

ASSESSMENT OF FLORA DIVERSITY, POPULATION STRUCTURE AND TREE STABILITY IN LUFASI PARK, LEKKI, LAGOS, NIGERIA

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ABSTRACT

Plants are fundamental components of the ecosystem. They are known globally as a necessity for biological diversity which provide essential ecosystem services that range from carbon sequestration to hydrological regulation. Due to the lack of ecological data, there are significant gaps in conservation planning and urban environmental policy and implementation. This study examined the flora diversity, population structure and tree stability in three ecological zones: forest, riparian and built-up section of the Lekki Urban Forest and Animal Sanctuary Initiative (LUFASI) Park, located at the Lekki-Epe Expressway, Lagos, Nigeria. This research involved field sampling using standard ecological data collection techniques which were carried out on 30 sample plots of 25m x 25m each in three ecological zones: forest, riparian and built-up. A total of 879 individual trees were measured above diameter at breast height (DBH), of ≥ 5 cm representing 76 species and 30 families were recorded. The forest zone showed to be the highest diversity Shannon-Weiner index (H') = 3.14; Simpson's diversity index (d') = 8.54; Evenness = 0.45) which reflects a stable and well distributed tree community. The population structure analysis showed a reverse-J diameter distribution in the forest indicating healthy regeneration while the built-up section dominated by large ornamental trees shows poor regeneration. Tree stability based on slenderness coefficient showed the riparian as the most stable at (92.2%), the forest moderately stable at (42%) and the built up the least with (35.9%) of unstable trees. This study emphasized LUFASI Park's role as a biodiversity hotspot and climate buffer in Lagos and also indicate the need for enhancement planting, regeneration support and a sustainable integration into urban greening strategies.

KEY WORDS: floral diversity, population structure, tree stability, LUFASI Park, species richness

INTRODUCTION

Plants are integral components of ecosystems and are globally recognized as essential to biological diversity. They provide vital ecosystem services, including carbon sequestration, climate moderation, and hydrological regulation (Bohnett & An, 2023). Beyond these functions, trees and other floral species help control water run-off, thereby supporting ecosystem stability and sustainability (Walter *et al.*, 2023). In rapidly urbanizing cities such as Lagos, preserving the remaining green spaces has become increasingly important for maintaining biodiversity amid expanding industrial and infrastructural development (Oyewo & Oyewale, 2023).

However, accelerated population growth and industrial expansion worldwide have intensified pressures on natural ecosystems, leading to deforestation, habitat loss, overexploitation of resources, and the spread of invasive species (Walter *et al.*, 2023). In Nigeria, habitat degradation is driven by multiple factors, including flooding associated with rising sea levels, open grazing, seasonal bush burning for agriculture, logging and wood harvesting, and infrastructural development (Izah & Aigberua, 2023). These impacts are particularly evident in the Lekki–Epe axis of Lagos State, where rapid urbanization and coastal development have significantly diminished indigenous flora. Olaoti-Laaro *et al.* (2024) reported that approximately 65 out of the 560 recorded tree species in Nigeria are currently threatened with extinction due to these anthropogenic pressures.

The rapid decline in Nigeria’s plant diversity underscores the urgent need for effective ecological management and the establishment of baseline data for protected areas (Walter *et al.*, 2023). Although floristic diversity and population structure are widely used indicators of forest health, tree stability also plays a critical role in the sustainable management of urban green spaces. Systematic documentation of floral diversity and population structure provides essential insights into species composition, ecological interactions, and the threats facing plant communities (Agbelade, 2021).

LUFASI (Lekki Urban Forest and Animal Sanctuary Initiative) Park represents an important remnant of the coastal rainforest and mangrove ecosystem in Lagos. Despite its ecological significance as a biodiversity hotspot, there is limited comprehensive quantitative information on its floristic composition, demographic distribution, and structural integrity of tree species. Therefore, this study aims to develop an updated baseline floral assessment of LUFASI Park to support informed management decisions and strengthen conservation planning for the protected area.

The Study Area. LUFASI Nature Park is a 20-hectare riparian forest conservation area located along the Lekki–Epe Expressway in Majek, Sangotedo, within

the Ibeju-Lekki axis of Lagos State, Nigeria. Established in 2013, the park was created to conserve natural habitats within an urban landscape and to function as a field laboratory for environmental education and ecological research (Adedapo *et al.*, 2023). Geographically, it lies between Latitudes 06.46246° N and 06.46590° N and Longitudes 003.65396° E and 003.65523° E, encompassing both built-up and riparian zones.

The Park experiences a tropical wet-and-dry climate, with a distinct rainy season from April to October, annual rainfall exceeding 1,000 mm, consistently high temperatures ranging from about 20°C to the low 30°C, and high relative humidity. Its landscape includes forest reserves, ponds, and small lakes that support native tree species such as Ekki (“iron wood”) and provide habitat for bird species including the endangered Hooded Vulture and the African Pied Hornbill. In addition to serving as a refuge for rescued and rehabilitated wildlife, LUFASI Nature Park provides shaded trails, picnic areas, and open recreational spaces, thereby promoting biodiversity conservation, research, environmental awareness, and nature-based recreation (WeatherSpark, 2026).

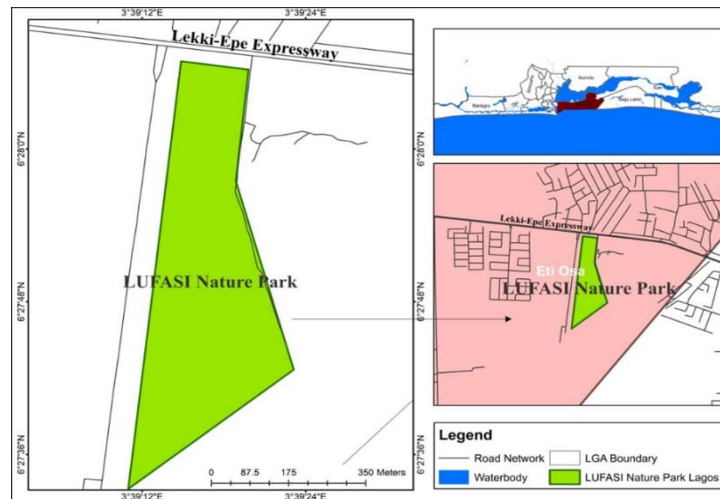


FIG 1: Geographical Location of the Study Area

MATERIAL AND METHOD

A ground-based inventory was used to collect information on tree species diversity and tree growth characteristics of individual trees in the park using a systematic transect line design (Figure 2).

