

THESIS

PHOTOVOICE AS A TECHNIQUE TO UNDERSTAND THE PERCEPTIONS OF LOCAL PEOPLE  
NEIGHBORING TARANGIRE NATIONAL PARK IN TANZANIA ON THE RISKS CAUSED BY  
MIGRATORY ANIMALS

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## ABSTRACT

### PHOTOVOICE AS A TECHNIQUE TO UNDERSTAND THE PERCEPTIONS OF LOCAL PEOPLE NEIGHBORING TARANGIRE NATIONAL PARK IN TANZANIA ON THE RISKS CAUSED BY MIGRATORY ANIMALS

What is the impact of wildlife on communities neighboring national parks and protected areas? Understanding perceptions of risk by local communities on wildlife can help conservation efforts and the development of acceptable policies for parks and protected areas. This study examines communities along the eastern boundary of Tarangire National Park using a combination of Photovoice techniques and individual interviews to determine how these communities perceive risk from wildlife to their agriculture, livestock and economies. Here Photovoice was used to articulate participants' perception of risks to their livelihoods from migratory wildlife that transversed the national park. Three villages (Terrat, Narakauwo and Emboreet) were chosen based on their proximity to wildlife migration corridors and 12 participants from each village were asked to document their perceptions of risk from wildlife using digital cameras. Photovoice uses images taken by participants on a pre-determined topic, followed by interviews of the participants on the photographs to determine themes. In addition, twenty participants from the same villages were interviewed on their perception of risk from wildlife damage using survey questions and narratives. The characteristics of each village (size, distance from each other and distance from park boundary) were determined using GIS and satellite imagery. The villages had different perceptions ( $p = 0.003$ ) based on the three categories of risk: wildlife damage, crop damage and shared resources. Village size had no influence on the peoples' perceptions of risk; however land use patterns (farm land and associated activities) showed some influence on perceptions of risk. Changes in land use for two of the villages, Emboreet and Narakauwo, indicated a large increase in farming activities, which are likely to influence peoples' perception of risk. In Emboreet village, which has more farm land, the greatest risk was perceived as crop damage. The results of this study demonstrate the complex relationships between

protected areas, migratory wildlife and community villages. To balance the needs to protect highly migratory species such as the wildebeest, conservation managers need to incorporate the perceived risks among villages and the factors that influence those perceptions.

Key words: Perception of risk, Tarangire National Park, Photovoice, land covers changes, farm land

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## 1. INTRODUCTION

The establishment of Yellowstone National Park in 1872 motivated international efforts to establish national parks and preserves all over the world (National Park Act of 1872). However, in many international parks established following the model of Yellowstone, the impact of the park on local communities was not considered. For example in Kenya and Tanzania, national parks and preserves were established with little regard to the Maasai who lived in and near proposed parks and had lived in harmony with wildlife for many years (Deihl, 1985). In these countries, the designation of a park made resources inside the park inaccessible for local pastoralists and protected the migratory wildlife crossing the parks' borders (Baird, Leslie, & McCabe, 2009). About 70% of Kenyan wildlife populations overlap with pastoralists when the wildlife disperses outside protected areas and into the community land, and that results in conflicts because of the shared importance of these dispersal areas to both people and wildlife (Sachedina & Nelson, 2012; Western & Gichohi, 1993). Despite many studies conducted on human and natural resource interactions, few have considered community perceptions or studied how these perceptions are expressed by the local people themselves. This may result in the failure of those conservation programs that do not address the needs of local people as expressed by those communities (Baird et al., 2009; Songorwa, 1999)

Human-wildlife conflict happens when an action by humans or wildlife has a negative effect upon one another (Conover, 2002). The impact can be on social, economic or cultural life for local people, or the destruction of animals, or disruption of migratory populations (SARPO, 2005). Local people neighboring protected areas in Africa face cumulative conservation costs, such as denial of access to natural resources, threats from wildlife, and unequal distribution of revenue generated from tourism activities (Beh, 2011). For land managers, these costs hinder full achievement of conservation targets (Balint, 2006; Beh, 2011; Western & Wright, 1994). The increase in human population while the land space is limited results in increasing conflicts between humans and migratory animals (Coughenour, 1991; Lynn, 2010). For example, farmers suffer economically through crop damage while the loss of habitat for wildlife population or killing animals that encroach on human settlements may result in



population decline or extinction of protected species (SARPO, 2005). Also, predators following migrating herds out of park boundaries, such as Tarangire, can also prey upon livestock (Baird et al., 2009; Meyer, 2008).

Wildebeest migrate to open areas of the Simanjiro Plains during the wet season between December and May of each year for grazing and breeding purposes (Borner, 1985; Sachedina, 2006) and to access minerals and green forage (Boone, Thirgood, & Hopcraft, 2006; Jarman & Sinclair, 1979). However, land fragmentation due to human activities in wildlife dispersal areas can prevent animals from reaching critical wet season forage site (Boone, 2007). Cultivation expansion in Maasai pastoral lands raises conservation and economic concerns (Hobbs, et al., 2008; Thornton et al., 2007). These situations have created an urgent need to involve all stakeholders in natural resource conservation efforts through collaborative learning and consensus decision-making processes.

For several decades, perceived risk has been of more concern to policy makers and most of the research on peoples' perspectives has been done by psychologists (Sjoberg, 2000). However, recently ecologists have begun to acknowledge the need to include peoples' perspectives in ecological systems and conservation (Naughton-Treves & Treves, 2005). Usually perspectives of risk from wildlife are based on large animals, dangerous species, and the control people have over wildlife (Dickman, 2010; Mishra, 1997; Naughton-Treves, 2001). Maasai perceive wild animals as God's creatures, so they believe the animals have a right to share the land with people; however, they are of no benefit to the Maasai since they do not provide milk or food (Roque de Pinho, 2009). A study by Akama (1995) which looked at pastoralists and farmers attitudes about national park in Kenya, indicated that education and non-farming activities improves attitudes towards protected areas.

In a study by Roque de Pinho (2009) crop damage was the main conflict mentioned followed by killing or livestock attack by wildlife and losses of livestock through zoonotic disease particularly malignant catarrhal fever. In the same study women were found to have negative attitudes towards wildlife due to lack of awareness of its economic benefits and fear for wild animals. Maasai regard wild animals as part of God's creation, hence they have equal right with people and livestock. Maasai seldom

kill wild animals for self-defense or retaliate for killed livestock. Knowing local people's attitudes about protected areas and migratory wildlife, along with the reason for those perceptions, can help conservation efforts and the development of acceptable local policy (Manfredo, 2008).

What is the perception of risk for local people in human wildlife conflicts near Tanzania's national parks? Understanding peoples' perception of risk before implementing any human-wildlife conflict mitigation measures can generate approaches that satisfy all stakeholders (Catherine, 2004). Local people demand that they have a voice, and their knowledge should be taken into consideration in research and decision-making (Peterson et al., 2010). Holmes (2003) studied the influence of community services provided by protected areas on the local people's attitudes. He found that individual and community perceptions are influenced by the degree of interaction between protected areas and local community. A recent study conducted by Baird et al., (2009) on the local perceptions of risk and behavior response in eight villages bordering the eastern part of Tarangire National Park indicated that people closer to the national parks perceived they are at a higher risk for wildlife-related problems than those who are living far from the parks.

Parks and protected areas are part of larger ecosystems, and land use changes in unprotected areas have an impact on ecosystem function inside the protected areas (Hansen & DeFries, 2007). Land use changes pose challenges for migratory populations in the drylands of East Africa because most protected areas do not possess both dry and wet season resources and animals continue to migrate in and out of protected area boundaries along established migratory routes in search for these resources (Boone et al., 2006; Homewood et al., 2001; Voeten, Van De Vijver, Olf, & Van Langevelde, 2009). Degradation at either end of the migratory cycle can lead to a decline in migratory ungulate populations (Ottichilo, De Leeuw & Prins 2000; Voeten et al., 2009). For example, wildebeests and zebra movement from the Tarangire to Simanjiro plain has decreased (Kahurananga & Silkiliwasha, 1997) and according to the Tanzania Wildlife Research Institute (TAWIRI) May 2001 aerial survey report for the Tarangire ecosystem, the wildebeest population has declined from 43,437 in 1988 to 5,257 in 2001 (See Appendix 1). One potential cause of the decline of these species is increasing and intensive land use like farming,

and settlements outside protected areas that affects the greater ecosystem function and can prevent migratory movement (DeFries et al., 2007; Lynn, 2010). The impact of land use changes affects people, livestock, vegetation and wildlife, which causes conflicts among and between land users and land managers in many areas (Lynn, 2010). The study by Hobbs et al. (2008) on fragmentation of rangelands indicated that habitat transformation due to residential development and land degradation results in unproductive land. Wildlife and domestic animals' productivity depends on the availability and accessibility of the heterogeneity in landscapes (Boone et al., 2005; Boone & Hobbs, 2004)

Land use changes in the Simanjiro Plains have been an issue of concern for the past 40 years because of its relation to habitat fragmentation which limits wildlife movement within the Tarangire-Manyara ecosystem (Kshatriya et al., 2007; Lamprey, 1964). Land use changes have been an interesting topic since wildebeest and zebra spend more than half a year at Simanjiro plains during wet season (Lynn, 2010).

Photovoice is a participatory research approach where participants photograph their daily life and discuss what those photographs represent (Green & Kloos, 2009; Kenney, 2008) based on their community concern and needs for the future as seen through their eyes (Beh, 2011). According to Willson et al. (2006) a Photovoice is a participatory research that promotes people who were usually *under the lens* to behind the lens, and through documenting their community concerns - "enable the world to see through their eyes." Photovoice uses photographs as a means to deliver evidence/message and act as a of means sharing knowledge and experience. The term used before Photovoice was photo novella as the means of using photographs to tell a story or to teach language and literacy. Freire (1970) noted that visual image is a means that will enable people to think critically about their community and discuss the social and political issues that affect their community. Since everyone can learn to use a camera, Photovoice was thought to be a useful tool to be used by people of different backgrounds, like people who do not know how to read or write and those with health conditions that include a social stigma.

Photovoice is a technique that has been used in the health sciences and to judge community economic status perceptions (Jurkowski 2007; Wang, 1999), and it has shown valuable results in public

health (Baker & Wang, 2006; Wang et al., 2004) and youth empowerment (Parker, 2010; Strack, 2004). Even though Photovoice has done well on health and empowering youth, the application of Photovoice to wildlife issues is more recent (Beh, 2011). Beh did the Photovoice project at Samburu in 2009-2010 when there was a severe drought in the region. He asked Samburu people to document their community concerns on conservation. Several issues were raised including deforestation, pollution, soil erosion and limited conservation education in the community. The Photovoice method was found to be effective in this study due to visual presentation of the issues of community concerns through pictures and the story given by photographers based on the pictures taken.

