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Distribution Patterns of Human Elephant Conflict in Areas Adjacent to Rungwa Game Reserve, Tanzania

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Natural Resources Management

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List of Abbreviations

RGR	Rungwa Game Reserve
HEC	Human Elephant Conflict
IUCN	International Union for Conservation of Nature
TAWIRI	Tanzania Wildlife Research Institute
WD	Wildlife Division
PA's	Protected Area
HWC	Human Wildlife Conflict
AfESG	African Elephant Specialist Group
NBST	National Bureau of Statistics -Tanzania
URT	United Republic of Tanzania
TZS	Tanzania Shillings
USD	United States Dollar
PAC	Problem Animal Control

Abstract

Human pressure on terrestrial ecosystems has caused loss and fragmentation of habitats for wildlife species. That has brought humans and wildlife in close proximity intensifying human wildlife conflicts, especially when wild animals with wide home ranges, such as African and Asian elephants, are involved. This study assesses distribution patterns of human elephant conflict (HEC) in areas adjacent to Rungwa Game Reserve (RGR) in Tanzania. Questionnaire survey was used as a tool for data collection from the people around the reserve. Results of the study inferred that, the elephant was a most problematic animal in the area with crop raiding as a prominent conflict. Distance from the villages to the protected area was a major factor affecting distribution of the conflict between humans and elephants, where people in villages close to the reserve were more affected by crop raiding elephants. Other factors are increasing human population associated with immigrants and farming activities close to Rungwa Game Reserve. It was also found that, awareness of HEC mitigations was higher in villages close to the park than in further away villages. However, the mitigation methods were not effective in controlling crop raiding elephants. Thus, application of effective mitigations is very important for sustainable co-existence between humans and elephants. Attitudes of local people were not affected by the effect of crop raiding elephants instead awareness of conservation benefits appeared to have a more important influence on attitudes. Tolerance of costs from problem elephants has its limit, so management of HEC is highly needed. Alleviation of HEC should go together with effective management of PA's, buffer zones, dispersal areas and wildlife corridors. Community-based conservation is among the best options that should be applied as it involves sharing of costs and benefits with local people around the PA's. Much should also be done on improving community based HEC mitigations in areas around RGR.

Key words: *Rungwa Game Reserve, human elephant conflict, crop raiding elephants, local communities, awareness of mitigation measures and attitude.*

Introduction

Increasing pressure towards terrestrial ecosystems as a result of human activities has led to loss and fragmentation of habitats for large numbers of wildlife species (Hill, 1998). This has brought the wildlife and humans in close proximity, intensifying human-wildlife conflict (HWC), especially animals with wide home ranges such as the African (*Loxodonta africana*) and Asian (*Elephas maximus*) elephants (Kumar et al., 2011). HWC is among the major challenges facing management of protected areas (PA's). Conflicts are associated with increasing settlements and farming activities close to the PA's where farms near to the park are more likely to be raided by wild animals. The animals that are known to raid crops are elephants, flocks of birds and primates among others (Primack, 2014, p 391 - 415). Either, encroachment of PA's and loss of buffer zones are some of the reasons for the increase of HWC. It has been pointed out that, more than two thirds of the buffer zones have lost their vegetation cover due to the upsurge demand of natural resources (Mayaux et al., 2005). As pointed out by Madden (2004), "*HWC take place when the need and behaviour of wildlife impact negatively on the goal of humans or when the goals of human negatively impact the need of wildlife*". Lack of consensus in human wildlife conflicts has intensified negative attitudes for the conservation of a wide range of species. In this respect, it is not expected that local people will be in favour of sharing the same land with wildlife species. This is not only a threat to animals outside PA's but also a threat to the dispersal and movements of migratory species (Okello, 2005).

Human-elephant interactions appeared to be a potential area of studies based on conflicts associated with sharing of resources by the two species (Madden, 2004, Parker et al., 2007). In that regard, human elephant conflict (HEC) is viewed to be a complex phenomenon across the range of African elephants that draw attention of different actors including wildlife authorities, non-governmental organizations, international organizations and inter-governmental organizations (Røskaft et al., 2012). Defined by AfESG (2007) under IUCN "HEC is "*any human-elephant interaction which results in negative effects on human social, economic or cultural life, on elephant conservation or on the environment*".

Conflicts happen directly when elephants damage crops, infrastructure, properties or water systems, attack people and cause injuries or loss of life. Indirectly, people along the conflict zones

spend much time guarding their fields from crop raiding elephants, filled with insecurity in conducting daily activities such as planting of cash crops, children walking to and from school, as well as collection of firewood. Hence, such a conflict affects social economic development of the particular communities (Røskaft et al., 2012). In those escalating cases elephants are also victims of being killed or wounded by humans concerning security of human life or by revenging. With this background human-elephant conflict (HEC) is not only jeopardizing the conservation initiatives but is also a threat to the wellbeing and livelihoods of rural human populations (Kumar et al., 2011).

HEC is one of the greatest challenges when addressing the balance between conservation of elephants and human wellbeing in Africa and Asia. There are various challenges in the management of the co-existence between elephants and humans. The challenges may be based on how different groups of people view elephants in different ways. Elephants can be viewed as an interesting icon of conservation, exploitable, a valuable resource and a key species in terrestrial ecosystems, or as dangerous and destructive (Dublin and Hoare, 2004).

The efforts applied in HEC management are also hampered by the attribute of the poor living standard in developing countries. These include the vicious cycle of poverty; rapid growth of human population; alarming fragmentation and loss of wildlife habitats through extension of land for agriculture or uncontrolled logging (Kikoti et al., 2011).

This study aims to resolve various issues of HEC that are involved in conservation, socio-economic and political issues. It is a cross-cutting issue where human population density increases simultaneously with an increasing pressure on wildlife in PA's. As a result of increased contact between elephants and people HEC persist especially in areas adjacent to PA's, along the corridors and dispersal zones (Fernando et al., 2008).

Problem Statement and Justification

Strong management of HEC is highly needed to solve the escalating decline in numbers and distributions of elephants in which eight percent of African elephant's range is known to be outside the PA's (Hoare, 1999). Tanzania is among the African countries with the largest

population of African elephants and is facing a challenge of addressing HEC across areas adjacent to PA's (Blanc, 2007). Wildlife Conservation Act No. 5 of 2009 also recognizes elephants as one of the dangerous/problem animals involved in the consolation scheme. The government of Tanzania has introduced a consolation scheme to those who are affected by problem animals such as elephants based on the distance from the Wildlife PA's (MNRT, 2009). Explained by MNRT (2009) the scheme involves *amount of money that is paid as consolation to a person or groups of persons who have suffered loss of life, livestock, crops or injury caused by dangerous animals*. The dangerous animals identified by the consolation scheme are, African Elephant, Hippopotamus (*Hippopotamus amphibious*), Buffalo (*Syncerus caffer*), Black Rhino (*Diceros bicornis*), Nile Crocodile (*Crocodylus niloticus*), Lion (*Panthera leo*) and Spotted Hyena (*Crocuta crocuta*). However, the distribution pattern of the conflict is not well known. Crop raiding animals especially elephants have been causing much problems to the people around most of the PA's in the country (WD, 2015). For the past four financial years, 11,846 acres of crops were raided by problem animals in Tanzania (Figure 1)

