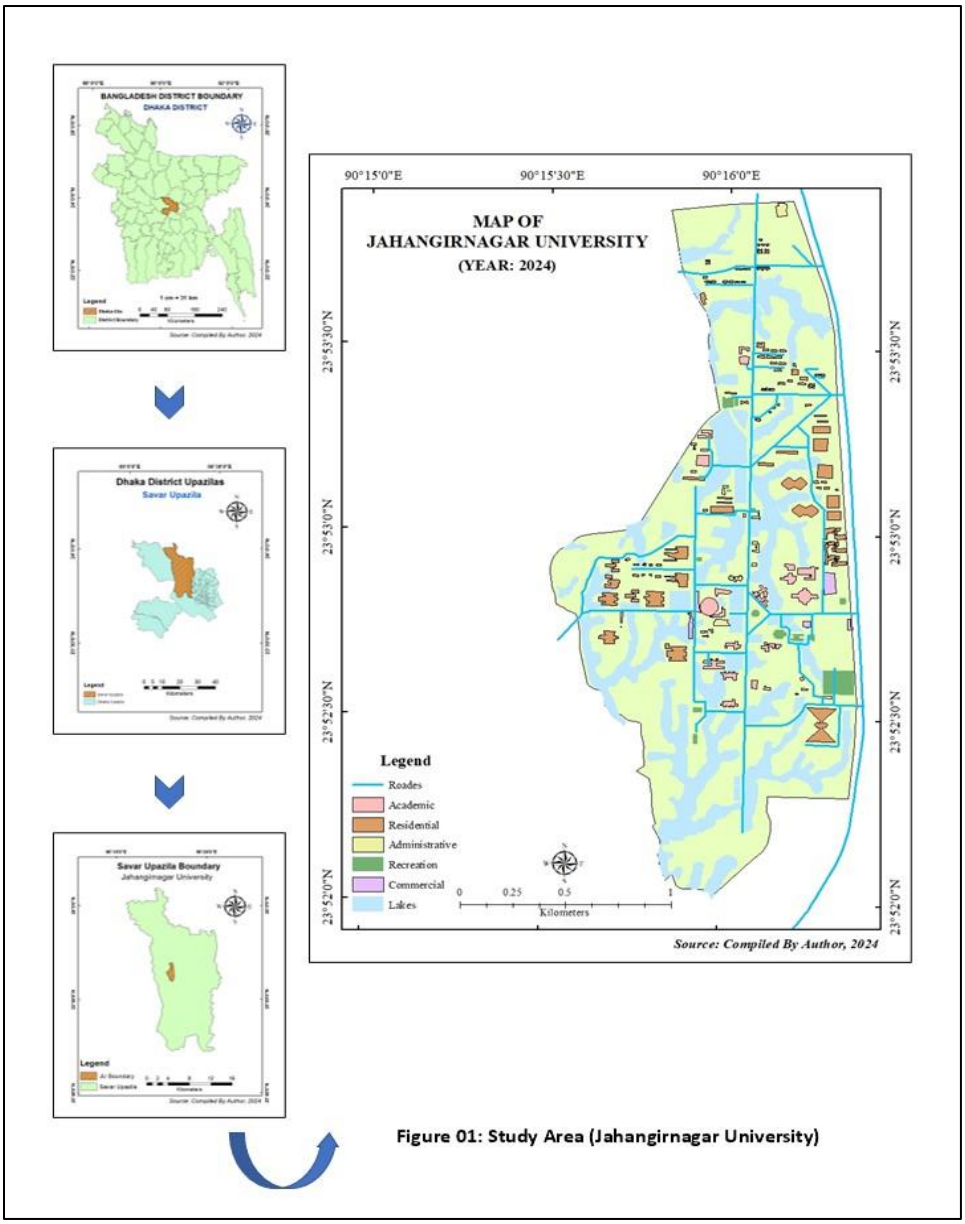


Figure 01: Study Area (Jahangirnagar University)

Figure 1: Study Area (Jahangirnagar University)

Study Area

Jahangirnagar University, located in Savar, Dhaka, spans approximately 697.56 acres (Jahangirnagar University, 2024). The geographical coordinates of the campus are approximately 23.8791° N latitude and 90.2653° E longitude, situating it in a subtropical region. The climate is humid with distinct wet and dry seasons, influenced by monsoon rains, which contribute to the lush vegetation and diverse wildlife.

