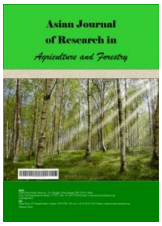

Asian Journal of Research in Agriculture and Forestry

6(4): 29-40, 2020; Article no.AJRAF.61452
ISSN: 2581-7418

Tree Diversity in Urban Parks and Gardens of Ibadan City, Nigeria

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Authors' contributions

This work was carried out in collaboration among all authors. Author OSO designed the study, performed the statistical analysis, wrote the protocol and wrote the first draft of the manuscript. Authors AOO and AFA managed the analyses of the study. Author OSO managed the literature searches. All authors read and approved the final manuscript.

Article Information

DOI: 10.9734/AJRAF/2020/v6i430112
Editor(s):
(1) Dr. Lucia Bortolini, University of Padova, Italy.
(2) Dr. Pierre A. Raoufou Radji, University of Lome, Togo.
Reviewers:
(1) Felipe Kauai, Federal University of Paraná, Brazil.
(2) Marisa Silva Aparicio, Intercultural University, Mexico.
Complete Peer review History: http://www.sdiarticle4.com/review-history/61452

Original Research Article

Received 27 July 2020
Accepted 05 October 2020
Published 06 November 2020

ABSTRACT

Aims: To assess the species diversity of trees in parks and gardens across the urban area of the city of Ibadan.
Study Design: Total enumeration was conducted for data collection; All the trees in the urban parks and gardens were identified. The species similarity and diversity of trees were computed.
Place and Duration of Study: Parks and gardens within the urban area of Ibadan city, Nigeria, Department of Forestry Technology, Federal College of Forestry, Ibadan, Nigeria, Department of Forestry and Wildlife Management, Federal University of Agriculture, Abeokuta, Nigeria, between April, 2019 and March, 2020.
Methodology: The parks and gardens were identified on google earth image. The species and family of all the trees within the parks and gardens were identified. The density, species richness, relative abundance, similarity, diversity and evenness were also estimated. The Shannon-Wiener diversity index, Simpson's diversity index, and Pielou's species evenness index were used in estimating the species diversity.

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Results: The findings reveal a significant species composition of 82 species distributed across 34 families, with *Senna sesame* and Fabaceae being the most abundant species and family respectively. The trees with a population of 2,471 trees are largely dominated by exotic and evergreen species. The species richness, similarity, and diversity were relatively high.
Conclusion: The study provides an opportunity to evaluate the contribution of urban parks and gardens to the ecological integrity and health of a city, thereby serving as essential information for preparing workable conservation strategies.

Keywords: Urban park and garden; urban trees; tree species diversity; Ibadan; Nigeria.

1. INTRODUCTION

Parks and gardens in cities encompass green spaces managed for recreational purposes and form the largest share of publicly available green space for inner-city dwellers [1,2]. They augment the environmental, ecological, and aesthetic richness of a city [3]. They also serve as a depot of intangible or non-market benefits [3]. In many countries most importantly developed countries, parks and gardens provide considerable biodiversity benefits [4] and ecosystem services that have a positive impact on the quality of life, human health and wellbeing [4,5,6]. [7] define urban park and garden as demarcated urban open spaces subjugated by vegetation and water features and usually earmarked for public use. They tend to be characterised by high levels of habitat diversity and microhabitat heterogeneity [8], therefore having a positive impact on biodiversity although their principal role is recreational.

Urban parks and gardens makes available quality habitation for urban flora and fauna [9,10,11,2]. Over the years, they have proven to impact the distribution of biodiversity for numerous taxa and birds in several other cities in Europe, America, Spain and Japan [8,12,13]. For several cities in developing countries, urban parks and gardens specifically serve as the only reference to nature, providing important social and psychological functions that considerably improve the city's quality of life [14,15,16,17,18,1]. Tree species composition of urban parks and gardens often vary widely amongst cities in relation to geographical location, urban history, land area or population [19,20,21,22]. Trees in urban parks and gardens are often characterized by extraordinary levels of diversity and microhabitat heterogeneity [23,11], which contribute several valuable ecosystem services such as water flows or run-off regulation, provision of clean air, cushion microclimatic variations, biodiversity hotspots, better-quality aesthetics value, enhanced recreation, education and learning activities, soil erosion decrease, heat effect and carbon dioxide emissions mitigation, and lesser noise levels [24,25,8,9,4,26,1].

