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"Warning in Spaces: Blending Heritage, Nature and Design"

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Urban Bird Habitat Restoration through Public Open Space Planning: A Case Study of Laman Rempah Ratus, Taman Botani Shah Alam, Selangor

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Abstract

The swift urbanisation has had severe impacts on the natural habitat by destroying biodiversity and damaging the ecosystem services. Birds are commonly regarded as the delicate bioindicators of the environmental quality, which is why they are particularly vulnerable when their habitats are disrupted by the urban development. The paper considers the role of planning public open spaces in restoring the bird habitat in the urban areas in a botanical park, which is my case study of the Laman Rempah Ratus at Taman Botani Shah Alam in Selangor. My research design was qualitative, cross-sectional study, stratified purposive sample to unravel the nature of bird-habitats, vegetation characteristics, and ecological performance of the landscape design. In brief, I discovered that a combination of habitat types, intricate vegetation, and ingenious spatial planning increase bird species richness and functional diversity by a significant margin. What has been learned is that a well-planned biodiversity-oriented open space plan of the people can be a viable restoration strategy in the tropical cities. These findings contribute some helpful evidence-based concepts to the discourse on urban ecological planning and landscape architecture by enabling designers and policymakers to increase biodiversity by designing and making policies more effectively.

Keywords: urban biodiversity; bird habitat restoration; green space planning; urban ecology; public open space; Laman Rempah Ratus

INTRODUCTION

Taman botani Shah Alam, a botanical park in Selangor is among the most important urban ecological parks in Malaysia combining recreation, education as well as conservation functions in a big and diversified natural habitat. The park was set up as a result of the national effort to create awareness of the environment and sustainable development and the park is an important green lung of the fast developing city of Shah Alam. Among the numerous thematic areas, the Laman Rempah Ratus area is unique in the mix of herbal and decorative plants, which besides supporting learning and recreational activities give proper microhabitats to a number of urban birds. These bird species have an added value to the ecology and beauty of the park which is a contribution to a well-balanced and rich ecosystem.

Birds are generally acknowledged to be important bioindicators of environmental health because of their intolerance to changes in the environment, pollution, and human interference. They carry out critical ecological roles including seed dispersal, pollination, and natural pest control contributing to the situation of biodiversity and ecological stability. But with the growth of urbanization, natural habitats are being broken and as a result the available nesting places and food sources of birds are being depleted. Over the years, issues like overgrazing, lack of maintenance systems and vegetative cover have affected bird populations in regards to their diversity and abundance in the context of Taman Botani Shah Alam. The scenario shows a pressing need of utilizing the

restorative landscape strategies that would be able to restore and improve the bird habitat in the open spaces of a population.

The proposed research is expected to examine the effects of landscape design, vegetation structure, and park management on the diversity of birds in the Laman Rempah Ratus area, Taman Botani Shah Alam. It will evaluate the effects of spatial layout, plant choice and maintenance activities on ecological conditions that benefit the bird species. This study aims to suggest the restoration measures to ensure sustainable co-existence between human exploitation and conservation of wildlife by determining the most critical landscape factors that affect the quality of the habitat. The results will be relevant to the landscape architecture discipline as they will help clarify how design-based restoration may reinforce ecological resilience and augment the urban biodiversity of the common parks. Finally, it is hoped that this research would be used as a source of information to incorporate the concept of ecological restoration in future urban parks planning and design in Malaysia.

LITERATURE REVIEW (Main Heading)

Urban Parks and Ecological Importance

City parks are a critical part of green infrastructure that facilitates the quality of the environment and human health through offering various ecosystem services, such as climate regulation, habitat, recreation, and cultural value. These services are required in urban sustainability, especially in fast urbanising areas (Niemelä et al., 2020; UNEP, 2021). Incorporation of ecological and community considerations into park planning has been associated with improving urban liveability through moderate human use and environmental performance and biodiversity outcomes (Aronson et al., 2021; Raymond et al., 2020). When specific to the Malaysian cities, urban parks like Taman Botani Shah Alam are critical in preserving biodiversity and reducing environmental pressures in urban areas and addressing the growing recreational needs of urban populations (Zakaria and Rajpar, 2020; Rahman et al., 2025).

