Journal of Sustainable Development in Africa (Volume 17, No.7, 2015)
ISSN: 1520-5509
Clarion University of Pennsylvania, Clarion, Pennsylvania

ECOTOURISM DEVELOPMENT IN OKOMU NATIONAL PARK, NIGERIA

[1]Oluwatobi Emmanuel Olaniyi, [1]Babafemi George Ogunjemite and [2]Shadrach Olufemi Akindele
[1]Department of Ecotourism and Wildlife Management, Federal University of Technology, Akure, Nigeria.
[2]Department of Forestry and Wood Technology, Federal University of Technology, Akure, Nigeria.

ABSTRACT

We determined the impact of ecotourism infrastructural development on the woody components of Okomu National Park. This necessitated identifying the ecotourism attractions/facilities, interviewing of respondents and on-site observation and quadrant method were employed in acquiring information on ecotourism attractions/facilities and vegetation assessment respectively. Significant variations were observed in the tree growth variables measured between the ecotourism built-up and the control areas. The abundance distribution model, kernel density and species accumulation curves itinerated the pictorial disparity in distribution of woody vegetations' abundance between the areas. Furthermore, the IUCN Red data endangered species of *Diospyros crassiflora* had been eroded from the ecotourism built-up areas; while the vulnerable species of *Anopyxis klaineana* were conspicuously absent in the control areas. These differences depicted the non eco-friendly approaches taken in the design, implementation and maintenance of ecotourism attractions and facilities. However, concerted efforts had to be taken by relevant stakeholders to forestall this inimical growth towards sustainable ecotourism development.

Keywords: Ecotourism Development, Okomu National Park, Woody Vegetation, Species Accumulation Curves, Southwest Nigeria.

INTRODUCTION

Ecotourism's perceived potential as an effective tool for sustainable development is the main reason why developing countries are now embracing it and including it in their economic development and conservation strategies (Kiper, 2013). It helps in community development by providing the alternate source of livelihood to local community. Sustainable packaging of the ecotourism attractions in an ecotourism destination without disturbing the ecosystem is a concerning issue in the world today. Many countries have ensured their regional development by this concept, while very few countries are still far-fetched. Increased human interference in ecologically fragile areas can cause irreversible change in the existing ecological processes. These problems can be reflected in degrading natural resources, vegetation structure and the size of the habitat patch, increasing deforestation and decreasing upstream water flow (Tourism Queensland, 2002). In achieving sustainability of ecotourism development, Brown *et al.* (1997) opined that it is contingent to reconcile on tourism activities with local socio-economic values and environmental protection.

The rapid development and widening appeal of ecotourism has raised significant challenges for the sector (Reynolds and Braithwaite, 2001). The construction of ecotourism infrastructures such as roads, tracks, car parks, toilets, visitor centers and accommodation causes irreversible loss of extensive areas of vegetation, with direct and indirect impacts in adjacent undisturbed natural vegetation (Pickering, 2007). Although, the total area allocated to infrastructure may be relatively small compared to the total area of the park, the impacts at that site could be severe and often permanent (Smith and Newsome, 2002; Pickering and Buckley, 2003; Turton, 2005). Okomu National Park is becoming one of the 'foremost ecotourism destinations among the protected areas of Nigeria. Therefore, caution had to be taken by stakeholders to mitigate the negative effects of ecotourism development due to the presence of some vulnerable animal species such the Nigerian White-throated Guenon (*Cercopithecus erythrogaster pococki),* African Forest Elephant (*Loxodonta africana cyclotis*) in the park. Steps had to be taken in order to preserve these ecological components.

Moreover, if concerted efforts are not made towards its sustainable development, there will be a time when such developments will raise questions on the acceptable balance between satisfying the short-term physical and social needs of humans for economic welfare and leisure, and the longer-term need to protect the environment. Despite ecotourism's sustaining capability, it's not enough to neglect the possible negative effects that could emanate from the injudicious biodiversity management of ecotourism destinations. Therefore, this necessitated ascertaining the ecotourism attractions and facilities being developed, as well as assessing the impacts of the infrastructural development towards ecotourism on the woody vegetation of the park.

METHODOLOGY

Geographical description

Okomu National Park was established by Decree 46 of 1999 and located between Latitude 6^0 15'N and 6^0 25' N and longitude of 5^0 90'E and 5^0 23' N (Figure 1). The Park covers an area of 202.24 km² (Okomu National Park, 2010). The topography is gentle ranging between 30m and 60 m above sea level. Rainfall is between 1,524 and 2,540mm. The park's dry season occurs

from December to February and the wet season lasts from March to November (Soladoye and Oni, 2000). Vegetation is Guinea-Congo lowland rain forest, including areas of swamp-forest, high forest, secondary forest and open shrub (Okomu National Park, 2010).

METHOD

Information on the ecotourism attractions/facilities and infrastructures of the study area were collected using interview method and on-site observation. Officers in the Ecotourism Unit of the park were interviewed. Quadrant method was used in the assessment of the vegetation of the park (FAO, 2009). Floristic Dissimilarity (FD; Cole, 1978) was calculated. Ecotourism infrastructures/attractions/facilities /scenic spots were selected to measure the impacts of ecotourism development on the woody vegetation. Twenty five plots (25 × 25 m^2) were marked out in each of the spots identified in order to determine the floristic dissimilarity. The same number of largely undisturbed 'control' areas that are 100 m away from the development sites were also assessed.

Floristic Dissimilarity, $FD = 0.5S\ /Pi1 - Pi2/$ i = 1~n (1)

Pi1 and Pi2 are the amount of species i in a control site and developed site respectively, and n is the number of species. The value of FD can vary between 0 and 100%, where 0 means that an impacted site and its control site are identical in terms of the species and their relative abundance; a value of 100% means that the two sites have no species in common (Hammitt and Cole, 1998).