In recent time, there is a growing awareness of the conservation potential of parks and gardens in Ibadan city. The lack of understanding of the biodiversity distributions in these parks and gardens makes it very difficult for the city to plan park and garden conservation strategies. Therefore, there is a need for an assessment of the trees in these parks and gardens. Here we assess the biodiversity and distribution of trees in urban parks and gardens across the urban area of Ibadan city to provide baseline surveys of park and garden tree diversity in this south-western city of Nigeria. Tree species diversity provides the resistance and resilience necessary to ensure the long-term provision of benefits and ecosystem services [27]. Such information is essential to properly evaluate the contribution of parks and gardens to the ecological integrity and health of Ibadan.

This paper addresses the following specific objectives: (1) identification of the species composition of trees within the parks and gardens, and (2) evaluation of the species similarity and diversity of trees within the parks and gardens. This study will thus provide fundamental information essential for planning and preparing an efficient and effective park and garden conservation strategies.

2. MATERIALS AND METHODS

2.1 Study Area

The study was conducted within the urban area of Ibadan, Nigeria. Ibadan is one of the prominent cities in Nigeria, having it extent between latitude 7° 2' N - 7° 44' N and longitudes 3° 30' E - 4° 9' E. The city comprises of 11 local government areas (LGA), with 5 LGAs within the urban area and 6 LGAs within the peri-urban

area. The urban area is more developed (with scanty urban forests/trees) than the peri-urban area. There are five (5) parks and gardens within the urban area; these includes National Museum of Unity, Ibadan Polo Club, Ibadan Golf Club, Ibadan Recreation Centre, and Agodi Garden (Fig. 1). Ibadan city is located at a distance of about 120 km East of the border with the Republic of Benin in the forest zone, close to the boundary between the forest and the Savanna. The elevation of the city ranges from 150 m - 275 m above sea level. The climate of the city is a tropical wet and dry climate with a lengthy wet season. The annual mean minimum and maximum temperature are 21.42^{o}C and 26.46^{o}C respectively. The wet season runs from March through October, though August seem somewhat of a lull in precipitation, while November to February forms the city's dry season, during which it experiences the typical West African harmattan. It receives a mean total rainfall of 1420.06 mm, falling in approximately 109 days. There are two peaks for rainfall, June and September.

2.1.1 National museum of unity

The National Museum of Unity, Ibadan is a Heritage Institution established to manage the nation's heritage. It is located on latitude 7° 23' 11" N and longitude 3° 52' 10" E. It occupies approximately 5.87 hectares. It is devoted to conservation and promotion of the cultural heritage resources of Nigeria. It includes the main complex (where there is the galleries where objects collected from various cultural ethnic groups of Nigeria as well as objects from the south-west Nigeria are exhibited) and the Indigenous Tree Bank (where trees that are peculiar to Nigeria and West Africa sub-region are planted for the purpose of preservation).

