Journal of Forestry Research and Management. Vol. 21(3).43-51; 2024, ISSN 0189-8418

www.jfrm.org.ng

ASSESSMENT OF OPEN-GROWN TREE SPECIES ON INSTITUTIONAL PROPERTIES IN IBADAN SOUTH WEST LOCAL GOVERNMENT

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ABSTRACT

Urban green spaces, adorned with trees shape community character and enhance aesthetics in streets, parks, and institutions, and alsoprovide habitats for wildlife. Open-grown trees, in dispersed woodlands, play a crucial role in maintaining ecological balance amid crowded urban environments. This research investigated the species composition, structure, and diversity of open-grown trees on Institutional properties in Ibadan South West Local Government Area of Oyo State, Nigeria, to better understand the ecological contributions of these trees to the local environment. Seventeen institutions within Ibadan South West Local Government were purposively selected for the study. Open-grown tree species were identified and enumerated using a systematic approach, beginning with Google Earth imagery followed by subsequent on-the-ground verification and enumeration. The study also assessed the total number of trees, diameter at breast height (DBH), and total height across the institutions. The enumeration process resulted in the identification of a total of 404 open-grown trees where a total of 32 tree species belonging to 17 families were identified. *Terminalia catapa* emerged as the most prevalent species with 90 individuals and *Fabaceae* exhibited the highest family frequency (9).YMCA Multipurpose Hall had the highest value in all (49, 45.43m and 505.1m) respectively revealing variations in tree abundance and dimensions. The study highlights the importance of open-grown trees in urban areas, emphasizing their role in biodiversity conservation and sustainable urban management.

Keywords: Urban-forestry,Institutional properties, Tree species diversity, Open-grown trees

Introduction

Trees, defined as perennial plants with an elongated stem or trunk supporting branches and leaves, are a fundamental aspect of our global environment, with an estimated 3 trillion mature trees worldwide (Crowther *et al.,* 2015). Beyond their sheer abundance, trees play a pivotal role in shaping the character of communities, contributing to the creation of serene, aesthetically pleasing surroundings in streets, parks, playgrounds, and backyards. They enhance our quality of life by introducing natural elements and providing habitats for wildlife in urban settings. Acknowledged as a significant component of urban green spaces, trees play a crucial role in enhancing street aesthetics, thereby contributing to the creation of a more favourable urban environment (Adeyemi and Adesoye, 2016). Thechoice,selection, nature, arrangement and distribution of trees depend on people's tastes and fashion (Olokeogun *et al*., 2020).

Open-grown trees,situated in widely spaced woodlands where individual trees experience minimal competition and exhibit distinctive

characteristics (Nowak *et al.*, 2006). Typically, they have a shorter, squat stature, characterized by a fat trunk with a substantial diameter and spreading limbs, some of which grow almost horizontally (Kiran and Kinnary, 2011). Beyond their unique appearance, open-grown trees contribute significantly to maintaining ecological balance in crowded and polluted environments. They excel in providing true shade and create a commanding visual contrast between dense landscaping and open spaces (Green, 2007; Kiran and Kinnary, 2011).

An essential aspect of understanding and managing open-grown trees involves conducting tree inventories. These inventories offer a comprehensive overview of the tree population, aiding in management, comparing species distribution in different areas, and monitoring and managing hazardous trees (Merry-weather, 2001). Assessing open-grown trees is vital for establishing baseline information necessary for sustainable management and conservation. It also helps monitor and improve tree cover while addressing threats that may lead to tree canopy loss (Andersen *et al.*, 2002). Key variables, such as diameter at breast height (DBH) and total height, are measured for each tree, forming the basis for assessing species diversity within a given community (Tuomisto, 2010). This information is invaluable for analysing the impact of environmental change, identifying critical habitats for threatened species, and planning effective strategies for increasing urban tree canopy (Fleishman *et al.*, 2005; USDA, 2018).

Ibadan Southwest Local Government Area, situated in Oyo State, is a prominent area hosting numerous institutional properties, both public and private, such as business parks, schools, and research institutes. Within this locale, diverse tree species exist across various institutions. This research aims to assess open-grown tree species on institutional properties in Ibadan South West Local Government, contributing to our understanding of the urban environment and facilitating informed decision-making for sustainable management and conservation of these valuable natural assets.

