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RESEARCH ARTICLE

GEOSPATIAL DELINEATION OF ARBOREAL EPIPHYTES IN A GREENBELT CANOPY FORMATION IN PARTS OF RIVERS STATE, NIGERIA

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ABSTRACT

Greenbelt canopy plays major role in epiphyte distribution and diversity. This research aimed at assessing the usefulness of geospatial application in the delineation of arboreal epiphyte in greenbelt canopy in parts of Rivers State. A total of 214 tree canopies (mostly of *Azadirachta indica*) were sampled from both the western and the eastern wing of the study sites using three basic ecological tools [the Braun-Blanquet releve and RRED – Analysis methods and Geospatial tool (GPS, Remote Sensing (RS), and ESRI's ARCMAP GIS version 10.4)]. Result had *Oleandra distenta* Kunze and *Platycerium bifurcatum* Schwein f. with the highest frequency, density and diversity across most of the sampled plots in both study sites. *Oleandra distenta* recorded highest IVI value and contiguous distribution pattern across all sampled plots. Sampled plot 10 with highest (398.56) species richness, plot 7 with least (18.03) richness in the west and highest (260.67) richness in plot 9, least (33.48) richness in plot 5 of eastern site were recorded. *Drynaria laurentii* (Christ) Heiron had highest density (37.80), abundance (187), and evenness (80.36) in sampled plot 4 in the western wing. This result has shown variant diversity in the epiphytic proliferation based on variant canopies, barks composition and related growth factors.

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INTRODUCTION

Spatial distribution is an important characteristic of population and individual made up of immobile organisms and their distribution in space (Leps and Kindlamann, 1987). Some of the common spatial technologies used in the determination of geospatial distribution and management of vegetation includes; Global positioning system (GPS), Remote sensing (RS), Geographic information system (GIS) (Sonti, 2015). Geospatial technology describes the range of modern tools often used in the geographic mapping and analysis of earth and human societies. The use of geospatial tools/technologies have been adopted for better management of land, understanding the spatial distribution of structure and composition of vegetation system and other natural resources for a sustainable ecosystem production and services (Palaniswami *et al*., 2011; Plumptre and Davenport, 2017) Geospatial technology has revealed the occurrence and distribution of epiphytes on forest canopy, the relationship between landscape, and spatial prediction of probability of occurrence in the rainforest region (Plumptre and Masozera, 2002). Geospatial tools have also revealed the ecological elegance of epiphytic species on host plant, evaluate land use ecology over a period of time, identify and measure vegetation dynamics and trend. (Sonti, 2015). The geographic information system and remote sensing technology have been used to assess the trend of vegetation canopy density of an area (Sonti, 2015) as well as their vertical distribution (Reyes-Garcia *et al*., 2008). Greenbelt canopy is the aggregate of gowns comprising all foliage, twigs, branches, epiphytes as well as the air in a stand of vegetation, in a forest (Parker, 1995). Various types of canopies have been identified among which include open canopy, dispersed clump canopy, thicket canopy and single ponderosa pine / Gambel oak single stem canopy type (Scott, 2009). Epiphytes are plants that germinate, grow and live by attachment upon another living plant without specific roots and devoid of a stage in the soil (Kromer and Gradstein, 2003). Arboreal epiphytes are known as true or obligate vascular epiphytes because they are non-parasitic to stems, trunk of trees and plant canopy (Erwin, 1988).

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Though Kromer and Gradstein, (2003) have recorded over 27,600 plant species under 73 families in which 913 genera are epiphytes. Kress (1986) has however noted about 24,000 as vascular plants epiphytic species in nature accounting for about 9% of all plants. They constitute a major part of the global biodiversity (account for about 10% of the total vascular plant diversity) in greenbelt canopy (Kress, 1986). The most striking characteristics of arboreal epiphytes found in tropical rainforest and any flora landscape formation is the change and environmental disturbance as well as high diversity based on greenbelt canopy which gives them access to atmospheric water and minerals; and their sensitivity to climate (Kromer, 2016). Vascular epiphytes are significant not because of the number of space they occupy but because of the biomass they accumulate (Gentry and Dodson 1987, Benzing 1990, Nadkarni., 1994, Isaza *et al.,* 2004). The diversity of epiphytes in greenbelt canopy of a tree has been categorized into three major groups viz: vascular epiphytes, Hemi-epiphytes and Non-vascular epiphytes. (Nalini *et al.,* 2001). The most common methods in estimating the diversity of a species in a study site are those related to species richness; (Luis and Raul, 2004). Many works on the spatial distribution of plant species have earlier been documented (Palaniswami 2011, Plumptre and Davenport, 2017). Using a RRED-Analysis, approach the haphazard collection of epiphytic species and a bias impression of species richness which only focuses on the epiphytic species richness and frequency (Wolf *et al.,* 2009). But in this research, the RRED Analysis method will be used to determine the phytosociology of the epiphytic species. Though in the quest of using geospatial tools to determine the spatial distribution of epiphytes, geospatial tool like remote sensing has proven to be a very useful tool for mapping the spatial distribution of plant diversity in tropical forest and solving the practical problems. Therefore the use of geospatial technologies in this present research was aimed at evaluating the relevance of geospatial tool in the assessment of spatial distribution of epiphyte in a greenbelt canopy formation. Thus with the objectives of; evaluating the degree of arboreal epiphyte spatial distribution in the green belt canopy formation of the study site, and determining the qualitative and quantitative ecological elegance and phytosociological indices of the epiphyte.

MATERIALS AND METHODS

Overview description of the Study Area, Location and Site

Rivers State is one of the thirty six States in Nigeria; located between longitudes $6^{O}\ 23^{1}$E & $7^{O}\ 36^{1}$E and latitude $4^{O}\ 18^{1}$N & $5^{O}\ 45^{1}$N of the equator (Fig. 1). To the East it is bounded by Imo River and Akwa-Ibom and bounded to the West by Bayelsa State. It is equally bounded to the North by Imo State and Abia State and to the South by the Atlantic Ocean (Edwin-Wosu *et al.,* 2013). This area is associated with an average climatic condition of maximum rainfall pattern and a relative humidity under the influence of latitudinal and seasonal variations but comparatively uniform due to proximity of the ecozone to the Atlantic Ocean (Alagoa, 1999, Kuruk, 2004). The area is characterized by mangrove forest, fresh water, raffia palm vegetation and tropical rainforest (Egwuogu *et al.,* 2016). The soil is often sandy silt or sandy loam well drained with both fresh and salt water and clayey in nature and by topographic variation with some sections underlain by impervious clay pan often leached due to heavy rainfall, thus making it alkaline (salty) and sometimes acidic in nature (Egwuogu *et al.,* 2016). Presently the State consists of twenty three (23) local government areas including Obio / Akpor the study location. Obio / Akpor Local Government Area is located between latitudes $4^{O}\ 45^{1}$N and $4^{O}\ 65^{1}$N and longitude $6^{O}\ 50^{1}$E and $8^{O}\ 00^{1}$E (Fig. 2) and covers about 260km^2; characterized by a tropical monsoon climate of maximum rainfall (Egwuogu *et al.,* 2016). It houses several localities, towns and suburbs, including Choba the study site with the sampled station at the Abuja campus of the University of Port Harcourt (Wikipedia 2017), geo-referenced to latitude 4.9017 and longitude 6.9204 (Google 2017).

Field Sampling

Arboreal epiphyte assessment: A field survey and inventory of arboreal epiphyte was carried out on a greenbelt canopy formation. A total stand of 214 tree (mainly *Azadirachta indica*) canopies were enumerated from the inlet direction of Delta –Abuja campus gate of UNIPORT (Figs. 3a, b). By the eastern location (right wing) of the sampling station with distance coverage of 1560m, 69 of 105 canopy formations were epiphyte bearing trees; while 72 of 109 canopies on the western location (left wing) with distance coverage (1600m) were epiphyte bearing trees. Though a total distance 1560m and 1600m was covered for the eastern and western geographical location of the sampling station respectively, a distance of 1200m on the western part and 1000m on the eastern part respectively was enumerated based on epiphyte bearing canopy trees. This was implemented using three basic ecological tools involving; Braun – Blanquet releve method (1964), RRED-analysis (Shaw and Bergstron, 1997) and Geospatial tool (GPS, RS and ESRI's ARCMAP GIS version 10.4).