According to Wang and Burris, (1997) Photovoice has three aims: 1) to enable people to record and reflect on their community's strengths and concerns, 2) to promote critical dialogue and knowledge about important issues through large and small group discussion of photographs, and 3) to reach policy makers. Photovoice was proven to be an effective way to do community-based research since Photovoice is a community-based participatory research. It was chosen as an appropriate technique to address community-based conservation education and outreach programs in Africa, and also for the communities whose people are illiterate and cannot document their perspectives through other means like writing (Beh, 2011). However, with all these strengths of Photovoice technique, the future hope of the community can only be attained if the communities' concerns are effectively delivered to policy makers and the recommendation are implemented (Wang and Burris, 2007).

To understand the perceptions of risk by Maasai communities neighboring Tarangire National Park in Tanzania, Photovoice was used to give local people the opportunity to record and reflect their perceptions of risk when interacting with wild animals by using photographs, discussion and individual interviews.

The study on the impact of human activities on land use/cover changes requires a combination of social science data and remotely sensed and other spatial data (Rindfuss, Walsh, Mishra, Fox, & Dolcemascolo, 2004). In this study, I investigated the perception of local people neighboring Tarangire National Park on risk caused by migratory animals. For this study "risk" was defined broadly through the

problems and concerns local people had when they interact, or may interact, with wild animals. To gather data that combines social science and other data sources, three methods were used: Photovoice technique, individual interview and satellite images classification. For Photovoice, face-to-face individual interviews were conducted in each of the three villages with respondents from different backgrounds. Community members were then interviewed and respondents were asked questions about their interactions with wild animals and the risks they encounter due to these interactions. Finally, remote sensing technology was used to determine the extent of cultivation in each village; Landsat images were used to detect the changes on farming activities between 1993 and 2009. Mapping land cover change in pastoralists' communities is an essential way to understand the relationship between ecosystems and human activities (Boone, et al., 2007; Lu et al., 2004; Rindfuss & Stern 1998).

### **Objective of the study**

The objective of this study was to determine the perception of risk by villagers among villages and association these perceptions with characteristics of the villages and surrounding landscape

Research hypotheses:

1. *Different villages will have different perception of risk.* Peoples' perception of risk will differ among villages depending on the economic activities they are engaged in and their issues of concerns, like how they benefit from conservation and the compensation by the government for loss to wildlife.
2. *Increase in human development and cultivation increases perception of risk.* Since agriculture activities are not compatible with wild animals, it is expected greater cultivation will lead to more perceptions of risk.
3. *Villages closer to the park have greater perceptions of risk associated with wildlife.* Villages near the park are expected to experience more interactions with wild animals when they migrate from the park to dispersal areas or to raid crops.

4. *Larger villages will have lower perception of risk from wildlife.* The size of the individual villages may be indicative of available resources, such as grazing land, within the village extent, potentially reducing perceptions of risk from wild animals.

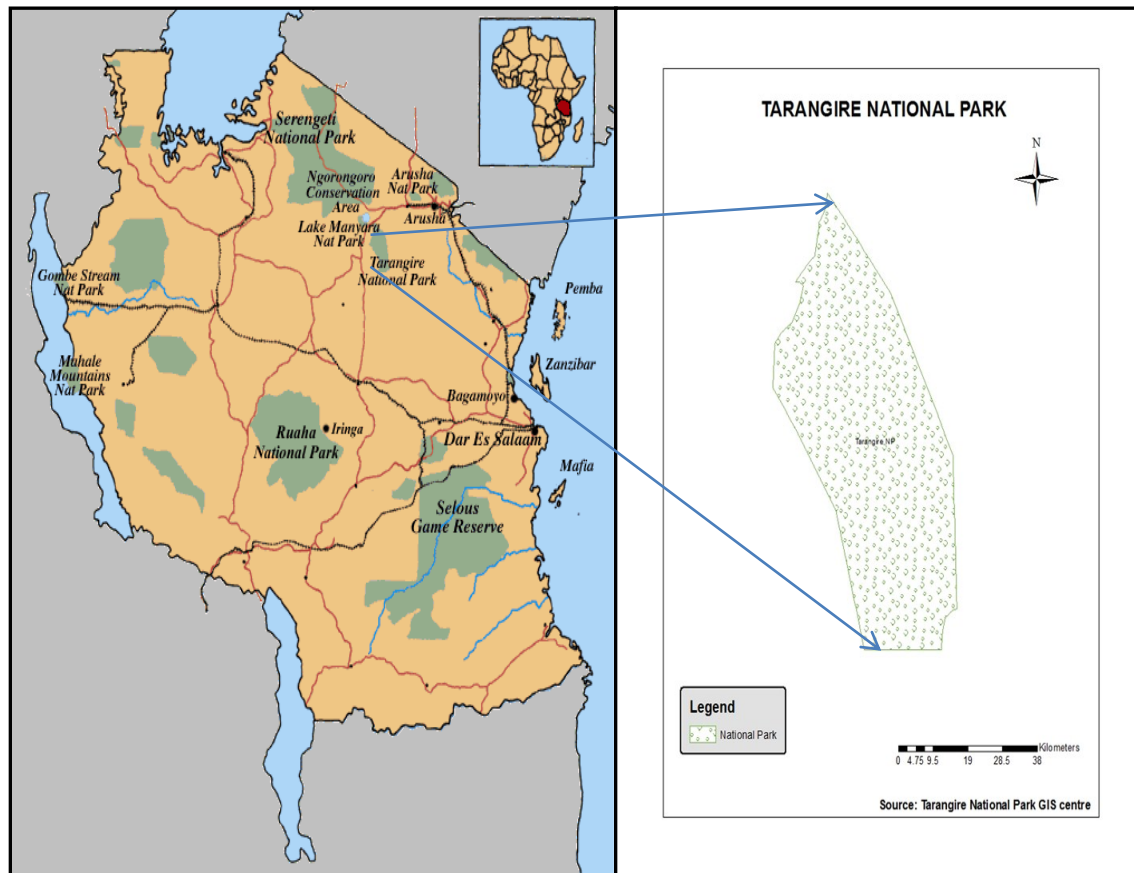
#### **Research questions**

1. What is the perception of risk among the three villages? Photovoice technique will be used to determine main themes of risk. Here, villagers were asked to photograph their perceptions of risk and then describe the risk and why they took the particular photograph. The risk themes will be determined from photographs taken by participants from three villages as a tool to capture villagers' perceptions as the main theme informing the research. Interview data will be compared to individual perceptions for each village to validate the perceptions of risk for the village as a whole.
2. Does size of land used/farms affect perception of risk?
3. How does distance from the park affect perception of risk?
4. Does size of the village determine the perception of risk? Do larger villages have different perceptions of risk than smaller ones and if so, how do those perceptions vary and does it match individual perceptions (based on research question 1)?

## 2. METHODS

### 2.1 Study area: Tarangire National Park and Simanjiro plains

Tarangire National Park was established in 1970 and occupies an area of 2,860 Km<sup>2</sup>, making it the fifth largest park in Tanzania (Figure 1). The park lies 118 Km southwest of Arusha within the administrative districts of Babati, Simanjiro and Kiteto in the Manyara region and Monduli district in the Arusha region and Kondoa district in the Dodoma region (TANAPA, 2002).

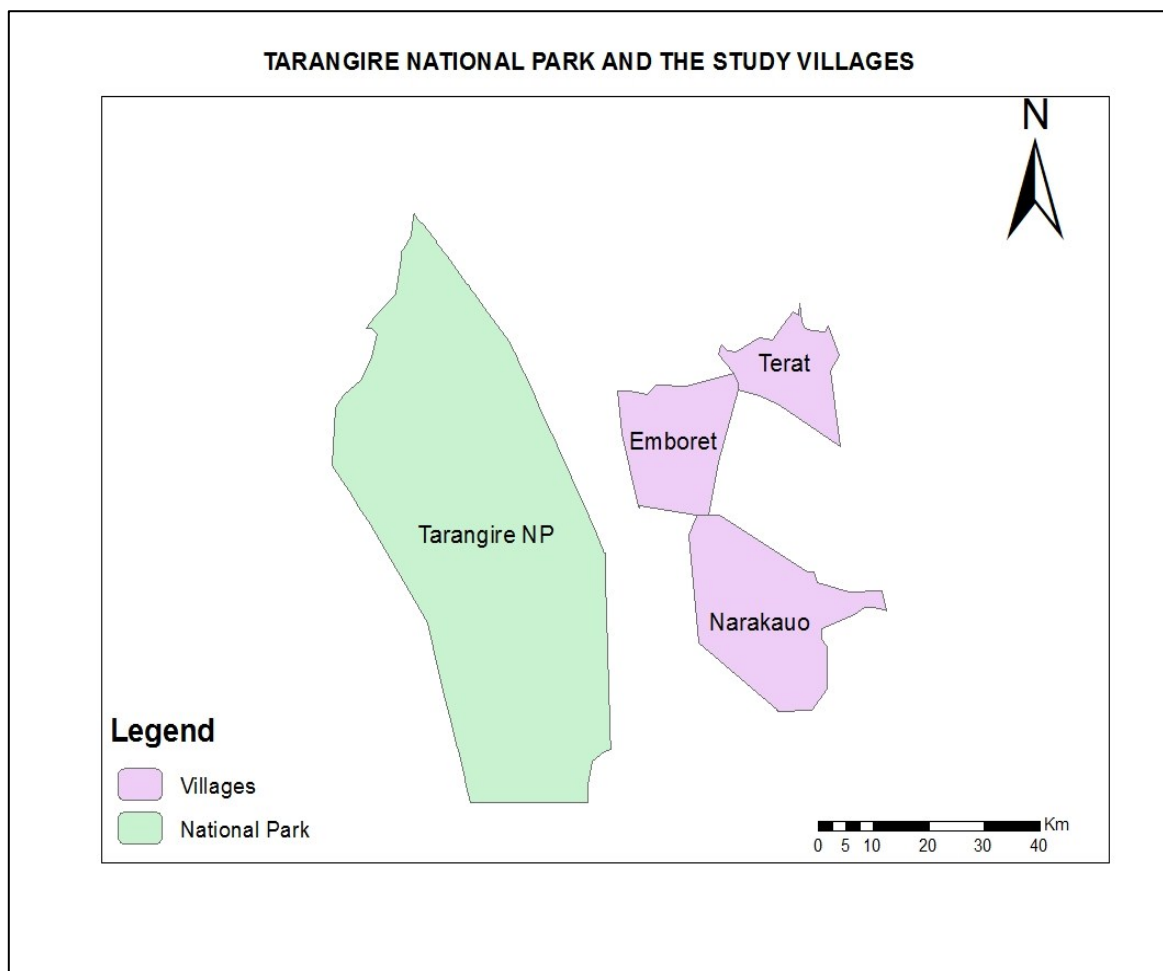


**Figure 1: A map of showing the location of Tarangire National park**

Tarangire is situated on a wooded steppe in the arid acacia savannah belt that is dominated by acacia and commiphora species (TANAPA, 2002). The Tarangire-Manyara Ecosystem, which encompasses

35,000 km<sup>2</sup>, boasts the second largest migration of large ungulates in East Africa after the Serengeti-Mara ecosystem and one of the largest on the planet (Baird et al., 2009; Kahurananga, 1981; Lamprey, 1964).

