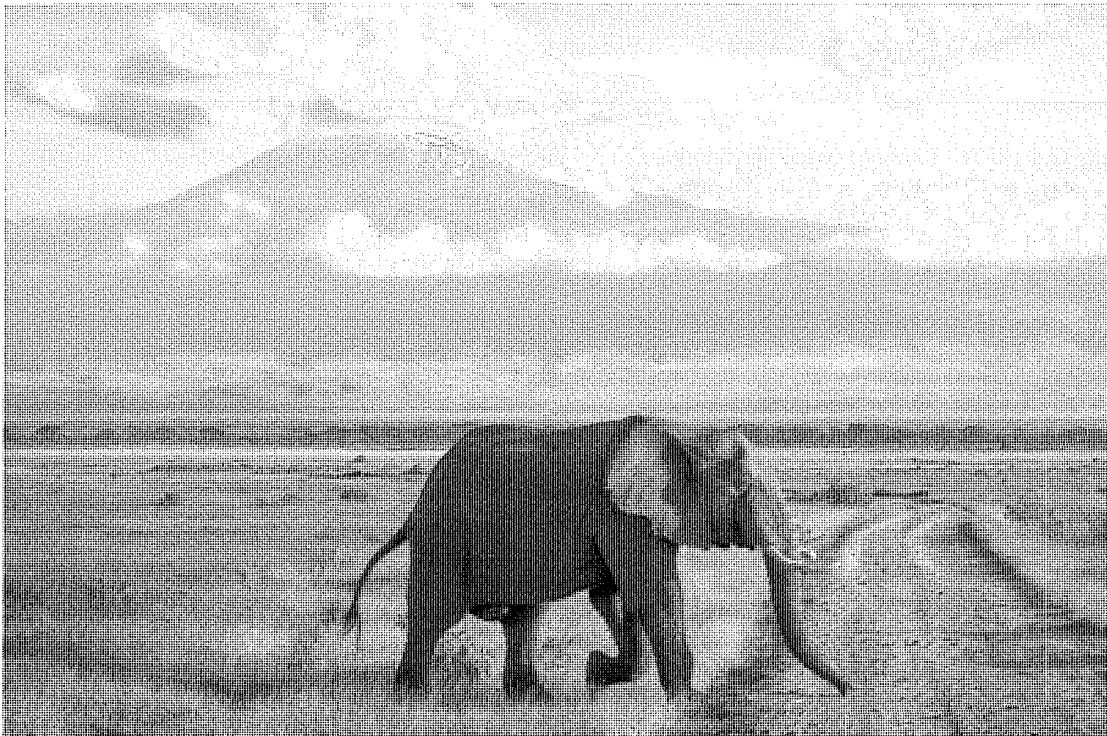


# Human-Elephant Conflict in the Wildlife Corridors of Northern Tanzania

Extended Essay | Environmental Systems and Societies



*(Elephant Crossing The Road, 2012)*

### Acknowledgments

First and foremost, I'd like to thank \_\_\_\_\_, my supervisor, for his ongoing support and guidance through the writing process of this research paper. I'd also like to express my gratitude to the workers at the Lake Manyara National Park for speaking to me about the human-elephant conflicts in the Lake Manyara-Tarangire wildlife corridor. Special thanks to their park ecologist - \_\_\_\_\_, and \_\_\_\_\_ and \_\_\_\_\_ - park rangers.

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## Introduction

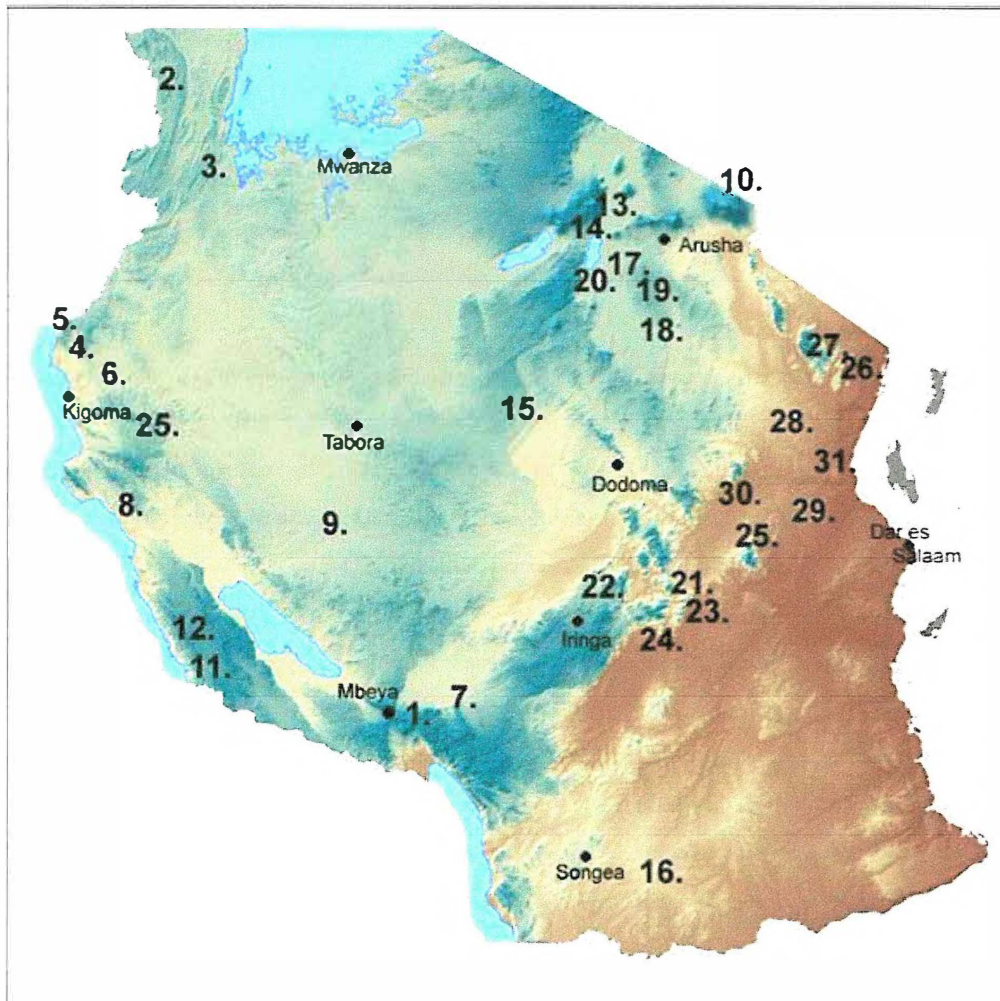
Tanzania is known to have some of the most spectacular wildlife in the world and a profusion of natural resources. With more than 25% of its land made up of protected areas (Jones *et al.*, 2009), at the heart of conservation today is the country's ongoing struggle of balancing the ever-growing human population of 46,261,942 and its diverse fauna and flora (CIA, 2007). Although Tanzania puts its best efforts in protecting the magnificent wildlife, the urbanization of rural areas and the change to an agricultural way of life results in the destruction of habitat and wildlife (Weiss, 2013). As this occurs, communities neighboring protected areas and its buffer zones are often put at great risk from human-wildlife conflicts due to edge effects (Shemwetta and Kideghesho, 2000).

