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Assessment of floristic biodiversity of urban and peri-urban Ogbomoso, Nigeria

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Urbanization poses serious threats to floristic biodiversity, resulting in species loss and reduced ecosystem services. This study assessed plant diversity in urban and peri-urban Ogbomoso, Nigeria, across 36 locations and 50 quadrat plots. A total of 144 species, representing 118 genera and 45 families, were documented. Fabaceae was the most species-rich family (20 species), while herbs dominated the flora (42%), followed by trees (26%) and shrubs (17%). Diversity analysis showed moderate to high values: the overall Shannon-Wiener index (H') was 2.42, slightly higher in peri-urban sites (2.45) than in urban sites (2.40). Species richness (Margalef's index) was greater in peri-urban areas (4.21) compared to urban areas (3.70), while evenness remained balanced ($J = 0.79$). *Hyptis suaveolens* was the most abundant species with 2,165 individuals, contributing 19.5% relative density and the highest importance value index (IVI) of 22.7, whereas *Azadirachta indica* occurred most frequently (90% of plots). Rare species such as *Albizia adianthifolia* and *Anchomanes difformis* were each represented by a single individual. The findings reveal that, despite relatively high diversity, urbanization has shifted community structure toward herbaceous dominance at the expense of woody species. Conservation efforts should prioritize rare species and integrate ecologically valuable trees into urban forestry planning.

Key words: Urbanization, urban forestry, deforestation, vegetation cover, biodiversity indices.

INTRODUCTION

Urban forestry, as an intersection of art, science, and technology, emphasizes the sustainable management of vegetation resources in cities to deliver ecological, social, and economic benefits (Konijnendijk et al., 2006). Urban

green spaces, including trees, shrubs, grasses, and other vegetation, contribute significantly to air purification, climate regulation, recreation, and biodiversity conservation (Vogt, 2020; O'Brien et al., 2022). Beyond

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environmental functions, urban vegetation provides essential ecosystem services such as food, medicine, and cultural value (Agbelade et al., 2017; Bolanle-Ojo et al., 2020). Consequently, understanding floristic composition and diversity in urban ecosystems is fundamental for achieving sustainable urban development, particularly in rapidly urbanizing regions. Urbanization exerts immense pressure on green spaces by converting natural habitats into built environments, thereby driving biodiversity loss, habitat fragmentation, and ecosystem degradation (Ancha et al., 2021). The peri-urban interface, where rural and urban systems meet, is especially vulnerable due to land-use conflicts, agricultural intensification, and unregulated expansion (Esio and Igba, 2014). Across Nigeria, studies have documented how unchecked urban growth reduces vegetation cover and alters species composition in cities such as Ibadan (Agbelade et al., 2016), Abuja (Agbelade et al., 2017), and Makurdi (Ikyaagba et al., 2015). These studies reveal that although urban areas continue to harbor diverse plant species, anthropogenic disturbances often result in habitat fragmentation and species homogenization, favoring opportunistic or invasive taxa over native woody species and threatening long-term ecological stability.

In Ogbomoso, southwestern Nigeria, rapid urban expansion has created environmental challenges including air and water pollution, habitat loss, and increased land-use pressure (Akindele, 2017; Makinde and Akiode, 2020; Olaosegba et al., 2022). Despite these pressing issues, research on floristic biodiversity in the town remains very limited. The few previous studies have focused mainly on related environmental themes such as water quality (Bamigboye et al., 2020), land use and climate variability (Akindele, 2017; Ogunbode and Ifabiyi, 2019), and the built environment (Adetunji et al., 2018). To the best of current knowledge, no comprehensive survey of urban and peri-urban floristic diversity in Ogbomoso exists, unlike similar efforts in Ibadan, Abuja, or other Nigerian cities. The paucity of such studies represents a significant knowledge gap. Given Ogbomoso's position within the derived savanna ecological zone, where vegetation is particularly sensitive to disturbance (Oni et al., 2015), the absence of floristic baseline data hinders the ability of researchers, planners, and policymakers to monitor biodiversity changes or design targeted conservation interventions. Furthermore, invasive species such as *Hyptis suaveolens* and *Azadirachta indica* have been reported to dominate degraded ecosystems in southwestern Nigeria (David et al., 2020; Yaradua et al., 2022), yet their extent and ecological significance in Ogbomoso remain undocumented. This challenge underscores the urgent need for local-scale biodiversity studies that can guide effective conservation and urban greening policies.

The present study addresses the identified gap by systematically assessing the floristic biodiversity of urban

and peri-urban locations in Ogbomoso, Nigeria. It provides both qualitative and quantitative insights into species composition, abundance, diversity indices, and ecological values. By comparing urban and peri-urban landscapes, the study highlights patterns of species richness and distribution, identifies dominant and rare species, and evaluates the implications of urbanization on ecological stability. It was hypothesized that peri-urban areas will exhibit greater species richness than urban areas, owing to their relatively lower levels of disturbance. Ultimately, the findings are expected to provide insights into evidence-based conservation strategies and guide sustainable urban planning in Ogbomoso and other rapidly growing cities across the country.

MATERIALS AND METHODS

Study area

This study was conducted in Ogbomoso metropolis, Oyo State, Nigeria. Ogbomoso Geo-Political Zone constitutes five local government areas (LGAs), namely Ogbomoso North, Ogbomoso South, Surulere, Oriire and Ogo-Oluwa LGAs (Ogunbode and Ifabiyi, 2019). Out of the five, only Ogbomoso North and Ogbomoso South LGAs form the nucleus of the metropolis. The study area lies between Latitude 7°55'N and 8°39'N and Longitude 3°05'E and 4°27'E of the Greenwich meridian (Olaosegba et al., 2022) (Figure 1). It is 104 km Northeast of Ibadan, 58 km Northwest of Osogbo, 57 km Southwest of Ilorin (Adegbola et al., 2012). It is approximately 347 m elevation above the mean sea level with land area of 263.832 km². The study area falls in a derived savannah region with two distinct seasons, wet and dry (Oni et al., 2015) and average daily temperature ranging between 25 and 35°C (Olaosegba et al., 2022), agriculture being the main occupation of the residents (Adetunji et al., 2018). With the establishment of Ladoke Akintola University of Technology (LAUTECH) in 1990, the study area has practically undergone transformations on its landscape, a development that would interest an urban ecologist to analyze.

Identification of study locations and study sites

A total of 36 study locations, comprising 14 peri-urban and 22 urban landscapes were identified, visited, and georeferenced between August 2020 and May 2021 (Figure 2). In this study, urban landscape refers to the mosaic of built-up areas, infrastructure, and associated green spaces that constitute the physical environment of Ogbomoso township, covering substantial portions of Ogbomoso North and South LGAs (Figure 2). It integrates residential, commercial, industrial, transportation, and recreational zones, alongside fragmented patches of vegetation such as parks, gardens, street trees, and remnant natural habitats (Forman, 2014). By contrast, peri-urban landscape denotes the transitional zone between rural and urban environments, characterized by mixed land uses including agriculture, settlements, undeveloped land, and expanding infrastructure often marked by rapid land-use change and ecological stress (Simon et al., 2004).

Study locations were selected based on land-use characteristics

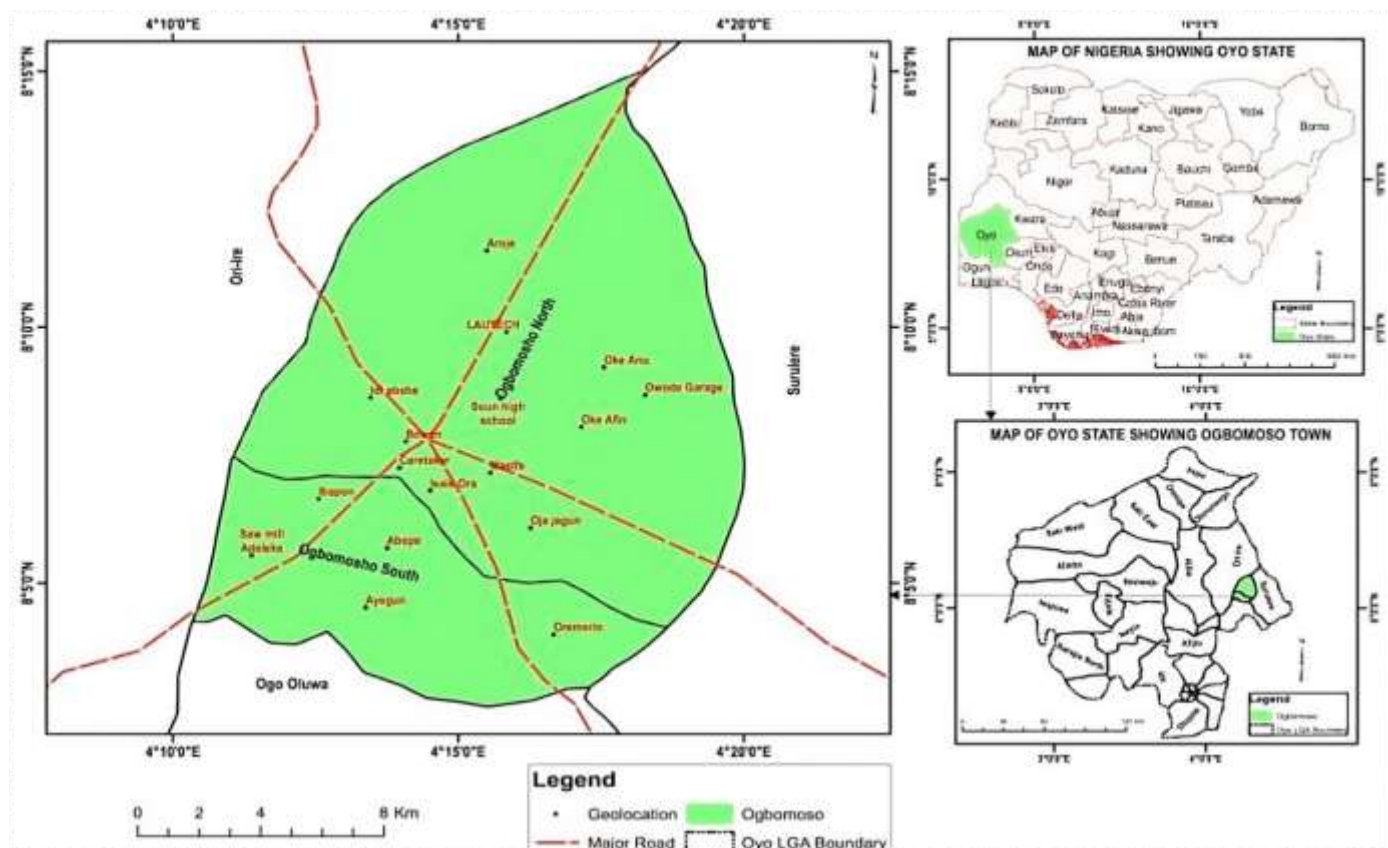


Figure 1. The map of the study area.
Source: Bamigboye et al. (2020).