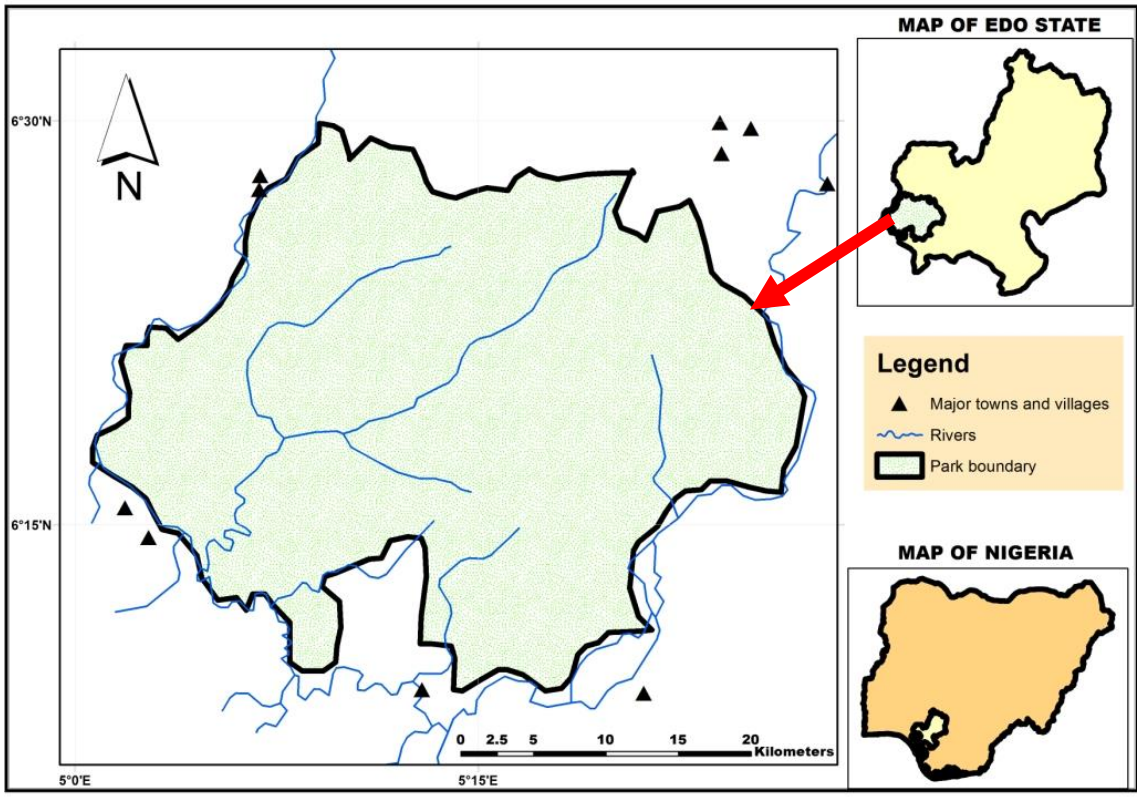

Figure 2: Location of Okomu National Park in Edo State, Nigeria

RESULTS

Table 1 presents the ecotourism attractions/facilities in Okomu National Park, Nigeria. Eighteen (18) ecotourism attractions/ facilities were identified. These include: hanging foot bridge, old tree house, Iron bridge, Lakes 36, 52, 61, 64 (New tree house) and 94, Arakhuan stream, restaurant/bar, children playing ground, swimming pool, chalets, museum, sitting ground, Rangers' quarters, Osse River and Okomu River. Fourteen (14) of the ecotourism attractions/ facilities were located in ArakhuanRange, Julius Creek and Babui Ranges had of one (1) ecotourism facility each – Iron bridge and Lake 94 respectively. Ecotourism attractions/ facilities with natural and human-made buildings, structures and sites that were designed for a purpose other than attracting visitors had the highest frequency of occurrence (8) each, while human-made buildings, structures and sites that are designed to attract visitors and are purposely-built to accommodate visitors' needs had the least frequency of occurrence (2).

Table 2 shows the phyto-sociological variables of woody vegetation in the ecotourism built-up area of Okomu National Park, Nigeria. Eighteen (18) woody species had the least frequency of occurrence (1), while *Antonata microphylla* had the highest frequency of occurrence (27). *Cola smittii* had the least mean tree height (2.60 ± 0.0000 m) at 95% Confidence limit, while *Basqua angolese* had the highest mean tree height (50.30 ± 0.0000 m). *Anoa claenena* had the least mean girth size (5.30 ± 0.0000 cm), while *Basqua angolese* had the highest mean girth size (290.50 ± 0.0000 cm). *Rothmania whitefidei* had the least mean canopy size (1.17 ± 0.27 m), while *Mangifera indica* had the highest mean canopy size (15.55 ± 1.05 m). Family *Leguminosae* had the highest number of woody vegetation species (7) - *Albizia ferruginea, Afzelia africana, Anthonotha macrophylla, Baphia nitida, Baphia pubescens, Hylodendron gabunense* and *Pentaclethra macrophylla.*

Table 3 shows the phyto-sociological variables of woody vegetation in the ecotourism control area of Okomu National Park, Nigeria. Seventeen (17) woody species had the least frequency of occurrence (1), while *Strombosia grandifolia* had the highest frequency of occurrence (47). *Trichilia africana* had the least mean tree height (4.50 ± 0.0000 m) at 95% Confidence limit, while *Irvingia gabonesis* had the highest mean tree height (42.20 ± 0.0000 m). *Canarium schweifurthii* had the least mean girth size (3.20 ± 0.0000 cm), while *Strombosia postulata* had the highest mean girth size (182.45 ± 15.45 cm). *Terminalia superba* had the least mean canopy size (0.40 ± 0.0000 m), while *Strombosia postulata* had the highest mean canopy size (18.35 ± 0.55 m). Family *Leguminosae* had the highest number of woody vegetation species (10) - *Albizia ferruginea, Afzelia africana, Anthonotha macrophylla, Baphia nitida, Baphia pubescens, Distemonanthus benthamianus, Hylodendron gabunense, Pentaclethra macrophylla, Piptadeniastrum africanum* and *Tetrapleura tetraptera.*

Table 4 presents the independent T-test for the tree growth variables of woody species in the vegetation of the ecotourism built-up and control areas of Okomu National Park, Nigeria. Built-up areas had the least mean tree height (10.66 ± 1.40 m) at 95% confidence limit, while the control areas had the highest mean tree height (15.95 ± 1.23 m). There is significant difference ($P < 0.05$) in the tree height between ecotourism built-up and controlled areas ($T = -2.53$, $P = 0.01$). Built-up areas had the least mean girth size (35.70 ± 5.55 cm) at 95% confidence limit, while the control areas had the highest mean girth size (35.58 ± 3.99 cm). There is no significant difference ($P > 0.05$) in the tree girth size between ecotourism built-up and controlled areas ($T = 0.02$, $P = 0.99$). Built-up areas had the least mean canopy size (2.53 ± 0.37 m) at 95% confidence limit, while the control

areas had the highest mean canopy size (3.98 ± 0.39 m). There is significant difference ($p < 0.05$) in the tree canopy size between ecotourism built-up and controlled areas.

Table 5 shows the summary of the phyto-sociological characteristics of woody vegetation in the developed and controlled areas of Okomu National Park, Nigeria. A total of one hundred and sixty one (161) stands of woody trees belonging to forty five (45) different species and twenty six (26) families were observed in the developed areas, while total of four hundred and eighty four (484) stands of woody trees belonging to seventy three (73) different species and twenty eight (28) families were recorded in the controlled areas. The built-up areas recorded the least Shannon Werner diversity index (3.29), while the control areas recorded the highest Shannon Werner diversity index (3.77). The least Simpson evenness index was recorded in the developed areas, while the highest Simpson evenness index was recorded in the control areas. The built-up areas recorded the least Chao-1 (54.71), while the control areas recorded the highest Chao-1 (88.11).

Figure 2 presents abundance distribution model of woody vegetation in the ecotourism built-up and controlled areas of Okomu National Park, Nigeria. The built-up areas had an evenly distributed and significantly related ($p < 0.05$) abundance of woody vegetation species ($K = 0.06$, $\chi^2 = 49.20$, $P = 0.00$), while the controlled areas had an evenly distributed and significantly related ($p < 0.05$) abundance of woody vegetation species ($K = 0.05$, $\chi^2 = 67.14$, $P = 0.04$).

Figure 3 shows kernel density of woody vegetation in the ecotourism built-up and control areas of Okomu National Park, Nigeria. The built-up areas had the least density of woody vegetation species per hectare (- Log likelihood = -55.22, Akaike IC = 119.40), while the control areas had highest density of woody vegetation species per hectare (- Log likelihood = -157.10, Akaike IC = 322.80).