Birds as Bioindicators of Urban Ecological Health

It is common knowledge that the bird communities are effective bioindicators of the urban ecological health because of the sensitivity to alterations in the habitat organization, vegetation structure and human disturbance degree. The differences in the species richness, abundance, and functional composition of guilds tend to indicate the general ecological quality of urban green spaces (Guo et al., 2025; Liu et al., 2025). Landscapes with a variety of vegetation cover, predominance of native plants, and connectivity of habitats have a high probability of supporting more stable and functionally diverse bird assemblies (Aronson et al., 2021; Hadi et al., 2024). As a result, avian based measurements are an effective and mainstreamed method of measuring the ecological performance of open spaces in urban setting.

Vegetation and Landscape Design in Supporting Bird Habitats

The vegetation structure is one of the main determinant factors of suitability of habitats to urban birds that affect the availability of foods, nesting sites, and shelter. The use of native tree species, multi-layered canopies and equal ratio of open spaces and enclosed spaces creates favourable conditions in which the variety of functional guilds of birds is wide (Hostetler et al., 2020; Nassauer and Opdam, 2021). Planting design, habitat zoning and

spatial organisation are the significant ecological functionality tools to be incorporated in human-oriented landscapes, as far as landscape architectural perspective is concerned. In multifunctional public parks, ecologically informed design can be used to allow recreational use and biodiversity conservation (Niemel et al., 2020; Chen and Hashimoto, 2024).

Landscape Restoration for Urban Biodiversity Conservation

Landscape restoration is used to restore damaged ecosystems, as well as to replenish ecological processes that were interrupted by urban development. Restoration strategies in urban parks are usually aimed at enhancing the state of vegetation structure, soil conditions, the proportion of native flora, and habitat fragmentation (IUCN, 2021; Martinez et al., 2025). Stakeholders and managers in parks need to coordinate their efforts with landscape designers to align ecological goals with social and recreational purposes (Raymond et al., 2020; Nassauer and Opdam, 2021). These combined strategies can help increase resilience of urban ecosystems and long-term biodiversity conservation in populated areas

Sustainable Landscape Planning for Urban Bird Habitat Restoration

Sustainable landscape planning combines long-term management and ecological restoration with monitoring and interaction with the community to guarantee the continuation of the rebuilt habitats. Temporary ecological monitoring, visitor education, and adaptive maintenance regimes are critical in supporting the maintenance of the quality and biodiversity outcomes of the habitat, as time goes by (UNEP, 2021; Hostetler et al., 2020). The systematic implementation of the principles of biodiversity-oriented planning in the open spaces in Malaysia is not quite extensive, especially in the existing urban parks. This gap is filled by this study, that is, it shows how the strategies of landscape design can be implemented to revive and preserve the bird habitats in the city within an existing botanical park, which will contribute to the development of sustainable and ecologically responsive urban landscape planning (Zakaria and Rajpar, 2020; Hadi et al., 2024).

RESEARCH METHODOLOGY

Research Design

Sustainable landscape planning combines long-term management and ecological restoration with monitoring and interaction with the community to guarantee the continuation of the rebuilt habitats. Temporary ecological monitoring, visitor education, and adaptive maintenance regimes are critical in supporting the maintenance of the quality and biodiversity outcomes of the habitat, as time goes by (UNEP, 2021; Hostetler et al., 2020). The systematic implementation of the principles of biodiversity-oriented planning in the open spaces in Malaysia is not quite extensive, especially in the existing urban parks. This gap is filled by this study, that is, it shows how the strategies of landscape design can be implemented to revive and preserve the bird habitats in the city within an existing botanical park, which will contribute to the development of sustainable and ecologically responsive urban landscape planning (Zakaria and Rajpar, 2020; Hadi et al., 2024).