Sampling methods: An integrated sampling approach involving the Braun –Blanquet relieve method (1964), and Rapid and Representative Epiphyte Diversity (RRED Analysis) method (Shaw and Bergstron, 1997 and geospatial tools [GPS, Remote Sensing (RS) and Geographic Information System (ESRI'S ARCMAP version 10.4)] were adopted. Individual trees were assessed using single rope tree climbing technique which helps to determine the presence of epiphyte for maximum sampling of the microhabitats of the upper canopy community without creating injuries on the tree. The individual tree coordinates were taken using a handheld GPS (BHnav300 model) to show the geospatial distribution of the trees bearing epiphytes and the non-epiphyte bearing trees. The coordinates were arranged using Microsoft excel and then imported into ESRI'S ARCMAP software in which the geo-referenced map showing the satellite imagery and the spatial distribution of the trees was produced.

Sampling procedure: Adopting the Braun – Blanquet relieve method (1994) and RRED-Analysis (Shaw and Bergstrom, 1997) a total of 11 sampling plots of eastern and western location of the study site, under a belt transect (100m) each was laid on the horizontal distribution pattern. Five sub-sampled units (20m x 3m) each of the transect direction of the sampled plot were laid for sampling. Hence epiphytes prefer trees with larger diameter at breast height (Hazell *et al.,* 1998, Ingerpuu and Vellak, 2007).

The ecological tools were used to determine the abundance of epiphyte based on the tree diameter at breast height (DBH) hence; this will help in determining the various data analysis on the epiphytic distribution.

Data analysis: The data analysis of the epiphytic distribution was based on standard phytosociological indices as exemplified below to determine frequency of distribution, abundance, and density of the representative species of the study site (Supriya and Yadava, 2006; Shukla, 2009 amd Chikkahuchaiah *et al*., 2016). The species diversity in richness of the sampled sites and diversity among species within a sampled site was estimated using the Margalef (1958) richness index and Shannon-Wiener, (1963) diversity index respectively. The degree of evenness or equitability (Pielou, 1969) index was estimated. The species were described in semi-quantitative Pryor scale terms (Pryor, 1981). The relative density, relative abundance and relative frequency (Misra, 1968) the importance value index (IVI) (Shukla and Chandel, 1980) were estimated. The distribution patterns in line with the "Rule of Thumb" designated as; Regular (< 0.03), Random (0.03 - 0.05) and Contagious (> 0.05) distribution (Curtis and Cottam, 1956). Life form spectrum (Raunkiaer, 1934; Kershaw, 1975; Mueller – Dombois and Ellenberg, 1974) was estimated. The similarity and dissimilarity assessment of eastern and western location of the study site were carried out by enumerating and sorting out into common species and species unique to variation pattern of common species of each plot using the Sorenson (1948) similarity coefficient index

$$\% \text{ Frequency} = \frac{\text{Number of transects of in which the species occurred}}{\text{Total number of transect studied}} \times \frac{100}{1}$$

$$\text{Abundance} = \frac{\text{Total number of individual occurrence of a species in all transect}}{\text{Total number of transect in which the species occurred}}$$

$$\text{Density} = \frac{\text{Total number of individuals of a species in all transect}}{\text{Total number of transect studied}} \times \frac{100}{1}$$

$$\text{Relative frequency} = \frac{\text{Number of occurrence of the individual species}}{\text{Number of occurrence of all the species}} \times \frac{100}{1}$$

$$\text{Relative abundance} = \frac{\text{Abundance occurrence of the species}}{\text{Abundance occurrence of all the species}} \times \frac{100}{1}$$

$$\text{Relative density} = \frac{\text{Number of individual of the species}}{\text{Number of individual of all the species}} \times \frac{100}{1}$$

Importance Value Index = RF + RA + RD

Species diversity index (H') = $- \sum \rho i \, I\eta \, \rho i$

Where $\rho i = n_{1/N}$ (n_1 = number of individuals of a species, N = total number of individuals of all the species)

Species richness (Margalef index): $R = \frac{S-1}{Log\ N}$ of sampled plots

Where (S = Total number of species, N = Total number of individuals)

Species evenness or Equitability Index (Pielou 1969) is calculated as: $E = H' / Log.S$

Where H' = diversity index and S = total number of species

The life form classification (Kershaw, 1975; Raunkiaer, 1934; Mueller – Dombois and Ellenberg, 1974) entails:

- Phanerophytes (Trees & Shrubs)
  - Megaphanerophytes >30m in height
  - Mesophanerophytes 8 – 30m
  - Microphanerophytes 2 – 8m
  - Nanophanerophytes <2m
- Chamaephytes (buds borne close to the ground)
- Hemi-cryptophytes (buds borne at or in the soil surface)
- Cryptophytes (buds borne below ground or below water)
  - Geophytes (with rhizomes, bulbs or underground tuber)
  - Helophytes (perennating organ in soil or mud below water level)
  - Hydrophytes (water plants, perennating buds from submerged rhizomes)
- Therophytes (no perennating buds, annual or ephemeral plants)

- Epiphytes (air plants, no root in the soil)

Similarity index using Sorenson model is calculated as: $C = \frac{2W}{A+B}$

Dissimilarity is calculated as: 1 – C.

Where W = number of common species

RESULTS

The report of the study has recorded variation in structural life habit across the species (Table 1) as well as in the phytosociological indices of enumerated prevalent species among the six species namely *Platycerium bifurcatum, Oleandra distenta, Phymatodes scolopendria, Pyrrosia mechowii, Nephrolepis pumicicola,* and *Drynaria laurentii* in the western (Table 2) and five species namely *Phymatodes scolopendria, Pyrrosia mechowii, Platycerium bifurcatum, Oleandra distenta*, and *Nephrolepis pumicicola* in the eastern sampled plots (Table 3) of the study location sites; while the geospatial distribution of epiphytes among tree and non-tree bearing epiphytes was represented in Figure 4.

Frequency of occurrence: On the Western location sampled plots (Sp) as shown in Table 2, clarified that *Platycerium bifurcatum* has the highest frequency (100%) in sp10 and a least frequency (40%) in sp11. *Oleandra distenta* recorded the highest frequency (100%) in sp5, 8, 10 and the least frequency (20%) in sp7. *Phymatodes scolopendria* recorded the highest frequency (100%) in sp10 and the least frequency (40) in sp5, while *Pyrrosia mechowii* had a least frequency of 20% in sp1, 2, 3, 8, 9 & 10 respectively and highest frequency (80%) in sp11.

Table 1: Herbaceous epiphytes identified in the study site

Species	Family	Common name	Life form
Platycerium bifurcatum Schwein F.	Polypodiaceae	Elkhorn fern	Herbaceous epiphyte
Oleandra distenta Kunze	Davalliaceae	Creeper fern	Herbaceous epiphyte
*Phymatodes scolopendria (*Bum F.) Ching	Polypodiaceae	Monarch fern	Herbaceous epiphyte
*Pyrrosia mechowii (*Heiron) Alston	Polypodiaceae	Pyrossia fern	Herbaceous epiphyte
Nephrolepis pumicicola Ballard	Davalliaceae	Macho fern	Herbaceous epiphyte
Drynaria laurentii (Christ) Heiron	Polypodiaceae	Basket fern	Herbaceous epiphyte