and accessibility. The 14 peri-urban locations were identified along major and minor exit roads as well as administrative boundaries of Ogbomoso metropolis, representing transitional zones between urban and rural environments. The 22 urban locations were purposively selected within Ogbomoso North and South LGAs, guided by the presence of visible vegetation within the built-up areas, while deliberately avoiding highly disturbed sites devoid of plant cover. This approach enabled the capture of biodiversity patterns across a gradient of anthropogenic pressures and fragmented vegetation habitats. Within these locations, a total of 50 sampling plots were established for vegetation analysis: 28 in the peri-urban areas and 22 in the urban areas. Each peri-urban location was represented by two randomly selected study sites to maximize inclusion of naturally occurring plant populations, whereas each urban location was represented by a single study site owing to the discontinuities in natural plant populations within the urban landscape.

Determination of qualitative and quantitative features of the vegetation

Vegetation sampling was carried out by visiting the selected study locations. At each site, a 20 m × 20 m (400 m²) plot was established to provide adequate space for capturing trees and shrubs. In addition, five 1 m × 1 m subplots were delineated, one at each of the four corners and one at the center of the main plot to facilitate

the sampling of annual species (Sewale and Mammo, 2022). Each sampling point in the peri-urban sites was located at least 100 m away from the forest or bush margin, while avoiding crop farms and plantations. Within each plot, all encountered plant species were identified using reference materials available at the Herbarium of Ladoké Akintola University of Technology, Ogbomoso, Nigeria. Furthermore, the number of individuals of each species was counted and recorded from the 400 m² plots (for trees and shrubs) and 1 m² subplots (for annuals), as appropriate. Within each subplot, the presence of any visible portion of an annual plant of the runner lifeform was recorded as an occurrence. However, for counting the number of individuals of a species, the presence of the plant's root within the subplot was required.

Species diversity analysis

The qualitative and quantitative data obtained from vegetation analysis were used to calculate the species diversity of the study area, thus providing quantitative description of the plant communities. These include the Shannon-Wiener diversity index, Shannon's equitability or evenness index and species richness.

Shannon-Wiener diversity index (H')

The Shannon-Wiener diversity index (H'), which is a measure of the

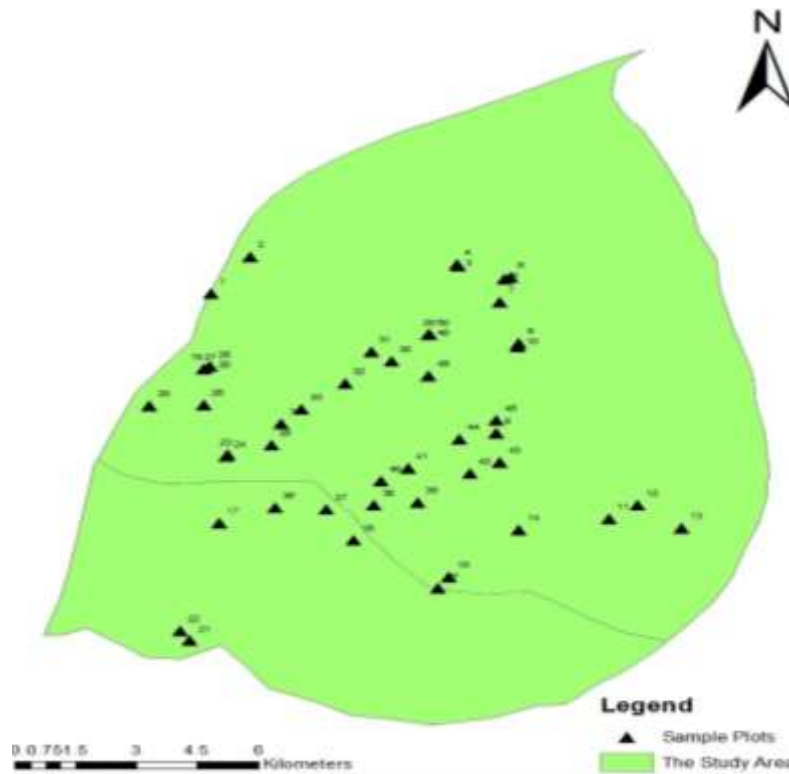


Figure 2. The map of the study area shows spatial distribution of the 36 locations of the sample plots.

diversity of species in a community, was computed for each of the 50 plots using Equations 1 and 2 (Kassa et al., 2016):

$$H' = -\sum_{i=1}^s (P_i \ln P_i)$$

$$P_i = \frac{\text{Number of individuals of a species in a community or quadrat}}{\text{Total number of individuals of all the species in the community or quadrat}}$$

where H' = Shannon-Wiener diversity index; S = the number of species encountered; P_i = the proportion of individuals or abundance of the i th species expressed as a proportion of the total cover; $\ln$ = log base n (natural logarithm).

Shannon's equitability or evenness index (J)

Shannon's equitability index, which is a measure of the evenness of species in a community (Joshi et al., 2019), was calculated from the ratio of observed diversity to maximum diversity using Equation 3 (Belay, 2016):

$$J = \frac{H'}{H_{max}} = \frac{H'}{\ln(S)}$$

Where J = evenness; H' = Shannon-Wiener diversity index; H_{max} = maximum possible diversity ($= \ln S$) = species richness; $\ln$ = natural logarithm; S = total number of species in the sample.

Species richness (D)

Species richness, which is the count of the number of different species in a given area (Joshi et al., 2019), was calculated using the Margalef's (1958) index of richness (D) in Equation 4:

$$D = \frac{S-1}{\ln N}$$

where S = Total number of species; N = Total number of individuals. For each of the Shannon-Wiener diversity index, evenness index, and species richness computed, the mean value of the 22 plots was calculated and taken as the overall index for urban locations. Similarly, the mean value of the 28 plots in the peri-urban locations was calculated and taken as the overall index.

Structural analysis of vegetation cover

Structural analysis of the vegetation cover involved calculating the frequency, relative frequency, density, relative density, Importance Value Index (IVI), abundance, and relative abundance of all the plant species encountered:

Frequency and relative frequency

Frequency expresses the degree of occurrence of individual species in an area (Nodza et al., 2021). It is expressed as percentage of occurrence and calculated as follows:

$$\text{Frequency (\%)} = \frac{\text{Total number of plots in which species occurred}}{\text{Total number of plots studied}} \times 100$$

Relative frequency specifies the frequency of a particular species in relation to total frequency of all the species present in the community and this was determined using Equation 6 as follows:

$$\text{Relative Frequency (\%)} = \frac{\text{Frequency of each species}}{\text{Total frequency of all species}} \times 100$$

Density and relative density

Density shows the number of individuals per unit area, and it indicates the statistical strength of a species in a community (Travlos et al., 2018) and this was determined using Equation 7 as follows:

$$\text{Density (No/ha)} = \frac{\text{Number of individuals of a species}}{\text{Total number of plots studied} \times \text{area of each plot (m}^2\text{)}} \times 10,000$$

The proportion of density of species with respect to the total density of all the species within an area is referred to as relative density. It is the numerical strength of a species in relation to the total number of individuals of all species (Joshi et al., 2019):

$$\text{Relative density (\%)} = \frac{\text{Density of a given species}}{\text{Total densities of all species}} \times 100$$

Importance Value Index (IVI)

The IVI indicates the overall importance of each species in the study area (Curtis and McIntosh, 1951) and it is computed as the summation of relative frequency and relative density:

$$\text{IVI} = \text{Relative frequency} + \text{Relative density}$$

Abundance and relative abundance

Abundance denotes the number of individuals of different species in the community per unit area (Joshi et al., 2019), and was determined for all the species using Equation 10:

$$\text{Abundance} = \frac{\text{Total number of individuals of the species}}{\text{Total number of plots in which the species occurred}}$$

Similarly, relative abundance was calculated as the abundance of the species divided by the sum of abundance of all species multiplied by 100 (Equation 11):

$$\text{Relative abundance} = \frac{\text{Abundance of the species}}{\text{Total abundance}} \times 100$$

RESULTS

Floristic composition of the urban and peri-urban locations of Ogbomoso

A total of 144 plant species, belonging to 118 genera and 45 families were encountered across the study area. About 54% of the families recorded from the study area were represented by two or more species, while about

47% were represented by only a single species. The Fabaceae family emerged as the most dominant with 20 species, followed closely by Malvaceae with 15 species. The families Asteraceae and Poaceae exhibited notable diversity with 9 species each; Apocynaceae and Rubiaceae contributed 4 species each, while Anacardiaceae, Combretaceae, Convolvulaceae, Cyperaceae, Loganiaceae, Moraceae, and Sapindaceae each accounted for 3 species each (Appendix 1). A total of 7 families (constituting 16%) were each represented by two species, while the remaining 21 families, constituting 47%, were each represented by a single species.

The genus *Sida* emerged as the most diverse, represented by four species, followed by *Alternanthera* with three species; 11 other genera were represented by two species each, while the remaining plant genera were each represented by a single species. Regarding plant habits, the survey identified 37 species of tree, 25 of shrub, 60 of herbs, 14 of climbers, and 8 of grass, with herbs prevailing as the dominant plant habit (Appendix 1).