In recent years, it has become increasingly challenging to prevent protected areas from becoming isolated (Hofer and Mpanduji, 2004). Pieces of land get disconnected from each other due to the expansion of agricultural plots and human settlements (Jones *et al.*, 2013). The isolation of land is a true concern as habitats need to be connected for wildlife to truly thrive and sustain itself for years to come. 'Islands' of land prevent animals from relocating to a new habitat when changes occur in the ecosystem (i.e. dry/wet season) and so survival becomes extremely challenging (EPRD, 2004). As the wildlife populations become segregated, it is difficult for them to be with members of their own species (Hofer and Mpanduji, 2004). Therefore, there is also a loss of genetic variation in future offspring due to inbreeding; this has its own implications on the species' well-being as it 'will lead to vulnerability to various diseases and genetic defects (Richard, 2011).' In addition to this, the fragmentation of land results in a further collapse of ecological processes like migration, dispersal and other natural functions that are essential for healthy ecosystems (EPRD, 2004).

With an rapidly growing human population in rural areas in Tanzania, the survival of the African elephant species (*Loxodonta africana*) goes at the top of the agenda for many conservationists and ecologists. Wildlife corridors are crucial in reducing the effects of the land fragmentation and human developments as they act as an environment that allows elephants to migrate between protected areas. However, human-elephant conflict in wildlife corridors is particularly a problem in northern Tanzania.

Wildlife corridors make it feasible for species to migrate safely between 'islands' and are normally recognised through their use by landscape-species (eg. *Aciononyx jubatus*, *Loxodonta Africana*) (Mduma *et al.*, 2015). The Tanzania Elephant Management Plan defines a wildlife corridor as 'an area with no legally protected status lying between two protected areas, through which wild animals are known or believed to move, and which connects the two protected areas by natural vegetation types such as grassland or forest (or where such a connection could be restored) (Mduma *et al.*, 2015).' Figure 1 illustrates a map of Tanzania's wildlife corridors which corresponds to the list of confirmed corridor names in Figure 2 (Jones *et al.*, 2009).

**Figure 1.** Map of Tanzania and its Wildlife Corridors (Jones *et al.*, 2009)



*N.B. Numbers on the Map correspond to the Corridor Names in Figure 2*

**Figure 2.** Names of the Confirmed Wildlife Corridors in Tanzania (Jones *et al.*, 2009)

Map Number	Corridor Name
1	Bujingijila (Mt. Rungwe-Livingstone)
2	Burigi-Akagera (Rwanda)
3	Burigi-Moyowosi/Kigosi
4	Gombe-Kwitanga
5	Gombe-Mukungu-Rukamabasi
6	Greater Gombe Ecosystem-Masito-Ugalla
7	Igando-Igawa
8	Katavi-Mahale
9	Katavi-Rungwa
10	Kilimanjaro-Amboseli (Kenya) (Kitendeni)
11	Loazi-Kalambo
12	Loazi-Lwafi
13	Manyara Ranch-Lake Natron
14	Manyara-Ngorongoro (Upper Kitete/Selela)
15	Muhezi-Swaga Swaga
16	Selous-Niassa (Mozambique)
17	Tarangire-Makuyuni (Makuyuni)
18	Tarangire-Mkungunero/Kimotorok
19	Tarangire-Simanjoro Plains
20	Tarangire-Manyara (Kwakuchinja)
21	Udzungwa-Mikumi
22	Udzungwa-Ruaha
23	Udzungwa-Selous
24	Udzungwa Scarp-Kilombero NR (Mngeta)
25	Uluguru North-South
26	Usambaras, East (Derema)
27	Usambaras, West
28	Wami Mbiki-Hangeni/ Southern Masai Steppe
29	Wami Mbiki-Jukumu/Gonabis/Northern Selous
30	Wami Mbiki-Mikumi
31	Wami Mbiki-Saadani

The Tanzanian Wildlife Research Institute (TNP, 2013) have identified five types of corridors in Tanzania:

- I. 'Unconfirmed corridors' that are inadequately documented as there is little information recognizing whether they are still in use;
- II. 'Uncultivated lands between protected areas' with few records on migration between protected areas;
- III. 'Continuous or semi-continuous non-agricultural land between protected areas with anecdotal information on animal movements';
- IV. 'Known animal movement routes between protected areas' and
- V. 'Potential connectivity of important habitats (Jones *et al.*, 2009).'

Corridors are especially important for the existence of African elephants (*Loxodonta africana*). Since elephants have such a large home range (approximately 3000km<sup>2</sup>), the maintenance of wildlife corridors is crucial (Feeding Ecology and Diet, 2013). The home range of a particular species is the area in which the animal normally stays in (Encyclopedia Britannica, 2013). This includes 'the region that encompasses all the resources the animal requires to survive and reproduce.' Much is being done to protect Tanzania's elephant population, but in recent years, researches have found an 'increasing loss of connectivity between core wildlife habitat areas (Mduma *et al.*, 2015).' As a result there is a danger of human-elephant conflicts as human settlements move into elephant range (Mduma *et al.*, 2015). Interaction between the two populations is said to be 'exclusively negative (Lee and Graham, 2006).' Conflicts normally include: injuries and fatalities, 'financial losses as a result of crop-raiding', and 'constraints on general day-to-day human activities (Lee and Graham, 2006).'

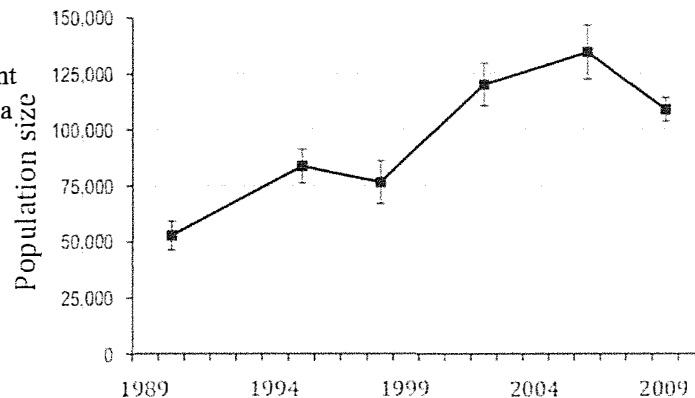
Tanzania has a number of wildlife corridors, many of which are in inadequate condition to act as suitable corridors as they may no longer be viable in a few years (Jones *et al.*, 2009). As human-elephant conflict is a matter that currently affects northern Tanzania, this essay will discuss the following question: To what extent are the wildlife corridors in northern Tanzania effective in reducing human-elephant conflicts near protected areas and what suggestions can be made to manage this conflict?