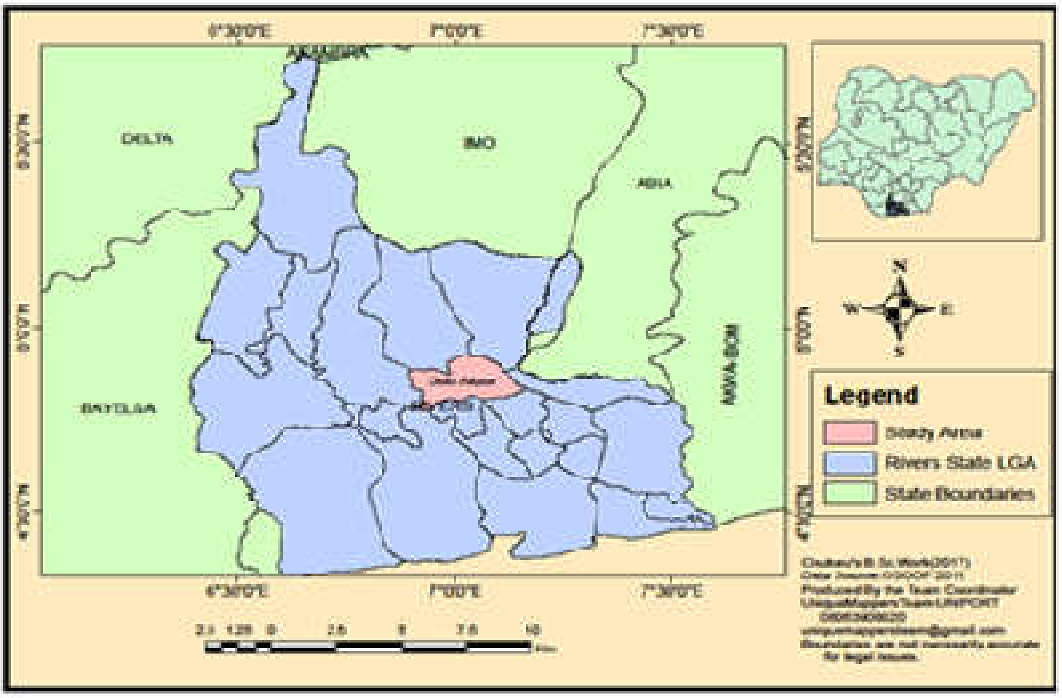

Fig. 1: Rivers State study area, displaying Obio / Akpor LGA study location

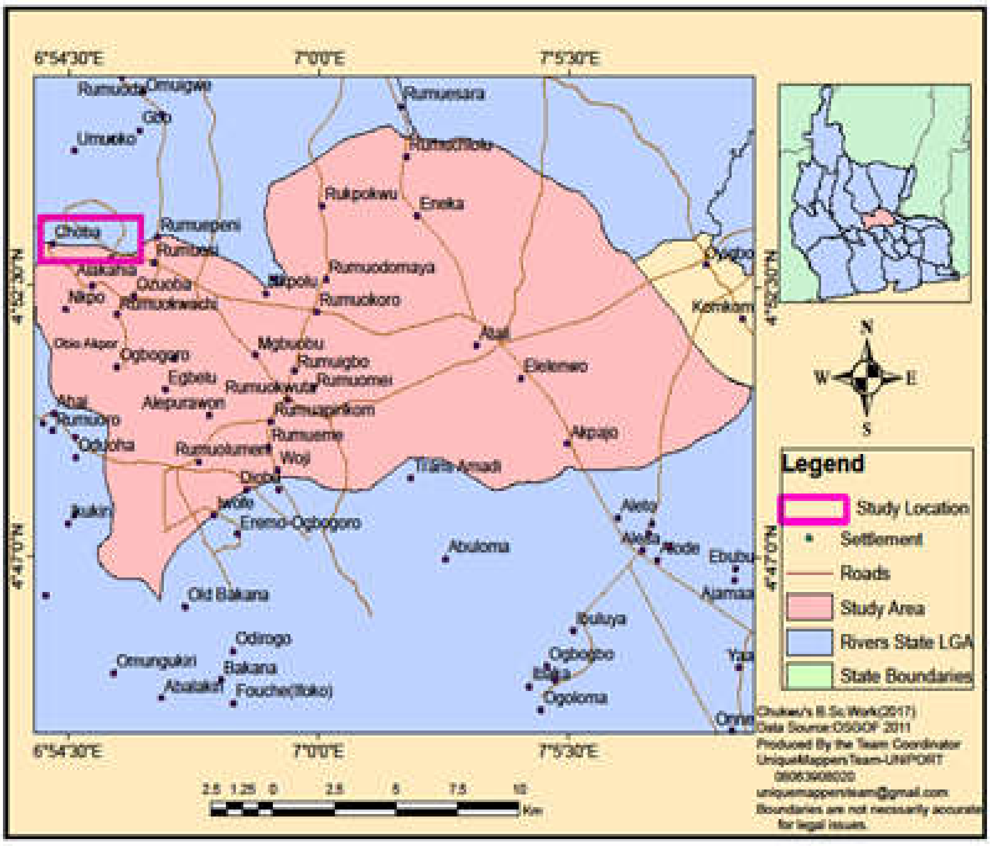

Fig. 2: Obio / Akpor study location indicating Choba, study site

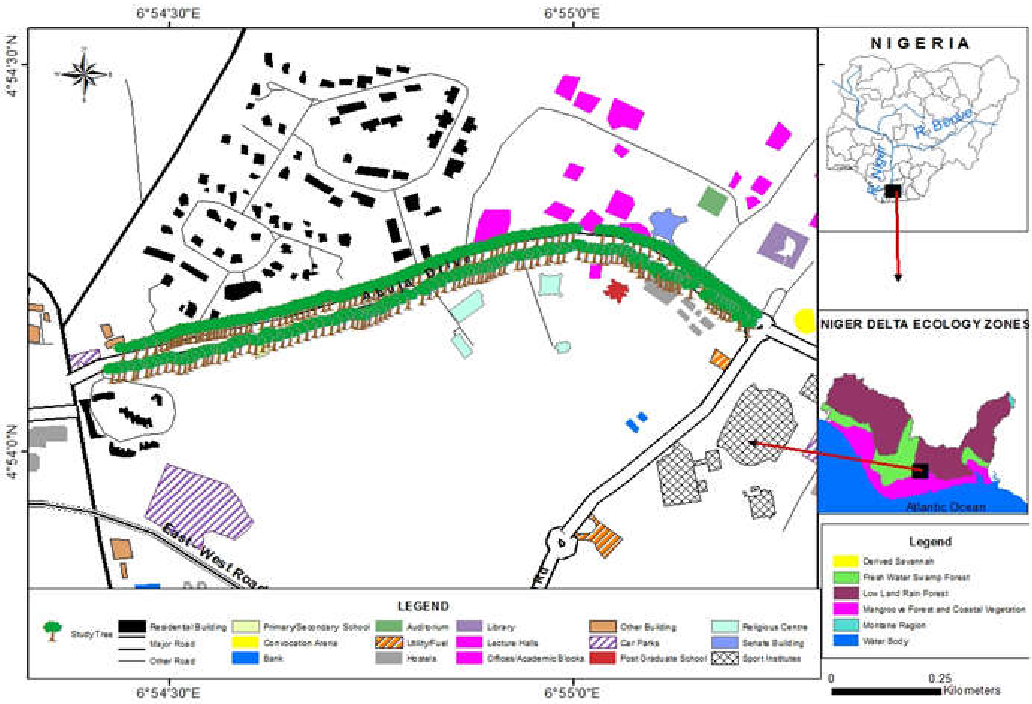

Figure 3a: GIS representation of sample location of the study trees of the canopy formation in UNIPORT environment (from Delta-Abuja gate to Ofrima roundabout)