Figure 4 presents the species accumulation curves of woody vegetation in the ecotourism built-up and control areas of Okomu National Park, Nigeria. The least richness (45) was recorded in the built-up areas, while the highest richness (73) was recorded in the control areas.

Table 6 present the floristic dissimilarity between the ecotourism built-up and control areas of Okomu National Park, Nigeria. Woody floristic compostion of eight (8) ecotourism attractions/facilities with their control areas were assessed. Iguowan gate had the least occurrence (3) of woody vegetation species in the developed areas, while Arakhuan tourist camp had the highest occurrence (18) of woody vegetation species in the developed areas. Lakes 61 and 94 gate had the least occurrence (18) of woody vegetation species each in the control areas, while Arakhuan tourist camp had the highest occurrence (34) of woody vegetation species in the control areas. The least floristic dissimilarity index (2.5) was recorded at the Iron Bridge with more species and their relative abundance in common, while the highest floristic dissimilarity index (11.5) was recorded at the Iguowan gate with lesser species and their relative abundance in common.

DISCUSSION

Vegetation of Okomu National Park

The vegetation of Okomu National Park shows some potential for conservation and ecotourism purposes with eighty-four (84) species of plants recorded. Species composition of the ecotourism built-up and control areas shows the expression of the extent of infrastructural development's impact through ecotourism on the park. This was due to the fact that environmental impacts can be associated with tourism infrastructure (Newsome *et al.*, 2002a; Turton, 2005). The presence of *Elaeis guineensis, Citrus sinensis, Mangifera indica* and *Carica papaya* confirmed the human activities that had taken place in the site. Ogunjemite *et al.* (2013) opined that the preponderance of *Elaeis guineensis* in a protected area could have demonstrated a level of cultivation around the site and the ability of wild fauna resources of the site in the dispersal and regeneration of the forest. Primates and birds which were more diverse in the site are good agents of dispersal and regeneration therefore aid to healthy growth of forest (Wahungu *et al.*, 2012; Wiafe and Amoah, 2012). Also, the presence of *Treculia africana* in the control areas shows that the site may have been protected traditionally in the past (Ogunjemite *et al.*, 2013), and the ecotourism development could have been one of the greatest factors for its absence in the ecotourism built-up areas.

There was slight difference in the species and family compositions recorded during the study [eighty-four (84) species belonging to thirty-three (33) families of plants] to that recorded by Oduwaiye *et al.*, (2002) - sixty seven species from twenty five families in Okomu National Park. The increment was a reflection of the succession that had taken place within a time span. However, the woody vegetation in the ecotourism built-up areas (forty five (45) different species and twenty six (26) families) were observed in the developed areas was observed to be lesser than the previous vegetation assessment result, which was a clear indication of forest destruction posed by non-ecofriendly approach of infrastructural development in the site towards ecotourism.

The transitional phases in the early management of the park (Forest Reserve-Wildlife Sanctuary-National Park) through various human influences were demonstrated by the occurrence of the exotic species such as *Gmelina arborea* and *Tectona grandis* in the built-up areas. As such, these exotic species were more frequent in the ecotourism built-up areas such as chalets, museums, restaurant/bar, swimming pool and children playing ground. Nevertheless, the forest still compare well with some secondary forests of southwest Nigeria that are currently been considered for conservation purposes in the region.

The vegetation of Okomu National Park contains IUCN Red data listed species such as *Entandrophragma angolense, Lovoa trichilioides, Anopyxis klaineana, Nauclea diderrichii* (vulnerable), and *Diospyros crassiflora* (endangered). It showed the great potential of the site for conservation, ecotourism and research purposes. The endangered species of *Diospyros crassiflora* had been eroded from the ecotourism built-up areas; while the vulnerable species of *Anopyxis klaineana* were conspicuously absent in the control areas. Sun and Walsh (1998) and Pickering (2005) opined that the most obvious and direct impact of ecotourism development is vegetation clearance, and the damage is not only restricted to the initial removal of native vegetation, but also to usually indirect effects in adjacent natural vegetation. However, the ecological disparity can be connected to developmental and maintenance approaches in the site. Therefore, it calls for more ecological considerations in the ecotourism developmental processes in order to ensure ecological sustainability.

Implications of diverse Ecotourism attractions/facilities on national development, cultural integration and livelihood improvement

The diverse nature of the ecotourism attractions and facilities (natural, human-made and even cultural) of Okomu National Park is an indicator of its great potential to contribute into National development in Nigeria including cultural integration and livelihood improvement of the host communities. Ecotourism development had been discovered to be a panacea to national development (Honey, 1999; Lindberg, 2001; Matthews, 2002). Presently, Nigeria is yet to seek for an alternative means to oil exploration in revenue generation (Ijeh, 2010; Anwana, 2011; Akujuru, 2015). However, the presence of these ecotourism virtues in the park amidst other ecotourism destinations in the country depicted a greater future for the nation. These ecotourism potentials toward national development can fully be attained in an atmosphere of sustainable packaging the ecotourism attractions in such a way there will be little or no negative impact to the ecosystems. Much more, at certain periods of the year, the people of Udo – one of the largest and most important traditional host communities to the ecotourism destination- exercised some traditional rituals and worship the Arakhuan River. This river is one of the natural attractions in the park with some cultural and historical importance to the community. Also, it served as cultural attractions during the ritual periods, during which indigenes and non-indigenes that were born as a result of worshipping the river come to pay their homage. Friends and relatives of these people were present to witness the cultural activities, and it usually gives the on-site tourists the privilege to gain a sense of satisfaction witnessing the cultural event.

Ecotourism development and phyto-sociological characteristics

The composition of woody vegetation is important to determining the influence of development on an ecotourism destination (Pickering and Hill, 2007; Okech and Bob, 2009; Olaniyi and Ogunjemite, 2015). Presently, due to the pressing needs for alternative means of revenue generation in Nigeria (Uzonwanne, 2015), little or no considerations had been given to sustainable development by balancing infrastructural development and ecosystem maintenance. Ecotourism is being rooted on the principle of its conservation capability. The process of its development had raised a question whether it had been a curse or a blessing to the woody vegetation of Okomu National Park – the largest home to the vulnerable *Cercopithecus erythrogaster pococki* in Southwest Nigeria. In the study, significant variations were observed in the tree growth variables (height and canopy size) and phyto-sociological characteristics (number of individual woody vegetation /ha, number of species and families, Shannon Werner diversity index, Simpson evenness index and Chao-1) of woody vegetation between the ecotourism built-up and control areas. Furthermore, the abundance distribution model, kernel density and species accumulation curves itinerated the pictorial disparsity in distribution of woody vegetations' abundance between the ecotourism built-up and control areas.

It was observed that the infrastructural development towards ecotourism had significant effect on the vertical strata and connectivity of the forest canopy cover. The control areas still maintained higher tree height in course of their ecological succession. However, the development is yet to have significant effect on the trees girth size. Also, floristic dissimilarity indices were observed to decrease with the reduced gradient in concentration of ecotourism attractions and facilities from Arakhuan

range to the Iron bridge (the most remote ecotourism attraction). Therefore, concentration of ecotourism attractions and facilities in an ecotourism destination can be one of the driving forces to its floristic dissimilarity.