However, recent studies have raised concerns about environmental changes on the campus. Over the past 35 years, the university has lost nearly 40% of its water bodies and 26.5% of its vegetation cover, primarily due to increased built-up areas (Taj, 2024).This environmental decline poses challenges to maintaining the campus's biodiversity and ecological balance.

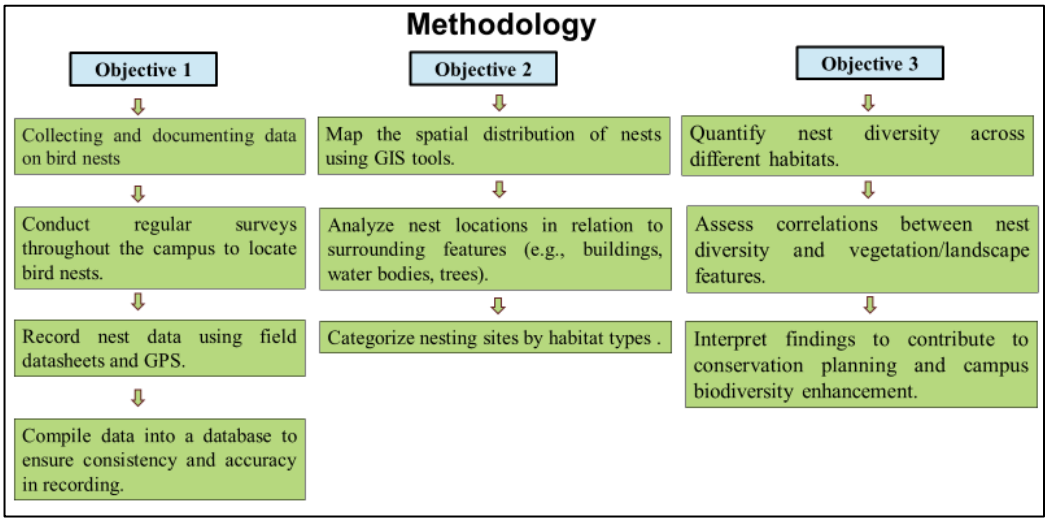
Data and Methods

To meet the objectives of this study, a comprehensive methodology was developed to document bird nests on the Jahangirnagar University campus. This involved employing a multifaceted approach that included field surveys, photography, GPS mapping, and additional supplementary techniques.

- **Field Surveys:** The integration of fieldwork and survey methods offers significant advantages in design, data collection, and analysis, paving the way for a novel approach to social research (Sieber, 1973). These surveys involved walking predetermined transects and visually inspecting trees, shrubs, and other potential nesting sites. The surveys were carried out at different times of the day to capture the nesting activity of diurnal and nocturnal bird species.
- **Photography:** A non-destructive and efficient method for quantifying nest materials has been developed using photographs, providing benefits such as time efficiency and access to data that were previously unattainable (Sugasawa et al., 2021). High-resolution photography was used to document the physical characteristics of bird nests, including their structure, materials used, and the surrounding habitat. Photographs also served as a visual record to support subsequent analysis and verification of field observations.
- **GPS Mapping:** Global Positioning System (GPS) devices were used to accurately record the geographic coordinates of each bird nest. This spatial data enabled the creation of detailed maps showing the distribution of nests across the campus. GPS mapping also facilitated the identification of nesting hotspots and the analysis of spatial patterns in nest distribution.

- **Geographic Information System (GIS):** GIS technology was used to process and analyze spatial data collected through GPS. It enabled the visualization of nest locations, identification of nesting hotspots, and analysis of spatial patterns in nest distribution.

Documentation of Data



The detailed findings from the study focusing on the types of birds, their location and distribution pattern of bird nests observed on the Jahangirnagar University campus.

