

The Effect of Human Activity on the Survival of Primates in Kimbi-Fungom National Park, Northwest Region, Cameroon

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ABSTRACT

The relationship between humans, biodiversity, and ecosystem has been a subject of ecological, social and political interest in the past decades. Trends in wildlife population have followed changes associated with human interventions such as expanding urbanization, logging, agriculture, and hunting. Typically human interference on wildlife habitats and the exploitation of wildlife species has rendered wildlife vulnerable. This study was aimed at assessing the negative impact of human activities on wildlife in the kimbi-fungom national park. The research data was collected through the laying of 3-kilometer transects in different locations of the national park. Along these transects, human activity signs or presence is seen or heard were recorded. The study revealed a significant link between human activity and the seasonal changes, $\chi^2=8.182$ df=14 $P<0.05$. Also, the association between human and animal activities $\chi^2=72.290$ df=70, $P<0.05$ within the national park was a reflection of a forced relation. Furthermore, the national park was observed with a lot of anthropogenic activities, very challenging to the conservation of wildlife. Among the human activities observed in the national park, farming was the most prominent 13.16% closely followed by trapping of wildlife 11.84%. The conservation management plan of a national park prevents farming and animal killing within the national park area. But in a conservation management system which does not give a provision for alternative farming land and hunting areas for the local inhabitants the tendency for encroachment is highly expected. The unsustainable hunting of wildlife, gathering of non-timber forest resources, and the various forms of crop cultivation in kimbi-fungom national park is raising many conservation questions on the welfare of these resources. The primate ecology, especially the arboreal primate species is so dependent on trees for their survival, hence, crop cultivation and felling of trees has constituted many problems to these animals. Consequently, the primate population may face a serious decline and extirpation if not properly checked and controlled by the conservation authorities. However, this study recommends a sustainable conservation management plan as an ecological remedy.

INTRODUCTION

Humans have long established their dependence on natural resources for essential life requisites and concurrently demonstrating limited consideration for impending changes that may affect the supply of these resources. The continuous reliance of humans on natural resources has been exacerbated by a recorded increase in population growth and diverse activities of distinct human societies on the available natural resources [1]. Human influences particularly affecting ecosystem processes are causing unusual changes such as changing spatial extent, composition, and configuration of habitats and species, and are depleting species population [2]. Human linked threats on habitat and species, particularly large mammals, have motivated the inclusive and increasing consideration of humans in conservation planning. Yet, it is not fully known how the abundance and distribution of different large mammal species are related to different human activities, and how large mammal species respond to different habitats and habitat alterations caused by humans. The human society in Cameroon is diverse and has emerged from various ethnic and cultural backgrounds [3]. Three main human societies in which others are embedded in Cameroon include; hunter-gatherer, agrarian, and industrial societies. The human society, cultures, and attitude of the Cameroonian people are tightly associated with the ecosystem around them and have actually influenced the ways people relate with and use natural resources. While some tradition or local cultures promote the conservation of sacred places and species through traditional binding laws and taboos [4] some are encouraging the exploitation and use of natural resources for either traditional medicine, decoration, consumption, and commercialization [5,6] that to a larger extent has led to depletion of resources. The increasing need for natural resources for wellbeing by the Cameroonian society has triggered the modification of old technology and the introduction of new techniques for resource collection.

Socio-economically, humans depend on the natural ecosystem and biodiversity for food security, income and the array of ecosystem services it provides for their welfare [7,8]. The trends in the use and exploitation of natural resource for economic improvement are already unsustainable and costing more than it is worth. In most part of Cameroon, a large expanse of natural habitat has been converted to agricultural land not only to ensure food security but also for export [9]. Large areas of forest have also been logged mainly for export to boost the country's economy [10,11]. Wildlife and other natural resources are being hunted, harvested and traded to secure food supply and household income [12,13]. These socio-economic activities are depleting habitats and species and have led to perceptible variations and changes in some landscape pattern and species abundance.

