

Original Article

Human Wildlife Conflict in Tanzania with a Focus on Elephant and Lion

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Abstract

Conflict between expanding human population in many African countries and its remaining wildlife continues to demand a considerable attention from governments, conservationists, human rights activists, academicians, non-governmental organizations as well as the affected people. Despite the effort that has been put into understanding and resolving human wildlife conflict, no clear solution or set of solutions has emerged. Although the problem animal species varies widely depending on location and circumstance, the two species that command the greatest attention in Tanzania are elephant and lion. This study was conducted to synthesise an understanding of the extent and nature of human, elephant and lion conflict in Tanzania, the causes of the conflict, the mitigation measures being undertaken as well as their effectiveness in reducing the conflict so as to recommend a way forward for the country in terms of policy and practice. The study was conducted in five villages in western Serengeti, which adjoin the northern portion of Ikorongo and Grumeti Game Reserves. A questionnaire was administered to 10 households in each village, which were randomly selected. Consultative meetings were also held with 25 key informants. Data were analyzed with a Special Package for Social Sciences version 17. Results indicated that major conflicts, which affected people, were crop raiding by elephants and livestock depredation by lions, which ultimately resulted into retaliatory killing of both species. Rising incidents of conflict were associated with the growing contact between people and animals due to growing human population. Different deterrent measures were employed to counteract human-elephant and lion conflicts. It is recommended that, despite electric fencing inflicting some negative impacts, it has proved effective in some eastern and southern Africa and therefore should be integrated with other novel mitigation measures to reduce conflicts to acceptable level.

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Introduction

Growing competition between wild animals and people for space and resources has increasingly become a conservation challenge in many parts around the world [1,2]. One of the great consequences of this competition has been escalated Human-Elephant Conflict (HEC) and Human-Lion Conflict (HLC) [3-5]. Whereas the greatest threat caused by elephants is crop raiding and livestock depredation by lions, retaliatory killing to both species has increasingly contributed to the decline in their populations [6]. This study therefore sought to review the current situation of HEC and HLC in Tanzania focusing on western Serengeti as a case study and recommend the more practicable mitigation measures.

Methodology

The study was conducted in January 2017. Five villages were surveyed. These were Iharara, Makundusi and Bonchugu in Serengeti District and Mariwanda and Nyamatoke in Bunda, which represented a continuum along the Grumeti Reserves-public land interface from the eastern to the western side (Appendix 1). A questionnaire (Appendix 2) was administered to 10 households in each of the five villages. Households were randomly selected from a village register using a simple random sampling procedure. Consultative meetings were held to gather information from 25 key informants. Secondary data were collected from both published and grey literature. Data were analyzed using the Special Package for Social Sciences (SPSS) version 17).

Results and Discussion

Extent and nature of HWC

Direct impacts of human elephant conflict include injury and killing of people and livestock, crop raiding, competition over scarce resources such as water and forage and destruction of food storage facilities and other structures. Eighty eight percent of all the respondents (n=50) contended that crop raiding by elephants was a serious problem. The most intense conflict appeared to be on the boundary between protected areas and village land and within and around traditional wildlife movement routes. Severity of crop raiding by elephants in Tanzania was consistent with other countries in the east and southern Africa. Although circumstances of crop raiding might be so different, of all crop damage cases by large mammals, which were reported in Zimbabwe and Kenya for example, elephants were attributed to account for 75% and 90% respectively [7] (Parker and Osborn, 2001). Although information from the Tanzania Wildlife Authority (TAWA), which showed that crop raided by wildlife countrywide increased by more than 500% from 1,146 hectares in 2011 to 7,370 in 2014 could not explicitly classify animal species that were involved (Appendix 3), elephant was previously reported as the major marauder in Tanzania [8-15].

Direct impacts of human-lion conflict include human and livestock attack. The estimated number of attacks on people by lions between January 1990 and September 2004 in Tanzania was 863; an average of about 58 people per year [17]. Just over a third of these attacks

occurred in the south eastern part of Tanzania, where lions are known to be man-eaters. The incidence of human attacks by man-eating lions in Tanzania increased from an average of 30 cases per year in early 1990s to over 100 in 2004. Unlike in pastoral communities like in the Maasai Steppe where livestock attack was also pervasive [5] as well in Loliondo Game Controlled Area [18], all the villages in western Serengeti, which were surveyed during this study, indicated that HLC was currently not a serious problem, the finding that was consistent with reports from other agro-pastoral communities such as Mpimbwe Village, which is located within Katavi-Rukwa ecosystem [19] and in villages which adjoin Mikumi National Park in Central Tanzania [9,20]. Respondents in this study associated the declining lion attacks to both humans and livestock with the decrease in lion populations.

