BIODIVERSITY CONSERVATION AND RURAL DEVELOPMENT: INSEPARABLE OPTIONS FOR PROTECTED AREA MANAGEMENT. A CASE STUDY OF FOUR NIGERIAN NATIONAL PARKS

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The establishment and management of Protected Areas have become the cornerstones of biodiversity conservation strategies. However, efforts aimed to manage these areas have paid little or no attention to livelihoods and needs of the surrounding communities. Therefore, this study assesses the socio-economic predictors of the local people's needs and also establishes the link between biodiversity conservation and rural development. A survey of villages around four Nigerian national parks has been carried out to determine available infrastructural facilities, the facilities mostly desired by villagers and the socio-economic predictors of the local people's needs and their dependence on the national park resources. The selection of the study areas was performed through multi-stage random sampling, with a focus on villages within a 10-km radius of each national park boundaries. Primary data were collected from 1500 respondents in 106 local communities around four national parks, i.e. 22 around the Cross River National Park (CRNP), 22 around the Gashaka Gumti National Park (GGNP), 27 around the Kainji Lake National Park (KLNP), and 35 around the Old Oyo National Park (OONP). The collected data were analysed and presented descriptively, while logistic regression was used to identify the socio-demographic predictors of needs by local people. Results of the demographic characteristics show that there were more male respondents interviewed (73.2%) than female respondents (26.8%) in all four national parks. In all the four studied national parks, farming has a predominant occupation: CRNP (99.3%), GGNP (93.9%), KLNP (90.5%), and OONP (85.2%). The major number of respondents is married: CRNP (77.0%), GGNP (70.0%), KLNP (84.4%), and OONP (79.6%), and is within the age group of 15–25 years: CRNP (43.0%), GGNP (30.0%), KLNP (36.2%) and OONP (25.2%). All of the respondents interviewed in CRNP were Christians (100%), while the majority of respondents in GGNP (87.3%), KLNP (99.2%), and OONP (53.1%) were Muslims. In terms of educational qualifications, there was a high level of illiteracy among the people living around the studied national parks as most of the respondents in CRNP had primary (45.3%) and secondary education (32.7%). However, for the other three national parks, we demonstrated a higher percentage of non-formal education: GGNP (61.5%), KLNP (63.1%) and OONP (68.1%). The obtained results show that the study area is characterised by a lack of infrastructures, such as roads (96.4%), electricity (97.7%) and limited provision of service, such as medicine (91.1%), potable water (96.5%), and education services (86.6%). The majority of the interviewed respondents in communities around the national parks indicated the provision of health care centres (78.5%), boreholes/portable water (77.7%), roads (68.6%), the establishment of schools (59.7%) and employment (56.2%). Our results show that the communities' expectation was for basic infrastructures, such as the provision of potable water (77.5%), health care centres (78.5%), electricity (78.1%), and roads (68.9%). The logistic regression analysis indicated that the predictors of the respondents' infrastructural needs were gender ($\beta = 0.068$, $p < 0.01$), age ($\beta = 0.032$, $p < 0.01$), and education level ($\beta = 0.047$, $p < 0.05$). The study concludes that there is a need for the federal, state and local governments to provide the basic infrastructures in villages surrounding the studied national parks to reduce the pressure and over-dependence of the local people on the national park resources. The literacy campaign and conservation education should be taken to the grass-root because the majority of the local people are illiterates and live around biodiversity hotspots.

Key words: attitude, biodiversity, infrastructure, local people, needs, Protected Area

Introduction

Biodiversity implies the variety of all forms of life, from genes and species to ecosystems and remains the living natural heritage to all. The biodiversity is crucial for the reduction of poverty, due to the basic goods and ecosystem services it provides. The world's poorest people depend on forests to varying extents (Cámara-Leret et al., 2019). Globally, about 2 600 000 000 people worldwide draw their livelihoods either partially or fully from agriculture. More than 3 000 000 000 people depend on marine and coastal biodiversity, while over 1 600 000 000 people rely on forests and non-timber forest products (CBD, 2016).

The deep relationship between people and forests and their associated biological diversity has a long history (Roberts, 2019). Indigenous communities often have a deep cultural and spiritual

relationship with their ancestral forest lands and age-old knowledge about biodiversity. It is not just coincidence that the majority of the world's remaining biodiversity resides in indigenous territories (Taylor et al., 2012; Verschuuren & Brown, 2018). The biodiversity ultimately provides people with raw materials for food and feed, construction, clothing, handicrafts, medicines and other daily livelihood needs (Cámara-Leret & Dennehy, 2019). Around the world, human activities are taking a heavy toll on biodiversity and ecosystem services through unsustainable agriculture, unsustainable industrial logging, overhunting creeping urbanisation, rampant coastal development and rapacious over-fishing, which are fragmenting and destroying the natural environment (Lewis & Maslin, 2015; Barlow et al., 2016; Potapov et al., 2017; Evans et al., 2018).

