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Biocultural Potential of Multifunctional Flora in Urban Green Open Spaces: A Case Study of Tabebuya Park, South Jakarta

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Abstract: This study aimed to identify the composition of flora species in Tabebuya Park, analyze the biocultural potential of its flora, and explain its implications for strengthening the ecological, social, and cultural functions of urban green open spaces. The main issue underlying this study is the lack of integrated information on species composition and the biocultural use potential of flora in urban parks as a basis for urban green space management. The study employed an exploratory approach using the cruise method through direct inventory of all vegetation at the study site. Species identification was conducted based on morphological observations, visual documentation, and the use of an artificial intelligence (AI)-based plant identification application as a preliminary tool, which was subsequently verified using botanical literature and taxonomic references. Data were analyzed descriptively and quantitatively by calculating relative frequency and grouping plants according to ethnobotanical use categories derived from the literature. The results showed that Tabebuya Park contains 53 plant species from 34 families, with high multifunctional potential, including 42 medicinal species, 31 ornamental plants, 9 aromatic plants, 2 dye-producing plants, 21 food and beverage plants, 5 culinary spice plants, 20 cosmetic plants, and 10 plants used for rituals or customary practices. These findings confirm that Tabebuya Park functions not only as an aesthetic element of the urban landscape, but also as a biocultural green space that plays an important role in providing ecosystem services, supporting educational activities, and improving the quality of life of urban communities.
Keywords: Green open space; biocultural; floral diversity; urban park; ecosystem services

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INTRODUCTION

The rapid expansion of urban areas has led to the conversion of green land into built-up areas, resulting in declining environmental quality and reduced urban ecosystem sustainability. Urban green open spaces (GOS) play a strategic role in providing a wide range of ecosystem services, including urban heat island mitigation, air quality improvement, noise reduction, microclimate regulation, and stormwater management (Lin & Li, 2025; Zhang & Qian, 2024). In addition, GOS contributes to public physical and mental health by providing spaces for recreation and social interaction (Egerer et al., 2024). Despite the growing recognition of these benefits, several important issues in GOS management remain unresolved, particularly in Jakarta, and require greater attention.

First, species inventories at the individual urban park scale remain limited, constraining comprehensive mapping of floral diversity. Second, vegetation data have not yet been adequately linked to the utilitarian value of plants, including their use in various social and cultural contexts. Third, the application of the biocultural green space concept in urban park management remains suboptimal. This concept, which integrates biodiversity values with local cultural values, is essential for incorporating ecological, social, and cultural functions into urban public spaces.

Therefore, this study aims to address these data gaps and provide a scientific basis for more adaptive and sustainable GOS management.

Previous studies on GOS have largely focused on vegetation structure, land cover, and biodiversity (Farkas et al., 2023; Junaidi & Salam, 2025). However, studies that integrate floral inventories with the ethnobotanical uses of plants at the urban park site scale, particularly in relation to biocultural green spaces, remain limited, especially in Indonesia. In fact, information on plant uses for medicine, food, cosmetics, as well as ritual and cultural purposes constitutes an important component in assessing the multifunctionality of GOS as biocultural green space (Francini et al., 2022; Radonic et al., 2025). This gap highlights the need for research that systematically documents species diversity and the ethnobotanical use categories of plants in urban green open spaces.

This study aims to inventory the species composition of vegetation and examine the biocultural potential of multifunctional flora in urban green open spaces through a case study of Taman Tabebuya, South Jakarta. The study is expected to make a scientific contribution by providing integrated floristic and ethnobotanical data at the urban park scale, as well as a practical contribution by serving as a basis for GOS management that is oriented not only toward aesthetics, but also toward ecological, educational, and socio-cultural functions. Accordingly, the findings of this study are expected to serve as a reference for the development of more adaptive, data-driven, and sustainable urban green open space management.

METHOD

This study employed an exploratory approach using a descriptive floristic study and species inventory assessment in urban green open spaces. This approach was selected because it is effective for more comprehensively documenting species composition in open areas with heterogeneous vegetation that has not been systematically mapped, as demonstrated in flora inventory studies conducted in urban parks (Sarigu et al., 2025). The study aimed to describe species composition and identify the potential uses of plants based on relevant scientific literature. The research was conducted at Tabebuya Park, Jl. M. Kahfi 1, Ciganjur Subdistrict, South Jakarta, from May to August 2025, taking the growing season into account to obtain comprehensive data. The park covers an area of 9,626 m².