This project was conducted in three villages (Emboreet, Terrat and Narakauwo) located in the Simanjiro District in the Manyara region, Tanzania. These villages are located at the eastern border of Tarangire National Park (Figure 2) in Simanjiro plains. The villages were chosen based on their proximity to the park boundary and wildlife corridors.



**Figure 2: The location of the three villages used for Photovoice study near Tarangire National Park**



## **2.2 Photovoice**

In this study, I used the Photovoice method to determine local perceptions of risk in the wildlife dispersal area of Simanjiro. This Simanjiro Photovoice project was initiated in July 2011 (dry season), resumed December 17, 2011, and concluded on January 12, 2012 (wet season). First village leaders (Emboreet ward) were introduced to the project and its objectives, and their assistance was requested to engage villagers in the project. Twelve volunteers were chosen from each village to participate in the project after researchers were satisfied that they qualified according to the approved protocol. Participants were required to be villagers of the study area and adults. For the cases where fewer villagers than the target number appeared, I directly contacted additional villagers based on recommendations from village leaders. A total of 36 participants from three villages were given digital cameras and were asked to take photographs of their interactions with wildlife.

The Photovoice process includes 3 steps: participants come together to discuss the process, participants take individual photographs, and participants bring photographs to a focus group meeting of all Photovoice participants for discussion (Wang et al., 2004). I organized two days of training for the villages where we first conducted one hour sessions on how to handle and use the cameras to take photographs at each of the three villages. The cameras were then given to the participants to practice with for the rest of the day. The second session reviewed what participants learned from the first day and assessed the individual photographs taken from day one for improvements.

To meet the objective of this study, the participants were asked to take photographs of their interactions with wild animals, particularly wildebeests; to explain what their photograph is about based on the pros and cons of interactions; and to provide recommendations of what should be done to improve the situation. Each photographer was then asked to select three photographs that represented the most important issues of concern to them, and then to present them in the discussion session with their fellow participants. The photographs chosen represented the top perceived risks that the participants were most concerned about and that they felt needed to be addressed. The chosen photographs were displayed on a laptop for other participants to see and comment on. The discussion started with the photo owner giving

explanations of where the photo was taken, what it was about, and his/her recommendations. Then, other members were given a chance to comment on the photo presented or ask questions for clarification.

Photovoice participants' stories were recorded on digital voice recorders and then transcribed by hand. The stories were analyzed by repeatedly listening to the recorded stories and identifying the themes (Beh, 2011). Themes were generated based on how frequently the issue was mentioned in the discussion, and on interesting events that participants used most of the time when talking about them. The Photovoice discussions from summer 2011 were transcribed to generate the themes from each village. These themes were then presented to the participants in the winter 2011 phase so that the photographers could take photographs based on these themes.

To calculate the perception of risk by people, the numbers of people presenting a certain type of risk were counted and as each participant could contribute only three pictures representing the themes most important to them. And therefore, the total number of photographs used for each village per season was 36 (Table 7).

Moreover to meet the third goal of photovoice, the meeting between Photovoice participants, village leaders and the management of Tarangire National Park was organized. The participants from the three villages traveled to Tarangire National Park for the meeting on January 10<sup>th</sup> 2012.

### **2.2.1 Data processing.**

Perceptions of risk by season (wet or dry) were tested using a t-test. The relationship between perception of risk and location (villages) was tested using a general linear model (SAS GLIMMIX) procedure to determine correlations on non-constant variability where the response is not necessarily normally distributed as a way to determine whether the perception of risk differed by village. The GLIMMIX was used because it works with non-normal data and it allows correlation amongst responses.

## **2.3 Satellite image classification**

### **2.3.1 Data processing.**

Satellite images (1993, 2000 and 2009) were acquired from the United States Geological Survey (USGS). The satellite images consist of a Landsat TM scene (February 1993) and Landsat ETM+ scenes (February 2000 and November 2009). All three scenes covered the entire Tarangire National Park and study area (three villages). Since the images were in geographic coordinate system (WGS84), the park and villages shape files that were in local coordinate system of UTM were projected to WGS84. The 7-band GeoTiff files were loaded into the ENVI (Environment for Visualizing Images) software for image stacking into three bands and the resulting images were displayed in bands 4, 3, 2 (RGB). By using ArcMap, four areas/polygons were created from each village based on the location of the farms. The ENVI software was used to resize the three images based on the 12 polygons and then import resized images to ECOGNITION software for supervised classification. Then the classified images were imported to ENVI to calculate change between years. A table was created to summarize the farming land change that had occurred from 1993 to 2009 (Table 10).

## **2.4 Individual Interviews**

We conducted in-depth interviews with respondents from a wide range of backgrounds at these three villages neighboring Tarangire National Park. We used a purposive sampling method to select research participants for the study. The purposive sampling is the sampling technique that best used by researcher who want to explore the knowledge and experience of study community. Researcher comes up with what required to be known and look for right people within the community who would be able to share their knowledge (Tongco, 2007). This was done by requesting village leaders to recommend villagers, both women and men, who were engaged in different economic activities to participate in interviews. The survey questions were open-ended, giving participants' room to articulate and expand their views. The interviews provided insights on the peoples' perception of risk from the interactions with

wild animals, interactions between the community and the park, as well as more information on other potential interviewees within the communities.

For two sessions between December 17, 2011 and January 12, 2012, we interviewed 60 participants (20 from each village) to learn more about their perspectives on and interactions with migratory animals, particularly wildebeest. Each interview lasted between 20-60 minutes and consisted of about 20 open-ended questions (See Appendix 2). These individuals were different from the Photovoice participants.

#### **2.4.1 Data processing.**

To determine the perceived risk by local people using interview data collected, transcriptions of villager's interviews stories were used to identify perception of risk for each participant based on the emphasis they put on the issue, key words or phrases used, and how frequently certain types of risk were mentioned. From summaries of the above data, each individual was assigned to one risk category based on participant stress on the risk or how frequently he/she mentioned the risk. Risks for each village for all 20 participants were combined and the top three risks mentioned by participants were selected for further analysis using a chi-square test to test the relation between villagers and risks. Data were all from adult participants and data from both male and female respondents were aggregated.

## 2.5 Villages' size and the distance from the park

To calculate the distance between the park and the villages, ArcMap 10 was used to locate the centroid in each village polygon and the distance between the park boundary and the centroid of each village and the size of each village was calculated (Table 1).

**Table 1: Characteristics of three study villages near Tarangire National Park.**

| Villages  | Area (sq km) | Distance          |                             |      |
|-----------|--------------|-------------------|-----------------------------|------|
|           |              | from park<br>(km) | Distance from neighbor (km) |      |
| Terrat    | 248.51       | 48.42             | Emboreet-Terrat             | 23.8 |
| Emboreet  | 371.67       | 22.01             | Emboreet-Narakauwo          | 32.9 |
| Narakauwo | 621.99       | 28.75             | Narakauwo-Terrat            | 40.6 |

### 3. RESULTS

The three issues crop damage, disease and shared resources were perceived as main risk to people and their properties. Several other issues came up during Photovoice and interview including conflicts with hunting companies and people and livestock attacked by wild animals.

The results generated from data collected from Photovoice and interview participants using the top three issues were categorized based on participants' description of the risk (Table 2). The summary of total photographs presented by participants can be seen in table 3.

**Table 2: Risk categories as defined by the participants during Photovoice and individual interviews.**

| RISK                   | DESCRIPTION   |
|------------------------|---|
| Crop damage            | Eating crops<br>Trampling crops   |
| Shared resources       | Competition for limited resources like water sources and grazing area                       |
| Disease                | Sick cattle, cost of treating cattle and facilities for treating cattle.                    |
| Attack by wild animals | People and livestock being injured or killed by wild animals, villagers' worry about attack |

**Table 3. Summary of photographs presented by participants**

| Village   | Photovoice participants | Photographs with study themes | Themes generated | Total photographs |
|-----------|-------------------------|-------------------------------|------------------|-------------------|
| Terrat    | 12/2 seasons            | 53                            | 4                | 562               |
| Narakauwo | 12/2 seasons            | 45                            | 5                | 774               |
| Emboreet  | 12/2 seasons            | 42                            | 5                | 374               |

## Overall Photovoice result

### Three main perceptions of risk by photographer

The following are photographs taken by participants to show their perceptions of risk and their statements that give detail information about the photo. The three main perceptions of risk were crop damage, diseases and shared resources. The three perceptions of risk were selected based on photographs presented by participants. The code used represent individual from each village: the letter T represent participants from Terrat village, E represent participants from Emboreet village and N represent participants from Narakauwo.

#### 1: Diseases

T1 took this picture (Figure 3) showing a cow treated in “josho” (dip- tank or trough to kill parasites in cattle). He identified ticks as a vector for transmitting diseases among animals. He said it is very important to wash/treat their cattle so as to avoid tick-borne diseases, and that these “josho” must contain a precise amount of medicine to avoid overdosing or under-dosing the cattle since excess treatment might kill the cattle.



**Figure 3: Treating cattle (Courtesy T1)**

According to local people’s experience in this area, it is recommended to wash/treat the cattle two or three times per month.

T1 added: *This picture has relationship with wild animals in the sense that if ticks from wild animals have “ndigana kali” (east coast fever) and then bite untreated cattle, they transmit this disease to cattle.*

T1 elaborated that the advantage of treatment is to prevent their cattle from getting diseases from wild animals. However, it seems that the community has limited access to these treatments and local

people cannot afford it. Because of his interest in this project T1 met with a ward veterinary doctor to discuss the issue of zoonotic diseases. They recommended research on these diseases as the way forward for future efforts

**T2:** *The josho is an important facility for pastoralists; however we are lacking enough water to operate this treatment facility. So, if we receive any means of getting assistance of water supply and medicine it would be helpful.*

**T1:** *We need taps that can bring water from borehole. In the past years we used to get assistance from World Vision for the supply of treatments.*

*Currently, individual local businessmen are the ones that operate it. Since we have only two josho for the whole of Terrat ward, about 3,000 cattle have to be washed per day. We usually need to treat our cattle two times per month but it also depends on treatments availability.*

**T3:** *We also need veterinary doctors to do this work since these local businessmen who operate it currently are not livestock experts and this poses a threat to our cattle.*



**Figure 4: A sick cow (Courtesy T4)**

**T4:** *This cow (Figure 4) is weak because it has a disease called ndigana (east coast fever). It has suffered for a long time, although it is recovering now after treatment. Before the treatment the animal could not even stand on its own. The relationship between this disease and wild animals is that ndigana is the disease caused by ticks.*



**E1:** *This picture (Figure 5) shows a young boy taking cattle far away from wildebeest areas to avoid disease transmission from wildebeest to cow. You can see wildebeest from far behind. From the beginning of this month of January you cannot predict when wildebeest will start breeding, though we know the highest breeding peak is from February to March. So to be on the safe side we try to prevent cattle from eating grass from areas where there are wildebeest.*



**Figure 5: A boy taking cattle away from wildebeest (Courtesy E1)**

*We are forced to take our cattle into wilderness areas where we have encounters with other challenges like dangerous wild animals, including buffalo, elephant and lion. There are cases where buffalo killed cows; lions attack*

*people and cattle and elephants kill people. Also, in these areas there are lots of ticks that cause diseases to cattle.*

E1 elaborated on their adaptation mechanism of separation of cows and wildebeest. Villagers accept this; however, they usually face other challenges in these refuge areas. The issues of tick-borne diseases as well as an encounter with dangerous animals are critical in these areas, but they find it less risky than to allow cows to graze together with wildebeest.