Sustainable rural development is the key to maintain active local communities in rural and semi-natural areas, avoiding depopulation and preserving sites of high ecological value, including Protected Areas, and ecosystem functions and services, upon which the society relies and that contribute to poverty alleviation both locally and globally (de Castro-Pardo et al., 2021). Nigeria has created Protected Areas under the co-ordination of National Park Services aiming to protect the biodiversity. As a result, residents of communities surrounding Protected Areas could not meet their basic needs, like employment, water provision, educational facilities, medical services, energy supply, livestock grazing, and motor-able roads (Olufemi & Kenneth, 2019). Rural people may be poor, sometimes to the point of mere subsistence and may have a few options for coping with the challenges of making a living and so need to supplement their income by exploitation of natural resources to provide a reasonable livelihood. Conflicts always also arise due to the pressure of a growing population, widespread poverty and unsustainable land-use practice outside Protected Areas (Osunsina & Fagbeyiro, 2015). It is increasingly recognised that the biodiversity is ultimately lost or conserved at the local and rural levels due to the high prevalence of poverty (Yosef, 2015). It has been observed that the impacts of Protected Areas on local livelihoods can be major determinants of attitudes of local communities toward conservation (Bennett & Dearden, 2014; Clements et al., 2014; Bragagnolo et al., 2016; Abukari & Mwalyosi, 2018a,b, 2020).

The success of conservation strategies through Protected Areas may lie in the ability of managers to reconcile biodiversity conservation goals with social and economic issues and to promote greater compliance of local communities with Protected Areas' conservation strategies (Andrade & Rhodes, 2012). Enhancing social and economic development, while preserving nature, is one of the most significant challenges for humankind in the XXI century. Hence, finding new pathways for reconciling socio-economic well-being and nature sustainability is critically important for contemporary societies, especially in tropical developing countries where sustaining local livelihoods often clashes with biodiversity conservation (Campos-Silva et al., 2021; de Castro-Pardo et al., 2021). Ensuring positive outcomes for both biodiversity and people requires a careful balance between conservation goals and demands for resources that support livelihoods and needs of the rural people (FAO & UNEP, 2020). In view of the foregoing, this study was conducted to assess the facilities and amenities available in the neighbouring villages around a national park, the amenities mostly desired by the villages and the socio-economic predictors of the local people's needs. The study specifically considers and establishes the link between biodiversity conservation and rural development.

Material and Methods

The study has been carried out in Cross River National Park (CRNP), Gashaka Gumti National Park (GGNP), Kainji Lake National Park (KLNP), and Old Oyo National Park (OONP). Table 1 shows a brief description of these national parks. Primary data were collected from local communities in support zones of Nigerian national parks. The study was done using multi-stage random sampling. The national parks are divided into ranges, which serve as units for protection and conservation activities, and are located in various geographical zones for ease of protection and administrative activities. Within the ranges, there are the support zones of villages near national parks that were selected for the study. The communities and villages, where the national parks are located, are in 19 local government areas in the northern and southern parts of Nigeria with a total population of 2 758 299 according to a 2006 population census and Federal Republic of Nigeria Official Gazette (National Population Commission, 2010). However, this official gazette lacks a breakdown of the number of people for each of the selected communities and villages in each of the local governments. The survey method was conducted in line with Ogunjinmi et al. (2014).