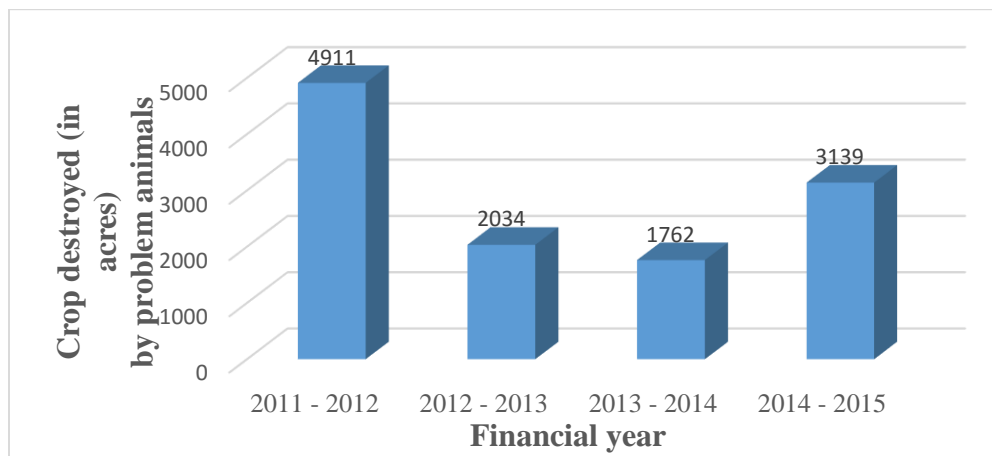


Figure 1: Crop destroyed in Tanzania by problem animals in the past four financial years

Following effects of the crop raiding animals, government of Tanzania had spent about 856,333,000 TZS (USD 713,611) in consolation (Figure 2) from financial year 2011-2012 to 2014-2015 (WD, 2015).

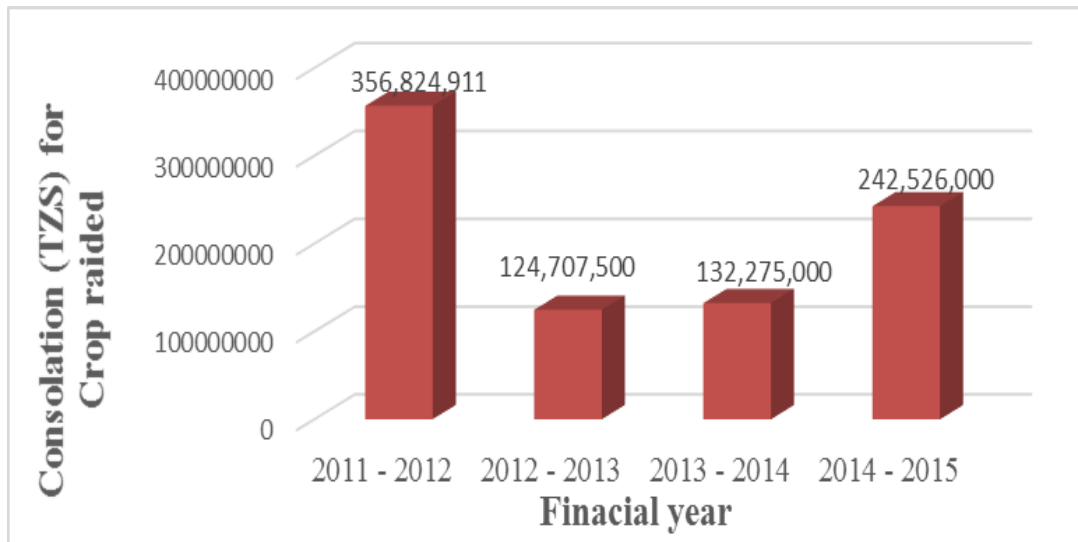


Figure 2: Amount of money “Tanzanian Shillings” used in consolation for crop raided by problem elephants for the past four financial years

Wildlife PA’s in Tanzania range from National Parks, Conservation Area Authority, Game Reserves and Game Controlled Areas covering 24% of the total land (MNRT, 2007). HEC is among the important challenges that faces management of Rungwa Game Reserve (RGR), part of the Rungwa-Ruaha ecosystem, which is a stronghold of African elephants. The increasing pressure from the surrounding communities through uncontrolled socio-economic activities locally fuels HEC in areas adjacent to RGR. However, prior to this study there was only anecdotal information on the factors which affect the distribution pattern of HEC in the area.

This study used the opportunity to increase the understanding of reliable information on the distribution patterns of HEC in the area. Findings from this study are expected to be of great contribution in management of HEC around RGR. Areas of focus are made available for actors who take part in HEC management which include affected communities, effect of land use changes and population increase associated with influx of immigrants.

Objective

The objective of this Master's Thesis was to assess and understand the factors which affect distribution patterns of Human Elephant Conflict (HEC) in areas adjacent to Rungwa Game Reserve, Tanzania, in order to come up with a management plan.

Hypotheses

1. HEC incidents are higher in areas close to PA than in areas further away from PA.
2. Local communities close to the PA are more aware of mitigation measures applied in HEC than communities further away.
3. HEC causes negative attitudes of local people toward conservation of elephants and other wildlife.

Theoretical Background

Factors Affecting Distribution of HEC

Various studies have been conducted to assess the distribution and prevalence of HEC in Africa and Asia (Hoare, 1999, Kumar et al., 2011, Sitati et al., 2005, Sitati et al., 2003). It was learned that, occurrence of HEC can be affected by a number of factors; intensity of rainfall, distance from the protected areas, human settlement density, areas under agriculture, mitigation measures applied and habitat fragmentation. This study involves various theoretical backgrounds such as ecology and behaviour of African elephants as well as land use changes which appear to have a potential impact on the distribution of HEC based on findings from other studies (Okello, 2005, Parker and Osborn, 2006, Raihan Sarker and Røskaft, 2010). Elephant ecology and behaviour have been observed to affect the distribution of HEC along the ecosystems with high population density of elephants.

Behavioural Ecology of Elephants and HEC

African elephant is the largest terrestrial animal and currently resides in 37 sub-Saharan countries. There are two sub species of the African elephant that include African savannah elephant (*Loxodonta africana africana*) and forest elephant (*Loxodonta africana cyclotis*). The species was

red listed by IUCN in 2004 and given a conservation status vulnerable (Blanc, 2008). African elephants are found in different zones from tropical through sub-tropical to temperate zones. The species is also found in arid and semi-arid areas. The home range of African elephants may differ based on the condition of the particular habitat. In high-quality habitats (e.g. Lake Manyara, Tanzania) the African elephant is known to occupy an area of 15 to 52 km². However, in the desert (e.g. West Namibia) they can occupy an area of more than 18,000 km² (Parker et al., 2007). The African elephants are normally characterized by migration behaviour in search of food, water, space and other resources based on ability to move longer distance across their ranging routes (Gereta and Røskaft, 2010, p 186 - 210). In addition to that, elephants need about 160 litres of water and a diet from various vegetation which amount to at least 5% of its body weight ranging from 100 to 300 kg per day. African elephants would also prefer areas characterized by fertile soil and with enough water (Parker et al., 2007). With that background the distribution of elephants is related to that of humans; thus a result is an increased competition between the two species which is unavoidable.