T1 said: *Since this disease has been persistent in our community for a long time, we have adapted a way of separating our cattle from wildebeest during the wildebeest breeding season. So, I recommend pastoralists to take their cattle far away from wildebeest calving sites to avoid this disease. Also, we have to be careful with flowing water that might carry those viruses.*

**T5:** *As my fellow said, wildebeest calving site is very dangerous for livestock since they get fever if they graze in those areas.*

When I asked him what their former fathers' were doing to avoid these diseases T5 said:

*In past years our father used to take their cattle away from these wildebeest breeding areas and return when wildebeest are gone or when breeding season is over. However, then there were vast open areas but nowadays we cannot do that since every area is occupied and has owner with different human activities.*

According to T5 and his fellows, a wildebeest breeding site is an unsafe grazing area for their cattle due to this un-curable disease, malignant catarrhal fever. At the same time separating cattle and wildebeest as they were done in past years is becoming challenge as time goes by due to increases in human population and their activities.

## **2: Shared resources**

**T6:** *I took this picture (Figure 6) to show interactions among cows, children and wild animals. During this time when migratory herbivores are near settlements, the dangerous animals are also present, which is not safe for people. There were times when children were eaten by lions when they were herding in the pastureland because usually carnivores follow zebras and wildebeest when they migrate.*



**Figure 6: Livestock grazing with zebra (Courtesy T6)**

**N1:** *This dam (Figure 7) is the only permanent source of water we have in our village. Human beings, wild animals and livestock in the village use this water. This situation is not good health-wise and also for peoples' safety. There are diseases that can be transmitted between people and among domestic animals and wild animals.*



**Figure 7: Cattle drinking water at Narakauwo dam (Courtesy N1)**

*Also, we do not know how long this dam will last because its bank is now too shallow and not strong because there are some wild animals like elephant and buffalo that destroy the dam banks.*

**N2:** *Domestic animals and local people use this dam in the afternoon while wild animals at night and early morning. This situation is not good health-wise because these animals urinate in the dam; some animals get diseases that can be transmitted among animals and even to people. Because of this sharing there are cases where people and cows were attacked by wild animals, especially buffalos, in this dam. During drought years we had many cases of wild animals got stuck in mud in the dam, in one case nine buffalos were stacked in the mud and we had to call Tarangire National Park for rescue.*

When asked if wildebeest also come to this dam N3 replied: *Since this dam is surrounded by huge shrubs, wildebeest usually do not come to this place. However, they are found in other open areas of the village.*

**T7:** *Since we, as a village, have decided to stay with these wild animals, the government should provide services like schools, hospitals and pay for our children's school fees so we can also feel the benefits of wild animals in our community.*

The main concern that was raised here was sharing benefits generated from the conservation of wild animals. The photographers felt that their community should benefit more from wild animals since they are the ones that incur loss of their properties through wildlife.

**N2:** *In the picture (Figure 8) you can see zebra; these are one of the most destructive wild animals in the farms. They eat a lot of maize.*

**N4:** *They migrate from Tarangire National Park to this area. When they are here they graze together with domestic animals. We do not mind when they share the grazing areas except after wildebeest start*



**Figure 8: Zebra grazing at Narakauwo (Courtesy N2)**

*calving due to disease they transmit to cow. Also, during drought years we do suffer from shortages of pasture, but when we try to take our cattle near Tarangire they arrest us.*

For N4, people being arrested when they take their livestock near Tarangire National Park during drought years is an indication of lack of collaboration between villages and park. N4 was expecting since they allow wild animals to graze in their land the park should do the same particularly during drought years.

### **3: Crop damage**

*E2: As you can see in this picture (Figure 9), these wildebeest are grazing between farms that are already prepared for sowing. The area where they are grazing is the farm which is not yet prepared for farming.*



**Figure 9: Wildebeest in the farm  
(Courtesy E2)**

*There are two effects caused by these animals by being in this area. First, during wildebeest breeding season (February-March) pastoralists have to take their cattle far away from these areas to prevent their cattle from getting wildebeest diseases. Another effect is that these animals destroy farms as soon as we sow, so we have to chase them away to avoid them from scratching seed. Moreover, we have to guard the wild animals from eating our crops from the day when seeds sprout until harvesting time. This means we usually have to work to protect our farms from the day we sow seed to the harvesting day.*

When asked if they are aware that according to Tanzania wildlife act 2009 there is compensation program E3 replied that;

*According to wildlife law we are supposed to get compensation for our farms or cattle but I have never seen anybody being paid. We do not even know where to go to complain. When a village official reports to the district level that there are wild animals in the farm, they send a game ranger to chase them away and sometimes they order to kill one wild animal and distribute the meat to the villagers, but that cannot be compensation. That is why we are saying government is not doing right to us. The loss we are getting*



*is for an individual person but the revenue we are getting from photographic tourism is for the whole community whether you have been affected by wild animals or not.*

**E1:** *This picture shows how these animals are living comfortably in our land. They become destructive when the planting season begins because they destroy farms while playing in the farm that is already planted and crushing crops. So, the farmers have to protect their farms.*

When asked if they do not want wild animals at all, E1 replied that it is not that they do not want wild animals in their village land at all, but they do not want wild animals to be on the farms. He added that they do not have problems with wild animals if they are not destructive.

**E1:** *This picture (Figure 10) shows farm that was destroyed by wild animals. This farm belongs to family with the house behind the picture.*

*They planted beans but when beans start sprouting zebra and wildebeest came eat and destroyed the whole farm, this is why the farm looks like nothing was planted. Some people give up replanting these farms because they don't*

*have more seeds or money to buy extra seed to replant. For example the family that their beans farm was eaten failed to purchase beans because one sack of beans cost Tsh 200,000 (\$133). One sack of beans can plant about four acres.*



**Figure 10: A farm destroyed by the wild animals (Courtesy E1)**

*E1: Government uses revenue generated from tourism activities at Emboreet to develop other areas that are not affected by these animals and it forgets about us whose farms are destroyed and our cattle are eaten with carnivores.*

T8 took this picture (Figure 11) of ostriches at her farm. She said ostriches are very destructive because they eat beans. She recommended for people to build the fence around their farms. She also added that since the government is the one that benefits from these animals, it should find a way to prevent these animals from destroying villager's farms.



**Figure 11: Ostrich in the farm (Courtesy T8)**

#### **Other perception of risk identified by photographer.**

Apart from the three perceptions of risk listed above, local people also identified the following concerns:

#### **1: Development project**

T1: *I took this picture (Figure 12) to show a classroom that was built by Tanzania National Parks (TANAPA) in the year 2003. This shows one of the benefits we receive by having these wild animals in our village community. These animals migrate to this area during the rainy season (December-February) and then return to Tarangire in August of each year when the rain stops. We are still thinking we receive very little benefit proportionally from the large benefits generated through conserving these wild animals.*



**Figure 12: Classroom built by TANAPA in 2003 (Courtesy T1)**

*When we look at this building it reminds us of many things that we are supposed to have as a village. We feel that this classroom is not the only thing that TANAPA can do for us compared to the efforts and sacrifice we are making to protect their animals. We have village game scouts whose school fees for their training was paid by Ujamaa Community Resource Trust. These village scouts make sure that wild animals are not poached in village land. So we think, every two years TANAPA should at least build two classrooms or build a village office or provide food (lunch) in schools for students.*

Currently, Terrat village receives 5 million Tanzanian shillings per year through Ujamaa Community Resource Trust (UCRT) of Dorobo, the company that deals with photographic tourism. Through this money they were able to build two classrooms at Losong’wani primary school. Other small village development projects also depend on this revenue. The current balance in village account is 12,900,000 Tanzania shillings (\$8,600) that was generated through fees charged to tourists who visit the village for photographic activities.

**T3:** *This picture (Figure 13) is the toilet at Losong’wani primary school for 330 students and teachers.*

*This situation is not healthy for our children. I decided to take this photo to show that despite having all these wild animals in our community, we do not have even a proper toilet for our children. This shows that only a few people are benefiting from conservation of these wild animals.*



**Figure 13: School toilet (Courtesy T3)**

*Another loss we receive is from crop damage at the school farm. There were some years when we cultivated, but we do not get any harvest due to crop raided by wild animals.*

T3 who is a teacher at Losong’wani was very disappointed at the way students from his school and other school in these potential area for wildlife do not benefit from tourism. He showed that schools

lack important basic needs like toilets for students. He questioned how these future generations can understand the importance of wildlife conservation if they do not benefit from it.

## **2: Carnivore attacks**

*N3: I took this picture (Figure 14) to show how our communities sometimes defend/protect themselves and their properties from wild animals. These are moran (Maasai warriors), when there is any case of lion attacking cattle they mobilize themselves for lion search and they kill it. After they kill lion they come back home and celebrate.*



**Figure 14: Maasai warriors (Courtesy T3)**

To deal with dangerous wild animals and any other intruder to their community, the Maasai community has warriors who protect people and their properties.

*T1: Often livestock are eaten by carnivores when they are taken to wilderness areas during wildebeest calving season because in the wilderness is where these carnivores hide. Also, more cases of conflict happen after the wildebeest have returned to the national park because some lions remain in these areas, and since they do not have other sources of food, they turn to livestock and people.*



### 3: Conflict with hunters

E4 identified this area (Figure 15) as a land set aside by the village for tourism business. E4 elaborated that this area is used for photographic tourism where any tourism company can lease the area and pay a certain amount to the village. She pointed out this as one advantage of having wildlife in their area.



**E1:** *You know through photographic tourism the village gets 40% of revenue while through hunting village receives nothing.*

*Another thing about these hunting companies*

**Figure 15: Areas set aside for photographic activity (Courtesy E4)**

*is that they have the tendency of killing herbivores for lion or leopard so that it become huge for good trophy or sometime they kill herbivore as bait. Sometime when these hunters realize it is lioness they stop supplying it with meat and since this lioness is used to getting easy food its next target is livestock and sometimes they attack people. This area has become dangerous for people and even livestock.*

This land set aside by the village seems like an opportunity for the village to generate revenue. However, based on participants' responses and discussions, it looks like the village has very little power in these areas because of government interference. The government permits hunters in these same areas, which scares away tourist photographers since these two activities are not compatible. Another challenge the village faces is that the villagers have no say regarding hunters that come to hunt in their village area. Hunters do not report to the village office, their permits are not inspected, and so the village government does not know if they hunt legally. In addition, the government is also at risk of losing revenue from unethical hunters.

