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Forest resources as ecotourism attraction: Cross River National Park, Nigeria

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Abstract Cross River National Park (CRNP) in Nigeria with its natural resources of tourist significance can help to foster a culture of conservation and recreation among the public. This study identified ecotourism attractions in CRNP aiming to promote its sustainable use and to enhance its planning as a haven for ecotourism in Nigeria. A field survey of ecotourism resources was conducted in the park during 2010-2014. Fauna resources were identified along the 5 km transects that covered existing trails and jeep tracks in both dry and wet seasons. Quadrat method (15 sample plots of 50 m x 20 m) was used for the vegetation assessment and Shannon-Weiner Diversity Index (*H*) and descriptive statistics were calculated. Findings revealed that the rainforest, game viewing, birdwatching, mountain climbing, camping, rock formation, village tour, botanical garden tour and water recreation as core ecotourism attractions in CRNP. Fifteen wild animal species belonging to nine families were observed (endangered 01, least concerned 12, near threatened 01, vulnerable 01). Wild animals included drill monkey *Mandrillus leucophaecus* (endangered), elephant *Loxodonta africana cyclotis* (vulnerable), bat *Eidolon helvum* (near threatened), and bare-headed rock fowl *Picarthates oreas* (endemic) which are "ecostars" and "a must see" that warrant a visit to the park. Other animals were least concerned. A total of 81 tree species belonging to 26 families were identified. Shannon-Wiener Diversity index ($H^{'}$) of 3.88 and 3.84 were recorded for Oban and Okwango divisions respectively. The most dominant family in Oban was Leguminosae (12 species) and in Okwango, it was Apocynaceae (10 species). Managing and promoting the sustainable use of the park's numerous resources to actualize the potential value non-consumptively through ecotourism is hereby recommended.

Keywords: attraction, conservation ecotourism, national park, rainforest

1 Introduction

Tourism is both leisure and a self-indulgent pursuit. It is a global phenomenon that has experienced rapid growth in the developing countries of the world. Smith (2004)

noted that tourism and travel have been part of the human experience for millennia, describing it as a form of movement that characterizes *Homo sapiens*. Ecotourism is a type of specialty travel incorporating a diverse array of activities and tourism type, from bird watching, game viewing, scientific study, photography, diving, trekking, to regeneration of damaged ecosystems. The International Ecotourism Society defined ecotourism as "responsible travel to natural areas that conserves the environment, sustains the well-being of the local people, and involves interpretation and education" (TIES 2015). It has been able to capitalize on the increased motivation to experience and preserve natural environments (Diamantis 2004). Tourism industry has wholly embraced ecotourism, and its global importance has been recognized by the UN through the declaration of the year 2002 as the "International Year of Ecotourism"

The concern of tourists for environmental issues has increased, and ecotourism has become a known sector of tourism that should be developed (Holden 2003), because of its strategy of understanding nature and imparting conservation measure on biodiversity. Biodiversity is the backbone of the ecotourism industry. The role of biodiversity in tourism ranges from biodiversity as an attraction (i.e., many wildlife are focal species), resources for consumptive goods (i.e., culinary), natural components to support ecological services (i.e., pollination), to aesthetics (i.e., ornamental plants) (Higginbottom 2004, Newsome *et al*. 2012). Biodiversity, however, is not a tourist attraction unless its tourism potential value is converted and actualized as objects which are able to attract tourists (Drumm and Moore 2002). The success of tourism attraction, therefore, depends on the ability of tourism planners and managers to actualize the potential value of biodiversity as a tourist attraction (Luchman 2017). Ecotourism is seen as an interfacing of conservation concerns and tourism interest. Essentially, ecotourism derives its attraction from a combination of groups to be made from marketing a product that exists in its natural state in a specific geographic location and the potential to make such ecologically, economically, and socially sustainable (Ijeoma 2007).

The National Park divisions at Oban and Okwango in Cross River State, Nigeria is a wildlife park suitable for ecotourism. The Cross River National Park (CRNP) is an important ecological gene pool containing one of the oldest rainforests in Africa. Because of its critical conservation status, it has been designated as one of the 25 UN biodiversity hot spots in the world (CRNP 2010). The forest resources represent a tourism haven capable of instilling conservation consciousness in the mind of the tourists that patronize the park. Therefore, adequate knowledge of the occurrence of the tourism products in an ecosystem is vital to enhance its effective marketing, increased patronage and sustainable use through ecotourism. Despite the enviable potential Nigeria is endowed with, the country has remained an unpopular tourist destination. Therefore, this study was conducted to identify the park's core tourist attractions, to determine the potential recreation activities of ecotourism, to assess the fauna and flora resources of CRNP forest as a draw for ecotourism and to promote argument for its successful conservation and sustainable use. This will enhance

effective decision-making in the competing economic, social and environmental demands of sustainable development in Nigeria.