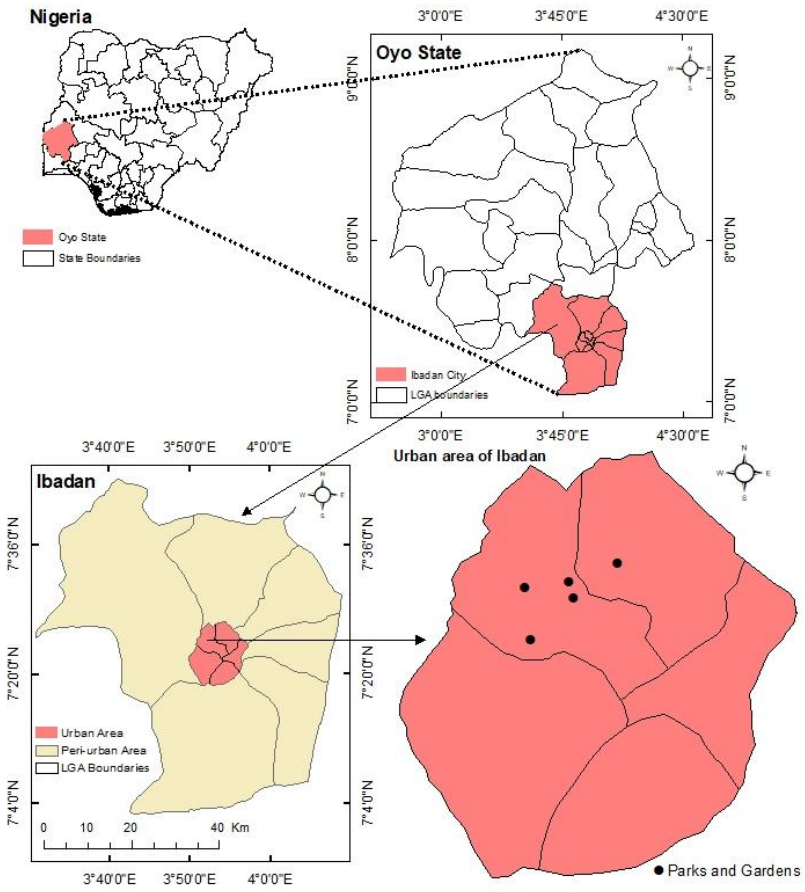

Fig. 1. Location map of the study area, urban area of Ibadan (showing the parks and gardens) in Oyo State, Nigeria

2.1.2 Ibadan polo club

The Ibadan Polo Club was established primarily for the purpose of the game of polo. It is located on latitude 7° 24' 17.19" N and longitude 3° 52' 18.61" E. It is a place where families, friends, and neighbours can relax and enjoy the afternoon watching polo or socializing (celebrating and reconnecting) with friends and family off the field.

2.1.3 Ibadan golf club

The Ibadan Golf Club formed in 1990 as a private members' club not only to encourage and promote the playing of the game of golf, but to promote recreational and social interest of members. It is located on latitude 7° 24' 19.97" N and longitude 3° 52' 55.05" E. It has beautiful turf with significant number of trees suitable for recreation and aesthetic purpose.

2.1.4 Ibadan recreation centre

The Ibadan Recreation Club was established in 1902 for the purpose of recreation and other park activities. It is located on latitude 7° 24' 1.27" N and longitude 3° 53' 3.27" E. It was initially known as Ibadan European Club. The club consists of numerous trees and other state of the art facilities which includes tennis courts, basketball courts, squash court, billiard table, swimming pool, and bar.

2.1.5 Agodi gardens

Agodi Gardens formerly known as Agodi Zoological and Botanical Gardens was established 1967. It is located on latitude 7° 24′ 25″ N and longitude 3° 53′ 57″ E. It is a serene environment on 150 acres (61 ha) of land. The garden consists of diverse tropical trees (for picnics and other social gatherings) and children's facilities including a swimming pool with inflated balloons. Other attractions within the garden includes, Water park, Lake, Mini zoo, Play area and rides.

2.2 Data Collection for Species Composition and Diversity

The parks and gardens were identified with reference to google earth image following [1]. Field studies of the biodiversity in these parks and gardens were carried out. All trees were identified to the species level. The family of the trees, common names of species, type of species, and species phenology was assessed with reference to tree species catalogue prepared by the Herbarium Section, Forestry Research Institute of Nigeria (FRIN). A number of measures of density, species richness, relative abundance, similarity, diversity and evenness were also calculated. The number of individuals of a particular species in all the parks and gardens was used as an indication of density. The number of species indicates species richness, while the percentage of the total number of trees constituted by the species indicate relative abundance. Similarity, diversity and evenness were assessed based on species richness (the number of tree species in each park and garden), relative abundance, and diversity index. The Shannon-Wiener diversity index, Simpson's diversity index, and Pielou's species evenness index were adopted following [28] and [29]. The Shannon–Wiener index indicates the species heterogeneity of a vegetation community, Simpson index describes the probability that a second individual drawn from a population (tree community) should be of the same species as the first, while Evenness index refers to the distribution pattern of the individuals between the species. The adopted indexes are defined as follows;