Besides human imposed ecological processes affecting species and their habitats, human social factors such as demography, socioeconomic and attitude towards nature [14] and diversity in human societies [15,16] are also contributing to the loss of habitats and species [17,18]. On a global scale, human demographic growth has stimulated more pressure on habitat and species. Unlike humans who can cope in a wide variety of environments through cultural adaptations [19], natural resources are somewhat finite or exhaustible in nature [20] and are threatened by the growing human population [21,22] especially in developing Sub-Saharan Africa [23] and particularly in Cameroon where the key resources are becoming vulnerable, triggered by the ever-increasing human population [24,25]. With an estimated national population density of about 44 persons per square km and a birth rate of about 36.2% in 2010 [22,26], the demand for fertile land, forest and the diversity of biological resources particularly wildlife are on the rise in Cameroon. The costs of increasing dependence by the increasing Cameroonian population on the use of natural landscape and wildlife are already overwhelming and are expected to increase in the future. Therefore adequate policies or monitoring framework for habitat, wildlife, and human activities are vital and may halt extensive damages on landscapes and species communities. However, this survey was focused on investigating the negative impacts of the local inhabitants in Kimbi-fungom national park to the wildlife resources.

MATERIALS AND METHODS

Description of the Study Area

Kimbi-Fungom National Park (KFNP) is located between latitude 6.5-6.9° N and longitude 9.8-10.5° E in the Northwest Region of Cameroon and covers a total land surface area of 95,380 hectares (**Figure 1**). This national park is situated within three administrative divisions in the Northwest Region of Cameroon; Menchum, Boyo and Dongo Mantung [27]. The region experiences two seasons, a long rainy season from mid-March to mid-November, and a short dry season from mid-November to mid-March. The wettest months are July, August, and September and the driest months being January and February. The national park drainage system includes Kimbi, Katsina Al, and Kendassamen rivers. The soil types in this area include Acrisols, Andosols (black soils of volcanic landscapes), and Ferrasols [28]. The vegetation is principally lowland tropical rainforest at the Fungom low altitude area of the national park, which is progressively transformed into a savanna landscape towards its northern region. The national park also harbors many wildlife species; primates, ungulates, carnivores, a host of rodents, reptiles, and amphibians. Endangered species such as Chimpanzee (*Pan troglodytes ellioti*) and pangolin (*Smutsia gigantea*) are found in the park. Other primates include Mona monkeys (*Cercopithecus mona*), Putty-nosed monkeys (*Cercopithecus nictitans*) and baboons (*Papio anubis* and *P. cynocephalus*).

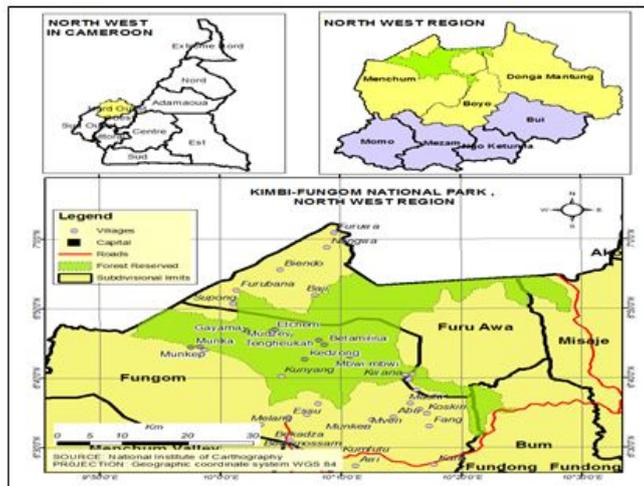


Figure 1. Kimbi Fungom National Park (KFNP) map.