E2 argued for government and hunting companies to recognize and value the community that protects these wild animals;

*I am saying this because you find hunting companies recognize only ministry and not the village where they come to hunt. So, I am suggesting for these companies to recognize the village where they come to hunt, and if possible to pay certain amount in the village since currently nothing is paid to the village level by hunting companies. I am saying this because currently hunting companies just come with their permit; they go hunting without even showing village officials their documents. A village does not even know how many animals they have been hunted since we are not involved.*

**The following is an overall responses and statistics from local people from the three villages who participated in the interview.**

At Narakauwo village we interviewed nine female and 11 male participants with an age range from 20-60 years. About 80% (n=16) of participants were from Narakauwo, 20% (n=4) from neighboring villages where most 85% (n=17) of them were Maasai, and 15% (n=3) Warangi, Waarusha, and Iraqw. All participants claimed knowledge of wildebeest migrating into the village as soon as the rainy season begins and claim the wildebeest cause diseases which cause blindness in cows and can also be fatal.

Tarangire National Park borders all of the surveyed communities but only about half, 65% (n=13), of the local people interviewed were aware of the park and its responsibility, while 30% (n=6) of the participants said they just heard about the park but had never been there, and one participant didn't know about the park at all. Also, about half, 45% (n=9), responded that there is a no relationship between the park and the village. Farming was identified as the activity that is most affected by wild animals.

About 89% (n=9) of interviewed women said there is no benefit they receive from wildlife conservation and 56% mentioned fear wild animals while 23% (n=11) of male interviewed do not recognize benefits from wildlife.

At Emboreet village there were eight female and 12 male participants with an age range from 22-60 years. Eighty-five percent (n=17) of the participants were from Emboreet, 15% (n=3) from neighboring villages and Ngorongoro who moved to Emboreet in order to engage in agriculture activities that are not allowed in Ngorongoro. Most of them are Maasai who are agro-pastoralists. All participants were familiar with wildebeest and most of them categorized wildebeest as "polite" animals. However,

wildebeests were identified as the enemy of cattle, because they can transmit deadly disease to the cows. Some participants also mentioned that wildebeest eat the young leaves of the maize plants. About 65% (n=13) of Emboreet acknowledged knowing about Tarangire National Park; however, some confused the park with a private campsite Kikoti that borders the park and the village. They also could not identify whether it is the park or this private campsite that provided funding for their village development projects. Most participants use the word “mpaka” (meaning boundary) when they were referring to the park. According to participants, there are benefits that the village receives from wild animals including support from Tarangire National Park and the Kikoti campsite. Both stakeholders help fund village development projects, such as building classrooms, Emboreet secondary school laboratory, and a village office. Moreover, Emboreet village receives some revenue from photographic activity, as well as from lending village land to the Kikoti campsite. Women also receive a certain amount of money to run small businesses (e.g., selling vegetables and small shops).

About 88% (n=8) of interviewed women said there is no benefit they receive from wildlife conservation and 38% mentioned fearing wild animals while 42% (n=12) of males interviewed do not recognize benefits from wildlife.

Human-wildlife conflict issues that came up frequently during interviews were wildebeests and disease transmission to cows, and a shortage of shared resources (such as water) between wild animals (mainly wildebeest and zebra) and cattle. Others issues discussed during interviews were carnivores (lions and hyena) attacking people and cattle, and crop raids by wildebeest and zebra. Another issue that seems to worry local people was the park boundary expansion. Half of Emboreet participants (n=10) agreed that an increase in human populations causes an increase in conflicts among people, as well as between people practicing agriculture and wildlife.

There were 10 female and 10 male participants at Terrat village with an age range from 20-70 years. Sixty-five percent (n=13) were from Terrat, 35% (n=7) migrated from neighboring villages, and 90% (n=18) were Maasai who act as agriculture and livestock keepers. Sixty-five percent of Terrat participants' views on wildlife were positive toward wildlife. All participants responded that they know

wildebeest and that wildebeest migrate to the village during wet season, and leave when the rain stops. About 65% participants are aware of Tarangire National Park and its responsibility of protecting wild animals while 30% heard about the park but only knew they were not allowed to cross the park boundary.

With respect to knowledge about the relationship between the park and the village, 45% (n=9) did not know if there was any relationship, 30% (n=6) said there is good relationship and 25% (n=5) said the relationship is bad. Also, 55% (n=11) do not recognize the benefits from tourism activities and wildlife. Forty percent (n=8) cited benefits, such as revenue from a photographic company called CRT, as well as support from Tarangire that included new classrooms, beds for the girls' dormitory, and wild meat supply. About 70% (n=10) of interviewed women do not recognize benefits from wildlife conservation and 20% mentioned fear of wild animals when performing their daily activities including doing to farm and fetching water and firewood while 30% (n=10) of males interviewed did not recognize benefits from wildlife.

Participants also mentioned other issues including rabies transmitted from carnivores to dogs and people, crop damage, and carnivores attacking cattle and people. The participants also mentioned hunting permits issued by District Officers, with a lack of enforcement. Participants also worried that the government and park were using researchers and Non-Governmental Organization (NGOs) to convince villagers to stop agricultural activities and engage in conservation like the establishment of Wildlife Management Areas (WMAs). According to Tanzanian wildlife policy, WMA "means an area declared by the Minister to be so and set aside by village government for the purpose of biological natural resources conservation" (URT, 1998) where local people will have full mandate of managing and benefiting from their conservation efforts. The aim of giving WMA management to local communities is not only to protect corridors, migration routes, and buffer zones, but also to enable the local communities to obtain economic benefit from wildlife conservation. However, participants are worried that if they establish WMA the government will later claim the land to be part of the park. Lastly, Terrat participants highlighted that the park provides more support to the villages that are very close to the park boundary and ignores villages that are farther away that have more interactions with migratory animals.

### Research questions

The following results are going to address the four research questions that aim to determine the perception of risk by village and association of these risks with farm size, village size and distance from the park

#### 1. What is the perception of risk among the three villages?

The chi-square test on the perceptions of risk between dry and wet season shows that there is no statistical difference between the two seasons with a p-value of 0.663 (Figure 16). Since there was no statistical variation by season, the two seasons were combined to make one variable for subsequent testing of perception of risk among the villages.

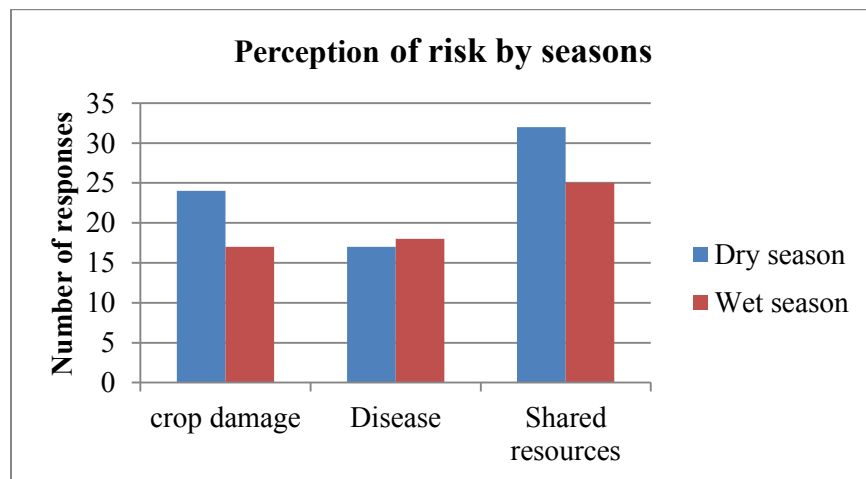


Figure 16: Graph showing perception of risk for dry and wet seasons

The generalized linear model tested the difference between villages in risk perception, and indicated a statistical difference between the type of risk perception identified by each village ( $p < .003$ ) (Table 4).

**Table 4: Differences on perceptions of risk between villages**

| Village   | Estimate | Standard error | DF | T Value | Pr> t  | Mean   | Standard Error Mean |
|-----------|----------|----------------|----|---------|--------|--------|---------------------|
| Emboreet  | -0.745   | 0.1992         | 28 | -3.74   | 0.0008 | 0.3219 | 0.04347             |
| Narakauwo | -0.761   | 0.2083         | 28 | -3.65   | 0.0011 | 0.3183 | 0.04521             |
| Terrat    | -0.733   | 0.1801         | 28 | -4.07   | 0.0003 | 0.3246 | 0.03949             |

The results on the relationship between perception of risk and villages using data collected through Photovoice showed more perception of risk from crop damage than disease at Emboreet ( $p < .009$ ) (Table 5).

**Table 5: The comparison between types of perceptions of risk at Emboreet**

| Village  | Risk        | Risk             | Estimate | Standard Error | DF | T value | Pr> t  |
|----------|-------------|------------------|----------|----------------|----|---------|--------|
| Emboreet | Crop damage | Disease          | 1.3516   | 0.4999         | 56 | 2.70    | 0.0091 |
| Emboreet | Crop damage | Shared resources | 0.5978   | 0.4501         | 56 | 1.33    | 0.1895 |
| Emboreet | Disease     | Shared resources | -0.7538  | 0.5114         | 56 | -1.47   | 0.1461 |

Also at Narakauwo perception of risk from crop damage and shared resources show there was statistical significance ( $p = 0.0095$ ) with perception of risk from crop damage being less than shared resources ( $t = -2.68$ ) and diseases less than shared resources ( $p < .002$  and  $t = -3.13$ ) (Table 6).

**Table 6: The comparison between types of perceptions of risk at Narakauwo**

| Village   | Risk        | Risk             | Estimate | Standard Error | DF | T value | Pr> t  |
|-----------|-------------|------------------|----------|----------------|----|---------|--------|
| Narakauwo | Crop damage | Diseases         | 0.2877   | 0.5381         | 56 | 0.53    | 0.5950 |
| Narakauwo | Crop damage | Shared resources | -1.2993  | 0.4841         | 56 | -2.68   | 0.0095 |
| Narakauwo | Diseases    | Shared resources | -1.5870  | 0.5072         | 56 | -3.13   | 0.0028 |

At Terrat there was significant difference between crop damage and disease ( $p < .055$ ) as well as between crop damage and shared resources ( $p$ -value .023). Both disease and shared resources were perceived as risks (Table 7).

**Table 7: The comparison between types of perceptions of risk at Terrat village**

| Village | Risk        | Risk             | Estimate | Standard Error | DF | T value | Pr> t  |
|---------|-------------|------------------|----------|----------------|----|---------|--------|
| Terrat  | Crop damage | Disease          | -0.8967  | 0.4581         | 56 | -1.96   | 0.0553 |
| Terrat  | Crop damage | Shared resources | -1.0635  | 0.4551         | 56 | -2.34   | 0.0230 |
| Terrat  | Diseases    | Shared resources | -0.1668  | 0.4086         | 56 | -0.41   | 0.6847 |

The results (Table 8) on differences of villages by risk are quite similar to the percentage of participants' responses where at Terrat disease and shared resources have the highest percentage of 75%

and 71% of participants perceiving disease or shared resources as the dominant risk. At Emboreet, crop damage has the highest perceived risk by half of the population, while at Narakauwo the 75% of the participants found shared resources as the greatest perceived risk. This means that 75% of people in Terrat listed diseases as a main risk, 50% of people in Emboreet listed crop damage as their main risk and 75% of people at Narakauwo listed shared resources as a main risk.