2 Material and Methods

2.1 Study area

Cross River National Park (CRNP) is located in Cross River State between longitudes 5º.05'-6º.29' N and latitudes 8º.15'- 90.30' E in Nigeria (Figure 1). It covers an area of approximately 4000 km^2, divided into two non-contiguous divisions – the Oban hills in the Southern part covering 3000km^2, and the Okwangwo division in the Northern part covering 1000 km^2 of primary moist rainforest ecosystem in the Northern and Central parts, and montane mosaic on the Obudu plateau (CRNP 2010).

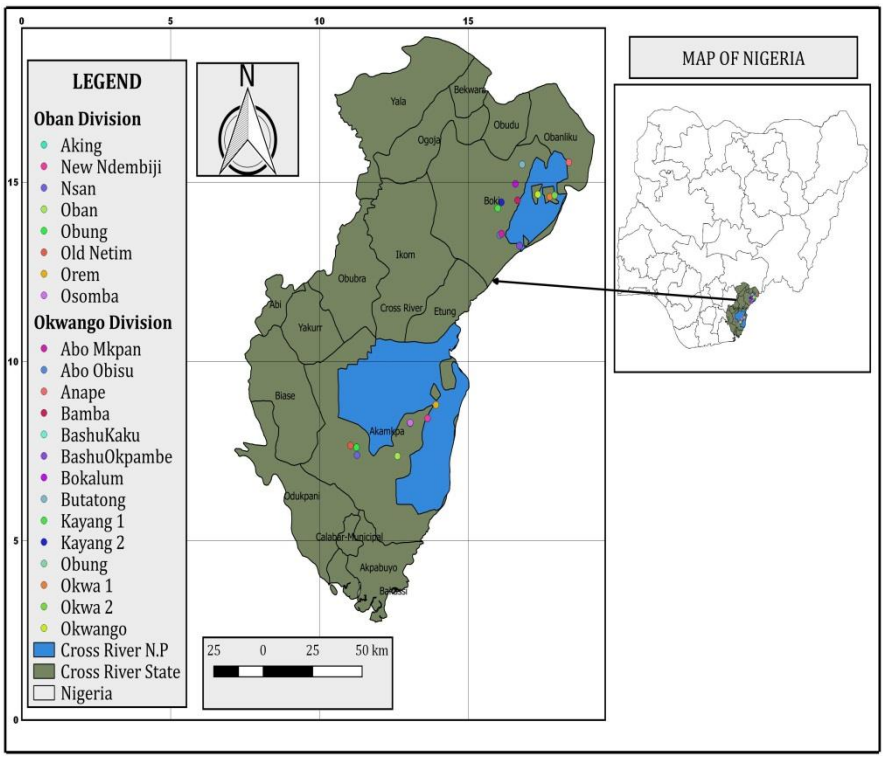

Fig. 1: Oban and Okwangwo divisions of Cross River National Park with Support Zone Communities

The terrain is rough, and elevation rises from the river valleys to over 1000 m in mountainous areas. The Park has a tropical climate characterized by a rainy season between April and November. The annual rainfall ranges between 2000 mm to 3000 mm; relative humidity in and around the park range from 80-90%. The temperature rarely falls below 19°C with an annual mean of 27°C (Udoidung *et al*. 2007). Many ecosystems including the tropical rainforest and mangrove forest occur in Cross River State. The geographical location of the state favours ecotourism as the state is accessible by air through the Calabar Airport, by sea through the Calabar Sea Port and by road through the trunk roads from Akwa Ibom, Ebonyi and Abia States (Udoidung *et al*. 2007). The ecology of the state has made it a renowned wildlife sanctuary and the government has made substantial investment to develop its tourism potentials across the state in order to realize its aspiration of making the state the flagship of tourism in the country. The rich cultural heritage and strategic coastal location are great impetus for the rapidly developing culture and business tourism in the state.