In response to problems impacted on people by wildlife, the animals are often killed in retaliation, by either poisoning, trapping or shooting and through government-sanctioned lethal control programmes. Despite the information on retaliatory killing of wildlife being sparse and not entirely available on official records because it was mostly done secretly [21], few cases of carnage were reported in western Serengeti during the current study particularly on elephants. Reports from elsewhere in Tanzania indicate that 28 lions were killed between 2004 and 2008 in villages neighbouring the Selous-Niassa corridor, in retaliation against various costs inflicted by the animals [22]. Lions were repeatedly killed in the south-eastern part of the country using poison and sometimes trapped with fishing nets then speared [17]. Lack of documentation on retaliatory killing of elephants and lions, which is normally done secretly, was not an exceptional phenomenon to Tanzania. In Kenya, a total of 14 elephants, which were found dead with tusks intact between 1992 and 1993 implied that the killings were either retaliatory, defence or for ritual purposes [23]. Lion numbers in Nairobi National Park were suspected to decline through retaliatory killing from approximately 35 animals in 1998 to 9 in 2005 to introduced compensation scheme [24]. At Etosha National Park in Namibia, despite that the park was completely fenced since 1973; around 30 to 40 lions were shot or poisoned on commercial ranches every year between 2000 and 2005 [6].

Causes of the conflict

The primary cause of the conflict was identified as the growing human population and increasing landscape transformation from natural to cultivated village land, bringing human societies and wildlife into closer contact and increased competition for access to resources. Whereas elephants moved into settled land mostly during wet season in search of water, forage and probably minerals, lions moved most frequently into villages when their preferred prey species particularly zebra and wildebeest had migrated into other areas in the Serengeti ecosystem during dry season. During mid rainy season is when many agricultural crops particularly maize and millet are ripening. While the Tanzania and Mara Region average human population growth rate per annum was 2.7% and 2.5% respectively between 2002 and 2012 that of Serengeti and Bunda districts were 4.0% and 2.9% in that order [25]. Seventy percent of all respondents settled within 15 kilometres from wildlife reserve boundary. Majority (63%) who encountered wildlife and suffered from damage settled and cultivated between zero and five kilometres. With the exception of Makundusi village, other four villages, which were surveyed, lacked approved land use plans. Lack of land use plans prompted immigrants from either within or outside the surveyed villages to settle right on the

periphery of wildlife protected areas, within corridors, traditional migration routes and dispersal areas, and undertake economic activities, which were incompatible with wildlife conservation.

Observation made in this study on relationship between settlement patterns closer to protected areas and HWC conflict level was consistent with previously studies conducted within the same study area and elsewhere [26-31]. The fact that there was a negative correlation between human density and elephant numbers in the eastern and southern African countries where elephant ranged (Pearson correlation = -0.281; $n=16$; Correlation significance = 0.292), implies that the larger the human density, the more habitat destruction it was, thus the higher escalating HEC and the ultimate retaliatory killing incidents of elephants.

Local increase in wildlife particularly elephant and lion within the study area has also narrowed the gap between wildlife habitats and human settlements. Elephant numbers within Serengeti Ecosystem excluding Masai-Mara National Reserve in Kenya swelled from 1,357 in 1994 [32], to 6,087 in 2015 [33]. The lion population in Grumeti Reserves increased exponentially at an average rate of 21% per year between 2003 and 2014 [34]. The fact that HEC in western Serengeti became apparent since early in 2000s [28] could be associated with swelling wildlife populations. In Kruger National Park when culling was stopped in 1995, elephant population soared from around 7,000 in 1996 to 12,000 in 2006 which coincided with an increase in HEC in surrounding areas [35,36]. HEC in Botswana was associated with relatively high elephant populations, which accounted for about 31% of the continental total [37]. Increase in the elephant number to the northern part of Namibia, which was partly attributed to movement of animals from Botswana also escalated HEC levels [38].