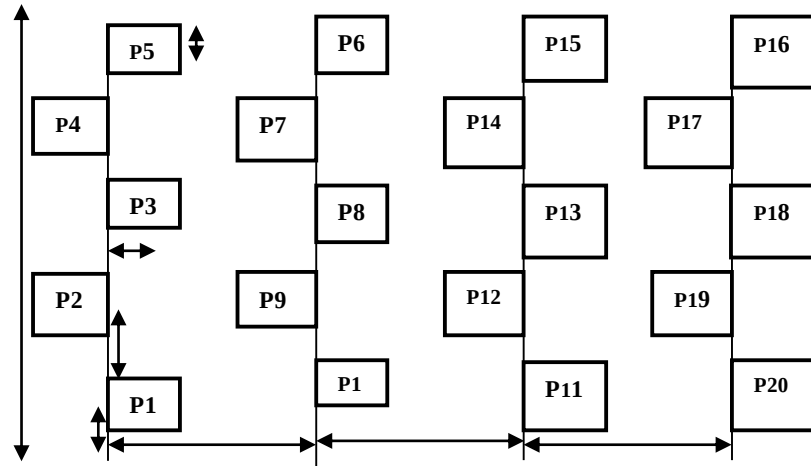


FIG 2: Layout of sample plot using systematic line transect sampling method. Tree species data were collected using at least three systematic transects per zone, with five 25 m × 25 m plots per transect, spaced 20 m apart and preceded by a 20 m edge buffer (Figure 2). All trees with a diameter at breast height (DBH) ≥ 1.3 m were measured, capturing most woody plant classes. Data recorded included DBH and total tree height, and species were identified.

Herbarium specimens. Plant samples from multiple species were collected, pressed, dried, and curated in the herbarium following standard protocols (Radford et al., 1974). Tree species that could not be identified in the field, specimens were collected and sent to the University of Lagos Herbarium for accurate identification. This process established a permanent record of the area's vegetation and flora, providing a valuable reference for future conservation and research efforts.

Conservation Status Assessment. The International Union for Conservation of Nature (IUCN) Red List of Threatened Species (IUCN, 2022-2) classifies species into nine conservation categories: Not Evaluated (NE), Data Deficient (DD), Least Concern (LC), Near Threatened (NT), Vulnerable (VU), Endangered (EN), Critically Endangered (CR), Extinct in the Wild (EW), and Extinct (EX). These categories were adopted to assess and classify the conservation status of the species in the study.

Vegetation analysis. Biodiversity indices were employed to assess species abundance, evenness, and to compare community diversity. Species diversity analyses were conducted using PAST (Paleontological Statistics) version 4.03, with the probability level set at 0.05. Basal area was calculated using standard formulae, and the

biodiversity indices listed below were computed following the methods described by Onilude *et al.* (2020) and Onyekwelu *et al.* (2022).

Species relative density (%), an index for assessing species relative distribution within an ecosystem, was computed using:

$$RD = \left(\frac{n_i}{N} \right) \times 100 \quad (1)$$

Where RD (%) = species relative density; n_i = number of individuals of species i ; N = the total number of all individuals of all species in the entire site.

Species Relative Dominance (RDo (%)), useful in assessing the relative space occupancy of a species, was estimated using:

$$RDo = \frac{(\sum Ba_i \times 100)}{\sum Ba_n} \quad (2)$$

Where: RDo (%) = species relative dominance; Ba_i = basal area of all individual trees belonging to a particular species i ; Ba_n = stand basal area

Species Richness (S): Refers to the total number of different species present in the ecosystem. It was calculated using:

$$D = \frac{S}{\sqrt{N}} \quad (3)$$

Where: D = Menhinick's index; S = Number of species and N = Number of individuals

Species diversity index: It was estimated using the Shannon–Wiener Diversity Index which accounts for both species richness and evenness.

$$H' = - \sum_{i=1}^S p_i \ln(p_i) \quad (4)$$

Where H' = Shannon-Wiener diversity index; S = total number of species in the site; p_i = proportion of S made up of the i th species; $\ln$ = natural logarithm.

Species evenness: Calculated using Shannon's Equitability (EH) Index

$$E_H = \frac{H'}{H_{\max}} = \frac{\sum_{i=1}^S p_i \ln(p_i)}{\ln(S)} \quad (5)$$

Importance Value Index (IVI, %). Calculated as the average of Relative Density (RD) and Relative Dominance (RDo).

$$IVI = \left(\frac{RD + RDo}{2} \right) \quad (6)$$

Basal Area computation. The Basal area of each tree will be estimated using:

$$BA = \frac{\pi D^2}{4} \quad (7)$$

Where, BA = Basal Area (m^2), $\pi = 3.142$ (constant)

RESULTS AND DISCUSSIONS

A total of **879 individual trees** ($\text{DBH} \geq 5 \text{ cm}$) were recorded across LUFASI Nature Park. The forest, riparian, and built-up sections contained **349, 170, and 360 trees**, respectively. These were distributed among **51 species from 23 families** in the forest zone, **30 species from 21 families** in the riparian zone, and **26 species from 17 families** in the built-up zone (Table 1). The forest section showed the highest species richness and number of families compared to the riparian and built-up sections, although it did not surpass them in Shannon–Wiener evenness or total number of individual trees (Table 1).