Seasonal Nesting of different Bird:

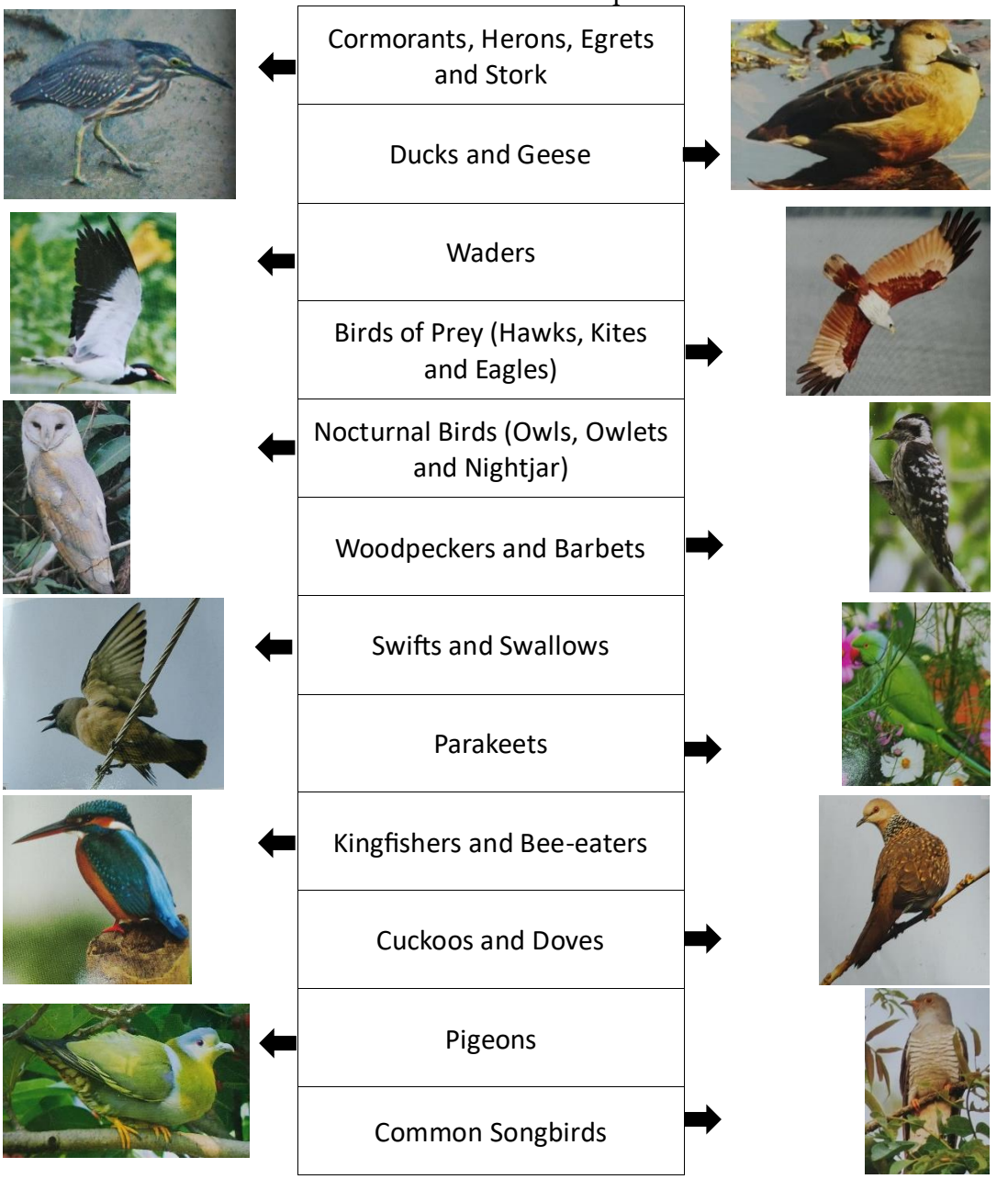
- Jahangirnagar University is a land of good number of fascinating migratory birds both water birds, ducks, snipes and other land birds like wagtail, warblers and so on.
- Approximately, 195 species, 81 passerines and 114 non-passerines, have been recorded in the area. Seventy-eight species were recorded as breeding residents.
- The University campus is an ideal breeding area with a friendly, vibrant culture and a diverse range of bird species in fact, this campus is an urban ornithological jewel