CONCLUSION

It is pertinent that ecotourism can be considered as a tool in the integration of leisure, conservation and socio-cultural wellbeing of host communities towards sustainable development on a local, national, regional and international scale. However, poor planning, implementation, maintenance and monitoring processes of ecotourism development had been the germane issues in tapping into its blessing in Okomu National Park. The observed differences in the trees vertical strata, connectivity of the forest canopy cover and floristic dissimilarity between the ecotourism built-up and control areas depicted the non eco-friendly approaches taken by the park authority in the design, implementation and maintenance of ecotourism attractions and facilities. Therefore, there will be need for the park management to draft an ecotourism management plan for the sustainable development of the ecotourism destination. Major stakeholders such as the National Park Service, host communities, non-governmental organizations, international organizational, researchers, and private tour operators amidst others should be involved in the planning process. Complete bush clearing towards infrastructural development in ecotourism, and maintenance of the existing ecotourism attractions/facilities should be highly discouraged. Although, the humid nature of the park had been the rationale behind clearing bushes close to the structures for their longetivity during maintenance exercise, more researches should be undertaken by ecologists and building professionals for the design of suitable lodges with appropriate building materials in order to mitigate the negativity of this natural climatic phenomenon.

Table 1: Ecotourism attractions/facilities in Okomu National Park, Nigeria

Ecotourism attractions/facilities	Locations/ Ranges	Types of attractions[1]	Objects of attraction/ Activities
Hanging foot bridge	Arakhuan	Human-made (1)	
Old tree house	Arakhuan	Human-made (2)	
Iron bridge	Julius Creek	Human-made (1)	
Lake 52	Arakhuan	Natural	Crocodile
Lake 36	Arakhuan	Natural	Elephant, Warthog, Red River hog
Lake 94	Babui	Natural	Different birds
Lake 64 (New tree house)	Arakhuan	Natural	Bats
Lake 61	Arakhuan	Natural	Buffalo, Elephant
Arakhuan stream	Arakhuan	Natural	Arakhuan festival
Restaurant/Bar	Arakhuan	Human-made (1)	
Children playing ground	Arakhuan	Human-made (1)	
Swimming pool	Arakhuan	Human-made (1)	

Chalets	Arakhuan	Human-made (1)	
Museum	Arakhuan	Human-made (2)	
Sitting ground	Arakhuan	Human-made (1)	
Rangers' quarters	Arakhuan	Human-made (1)	
Osse River	Boundary	Natural	Boat cruising
Okomu River	Periphery	Natural	Boat cruising, sport fishing

[1]Swarbrooke (2002)

Human-made (1) signifies ***human-made buildings, structures and sites that were designed for a purpose other than attracting visitors***, but which now attract substantial numbers of visitors who use them as leisure amenities.

Human-made (2) signifies human-made buildings, structures and sites that are ***designed to attract visitors and are purpose-built to accommodate their needs*.**

Table 2: Phyto-sociological parameters of woody vegetation in the ecotourism built-up areas of Okomu National Park, Nigeria

Family Composition	Species Composition	Frequency	Tree height (m)	Girth (cm)	Canopy size (m)
Anacardiaceae	*Mangifera indica*	2	20.05 ± 0.85	116.75 ± 13.65	15.55 ± 1.05
Annonaceae	*Annona muricata*	1	5.60 ± 0.00	5.30 ± 0.00	1.90 ± 0.00
	Cleistopholis patens	9	29.18 ± 4.37	73.62 ± 27.43	4.38 ± 1.18
Apocynaceae	*Alstonia boonei*	4	26.18 ± 8.08	87.50 ± 48.85	4.10 ± 1.70
	Funtumia elastica	1	30.60 ± 0.00	20.90 ± 0.00	2.10 ± 0.00
Bombacaceae	*Ceiba pentandra*	9	31.20 ± 4.41	134.29 ± 57.33	4.42 ± 1.35
Burseraceae	*Dacryodes edulis*	1	3.50 ± 0.00	17.10 ± 0.00	1.30 ± 0.00
Caricaceae	*Carica papaya*	1	7.30 ± 0.00	66.20 ± 0.00	4.40 ± 0.00
Combretaceae	*Terminalia superb*	2	31.25 ± 9.05	106.40 ± 93.70	3.20 ± 3.00
Irvingiaceae	*Irvingia smithii*	5	15.70 ± 5.40	49.22 ± 9.98	6.52 ± 0.51
Lecythidaceae	*Combretodendron africanum*	1	42.20 ± 0.00	138.40 ± 0.00	2.60 ± 0.00
Leguminosae	*Albizia ferruginea*	1	40.20 ± 0.00	60.40 ± 0.00	3.10 ± 0.00
	Afzelia Africana	5	13.44 ± 3.42	33.82 ± 9.18	3.56 ± 0.77
	Anthonotha macrophylla	27	19.12 ± 1.45	40.86 ± 4.10	4.09 ± 0.58
	Baphia nitida	3	18.97 ± 1.98	107.87 ± 43.35	6.67 ± 0.93
	Baphia pubescens	1	19.70 ± 0.00	50.40 ± 0.00	2.90 ± 0.00
	Hylodendron gabunense	1	16.80 ± 0.00	95.30 ± 0.00	6.90 ± 0.00
	Pentaclethra macrophylla	2	25.20 ± 10.10	62.90 ± 27.70	6.50 ± 1.80
Meliaceae	*Entandrophragma angolense*	2	35.00 ± 4.30	118.15 ± 93.05	12.20 ± 9.00
	Lovoa trichilioides	1	15.70 ± 0.00	10.30 ± 0.00	1.50 ± 0.00
Moraceae	*Bosqueia angolensis*	1	50.30 ± 0.00	290.50 ± 0.00	3.30 ± 0.00
	Ficus exasperata	1	11.60 ± 0.00	121.30 ± 0.00	14.10 ± 0.00
	Musanga cecropioides	3	25.13 ± 10.29	36.37 ± 27.07	3.57 ± 2.42

Values signify Mean ± Standard error at 95% Confidence limit

Table 2 (Contd.): Phyto-sociological parameters of woody vegetation in the ecotourism built-up areas of Okomu National Park, Nigeria