### Kilimanjaro-Amboseli (Kitendeni) Wildlife Corridor

The elephant population in Tanzania has been fluctuating for a number of years (*Figure 3*), however in 2009, it was estimated at 109,051 (Mduma *et al.*, 2015). Several years of poaching in the 1980s, resulted in a population of just over 55,000 elephants. After reaching its peak in 2007 with approximately 130,000 elephants, the population began to decline at an astonishing rate, resulting in a population of around 110,000 elephants. This decrease in elephant population is a cause for concern because there is severe conflict occurring between the human and elephant populations, bringing us to this result.

**Figure 3.** The elephant population in Tanzania between 1989-2009 (Mduma *et al.*, 2015)



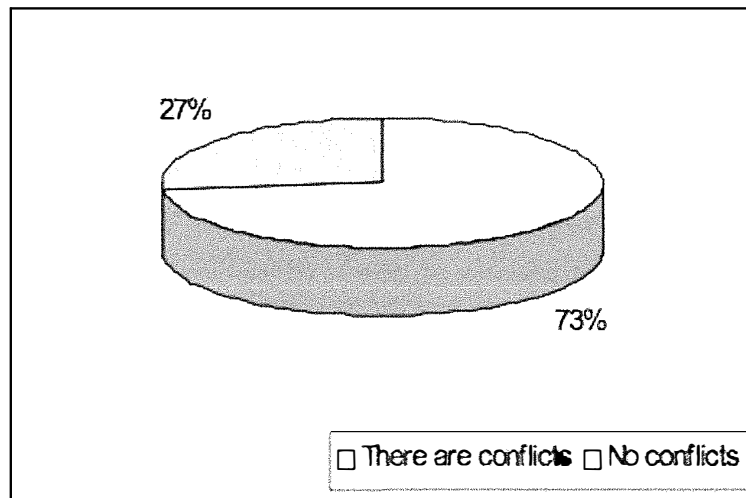
The majority of corridors in Tanzania are largely threatened by human impact in recent years, however, the wildlife corridor between Mt. Kilimanjaro and Amboseli National Park (Kitendeni wildlife corridor; 10) is especially put at risk. The Kitendeni wildlife corridor is located on the northwestern side of Mt. Kilimanjaro and connects to the Amboseli National Park in Kenya. Therefore, the Kitendeni corridor also goes through the international border between these two nations. Like many of the other corridors in Tanzania, this one is greatly under threat from the increase of human activities in this area.

A study was conducted by Christine Noe in 2003 which aimed to 'asses the extent and magnitude of land use changes between 1952 and 2001', 'the causes of such land use changes', and their impacts on the Kitendeni wildlife corridor and its biodiversity (Noe, 2003). A field survey was conducted on four villages: Kamwanga, Irkaswa, Kitendeni and Lerangw'a (Noe, 2003). Researchers studied the villages on the Tanzanian side of the wildlife corridor and also ones that bordered it. 30 people were interviewed from each village and only 10 were interviewed in Irkaswa. During the interviews, villagers were asked whether there were any forms of human-wildlife conflict taking place in the corridor. From the 100 people that were questioned, approximately 26.7% reported no conflicts and 73.3% said there were conflicts, as seen in *Figure 4* (Noe, 2003). Species that seemed to cause the most trouble, were: 'gazelle, baboons, elephants, warthogs,