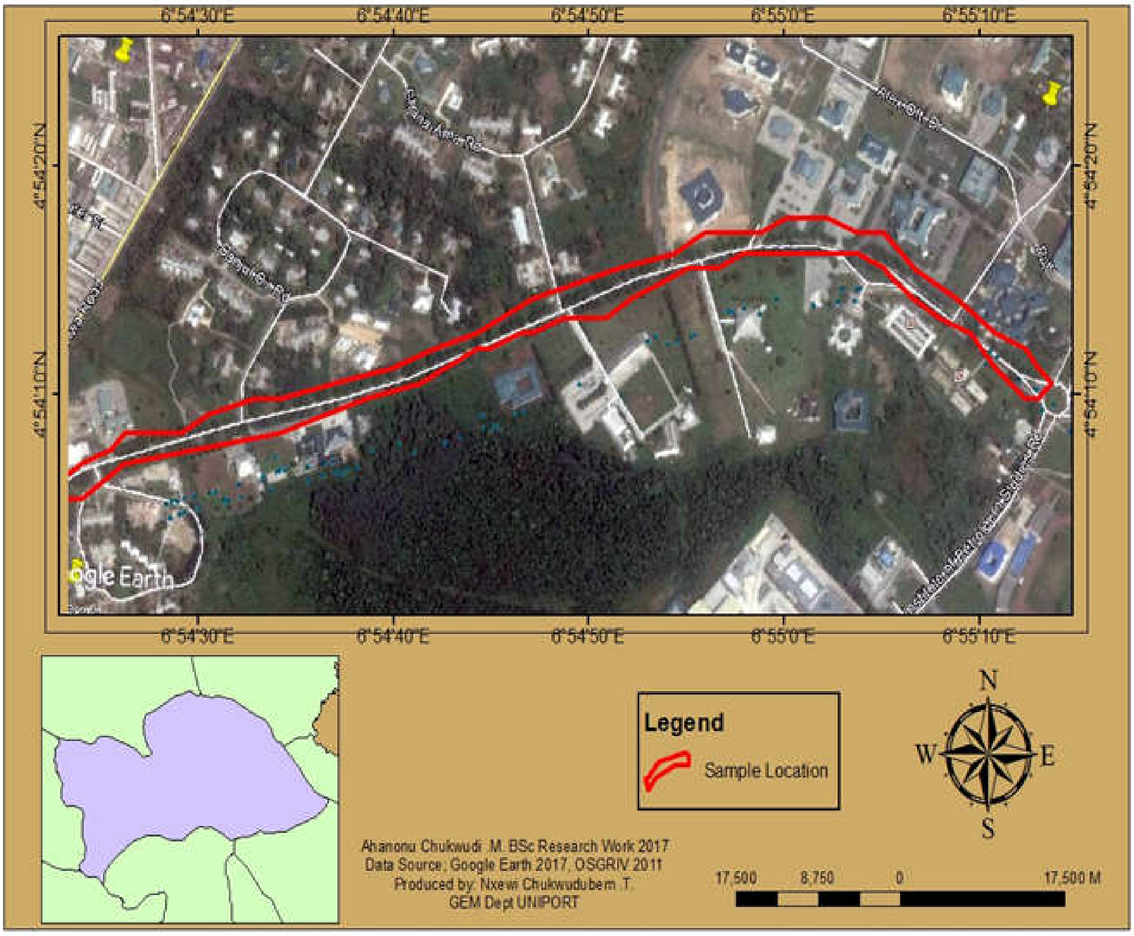

Figure 3b: Satellite imagery of sample location the study trees of the canopy formation in UNIPORT environment (from Delta-Abuja gate to Ofrima roundabout)

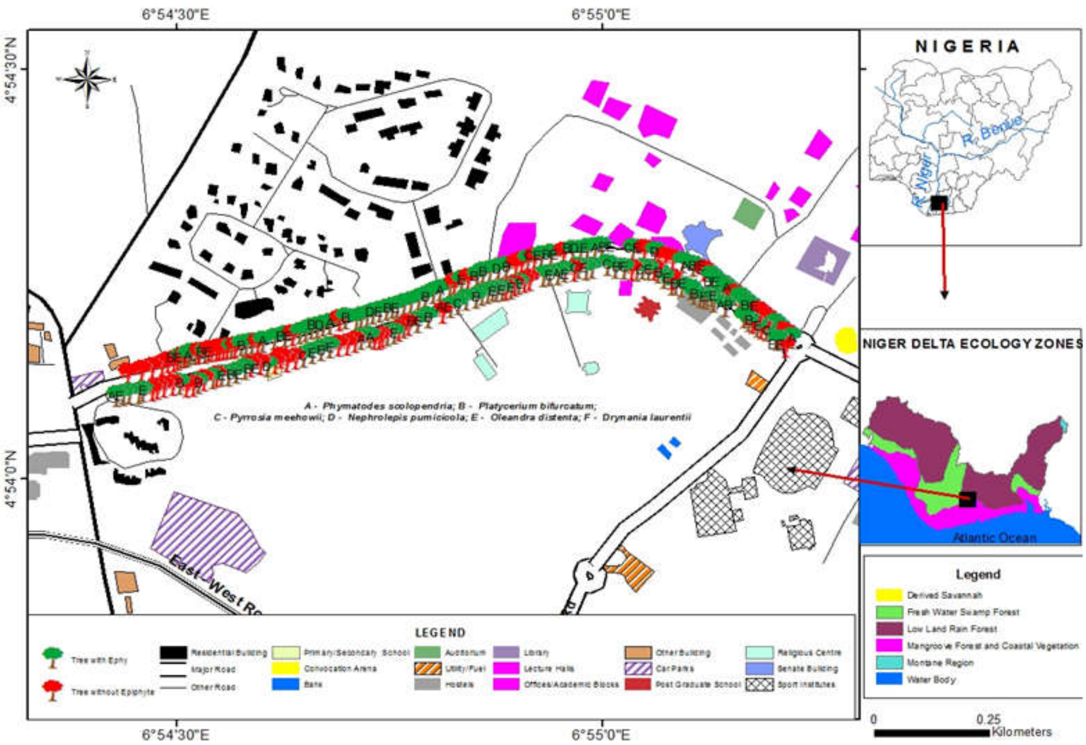

Fig. 4: Geospatial distribution of epiphyte and non-epiphyte bearing green canopy formation of the study site

Table 2. Phytosociological means of herbaceous epiphytes identified in the Western study site