Prevention measures

A variety of human-wildlife conflict mitigation measures were practised, which fell into proactive and reactive categories. Whereas proactive approaches included physical barriers, sensory deterrents, guarding and land use planning, the reactive ones involved scaring and killing. Financial programs including benefit sharing and consolation for losses incurred were also implemented so as to improve tolerance for losses and wildlife. Unlike in Namibia where majority of the local people became more tolerant to elephants despite the animal species continuing to pose great conflict with people because they received reasonable benefits from communal conservancies [38], 85% of all the respondents in this study ($n=50$) contended that benefit sharing approach had not delivered suitable benefits. Further, data from TAWA revealed that consolation policy had proved unsustainable both administratively and financially as 77% of the government-approved consolation claims from various Tanzania Mainland districts for the period of 2011-2015 was still outstanding at the end of 2016 (Appendix 4).

The proactive approach through land use planning and buffers around protected areas has largely failed due to lack of implementation or enforcement. However, this approach still has applicability where the opportunity still exists. Most households therefore relied on traditional approaches like guarding, beating drums or playing loud music, using fire and smoke, and chasing wildlife away when they entered a settlement area. These approaches have however, not succeeded in reducing conflict to an acceptable level as the animals have habituated and are sometimes becoming dangerous when

animals particularly elephants get annoyed. Novel methods such as using chili, bees, and community task forces have also been applied in a localized manner with varying success. Chili fences and chilli bricks are increasingly adopted in Tanzania and have demonstrated potential to reduce conflict [39-41]. Using dogs to guard livestock is a traditional technique that has been modified to improve effectiveness by using breeds selected for their propensity to this purpose. This approach has seen variable rates of success, and due to the expense of the recommended breeds, is currently dependent on support from non-governmental organizations.

Electric fencing approach, which is currently not practiced in Tanzania [42], has proven effective in reducing human-elephant and lion conflict to an acceptably low level elsewhere in the east and southern Africa countries [23,43-49]. The approach is however, confronted with various challenges among them being the relatively high monetary cost involved in terms of investment, maintenance and monitoring than many other preventive methods [44,46,50-52] and prevention of wide ranging especially for species, which populations are no longer viable in small reserves [52]. Other shortcomings of the approach are; preventing the animals from accessing seasonal resources outside the confinement [53], potential for impairing opportunities for genetic exchange and the ultimate inbreeding [54], interference with ecosystem structure and functions in case of populations' growth beyond carrying capacity within the enclosure [53] and potential for hindering the local people from accessing traditional resources [52].

Conclusion and Recommendations

Conclusion

HWC remains one of the salient problems, which face sustainable wildlife conservation in Tanzania. Local communities have built negative attitude thus failed to fully support conservation efforts partly due to HEC and HLC. Insufficient benefits the local people obtain from living with wildlife reduce their willingness to support conservation efforts. Deprived people now and again conduct economic activities, which are illegal and ecologically damaging. Retaliatory killing of elephants and lions is sometimes pursued as a revenge and self-compensation for incurred losses.

This study revealed that no single method would be effective to mitigating HWC in Tanzania on its own. In other southern Africa countries where electric fences have been properly designed, regularly maintained and supported by local communities the approach has proved effective as a single solution. However, there are currently two schools of thoughts on the application of electric fence as a conservation tool. One group argues that in the face of burgeoning human population, electric fencing would be a powerful tool to preventing wildlife from upsetting people as well as decreasing retaliatory killing of the animals (www.nature.com/news/fences-divide-lion-conservationists, visited on 28th September 2017). The other camp contends that as long as many wild animals wander between protected areas and public land, the ability of wildlife to move across landscapes particularly in Africa's dry-lands will be threatened by those barriers [51,52]. In view of the above, the conservation policy in Tanzania needs review to integrate traditional preventive measures with novel methods. This integration should include the use of electric fences, reinforced chain link fences around livestock kraals, well equipped and functional game posts, community task forces with guard dog programs, chili-integrated techniques and small drone programmes.