**Figure 4.** Human-Wildlife Conflicts in Kamwanga, Irkaswa, Kitendeni and Lerangw'a (Noe, 2003)

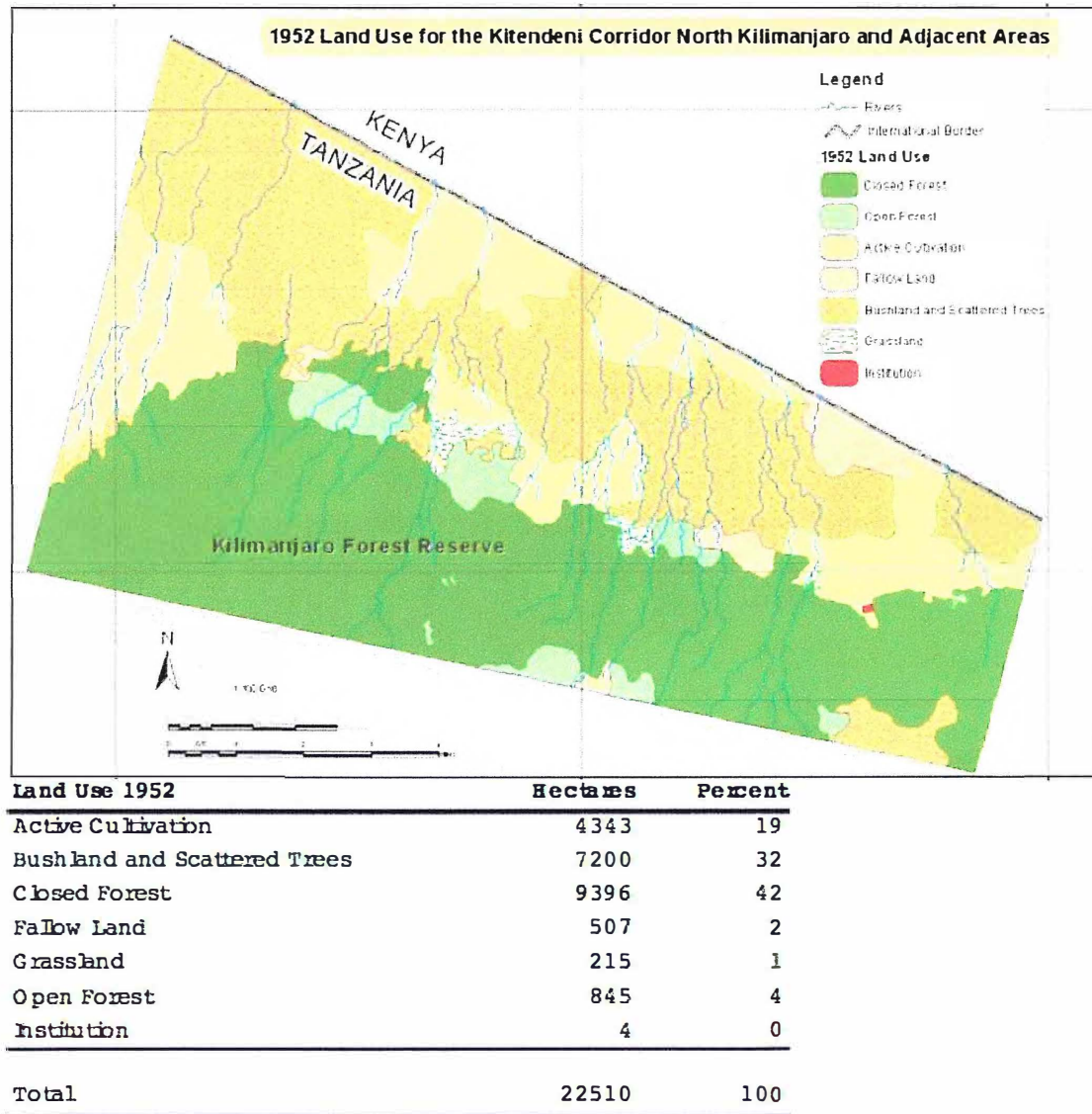
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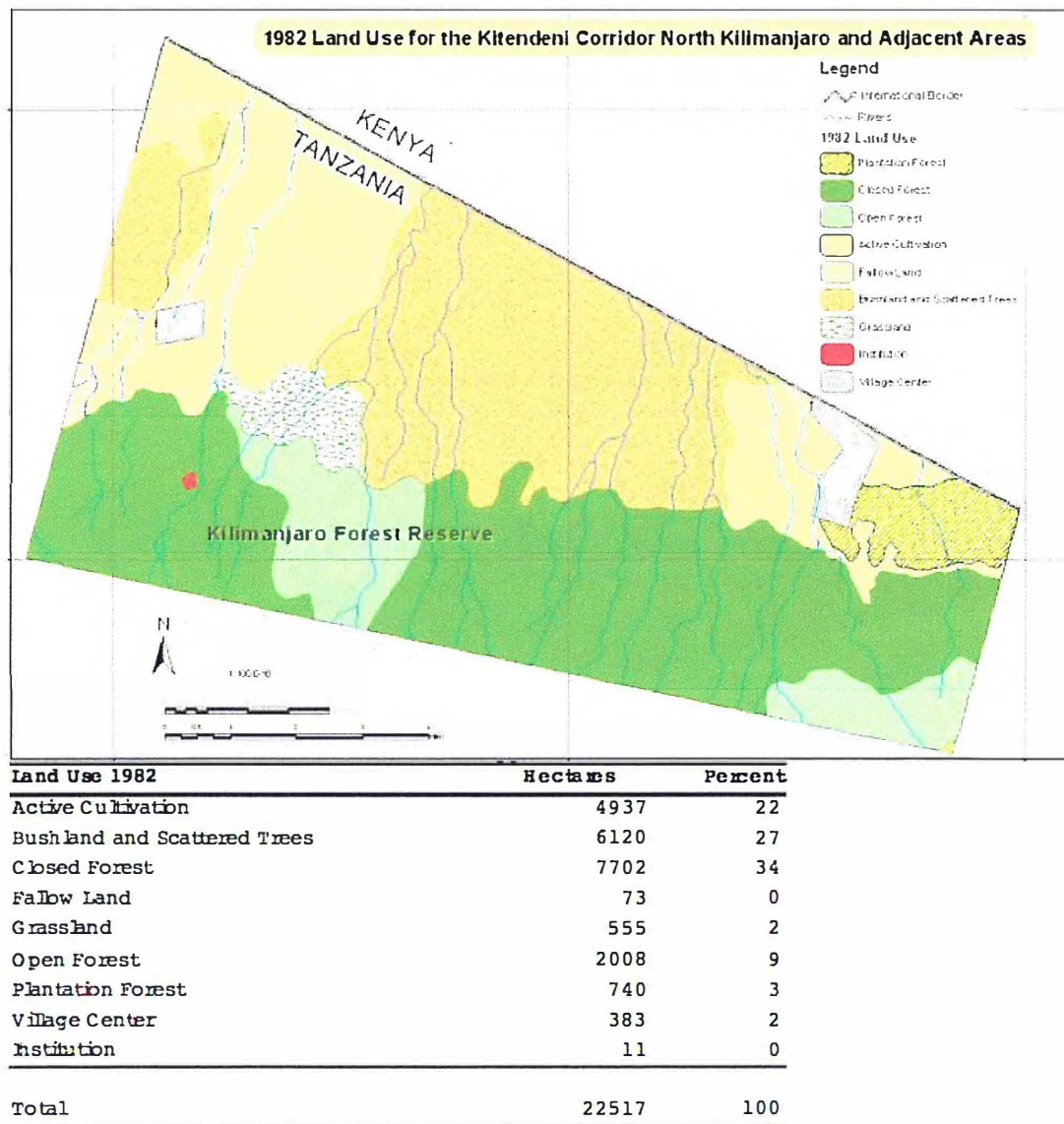
elands, buffaloes, velvet monkeys, rodents and gerenuks (Noe, 2003).’ The human-wildlife conflict on the corridor, which truly began after the 1970s, could be attributed to its size. TAIWIRI states that the width of the Kitendeni corridor ‘was reduced from 10km in 1990 to 5km in 2000 (Jones *et al.*, 2009).’ Although a shocking fact, changes in land use from grazing areas to farms and settlements are likely to have caused the increase in human-wildlife conflict. Evidently, areas that were previously used for dispersal are now either blocked by settlements and farms, for that reason, wild animals have had to continue using their old migration routes.

Having said that, it is difficult to be certain of the exact percentage of villagers experiencing such conflict. This data refers to the human-wildlife conflict in the Kitendeni corridor but not specifically to the interactions with elephants. Therefore, the assumption has to be made that as human-wildlife conflict increases, so does the conflict between the human and elephant populations. It is also just as important to consider the weaknesses in the sampling procedure. Due to the fact that the data in this study was collected primarily using interviews, it is likely that conflict reported by villagers could be due to slight exaggeration from the intention of getting compensation for their troubles (Caro *et al.*, 2009).