Table 1. Brief description of the four selected national parks in Nigeria

Parameters*	National parks			
	CRNP	GGNP	KLNP	OONP
Area	4000 km^2	6731 km^2	5340.83 km^2	2512 km^2
Longitude	08.445322–08.44887° E	11.482732–11.484554° E	03.331740–05.503340° E	03.350010–04.420044° E
Latitude	05.344991–05.348319° N	7.56311568–7.565193° N	09.402200–10.322640° N	08.150023–09.05012° N
Location in Nigeria	South-eastern part	North-eastern part	North-central part	South-western part
State	Cross River	Adamawa and Taraba	Kwara and Niger	Oyo
IUCN category	II	II	II	II
Local government areas covered	5	4	5	11
Year of the foundation	1991	1991	1979	1991
Predominant vegetation	Moist tropical primary rainforest and mangrove swamps on the coastal zones	Montane forests and savanna grassland	Northern Guinea savanna	Southern Guinea savanna
Climate	Rainy season: April – November; dry season: December – March.	Rainy season: May – October; dry season: November – April.	Rainy season: April – September; dry season: October – April.	Rainy season: March – November; dry season: December – February.
Division	Oban Hills and Okwango divisions	Gumti and Tango sectors	Borgu and Zugurma sectors	One contiguous sector
Uniqueness	It is a United Nations biodiversity hotspot	It has enclave villages, and it is an Important Bird Area	It has enclave villages, a long lake (136 km), and an Important Bird Area	It has an archaeological site of ruins of the Old Oyo Empire
Animal diversity	It has 15 primate species, including *Gorilla gorilla diehli* Matschie, 1904, and *Pan troglodytes* (Blumenbach, 1799); 75 mammal species, including *Loxodonta cyclotis* Matschie, 1900, and *Syncerus caffer nanus* (Boddaert, 1785); 42 snake species, over 350 bird species, and 950 butterfly species. It is one of two sites in Nigeria, where *Phyllastrephus xavieri* (Oustalet, 1892) is found. Other species rare in Nigeria are *Macheiramphus alcinus* Westermann, 1851, *Aquila africana* (Cassin, 1865), and *Malimbus racheliae* (Cassin, 1857).	It has a diversity of rare and highly threatened fauna, 103 species of mammals (e.g. *Colobus guereza* Rüppell, 1835, *Potamochoerus porcus* (Linnaeus, 1758), *Panthera leo* (Linnaeus, 1758), *Cephalophus silvicultor* (Afzelius, 1815), *Kobus ellipsiprymnus* (Ogilbyi, 1833), *Pan troglodytes*), more than 500 bird species, 55 fish species, and over 500 butterfly species. It has threatened migratory animal species, such as *Taurotragus derbianus* (Gray, 1847), and *Acinonyx jubatus* (Schreber, 1775).	It has a diversity of 65 mammal species, 350 bird species, 30 species of reptiles and amphibians, 118 fish species. Common animal species are *Loxodonta africana* (Blumenbach, 1797), *Syncerus caffer* (Sparrman, 1779), *Hippotragus equinus* (É. Geoffroy Saint-Hilaire, 1803), *Kobus kob* (Erxleben, 1777), *Panthera leo*, *P. pardus* (Linnaeus, 1758), *Crocodylus niloticus* Laurenti, 1768, *Python sebae* (Gmelin in Linnaeus, 1789), *Varanus niloticus* (Linnaeus, 1758).	It is represented by numerous mammal species, like *Kobus kob*, *Hippotragus equinus*, *Alcelaphus buselaphus* (Pallas, 1766), *Sylvicapra grimmia* (Linnaeus, 1758), *Tragelaphus scriptus* (Pallas, 1766), *Papio anubis* (Lesson, 1827), *Syncerus caffer* (Sparrman, 1779), *Potamochoerus porcus*, *Panthera leo*, *Crocuta crocuta* (Erxleben, 1777), over 200 bird species.
Plant diversity	Over 1568 plant species were identified, 77 of which are endemic to Nigeria. They include 1303 flowering plants, 141 lichens and 56 moss species (e.g. *Ancistrocladus korupensis* D.W.Thomas & Gereau, *Berlinia confusa* Hoyle, *Coula edulis* Baill., *Hannoa klaineana* Pierre & Engl., *Klainedoxa gabonensis* Pierre ex Engl., *Khaya ivorensis* A.Chev., *Lophira alata* Banks ex C.F.Gaertn., *Prunus africana* (Hook.f.) Kalkman).	Some of the common tree species are *Acacia nilotica* (L.) Willd. ex Delile, *Afzelia africana* Sm. ex Pers., *Khaya senegalensis* (Desr.) A.Juss., *Daniellia oliveri* (Rolfe) Hutch. & Dalziel, *Isoberlinia doka* (Craib & Stapf), *Vitellaria paradoxa* subsp. *nilotica* (Kotschy) A.N.Henry, Chithra & N.C.Nair, *Albizia gummifera* (J.F.Gmel.) C.A.Sm., *Triplochiton scleroxylon* K.Schum., *Aubrevillea kerstingii* (Harms) Pellegr.	Common tree species are *Afzelia africana*, *Daniellia oliveri*, *Vitellaria paradoxa* subsp. *nilotica*, *Isoberlinia doka*, *Burkea africana* Hook. *Pterocarpus erinaceus* Poir., *Parkia clappertoniana* Keay, *Khaya senegalensis*, *Detarium microcarpum* Guill. & Perr.	Common tree species are *Burkea africana*, *Vitellaria paradoxa* subsp. *nilotica*, *Daniellia oliveri*, *Lophira alata*, *Anogeissus leiocarpa* (DC.) Guill. & Perr., *Detarium microcarpum*, *Annona senegalensis* Pers., *Hymenocardia acida* Tul., *Parkia clappertoniana*, *Piliostigma thonningii* (Schumach.) Milne-Redh., *Terminalia macroptera* Guill. & Perr.

Note: * – Information is provided according to NPSN (2022); CRNP – Cross River National Park, GGNP – Gashaka Gumti National Park, KLNP – Kainji Lake National Park, OONP – Old Oyo National Park.

In all ranges (administrative zones) of the selected national parks, amounting to 109 communities, 10% from the list of communities were randomly selected. They were chosen between 0 km and 10 km from a national park's boundaries. The total number of communities within this range was based on National Park Service records. In each community, a list of households was obtained from community heads or community leaders. Household heads, or in their absence, any member willing to participate, were invited for questionnaire administration. The total number of selected households was 1500 (300 ones were related to CRNP, 330 to GGNP, 390 to KLNP, and 480 to OONP), representing 10% of the total number of households among all 106 surrounding villages comprising 22 around CRNP, 22 around GGNP, 27 around KLNP, and 35 around OONP.

Data analysis

Data were obtained using a set of questionnaires administered to respondents in each village. The questionnaire comprised the socio-demo-

graphic characteristics of respondents, amenities available in the village and amenities they desire from a national park. The explanatory and dependent variables are operationalised in Table 2. The collected data were analysed and presented descriptively using the Statistical Package for Social Sciences (SPSS) version 21 (IBM Corporation, USA). Data were analysed and presented descriptively in frequency, and percentages, while the logistic regression was used to identify the socio-demographic predictors of need by the local people.

Results and Discussion

The result of the demographic characteristics shows that there were more male respondents interviewed (73.2%), than female respondents (26.8%) in the four national parks. This is similar to the study carried out by Osunsina (2016) showed that men were predominant in the sample population. Most of respondents were married (78.2%), while a larger proportion of respondents were also between the age ranges of 15–25 years (32.7%). All of the interviewed respondents in CRNP were Christians (100%), while the majority of respondents in GGNP (87.3%), KLNP (99.2%) and OONP (53.1%) were Muslims. In terms of the educational qualification, most of the respondents in CRNP had primary (45.3%) and secondary education (32.7%). But in the other three national parks, a higher proportion of respondents had non-formal education: GGNP (61.5%), KLNP (63.1%) and OONP (68.1%) (Table 3). This shows a high level of illiteracy among the people living around the national parks. This is caused by the location of villages in remote areas, where there are no schools within reach. Osunsina & Fagbeyiro (2015) indicated that the education affects many aspects of life, including how individuals relate to and perceive the national parks and their natural resources. The level of formal education associated with respondent age influenced attitudes of the people. It has become common sense in Nigeria that resources have to be re-distributed evenly. Among these resources there are those affecting the provision of formal education. To succeed in influencing the people to be socially and environmentally responsible, the government will be obligated to conceive, develop and implement a comprehensive environmental education programme.