Extreme demand of larger home range always brings elephants into conflict with human (Nahonyo, 2009). RGR is surrounded by communities with different social economic activities including agriculture and livestock keeping which exert much pressure on the home range of elephants. Land use changes especially in the areas around the PA's is considered to fuel HWC. Based on the study conducted at Amboseli NP in Kenya, negative impacts from wildlife to the communities around protected areas were found to be dependent on land use practices (Okello, 2005). In the same study the mitigation measures were also observed to be related to the land use activities practiced by the surrounding communities. In that view, my study was 'among others' assess how land use changes are affecting the distribution of HEC in areas around RGR.

Methodology

Study Area

Rungwa Game Reserve is a unification of three game reserves namely; Rungwa, Kizigo, and Muhesi that were established at different times. Rungwa was the first one to be gazetted in

1951 followed by Kizigo (1972). Finally, Muhesi (1995) was added later to be part of Rungwa. The total area of RGR located at the Central and Western part of Tanzania is 17,340 km² (WD, 2015). RGR is part of Rungwa-Ruaha Ecosystem that includes protected and unprotected areas (Figure 3) with a total area of 50,886 km². The ecosystem is known to have the largest population of African elephants in Tanzania with regards to a survey that was conducted in 2013. The number of elephants was estimated to amount 20,090 individuals within the Ruaha-Rungwa ecosystem. It is considered to be the second largest wildlife area in Tanzania after Selous-Mikumi ecosystem (TAWIRI, 2013). Moreover, RGR is characterized by hills mixed with forest patches, streams and rivers which offer a special habitat for wildlife species. The reserve is composed of Mpera River which amount as a main source of water especially during the dry season from July to November. The game reserve is characterized by Miombo woodlands which offer the special habitats for a number wildlife species among others including; lion, leopard (*Panthera pardus*), spotted hyena (*Crocuta crocuta*), jackal (*Canis aureus*), buffalo, greater kudu (*Tragelaphus stepsiceros*), African elephant, zebra (*Equus grevy*), hippopotamus, Nile crocodile, bush pig (*Potamocheurus larvatus*), warthog (*Phacochoerus africanus*), baboon (*Papio sp*), vervet monkey (*Chlorocebus pygerythrus*) as well as various antelopes such as impala (*Aepyceros melampus*), duikers (*Cephalophinae sp*) and large concentrations of birds (WD, 2015). The reserve experiences a long dry season from June to November and a single rain season from November to April. Amount of rainfall ranges from 500 mm to 700 mm and the mean annual temperature is 28°C (Nahonyo, 2001).



Figure 3: Map showing the areas of Ruaha-Rungwa Ecosystem inside Tanzania (Source: TAWIRI aerial survey, 2013)

This study involved a questionnaire survey conducted in the communities adjacent to RGR with respondents been selected from the villages' administrative level. Tanzania is divided into different administrative levels from, regions, districts, divisions and wards. Wards are further divided either into streets (in urban areas) or villages (in the rural area). Furthermore, the villages are subdivided into hamlets (URT, 2013). RGR is surrounded by four districts (Manyoni, Sikonge, Chunya and Chamwino) from four regions (Singida, Dodoma, Mbeya and Tabora). The larger proportion (98%) of RGR is located within Manyoni District in Singida Region whereas the rest (2%) is shared by Chamwino, Chunya and Sikonge Districts which are in Dodoma, Mbeya and Tabora Regions respectively. The survey was administered in the seven (7) villages among which, five were selected from Manyoni District (Damwelu, Ipande, Njirii, Rugwa and Kintanula), one from Sikonge District (Majojoro) and the last village (Kanoge) from Chunya District (Figure 4). Local communities at the village levels are highly affected by the HEC and management of conflicts at the local level involve different actors from the affected communities, District Game

Officers under Districts' councils and management of the nearby PA's such as RGR and Anti-poaching units. At the National Level Problem Animal Control Units are headed by the Wildlife Department under the Ministry of Natural Resources and Tourism.

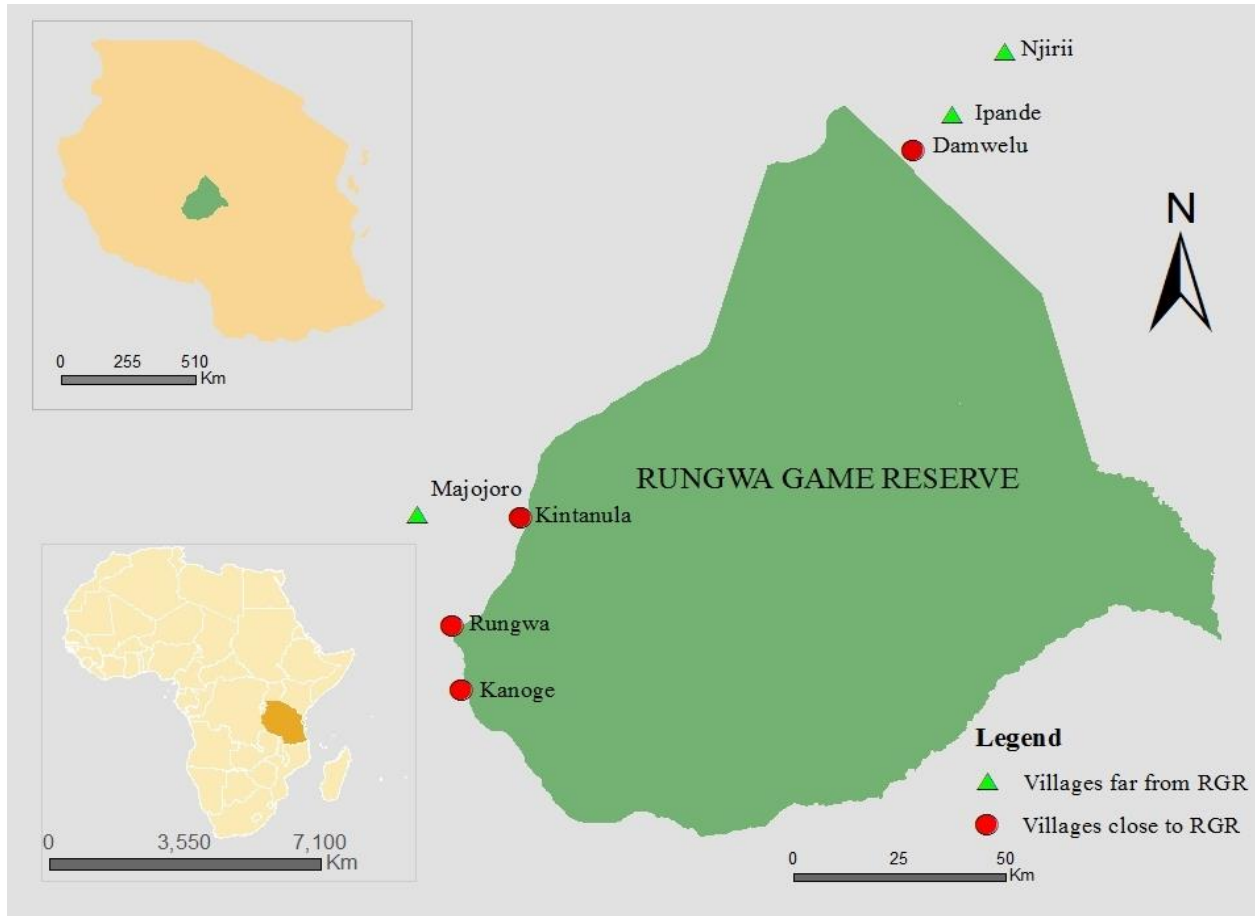


Figure 4: Map showing villages close (Red dots) and far (Green triangles) from RGR in which the questionnaire survey was conducted. Insert maps on the top left indicates location of RGR in Tanzania and bottom left shows location of Tanzania in Africa.