- The Shannon-Wiener diversity index:

$$H' = -\sum_{i=1}^{R} \mathcal{P}i \ \mathrm{In}\, \mathcal{P}i$$

Where H' is the Shannon-Wiener diversity index, R is the total number of species in the study area, $\mathcal{P}i$ is the proportion of R made up of the *i*th species, and In is the natural logarithm. When all species in the data set are equally common, all $\mathcal{P}i$ values = 1/R and H' = In(R). The more unequal the abundance of species, the larger the weighted geometric mean of the $\mathcal{P}i$ values, the smaller the index. The diversity is termed low if the abundance is dominated by one species (the index will be close to zero) and high If the abundance is dominated by more than one species [30]. If the diversity is low, the uncertainty of prediction is low. However, if diversity is high, uncertainty is high. H' increases as both the number of species increases and as the relative representation of each species in the community becomes more even [31].

- Simpson's Diversity index:

$$D = \sum \left(\frac{n_j (n_j - 1)}{N\,(N-1)} \right)$$

Where D is Simpson's diversity, n_j is the abundance of the ith species, and N is the abundance of the total stand. The value of D ranges from 0 to 1, with 0 representing infinite diversity and 1 representing no diversity. Lower values indicate more diversity while higher values indicate less diversity. As a result of this, D is usually expressed as its inverse (1/D) or its compliment (1-D) so that higher values indicate higher diversity [32].

- Pielou's species evenness index:

$$E_H = H'/H_{max} = H'/In(S)$$

Where E_H is evenness index, H' is the Shannon-Wiener diversity index, S is the total number of species in the community, and In is the natural logarithm. E_H is constrained between 0 and 1. The less evenness in communities between the species (and the presence of a dominant species), the lower E_H is and vice versa.

3. RESULTS AND DISCUSSION

3.1 Species Composition

The composition tree species of urban parks and gardens across the urban area of Ibadan was presented in Table 1, Table 2, and Fig. 2. Table 1 shows the species composition, density and percentage density of trees. A total number of 2,471 trees were identified. The composition consists of 82 species (distributed across 34 families). *Senna sesame* had the highest percentage density with 28.25%, while *Anacardium occidentale, Alstonia boonei, Roystonea regia, Dracaena manni, Dacryodes edulis, Thuja occidentalis, Afzelia Africana, Samanea saman, Irvingia gabonensis, Irvingia wonbolu, Lagerstroemia indica, Melia azeachdarach, Anthiaris toxicaria, Ficus lutea, Ficus thonningiiFicus vogeliana, Moringa oleifera, Bambusa vulgaris, Malacantha alinifolia,* and *Trema orientalis* had the least (0.04%).

Table 2 shows the Attributes of the ten most dominant species of trees. *Senna sesame* has the highest proportion with 3.8, while *Eucalyptus camaldulensis* has the least (0.2). Amongst these dominant species, 6 are exotic and only 4 are indigenous species. Also, 6 are evergreen, while 4 are deciduous species. Furthermore, Fig. 2 shows the number of species within each family. The family of Fabaceae had the highest number of species with 13 species, followed by Moraceae (7), Arecaceae and Myrtaceae (5), Combretaceae, Meliaceae, and Rubiaceae (4), Anacardiaceae and Apocynaceae (3), Annonaceae, Bignoniaceae, Cupressaceae, Irvingiaceae, Lythraceae, Malvaceae, Sapindaceae, Sapotaceae, and Sterculiaceae (2), while Asparagaceae, Asteraceae, Burseraceae, Caricaceae, Casuarinaceae, Euphorbiaceae, Lamiaceae, Lauraceae, Moringaceae, Pinaceae, Poaceae, Strombosia, Rutaceae, Verbenaceae, Ulmaceae, and Urticaceae had the least (1).