2.2 Data collection and analysis

Ecotourism resources available in the park were carefully observed and assessed. The Global Positioning System (GPS) surveying method was used in the mapping of ecotourism resources in the study area (Shrestha 2006). Relevant pictures that depict specific and exciting characteristic features of interest were taken using digital Camera-Samsung zoom lens 5x (14.2 Megapixels) and GPS (GPS- 550 Magellan) for the geographic coordinates reading. Fauna resources were identified along the existing 5 Km transects, trails and Jeep tracks within the park. Observations were recorded between 6.30 am to 11.00 am in the morning and 4.00 to 6.30 pm in the evening three days a week to identify the fauna species. Twenty-four days of observation were carried out in February (Dry season) and August (Rainy season), 2012 , making up 12 days in each season. Spoors such as faecal droppings, footprints spines, calls, and trails were recorded and used to determine the presence of the animals in the park in addition to the direct observations. There are no recent studies so these data will provide some baseline information.

Quadrat method was used for the vegetation assessment of Oban and Okwango divisions of the park. The method adopted by FAO (2009) was modified and a total of 15 plots with 50m x 20m quadrant size each were established on three lines transversed evenly along the existing Jeep track within the study area. Five plots were marked on each line at 10 km interval. Identification of tree species within each plot was carried out. All identified trees were allocated to families and the number of species was obtained for the diversity classification of tree species in each family using Keay (1989). The total density was calculated as well as the diversity and species evenness. Species relative density (RD) and relative frequency (RF) of each site were computed using equations 1 and 2. Species diversity index was calculated

using Shannon–Wiener diversity index (eq. 3), while Shannon's equitability index (E_H) (eq. 4) was adopted for estimating species evenness.

Species Relative Density (RD):

This refers to the number of individuals of a given species divided by the total number of individuals of all species.

$$RD = \left[\frac{ni}{N}\right] X\ 100 \quad (1)$$

where, RD = relative density, n_i = number of individual species I, and N = total number of individual in the entire population.

Relative Frequency (RF):

RF was obtained using the formula given by Oduwaiye *et al*. (2002).

$$RF = \frac{\sum Fi\ X\ 100}{Fn} \quad (2)$$

where, RF = relative frequency, Fi = number of plot where species was found, and Fn = total frequency of all species.

Shannon-Wiener Diversity Index (H^I):

The equation given by Price (1997) was adopted.

$$H^1 = \sum_{i=1}^{s} Pi ln Pi \quad (3)$$

where, S= total number of species in the community, Pi= proportion of a species to the total number of plant in the community, *ln* = natural logarithm.

Species Evenness Index (E_H):

In each forest community, species evenness was determined using Shannon's Equitability (E_H).

$$E_H = \frac{H}{Hmax} = \frac{\sum_{i=1}^{s} piln(pi)}{ln(S)} \quad (4)$$

3 Results

3.1 Ecotourism resources in Cross River National Park

Prominent recreational activities that can be conducted in the Cross River National Park (CRNP) are hiking in the rainforest vegetation, mountaineering, water recreation in the natural water body (e.g. Kwa river), game viewing, bird watching, botanical garden tour and visit the natural history museum as presented in Table 1. The topography presents very interesting sceneries for ecotourism activities and harbors rare species of animals such as the critically endangered Cross River Gorilla *(Gorilla gorilla diehli),* and the endangered Chimpanzee *(Pan troglodytes).* Village tours can provide visitors the opportunity to explore the way of life of the local communities.

Table 1: Ecotourism attractions in Cross River National Park, Nigeria.

Attractions	Location
Wilderness hiking	The entire park
Game viewing/ bird watching	The entire park
Mountain viewing/ climbing	Park rugged terrain rising from 100 m in the river valleys to over 1000m in the mountains Mbe Mountain
Forest camping	The entire park
Rock formation	Bat caves in Oban division
Village tours	105 Support Zone communities of CRNP
Tour of botanical garden	Okwangwo Division
Water recreation	Natural water pool – kwa- river, Bemi river, Oyi river and Okon river
Natural History Museum	Oban Division

CRNP is endowed with biodiversity resources, which serve as a major source to attract ecotourists to this area. Fifteen wild animal species belonging to 9 families were observed (Table 2) and a total of 81 tree species belonging to 26 families were identified in Oban and Okwango divisions of CRNP (Tables 3 and 4). The diversity index ($H^{'}$) and equitability (evenness) (E_H) for Oban Division is 3.88 and 0.62 and for Okwango division *H* is 3.84 and (E_H) 0.53, respectively (Table 5).

According to the Redlist Conservation Status in 2015, the animals encountered included endangered Drill monkey (*Mandrillus leucophaecus)* vulnerable Elephant (*Loxodonta africana cyclotis)* near threatened Bat (*Eidolon helvum*), and others were at the least concerned status. The endemic Bare-headed rock fowl *Picarthates oreas*

and the Cameroonian vine, *Ancistrocladus korupensis* are "ecostars" and "a must see" that warrant a visit to the park.