Materials and Methods

Study Area

The study purposively selected 17 institutions within Ibadan South West Local Government to comprehensively examine the open-grown tree species in the region and Figure 1 illustrates the map of the study area, providing a visual representation of the selected institutions and their spatial distribution within Ibadan South West Local Government. The selected institutions include:

1. Our Lady of Apostle Secondary School (S1)
2. YoungMen ChristianAssociation(YMCA) Multipurpose Hall (S2)
3. Ring Road State Hospital Adeoyo (S3)
4. Oke-Bola Comprehensive High School (S4)
5. Ibadan Municipal Government (IMG) Grammar School (S5)
6. Ibadan International School (S6)
7. New Covenant Church (S7)
8. Oyo Judiciary Ministry of State Education (S8)
9. College of Animal Health and Production (S9)
10. Institute of Agricultural Research &Technology (IAR&T) (S10)
11. College of Agriculture (Moore Plantation) (S11)

Journal of Forestry Research and Management. Vol. 21(3).43-51; 2024, ISSN 0189-8418
www.jfrm.org.ng

12. Ibadan Special Group House (S12)
13. Best Western Plus Hotel, Ibadan (S13)
14. Premier F.M (S14)
15. State High Court (S15)
16. Muslim Model College, Oke Ado (S16)
17. National Union of Journalists House/Secretariat (S17)

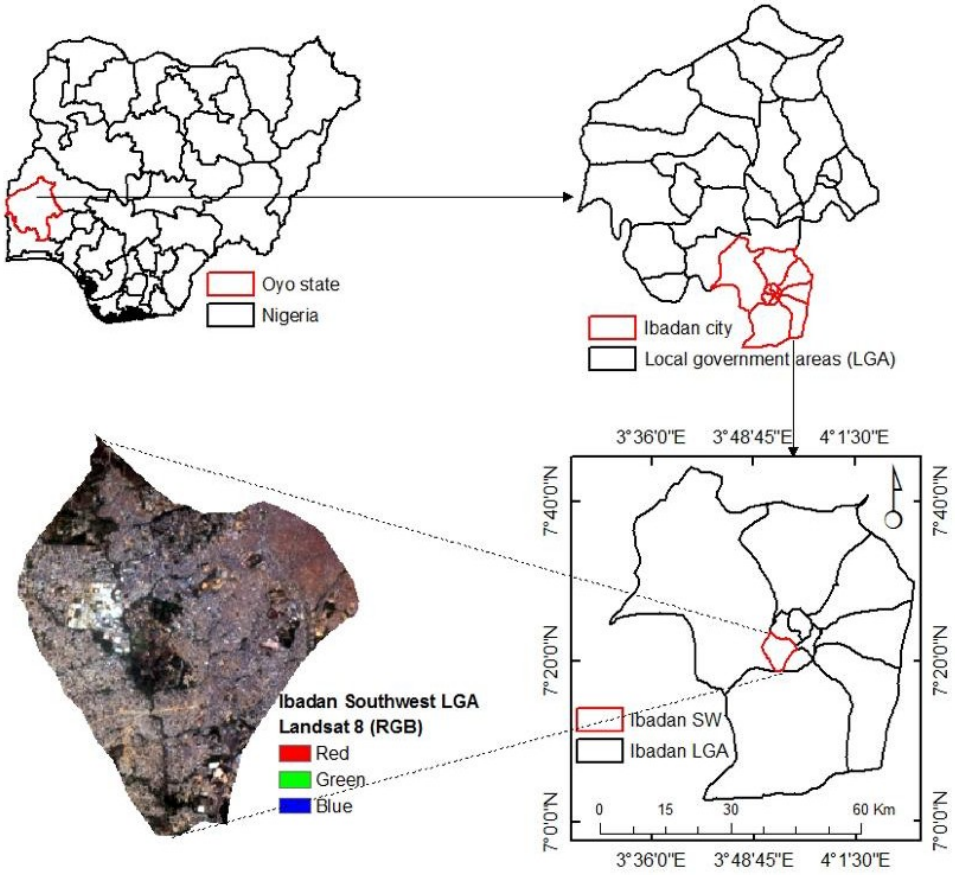


Figure 1: Map showing the study area, Ibadan South West Local Government, Oyo State