Western location sampled plot 1													
Species	%F	A	D	%RF	%RA	%RD	IVI	RIVI	mSR	SdH'	SdE	A/F	Remark
Platycerium bifurcatum Schwein F.	80	3.5	8	40	6.54	27.78	74.32	24.77		139.10	231.81	0.04	++++
Oleandra distenta Kunze	40	44	17.60	20	82.24	61.11	163.35	54.45	46.33	361.51	602.52	1.10	++
Phymatodes scolopendria (Burm F.) Ching	60	5	3	30	9.35	10.42	49.77	16.59		84.46	140.77	0.08	+++
Pyrrosia mechowii (Heiron) Alston	20	1	0.20	10	1.87	0.69	12.56	4.19		13.80	23.00	0.05	+
TOTAL	200	53.50	28.8	100	100	100	300	100		598.87	998.10	1.27	
Western location sampled plot 2													
Species	%F	A	D	%RF	%RA	%RD	IVI	RIVI	mSR	SdH'	SdE	A/F	Remark
Phymatodes scolopendria (Burm F.) Ching	60	17.3	10.40	23.08	26.49	25.74	75.31	25.10		141.35	202.22	0.29	+++
Platycerium bifurcatum Schwein F.	80	13.5	10.80	30.77	20.67	26.73	78.17	26.06	56.37	147.98	211.70	1.17	++++
Oleandra distenta Kunze	80	20.5	16.40	30.77	31.39	40.59	102.75	34.25		206.71	295.72	0.26	++++
Nephrolepis pumicicola Ballard	20	13	2.60	7.69	19.91	6.44	34.04	11.35		52.15	74.61	0.65	+
Pyrrosia mechowii (Hieron) Alston	20	1	0.20	7.69	1.53	0.50	9.72	3.24		9.60	13.73	0.05	+
TOTAL	260	65.3	40.40	100	99.99	100	299.99	100		557.79	797.98	2.42	
Western location sampled plot 3													
Species	%F	A	D	%RF	%RA	%RD	IVI	RIVI	mSR	SdH'	SdE	A/F	Remark
Phymatodes sclopendria (Burm F.) Ching	60	36.70	22	23.08	30.66	35.14	88.88	29.63		173.21	247.80	0.61	+++
Platycerium bifurcatum Schwein F.	80	5	4	30.77	4.18	6.39	41.34	13.78	88.13	66.82	95.60	0.06	++++
Oleandra distenta Kunze	60	28	16.80	23.08	23.39	26.84	73.31	24.44		136.74	195.62	0.47	+++
Pyrrosia mechowii (Hieron) Alston	20	1	0.20	7.69	0.84	0.32	8.85	2.95		8.38	11.99	0.05	+
Nephrolepis pumicicola Ballard	40	49	19.60	15.39	40.94	31.31	87.64	29.21		170.26	243.58	1.23	++
TOTAL	260	119.7	62.60	100.01	100.01	100	300.02	100.01		555.41	794.59	2.42	
Western location sampled plot 4													
Species	%F	A	D	%RF	%RA	%RD	IVI	RIVI	mSR	SdH'	SdE	A/F	Remark
Phymatodes sclopendria (Burm F.) Ching	60	10.30	6.20	25	3.09	7.26	35.35	11.78		54.74	78.31	0.17	+++
Platycerium bifurcatum Schwein F.	80	4.50	3.60	33.33	1.35	4.22	38.90	12.97	120.74	61.85	88.48	0.06	++++
Oleandra distenta Kunze	60	29.70	17.80	25	8.91	20.84	54.75	18.25		95.18	136.17	0.50	+++
Drynaria laurentii (Christ) Heiron	20	187	37.80	8.33	56.07	43.79	108.19	36.06		220.08	314.85	9.35	+
Nephrolepis pumicicola Ballard	20	102	20.40	8.33	30.59	23.89	62.81	20.94		112.93	161.56	5.10	+
TOTAL	240	333.5	85.40	99.99	100.01	100	300	100		544.78	779.37	15.18	
Western location sampled plot 5													
Species	%F	A	D	%RF	%RA	%RD	IVI	RIVI	mSR	SdH'	SdE	A/F	Remark
Phymatodes sclopendria (Burm F.) Ching	40	72.50	29	15.39	43.85	33.26	92.50	30.79		181.87	303.12	1.81	++
Platycerium bifurcatum Schwein F.	80	11.25	9	30.77	7.20	10.32	48.29	16.08	143.67	81.31	135.52	0.14	++++
Oleandra distenta Kunze	100	27.60	27.60	38.46	16.69	31.65	86.80	28.89		168.26	280.43	0.28	+++++
Nephrolepis pumicicola Ballard	40	54	21.60	15.39	32.66	24.77	72.82	24.24		135.61	226.02	1.35	++
TOTAL	260	165.35	87.20	100.01	100.40	100	300.41	100		567.05	945.09	3.58	
Western location sampled plot 6													
Species	%F	A	D	%RF	%RA	%RD	IVI	RIVI	mSR	SdH'	SdE	A/F	Remark
Platycerium bifurcatum Schwein F.	60	43.67	26.20	33.33	57.46	57.46	148.25	49.42		321.85	674.74	0.73	+++
Phymatodes sclopendria (Burm F.)Ching	60	2.00	1.20	33.33	2.63	2.63	38.59	12.86	93.50	61.22	128.34	0.03	+++
Oleandra distenta Kunze	60	30.33	18.20	33.33	39.91	39.91	113.15	37.72		232.37	487.15	0.51	+++
TOTAL	180	76	45.60	99.99	100	100	299.99	100		615.44	1290.23	1.27	
Western location sampled plot 7													
Species	%F	A	D	%RF	%RA	%RD	IVI	RIVI	mSR	SdH'	SdE	A/F	Remark
Platycerium bifurcatum Schwein F.	80	7.25	5.80	66.67	20	60.24	147.09	49.30		318.83	668.41	0.09	++++
Oleandra distenta Kunze	20	16	3.20	16.67	44.14	33.33	94.14	31.38	18.03	185.81	389.54	0.80	+
Nephrolepis pumicicola Ballard	20	13	0.60	16.67	35.86	6.25	58.78	19.59		104.00	218.03	0.65	+
TOTAL	120	36.25	9.60	100.1	100	100	300.01	100.27		608.64	1275.98	1.54	
Western location sampled plot 8													
Species	%F	A	D	%RF	%RA	%RD	IVI	RIVI	mSR	SdH'	SdE	A/F	Remark
Platycerium bifurcatum Schwein F.	80	6.25	5	30.77	4.46	5.56	40.79	13.60		65.70	93.99	0.08	++++
Oleandra distenta Kunze	100	61	61	38.46	43.49	67.78	149.75	49.91	127.33	325.76	466.04	0.61	+++++
Pyrrosia mechowii (Hieron) Alston	20	8	1.60	7.69	5.70	1.78	15.17	5.06		17.92	25.64	0.40	+
Phymatodes sclopendria (Burm F.)Ching	40	47	18.80	15.39	33.51	20.89	69.79	23.26		128.68	184.09	1.18	++
Nephrolepis pumicicola Ballard	20	16	3.60	7.69	12.83	4	24.52	8.17		34.07	48.74	0.90	+
TOTAL	260	140.25	90	100	99.99	100	300	100		572.13	818.50	3.17	

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Western location sampled plot 9													
Species	%F	A	D	%RF	%RA	%RD	IVI	RIVI	mSR	SdH'	SdE	A/F	Remark
Phymatodes sclopendria (Burm F.) Ching	40	38	1520	1818	3108	2542	7468	2489		139.89	200.13	0.95	++
Platycerium bifurcatum Schwein F.	80	1025	820	3636	839	1371	5846	1949	8412	103.29	147.77	0.13	++++
Pyrrosia mechowii (Hieron) Alston	20	3	0.60	9.09	2.45	1.00	1254	4.18		1377	1970	0.15	+
Oleandra distenta Kunze	60	54	3240	2727	4417	5418	125.62	4188		263.68	377.23	0.90	+++
Nephrolepis pumicicola Ballard	20	17	340	9.09	1391	5.69	2869	9.56		4182	5983	0.85	+
TOTAL	220	12225	5980	9999	100	100	299.99	100		56245	804.66	2.98	
Western location sampled plot 10													
Species	%F	A	D	%RF	%RA	%RD	IVI	RIVI	mSR	SdH'	SdE	A/F	Remark
Phymatodes scolopendria (Burm F.) Ching	100	10260	10260	2778	3150	3667	9595	3198		190.18	272.07	1.03	+++++
Platycerium bifurcatum Schwein F.	100	2460	2460	2778	755	8.79	4412	1471	39856	7256	103.81	025	+++++
Oleandra distenta Kunze	100	123	123	2778	3777	4396	109.51	3650		223.34	319.52	1.23	+++++
Nephrolepis pumicicola Ballard	40	7250	29	1111	2226	1037	4374	1458		7177	102.68	1.81	++
Pyrrosia mechowii (Hieron) Alston	20	3	0.60	5.56	0.92	021	6.69	223		5.52	7.90	0.15	+
TOTAL	360	325.7	279.80	100.01	100	100	300.01	100		563.37	805.98	3.47	
Western location sampled plot 11													
Species	%F	A	D	%RF	%RA	%RD	IVI	RIVI	mSR	SdH'	SdE	A/F	Remark
Platycerium bifurcatum Schwein F.	40	12	4.80	2500	1250	8.70	4620	1540		7691	15285	0.30	++
Oleandra distenta Kunze	60	7067	4240	3750	7362	7681	187.93	6264	113.63	427.35	895.91	1.18	+++
Pyrrosia mechowii (Hieron) Alston	60	1333	8	3750	1388	1449	6587	2196		119.80	251.15	0.22	+++
TOTAL	160	96	5520	100	100	100	300	100		624.06	1299.91	1.70	

%F = Frequency, A=Abundance, D=Density, %RF=Relative Frequency, %RD=Relative Density, %RA=Relative Abundance, IVI=Important Value Index, mR=Margalef Richness, SdH' = Species diversity Richness, SdE= Species diversity Evenness, A/F = Distribution pattern.

Table 3: Phytosociological means of herbaceous epiphytes identified in the Eastern study site