Research Data Collection

After understanding the vegetation of the national park and the orientation of the topography, the park was divided into 20 research blocks. This was to avoid bias in forest fragment selection and data collection on primates since the national park is made up of different vegetation types affected by human activities. The line transects technique, as described by Buckland et al. [29], was employed. The line transect survey method has been used by several researchers on their study of mammals, especially primates in Africa due to the nature of mammalian species and rugged terrain of most study areas in the continent [30]. In each block, a 3-kilometer-transect was established in selected forest fragments taking into consideration the landscape configuration. A total of twenty 3-line transects were established in the national park with the aid of GPS. Since the park is made up of different vegetation types, we made sure that the starting points of all transects were from the forested area. Most of these forest fragments were surrounded by farm and grazing land, ranging from 2.2 hectares to 76 hectares, fragmented from 1982 to 2018. Line transects have been the main method used to survey diurnal primates [29]. About 2 hours were used to walk on each transect [31], looking ahead and sideways to detect animals, and occasionally using binoculars to determine primate group sizes. Each transect was walked by three observers, within the range of 25 m on both sides of the central line. In small forest fragments (isolated fragment from human actions and gallery forests) and dense woody savanna, we focused on concentrated searches once informed about the presence of primates. Along the transects, data was collected on both the observed or heard human activities. Human activities like farming, hunting, trapping, logging, gathering, settlement, ancient human trails, settlement, gunshots, empty bullet-shells, honey harvesting, water-fetching, and tree-felling. Data was also recorded on the primate activities, such as feeding, moving, playing, resting, calling, and grooming.

Data Analysis

The research data collected from the field was analyzed by the use of SPSS. The social activities of primates such as feeding, moving, playing, resting, calling, and grooming were tested on human activities in the national park area. The human activity was further tested with environmental parameters such as the dry and rainy seasons. This statistical test was to enable us to know the impact of human activities on the primate distribution.

RESULTS

The national park was observed with a lot of anthropogenic activity very challenging to the conservation of wildlife (Figure 2). Among the human activities observed in the national park, farming was the most prominent 13.16% closely followed by trapping 11.84%. The management plan of a national park prevents farming and animal killing within the national park area. But in a conservation management system which does not give a provision for alternative farming land and hunting areas for the local inhabitants the tendency for encroachment is highly expected. National park management in Cameroon lacks the implementation of effective management strategies in the management program. For this reason, most protected areas in the country are facing this challenge since the villages within the protected areas cannot be resettled to the peripheral zones where they can carry out their activities without destruction of the wildlife habitat. Since this particular national park is faced with a spectrum of human activities, which is already a serious threat to the survival of the habitat and its wildlife species, the need for an effective management plan or strategy is inevitable. Cameroon has an extensive network of protected areas in which there is rich animal biodiversity. These protected areas are located in multi-stakeholder and multi-functional spaces, generating conflicts between stakeholders, and also

between humans and wildlife. According to IUCN [32], Human-Wildlife Conflict (HWC) is a situation that occurs when the basic needs of wildlife interfere with those of humans, generating negative consequences for both communities and animals. Despite the presence of conservation programs in Cameroon protected areas, several anthropogenic activities including; logging, cattle grazing, the dependence of community on forest resources to satisfy social and economic needs, irrational consideration of areas within the landscape for infrastructural development [33,34] there is still no sign of refrain from the ecosystem unsustainable exploitation. Crop damage is one of the most prevalent forms of human-wildlife conflict in Cameroon and is particularly severe around protected areas.

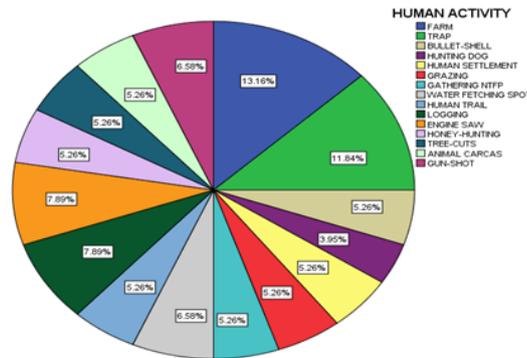


Figure 2. Human activity.

