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The Concept of an Ideal Urban Forest and Its Role as a Sustainable Educational Tourism Destination: A Case Study of Pekanbaru Urban Forest

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Abstract

Urban forests are strategic components of urban green space systems because they provide ecological, recreational, and educational functions that collectively support sustainable urban environmental quality. This study aims to formulate an ideal model of an urban forest concept as a sustainable educational tourism site based on empirical findings derived from visitor perceptions and the ecological conditions of the Pekanbaru Urban Forest. The research employed a simple mixed-method approach dominated by descriptive quantitative analysis involving 96 respondents, complemented by ecological observations and in-depth interviews with site managers. The results indicate that cleanliness and comfort received positive assessments (scores 4.21 and 4.12), whereas environmental education facilities (3.88), educational activities (3.45), and promotional efforts (3.22) fell within the moderate to low categories. These findings highlight a significant gap between the ecological potential of the area and the development of its educational functions. A synthesis of empirical data and theoretical insights produced six components of the ideal urban forest concept: (1) adaptive ecology, (2) environmental education facilities, (3) interpretive trails, (4) sustainable educational tourism programs, (5) inclusive accessibility, and (6) collaborative governance. Policy analysis further demonstrates that strengthening the educational function aligns with the mandates of Law No. 26/2007 on Spatial Planning, SDG 11.7 targets regarding inclusive green spaces, and the Pekanbaru Strategic Environmental Assessment (KLHS) emphasizing the enhancement of environmental quality. This study concludes that the integration of ecological planning, educational development, and collaborative governance forms the essential foundation for positioning urban forests as centers of sustainable environmental learning.

Keywords: Urban Forest, Educational Tourism, Adaptive Ecology, Governance, Environmental Education

INTRODUCTION

The rapid development of urban areas has generated significant ecological impacts, particularly in fast-growing cities such as Pekanbaru. Accelerated urbanization over the past decade has contributed to rising air temperatures, reduced soil permeability, increased air pollution, and a declining proportion of urban green open space (RTH). The urban heat island (UHI) phenomenon has been reported to intensify in Pekanbaru, with temperature differences between the city center and suburban areas reaching 3–4° (Rahmayani & Syafri, 2021). In this context, urban forests play a critical ecological role in lowering ambient temperatures, improving air quality, enhancing rainwater infiltration, and supporting biodiversity conservation (World Health Organization, 2020).

Beyond ecological functions, urban green spaces also serve as recreational and social environments. Several studies indicate that the presence of green spaces is positively associated with improved mental health, increased physical activity, and stronger social interaction among residents (Lee & Maheswaran, 2021; Pearlmutter et al., 2017). Urban forests further function as environmental learning spaces, particularly in enhancing ecological literacy among visitors. Nature-based learning has been shown to effectively increase environmental awareness and promote pro-environmental behavior (Konijnendijk, 2018; Kuo et al., 2019).

Pekanbaru City possesses an urban forest area of approximately ±10.4 hectares, functioning as a public green space. Ecologically, the area is in relatively good condition, characterized by multistrata vegetation and preserved floral diversity. Similar ecological

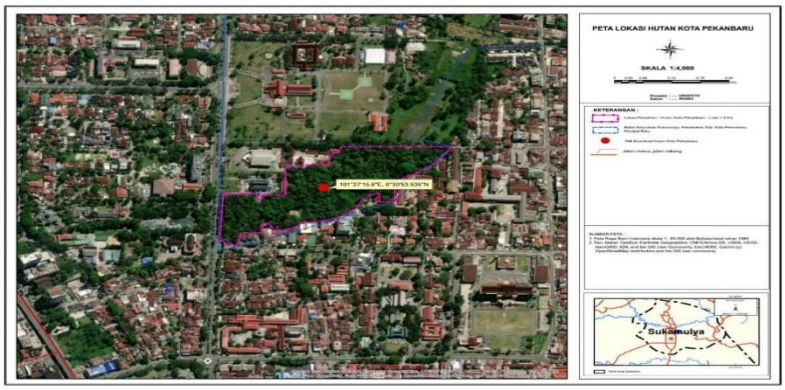
characteristics have been identified as key indicators of urban forest quality and resilience, particularly in supporting biodiversity and microclimate regulation (Kendal et al., 2020; Livesley et al., 2016). However, interviews and field observations reveal that its educational function has not been utilized optimally. Limited interpretive facilities, insufficient educational programs, and weak promotional efforts represent the primary barriers to developing the urban forest as an environmental learning space (Vieira & al., 2022; Zhang et al., 2022). Previous studies highlight that the absence of interpretive infrastructure and structured environmental education programs significantly reduces the effectiveness of urban green spaces as learning environments (Ballantyne & Packer, 2016; Lindemann-Matthies & Kamer, 2019). This gap highlights the need for an empirical analysis of visitor perceptions, educational facility requirements, and alignment between the site's development direction and existing environmental and spatial planning policies.