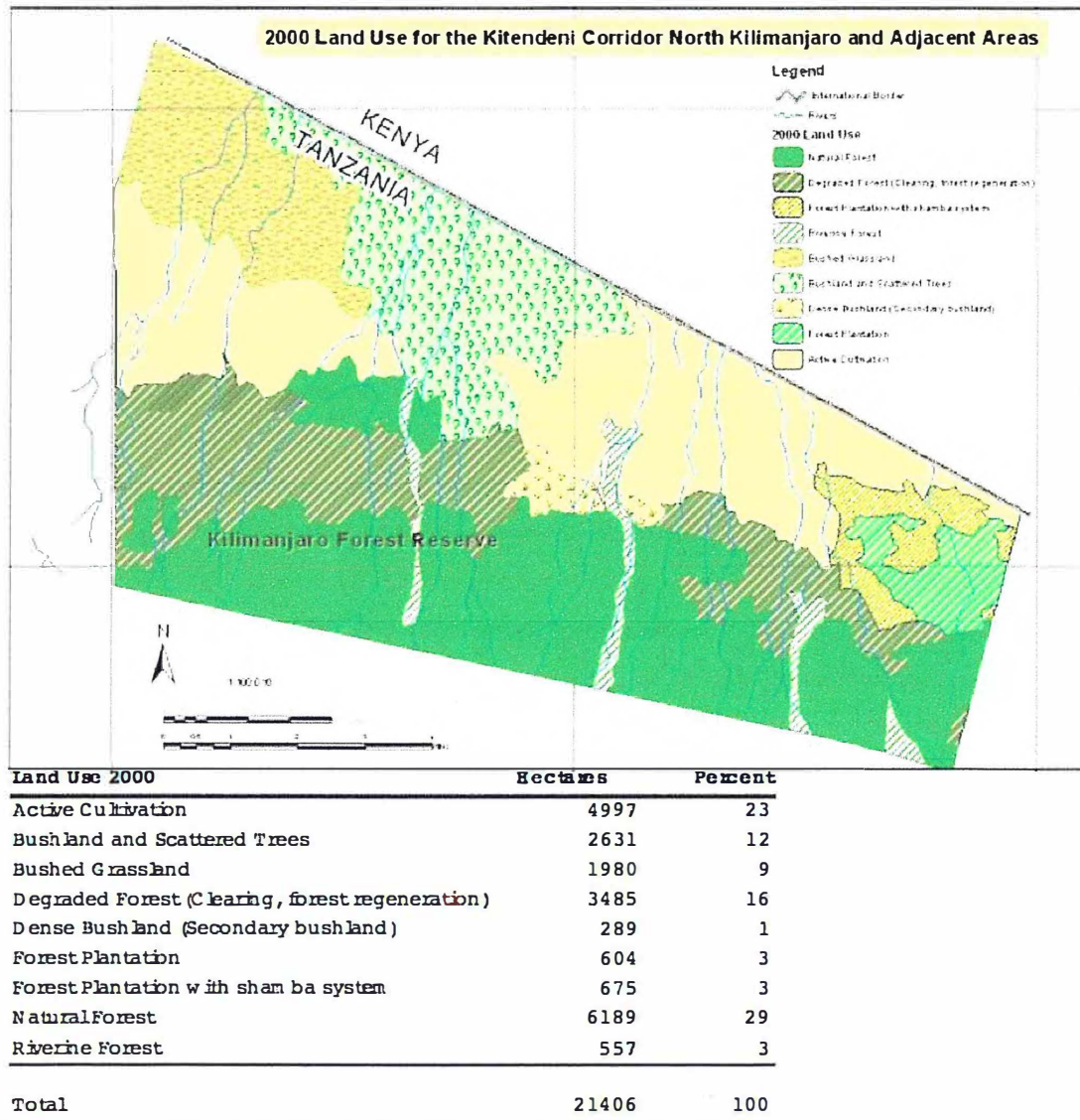
In addition to the structured interviews, aerial photographs were taken in 1952 and 1982; in 2000 satellite imagery was used (Noe, 2003). The areal extent of each type of land cover looks at their proportions and changes, relative to their study periods. For the purposes of this study, the cover type ‘Bushland and Scattered Trees’ refers to the routes used by wildlife to migrate and the areas in which they graze. From *Figure 5* and *Figure 6*, one can see that the area covered by bushland and scattered trees has decreased from 7,200 ha to 6,120 ha. In other words, this cover type has gone down from 32% to 27%.

**Figure 5.** Land Use/Cover Types in 1952 in the Kitendeni Corridor (Noe, 2003)

**Figure 6.** Land Use/Cover Types in 1982 in the Kitendeni Corridor (Noe, 2003)



**Figure 7.** Land Use/Cover Types in 2000 in the Kitendeni Corridor (Noe, 2003)



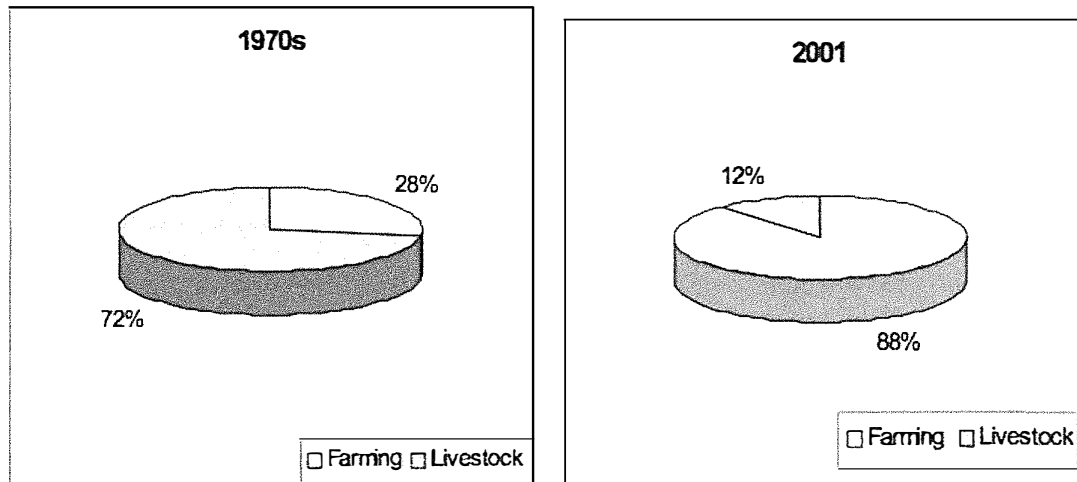
From 1952 to 1982, it is evident that active cultivation has increased from 19% to 22%. Researchers suggest that there was active cultivation in the Kamwanga area and this was heavily concentrated around settlements. Due to the fact that the agricultural activity has been allowed on the corridor, it has greatly decreased its size and also affected the migratory routes. This has evidently had an effect on the relationship between the human and elephant populations.

*Figure 7* shows a continuation of the trend explained above. The cover type 'Bushland and Scattered Trees' has been converted to other types of land. This no longer provides a safe environment for the elephants to migrate in, between the Kilimanjaro and Amboseli national parks. From 1982 to 2001, it is evident that the active cultivation has not changed much, in fact, it has increased by only 30 ha. However, a new cover type is present in the satellite image - degraded forest. It is likely that this forest is being cleared for agricultural purposes. Therefore, we can assume that the active cultivation is much higher now, in 2013. One can see that 'Bushland and Scattered Trees', in other words - the migratory routes, make up only 12% of this area (2631 ha). This is, approximately, a 63% decrease from 1952 to 2001. Villagers stated that, 'the land use pattern in 1952 favoured a range of wild animals that were passing through the corridor from the forest through the areas of bush to Amboseli and back to the forest (Noe, 2003).' Similarly, Grimshaw and Forley (1990) also reported that 'before establishments of farms and settlements in Leangw'a village there was a high movement of elephants moving up and down from the reserve through the present village centre. Now there is a low concentration and the route has changed from the village centre to the river valley to avoid settlements and people (Noe, 2003).' From this, one can say that the changes in land use from traditional grazing areas to farms and settlements do, in fact, have severe consequences on the wildlife and specifically to the elephant populations using this corridor. As stated previously, elephants have a large home range and require a large, natural habitat to migrate from place to place and so encroachment on human land is likely in present circumstances. As animals fear human presence and their establishments, they are deterred from these areas and forced to utilise their old routes, near the Kamwanga river valley.