Sample unit

This study concentrated on the local communities residing in the villages that are close as well as far away from RGR for primary data collection. Stakeholders taking part in HEC management such as Management of RGR, Districts Game Officers, Anti-poaching Units and the

Wildlife Division were recruited for focused group discussion and secondary data collection. With that background consideration was given to the actors involved in management of HEC from the local to the national level along with affected communities at the local level. According to a Wildlife Conservation Act No 5 of 2009 and Consolation Regulation of 2012, Director of Wildlife foresees the management of HEC and consolation to the affected communities in Tanzania main land. He makes use of the wildlife officers (i.e officers, wardens, and rangers) from the Game Reserves and Anti-poaching units distributed across the country in problem animals control by using various measures such as disturbance shooting and destruction of the problem animals. Again, claims from the affected communities to the Director of Wildlife based on the damage and loss caused by the problem/dangerous animals, involve various leaders from Village to the District levels. Those leaders as pointed out by the aforementioned Regulation include Village Executive Officer, Livestock Officer, Agriculture Officers, Medical Officer and District Game Officers. Wildlife department (WD) in collaboration with Tanzania Wildlife Research Institute (TAWIRI), Non-Governmental Organizations (NGO's) and Researchers have been working on adoption of various mitigation measures applied by the affected communities at the conflict zone. In that view, not only affected peoples but also the actors involved in the management and control of HWC were important source of data related to distribution of HEC around RGR.

Sample Size

A total of 210 respondents were interviewed. Representatives from 30 households in each of the seven selected villages were involved. Defined by URT (2013), Households “*refers to a person or group of persons who reside in the same homestead/compound but not necessarily in the same dwelling unit, have same cooking arrangements, and are answerable to the same household head*”.

Key informants were selected from the sampled villages and stakeholders involved in HEC management from the local to the national level for formal and informal discussions. Seven group discussions were conducted one from each of the selected villages. Each group had a range of five to ten members from village government council. I had four discussions with a Manager of RGR,

Game Officer of Manyoni District, Head of Anti-Poaching Unit of Manyoni and Head of Problem Animal Control Unit at Wildlife Division respectively.

Sampling Design

Stratified random sampling technique was used in selection of the villages for survey where the attributes of the strata were the villages known to have HEC incidences and locations from RGR. Among the selected villages, a simple random sampling approach deployed in the selection of respondents from the households. Registers with names of households were made available by village leaders. Average number of household in each village was 400. In that case more than 7% of the population was involved in the questionnaire survey.

Questionnaire involved closed and open-ended questions. The questions aimed to collect various data including, background data of the respondents such as sex, age and ethnicity, education, whether head of the household was native/resident (born in the same region) or immigrant (immigrated from other regions apart from Singida, Dodoma, Tabora and Mbeya), reason for migration, main source of income and size of household. The ethnic groups recorded as residents in the study area include Taturu, Nyaturu, Gogo, Kimbu and Nyamwezi whereas immigrants were Sukuma and others. Other important parts of the questionnaire recorded respondents' socio-economic activities and their locations from the boundary of RGR, occurrence of HEC, how respondents have been affected by HEC, mitigation applied to control HEC, comments on the effective mitigations to be applied and attitude of respondents on conservation of elephant and other wildlife. The terms "close" and "far away" were used to explain locations of administrative areas and socio-economic activities in relation to a boundary of RGR. The administrative areas bordered with the reserve are regarded as being close whereas those which do not share their boundaries with RGR were considered to be far away (more than 1 km away). On other hand, the social economic activities within 1 kilometre from the boundary of RGR were considered close while those in more than 1 kilometre presumed to be far away. Socio-economic activities included among others; cultivation and grazing of livestock.

Data Collection

This study encompassed primary and secondary data. Primary data was collected from selected people around RGR through questionnaire survey while secondary data was obtained from actors involved in management of HEC and conservation of wildlife along with published and unpublished literature from internet through NTNU search engine.

Field visits were also conducted to the conflict zone for observation of HEC incidents as well as focused group discussions so as to compare and validate the findings from primary data.

Description of Respondents

An adult male or female either head or member of the selected household was reliable interviewee. In this regards adult means, any member of the household from the age of 18 years old and above. Most of the respondents were males (n = 132, 66%) while females (n = 72, 34%) happened to be in relative small proportion. Age of respondents was in the range of 21 to 84 with an average of 44.6 (± 12.4 SD) years old. Furthermore, size of the households was also assessed and explained in three categories according to the number of individual in the household. The first one was regarded as a small household (1 to 4 members) with few interviewee (n = 27, 12.9%) followed by the medium household (5 to 10 members) with huge number of respondents (n = 114, 54.3%) while the larger category (with more than 10 member) had intermediate number (n = 69, 32.9%) of representatives.

The education levels of interviewee ranged from those who had never been to school (n = 47, 22.4%), attended primary school (n = 155, 73.8%) and from secondary school and above (n = 8, 3.8%).

The study managed to record locations of human activities in relation to distances from the boundary of RGR that includes, settlement areas, farm for crops cultivation, pasture and water sources.

Sources of income for respondents covered single source of crops cultivation (n = 100, 47%) and combination of livelihoods (n = 110, 52.4%) that encompassed cultivation, livestock keeping, employment and business. Crop cultivation was the main source of income for the

respondents where by majority (n = 194, 92.4%) engaged in multi-crops cultivation that comprised of maize and others (millet, sorghum, lentils, tobacco, beans etc.) followed by those who cultivated only maize (n = 7, 3.3%) while few of them (n = 9, 3.8%) did not have farms.

Analysis of Data

Statistical Package for Social Science (SPSS-21) Software and Microsoft Excel were used in the analysis of quantitative data. In data analysis Chi-square tests and logistic regressions were used in testing the hypotheses with a significance level of $p < 0.05$. I tested these hypotheses using age, sex, gender, education level, residence status, effect of crop raiding elephants, distance of the villages from RGR, awareness of HEC mitigation, if they own livestock or not, awareness of conservation benefits and participation in conservation as variables. Mean is presented as mean \pm SD.

Qualitative data were ranked and weighed according to the attributes of HEC.

Results

Human Elephant Conflicts

Human wildlife conflicts were found to involve a number of wildlife animals ranging from elephants (59%, n = 124), bush pigs (16.2%, n = 34), greater kudu (6.2%, n = 14), spotted hyenas (3.3%, n = 7) and others (2.4%, n = 5). The other animals here include primates (baboons and vervet monkeys), antelopes (impala, duikers etc), jackals, lions and leopards.

A significantly larger proportion of respondents (99%, n = 120,) who encountered problem elephants, were from villages close to RGR compared to those (77%, n = 90) far away from the park ($\chi^2 = 27.8$, $df = 1$, $p < 0.001$).