TABLE 1: Comparative Tree Diversity Indices and Growth Parameters Across the Forest, Riparian, and Built-Up Sections of LUFASI Park

Tree indices and growth variables	Forest	Riparian	Built-up
Number of Families	23	21	17
Number of Species	51	30	26
Number of individual trees	349	170	360
Shannon–Weiner diversity index (H')	3.14	2.68	1.6
Species richness (Margalef Index)	8.54	5.65	4.59
Shannon–Wiener's evenness	0.45	0.49	0.18
Mean DBH (cm)	22.28	18.47	40.72
Min DBH – Max DBH (cm)	5 – 250	5 - 73.4	5 – 118
Mean basal area (m^2)	0.075	0.038	0.151
Min basal area – Max basal area (m^2)	0.002 – 4.909	0.002 – 0.423	0.002 – 1.094

The highest tree diversity in LUFASI Nature Park was recorded in the forest section (Shannon–Wiener index = 3.14), followed by the riparian section (2.68), and the built-up section (1.60). Species richness followed a similar trend, with the forest zone exhibiting the greatest number of species and the built-up area the least. However, Shannon–Wiener evenness showed a different pattern, with the riparian zone having the highest evenness (0.49), followed by the forest (0.45) and the built-up section (0.18).

Mean tree diameter at breast height (DBH) ranged from 18.47 cm in the riparian zone to 40.72 cm in the built-up zone, while the largest individual trees were observed in the forest section (maximum DBH = 250 cm) (Table 1). The relatively low mean DBH in the riparian zone indicates that trees in this area are generally younger, thinner, and frequently disturbed, likely due to periodic flooding, soil erosion, and anthropogenic pressures that limit growth and maturity. In contrast, the built-up section exhibits a higher mean DBH, reflecting older, fewer, and selectively planted trees that are often maintained for ornamental or microclimate purposes.

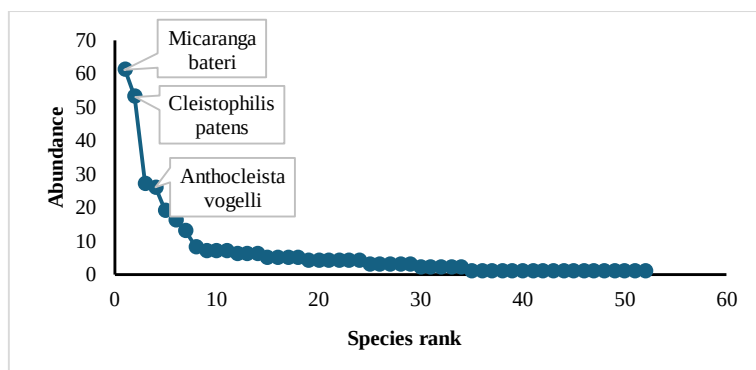


FIG 3: Rank-abundance curve for tree species in the Forest section of LUFASI

The highest mean basal area was observed in the built-up section (0.151 m²), followed by the forest (0.075 m²), and the lowest in the riparian zone (0.038 m²) (Table 1). The higher basal area in the built-up area reflects the presence of larger, canopy-forming trees, consistent with urban green infrastructure design that prioritizes shade and microclimate regulation. Conversely, the lower basal area in the riparian zone highlights restricted growth potential due to hydrological stress and ongoing anthropogenic disturbance.

The Importance Value Index (IVI) analysis for the forest section indicated that *Macaranga barteri* (IVI = 10.17) had the highest ecological significance, followed by *Cleistophilis patens* (8.41) and *Piptadeniastrum africanum* (6.58) (Table 2). The lowest IVI values were recorded for *Dialium guineensis* and *Rauvolfia vomitoria*, both with an IVI of 0.17 (Table 2). Regarding conservation status, approximately 76.5% of tree species in the forest section were classified as Least Concern under the IUCN Red List, including species such as *Psychotria vogeliana*, *Macaranga barteri*, *Xylopia aethiopica*, *Trichilia monadelphica*, *Ficus thonningii*, and *Celtis zenkeri* (Table 2). About 11.8% of species were categorized as Vulnerable, including *Nauclea diderrichii*, *Lophira alata*, *Entandrophragma cylindricum*, and *Sterculia oblonga*. Furthermore, 3.9% of species, namely *Manilkara obovata* and *Mangifera indica*, were listed as Data Deficient according to the IUCN classification (Table 2).

The Importance Value Index (IVI) analysis of the riparian section showed that *Anthocleista vogellii* (IVI = 12.8), *Uapaca guineensis* (9.7), and *Piptadeniastrum africanum* (9.2) were the most dominant tree species (Table 3). The lowest IVI values were recorded for *Dillenia indica* and *Uvaria chamae*, both with an IVI of 0.38 (Table 3).

In the riparian zone, most tree species (76.7%) were classified as Least Concern, while 13.3% were Vulnerable, 6.7% were Near Threatened, and *Mangifera indica* was Data Deficient. Vulnerable species face high extinction risk, and Near Threatened species face significant risk due to limited populations (Table 3).

In the built-up section, *Elaeis guineensis* had the highest IVI (37.19), followed by *Mangifera indica* (10.42) and *Alstonia congensis* (7.56), while *Homalina africanum* and *Thuja occidentalis* had the lowest IVI (0.2). Most species were classified as Least Concern, with *Lophira alata* and *Roystonea regia* listed as Vulnerable, and *Entandrophragma angolense*, *Eucalyptus camaldulensis*, and *Piptadeniastrum africanum* as Near Threatened (Table 4).