Family Composition	Species Composition	Frequency	Tree height (m)	Girth (cm)	Canopy size (m)
Ochnaceae	*Lophira alata*	5	40.22 ± 2.46	188.48 ± 4.47	7.38 ± 2.06
Olacaceae	*Stombosia grandifolia*	15	22.30 ± 2.84	66.18 ± 14.43	4.26 ± 0.72
Palmae	*Elaeis guineensis*	5	12.62 ± 1.68	63.92 ± 22.78	6.08 ± 1.95
	Raphia veriphera	2	32.70 ± 2.60	65.40 ± 5.40	5.30 ± 0.10
Passifloraceae	*Barteria nigritana*	4	13.38 ± 3.10	15.10 ± 1.83	2.63 ± 0.43
Rhizophoraceae	*Anopyxis klaineana*	2	36.25 ± 6.65	178.30 ± 17.50	14.10 ± 0.90
Rhomnaceae	*Maesopsis eminii*	1	20.30 ± 0.00	36.60 ± 0.00	2.80 ± 0.00
Rubiaceae	*Canthium subcordatum*	1	16.10 ± 0.00	55.40 ± 0.00	2.60 ± 0.00
	Mitragyna ciliate	2	32.10 ± 3.40	60.30 ± 9.90	3.15 ± 0.45
	Nauclea diderrichii	7	34.71 ± 4.66	139.34 ± 25.50	7.03 ± 1.04
	Porterandia clandantha	6	26.38 ± 6.76	69.42 ± 15.73	5.87 ± 0.83
	Rothmannia whitfieldii	11	19.74 ± 3.93	21.95 ± 3.40	1.17 ± 0.27
Rutaceae	*Citrus sinensis*	2	9.70 ± 3.40	53.95 ± 39.75	4.05 ± 3.15
	Zanthoxylum zanthoxyloides	2	15.40 ± 3.00	45.30 ± 24.80	4.60 ± 3.00
Sapindaceae	*Blighia sapida*	2	17.05 ± 2.35	37.40 ± 27.70	4.00 ± 2.70
Simaroubaceae	*Hannoa klaineana*	1	12.30 ± 0.00	45.10 ± 0.00	2.50 ± 0.00
Sterculiaceae	*Cola millenii*	1	2.60 ± 0.00	5.60 ± 0.00	1.60 ± 0.00
	Theobroma cacao	2	8.70 ± 0.40	52.05 ± 7.15	5.85 ± 0.55
Tiliaceae	*Desplatsia subericarpa*	1	6.30 ± 0.00	10.70 ± 0.00	2.20 ± 0.00
Ulmaceae	*Celtis zenkeri*	2	25.50 ± 5.20	45.50 ± 35.30	4.65 ± 2.15
Verbenaceae	*Gmelina arborea*	1	22.60 ± 0.00	105.30 ± 0.00	12.10 ± 0.00
	Tectona grandis	2	19.65 ± 0.95	79.50 ± 0.10	9.85 ± 0.65

Values signify Mean ± Standard error at 95% Confidence limit

Table 3: Phyto-sociological parameters of woody vegetation in the ecotourism control areas of Okomu National Park, Nigeria

Family Composition	Species Composition	Frequency	Tree height (m)	Girth (cm)	Canopy size (m)
Annonaceae	*Enantia chlorantha*	5	20.40 ± 5.76	36.02 ± 16.80	7.38 ± 3.05
	Annona muricata	4	27.35 ± 11.09	38.38 ± 18.48	1.80 ± 0.64
	Anonidium mannii	13	15.87 ± 2.75	36.25 ± 10.27	3.60 ± 0.98
	Cleistopholis patens	6	32.62 ± 4.86	81.78 ± 17.49	5.90 ± 1.50
	Monodora myristica	2	12.05 ± 6.85	12.80 ± 5.50	2.00 ± 1.80
	Xylopia aethiopica	1	25.60 ± 0.00	30.20 ± 0.00	0.60 ± 0.00
Apocynaceae	*Alstonia boonei*	5	39.56 ± 4.09	134.86 ± 27.13	7.44 ± 1.33
	Pleiocarpa pycnantha	1	21.90 ± 0.00	75.60 ± 0.00	6.50 ± 0.00
	Funtumia elastica	8	12.31 ± 2.00	17.48 ± 2.67	4.31 ± 1.02
	Rauvolfia vomitoria	8	8.90 ± 1.22	9.31 ± 2.22	1.89 ± 0.61
	Voacanga africana	16	14.01 ± 2.03	25.51 ± 6.82	3.58 ± 0.46
Bombacaceae	*Ceiba pentandra*	3	23.43 ± 6.03	81.47 ± 12.01	6.60 ± 1.95
Burseraceae	*Canarium schweinfurthii*	1	6.70 ± 0.00	3.20 ± 0.00	0.50 ± 0.00
Capparaceae	*Boscia augustifolia*	1	30.90 ± 0.00	15.50 ± 0.00	2.60 ± 0.00
	Buchholzia coriacea	6	21.48 ± 2.63	20.78 ± 4.01	2.68 ± 0.71
Combretaceae	*Terminalia superb*	1	20.70 ± 0.00	15.30 ± 0.00	0.40 ± 0.00
Ebenaceae	*Diospyros crassiflora*	7	16.85 ± 2.97	31.39 ± 10.49	5.01 ± 1.33
	Diospyros insculpta	24	14.50 ± 1.55	22.84 ± 3.17	2.88 ± 0.69
	Diospyros mespiliformis	2	5.75 ± 0.95	10.30 ± 1.40	3.40 ± 1.00
Euphorbiaceae	*Jatropha multifida*	3	30.37 ± 2.98	115.50 ± 37.53	4.83 ± 1.33
	Macaranga barteri	4	31.80 ± 2.39	45.70 ± 6.39	3.20 ± 0.41
	Margaritaria descoidea	6	31.90 ± 3.86	88.48 ± 34.62	8.03 ± 2.26

Values signify Mean ± Standard error at 95% Confidence limit

Table 3 (Contd.): Phyto-sociological parameters of woody vegetation in the ecotourism control areas of Okomu National Park, Nigeria

Family Composition	Species Composition	Frequency	Tree height (m)	Girth (cm)	Canopy size (m)
Guttiferae	*Allanblackia floribunda*	4	16.87 ± 2.30	33.80 ± 9.68	5.67 ± 0.32
	Harungana madagascariensis	1	40.80 ± 0.00	80.50 ± 0.00	8.70 ± 0.00
Irvingiaceae	*Irvingia smithii*	1	42.20 ± 0.00	0.60 ± 0.00	5.30 ± 0.00
Lecythidaceae	*Combretodendron africanum*	4	17.45 ± 4.36	29.48 ± 8.03	3.65 ± 1.91
	Napoleonaea imperialis	5	10.34 ± 3.10	12.62 ± 4.53	3.28 ± 0.54
Leguminosae	*Albizia ferruginea*	4	19.08 ± 2.74	31.30 ± 5.51	1.90 ± 0.78
	Afzelia africana	10	13.99 ± 3.13	37.34 ± 9.93	4.96 ± 1.36
	Anthonotha macrophylla	7	22.63 ± 5.05	44.44 ± 25.01	2.33 ± 0.60
	Baphia nitida	1	6.40 ± 0.00	7.70 ± 0.00	3.30 ± 0.00
	Baphia pubescens	1	6.40 ± 0.00	12.60 ± 0.00	3.80 ± 0.00
	Distemonanthus benthamianus	3	19.07 ± 1.60	28.97 ± 8.00	6.70 ± 0.12
	Hylodendron gabunense	5	35.50 ± 0.00	20.90 ± 0.00	2.30 ± 0.00
	Pentaclethra macrophylla	5	11.44 ± 2.65	30.22 ± 10.86	4.88 ± 1.59
	Piptadeniastrum africanum	1	33.50 ± 0.00	168.10 ± 0.00	16.30 ± 0.00
	Tetrapleura tetraptera	2	15.85 ± 4.75	58.30 ± 47.60	7.25 ± 4.15
Meliaceae	*Carapa procera*	16	5.66 ± 0.53	9.34 ± 0.99	1.43 ± 0.39
	Entandrophragma angolense	17	15.36 ± 2.71	40.25 ± 11.33	2.96 ± 0.71
	Guarea cedrata	10	16.71 ± 1.04	33.30 ± 6.09	4.44 ± 0.88
	Guarea thompsonii	11	26.70 ± 3.45	52.89 ± 15.13	4.36 ± 0.65
	Khaya ivorensis	4	28.15 ± 8.66	73.10 ± 29.04	4.88 ± 3.27
	Lovoa trichilioides	8	21.15 ± 5.42	56.89 ± 25.78	3.28 ± 1.18
	Lovoa trichilioides	3	10.10 ± 4.40	27.07 ± 14.82	4.43 ± 2.51
	Trichilia heudelotii	4	30.40 ± 1.13	146.40 ± 25.23	12.65 ± 1.11