Table 1: Different Bird Species found in Jahangirnagar University

Serial	Name of Bird Groups	Local Names of the Bird Groups
1	Cormorants, Herons, Egrets and Stork	পানকৌড়ি (Cormorants) বক (Herons) সাদা বক (Egrets) সারস (Stork)
2	Ducks and Geese	হাঁস (Ducks) রাজহাঁস (Geese)
3	Waders	জলপিপি (Lapwings) চখাচখি (Jacanas) স্যান্ডপাইপার (Sandpipers)
4	Birds of Prey (Hawks, Kites and Eagles)	বাজপাখি (Hawks) চিল (Kites) ঈগল (Eagles)
5	Nocturnal Birds (Owls, Owlets and Nightjar)	ছোট প্যাঁচা (Owlets) রাতচরা (Nightjar)
6	Woodpeckers and Barbets	কাঠঠোকরা (Woodpeckers) বসন্তবৌরি (Barbets)
7	Swifts and Swallows	বাতাসি পাখি (Swifts) আবাবিল (Swallows)
8	Parakeets	টিয়া (Parakeets)
9	Kingfishers and Bee-eaters	মাছরাঙা (Kingfishers) সবুজ বাঁশপাতি (Green Bee-eater)
10	Cuckoos and Doves	কোকিল (Cuckoos) ঘুঘু (Doves)
11	Pigeons	কবুতর (Pigeons)
12	Common Songbirds	শ্যামা (Shama) দোয়েল (Oriental Magpie Robin) ময়না (Myna) ফিঙে (Drongo)

Table 2: Bird Group and Their Photographs

List of the Bird Group



Photograph Courtesy: MM Feeroz, MK Hasan, AK Datta, T Rahman

**Photographs included in this paper are used with permission from the credited individuals*

Findings and Discussion

Distribution of Bird Nests

The spatial distribution of bird nests across the Jahangirnagar University campus is meticulously mapped and analyzed, revealing the following key findings:

Habitat Preferences

Bird species exhibited distinct preferences for specific habitats based on their ecological needs. These preferences were shaped by factors such as vegetation type, proximity to water bodies, and availability of food resources. For instance:

- Waders (e.g., egrets and herons): Favored swampy vegetation and inundated paddy fields often located near the edges of lakes or ponds. These areas provided suitable feeding grounds and ample cover for nesting.
- Kingfishers: Preferred overhanging trees close to ponds or lakes, which offered strategic vantage points for hunting and safe nesting sites.
- Songbirds: Selected wooded areas and garden zones with dense foliage, which provided both concealment from predators and access to food sources such as insects and fruits.
- Waterfowl: Often nested in open fields or grassy areas near water bodies, benefiting from both the shelter of vegetation and proximity to aquatic food resources.

These patterns align with descriptions from bird ecology studies, highlighting that habitat heterogeneity plays a crucial role in supporting avian biodiversity.

Nesting Density

The analysis revealed certain areas of the campus as nesting hotspots, with notably higher concentrations of bird nests. These hotspots were commonly located:

- In forested patches or clusters of trees along the periphery of the campus.
- Near water bodies, such as ponds, lakes, and adjacent swampy areas.
- In gardens and areas with well-maintained greenery, which provided optimal nesting conditions.

These findings emphasize the importance of preserving and managing diverse habitats to sustain the nesting requirements of various bird species on the campus. By understanding the spatial distribution and habitat preferences of bird nests, conservation measures can be implemented to maintain and enhance the ecological balance and biodiversity of the area.

