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International Journal of Real Estate Studies

INTREST

People, Wildlife and Contest for Space in Okomu National Park, Nigeria: The Experience of the Host Communities and Managerial Perspective

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Article history: Received: *2 March 2022* Received in revised form: *9 May 2022*
Accepted: *29 May 2022* Published online: *29 June 2021*

Abstract

Human-wildlife conflict (HWC) has increased globally in recent years. This is true in the case of sub-Saharan Africa, particularly, Nigeria, a country rich in biodiversity. This study examines the types, nature and causes of HWC in Nigeria using Okomu National Park (ONP) and its host communities as a case study. Data were obtained through questionnaire administration and focus group discussions (FGDs). Four rural communities within five kilometers radius of ONP were selected using a simple random approach. Using the systematic sampling technique to select households, 224 copies of a questionnaire were distributed in these host communities. Convenient sampling was utilized to identify park management who were participating in FGDs. A total of ten FGDs were held, with each session lasting twenty minutes and engaging at least five participants. Information collected were analyzed using frequency distribution, mean score and content analysis. Respondents ranked crop damage as the commonest HWC while wildlife poaching, human settlements expansions and agricultural extensions are perceived as the main reasons for HWC in the host communities. Results show that a number of the host communities' responses to HWC are not in the best interest of biodiversity conservation, safety and environmental health. The study concludes that HWC is apparent in the study area and this is likely to worsen in the near future. This study is of the opinion that effusively enforcement of wildlife poaching penalties, compensation plan, community enlightenment, sustainable land-use planning, and park management technology will do much as preventive measures to HWC in the study area.

Keywords: Conservation, human-wildlife conflict (HWC), Okomu National Park, host communities, biodiversity

1.0 INTRODUCTION

Natural park or protected areas, an essential component of urban and/or rural green infrastructure are important land-use known for their multiple ecosystem services. Natural park or protected areas make vital contributions to the planet's health and to human well-being, by protecting endangered habitats and species, storing carbon among other benefits. Among other functions, they provide environmental services, such as air and water refinement, and increase both recreational and ecotourism opportunities as well as the attractiveness of the human environment (Madden, 2004). Owing to their significance, natural parks serve as protected spaces that provide human interactions with nature and wildlife.

Human interactions with wildlife are a defining experience of human existence (Nyhus, 2016). These relations, nevertheless, often resulted in contentious behavior (König et al., 2020). As human populations increase and natural habitats shrivel, humans and wildlife are increasingly coming into competition over living space and food. According to the World Conservation Union (see IUCN, 2003), HWC is a threat, resulting directly from the competition between communities and wildlife over natural resources, entailing consequential tangible costs to both people and wildlife. HWC is said to occur when the requirements of wildlife encroach on the needs of human populations and vice-versa (Distefano, 2005). This conflict is one of the main threats to the continued survival of many wildlife species. It is also a significant threat to human livelihoods (Nyhus, 2016). Carnivorous and mega-herbivores animals are particularly susceptible to the threat of continuous existence due to HWC (Wolf & Ripple, 2017) and the loss of these species can in sequence, transform ecosystems and trigger collapses (Estes et al., 2011).

While cases of HWC date back to antediluvian eras (Gordon, 2009), its severity has increased lately (Sharma et al., 2021), affecting both developed and developing nations (Lamarque et al., 2009). The developing countries are nevertheless, more vulnerable to HWC and, particularly, HWC has become more severe in Africa where majority of the people depends on agriculture, which accelerates the conversion of wildlife habitat to agricultural fields (Fairet, 2012). Currently, HWC is ranked as one of the highest main dangers to wildlife conservation in the Africa continent (Benjamin-Fink, 2019). In the region, wildlife attacks humans, damage their property, invade farm yields, and kill farm animal. In contrast, human-beings engage in revengeful killings (Peterson et al., 2010; White & Ward, 2010).

The motives for HWC are numerous. For wildlife, it is their habitation deprivation owing to growth in the human population and activities (Benjamin-Fink, 2019). Evidence has it that more than half of the earth's land surface has been transformed by human activity (Benjamin-Fink, 2019). Land-use change has been linked to some wildlife disappearance, changes in species diversity, declines in air and water quality, increases in carbon dioxide emissions, and climate change (Sharma et al., 2021). Human infringement into protected areas is evidenced among other things, in Nigeria, Uganda, Ghana, Congo, Kenya, Tanzania, and South Africa (Benjamin-Fink, 2019). Conversely, it is largely the invasion of human's farmland by the wildlife (Choudhury, 2004; Hill, 2018) that has led to their pugnacious attitude (Acharya et al., 2017).

Alleviation of HWC is vital to biodiversity conservation, human safety, and environmental health (Sharma et al., 2021). However, this requires a thoughtful understanding of the types, nature and salient causes besides interrelated socio-ecological elements such as the past and current land management practices as well as complex social, political and economic processes. Identifying potential ways to reduce HWC should be the foremost goal of HWC's researches (Thomassen et al., 2011) and the essential for discovering operational way-outs to HWC is to understand in details, the dynamics, and nature of HWC (Thomassen et al., 2011). Besides, the opinions of the concerned stakeholders including, practitioners, policy makers, local farmers and resident communities are of great importance (Digun-Aweto et al., 2015). Thus, having a clear understanding of the host communities' perceptions of wildlife is a vital component for conservation planning and park management. Besides, promoting community inclusion for improving coexistence between humans and wildlife was suggested by Madden (2004) as an essential element for sustaining livelihoods and the protection of flora and fauna, especially, endangered species (Ghoddousi et al., 2018).

Globally, research on HWC has evolved over years. Several authors have employed different methodologies to understand HWC (e.g. Acharya et al., 2017; Adedoyin et al., 2018; Akinsorotan et al., 2021; Carter & Linnell, 2016; Digun-Aweto & Van Der Merwe, 2019; Odunlami & Osumenya, 2020; Wester et al., 2019). However, a recent study showed that about 87% of HWC studies concentrated on the Asian countries (Sharma et al., 2021). This indicates a dearth of research in Africa region and other continents. This knowledge gap may have serious implications on global biodiversity conservation. Whereas HWC are trans-boundary in nature, often have far-reaching, transboundary impacts on ecological processes and can threaten biodiversity outside protected area boundaries (Davies & White, 2012). As such, concentrating the issue in a few parks, nations or regions may limit the generalization of results and thwart efforts of government and non-government bodies to tackle HWC holistically. There is therefore the need to understand the issues from different locations' perspectives in order to form a worldwide outlook.