**Table 8: The percentage based on peoples' perception of risk for each village.**

| Village   | Crop damage<br>% | Disease<br>% | Shared<br>resource<br>% | t-value | p-value |
|-----------|------------------|--------------|-------------------------|---------|---------|
| Terrat    | 33.3             | 75           | 70.8                    | >-1.96  | ≤.055   |
| Emboreet  | 50               | 25           | 37.5                    | >2.70   | ≤.009   |
| Narakauwo | 29.2             | 33.3         | 75                      | >2.68   | ≤.009   |

Note: The total number of people participated in Photovoice techniques for each village, were 24 for both dry and wet seasons.

The interview data ( $\chi^2 = 6.46$  and p-value 0.167) was not significantly different between villages at  $\alpha = 0.10$  (Table 9). However, percentage responses indicated most villagers (40%) at Terrat perceived disease as a risk while 60% and 50% of villagers at Emboreet and Narakauwo respectively listed the crop damage as their main risk (Table 9).

**Table 9: Percentage of people according to type**

| Village   | Crop damage | Disease | Shared resources | others |
|-----------|-------------|---------|------------------|--------|
| Terrat    | 30%         | 40%     | 30%              | 0      |
| Emboreet  | 60%         | 30%     | 10 %             | 0      |
| Narakauwo | 50%         | 15%     | 30 %             | 5%     |

Note: The total numbers of people interviewed for each village were 20.



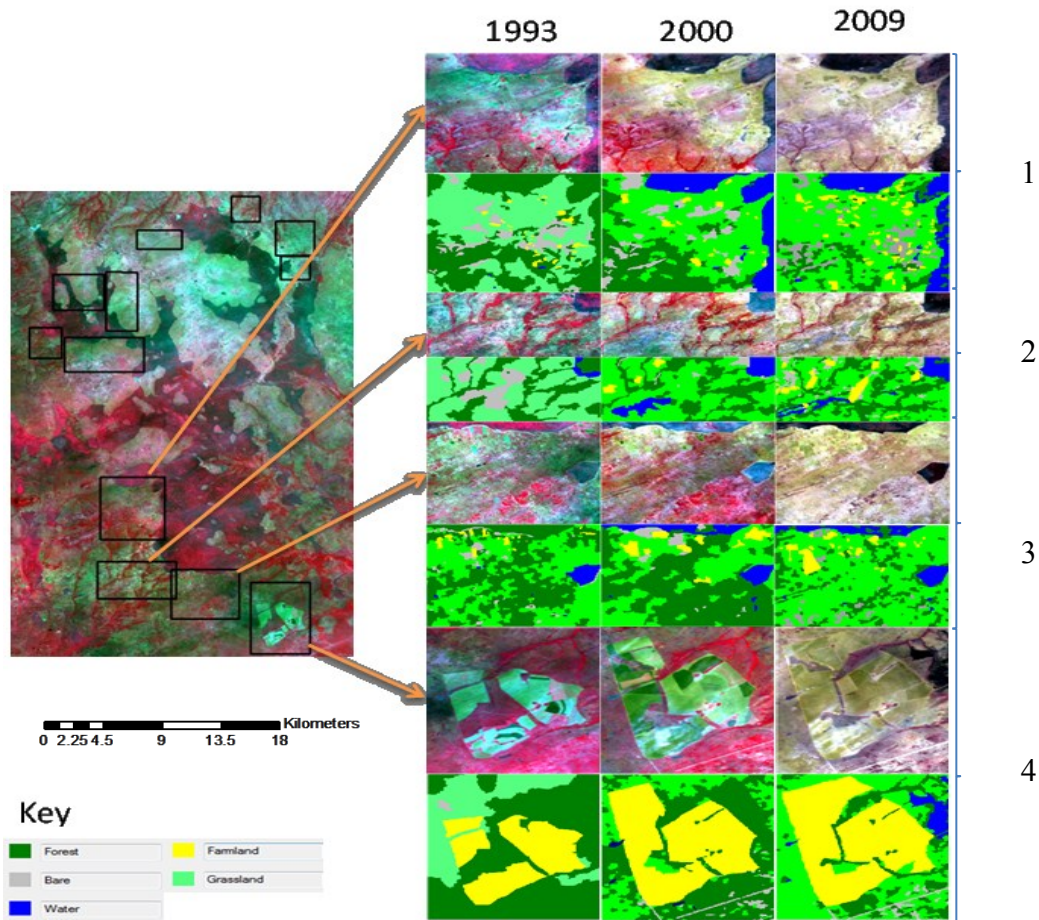
## 2. Does the increase in farms affect perception of risk?

The increase in farming activities were observed between 1993 and 2000 with the opening of new farms at Narakauwo (area 2), Emboreet (area 1) and Terrat (area 3). There were no abandoned farms in this period of time. The change between 2000 and 2009 showed increases in most of farms, however some farms also showed decreases, at Narakauwo (area 3), and area 4 for both Emboreet and Terrat (Table 10).

**Table 10: Statistics for change detection within each of the three villages**

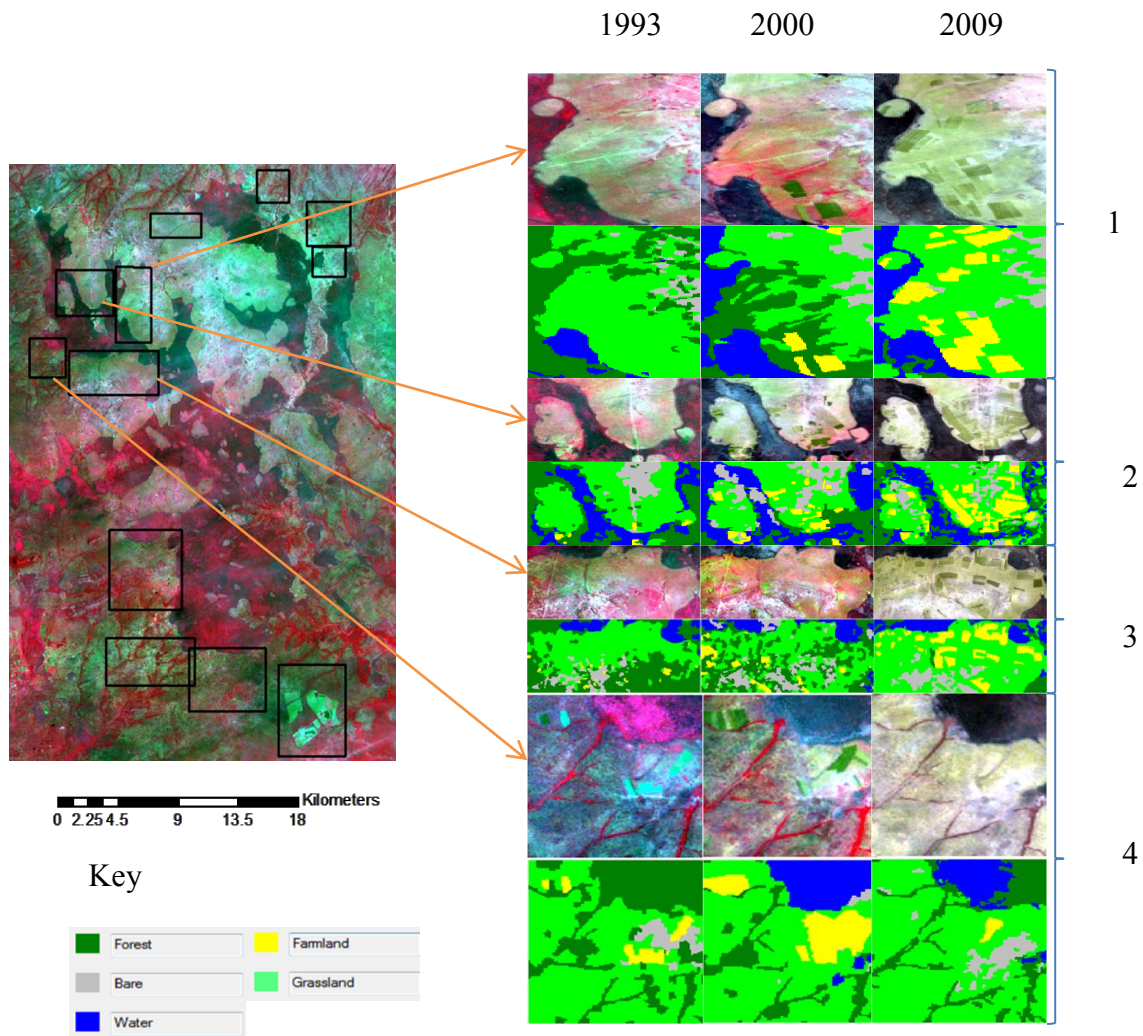
| Village   | Area | 1993-2000 |         | Percentage change | 2000-2009 |        | Percentage change |
|-----------|------|-----------|---------|-------------------|-----------|--------|-------------------|
|           |      | Initial*  | Final*  |                   | Initial * | Final* |                   |
| Narakauwo | 1    | 101.61    | 110.88  | 9.1               | 110.88    | 320.04 | 188.6             |
|           | 2    | 0         | 71.37   | 0                 | 71.37     | 261.27 | 266.1             |
|           | 3    | 78.39     | 203.67  | 159.8             | 203.67    | 199.62 | -2                |
|           | 4    | 1396.62   | 2252.25 | 61.3              | 2252.25   | 2494.8 | 10.8              |
| Emboreet  | 1    | 0         | 90.54   | 0                 | 90.54     | 449.64 | 396.6             |
|           | 2    | 29.61     | 144.36  | 387.5             | 144.36    | 367.02 | 154.2             |
|           | 3    | 54.45     | 170.1   | 212.4             | 170.1     | 510.03 | 199.8             |
|           | 4    | 47.61     | 159.48  | 234.9             | 159.48    | 12.87  | -91.9             |
| Terrat    | 1    | 21.42     | 137.79  | 543.3             | 137.79    | 161.82 | 17.4              |
|           | 2    | 17.91     | 24.03   | 34.2              | 24.03     | 78.03  | 224.7             |
|           | 3    | 0         | 66.87   | 0                 | 66.87     | 349.2  | 422.20            |
|           | 4    | 25.83     | 55.53   | 114.9             | 55.53     | 28.8   | -48.1             |

\*In hectares



**Figure 17: Narakauwo study areas, with the 1993, 2000 and 2009 difference images shown in the three columns, respectively**