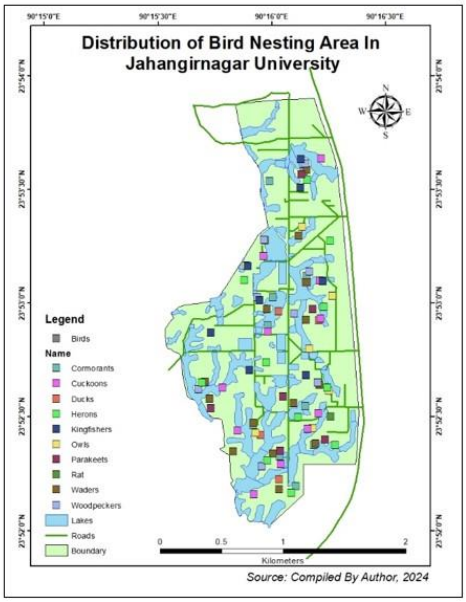


Figure 2: Distribution of Bird Nests in Jahangirnagar University.

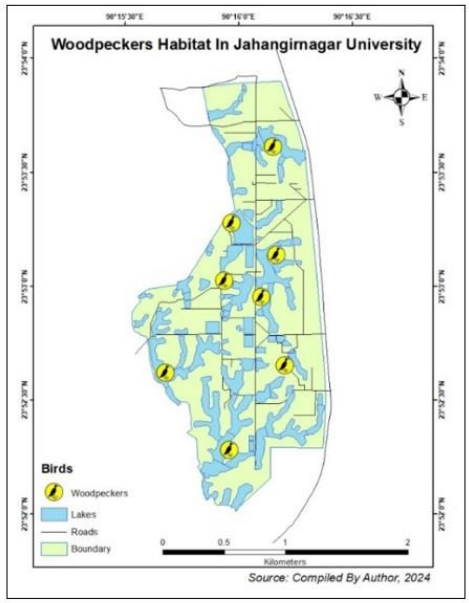


Figure 3: Woodpeckers Habitat in Jahangirnagar University

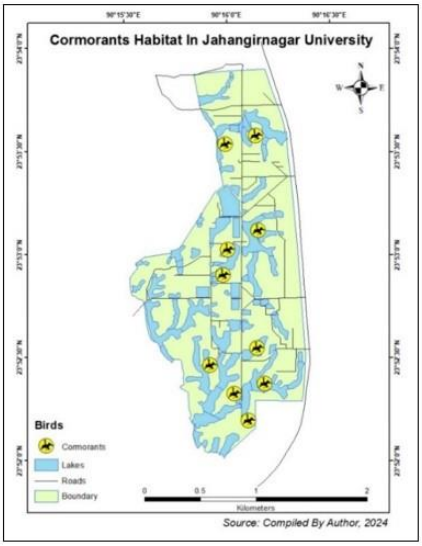


Figure 4: *Cormorant Habitat in Jahangirnagar University*

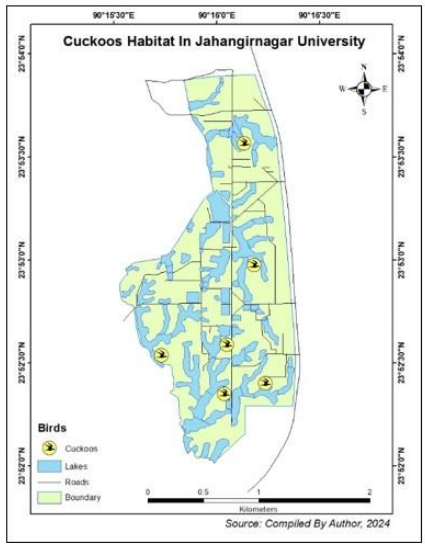


Figure 5: *Cuckoos Habitat in Jahangirnagar University*