A higher frequency of respondents (79.2%, n = 120) in villages close to the park boundary experienced crop raiding elephants than those (36.7%, n = 90) in faraway villages ($\chi^2 = 39.03$, $df = 1$, $p < 0.001$). Maize crop was highly affected (57%, n = 210) by the crop raiding elephants compared to other crops (18%), whereas other interviewee (25%) had no knowledge of the vulnerable crops. Extent of crops destroyed by elephants was significantly higher (86.1%, n = 36)

in farms close to RGR than in those far away (58.8%, n = 165) from the reserve ($\chi^2 = 23.95$, $df = 2$, $p < 0.001$), while the other group (n = 9) did not have farms for cultivation. Higher frequency of respondents experienced incidents of crop raiding elephants during the first half of a year (46.7% n = 210) followed by a less frequency (39.5%) with knowledge of the crop raiding in both halves of the year. The rest of the respondents (13.8%) were not aware about time of a year with high incidents of crop raiding elephants. Most of the respondents (88%) acknowledged that, crop raiding caused by problem elephants would happen during the night while others (12%) were not aware of which time of a day with incidence crop raiding. More immigrants (67.9%, n = 106) than residents (53.8%, n = 104) were affected by crop raiding elephants ($\chi^2 = 4.37$, $df = 1$, $p = 0.037$).

Possible reasons for HEC, were; 1) farm yards might be too close/along the elephant corridor (33.3%). 2) Elephants were looking for water in the village land (25.2%). 3) Elephants prefer to feed on a certain kind of crop (17.1%) and 4) farms are too close to RGR (6.7%), while 5) some of the respondents (17.6%) were not aware of the possible reasons for the HEC in their area. The possible reasons for HEC suggested differed significantly among villages that were close and far away from RGR (Table 1).

Table 1: Possible reasons for HEC suggested by respondents from villages that are close and far away from RGR (n = 210).

		Villages around RGR		χ^2
		Close	Far away	
Possible reason for HEC	Don't know	6 (5.0%)	31 (34.4%)	50.7
	Elephant looking for water	31 (25.8%)	22 (24.4%)	
	Farm yard along/close to elephant corridor	37 (30.8%)	33 (36.7%)	
	Farm yard close to RGR	13 (10.8%)	1 (1.1%)	
	Elephant prefer to feed on certain kind of crops	33 (27.5%)	3 (3.3%)	
Total		120 (100%)	90 (100%)	p < 0.001

A stepwise logistic regression analysis with “effect of crop raiding elephants” as a dependent variable and with “villages’ distance from RGR, distance from farm to RGR and residence status” was significant. Distance from villages to RGR independently explained the variation in crop destroyed by elephant significantly (Table 2).

Table 2: *Logistic regression with "crop destroyed by elephant" (no, yes) as dependent variable, and with village and farm distance and residence status as independent variables.*

Independent Variables	B	S.E.	Wald	df	p
Villages' distance from RGR (close)	-2.050	.396	26.806	1	.000
Farm’s distance from RGR (close)	-.362	.596	.369	1	.543
Residence status (residents)	.504	.355	2.016	1	.156

Awareness of HEC Mitigations

Most of the respondents had knowledge of two groups of mitigation methods. These were; 1) noise making (n = 118, 56.2%) and 2) combination of methods (n = 26, 12.4%). The latter encompasses disturbance shooting organized by wildlife authorities, destruction of problem elephants, making fire during the night around the protected fields, throwing of stones by hand catapult and flashing light. However, some of them (n = 66, 31.4%) were not aware of any HEC mitigation method.

A statistically significantly higher proportion of respondents (84.2%, n = 120) in villages close to RGR had knowledge of HEC mitigation methods applied than those (47.8%, 90) in the villages further away from the park boundary ($\chi^2 = 31.60$, $df = 1$, $p < 0.001$). Furthermore, a statistically significantly higher frequency of interviewee with some education (75.5%, n = 163) appeared to be aware of HEC mitigations applied than those (44.7%, n = 47) who have never been to school ($\chi^2 = 16.04$, $df = 1$, $p < 0.001$).

On other hand, most respondents (77.1%, n = 210) were unable to give comments on effective mitigation measures that should be applied whereas a few argued that, relevant authorities

should come up with effective mitigations (8.1%) along with deployment of rapid problem animal control (PAC) unit (14.8%).

A logistic regression analysis with “awareness of HEC mitigation” as dependent variable and with “level of education, age, sex of respondents, ownership of livestock, effect of crop raiding elephant, distance from villages and farms to RGR” as independent variables was significant. The analysis inferred that, effect of crop raiding elephants and level of education explained the awareness of HEC mitigation significantly (Table 3).

Table 3: Logistic regression with "awareness of HEC mitigation" (no, yes) as dependent variable, and with a set of independent variables as described in the table.

Independent Variables	B	S.E.	Wald	df	p
Effect of crop raiding elephants (not affected)	1.725	.412	17.517	1	.000
Education level (not educated)	1.063	.421	6.376	1	.012
Villages' distance from RGR (close)	-.626	.421	2.211	1	.137
Farm's distance from RGR (close)	-19.457	6426.725	.000	1	.998
Age	.011	.014	.542	1	.462
Sex (male)	-.170	.399	.181	1	.671
Livestock ownership (do not have)	.512	.394	1.689	1	.194

Attitudes of Local Communities toward Elephants and Wildlife Conservation

Participation of locals in conservation, associated with number of variables that include; awareness of benefits from wildlife conservation, distance from villages to RGR, education levels and effect of crop raiding elephants. A larger proportion of respondents (46.5%, n = 129) that was aware of wildlife conservation benefits to the communities in the villages, appeared to support conservation compare to the lower proportion (4.9%, n = 81) without knowledge of the conservation benefits. There was a significant difference among awareness of the wildlife conservation benefits and support to wildlife conservation ($\chi^2 = 40.59$, $df = 1$, $p < 0.001$). Engagement in conservation education and anti-poaching activities are among the wildlife conservation supports acknowledged by of the respondents.

A larger number of respondents (34.4%, n = 90) not aware of conservation benefits, was found in villages located far away from RGR compared to those (18.3%, n = 120) who were in the villages closer to the reserve. Thus, a significantly larger proportion of those (81.7%) who had knowledge of wildlife conservation benefits, were observed to reside in the villages adjacent to RGR ($\chi^2 = 48.40$, $df = 1$, $p < 0.001$; Table 4).

Table 4: Awareness of wildlife conservation benefits in villages close and far away from RGR.

		Villages surveyed around RGR		χ^2
		Close	Far away	
Awareness of wildlife conservation benefit	Not aware	22 (18.3%)	59 (65.6%)	48.40
	With awareness benefit	98 (81.7%)	31 (34.4%)	
Total		120 (100%)	90 (100%)	$p < 0.001$

Participation of local communities in conservation varied according to education levels of the respondents. Statistically significantly higher frequency of respondents (87.5%, n = 64) who support conservation was educated compared to the lower frequency (73.3%, n = 146) that involved those who did not support conservation ($\chi^2 = 5.17$, $df = 1$, $p < 0.023$).