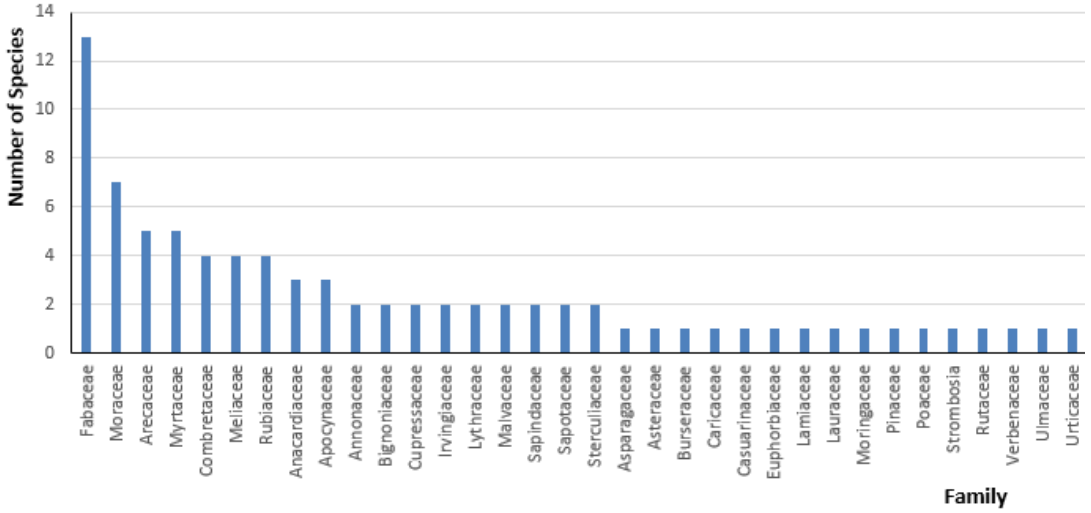

Fig. 2. Family and number of species of trees in parks and gardens within the urban area of Ibadan

Table 1. Tree species composition of parks and gardens in the urban area of Ibadan

S/N	Family	Species	Density	PD (%)
1	Anacardiaceae	*Anacardium occidentale* L.	1	0.04
		Mangifera indica L.	41	1.66
		Spondias mombin L.	6	0.24
2	Annonaceae	*Cleistopholis patens* (Bent.)	5	0.20
		Polyalthia longiflora (Sonn.)	15	0.61
3	Apocynaceae	*Alstonia boonei* De Wild	1	0.04
		Calotropis procera (Aiton)	2	0.08
		Plumeria alba L.	2	0.08
4	Arecaceae	*Archontophoenix alexandrae* (F.Muell.)	3	0.12
		Borassus aethiopum Mart.	2	0.08
		Cocos nucifera L.	11	0.45
		Elaeis guineensis Jacq.	27	1.09
		Roystonea regia (Kunth)	1	0.04
5	Asparagaceae	*Dracaena mannii* Baker	1	0.04
6	Asteraceae	*Vernomia amygdalina* Delile	16	0.65
7	Bignoniaceae	*Newbouldia laevis* (P.Beauv.)	12	0.49
		Tecoma stans (L.)	7	0.28
8	Burseraceae	*Dacryodes edulis* (G.Don)	1	0.04
9	Caricaceae	*Carica papaya* L.	21	0.85
10	Casuarinaceae	*Casuarina equisetifolia* L.	14	0.57
11	Combretaceae	*Terminalia catappa* L.	78	3.16
		Terminalia ivorensis A.Chev.	19	0.77
		Terminalia randii Baker f.	35	1.42
		Terminalia superb Engl.	10	0.40
12	Cupressaceae	*Callitris intratropica* R.T.Baker	2	0.08
		Thuja occidentalis L.	1	0.04
13	Euphorbiaceae	*Hevea brasiliensis* (Willd. ex A.Juss.)	6	0.24
14	Fabaceae	*Afzelia Africana* Pers.	1	0.04
		Albizia adianthifolia (Schum.)	5	0.20
		Albizia lebbeck (L.)	117	4.73
		Cassia senna L.	12	0.49
		Cassia fistula L.	12	0.49
		Delonix regia (Hook.)	271	10.97
		Gliricidia sepium (Jacq.)	59	2.39
		Leucaena leucocephala (Lam.)	27	1.09
		Peltophorum pterocarpum (DC.)	14	0.57
		Piptadeniastrum africanum (Hook.f.)	11	0.45
		Pterocarpus santalinoides DC.	2	0.08
		Samanea saman (Jacq.)	1	0.04
		Senna siamea (Lam.)	698	28.25
15	Irvingiaceae	*Irvingia gabonensis* (Aubry-Lecomte ex O'Rorke)	1	0.04
		Irvingia wonbolu Vermoesen	1	0.04
16	Lamiaceae	*Gmelina arborea* Roxb.	51	2.06
17	Lauraceae	*Persea Americana* Mill.	6	0.24
18	Lythraceae	*Lagerstroemia indica* L.	1	0.04
		Lagerstroemia speciose (L.)	19	0.77
19	Malvaceae	*Bombax buonopozense* P.Beauv.	11	0.45
		Ceiba pentandra (L.)	9	0.36
20	Meliaceae	*Azadirachia indica* A.Juss.	15	0.61
		Cedrela odorata L.	18	0.73
		Khaya senegalensis (Desv.)	3	0.12
		Melia azedarach L.	1	0.04
21	Moraceae	*Antiaris toxicaria* Lesch.	1	0.04