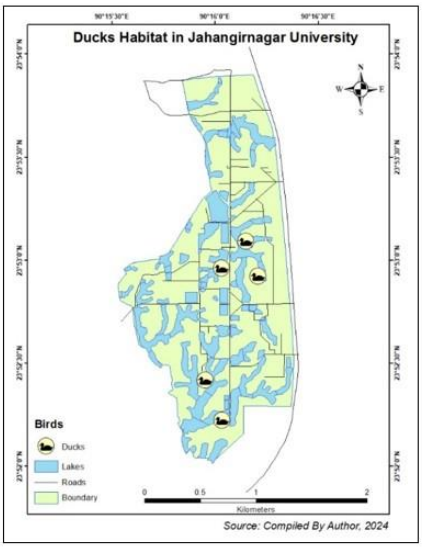


Figure 6: *Ducks Habitat in Jahangirnagar University*

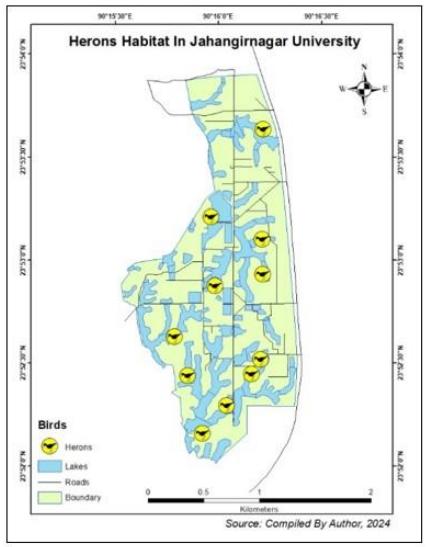


Figure 7: *Herons Habitat in Jahangirnagar University*

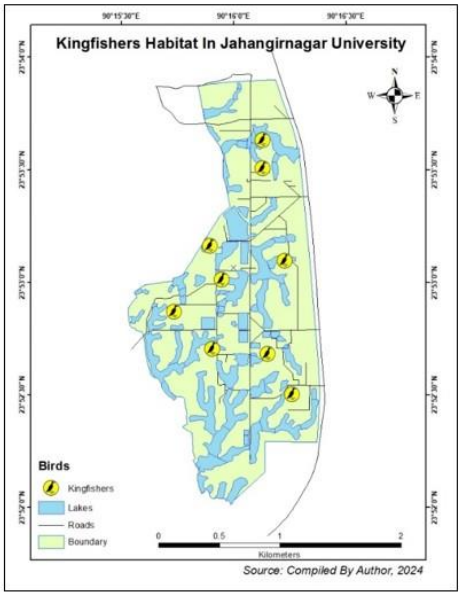


Figure 8: *Kingfishers Habitat in Jahangirnagar University*

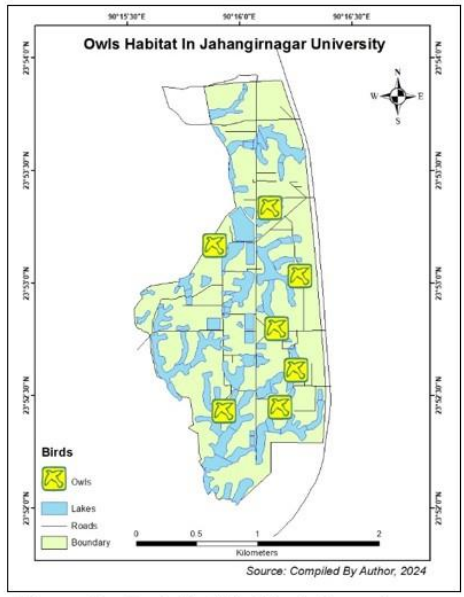


Figure 9: *Owls Habitat in Jahangirnagar University*

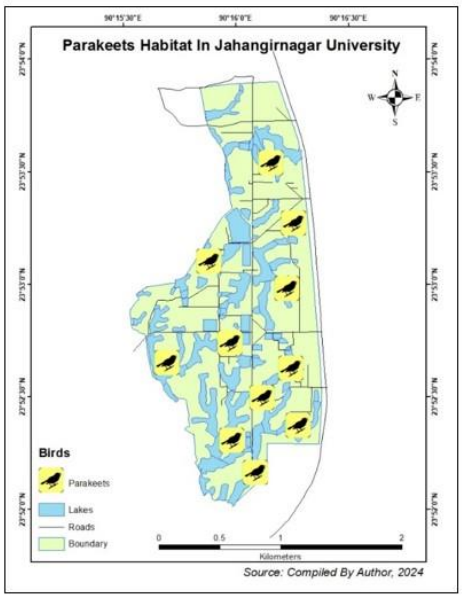