A significantly higher proportional of respondents (81.3%, n = 64) who support conservation were highly affected by crop raiding elephants compared to a lower proportion (52.1%, n = 146) that did not support conservation ($\chi^2 = 17.3$, $df = 1$, $p < 0.001$).

Participation in conservation activities was significantly higher (46.7%, n = 120) in villages close to RGR compared to villages far away from the reserve (8.9%, n = 90; $\chi^2 = 34.64$, $df = 1$, $p < 0.001$).

The study successfully recorded comments from respondents about conservation of elephants and other wildlife. A few respondents gave no comment (14.3%) while others revealed a positive response by giving various suggestions. The comments ranged from deployment of a PAC unit in the conflict zone (35.7%), provision of conservation education (11.9%), introduction

of effective consolation scheme (8.1%), sensitization of HEC mitigation measures and intensive anti-poaching activities (15.2%) to improve management of RGR.

A very small proportion of respondents acknowledged the fact that, elephants have been killed by wildlife authorities during PAC (2.4%, n = 210) and retaliatory killing organised by local people (0.5%) in the village land while the majority (97.1%) were not aware of such killing. The knowledge of elephants killed was not dependent on whether respondents were in villages close or far from RGR ($\chi^2 = 2.61, df = 1, p = 0.11$).

A stepwise logistic regression analysis with “support of locals in conservation” as dependent variable and with “village distance from RGR, conservation benefit awareness, crop destroyed by elephant, level of education, livestock ownership, residence status, age and sex of the respondents” as independent variable was significant. Village distance, conservation benefit awareness and livestock ownership explained most of the variation of locals support in conservation (Table 5).

Table 5: Logistic regression with "support of locals in conservation" (no, yes) as a dependent variable, and with different independent variables as explained in the table.

Independent Variables	B	S.E.	Wald	df	p
Conservation benefit awareness (not aware)	1.717	.613	7.831	1	.005
Villages' distance from RGR (close)	-1.415	.503	7.906	1	.005
Livestock ownership (do not have)	-1.094	.408	7.195	1	.007
Sex (male)	-.568	.418	1.844	1	.174
Residence status (residents)	.171	.400	.183	1	.669
Education level (not educated)	.171	.540	.100	1	.752
Age	.023	.017	1.852	1	.174
Effect of crop raiding elephants (Not affected)	.090	.463	.038	1	.846

Discussion

Human Elephant Conflict

Local communities around RGR have been in conflict with a number of wildlife animals namely; elephants, bush pigs, greater kudus, spotted hyenas, jackals, lions, leopards, small antelopes and primates of which elephants appeared to be most problematic. Damage that have been caused by marauding elephants was crop raiding where local farmers growing maize were the ones who had been suffering most from human elephant interactions in that area. Crop raiding elephants as the most problematic animals have also been reported by other studies where farmers close to PA's were highly affected such as those around Amboseli National Park in Kenya, Ruaha National Park in Tanzania, and a number of protected areas in Bangladesh (Nahonyo, 2001, Okello, 2005, Raihan Sarker and Røskaft, 2010). Extent of crop destruction associated with problem elephants have been affected by distance of villages from the boundary of PA's. The villages close to RGR more than those the further away, were highly affected by crop raiding elephants. A same finding has been reported by other studies where the villages close to PA's have experienced great losses caused by elephants (O'Connell-Rodwell et al., 2000, Raihan Sarker and Røskaft, 2010, Sukumar, 1991). Results of this study and others as mentioned above support the first hypothesis that, crop raiding incidents observed to increase with decreasing distance from the boundary of RGR. Crop destruction caused by elephants was thus associated with distance of villages and farms from the PA's boundary and presence of immigrants. More immigrants than residents were highly affected by problem elephants in the local communities around RGR. However, distance of villages had a strong impact on the extent of HEC in the area. With that background local communities in villages close to the park are more vulnerable to problem elephants than those in villages faraway.

The study revealed that, incidences of crop raiding elephants are more pronounced during the first half of a year dominated by wet season. Moreover, results of this study inferred that, reasons behind damage caused by crop raiding elephants are associated with ecological behaviour of African elephant and land use activities of the surrounding communities especially farmers. Migration of the African elephant through wildlife corridors that connect RGR with other PA's,

preference of certain kinds of crops, searching of water in the villages' land, lack of buffer zones, crop cultivation along/close to wildlife corridors are the main reasons for occurrence of HEC.

Other studies have come up with the supportive findings that, crop cultivation near a PA's, wildlife corridor or water sources, can be among the reasons for an upsurge of damage caused by crop raiding elephants (Naughton et al., 1999, Mosojane, 2004). Furthermore, vulnerability to problem elephants is not only associated with distance from the villages to the PA's, but also concentration of immigrants and land use activities especially farming around the reserves (Nahonyo, 2001, Okello, 2005, Nelson et al., 2003). An increasing human population and engagement in farming activities near RGR are likely to be major reasons for incidences of crop raiding elephants supported by the fact that, immigrants were more affected than residents. Most of the immigrants near RGR are from the Sukuma tribe originated from the northern part of Tanzania (Mwanza and Shinyanga Regions). They have been moved from their regions as nomadic agro-pastoralists to other regions in searching of fertile land for farming and grazing livestock. Demand of the fertile land for agriculture by this ethnic group, have been reported to involve resource use conflicts between human and wildlife (Njau et al., 2013). Destruction of Usangu wetlands in the southern part of Ruaha-Rungwa ecosystem is reported from the same study to have been caused by pressure of increasing human population associated with immigrants. The wetlands have offered habitats for wildlife and serve as the main source of water for wildlife populations including elephants in the southern part of the ecosystem.

Awareness of HEC mitigations

Findings of this study revealed that, most of local communities in villages close to RGR were aware of two groups of HEC mitigations. HEC mitigations applied by the affected communities themselves and those which were organized by the wildlife authorities. Noise making, flash light, use of fire around the fields and hand catapult were applied by the local communities while disturbance shooting and destruction of problem elephants were implemented by wildlife authorities. The traditional methods applied by the locals are of simple technology and affordable. Noise making techniques involve hitting objects such as tins, drums, yelling, and sometimes whistling to deter problem elephants from the fields. The noisemakers also referred to

as auditory deterrents, are pointed out by other studies as one of the low cost methods applied by affected communities near the parks to deter crop raiding elephants (Osborn and Parker, 2003). The same findings were obtained from a study conducted near PA's in Namibia where noise making methods were used by local communities adjacent to the PA's to deter crop raiding elephants (O'Connell-Rodwell et al., 2000). Furthermore, disturbance shooting and destruction of problem elephants have been used by wildlife authorities near PA's in Kenya to deter crop raiding elephants from agricultural land (Hoare, 2001, Hoare, 2012). The results of my study and other studies explained above, support my second hypothesis that, local communities close to RGR are aware of HEC mitigations than those who are faraway. However, other study has pointed out that, application of traditional technique in controlling HEC have failed in various areas (Sukumar, 1991). Either, disturbance shooting and destruction of crop raiding could not repel crop raiding elephants from agriculture land close to PA's in Kenya and Zimbabwe. It was learned that, problem elephants habituate to gun shots with time and killing of crop raiding elephants to lesson other members of the group "not to return to the crop field" proved wrong (Hoare, 2001). Other studies explained that, each HEC mitigation has its own setbacks (Sitati and Walpole, 2006) in that background, it is recommended to deploy a combination of methods for effective management of crop raiding elephants (Parker and Osborn, 2006).

