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## ASSESSMENT OF FLORA RESOURCES FOR SUSTAINABLE TOURISM DEVELOPMENT IN SELECTED BOTANICAL GARDENS OF SOUTHWESTERN NIGERIA

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**ABSTRACT:** This study determined the diversity and abundance of the plant resources in the natural environment of the selected Botanical Gardens of Southwestern Nigeria. Reconnaissance surveys of botanical gardens were conducted in ten sites across the southwest ecological zone while three were selected based on the major ecological zonation of southwestern Nigeria. The three selected botanical gardens were: The University of Ibadan Botanical Garden, Ibadan, Oyo State (UIBG), Ladoke Akintola University of Technology Botanical Garden, Ogbomosho, Oyo State (LAUTECHBG) and the Lekki Urban Forest and Animal Sanctuary Initiative, Lagos state (LUFASI). On-site observation was used to identify and classify the different plant resources within each of the selected botanical gardens and also to determine the diversity and abundance of the plant resources in the selected botanical gardens. The Simpson Index and Shannon-Weiner Diversity Index were used to quantify species richness and abundance within sites. Statistical analysis of the Community structure across sites was tested using the One-way analysis of variance (ANOVA). The results revealed the floristic composition of botanical gardens of Southwestern Nigeria. In all locations sampled, exotic species of plants used primarily in afforestation projects like *Gmelina aborea*, *Tectonia grandis*, *Azadirachta indica*, *Pinus strata* were recorded. The plant species diversity across sites and the abundance of woody plant species were also recorded. Hence, the role of botanical garden in the conservation of plants and environment cannot be overemphasized. This implied that there is a need to harness the potentials of botanical gardens in nature conservation.

Key words: Flora, species, diversity, abundance, tourism

### 1. INTRODUCTION

The World Tourism Organization (WTO, 2003) defines tourism as the activities of persons travelling to and staying in places outside their usual environment for not more than one consecutive year. For the first time, human beings gathered plants from the nature, and cultivated plants on the fields during the Neolithic period (Deniz, 2014). The first true botanic garden was established in Italy in 1543, at the University of Pisa. The Universities of Florence and Padua soon followed the example set at Pisa and created their own garden in 1545. Rome

established its garden in around 1566 and Bologna in 1567 (Oldfield, 2007).

According to Kuzevanov and Sizykh (2006), botanic gardens are innovative institutions that help in many ways through the introduction of new economically valuable plant species, a friendly and secure environment, an improvement and beautification of settlements, a city greening, a restoration and a repatriation of rare plants, a continuous education and public awareness. Botanic gardens are places dedicated to the collection, cultivation and display of plants. These

are often for research, education, aesthetic and recreational purposes. Botanic gardens are special protected areas with scientific functions such as research and protection, educational functions such as education, training, culture and recreational functions such as eco-tourism, recreation and landscape (Demir, 2012). The need for conservation and sustainable use of biodiversity became globally recognized by botanic gardens in the second half of the twentieth century with many gardens becoming actively engaged in the conservation of rare and threatened plant species. Botanical gardens link plants with the well-being of people, and also help to conserve indigenous and local knowledge, to encourage the sustainable use of plant resources for the benefit of all, as part of sustainable development (Chavez and Sharrock, 2013).

Botanical gardens can contribute to actively changing attitudes and behavior towards the natural World. They have the potential to convey the relevance of plants to human life, and the impact which human lifestyles have upon the natural world, to every part of the societal spectrum (Botanical Gardens Conservation International, 2010). Plants are the key determinant to maintaining the balance of environment and biodiversity and help our ecosystem to achieve its stability. They are essential to support the biodiversity and help us to achieve the sustainable development (Blackmore *et al.*, 2011). These gardens were used for research, often connected to universities, and received plants from returning explorers e.g. the Kew Botanical garden in the Great Britain. The *Aro* hospital in Abeokuta is a typical example in Nigeria which affords a psychiatric patient to enjoy the healing effect from a natural environment.