To reverse the existing destructive trends of people-related activities and living styles, the environmental enlightenment and ethics must become a basic goal on all levels within the school system. Sustainable resource utilisation can be achieved to a large extent by developing and investing in a citizenry that is knowledgeable about the environment and has skills to recognise and deal effectively with the problems. Through formal education, people make sense of their experiences and develop their knowledge and understanding of natural and human activities, which influence and shape the environment. This helps to focus energies on certain issues and address appropriate audiences. Taking into cognizance problems facing Nigeria, emphasis and focus on school children has benefits and limitations.

Adekunle et al. (2012) and Olunusi et al. (2022) established a relationship between the level of education and the knowledge of conservation and sustainable use among respondents utilising natural resources. Morar & Peterlicean (2012) affirmed that education can help people gain knowledge, skills, motivation values and the engagement needed to manage efficiently Earth resources and to take responsibility for maintaining the environment quality. Osunsina & Fagbeyiro (2015) also reported that younger respondents have a higher educational level than older respondents, because now younger respondents have more access to education, as compared with older respondents in the Old Oyo National Park (Nigeria). In all selected national parks, farming was considered the predominant occupation, namely CRNP (99.3%), GGNP (93.9%), KLNP (90.5%), and OONP (85.2%). Similar studies of Osunsina (2016) and Osunsina & Fagbeyiro (2015) showed that farming is the predominant occupation practised around national parks due to the highly fertile land found around Protected Areas.

Table 2. Operationalisation of variables used in the study for analysis of data from four Nigerian national parks

Explanatory variables	Description	Operationalisation
Gender	Whether the respondent is a male or female	1 for male, 0 female
Age	The actual age of respondents in years	Age
Education	Education attainment of respondent	1 for non-formal, 0 otherwise
Occupation	The occupation of the respondent	1 for farming, 0 otherwise
Marital Status	The marital status of the respondent	1 for single, 0 otherwise
Religion	The religion of the respondent	1 for Christian, 0 otherwise
Community infrastructural need	Whether the respondents need the infrastructure	1 for Yes, 0 for No
Dependent variable	Description	Operationalisation
Support for conservation	Whether respondents support conservation activities in a national park or not	1 for Yes, 0 for No

Table 3. Demographic characteristics of respondents around the four selected national parks in Nigeria

Parameters	Variables	National parks and sampling size				
		CRNP n = 300 (%)	GGNP n = 330 (%)	KLNP n = 390 (%)	OONP n = 480 (%)	In total n = 1500 (%)
Gender	Male	248 (82.7)	247 (74.8)	251 (64.4)	352 (73.3)	1098 (73.2)
	Female	52 (17.3)	83 (25.2)	139 (35.6)	128 (26.7)	402 (26.8)
Marital status	Single	69 (23.0)	99 (30.0)	61 (15.6)	98 (20.4)	327 (21.8)
	Married	231 (77.0)	231 (70.0)	329 (84.4)	382 (79.6)	1173 (78.2)
Age	15–25	129 (43.0)	100 (30.3)	141 (36.2)	121 (25.2)	491 (32.7)
	26–35	59 (19.7)	69 (20.9)	111 (28.5)	77 (16.0)	316 (21.1)
	36–45	39 (13.0)	45 (13.6)	55 (14.1)	85 (17.7)	224 (14.9)
	46–55	38 (12.7)	47 (14.2)	30 (7.7)	103 (21.5)	218 (14.5)
	56–65	13 (4.3)	31 (9.4)	31 (7.9)	52 (10.8)	127 (8.5)
	66 and above	22 (7.3)	38 (11.5)	22 (5.6)	42 (8.8)	124 (8.3)
Religion	Christianity	300 (100)	42 (12.7)	3 (0.80)	210 (43.8)	555 (37.0)
	Muslim	0 (0)	288 (87.3)	387 (99.2)	255 (53.1)	930 (62.0)
	Traditional	0 (0)	0 (0)	0 (0)	15 (3.1)	15 (1.0)
Qualification	Non-formal	54 (18.0)	203 (61.5)	246 (63.1)	327 (68.1)	830 (55.3)
	Islamic	0 (0)	24 (7.30)	63 (16.2)	38 (7.9)	125 (8.3)
	Primary	136 (45.3)	63 (19.1)	24 (6.2)	75 (18.3)	298 (19.9)
	Secondary	98 (32.7)	40 (12.1)	47 (12.1)	8 (1.7)	193 (12.9)
	Tertiary	12 (4.0)	0 (0)	10 (2.6)	32 (6.7)	54 (3.6)
Occupation	Farmer	298 (99.3)	310 (93.9)	353 (90.5)	409 (85.2)	1370 (91.4)
	Trader	0 (0)	0 (0)	25 (6.4)	16 (3.3)	41 (2.7)
	Fisherman	0 (0)	4 (1.2)	5 (1.3)	8 (1.7)	17 (1.1)
	Civil servant	2 (0.7)	16 (4.8)	7 (1.8)	23 (4.8)	48 (3.2)
	Hunter	0 (0)	0 (0)	0 (0)	24 (5.0)	24 (1.6)

Note: Proportion is indicated in percentages (%); CRNP – Cross River National Park, GGNP – Gashaka Gumti National Park, KLNP – Kainji Lake National Park, OONP – Old Oyo National Park.