Table 2: Fauna species encountered in Cross River National Park, Nigeria.

Family	Common Name	Scientific Name	Evidence	Remark	IUCN Status *	Population Trend
Bovidae	Red flanked duiker	*Cephalophus rufilatus*	Faecal dropping	Fresh	LC	Decreasing
Bovidae	Blue duiker	*Cephalophus monticola*	Footprint/ trail	Fresh	LC	Stable
Bovidae	Bush buck	*Tragelaphus scriptus*	Footprint	Fresh	LC	Stable
Hystricidae	Porcupine	*Altherurus africanus*	Footprint/ trail	Fresh	LC	Unknown
Suidae	Red River hog	*Potamochoerus porcus*	Footprint	Fresh	LC	Decreasing
Sciuridae	Giant tree squirrel	*Protoxerus stangeri*	Sighting	On a tree	LC	Unknown
Sciuridae	Ground squirrel	*Xerus erythropus*	Sighting	Crossing transect line	LC	Stable
Elephantidae	Forest elephant	*Loxodonta africana cyclotis*	Footprint/ feeding trail/ dung	Dung about 2 weeks old	V	Increasing
Viverridae	Palm Civet	*Viverra civetta*	Sighting	individual on tree	LC	Decreasing
Viverridae	Mongoose	*Ichneumia albicauda*	Footprint	More than 10 sighting	LC	Stable
Cercopithecidae	Drill Monkey	*Mandrillus leucophaeus*	Sighting/ Vocalisation	About 15 individuals on a tree feeding on fruit	EN	Unknown
Cercopithecidae	Mona monkey	*Cercopithecus mona*	Sighting/ Vocalisation	5 individuals	LC	Unknown
Cercopithecidae	Tantalus monkey	*Cercopithecus aethiops*	Sighting	1 individual	LC	Stable
Capitonidae	Yellow-spotted barbet	*Buccanodon duchaillui*	Sighting	1 individual	LC	Stable
Pteropodidae	Fruit Bats	*Eidolon helvum*	Sighting	More than 20 sighted at Erokut rock	NT	Decreasing

*LC-Least Concern, V-Vulnerable, NT- Near Threatened, EN- Endangered

Table 3: Tree species observed in Oban Division of Cross River National Park.

Species	Family	IUCN Status #	Density (Ha-1)	Relative Density	pi*ln(pi)
Allanblackia floribunda	Guttiferae	VU	5	0.581395	-0.02993
Alstonia congensis	Apocynaceae	LC	44	1.98915	-0.08204
Antrocaryon micraster	Anacardiaceae	VU	8	0.180832	-0.0121
Anonidium mannii	Annonaceae	LC	12	0.542495	-0.02993
Antiaris toxicaria	Moraceae	LC	5	0.361664	-0.02152
Anthocleista vogelii	Apocynaceae	LC	5	0.180832	-0.0121
Baphia nitida	Fabaceae	LC	24	0.542495	-0.02993
Bridelia micrantha	Euphorbiaceae	LC	40	2.712477	-0.10285
Brenania brelie	Leguminosae	LC	2	0.180832	-0.0121
Carapa procera	Meliaceae	LC	22	2.531646	-0.09787
Chrysophyllum albidum	Sapotaceae	NT	5	0.361664	-0.02152
Christiana africana	Tiliaceae	LC	16	0.180832	-0.0121
Cleistopholis patens	Annonaceae	LC	8	0.361664	-0.02152
Cola acuminate	Sterculiaceae	LC	64	0.723327	-0.03767
Corynanthe pachyceras	Rubiaceae	LC	64	0.723327	-0.03767
Coula edulis	Olacaceae	LC	154	5.244123	-0.16179
Cylicodiscus gabunensis	Leguminosae	LC	32	0.361664	-0.02152
Distemonanthus benthamianus	Olacaceae	LC	34	3.435805	-0.12157
Dialium guineens	Leguminosae	LC	192	2.169982	-0.08747
Desplatsia dewevrei	Tiliaceae	LC	96	2.169982	-0.08747
Pycnanthus angolensis	Myristicaceae	LC	16	0.180832	-0.0121
Dacryodes edulis	Burseraceae	NL	32	0.361664	-0.02152
Diospyros mespiliformis	Ebenaceae	LC	13	0.723327	-0.03767
Desplatsia dewevrei	Tiliaceae	LC	6	0.361664	-0.02152
Diospyros suaveolens	Ebenaceae	NL	5	0.361664	-0.02152
Diospyros zenkeri	Ebenaceae	LC	84	3.797468	-0.1303
Enantia chlorantha	Annonaceae	LC	21	0.723327	-0.03767
Entandrophragma cylindricum	Meliaceae	VU	11	0.361664	-0.02152
Ficus capensis	Moraceae	NL	32	0.723327	-0.03767
Funtumia elastica	Apocynaceae	LC	48	0.542495	-0.02993
Garcinia mannii	Guttiferae	VU	88	1.98915	-0.08204
Garcinia staudtii	Guttiferae	VU	32	0.361664	-0.02152
Guibourtia ehie	Leguminosae	LC	16	0.180832	-0.0121
Guarea glomerulata	Meliaceae	NL	21	0.723327	-0.03767
Guarea thompsonii	Meliaceae	VU	16	0.361664	-0.02152
Hannoa klaineana	Simaroubaceae	NL	112	1.265823	-0.05834
Hunteria umbellata	Apocynaceae	LC	112	1.265823	-0.05834
Distemonanthus benthamianus	Leguminosae	LC	48	0.542495	-0.02993
Irvingia gabonensis	Irvingaceae	NT	32	0.361664	-0.02152
Khaya ivorensis	Meliaceae	VU	2	0.180832	-0.0121
Lophira alata	Ochnaceae	VU	8	0.361664	-0.02152
Maesobotrya barteri	Moraceae	LC	88	1.98915	-0.08204
Microdesmis puberula	Euphorbiaceae	NL	12	0.542495	-0.02993
Milicia excelsa	Moraceae	NT	2	0.180832	-0.0121
Millettia griffoniana	Leguminosae	LC	64	2.169982	-0.08747
Musanga cecropioides	Moraceae	LC	52	2.350814	-0.09274
Neoboutonia glabrescens	Euphorbiaceae	NT	5	0.361664	-0.02152
Nesogordonia papaverifera	Sterculiaceae	VU	8	0.180832	-0.0121
Newbouldia laevis	Bignoniaceae	NL	8	0.180832	-0.0121