TABLE 1: Presents the distribution, ecological significance (IVI), and conservation status of tree species in the forest section of LUFASI Park

Family	Species Name	FRQ	RF (%)	Mean BA	RDo (%)	IVI	IUCN	Habit
Euphorbiaceae	<i>Alchornea cordifolia</i> (Schumach. & Thonn.) Müll.Arg.	2	0.57	0.002	0.05	0.31	Least Concern (LC)	Shrub
Fabaceae	<i>Albizia ferruginea</i> (Guill. & Perr.) Benth.	1	0.29	0.018	0.45	0.37	Vulnerable (VU)	Tree
Apocynaceae	<i>Alstonia boonei</i> De Wild.	5	1.43	0.071	1.78	1.60	Least Concern (LC)	Tree
Anacardiaceae	<i>Anacardium occidentale</i> L.	2	0.57	0.215	5.38	2.98	Least Concern (LC)	Tree
Annonaceae	<i>Annona muricata</i> L.	3	0.86	0.003	0.08	0.47	Least Concern (LC)	Tree
Annonaceae	<i>Anonidium mannii</i> (Oliv.) Engl. & Diels	1	0.29	0.216	5.40	2.85	Near Threatened (NT)	Tree
Meliaceae	<i>Azadirachta indica</i> A.Juss.	1	0.29	0.033	0.83	0.56	Least Concern (LC)	Tree
Gentianaceae	<i>Anthocleista djalensis</i> A.Chev.	6	1.72	0.154	3.85	2.79	Least Concern (LC)	Tree
Gentianaceae	<i>Anthocleista vogelli</i>	27	7.74	0.068	1.70	4.58	Least Concern (LC)	Tree
Fabaceae	<i>Anthonotha macrophylla</i> P.Beauv.	1	0.29	0.024	0.60	0.44	Least Concern (LC)	Tree
Phyllanthaceae	<i>Bridelia ferruginea</i>	6	1.72	0.011	0.28	1.00	Least Concern (LC)	Tree
Malvaceae	<i>Ceiba pentandra</i> (L.) Gaertn.	1	0.29	0.121	3.03	1.66	Least Concern (LC)	Tree
Cannabaceae	<i>Celtis zenkeri</i> Engl.	1	0.29	0.11	2.75	1.52	Least Concern (LC)	Tree
Annonaceae	<i>Cleistanthus patens</i> (Benth.) Engl. & Diels	53	15.19	0.065	1.63	8.41	Least Concern (LC)	Tree
Arecaceae	<i>Cocos nucifera</i> L.	6	1.72	0.035	0.88	1.30	Not evaluated	Tree crop
Malvaceae	<i>Cola nitida</i> (Vent.) Schott & Endl	1	0.29	0.018	0.45	0.37	Least Concern (LC)	Tree
Fabaceae	<i>Dialium guineense</i> Willd.	1	0.29	0.002	0.05	0.17	Least Concern (LC)	Tree
Putranjivaceae	<i>Drypetes gilgiana</i> (Pax) Pax & K.Hoffm.	4	1.15	0.008	0.20	0.67	Least Concern (LC)	Tree
Arecaceae	<i>Elaeis guineensis</i> Jacq.	16	4.58	0.213	5.33	4.96	Least Concern (LC)	Tree
Meliaceae	<i>Entandrophragma cylindricum</i> (Sprague) Sprague	1	0.29	0.245	6.13	3.21	Vulnerable (VU)	Tree
Meliaceae	<i>Entandrophragma angolense</i> (Welw.) C.DC	1	0.29	0.023	0.58	0.43	Vulnerable (VU)	Tree
Myrtaceae	<i>Eucalyptus camaldulensis</i> Dehnh.	1	0.29	0.368	9.21	4.75	Not native range	Tree
Moraceae	<i>Ficus mucosa</i> Welw. ex Ficalho	2	0.57	0.06	1.50	1.04	Least Concern (LC)	Tree
Moraceae	<i>Ficus thonningii</i> Blume	2	0.57	0.072	1.80	1.19	Least Concern (LC)	Tree
Lamiaceae	<i>Gmelina arborea</i> Roxb. ex Sm.	7	2.01	0.039	0.98	1.49	Least Concern (LC)	Tree
Hypericaceae	<i>Harungana madagascariensis</i> Lam. ex Poir.	5	1.43	0.019	0.48	0.95	Least Concern (LC)	Tree
Anacardiaceae	<i>Lannea welwitschii</i> (Hiern) Engl.	1	0.29	0.021	0.53	0.41	Least Concern (LC)	Tree
Ochnaceae	<i>Lophira alata</i> Banks ex C.F. Gaertn.	7	2.01	0.096	2.40	2.20	Vulnerable (VU)	Tree
Euphorbiaceae	<i>Macaranga heudelotii</i> Baill.	8	2.29	0.019	0.48	1.38	Least Concern (LC)	Tree
Anacardiaceae	<i>Mangifera indica</i> L.	5	1.43	0.029	0.73	1.08	Data Deficient (DD)	Tree
Sapotaceae	<i>Manilkara obovata</i> (Sabine & G.Don) J.H.Hemsl.	1	0.29	0.008	0.20	0.24	Data Deficient (DD)	Tree
Phyllanthaceae	<i>Margaritaria discoidea</i> (Baill.) G.L. Webster	1	0.29	0.019	0.48	0.38	Least Concern (LC)	Tree
Euphorbiaceae	<i>Macaranga barteri</i> Müll.Arg.	61	17.48	0.114	2.85	10.17	Least Concern (LC)	Tree
Urticaceae	<i>Musanga cecropioides</i> R.Br. ex Tedlie	3	0.86	0.053	1.33	1.09	Least Concern (LC)	Tree
Rubiaceae	<i>Nauclea diderrichii</i> (Laurent) Merr.	4	1.15	0.314	7.86	4.50	Vulnerable (VU)	Tree
Fabaceae	<i>Pentaclethra macrophylla</i> Benth.	2	0.57	0.018	0.45	0.51	Least Concern (LC)	Tree
Lauraceae	<i>Persea americana</i> Mill.	4	1.15	0.058	1.45	1.30	Not native range	Tree
Fabaceae	<i>Piptadeniastrum africanum</i> (Hook.f.) Brenan	4	1.15	0.48	12.01	6.58	Near Threatened (NT)	Tree
Rubiaceae	<i>Psychotria vogeliana</i> Benth.	7	2.01	0.019	0.48	1.24	Least Concern (LC)	Tree
Myristicaceae	<i>Pycnanthus angolensis</i> (Welw.) Warb.	4	1.15	0.007	0.18	0.66	Least Concern (LC)	Tree
Arecaceae	<i>Raphia hookeri</i> G.Mann & H.Wendl.	1	0.29	0.181	4.53	2.41	Least Concern (LC)	Tree