Recommendations

Based on the findings of this review, the following actions are recommended as a way forward:

- To ensure rational benefit sharing from wildlife resource, the Government must encourage rural communities to establish WMAs where wildlife exists on village land and strengthen the already established ones then devolve the management of wildlife including the elephant and lion to both communal and private landowners
- Many villages adjacent to protected areas are lacking rational land use plans. Where these are in place, the spatial delineation of land uses does not adequately buffer the community from wildlife conflict. In addition, land use plans where they are in place, have not been implemented and enforced. Therefore, where the opportunity still exists, land use planning and implementation must be used as a primary recourse to proactively avoid conflict.
- Land use planning should include the regulation of immigrants from other areas into vacant land neighbouring protected areas.
- Where dense settlement and human activity directly adjoins protected area and sharp edges have already occurred, the Wildlife Policy should be reviewed to allow and support the erection of electrified fences along those boundaries. Where this is implemented it should be done in compliance with the environmental impact assessment regulations and guaranteed maintenance support. In this instance, communities should also be adequately sensitized so they can see themselves as partners in making such infrastructure a success and mutually beneficial
- Where settlement is much less dense or some distance from the boundary of the protected area, other deterrent measures including chain link protected bomas, guard dog programmes, chilli bombs and functional game posts must be encouraged and supported
- Data emanating from human wildlife conflict incidents and the effectiveness of mitigation measures needs to be systematically collected and analysed periodically so that proper adaptive management of the situation can be practiced
- In order to effectively evaluate HWC programs, there is a need to establish clear objectives for reducing conflict and define levels of acceptable losses to wildlife

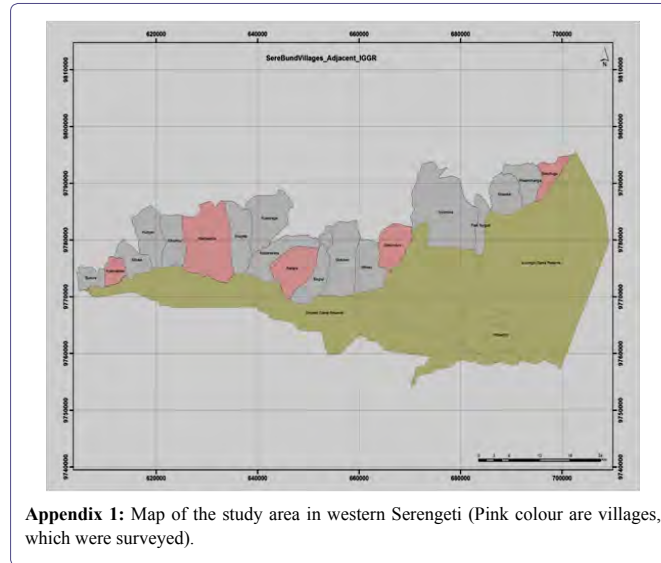
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Date
 Sex
 Village
 Number of wives
 Distance from the game reserve/WMA boundary

Name of respondent
 Age
 Ward
 Number of dependent children

Residence

When did you settle here?
 Where did you come from?

Occupation

What are your major sources of income?

Agricultural crops	Livestock	Petty business (Bar, kiosk, shop etc)	Formal employment	Other (specify)

If farming, where you do farm? (1) Around homestead (2) Away from homestead

If away from homestead, what is an approximate distance from Grumeti Reserves in kilometres?

(1) 0-2 (2) 3-5 (3) 6-8 (4) 9-11 (5) 12-15 (6) > 15

If farming, what are the three main crops you planted and size of each field?

Crop type	Maize	Beans	Sorghum	Millet	Cassava	Sweet potatoes	Tobacco	Rice	Other
Field size									

What was the yield per crop in year 2015 in 100-kg bag and kilogrammes for tobacco?

Maize	Beans	Sorghum	Millet	Cassava	Sweet potatoes	Tobacco	Rice	Other (specify)	Other

If livestock keeping, what type of animals do you keep and their numbers?

Livestock type	Cattle	Goats/Sheep	Donkey
Number of animals			

Where do you graze your livestock?

Own Land Around Homestead	Own Land Away From Homestead	Village Land Reserved for Livestock grazing	Game Reserve or Ikona WMA

Is grazing area for your livestock sufficient? Yes No

If not enough, how do you solve the problem?

Human-Elephant and as Well as Lion Conflict

Do you experience any conflict with elephants? Yes No

If yes, what type of conflict?

Crop Damage	Human injury	Human killing	Food store breakage	Water sources destruction	Other

If crop damage, what is the portion of each field crop was damaged in 2015): e.g. 1/4, 1/2, 3/4 or the whole field?

