



**SPECIAL PROJECT REPORT**



**TITLE: ECONOMIC ASSESSMENT OF THE EFFECT OF WILD  
MAMMALS AND BIRDS ON CROP PRODUCTION IN THE AREA  
SORROUNDING UDZUNGWA MOUNTAIN NATIONAL PARK**

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**A SPECIAL PROJECT REPORT TO BE SUBMITTED AS A PARTIAL  
FULFILMENT OF THE DEGREE OF BACHELOR OF SCIENCE IN  
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## ABSTRACT

This study assessed economic assessment of impact of wild mammal and birds in crop production in the area bordering Udzungwa Mountain Nation Park. Three villages bordering the park were selected purposively (Mang'ula, Msolwa ujamaa and Sanje). Village register was used as sampling frame from which households for interview was obtained. 74 households were interviewed. 37 households with crop farms damaged by wild mammals and birds and another 37 households whose crop farms were not damaged by wild mammals and birds. Data were collected using structured household questionnaires, one to one interviews, reviewing of literature, and was later analyzed using statistical package for social scientists (SPSS). The result of the study indicated that animal species and bird species involved in crop raiding in the study village were Baboons, elephants Vervet monkeys, Blue monkey wild pig and Colobus monkeys were the destructive crop raider in kilombo district. They cause heavy crop losses while squirrels Rats, butterflies and Bird including *Quelea quelea* are also raider but with less effect compared to the first group. Food crop are most raided crop within the areas surrounding Udzungwa Mountain Nation Park include, rice, maize, bananas and sugar cane this is due to its preference by many of the vermin. Other crop that have mention by the most villagers including fruit and vegetables on the small garden near home also coconuts and palm oil. Also the income from non-wild animal damaged farms was TZS 300,000 per acre per year whereas income from wild animal damaged crop farms were TZS100, 000,000 per acre per year. Despite crop raiding, other factors affecting crop cultivation including the size of the farm cultivated, annual rainfall, diseases and management of the farm active. Therefore, the amount lost by the farmers living nearby protected area should be compensated immediate by the government and sectors involved, conservation education is paramount, coherent land use plans should be emphasized to determine where certain crops can be grown.

## **DECLARATION**

I, MASARE SARAH JOSEPH, do here by declare to the Senate of Sokoine University of Agriculture that this special project report is my own original work done within the period of registration and that it has neither been submitted nor being concurrently submitted in any other institution.

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## CHAPTER ONE

### 1.0 INTRODUCTION

#### 1.1 Background

The history of wildlife conservation in Tanzania has started a long time during pre-colonial era, where the pre-colonial society used custom, taboos and believe to conserve natural resource. The conservation idea of native lasted until the coming of Europeans, where the idea of conservation among the pre-colonial traditional society was highly disputed (Redford and Sanderson, 2000; Songworwa *et al.*, 2000). The American Yellowstone model was adapted (popular known as ‘fences and fines’ or ‘fortress conservation’ approach), where hunting practices by the native was presented as cruel, barbarous and wasteful (Adam & McShane, 1996; Lewis *et al.*, 1990). And it was during this period of time, where Human wildlife conflict started to arise.

Long temporal studies monitoring large herbivore populations in African rangelands such as in Kenya and Tanzania have shown that wildlife outside national parks and game reserves has declined drastically over the last 2 decades (Caro *et al.*, 1998). This is due to the fact that significant proportions of wildlife reside outside of protected areas (Hoare, 1999a), where they are exposed to the possible effects of anthropogenic factors such as agricultural encroachment, competition with livestock, legal and illegal hunting and human population.

Human wildlife conflict is one of the major threats to conservation, house hold food security and rural incomes. A common, ancient and global example of human wildlife

conflict is crop raiding (Hill, 1997; Treves, 2001). Crop raiding can be simply defined as wild animals moving from their natural habitat into agricultural land to feed on the crops that humans grow for their own consumption and trade (Zubiri and Switzer, 2001). Until recently, there has been little attention given to vertebrate species that damage crops, particularly crops of small-scale farmers in tropical and sub-tropical regions. Yet, there is good evidence that crop raiding is not a new phenomenon. Perhaps not surprisingly, certain species of primates are very successful crop raiders (Hill, 1997).

Agriculture forms the baseline to Tanzania's economy, contributing about 45% of the GDP (World Bank, 2009), thus the government increased focus on agriculture through "Kilimo Kwanza" but also this sector underpins the livelihoods of 80% of the population (UNEP Adapt) and is therefore critical for poverty reduction. Farmers in rural Tanzania mainly practice subsistence agriculture, while surplus from a given agricultural season may be sold off to supplement farmers' income. The practices thus guarantee food security and income for the particular communities.