The obtained results showed that communities around the selected national parks have benefited from them in terms of employing people from these communities. However, this seems to be more pronounced in KLNP and OONP (46.5% and 55.3%, respectively). Some respondents also indicated that they have received donations of educational material from national parks. Other benefits enjoyed from national parks include the provision of the borehole, renovation of health centres and schools (Table 4). Kainji Lake National Park was able to provide more assistances and amenities to villages around it through the Local Empowerment and Environmental Management Project (LEEMP) sponsored by the Global Environment Facility (GEF). This observation is consistent with Osunsina et al. (2018), stated that KLNP only showed strengths in the community support for this national park primarily because of the GEF/LEEMP programme going on in KLNP, which is a part of an integrated conservation and development programme.

In terms of the community expectation from the national park, our results showed that communities' expectations were basic amenities/infrastructures. These expectations were based on the fact that the national park establishment has denied them of the basic resources, which they use, and that national parks are the closest government institutions to them. The study shows that most of the essential and basic infrastructures were lacking in many villages. Zhu et al. (2018) and Ayivor et al. (2020) noted that most of the national parks are located in remote areas, with restrictions to development which further exacerbate the existing poverty and reliance on natural resources, most often lacking in such infrastructures as roads and limited provision of services (e.g. medicine, potable water, education services). The majority of respondents in communities around the selected national parks indicated the provision of health care centre (78.5%), borehole/portable water (77.7%), roads (68.6%), establishment of schools (59.7%) and employment (56.2%) (Table 5). However, our study showed the lower number of respondents demanding for provision of financial assistance (20.7%), provision of farmlands (21.1%), and electricity (21.9%) (Table 5). A similar study of Akosim & Mbaya (2012) conducted in the Chad Basin National Park (Nigeria) revealed the development options demanded from the national park management to elicit the support of the resident as employment (21.77%), pipe borne-water (20.41%), roads (15.65%), electricity (11.57%), health facility (8.84%), while farmland areas (2.04%), agricultural inputs (5.44%), schools (6.1%), viewing centres (5.44%), and community woodlots (2.72%) were the least demanded.

Table 4. Amenities benefited by neighbouring villages in the four selected national parks from the Nigerian National Park Service

Indicators	National parks and sampling size				
	CRNP n = 300 (%)	GGNP n = 330 (%)	KLNP n = 390 (%)	OONP n = 480 (%)	In total n = 1500 (%)
Grading of roads					
Yes	0 (0)	0 (0)	52 (13.2)	32 (6.7)	84 (5.6)
No	300 (100)	330 (100)	338 (86.8)	448 (93.3)	1416 (94.4)
Renovation of schools					
Yes	0 (0)	41 (12.4)	117 (30.0)	43 (9.0)	201 (13.4)
No	300 (100)	289 (87.6)	273 (70.0)	437 (91.0)	1299 (86.6)
Renovation of health centres					
Yes	0 (0)	37 (11.2)	56 (14.4)	41 (8.5)	134 (8.9)
No	300 (100)	293 (88.8)	334 (85.6)	439 (91.5)	1366 (91.1)
Provision of well/borehole					
Yes	0(0)	26 (7.9)	2 (0.4)	24 (5.0)	52 (3.5)
No	300 (100)	304 (92.1)	388 (99.5)	456 (95.0)	1448 (96.5)
Provision of electricity					
Yes	0 (0)	0 (0)	10 (2.6)	24 (5.0)	34 (2.3)
No	300 (100)	330 (100)	380 (97.4)	456 (95.0)	1466 (97.7)
Employment for villagers					
Yes	51 (17.0)	53 (16.0)	181 (46.4)	265 (55.2)	550 (36.7)
No	249(83.0)	277 (84.0)	209 (53.6)	215 (44.8)	950 (63.3)
Provision of educational materials					
Yes	0 (0)	7 (2.1)	30 (7.7)	23 (4.8)	60 (4.0)
No	300 (100)	323 (97.9)	360 (92.3)	457 (95.2)	1440 (96.0)

Note: Proportion is indicated in percentages (%); CRNP – Cross River National Park, GGNP – Gashaka Gumti National Park, KLNP – Kainji Lake National Park, OONP – Old Oyo National Park.

Table 5. Amenities expected by neighbouring villages from Nigeria National Park Service in the four selected national parks

Indicators	National parks and sampling size				
	CRNP n = 300 (%)	GGNP n = 330 (%)	KLNP n = 390 (%)	OONP n = 480 (%)	In total n = 1500 (%)
Provision of farmlands					
Yes	104 (34.6)	55 (16.7)	133 (34.2)	25 (5.2)	317 (21.1)
No	196 (65.4)	275 (83.3)	257 (65.8)	455 (94.8)	1183 (78.9)
Provision of health centres					
Yes	199 (66.3)	279 (84.5)	319 (81.8)	380 (79.2)	1177 (78.5)
No	101 (33.7)	51 (15.5)	71 (18.2)	100 (20.7)	323 (21.5)
Provision of borehole					
Yes	277 (92.3)	290 (88.0)	333 (85.4)	263 (54.8)	1163 (77.5)
No	23 (7.7)	40 (12.0)	57 (14.6)	217 (45.2)	337 (22.5)
Provision of schools/school materials					
Yes	143 (47.7)	251 (76.1)	245 (62.8)	256 (53.4)	895 (59.7)
No	157 (45.0)	79 (23.9)	145 (37.2)	224 (46.6)	605 (40.3)
Provision of roads					
Yes	178 (59.3)	229 (69.4)	270 (69.2)	352 (73.3)	1029 (68.6)
No	122 (40.7)	101 (30.6)	120 (30.8)	128 (26.7)	471 (31.4)
Provision of employment opportunities					
Yes	152 (50.7)	103 (31.2)	275 (70.5)	313 (65.2)	843 (56.2)
No	148 (49.2)	227 (68.8)	115 (29.5)	167 (34.8)	657 (43.8)
Provision of electricity					
Yes	131 (43.7)	94 (28.5)	9 (2.3)	95 (19.8)	329 (21.9)
No	169 (56.2)	236 (71.5)	381 (97.7)	385 (80.2)	1171 (78.1)
Provision of the financial assistance					
Yes	36 (12.0)	43 (13.0)	16 (4.1)	216 (45.0)	311 (20.7)
No	264 (88.0)	287 (87.0)	374 (96.9)	264 (55.0)	1189 (79.3)

