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Human Wildlife Conflict: Causes, Consequences and Management Strategies in Mount Cameroon National Park South West Region, Cameroon

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Abstract— *Human Wildlife Conflict is as old as agriculture in the world and in Africa in particular. The main objective was to contribute to the sustainable management of MCNP via mapping out the extent and occurrence of human wildlife conflict. Questionnaire, semi-structured interviews, and a focus group discussion guide were used to determine local people's perceptions and to identify animals causing human wildlife conflict in the four sample villages. The second method used was the line transects method (tracts for instance; footpaths or motor able roads) where bio-indicators of these species causing conflicts were recorded and on foot. The universal pacing method was used to estimate the area damaged and quantity lost. GIS technique was used to map out the spatial distribution of the conflict zones. Results revealed that elephants represented an individual percentage of 14.93 in terms of animal most involved in human wildlife conflict specifically crop raiding. The intensity of damage was higher cumulatively in rodents more than elephants and other species with occurrence from January to December with peaks being August and March. Farms closer to the protected area recorded more damage in monetary value. Cocoyam's, cocoa, maize and plantain/banana were the most affected in terms of economic loss. Bomana village experienced 30% of cocoa loss. Cocoa and banana had a strong correlation coefficient of r= 0.8 in term of quantity damaged and distance of the conflict area from the four villages (Bomana, kotto1, kuke- kumbu and Ebie). Concerning the local perception of animals involve in HWC, most respondents (98.2%) recognized elephant as dangerous. The spatial distribution of the conflict areas revealed a high concentration of conflict in Bomana and kotto1 owing to the closeness (less than 3km) of the village to the protected area. Thus, creating community awareness of the importance of wildlife and the collaborative participation of all stakeholders in management will reduce encroachment into the park and minimize human wildlife conflict around the peripheries.*

Keywords— Crops Raided, Crops Raiders, Human Wildlife Conflict, Perception, Protected Area, Sustainable Management.

I. INTRODUCTION

Findings in the 21st century show that, humans have greatly dominated the landscape, with every ecosystem on the earth being influenced by human activities (Vitosuek et al. 1997). About 40-50% of the earth's surface , has been transformed by humans with 10-15% allocated for different land use types such as agriculture, irrigation or urban development while an additional 6-8% has undergone conversion to pasture (Olson et al. 1998; Vitosuek et al. 1997). This human disturbance has greatly affected the Earth's habitable land.

The human disturbance index indicates that almost three-quarters of the Earth's habitable land surface have been disturbed by humans (Hannah et al. 1994; Hannah et al. 1995). Much of this anthropogenic impact is due to the world's burgeoning human population, which currently stands at 7 billion and which the UN predicts to reach 8.9 billion by 2050 (UN, 2004). The resultant human transformation of the global environment, as described above, has been so striking that it has been defined by some as a new geological epoch, termed the 'anthropocene' (Sanderson et al. 2002; Steffen and Tyson 2001). Human wildlife conflict is of major importance in the world and Africa in particular.

Human wildlife conflict is a term which is most often used by conservationists and is defined as; 'When the needs and behavior of wildlife impact negatively on the goals of humans or when the goals of humans negatively impact the needs of wildlife' (WPC, 2003). According to IUCN (2005) human wildlife conflict (HWC) is a situation that occurs when the basic needs of wildlife

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interfere with those of humans, generating negative consequences for both communities and wildlife. This definition is similar to that of Parker et al, (2007). Conflict emerges when wildlife and human requirements overlap with consequential costs to humans and the wildlife (Osei-Owusu & Bakker, 2008).

Human wildlife conflict occurs in a vast range of situations. It is also specific in terms of habitat, geographical location, vegetation and climate with a diverse population of species. According to Thirgood (2005) there are 5types of HWC namely; Crop raiding, predation upon games species, predation upon livestock, human attacks and disease transmission. Notwithstanding, other authors include; human injuries and house/property damages as types of Human wildlife conflict.

With the spread of settlements, changing land use and natural habitats, much of the world's remaining biodiversity have become increasingly restricted to small, fragmented patches within a matrix of human-dominated landscapes (Laurance and Bierregaard 1997; McCloskey and Spalding 1989; Primack 1993).

Human-wildlife conflict is as old as agriculture in the world. Several reports have been documented on human-wildlife conflicts in the world. The conflict has consequences both on the economy, environment, society and culture. Several wildlife species are responsible for causing substantial damages both to crop and livestock production. For this reason, some of these species are often referred to as pests. The monetary losses incurred from the different types of damages can be high or low depending on the type and intensity of damage.

This research will be important for a number of reasons. First, wildlife damage represents a tangible threat to livelihoods in terms of personal injury, crop and livestock losses, property damage, and loss of opportunity costs (Happold, 1995; Emerton, 2001; Choudhury, 2004; Hill, 2004; Graham et al., 2005; Linnell et al., 2010). Second, attitudes towards PAs are often influenced by real or perceived damage caused by wildlife (Els, 1995; de Boer & Baquete, 1998; Hill, 2004; Anthony, 2007). Third, active persecution by humans following wild predator attacks on livestock has been identified as an important component in observed carnivore declines (Mishra, 1997; Woodroffe, 2001; Hazzah et al., 2009). Finally, HWC are potentially socially corrosive, creating and reflecting larger conflicts of value and class and other interests (McGregor, 2005).

Significant studies have been carried out in the South, Far-north, East and North Regions of Cameroon on HWC. It is also known that the most common type of human-wildlife conflict is crop-raiding by wild animals, especially large mammals (Tchamba, 1995).

However, despite several studies carried out in the South, East, Far-North, North and Adamaoua Regions of Cameroon, human wildlife conflict has not yet been effectively analyzed in most key protected areas in the South West Region of Cameroon. Moreover, mapping out the extent, and occurrence is not documented in most PAs in the South West Region. Thus this study will be focused on Human Wildlife Conflict particularly crop raiding in MCNP.

The South West Region harbors a significant biodiversity ranging from forest elephants, chimpanzees, antelopes etc. Thus, identifying and mapping out the various HWC hot spots will aid in reviewing the HWC management strategy at the Regional level in particular and national level at large. The current increasing population and expansion of arable land indicate that, significant measures must be put in place in order to prevent, mitigate and control conflicts arising between humans and wildlife in this key protected area.

1.1. Problem statement

Human wildlife conflict is not a new or recent phenomenon in the field of wildlife conservation and in Africa in particular. Conserving biodiversity and improving livelihood in riparian communities around protected areas aids in reconciling development and conservation of the rich biodiversity of the region.

Agriculture that is the back bone of the country's economy makes up about 80-90% of Cameroon's economy. The recent growth and employment strategy paper of the country clearly outline the various criterion and indicators for agriculture to be more productive in the country (Cameroon's Growth and Employment strategy paper, 2035). However, little or no emphasis is laid on the importance of biodiversity conservation and the role played by the riparian communities.

Many hurdles are still encountered in most peripheral communities around the PA where anthropogenic activities are practiced. Thus, the ineffective management of PAs and biodiversity conservation in this region emanates from; encroachment, illegal timber exploitation, poaching, unsustainable harvesting of NTFPs, expansion of enclaves, insufficient funds, lack of management plans/ inadequate legal status of PA, inadequate demarcation of boundaries, over grazing, bush fires, conflicting land uses, insufficient PA personnel, absence of cross-border coordination and cooperation for biodiversity conservation, allocation of mining concession within PA and human-wildlife conflict. This study shall be focused on the problem of HWC particularly crop raiding.