Plant species diversity indices

Results indicated that the Shannon-Wiener index of diversity in Plot 16 had the highest diversity of plant species with corresponding $H' = 3.05$ and 38 species while the lowest diversity index was observed in Plot 44 ($H' = 1.60$) having only 12 species. Likewise, Plot 8 had the highest value of evenness with corresponding value of $J = 0.93$ while Plot 6 recorded the lowest evenness with corresponding $J = 0.60$ (Table 1). The Margalef's index of species richness in Plot 16 was the highest with the value of $D = 6.70$ while Plot 44 had the lowest species richness with the value of $D = 2.12$ (Table 1). The results of the Shannon-Wiener diversity index (H') for the urban and peri-urban locations were 2.40 and 2.45 respectively while Shannon's maximum diversity index (H_{max}) were 3.01 and 3.14 for the urban and peri-urban locations respectively. The overall Shannon-Wiener diversity index (H') was 2.42 while the overall Shannon's maximum diversity index (H_{max}) was 3.08 for the study area. The results of the evenness index (or Shannon's equitability) in urban and peri-urban locations were 0.80 and 0.78 respectively while the overall evenness index was 0.79. The results also revealed that Margalef's index of species richness was 3.70 and 4.21 for urban and peri-urban locations respectively while the overall Margalef's index of species richness was 3.96 (Table 2).

Plant species abundance and distribution in the study area

H. suaveolens was observed to have the highest

Table 1. Shannon-weiner plant diversity, evenness index and species richness indices of the study area.

Plot	Locations	Shannon-Weiner's Index (H')	Shannon's maximum (Hmax)	Evenness index (J)	Species richness Index (D)
1	P (08° 10' 33"N; 04° 12' 35"E)	2.56	3.22	0.79	4.01
2	P (08° 11' 14"N; 04° 13' 06"E)	2.26	3.18	0.71	3.66
3	P (08° 11' 04"N; 04° 15' 52"E)	2.03	3.22	0.63	4.05
4	P (08° 11' 06"N; 04° 15' 51"E)	2.69	3.40	0.79	5.11
5	P (08° 10' 50"N; 04° 16' 29"E)	2.10	3.30	0.64	4.43
6	P (08° 10' 51"N; 04° 16' 34"E)	1.71	2.83	0.60	2.78
7	P (08° 10' 24"N; 04° 16' 26"E)	2.33	3.00	0.78	3.43
8	P (08° 07' 59"N; 04° 16' 23"E)	2.45	2.64	0.93	2.73
9	P (08° 09' 38"N; 04° 16' 41"E)	2.14	3.30	0.65	4.50
10	P (08° 09' 35"N; 04° 16' 40"E)	2.61	3.30	0.79	4.78
11	P (08° 06' 24"N; 04° 17' 53"E)	3.01	3.66	0.82	6.59
12	P (08° 06' 39"N; 04° 18' 16"E)	2.67	3.04	0.88	3.86
13	P (08° 06' 13"N; 04° 18' 51"E)	2.74	3.47	0.79	5.40
14	P (08° 06' 11"N; 04° 16' 41"E)	2.25	3.29	0.69	4.48
15	P (08° 10' 33"N; 04° 12' 35"E)	2.21	3.00	0.74	3.35
16	P (08° 11' 14"N; 04° 13' 06"E)	3.05	3.64	0.84	6.70
17	P (08° 11' 04"N; 04° 15' 52"E)	2.74	3.26	0.84	4.55
18	P (08° 11' 06"N; 04° 15' 51"E)	2.66	3.04	0.87	3.82
19	P (08° 10' 50"N; 04° 16' 29"E)	2.34	3.43	0.68	5.21
20	P (08° 10' 51"N; 04° 16' 34"E)	2.77	3.37	0.82	5.35
21	P (08° 10' 24"N; 04° 16' 26"E)	2.14	2.64	0.81	2.58
22	P (08° 07' 59"N; 04° 16' 23"E)	2.07	2.71	0.76	3.05
23	P (08° 09' 38"N; 04° 16' 41"E)	2.32	3.09	0.75	3.80
24	P (08° 09' 35"N; 04° 16' 40"E)	2.08	2.30	0.91	2.38
25	P (08° 06' 24"N; 04° 17' 53"E)	2.61	3.14	0.83	4.04
26	P (08° 06' 39"N; 04° 18' 16"E)	2.49	3.04	0.82	3.69
27	P (08° 06' 13"N; 04° 18' 51"E)	2.68	3.22	0.83	4.60
28	P (08° 06' 11"N; 04° 16' 41"E)	2.76	3.37	0.82	5.04
29	U (08° 05' 19"N; 04° 15' 45"E)	2.55	3.26	0.78	4.74
30	U (08° 05' 07"N; 04° 15' 36"E)	2.34	2.94	0.79	3.56
31	U (08° 06' 19"N; 04° 12' 41"E)	2.55	3.26	0.78	4.75
32	U (08° 06' 00"N; 04° 14' 29"E)	2.58	3.14	0.82	4.32
33	U (08° 09' 10"N; 04° 12' 29"E)	2.35	2.89	0.81	3.45
34	U (08° 09' 13"N; 04° 12' 34"E)	2.62	3.09	0.85	4.10
35	U (08° 04' 09"N; 04° 12' 18"E)	2.19	2.94	0.75	3.32
36	U (08° 04' 19"N; 04° 12' 10"E)	2.44	3.14	0.78	3.92

Table 1. Cont'd.

37	U (08° 07' 35"N; 04° 12' 48"E)	2.55	2.89	0.88	3.18
38	U (08° 07' 33"N; 04° 12' 47"E)	2.04	3.00	0.68	3.59
39	U (08° 08' 29"N; 04° 11' 46"E)	2.40	3.14	0.77	4.16
40	U (08° 08' 30"N; 04° 12' 29"E)	2.43	3.09	0.79	3.88
41	U (08° 09' 10"N; 04° 12' 29"E)	2.47	2.77	0.89	2.99
42	U (08° 09' 13"N; 04° 12' 34"E)	2.43	3.22	0.76	4.35
43	U (08° 09' 48"N; 04° 15' 29"E)	2.08	2.71	0.77	2.77
44	U (08° 09' 18"N; 04° 14' 59"E)	1.60	2.48	0.64	2.12
45	U (08° 09' 29"N; 04° 14' 43"E)	2.54	3.09	0.82	3.77
46	U (08° 08' 54"N; 04° 14' 22"E)	2.43	2.83	0.86	3.14
47	U (08° 08' 25"N; 04° 13' 47"E)	2.39	2.77	0.86	2.87
48	U (08° 08' 09"N; 04° 13' 31"E)	2.53	3.09	0.82	3.74
49	U (08° 07' 45"N; 04° 13' 23"E)	2.41	3.04	0.79	3.57
50	U (08° 06' 36"N; 04° 13' 26"E)	2.77	3.40	0.81	5.06

U = Urban location; P = Peri-urban location.

Table 2. Summary of biodiversity indices of the study area.

Biodiversity indices	Urban	Peri-Urban	Study area (Urban and Peri-Urban)
No. of tree species	25	37	37*
No. of families	14	20	20*
Shannon-Weiner Index (H')	2.40	2.45	2.42**
Maximum diversity index	3.01	3.14	3.08**
Evenness Index	0.80	0.78	0.79**
Margalef's index	3.70	4.21	3.96**

*Values for the urban and peri-urban locations were not mutually exclusive, as the numbers observed in the urban areas were included within the broader counts for the peri-urban zone. Hence, the value for the entire study area was taken as the combined biodiversity metrics. **Mean value of both urban and peri-urban locations of the study area.

population of 2165 individuals, followed by *Sida acuta* with 631 individuals and *Danielia oliveri* with 550 individuals. Conversely, *Albizia adianthifolia*, *Anchomanes difformis*, *Carica papaya*, *Cleome gynandra*, *Hoslundia opposita*, *Kyllinga erecta*, and *Theobroma cacao* were among the species

with the lowest population, each having only one individual (Appendix 2). Analysis of percentage frequency indicated that *A. indica* exhibited the highest percentage frequency (90%) compared to other plant species. In terms of density, expressed as the number of individuals per ha, *H.*

suaveolens recorded the highest value (1,083/ha), followed by *S. acuta* (316/ha) and *D. oliveri* (275/ha). Conversely, density was as low as 1/ha in twelve plant species, including *A. adianthifolia*, *A. difformis*, *C. papaya*, *C. gynandra*, *H. opposita*, *K. erecta*, and *T. cacao*, among others (Appendix

2). *H. suaveolens* also demonstrated the highest relative density of 19.52%, followed by *S. acuta* (5.69%) and *D. oliveri* (4.96%). Conversely, *A. adianthifolia*, *A. difformis*, *C. papaya*, *C. gynandra*, *H. opposita*, *K. erecta*, and *T. cacao* exhibited the lowest relative density values of 0.01% each. Moreover, *H. suaveolens* displayed the highest Importance Value Index (IVI) of 22.73%, further emphasizing its preponderance in the study area. Overall, the most abundant plant species in the study area were *H. suaveolens*, followed by *Digitaria horizontalis*, while species such as *A. adianthifolia*, *A. difformis*, *C. papaya*, *C. gynandra*, *Gmelina arborea*, *H. opposita*, *K. erecta*, *Paullinia pinnata*, *T. cacao* and *Usteria guinensis* were among the least abundant. Within the 50 sampled plots in the study area, *A. indica*, *S. acuta*, *H. suaveolens*, *Tithonia diversifolia*, and *Gomphrena celosoides* were among the most widely distributed species, occurring in 45, 39, 36, 28, and 25 plots, respectively (Appendix 2).