Using Okomu National Park (ONP) in Nigeria and its host communities as a case study, this study analyses HWC types, nature, dimensions, causes and responses from the residents' experiences and the park managerial perspective. This study is borne out of the following concerns. First, there are pieces of evidences of HWC in Nigeria, particularly in the study area (Akinsorotan et al., 2021; Digun-Aweto et al., 2015). Second, there is dearth of HWC studies in the Sub-Saharan Africa (Sharma et al., 2021). Third is the fact that Nigeria, particularly the study area accounts for consequential collections of biodiversity (CBD, n.d.) and these are being endangered by urbanization, expansion of agriculture and industrialization. Most species (e.g. African forest elephant [Loxodonta cyclotis], White throated guenon [Cercepithicus erythrogaster], Northwestern African cheetah [Acinonyx hecki], West African lion [Panthera leo] among others, which were originally common in ONP, are becoming rare. Fourth, HWC has become a major threat to the survival of many species in the park, the integrity of ONP, and the host communities' appreciation of wildlife value. It has also affected their support for conservation and resource-management measures that can drive wildlife-based economies (e.g. nature tourism and ecotourism). Fifth, HWC in ONP involves many important wildlife species (Ajayi, 2019) whose extinction could irrevocably change ecosystems, and lead to loss of ecological integrity. Sixth, HWC has an impact on yields, profits and safety (Ajayi, 2019). In the study area, HWC impacts food security, local economic growth, and opportunities for achieving sustainable development, and lastly, the concern about the scarcity of mechanisms that provide wildlife-derived benefits to, and secure livelihoods for ONP host communities.

The rest of this article contains relevant information about where the study is taking place, the research methodology, results and discussion of the findings. The paper concludes with recommendations to address HWC in the study area and future research directions.

2.0 CONTEXTUAL SETTING

The current research is carried out in Nigeria, a country that traverses diverse climatic and ecological precincts and occupies a distinctive geographical position in the Africa continent (see Figure 1). The country's diversity in natural ecosystems extends from semi-arid savanna to mountain forests, rich seasonal floodplain environments, rainforests, vast freshwater swamp forests and diverse coastal vegetation (CBD, n.d.). Nigeria's Niger Delta contains the largest tract of mangrove in Africa continent. Adaptable climatic conditions and physical features have gifted Nigeria with some of the richest wildlife and ecosystem on the continent (CBD, n.d.).

Like many other countries, there are accounts of HWC in Nigeria. In Gashaka Gumti National Park, Tantalus monkeys (Chlorocebus tantalus) aided crops while baboons attacked poultry livestock reared in Mayo Yum and Gashaka communities in June, 2009 (Eniang et al., 2011). In 2012, two people and about thirty herds were killed by a raging West African lion some communities in Gulani area of Yobe State (Odunlami & Osumenya, 2020). Besides, Nile rat (*Arvicanthis niloticus*), Mona monkey (*Cercopithecus mona*) and the Grasscutter (*Thryonomys swinderianus*) have been described to cause damage of yields in Katsina-Ala area of Benue state in 2014 (Bukie, et al., 2018). In Kainji Lake, monkeys, rodents, and birds are accountable for the raiding of crops while in the Borgu sector of the park, Olive baboon (*Papio anubis*), Patas monkey (*Erythrocebus patas*) and Green monkey (*Chlorocebus sabaeus*) were responsible for the raiding of locals' farms (Ogunjobi & Adeola, 2016). In 2018, an elephant (*Loxodonta cyclotis*) was killed by the hunters in Idanre in Ondo state. Some elephants had also repeatedly encroached into the community, destroying homes, and farmlands and causing injuries to the natives (Odunlami & Osumenya, 2020). Unfortunately, these are just a few examples of HWC that occur daily (causing death, serious bodily injury, loss of livelihood and biodiversity) at Nigerian parks where several cases go without being seen and/or unreported.

The current study is carried out in ONP. Geographically, it is located in longitude 5º 90'E and 5º23'E and latitude 6º 15'N and 6º 25'N (see Figure 1), within the Ovia South-West Local Government Area of Edo State in Nigeria. The park is a forest enclave covering 202.24km^2 of land. ONP is gifted with distinctive and uncommon biodiversity of universal significance (Ajayi, 2019). The park is one of the richest in terms of species, genetic, and ecosystem diversity in sub-Saharan region (Ajayi, 2019). The park climate is tropical with monthly average temperatures of 18°C minimum and feature hot temperatures throughout the entire year. The ONP is surrounded by rural communities (see Figure 1). However, urbanization in these villages has resulted in significant land-use change, thereby forcing human activities to move into wildlife territory (Akinsorotan et al., 2021). ONP is among the remaining high secondary forests in West Africa S\sub-region (Ajayi, 2019). ONP houses rare and endangered species like the forest elephant (Loxodonta Africana cyclotis) and the white-throated monkey (Cercopithecus erythrogaster), Nigeria-Cameroon chimpanzees among others (Akinsorotan et al., 2021).