However, very few among the local communities near RGR came up with suggestions of effective HEC mitigations that include; deployment of rapid problem animal control unit that involves disturbance shooting and destruction of problem elephants organized by wildlife authorities. Most of the local people close to the reserve were unable to suggest any effective HEC mitigations that should be applied to get hold of marauding elephants. Crops cultivated by locals in the area seemed vulnerable to crop raiding elephants where maize was more affected. Other studies have recognized chilli (*Capsicum spp*) as a cash crop with high economic value that can also serve as an input of community-based HEC mitigation (Osborn and Parker, 2002). Chilli appeared less palatable to crop raiding animals compared to other crops such as maize (*Zea mays*), sorghum (*Sorghum vulgare*) and cotton (*Gossypium hirsutum*). In that case it has been suggested that, chilli can be a suitable alternative crop for the communities which share the same land with the crop raiding animals (Parker and Osborn, 2006). Furthermore, noise from African honeybees (*Epis meliffera*) is known to be deterrent to African elephants where upon hearing sound from

disturbed honeybees African elephants produced alarm calls and make all members in the group to run away from the source of that sound (King et al., 2010). Despite of the presence of some limitations, beehive fences hold to be one of the most effective mitigation methods of crop depredation caused by African elephants (King et al., 2009). Even though locals close to RGR revealed to be aware of HEC mitigations but incidences of crop raiding elephants were high in the same area. Thus, application of effective mitigation measures is required to ensure sustainable co-existence among humans and African elephants. In Namibia, electric fences appeared to be effective in protecting agricultural fields close to the PA's (O'Connell-Rodwell et al., 2000). The fields with electric fence were not affected by crop raiding elephants whereas those without fence were highly affected.

Attitudes

In this study, attitudes of local people toward conservation of elephants and other wildlife was assessed based on willingness to participate in conservation activities and reactions of the locals owing damage caused by crop raiding elephants. Participation of local communities in conservation appeared to have significant associations with a number of variables such as; awareness of conservation benefits, distance from the villages to RGR, education level and effect of crop raiding elephants. The regression analysis revealed that, only conservation benefit awareness, villages' distance and ownership of livestock had strong influence on the willingness of local communities to participate in conservation. However, effect of crop raiding elephants had no significant influence on participation of locals in conservation, where the communities suffered from crop raiding in villages close to the reserve appeared to participate in conservation. Either, damage caused by people around RGR such as killing of elephants was in very small proportion where it was not related to the effect of crop raiding elephants. Either, in the focussed group discussion¹ with members of village of government councils and wildlife officers of Manyoni

¹ Key informants were selected from the sampled villages and stakeholders involved in HEC management from the local to the national level for formal and informal discussions. Seven group discussions were conducted one from each of the selected villages. Each group had a range of five to ten members from village government council. Either, I had four discussions with a Manager of RGR, Game Officer of Manyoni District, Head of Anti-Poaching Unit of Manyoni and Head of Problem Animal Control Unit at Wildlife Division respectively.

District it was noted that, killing of problem elephants in villages around the reserve happened during the problem animal control organised by wildlife authority. In that view, the results of this study do not support the third hypothesis which state that, HEC cause negative attitudes toward elephant and wildlife conservation. The results inferred that, other factors apart from the effect of crop raiding elephants, affect the attitudes of the communities around the reserve.

From the discussions with key person informants, local communities appeared to receive benefits from hunting tourism conducted in RGR. From the financial year 2011/2012 through 2014/2015, 25% of revenues collected from the trophy hunting by the central government was disbursed to support social economic developments of the local people. Manyoni District received a total amount of TZS 324,962,413 (147,710USD) for enhancement of the social services. Benefit from conservation directed to locals close to RGR, can be the main factor which outweigh cost which they incur from crop raiding elephants. The same finding was also reported by a study conducted in Zimbabwe where the local communities were observed to accept costs of sharing the same land with African elephants (Hoare and Du Toit, 1999). But the same study put clear that, people can accept costs from wild animals to a certain threshold beyond which the wild animals suffer from negative attitudes of the affected people.

In line with the third hypothesis, other studies found that, people who experienced food insecurity caused by crop raiding animals, have developed negative attitudes toward wild animals involved (Barirega et al., 2010, Nahonyo, 2001). Management of crop raiding elephants near RGR is imperative where affected farmers are more likely to experience food insecurity and in turn develop negative attitudes toward problem elephants. Contrary to the results of this study, local people affected by damage caused by elephant in the southern part of Ruaha-Rugwa Ecosystem, showed negative attitudes. The locals reacted by killing problem elephants through pit traps and spears (Nahonyo, 2009). In that background, negative attitudes developed in people around PA's due to HEC, can be a threat to population viability of the African elephant.

Conclusion and Recommendations

Conclusion

Farmers in the villages close to RGR were highly affected by crop raiding elephants compared to those in villages faraway supporting my first hypothesis. Land use activities and increasing human population caused by influxes of immigrants are among the reasons behind negative interactions between humans and elephants around the reserve. In line with the second hypothesis, awareness of HEC mitigations was higher among local people near RGR compared to those who reside far away from the reserve. However, effectiveness of the mitigations applied is questionable the fact which suggest a need of building capacity for more community-based mitigations. Contrary to the third hypothesis, incidences of crop raiding elephants had no effect on attitudes of the local communities adjacent to RGR. However, awareness of conservation benefits had stronger influence on the attitude of people around the reserve where participation of locals in conservation was effectively explained by the awareness of conservation benefits. Even though, attitudes of local people were not affected by the effect of crop raiding elephants, management of HEC around the reserve is of crucial important because cost tolerance of the locals has its threshold.

Recommendations

Management of HEC

Alleviation of HEC around RGR should first and foremost involve effective management of suitable habitat for African elephants that include among others; effective supervision of PA's, buffer zones, dispersal areas and corridors. Human activities should be as minimum as possible in the habitat of elephants. In that view, elephants would meet their need without being in compromise with goals of the surrounding communities.

Community Based Conservation

Village lands around RGR encompass potentials for conservation of elephants and other wildlife that attract involvement of local communities in conservation through establishment of Wildlife Management Areas (WMA). Either, WMA provide the opportunity for local communities

to set aside areas for and participate in conservation of wildlife and other biological resources. With that tool, communities will take charge of conservation outside the core protected areas along with sharing of cost and benefits associated with wildlife. Eventually, HEC will be minimized due to the facts that, WMA involve effective supervision of dispersal areas, corridors, and buffer zones.

Land Use Planning

Land use planning is one of the important tools which is missing in most of the villages around RGR that could be helpful in controlling land use activities of the local peoples. Implementation of the land use planning would recognize management of the buffer zones, dispersal areas, wildlife corridors and core protected areas. That will ensure effective control of resource use conflicts between human and wildlife especially those with wide home range such as elephants.

Community-based Wildlife Deterrents

Relevant authorities responsible for management of Human Wildlife Conflicts (HWC) such as Wildlife Division (WD) and Tanzania Wildlife Research Institute (TAWIRI) should enforce sensitization of effective community-based HEC mitigations in areas near RGR. The awareness of effective mitigation methods which can be applied by the communities themselves are very pertinent as that will reduce reliance on Problem Animal Control Unit from wildlife authorities. The HEC mitigations that should be introduced in the area include among others; chilli and beehives fence techniques. These measures are more advantageous as they can safely deter elephants away from the conflict zone and at the same time serve as a source of livelihood.