Data Collection

The identification and enumeration of open-grown trees were carried out using a systematic approach. Initially, Google Earth images were referenced, guided by the methodology outlined by Nagendra and Gopal (2011). Subsequently, on-the-ground verification and enumeration were conducted through a comprehensive field survey. To ensure accurate identification of tree species, the expertise of a taxonomist familiar with plant identification from the Forest Herbarium Ibadan (FHI), Forestry Research Institute of Nigeria (FRIN), was enlisted. This collaboration facilitated the identification of species and their respective families. Concurrently, essential parameters such as the diameter at breast height (DBH) and total

height (TH) of each tree were meticulously measured.

Diameter at breast height (DBH) measurements were taken at 1.3 meters above ground level using a diameter tape, while the total height (TH) of each species was measured by standing 20 meters away from its base. This approach ensured clear visibility of the tree crown and accurate measurements using appropriate instruments. Species composition was determined by calculating both frequency and percentage frequency, following the methodology outlined by Adeyoju (2001). To assess the overall diversity of the identified species, the study employed the Shannon-Wiener diversity index (H) and Simpson's Diversity index (D), by the methods described by Magurran (2004). These indices provide valuable insights into the variety and abundance of open-grown tree species within the study area, contributing to a comprehensive understanding of the ecological dynamics in Ibadan South West Local Government.

The species diversity used includes:

Shannon-Wiener diversity index:

$$H' = \sum_{pi}^{S} \ln_{i=1}(pi) \quad \ldots\ldots \text{Eqn 1}$$

Where H' is the Shannom-Wiener diversity index, S is the total number of species in the study area,*pi* is the proportion of S made up of the *i*th species and ln is the natural logarithm.

Simpsons Diversity Index:

$$D = \sum \left(\frac{n_i(n_i-1)}{N(N-1)}\right) \quad \ldots\ldots\ldots\ldots \text{Eqn 2}$$

Where, D= Simpsons diversity, n_i=Abundance of the ith species, N= Abundance of the total stand.

Data Analysis

Data obtained were analysed using descriptive statistics which involve frequency and percentage; results are presented in table and chart.

Results and Discussion

Species composition of open-grown trees on institutional properties

The enumeration process helped in the identification of a total of 404 open-grown trees;a comprehensive overview of the species diversity among open-grown trees, reveals a total of 32 distinct species spanning 17 families with various frequencies as presented in Table 1. Noteworthy findings include *Terminalia catappa* emerging as the most prevalent species with 90 individuals, followed by *Azadirachta indica* (63), *Polyalthia longifolia* (56), and *Mangifera indica* (45). *Cassia fistula* and *Tectona grandis* each recorded 19 individuals, while *Anacardium occidentale* had 16. Additionally, *Terminalia radii* (15), *Senna fistula* (11), *Moringa oleifera* (9), and *Senna siamea* (8) contribute to the diverse array. *Eucalyptus camaldulensis* and *Morinda lucida* each account for 7 individuals, with *Gmelina arborea* and *Spondiasmombin* at 5 individuals. Furthermore, *Pinus caribaea* has 4 individuals, *Delonix regia* 3, *Annona muricata* and *Citrus sinensis* 2 each, and 14 other species with a representation of 1 individual each. These findings highlight the richness and diversity of open-grown trees in the study area, providing valuable insights into the local arboreal landscape.Figure2 also depicts family frequency, with Fabaceae exhibiting the highest frequency (9), followed by Anacardiaceae (3), while Annonaceae, Combretaceae, Lamiaceae, Moraceae, and Myrtaceae had a frequency of (2) each. Arecaceae, Bignoniaceae, Malvaceae, Meliaceae, Moringaceae, Pinaceae,

Rubiaceae, Rutaceae, and Sapindaceae showed the lowest frequency (1).