The study was designed in several main stages: (1) preparation, (2) field survey, (3) species identification, (4) ethnobotanical data collection through literature review, and (5) data analysis. During the survey stage, the researchers systematically explored the entire green open space area and recorded every plant species encountered. All identified species were visually documented, and their morphological characteristics were recorded, following floristic inventory procedures commonly applied in parks and public green spaces (Sarigu et al., 2025).

The research instruments included: (1) vegetation observation sheets, (2) digital cameras and mobile devices for visual documentation, (3) artificial intelligence (AI)-based plant identification applications such as LeafSnap and PlantNet, and (4) a literature search on plant uses, including flora books, scientific journal articles, and relevant ethnobotanical references, to determine plant use categories.

The validity of plant identification was ensured through source triangulation by comparing identification results from multiple applications and cross-checking them against recognized botanical literature or online taxonomic databases, as commonly applied in ethnobotanical and floristic inventory studies (e.g., the use of identification keys, regional floras, and online databases) (Santos et al., 2021). For species with

high morphological similarity, additional verification was conducted using key diagnostic traits and reference sources. Data reliability was strengthened through repeated observations and recording at different times, a practice that is also common in vegetation studies and urban green space use assessments (Xu et al., 2024).

Data Analysis

Vegetation data obtained from the inventory were analyzed using a quantitative descriptive approach to describe species composition and the ethnobotanical use potential of plants at the study site. The analysis was conducted by calculating the relative frequency (RF) of each plant family and species to determine the level of dominance and representation of each taxon within the vegetation community. Relative frequency was calculated as the percentage occurrence of a family or species relative to the total number of identified families or species, using the following formula (Chrisnawati et al., 2021):

$$FR = \frac{n_i}{N} \times 100\%$$

Notes:

n_i = number of occurrences of the i-th family or species

N = total number of identified families or species

Relative frequency values were used to interpret vegetation community structure and to identify dominant families or species as well as those with low frequency, as is commonly practiced in flora inventory studies and vegetation analyses in urban green open spaces.

Furthermore, each plant species was classified into ethnobotanical use categories based on a review of scientific literature and relevant ethnobotanical references. These categories included: (1) medicinal plants, (2) ornamental plants, (3) aromatic plants, (4) dye-producing plants, (5) food and beverage plants, (6) culinary spice plants, (7) cosmetic plants, (8) plants used for ritual and customary purposes, as well as other use categories reported in the literature (Kurniawan et al., 2018; Francini et al., 2022). A single plant species could be assigned to more than one use category, considering the multifunctional nature of plants in an ethnobotanical context.

RESULTS AND DISCUSSION

Floristic Composition and Diversity in Tabebuya Park

The vegetation inventory conducted in Tabebuya Park, which covers approximately 9,626 m² and is located on Jl. Moh. Kahfi I, Ciganjur, South Jakarta, recorded 53 plant species belonging to 34 families. The vegetation composition comprises a wide range of life forms, including shade trees, shrubs, bushes, herbs, aquatic plants, and epiphytes, forming the multilayered vegetation structure that is characteristic of urban parks. The presence of these diverse vegetation strata is important because it contributes to ecosystem stability, provides microhabitats, and enhances ecosystem services in urban environments.

Based on relative frequency analysis, the families Fabaceae and Euphorbiaceae were the most represented, each accounting for 7.55% of the total identified families. The dominance of these families was mainly influenced by the presence of several cultivated and ornamental species commonly used in urban landscaping, such as *Nephelium lappaceum*, *Pometia pinnata*, *Codiaeum variegatum*, and *Acalypha wilkesiana*. This distribution pattern indicates that the

vegetation community in Tabebuya Park is not dominated by only one or two plant families, but instead exhibits a relatively balanced taxonomic diversity. This finding is consistent with studies of other urban parks showing that parks with heterogeneous landscape designs tend to have higher species and family richness than parks with more homogeneous vegetation composition (Chang et al., 2021; Sarigu et al., 2025). The presence of water elements containing species such as *Nymphaea* spp., *Cyperus papyrus*, and *Aquarius palifolius* further enriches habitat types and contributes to increased biodiversity, as also reported in studies of urban green open spaces in other regions (He et al., 2024). The complete list of identified plant species is presented in Table 1.