Eastern location sampled plot 1													
Species	%F	A	D	%RF	%RA	%RD	IVI	RIVI	mSR	SdH'	SdE	A/F	Remark
Platycerium bifurcatum Schwein F.	40	1.00	0.40	33.33	2.86	2.00	38.19	12.73		60.42	126.67	0.03	++
Oleandra distenta Kunze	60	32.00	19.20	50.00	91.43	96.00	237.43	79.14	39.83	564.02	1182.43	0.53	+++
Pyrrosia mechowii (Heiron) Alston	20	2.00	0.40	16.67	5.71	2.00	24.38	8.13		33.82	70.90	0.10	+
TOTAL	120	35.00	20	100	100	100	300	100		658.26	1380.00	0.66	
Eastern location sampled plot 2													
Species	%F	A	D	%RF	%RA	%RD	IVI	RIVI	mSR	SdH'	SdE	A/F	Remark
Platycerium bifurcatum Schwein F.	60	3.67	2.20	30.00	3.22	3.77	36.99	12.33		58.00	96.67	0.06	+++
Phymatodes scolopendria (Burm F.) Ching	80	32.00	25.60	40.00	28.03	43.84	11.87	37.29	95.67	12.75	21.25	0.40	++++
Oleandra distenta Kunze	40	74.50	29.80	20.00	65.25	51.03	136.28	45.43		290.88	484.80	1.86	++
Nephrolepis pumicicola Ballard	20	4.00	0.80	10.00	3.50	1.37	14.87	4.96		17.43	29.05	0.20	+
TOTAL	200	114.17	58.40	100	100	100.01	300.01	100.01		379.06	631.77	2.52	
Eastern location sampled plot 3													
Species	%F	A	D	%RF	%RA	%RD	IVI	RIVI	mSR	SdH'	SdE	A/F	Remark
Nephrolepis pumicicola Ballard	20	10.00	2.00	9.09	9.62	2.76	21.47	7.16		28.59	40.90	0.50	+
Platycerium bifurcatum Schwein F.	60	11.00	6.60	27.27	10.58	9.09	46.94	15.65	102.43	78.46	112.25	0.18	+++
Phymatodes sclopendria (Burm F.) Ching	20	1.00	0.20	9.09	0.96	0.28	10.33	3.44		10.48	14.99	0.05	+
Oleandra distenta Kunze	80	77.50	62.00	36.36	74.52	85.40	196.28	65.43		450.05	643.85	0.97	++++
Pyrrosia mechowii (Heiron) Alston	40	4.90	1.80	18.18	4.33	2.48	24.99	8.33		34.93	49.97	0.11	++
TOTAL	220	104	72.60	99.99	100.01	100.01	300.01	100.01		602.51	861.96	1.81	
Eastern location sampled plot 4													
Species	%F	A	D	%RF	%RA	%RD	IVI	RIVI	mSR	SdH'	SdE	A/F	Remark
Platycerium bifurcatum Schwein F.	60	11.33	6.80	27.27	11.46	12.19	50.92	16.97		86.92	144.87	0.19	+++
Pyrrosia mechowii (Heiron) Alston	60	3.00	1.80	27.27	3.04	3.23	33.54	11.18	91.33	51.17	85.288	0.05	+++
Oleandra distenta Kunze	80	50.50	40.40	36.36	51.10	72.40	159.86	53.29		352.29	587.15	0.63	++++
Phymatodes sclopendria (Burm F.) Ching	20	34.00	6.80	9.09	34.40	12.19	55.68	18.56		23.55	39.25	1.70	+
TOTAL	220	98.83	55.80	99.99	100	100.01	300	100		513.93	856.55	2.57	

Continue …..

Species	%F	A	D	%RF	%RA	%RD	IVI	RIVI	mSR	SdH'	SdE	A/F	Remark
Eastern location sampled plot 5													
Species	%F	A	D	%RF	%RA	%RD	IVI	RIVI	mSR	SdH'	SdE	A/F	Remark
Pyrrosia mechowii (Heiron) Alston	60	2.67	1.60	27.27	5.78	6.56	39.61	13.20		63.29	90.54	0.05	+++
Platycerium bifurcatum Schwein F.	40	3.00	1.20	18.18	6.50	4.92	29.60	9.87	33.48	43.55	62.30	0.08	++
Oleandra distenta Kunze	80	22.50	18.00	36.36	48.73	73.77	158.86	52.96		349.65	500.22	0.28	++++
Nephrolepis pumicicola Ballard	20	17.00	3.40	9.09	36.82	13.93	59.84	19.95		106.34	152.13	0.85	+
Phymatodes scolopendria (Burm F.) Ching	20	1.00	0.20	9.09	2.17	0.82	12.08	4.03		13.07	18.70	0.05	+
TOTAL	220	46.17	24.40	99.99	100	100	299.99	100.01		575.90	823.89	1.31	
Eastern location sampled plot 6													
Species	%F	A	D	%RF	%RA	%RD	IVI	RIVI	mSR	SdH'	SdE	A/F	Remark
Platycerium bifurcatum Schwein F.	20	20.00	0.20	14.28	40.32	1.08	55.68	18.56		97.20	203.77	1.08	+
Oleandra distenta Kunze	100	15.60	15.60	71.43	31.45	83.87	186.75	62.26	36.90	424.16	889.22	0.16	+++++
Pyrrosia mechowii (Heiron) Alston	20	14.00	2.80	14.28	28.22	15.05	57.53	19.18		101.25	212.26	0.70	+
TOTAL	140	49.60	18.60	99.99	99.99	100	299.96	100		622.61	1305.25	1.94	
Eastern location sampled plot 7													
Species	%F	A	D	%RF	%RA	%RD	IVI	RIVI	mSR	SdH'	SdE	A/F	Remark
Platycerium bifurcatum Schwein F.	60	6.67	4.00	33.33	3.28	6.27	42.88	14.29		69.99	100.13	0.11	+++
Nephrolepis pumicicola Ballard	20	94.00	18.00	11.11	46.15	29.47	86.73	28.91	88.70	60.30	86.27	4.70	+
Oleandra distenta Kunze	60	51.00	30.60	33.33	25.04	47.96	106.33	35.45		215.49	308.28	0.85	+++
Phymatodes sclopendria (Burm F.) Ching	20	51.00	10.20	11.11	25.04	15.99	52.14	17.38		89.53	128.08	2.55	+
Pyrrosia mechowii (Heiron) Alston	20	1.00	0.20	11.11	0.49	0.31	11.91	3.97		12.81	18.33	0.05	+
TOTAL	180	203.67	63	99.99	100	100	299.99	100		448.12	641.09	8.26	
Eastern location sampled plot 8													
Species	%F	A	D	%RF	%RA	%RD	IVI	RIVI	mSR	SdH'	SdE	A/F	Remark
Platycerium bifurcatum Schwein F.	40	3.50	1.40	28.57	9.05	6.48	44.10	14.70		72.52	152.03	0.09	++
Oleandra distenta Kunze	60	30.67	18.40	42.86	79.31	85.19	207.36	69.12	43.19	480.40	1007.12	0.51	+++
Phymatodes sclopendria (Burm F.) Ching	40	4.50	1.80	28.57	11.64	8.33	48.54	16.18		81.84	171.57	0.11	++
TOTAL	140	38.67	21.60	100	100	100	300	100		634.76	1330.72	0.71	
Eastern location sampled plot 9													
Species	%F	A	D	%RF	%RA	%RD	IVI	RIVI	mSR	SdH'	SdE	A/F	Remark
Oleandra distenta Kunze	80	181.00	144.80	50.00	75.64	92.00	216.64	72.21		506.01	843.35	2.26	++++
Platycerium bifurcatum Schwein F.	40	1.50	0.60	25.00	0.62	0.38	26.00	8.67	260.67	36.79	61.32	0.04	++
Pyrrosia mechowii (Heiron) Alston	20	2.00	0.40	12.50	0,83	0.25	13.58	4.53		15.39	25.65	0.10	+
Phymatodes sclopendria (Burm F.) Ching	20	58.00	11.60	12.50	23.92	7.37	43.79	14.60		71.88	119.80	2.90	+
TOTAL	160	242.50	157.40	100	100.01	100	300.01	100.01		630.07	1050.12	5.30	
Eastern location sampled plot 10													
Species	%F	A	D	%RF	%RA	%RD	IVI	RIVI	mSR	SdH'	SdE	A/F	Remark
Platycerium bifurcatum Schwein F.	60	3.33	2	37.50	1.41	3.85	42.76	14.25		69.74	116.23	0.06	+++
Oleandra distenta Kunze	20	215.00	43.00	12.50	91.17	82.69	186.36	62.12	85.00	423.10	705.17	10.75	+
Pyrrosia mechowii (Heiron) Alston	40	14.50	5.80	25.00	6.15	11.15	42.30	14.10		68.79	114.65	0;36	++
Phymatodes scolopendria (Burm F.) Ching	40	3.00	1.20	25.00	1.27	2.31	28.58	9.53		41.61	69.35	0.08	++
TOTAL	160	235.83	52.00	100	100	100	300	100		603.24	1005.40	11.25	
Eastern location sampled plot 11													
Species	%F	A	D	%RF	%RA	%RD	IVI	RIVI	mSR	SdH'	SdE	A/F	Remark
Oleandra distenta Kunze	100	25.80	25.80	50.00	51.29	77.71	179.00	59.67		403.26	672.10	0.26	+++++
Phymatodes scolopendria (Burm F.) Ching	40	9.00	3.60	20.00	17.89	10.84	48.73	16.24	53.70	82.25	137.08	0.23	++
Platycerium bifurcatum Schwein F.	40	3.50	1.40	20.00	6.96	4.22	31.18	10.39		46.58	77.63	0.09	++
Nephrolepis pumicicola Ballard	20	12.00	2.40	10.00	23.86	7.23	41.09	13.70		66.31	110.52	0.60	+
TOTAL	200	50.30	33.22	100	100	100	300	100		598.40	997.33	1.18	

%F = Frequency, A=Abundance, D=Density, %RF=Relative Frequency, %RD=Relative Density, %RA=Relative Abundance, IVI=Important Value Index, mR=Margalef Richness, SdH'=Species diversity Richness, SdE=Species diversity Evenness, A/F=Distribution pattern.