Table 1: Tree species composition of open-grown trees on institutional properties in Ibadan Southwest Local Government

S/N	Family	Species	Frequency	Percentage
1	Anacardiaceae	*Anacardium occidentale*	16	3.96
		Mangifera indica	45	11.14
		Spondiasmombin	5	1.24
2	*Annonaceae*	*Annona muricata*	2	0.50
		Polyalthia longifolia	56	13.86
3	*Apocynaceae*	*Alstoniaboonei*	1	0.25
4	*Arecaceae*	*Cocoa nucifera*	1	0.25
5	*Bignoniaceae*	*Newbouldialaevis*	1	0.25
6	*Combretaceae*	*Terminalia catapa*	90	22.28
		Terminalia radii	15	3.71
7	*Fabaceae*	*Albizia adiantifolia*	1	0.25
		Albizia lebbeck	1	0.25
		Cassia fistula	19	4.70
		Delonix regia	3	0.74
		Gliricidiasepium	1	0.25
		Leucaena leucocephala	1	0.25
		Peltophorumafricanum	1	0.25
		Senna fistula	11	2.72
		Senna siamea	8	1.98
8	*Lamiaceae*	*Gmelina arborea*	6	1.49
		Tectona grandis	19	4.70
9	*Malvaceae*	*Ceiba pentandra*	1	0.25
10	*Meliaceae*	*Azadirachta indica*	63	15.59
11	*Moraceae*	*Antiaris Africana*	1	0.25
		Ficus exasperate	1	0.25
12	*Moringaceae*	*Moringa oleifera*	9	2.23
13	*Myrtaceae*	*Eucalyptus camaldulensis*	7	1.73
		Psidium guajava	5	1.24
14	*Pineceae*	*Pinus caribaea*	4	0.99
15	*Rubiaceae*	*Morinda lucida*	7	1.73
16	*Rutaceae*	*Citrus sinensis*	2	0.50
17	*Sapindaceae*	*Blighia sapida*	1	0.25
Total	**17**	**32**	**404**	**100**

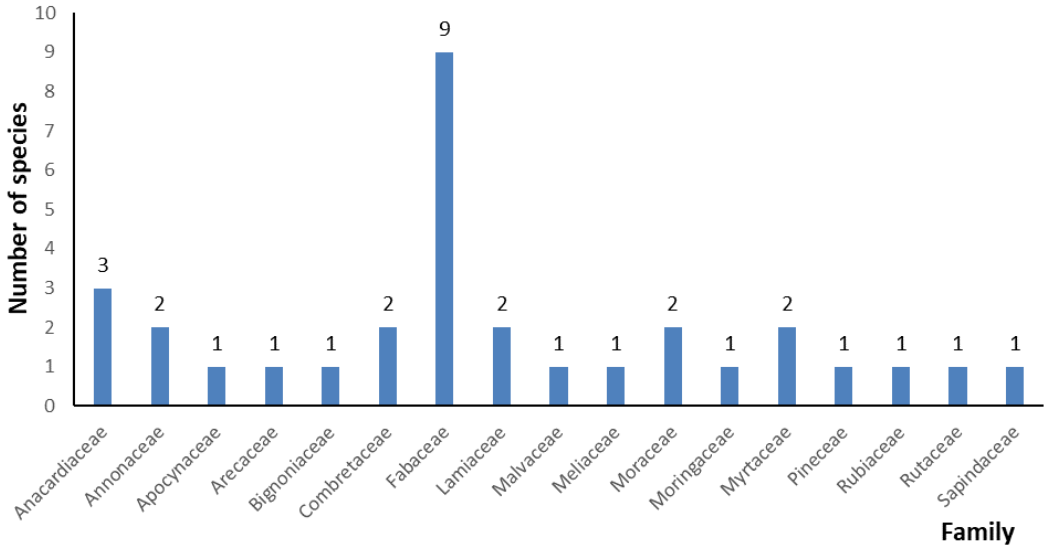


Figure 2: Family and number of species of open-grown trees on institutional properties in Ibadan Southwest local government

The comparative analysis of open-grown trees across institutional properties within the study area, as outlined in Table 2, revealed the total number of trees (TNT), total diameter at breast height (TDBH), and total height (TH) for each property. YMCA Multipurpose Hall boasted the highest total number of trees (49), followed by the College of Animal Health and Production (45), while Premier F.M. had the lowest total number of trees (5). In terms of height, YMCA Multipurpose Hall recorded the highest value (45.43m), followed by the College of Animal Health and Production (44.5m), with Premier F.M. having the lowest height (7.82m).