Maize	Beans	Sorghum	Millet	Cassava	Sweet potatoes	Tobacco	Rice	Other

If human injury/killing, how many family member(s) were injured/ killed by elephant n 2015?

If food store breakage, how many incidences occurred in year 2015?

At what time does most damage by elephant occur? Day Night

What are the three main methods you employ to mitigate elephant damage?

- (i)
- (ii)
- (iii)

How effective are the methods you employ to deter elephant damage?

Very effective Effective Moderate Less effective Not effective

What do you think should be done to reduce HEC problem?

- (i)
- (ii)
- (iii)

Human-Lion Conflict

Do you experience any conflict with lions? Yes No

If yes, what type of conflict?

Number of Family Members Killed	Number of Family Members Injures

How many livestock and people were injured or killed by lions in your family in 2015?

What are the three main methods you use to reduce the problem lion attacks?)

- (i)
- (ii)
- (iii)

How effective are the methods you employ to reduce the problem of lion attacks?

Very effective Effective Moderate Less effective Not effective

Out of the three methods you have mentioned in 4.4 which one you think is easy to apply with relative less cost?

Mention two things you advice should be done to reduce HLC?

- (i)
- (ii)

Response to Elephant Damage and Lion Attacks by Relevant Authorities

Do you report damages/attacks made by elephants and lions to relevant authorities? Yes No

Where do you report? (i) Village Council (ii) District Council (iii) Game Reserve (iv) National Park (v) Singita Grumeti Fund (vi) Anti-poaching Unit (vii) WMA

How long on average does it take to report incidences (days/hours)

What is often the response when you reported the incidence?

Were you paid consolation for crop damage, injury or human and livestock killing in 2015 if at all there were such incidences? Yes No

If you were paid, how long time elapsed before you received consolation payment?

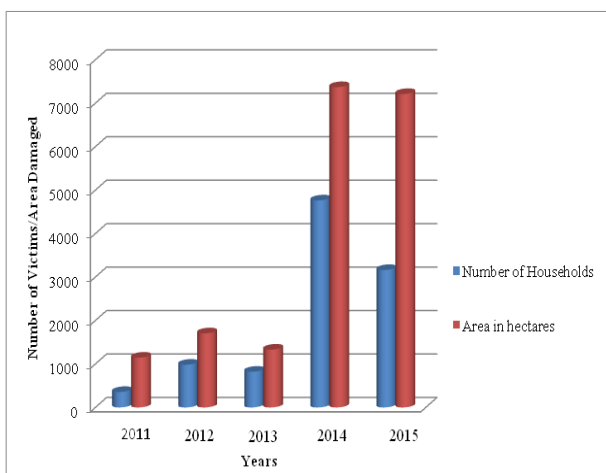
If you were not paid, do you know the reason of not being paid?

Elephant and lion conservation perception/attitude

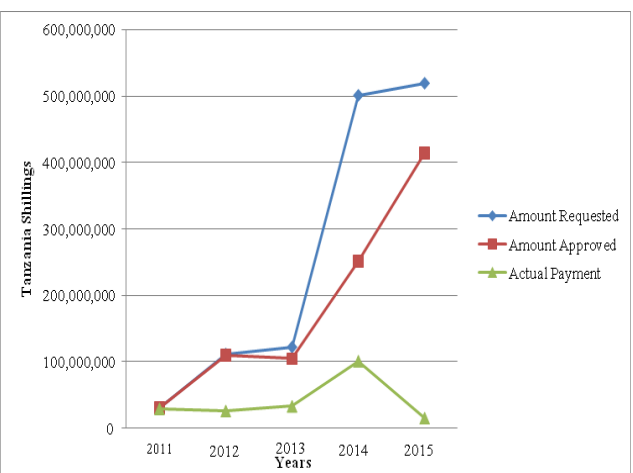
What is your perception on the elephant and lion conservation efforts made by the Government?

- (i) Very good (ii) Good (iii) Moderate (iv) Poor (v) Very poor

Appendix 2: Questionnaire for Villagers.



Appendix 3: Total area of crop fields damaged and number of households involved (2011-2015) in Tanzania (Source: Summary from raw data at TAWA, February 2017).



Appendix 4: Amount of consolation payment for damaged crops requested, approved and actual amount payment paid by December, 2016 (2011-2015) in Tanzania (Source: TAWA, 2017).



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