Most studies, carried in the country on human wildlife conflict are limited to the North and South Regions of Cameroon (Bauer et al. 2001; Van Bommel et al. 2007;

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Bauer et al. 2010; Tumenta, 2012) With regards to human-wildlife conflict in particular; **a**nimals are a major threat around the villages closed to PA. In April 2013, it was reported a man was killed by an elephant in his farm closed to the KNP (MINFOF, 2013). This justifies the investigation of the extent of HWC in this region.

In general, when animals raid crops or threaten human life in local villages, the communities feel that their economy and existence are undermined, especially since there is no policy on compensation in the country. The animals that are involved in crop damage, livestock attacks and human injuries include; elephants, lions, buffaloes, monkeys and many others. Thus, addressing the issue of Human wildlife conflict (crop raiding) around the peripheries of protected areas will aid in improving the livelihood of communities around the area while conserving the rich fauna and flora biodiversity of the PA.

1.2. Research question

1.2.1. Overall question

What is the extent of Human-wildlife conflict in Mount Cameroon National Park, South West Region?

1.2.2. Secondary Questions:

- Which animals are involved in Human wildlife conflict in mount Cameroon national park of the South west region of Cameroon?
- What type of damage and quantities damaged do these animals cause in this protected area?
- What is the spatial distribution of HWC and what periods do these conflicts occur.
- What is the cost of most common techniques practiced for mitigating and preventing this conflict?
- What management strategies can be propose to minimize this conflict?

1.3. Overall objective:

Contribute to the sustainable management of Mount Cameroon national park in the South West Region of Cameroon, via mapping out the extent and occurrence of human wildlife conflicts.

1.3.1 Specific objectives

- Identify wildlife species involve in HWC in the peripheral communities of the PA
- Evaluate the cost of HWC incurred through crop raiding
- Establish a map showing the spatial distribution of HWC-prone areas
- Determine the cost of most commonly practiced techniques to minimize HWC in the PA
- Propose management strategies for mitigating the conflict in MCNP

II. MATERIALS AND METHODS

2.1. Description of Study area:

2.1.1. Location:

According to Geospatial-Intelligence Agency, a member of the Intelligence community of the United States of America, and a Department of Defense (DoD) Combat Support Agency, the South West Region is located at Latitude **:** 5° 25' 00" N and Longitude **:** 9° 20' 00" E. The Region is made up of six(6) divisions ; Fako, Koupé-Manengouba, Lebialem, Manyu, Meme, and Ndian. The study was carried out in one of the key protected areas in the South West Region of Cameroon namely; Mt.Cameroon national park,**(fig .1).**

Mount Cameroon National Park is located in the SWR of Cameroon in the Fako Division and within four subdivisions; Buea, Muyuka, Mbonge and Idenau **(Fig. 1**). It lies on the coast, in the Gulf of Guinea, 3°57'-4°27' N and 8°58'-9°24'E. It is a huge volcanic mass with its long axis (about 45 km long and 30 km wide) running SW to NE. The main peak is at 4°7'N, 9°10'E and an active volcano which covers a surface area of 58.154 ha (Kobe & Wilson, 2003).

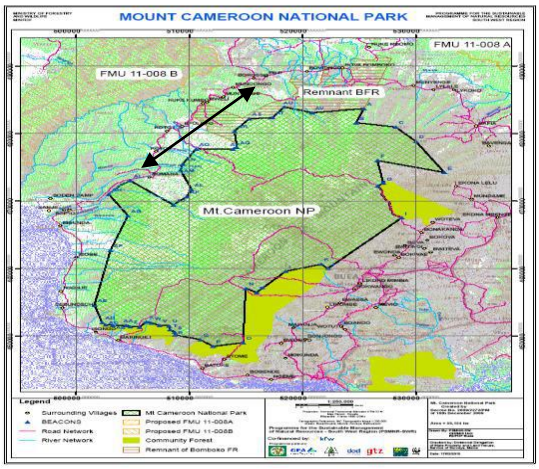

Fig.1: Location of mount Cameroon national park and the study areas

2.1.3. Biophysical characteristics

2.1.3.1. Climate

The climatic conditions of the study areas are characterized by two seasons: one dry season from November to mid-March and one wet season from mid-March to October with the wettest months being July and September. Sometimes, insignificant rains occur in the month of March, April and May and vary depending on the year. Variation between wet and dry season rainfall is greatest at the coastal sites particularly in mount Cameroon (Frasser et al., 1998), On MCNP at lower altitude annual rainfall ranges from over 10,000 mm at Cape Debundscha to less than 2,000 mm in the north-east of the massif around Munyenge Metombe (Embretch et'al 1987).The Mean annual rainfall decreases with altitude to approximately 4,000 mm at

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1,000m and to less than 3,000 mm above 2,000m (Payton,1993)

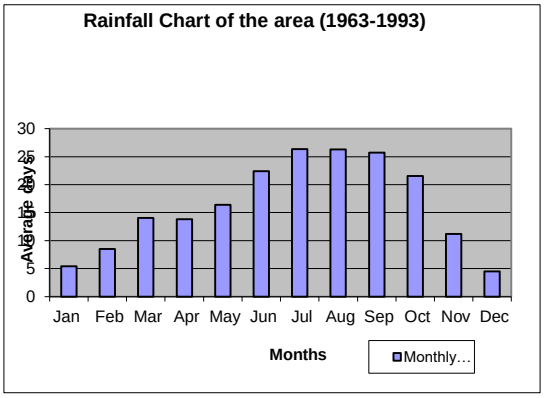

Fig.2: Rain chart of the area (source: CDC)

2.1.3.2. Relief and Topography

The PA is strongly dissected and rugged upland areas, characterized by long, steep, irregular slopes, plateau, lowlands and deeply incised seasonal streams, springs, rivers and crater lakes. The terrains are characterized by piles of granite boulders and horsts, basaltic rocks etc. MCNP extends up to 4100m from sea level.

2.1.3.3. Geology and Soil

With respect to the geology of the study area, the soils are rich in basalt and andesite in other parts it is mostly older tertiary lava or composed of a mean texture of sandy clay dominated by sand. Data assessing the suitability of the soils of the region for the cultivation of oil palm identified older sedimentary soils as well as volcanic soils as the main soil types in this area with the north-east flanks of the mountain comprising of metamorphic volcanic formations. The soils are fertile with high levels of nutrients and organic matter.

2.1.3.4. Hydrology

In MCNP, Watercourses from the PA drains into the ocean and other rivers around the mountain. It is drained principally by River idenau and its multiple tributaries.

2.1.3.5. Vegetation

The vegetation type varies slightly across the region. This change favors the endemic status of some flag species in the region. In West Africa, Mount Cameroon is unique for having a relatively unbroken sequence of natural vegetation from lowland evergreen forest almost at sea level to sub-alpine prairies near its summit (Acworth et al., 1996). Mount Cameroon is known for its exceptional plant diversity and high number of endemic species. Evidence of this richness is that over 2,300 species of plants in more than 800 genera and 210 families, 49 strictly endemic (only occurring on Mount Cameroon) and 50 near endemic plant species (also occurring in Bamenda Highlands, Oku, Kupe, Korup, Obudu Plateau and Bioko) are found in the area. Cheek *et al*. (1996) argued that almost all of the plant families endemic to Tropical Africa: Huaceae, Medusandraceae, Lepidobotryaceae, Octocknemataceae and Hoplestigmataceae are found on Mount Cameroon and the surrounding foothills.

