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COMPARATIVE ASSESSMENT OF PLANT SPECIES AND THEIR TAXA DISTRIBUTION BETWEEN THE CAPITAL CITIES OF AKWA IBOM AND BAYELSA STATES, NIGERIA

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ABSTRACT: *The study examined the comparative assessment of plant species and their taxa distribution between the Capital Cities of Akwa Ibom and Bayelsa States, Nigeria. The study established quadrats of 30mx200m along road (transects) in GRAs of Uyo City, Akwa Ibom State and Yenagoa City, Bayelsa State labelled as sampled sites and a quadrat of 100mx100m were established as control sites (secondary forest) at a minimum of 300m from the sampled sites. Descriptive statistics were employed to analyse the data. Findings revealed that that a total of 32 plant individual species types were found in the sampled sites in Uyo while a total of 16 plant individual species types belonging to 13 families were found in Yenagoa. Also, the 32 individual plant species found under the sampled sites belong to 20 families with Arecaceae and Moraceae having the highest species individuals in Uyo Town while 26 individual plant species were identified belonging to 19 families with Apocynaceae and Guthiferae producing the highest numbers of species individuals in Yenagoa. The study can be concluded that there was variation in the plant taxa between Akwa Ibom State and Yenagoa State as the plant composition in the Uyo is more than that of Yenagoa Town suggesting the influence of the level of urbanization and other anthropogenic activities. The study recommended that urban greening activities should commence immediately in the areas where there is a shortage of plant composition.*

KEYWORDS: Plant, Taxa, Species, Families, Quadrat, Capital cities, Nigeria.

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INTRODUCTION

Predicting a list of plant taxa most likely to be observed at a given geographical location and time is useful for many scenarios in biodiversity informatics (Wittich et al., 2018). Accurate plant species identification represents the basis for all aspects of plant-related research and is an important component of workflows in plant ecological research (Elphick, 2008). Numerous activities, such as studying the biodiversity richness of a region, monitoring populations of endangered species, determining the impact of climate change on species distribution, and weed control actions depend

on accurate identification skills (Wittich et al., 2018). Central to the issue of urban biodiversity is biotic homogenization which may be defined as the process of replacing localized native species with increasingly widespread non-native species (McKinney, 2006). Several examples can be used to explain the central issue of biotic homogenization. One, the establishment of the rock dove (*Columbia livia L*.), house mouse (*Mus musculus L*.), and feral house cat (*Felis catus L*.) in ecosystems throughout the globe and their direct impact on the loss of native species are some prime examples of biotic homogenization. Similarly, faced with no natural enemies, exotic species may out-compete native species for resources leading to reduced numbers of native species and/or local extinctions. The introduction of exotic flora and fauna has greatly affected native and overall species richness and abundance throughout the globe. The problem with biotic homogenisation is that although diversity at the local or regional scale may increase with the introduction of exotics, overall biodiversity at the global scale decreases. Global biodiversity is expected to continue to decline for at least the next few centuries (Sax and Gaines, 2003). Urbanisation promotes biotic homogenization by increasing the importation of non-native species through accidental and intentional importation. Urban areas also provide a favourable habitat for the establishment of non-native species by providing food resources, reducing the threat of natural enemies, and/or by altering the physical environment in favour of the non-native species, for example, through the urban heat island effect (McKinney, 2006). Cities also serve as the main source from which introduced species can further spread into an area (Tait *et al*., 2005). Therefore, native species restoration programs and exotic-invasive species management plans are critically important in urban areas.

Biotic homogenisation cannot be fully understood without having documented, long-term, historical data. Understanding the interactions of exotics and natives over time within cities is crucial. Unfortunately, particularly for urban ecosystems, there is a general lack of such temporal biodiversity studies (Tait *et al*., 2005). A notable exception is Adelaide, Australia, an isolated city with over a million residents (Tait *et al*., 2005).