This study has shown a significant link between human activity and the seasonal changes, $\chi^2=8.182$ df=14 P<0.05 (Figure 3). Expectedly, human activities were witnessed in both seasons, the dry and wets seasons experienced the highest degree of farming activity 16.6% and 8.824% respectively. In this area, the source of livelihood for the local inhabitants is farming, hunting and gathering the forest resources that they need unstopable. A possible approach to change this style of behavior in these villages is providing what the people need and what compels them to go for the protected area resources. Income generation stands as a major social challenge to these people, hence, any preventive measures embarked upon by any government authority would rather root misery into these communities.

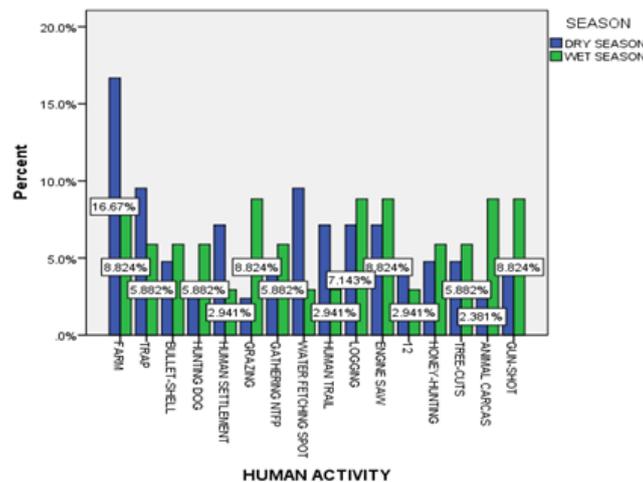


Figure 3. Human activity and season.

The association between human and animal activities $\chi^2=72.290$ df=70, P<0.05 (Figure 4) within the national park is a reflection of a forced relation. The villagers in this area, just like in any other place in Cameroon consider the national park as their own forest seized by the national government for her conservation interest without any formal agreement that would host their needs. For this reason, there is a growing conflict that can never prevent the local inhabitants from using this area for their survival. This study has observed a co-specific association between the village community and wildlife population, however, the co-existence is believed to disadvantage the wildlife population since there are already signs of their population decline.

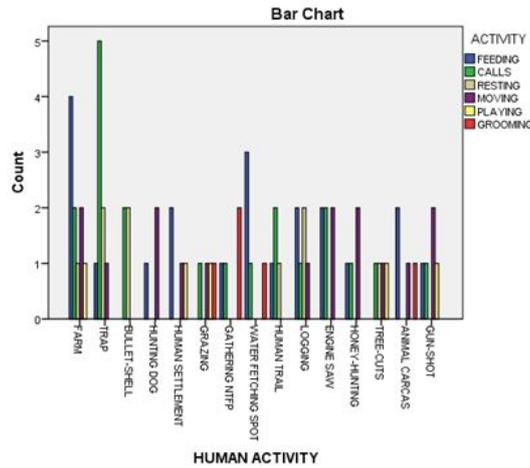


Figure 4. The human activity and the primate activity.

Data reduction using factor analysis was performed. The extraction was good for all the predictors except 1 which is ‘gun-sound’ as the Eigen Values (Table 1). This, therefore, implies that nearly all the predictors of threats have acceptable variability and can fit in further analysis. The Eigen Values indicate that none of the predictors overshadowed others in terms of distribution of the animals. This is verified by the correlation table below whereby all the indicators had moderate correlation coefficient.

Table 1. Influence of human threats on the animal population.