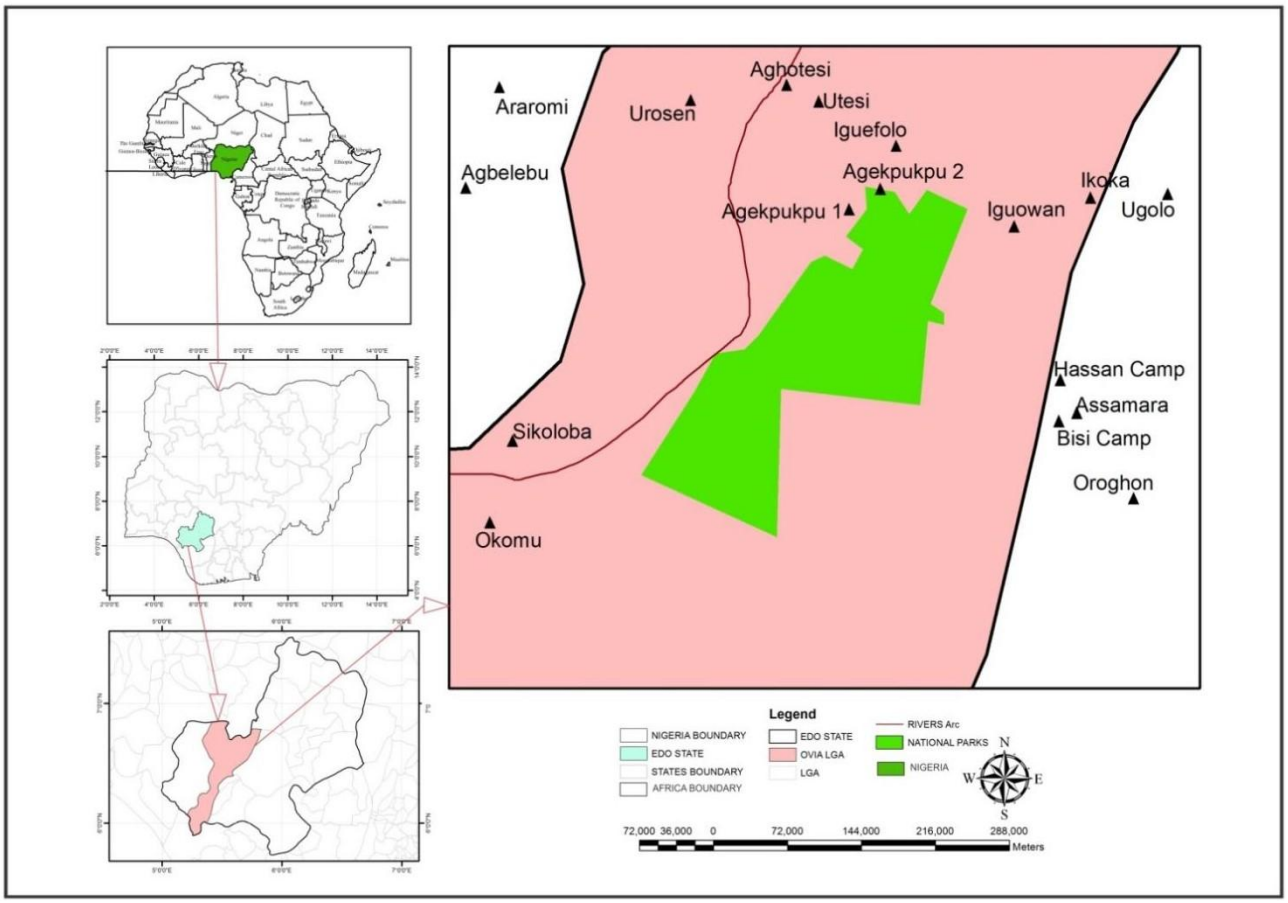

Figure 1 The ONP and its host communities in Africa and Nigeria context

The study area was selected having considered some motivations. First, it is among the currently existing secondary forests in Nigeria with a very rich, unique and distinct ecosystem and biodiversity. The ONP has been identified as being of critical importance for long-term conservation of African wildlife species (Akinsorotan et al., 2021). Second, its host communities live adjacent to the park. Globally, HWC generally take place where group of people live adjacent to protected areas (Benjamin-Fink, 2019). Third, HWC has been noted in this area (Akinsorotan et al., 2021) due to human settlements expansions and local people that are predominantly engaged in crop farming, nomadic herding, and fishing. Also, the study area supports communities of herders for whom livestock grazing of sheep, goats and cattle is their main income source. Fourth, with a few notable exceptions (Ajayi, 2019; Akinsorotan et al., 2021; Digun-Aweto et al., 2015), not much attention has been devoted to understanding host communities' experience and managerial perspectives of HWC in Nigeria, particularly in ONP. In terms of methodology, there is paucity of studies carried out so far that identify the severity, causes and consequences of HWC using both quantitative and qualitative research approaches simultaneously.

3.0 METHODOLOGY

Using the qualitative and quantitative research approach, the study used questionnaire administration and focus group discussions (FGDs) to obtain information from communities within 5km radius of ONP. The 5km range was selected because the extent and magnitude of HWC will be more severe within this distance. This assertion was confirmed by previous studies (i.e. Mackenzie, 2012; Sharma et al., 2021) that those communities closer to protected areas tend to experience the impact of HWC compared to communities outside this range.

The questionnaire captures socio-economic profile of residents in these rural communities, issues on types, nature, causes and prevalence of HWC, as well as defensive behavior and precautionary measures to HWC. Systematic sampling procedures were used to select *respondents* in the selected communities while ONP personnel and park rangers were surveyed using convenience sampling for FGDs.

3.1 Sampling Procedure

The study adopted a multi-stage sampling technique. At the first stage, four communities within 5km radius around the ONP were selected using simple random sampling. The sixteen communities identified around ONP were written in folded papers and put in a bowl. Subsequently, the four communities were selected one after the other without replacement. The selected communities are Iguowan, Iyaye, Julius Creek and Hassan Camp. These villages differ in sizes, population and geographic location. In the second stage, the number of households in each of the selected communities was determined through enumeration. There were 72, 192, 604 and 263 households respectively in Iguowan, Iyaye, AT&P/Julius Creek and Hassan Camp communities. Having explored a systematic random sampling procedure, one of every twentieth household from each of the selected community was surveyed, representing 5%. This is considered satisfactory as suggested by Oduwaye (2013) who recommended a minimum of 3% for a homogeneous population sample. Based on the sampling technique, a total of 224 copies of a questionnaire were administered. However, only 177 copies were properly completed and retrieved, representing 79% response rate. For FGDs, the park personnel and rangers were surveyed using convenience sampling. A total of ten FGDs were conducted with each group having at least three discussants.

3.2 Data Collection

Data collection was carried out in March, April and May 2021. The questionnaires were administered to household heads or their representatives in the selected communities. The interview instrument was prepared in English language. In some instances, the instrument was interpreted to locals in their native languages.

To test the instruments, a pilot study was conducted on a sample of 18 residents. The rule of thumb is to test the survey instrument on at least 12 to 50 people before full-scale administration (Tavakol & Dennick, 2011). Feedback was obtained on the length of the instrument, the format of the Likert scales, content validity, and question ambiguity. The instrument was revised and further administered to 13 residents**.** Before its application, a social psychology and conflict management expert reviewed the instrument and offered suggestions for improvement. Thereafter, adjustments were made to the overall style and content of the instrument. Only relevant and necessary questions were retained. Moreover, the number of questions was reduced to ensure the seamless flow of the questionnaire and to increase the response rate.