The findings provide valuable insights into the species composition, structure, and diversity of both avenue and open-grown trees in the study area. The prevalence of open-grown trees, especially dominated by *Terminalia catappa* and *Azadirachta indica*, suggests their effectiveness in diverse environments, a concept supported by Adeyemi and Adesoye (2012) and aligned with their structural value as emphasised by Pretzsch (2014). These species not only contribute to aesthetics but also serve functional roles in environmental and socio-economic uplift, in line with the broader concept of urban forestry (Kohli e*t al.,* 1998).

The identified tree species present a rich collection suitable for aesthetic enhancement, shade provision, and air quality improvement within the institutional setting, aligning with the environmental services highlighted by Agbeja and Akindele (2016). Additionally, the prevalence of species like *Terminalia* spp. can serve as a valuable seed source, further enhancing the diverse ecological and socio-economic contributions of trees to the dynamics of the study area.

Table2: Total number, total diameter at breast height and total height of open-grown trees on each institutional property

S/N	Institutional property (Site)	TNT	TDBH (m)	TH (m)
1	Our Lady of ApostleSecondary School	9	10.72	116.5
2	YMCAMultipurpose Hall	49	45.43	505.1
3	AdeoyoHospital	23	21.35	222.8
4	Oke-BolaComprehensive High School	18	33.01	207.5
5	IMG Grammar School	24	31.75	305.7
6	Ibadan International School	12	14.6	110.4
7	New Covenant Church	11	16.32	132.9
8	Oyo Judiciary Ministry of State Education	20	29.23	238.1
9	College of Animal Health and Production	45	44.5	458.3
10	IAR&T	35	28.28	317.5
11	College of Agriculture (Moore plantation)	35	33.96	352.44
12	Ibadan Special GroupHouse	25	16.25	272.9
13	Best Western PlusHotel, Ibadan	23	11.26	263.2
14	Premier F.M	5	7.82	58.8
15	State High Court	24	38.02	319.6
16	Muslim Model College, Oke-Ado	17	14.66	169.9
17	National Union of Journalists(NUJ)House	29	31.03	392
	Total	**404**	**428.19**	**4443.64**

Species diversity

The species diversity of open-grown trees was meticulously examined and is presented in Table 3. The results indicate a noteworthy prevalence of species diversity among open-grown trees. Specifically, the Shannon-Wiener diversity index (H') and Simpson's Diversity Index (1-D) for open-grown trees were recorded at 5.281 and 0.987, respectively.The observed high species richness and diversity among open-grown trees align with findings reported by IIRS (2002), suggesting that elevated species richness is indicative of heightened diversity values (IIRS, 2002).

Table 3:Diversity indices of the study area

Diversity	Open Grown Trees
Taxa_S	35
Individual	404
Simpson (1-D)	0.987
Shannon (H')	5.281

Numerous studies have consistently reported elevated values for species richness and diversity in tropical forest ecosystems across both urban and rural settings. Notable references include studies by Onyekwelu *et al.* (2008), Adeyemi and Adesoye (2012), Adekunle *et al.* (2013), Agbeladeet *al.* (2016), Olokeogun*et al.* (2017), Olajuyigbe and

Jeminiwa (2018), and Olajuyigbe and Akwarandu (2019). These findings collectively underscore the robust species diversity of open-grown trees, contributing valuable insights to our understanding of ecological dynamics in various settings.

Conclusion

In conclusion, the assessment of open-grown trees on institutional properties in Ibadan South West Local Government reveals a rich diversity of species, emphasizing their significant role in urban environments. *Terminalia catapa* and *Azadirachta indica* dominate the open-grown tree population, showcasing their suitability for open spaces. The variations in total numbers, diameter, and height across different institutions highlight the importance of tailored management strategies. The high species diversity indices affirm the richness and even distribution of open-grown trees. These findings underscore the need for ongoing monitoring, conservation, and strategic planning to ensure the sustainability of these vital natural assets in the urban landscape.

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