Note: Proportion is indicated in percentages (%); CRNP – Cross River National Park, GGNP – Gashaka Gumti National Park, KLNP – Kainji Lake National Park, OONP – Old Oyo National Park.

The majority of the rural people resort to the usage of medicinal plants because orthodox medicine and hospital services are not available in most of the villages. In those, where medical facility was available, they were not easily affordable by villagers. Therefore, most rural people solely depend on medicinal plants for their health care needs. This was also reported by Osunsina et al. (2012, 2014)

in studies on medicinal plants and food additives used by communities around four national parks. In the report on the state of the world's forests, FAO & UNEP (2020) stated that biodiversity provides a wide range of products and services that contribute to human health, including medicine, food, clean water and air, shade or simply a green space, allowing to exercise and relax. Various studies (e.g. Muhumuza & Balkwill, 2013; Willis, 2017; Saez, 2019) show that in African communities, local people traditionally depend on environmental resources directly for survival. People hunt animals, collect wild fruits, and their culture revolves around resources in the environment. However, respondents complained that the medicinal plants were not found anymore in the «free area» because their habitats have been cleared for agricultural activities.

In CRNP, five villages have partly good roads; all villages, except one, have primary schools; 14 villages have secondary schools; 12 villages have health centres, while only one village has a borehole and electricity supply (Fig. 1). In GGNP, only five villages have tarred roads; 15 villages have a primary school, and one village has a secondary school. In terms of health facilities, eight villages have health centres or dispensaries, three villages have a borehole, and none of the villages has electricity (Fig. 1). In KLNP, only two villages have tarred roads; 23 villages have a primary school; two villages have secondary schools; 12 villages have health centres. In addition, seven villages have a borehole, and two villages have electricity. In OONP, only two villages have tarred roads; 17 villages and two villages have primary and secondary schools, respectively. In terms of health facilities, three villages have health centres, six villages have boreholes/well, and only one village has electricity (Fig. 1).

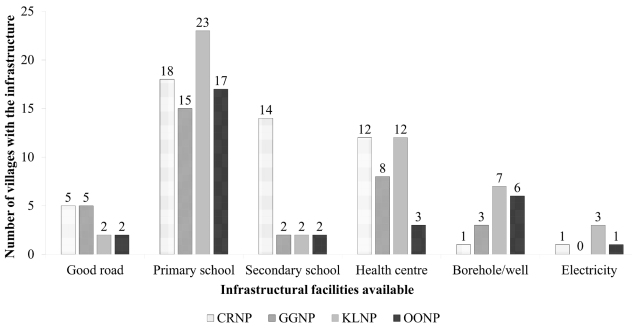

Fig. 1. Infrastructural facilities available in villages around the selected four Nigerian national parks. Designations: CRNP – Cross River National Park, GGNP – Gashaka Gumti National Park, KLNP – Kainji Lake National Park, OONP – Old Oyo National Park.

The over-dependence of the rural people on the national park resources can be related to the unavailability or inadequacy of some vital infrastructural facilities, which are needed by villagers. Such facilities include good roads, schools, health centres, boreholes, and electricity. The lack of water and health centres causes villagers to intrude into the national park for water and medicinal plants. Several authors (e.g. Ayivor et al., 2013, 2020; Zhu et al., 2018) have linked the poverty and basic needs of local communities in Protected Areas as driving forces that compel the people to over-exploit natural resources in Protected Areas to the detriment of biodiversity conservation. FAO (2017) and FAO & UNEP (2020) reported that income and wild foods from forests provide a safety net during seasonal food shortages and during times of famine, crop failure, and economic, social and political shocks. Harvesting food from forests is an important strategy for coping with periods of the food insecurity, especially for vulnerable households living in and close to Protected Areas. The dependence of the local people on national park resources for their livelihood and survival affects biodiversity conservation in those national parks. Hence, the success of any conservation programme is dependent on meeting needs of the local people. Alix-Garcia et al. (2015) and Jayachandran et al. (2017) revealed that successful conservation of wildlife and forest biodiversity was also a result of recognising needs of the local people in Mexico and Uganda, respectively. Several studies (e.g. Ayivor et al., 2013; Muhumuza & Balkwill, 2013) asserted the strong link between the livelihood and dependence of the people on natural resources of national parks.