S/N	Family	Species	Density	PD (%)
		Ficus exasperate Vahl	5	0.20
		Ficus benjamina L.	3	0.12
		Ficus lutea Vahl	1	0.04
		Ficus mucuso Welw.ex Ficalho	5	0.20
		Ficus thonningii Blume	1	0.04
		Ficus vogeliana (Miq.)	1	0.04
22	Moringaceae	*Moringa oleifera* Lam.	1	0.04
23	Myrtaceae	*Eucalyptus camaldulensis* Dehnh.	45	1.82
		Melaleuca leucadendra (L.)	43	1.74
		Eucalyptus torelliana F.Muell.	90	3.64
		Psidium guajava L.	8	0.32
		Eucalyptus globulus Labill.	196	7.93
24	Pinaceae	*Pinus caribaea* Morelet	31	1.25
25	Poaceae	*Bambusa vulgaris* Schrad.	1	0.04
26	Sapindaceae	*Blighia sapida* K.D.Koenig	3	0.12
		Lecaviodiscus cupanioides Planch. ex Benth.	4	0.16
27	Sapotaceae	*Chrysophyllum albidum* G.Don	2	0.08
		Malacantha alnifolia (Baker)	1	0.04
28	Sterculiaceae	*Mansonia altissima* (A.Chev)	8	0.32
		Triplochiton scleroxylon K.Schum.	42	1.70
29	Strombosia	*Strombosia pustulata* Oliv	2	0.08
30	Rubiaceae	*Anthocephalus cadamba* (Roxb.)	13	0.53
		Canthium spp Lam.	2	0.08
		Morinda lucida Benth.	10	0.40
		Nauclea diderrichii (De Wild.)	2	0.08
31	Rutaceae	*Citrus sinensis* (L.)	7	0.28
32	Verbenaceae	*Tectona grandis* L.f.	234	9.47
33	Ulmaceae	*Trema orientalis* (L.)	1	0.04
34	Urticaceae	*Musanga cecropioides* R.Br. ex Tedlie	2	0.08
Total	34	82	2471	100

Note: Percentage Density (PD)

Table 2. Attributes of the most frequently encountered tree species in parks and gardens of the urban area of Ibadan