DISCUSSION

Floristic composition of the study area

The results of this study underscore the complex interplay between urbanization and floristic biodiversity in Ogbomoso, reflecting patterns widely documented in other fast-growing tropical cities. The occurrence of 144 species across 45 families indicates a still-rich flora despite increasing anthropogenic pressure, suggesting that urban and peri-urban landscapes can continue to serve as important biodiversity reservoirs when managed effectively. Like observations in Ibadan (Agbelade et al., 2016), and Nairobi (Nyambane et al., 2016), peri-urban zones in Ogbomoso exhibited higher species richness and diversity than urban cores, highlighting their role as ecological buffers mitigating biodiversity loss. This reinforces the need for urban planning strategies that integrate peri-urban green belts and protect remnant vegetation patches as part of broader biodiversity conservation frameworks. The predominance of herbs (42%), especially the overwhelming dominance of *H. suaveolens* reveals a trend toward ecological simplification and the proliferation of disturbance-tolerant or invasive taxa. *H. suaveolens*, a well-documented invasive species in West Africa (David et al., 2020), thrives in disturbed and nutrient-depleted soils, forming dense stands that suppress native species regeneration through allelopathic effects. Its abundance in Ogbomoso reflects intense human disturbance, soil exposure, and habitat fragmentation typical of expanding urban areas. The pattern aligns with findings from urban landscapes along Lagos-Sagamu-Abeokuta expressway (Walter et al., 2023) and in Ashanti region of Ghana (Anning and Yeboah-Gyan, 2007), where invasive or opportunistic

herbs dominate in response to frequent vegetation clearance. From a conservation standpoint, this dominance signals the urgent need for invasive species management programs, ecological restoration of degraded sites, and integration of native plantings in urban greening initiatives to restore functional diversity.

Conversely, the low abundance and restricted distribution of native trees such as *A. adianthifolia*, *D. oliveri*, and *Blighia sapida* demonstrate how urbanization disproportionately affects woody species with longer regeneration cycles; similar declines in native tree populations and measurable tree-cover loss have been documented in other African cities, namely Nairobi (Oloo et al., 2021), Accra (Puplampu and Bofo, 2021), and Lagos (Adeyemi and Shackleton, 2024), underscoring a regional trend of woody-species depletion under rapid urban growth. Ecologically, the decline of native trees reduces canopy cover, habitat heterogeneity, and carbon sequestration potential, which are key elements of urban climate adaptation and ecosystem resilience. Incorporating native and multipurpose trees into urban forestry and landscape design will therefore be essential to counteract homogenization and enhance biodiversity-based ecosystem services.

Several previous studies have reported the dominance of Fabaceae in tropical rainforest ecosystems (Adekunle et al., 2013; Olusola and Oyeleke, 2015; Olajuyigbe and Jeminiwa, 2018; Olajuyigbe and Akwarandu, 2019). Interestingly, Agbelade et al. (2016) found Fabaceae to be the dominant family in both urban and peri-urban areas of Ibadan, Oyo State, Nigeria, which lies at the intersection of the savannah and rainforest. This suggests that Fabaceae is widespread across Nigeria. However, Onyekwelu et al. (2008) did not find Fabaceae in the Queen's forest, Oluwa forest and Elephant forest in tropical rainforest ecosystems, while Salami and Akinyele (2018) only found one species representing the family in Omo Biosphere Reserve in Ogun State, Nigeria. The prevalence and abundance of Fabaceae species may be attributed to their invasive characteristics (Bolanle-Ojo et al., 2020) and effective pollination, dispersal, and germination mechanisms (Dibaba et al., 2022), allowing them to successfully colonize the landscape. Approximately 42% of the recorded plant species in the study area are herbs (Appendix 1), which may be due to the presence of canopy gaps caused by human activities (Dibaba et al., 2022). The relatively low number of tree species compared to herbs suggests a high level of deforestation in the study area.

The study conducted by Dibaba et al. (2022) recorded 38 tree species from 37 genera and 21 families, while the present study found 25 tree species in 24 genera and 14 families in urban locations on the one hand, and 37 tree species in 36 genera and 20 families in peri-urban locations on the other hand. These findings are like those of Abdullahi (2010) in a survey of Yankari Game

Reserve, Bauchi, Nigeria, which recorded that 47 species from 19 families, and Ikyaagba et al. (2015) study in Federal University of Agriculture, Makurdi, Benue State, Nigeria, which recorded 52 tree species in 48 genera and 22 families. Notably, the number of tree species was higher in peri-urban locations of Ogbomoso than in urban locations, contrasting with the findings of Agbelade et al. (2016) in Ibadan, Oyo State, Nigeria, where 54 and 19 tree species were recorded in urban and peri-urban locations, respectively. It is important to note, however, that Agbelade et al. (2016) included only one peri-urban location namely Omi Adio in their study. In most urban vegetation studies, tree species are emphasized not because herbs, grasses, or shrubs are unimportant, but because trees provide a stable, visible, and ecologically meaningful framework for assessing long-term vegetation patterns and ecosystem health in urban and peri-urban landscapes (Liang and Huang, 2023).

The herb species *H. suaveolens* was found to have the highest population of 2165 individuals, relative density of 19.52%, and Important Value Index of 22.73%, making it the most abundant and densely populated species in both urban and peri-urban locations of Ogbomoso. This can be attributed to its invasive nature, which allows it to colonize different types of ecosystems in tropical and sub-tropical regions worldwide (Padalia et al., 2014). According to David et al. (2020), this species has an ecological amplitude and seed dimorphism that enable it to germinate over a wide range of temperatures, leading to year-round seed germination. In the same way, the tree species *A. indica* had the highest frequency (90%) in the study area, making it the most frequent and important plant species. This finding is consistent with that of Yaradua et al. (2022), which found *A. indica* to have the highest frequency in Umaru Musa Yar'Adua University, Katsina, Nigeria. The invasive nature of *A. indica* and its historical uses may have contributed to its floristic richness (Abdullahi and Abba, 2021). The tree produces many fruits that can be easily dispersed by birds, which may be helpful in its spread (Yaradua et al., 2022).

Plant species diversity in the study area

Biodiversity indices are essential for understanding the extent of diversity and abundance of species in built-up environments (Agbelade et al., 2016). These indices enable comparisons between different habitats having scaled diversity and abundance to a common level, with higher values indicating greater species richness (Salami et al., 2018). In this study, the highest Shannon-Weiner's diversity indices were recorded for plots 16, 11, 20 and 50, with values of H' ranging from 3.05 to 2.77, corresponding to 38, 39, 29, and 29 species, respectively (Table 1). This indicates a high level of species diversity in these plots. In contrast, plot 44 had the lowest diversity

index ($H' = 1.60$) with only 12 species, possibly due to anthropogenic, topographic, and/or biological factors. The relatively high species diversity in other plots may be attributed to the existence of environmental gradients/ecological niches that support a diverse biotic community (Sewale and Mammo, 2022). Comparing the results of this study with previous studies, it was found a higher mean value of Shannon-Wiener diversity index (that is, $H' = 2.42$) compared to that of Wakawa et al. (2017) in Gashua, Yobe State, Nigeria (that is, $H' = 1.97$). Also, Margalef's index of species richness in this study (that is, $M = 3.96$) was higher than that of Wakawa et al. (2017) their mean value being $M = 2.52$. The evenness index (Shannon's equitability) was 0.79 in this study (Table 2) compared to 0.38 in theirs. These variations may be due to differences in climatic conditions between the two locations, with the Guinea savannah (that is, Ogbomoso) receiving more rainfall than the Sahel savannah (that is, Gashua) annually (Adeniji et al., 2021). Precipitation is a crucial environmental factor determining vegetation cover and species distribution, which may account for the highlighted differences in biodiversity indices (Abdullahi and Abba, 2021).

The calculated mean Shannon-Wiener diversity index in this study is lower than that reported by Agbelade et al. (2016) in Ibadan, Oyo State, but with a similar evenness index. Another study by Agbelade et al. (2017) found a higher Shannon-Wiener diversity range of 3.56 for urban locations and 2.24 for peri-urban locations in the Federal Capital Territory, Abuja, indicating higher species diversity in those urban centers. The careful planning, management, and planting of trees in Abuja city may have contributed to this finding (Agbelade et al., 2017). Furthermore, the overall Shannon-Wiener index of plant species ($H' = 2.42$) in this study is lower than that reported for tropical forest ecosystems by Ikyaagba et al. (2019), possibly due to increased anthropogenic activity and lack of vegetation protection measures in Ogbomoso town and its surroundings.

Ecological implications of urbanization on floristic diversity

The findings of this study reveal a clear ecological shift in the vegetation structure of Ogbomoso, shaped by the intensity of urbanization. While the presence of 144 plant species across 45 families indicates that floristic diversity is still relatively high, the dominance of herbs (42%) and the overwhelming abundance of *H. suaveolens* (over 2,100 individuals; $IVI = 22.7$) point to ecological simplification driven by anthropogenic disturbance (Akomolafe et al., 2025). The comparatively higher species richness in peri-urban sites ($D = 4.21$) versus urban sites ($D = 3.70$) reflects the buffering role of less-disturbed habitats in sustaining biodiversity, yet the

modest difference in Shannon-Wiener indices (2.45 vs. 2.40) suggests that urban habitats still retain appreciable but increasingly homogenized plant communities. The frequent occurrence of *A. indica* (90% of plots) highlights the spread of naturalized or exotic species that may further alter community composition. From an analytical standpoint, these patterns imply that urbanization is not merely reducing biodiversity but is restructuring it in favor of opportunistic herbs and a few resilient tree species, potentially undermining long-term ecosystem resilience (Moro et al., 2023). Thus, the results underscore the urgent need for policies that counteract biotic homogenization by protecting remnant habitats, promoting native tree planting, and curbing the spread of invasive taxa.

Conclusion

This study provides the first comprehensive assessment of floristic biodiversity across urban and peri-urban landscapes of Ogbomoso, Nigeria.