Results of the modelling of explaining the socio-demographic predictors of community needs in the four selected Nigerian national parks are presented in Table 6. The likelihood ratio test indicates that the logistic regression model is significant with χ^2 test statistics of 32.38 for support the biodiversity conservation. This shows that the socio-demographic variables of respondents were significantly related to their support of the biodiversity conservation in national parks. In addition, the model predictions are correct at 74.1% support for biodiversity conservation in national parks. This shows that the explanatory variables can be used to specify dependent variables (i.e. biodiversity conservation in a national park) in discrete terms (0, 1) with a high degree of accuracy.

Table 6. Socio-demographic predictors of the respondents' infrastructural needs in four Nigerian national parks

Parameters	B	SE	Wald	p-value	Exp.(B)
Gender	0.463	0.158	8.610	0.003**	1.589
Age	0.739	0.159	21.560	0.000**	2.093
Religion	1.627	0.136	144.138	0.000**	5.089
Marital Status	-1.145	0.200	32.891	0.000**	0.318
Occupation	0.438	0.253	2.986	0.084	1.549
Education	0.052	0.137	0.144	0.704	1.053
Community needs	1.133	0.576	3.873	0.049*	3.105
Constant	-0.735	0.610	1.449	0.229	0.480
Correct Prediction (%)	74.1				
Final model fit					
-2 log-likelihood	1503.18				
Nagelkerke R^2	0.214				

Note: * – $p < 0.05$; ** – $p < 0.01$; B – unstandardised beta, SE – standard error, Wald – Wald test statistics, Exp.(B) – exponential value of regression.

Gender ($p < 0.01$), age ($p < 0.01$), religion ($p < 0.01$), marital status ($p < 0.01$), and community infrastructural needs ($p < 0.05$) are the predictors of the community support for biodiversity conservation in the four selected national parks. However, the occupation and education of the respondents are not statistically related to the respondents' support for biodiversity conservation. The final model fit indicated that 74.1% of the variation in the respondent support for biodiversity conservation is explained by the logistic model indicating a strong relationship between the predictors and the predictions. Age has a significant influence on attitudes and perceptions of the local communities on resource use and conservation. This finding is similar to the observed relationship between age and respondents' use of natural resources that was stated by Osunsina & Fagbeyiro (2015).

Gender has a significant influence on attitudes and support of the local communities on resource use and conservation. The study by Ogunjinmi et al. (2012) on gender and traditional responsibilities in natural resources utilisation and management indicated that women are usually the ones engaged in household subsistence activities, such as the collection of water, fodder, herbs for medicinal purposes and wood for fuel and other materials. Marital status has a significant effect on the support for biodiversity conservation; larger households are likely to be highly dependent on natural resources for their livelihood. This is in line with the study by Ratsimbazafy et al. (2012) where households were highly dependent on the forest to generate income remained reluctant and unsupportive of conservation efforts. Community infrastructural needs also have a significant influence on the support for biodiversity conservation. Olufemi & Kenneth (2019) stated that the quest for infrastructural needs is assuming a high dimension around Protected Areas, and meeting these needs will ensure recognition and support for intact ecosystems. The study further shows that religion has a significant effect on the support for biodiversity conservation. Several studies (Berkes, 2013; Mikusiński et al., 2014; Murray & Agyare, 2018) have shown that religion provides values, belief and environmental ethics that shape how various societies interact with biological diversity and nature in general and are central to basic beliefs and ethics that influence people's behaviour, which is relevant to conservation interventions.

Nigerian national parks should be commended in their efforts at providing villages around them with some basic amenities such as schools, building and renovation of classrooms, the building of dispensaries and clinics, provision of notebooks for students and grading of community roads. This has gone a long way to motivate the support of the biodiversity conservation. Muhumuza & Balkwill (2013) indicated that people may be motivated to conserve biodiversity in national parks for various reasons. Other studies (e.g. Alix-Garcia et al., 2015; Jayachandran et al., 2017) in Mexico and Uganda suggest that programmes offering payments and incentives in compensation for conservation activities have successfully reduced rates of deforestation and biodiversity loss.

However, gestures of national parks in providing amenities for villages are not so much appreciated by the people because they bore the weight of social and economic implications of conservation, and because they have been neglected by (federal, state and local) governments that should provide them with basic amenities. Therefore, the national park is seen as a social problem and hindrances to their benefit from their God-endowed resources. It is quite disturbing that the Nigeria's national parks are encumbered with a problem of poor funding and socio-economic problems of surrounding villages to the extent that they are unable to face challenges of their establishment. Many other national parks in the world have gone beyond protection and anti-poaching activities to an increase in the animal population and restoring extinct or threatened species to a viable population. No wonder many species of animals such as *Kobus ellipsiprymnus* (Ogilbyi, 1833), *Loxodonta africana* (Blumenbach, 1797), *Panthera pardus* (Linnaeus, 1758), *Gorilla gorilla* (Savage, 1847), *Pan troglodytes* (Blumenbach, 1799) are not commonly seen anymore or have disappeared in some of Nigeria's national parks, because of poaching activities. Osunsina et al. (2018) identified the poor funding in most national parks in Nigeria and revealed that the funding was considered inadequate to conduct critical management activities and irregular at the time needed to conduct these activities.

This trend is not likely to change unless there is a review of the national biodiversity convention and the roles of federal, state and local governments are well specified and implemented. It is noteworthy that the biodiversity conservation is a national issue which cannot be tackled by a single government parastatal. It should be noted that no national park or other Protected Areas can solely cater for needs of rural communities around its fringes without the assistance of national or international donors and international conservation organisations. Smith (2014) stated that, without the external financial revenue, the wildlife departments or national parks cannot individually fund the development aspects of rural communities living around national parks. Therefore, it should be the responsibility of the three-tier of the government in Nigeria. Efforts should be made to integrate this into the national budget and planning. The Nigeria's national parks are gradually drifting towards the empty forest syndrome described by Redford (1992) as an ecosystem that is void of large mammals. This must not be encouraged.