Based on these considerations, this study aims to analyze visitor perceptions regarding the use of the Pekanbaru Urban Forest as an educational tourism object, identify factors influencing the area's educational function, and formulate an ideal urban forest concept based on six key dimensions: adaptive ecology, educational facilities, interpretive trails, educational programs, inclusive accessibility, and collaborative governance. These dimensions are proposed as a comprehensive model for developing a sustainable educational urban forest in Pekanbaru. This approach is consistent with recent studies emphasizing the importance of integrating ecological quality, educational design, and governance frameworks in optimizing the multifunctional role of urban forests (Ahern et al., 2023; Almeida et al., 2023). Accordingly, this study contributes both theoretically and practically by proposing an integrative model that bridges ecological quality, environmental education, and governance frameworks, thereby strengthening the multifunctional role of urban forests in achieving sustainable development goals.

RESEARCH METHODS

This research was conducted at Pekanbaru Urban Forest, located on Diponegoro Street, Suka Mulia, Sail District, Pekanbaru City, Riau Province. The site was purposively selected as it represents one of the main public green open spaces with significant ecological and educational potential, covering approximately 10.4 hectares dominated by local vegetation and recreational pathways. The study was carried out from September to October 2025, including field observations, questionnaire distribution, interviews, secondary data collection, and data analysis.

Figure 1. Research Location Map of Pekanbaru Urban Forest



Source: *Processed by the Researcher* (2025)

This study employed a mixed-method approach with a dominant quantitative component. According to John W. Creswell (2014), mixed-method research integrates quantitative and qualitative approaches to provide a more comprehensive understanding of a research problem. The quantitative approach was used to measure visitor perceptions through numerical data, while qualitative data were utilized to support contextual interpretation.

The quantitative method, based on a structured Likert-scale questionnaire, was applied to capture numerical data related to six visitor perception variables. This approach aligns with the principles of quantitative research, which emphasize measurement, statistical analysis, and generalization of findings (Sugiyono, 2019). Meanwhile, qualitative data were obtained through ecological observations and in-depth interviews to explore environmental conditions, visitor experiences, and management practices.

Ecological observations documented vegetation characteristics, educational facilities, accessibility, and the physical condition of the area. In-depth interviews with visitors and site managers were conducted to gain insights into management dynamics, educational needs, and challenges in developing educational tourism programs (Smith & Abdullah, 2023). The integration of quantitative and qualitative data enabled methodological triangulation, which, as noted by Norman K. Denzin (1978), enhances the validity and credibility of research findings by examining phenomena from multiple perspectives.

The study population consisted of all visitors to the Pekanbaru Urban Forest during the data collection period. Since the total population size was unknown, the sample size was determined using the Slovin formula with a margin of error of 10%, resulting in 96 respondents. The sampling technique applied was accidental sampling, where respondents were selected based on their availability and willingness to participate at the research site. This technique is considered appropriate for studies involving dynamic and heterogeneous populations, particularly in tourism research contexts (Babbie, 2016).