Apocynaceae	<i>Rauvolfia vomitoria</i> Wennberg	1	0.29	0.002	0.05	0.17	Least Concern (LC)	Tree
Malvaceae	<i>Sterculia oblonga</i> Mast.	5	1.43	0.021	0.53	0.98	Vulnerable	Tree
Malvaceae	<i>Sterculia tragacantha</i> Lindl.	3	0.86	0.003	0.08	0.47	Least Concern (LC)	Tree
Meliaceae	<i>Trichilia monadelpha</i> (Thonn.) J.J.de Wilde	1	0.29	0.139	3.48	1.88	Least Concern (LC)	Tree
Annonaceae	<i>Uvaria chamae</i> P.Beauv	6	1.72	0.012	0.30	1.01	Least Concern (LC)	Tree
Annonaceae	<i>Uapaca guineensis</i> Müll.Arg.	26	7.45	0.018	0.45	4.09	Least Concern (LC)	Tree
Annonaceae	<i>Xylopia aethiopica</i> (Dunal) A.Rich.	19	5.44	0.027	0.68	3.06	Least Concern (LC)	Tree
Annonaceae	<i>Xylopia longipetala</i> De Wild. & T.Durand	13	3.72	0.009	0.23	1.98	Least Concern (LC)	Tree
Rutaceae	<i>Zanthoxylum gillettii</i> (De Wild.) P.G.Wateman	4	1.15	0.05	1.25	1.20	Least Concern (LC)	Tree
Rutaceae	<i>Zanthoxylum zanthoxyloides</i> (Lam.) Zepern. & Timler	1	0.29	0.067	1.68	0.98	Least Concern (LC)	Tree
Total		349		3.997				

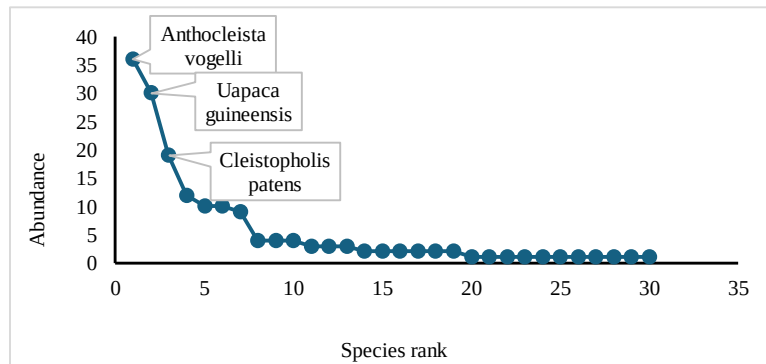


FIG 4: Rank abundance curve for tree species in the Riparian section of LUFASI

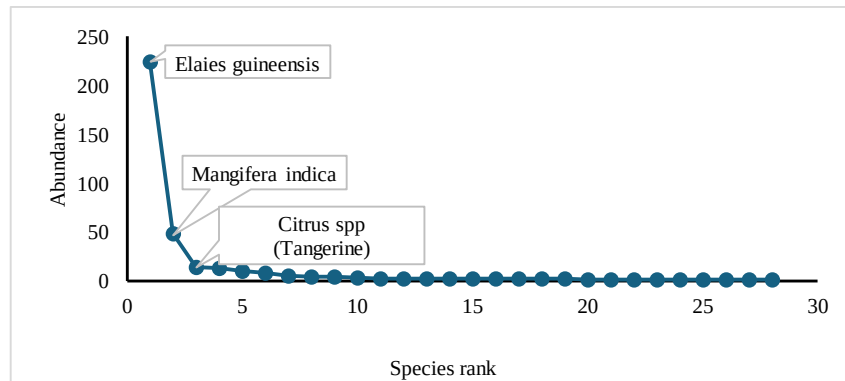


FIG 5: Rank abundance curve for species in the Built-up section of LUFASI

OLAKITAN: Assessment of flora diversity, population structure and tree stability in Lufasi Park, Lekki, Lagos, Nigeria

TABLE 2: Distribution, ecological significance (IVI), and IUCN conservation status of tree species in the riparian section of LUFASI Park