Component	Initial Eigen values			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	1.302	7.66	7.66	1.302	7.66	7.66
2	1.151	6.773	14.433	1.151	6.773	14.433
3	1.079	6.349	20.781	1.079	6.349	20.781
4	1.062	6.25	27.031	1.062	6.25	27.031
5	1.055	6.209	33.24	1.055	6.209	33.24
6	1.041	6.122	39.362	1.041	6.122	39.362
7	1.041	6.122	45.485	1.041	6.122	45.485
8	1.041	6.122	51.607	1.041	6.122	51.607
9	1.041	6.122	57.73	1.041	6.122	57.73
10	1.041	6.122	63.852	1.041	6.122	63.852
11	1.041	6.122	69.975	1.041	6.122	69.975
12	1.024	6.025	76	1.024	6.025	76
13	1.02	6	82	1.02	6	82
14	1.02	6	88	1.02	6	88
15	1.02	6	94	1.02	6	94
16	1.02	6	100	1.02	6	100
17	9.90E-017	5.83E-016	100			

It is clear that none of the predictors significantly influence the animal abundance but in most of the cases, the influence is not null. The human threats perceived as hindering the abundance of primates are hunting, human

settlement, grazing, a collection of non-timber forest products, human paths which characterize intense human activities, logging, trap and bees hives (Figure 5). The component plot, Principal Component Analysis (PCA) substantiates this correlation trend as almost all the indicators share the same components with animal density, thus, indicating that the components have the same level of influence on the animal. Wood engine-saw sound stands on its own and a close analysis of the correlation table shows that it has the highest correlation coefficient which is negative, thus, implying that it has the highest negative impact on animal density.

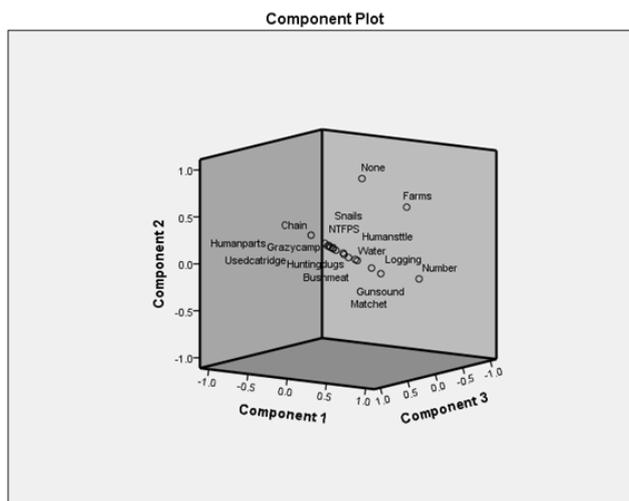


Figure 5. The component plot in Principal Component Analysis (PCA).

DISCUSSION

Forest resources are also an important source of livelihood to the human population living adjacent the park. Driven by the high cost of domestic livestock reared in this area and the lack of cheaper alternative sources of protein [35], bushmeat resources (considered to be readily available and cheap) mainly acquired through hunting and poaching, now constitute an essential source of protein and main source of income for these local inhabitants [35]. Fauna taxa mainly targeted for bushmeat and alternative source of protein are the ungulates, primates, fish, reptiles, and rodents common in the area. Hunting activity has mainly employed traditional trapping techniques but with the increasing demand for bushmeat (aggravated by the influx of population into the park area), modern techniques requiring the use of wire snares, modified den guns and rifles are now being used for hunting especially when primates are also targeted [34].

The relationship between humans, biodiversity, and ecosystem has been a subject of ecological, social and political interest in the past decades [36-38]. Many studies have presented humans as a threat factor and human activities as detrimental to both species and ecosystems [39,40]. Humans have favorably settled in areas of high biodiversity over the area with low biodiversity [41]. Owing to their cultural adaptations, humans have colonized nearly all ecosystems on earth [14] exploiting and using natural resources from them to improve their wellbeing [42,43]. In the course of improving wellbeing, humans have reversibly or irreversibly altered habitats forms and species concentrations. Studies have indicated that human activities may reduce habitat patch size [44], create new habitats [45] and increase fragmentation [44,46], which are all detrimental to species especially a specialist that may not quickly adapt to the human-imposed changes.