Further Studies

This study assessed HEC based entirely on the knowledge of local communities around RGR. I would recommend further studies to concentrate on monitoring actual movement of

elephants in Ruaha-Rungwa ecosystem that may involve radio collaring along with observation of damage caused by both problem elephants and the local people.

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Appendix (Questionnaire used)

Questionnaire for household,

Questionnaire No: _____ Interviewer: _____ Date _____

Household GPS Coordinate: -

_____ Village _____

A. General information about a respondent

- I. Sex: 1. Male () 2. Female ()
- II. Tribe _____
- III. Place of origin _____
- IV. Age: 1. 18-30 (), 2. 31-40 (), 3. 41-50 () Above 50 ()
- V. Level of Education: 1. Primary school (),
2. Secondary school or above (),
3. Other (specify) _____
- VI. Were you born in this village? 1. Yes (), 2. No ().
- VII. If immigrated to this village, what was the reasons?
 1. Land for agriculture ()
 2. Pasture for livestock ()
 3. Marriage ()
 4. Employment ()
 5. Income generating activities ()
 6. Education for children ()
 7. Other (specify) _____
- VIII. Household composition

Gender	Number	Adults (≥ 18 year)	Youth (11 -17years)	Children (6 -10 years)
Males				
Females				
Infants (0-5 yrs)				

IX. What are your major sources of income?

1. Cultivation ()
2. Livestock keeping ()
3. Charcoal making ()
4. Employed ()
5. Business ()
6. Others (Specify) _____

X. If cultivation is among the source of your income, what types of crops do you grow?

B. Nature and types of human elephant conflict in relation to the distance from Rungwa Game Reserve and other human wildlife conflicts

1. Have you ever experienced conflicts/problems with elephants in your village in the past 2 years?

1. Yes (), 2. No ().

2. If an answer for the question above is "yes" What are types of conflicts with elephants known to occurred in the past 2 years based on the following categories,

1. Crop raiding ()
2. People attacked and killed ()
3. People were attacked and injured ()
4. Grain stores demolished by elephant ()
5. Water infrastructure destroyed ()
6. Livestock were attacked by elephant ()
7. Others (specify) _____

3. What are the possible reasons/conditions that influence elephants to attack people, damage crops and other property based on the following alternatives?

1. Elephants looking for water in the village land ()
2. Settlement along / close to wildlife/elephant corridor ()
3. Farm yard close or along the elephant corridor ()
4. Settlement and/ or farms close to RGR ()
5. Elephants prefer to feed a certain kind of crop(s) ()
6. Others (specify) _____

4. What is the average distance from your home to RGR

1. <1Km ()
2. >1km ()

5. Where do you fetch water for domestic use?

1. Natural springs, rivers, dams or basins in the public land ()
2. Natural springs, rivers, dam, or basins in RGR ()
3. Piped water ()
4. Shallow wells ()
5. Other sources (Specify) _____

6. Do you share the same water sources with elephants? 1. Yes (), 2. No ().

7. If the answer for the above question is "yes" what are they?

1. Natural springs, rivers, dams or basins in the public land ()
2. Natural springs, rivers, dam, or basins in RGR ()

3. Others (Specify)_____

8. Can you recall the average damage of crops (in acres) caused by wild animals for the past 12months?

	Type of crop	Acres cultivated	Acres damaged	Animals responsible
1				
2				

9. Rank crops with respect to their vulnerability to crop damage by wildlife?

1. _____
2. _____
3. _____

10. Do you face problems with other wild animals in your area? 1. Yes (), 2. No ()

11. How can you rank them including elephant from the most problematic to the least ones?

1. Elephant ()
2. Hyena ()
3. Bush pig ()
4. Baboon ()
5. Lion ()
6. Others (Specify)_____

12. Do wild animals prey on your livestock? 1. Yes (), 2. No ()

13. If the answer to question above is yes, what are the wild animals involved and the livestock preyed?

Year	Wild animal involved	Livestock killed	Number of livestock
	1.		
	2.		
	3.		

14. What is the average distance from your farms to RGR?

1. < 1Km ()
2. >1km ()
3. Do not have farm ()

15. Do you have the livestock? Yes (), No ()

16. If the answer is yes for the question above, how many livestock do you own? (Number)

1. Cattle_____
2. Sheep_____
3. Goat_____
4. Others (specify)_____

17. Where do you fetch pasture for your livestock?

1. From the village land which is >1km from RGR ()
2. From the village land which is <1km from the RGR boundary ()
3. Others (Specify)_____

18. Where do you get water for your livestock?

1. Natural springs, rivers, dams or basins in the public land ()
2. Natural springs, rivers, dam, or basins in RGR ()
3. Others (Specify)_____

C. Awareness of local communities toward HEC mitigation measures

19. Are you aware of mitigation measures that have been applied to control HEC? Yes (), No ()

20. What are the mitigation measures currently in place for the control of HEC? (Rank them by name and number in the bracket from the most effective to te least ones)

1. Disturbance shooting ()
2. Destruction/killing of the problem elephant ()
3. Chili methods ()
4. Making noise through bang of tins and other noise making objects ()
5. Beehives fence ()
6. Flash light ()
7. Consolation scheme ()
8. Others (Specify)_____

21. What are the other mitigation measures which you think will be effective when applied?

1. Translocation of problem elephants ()
2. Eviction of people from the conflict zone ()
3. Others (specify)_____

22. Is crop raiding seasonal?

1. Yes () which months _____
2. No () or year round, for which crops_____

23. At what time of the day do most of HEC incidents occur?

1. Day ()

2. Night ()

24. Upon HEC incidents, where do you report such cases?

1. Village leaders ()
2. Ward leaders ()
3. District Game Officer ()
4. Wildlife authority (Management of RGR, Antipoaching Units etc) ()
5. Others (Specify)_____

25. What can you say about the response of the relevant authorities after they receive the report of cases?_____

D. Attitude of local communities toward elephants and wildlife conservation

26. Have you ever heard of elephant killed in the village land? 1. Yes (), 2. No ().

27. If the answer for the above question is "yes" what was the reason for the killing?

1. Problem animal control conducted by wildlife authority ()
2. Problem animal control organized by the local people ()
3. Poaching for ivory involved local people ()
4. Retaliation killing organized by affected people ()
5. Others (Specify)_____

28. Can you share the same land with elephant? 1. Yes (), 2. No ()

29. Is there any importance of conserving elephant and other wildlife? 1. Yes (), 2. No ()

30. What are the benefits you normally get from elephant and wildlife conservation?

31. Do you support the current conservation initiatives of elephant and other wildlife? 1. Yes (), 2. No ()

32a). If yes, what kind of support do you offer?

1. Play the role of informant in uncovering of poachers ()
2. Participate physically in anti-poaching activities with wildlife authority ()
3. Others (specify)_____

b). If no, why not and do u have any suggestions to improve these conservation initiative or something similar_____

33. What are your comments or interesting suggestions/story related to HEC, elephant and wildlife conservation? _____