Family	Species	Frq	RF(%)	mean BA	RDo(%)	IVI	IUCN	Habit
Fabaceae	<i>Albizia ferruginea</i> (Guill. & Perr.) Benth.	1	0.588235	0.003	0.264784	0.42651	Vulnerable (VU)	Tree
Apocynaceae	<i>Alstonia boonei</i> De Wild.	9	5.294118	0.005	0.441306	2.867712	Least Concern (LC)	Tree
Gentianaceae	<i>Anthocleista djalensis</i> A.Chev.	1	0.588235	0.003	0.264784	0.42651	Least Concern (LC)	Tree
Gentianaceae	<i>Anthocleista vogelii</i> Planch.	36	21.17647	0.051	4.501324	12.8389	Least Concern (LC)	Tree
Annonaceae	<i>Cleistopholis patens</i> (Benth.) Engl. & Diels	19	11.17647	0.047	4.148279	7.662375	Least Concern (LC)	Tree
Dilleniaceae	<i>Dillenia indica</i> L.	1	0.588235	0.002	0.176523	0.382379	Least Concern (LC)	Tree
Putranjivaceae	<i>Drypetes afzelii</i> (Pax) Hutch.	2	1.176471	0.047	4.148279	2.662375	Least Concern (LC)	Tree
Arecaceae	<i>Elaeis guineensis</i> Jacq.	3	1.764706	0.173	15.2692	8.516951	Least Concern (LC)	Tree
Moraceae	<i>Ficus lutea</i> Vahl.	3	1.764706	0.03	2.647838	2.206272	Least Concern (LC)	Tree
Hypericaceae	<i>Harungana madagascariensis</i> Lam. ex Poir.	1	0.588235	0.013	1.147396	0.867816	Least Concern (LC)	Tree
Ochnaceae	<i>Lophira alata</i> Banks ex C.F.Gaertn.	2	1.176471	0.084	7.413945	4.295208	Vulnerable (VU)	Tree
Euphorbiaceae	<i>Macaranga heudelotii</i> Baill.	2	1.176471	0.013	1.147396	1.161933	Least Concern (LC)	Tree
Euphorbiaceae	<i>Margaritaria discoidea</i> (Baill.) G.L.Webster	1	0.588235	0.018	1.588703	1.088469	Least Concern (LC)	Tree
Anacardiaceae	<i>Mangifera indica</i> L.	3	1.764706	0.055	4.854369	3.309537	Data Deficient (DD)	Tree
Euphorbiaceae	<i>Macaranga barteri</i> Müll.Arg.	10	5.882353	0.023	2.030009	3.956181	Least Concern (LC)	Tree
Rubiaceae	<i>Morinda lucida</i> Benth.	1	0.588235	0.003	0.264784	0.42651	Least Concern (LC)	Tree
Urticaceae	<i>Musanga cecropioides</i> R.Br. ex Tiedl.	12	7.058824	0.043	3.795234	5.427029	Least Concern (LC)	Tree
Oleaceae	<i>Olax mannii</i> Oliv.	1	0.588235	0.026	2.294793	1.441514	Vulnerable (VU)	Tree
Fabaceae	<i>Piptadeniastrum africanum</i> (Hook.f.) Brenan	2	1.176471	0.195	17.21094	9.193707	Near Threatened (NT)	Tree
Rubiaceae	<i>Psychotria vogeliana</i> Benth.	10	5.882353	0.028	2.471315	4.176834	Least Concern (LC)	Tree
Myristicaceae	<i>Pycnanthus angolensis</i> (Welw.) Warb.	2	1.176471	0.076	6.707855	3.942163	Least Concern (LC)	Tree
Arecaceae	<i>Raphia hookeri</i> G.Mann & H.Wendl.	1	0.588235	0.071	6.266549	3.427392	Near Threatened (NT)	Tree
Apocynaceae	<i>Rauvolfia vomitoria</i> Wennberg	1	0.588235	0.004	0.353045	0.47064	Least Concern (LC)	Tree
Malvaceae	<i>Sterculia oblonga</i> Mast.	1	0.588235	0.003	0.264784	0.42651	Vulnerable (VU)	Tree
Combretaceae	<i>Terminalia catappa</i> L.	4	2.352941	0.045	3.971756	3.162349	Least Concern (LC)	Tree
Moraceae	<i>Trilepisium madagascariense</i> DC.	2	1.176471	0.039	3.442189	2.30933	Least Concern (LC)	Tree
Phyllanthaceae	<i>Uapaca guineensis</i> Müll.Arg.	30	17.64706	0.019	1.676964	9.662011	Least Concern (LC)	Tree
Annonaceae	<i>Uvaria chamae</i> P.Beauv	1	0.588235	0.002	0.176523	0.382379	Least Concern (LC)	Tree
Lamiaceae	<i>Vitex grandifolia</i> Gürke	4	2.352941	0.005	0.441306	1.397124	Least Concern (LC)	Tree
Annonaceae	<i>Xylopia aethiopica</i> (Dunal) A.Rich.	4	2.352941	0.007	0.617829	1.485385	Least Concern (LC)	Tree
	Total	170		1.133				

TABLE 3: The distribution, ecological significance (IVI), and IUCN conservation status of tree species in the built-up section of LUFASI Park

Family	Name	Frq	RF (%)	Mean BA	Rdo (%)	IVI	IUCN	Habitat
Apocynaceae	<i>Alstonia congensis</i> Engl.	8	2.22	0.197	12.89	7.56	Least Concern (LC)	woody tree
Anacardiaceae	<i>Anacardium occidentale</i> L.	3	0.83	0.125	8.20	4.52	Least Concern (LC)	tree crop
Gentianaceae	<i>Anthocleista vogelii</i> Planch.	2	0.56	0.018	1.20	0.88	Least Concern (LC)	woody trees
Meliaceae	<i>Azadirachta indica</i> A.Juss.	2	0.56	0.026	1.71	1.13	Least Concern (LC)	woody trees
Fabaceae	<i>Calliandra haematocephala</i> Hassk.	2	0.56	0.011	0.69	0.62	Least Concern (LC)	ornamental shrub
Rutaceae	<i>Citrus reticulata</i> Blanco	14	3.89	0.028	1.82	2.85	Not assessed (widely cultivated)	tree crop
Arecaceae	<i>Cocos nucifera</i> L.	5	1.39	0.045	2.94	2.16	Not assessed (widely cultivated)	tree crop
Arecaceae	<i>Dypsis lutescens</i> (H.Wendl.) Beentje & J.Dransf.	16	4.44	0.003	0.17	2.31	Near Threatened (NT)	woody trees
Arecaceae	<i>Elaeis guineensis</i> Jacq.	224	62.22	0.186	12.17	37.19	Least Concern (LC)	tree crop
Meliaceae	<i>Entandrophragma angolense</i> (Welw.) C.DC.	2	0.56	0.004	0.27	0.42	Near Threatened (NT)	woody trees
Myrtaceae	<i>Eucalyptus camaldulensis</i> Dehnh.	1	0.28	0.181	11.86	6.07	Near Threatened (NT)	woody trees
Moraceae	<i>Ficus mucosa</i> Welw. ex Ficalho	1	0.28	0.007	0.46	0.37	Least Concern (LC)	woody trees
Moraceae	<i>Ficus sur</i> Forssk.	2	0.56	0.037	2.42	1.49	Least Concern (LC)	woody trees
Moraceae	<i>Ficus lutea</i> Vahl	1	0.28	0.033	2.16	1.22	Least Concern (LC)	woody trees