With a cut-off value of 0.75 (Tavakol & Dennick, 2011), the internal reliability of the data collection instrument was tested using Cronbach's alpha values. Reliability test showed the instrument was acceptable, with an alpha coefficient of 0.79 (Tavakol & Dennick, 2011). The final instrument captures the socio-economic profile of the people in these communities, issues on the types, nature, causes and prevalence of HWC, defensive behavior and the precautionary measures set up by the park executives. On the perception of HWC type, respondents were asked to express their view using one of the five-point Likert scales: *Very Severe (VS), Severe (S), Just Severe (JS), Not Severe (NS)* and *Not Experience At All (NEAA)*. Regarding causal factors, each of the factors was rated by respondents using one of the five Likert scales: *Strongly Agree (SA), Agree (A), Neutral (N), Disagree (D)* and *Strongly Disagree (SD)* while residents' perception of the frequency of the different type of HWC was rated using one of the five Likert scales: *Very Frequent* (VF), *Frequent* (F), *Normal* (N), *Not Frequent* (NF) and *Not Frequent At All (NFAA).*

3.3 Data Analysis

Statistical software (SPSS 16.0) was used to explore the data collected. Generally, descriptive statistics was used in this study. While frequency distributions were used to describe the villagers' socioeconomic characteristics, mean indices ranking, frequency distributions, bar and pie charts were used to explore HWC trend and mitigation variables. The mean indices were used to summarize the Likert scale into three different indices: Perceived Severity Index (PSI), Perceived Causal Index (PCI) and Perceived Frequency Index (PFI). The following scale measurement was used regarding mean scores, where 1 = not experience at all/strongly disagree /not frequent at all (≥1.00 and ≤1.80); 2 = not severe/disagree/not frequent (≥1.81 and ≤2.60); 3 = just severe/neutral /normal (≥2.61 and ≤3.40); 4 = severe/agree/frequent (≥3.41 and ≤4.20), and 5 = very severe /strongly agree/very frequent (≥4.21 and ≤5.00).

To arrive at the scale measurement used regarding mean scores, a weightiness rate of 5, 4, 3, 2 and 1 were attached to each of the rating above. The sum of the weightiness (SWV) value was also calculated as the totaling of the multiplication of the value attached to a rating and the respective number of respondents. This is depicted in the following equations:

$$\mathbf{SWV} = \sum_{I=1}^{5} X_i Y_i \qquad \text{---------- (i)}$$

Where: SWV = summation of weight value,

X_i = number of respondents to rating i;

Y_i = the weight assigned a value (i = 1, 2, 3, 4, 5).

The SWV was then divided by the number of respondents to arrive at each perceived index. This is expressed mathematically as:

$$\textbf{PSI/PCI \& PFI} = \frac{SWV}{\sum_{i=1}^{5} i = X_i} \quad \text{---------- (ii)}$$

In the case of focus groups, ten (10) focused group discussions (comprising at least 5 individuals per group) were carried out. Each FGD lasted about one-third of an hour. This study upholds an avoidance of harm, and confidentiality during questionnaire administration and FGDs. All respondents were acquainted as to the aim and objectives of the study, and given the opportunity to partake and withdraw their participation whenever they want. Narrative techniques of reporting were used to analysis information from FGDs.

4.0 RESULTS AND DISCUSSION

Survey findings are discussed under various subsection headings as follows. Unless where otherwise stated, the tables and charts through which data were summarized are the products of a survey carried out by the authors in March, April and May 2021.

4.1 Description of the Host Communities' Respondents

In the final sample of residents, 62% were male, 71% were between 36 and 50 years of age while 14% of the respondents were 51 years and above. Some 23% had vocational and/or technical education while only 10% had post-secondary school education. Hence, formal education level is low in the study area; a situation that could facilitate HWC (Manoa & Mwaura, 2016; Ogada et al., 2003). While 51% engaged in crop farming, some 35% were in livestock farming, grazing sheep, goats and cattle. All these professions around protected areas have been found to be favorable to HWC (Akinsorotan et al., 2021; Digun-Aweto et al., 2015; Hill, 2018; Madden, 2004). Results show that some 43% of the respondents have resided in Okomu for 20 to 30 years. Findings show a two-tiered form of residency in the study area: natives and non-natives. While 58% are native of the selected villages, others (42%) are those who are migrants and/or settlers from other villages, towns and states in the country. Moreover, the majority of the sample (78%) have suffered and/or witnessed HWC prior to the conduct of this survey in March, April and May 2021.

From these findings, it can be inferred that the house heads of communities around ONP are male-dominated young adults with less formal education; probably because of the nature of the dominant occupation (*crop production and livestock rearing*) that requires great physical energy but less formal education. Explicitly, HWC sufferers, indigenous and long-time dwellers (*who are in the best position to express views regarding HWC*) were sufficiently involved in the final sample.

4.2 Perception of HWC Types

As depicted in Table 1, results show that crop damage (*PSI* = 3.22) was the most important types of HWC while human loss of life (*PSI* = 1.20) was the least type of HWC in the study area. This is expected as majority of the residents engaged in crop farming and production. FGDs on animals' extravagances revealed that animals such as monkeys (Cercopithecidae), baboons (Papio), African elephants (*Loxodonta africana*), buffalos (Syncerus caffer), duikers (Cephalophinae) and porcupines (Erethizontidae) were frequently seen by residents' on their crop and animal farms. It was said however, that the baboons and monkeys, particularly white throated guenon (*Cercepithicus erythrogaster)* constituted major nuisance to crop damage in Okomu. Previous findings have listed monkeys among wild animals that attack crops (e.g. Eniang et al., 2011; Sharma et al., 2021). Furthermore, other types of HWC in the study area include destruction of property (*PSI* = 2.36), human threat (*PSI* = 2.25), livestock killing by wildlife (*PSI* =1.75) and human injuries (*PSI* =1.38).

Corroborating the earlier results, the majority of participants in FGDs agreed that crop damage was the most important type of HWC in the study area. However, some minorities argued that destruction of property, human threats and cases of missing livestock are just as common as crop-raiding. Precisely, a participant argued that: *"Fine! We have many instances of crop raiding by animals. Yet, problems like destruction of properties, the human threats as well as missing livestock are also as common as crop raiding and damages in this area […]*" (Male/35/ONP staff). In another view, a key informant argues that: "*what we experience here most often is crop destructions […]*" (Male/55/ONP staff).

In another opinion, an FGDs participant said: "*[…] the commonest type of human wildlife conflict is crop damages and this is because of shortage of foods for most herbivorous wildlife as they couldn't find species of plants they love eating in the park. This could also be attributed to the deforestation of the park by residents. So, a number of wildlife goes to feed on farmers' crops. Some may return while others may be captured, killed and/or injured by farmers […]"* (Male/57/Park staff). In other words, a key informant argued that: "*[…] it is not that we don't experience issues such as destruction of property, human threat, and livestock killing by wildlife, human injuries and the likes. Of a truth, we do experience these. However, these are not as common as wildlife feeding on farmers' produces […]*" (Male/44/Park staff).