Data were collected from both primary and secondary sources. Primary data included: (1) Likert-scale questionnaires measuring visitor perceptions; (2) ecological observations documenting vegetation, facilities, accessibility, and environmental conditions; and (3) in-depth interviews with visitors and site managers. Secondary data consisted of official documents from the Pekanbaru Environmental and Forestry Service, visitor statistics, and relevant scientific literature on urban forests, environmental perception, and educational tourism.

The main research instrument was a structured questionnaire covering six variables: cleanliness and comfort, educational facilities, visitor experience, accessibility, educational activities, and environmental promotion. The questionnaire was developed based on theories of environmental perception and urban forest functions. Content validity was ensured through expert judgment, while the use of a Likert scale (1 = strongly disagree to 5 = strongly agree) follows standard practice in perception studies (Likert, 1932).

Quantitative data were analyzed using descriptive statistical techniques, including tabulation, calculation of mean values, and categorization of perception levels. Descriptive statistics are commonly used to summarize and interpret quantitative data in social research (Bryman, 2016). The quantitative findings were then integrated with qualitative insights obtained from observations and interviews through triangulation, enabling the study to generate comprehensive and valid conclusions that reflect both numerical patterns and contextual realities (Moleong, 2018; Umar, 2019).

This methodological approach ensures analytical robustness by combining numerical generalization with contextual depth, thereby enhancing the reliability and validity of the study findings.

RESULTS AND DISCUSSION

Results

Visitor Perception Statistics

The analysis of visitor perceptions regarding the utilization of the Pekanbaru Urban Forest as an educational tourism site reveals measurable variation across six key dimensions. The statistical results are presented in Table

Table 1. Visitor Perception Statistics

No	Dimension	Score	Category
1	Cleanliness & Comfort	4.21	Good
2	Visitor Experience	4.12	Good
3	Educational Facilities	3.88	Moderate
4	Accessibility	3.74	Moderate
5	Educational Activities	3.45	Low
6	Promotion	3.22	Low

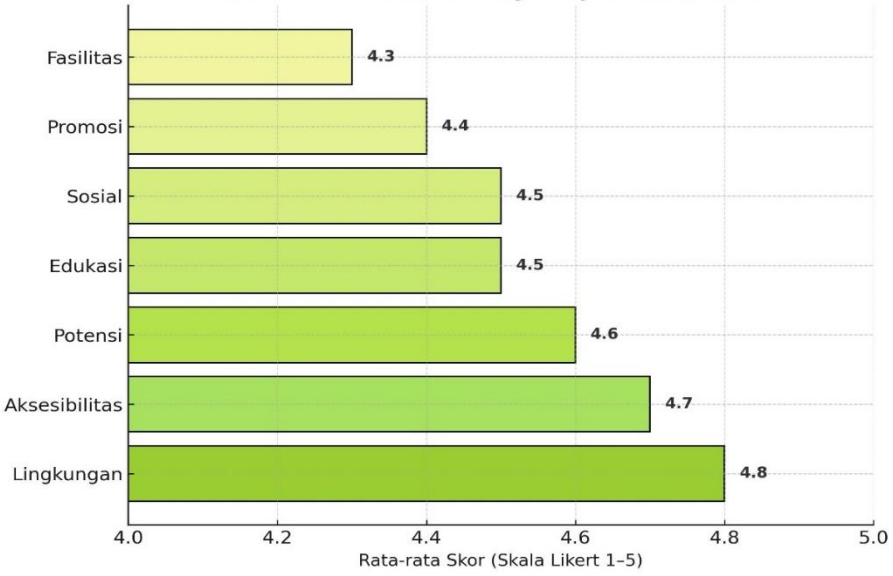
Source: *Processed by the Researcher* (2025)

The results indicate that the highest perception score was recorded in the cleanliness and comfort dimension (4.21), followed by visitor experience (4.12), both categorized as "good." Educational facilities (3.88) and accessibility (3.74) fall within the "moderate" category, indicating acceptable but not optimal performance. In contrast, educational activities (3.45) and promotion (3.22) received the lowest scores, both categorized as "low."

These results demonstrate a clear differentiation between dimensions related to environmental quality and those associated with educational and communication functions.