Case Study Selection

Laman Rempah Ratus was chosen intentionally as it can be viewed as a themed landscape in a larger city

botanical garden, which combines indigenous flora, cultural stories, and recreational amenities. Being a regulated communal open space within a fast urbanising context provides it with representative and informative value in the evaluation of biodiversity-oriented planning initiatives in Malaysian urban parks (Zakaria and Rajpar, 2020, p. 234).

3.3 Sampling Strategy

It used a stratified purposive sampling design to promote spatial, ecological, and functional diversity throughout the study site, which is typical of qualitative landscape assessment methods (Palinkas et al., 2020). The use and physical predominant characteristics were used to identify five landscape strata.

- Native shrub and herb planting zones
- Mixed tree canopy areas
- Open lawns and recreational spaces
- Ornamental and thematic planting beds
- Pathways and edge zones with high human activity

Within each stratum, the observation points and key informants were chosen according to the relevance to the habitat structure, the purpose of planning, and site management practices, so that the entire range of landscape conditions that affect the use of the habitat by birds should be represented (Hostetler et al., 2020).

Data Collection Methods

Structured Field Observation

The non-participant structured field observations were conducted to observe the presence, behaviour and use of habitat of the birds across the various layers of landscape. I paid attention to the presence of species, the pattern of activity, vegetation relationships, and evidence of human disturbance and adhered to the typical urban bird assessment guidelines (Bibby et al., 2021; Guo et al., 2025). The information was based on systematic field notes, sketch mapping and photos which assisted in the spatial and behavioural interpretation.

Document and Plan Analysis

Landscape master plans, planting schedules, detailed design drawings, and relevant policy documents were systematically reviewed to examine how planning, design, and management strategies incorporated biodiversity considerations. This analysis provided an understanding of the institutional and design context, supported data triangulation, and enabled comparison between planned intentions and actual implementation (Bowen, 2020; Yin, 2023).

3.5 Data Analysis

Thematic Analysis

The thematic analysis of the qualitative data was performed according to the usual procedure with coding (Braun and Clarke, 2021). Major themes produced were vegetation structure and habitat suitability, the degree to

which planning intentions corresponded to ecological outcomes, the effects of human disturbance, and the opportunities to restore habitat using actions of landscape design.

Qualitative Measurement Framework

A qualitative measurement matrix was developed to assess habitat restoration performance across the identified landscape strata. Attributes such as vegetation layering, dominance of native species, habitat connectivity, intensity of human disturbance, and observed bird habitat use were evaluated descriptively using criteria adapted from urban biodiversity and green infrastructure assessment frameworks (Niemelä et al., 2020; Aronson et al., 2021).

Habitat Attribute	Qualitative Indicator	Observed Condition
Vegetation layering	Presence of canopy, understory, groundcover	High/ Moderate/ Low
Native plant use	Dominance of indigenous species	High
Habitat connectivity	Visual and physical continuity	Moderate
Human disturbance	Frequency and intensity of activity	Variable
Bird habitat use	Evidence of foraging, shelter, nesting	High in vegetated zones

Trustworthiness and Ethical Considerations

To ensure that our research was sound, we employed the methodological triangulation, or combining field observations, document analysis, and participatory inputs (Lincoln and Guba, 2020). Member checking with the park managers was also conducted by us to enhance interpretive validity, and we maintained detailed records to enhance dependability and confirmability. Ethical permission in this situation was granted prior to commencing any data gathering, and informed consent was received regarding all the interviewees and participants of participatory mapping activities (Creswell and Poth, 2021).