Table 3. Continued

Species	Family	IUCN Status #	Density (Ha-1)	Relative Density	pi*ln(pi)
Octoknema affinis	Octoknemaceae	NL	11	0.723327	-0.03767
Omphalocarpum procerum	Sapotaceae	LC	2	0.180832	-0.0121
Ongokea gore	Olacaceae	LC	3.2	0.361664	-0.02152
Ouratea calophylla	Ochnaceae	NL	5	0.361664	-0.02152
Acacia albida	Leguminosae	LC	60	0.180832	-0.10285
Parkia bicolor	Leguminosae	LC	112	2.712477	-0.05834
Pentaclethra macrophylla	Leguminosae	LC	48	1.265823	-0.02993
Piptadeniastrum africanum	Leguminosae	LC	5	0.542495	-0.0121
Poga oleosa	Anisophylleaceae	LC	16	0.180832	-0.0121
Prosopis africana	Leguminosae	LC	18	0.180832	-0.07642
Pycnanthus angolensis	Myristicaceae	NL	32	1.808318	-0.02152
Rauvolfia mannii	Apocynaceae	LC	32	0.723327	-0.03767
Rauvolfia vomitoria	Apocynaceae	LC	128	1.446655	-0.0646
Rothmannia hispida	Rubiaceae	LC	96	1.084991	-0.05179
Amphimas pterocarpoids	Leguminosae	LC	3	0.180832	-0.0121
Spathodea campanulate	Bignoniaceae	LC	3	0.180832	-0.0121
Staudtia stipitate	Myristicaceae	LC	24	1.627486	-0.07062
Dacryodes edulis	Burseraceae	NL	4	0.180832	-0.0121
Sterculia oblonga	Sterculiaceae	LC	16	0.542495	-0.02993
Sterculia rhinopetala	Sterculiaceae	LC	11	0.361664	-0.02152
Sterculia tragacantha	Sterculiaceae	LC	32	0.723327	-0.03767
Strombosia grandifolia	Olacaceae	NL	448	5.063291	-0.15812
Strombosia pustulata	Olacaceae	LC	368	8.318264	-0.21551
Tabernaemontana pachysiphon	Apocynaceae	LC	80	0.904159	-0.04493
Trichilia lanata	Meliaceae	LC	112	1.265823	-0.05834
Trilepisium madagascariense	Moraceae	CR	48	1.627486	-0.07062
Uapaca staudtii	Euphorbiaceae	LC	48	1.084991	-0.05179
Uapaca togoensis	Euphorbiaceae	LC	64	0.723327	-0.03767
Vitex doniana	Verbenaceae	LC	32	0.361664	-0.02152
Xylopia aethiopica	Annonaceae	LC	144	1.627486	-0.07062
Zanthoxylum zanthoxyloides	Rutaceae	EN	64	0.723327	-0.03767
					3.88336