Values signify Mean ± Standard error at 95% Confidence limit

Table 4 (Contd.): Phyto-sociological parameters of woody vegetation in the ecotourism control areas of Okomu National Park, Nigeria

Family Composition	Species Composition	Frequency	Tree height (m)	Girth (cm)	Canopy size (m)
Menispermaceae	*Sphenocentrum jollyanum*	23	12.44 ± 0.41	9.67 ± 0.73	1.37 ± 0.05
Moraceae	*Antiaris africana*	2	11.10 ± 1.70	12.50 ± 3.90	5.10 ± 0.40
	Myrianthus arboreus	3	12.83 ± 5.13	41.77 ± 27.04	8.23 ± 4.71
	Treculia africana	1	4.50 ± 0.00	5.40 ± 0.00	1.50 ± 0.00
Myristicaceae	*Pycnanthus angolensis*	7	16.64 ± 5.13	33.10 ± 16.93	2.93 ± 0.76
	Staudtia stipitata	3	34.90 ± 2.08	69.60 ± 19.32	9.67 ± 2.07
Ochnaceae	*Lophira alata*	6	27.35 ± 4.79	38.83 ± 11.98	3.23 ± 0.64
Olacaceae	*Strombosia grandifolia*	47	17.39 ± 1.61	37.98 ± 4.74	4.00 ± 0.50
	Strombosia postulata	2	28.75 ± 4.45	182.45 ± 15.45	18.35 ± 0.55
Passifloraceae	*Barteria fistolosa*	15	11.98 ± 2.41	15.03 ± 2.50	1.58 ± 0.38
	Barteria nigritana	1	5.20 ± 0.00	6.20 ± 0.00	1.20 ± 0.00
Rhomnaceae	*Maesopsis eminii*	1	13.40 ± 0.00	15.80 ± 0.00	4.20 ± 0.00
Rubiaceae	*Nauclea diderrichii*	1	19.40 ± 0.00	71.10 ± 0.00	14.30 ± 0.00
	Canthium glabriflorum	2	41.20 ± 4.50	72.70 ± 22.60	6.25 ± 2.45
	Pausinystalia johimbe	8	12.16 ± 2.84	23.68 ± 11.81	4.30 ± 0.71
	Porterandia clandantha	11	24.00 ± 3.29	56.85 ± 9.26	6.63 ± 1.79
	Rothmannia whitfieldii	3	11.37 ± 0.62	24.20 ± 1.79	1.07 ± 0.13
Rutaceae	*Zanthoxylum zanthoxyloides*	11	22.95 ± 2.82	47.15 ± 9.01	4.19 ± 0.50
	Zanthoxylum leprieuri	1	8.60 ± 0.00	16.40 ± 0.00	2.20 ± 0.00
Sapindaceae	*Blighia sapida*	1	40.20 ± 0.00	85.30 ± 0.00	4.20 ± 0.00
Sapotaceae	*Chrysophyllum albidum*	13	9.27 ± 1.41	12.52 ± 2.12	1.45 ± 0.37
Simaroubaceae	*Hannoa klaineana*	3	16.00 ± 7.12	41.83 ± 28.71	6.27 ± 3.77

Values signify Mean ± Standard error at 95% Confidence limit

Table 4 (Contd.): Phyto-sociological parameters of woody vegetation in the ecotourism control areas of Okomu National Park, Nigeria

Family Composition	Species Composition	Frequency	Tree height (m)	Girth (cm)	Canopy size (m)
Sterculiaceae	*Cola nitida*	1	6.30 ± 0.00	8.60 ± 0.00	4.90 ± 0.00
	Cola millenii	4	21.90 ± 8.09	51.48 ± 20.04	4.00 ± 1.10
	Sterculia obloga	14	20.46 ± 3.11	49.93 ± 13.35	4.17 ± 0.70
Tiliaceae	*Desplatsia subericarpa*	2	5.50 ± 0.30	8.35 ± 1.15	2.45 ± 0.25
Ulmaceae	*Celtis zenkeri*	44	17.23 ± 1.70	31.55 ± 7.81	3.29 ± 0.43

Values signify Mean ± Standard error at 95% Confidence limit

Table 4: Independent T test for the tree growth variables of woody vegetation in the ecotourism built-up and control areas of Okomu National Park, Nigeria

Vegetative parameters	Developed areas	Control areas	T value	Significant level
Mean height (m)	10.66 ± 1.40^{a}	15.95 ± 1.23^{b}	-2.53	0.01^{*}
Mean girth size (cm)	35.70 ± 5.55^{a}	35.58 ± 3.99^{a}	0.02	0.99^{ns}
Mean canopy size (m)	2.53 ± 0.37^{a}	3.98 ± 0.39^{b}	-2.30	0.02^{*}

* implies significant difference ($p < 0.05$), ns implies non- significant difference ($p > 0.05$)

Mean ± Standard error with the same superscript signifies there is no significant difference ($P > 0.05$)

Table 5: Summary of the phyto-sociological characteristics of woody vegetation in the built-up and control areas of Okomu National Park, Nigeria

Parameters/ indices	Developed areas	Control areas
No. of individual woody vegetation /ha	161[a]	484[b]
No. of Species	45[a]	73[b]
No. of Families	26[a]	28[a]
Shannon Werner diversity index	3.29[a]	3.77[a]
Simpson evenness index	0.94[a]	0.96[a]
Chao-1	54.71	88.11

Values with the same superscript signifies there is no significant difference ($p > 0.05$)