Nephrolepis pumicicola recorded least frequency (20%) in sp2, 4, 7, 8 & 9 respectively with a similar least frequency (20%) by *Drynaria laurentii* in sp4. On the eastern location as shown in Table 3, clarified that the highest frequency (60%) in sp7 and sp10 respectively and least frequency (20%) in sp6 were recorded by *P. bifurcatum. Oleandra distenta* had a highest frequency (60%) with *P. mechowii* recording the least frequency (20%) in sp1. Also in sp6, *O. distenta* has recorded a highest frequency (100%) while a least frequency (20%) was recorded for *P. mechowii and P. bifurcatum* which also had the highest frequency (60%) with *O. distenta* and least frequency (20%) among *P. mechowii, P. scolopendria* and *N. pumicicola* in sp7. In sp8 and 9, *O. distenta* recorded highest frequency (60% & 80%) respectively while *P. bifurcatum* (40%), *P. mechowii* (20%) and *P. scolopendria* (40% and 20%) were least in frequency distribution. A highest frequency (80%) for *Phymatodes scolopendria* and least frequency (20%) for *Nephrolepis pumicicola* in sp2 were recorded while sp3 and 5 has *O. distenta* with the highest frequency (80%) respectively, and least frequency (20%) of *P. scolopendria* and *N. pumicicola* recorded. In sp10, least frequency (20%) of *O. distenta*, which also had highest frequency (100%) with least frequency (20%) of *N. pumicicola* in sp11 were recorded.

Abundance: *Platycerium bifurcatum* recorded the highest abundance (43.67) in sp6 and least abundance (4.50) in sp4 among sampled plots while *O. distenta* had the highest abundance (123) in sp10. *Phymatodes scolopendria* recorded the highest abundance (72.50) in sp5 and least (2.00) in sp6 while *N. pumicicola* had a highest abundance (49) in sp3, with *D. laurentii* recording a similar highest abundance (187) in sp4. *Pyrrosia mechowii* recorded least abundance (1) in sp1, 2, and 3 respectively (Table 2). On the eastern location *P. bifurcatum* has the highest abundance (20) in sp6 and least abundance of (1) in sp1 while *O. distenta* recorded the highest abundance (215) in sp10 among sampled plots. *Pyrrosia mechowii* had the least abundance (1) in sp7 with *P. scolopendria* (1) in sp3 while *N. pumicicola* recorded a highest abundance (94) in sp7. More data are outlined in Table 3.

Density: The data outlined in Table 2, outlined that *Platycerium bifurcatum* recorded the highest density (26.20) in sp7 and a least density of 4.80 in sp11, while *O. distenta* similarly recorded highest density (123.00) in sp10. *Phymatodes scolopendria* recorded highest density (29) in sp5 and a least density (1.20) in sp6. *Pyrrosia mechowii* also had least density (0.20) in sampling plots 1, 2, 3, respectively, with *N. pumicicola* recording a similar least density (0.60) in sp7. *Drynaria laurentii* recorded a highest density of 37.80 in sp4. The eastern *P. bifurcatum* recorded least density (0.20) in sp6 while *O. distenta* had the highest density (144.80) in sp10. *Pyrrosia mechowii* recorded least density (0.20) in sp7, with *P. scolopendria* (0.20) in sp3, & 5 respectively and *N. pumicicola* (0.80) in sp2, (Table 3).

Importance Value Index (IVI): *Platycerium bifurcatum* recorded highest IVI of 148.25 in sp6 and least IVI (46.20) in sp11 respectively in western location (Table 2), while *O. distenta* recorded the highest prevalent IVI (187.93) in sp11. *Phymatodes scolopendria* recorded highest IVI (92.50) in sp5 and least IVI (35.35) in sp4 with *P. mechowii* least IVI (6.69) in sp10. *Nephrolepis pumicicola* recorded a least IVI (58.78) in sp7 and *D. laurentii* a highest IVI (108.19) in sp4. In the eastern location (Table 3) *P. bifurcatum* recorded least IVI value (31.18) in the sp11 while *O. distenta* recorded the highest prevalent IVI value (237.43) in sp1. *Pyrrosia mechowii* recorded least IVI value (11.91) in sp7, *P. scolopendria* least IVI value (10.33) in sp3 and *N. pumicicola* least IVI (4.96) in sp3.

Sampled plot species richness: The Margalef richness among the 11 sampled plots of western location has recorded highest species richness (398.56) in sp10 while sampled plot 7 has the least species richness of 18.03, (Table 2). The eastern location sampled plots had highest species richness (260.67) in sp9 while the least species richness (33.48) was recorded in sp5 (Table 3).

Species diversity: The western location has recorded (Table 2), that a least diversity (76.91) of *P. bifurcatum* in sp11 while *O. distenta* had the highest diversity (427.35) in sp11. *Phymatodes scolopendria* recorded the highest diversity (181.87) in sp5 and a least diversity (61.22) in sp6. *Pyrrosia mechowii* recorded the least diversity (5.52) in sp10, and while *N. pumicicola* had recorded a least diversity (104.00) in sp7, *D. laurentii* highest diversity (220.08) in sp4. *Platycerium bifurcatum* in the eastern location recorded highest diversity (97.20) in sp6 and least diversity (46.58) in sp11, while *O. distenta* was recorded to have the highest diversity (564.02) in sp1. *Pyrrosia mechowii* had a least diversity (12.81) in sp7 and *P. scolopendria* also least diversity (10.48) in sp3 as outlined in Table 3.

Species evenness: Result from the western location as outlined in Table 2, indicated *P. bifurcatum* with the highest evenness (674.74) in sp6 and least evenness (152.85) in sp11. *Oleandra distenta* recorded the highest evenness (895.91) in sp11, while *P. scolopendria* with also highest evenness (303.12) in sp5 had recorded a least evenness (61.22) in sp6. *Pyrrosia mechowii* recorded least evenness (7.90) in sp10, with *N. pumicicola* also recording least evenness (218.03) in sp7 while *D. laurentii* recorded a least evenness of 314.85 in sp4. In the eastern location as outlined in Table 3, *P. bifurcatum* has recorded least evenness (77.63) in sp11; *O. distenta* recorded the highest evenness (1182.43) in sp1, while *P. mechowii* had recorded the least evenness (18.33) in sp7, with *P. scolopendria* (14.99) in sp3.

Structural life form and similarity index: Generally, in all sampled coordinates of the Western and Eastern plots, the structural life habit were observed to be herbaceous epiphytes (Table 1), while the Sorenson index has recorded more similarity (90.91%) than dissimilarity (-89.91%) of species composition between the western and eastern coordinates.

Distribution pattern (Ratio: A/F): In the western location *P. bifurcatum* recorded a regular distribution in sp1 and a contiguous distribution in sp2, 3, 4, 5, 6, 7, 8, 9, 10 & 11 respectively, while *O. distenta* was contiguous in distribution in all the sampled plots (1-11). *Phymatodes scolopendria* recorded regular distribution in sp6 and contiguous distribution in sp1, 2, 3, 4, 5, 8, 9 & 10 respectively; *Pyrossia mechowii* recorded regular distribution in sp1, 2 & 3 and a contiguous distribution in sp8, 9, 10 & 11 respectively; with *N. pumicicola* in contiguous distribution in sp2, 3, 4, 5, 7, 8, 9 & 10 respectively while *Drynaria laurentii* recorded a contiguous distribution in sp4 (Table 2). On the eastern location *P. bifurcatum* was regularly distributed in sp1, 2 & 9 and contiguously distributed in sp3, 4, 5, 6, 7, 8, 10 & 11 respectively; while *O. distenta* recorded contiguous distribution in all sampled plots (1-11). *Phymatodes scolopendria* recorded regular distribution in sp3 & 5 respectively and a contiguous distribution in sp2, 4, 7, 8, 9, 10 & 11 respectively; *Pyrossia mechowii* recorded a regular distribution in sp4, 5 & 7 and a contiguous distribution in sp1, 3, 6, 9 & 10 respectively while *N. pumicicola* recorded a contiguous distribution in sp2, 3, 5, 7, & 11 respectively (Table 3).