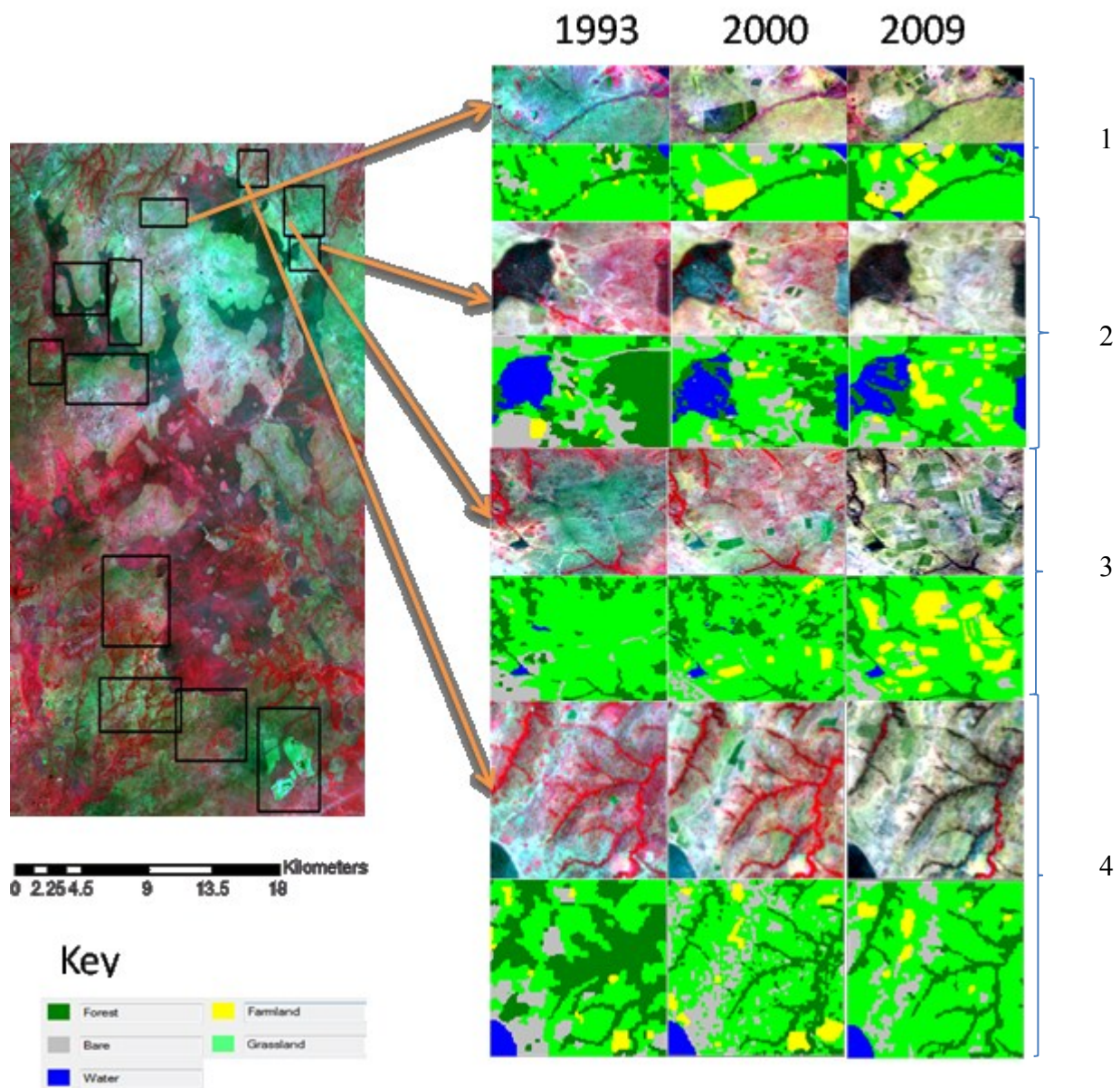
Figure 17 shows land cover changes in four different areas at Narakauwo village for three different years (1993, 2000, and 2009). In each row the above image shows raw images and the below images show land cover classification. All four areas increased in the number of farms and total area of farm land size between 1993 and 2000, while between 2000 and 2009 three areas (1, 2, and 4) show increases. The result for change detection between 1993 and 2000 for area 4 shows an increase of about 160% and between 2000 and 2009 there was 266% increase. Area 3 has two percent decrease between 2000 and 2009 (Table 10).



**Figure 18: Emboreet study areas, with the 1993, 2000 and 2009 images shown in the three columns, respectively.**

Figure 18 shows land cover changes in four different areas at Emboreet village for three different years (1993, 2000, and 2009). In each row the above image shows raw images and the below image shows land cover classification. All four areas have increased in the number of farms between 1993 and 2000. The result for change detection between 1993 and 2000 for area 2 shows the highest percentage change of about 388. Also, in 2000 to 2009, area 1 shows the highest percentage increase of 397, however, there is a decrease (92%) in area 4 (Table 10).





**Figure 19: Terrat study areas, with the 1993, 2000 and 2009 images shown in the three columns, respectively.**

Figure 19 shows land cover changes in four different areas at Terrat village for three different years (1993, 2000, and 2009). In each row the above image shows raw images and the below image shows land cover classification. All four areas have seen an increase in the number of farms between 1993 and 2000. The result for change detection between 1993 and 2000 at area 1 shows an increase of more than five times the original farm size (543%). Also, in 2000 to 2009, area 3 shows the highest

percentage increase of more than four times (422%), however, there is a percentage decrease (48%) at area 4 (Table 10).

### **3. Does distance from the park affect perception of risk?**

The results indicate that the nearest village, Emboreet (22 Km), perceived crop damage as the risk, while intermediate village Narakauwo (28 Km) identified shared resources as perceived risk, and the farthest village Terrat (48km) perceived both shared resources and disease as the main risks.

### **4. Does size of the village determine the perception of risk? Do larger villages have different perceptions of risk than smaller ones and if so, how do those perceptions vary and does it match individual perceptions (based on research question 1)?**

The village Narakauwo is about twice the size of the other two villages (Terrat and Emboreet) and has a different perception of risk (Table 1). The two small-sized villages have the same individual perceptions of risk when using both Photovoice and interview methods. Results showed 75% (Photovoice) and 40% (Interview) of people at Terrat listed disease as the main risk. At Emboreet results indicated 50% of Photovoice and 60% of interviewees listed crop damage as the main risk. However, at Narakauwo 75% of photographers indicated shared resources as the main risk and 50% of interviewees indicated crop damage as the main risk (Table 8 and 9). Diseases and crop damage was perceived as the main risk at Terrat and Emboreet respectively. However, the large size village Narakauwo has different perceptions of risk based on the method used. When Photovoice was used, participants listed shared resources as a main risk while crop damage was listed as main risk when the interview method was used. Apparently, individuals from Narakauwo and Emboreet have similar perceptions of risk (crop damage) for the interview method.

## 4. DISCUSSION

### 1: What is perception of risk among three villages?

The results from Photovoice data indicated that the study villages had different perception of risk. Emboreet village perceived crop damage as a leading risk. Shared resources and disease were perceived as risks at Terrat while at Narakauwo village shared resources were perceived as a risk. These results from each village were what I was expecting based on personal observation during Photovoice discussions. At Emboreet participants were more concerned about farms during Photovoice discussion because they are more engaged on farming activities and Emboreet participants are also worried that the park might expand its boundary and take their land. To secure their land, the villagers develop more farmland around the village. At Narakauwo, shared resources were the perceived risk because the village has only one reliable source of water that was shared by wildlife and cattle. Most participants were concerned about their health and safety since they share this water source with wild animals and livestock. They identified zoonotic diseases like anthrax and the chances of being attacked by dangerous wild animals like buffalos and lions. At Terrat participants were more concerned about disease (malignant catarrhal fever) because wildebeest breed on their village land. The presence of Holland cheese factory at Terrat seems to motivate people to keep cow since they are sure of market for the milk. Also, insufficient treatments supply at the village for tick borne diseases raise people's concern for their cattle too. Terrat village has set aside the grazing area for both livestock and wild animals where agriculture activities are completely restricted, this might be one of the reasons why most villagers at Terrat did not talk much about the risk of crop damage. However, this interaction between livestock and wild animals increases the risk of disease to livestock and cattle treatment is expensive for the villagers, and they lack veterinary doctors and the reliable water and facilities for treating their cattle.

These findings agreed with the results of study done by Roque de Pinho (2009) at Amboseli Ecosystem in Kenya on human-wildlife interaction which indicated that most 68% (n=65) participants mentioned crop damage and disease as their main problem in their community. Similarly, a study by

Baird et al., (2009) indicated that 98% (n=30) of interviewed people at Terrat mentioned livestock disease as the risk.

The chi square results from interview data indicated villages have similar perception of risk. However, the percentage responses among villages suggest differences. These differences might be caused by limited data collected as well as the reason that each interview participant was assigned only one perception of risk that they gave a high concern.

## **2: Does the increase in farm lands affect the perception of risk?**

All of the four selected areas/polygon for each village have showed an increase in farm lands size from 1993 to 2009. Three of the four areas showed the increase in farm land from 2000 to 2009 while one showed a decrease. The rapid increase in farm land at a village like Emboreet was expected to influence the perception of risk especially on crop damage. The decrease in farm lands can be explained by the abandonment of the farm land. People at Simanjoro abandon their farm because of the area is arid and has sandy soils (Kshatriya et al., 2007). The same study indicated 79% of areas under agriculture in 1984 was abandoned and was not under cultivation in 2000. For the Narakauwo and Terrat villages the increase in farming lands does not seem to influence the perception of risk to the villagers. This can be explained by higher concerns and value for their livestock (Terrat) and peoples' health (Narakauwo). Moreover, the study by Lynn (2010) that was done at four villages in Simanjoro plains, found out that wild animal avoid cultivated areas during daytime and graze far from farms, however, no information was collected during the night time. This avoidance of cultivated land during the day might reduce the crop damage incidences that are caused by wild animals.

## **3: How does the distance from the park affect perception of risk?**

The distance to the park was expected to influence the perception of risk, where the nearest village to the park was expected to have more perception of risk then the farthest village. However, the results could not verify this since each village has a different type of perception of risk. Other factors like types of human activities practiced in the village and the fact that migratory animals move from one place

to another might explain why the distance does not matter. Villagers at Emboreet village are more engaged in farming activities and they also lend their land to people from Arusha city with the payment being money or part of the harvest. At Narakauwo people were concerned about their health since they are sharing water well with wild animals and livestock. Participants at Terrat were concerned about disease due to interactions between wild animals and their livestock.

#### **4: Does the size of the village determine the perception of risk?**

Larger villages were expected to have less perception of risk due to the availability of land, hence low competition for resources. However, the results indicated that the small-size village (Terrat), and the largest village (Narakauwo) perceived crop damage as the main risk. This means that village size was not the factor that influences the perception of risk. Other factors such as limited resources, in this case water, might be the reason for these results. Perceptions of risk can also be explained by peoples' needs and worries. Future studies could address this perception by looking at the human activity that local people are engaging in, village land use, and land distribution among villagers and its productivity.

The emphasis was given to wildebeest since initially the aim of this study was to compare the issue of human wildlife conflicts between communities adjacent to Tarangire National Park in Tanzania and Great Sand Dunes National Park in the United States. However, I failed to do the comparison due to insufficient information from Great Sand Dunes. For the distance, I did not do distance of the field, households and the grazing land. Future studies should focus on this issue. Since the center of the nearest village used in this study might be far from the park boundary compared to some households at the edge of the farthest village, it might be difficult to compare the attitude of people in the village based on the distance.