Table 1. Plant species recorded in Tabebuya Park

No.	Scientific Name	Family	Local Name
1	*Syzygium jambos* (L.) Alston	Myrtaceae	Pucuk merah
2	*Allamanda cathartica* L.	Apocynaceae	Alamanda
3	*Canna indica* L.	Cannaceae	Bunga tasbih
4	*Cordyline fruticosa* var. *lilinoe*	Asparagaceae	Hanjuang merah
5	*Citrus limon* (L.) Burm.f.	Rutaceae	Jeruk lemon
6	*Homalomena rubescens* Engl.	Araceae	Nampu
7	*Samanea saman* (Jacq.) Merr.	Fabaceae	Trembesi
8	*Plumeria rubra* L.	Apocynaceae	Kamboja bali
9	*Casimiroa edulis* La Llave	Rutaceae	Sapote
10	*Swietenia macrophylla* King	Meliaceae	Mahoni
11	*Tabernaemontana divaricata* (L.) R.Br. ex Roem. & Schult.	Apocynaceae	Mondokaki
12	*Ravenala madagascariensis* Sonn.	Strelitziaceae	Pisang kipas
13	*Tabebuia rosea* (Bertol.) DC.	Bignoniaceae	Tabebuya
14	*Aesculus hippocastanum* L.	Sapindaceae	Berangan kuda
15	*Hibiscus rosa-sinensis* L.	Malvaceae	Kembang sepatu
16	*Codiaeum variegatum* (L.) Blume	Euphorbiaceae	Puring
17	*Nephelium lappaceum* L.	Sapindaceae	Rambutan
18	*Alocasia macrorrhizos* (L.) G.Don	Araceae	Talas
19	*Diospyros blancoi* A.DC.	Ebenaceae	Kesemek / Bisbul
20	*Acalypha wilkesiana* Müll.Arg.	Euphorbiaceae	Daun bunga
21	*Schizolobium parahyba* (Vell.) S.F.Blake	Fabaceae	Pakis Brazil
22	*Chrysophyllum cainito* L.	Sapotaceae	Sawo duren
23	*Annona muricata* L.	Annonaceae	Sirsak
24	*Musa balbisiana* Colla	Musaceae	Pisang
25	*Salix viminalis* L.	Salicaceae	Willow
26	*Thunbergia laurifolia* Lindl.	Acanthaceae	Thunbergia
27	*Delonix regia* (Bojer ex Hook.) Raf.	Fabaceae	Flamboyan
28	*Heliconia psittacorum* L.f.	Heliconiaceae	Pisang-pisangan
29	*Osmoxylon lineare* (Merr.) Philipson	Araliaceae	Ararea
30	*Echinodorus palaefolius* (Nees & Mart.) J.F.Macbr.	Alismataceae	Melati air
31	*Euphorbia tithymaloides* L.	Euphorbiaceae	Zig-zag / getah ular
32	*Ruellia simplex* C.Wright	Acanthaceae	Kencana ungu
33	*Cinnamomum verum* J.Presl	Lauraceae	Kayu manis
34	*Hymenocallis littoralis* (Jacq.) Salisb.	Amaryllidaceae	Bakung
35	*Dypsis lutescens* (H.Wendl.) Beentje & J.Dransf.	Arecaceae	Palem kuning