At least 42 plant species and three genera are strictly endemic and another 50 species are near-endemic to Mount Cameroon (Cable and Cheek 1998, Cheek *et al.* 1994, WWF and IUCN 1994). The exceptional plant species diversity of Mount Cameroon is a result of the wide range of physical and climatic factors such as volcanism, altitude, geology and rainfall (Tchouto, 1995). The vegetation belts on the mountain have been classified based on altitudinal variations.

2.1.3.6. Fauna

The protected area, is rich in fauna, although the mammal fauna of the parks are fairly well documented. Also, other groups such as insects (excluding butterflies) and mollusks remain virtually unknown.

a) **Mammals**

The mammalian fauna is peculiar in this protected area of the south west region. MCNP harbors wide variety mammals with key mammals such as; chimpanzee, Press' Guenon and the last isolated threatened population of forest elephants (*Loxodonta Africana)* in the region with an estimated population of 178 individuals (Ekobo, 2003).

2.1.4.0. Socio-economic characteristics

2.1.4.1. Human Population

The MCNP constitute a total number of 58 peripheral villages with an estimated population of 72,000 inhabitants. There exist different ethnic groups in this key protected area. The indigenes of this PA are; Bomboko's, Balandos, Bawerians and Bakolle's. The population is also made up of ethnic groups from the west and northwest regions of Cameroon such as the Bamilike and Mohghamo's.

2.1.4.2. Local Institutions

The social organization of the villages in the protected area is made of a chief, regent chief (traditional) and other community-based structures. Chiefs are generally educated and not always found in the village. They are assisted by the regent chief who is permanently in the village. The regent chief handles all the aspects of the culture. Important decisions are usually taken in consultation with the traditional council and regent chief. Traditional societies constitute a major aspect of the culture and tradition of the Bomboko and Bakweri people. Most young males, in the traditional set-up, are usually initiated into the "Malle" (elephant dance society), while the females are initiated into Malova, Liengu. There is a very strong solidarity and communication system between members of the traditional societies. Annual and periodic group come-together are organised, where members meet to celebrate. The traditional societies play an important

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role in law reinforcement and maintenance of peace and order in the villages. Such societies could play a vital role in re-enforcing park management rules. The common language in this PA is Pidgin and English. Community based institutions for the management of natural resources also exists such as village Forest Management Committee (VFMC) and other village development associations.

2.1.4.3. Agriculture

Subsistence farming and agro industrial farming, forms the basis of the farming system in this PA. Both food crops (cassava, plantains, bananas, cocoyams) and cash crops (cocoa, coffee and oil palm) are produced. Agriculture is presently the most important economic activity carried out in the area, employing about 95% of the population, while timber exploitation, hunting and petty trading are also practised by some inhabitants. Farm sizes range between 0.25 ha to more than 10 ha. Cocoa farms in the Mt Cameroon area generate more significant benefits for conservation and local livelihood than commercial plantations, roughly 50 tree species are commonly retained or planted in cocoa farms (Sarah *et al*, 2007)

Non-indigenous farmers own the largest farms and account for most of the agricultural production of the area. Market for farm produce is readily available by middlemen, who buy at farm gates. In general, farming is done using family labour and outside labour (part time contractors). Cocoa *Theobroma cacao* , Coffee *Coffea robusta*, Cocoyam's, Cassava *etc* and, as well as fruit trees, both planted and wild are continuously harvested.

2.2. Methods of data collection

2.2.0 .Research design

The research carried out was both qualitative (direct observation, focus group discussion and pictorial analysis) and quantitative (Semi- structured questionnaires) as well as GIS methods in nature with the application of descriptive methods. Cross sectional data collection was used to isolate important variables.

2.2.1. Target population

The findings were made on 20households per 4villages in the key protected areas. Focus group discussions were held in each of the villages (Bomana, kotto2, kuke-kumbu and Ebie). The Heads and chairpersons of the various focus groups were equally consulted and included in the study.

2.2.1.2. Sampling frame

The main objective of this study was to Map the extent of HWC, its magnitude and its occurrence in Mount Cameroon National Park in the South West Region of Cameroon. The respondents of the study were farmers, administrators etc. The administrators selected were at Regional, Divisional, and Sub-Divisional and local village council chairpersons of the selected villages. Selection of the respondents was randomly conducted.

2.2.1.4. Sampling sites

Studying area

Pre-selection: A reconnaissance survey was carried out in the PA in other to identify villages with anthropogenic practices towards the PAs. Selections of the communities were oriented towards communities with known HWC based on information from residents and NGOs in the area. Within each of the selected communities, the area towards the PA with the highest concentration of food crop gardens and/or cocoa plantations were pre-selected. At least 3 approximate line transects were established from each village through farmlands/ gardens/plantations towards the PA to observe crop tenure, land tenure, farm practices, crop damages and livestock depredation.

2.2.1.5. Sample size

Multistage random sampling was done to determine the sample size of respondents affected (not a normal distribution). The sampling size was 100 households from five villages with distribution of 20households per five villages namely; Bomana, Kotto(I), Kotto(2), Kuke-kumbu and Ebie as they were found to be adjacent to the Protected area**.** But the community of kotto(1) did not accepted the investigation of the researcher therefore rounding the number of villages down to 4villages that is; Bomana, kotto2, Kuke-kumbu and Ebie.

2.3.0. Data collection technique

2.3.1. Collection techniques

This study was carried out in the Mount Cameroon National Park in the South West Region of Cameroon during a 6month duration period August 26- March 26. To realize the objectives as mentioned above, secondary data, primary data, and results analysis were carried out.

2.3.1.1. Secondary data

Secondary data was collected from the libraries of DEPFOR of the University of Dschang, Mount Cameroon National park, GIZ archives, WWF archives, Regional delegation of MINFOF, MINADER and MINADT. The use of search engines such as Google scholar was used to search related concepts and literature reviews.

2.3.1.2. Primary data:

100 open and close ended questionnaires were distributed to 4 villages (Bomana, kotto1, kuke-kumbu and Ebie) chosen from 12peripheral villages base on previous complains and reports submitted to the authorities of the MCNP by the cluster village president of village forest management committee's(VFMC). All questions were administered in English because of the anglo-Saxon nature of the Region and the targeted population in particular. Interview guide survey was done with the conservator of the PA, Regional Delegates of (MINFOF,

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MINEPDED, MINADER, MINADT and MINPADT) and NGO's (WWF, GIZ and WCS) because they are directly or indirectly involved with the conservation of Mount Cameroon National Park. This survey was guided by the following questions (see appendix 1). At the community levels, the interviews we conducted with the aid of a participatory relax appraisal method during focus group discussion gatherings with the assistance of the village head and VFMC. This information collected was mainly primary data needed for further analysis.

2.3.1.2. Observation/direct assessment:

Direct observations were made in the four (4) peripheral communities (villages) around the PA. With the aid of a field guide given by the VFMC, at least three major farm tracts (foot paths or motorable paths) were selected in each village and used for damage assessment. Conflicts (crop damage) were assessed and geographical coordinates were recorded with the aid of a GPS of mark Garmin 76csx. Tracks (transect lines) of length between 2-5km were placed at intervals of 200m from the village to the PA and snap shots of the presence of animal indices were taken with the use of a Samsung digital camera..

With the aid of a pacing method, damage lost was estimated onsite. The surface area of the specific type of conflict (crop raiding) was determined. The zones of conflict were geo-referenced with a GPS of mark Garmin 76csx..The costs price of the different produce damaged were estimated via a market survey prices in the communities (villages).