It is, therefore, evident from the above discussions and residents' perceptions that crop-raiding is a major problem in the study area. As a matter of fact, these findings are not peculiar to the study area. Crop damage has been identified by many authors (e.g. Benjamin-Fink, 2019; Dunham et al., 2010; Harich et al., 2013; Hill, 2021; Sharma et al., 2021) as being the HWC type requiring the most attention and effort in and around protect areas.

Table 1 Types of HWC

Types of HWC	Rating and Weight Value							
	VS (5)	S (4)	JS (3)	NS (2)	NSA (1)	SWV	PSI (2.02)	MD
Crop damage	48	42	28	19	40	570	3.22	+1.20
Destruction of property	20	10	30	71	46	418	2.36	+0.34
Human threat	15	17	30	52	63	400	2.25	+0.23
Livestock killing by wildlife	-	-	41	52	84	311	1.75	-0.27
Human injuries	-	-	17	34	126	245	1.38	-0.64
Human life loss	-	-	-	36	141	213	1.20	-0.82

Despite the information that the park may host some meat-eating animals such as baboons (refer to the website of National Park Service of Nigeria, 2014), it is interesting to see that livestock killing by meat-eating animals and perhaps, loss of human life was not among the three most severe HWCs in the study area. This could probably imply decreased and/or extinction of carnivores or dangerous wildlife in the study area or perhaps, there is still an abundance of natural prey sources in the forest area. It has been argued that the decrease in natural prey leads to animals' search for other sources of games and preying on nearby livestock (Mekonen, 2020).

While this outcome seems good, crop yields raiding (as *shown in this study*) could be as dangerous as the killing of livestock and loss of human life. Crop raiding hurt the residents' source of revenue. The damage of crops could put the residents in a problematic financial situation such as not being able to provide for the basic needs of families. This can have many negative implications. First, it can lead to an increase in the poverty level of the communities. Second, it has the potential to cause a food security crisis. Third, it can lead to intolerance toward wildlife as a result of retaliatory attacks from farmers. Finally, it has the potential to undermine local support for conservation. Previous studies (e.g. Makindi et al., 2014; Ojo et al., 2009; Sharma et al., 2021) have found crop-raiding and killing of livestock by wild animals as factors influencing poverty, reprisal attacks and humans' negative attitudes towards biodiversity conservation.

4.3 Perception of Causes of HWC

Besides perceived severity of HWC, attempt was made to obtain from respondents' view, the causes of HWC in the study area. From the summary presented in Table 2, findings show that wildlife poaching (*PCI* = 3.76) was the major cause of HWC in the study area. From the FGDs, it was clearly evident that poaching is being done in the region for a number of bizarre motives, including the desire to eat "*bush meat*". One of the FGDs' participants said *"[…] a number of times, I have heard villagers say that wildlife meat is good for their body. They believe that the meat has medicinal value compared to livestock meats. Some kill wildlife here for ego in the community, desire for their skin and aesthetic reasons"* (Male//45/Park staff). Next to poaching, is urbanization and population expansion (PCI = 3.74). Other perceived significant causes of HWC include expanded cultivation and livestock husbandry (*PCI* = 3.62), increasing human development activities, including human settlement expansions (*PCI* = 3.35), increasing densities of livestock grazing (*PCI* = 3.28) and proximity of the communities to the forest boundary (*PCI* = 3.27). Recent studies (e.g. Carlson, 2018; Mekonen, 2020; Sharma et al., 2021) have also found these factors as the foremost root causes of HWC.

Table 2 Perceived causes of HWC

Causes	Rating and Weight Value							
	SA (5)	A (4)	Neutral (3)	D (2)	SD (1)	SWV	PCI (2.95)	MD
Wildlife poaching	56	64	27	19	11	666	3.76	+0.81
Urbanization & population expansion	67	58	14	15	23	662	3.74	+0.79
Expanded cultivation and livestock husbandry	50	55	41	16	15	640	3.62	+0.67
Increasing human development activities	50	39	38	23	27	593	3.35	+0.40
Increasing densities of livestock grazing	35	62	32	13	35	580	3.28	+0.33
Proximity of communities to forest boundary	50	33	42	19	33	579	3.27	+0.32
Habitat degradation and fragmentation	35	31	26	29	56	491	2.77	-0.18
Improper zoning of the protected area	15	49	31	44	38	490	2.77	-0.18
Disappearances of buffer zones	18	43	38	28	50	482	2.72	-0.23
Too much access to reserves	13	57	26	31	50	483	2.73	-0.22
Land use transformation	30	34	18	27	68	462	2.61	-0.34
Negative attitude towards reserve and wildlife	15	9	17	51	85	349	1.97	-0.98
Eco-tourism	7	10	8	65	87	316	1.79	-1.16

In term of increasing cultivation and densities of livestock grazing and husbandry, an FGDs participant put the situation like the following: *"[…]increasing cultivation and overgrazing contribute to ONP/forest degradation and importantly, HWC here. These happen because the local communities were mainly into farming and livestock production. At times, the local people cut grass and plants in the park to feed their livestock and construct their sheds as well. This is absolutely unlawfully!" (Male/49/Park Staff).* It might therefore be inferred that local people exploit the protected natural resources in ONP for their personal gain. This behavior, for instance, might cause plants' shortage for herbivorous animals' consumption and inconvenience the natural behavior of animals in the protected area.

The FGDs participants further stressed the causes of HWC in ONP. In his own opinion, a key informant stated thus: "*[…] the main causes of human-wildlife conflict is the multiplication of animals in numbers due to their large reproductive system, destruction of animal homes, and smaller house range for animals due to quest for land"* (Male/47/Park staff). Another key informant said: "*[…] increase in population of the host communities is the main cause of HWC in the study area. The residents are no longer comfortable and their need for expansion makes them ventures into the park for survive. Initially, when the park was established, the rural communities were small but as*

time goes on, the sizes of the communities increased and couple with the prevailing unemployment rate in the country, I think the people of Okomu felt that they had no option but to encroach on the park for farm land" (Male /56/Camp officer).