*LS (Least Concerned), V (Vulnerable), NT (Near Threatened), NL (Not Listed), E (endangered), CR (Critically Endangered)

A total of 80 tree species belonging to 25 families was identified in Oban division while 78 species belonging to 22 families were recorded in Okwango division. Leguminosae (12*)* and Apocynaceae (10) were the most dominant families in Oban and Okwango divisions respectively. Other dominant families in both divisions were *Moraceae*, *Olacaceae*, and *Guttiferae*. The slight variation in the diversity index signified that Oban division is more diverse in woody tree species than Okwango division. Notable amongst the flora species are the critically endangered (*Trilepisium madagascariense)*, endangered (*Zanthoxylum zanthoxyloides*), Near threatened (*Irvingia gabonensis*, *Neoboutonia glabrescens*, *Milicia excels*, *Chrysophyllum albidum*) and Vulnerable *(Nesogordonia papaverifera, Lophira alata, Khaya*

ivorensis, Guarea thompsonii, Garcinia mannii, Garcinia staudtii, Entandrophragma cylindricum, Antrocaryon micraster, Allanblackia floribunda).

Table 4: Tree species observed in Okwango Division of Cross River National Park.

Species	Family	IUCN Status #	Density (Ha-1)	Relative Density	pi*ln(pi)
Acacia albida	Apocynaceae	LC	2	0.246914	-0.01218
Allanblackia floribunda	Guttiferae	VU	7	0.740741	-0.03012
Alstonia congensis	Apocynaceae	LC	59	2.716049	-0.08251
Amphimas pterocarpoides	Apocynaceae	LC	6	0.493827	-0.02166
Anonidium mannii	Annonaceae	LC	8	0.740741	-0.03012
Anthocleista vogelii	Apocynaceae	LC	5	0.246914	-0.01218
Antiaris toxicaria	Moraceae	LC	6	0.493827	-0.02166
Antrocaryon micraster	Apocynaceae	VU	176	8.148148	-0.17672
Baphia nitida	Fabaceae	LC	24	0.740741	-0.03012
Brenania brelie	Fabaceae	NL	16	0.246914	-0.01218
Bridelia micrantha	Fabaceae	LC	80	3.703704	-0.10343
Carapa procera	Meliaceae	LC	45	3.45679	-0.09842
Christiana africana	Olacaceae	LC	3	0.246914	-0.01218
Chrysophyllum albidum	Sapotaceae	NT	3	66.66667	-0.02166
Cleistopholis patens	Annonaceae	LC	11	0.493827	-0.02166
Sterculia oblonga	Sterculiaceae	LC	4	0.987654	-0.03791
Staudtia stipitate	Olacaceae	LC	4	0.987654	-0.03791
Coula edulis	Olacaceae	LC	240	7.407407	-0.16624
Cylicodiscus gabunensis	Olacaceae	LC	16	0.493827	-0.02166
Dacryodes edulis	Burseraceae	NL	16	0.493827	-0.02166
Desplatsia dewevrei	Tiliaceae	LC	5	0.493827	-0.02166
Dialium guineense	Leguminosae	LC	96	2.962963	-0.08797
Diospyros mespiliformis	Ebenaceae	LC	21	0.987654	-0.03791
Diospyros suaveolens	Ebenaceae	NL	16	0.493827	-0.02166
Diospyros zenkeri	Ebenaceae	LC	168	5.185185	-0.131
Distemonanthus benthamianus	Leguminosae	LC	304	4.691358	-0.12223
Drypetes chevalieri	Euphorbiaceae	NL	64	2.962963	-0.08797
Enantia chlorantha	Annonaceae	LC	32	0.987654	-0.03791
Entandrophragma cylindricum	Meliaceae	VU	32	0.493827	-0.02166
Ficus capensis	Moraceae	NL	64	0.987654	-0.03791
Funtumia elastica	Apocynaceae	LC	10	0.740741	-0.03012
Garcinia staudtii	Guttiferae	VU	16	0.493827	-0.02166
Garcinia mannii	Guttiferae	VU	88	2.716049	-0.08251
Guarea glomerulata	Guttiferae	NL	96	1.481481	-0.05211
Guarea thompsonii	Meliaceae	VU	32	0.493827	-0.02166
Guibourtia ehie	Guttiferae	LC	8	0.246914	-0.01218
Hannoa klaineana	Simaroubaceae	NL	112	1.728395	-0.05869
Hunteria umbellate	Guttiferae	LC	112	1.728395	-0.05869
Irvingia gabonensis	Irvingiaceae	NT	32	0.493827	-0.02166
Khaya ivorensis	Meliaceae	VU	16	0.246914	-0.01218
Lophira alata	Ochnaceae	VU	16	0.493827	-0.02166
Maesobotrya barteri	Euphorbiaceae	LC	176	2.716049	-0.08251
Microdesmis puberula	Euphorbiaceae	NL	16	0.740741	-0.03012
Milicia excelsa	Moraceae	NT	8	0.246914	-0.01218