Visitor Perception Diagram

Figure 2. Visitor Perception Diagram



Source: *Author's Data Processing* (2025)

The diagram visually illustrates the variation in perception scores across dimensions. Cleanliness and comfort dominate as the highest-rated dimension, followed by visitor experience. In contrast, educational activities and promotion appear as the lowest-rated dimensions.

Data processing was conducted systematically to ensure analytical rigor. Initial data cleaning, validation, and consistency checks were performed using Microsoft Excel 2021. Mean values for each indicator were calculated using standard statistical functions. Reliability testing using IBM SPSS Statistics 26 shows that Cronbach's Alpha values exceeded 0.70 for all variables, indicating strong internal consistency of the measurement instrument.

Descriptive statistical analysis, including mean, minimum, maximum, and standard deviation, was also performed to support interpretation. Visualization in the form of bar charts further highlights disparities between dimensions, particularly the relatively large gap between ecological quality indicators and educational components.

Discussion

Environmental Quality and Visitor Satisfaction

The findings confirm that the Pekanbaru Urban Forest performs well in terms of its fundamental ecological and recreational functions. High scores in cleanliness and comfort, as well as visitor experience, indicate that the urban forest has successfully fulfilled its primary role as a green open space that provides environmental quality and psychological comfort for visitors.

This result is consistent with previous studies emphasizing that the physical attributes of urban green spaces—such as cleanliness, vegetation structure, and spatial comfort—are key determinants of visitor satisfaction and environmental preference (Junaidi & Rangkuti, 2024; Wang et al., 2020). The relatively high rating of visitor experience further suggests that the forest has already established a baseline level of attractiveness and usability as a recreational landscape.

However, these findings also indicate that the current success of the Pekanbaru Urban Forest is still largely confined to its ecological and aesthetic dimensions, rather than its broader multifunctional role.

The Ecological–Educational Gap: A Structural Limitation

A critical finding of this study is the existence of a significant ecological educational gap. While ecological quality indicators score highly, dimensions directly related to environmental education such as educational facilities, educational activities, and promotion remain relatively low.

This gap reflects a fundamental structural limitation in the current urban forest development paradigm, which remains predominantly oriented toward ecological aesthetics rather than functional integration with environmental education systems. The moderate score of educational facilities (3.88) indicates partial availability but insufficient integration, while the low score of educational activities (3.45) suggests the absence of structured, programmatic learning experiences.

The weakest dimension, promotion (3.22), further highlights the lack of an effective environmental communication strategy. Without adequate promotion, even existing educational potentials remain underutilized, limiting public awareness and engagement.

This pattern aligns with broader findings in Indonesian urban forestry studies, which note that urban forests are predominantly developed with a focus on greening and aesthetic enhancement, while educational and interpretive functions are often neglected due to limited institutional capacity, lack of program design, and weak stakeholder collaboration (Maulana et al., 2021; Rahmadani & Yusuf, 2020). Thus, the ecological educational gap identified in this study is not merely a local issue but reflects a systemic challenge in urban forest governance.

Toward an Ideal Urban Forest: Integrating Ecology, Education, and Governance

Addressing this gap requires a conceptual shift from viewing urban forests as static green spaces to recognizing them as dynamic socio-ecological learning systems. Based on empirical findings and theoretical synthesis, this study formulates six interrelated components of an ideal urban forest as a sustainable educational tourism destination.

1. Adaptive Ecology

Adaptive ecology forms the foundational layer of the system. The presence of multistrata vegetation, biodiversity stability, and endemic species enhances both ecological resilience and educational value. In the context of Pekanbaru, native species such as Shorea (meranti) and Macaranga (mahang) provide strong potential for contextual environmental learning rooted in local ecosystems.

2. Educational Facilities

Educational facilities act as the primary interface between ecological resources and visitor learning. The absence of interpretive signage, QR-based information systems, thematic arboretums, and outdoor classrooms represents a critical barrier to knowledge transfer. Without these facilities, ecological assets remain "silent," failing to communicate their value to visitors.