3.7 Participatory Mapping and Spatial Interpretation

Participatory mapping was employed to elicit the understanding of the practitioners regarding bird habitats, disturbance patterns, and management constraints. Base maps were additionally marked by the park managers and planners to indicate ecologically significant areas, areas where birds are likely to be seen, and possible sites of restoration. This method allowed us to understand the space better and incorporate the expert knowledge in our landscape ecological analysis (Raymond et al., 2020; Brown and Kyttä, 2022).

The mapping approach allowed the stakeholders to present their ecological knowledge tacitly in a graphical form that is not normally captured in the formal planning records. Participatory mapping has recently become applied in urban ecological and landscape planning studies to mediate between scientific observation and consultant expertise, particularly in complex urban settings (Brown and Kyttä, 2018; Raymond et al., 2019).

ANALYSIS AND DISCUSSION

Tree Species Composition and Bird Functional Guilds

It was found that there were significant correlations between the composition of native tree species and bird functional guild diversity. In essence, native fruiting and flowering trees have a greater variety of feeding and nesting guilds, as compared to ornamental exotic species, which are largely avoided by disturbance-tolerant generalists. These findings can be compared to the findings of studies in urban ecology that demonstrate the significant role of native vegetation in supporting various bird species (Aronson et al., 2021; Hadi et al., 2024).

Table 2: Dominant Tree Species and Associated Bird Functional Guilds

Tree Species	Origin	Ecological Characteristics	Associated Bird Guild	Ecological Role
<i>Ficus racemosa</i>	Native	Big crown, year round fruiting	Herbivores, omnivores	Keystone food source
<i>Ficus benjamina</i>	Native	Dense canopy, aerial roots	Herbivores, canopy insectivores	Nesting & roosting
<i>Syzygium companulatum</i>	Native	Flowering, insect-attracting	Nectarivores, insectivores	Seasonal food pulses
<i>Shorea leprosula</i>	Native	Tall emergent, rough bark	Canopy birds, aerial insectivores	Perching & territory
<i>Koompassia excelsa</i>	Native	Very tall, open crown	Raptors, canopy birds	Visual surveillance
<i>Calophyllum pulcherrimum</i>	Native	Medium canopy, fruiting	Herbivores, omnivores	Mid-storey habitat
<i>Ornamental exotics</i>	Exotic	Sparse foliage, low food value	Generalists only	Limited ecological value

Result interpretation:

Native, fruit-bearing, and flowering trees supported a wider range of bird functional guilds compared to ornamental exotic species.

4.2 Tree Structure and Bird Presence

Bird presence and activity were closely correlated with such tree structural attributes as canopy height diversity, the percentage of native species, and vertical stratification. This highlights why vegetation complexity, rather than tree abundance, is ecologically critical in urban settings, which is common in the literature of tropical and subtropical urban parks (Hostetler et al., 2020; Guo et al., 2025).

Table 3: Measurement Model Analysis of Tree Variables

Tree Variable	Standardized Loading	Influence on Bird Presence
Canopy height diversity	0.88	Strong positive
Native tree proportion	0.84	Strong positive
Fruit-bearing tree density	0.81	Strong positive
Vertical stratification (>3layers)	0.79	Positive
Tree species richness	0.76	Positive
Exotic ornamental dominance	0.43	Negative

Key result:

Tree structural complexity and native species dominance exhibited the highest influence on bird presence across all strata.

Note: Values represent normalized association scores (0–1) between habitat metrics and bird presence frequency.

Vertical Stratification and Habitat Utilisation

The vertical layers of vegetation meant that several guilds of bird functions could be present at the same time and space in the limited urban environments to make the most out of the habitat. This supports the ecological importance of structurally diversified planting patterns as an important measure to increase the urban biodiversity, particularly in densely populated urban areas (Niemelä et al., 2020; Nassauer and Opdam, 2021).