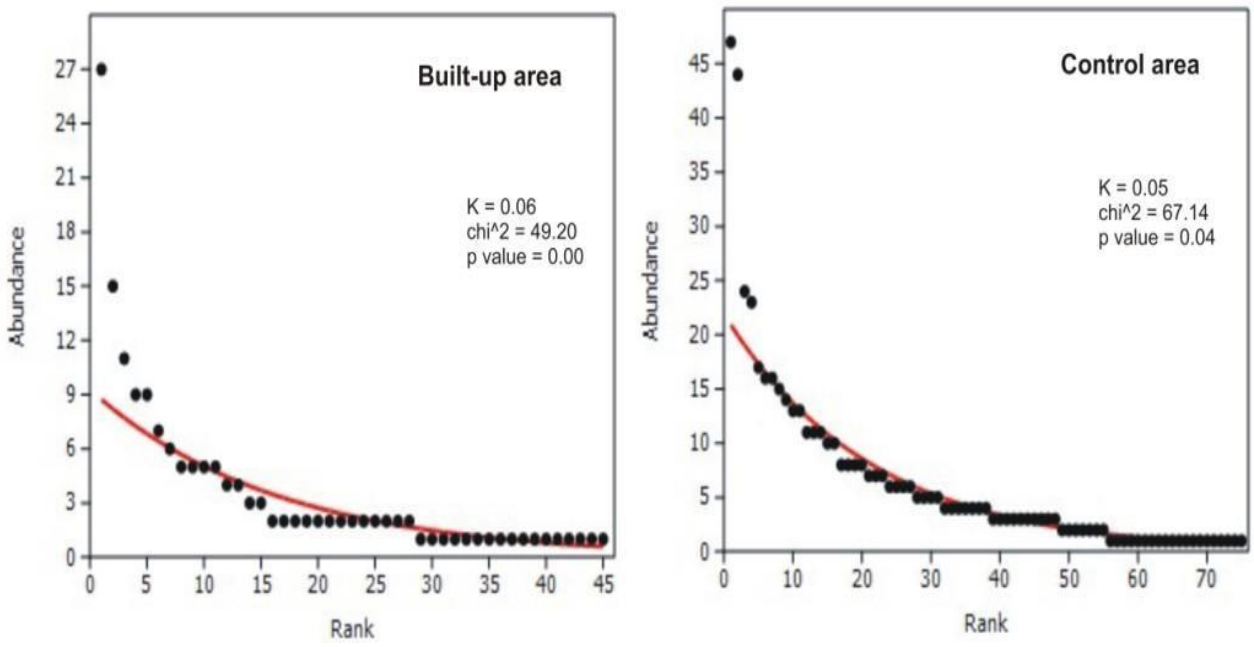

Figure 2: Abundance distribution model of woody vegetation in the ecotourism built-up and control areas of Okomu National Park, Nigeria

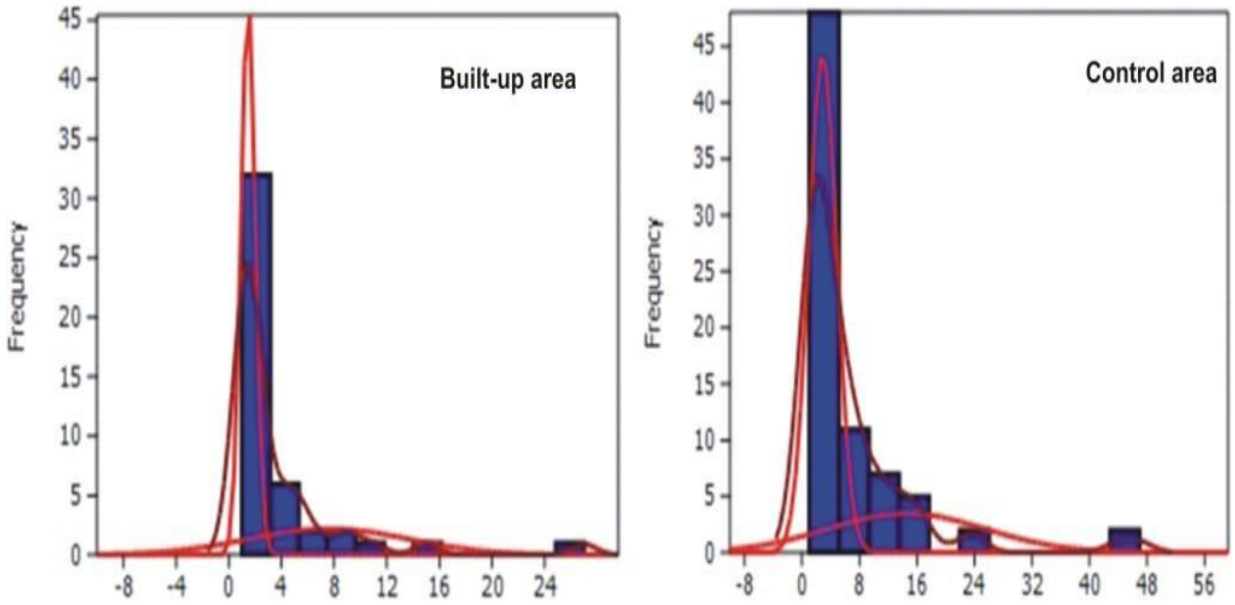

Figure 3: Kernel density of woody vegetation in the ecotourism built-up and control area of Okomu National Park, Nigeria

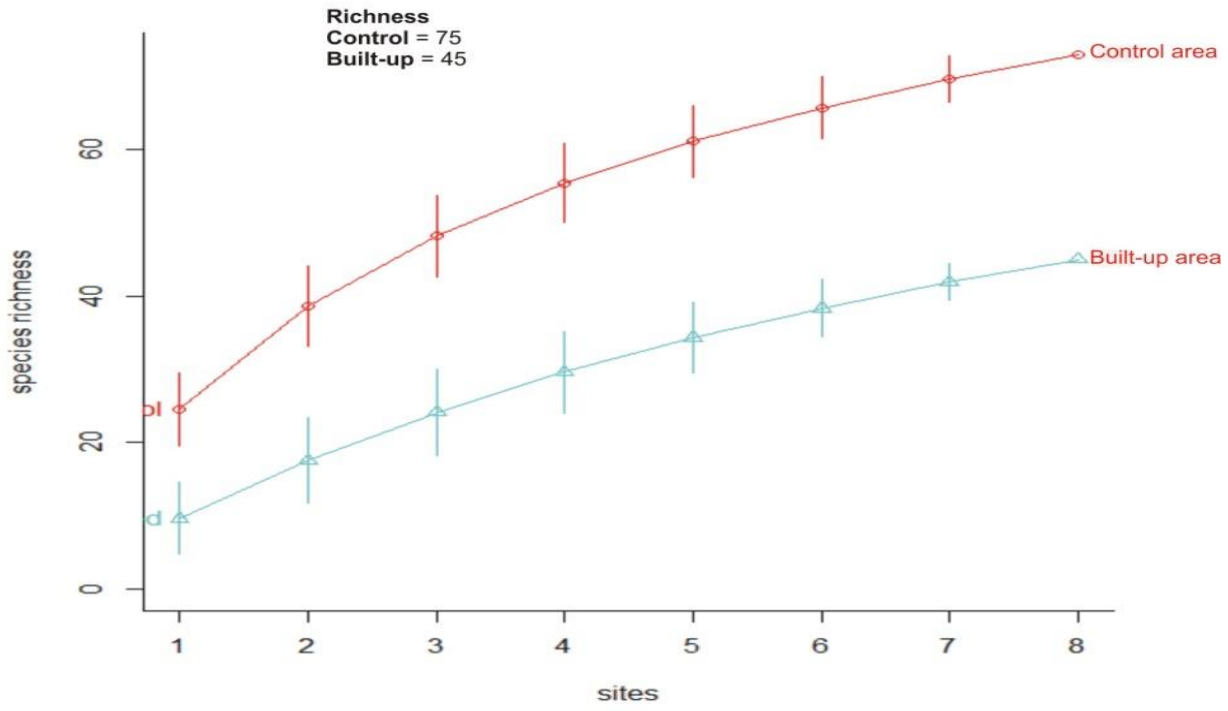

Figure 4: Species accumulation curves of woody vegetation in the ecotourism built-up and control areas of Okomu National Park, Nigeria

Table 6: Floristic dissimilarity between the ecotourism built-up and control areas of Okomu National Park, Nigeria

Ecotourism attractions/facilities	Number of species (Developed areas)	Number of species (Control areas)	Floristic dissimilarity index (%)	Ranking
Arakhuan tourist camp	18	34	8	3rd
Arakhuan Rangers' quarters	5	25	10	2nd
Iguowan gate	3	26	11.5	1st
Iron bridge	16	21	2.5	7th
Lake 94	8	18	5	6th
Lake 61	4	18	7	4th
Lake 36	13	29	8	3rd
Old tree house	9	21	6	5th

ACKNOWLEDGEMENTS

We would like to thank A.G. Leventis Foundation, Switzerland for providing an Education grant to the corresponding author for his PhD research, from which this manuscript was written. Also, our profound gratitude goes to the Nigeria National Park Service for issuing the entry permit into Okomu National Park in order to undertake this research.