A total of 144 plant species, representing 118 genera and 45 families, were identified. The Fabaceae family was the most species-rich (20 species), while herbs constituted the dominant growth form, accounting for 42% of all plants, reflecting the impact of deforestation and habitat alteration in the study area. Quantitative analysis revealed that species diversity and richness remain moderately high despite urbanization pressures. The Shannon-Wiener diversity index (H') averaged 2.42 for the entire study area, with slightly higher values in peri-urban sites (2.45) compared to urban sites (2.40). Evenness values were fairly balanced ($J = 0.79$ overall), indicating relatively equitable distribution of species across plots. Species richness, measured by Margalef's index, was greater in peri-urban (4.21) than in urban (3.70) areas, confirming higher ecological stability in less disturbed zones.

In terms of dominance and ecological importance, *H. suaveolens* emerged as the most abundant species with 2,165 individuals (19.5% relative density; $IVI = 22.7$), followed by *S. acuta* and *D. oliveri*, while species such as *A. adianthifolia*, *A. difformis*, and *K. erecta* were rare, each represented by a single individual. Notably, *A. indica* was the most frequently occurring tree species, found in 90% of the plots. Overall, the findings highlight that while floristic biodiversity in Ogbomoso remains relatively rich, urban expansion has significantly altered species composition, favoring opportunistic herbs over native woody species. Conservation interventions should prioritize rare and low-abundance species for protection and reintroduction, while urban greening strategies must integrate ecologically valuable trees to sustain ecosystem services.

CONFLICT OF INTERESTS

The authors have not declared any conflict of interests.

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Appendix 1. Enumeration of the plant species encountered in the study area.

SN	Plant species	Local name (Yoruba)	Family Name	Habit (Locations)
1	<i>Abutilon mauritianum</i> (Jacq.) Medik	Furu/Kawo	Malvaceae	Sh (U, P)
2	<i>Acalypha indica</i> L.	Jinwinnì	Euphorbiaceae	H (U, P)
3	<i>Achyranthes aspera</i> L.	Aboro	Amaranthaceae	H (U, P)
4	<i>Adansonia digitata</i> L.	Osè	Malvaceae	T (P)
5	<i>Agaricus bisporus</i> Burke	Olú	Agaricaceae	H (P)
6	<i>Ageratum conyzoides</i> L.	Imí esú	Asteraceae	H (U, P)
7	<i>Albizia adianthifolia</i> Schumach. & Thonn.	Banabánà	Fabaceae	T (P)
8	<i>Albizia zygia</i> (DC.) J.F Macbr.	Ayinré-weere	Malvaceae	T (U, P)
9	<i>Alchornea laxiflora</i> Benth	Peepe/Ijàn	Euphorbiaceae	Sh (U, P)
10	<i>Alternanthera brasiliana</i> (L.) Kuntze	Oko oru	Amaranthaceae	H (U, P)
11	<i>Alternanthera repens</i> (L.) Link	Dágunró	Amaranthaceae	H (U)
12	<i>Alternanthera sessilis</i> (L.) R. Br. ex DC.	Rèkù-rèkù	Amaranthaceae	H (U)
13	<i>Amaranthus spinosus</i> L.	Tètè elégún	Amaranthaceae	H (U)
14	<i>Amaranthus viridis</i> L.	Tètè `abáláyé	Amaranthaceae	H(U)
15	<i>Anacardium occidentale</i> L.	Kajú	Anacardiaceae	T (U, P)
16	<i>Anchomanes difformis</i> Blume	Ògìrì sákó	Araceae	H (P)
17	<i>Andropogon gayanus</i> Kunth	Òrùwà	Poaceae	H (P)
18	<i>Annona senegalensis</i> Pers.	Àbò/Ibòbò	Annonaceae	T (U, P)
19	<i>Anogeissus leiocarpus</i> (DC.) Guill. & Perr	Àyin	Combretaceae	T (P)
20	<i>Anthocleista djalensis</i> A. Chev.	Sápó	Loganiaceae	T (U, P)
21	<i>Aspilia africana</i> (Pers.) CD. Adams	Yúnyun	Asteraceae	H (U, P)
22	<i>Asystasia gangetica</i> (L.) T. Anderson	Lobiiri	Acanthaceae	H (P)
23	<i>Azadirachta indica</i> A. Juss	Dóngóyàró	Meliaceae	T (U, P)
24	<i>Bidens pilosa</i> L.	Àbéré òlókò	Asteraceae	H (U, P)
25	<i>Biophytum sensitivum</i> (L.) DC.	Ewé ònìyèbíyè	Oxalidaceae	H (U, P)
26	<i>Blighia sapida</i> K.D. Koenig	Ishin	Sapindaceae	T (U, P)
27	<i>Boerhaavia diffusa</i> L.	Ètipònlá	Nyctaginaceae	H (U, P)
28	<i>Borreria verticillata</i> (L) G. Mey.	Ìràwò ilè	Rubiaceae	Sh (U, P)
29	<i>Bridelia ferruginea</i> Benth.	Ìrà	Phyllanthaceae	T (P)
30	<i>Calopogonium mucinoides</i> Desv.	Apàsà dúdú	Fabaceae	C (U, P)
31	<i>Calotropis procera</i> (Aiton) W.T. Aiton	Bomubómú	Apocynaceae	Sh (U)
32	<i>Carica papaya</i> L.	Ìbépè	Caricaceae	T (U)
33	<i>Cassia mimosoides</i> L.	Kíleéfímíse	Fabaceae	H (U, P)
34	<i>Centrosema pubescens</i> Benth.	Èwà ahun	Fabaceae	C (U, P)
35	<i>Chamaecrista rotundifolia</i> (Pers.) Greene	Èpà ilè	Fabaceae	H (U, P)
36	<i>Chromolaena odorata</i> (L.) R.M. King & H. Rob.	Àkintólá	Asteraceae	Sh (U, P)

Appendix 1. Cont'd

37	<i>Cissus araliodes</i> (Hochst.) Planch.	Àbèékánná márùn-un	Vitaceae	C (U, P)
38	<i>Cleome gynandra</i> L.	Èkùyá	Cleomaceae	H (U, P)
39	<i>Cleome viscosa</i> L.	Èkùyá	Cleomaceae	H (U, P)
40	<i>Combretum racemosum</i> P. Beauv	Òkán	Combretaceae	Sh (P)
41	<i>Commelina benghalensis</i> L.	Gòdògbò	Commelinaceae	H (U, P)
42	<i>Corchorus olitorus</i> L.	Èwédú	Malvaceae	H (U, P)
43	<i>Crotalaria retusa</i> L.	Kórópò	Fabaceae	H (U, P)
44	<i>Cyperus esculentus</i> L.	Ofio	Cyperaceae	H (U, P)
45	<i>Dactyloctenium aegyptium</i> (L.) Willd.	Èwà èsìn	Poaceae	G (U, P)
46	<i>Danielia oliveri</i> (Rolfe) Hutch. & Dalziel	Ìyá	Fabaceae	T (U, P)
47	<i>Desmodium adscendens</i> (Sw.) DC.	Èpà-ilè	Fabaceae	H (U, P)
48	<i>Desmodium gangeticum</i> (L.) DC.	Ewé-èmó	Fabaceae	H (U, P)
49	<i>Desmodium tortuosum</i> (Sw.) DC.	-	Fabaceae	H (P)
50	<i>Digitaria horizontalis</i> Wild.	Eeran	Poaceae	G (U, P)
51	<i>Dioscorea bulbifera</i> L.	Ísu emínà	Dioscoreaceae	C (P)
52	<i>Dioscorea dumetorum</i> (Kunth) Pax	Gùdùgú	Dioscoreaceae	C (P)
53	<i>Elaeis guineensis</i> Jacq.	Òpe	Arecaceae	T (U, P)
54	<i>Eleusine indica</i> (L.) Gaertn.	Gbégi	Poaceae	H (U, P)
55	<i>Euphorbia heterophylla</i> L.	Egéle	Euphorbiaceae	H (U, P)
56	<i>Euphorbia hirta</i> L.	Emilè	Euphorbiaceae	H (U, P)
58	<i>Ficus sur</i> Forssk	Òpótó	Moraceae	T (U, P)
59	<i>Fluerya aestuans</i> (L.) Voigt	Olùfiyáfiyá	Urticaceae	H (U, P)
60	<i>Funtumia elastica</i> (Preuss) Stapf	Iré	Apocynaceae	T (U, P)
61	<i>Gliricidia sepium</i> (Jacq.) Kunth ex Walp.	Adagbamaniye	Malvaceae	Sh (U, P)
62	<i>Glyphaea brevis</i> (Spreng.) Monach	Atòrì	Malvaceae	Sh (U, P)
63	<i>Gmelina arborea</i> Roxb	Igi Mèlá	Lamiaceae	T (P)
64	<i>Gomphrena celosioides</i> Mart.	-	Amaranthaceae	H (U, P)
65	<i>Gossypium barbadense</i> L.	Òwú	Malvaceae	Sh (U)
66	<i>Heliotropium indicum</i> L.	Ogberí-àkùko	Boraginaceae	H (U)
67	<i>Hoslundia opposita</i> Vahl	Efinrin-osó	Lamiaceae	H (P)
68	<i>Hymenocardia acida</i> Tul.	Òrúpa	Phyllanthaceae	Sh (U, P)
69	<i>Hyptis suaveolens</i> (L.) Poit.	Jogbo	Lamiaceae	H (U, P)
70	<i>Imperata cylindrica</i> (L.) Raeusch	Èkan	Poaceae	G (U, P)
71	<i>Ipomea triloba</i> L.	-	Convolvulaceae	C (U)
72	<i>Ipomoea asarifolia</i>	Olúgànbe	Convolvulaceae	C (U, P)
73	<i>Jatropha curcas</i> L.	Làpálápá	Euphorbiaceae	Sh (U)