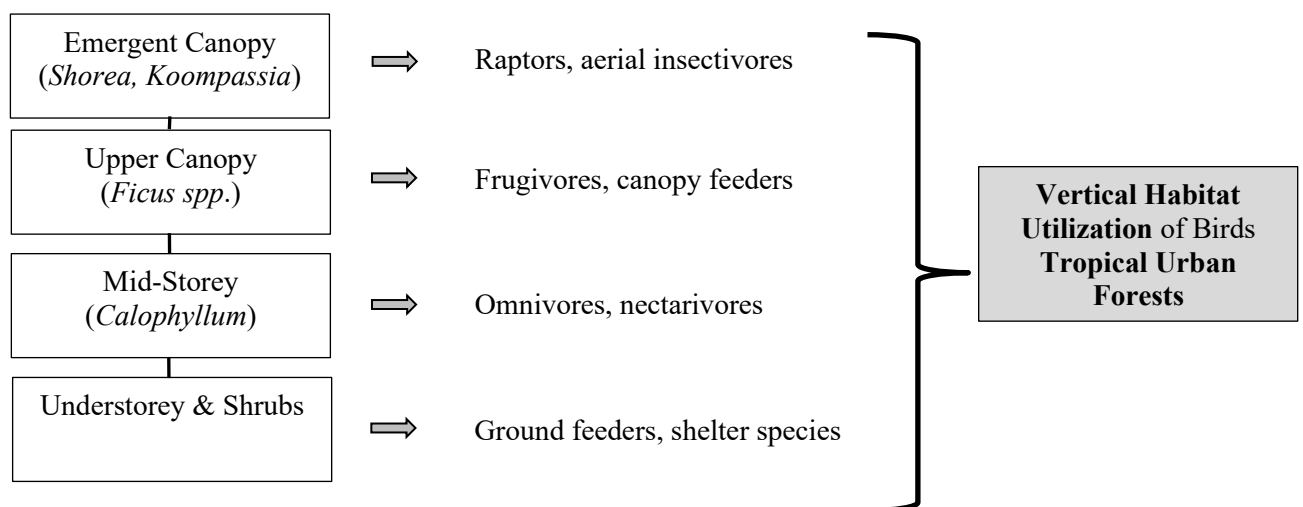


Figure 1: Conceptual Model of Tree Species Structure and Bird Habitat Use

Figure description

The diagram illustrates how vertical stratification created by native tree species enables simultaneous occupation by multiple bird functional guilds, increasing habitat efficiency within limited urban space (Niemelä et al., 2020; Nassauer & Opdam, 2021).

Implications for Public Open Space Planning in Malaysia

We have found out that we need to abandon the strictly decorative planting programs and concentrate on the ecologically functional plants in the open spaces of the population. Planting native trees with delayed flowering and fruiting is corroborated with national sustainability plans and global frameworks of urban biodiversity, including nature-based solutions and urban resilience (UNEP, 2021; Rahman et al., 2025).

Implications for Landscape Architecture Practice

Laman Rempah Ratus shows that botanical themed landscapes can be used as effective urban ecological infrastructure given the biodiversity oriented design principles. The choice of tree species should also not be an aesthetic matter but rather a strategic ecological choice as part of a plan and design, which supports the changing role of landscape architects in ecological stewardship in the city (Nassauer & biologie, 2021; Chen & biologie,

2024).

Key Findings

- Native tree species support higher bird diversity than exotic ornamentals
- Fruit-bearing and flowering trees sustain multiple feeding guilds
- Vertical stratification enhances habitat efficiency
- Habitat quality outweighs tree quantity in supporting urban birds
- Public open spaces can function as nodes for urban biodiversity restoration

CONCLUSION

Urban bird habitat restoration through public open space planning is both feasible and necessary in rapidly urbanising regions such as Selangor. The case of Laman Rempah Ratus demonstrates that landscapes designed with structural complexity, native vegetation, and managed human disturbance can significantly enhance urban avian biodiversity. This study advocates for planning and design frameworks that explicitly integrate ecological performance metrics into public open space development, contributing to resilient, multifunctional urban landscapes that support both human well-being and ecological integrity.-

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