The role of botanic gardens in sifting the world's flora to present the exquisite, spectacular, bizarre and rare is a powerful one. (Forbes, 2008) Many plants diversity and species have been affected and forced to face extinction, hence, a need to conserve plants through means such as botanical gardens (Donaldson, 2009). The array and variety of plant resources are fast being depleted particularly in areas of high human growth as in the region of Southwestern Nigeria. Botanical/Garden tourism is a type of tourism involving visits or travel to botanical gardens and places which are significant in the history of gardening. Botanic tourists often travel individually in countries with which they are familiar but often prefer to join organized garden tours in countries where they might experience difficulties with language, travel or finding accommodation in the vicinity of the garden (Bhardwaj, 2006). Botanical tourism is defined as a type of tourism which is formed to examine different plant species and their geographical features in the world (Ates *et al.*, 2016).

Although studying plants are not generally enthusiastic practices, visits to locations where we could learn about plants to develop interest in them should be encouraged. The botanical gardens, arboretum and herbarium are the most readily available locations to do this. Nevertheless, the botanical gardens in particular are the most obvious locations to enjoy such visits. Three of such botanical gardens in South Western Nigeria; University of Ibadan Botanical Garden, Oyo State, Ladoke Akintola University of Technology Botanical Garden, Ogbomosho, Oyo State and Lekki Urban Forest and Animal Sanctuary Initiative (LUFASI) Nature Park, Lekki, Lagos State were selected to be studied for the botanical components of their environment. A systematic study of the plant communities of the sites for tourism development will establish baseline information for the development of plant components for tourism purposes in Southwestern Nigeria.

## 2. MATERIALS AND METHODS

### 2.1 Study Area

The study was carried out in three Botanical Gardens of Southwestern Nigeria. These were University of Ibadan (UI) Botanical Garden Oyo State (Figure 1), Ladoke Akintola University of Technology (LAUTECH) Botanical Garden, Oyo State (Figure 2), and Lekki Urban Forest and Animal Sanctuary Initiative (LUFASI) Nature Park, Lekki, Lagos State (Figure 3), Southwestern Nigeria is a region of high population density. It is also regarded as part of hotspots of biodiversity of the Gulf of Guinea (Oates *et al.*, 2004).

The University of Ibadan Botanical Garden's vegetation is rich with diverse species comprising of a wide variety of woody trees, shrubs, collection of herbs, palms and climbers which are well represented (Alarape *et al.*, 2015). The Garden has over the years demonstrated a high sense of commitment to recreation, education, conservation and sustainable environment. The garden has a collection of indigenous plants, economic and ornamental trees, shrubs, herbs, palms and medicinal plant. The weather conditions in Ibadan vary between the two distinct seasons in Nigeria; the rainy season (March-November) and the dry season (November - February (Egbinola and Amobichukwu, 2013). At The UI Botanical Garden, the natural forest is represented at the margin of Ona Stream and could be seen to depict the glimpse representative of the original rainforest of the region. Patches of natural forest were observed at the extreme northern part of the garden where it was designated as Rock Garden Plot. The Bog Plot also appears to be very close to the natural forest.

At the LAUTECH Botanical Garden, the natural forest is a major factor in the management of the garden, well demarcated and regarded as conserved forest. This portion is found along the main stream of the Garden stretching almost the entire bank of the stream on its northern bank. This botanical garden takes after UI botanical garden in layout and planning except that it is relatively very young. It depicts the woodland savanna of the region.

LUFASI Nature Park is a non-governmental organization (NGO) dedicated Biological Garden in an urban hub where people can connect to and interact with nature in Nigeria. LUFASI sits on 20 hectares of land at the Majek area (KM 41) along the Lekki-Epe express way. The natural forest of LUFASI is essentially composed of the coastal line forest vegetation. Some portion of the forest could be said to be at some stages of regeneration from oil palm plantation that dominated the site before the establishment of the site as biological/botanical garden.