Further on the causes, one of the key informants thought: "*[…] the main cause of HWC here can be attributed to the park location. Take, for instance, other parks are located at the periphery of a state or town but ONP is in the midst of the ocean of other human activities such as Okomu oil plantation, Merchelin Rubber Factory (Sideko) and many minor but significant human activities at the centre. So what do you expect? There is bound to be conflict. In this place, we have land grabbers. We have land hunger as well. The activities of loggers are very high because of the rainforest vegetation of the park and the presence of merchantable and exploitable economic trees. People are looking for more land to farm. Besides, the system of farming here is bad; no culture of good agricultural practice, perhaps, due to their level of education. Yes, ignorance, I would say is another cause of HWC as many residents are not aware of the impact of the ecosystem; they are only interested in personal monetary gains. They are unaware of the tangible effect of trying to control erosion, balancing the ecosystem and climate change […]"* (Male/51/Assistant park conservator).

In the FGDs, it was mentioned that the main causes of HWC in the area is lack of buffer zone and according to the protected area law in Nigeria, a park must be 30m away from the buffer zone. Another participant (*Male/34/Park ranger*) argued that the damages cause by the wildlife is due to the fact that some communities share immediate boundary with the park; a situation which affords wild animals easy access to the communities, their crops, livestock and farm lands. In addition, a ranger (*Male/41*) noted weaknesses in the Nigerian Law of National Park and Unfenced Forest Land as some of the institutional foundations for HWC in the study area. The law is suffering from both substantive and execution problems. Some of key laws applied only to designate areas, and regarding the protection of some wildlife kinds, the ultimate challenge is the lack of provisions against habitat destruction from certain human activities such as oil and solid minerals quarrying. Besides, vital issues of climate change, energy, and community interest, are yet to be addressed in our law.

In similar view, an FGDs participant pointed to weaknesses in monitoring, park management and law enforcement mechanisms in ONP. He said "*[...] even law enforcement patrols that should happen on a daily basis inside the park are not done for different reasons: funding is low, motivation among rangers is very low because sometimes they are not provided adequate equipment and support, supervision is poor, almost non-existent […]*" (Male/51/Assistant park conservator). Therefore, having aggregated our discussions during FGDs, we thus inferred that human settlements expansions, agricultural extensions as well as weakness in the implementation of park law could also be major causes of HWC in the study area besides wildlife poaching. Similar causes of HWC have been reported in Tsavo Conservation Area in Kenya (Makindi et al., 2014). Besides, these factors have been documented as key reasons for increase in HWC in Namibia, Mozambique and Zambia (Ladan, 2014).

4.4 Perception of Frequency and Trend of HWC

This section presents the residents' opinion of the frequency of the different type of HWC conflict in the area. Findings show that the attacks occur majorly in the night (*PFI* = 3.49). Particularly, it was indicated that animals in ONP attack mostly at night when no one is watching. This is in line with Mekonen (2020) who found that animals usually invade farm produces in the break of dawn and eventide when villagers are absent near their crop farms. In addition, findings show that HWC occur daily but more pronounced during dry seasons.

Table 3 Prevalence of HWC

Time of Attack	Rating and Weight Value							
	VF (5)	F(4)	N (3)	NF (2)	NFA (1)	SWV	PFI (2.66)	MD
Night	63	54	9	10	41	619	3.49	+0.83
During weekdays	54	52	19	11	41	598	3.37	+0.71
During weekends	58	42	20	11	46	588	3.31	+0.65
Dry season	28	50	29	21	40	509	2.87	+0.21
Evening	10	40	33	48	46	451	2.54	-0.12
Rainy season	8	21	21	48	79	362	2.04	-0.62
Afternoon	9	18	19	55	76	360	2.03	-0.63
Morning	5	10	5	55	102	292	1.64	-1.02

This was further clarified by a participant during FGDs, "*[…] the conflict is not that unvarying. It can increase at a time and reduce at another time. Sometimes, we may not even record any occurrence. But most time, the elephants encroach because they need water during the dry season and they get it from the sucker of the plantain which is not available in the park*" (Male/49/Park ranger). Another participant put his experience as follows: "*[…] I have observed that crop-raiding peaked in the late raining season when crops would have mature*" (Male/44/Park ranger). Previous studies have also found seasonal variation in HWC incidents. For instance, Huang et al. (2018) found that HWC were unevenly distributed among seasons, villages, and communities around Daxueshan Nature Reserve, China. Also, Mukeka et al. (2019) found that HWC follows seasonal and inter-annual fluctuations, reflecting underlying rainfall variation in Narok County, Kenya.

Further findings show that HWC in ONP needs attention as majority (59%) of the respondents either indicated that HWC remained unchanged or have increased in the last 3 years. While FGDs participants were of the view that the conflict is increasing due to the increasing rate of unemployment, others argued unequivocally that the current rate of urbanization, population growth increasing demand for natural resources, and the growing pressure for access to land are responsible for the current HWC challenges. These, they said, may likely escalate in the nearest future.

4.5 Responses to HWC in the Study Area

In this section, existing preventive and defensive mechanism were measured. Besides, respondents were allowed to offer suggestions regarding how to effectively deal with HWC in the study area. Regarding the existing preventive and defensive mechanism, common measures used in preventing HWC were extracted from literature and listed for respondents to indicate as many as applicable to them (i.e. allowing multiple responses). Findings are summarized in Figure 2.