## 5. GENERAL CONCLUSION

Photovoice technique has shown the strength and ability to be used as a tool to understand peoples' perceptions of risk. It has empowered people at Simanjiro by giving the opportunity for their voices to be heard by park management and also introduced the new technique of using digital cameras. Also, Photovoice is a useful tool to search for themes from the perspectives of individuals.

Here, the themes generated from photographers and interviewees were overwhelmingly negative about the interaction between human and wild animals, and suggest that most villagers do not realize the benefits from wildlife. This study shows that most local people are used to staying and interacting with these wild animals; however, villagers are not pleased with the revenue they have been receiving from tourism activities. This finding is similar to the study done by Bruyere, Beh, & Lelengule (2009) in Samburu, Kenya: In this study, interviewees acknowledged the economic benefit the community received from tourism, but it remains very minimal compared to the revenue the park generates. Currently, local people from this study feel like they are abandoned by the Government and the revenue generated from wildlife conservation does not benefit their community, despite the fact that they are the ones that are mostly impacted by wild animals. This statement agrees with a study by Lynn (2010), which stated that the revenue generated from tourism activities benefit the whole country while the destruction caused by wild animals have more impact on local communities neighboring the protected area. The burden is greater during the wet season when these wild animals migrate to community land and share resources like pastures and water with livestock, which cause disease and threat human's lives as well as livestock.

Local people also want to be compensated for the loss they incur from wild animals. The Tanzania Wildlife Conservation Act (2009) has allowed the payment of consolation money and has given the minister the power to make regulation on the payment of consolation in case of loss of life, livestock, crops and injury caused by dangerous animals. However, most local people do not know that this exists, because they have never been paid even after submitting their loss report to village leaders. Another challenge is that in order to be paid they are required to bring evidence of the destruction with them which is very hard to prove (Lynn, 2010). Moreover, local people demand to be compensated equivalent to their

loss, rather than given consolation. For instance, if a cow is eaten by lion they demand to be paid the market price of that cow which is about 350,000 Tanzania shillings (230 US dollars). The same should apply to farms but according to the law, maximum compensation for farms that have been damaged is five acres (Tanzania Ministry of Wildlife, 2009).

Despite the fact that wildebeest cause disease (malignant catarrhal fever) to cattle, most participants identify wildebeest as polite and less destructive wild animals compared to zebra, lion, buffalo, and elephants. The reason behind this might be that local people have adaptive strategies to avoid this disease by taking their cattle away from wildebeest calving areas. According to most local people, wildebeest do not eat maize but they can be destructive when they go in the farm to play or when they move with zebra.

Another issue that participants frequently mentioned in the interviews was the fear that Tarangire National Park was planning to extend its boundaries. Several studies indicated this insecurity among local people; according to Lynn (2010), people responded to their fear by expanding the density of their farms. TNRF (2005) also reported that the reason pastoralists turn to agriculture is associated with the issue of land tenure insecurity and family livelihood.

Another issue that came up in this study is about hunters who are given permits from district levels to go hunting in the villages, and who tend to ignore the village government. Photographers from Emboreet and Terrat elaborate this as a poor way to go for sustainable wildlife conservation and revenue collection. They elaborate that since the hunters do not report to the village office, there is a high chance for them to hunt without permits or abuse what is in the permit.

The meeting among villagers in this study, village leaders with the management of Tarangire National Park, was one of the biggest and most successful steps to collaborative conservation for this region. This meeting was an eye-opener for both the villagers and the park management and helped clarify several issues for the villagers. For example, before this meeting, local people thought that Tarangire National Park was the institution responsible for the issue of compensation only to find out that it is the responsibility of the wildlife division at the district level. In the meeting the participants were also

advised to establish the WMA because it will benefit their villages. They were given examples of WMAs that have performed well. Participants requested that park management conduct a workshop that will clarify this issue to all villagers. On the other hand, the park management was amazed by the way local people are concerned about the poaching activity going on in their villages, usually done by people from Arusha, and their enthusiasm to collaborate with park management to end it. What we noticed during this meeting was that there was lack of connection between these two entities.

## 6. RECOMMENDATIONS

Since each village has different perception of risks, I recommend for Tanzania National Park and other conservation stakeholders to focus on these risks in each village when empowering people or when supporting development projects. For example, for the village like Emboreet where most people perceive crop damage as the main risk since they engage more in agriculture, villagers can be empowered to engage in other income generating activities like bee keeping and eco-tourism activities.

Also Tanzania National Parks should support development projects in all villages in Simanjoro Plain regardless of village distance from the park and more support can be given to those villages that have put more efforts on encouraging conservation. This might encourage other villages to engage on conservation.

Narakauwo participants recommended Government compensation to people whose properties have been destroyed by wild animals, support from Tarangire National Park to chase away destructive animals when villagers report to the park, and that the park reduce or kill destructive animals. They also recommended that the village government should receive money generated through photography and hunting activities that take place in their villages.

Participants from Terrat recommended that Tarangire National Park should prevent wild animals from entering the village or should protect local people's farms during the wet season. They also want more research done on treatments for the diseases transmitted from wildebeest to cows. Moreover, they requested that the government send a representative who can assess the destruction caused by wild animals as soon as people report an incident, so that people can be compensated for their loss. It was also recommended by participants that their fellow villagers should create a fence around their farms to prevent some of the wild animals from invading and eating crops, as well as reducing their farm size to increase grazing land for their cattle.

Another challenge that conservation stakeholders should be deal with is to create awareness among villagers in the study areas on how to establish the WMA. Wilfred (2011) identified four economic opportunities that communities might benefit from when a WMA is in place. These are:

subsistence hunting, non-consumptive tourism, beekeeping, and utilization of forest resources. The policy stated “The Wildlife Division, in collaboration with wildlife related institutions such as TANAPA, NCAA and District Councils will carry out vigorous sensitization sessions with the villages” (URT, 2003).

However, based on negative responses to a WMA by participants, it seems the sensitization has not been done in the study area. This situation demands that these conservation institutions act quickly in order to create awareness in this community so they can benefit from WMAs and hence reduce human-wildlife conflicts.

Community Conservation Services (CCS), the outreach program established by the Tanzania National Park (TANAPA) in the early 1990s, has the goal of sharing conservation benefits with neighboring communities. However, it is the community that has to initiate these projects (TANAPA, 2007), but since there is not enough information, most villages do not apply for these projects. Also, for the park like Tarangire, with 42 neighboring villages, it is difficult for a single person in the department to supervise all of the projects as well as provide conservation education to the local people and schools. Most people who participated in this study had never participated in any conservation education efforts, thus there is a demand for TANAPA to hire more staff for the outreach department. Moreover, even though the park has supported several development projects within the community, most people are not aware that it is the park that supported them. Therefore, there is a strong demand for the park management to involve all local people in the village when supporting these projects. This can be done by organizing regular village meetings and explaining the park contribution to the project and peoples’ responsibility. So, I recommend that the park hold regular meetings with local villagers to clarify these issues.

For the duration of the study, I noticed lack of communication between communities and conservation stakeholders such as the national park. So, for sustainable conservation of wild animals within the Tarangire-Manyara ecosystem, I recommend a collaborative conservation initiative among stakeholders. If people are aware of how their community benefits from wildlife and see that their traditional knowledge is incorporated in decision making, they might be tolerant of wildlife, and they will participate in conservation efforts. It is important for conservation managers to work on developing a

communication system that works for all stakeholders, and to assess the system every now and then to see if, and how, it works.

Since managing protected areas by a single entity is difficult, local people's involvement in decision-making can be a key factor in meeting the conservation goals (Bruyere et al., 2009). The first step to enable collaboration among conservation stakeholders should be to assess the existing communication system (Bruyere et al., 2009; Kernel, 2005), and to engage in meaningful discussion and exchange of information (Backman, Petrick & Wright, 2001; Bruyere et al., 2009; Bryan, 2004). The benefit of involving local communities can be seen in several studies; one is the connection formed in post-industrial England (Curry, 2000), and ecotourism in South America (Farrel & Marlon, 2002). Failure to incorporate local people may lead to lack of trust and poor participation of local people on conservation efforts (Songorwa, 1999). If the conservation stakeholders like Tanzania National Park decide to follow this strategy, there is possibility of minimizing peoples' negative perception of risk on wild animals.

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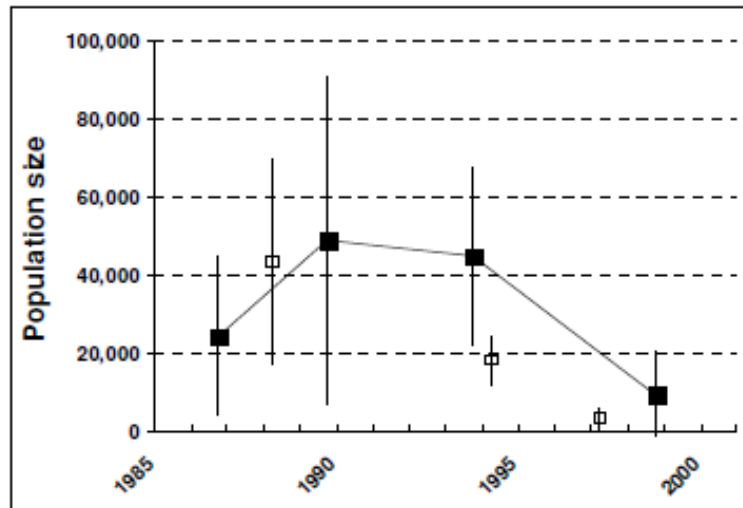
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**Appendix 1: Wildebeest population trends from historical Systematic Reconnaissance Flight (SRF) data, wet and dry seasons**



**Data source: Tanzania Wildlife Research Institute (TAWIRI) May 2001 Aerial Survey Report**

## **Appendix 2: Simanjiro questionnaire**

### **LOCAL PEOPLE PERCEPTION OF RISK ON MIGRATORY HERBOVORES AND PARK. A CASE STUDY OF TARANGIRE NATIONAL PARK, TANZANIA**

#### Personal information

1. Please tell me what is your tribe
2. How long have you been living here?
3. What attracted you to live here?
4. What social economic activity are you engaged in?
5. How do your tribe norms perceive wild animals and environment?

#### Human-wildlife issues

6. Are you familiar with the migratory animal wildebeest?
7. How frequently are do you encounter with wildebeest?
8. Can you please describe your perspectives on wildebeest: reasons?
9. Are wildebeest a problem to you? How?
10. What are resources shared between livestock, human being and wildebeest?
11. Do you think wildlife have advantage for you? Explain.
12. Do you think increase in land use changes contribute to increase in human wildlife conflict?
13. What are problems caused by other animals besides wildebeest?

#### Relationship with the park

14. Do you know Tarangire National Park?
15. What relationship does village/villager have with the park?
16. What are benefits you receive from wildlife authorities (Wildlife Division, Tarangire National Park)?

17. Are you by any chance involved in decision making concerning wildlife in your area?
18. Please describe solutions taken by the village, Division of Wildlife, and Tanzania National Parks to resolve these conflicts.
19. Please give your recommendation on how to resolve these human-wildlife conflicts.