Table 4. Continued

Species	Family	IUCN Status #	Density (Ha-1)	Relative Density	pi*ln(pi)
Millettia griffoniana	Leguminosae	LC	96	2.962963	-0.08797
Musanga cecropioides	Moraceae	LC	208	3.209877	-0.09327
Neoboutonia glabrescens	Moraceae	NT	11	0.493827	-0.02166
Nesogordonia papaverifera	Moraceae	VU	8	0.246914	-0.01218
Newbouldia laevis	Moraceae	NL	16	0.246914	-0.01218
Octoknema affinis	Olacaceae	NL	64	0.987654	-0.03791
Omphalocarpum procerum	Moraceae	LC	3	0.246914	-0.01218
Ongokea gore	Moraceae	LC	16	0.493827	-0.02166
Ouratea calophylla	Ochnaceae	NL	16	0.493827	-0.02166
Parinari macrophylla	Rosaceae	NL	112	1.728395	-0.05869
Parkia bicolor	Leguminosae	LC	240	3.703704	-0.10343
Pentaclethra macrophylla	Leguminosae	LC	8	0.246914	-0.01218
Piptadeniastrum africanum	Leguminosae	LC	64	0.987654	-0.03791
Amphima spterocarpoides	Apocynaceae	NL	16	0.246914	-0.01218
Prosopis africana	Leguminosae	LC	16	0.246914	-0.01218
Pycnanthus angolensis	Myristicaceae	NL	176	2.716049	-0.08251
Rauvolfia mannii	Apocynaceae	LC	32	0.987654	-0.03791
Rauvolfia vomitoria	Apocynaceae	LC	128	1.975309	-0.06498
Rothmannia hispida	Rubiaceae	LC	32	1.481481	-0.05211
Irvingia gabonensis	Irvingaceae	NT	8	0.246914	-0.01218
Staudtia stipitate	Myristicaceae	LC	72	2.222222	-0.07103
Sterculia oblonga	Sterculiaceae	LC	48	0.740741	-0.03012
Sterculia rhinopetala	Sterculiaceae	LC	11	0.493827	-0.02166
Sterculia tragacantha	Sterculiaceae	LC	32	0.987654	-0.03791
Strombosia grandifolia	Olacaceae	NL	448	6.91358	-0.15893
Strombosia pustulata	Olacaceae	LC	736	11.35802	-0.21649
Tabernaemontana pachysiphon	Apocynaceae	LC	16	1.234568	-0.0452
Trichilia lanata	Meliaceae	LC	56	1.728395	-0.05869
Trilepisium madagascariense	Moraceae	CR	72	2.222222	-0.07103
Uapaca staudtii	Euphorbiaceae	LC	96	1.481481	-0.05211
Uapaca togoensis	Euphorbiaceae	LC	64	0.987654	-0.03791
Vitex doniana	Verbenaceae	LC	16	0.493827	-0.02166
Xylopia aethiopica	Annonaceae	LC	144	2.222222	-0.07103
Zanthoxylum zanthoxyloides	Rutaceae	EN	64	0.987654	-0.03791
					3.83659

LS (Least Concerned), V (Vulnerable), NT (Near Threatened), NL (Not Listed), E (endangered), CR (Critically Endangered), RD (Relative Density)

Table 5: Summary of tree species diversity indices and distribution in Oban and Okwangwo Divisions of Cross River National Park (CRNP).