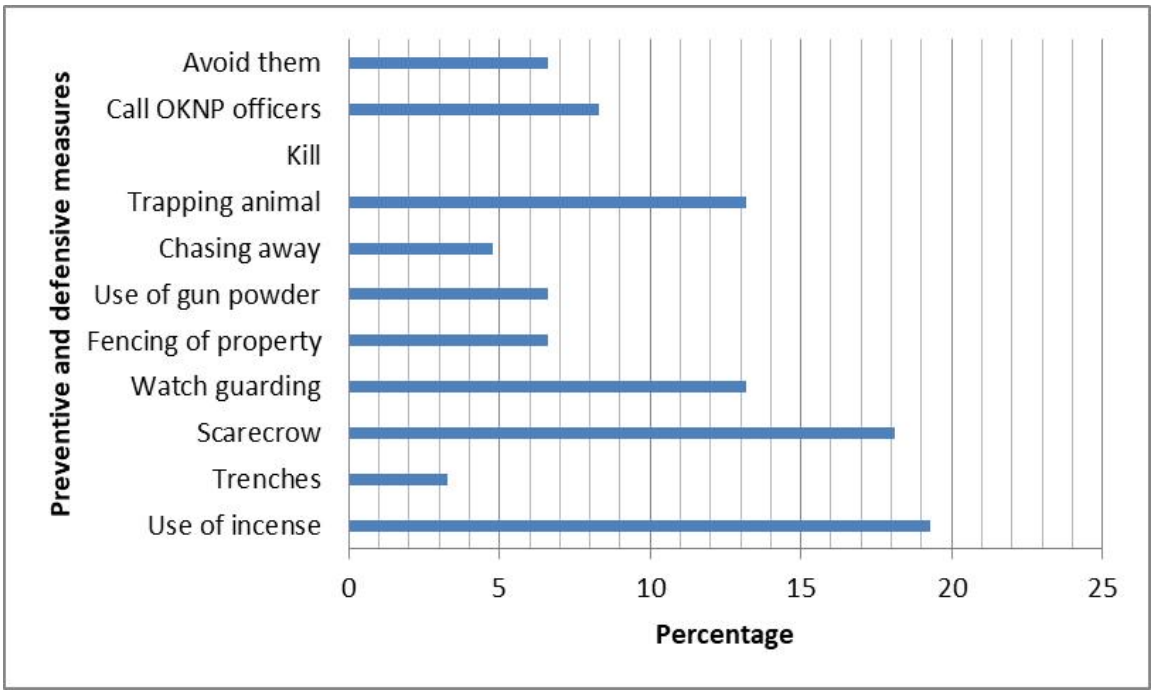

Figure 2 Distribution of preventive and defensive mechanism

Based on information from Figure 2, findings show that 19.3% of the preventive measures were the use of incense while the usage of scarecrow accounted for 18.1% of the mitigating measures. Results also depict that 13.2% of the preventive measures involve resident watch-guard and trapping of wild animals. Other measures such as calling ONP officers, fencing of properties and the use of trenches respectively, accounted for 8.3%, 6.6% and, 3.3% of the preventive and defensive measures against HWC in the study area. Similarly, watch/guarding and fencing-away of wild animals have been found (e.g. Johansson, 2009; Mukeka et al., 2019; Odunlami & Osumenya, 2020; Ojo et al., 2009) among important means of protecting crop raiders from crop lands.

Interestingly, findings from FGDs demonstrate that the host community people do kill wild animals even though none of the respondents admitted to this measure as shown in Figure 2. In a statement by one of the focus group discussants, he said: "*[…] trapping and killing of the wildlife are common method used by the community members to guard against attacks from the wildlife* (Male/35/Park ranger). During the FGDs, it was identified that fire arms, trap setting, fencing, scarecrow are major methods used by the villagers. In his statement, one of the participants said "*[…] the villages may not want to come open to you, perhaps, they are skeptical of the implication of their answers. But, it is true that community members kill protected wild animals either in form of reprisal attack or as a guard against attacks from the wildlife […]"* (Male/47/Park ranger). This finding (killing of wild animals) is not peculiar to the study area. Similar findings have been found elsewhere (e.g. Hill, 2018; König et al., 2020; Manoa & Mwaura, 2016; Mukeka et al., 2019; Ogada et al., 2003).

When asked to provide suggestions regarding mitigation measures to effectively deal with HWC in the study area (*permitting multiple responses*), compensation (38%) was indicated by the majority of the residents as the most preferred measure to deal with HWC in the study area. Other important measures provided by residents are the employment of local youth as park guards (22.2%), sensitization programs (15.8%), and alternative livelihood (12%). These views are similar to that of Loitokitok sub-county in the Amboseli region of Kenya where residents rated compensation as a tool of mitigating HWC in the region (Manoa & Mwaura, 2016).

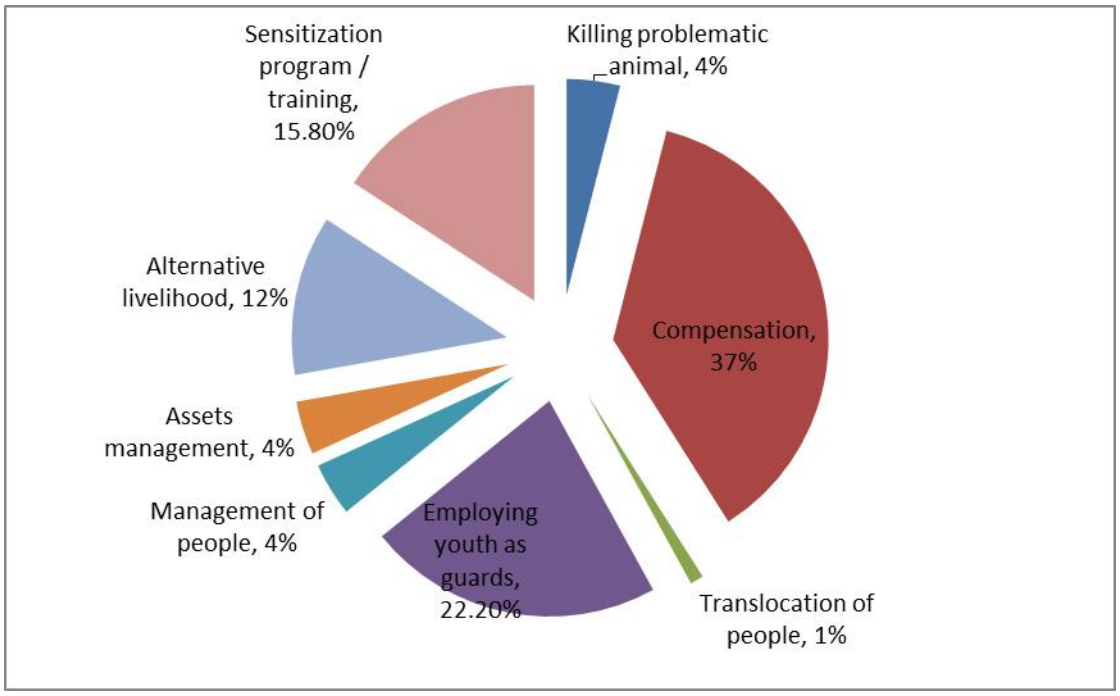

Figure 3 Perceived mitigation measures

In FGDs, more ideas on how to mitigate HWC in the area were opened up. For instance, a discussant argued that: "*the best measure to effectively deal with HWC is to enlighten the people through conservation education. The residents need to be taught the importance of forest conservation. Besides, the people need to be trained in self-employed skills that would divert their attention from the park resources. Lastly, our rangers need to be well trained and equipped as well […]"* (Female/40/Camp officer). Another discussant is of the opinion that: "*[…] measures such as the opening of more roads, installation of scare-crow in farms and the cultivation of repellant plants (such as chilli pepper, tobacco among others) should be done to effectively deal with HWC"* (Male/35/Planning research). Another key informant said: "*[…] to be able to deal effectively with HWC, the Park Law needs to be strengthened, equipment should be provided for rangers and aggressive enlightenment conservation campaign. The government needs to assist the park in terms of logistics resources and show more interest in the running of the park"* (Male/60/Assistant park conservator). He also said the community needs to show more support to the park growth.