Appendix 1. Cont'd

74	<i>Kigelia africana</i> (Lam.) Benth.	Pàndoró	Bignoniaceae	T (P)
75	<i>Kyllinga erecta</i> Schumach	Dogbodogbo	Cyperaceae	G (P)
76	<i>Lantana camara</i> L.	Èwòn-Agogo	Verbenaceae	Sh (U, P)
77	<i>Lonchocarpus cyanescens</i> Benth.	Èlú	Fabaceae	Sh (U, P)
78	<i>Malvastrum coromandelianum</i> (L.) Garcke	-	Malvaceae	H (U, P)
79	<i>Mangifera indica</i> L.	Mángorò	Anacardiaceae	T (U, P)
80	<i>Maranthes polyandra</i> Benth.	Aara	Chrysobalanaceae	T (P)
81	<i>Margaritaria discoidea</i> (Baill.) Webster	Awé	Phyllanthaceae	T (U, P)
82	<i>Mariascus alternifolius</i> (Lam.) Britton	Alúbòsà èrànko	Cyperaceae	H (U, P)
83	<i>Merremia quinquefolia</i> (L.) Hallier f.	-	Convolvulaceae	C (U, P)
84	<i>Milicia excelsa</i> (Welw) C.C Berg	Ìrókò	Moraceae	T (P)
85	<i>Mimosa pudica</i> L.	Patanmo	Fabaceae	H (U, P)
86	<i>Mitracarpus villosus</i> (Sw.) DC.	Ìràwò ilè	Molluginaceae	H (U, P)
87	<i>Mollugo nudicaulis</i> Lam,	Kújekúje	Molluginaceae	H (U)
88	<i>Momordica charantia</i> L.	Ejìnrín were	Fabaceae	C (U, P)
89	<i>Morinda lucida</i> Benth.	Òrúwo	Rubiaceae	Sh (U, P)
90	<i>Mucuna pruriens</i> (L.) DC.	Yèrèpè	Fabaceae	C (U, P)
91	<i>Newbouldia laevis</i> Seem.	Akòkò	Bignoniaceae	T (P)
92	<i>Ola subscorpioidea</i> Oliv.	Ifon	Olacaceae	Sh (U, P)
93	<i>Oldenlandia corymbosa</i> L.	Abílèré	Fabaceae	H (U, P)
94	<i>Oplismenus burmannii</i> (Retz.) P.Beauv.	Ìté oká	Poaceae	G (U, P)
95	<i>Panicum maximum</i> Jacq.	Ikín	Poaceae	G (U, P)
96	<i>Parkia biglobosa</i> Jacq. Benth.	Ìgbá	Fabaceae	T (U, P)
97	<i>Passiflora foetida</i> L.	-	Passifloraceae	C (U, P)
98	<i>Paullinia pinnata</i> L.	Kàkànselà	Sapindaceae	C (U, P)
99	<i>Pennisetum purpureum</i> Schumach	Èsú fúnfún	Sapindaceae	G (U, P)
100	<i>Phoenix dactylifera</i> L.	Òkùn	Arecaceae	T (U, P)
101	<i>Phyllanthus amarus</i> Schumach & Thonn.	Èyìn olobe	Phyllanthaceae	H (U, P)
102	<i>Phyllanthus muellerianus</i> (Kuntze) Exell	Àrúnjeran	Phyllanthaceae	Sh (P)
103	<i>Physalis angulata</i> L.	Kóròpò	Solanaceae	H (U)
104	<i>Piliostigma thonningii</i> (Schumach.) Hochst.	Abàfè	Fabaceae	T (U, P)
105	<i>Portulaca oleracea</i> L.	Èsísan omodé	Portulacaceae	H (U)
106	<i>Psidium guajava</i> L.	Gílóófà	Myrtaceae	T (P)
107	<i>Rauvolfia vomitoria</i> Afzel.	Asoféyejé	Apocynaceae	Sh (U, P)
108	<i>Richardia scabra</i> L.	-	Rubiaceae	H (U, P)
109	<i>Ricinus communis</i> L.	Làrà/Ewé-làà	Euphorbiaceae	Sh (U, P)
110	<i>Rottboellia cochinchinensis</i> (Lour.) Clayton	Hóolo	Poaceae	H (U, P)
111	<i>Sarcocephalus latifolius</i> (Sm.) E.A. Bruce	Ègbèsì	Rubiaceae	T (U, P)

Appendix 1. Cont'd

112	<i>Scoparia dulcis</i> L.	-	Plantaginaceae	H (P)
113	<i>Securidaca longipedunculata</i> Fresen	Ìpèta	Polygalaceae	T (P)
114	<i>Securinea virosa</i> (Roxb. ex Wild.) Baill.	Ìranjé	Euphorbiaceae	Sh (U, P)
115	<i>Senna obtusifolia</i> (L.) H.S. Irwin & Barneby	Abo réré	Fabaceae	Sh (U, P)
116	<i>Senna siamea</i> (Lam.) H.S. Irwin & Barneby	Ewé Kasíà	Fabaceae	T (U, P)
117	<i>Setaria pallide-fusca</i> (Schumach.) Stapf & C.E. Hubb.	-	Poaceae	G (U)
118	<i>Sida acuta</i> Burm.f	Òsépòtu	Malvaceae	H (U, P)
119	<i>Sida corymbosa</i> (L.) Lam.	Ìsékùtu	Malvaceae	H (U)
120	<i>Sida linifolia</i> Cav.	-	Malvaceae	H (U, P)
121	<i>Sida pilosa</i> Cav.	Eèsínlè	Malvaceae	H (U, P)
122	<i>Smilax hispida</i> Sm.	-	Smilacaceae	C (P)
123	<i>Solanum nigrum</i> L.	Òdú	Solanaceae	Sh (U)
124	<i>Solenostemon monostachyus</i> (P.Beauv.) Briq.	Ìronopolo	Lamiaceae	H (U, P)
125	<i>Spigelia anthemia</i> L.	Apàrán	Loganiaceae	H (U, P)
126	<i>Spilanthes costata</i> DC.	-	Asteraceae	H (P)
127	<i>Spondias mombin</i> L.	Ìyeyè	Anacardiaceae	T (P)
128	<i>Synedrella nodiflora</i> (L.) Gaertn	Àlùgànnbí	Asteraceae	H (U, P)
129	<i>Talinum triangulare</i> (Jacq.) Willd.	Gbúre	Portulacaceae	H (U)
130	<i>Tectona grandis</i> L.f.	Gedù	Lamiaceae	T (U, P)
131	<i>Tephrosia bracteolata</i> DC.	Rorò	Fabaceae	H (P)
132	<i>Terminalia schimperiana</i> Hochst.	Idí-òdàn	Combretaceae	T (U, P)
133	<i>Tetracera alnifolia</i> Willd.	Opòn	Dilleniaceae	Sh (P)
134	<i>Theobroma cacao</i> L.	Kòkó	Malvaceae	T (U)
137	<i>Trema orientalis</i> (L.) Blume	Àferè/Àféfé	Cannabaceae	T (P)
138	<i>Tridax procumbens</i> L.	Ìgbàlódé	Asteraceae	H (U, P)
139	<i>Urena lobata</i> L.	Ìlása omodé	Malvaceae	Sh (U, P)
140	<i>Usteria guineensis</i> A. Chev.	-	Loganiaceae	C (U, P)
141	<i>Vernonia amygdalina</i> Delile	Ewúro	Asteraceae	Sh (U, P)
142	<i>Vitellaria paradoxa</i> C.F. Gaertn	Igi emi	Sapotaceae	T (U, P)
143	<i>Vitex doniana</i> Sweet	Òrì	Lamiaceae	T (U, P)
144	<i>Waltheria indica</i> L.	Koríkòdì/Ewé-epo	Malvaceae	Sh (U, P)

C: Climbers (10%), H: Herbs (42%), Sh: Shrubs (17%), T: Trees (26%), G: Grasses (6%) U: Urban locations; P: Peri-urban locations.

Appendix 2. Some primary ecological parameters of the study area.