CRNP Division	No. of tree species	No. of families	Shannon-Weiner diversity index (H')	Species evenness (E_H)
Oban	80	25	3.88	0.62
Okwango	78	22	3.84	0.53

4 Discussion

Cross River National Park is a unique ecotourism site with its rich natural resources, geomorphological structure, rivers, climate and rich biological diversity. The core attractions of the park include wilderness hiking, game viewing, mountaineering, forest camping, rock formation, visits to the botanical garden, water recreation and village tours. Hiking in the rainforest vegetation was the prominent activity as the park provides wonderful wilderness experience with its dense canopy forests, consisting of tall trees with huge buttresses, the coolness of the environment, the freshness of the air and the sweet songs of the forest- dwelling birds. Its rich flora provides suitable habitats to many wild animals such as the Cross river gorilla, (*Gorilla gorilla diehli*) and the Chimpanzee (*Pan troglodytes)* and the bare-headed rock fowl (*Picarthates oreas)*. Birds and monkey call audible in the forest would be of interest to ecotourists. This agrees with Drumm and More (2002) assertion about ecotourism attraction whether they are wildlife viewing possibilities or dramatic natural landscapes, tend to be found in protected natural areas. Moreover, Rajib and Jaba (2012) stated that natural environment was the major purpose of tourists' visit to Bangladesh.

The Erokut rock formation is a major attraction to tourist where bat watching is prominent. Bemi River (referred to as natural swimming pool) in Butatong, Okwango division and Kwa river (shallow water) in Erokut, Oban division are good ecotourism attractions where tourist can dive and swim. Plans are also on the ground by the park management to utilize the Kwa river for sport fishing and canoe riding for ecotourists. Other attractions include nature trail in Kayang at the foot of Mbe mountain, Natural History Museum in Oban division, Botanical Garden in Okwango division where *Anceistrocladus kurupensis* that was discovered to have high medicinal properties effective against HIV/AIDS can be found (Obot *et al.* 1996, CRNP 2008). Rock of *Picathartes oreas* (rock fowl) endemic bird species is found in Bashu (Okwango division) a distance of 2 km gentle slope from the community known as Bashu Bird Sanctuary. Traditional lifestyle and culture are important and attractive elements for ecotourists. Traditional architecture is an important element of the cultural landscape, with buildings of wood, bamboo and mud walls and grass-thatched, high, pyramid-like roofs. The attribute of these resources in Cross River National Park makes the resources to be location specific for ecotourists and will have wide utility in the management of ecotourism in the park (Shrestha 2006, Srivastava and Anitha 2010).

Although fifteen wild animal species belonging to nine families were identified, the conservation status of the animals encountered show that six of the species are stable (Blue duiker *Cephalophus rufilatus*, Ground squirrel *Xerus erythropus*, Mongoose *Ichneumia albicauda*, Bush buck *Tragelaphus scriptus*, Tantalus monkey *Cercopithecus aethiops* and Yellow-spotted barbet *Buccanodon duchaillui*), four of the species' population is decreasing (Red flanked duiker *Cephalophus rufilatus*, Red

river hog *Potamochoerus porcus*, Palm civet *Viverra civetta*, fruit bats *Eidolon helvum*) and the population change of four are unknown (Porcupine *Altherurus africana*, Giant tree squirrel *Protoxerus stangeri*, Drill monkey *Mandrillus leucophaecus*, and Mona monkey *Cercopithecus mona*). Elephant *Loxodonta africana cyclotis* is the only species whose population is increasing.

The family *Leguminosae* and *Apocynacea* were dominant in Oban and Okwangwo divisions respectively. Other dominant families in both divisions were *Meliaceae, Euphorbiaceae, Moraceae, Olacaceae, Guttiferae* and *Sterculiaceae* which are mostly found in Nigerian rainforests as reported by Adekunle and Olagoke (2008) and Onyekwelu *et al*. (2008). Moreover, the diversity index and equitability (evenness) for the two divisions slightly differ. This slight variation signified that Oban division is more diverse in woody tree species than Okwango division. These diversities were above 3.5 and fall within the general limit recommended by Kent and Coker (1992). The species diversities for the two divisions further elucidate Zakaria *et al*. (2016) assertion that tropical rainforests are the most diverse among the world ecosystem in vegetation structure and composition.

5 Conclusions

Cross River National Park with its natural resources of touristic significance is a powerful ecotourism destination. In spite of the tremendous resources available in CRNP, ecotourism development in the park is still at its infancy stage, its potentials to support activities like wilderness hiking, game viewing, bird watching, mountaineering, village tour, forest camping, water recreation where tourist can dive and swim, participate in sport fishing and canoe ride cannot be overemphasized. There was a presence of diverse biological resources that are endemic to this area including those declared threatened or endangered. The diversity assessment shows that the two divisions were able to conserve both fauna and flora diversity however Oban division was more diverse in woody tree species than Okwango division. Hence, the species richness of the park can be sustainably managed if the park is further prevented from anthropogenic effects occasioned by logging, hunting, and collection of forest products to improve the vegetation status and invariably enhance wildlife population in the park.

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