From 1952 to 2001, the number of villages went from one to four. This has evidently increased the human-elephant conflicts in this corridor. The interview from this study also found that the percentage of population engaged in livestock keeping or farming has also experienced a dramatic change from 1970s to 2001 (Noe, 2003). In *Figure 8*, one can see that the proportion of people taking part in farming has increased from 28% to 88%. This is a huge change in 30 years and is the main reason for the change in land use. The latest satellite image for this study was taken in 2000. We can easily assume that there has been much development



**Figure 8.** Percent of population engaged in livestock keeping and farming in 1970s and 2001 (Noe, 2003)



in this area, in the past 13 years, and the corridor has further decreased in size. However, like many of the other wildlife corridors in Tanzania, there have been recent efforts to protect the wildlife, for instance, through village game scouts (VGS) and rangers and through Community Conservation Service (CCS) that aim to unitedly reduce the human-elephant conflict (Mduma *et al.*, 2015). Therefore, it is difficult to see whether the human-elephant conflict in this corridor has been reduced as this study was conducted in 2003. As of 2003, it is undeniable that this corridor is ineffective in reducing the human-elephant conflict as it has been aggravated from the 1970s and onwards.

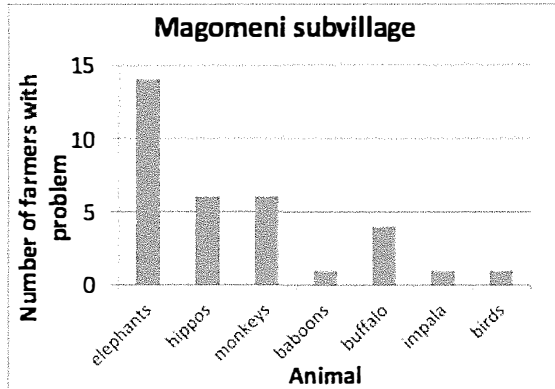
## Manyara Ranch-Lake Natron (Jangwani) Wildlife Corridor

The Manyara Ranch-Lake Natron wildlife corridor (Jangwani) is located near Lake Manyara National Park in Northern Tanzania; it encompasses an area of approximately 330 km<sup>2</sup> (Weiss, 2013). Like many of the other wildlife corridors in Tanzania, threats primarily include the increase of human settlements and agriculture.

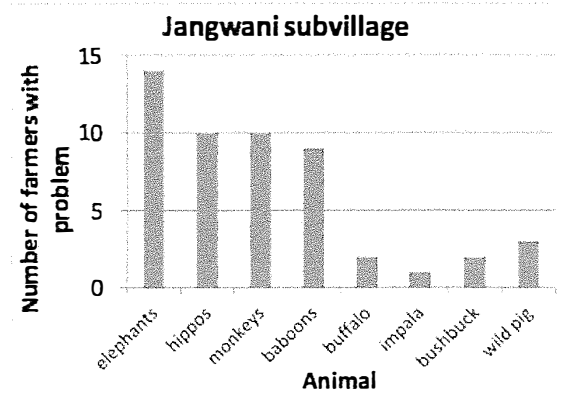
Shelby Weiss conducted a study in 2013, which examined the spatial distribution of perceptions on crop raiding in the subvillages of the Jangwani corridor (Weiss, 2013). The method of data collection were semi-structured interviews with 16 farmers in each of the four subvillages in Mto wa Mbu. Distances of the subvillages from the Lake Manyara National Park Boundary were also examined. The Magomeni Village ( $0.7 \leq \text{km} \leq 1.3$ ), Jangwani Village ( $0.0 \leq \text{km} \leq 0.6$ ), Migungani Village ( $0.0 \leq \text{km} \leq 2.8$ ), and the Mgombani Village ( $0.25 \leq \text{km} \leq 1.7$ ) were studied (Weiss, 2013). The researcher found that 62/64 farmers (96.88%) interviewed had previously experienced conflict with animals. As this percentage includes the majority of farmers, it's evident that this wildlife corridor undergoes many interactions between the humans and wildlife populations. 44/63 farmers (69.84%) said that these situations with animals were more frequent in the dry season as this is harvest time. Problems were also said to be getting worse by 40/64 farmers (62.05%) (Weiss, 2013).

In each of the subvillages, Weiss looked at the species that seemed to be causing the most problems. Results (as seen in *Figure 9*, *Figure 10*, *Figure 11* and *Figure 12*) were collected using the same interview process. Many farmers mentioned that they had problems with crop-raiding elephants. 15/16 farmers from the Migungani subvillage (*Figure 11*) complained about conflict with elephants. 14/16 spoke about conflict with elephants in the Jangwani and Magomeni (*Figure 9* and *Figure 10*) subvillages. Then, only 5/16 farmers reported conflict in the Mgombani subvillage (*Figure 12*). One would assume that the village closest to the Lake Manyara National Park would have the most problems with wildlife. To our surprise, the contrary was found. Villages closest to the park border are Jangwani and Mgombani. Magomeni is further away and the Migungani has the greatest distance from the park boundary. A possible explanation for this is Mgombani's close distance to the Mto wa Mbu village centre and the tarmac road. Mgombani farmers also stated that new infrastructure in the town had recently been built which would have deterred the elephants from that area and reduced the crop damage in his farm.

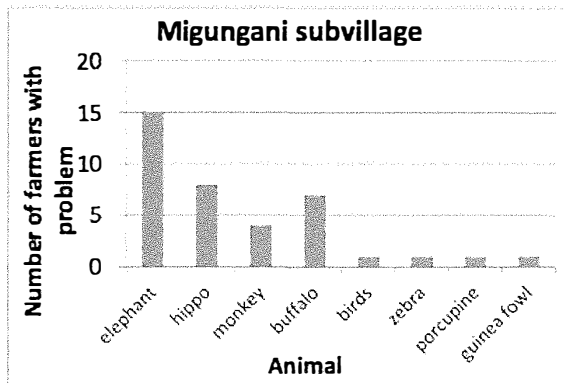




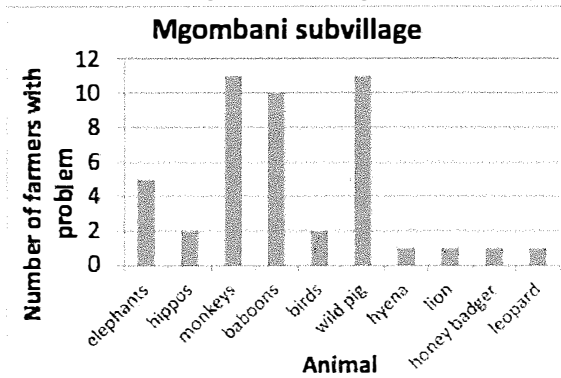
**Figure 9.** Animals that caused problems to farmers in the Magomeni subvillage (Weiss 2013)