By comparing current biodiversity data with historical data that has been regularly and systematically collected since 1836, Tait *et al*. (2005) found a dramatic change in species composition. The total number of plant and animal species had increased by nearly 30%, with a minimum of 648 species that had been introduced. However, at least 132 species have become locally extinct (Tait *et al*., 2005). According to Macek (2022), the human population has affected natural ecosystems since prehistoric times in many ways, causing disturbances in existing ecosystems creating novel habitats, and altering the colonisation and extinction rates with potentially long-lasting effects on biodiversity. More studies like this are needed. By studying historical patterns of change, one may be better able to predict species that are at risk of local extinctions and be better equipped to establish long-term biodiversity management

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plans. Thus, the present study focuses on comparing the plant species and their taxa distribution between the Capital Cities of Bayelsa States, Nigeria.

Materials and Methods

Study Area Description

The study was carried out in Uyo, Akwa Ibom and Yenagoa, Bayelsa States in the South-south region of Nigeria (Figure 1). The South-south region which is found within the Niger Delta of Nigeria is located between latitudes 5º 00'N and 6º 30'N and longitudes 5º 20'E and 9º 00'E.

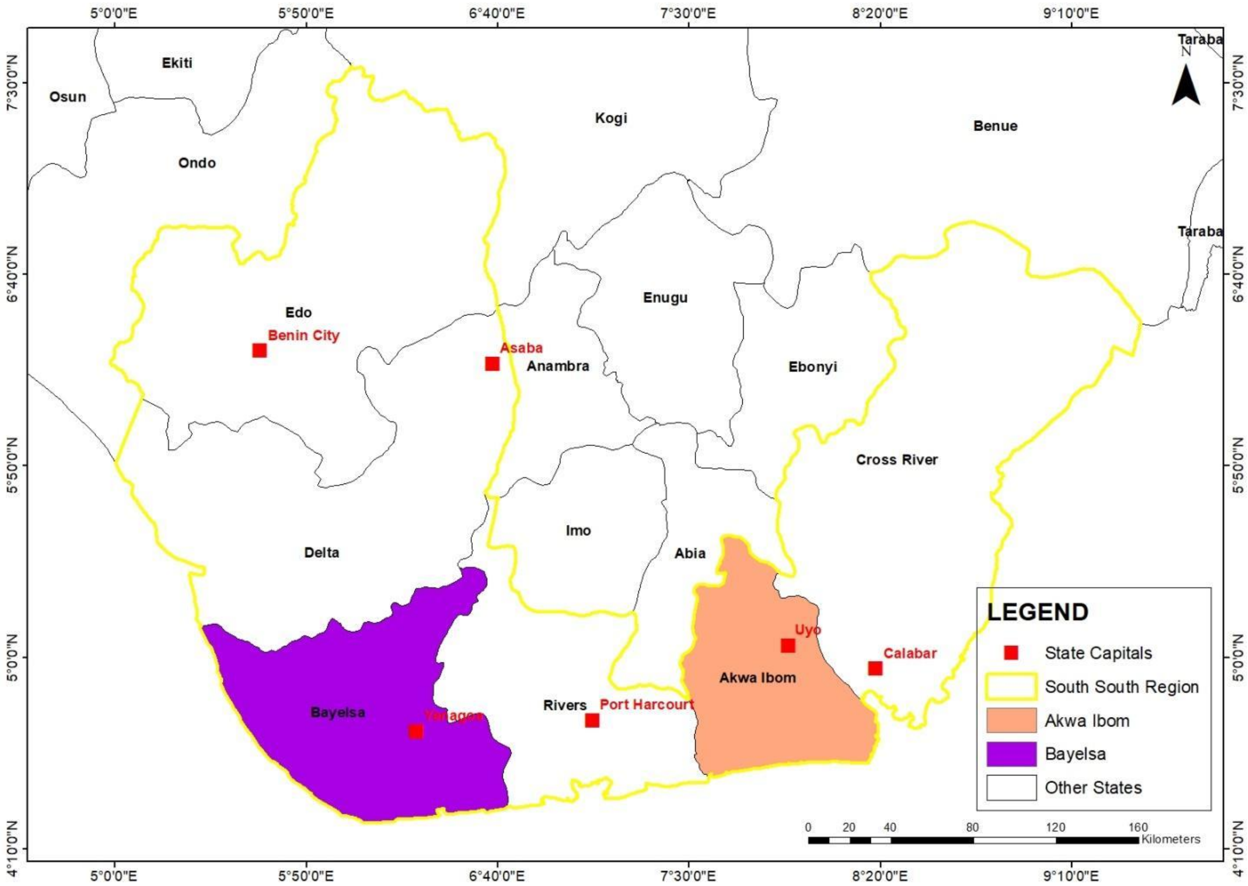

Figure 1. Akwa Ibom and Bayelsa States in the South-south region of Nigeria

The South-south region with the Niger River is sitting directly on the Gulf of Guinea on the Atlantic Ocean in Nigeria. The study area features a tropical monsoon climate, designated by the Koppen climate classification as "Am", and it is mostly found in the southern part of the country. This climate is influenced by the monsoons originating from the South Atlantic Ocean, which are brought into the country by the maritime tropical air mass, a warm moist sea-to-land seasonal wind (Britannica, 2014). Its warmth and high humidity give it a strong tendency to ascend and produce copious rainfall, which is a result of the condensation of water vapour in the rapidly rising air (Park, 2004).

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The temperature ranges are almost constant throughout the year. The South-south region of Nigeria experiences heavy and abundant rainfall. These storms are usually conventional due to the region's proximity to the equatorial belt. The annual rainfall received in this region is very high, usually above the 2,000 mm (78.7 in) rainfall totals given for tropical rainforest climates worldwide. Over 4,000 mm of rainfall is received in the coastal region of Nigeria around the Niger Delta area. Bonny Town found in the coastal region of the Niger Delta area in southern Nigeria receives well over 4,000 mm of rainfall annually (Geographical Alliance of Iowa, 2010). The geology includes a new threefold lithostratigraphic subdivision comprising an upper sandy Benin formation, an intervening unit of alternating sandstone and shale named the Agbada formation, and a lower shaly Akata formation. These three units extend across the whole delta and each ranges in age from early Tertiary to Recent (Short and Staeuble, 1967).