2.4.0. Data analysis

After sorting and coding of the questionnaires from the 4 villages, the primary data collected from the villages, were analyzed using statistical package for social science (SPSS) Ver.17 and Microsoft excel. The dependent variables identified were; incidence of HWC expressed as the amount of crop destroyed or spatial surface area. The independent variables included the different types of wildlife species involve in crop raiding, month and season of conflict, location of conflict etc. For crop raiding, the sizes of the farms were measure with the aid of the pacing method and the area damaged(x) was divided by the total area of the farm (z) in other to determine the portion damaged. Base on the cropping system, the quantity yield from the estimated damage area was multiplied by the cost price of the produce to obtain the overall quantity lost as a result of HWC in that season. The spatial distribution of HWC was determined from the coordinates obtained with a GPS and analyzed using Arc view 10.0. The analyzed data were summarized or presented in, figures and tables to ease understanding and interpretation.

III. RESULTS AND DISCUSSION

3.1. Animals most involve in HWC in Mount Cameroon National Park

In response to the first specific objective to identify animals most involve in HWC fig 4.3. shows that, elephants had the highest individual percentage in terms of animals listed by the respondents as involve in HWC. Elephants represented (14.93%) in terms of respondent percentages. Followed by Rodents, Primates and artiodactyla. Rodents had an overall percentage of 48.79 with squirrel and cane rat being the most listed (13.33% and 13.33% respectively) and porcupine (12%) and rat mole (10.13%) being the least. Primates and artiodactyla were the orders with species listed by the respondents being the least with overall percentage of 19.22% for primates and percentage of 6.93 for artiodactyla.

Within primates, chimps were highest with (10.4%) and monkeys (8.82%) while in artiodactyla, bush pig had the least percentage of respondents (3.75%). The results falls in line with that of (Ngueping, 2011) where elephants had the highest individual percentage in terms of animals involve in HWC in MCNP. Moreover, the research shows that damage' resulting from the animals is as a result of cropping types and crops cultivated. This results falls in line with that of Nchanji and Plumbre, (2003). According to this research, most farmers are said to be in the range between 500 m - 1.5km next to the reserve hence animals move from forest to farms easily. And with encroachment on their habitats, animals become notorious to planted crops.

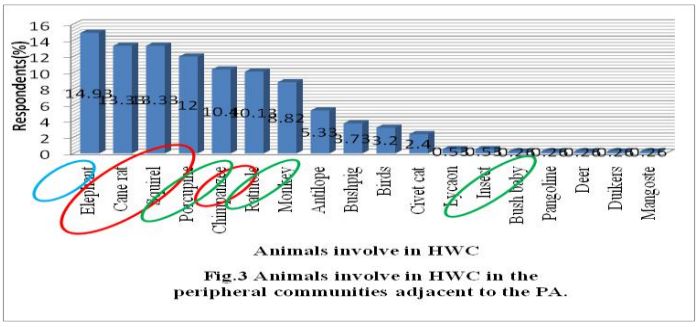

Fig.3 Animals involve in HWC in the peripheral communities adjacent to the PA.

3.1.1. Months and distribution of occurrence of conflicts

From the table below, the distribution of conflict is constant in some species all round the year but varies in distribution for elephants and chimpanzees. Elephants, chimpanzees and bushpigs are the main destructive animals interms in the villages (Bomana, Kotto2, Kuke Kumbu and Ebie). The month of July, August and September were the peak months of damages with elephants, chimps and bushpig having the respective damage percentages of 10.81%, 10.36% and 11.36%. The month November to January, had the least percentages of damages.

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The month of July to August had the heighest percentages of damages because it is the period of maturity/harvesting of most cash crops (Coaco) and foodcrops(banana, cocoyams, beans, maize, cassava etc) in the area. The month of November to Janauary had the least because within that period very little is cultivated and most cashcrops like coaco have been commpletely harvested. It was also noted from the analysis that during the month of May, insect damages were the heighest in terms of percentage (80.39%). The damage was mostly affecting coaco leafs and pods and eventually the entire plant.

	Distribution of damage per month MCNP										
Animals	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov
Elephant	6.62	6.84	7.5	7.72	10.59	10.59	10.81	10.31	10.31	8.16	5.29
Chimpanzee	7.31	7.01	7.01	7.01	10.36	10.36	10.36	10.36	10.36	8.84	5.48
Monkey	8.75	8.75	8.75	8.75	8.75	8.75	8.75	8.75	8.75	7.06	7.06
Drill	16.66	16.66	16.66	16.66	0	0	0	0	0	0	16.66
Squirel	8.57	8.57	8.57	8.57	9.1	9.1	9.1	9.1	9.1	6.96	6.6
Porcupine	8.43	8.43	8.43	8.43	9.25	9.25	9.25	9.25	9.25	7.2	6.37
Civet cat	7.61	7.61	7.61	7.61	9.52	9.52	9.52	9.52	9.52	8.57	6.66
Cane rat	8.52	8.52	8.52	8.52	9.09	9.09	9.09	9.09	9.09	7.19	6.62
Duikers	7.89	7.89	7.89	7.89	8.77	8.77	8.77	8.77	8.77	8.77	7.89
Bushpig	6.06	6.06	6.81	8.33	11.36	11.36	11.36	11.36	11.36	6.06	5.3
Birds	9.33	9.33	9.33	9.33	7.33	7.33	7.33	7.33	7.33	7.33	9.33
Ratmole	8.27	8.27	8.27	8.27	9	9	9	9	9	7.78	7.05

3.1.2.Local pereception of animals involve in HWC.

Local perception of animals involve in HWC, is an important aspect in representing the perception of the respondents with regard to the animals. This is premodial for the conservation of wildlife in this area. From **the results** it show that, most of the animals listed by the respondents as involve in HWC were percieved as dangerous. Elephants, Chimpanzees, monkeys,bushpigs, lycaons and rodents were the animals frequently listed as dangerous. Elephant had the heighest individual percentgae of 98.21, followed by chimpanzees (69.23%), monkeys(67.14%), lycaons and bush pig (59.25%) respectively. Moreover, other respondents, perceived some animals as animals used for traditional liabations which falls inline with studies carried out wherein, relationship between elephant's and traditional/indigenous people of Korup National Park, the Mount Cameroon National Park and the Banyang-Mbo Wildlife Sanctuary is complex (Powell, 1998; Stephenson, 2004) . In these conservation sites in Cameroon, there is a living believe that the elephants in these vicinities are transformed humans (totems). This believe further holds that once in a while some groups of villagers do transform from humans to elephants, bush pig etc to carry out vengeful acts in neighboring villages to equitable retribution for some misdeed or unpaid debt (Stephenson, 2004; Powell, 1998 and Tchamba 1995). The order rodentia was perceived as normal in most villages although a smaller portion was considered as dangerous. With regard to the results obtained from the focus group discussion gathering in the villages, the local perceptions were represented as ; Dangerous (Famine due to the destruction of crops; Reduction of income of farmers, Predation of livestock, Injuries and death due to snake bites and others); normal (proximity of the conflict zone to the PA, Level of hygiene, surrounding vegetation, cropping type); ritual(i.e. libation for poor harvests, initiation of youths in "Malle" society, sign of misfortune and deaths); economy (i.e. reduction of farmers income, absence of compensation from government authorities) and meat (i.e. source of income, source of protein etc)

3.2.Socio-economic lost of agricultural preduce resulting from HWC:

3.2.1.Quantification of crops loss:

From table.4.3, it reveals from the villages sampled, cocao, banana/plantain and cocoyams were the three crops most destroyed by wildlife in the area with greater economic loss. Loss of crops especially cocao, banana/plantain, cocoyams and other fruit crops were greater in kotto(II) and Bomana and lesser in kuke - kumbu and Ebie. In kuke- kumbu and Ebie, banana/plantain, cocoa and cocoyams were the most destroyed crops with cocao ranging from 27.02% in kuke to 31.37% in Ebie. Banana/plantian damaged ranged from 21.56% in Ebie to 27.02% in kuke kumbu. In Bomana, cocao destroyed was ranked 1st with a percentage of 30.5% closely followed by banana/plantain (23.72%) and (18.64%) for cocoyams. This could be explained by the fact that, most of the farmlands in Bomana and kotto2 were located close to the PA. In Ebie and kuke- kumbu, the farmlands were further from the PA and most of the crop damage were from rodents, artiodactyla and elephants. Elephants raid was a result of the search for drinking water during the dry season and the presence of fruit crops during both seasons. The table equally shows the sizes of the farms raided, the estimated mean quantity lost and the cost incurred from the lost quantities of produce. In Bomana village, the mean area damaged ranged from 0.4ha to 1ha, in kotto it ranged from 0.4ha to 0.6ha, in Kuke-kumbu from 0.5ha to 1.5ha and finally in Ebie the area damaged ranged from 0.4 to 1.5ha. thus, the overall area damaged in the 4 villages was within the surface area of 0.4ha $\geq$ 1.5ha. The reason for such area damaged was because some crops were preferably damaged by elephants, artiodactyla and rodents at different stages of the plant growth. The area damaged and the monetary value lost was different depending on the type of crop damaged and the cost price of the produce.

In bomana village, banana was ranked first (1st) with a respondent percentage of 25.9% and overall quantity loss of 602bunches and monetary value loss of 903,000 cfa.

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In kotto, maize with a damaged area of 0.6ha and quantity loss of 2,700Kg was ranked 1ST (First) with an economic loss of 756,000 cfa. In kuke- kumbu, maize was ranked first interms of economic loss with a monetray value of 959,000cfa and finally in Ebie, cocoyam was ranked first in terms of economic lost with an overall monetary value of 448,560 cfa. Thus, the quantity loss in terms of monetary value is higher in Bomana and kotto2 than the other villages because of the closeness of the farms damaged to the PA.

Table.1: Quantity of crop loss in Bomana

Crops	N	Mean area damaged (ha)	Mean quantity loss		Ranking of quantity loss	Cost (CFA)	Ranking of cost loss
			Kg	Bunches			
Maize	4	0.5	2000		1	560,000	2
Cassava	7	0.4	579		4	104,220	5
Banana	14	1		602	3	903,000	1
Cocoyam	11	0.6	1367		2	328,080	3
Cocoa	18	1	255		5	229,500	4

Table.2. Illustrating quantity of crop loss in kotto

Crops	N	Mean area damaged (ha)	Mean quantity loss		Ranking of quantity loss	Cost (CFA)	Ranking of cost loss
			Kg	Bunches			
Maize	6	0.6	2,700		1	756,000	1
Cassava	4	0.4	538		3	96,840	5
Banana	15	0.5		188	5	282,000	3
Cocoyam	11	0.5	1,306		2	313,440	2
Cocoa	14	0.5	235		4	211,500	4

Table.3. Illustrating quantity of crop loss in kuke-kumbu

Crops	N	Mean area damaged (ha)	Mean quantity loss		Ranking of quantity loss	Cost (CFA)	Ranking of cost loss
			Kg	Bunches			
Maize	4	1.5	3,425		1	959,000	1
Cassava	3	0.5	216		5	38,880	5
Banana	10	0.6		242	4	363,000	2
Cocoyam	10	0.5	1,245		2	298,800	3
Cocoa	10	0.5	272		3	244,800	4

Table.4. Illustrating quantity of crop loss in Ebie

Crops	N	Mean area damaged (ha)	Mean quantity loss		Ranking of quantity loss	Cost (CFA)	Ranking of cost loss
			Kg	Bunches			
Maize	3	0.4	315		5	88,200	4
Cassava	4	0.4	1250		2	225,000	3
Banana	11	0.8		267	4	400,500	5
Cocoyam	17	1	1869		1	448,560	1
Cocoa	16	1.5	357		3	321,300	2

The above results Fall in line with Barnes e tal (2003) and Nchanji et'al. (1998) findings as crops particularly attracted by large mammals and rodents in Protected areas.

3.2.2. Interrelationship between quantity damaged and distance covered from village.

In response to specific objective two, a correlation analysis was carried out to test the effect between quantity of crop damaged and distance covered from village to the PA. From the analysis, the coefficient of determination R^2 was larger in some crops per respective distances covered in the villages sampled and smaller in others. Cocoa had the strongest R^2 (71.1%) and r = 0.84(fig.4.). maize (fig.5.), banana (fig.6.) and cocoyam's (fig.7.) correlation coefficients were all negative with r = -0.22, r = -0.22 and r = -0.8 respectively. Thus, there was a strong correlation between the quantity of cocoa damaged and distance covered from the village to the park for cocoa and banana absolute "r"=0.8. This result is valid for large mammals (elephants, chimps, monkeys and swine's) whose damages were as a result of the proximity of the arable lands closest to the PA. In the order rodentia damages were irrespective of the distances covered from village to PA.

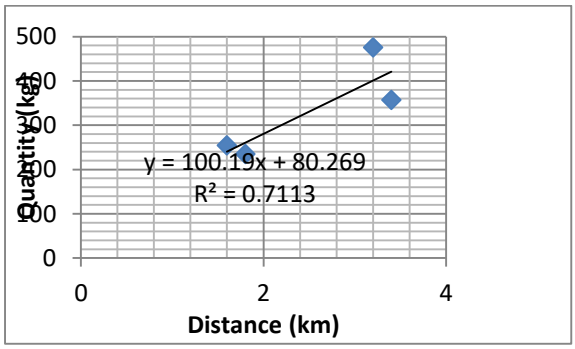

Fig.4: curve estimation of quantity damaged and distance covered for cocoa in four villages

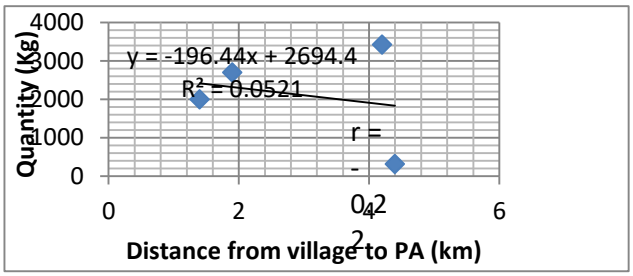

Fig.5: curve estimation of quantity damaged and distance covered for maize in four villages

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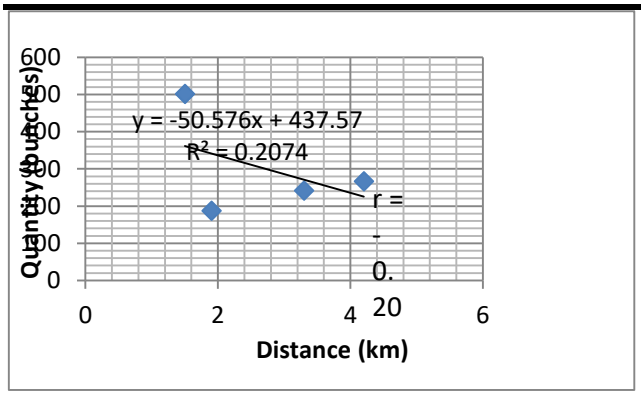

Fig.6: curve estimation of quantity damaged and distance covered for banana in four villages

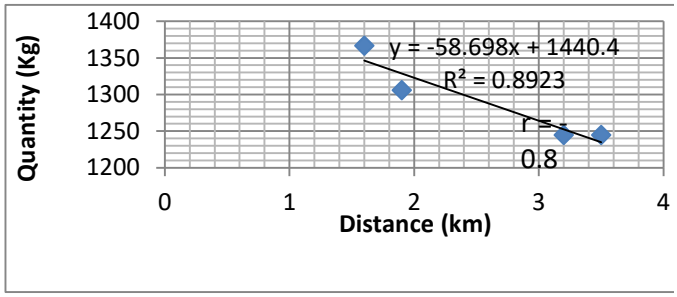

Fig.7: curve estimation of quantity damaged and distance covered for cocoyams in four villages

3.3. Establishing a map showing the spatial distribution of conflict prone zones

In response to specific objective three which is to map out the distribution of conflict prone zones, the location of the prone zones were analyze for the four villages and with the aid of field visits. Wild animal's tracts emerging from forests close to the Park boundaries enabled one to observe that, elephants, swine, chimps and other animals were using forest as a hiding place to damage neighboring farms and source of drinking water (Chong et al., 2005).