**Figure 10.** Animals that caused problems to farmers in the Jangwani subvillage (Weiss 2013)



**Figure 11.** Animals that caused problems to farmers in the Migungani subvillage (Weiss 2013)



**Figure 12.** Animals that caused problems to farmers in the Mgombani subvillage (Weiss 2013)

Although it is clear from this data that there is human-elephant conflict in the Jangwnai corridor, it is essential to examine its flaws. As stated previously, the data collection method generates reliability issues, as it is known by many researchers, that Tanzanian farmers tend to exaggerate their opinions in order to get something back for their troubles. Therefore, it's difficult to know whether their interview responses are true or merely an exaggeration, however, it would be very challenging to monitor this. In addition to this, a number of farmers interviewed in this study have participated in previous studies about human-wildlife conflict (Weiss, 2013). So, there is a tendency for them to tell researchers what they want to hear, instead of revealing to them the actual situation in their subvillage. Only 64 farmers were interviewed, this is not a big enough sample to show whether the results were statistically significant. Lastly, the interview was conducted in Kiswahili by a translator. When explaining the responses to the researcher, it is likely that some information may have been lost through translation.

Through this data, it may seem that the human-elephant conflict is being resolved as crop damage is less common in some areas. However, there is reportedly a substantial amount of conflict occurring in 75% of subvillages interviewed for this study. This study shines light to perhaps the new strategies of elephant avoidance near the perimeters of protected areas. For that reason, one can say that the Jangwani wildlife corridor is ineffective in reducing human-elephant conflict.

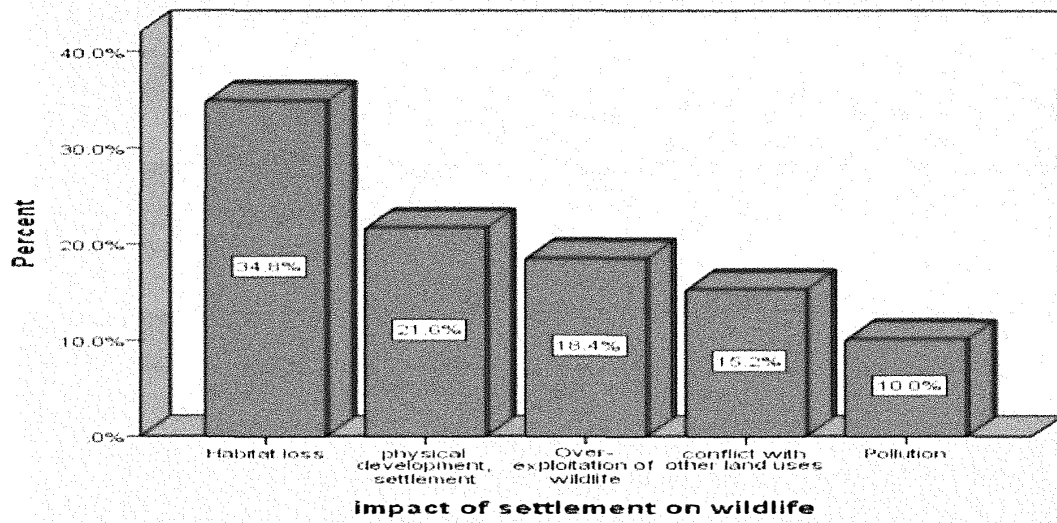
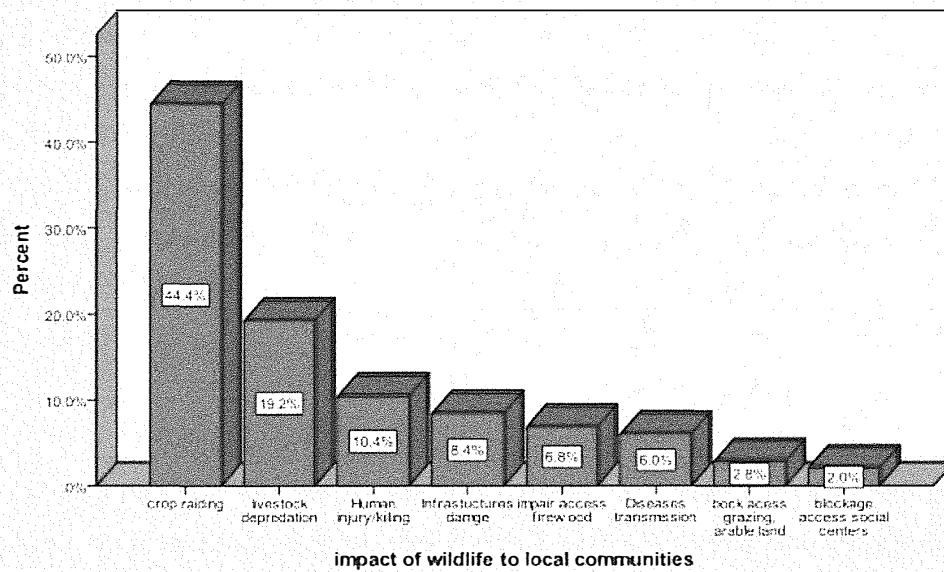
## Tarangire-Manyara (Kwakuchinja) Wildlife Corridor

The Tarangire-Manyara corridor (Kwakuchinja) connects Lake Manyara National Park with the Tarangire National Park, as seen in *Figure 2*. This corridor constitutes the Kwakuchinja Open Area (approximately 600km<sup>2</sup>) and reaches the Monduli district in the northern section of the corridor and the Babati district in the southern section (Jones *et al.*, 2009). Many wildlife species in this corridor have become locally extinct in recent years, including: Black rhinoceros, Thomson gazelle, Hartebeest, Kudu, Wild dog, Cheetah and Oribi (Mbugi and Inayasi, 2005).

Hariohay in 2013 conducted a study in the Kwakuchinja wildlife corridor which aimed ‘to document negative impacts to wildlife, caused by human settlements and land use changes as a result of pressure from human population growth and other human activities of local communities in K wakuchinj a wildlife corridor.’ In the three villages (Olasiti village, Minjingu village, Kakoye village), questionnaires were used to collect data and 250 households were chosen through random sampling. Many tribes constituted the sample population, such as: Meru, Barbaig, Chaga, Pare and Iraq, however more Masai took part in the study. Close-ended questions covered the main themes of: hunting, livestock depredations, crop damage and cultivated crops.

The study also looked at the villagers’ view of negative impacts on wildlife, by human settlements in the corridor. *Figure 13* illustrates that habitat loss (34.8%) was mentioned the most frequently by villagers. Interestingly, other tribes seemed to mention habitat loss more often than Masai (Hariohay, 2013). More than 50% mentioned habitat loss in the Minjingu village; approximately 25% said habitat loss from Olsaiti and less than 25% reported it in Kakoye (Hariohay, 2013). This is an ongoing problem on this wildlife corridor as the competition for resources is fierce. Rodgers *et al.* (2003) stated that 16% of the corridor was transformed into agricultural cultivation between 1987 and 2001. As the human population has been rapidly increasing, it is evident that the majority of land use changes happened in the last decade and similarly, caused more human-elephant conflict.