The south-south region is well-drained with both fresh and salt water. The saltwater is caused by the intrusion of seawater inland, thereby making the water slightly salty. Drainage of the study area is poor because of the presence of surface water and heavy rainfall between 2000mm and 2400mm (Mmom and Fred-Nwagwu, 2013). The vegetation includes the rainforest, swampy forest and mangrove (Geographical Alliance of Iowa, 2010). The primary economic activities in most rural communities in the south-south region include peasant farming, petty trading and fishing, and shifting cultivation (Slash & burn), which involves cultivating a piece of land for several years and then abandoning it for more fertile land is traditionally practised in the area. Some of the cash crops grown in the study area include oil palm (*Elaeis guineensis*), cacao (*Theobroma cacao*), cassava (*Manihot esculenta*) and rubber (*Herea brasiliensis*) (Enaruvbe & Atafo, 2015).

Plant Species Identification and Enumeration

The vegetation is made up of sampled roads in each major urban centre's government residential areas (GRAs) and control sites (Table 1). The study made use of (3) major street roads in the GRAs in each major city whereby plants were identified and enumerated to understand their vegetation status. These roads were selected based on their high vegetation composition and status, while the control sites were selected based on the diverse species of plants that can be enumerated and used as the basis of comparison for the research. The control sites are the primary or secondary forests, nature parks or any other relatively undisturbed forests in each study area. The control sites were located at a minimum of 300m away from the sampled roads (sites). The study applied transect methods whereby quadrats of 30 m by 200m used for the data collection were selected within each transect (street road). In other words, several quadrants were established regularly in relation to the road length for each sampled street road. Therefore, plant types were identified and enumerated on the spot with the help of a Taxonomist from the start to the end of the street road (transect). Quadrats of 30m x 200m were laid on both sides of the road and a gap of 100m was created till the next quadrant and so on until the end of the street road (Figure 2). On the other hand, the control sites' plant species were identified within selected secondary forests using also quadrat methods. Five (5) 30m x 30m randomly selected quadrats were delimited within quadrats of 100m x 100m laid within each control site for the collection of data on the vegetal composition and the plant species types. The data collected on plant types and composition were used for the computation of analytical vegetation features such as species composition which followed the standard phyto-sociological method. The identification of plants was also carried out with the help of a Taxonomist from the University of Port Harcourt. The plants that were not identified *in situ* were taken to the Herbarium at the University of Port Harcourt for Proper Identification.