However human alteration may have little effect on plants that may persist or recolonize within a short time [47] and on generalist species of animals that have the ability to roam over large areas and may survive under various habitat conditions. This, however, depends on the scale and intensity of human action. Cameroon is well-known for its rich biodiversity and encompasses unique and diverse flora, fauna and ecosystems [48,49]. This rich biodiversity is, unfortunately, experiencing pressures from national socio-economic development actions and mainly from the country's ever increasing and the dynamic human population that has continued to penetrate natural and remote ecosystems to satisfy social and economic needs, thereby threatening biodiversity. Forest degradation, habitat fragmentation, habitat loss and overexploitation of wildlife through hunting are some of the consequences [48]. One of the government's approaches to curb underlying and proximate national environmental stresses on biodiversity has been through the delimitation and implementation of in-situ protection strategies in protected areas [50].

In Cameroon, natural landscapes are dominated by diverse land-use and land-cover that constitute heterogeneous habitats for flora and fauna communities. Landscapes on the country are experiencing alterations from extensive logging, agriculture and other human manipulations [51,52] that has actually changed the physiognomy of once vast landscape and are responsible for declines and changes in species composition. In the northern part of Cameroon for instance, vast

lands within and outside protected areas are often exposed to wild and sometimes controlled fires that have left the savanna landscape in this part of the country fragmented [53]. Inherent to these problems, management of ecosystem supporting large wildlife population in Cameroon is often challenged by insufficient underlining knowledge on human societies, their activities and the effects of their activities on habitat and biodiversity that may allow projections and direct policies.

The type of activities humans carry out on the natural environment are directly linked with the type of human society they belong to, and the type of environment they live in [54]. The evolution of human societies and the increasing demand for resources has encouraged modification of technologies for the use of natural resources. The evolution of the level of technology applied in exploiting species and habitat and the attitude of humans towards nature prompted the classification of humans into different types of conventional societies including; hunting and gathering, horticultural, pastoral, fishing, agrarian and industrial society [15,16,54]. The selection and use of habitat by individual animal species in a heterogeneous landscape are influenced by several interacting factors including the provision of adequate habitat requirements such as shelter, cover, nesting site, and foraging grounds [55], and the special social systems, and dispersal patterns of animals [36]. Altering landscapes and habitats, therefore, may influence the persistence of species in a given habitat and may affect the supply of basic requirements for species the lack of which may lead to species decline, isolation or extirpation [36,56].

CONCLUSION

Trends in wildlife population have followed changes associated with human interventions such as expanding urbanization, land conversion to agriculture, and hunting of wildlife species. In the sub-Saharan African region, wildlife exploitation has been an important source of protein and income for rural communities who have few alternatives to constitute an integral part of livelihood. Though historically wildlife meat extraction has been sustainable, the current human population has in many areas surpassed the carrying capacity of forests. As a result, this important food and financial resource of poor communities are rapidly declining, putting at risk the future of a large section of the least privileged sections of the population. The dramatic pressure imposed on the populations of many targeted species, as well as the anticipated socio-economic effects that a collapse of wildlife populations could have, has led many conservation and wildlife managers to talk of a bush-meat crisis. Unfortunately, this crisis has led to the abusive exploitation of these animals from their habitats. The unsustainable hunting of wildlife, gathering of non-timber forest resources, and the various forms of crop cultivation in kimbi-fungom national park is raising many conservation questions on the welfare of these resources. The primate ecology especially the arboreal primate species is so dependent on trees for their survival, hence, crop cultivation and felling of the trees has constituted many problems to these animals. Consequently, the primate population may face a serious decline and extirpation if not properly checked and controlled by the conservation authorities. However, this study recommends a sustainable conservation management plan as an ecological remedy.

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