Base on the respondents, 99.6% of the conflicts where located on farms and no other conflicts were recorded around households. Cocoa had the highest percentage of 29 slightly followed by banana (26.1%) and cocoyam's (25.5%). The least was beans with overall percentage of 1.7%. Similarly, study at Banyang-Mbo, alongside a previous crop raiding study by Nchanji and Lawson (1998) showed that elephant damage and chimps were concentrated on particular fields and villages due to their location and surrounding vegetation.. Damages from rodents were irrespective of the vegetation type or hygienic conditions in the villages. Bomana and kotto2 had the highest number of conflict farms located closer to the park due to their geographical location and the demarcation of the boundary lines. Because of the rapid increasing population in Ebie village, most farmlands tend to be cultivated closer to the PA thus encouraging wildlife conflict. The mapping analysis of the conflict zones showed that most farmlands with recorded conflicts were closer to the park and to a greater extent to the park boundaries. In kuke kumbu and Ebie communities, most conflict zones were located in already proposed FMU-005B of the PA.

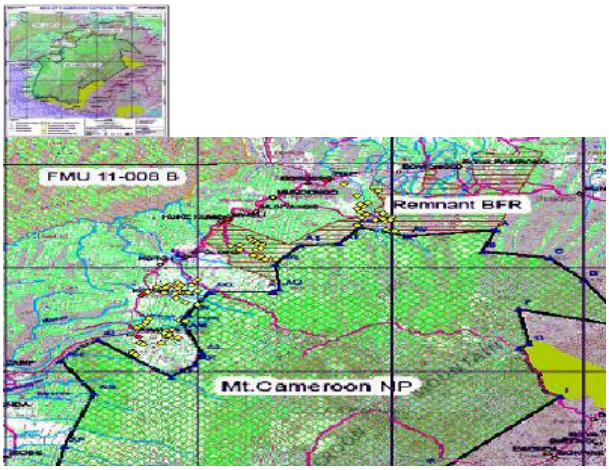

Fig.8. .Illustrating the spatial distribution of conflicts zones in villages
(Geo-referenced Map adapted from GIZ)

3.3.1. Seasons of conflict occurrence:

Mount Cameroon national park is noted with frequent rain falls which makes it very difficult to clearly determine rainy and dry seasons. Table 5 shows that, in general, most conflict occurred in both seasons though rainy season had the highest intensity of damage with rodentia especially squirrel having the height overall respondent percentage of 92, closely followed by antelopes with 90%. Rodents had the highest individual percentage because of their rapid reproduction rate and the fact that they are opportunistic feeders. Elephants and primates were found in both seasons because of the presence of crops especially in the harvesting or maturity periods of the crops growth cycle. The scarcity of water up the mountain (virgin forest and savannah) during dry seasons is another factor which triggers elephants and some primates such as chimps and drills to move down slope in search for drinking water (Chong et al., 2005). Because of the rich fertile volcanic soil and the presence of rainfall, continues farming activities is encouraged in these communities with crops such as banana, cocoa, cocoyam's, cassava and others cultivated. These cropping activities tend to favor the wildlife whose range of migration is not limited.

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Table.5: Seasons of conflict

	Seasons		
Species	Dry	Rainy	Both
Elephant	7.1	30.4	62.5
Chimpanzee	5.1	35.9	59
Monkey	3.2	6.5	90.3
Drill	100	0	0
Squirrel	0	8	92
Porcupine	0	13	87
Civet cat	8.3	33.3	58.3
Cane rat	2	10	88
Bushpig	7.1	14.3	78.6
Birds	20	13.3	66.7
Rat mole		10.8	89.2
Insect	50	0	50
Antelope		10	90
Deer	0	100	0

3.4. Cost-effectiveness of most commonly practiced techniques to minimize HWC in the PA.

3.4.1. Identification of prevention and mitigation strategies

Prevention and mitigation are of prime importance in HWC since it permits the communities concern to carry out anthropogenic practices while conserving wildlife. In the 4 villages adjacent to the PA, most of the strategies listed by the affected respondents were mitigating techniques. Fifteen (15) mitigating techniques are functional in the villages. Table 3.4.1 shows that, out of the 15 strategies listed, noise making was the most listed (14.4%), followed by libations (rituals) (13.7%) and the use of pepper repellants and clearing (12.6% and 12.6% respectively). 80% of the affected respondents in the four villages attributed the frequent damage irrespective of the mitigating strategies to inter-village conflicts and ethnic groups conflicts. In these conservation sites in Cameroon, there is a living believe that the elephants, bush pigs and Chimpanzees in these vicinities are transformed humans (totems). This belief further holds that once in a while some groups of villagers do transform from humans to elephants to carry out vengeful acts in neighboring villages to equitable retribution for some misdeed or unpaid debt (Stephenson, 2004; Powell, 1998 and Tchamba 1995). Though the strategies were identified, the effectiveness of the strategies was analyzed base on the respondent's quantity of loss. Moreover, the effectiveness of some of the strategies was not general but specific per animals involve in HWC in the four villages table 3.4.1.

Table.6. common techniques practiced in the villages for HWC minimization

Mitigation techniques	N	N(%)
Scarecrows	22	7.7
construction of huts	32	11.2
Trapping	10	3.5
Harmful hedges	2	0.7
Abandon farmlands	7	2.4
Poisoning	4	1.4
Community mobilization	5	1.7
Rituals	39	13.7
smoking/fires	5	1.7
Clearing	36	12.6
Chase objects	31	10.9
Pepper repellants	36	12.6
Riffles	2	0.7
Effective presence	12	4.2

3.4.2. Evaluation of the cost of most common techniques of mitigation in the villages

The effectiveness of a strategy depends on the cost incurred in establishing the technique and the time factor involved. With an average income of 50,000±200,000 CFA, most individuals involved tend to incur a lot of losses in establishing different methods of reducing the impact resulting from Wildlife while increasing the income. In table 7a, it shows that, a lot of time is spent in putting in place the below mentioned strategies operational. The abandonment of farmlands had the highest time spent approximately 2yrs with an estimated cost of 1211538CFA.

Judging from table 7b, it shows that, a lot of money is put in place by the affected individuals which greatly affect their livelihood thus, reducing their revenue from agricultural produce.