Villagers’ perception of the negative impacts on their communities by wildlife were also investigated. As shown in *Figure 14*, the villagers believed that crop raiding (44.4%) was the aspect of human-wildlife conflict that had the greatest impact on them (Hariohay, 2013). This aspect was mentioned more frequently than other aspects, which emphasises the fact that this is a true problem. It is also important to consider that on average, 382.91 kg of crops are lost per household every year.

**Figure 13. Negative Impacts on Wildlife by Human Settlement in the Kwakuchinja wildlife corridor (Hariohay, 2013)****Figure 14. Negative Impacts on the Local Communities by Wildlife in the Kwakuchinja Wildlife Corridor (Hariohay, 2013)**

As the villagers in this area are greatly dependent on their farms, this loss is significant and so may be the reason why this is mentioned frequently.

When comparing these aspects of human-wildlife conflict, in the villagers' perspective, it is evident that there's a clear cause-and-effect relationship between the two - habitat loss and crop raiding. Although this data is not specific to the human-elephant conflict taking place, we can still assume that this applies to elephants as they occupy this corridor and there is similar conflict occurring elsewhere. The study focuses primarily on the villagers' perception of negative impacts on them and on wildlife. This is very important as a resolution would not be possible without the consideration of both parties, however, this is merely an opinion and could be exaggerated.

Villagers' responses, from Kwaslema Malle Hariohay's study, were further supported by discussions I had with staff from the Lake Manyara National Park. In June 2013, I visited the headquarters to find out more about the human-elephant conflict in the Tarangire-Manyara (Kwakuchinja) wildlife corridor. I conducted semi-structured interviews with Yustina Kiwango (Kiwango), a park ecologist, and Deus Baruya and Paulina Mkama - rangers at the headquarters (Mkama). Questions (Appendix A) covered the themes of: elephant migration, protection of these species, human-elephant conflict and the management strategies used to reduce it. Responses were documented in note form.

The interviews I conducted confirmed the villagers' negative perception of elephant encroachment. One of the rangers stated that, 'people in the villages are not happy about this issue that is getting worse and they do not want [ elephants] to come on their land (Mkama and Baruya, 2013).' They added that, in some circumstances, 'the villagers have killed the elephants' when they trespass on human land. 'The Wildlife Conservation Act permits the killing of problem animals', in fact, TAIWIRI have reported that 1.72 elephants are killed annually in each district (Mduma *et al.*, 2015). Yustina Kiwango also explained to me that the problem lies within law 5 in the 2009 Wildlife Policy (Kiwango, 2013). She said, 'it does not recognise the wildlife corridors' boundaries and limits, and so there is no control over the villages. ' This is a problem as it does not validate the borders between protected and non-protected areas and so encroachment is more than likely.

## Suggestions

Although the human-elephant conflict in wildlife corridors is at a stage where it would be challenging to reverse the effects, much can still be done to prevent or reduce further conflict. Many techniques have been tried and tested by villagers worldwide, living close to elephant habituated areas. To prevent elephants from encroaching on their land, in Sri Lanka, villagers used beehive and chili fences (Elephant Action League, 2013). Similar techniques could be employed in villages, neighboring wildlife corridors in northern Tanzania. It's unlikely that this solution would entirely prevent elephants from encroaching on farmland and human settlements, however, it is an economical solution that has proven successful.

The Kenyan Wildlife Service have utilised electric fencing in attempts to stop elephants from encroaching on villages (Kenya). Although this method combats the main problem - human-elephant conflict, there are many factors that still require further consideration. Not only is this expensive, it ruins the natural environment of national parks. A large proportion of Tanzania's economy is built on tourism as many tourists visit its national parks to experience the unspoiled, rustic environment. Instead, a zoo-like feeling would be created once animals are confined to a small environment.

When crops are damaged by elephants, no compensation is given to the villagers that suffer from the destruction (Kiwango, 2013). A system could be established, whereby TANAPA would be legally obliged to provide compensation, when crop damage occurs. Although this would not entirely solve the problem and is only a short-term solution, it would, improve villagers' perception of wildlife as their financial losses would be made up for.

A long-term solution includes the creation and strict management of buffer-zones around key wildlife areas. Buffer zones prevent conflict between humans and wildlife as they act as natural barriers between protected and non-protected areas. This discourages wildlife from trespassing onto land used by humans and vice versa. The establishment of these boundaries and buffer zones would require surrounding villages to be relocated. Out of all the suggestions, this will certainly result in the most long-term benefits for both the elephant and human populations. Having said this, it is important to consider the time consuming nature of this solution and also the villagers' needs as it would be difficult to relocate everyone.

## Conclusion

There is little evidence indicating that the wildlife corridors in northern Tanzania are effective in reducing the human-elephant conflict near protected areas. Safe connectivity is vital for the well-being of animals and healthy ecosystems. After examining the Kitendeni, Jangwani, and Kwakuchinja wildlife corridors, it is evident that corridors in the northern Tanzanian region, lack the necessities to be successful.

An increasing human population in rural areas has resulted in settlements being built close to or on wildlife corridors. Land, previously used for migration and dispersal, is converted into other agricultural plots to establish farms and other developments. These activities lead to a loss of elephant habitats and so elephants are forced to use old migration routes that are, now, blocked by new developments. This has many economical implications on the villagers and so gives them negative perceptions of the elephants when they encroach on their land. Since the killing of problem animals is permitted, this has several consequences on the elephant population.

Human-elephant conflicts have gotten to a stage where they are extremely difficult to reverse. However, through sustainable planning of management schemes, progress can be made. Possible short term implementations include: natural methods through deterrent crops, electric fences, and also compensation for villagers. However, the most effective method is separation of human and elephant populations through buffer-zones and protection of wildlife corridors. These suggestions have their advantages and disadvantages, but by taking into account the needs of both the human and elephant populations, we can continue to resolve human-elephant conflicts.



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## Appendix

### A. Guiding Questions for the Interviews with Workers at Lake Manyara National Park Headquarters

Description of the Tarangire-Manyara corridor (background information)

How frequently do elephant herds occupy the corridor?

Do the elephants simply inhabit the corridor or do they use it to migrate between the two parks?

What migration routes do the elephant herds normally use?

Is this corridor a protected area?

What management schemes are in place?

What conflicts do the elephants of this region face when migrating between Tarangire and Manyara?

How much human-elephant contact is there along the corridor (what sort of conflict)?

What has been done to reduce the human-elephant contact?

Why is there this conflict?

What are the people's views about this issue?

Is there a lot of elephant poaching that takes place in this region (figures)?

Does this often take place in a certain area (if so, where)?

What has been done to stop this problem?

Can you give me an example when the elephants were severely exploited?

What has been done to protect the elephant populations in this area?