No.	Scientific Name	Family	Local Name
36	*Spathodea campanulata* P.Beauv.	Bignoniaceae	Spathodea
37	*Cocos nucifera* L.	Arecaceae	Kelapa
38	*Pandanus amaryllifolius* Roxb.	Pandanaceae	Pandan wangi
39	*Mangifera indica* L.	Anacardaceae	Mangga
40	*Nymphaea* spp.	Nymphaeaceae	Teratai
41	*Salix babylonica* L.	Salicaceae	Janda merana
42	*Cyperus papyrus* L.	Cyperaceae	Papirus
43	*Terminalia mantaly* H.Perrier	Combretaceae	Ketapang kencana
44	*Cordyline fruticosa* var. *glauca*	Asparagaceae	Hanjuang hijau
45	*Gynura procumbens* (Lour.) Merr.	Asteraceae	Sambung nyawa
46	*Euphorbia tirucalli* L.	Euphorbiaceae	Patah tulang
47	*Platycerium coronarium* (Koenig ex O.F.Müll.) Desv.	Polypodiaceae	Tanduk rusa
48	*Piper betle* L.	Piperaceae	Sirih hijau
49	*Syzygium polyanthum* (Wight) Walp.	Myrtaceae	Salam
50	*Bauhinia purpurea* L.	Fabaceae	Bunga kupu-kupu
51	*Ficus elastica* Roxb. ex Hornem.	Moraceae	Karet kebo
52	*Syzygium cumini* (L.) Skeels	Myrtaceae	Jamblang
53	*Pometia pinnata* J.R.Forst. & G.Forst.	Sapindaceae	Matoa

Multifunctional Potential of Flora and Ecosystem Services

The classification analysis based on ethnobotanical use categories showed that the flora of Tabebuya Park has very high multifunctional potential. Of the 53 identified species, 42 were recorded as medicinal plants, 31 as ornamental plants, 9 as aromatic plants, 2 as dye-producing plants, 21 as food and beverage plants, 5 as culinary spice plants, 20 as cosmetic plants, and 10 as plants used for ritual or customary purposes, in addition to several other use categories. The distribution of these potential plant uses is visually presented in Figure 1.

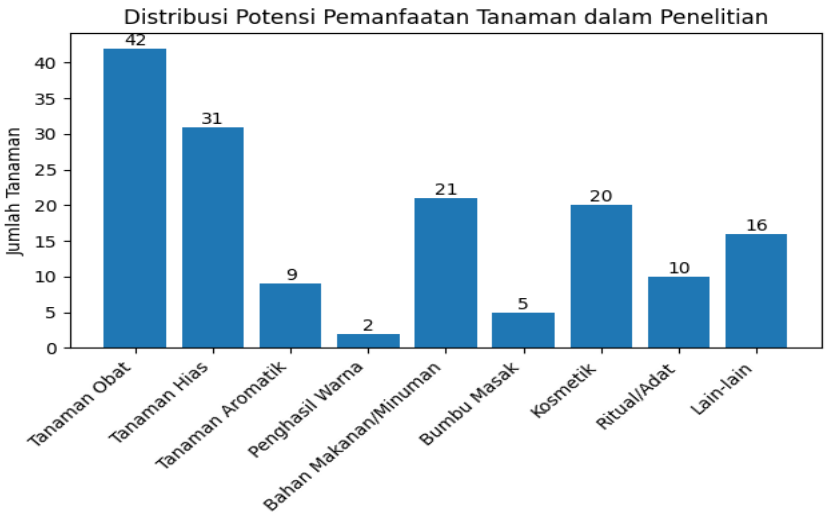

Figure 1. Distribution of plant-use potential in Tabebuya Park

As shown in Figure 1, the highest potential was found in medicinal and ornamental plant categories, indicating that the aesthetic function of urban parks can operate alongside their contributions to public health and well-being (Darmastuti, S., et al., 2024). Medicinal and aromatic plants are known to contribute to cultural and

regulating ecosystem services, particularly by creating environments that support relaxation, psychological restoration, and improved air quality (Francini et al., 2022). In addition, the presence of food plants and culinary spices reflects the concept of edible ornamental plants, namely plants that possess both aesthetic and consumptive value, which is increasingly being applied in sustainable urban landscape planning (Gunes & Kahraman, 2022).

From an ecosystem services perspective, the combination of medicinal, food, and ornamental plants in Tabebuya Park demonstrates contributions to provisioning services (food and medicinal resources), regulating services (microclimate regulation and environmental quality improvement), and cultural services (recreation, education, and cultural value). This multifunctional pattern reinforces the role of urban parks not merely as visual elements, but as green infrastructure that makes a tangible contribution to the sustainability of urban ecosystems (Fan et al., 2023).