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Species composition of plants was determined by identifying the plant species while the population of individual species were determined by direct counting of the population of each species in the sampled roads and control sites. Descriptive statistics were employed for the data analysis. The analysis was computed using SPSS version 24.0.

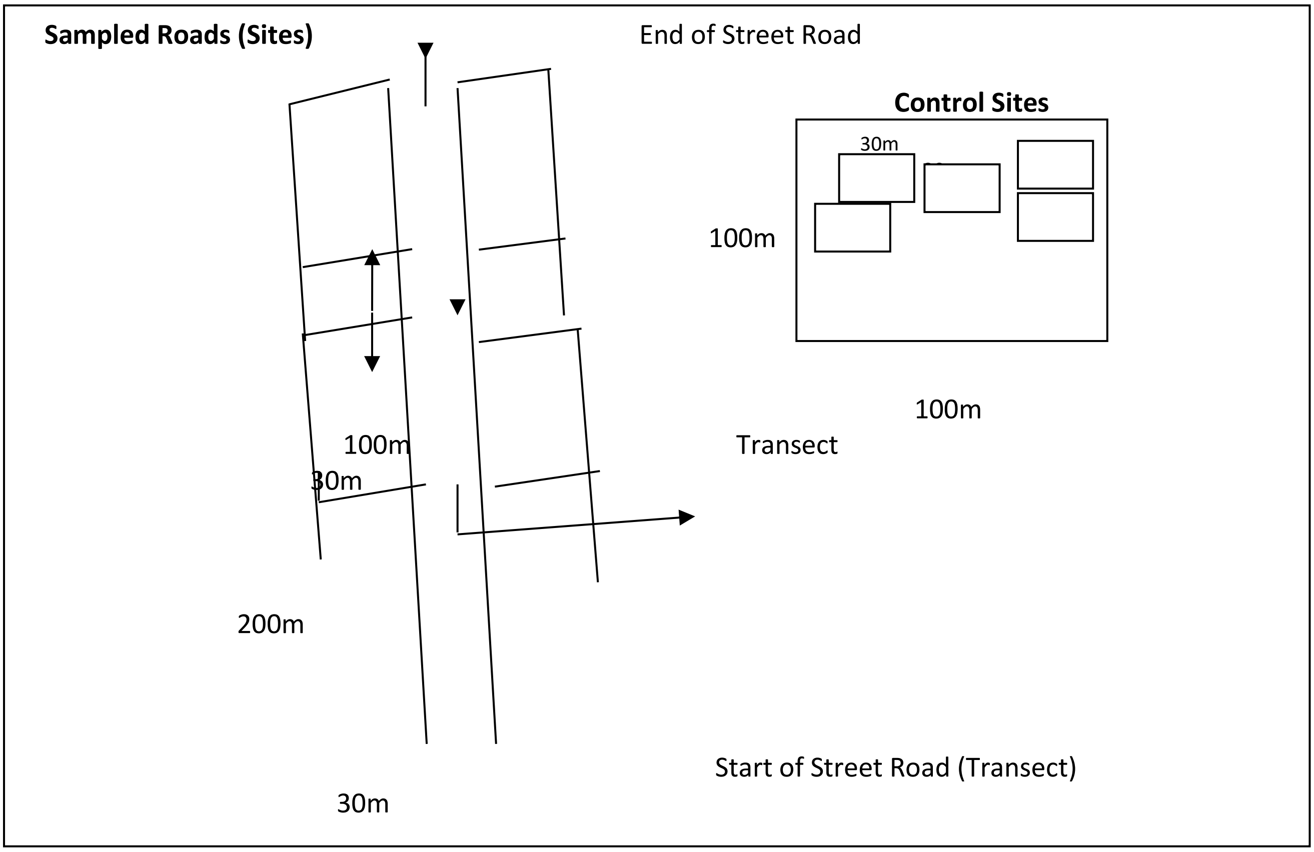

Table 1: Study Areas/Sampled Streets/Roads Names and Locations

State	Capital Cities	GRA	Selected Street name/Sampled Sites	Location	
				Northings	**Eastings**
Akwa Ibom	Uyo	Ewet Housing	Godwin Abe/1	5.01188^0	7.95012^0
			G-Lane/2	5.01677^0	7.94520^0
			Lagos Street/3	5.01281^0	7.94528^0
Bayelsa	Yenagoa	Otitio GRA	Biogbolo/1	4.93921^0	6.32203^0
			Erepa/2	4.93361^0	6.32187^0
			Otitio/3	4.93638^0	6.31922^0
Control Sites					
Akwa Ibom	Uyo (Secondary Forest)			5.05422^0	7.92774^0
Bayelsa	Yenagoa (Okordia clan secondary forest)			5.14036^0	6.44856^0

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RESULTS AND DISCUSSION

Sampled Sites and Control Sites in Uyo, Akwa Ibom State

The taxa distribution for identified plant species displayed in Table 2 revealed that a total of 32 plant individual species types were found in the sampled sites and a total of 31 individual plant species were found in the control sites. The 32 individual plant species found under the sampled sites belong to 20 families with Arecaceae and Moraceae having the highest species individuals. In the control sites, as displayed in Table 3, a total of 31 individual plant species were identified, belonging to 18 families of which Fabaceae had the highest number of plant species individuals.