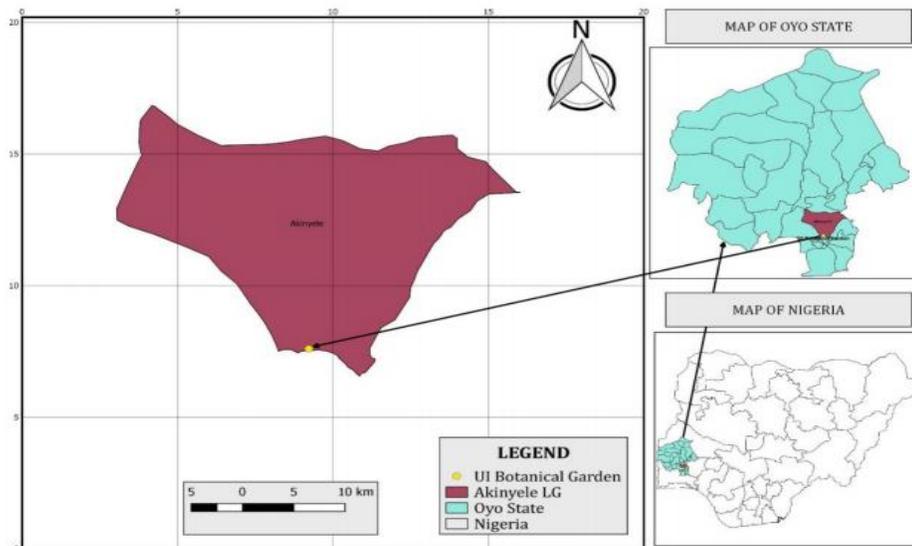


Figure 1: University of Ibadan Botanical Garden  
Source: Field Survey, 2019.

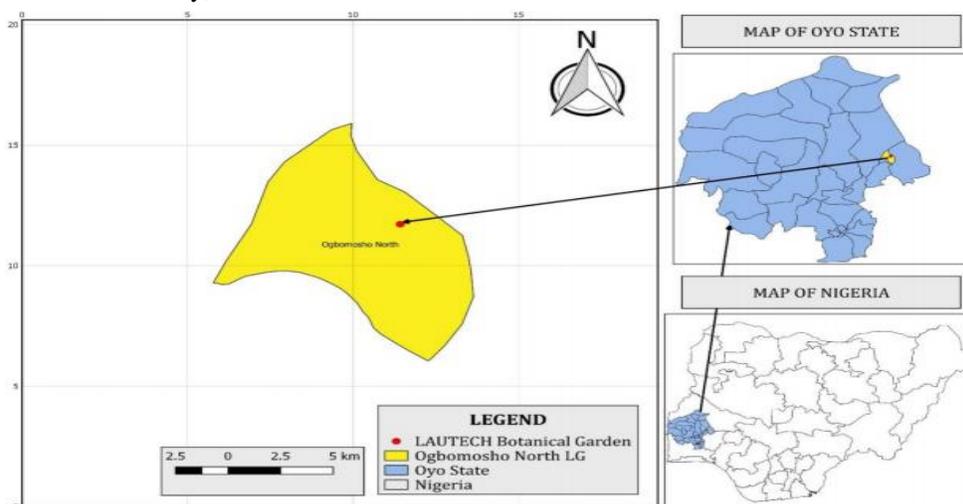


Figure 2: LAUTECH Botanical Garden  
Source: Field Survey, 2019.