Species	Proportion of trees (across all urban parks and gardens)	Common name	Type of species	Phenology
Terminalia catappa	0.4	Almond tree	Exotic	Evergreen
Albizia lebbeck	0.6	Flea tree	Exotic	Evergreen
Delonix regia	1.5	Flame tree	Indigenous	Deciduous
Gliricidia sepum	0.3	Quick stick	Indigenous	Evergreen
Senna sesame	3.8	Kassod tree	Exotic	Deciduous
Gmelina arborea	0.3	White teak	Exotic	Deciduous
Eucalyptus camaldulensis	0.2	River redgum	Indigenous	Evergreen
Eucalyptus torelliana	0.5	Cadaghi	Indigenous	Evergreen
Eucalyptus globules	1.1	Blue gum oil	Exotic	Evergreen
Tectonia grandis	1.3	Teak	Exotic	Deciduous

3.2 Species Similarity and Diversity

The similarity and diversity of tree species of parks and gardens across the urban area of Ibadan were presented in Tables 3 and 4. Table 3 shows the similarity between paired sites (urban parks and gardens). The similarity varied from 0.34 to 0.63 for all the sites. Agodi garden and Ibadan polo club were relatively more similar (S = 0.63), followed by National museum of unity versus Ibadan golf club (S = 0.57), Ibadan polo club versus Ibadan golf club (S = 0.53), Ibadan

recreation centre versus National museum of unity (S = 0.52), Ibadan recreation centre versus Ibadan golf club (S = 0.45), Agodi garden versus National museum of unity (S = 0.44), Ibadan recreation centre versus Ibadan polo club (S = 0.42), and National museum of unity versus Ibadan polo club (S = 0.42). The least similar pair was Agodi garden and Ibadan recreation centre (0.34).

Table 4 shows the diversity of tree species within the parks and gardens. Agodi garden has the highest species richness (number of species) with 46 species, followed by Ibadan recreation centre (32), Ibadan golf club (31), and National museum of unity (23), while Ibadan polo club has the least (19). Also, Ibadan golf club has the highest density (number of individual trees) with 924, followed by National museum of unity (770), Agodi garden (537), and Ibadan recreation centre (148), while Ibadan polo club has the least (91). Furthermore, National museum of unity has the highest species dominance with 0.746, followed by Ibadan golf club (0.1444), Agodi garden (0.132), and Ibadan polo club (0.107), while Ibadan recreation centre has the least (0.087). Also, Ibadan recreation centre has the highest species diversity with 0.913, followed by Ibadan polo club (0.893), Agodi garden (0.868), and Ibadan golf club (0.856), while National museum of unity has the least (0.254). Ibadan polo club has the highest species evenness with 0.647, followed by Ibadan recreation centre (0.568), Ibadan golf club (0.382), and Agodi garden (0.294), while National museum of unity has the least (0.091).

3.3 Discussion

The results reported above show the tree species composition and diversity of the urban parks and gardens in the urban area of Ibadan city. A total number of 2,471 trees (consisting of 82 species, distributed across 34 families) were identified in 5 urban parks and gardens (Table 1). According to several studies, 2,156 trees representing 34 species was reported in Ijesa region, Nigeria [33], 3757 trees, representing 176 species in Kumasi, Ghana [34], 70 woody species in Accra, Ghana [35], 91 woody species in south-western Mali [36], 86 woody species in Zoundweogo and Nahouri provinces, south-central Burkina Faso [37], 27 woody species in Tembaro District, Southern Ethiopia [38], 168 tree species in Zomba city, Malawi [39], 297 plant species in Lomé, Togo [40], 115,140 trees representing 254 species in Guangzhou, South China [22], 35,909 trees representing 462 species in Christchurch, New Zealand [41], 33,342 trees representing 159 species in Taipei city, Taiwan [42], 771,135 trees representing 414 tree species in Guangzhou, South China [43], and 1,423 trees representing 80 species distributed across 27 families in Bangalore city, India [1].