Salicaceae	<i>Homalium africanum</i> (Hook.f.) Benth.	1	0.28	0.002	0.13	0.20	Least Concern (LC)	Tree
Ochnaceae	<i>Lophira alata</i> Banks ex C.F.Gaertn.	1	0.28	0.010	0.62	0.45	Vulnerable (VU)	woody trees
Anacardiaceae	<i>Mangifera indica</i> L.	48	13.33	0.115	7.51	10.42	Least Concern (LC)	tree crop
Rubiaceae	<i>Morinda lucida</i> A.Gray	2	0.56	0.003	0.16	0.36	Least Concern (LC)	woody trees
Moringaceae	<i>Moringa oleifera</i> Lam.	2	0.56	0.012	0.76	0.66	Least Concern (LC)	Tree
Lauraceae	<i>Persea americana</i> Mill.	1	0.28	0.003	0.17	0.23	Not native range (widely cultivated)	Tree
Fabaceae	<i>Piptadeniastrum africanum</i> (Hook.f.) Brenan	4	1.11	0.187	12.25	6.68	Near Threatened (NT)	Tree
Apocynaceae	<i>Rauvolfia vomitoria</i> Wennberg	2	0.56	0.017	1.10	0.83	Least Concern (LC)	Shrub
Arecaceae	<i>Roystonea regia</i> (Kunth) O.F.Cook	10	2.78	0.084	5.52	4.15	Vulnerable (VU)	ornamental tree
Combretaceae	<i>Terminalia mantaly</i> H.Perrier	4	1.11	0.082	5.35	3.23	Not Evaluated	Tree
Cupressaceae	<i>Thuja occidentalis</i> L.	1	0.28	0.002	0.13	0.20	Least Concern (LC)	woody tree
Annonaceae	<i>Xylopia aethiopica</i> (Dunal) A.Rich.	1	0.28	0.112	7.35	3.82	Least Concern (LC)	Tree
Total		360						

Diameter size class distribution of tree species in LUFASI Nature Park. The diameter at breast height (DBH) class distribution across the forest, riparian, and built-up sections of LUFASI (Figures 5a–5c) reveals distinct structural patterns. In the forest section, the 10.1–20 cm DBH class recorded the highest number of stems (121), followed by ≤ 10 cm (96), while the 70.1–80 cm class had the fewest stems (2), indicating a predominance of small to medium-sized trees. Similarly, in the riparian section, the highest stem densities (53 each) were observed in the ≤ 10 cm and 10.1–20 cm DBH classes, with the lowest frequency recorded in the 70.1–80 cm class. In contrast, the built-up section was dominated by larger trees, with the highest number of stems occurring in the 40.1–50 cm DBH class, followed by the 50.1–60 cm class. The forest and riparian sections exhibit a reverse-J distribution pattern typical of regenerating stands, whereas the built-up section is characterized by relatively larger diameter trees.

Stability of trees in the park. The slenderness coefficient, defined as the ratio of total tree height (H) to diameter at breast height (DBH) measured at 1.3 m above ground (H/DBH , with both parameters in metres), is commonly used as an index of tree stability. The results indicate that a substantial proportion of trees fell within the low slenderness coefficient category, accounting for approximately 42% in the forest section, 92.2% in the riparian section, and 38.2% in the built-up section of LUFASI. Trees in the moderate slenderness category constituted 27.5%, 4.2%, and 25.9% in the forest, riparian, and built-up sections, respectively. Meanwhile, 30.4% of trees in the forest section, 3.6% in the riparian section, and 35.9% in the built-up section were classified within the high slenderness coefficient category (Table 5). The riparian section showed the greatest proportion of structurally stable trees, as indicated by the dominance of low slenderness values.

Species diversity varied across the study sections, with the highest Shannon–Wiener index recorded in the forest section (3.14), followed by the riparian section (2.68), and the lowest in the built-up section (1.60). This pattern is consistent with values

reported for Nigerian tropical forests, where Shannon indices typically range between 2.5 and 3.5 depending on disturbance intensity (Onilude *et al.*, 2020), suggesting moderate ecological stability in the forest section of LUFASI. However, the comparatively low diversity in the built-up area contrasts with higher values reported for urban forests in Ibadan (Shannon index ≈ 3.35) (Onyekwelu & Olabiwonnu, 2016), likely reflecting limited planting diversity and stronger anthropogenic pressures within LUFASI's developed zones. Structurally, the built-up section exhibited significantly higher mean basal area and DBH, indicating the dominance of larger trees despite reduced species diversity.

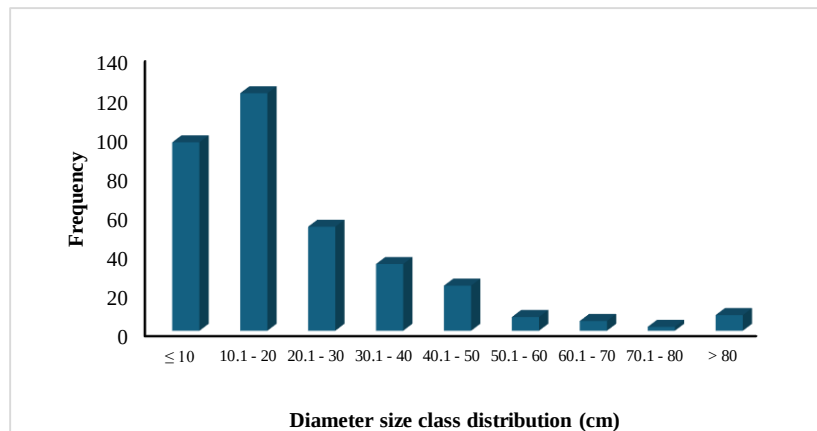


FIG 5a: Diameter class distribution of trees in the forest section of LUFASI Park