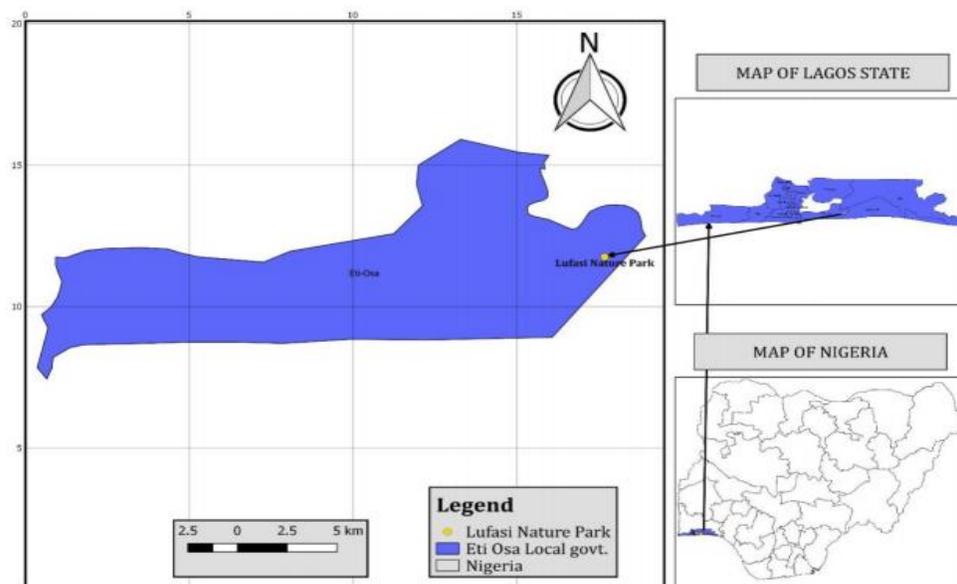


Figure 3: LUFASI Nature Park  
Source: Field Survey, 2019.

## 2.2. Data Collection and Analysis

Reconnaissance surveys of botanical gardens were conducted in ten sites across the Southwest Ecological zone. Site reconnaissance was done to confirm information from garden staff based on the following criteria: Availability of plant collections deliberately acquired for exhibition as botanical resources, general list of plants and approximate number of collections, definite organized way of collection, different sections within the garden, management orientation; as either strictly for research, recreation or both, presence and absence of distinct recreation facilities for the enjoyment of visitors, availability and presence of trained personnel (Curators) on site that can contribute and facilitate learning, absence and presence of visitors.

Based on the listed criteria, a total of ten (10) biological/Botanical gardens were visited for onsite assessment of their plant resources. From the 10 preliminarily assessed, three (3) botanical gardens were selected based on the major ecological zonation of Southwestern Nigeria.

On-site observation was used to identify and classify the different plant resources within each of the selected botanical gardens and also to determine the diversity and abundance of the plant resources in the selected botanical gardens. Most often plants in botanical gardens are labeled thus aiding their identification, nevertheless, not all are labeled, and in some locations labeling were absent. Plant identification therefore relies on available information on the list of the record of the garden and

assistance of the curator. Where there were doubts, identification followed the procedure of Lawrence's (1951) and as described by Key (1989) and Arbonnier Michel (2004). The Raunkier live-form procedure as described by Kershaw (1973) was used to classify plant on the basis of their origin, forms and usefulness. Life form classification involves constructing the biological spectrum of botanical resources of the three selected botanical gardens. This is to test the adaptation of collection to the ecology of the site as reflected by the climatic conditions. The life form is assumed to have evolved in direct response to climatic environment and accordingly, the proportion of life form in an area will give a good indication of its climatic zone.

Three 25×25 m<sup>2</sup> plots of the different segments of the natural forests/conserved forest/herboretum of the botanical gardens were assessed. All tree species that falls within these plots were identified, circumference was measured at breast height and the heights for all enumerated trees were measured using Haga Altimeter. The circumference or girth was calculated as index of productivity of the plant community of each garden site. The Simpson Index and Shannon-Weiner Diversity Index were used to quantify species richness and abundance within sites.

## 3. RESULTS

The species composition of plants in each of the sites expressed the vegetation characteristics of the locations. Table 1 shows the floristic composition of botanical

gardens of Southwestern Nigeria. In the swamp/mangrove environment, *Lophira alata*, *Raphia hokeri*, *Cocos nucifera*, *Rhizophora mangle*, *Avicennia nitida*, *Lovoa trichiliodes* and *Elaeis guineensis* were recorded. In the Rainforest belt, trees in the family *moraceae*, *ulmaceae* and *euphorbiaceae* were predominant while in the savanna environment,

prominent species such as *Khaya senegalensis*, *Vitex doniana*, *Phoenix rectililum*, *Parkia biglobosa*, *Daniela oliveri*, *Cassia spp*, *Ficus exasparata* are often encountered. In all locations sampled, exotic species of plants used primarily in afforestation projects like *Gmelina aborea*, *Tectonia grandis*, *Azadarica indica*, *Pinus strata* were also recorded.