Figure 10: *Parakeets Habitat in Jahangirnagar University*

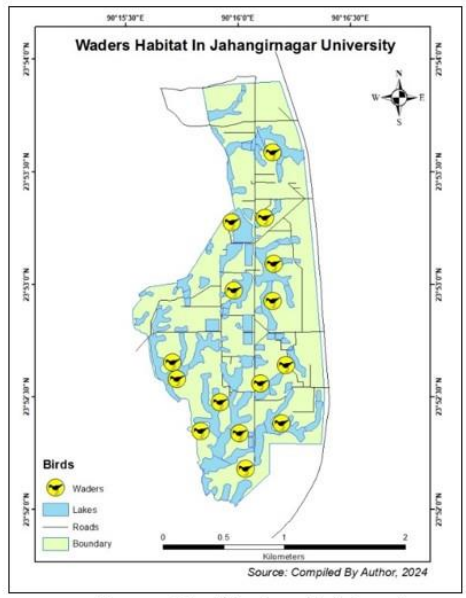


Figure 11: *Waders Habitat in Jahangirnagar University*

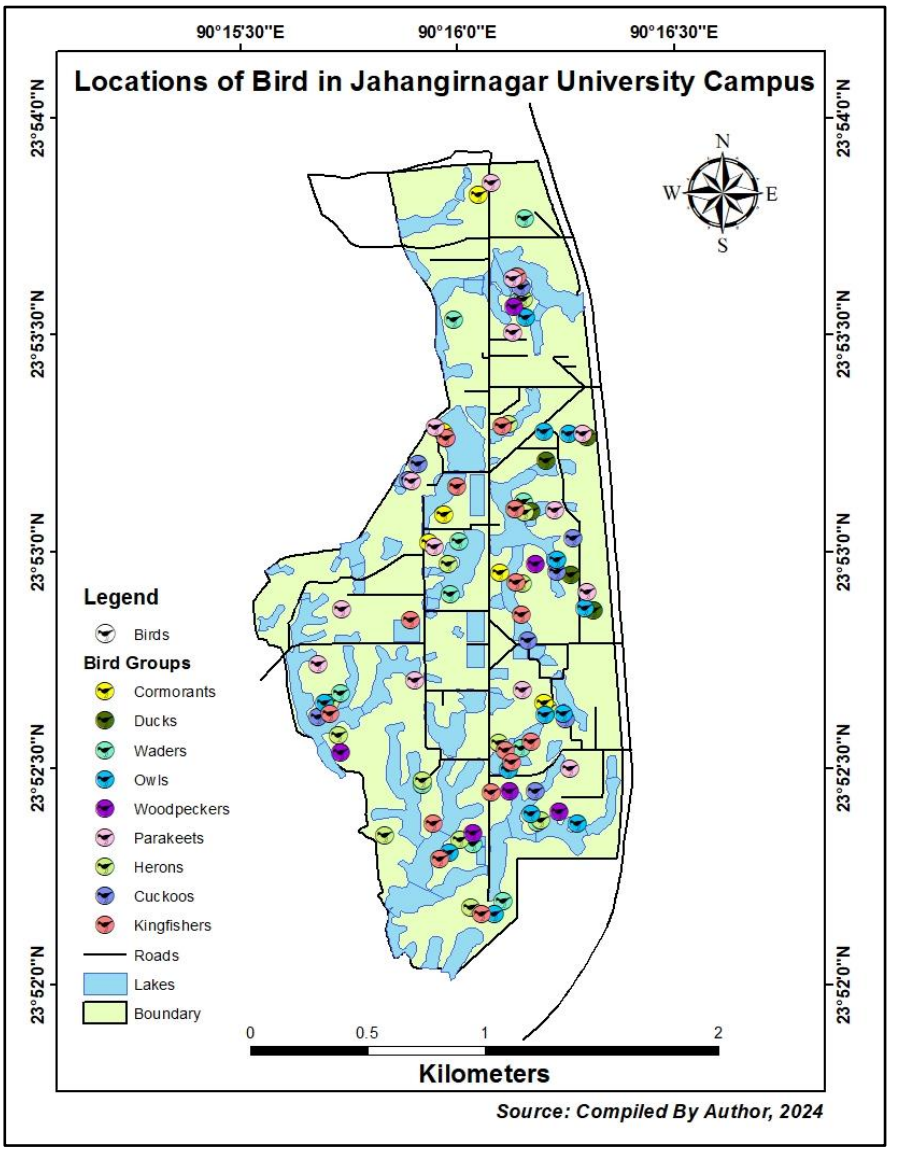


Figure 12: Locations of Birds in Jahangirnagar University Campus

This study sheds light on the avian biodiversity of Jahangirnagar University campus, focusing on bird type and distribution of bird nests.