Table 2: Identified Plant Species in Sampled Sites, Uyo

S/N	Plant Species Types	Life form	Family	Common name
1	*Albizia zygia*	Tree	Leguiminosae	West Africa Walnut
2	*Anacardium occidentale*	Tree	Anarcadiaceae	cashew
3	*Anona nuricata*	Tree	Annonaeae	Soursop
4	*Caesalpinia pulcherrima*	Tree	Caesalpinoideae	Pride of Barbados
5	*Carica papaya*	Shrub	Caricaceae	Pawpaw
6	*Citrus spp*	Tree	Rutaceae	Orange Tree
7	*Cocos nucifera*	Tree	Arecaceae	Coconut
8	*Cuphea california Torr.*	Shrub	Lythraceae	Cigar plant
9	*Cycas revoluta*	Shrub	Cycadaceae	Sago Palm
10	*Delonix regia*	Tree	Fabaceae	Pride of Barbados
11	*Elaeis guineensis*	Tree	Arecaceae	Oil Palm
12	*Erythrophlem ivorense*	Herb	Fabaceae	Poisonous Plant
13	*Ficus benjamina*	Tree	Moraceae	Weeping fig
14	*Ficus benjamina L.*	Tree	Moraceae	Variegated green ficus
15	*Ficus benjamina Nutt.*	Tree	Moraceae	Yellow ficus
16	*Ficus carica*	Tree	Moraceae/Cecropiaceae	Green Ficus
17	*Ficus nitida*	Tree	Moraceae	Ficus plant
18	*Hibiscus arnottianus*	Shrub	Malvaceae	White Hibiscus
19	*Hura crepitans*	Tree	Euphorbiaceae	Sandbox Tree
20	*Mangifera indica*	Tree	Anarcadiaceae	Mango
21	*Musa parasidiaca*	Shrub	Musaceae	plantain
22	*Musa sapientum*	Shrub	Musaceae	Banana
23	*Nerium oleander L.*	Shrub	Apocynaceae	Oleander
24	*Persea americana*	Tree	Lauraceae	Avocado Pear
25	*Polyalthia longifolia*	Tree	Annonaceae	Masquerade Tree
26	*Psidium guajava*	Tree	Myrtaceae	Guava
27	*Ralphia hookeri*	Tree	Arecaceae	Palm
28	*Rhizophora mangus*	Tree	Nyctaginaceae	Paper Flower
29	*Syagrus romanzoffiana*	Shrub	Arecaceae	Queen Palm
30	*Terminalia cattapa*	Tree	Combretaceae	Almond

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31	*Terminalia mantaly*	Tree	Combretaceae	Step Tree
32	*Vossiacuspidata*	Herb	Poaceae	Grass