REFERENCES

Akujuru, C.A. (2015). Revenue allocation in Nigeria and the dependency on oil revenue: the need for alternative solutions. *Global Journal of Arts Humanities and Social Sciences*, 3(2): 19-36.

Anwana, E. O. (2011). Impact of oil exploitation on sustainable development and green economy in Nigeria: The Niger Delta Case. *International Journal of Economic Development Research and Investment,* 2(2): 155-167

Brown, K., Turner, R.K., Hameed, H., Bateman, I. (1997). Environmental Carrying Capacity and Tourism Development in the Maldives and Nepal. *Environmental Conservation,* 24 (4): 316–325.

Cole, D.N. (1978). Estimating the susceptibility of wildland vegetation to trailside alteration. *Journal of Applied Ecology* 15, 281–286.

FAO, (2009). FAO National Forest Monitoring and Assessment. Manual for Local Level Assessment of Land Degradation , Sustainable Land Management and Livelihoods, Land Degradation Assessment In Drylands (LADA) Project, pp39- 66

Honey, M. (1999). Ecotourism and Sustainable Development: Who Owns Paradise? Washington, DC: Island Press.

Ijeh, C.A. (2010). Assessing the impact of overdependence on Oil Revenue to Nigeria Economy. Master of Business Administration (MBA) submitted to the Department of Management, Faculty of Business Administration, University of Nigeria, Enugu Campus. Pp117

Kiper, T. (2013). Role of Ecotourism in Sustainable Development. *Advances in Landscape Architecture.* 773-802

Lindberg, K. (2001). Economic Impacts. In D. B. Weaver (Ed.), The Encyclopedia of Ecotourism. New York: CABI International.

Matthews, E.J. (2002). Ecotourism: Are current practices delivering desired outcomes? A comparative case study analysis. Master's thesis submitted to the Faculty of the Virginia Polytechnic Institute and State University. Pp110.

Newsome, D. Moore, S.A. and Dowling, R. K. (2002). Natural Area Tourism: Ecology, Impacts and Management. Channel View Publications, Sydney.

Ogunjemite, B.G., Olaniyi, O.E. and Akinwumi, O.O. (2013): Maintenance of ecological integrity of a Warmspring site: The role of vegetation composition and cover of Ikogosi Warmspring, Ekiti State, Nigeria. *Proceedings of 36th Annual Conference on Green economy: Balancing Environmental sustainability and livelihoods in an emerging economy* held at University of Uyo, Akwa Ibom State, Nigeria 4th- 9th November, 2013; pp553- 562

Okech, R.N. and Bob, U. (2009): Sustainable Ecotourism Management in Kenya. Ethiopian Journal of Environmental Studies and Management 2(1): 57-65.

Okomu National Park, (2010). Nigeria National Park Service. Retrieved 4 November 2010.

Olaniyi, O.E. and Ogunjemite, B.G. (2015). Ecotourism development in Ikogosi Warmspring, Ekiti State, Nigeria: Implication on woody species composition and structure. *Applied Tropical Agriculture*. 20(2): In press

Pickering, C. and Hill, W. (2007): Impacts of recreation and tourism on plants in protected areas in Australia. CRC for Sustainable Tourism Pty Ltd. pp30.

Pickering, C.M. (2007). Impacts of recreation and tourism on plants in protected areas in Australia. CRC for Sustainable Tourism Pty Ltd. Pp30.

Pickering, C.M. and Buckley, R.C. (2003). Swarming to the summit: managing tourists at Mt Kosciuszko, Australia. *Mountain Research and Development.* 23:230-233.

Reynolds, P. C. and Braithwaite, D. (2001). Towards a conceptual framework for wildlife tourism. *Tourism Management* 22(1): 31-42.

Smith, A. and Newsome, D. (2002). An integrated approach to assessing, managing and monitoring campsite impacts in Warren National Park, Western Australia. *Journal of Sustainable Tourism,* 10: 343-359.

Soladoye, M. O. and Oni, O. (2000). Biodiversity studies at Okomu Forest Reserve in Edo State. A report of the National Agricultural Research Project. 128

Sun, D. and Walsh, D. (1998). Review of studies on environmental impacts of recreation and tourism in Australia. *Journal of Environmental Management,* 53: 323-338.

Swarbrooke, J. (2002). The Development and Management of Visitor Attractions (2nd Ed). Oxford: Butterworth-Heinemann.

Tourism Queenland, (2002). Queensland Ecotourism Plan 2003–2008; Tourism Queensland: Brisbane, Australia, 2002. Online [Available]: http://www.tq.com.au/fms/tq_ corporate/ special interests /ecotourism2/Queensland %20).

Turton, S.M. (2005) Managing environmental impacts of recreation and tourism in rainforests at the Wet Tropics of Queensland World Heritage Area. *Geographical Research,* 43: 140-151.

Uzonwanne, M.C. (2015). Economic Diversification in Nigeria in the Face of Dwindling Oil Revenue. *Journal of Economics and Sustainable Development,* 6(4): 61-67.

Wahungu, G.M., Kimuyu, D.M., Mureu, L.K., Ogutu, M.O. and Owino, B. (2012). Primates seed dispersal enhances forest regeneration and connectivity; Results from coastal forest fragments, Kenya. In Forest and trees: serving the people of Africa and the world, Kenya Forestry Research Institute, Nairobi, Kenya. Pp206.

Wiafe, E.D. and Amoah, M. (2012). Impact of conservation measures on Lowe's Guenon (*Cercopithecus campbelli lowei*) in a previously logged moist Forest Reserve in Ghana. In Forest and trees: serving the people of Africa and the world, Kenya Forestry Research Institute, Nairobi, Kenya. pp261.

ABOUT THE AUTHORS

OLANIYI, Oluwatobi Emmanuel: He is currently a lecturer and a PhD Student at the Department of Ecotourism and Wildlife Management, Federal University of Technology, P.M.B 704, Akure, Nigeria. E-mail: olaniyitobby007@gmail.com

OGUNJEMITE, Babafemi George: He is a Professor of Primate Ecology and Community at the Department of Ecotourism and Wildlife Management, Federal University of Technology, P.M.B 704, Akure, Nigeria.

AKINDELE, Shadrach Olufemi: He is currently a Professor of Forest Biometrics at the Department of Forestry and Wood Technology, Federal University of Technology, P.M.B 704, Akure, Nigeria.