Conclusions

There is a need to improve infrastructural facilities in villages surrounding the fours selected national parks. The over-dependence of the local people on national parks could be reduced, if there is a provision of facilities such as potable water, functional health centre and dispensaries and affordable and available liquid paraffin for cooking. The literacy campaign should also be taken to the grass-root because the majority of the local people are illiterates. Therefore, three tiers of the government (federal, state and local) should give attention to the development of basic amenities at the grass-root level, which, in turn, would reduce the pressure on natural resources and stem the tide of frequent conflicts between the national park staff and villagers.

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СОХРАНЕНИЕ БИОРАЗНООБРАЗИЯ И РАЗВИТИЕ СЕЛЬСКИХ ТЕРРИТОРИЙ: НЕРАЗДЕЛИМЫЕ ВАРИАНТЫ УПРАВЛЕНИЯ ОСОБО ОХРАНЯЕМЫМИ ПРИРОДНЫМИ ТЕРРИТОРИЯМИ. ИССЛЕДОВАНИЕ ЧЕТЫРЕХ НАЦИОНАЛЬНЫХ ПАРКОВ НИГЕРИИ

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Создание особо охраняемых природных территорий (ООПТ) и управление ими стало краеугольным камнем стратегий сохранения биоразнообразия. Однако усилия, направленные на управление ООПТ, практически не учитывали средства к существованию и потребности окружающих сообществ местного населения. В данном исследовании оцениваются социально-экономические предикторы потребностей местного населения, а также устанавливается связь между сохранением биоразнообразия и развитием сельских территорий. Было проведено обследование деревень, расположенных вокруг четырех национальных парков Нигерии, для определения доступных объектов инфраструктуры, наиболее востребованных сельскими жителями объектов, а также социально-экономических показателей потребностей местного населения и их зависимости от ресурсов национальных парков. Выбор территории исследования был осуществлен методом многоступенчатой случайной выборки с упором на села в радиусе 10 км от границ каждого национального парка. Первичные данные были собраны у 1500 респондентов из 106 местных сообществ вокруг четырех национальных парков, в том числе 22 вокруг национального парка Кросс-Ривер (НПКР), 22 вокруг национального парка Гашака Гумти (НПГГ), 27 вокруг национального парка Озеро Каинджи (НПОК), и 35 вокруг национального парка Олд-Ойо (НПОО). Собранные данные были проанализированы и описаны. Логистическая регрессия использовалась для выявления социально-демографических предикторов потребностей местного населения. Результаты демографических характеристик показывают, что в четырех национальных парках было опрошено больше мужчин (73.2%), чем женщин (26.8%). Во всех исследованных национальных парках преобладающим занятием местного населения является земледелие: НПКР (99.3%), НПГГ (93.9%), НПОК (90.5%), НПОО (85.2%). Наибольшее количество респондентов состоит в браке: НПКР (77.0%), НПГГ (70.0%), НПОК (84.4%), НПОО (79.6%). Наибольшее количество респондентов приходится на возрастную группу 15–25 лет: НПКР (43.0%), НПГГ (30.0%), НПОК (36.2%) и НПОО (25.2%). Все респонденты, опрошенные в НПКР, были христианами (100%), тогда как большинство респондентов в НПГГ (87.3%), НПОК (99.2%) и НПОО (53.1%) были мусульманами. В отношении уровня образования, среди населения, проживающего на территории исследуемых национальных парков, отмечен высокий уровень неграмотности, так как большинство опрошенных в НПКР имели начальное (45.3%) и среднее (32.7%) образование. Для остальных трех национальных парков была показана более высокая доля неформального образования: НПГГ (61.5%), НПОК (63.1%) и НПОО (68.1%). Полученные результаты показывают, что территория исследования характеризуется отсутствием таких объектов инфраструктуры, как дороги (96.4%), электричество (97.7%), и ограниченным предоставлением таких услуг, как лекарства (91.1%), питьевая вода (96.5%), а также услуги образования (86.6%). Большинство опрошенных респондентов в населенных пунктах вокруг национальных парков указали на наличие медицинских центров (78.5%), скважин/питьевой воды (77.7%), дорог (68.6%), открытий школ (59.7%) и трудоустройства (56.2%). Наши результаты показывают, что ожидания сообществ включают объекты базовой инфраструктуры, такой как обеспечение питьевой водой (77.5%), медицинские центры (78.5%), электричество (78.1%) и дороги (68.9%). Логистический регрессионный анализ показал, что предикторами потребностей респондентов в объектах инфраструктуры были пол ($\beta = 0.068$, $p < 0.01$), возраст ($\beta = 0.032$, $p < 0.01$) и уровень образования ($\beta = 0.047$, $p < 0.05$). Был сделан вывод о том, что федеральным, региональным и местным органам власти необходимо обеспечить наличие базовой инфраструктуры в деревнях, окружающих изученные национальные парки, чтобы уменьшить давление и чрезмерную зависимость местного населения от ресурсов национальных парков. Должна быть распространена кампания по распространению грамотности и просвещению по вопросам сохранения, поскольку большинство местного населения неграмотны и проживает в горячих точках биоразнообразия.

Ключевые слова: биоразнообразие, инфраструктура, местное население, особо охраняемая природная территория, отношение, потребности