S/N	Plant species	No. of individuals	No. of plots species occurred	Frequency (%)	Relative frequency (%)	Density (n/ha)	Relative density (%)	I.V.I	Abundance	Relative abundance (%)
1	<i>Abutilon mauritianum</i>	2 (P,2)	1 (P,1)	2	0.09	1.00	0.02	0.11	2.00	0.21
2	<i>Acalypha indica</i>	85(U,85)	8(U,8)	16	0.71	42.50	0.77	1.48	10.63	1.13
3	<i>Achyranthes aspera</i>	17(U,7; P,10)	2(U,1; P,1)	4	0.18	8.50	0.15	0.33	8.50	0.90
4	<i>Adansonia digitate</i>	3 (P,3)	1(P,1)	2	0.09	1.50	0.03	0.12	3.00	0.32
5	<i>Agaricus bisporus</i>	4(P,4)	1(P,1)	2	0.09	2.00	0.04	0.13	4.00	0.43
6	<i>Ageratum conyzoides</i>	22(U,11; P,11)	5(U,2; P,3)	10	0.45	11.00	0.20	0.65	4.40	0.47
7	<i>Albizia adianthifolia</i>	1(U=0; P=1)	1(P,1)	2	0.09	0.50	0.01	0.10	1.00	0.11
8	<i>Albizia zygia</i>	44 (U,8; P,36)	5(U,2; P,3)	10	0.45	22.00	0.40	0.85	8.80	0.94
9	<i>Alcohomea laxiflora</i>	18 (U,3; P,15)	8(U,1; P,7)	16	0.71	9.00	0.16	0.87	2.25	0.24
10	<i>Alternanthera brasiliana</i>	6(U,3; P,3)	2(U,1; P,1)	4	0.18	3.00	0.05	0.23	3.00	0.32
11	<i>Alternanthera repens</i>	20(U,20)	3(U,3)	6	0.27	10.00	0.18	0.45	6.67	0.71
12	<i>Alternanthera sessilis</i>	149(U,149)	7(U,7)	14	0.63	74.50	1.34	1.97	21.29	2.26
13	<i>Amaranthus spinosus</i>	51(U,51)	4(U,4)	8	0.36	22.50	0.46	0.82	12.75	1.36
14	<i>Amaranthus viridis</i>	14(U,12; P,2)	5(U,4; P,1)	10	0.45	7.00	0.13	0.58	2.80	0.30
15	<i>Anacardium occidentale</i>	99 (U,9; P,90)	19(U,3; P,16)	38	1.70	49.50	0.89	2.59	5.21	0.55
16	<i>Anchomanes difformis</i>	1(P,1)	1(P,1)	2	0.09	0.50	0.01	0.10	1.00	0.11
17	<i>Andropogon gayanus</i>	7(P,7)	1(P,1)	2	0.09	3.50	0.06	0.15	7.00	0.74
18	<i>Annona senegalensis</i>	66 (U,41; P,25)	15(U,7; P,8)	30	1.34	33.00	0.59	1.93	4.40	0.47
19	<i>Anogeissus leiocarpus</i>	53 (P,53)	9(P,9)	18	0.80	26.50	0.48	1.28	5.89	0.63
20	<i>Anthocleista djalensis</i>	50 (U,7; P,43)	15(U,1; P,14)	30	1.34	25.00	0.45	1.79	3.33	0.35
21	<i>Aspilia africana</i>	134(U,30; P,104)	16(U,4; P,12)	32	1.43	67.00	1.21	2.64	8.38	0.89
22	<i>Asystasia gangetica</i>	7(P,7)	1(P,1)	2	0.09	3.50	0.06	0.15	7.00	0.74
23	<i>Azadirachta indica</i>	545 (U,219; P,326)	45(U,18; P,27)	90	4.02	272.50	4.91	8.93	12.11	1.29
24	<i>Bidens pilosa</i>	5(U,5)	3(U=3; P=0)	6	0.27	2.50	0.05	0.32	1.67	0.18
25	<i>Biophytum sensitivum</i>	7(U=0; P=7)	4(P,4)	8	0.36	3.50	0.06	0.42	1.75	0.19
26	<i>Blighia sapida</i>	52 (U,41; P,11)	14(U,9; P,4)	28	1.25	26.00	0.47	1.72	3.71	0.40
27	<i>Boerhaavia diffusa</i>	172(U,117; P,55)	14(U,10; P,4)	28	1.25	86.00	1.55	2.80	12.29	1.31
28	<i>Borreria verticillata</i>	25(P,25)	3(P,3)	6	0.27	12.50	0.23	0.50	8.33	0.89
29	<i>Bridelia ferruginea</i>	30(P,30)	6(P,6)	12	0.54	15.00	0.27	0.81	5.00	0.53
30	<i>Calopogonium mucinoides</i>	155(U,37; P,118)	25(U,8; P,17)	50	2.23	77.50	1.04	3.63	6.20	0.66
31	<i>Calotropis procera</i>	4(U,4)	2(U,2)	4	0.18	2.00	0.04	0.22	2.00	0.21
32	<i>Carica papaya</i>	1(U,1)	1(U,1)	2	0.09	0.50	0.01	0.10	1.00	0.11
33	<i>Cassia mimosoides</i>	162(U,22; P,140)	18(U,5; P,13)	36	1.61	81.00	1.46	3.07	9.00	0.96
34	<i>Centrosema pubescens</i>	33(U,10; P,23)	3(U,1; P,2)	6	0.27	16.50	0.3	0.57	11.00	1.17
35	<i>Chamaecrista rotundifolia</i>	170(U,29; P,141)	15(U,3; P,12)	30	1.34	85.00	1.53	2.87	11.33	1.21
36	<i>Chromolaena odorata</i>	124(U,64; P,60)	23(U,10; P,13)	46	2.05	62.00	1.12	3.17	5.39	0.57
37	<i>Cissus araliodes</i>	4(P,4)	3(P,3)	6	0.27	2.00	0.04	0.31	1.33	0.14
38	<i>Cleome gynandra</i>	1(U,1)	1(U,1)	2	0.09	0.50	0.01	0.11	1.00	0.11
39	<i>Cleome viscosa</i>	4(U,3; P,1)	3(U,2; P,1)	6	0.27	2.00	0.04	0.31	1.33	0.14

Appendix 2. Cont'd

40	<i>Combretum racemosum</i>	6 (P,6)	2(P,2)	4	0.18	3.00	0.05	0.23	3.00	0.32
41	<i>Commelina benghalensis</i>	441(U,119; P,322)	31(U,13; P,18)	62	2.77	220.50	3.98	6.75	14.23	1.51
42	<i>Corchorus olitorus</i>	11(U,5; P,6)	5(U,3; P,2)	10	0.45	5.50	0.10	0.55	2.20	0.23
43	<i>Crotalaria retusa</i>	14(U,1; P,13)	4(U,1; P,3)	8	0.36	7.00	0.13	0.49	3.50	0.37
44	<i>Cyperus esculentus</i>	46(U,29; P,17)	7(U,4; P,3)	14	0.63	23.00	0.41	1.04	6.57	0.70
45	<i>Dactyloctenium aegyptium</i>	155(U,65; P,90)	14(U,8; P,6)	28	1.25	77.50	1.40	2.65	11.07	1.18
46	<i>Danielia oliveri</i>	550(U,49; P,501)	31(U,8; P,23)	62	2.77	275.00	4.96	7.73	17.74	1.89
47	<i>Desmodium adscendens</i>	43(U,6; P,37)	12(U,4; P,8)	24	1.07	21.50	0.39	1.46	3.58	0.38
48	<i>Desmodium gangeticum</i>	206 (U,51; P,155)	22(U,4; P,18)	44	1.96	103.00	1.86	3.82	9.36	1.00
49	<i>Desmodium tortuosum</i>	11 (P,11)	2(P,2)	4	0.18	5.50	0.10	0.28	5.50	0.58
50	<i>Digitaria horizontalis</i>	101(U,20; P,81)	3(U,1; P,2)	6	0.27	50.50	0.91	1.18	33.67	3.58
51	<i>Dioscorea bulbifera</i>	6(P,6)	3(P,3)	6	0.27	3.00	0.05	0.32	2.00	0.21
52	<i>Dioscorea dumetorum</i>	6(P,6)	5(P,5)	10	0.45	3.00	0.05	0.50	1.20	0.13
53	<i>Elaeis guineensis</i>	75(U,20; P,55)	11(U,2; P,9)	22	0.98	37.50	0.68	1.66	6.82	0.73
54	<i>Eleusine indica</i>	62(U,4; P,57)	8(U,1; P,7)	16	0.71	31.00	0.56	1.27	7.75	0.82
55	<i>Euphorbia heterophylla</i>	8(P,8)	3(P,3)	6	0.27	4.00	0.07	0.34	2.67	0.28
56	<i>Euphorbia hirta</i>	15(P,15)	2(P,2)	4	0.18	7.50	0.14	0.32	7.50	0.80
57	<i>Ficus exasperata</i>	54(U,41; P,13)	7(U,3; P,4)	14	0.63	27.00	0.49	1.12	7.71	0.82
58	<i>Ficus sur</i>	26(U,5; P,21)	10(U,2; P,8)	20	0.89	13.00	0.23	1.12	2.60	0.28
59	<i>Fluerya aestuans</i>	9(U,9)	1(U,1)	2	0.09	4.50	0.08	0.17	9.00	0.96
60	<i>Funtumia elastica</i>	19(U,4; P,15)	4(U,2; P,2)	8	0.36	9.50	0.17	0.53	4.75	0.51
61	<i>Gliricidia sepium</i>	9(P,9)	4(P,4)	8	0.36	4.50	0.08	0.44	2.25	0.24
62	<i>Glyphaea brevis</i>	2(P,2)	1(P,1)	2	0.09	1.00	0.02	0.11	2.00	0.21
63	<i>Gmelina arborea</i>	7(P,7)	7(P,7)	14	0.63	3.50	0.06	0.69	1.00	0.11
64	<i>Gomphrena celosioides</i>	396(U,200; P,196)	25(U,15; P,10)	50	2.23	198.00	3.57	5.80	15.84	1.68
65	<i>Gossypium barbadense</i>	2(U,2)	1(U,1)	2	0.09	1.00	0.02	0.11	2.00	0.21
66	<i>Heliotropium indicum</i>	10(U,10)	1(U,1)	2	0.09	5.00	0.09	0.18	10.00	1.06
67	<i>Hoslundia opposita</i>	1(P,1)	1(P,1)	2	0.09	0.50	0.01	0.10	1.00	0.11
68	<i>Hymenocardia acida</i>	53 (P,53)	7(P,7)	14	0.63	26.50	0.48	1.11	7.57	0.81
69	<i>Hyptis suaveolens</i>	2165(U,946; P,1219)	36(U,16; P,20)	72	3.21	1082.50	19.52	22.73	60.14	6.40
70	<i>Imperata cylindrica</i>	119(U,100; P,19)	14(U,11; P,3)	28	1.25	59.50	1.07	2.32	8.50	0.90
71	<i>Ipomea triloba</i>	3(U,3)	2(U,2)	4	0.18	1.50	0.03	0.21	1.50	0.16
72	<i>Ipomoea asarifolia</i>	11(U,11)	3(U,3)	6	0.27	5.50	0.10	0.37	3.67	0.39
73	<i>Jatropha curcas</i>	21 (U,21)	4(U=4)	8	0.36	10.50	0.19	0.55	5.25	0.56
74	<i>Kigelia africana</i>	4(P=4)	2(P=2)	4	0.18	2.00	0.04	0.22	2.00	0.21
75	<i>Kyllinga erecta</i>	1(P,1)	1(P,1)	2	0.09	0.50	0.01	0.10	1.00	0.11
76	<i>Lantana camara</i>	194(U,38; P,156)	20(U,9; P,11)	40	1.79	97.00	1.75	3.54	9.70	1.03
77	<i>Lonchocarpus cyanescens</i>	232(U,134; P,98)	23(U,8; P,15)	46	2.05	116.00	2.09	4.14	10.09	1.07
78	<i>Malvastrum coromandelianum</i>	20(U,20)	2(U,2)	4	0.18	10.00	0.18	0.36	10.00	1.06
79	<i>Mangifera indica</i>	18(U,2; P,16)	5(U,2; P,3)	10	0.45	9.00	0.16	0.61	3.60	0.38
80	<i>Maranthos polyandra</i>	7(P,7)	1(P,1)	2	0.09	3.50	0.06	0.15	7.00	0.74