NDVI and Bird Nest Location Association:

The Normalized Difference Vegetation Index (NDVI) serves as an effective metric for evaluating vegetation density and health, providing critical insights into habitat quality. Birds, as ecological indicators, often exhibit strong preferences for nesting in areas with dense and healthy vegetation. By analyzing NDVI values, a clear relationship between vegetation density and bird nesting patterns can be established.

Areas with higher NDVI values are typically associated with dense tree cover, abundant foliage, and less human disturbance, which collectively offer several advantages for nesting birds. These areas provide enhanced concealment from predators, reduced exposure to environmental stressors, and ample food resources, such as fruits, seeds, and insects. Conversely, regions with lower NDVI values, indicative of sparse or degraded vegetation, may experience reduced nesting activity due to a lack of adequate cover and food availability.

The spatial mapping of NDVI across Jahangirnagar University Campus revealed that nesting hotspots align with areas of high vegetation density, such as forested patches, tree clusters near water bodies, and garden zones with dense canopies. Birds like warblers and wagtails were observed to favor these locations for nesting, reflecting the role of healthy vegetation in fostering a supportive habitat.

This association between NDVI and bird nesting patterns underscores the importance of preserving and restoring vegetative cover to maintain avian biodiversity. By leveraging NDVI data, conservationists and researchers can identify critical habitats, monitor changes over time, and implement targeted strategies to enhance biodiversity conservation efforts.

NDVI Range	Vegetation Density	Bird Nest Area
< 0.1	Very low	Very low
0.1 ≤ NDVI < 0.3	Sparse	Low
0.3 ≤ NDVI < 0.5	Moderate	Moderate
0.5 ≤ NDVI < 0.7	High	Very High

Based on this table

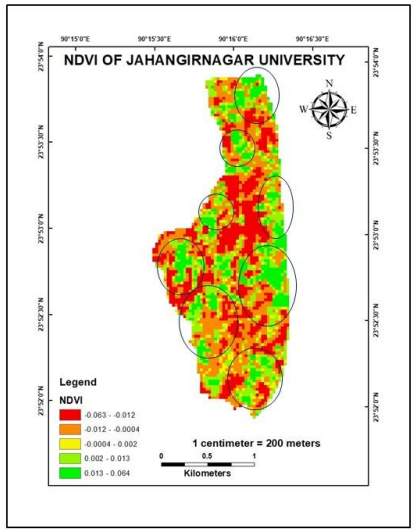


Figure 13: NDVI of Jahangirnagar University

Conclusion

The contextualization and spatial assessment of bird nests across the Jahangirnagar University campus highlight the ecological importance of this semi-urban landscape as a refuge for diverse avian species. This study provides valuable baseline data and reveals that nesting patterns are closely linked to habitat diversity, vegetation health, and human disturbance levels. Key nesting zones were found in forest patches, waterbody edges, and garden areas—demonstrating that habitat heterogeneity is essential for sustaining avian biodiversity.

By integrating GIS and NDVI tools, the study establishes a clear connection between vegetation density and nesting distribution. These insights support the need for strategic habitat management and emphasize the role of spatial tools in ecological planning.

While the findings are significant, they are based on limited seasonal field data. As the campus continues to change due to development and environmental shifts, future studies should incorporate updated and multi-seasonal datasets, as well as additional indicators like NDWI, to build a more comprehensive understanding of bird–habitat relationships.

Overall, this research contributes to local biodiversity knowledge and offers a replicable model for urban and campus-based conservation planning. It underscores the urgency of preserving green spaces and maintaining ecological balance in the face of urbanization.

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