Table 3: Identified Plant Species in Control Sites, Uyo

S/N	Plant Species Types	Life form	Family	Common name
1	*Alchornealaxiflora*	Shrub	Euphorbiaceae	Lowveld bead-string
2	*Acioabarteri*	Shrub	Chrysobalanaceae	Monkey fruit
3	*Albiziaadianthifolia*	Tree	Fabaceae	Flat crown
4	*Alchorneacordifolia*	Shrub	Euphorbiaceae	Xmas Tree
5	*Alstoniaboonei*	Tree	Apocynaceae	Gods Tree
6	*Anacardum occidentalis*Linn	Tree	Anacardiaceae	Cashew
7	*Anthocleista vogelii*	Tree	Loganiaceae	Cabage Tree
8	*Anthonotha macrophylla*	Tree	Fabaceae	African nut Tree
9	*Antiarisafricana*	Tree	Moraceae	False Iroko
10	*Bambusa vulgaris*	Shrub	Poaceae	Bamboo
11	*Baphia nitida*	Shrub	Fabaceae	Camwood
12	*Bombax buonopozense*	Tree	Malvaceae	Red flowered silk cottoned Tree
13	*Centrosema pubescens*		Fabaceae	Butterfly pea
14	*Chromolaen aodorata*	Shrub	Asteraceae	Siam weed
15	*Cleistopholis patens*	Tree	Annonaceae	Apako
16	*Cola acuminate*	Tree	Malvaceae	kola
17	*Combretum albidum*	Shrub	Combretaceae	Piluki
18	*Costusafer*	Tree	Costaceae	Spiral ginger
19	*Dracena sp. Linn.*	shrub	Asparagaceae	Dragon tree
20	*Elaeis guineensis*	Tree	Arecaceae	Oil palm
21	*Ficus exasperata*	Tree	Moraceae	Sand paper tree
22	*Garcinia manii*	Tree	Clusiaceae	Mangosteen
23	*Harungana madagascariensis*	Tree	Hypericaceae	Orange-milk Tree
24	*Leea guineensis*	Shrub	Vitaceae	Hawaiian holly
25	*Musanga cecropioides*	Tree	Urticaceae	Umbrella Tree
26	*Myrianthus arboreus*	Tree	Urticaceae	Monkey fruit
27	*Pterocarpus mildbraedii*	Tree	Fabaceae	Sierra Leone
28	*Raphia spp*	Tree	Arecaceae	Raffia Palm
29	*Senna alata*	Shrub	Fabaceae	Cassia alata
30	*Terminalia ivorensis*	Tree	Combretaceae	Black afara
31	*Urenalobata*	Shrub	Malvaceae	Caesarweed

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Sampled Sites and Control Sites in Yenagoa, Bayelsa State

The taxa distribution for identified plant species displayed in Table 4 for Yenagoa revealed that a total of 16 plant species were found belonging to 13 families. On the control sites displayed in Table 5, it was revealed that a total number of 26 individual plant species were identified belonging to 19 families with Apocynaceae and Guthiferae producing the highest numbers of species individuals.

Table 4: Identified Plant Species in Sampled Sites Yenagoa

S/N	Species Types	Life form	Family	Common name
1	*Alchorneacordifolia*	Shrub	Euphobiaceae	Christmas bush
2	*Bambusa vulgaris*	Shrub	Poaceae	Bamboo
3	*Carica papaya*	Shrub	Caricaceae	Paw paw
4	*Citrus spp*	Tree	Rutaceae	Orange Tree
5	*Cocos nucifera*	Tree	Palmae	coconut
6	*Cycas circinalis*	shrub	Cycadeceae	Sago Palm
7	*Cynodondactylon*	Herb	Poaceae	grass
8	*Delonix regia*	Tree	Fabaceae	Flame tree
9	*Elaeisguineensis*	Tree	Arecaceae	Oil Palm
10	*Mangiferaindica*	Tree	Anarcadiaceae	Mango
11	*Musa paradisica*	Tree	Musaceae	Plantain
12	*Musa sapientum*	Shrub	Musaceae	Plaintain
13	*Polyalthialongifolia*	Tree	Annonaceae	Masquerade tree
14	*Psidium guajava*	Tree	Plantae	guava
15	*Spondiascytherea*	Tree	Anacardiaceae	cashews
16	*Terminalia cattapa*	Tree	Combretaceae	Almond
17	*Terminalia mantaly*	Tree	Combretaceae	Madagascar Almond
18	*Thujasinensis*	Tree	Cupressaceae	Northern white-cedar