Appendix 2. Cont'd

81	<i>Margaritaria discoidea</i>	3(P,3)	2(P,2)	4	0.18	1.50	0.03	0.21	1.50	0.16
82	<i>Mariscus alternifolius</i>	12(U,12)	3(U,3)	6	0.27	6.00	0.11	0.38	4.00	0.43
83	<i>Merremia quinquefolia</i>	21(U,17; P,4)	6(U,5; P,1)	12	0.54	10.50	0.19	0.73	3.50	0.37
84	<i>Milicia excelsa</i>	5(P,5)	1(P,1)	2	0.09	2.50	0.05	0.14	5.00	0.53
85	<i>Mimosa pudica</i>	10(U,10)	1(U,1)	2	0.09	5.00	0.09	0.18	10.00	1.06
86	<i>Mitracarpus villosus</i>	44(P,44)	9(P,9)	18	0.80	22.00	0.40	1.20	4.89	0.52
87	<i>Mollugo nudicaulis</i>	12(U,6; P,6)	2(U,1; P,1)	4	0.18	6.00	0.11	0.29	6.00	0.64
88	<i>Momordica charantia</i>	5(U,5)	2(U,2)	4	0.18	2.50	0.05	0.23	2.50	0.27
89	<i>Morinda lucida</i>	7(U,1; P,6)	2(U,1; P,1)	4	0.18	3.50	0.06	0.24	3.50	0.37
90	<i>Mucuna pruriens</i>	3(P,3)	2(P,2)	4	0.18	1.50	0.03	0.21	1.50	0.16
91	<i>Newbouldia laevis</i>	2(P,2)	1(P,1)	2	0.09	1.00	0.02	0.11	2.00	0.21
92	<i>Ola subscorpioidea</i>	37(P,37)	4(P,4)	8	0.36	18.50	0.33	0.69	9.25	0.98
93	<i>Oldenlandia corymbosa</i>	333(U,30; P,303)	17(U,2; P,15)	34	1.52	166.50	3.00	4.52	19.59	2.08
94	<i>Oplismenus burmannii</i>	144(U,37; P,117)	8(U,1; P,7)	16	0.71	72.00	1.3	2.01	18.00	1.91
95	<i>Panicum maximum</i>	15(P,15)	2(P,2)	4	0.18	7.50	0.14	0.32	7.50	0.80
96	<i>Parkia biglobosa</i>	42(U,18; P,24)	11(U,3; P,8)	22	0.98	21.00	0.38	1.36	3.82	0.41
97	<i>Passiflora foetida</i>	22(U,7; P,15)	11(U,5; P,6)	22	0.98	11.00	0.20	1.18	2.00	0.21
98	<i>Paullinia pinnata</i>	6(U,1; P,5)	6(U,1; P,5)	12	0.54	3.00	0.05	0.59	1.00	0.11
99	<i>Pennisetum purpureum</i>	34(U,1; P,33)	11(U,1; P,10)	22	0.98	17.00	0.31	1.29	3.09	0.33
100	<i>Phoenix dactylifera</i>	36(U,4; P,32)	7(U,3; P,4)	14	0.63	18.00	0.32	0.95	5.14	0.55
101	<i>Phyllanthus amarus</i>	15(U,9; P,6)	3(U,3; P,1)	6	0.27	7.50	0.14	0.41	5.00	0.53
102	<i>Phyllanthus muellerianus</i>	71(U,7; P,64)	12(U,1; P,11)	24	1.07	35.50	0.64	1.71	5.92	0.63
103	<i>Physalis angulata</i>	29(U,29)	5(U,5)	10	0.45	15.50	0.26	9.71	5.80	0.62
104	<i>Ptilostigma thonningii</i>	82(U,10; P,72)	23(U,5; P,18)	46	2.05	41.00	0.74	2.79	3.57	0.38
105	<i>Portulaca oleracea</i>	9(U,9)	4(U,4)	8	0.36	4.50	0.08	0.44	2.25	0.24
106	<i>Psidium guajava</i>	8(P,8)	3(P,3)	6	0.27	4.00	0.07	0.34	2.67	0.28
107	<i>Rauvolfia vomitoria</i>	130(U,30; P,100)	22(U,8; P,14)	44	1.96	65.00	1.17	3.13	5.91	0.63
108	<i>Richardia scabra</i>	29(U,2; P,27)	4(U,1; P,3)	8	0.36	14.50	0.26	0.62	7.25	0.77
109	<i>Ricinus communis</i>	131(U,131)	12(U,12)	24	1.07	65.50	1.18	2.25	10.92	1.16
110	<i>Rottboellia cochinchinensis</i>	178(U,22; P,156)	17(U,4; P,13)	34	1.52	89.00	1.60	3.12	10.47	1.11
111	<i>Sarcocephalus latifolius</i>	20(U,9; P,11)	9(U,3; P,6)	18	0.80	10.00	0.18	0.98	2.22	0.24
112	<i>Scoparia dulcis</i>	11(P,11)	1(P,1)	2	0.09	5.50	0.10	0.19	11.00	1.17
113	<i>Securidaca longipedunculata</i>	3(U=3; P=0)	1(U=1; P=0)	2	0.09	1.50	0.03	0.12	3.00	0.32
114	<i>Securinega virosa</i>	68 (U,58; P,10)	10(U,7; P,3)	20	0.89	34.00	0.61	1.50	6.80	0.72
115	<i>Senna obtusifolia</i>	64(U,64)	10(U,10)	20	0.89	32.00	0.58	1.47	6.40	0.68
116	<i>Senna siamea</i>	10(U,3; P,7)	2(U,1; P,1)	4	0.18	5.00	0.09	0.27	5.00	0.53
117	<i>Setaria pallide-fusca</i>	12(U,12)	2(U,2)	4	0.18	6.00	0.11	0.29	6.00	0.64
118	<i>Sida acuta</i>	631(U,456; P,175)	39(U,21; P,18)	78	3.48	315.50	5.69	9.17	16.18	1.72
119	<i>Sida corymbosa</i>	16(U,14; P,2)	2(U,1; P,1)	4	0.18	8.00	0.14	0.32	8.00	0.85
120	<i>Sida linifolia</i>	3(P,3)	2(P,2)	4	0.18	1.50	0.03	0.21	1.50	0.16
121	<i>Sida pilosa</i>	19(U,7; P,12)	7(U,2; P,5)	14	0.63	9.50	0.17	0.80	2.71	0.29

Appendix 2. Cont'd

122	<i>Smilax hisipida</i>	3(P,3)	1(P,1)	2	0.09	1.50	0.03	0.12	3.00	0.32
123	<i>Solanum nigrum</i>	2(U,2)	1(U,1)	2	0.09	1.00	0.02	0.11	2.00	0.21
124	<i>Solenostemon monostachyus</i>	4(P,4)	1(P,1)	2	0.09	2.00	0.04	0.13	4.00	0.43
125	<i>Spigelia anthermia</i>	14(U,12; P,2)	3(U,2; P,1)	6	0.27	7.00	0.13	0.40	4.67	0.50
126	<i>Spilanthes costata</i>	4(U,2; P,2)	2(U,1; P,1)	4	0.18	2.00	0.04	0.22	2.00	0.21
127	<i>Spondias mombin</i>	22 (P,22)	3(P,3)	6	0.27	11.00	0.2	0.47	7.33	0.78
128	<i>Synedrella nodiflora</i>	135(U,38; P,97)	10(U,6; P,4)	20	0.89	67.50	1.22	2.11	13.50	1.44
129	<i>Talinum triangulare</i>	8(U,8)	3(U,3)	6	0.27	4.00	0.07	0.34	2.67	0.28
130	<i>Tectona grandis</i>	77(U,7; P,70)	9(U,2; P,7)	18	0.80	38.50	0.69	1.49	8.56	0.91
131	<i>Tephrosia bracteolata</i>	28(P,28)	1(P,1)	2	0.09	14.00	0.25	0.34	28.00	2.98
132	<i>Terminalia schimperiana</i>	52(U,2; P,50)	16(U,2; P,14)	32	1.42	26.00	0.47	1.89	3.25	0.35
133	<i>Tetracera alnifolia</i>	15(P,15)	2(P,2)	4	0.18	7.50	0.14	0.32	7.50	0.80
134	<i>Theobroma cacao</i>	1(U,1)	1(U,1)	2	0.09	0.50	0.01	0.10	1.00	0.11
135	<i>Thevetia peruviana</i>	16(U,12; P,4)	2(U,1; P,1)	4	0.18	8.00	0.14	0.32	8.00	0.85
136	<i>Tithonia diversifolia</i>	480(U,270; P,210)	28(U,16; P,12)	56	2.50	240.00	4.33	6.83	17.14	1.82
137	<i>Trema orientalis</i>	4(P,4)	2(P,2)	4	0.18	2.00	0.04	0.22	2.00	0.21
138	<i>Tridax procumbens</i>	76(U,5; P,71)	15(U,3; P,12)	30	1.34	38.00	0.69	2.03	5.07	0.54
139	<i>Urena lobata</i>	193(U,123; P,70)	24(U,18; P,6)	48	2.14	96.50	1.74	3.88	8.04	0.86
140	<i>Usteria guinensis</i>	2(P,2)	2(P,2)	4	0.18	1.00	0.02	0.20	1.00	0.11
141	<i>Vernonia amygdalina</i>	22 (U,10; P,12)	5(U,4; P,1)	10	0.45	11.00	0.20	0.65	4.40	0.47
142	<i>Vitellaria paradoxa</i>	19(U,3; P,16)	9(U,2; P,7)	18	0.80	9.50	0.17	0.97	2.11	0.22
143	<i>Vitex doniana</i>	79(U,3; P,76)	12(U,2; P,10)	24	1.07	39.50	0.71	1.78	6.58	0.70
144	<i>Waltheria indica</i>	19(U,13; P,6)	10(U,5; P,5)	20	0.89	9.50	0.17	1.06	1.90	0.20

U: Urban locations; P: Peri-urban location.