3. Interpretive Trails

Interpretive trails transform space into narrative. By structuring visitor movement through thematic routes—such as biodiversity or conservation trails—urban forests can facilitate experiential learning. This approach enhances ecological literacy by linking direct observation with structured information delivery.

4. Sustainable Educational Tourism Programs

The lack of structured programs represents one of the most significant weaknesses identified in this study. Activities such as birdwatching, environmental monitoring, conservation workshops, and school-based programs are essential for transforming passive recreation into active learning. These programs also strengthen long-term engagement and environmental awareness.

5. Inclusive Accessibility

Accessibility is not only a physical issue but also a social sustainability concern. The current condition of pathways and the absence of inclusive informational media limit access for vulnerable groups. Improving accessibility ensures that environmental education is equitable and inclusive.

6. Collaborative Governance

Perhaps the most decisive factor is governance. The absence of structured collaboration between government, academia, communities, and the private sector limits innovation and program sustainability. Collaborative governance enables resource sharing, program continuity, and adaptive management, making it a central pillar in developing educational urban forests.

Policy Analysis and Strategic Implications

From a policy perspective, the Pekanbaru Urban Forest is highly relevant to both national and global frameworks. Law No. 26/2007 mandates the provision of 30% green open space, positioning the urban forest as a key instrument in spatial planning compliance.

However, this study reveals that policy implementation remains quantitatively oriented, focusing on land provision rather than functional quality. Contemporary perspectives emphasize that green open space should be evaluated based on its ecological, social, and educational functions (Santoso & Widyaningsih, 2024).

At the global level, the Sustainable Development Goals (SDG 11) emphasize inclusive, safe, and sustainable urban environments. The relatively low performance in educational dimensions indicates that the Pekanbaru Urban Forest has not yet fully contributed to these broader sustainability targets.

Furthermore, the absence of explicit recognition of educational functions in the Spatial Planning Master Plan (RTRW) highlights a regulatory gap. This creates a strategic opportunity to integrate educational roles into spatial policy, potentially through the development of technical guidelines, zoning regulations, or a dedicated urban forest masterplan.

Research Novelty and Contribution

This study contributes to the literature by offering an integrative approach that combines visitor perception analysis, ecological evaluation, and policy assessment within a single

analytical framework. Unlike previous studies that focus primarily on ecological or aesthetic aspects, this research explicitly links environmental conditions with educational functions and governance structures.

The formulation of six key components of an ideal educational urban forest represents a context-specific yet scalable model. This model not only addresses local challenges in Pekanbaru but also provides a conceptual and practical reference for other urban areas in Indonesia facing similar limitations.

More importantly, this study reframes urban forests as multifunctional socio-ecological systems, emphasizing that sustainability is not achieved solely through ecological preservation but through the integration of education, participation, and governance.

CONCLUSION

The findings of this study indicate that the Pekanbaru Urban Forest possesses strong ecological potential to be developed as a public environmental education space, as reflected in its high levels of cleanliness, visitor comfort, and relatively diverse vegetation. However, its educational function remains suboptimal, particularly in relation to the availability of interpretive facilities, structured educational programs, and accessible environmental information. Through an integrative analysis of field data and recent theoretical developments, this study formulates six pillars of an ideal urban forest concept as a sustainable educational tourism destination: (1) adaptive ecology based on local species; (2) both physical and digital educational facilities; (3) thematic interpretive trails; (4) periodic and structured educational tourism programs; (5) inclusive accessibility; and (6) cross-sector collaborative governance.

The implementation of these six pillars is expected to significantly enhance the educational function of the Pekanbaru Urban Forest while supporting sustainable development goals, meeting Green Open Space (RTH) requirements mandated by Law No. 26/2007, and aligning with the strategic directions outlined in the Pekanbaru Strategic Environmental Assessment (KLHS). Transforming the urban forest into an active public educational space requires regulatory support, adequate facility provision, improved managerial capacity, and meaningful participation from community groups and educational institutions. With these efforts, the Pekanbaru Urban Forest has the potential to develop into a pioneering educational urban forest model in Riau serving not only as a green space, but also as a center for environmental learning and a catalyst for strengthening ecological literacy among the public.

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