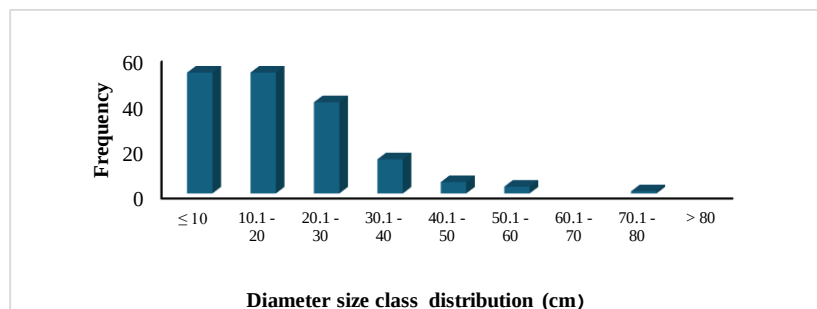


FIG 5b: Diameter class distribution of trees in the riparian section of LUFASI Park

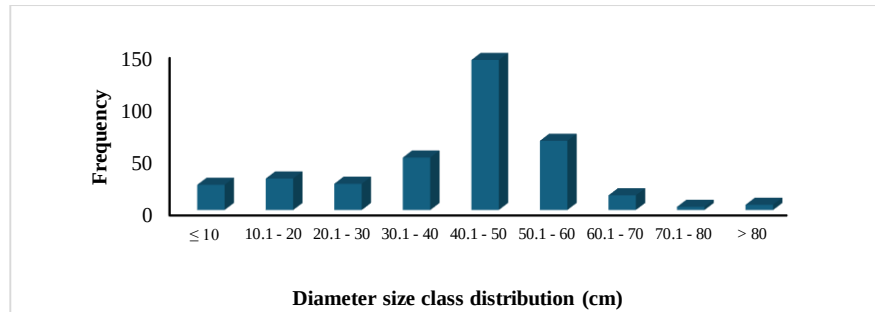


FIG 5c: Diameter class distribution of trees in the built-up section of LUFASI Park

TABLE 5: Stability categories of trees in various sections of LUFASI Nature Park

Stability categories	Forest		Riparian		Built up	
	Freq	P (%)	Freq	P (%)	Freq	P (%)
less than 70 (Low)	147	42.1	332	92.2	65	38.2
70 – 99 (Moderate)	96	27.5	15	4.2	44	25.9
above 99 (High)	106	30.4	13	3.6	61	35.9
Total	349	100	360	100	170	100

Note: Freq- Frequency, P (%) – Percentage (%)

Although urban green spaces are typically characterized by smaller, planted trees, the occurrence of large legacy specimens such as *Elaeis guineensis* and *Mangifera indica* accounts for the relatively higher structural values observed in the built-up section (Agbelade *et al.*, 2023). Species dominance at LUFASI Park exhibited clear zone-specific patterns. The forest section was dominated by *Macaranga barteri* and *Cleistopholis patens*, both pioneer species commonly associated with secondary forests in West Africa (Onyekwelu *et al.*, 2022). In the riparian zone, *Anthocleista vogellii* and *Uapaca guineensis* were predominant, consistent with the moisture-tolerant composition typical of riparian forests (Akinyemi *et al.*, 2020). The built-up section was overwhelmingly dominated by *Elaeis guineensis* (62.22%), reflecting deliberate anthropogenic planting preferences. This dominance pattern aligns with findings from other Nigerian urban forest studies, where exotic or economically valuable species often predominate (Erhabor *et al.*, 2020).

Approximately 11.8% of species recorded in the LUFASI forest were classified as Vulnerable, corroborating reports from other forest reserves where anthropogenic disturbances progressively reduce the presence of sensitive species (Viljur *et al.*, 2022). The diameter distribution in both the forest and riparian sections exhibited the classical inverse-J pattern, characterized by a high frequency of small-sized trees and a gradual

decline toward larger diameter classes. A similar distribution pattern was reported for woody species along the expressway corridor (Walter *et al.*, 2023). This structure, widely documented in Nigerian tropical forests (Viljur *et al.*, 2022), is commonly interpreted as evidence of continuous regeneration, sustainable population structure, and ecological stability.

However, the built-up section diverged from this trend, showing peak frequency in mid-sized classes (40-50 cm DBH). Similar patterns in Nigerian urban forests have been attributed to limited introduction of small stems due to space constraints, pruning, and human interference (Adeyemi & Shackleton, 2024). The slenderness coefficient provides an important measure of tree stability, with higher values indicating increased susceptibility to wind throw and lower values reflecting greater structural stability. Besides basic structural variables such as the basal area, tree slenderness is also a measure recognized as a good indicator of the wind-throw stability of trees (Oladoye *et al.*, 2020). The shape of trees can be influenced by silvicultural interventions, if applied early in the stand development.

The slenderness coefficient (SC) analysis indicated that most trees were stable (low SC) in riparian (92.2%) and forest (42.1%) sections, while a substantial proportion in forest (30.4%) and built-up areas (35.9%) fell into the high SC category. Comparable studies in Ibadan (Ige & Komolafe, 2022) found 40% of trees susceptible to windthrow, while in Oban Forest Reserve, 24% of trees exceeded stability thresholds (Negron-Juarez *et al.*, 2026). Thus, the LUFASI results fall within expected ranges but highlight elevated risk in built-up zones where trees are tall and slender, possibly due to selective landscaping. The exceptionally high stability in the riparian section may reflect a younger stand structure, with smaller, shorter trees resulting in lower SC values.

CONCLUSIONS

LUFASI Nature Park shows pronounced spatial variation in species composition, diversity, regeneration patterns, and structural stability across its forest, riparian, and built-up sections. The forest zone maintains the highest species richness and diversity, followed by the riparian section, while the built-up area reflects lower diversity and greater anthropogenic influence. Diameter class distributions in the forest and riparian zones demonstrate healthy regeneration and stable population structures, in contrast to the built-up section, where recruitment is limited and species composition is largely management driven. Although the majority of species are categorized as Least Concern, the occurrence of Vulnerable species underscores the conservation value of the park. LUFASI functions as an important urban biodiversity refuge, but targeted management

interventions particularly in the built-up section are necessary to enhance regeneration, structural stability, and long-term ecological resilience.

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