Table 1: Floristic characteristics of Botanical Gardens of Southwestern Nigeria

S/N	Botanical Gardens	Common Characteristic tree species identified	Presence/Absence of recreation facilities	Remark
1	UIBG	<i>Elaeis guineensis</i> , <i>Ficus spp</i> , <i>antiaris</i> , <i>Pterygota macrocarpa</i> , <i>Khaya grandifolia</i> , <i>Triplochyton scleroxylon</i> , <i>Cola gigantean</i>	Picnic facilities available in form of Hall, resting boots and children playing area	Mostly rainforest Characteristic species in preserved environment
2	OAUBG	<i>Albizia sp</i> , <i>Bombas bonopocense</i> , <i>Ceiba pentandra</i> , <i>Ficus spp</i> , <i>Theobrama cacao</i> , <i>Cola spp</i> and <i>Bambusa</i>	Picnic facilities patially available inform of sitting platforms	The site represent characteristic fallow rainforest of Southwestern Nigeria
3	LAUTECHBG	<i>Khaya senegalensis</i> , <i>Vitex doniana</i> , <i>Phoenix rectililum</i> , <i>Parkia biglobosa</i> , <i>Daniela oliveri</i> , <i>Cassia spp</i> , <i>Ficus exasparata</i> , <i>Brachystegia euricoma</i>	Picnic facilities available in form of Hall, resting boots and children playing area	Mostly savanna characteristic species
4	ABG	<i>Gmelina aborea</i> , <i>Tectonia grandis</i> , <i>Elaeis guineensis</i> , <i>Bombas bonoposense</i> , <i>Albizia sp</i> , <i>Ficus spp</i>	Picnic facilities available only inform of drinking and food boots	It is a mixture of exotic plantation and few new native colonizers
5	OZBG	<i>Piptadeniastum africana</i> , <i>Triplicyton scleroxylon</i> , <i>Lovoa tricliodes</i> , <i>Diospyrous spp</i> , <i>Cola gigantea</i> and <i>Ficus spp</i>	Picnic facilities available in form of Hall, resting boots and children playing area	Mostly rainforest characteristic with anthropogenic factors
6	FUNABBG	<i>Gmelina aborea</i> , <i>Tectonia grandis</i> , <i>Elaeis guineensis</i> , <i>Vitex doniana</i> , <i>Albizia sp</i> , <i>Ficus spp</i>	Not available	Exotic plantation species and remnant fallow species savanna rainforest transition
7	LUFASINP	<i>Lophira alata</i> , <i>Alstonia congensis</i> , <i>Raphia hokeri</i> , <i>Cocos nucifera</i> , <i>Rhizophora mangle</i> , <i>Avicennia nitida</i> , <i>Lovoa trichiliodes</i> and <i>Elaeis guineensis</i>	Picnic facilities available in form of Hall, resting boots and children playing area	Mostly coastal forest characteristic species being regenerated from Oilpalm plantation
8	MMBG	<i>Albizia sp</i> , <i>Raphia sp</i> , <i>Elaeis guineensis</i> , <i>Dripetis gilgiana</i> , <i>Myranthus aboreous</i>	Not available	It represent a degraded coastal forest environment
9	AGP	<i>Gmelina aborea</i> , <i>Tectonia grandis</i> , <i>Pinus strata</i> , <i>Casuarina equicentifolia</i> , <i>Elaesi guineensis</i> , <i>Vitex doniana</i> ,	Picnic facilities available in form of Hall, resting boots and children playing area	Mostly exotic species within fragmented fallow forest
10	UNILAGBG	<i>Cocos nucifera</i> , <i>Elaeis guineensis</i> , <i>Spondia monbi</i> , <i>Pinus strata</i> , <i>Casuarina equicentifolia</i> and other exotic species	Picnic facilities patially available inform of sitting platforms	Coastalswamp forest dominated with Mangrove species of

In Table 2, the number of plant species in different sections of UI Botanical Garden are presented. The results revealed that the Herboretum plot had the highest number of plants identified (27) while the children

garden and open field had the lowest number of plants identified (4 each).

Table 2: Plant species represented in different sections of UI Botanical Garden

S/N	Categories of Managerial Sections (Plots)	No of Plants Species Identified
1	Herboretum	27
2	Bog Plot	15
3	Medicinal	11
4	Rock Garden	15
5	Rose Garden	16
6	Ornamental Plants	34
7	Children Garden	4
8	Open Field	4
9	Nursery	25
10	Conserved forest	13

Table 3 shows the number of plant species represented in different sections of LUFASI Nature Park. The natural forest harbors the highest number of plant species (34) while the fern plot has the lowest number of five (5) plant species.