To park rangers, it was argued that provisions of sophisticated equipment for them will do more for HWC prevention. A park ranger reinstated the testimonial of the assistant park conservator thus: "*[…] just as our conservator have said before, I will like to say again that patrols that should happen daily inside the park are not done because we are not well funded. Our motivation is very low because we are not provided adequate equipment, arms and support system. So, if the government is ready to end this conflict, they need to empower us in terms of sophisticated weapons; patrolling vehicles, riffles and first-aid kit (in cases of any attack)"* (Male/39/Park ranger). This seems to be unanimously agreed upon by all the park rangers in the FGDs.

5.0 CONCLUSION

The current study examines the types, nature and causes of HWC in ONP and its host communities in Nigeria, West Africa. Like many parks in the world, this study showed that HWC is apparent in ONP, Nigeria with crop-raiding and damage as the most common type. Among other important reasons, the major causes of this conflict are wildlife poaching, human settlement expansions and agricultural extensions. The combination of those respondents who confirmed that HWC had remained unchanged and had increased are more than those who were of the opinion that the conflict had decreased in the last three years. This study perceives that with the increasing population of the host communities and the growing pressure for access to land, this problem is likely to escalate in the nearest future. The conflict has become the foremost affliction to wildlife sustainability in the area. Besides, it impacts on the economic loss of the villagers around the park. Thus, HWC has deleterious effects on the host communities and wildlife. Results show that community responses to HWC are not in the best interest of biodiversity conservation: wild animals are being trapped and killed while the protected area itself is being encroached day by day. In fact, this has led to the reduction and perhaps, local extinction of numerous species such as African wild dogs (*Lycaon pictus*), and African elephants (Loxodonta), baboons (Papio), buffalos (Bubalus bubalis) among others. All these are serious stumbling blocks to wildlife conservationists.

This study adds to the burgeoning literature by providing the Nigerian experience of HWC using both quantitative and qualitative approaches. This research provides further input toward enhancing natural park management and biodiversity conservation in Nigeria. Based on this study's findings, the following recommendations are put forward in addressing HWC and its impacts in the study area:

1. Given the level of wild animal poaching in the study area, it is high time the criminal ruling regarding this behavior is effusively enforced. It seems that other interventions so far do not have the desired effect in this regard. Nonetheless, criminal procedure and punishment must occur in a proportionate and reasonable manner.
2. There should be a policy on compensation (in terms of money being paid and/or farmland resettlement in the victims' choice area) for wild animal-induced damages that are suitable to the local community situations. During this study, no compensation policy was planned or in place. The compensation policy will serve as insurance for HWC that may occasionally occur. Compensation schemes have been applied in areas with HWC and some of them had positive impacts (Huang et al., 2018).
3. Formal education is low in the study area. Thus, the need for the park management to embark on public education programmes in the study area. This measure has been proven effective (Manoa & Mwaura, 2016; Ogada et al., 2003). People should be educated about wildlife and the benefits of biodiversity conservation. This will foster more positive attitudes to flora and fauna management.
4. Furthermore, sustainable land use planning would be vital in controlling HWC in the study area; particularly in the area of encroachments. These techniques may well include relocating crop production and animal husbandry activities out of animals' range of routes, grouping crop fields and moving them from the park's edge nearby to farmers' dwellings, and repositioning boundaries of the park or creating buffer zones.
5. Residents have a duty to supportively protect their crops against raiders. It was said that measures such as cultivation of repellant plants (such as chili pepper, tobacco among others) should be done to effectively deal with HWC. However, search must be conducted to identify other alternative crops that can repel crop raiders in the area so that most effective one is applied. Barriers such as fences (electrically powered wires, barbed wires, concrete walls, among others), hedgerows and trenches can be used. These barriers can also serve as impediments, protecting humans from potential danger and simultaneously protect conservation areas from human impact. Because of its huge land area, fencing of the park may not be realistic. However, residents' farms and sheds can be fenced and give animals the freedom of movement. This mitigation was used by farmers at Panamentaga South of Chobe National Park and Kasane in Northern Botswana.
6. Government, private sectors, and non-governmental organizations in biodiversity conservation, nature tourism and ecotourism industries need to motivate parks rangers with the provision of state-of- the art technology and corresponding training. In recent years, advances in technology have made patrol possible and to pinpoint an animal's exact location using the steady pings from satellites. Technology has advance so much that one can now track poachers, land encroachers, animals through the use of geographic information system (GIS). This technology will allow the park rangers to track animals. They will be able to identify and monitor animals' movement, patterns, species numbers, and behaviors and prevent poaching.
7. Finally, there should be local community engagement in terms of participatory management and employment of the local youths.

Despite its significance, this study does have some inadequacies which can be explored further in future study. One of such limitations is that this report is based only on FGDs from the park management perspective. Future studies should see a balance between FGD responses from the park management, communities and perhaps, other stakeholders. Also, discretion should be applied while drawing any generalization, particularly from a somewhat non-randomized selection of the park staff. Another area to expand this research is the development of more case studies. This single case study does not allow a longitudinal and comparative analysis of HWC status. While the measurement of dwellers' experience and managerial perspective exhibit good constructs and reliability, it requires additional substantiation with other similar parks in Nigeria and elsewhere. The comparative assessment of these cases will provide a better understanding of this issue.

Also, the sample size is rather small and the techniques of analysis were basically descriptive. The impending studies may thus consider a larger sample size and new approaches to data collection by obtaining time-series records of HWC incidences, and their influencing factors in the study area. Moreover, upcoming studies should consider vigorous techniques of data analysis. For instance, the usage of minimum or maximum normalization, as well as validation of the HWC indices using factor analysis or principal component exploration. Forthcoming studies should conduct relevant diagnostics checks for more interactions between HWC factors and host communities' variables using reliable statistical techniques. Therefore, in order to improve the analytical precision of HWC studies, more rigorous analyses (e.g. OLS regression, robust regression methods, constrained linear regression, regression with censored and truncated data, regression with measurement error, and multiple equation models among others) should be applied to validate HWC theories, beyond descriptive analyses.

Acknowledgement

This research would not be able to achieve without a support and an approval from the Conservator General of Nigerian Parks. We are also grateful to the host villagers, conservator of the park, staff and rangers of ONP. Lastly, our sincere appreciation goes to members of staff and rangers who served as guides, questionnaire interpreters and research assistants.

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