Table.7a. Time spend in establishing mitigation techniques in the four villages

Strategies	N	Min. time (hours,yr)	Max.time (hours,yr)	Mean. time(hours,yr)	Std. deviation
Scarecrows	30	1	168	17.33	42.87
Homestead constructions	37	24	8064	717.8	1922.56
Trapping	9	1	48	6.44	15.58
Abandon farmlands	13	1year	5years	1.84year	1.14
Poisoning	2	1	1	1	0.00
Pepper repellants	29	672	4032	2039.1	457.28
Clearing	19	672	1344	1008	

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Table.7.b. Cost incurred in minimizing HWC in the four villages

Strategies	N	Min. cost (CFAF)	Max. cost (CFAF)	Mean. cost(CFAF)	Std. deviation
Scarecrows	30	1,000	180,000	21,716.7	35191.4
Homestead constructions	37	5,000	700,000	140,783.1	200933.8
Trapping	9	5,000	30,000	16,444.4	9988.8
Abandon farmlands	13	750,000	230,000	1,211,538.4	544729.9
Poisoning	2	200,000	400,000	300,000	141421.3
Pepper repellants	29	5,000	150,000	35,862	25180.38
Clearing	19	20,000	120,000	88,421	

The effectiveness of the techniques practiced in the villages was subjective. Most techniques were not effective for the entire wildlife causing HWC in these villages. From table 8, techniques that were effective, were not entirely effective for large mammals such as elephants, chimpanzees and bush pigs. The hygienic condition of most farms favored the effectives of the strategy especially for rodents but not for large mammals. Pepper repellants were not effective this resulted to the "human animals" (totems) with ability to identify pepper repellants and the fact that antelopes eat up leafs of the pepper repellants cultivated in most areas of conflicts. Techniques that was most effective in the areas though had little percentages of respondents answered, had no exception in terms of wildlife involve. For instance, smoking or the use of fires, abandonment of conflict area as strategies was overall effective in all of the villages though had the least percentage of respondents effectiveness (2.4% and 1.7% respectively)

Moreover, Nchanji (1998) reported that crop raiding is a serious problem as crop raiding animals can have a devastating impact on the standard of living of peasants whose entire survival is dependent on subsistence agriculture. He estimated that in situations where farmers guarded their crops, the loss incurred was 30% and where there was no guarding at all, it was 98%.

In a similar study, Chambers, (1992), noted that in some cases, there was severe food shortages, high food prices, malnutrition and morbidity increased besides the rural agricultural society becoming poorer and poorer, with the majority of children not going to school. In situations where farmers guarded their crops, the children were most often forced to abscond from school so as to guard the crops.

Table.8. Effectiveness of common techniques practiced by respondents

Mitigation techniques	Effectiveness	N	N (%)	Ranking	Wildlife exceptions
Scarecrows	Not effective	22	7.7		
Construction of huts	Not effective	32	11.2		
Trapping	Effective	10	3.5	3	Elephants, chimps,
Harmful hedges	Not effective	2	0.7		
Abandon farmlands	Effective	7	2.4	4	
Poisoning	Effective	4	1.4	5	
Community mobilization	Not effective	5	1.7		
Rituals/libations	Not effective	39	13.7		
smoking/fires	Effective	5	1.7	6	
Clearing	Effective	36	12.6	1	Elephants, chimps,
Chase objects	Effective	31	10.9	2	Elephants, chimps and bush pigs,
Pepper repellants	Effective	36	12.6	1	Rodents,
Riffles	Effective	2	0.7	7	Rodents
Effective presence of Humans	Not effective	12	4.2		Rodents

3.5. Propose management strategies to minimize the conflict.

Table.9a.Communities response to what measures should be use to reduce crop raiding

Suggestion	Frequency	Percentages
Compensate for agricultural damages via alternative income generating activities.	68	14.84
Buffer zones should be re-demarcated	36	7.8
Administrative killing of Elephant should be done by forest rangers	70	15.28
Authorization to kill other large mammals should be executed by VFMC	10	2.18
Authorization to trap rodents with high reproductive rate	50	10.91
Trans-location of large mammals	56	12.22
crops preferred by wildlife should be planted in the park	21	4.58
Limits of the PA should be fenced with barb wires.	72	15.72
Farmers should be supplied with chemicals to help clean their farms	45	9.82
Foresters should determine and monitor the carrying capacity of invading large mammals.	10	2.18
Non-indigenes should purchase land titles from village heads(chiefs)	20	4.36

From table.9a. above, 12key measures were suggested and highly recommended by the riparian villages in order to curb the intensity of crop raiding in the four villages. Fencing of the PA (15.72%) represented the most suggested measure to curb the intensity of crop raiding in the communities followed by administrative killing (15.28%) and compensation for agricultural losses (14.48%). Monitoring the carrying capacity of invading

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mammals (2.18%) was the least measure suggested and recommended by the communities.

Table.10b Administrator's responses to what measures should be use to reduce crop raiding

Suggestion	Frequency	Percentages
Intensive sensitization on HWC	6	14.28
Buffer zones should be clearly defined	3	7.14
community should be educated on what to do when in contact with wildlife	6	14.28
Forestry and wildlife Law sho uld lay more emphasis on HWC.	4	9.52
Promote community patrolling	3	7.14
Bee farming should be promoted at the limits of PA against invading mammals.	1	2.38
Prevent indigenes from acquiring lands at the limit of the PA	6	14.28
Produce crops which are not prone to attacks.	6	14.28
Budgeting for collaborative wildlife control programs.	5	11.9
Authorization permit of the administrative killing of invading mammals should be decentralized.	2	4.76

Base on the table above, administrators suggested measures to reduce the intensity of crop raiding in the riparian communities. Intensive sensitization(14.28%), alter cropping type (14.28%), discourage acquisition of land titles at PA limits (14.28%) were the measures mostly suggested to curb the intensity of crop raiding. Budgeting for collaborative wildlife control program (11.9%) was the second measure highly recommended by administrators. Base on collaborative and participative discussion meetings in the villages with their respective VFMCs and Focus group discussions meetings, the following strategies were collectively proposed by the communities involve in crop raiding as further measures to be implemented to mitigating crop raiding intensity.

However, human-wildlife conflict can be managed through a variety of approaches. Prevention strategies endeavor the villages affected to avoid the conflict occurring in the first place and take action to address root causes. Protection strategies are implemented when the conflict is certain to happen or has already occurred. Mitigation strategies attempt to reduce the level of impact and lessen the problem. The main difference between the options is the moment at which the measure is implemented. By definition management techniques are only cost-effective if the cost of implementing the technique is less than the value of the damage, taking into account the fact that a short period of active management may have a continued effect, by instating longer-term protection of crops. Human-wildlife conflict can be reduced, and in some cases totally prevented, by implementing changes to the resource or production that causes the conflict. This can be achieved by altering the resource itself, or the way it is managed or making changes to the surrounding landscape so that the problem-causing animal is more vulnerable, easier to spot by people and dogs, and generally less at ease in the area (Muruthi, 2005). The following strategies will aid in managing crop raiding conflicts in the

3.5.1. Lethal control strategies

3.5.1.1. Administrative killings of animals causing problems

With lethal control or administrative killing, it is obviously desirable to focus on those individuals actually causing the problem, or at least to target the group of animals whose home range includes the site where the problem is occurring. In reality, it is often difficult for wildlife managers to obtain permission to shoot an animal quickly since the decision comes solely from the minister who is not in the field, thus making killing the culprit virtually impossible as in the case of MCNP. Any individual is then killed to satisfy the demand for action and revenge by the aggrieved community, especially in the case of crop raiding in the PA. In the adjacent villages (Bomana, kotto1, Ebie and kuke-kumbu) administrative killing was authorized in 2010 in the villages but non was executed. The community's complaints of lack of specialize licensed wildlife hunters in the villages. Thus, administrative killings must be carried out by MINFOF officials not indigenes.