Table 3: Plant species in different sections of LUFASI Nature Park

S/N	Categories of Managerial Sections (Plots)	No of Plants species Identified
1	Nursery	20
2	Ornamentals	17
3	Collections	14
4	Natural Forest	34
5	Regenerating Forest	20
6	Fern Plot	5

Table 4 shows the number of plant species represented in different sections of LAUTECH Botanical Garden. The result showed that Natural/Conserved Plot was composed of the highest number of plant species (32) while open field had the lowest number (10) of plant species identified.

Table 4: Plant species in different sections of LAUTECH Botanical Garden

S/N	Categories of Managerial Sections (Plots)	No of Plants species Identified
1	Natural/Conserved Plot	32
2	Bog Plot	24
3	Medicinal	17
4	Ornamental Plants	28
5	Research Plot	14
6	Open Field/Others	10
7	Admin/Nursery	16

Table 5 shows the plant species diversity across the three study sites. The LAUTECH botanical garden has the highest record of species richness (199) while the LUFASI botanical garden has the lowest species richness (89). The UI botanical garden has the highest species evenness (0.53) while the LUFASI botanical garden has the lowest species evenness (0.72). Furthermore, the UI botanical garden has the lowest species diversity of 2.58 while the LUFASI botanical garden has the highest species diversity (3.42).

Table 5: Plant species diversity across Sites (UI, LUFASI AND LAUTECH Botanical Gardens)

Parameter	UI	LUFASI	LAUTECH
Species Richness	136	89	199
Species Evenness	0.53	0.72	0.55
Species Diversity	2.58	3.42	2.91

Table 6 shows the abundance of the woody plant of the study sites. The LUFASI botanical garden had the highest tree frequency/sample plot (133.5) while the LAUTECH botanical garden had the highest tree density/hectare (1061.3).

Table 6: Woody plant abundance expressed as density/hectare in UI, LUFASI and LAUTECH Botanical Gardens

Parameter	UI	LUFASI	LAUTECH
Tree frequency/sampled plot	36	133.5	66.3
Tree density/hectare	573	712	1061.3

#### 4. DISCUSSION

The level of species diversity found in the study areas agrees with the study of He *et al.* (2005) that the primary purpose of establishing botanical gardens was to collect and preserve medicinal plants. Krishnan and Novy (2016) opined that botanical gardens have served as plant introduction centers. The role of botanical garden in the conservation of plants and environment is supported by Donaldson (2009) that the range of scientific activities conducted by botanical gardens often includes conservation, propagation, horticulture, seed science, taxonomy, systematics, genetics, biotechnology, education, restoration ecology, public education, and much more. In addition, the plant species found in the botanical garden serves not just as shade for visitors but also provoked visitors' interest in getting to know about not just the ecological functions of those plants but also their health and therapeutic effect which captures the educational purpose of sustainable tourism development.

From this study, it could be deduced that the three aforementioned botanical gardens have the required plant species needed to attract more visitors to these gardens. This was made possible because those plant species are species not common around human encroached environment. The influx of visitors into the gardens also confirms that people are more eco-centric in whatever action they take in the environment and this would help push for more plants advocate now and later.

## 5. CONCLUSIONS AND RECOMMENDATIONS

The following conclusions are drawn from this study:

1. It is evident from the findings of this study that botanical gardens are regarded as both sites for plant conservation and sites for recreation by locals as well as visitors. This institution has the potential to communicate plant conservation to a wide audience.
2. They communicate the importance of conserving plants, reaching out to diverse audiences, and also to communicate how this may be achieved.
3. There is therefore, a need to harness the potentials of botanical gardens in nature conservation.
4. It is recommended from this study that there is therefore, a need to harness the potentials of botanical gardens in nature conservation for posterity sake.
5. Further study on assessment of flora resources for sustainable tourism development in botanical gardens of other regions in Nigeria is also recommended.

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