DISCUSSION

Following the use of geospatial technology in the delineation of arboreal epiphyte of greenbelt canopy formation in parts of Rivers State, the study has recorded some degree of phytosociological dynamics among epiphytes in the western and eastern coordinates of the study location. In all the phytosociological index of study, it was observed that *Oleandra distenta* tend to have the highest value in all the quantitative ecological values in most of the sampled plots in both the western and eastern coordinates of the study site. *Pyrossia mechowii* had the least value in the western site while *Phymatodes scolopendria* recorded the least value in the eastern site of the study location. This possibly might be as a result of the variations among host species in relation to several assertions on factors including: bark morphology, chemical composition and some other morphology that helps them in water retention which enhances the development and distribution of epiphytes (Benzing, 1990; Hietz and Briones 1994; Higgins 2004; Reyes-Garcia et al., 2008; Zhang et al., 2015). It was observed that bigger trees such as *Azadirachta indica* (Neem plant) could offer large surface area and several microhabitats that could support larger numbers of epiphytes. This corroborates the assertion by Annaseslvam and Parthsarathy (2001); Flores-Palacios and Garcia-Franco (2006) who has observed the impact of variant bark morphology of host plant on epiphyte proliferation. It has also been noted that branch inclination, position and diameter as well as the regorousity of tree bark enhanced the ability of epiphytic species to adhere to substrate, resulting to a great influence on the growth and development of epiphyte along the host vertical axis (Bogh, 1992; Neider et al., 2000). Similar study on the epiphytic spatial distribution depends on their relationship between their particular requirements [biotic factors (availability of host, dispersers and pollinators) and abiotic factors (temperature)] for germination, survival, growth, and reproduction, because the height of host plant tends to determine the abundance of epiphytes (Nieder et al., 2000, Zotz and Vollrath 2003; Benavides et al., 2011). It was noted that *Platycerium bifurcatum* and *Oleandra distenta* were the most frequent species of the sampled plots seen on the western location and the eastern location respectively basically due to the height and availability of light which penetrates the simple leaf arrangement of *Azadirachata indica* (host plant). This corroborates Reyes- Garcia, et al. (2008) and Benavides et al. (2011) who in similar study had recorded epiphytic abundance based on the growth factors and height of host plant. By the Margalef (1958) index of sampled plot richness the western coordinate of the study site with six epiphytic species (*P. scolopendria, P. bifurcatum, O. distenta, N. pumicicola, P. mechowii* and *D. laurentii*) with variant sampled richness had the highest species richness (389.56) in sampled plot ten & least (18.03) species richness in sampled plot seven. The eastern coordinate with five epiphytic species (*P. mechowii, P. bifurcatum, O. distenta, N. pumicicola* and *P. scolopendria*) with variant sampled richness had the highest species richness (260.67) in plot nine & least (33.48) species richness in sampled plot five. *Drynaria laurentii* was found only on one sampled plot (plot 4) throughout the canopy formation of the western coordinate, this possibly might be as a result of the host plant factor influencing the patterns of colonization as recorded by its highest abundance, density, Importance Value Index, species diversity and species evenness. This reaffirms the earlier assertion by Nalini (2001) in light of host plant bark texture and pH influence.

Although the epiphytic species was found only on one sampled plot in the western coordinate of the study site, this according to D'Amato et al. (2009) might have been due to structural vegetation changes as similarly observed in many regions of the world. This might have attributed to the alteration in the greenbelt canopy thus creating a narrow ecological niche of species specialist, which influences the epiphytic biomass and frequency, and this according to Vellend et al. (2006), may lead to local extinction of the species if the changes persist for a long period of time. There were more epiphytes on the western coordinate unlike the opposite eastern coordinate (with less species) of the study site, which invariably means that the horizontal distribution might be a result of the tree types, bark formation, host species mineral component and some disturbances like tree logging, which if not controlled shall increase the rate of epiphytic loss (Barthlott et al., 2001; Vandunne, 2002; FAO, 2010). According to Forsyth and Miyata, (1984); Kim, et al. (1997) flaky barks has also been associated with increased water retention and has helped in the increased growth of epiphyte. It was noticed that out of the 214 plants enumerated, 11 tree stands of *Poiciana regia* belonging to the family - Fabaceae and 1 stand (*Gmelina arborea*) of the family- Verbenaceae on eastern parts of the coordinate had smooth barks and no form of epiphytic growth was seen on them. This possibly could also confirm the rationale for greater epiphytic proliferation in the Western site of the study location than the eastern site.

The distribution pattern of species among the sampled plots in the Western and Eastern coordinates based on the Curtis and Cottam (1956) ratio of abundance to frequency (A/F) had indicated that the species were contiguous and random, non-regular in distribution within and among sampled plots of the study location. The Western coordinate had *Oleandra distenta* with the highest distribution (16.16%) contiguous, while *Drynaria laurentii* had the least (1.52%) contiguous distribution patterns. Also it was observed that *Pyrossia mechowii* had the highest pattern (5.55%) in random distribution while *Platycerium bifurcatum* and *Phymatodes scolopendria* had least (1.52%) random distribution patterns. In the Eastern coordinate *Oleandra distenta* had the highest distribution (20%) in contiguous pattern, while *P. mechowii* and *N. pumicicola* had the least (9.10%) contiguous patterns respectively. In random distribution pattern *P. bifurcatum* and *P. mechowii* had the highest (5.50%) respectively, while *P. scolopendria* had least (3.64%) random distribution. Such variation in distribution pattern of species between the two coordinates could be attributed to differences in host species combination and morphological characteristics. The epiphytes distribution according to (Barthlott et al., 2001, Kromer and Gradstein 2003, Benavides et al., 2006, Cascante marin et al., 2006, Woods and Dewalt, 2012) are quite influenced by the host characteristics which include the host species combination, the stand age and their dispersal limitations. Generally, in all sampled coordinates of the Western and Eastern sampled plots, the structural life form were observed to herbaceous epiphytes in corroboration to the life form classification of Kershaw (1975), Raunkiaer (1934) and Mueller – Dombois and Ellenberg (1974). The Sorenson index (1948) has shown the similarity and dissimilarity of species composition between the eastern and western coordinates. A more similarity value (90.91%) was observed showing that they are more similar than dissimilar (-89.91%) in species composition. Studies has shown that canopy density and branching plays major role in the distribution of epiphyte because the leaf characteristics of host plant plays a major role in determining the light quantity filtering down from the upper canopy branching of the tree (Whitmore, 1989). This also conforms to the morphological attributes of the *Azadirachta indica* (host plant), which possibly must have impacted on the growth of the epiphytes enumerated on the sampled coordinates (eastern and western wing) of the study location. Based on the research it has been observed that the western coordinate was mostly of dispersed clumps canopy which allowed more of epiphyte species while the eastern coordinate was mostly made of 2 different canopy formations including open canopy (mostly made of understory plant cover, predominated with herbs and grasses) and dispersed clumps canopy. Similarly, Thorsten and Gradstein (2016) in the study of arboreal epiphytes using RRED-analysis has noticed that most epiphytes mostly occur on the zone three and four of their host plants, as been exemplified with *Phymatodes scolopendria* as a result of branch formation of the canopy.

Conclusion

The use geospatial tool and RRED analysis in the delineation of arboreal epiphyte has shown it relevance in the assessment of spatial distribution of epiphyte in a greenbelt canopy formation. Two different species of plant (11 *Poiciana regia* stands and 1 *Gmelina arborea* stand) of the 214 tree stands sampled, had no epiphytes on them. This was due to their smooth bark which gave no room for development of epiphytes. Though the epiphytes were mostly seen on a common host but there was diversity in the epiphytic proliferation. This might imply that the epiphytic development does not solely depend on the host species but on some related growth factors.

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