Table 3. Tree species similarity (Jaccard index) indices of parks and gardens in the urban area of Ibadan

	PG1	PG2	PG3	PG4	PG5
PG1	1	0.34375	0.43478	0.63158	0.41935
PG2		1	0.52174	0.42105	0.45161
PG3			1	0.42105	0.56522
PG4				1	0.52632
PG5					1

Note: Agodi Garden (PG1), Ibadan Recreation Centre (PG2), National Museum of Unity (PG3), Ibadan Polo Club (PG4), and Ibadan Golf Club (PG5)

Table 4. Tree species diversity of parks and gardens in the urban area of Ibadan

	PG1	PG2	PG3	PG4	PG5
Taxa S	46	32	23	19	31
Individuals	537	148	770	91	924
Dominance D	0.132	0.087	0.746	0.107	0.144
Simpson 1-D	0.868	0.913	0.254	0.893	0.856
Evenness e^H/S	0.294	0.568	0.091	0.647	0.382

Note: Agodi Garden (PG1), Ibadan Recreation Centre (PG2), National Museum of Unity (PG3), Ibadan Polo Club (PG4), and Ibadan Golf Club (PG5)

The composition of the ten most common species is dominated by exotic species and evergreen (Table 2). Similarly, many studies have found that the number of exotic species is greater than indigenous species in urban parks and gardens [43,44,45,46,27,1,7,41]. This also suggests that the tree species can survive challenges relating to variation in environmental conditions. [47] noted that exotic species in parks and gardens have a better chance to cope with fluctuating environmental conditions than indigenous species. In addition, the dominance of the exotic species suggests that the species was the most preferred choice of species at the time of planting based on the level of knowledge or technical knowhow and awareness of the individuals involved in the design and establishment of the parks and gardens. According to [48], in a designed landscape, the selection of plants is usually rested upon individual taste and fashion dictates of the period, rather than starting from and following directives determined by the objective of creating a certain space characteristic. People choose, arrange and remodel according to their needs and wishes.

The species richness of the urban parks and gardens is also relatively high (Tables 1 and 4). [42] and [26] also reported high species richness in parks and gardens of the city of Taipei, Taiwan. This further confirms the report of [49], [50], [46], and [51] that parks and gardens in cities are usually characterized with greater species richness. According to [52], a combination of a high incidence of introduced species, socio-economic factors, land use and land cover heterogeneity, and diversity of environmental factors (such as soil and climate diversity) contribute to relatively high levels of species richness in urban and suburban areas. [26] stated that urban parks with site heterogeneity and multiple functions accommodate the highest richness. However, institutional grounds (institutional forest in different districts and land-uses) were reported to have more species than parks in a study of tree species diversity conducted in Guangzhou, China [22].

The species diversity of trees in urban parks and gardens are relatively high (Table 4). [32] reported that higher values of Simpson's diversity index (expressed as its inverse or compliment) imply higher diversity. This also suggests that these trees could enhance multiple urban ecosystem services and stability. According to [53] and [54], high species diversity can optimize multiple ecosystem services and ensure urban tree stability in the face of disturbance. [47] also stated that high species diversity is needed in achieving resilient urban tree stock as an important contributor to urban ecosystem stability, specifically in the face of biotic and abiotic change [55].

4. CONCLUSION

This study attempted to assess the diversity of tree species in urban parks and gardens within the urban area of Ibadan city, Nigeria. The findings reveal an overwhelming species composition of 82 species distributed across 34 families, dominated by exotic and evergreen species. The most dominant tree species and family are *Senna sesame* and Fabaceae respectively. The species similarity varied from 0.34 to 0.63. The species richness and diversity range from 23 to 46 and 0.254 to 0.913 respectively. The diversity assessment of the urban parks and gardens is important because of the biodiversity conservation potential of open green space in urban centres. The study would be useful for policymakers and planners, especially those who are involved in urban landscape management and city planning.

ACKNOWLEDGEMENTS

The authors thank the Department of Forestry and Wildlife Management, Federal University of Agriculture, Abeokuta, Nigeria, and the Department of Forestry Technology, Federal College of Forestry, Ibadan, Nigeria for co-hosting this research and providing initial training.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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