3.5.2. Non- lethal strategies

3.5.2.1 Alternative water sources for wildlife species (big mammals)

Large mammals which cause HWC in mount Cameroon national park usually trek for longer distances in search for drinking water points during the dry season. This is due to the mountainous nature of the park which drains water downstream during this period. As a result of water shortages, elephants, and chimpanzee's etc move down to the neighboring streams in search for water thus causing agricultural damages. Thus, the creation of a water reservoir was proposed by the sampled adjacent villages in the PA from preventing the wildlife from moving downstream during periods of droughts hence reducing resulting damages in the villages. This may in turn boost tourism potential for the community (Muruthi, 2005). Thus, water management can be a good means of reducing wildlife populations when increasing numbers generate human-wildlife conflict and causes agricultural damages.

3.5.2.2. Review the demarcation of buffer zones:

Zoning of PA is an important aspect in wildlife conservation and mitigation of HWC. It aids in attributing particular sections at the periphery of the national park for

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particular objectives. Conflict zones in Bomana, kotto2 and to a greater extent kuke-kumbu, are closest to the PA. Thus, in the above villages, most of the farmlands are located ≤100m from the PA boundary lines and the village's ≤ 3km from the village to the respective boundary lines. Buffer zones in the above communities should be re-addressed for the better management of HWC in the area. Unpalatable crops should be cultivated and bee farming established at the boundary lines of the National park with respect to the adjacent villages. This will prevent the animals from trespassing into individuals farmlands. Zoning distance from the park to the nearest anthropogenic activities should be 2km which is not the case of the above mentioned communities. It is therefore a preventive approach designed to alleviate human-wildlife conflict by creating landscapes in which people and wildlife can co-exist and have as little negative impact on each other as possible (Muruthi, 2005)..

3.5.2.3. Olfactory deterrents

Some chemical compounds deter elephants effectively either by generating an unpleasant or painful smell or by simulating a targeted compound such as a hormone that triggers fear can be use in the areas. Capsaicin resin extracted from chilli peppers (Capsicum sp.), which causes an extremely unpleasant irritation and burning, is the most effective and widespread. Repellents based on this resin have been used to alter behavior in a variety of species, including bears, ungulates, dogs, and humans (Bullard, 1985). Capsicum deterrent is employed under different forms. Gingers plants will equally aid as olfactory deterrents around the conflict zones. Chilli-impregnated twine and burning balls of elephant dung containing chilies registered some success in Zimbabwe (Osborn and Parker, 2002, Parker and Osborn, 2006. Thus, the implementation of chilies can be effective in the mount Cameroon national park especially in farmlands closer to the protected area.

3.5.2.3. Barriers of harmful hedges:

The planting of harmful hedges around farmlands such as pepper and other exotic plants with thorns will aid in mitigating the impact resulting from HWC on agricultural produce and are cost-effective. In the Malian Gourma they make up 32 percent of protective measures used, as against 28 percent for moats (Maïga, 1999).

3.5.2.4. Establishment of compensation schemes

3.5.2.4.1. Insurance schemes

The insurance scheme is an innovative compensation approach where farmers pay a premium for cover against a defined risk, such as crop raiding. The premium can be set at the true market rate or be subject to subsidy provided by conservation organizations (Muruthi, 2005). The method also requires an accurate assessment of the cause of crop damage with the inclusion of the various ministries MINADER, MINFOF, MINADT and MINEPDED. Because it operates on a more local scale, reports can be more easily verified with the aid of the VFMC's.

3.5.2.4.2. Enhance indirect compensation

Indirect compensation systems rely on giving out licenses to exploit natural resources, through tourism, hunting or collecting fuel wood, timber, NTFPs, fodder, etc should be instituted in the management strategy of HWC in the area. This type of compensation scheme, is also known as the "settlement of rights" to use natural resources, which appears to be a more practical solution than monetary payment. Indeed, the benefits derived from the legitimate use of natural resources influence the attitudes and perceptions of rural residents (Sekhar, 1998).

CONCLUSION

The study revealed that, HWC (crop raiding) is a major hurdle in mount Cameroon with elephants and rodents being the most destructive wildlife in terms of crop raiding . Maize, Banana , cocoyam were the most raided followed by cocoa (cash crop).

Elephant, chimpanzees, monkeys, drills, squirrels, porcupine, civet cats, cane rats, duikers, bush pig, birds, rat mole, insect, bush baby, lycaon, pangoline, antelope and deers were the animals involve in HWC and crop raiding in particular. No damages were recorded in livestock depredation and human damages in the various communities.

The intensity of damage was higher in elephants and rodents in the PA with occurrence from January to December. Damages were observed from January to March and from October to January with peaks being August and March with large mammals like elephants and chimps frequently observed close to the village in search for drinking water in the nearby streams. Bomana and kotto were closer to the PA that is less than 3km from the PA thus, a shorter migration range for the animals to move from the park to neighboring farms in the village and destroy. For instance; duikers, antelope, civet cat, bush fowl., bush pig, cane rat, chimpanzee, elephant, monkeys., porcupine, and rat moles were frequently noted in these conflict zones in search of water points most especially during the dry seasons .

IV. RECOMMENDATIONS

4.1. To the local population

4.1.1. Community awareness

Awareness in HWC is an important management approach which is not fully understood by most indigenes in the villages adjacent to the PA. Thus, sensitization campaigns should be carried out in schools, social groups and village traditional council on cost-effective methods

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of addressing human-wildlife conflict while benefiting from their natural resources. Local approaches or techniques should be vulgarized and enhance at the local level for better management of wildlife causing conflicts. Training should be directed towards the innovation of new techniques at the local level. The indigenes should be educated on the different types of wildlife species and their behaviors. This approach will help the communities to better interact with the wildlife and ameliorate their negative attitudes towards wildlife as time passes-by while portraying its economic value, aesthetic importance and recreational advantages for touristic purposes.

To avoid heavy economic losses or high mitigating investments, highly palatable seasonal crops such as maize, ground nuts, and sweet potatoes should not be grown near the forest edge. This is because these crops seem more attractive to crop raiders than wild foods, thus making them more attractive to wildlife. Farmers should be encouraged to correctly time their crops when planting such that by the time the food is finished in the forest, the crops are already harvested since the seasonality of fruiting and ripening of both wild and domestic crops tend to occur at the same time. This is influenced by seasonal patterns of rainfall, which are similar for both wild and domestic plants.

4.2. To the government

4.2.1.1. National framework on HWC management

The law on forestry and wildlife should be review in collaboration with other ministries such as MINADER, MINEDEP and local communities adjacent to PAs, with specific emphasis laid on HWC management. The Law should give more room for protection of biodiversity in collaboration with local population. Thus reviewing the law and promoting environmental education and wildlife awareness in the communities will aid in curbing the effect resulting from the HWC.

4.2.1.2. Review land use planning

Majority of the lands attributed to the farmers are not well mapped out by the necessary expertise from the ministry of MINEPAT. Thus the proper allocation of land titles in areas of cultivations in collaboration with forestry and agricultural experts will go a greater mile in reducing the effect of HWC in the livelihood of the indigenes. This will aid in the sustainable management of the wildlife and improve livelihood of the local communities.

4.3. To non-governmental organizations and the MCNP

4.3.1.1. Implementation of co-monitoring management program

This involves the participation of different stakeholders and the monitoring of the intensity and magnitude of HWC in the villages adjacent to the PA. As such, it is advisable to use complete neutral personnel who already knows the conflict zone and would act as a mediator between the administration and the population around the Park (Ekpe, 2011).

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