Biocultural Value and Educational Potential of Urban Green Open Space

The presence of 10 plant species used for ritual or customary purposes, together with various species with multiple uses, reflects the biocultural dimension of Tabebuya Park. The biocultural concept emphasizes the interconnection between biodiversity and the socio-cultural practices of local communities, including traditional knowledge related to plant use. In urban contexts, the presence of culturally valuable plant species in public spaces has the potential to strengthen local identity while also serving as a medium for intergenerational knowledge transfer.

Urban parks with diverse plant species of ethnobotanical value also have strong potential as spaces for environmental education. Information on plant functions and uses can be utilized in both formal and informal learning activities, such as education on medicinal plants, local food resources, and biodiversity conservation. Previous studies have shown that green spaces with educational elements can increase environmental awareness and strengthen public engagement in nature conservation efforts (Radonic et al., 2025).

Accordingly, Tabebuya Park has the potential to be developed as an “urban ethnobotanical laboratory” that not only supports plant conservation but also strengthens human–nature relationships through educational and cultural approaches. This potential represents an added value that is rarely taken into account in urban park management, which is generally oriented primarily toward aesthetics.

Implications for Urban Green Open Space Planning and Management

The findings of this study emphasize the importance of considering plant species composition, not merely the total area of green open space, in the planning and management of urban green infrastructure. The diversity of plant functions recorded in Tabebuya Park indicates that appropriate species selection can improve the efficiency of green open spaces in delivering multiple ecosystem services simultaneously. This finding is in line with the view that vegetation quality and diversity are key determinants of the ecological and social value of urban green spaces (Cameron & Blanuša, 2016; Kifayatullah, et al., 2025).

From a practical perspective, Tabebuya Park provides a strong basis for development as an educational park for medicinal and food plants, a sensory-based therapeutic garden, and a conservation space for flora with cultural and economic value (Moszkowicz, K. et al., 2025). However, the development of such multifunctionality should be balanced by management strategies that take safety and sustainability into account, including plant toxicity, allergy risks, species origin (native

or introduced), invasive potential, and maintenance and water requirements (Sarigu et al., 2025).

In the context of global research, the multifunctional floral profile of Tabebuya Park is aligned with the growing trend of developing biocultural green spaces in cities worldwide, integrating ecological, health, and cultural dimensions within a single urban landscape system (Toscano et al., 2025). Therefore, the findings of this study are relevant not only at the local scale, but also contribute to the broader scientific discourse on sustainable and biodiversity-based urban green open space management.

CONCLUSION

Tabebuya Park demonstrates high floristic diversity, with 53 plant species representing 34 families and forming a multilayered vegetation structure that supports ecological functions in an urban environment. Its relatively balanced taxonomic composition, without strong dominance by a single family, indicates substantial potential to enhance ecosystem stability, provide microhabitats, and strengthen urban ecosystem services. The flora of Tabebuya Park also exhibits strong multifunctionality, particularly in its roles as medicinal, ornamental, food, aromatic, and culturally significant plants. This finding highlights that urban parks should be understood not only as aesthetic landscape elements, but also as green infrastructure capable of simultaneously delivering provisioning, regulating, and cultural ecosystem services. Moreover, the presence of ethnobotanically valuable and bioculturally important species underscores the park's educational and social significance. Tabebuya Park therefore has considerable potential to be developed as an urban ethnobotanical laboratory that integrates biodiversity conservation, public education, community well-being, and cultural values. Overall, the study emphasizes that urban green open space planning and management should prioritize plant composition, diversity, and functional value rather than focusing solely on spatial extent. With appropriate management that considers safety, sustainability, and species suitability, Tabebuya Park may serve as a model for multifunctional urban parks that contribute meaningfully to ecological resilience, social benefits, and biocultural sustainability.

RECOMMENDATION

Future research should include quantitative ecological measurements, such as species abundance, diversity indices, and seasonal variation, to better evaluate the ecological performance of urban park flora. Comparative studies across different urban green spaces are also needed to identify the main factors influencing plant diversity and multifunctionality. In addition, further investigation of ecosystem services, plant safety, and community perceptions would strengthen the scientific basis for developing multifunctional, sustainable, and culturally relevant urban parks.

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