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Table 5: Identified Plant Species Types in Control Sites, Yenagoa

S/N	Species Types	Life form	Family	Common name
1	*Alchornea cordifolia*	Shrub	Euphorbiacea	Christmas bush
2	*Alstonia boonei*	Tree	Apocynaceae	Cheese wood
3	*Alstonia congesis*	Shrub	Apocynaceae	Stool wood
4	*Anthocleista vogelii*	Tree	Loganiaceae	Cabbage palm
5	*Anthonotha macrophylla*	Tree	Fabaceae	Bumbuse
6	*Bambusa vulgaris*	Tree	Poaceae	Clumping bamboo
7	*Bridellamicrantha*	Tree	Phyllanthacae	Trade asas
8	*Cleistopholis patens*	Tree	Annonaceae	Apako
9	*Combretum micranthia*	Shrub	Combretaceae	Bushwillows
10	*Elaeisguineensis*	Tree	Arecaceae	Oil palm
11	*Endodesima calophylloides*	Tree	Guttiferae	Ironwood
12	*Erasmopatha microcarpa*	Shrub	Moraceae	Chinese banyan
13	*Garcinia kola*	Tree	Guttiferae	Bitter Kola
14	*Guarea cedrata*	Tree	Meliaceae	Light Bosse
15	*Harungana madagascariensis*	Tree	Guttiferae	
16	*Heveabrasiliensis*	Tree	Euphorbiaceae	Para rubber tree
17	*Lophira alata*	Tree	Cochnaceae	Red Ironwood Tree
18	*Militia aboensis*	Tree	Fabaceae	
19	*Musanga cecropioides*	Tree	Urticaceae	Umbrella Tree
20	*Newbouldialaevis*	Shrub	Bignoniaceae	Sesemasa
21	*Pycanthusagolensis*	Tree	Myristicaceae	African Nutmeg
22	*Psidium guajava*	Shrub	Myrtaceae	Guava
23	*Raphia manii*	Tree	Calamoideae	
24	*Raphia vinifera*	Tree	Arecaceae	Wine Palm
25	*Rauwolfia vomitoria*	Tree	Apocynaceae	Devils Pepper
26	*Rhizophora racemosa*	Shrubs	Rhizophoracea e	Rhiza mangrove

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DISCUSSION OF FINDINGS

The study identified a total of 50 individual plant species types in the sampled sites and 57 individual plant species types in the control sites from sampled study sites in the study area. The identified plant species under the sampled sites are composed of both native and non-native (exotic) plant species with more exotic and ornamental plant species. The variations in plant species types and composition between sampled sites and control sites differ as high compositions were only experienced on herbaceous plant species in the sampled sites. However, the control sites recorded species compositions which were evenly distributed among identified plants. The study conducted by Mellinger et al., (2018) on the diverse effects of the degree of urbanisation on species diversity revealed that even distribution of plant species type reduced with level of urbanisation. The findings of Nascimento et al. (2020) also corroborate these findings that the introduction of non-native plants has been on the increase in urban centres and has continued to affect plant biodiversity. Furthermore, concerning the type of identified plants more native plants were observed in the control sites. This may have favoured species compositions because of low habitat fragmentation as urban centres are known for their high socio-economic that most times do not consider ecosystem formations.

CONCLUSION AND RECOMMENDATIONS

The study can be concluded that there was variation in the plant taxa between Akwa Ibom State and Yenagoa State as the plant composition in the Uyo is more than that of Yenagoa Town suggesting the influence of the level of urbanization and other anthropogenic activities. It can also be concluded that the plant composition at the control sites was more than that of the experimental sites. The study recommended that urban greening activities should commence immediately in the areas where there is a shortage of plant composition.

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