There is a high degree of dependence on agriculture for subsistence within communities of Kilombero district, as it may be the case elsewhere in Africa. For approximately up to 70% of people, agriculture is the sole source of livelihood (ASDP FINAL, 2006). However, much as agriculture is important to the farmer and the country's economy in general, it is threatened by a number of factors which include; soil degradation, land tenure, misuse of agrochemicals, low technological inputs, low yields, and poor agricultural product marketing. And in case of household level, subsistence farming is threatened by erratic climatic patterns, civil unrest, cattle rustling, pre and post-harvest losses (NEMA, 2000) and crop raiding by animals. Where's crop raiding mainly occur in

the farmers of the people surrounding the protected area unlike those live from the distance.

Crop damage caused by raiding wildlife is a prevalent form of human–wildlife conflict along protected area boundaries (Treves, 1998). The individual economic losses suffered from crop raiding can be relatively high in developing countries, because farmers are poor and rarely compensated for their losses (Sekhar, 1998; Rao *et al.*, 2002). Such losses can make communities antagonistic and intolerant towards wildlife, which can result in retribution killing of problem species as well as undermining and delaying conservation strategies (Nyhus *et al.*, 2000).

## **1.2 Problem Statement and Justification of the Study**

Human-wildlife conflicts have been in existence for as long as human have existed and wild animals, since the time when they have share same landscapes and resources (Lamarque *et al.*, 2008). A common, ancient and global example of human wildlife conflict is crop raiding and encroachment (Hill, 1997; Treves, 2001). Now days many conservationist has focused on the study to measure the intensity and status of conflict, forgetting to study the socio-economic impact by doing evaluation on how the farmer encounter economic loss from the result of crop destruction by wild animals. In Tanzania human wildlife conflict has been encounter in many nation park especial with the people surrounding the national park, With reference to Udzungwa- soleour corridor also the conflict is high.

### **1.2.1 Justification of the study**

This study will assess the economic impact of wild animals on crop production. Outcome of this study will contribute to policy development to improve management of wildlife in villages around national parks. Also the results will inform conservationists to have better decisions on compensations for losses caused by wildlife to farmers. But also suggest strategies for conservation within protected areas which will reduce the impact resulting from crop raiding by the wild animals.

### **1.2.2 Why studying it at villages around Udzungwa Mountain National park**

Crop raiding by the animals either wild or domestic always result into a big misunderstanding among the actors. In pack crop raiding result into negative perceptions of the community towards conservation initiatives and protected areas. As the result people cannot withstand the damages and loss done to them by the wild animal hence, Local people revenges against conservation initiatives though illegal activities in protected areas, violence and vandalism of resource thus threatening the survivor of wild animals (Kideghesho, 2006). To minimize threat and insure survival of the udzungwa mountain living organism, (wild animals and the forest), the study will be conducted in three of the village around the park including Mang'ula, Msolwa and Sanje villages, to represent other villages and find the possible solution that will favor many other villages around Udzungwa mountain national park.

### **1.3 Objectives of the study**

#### **1.3.1 General objective**

To assess economic impact of wild mammals and birds to crop production in the areas bordering Udzungwa mountain national park

#### **1.3.2 Specifics objectives**

1. To identify wild mammal and birds damaging agricultural crops in areas adjacent to Udzungwa national park
2. To determine crop farmers' annual income in the study villages
3. To compare income from crop farm damaged by wild mammal and birds and income from crop farms not damaged by wild mammals and birds

### **1.4 Study hypotheses**

#### **1.4.1 Null Hypothesis**

Income from wild animals and birds damaged crop farms are not different from income from non-wild mammals and birds damaged crop farms.

#### **1.4.2 Alternative Hypothesis**

Income from crop farms damaged by wild mammals and birds are different from income from crop farms not damaged wild mammals and birds.

## **CHAPTER TWO**

### **2.0 LITERATURE REVIEW**

#### **2.1 Human Wildlife Conflict**

Human wildlife conflicts is not a new problem in Africa. Although conservationists view human wildlife conflict as a critical new problem created by growing rural populations settling in or near wildlife habitats. Historically experts realized that agriculturalists have lost crops and livestock to wild animals for centuries (Vansina, 1990; Sukumar, 1994). Apart from crop riding other cause of human wildlife conflict include agricultural encroachment, competition with livestock and attack by wild animals, illegal hunting and human population growth.

In Tanzania, Human-wildlife conflict is a common phenomenon in the Tarangire-Manyara ecosystem, GEP PPROJECT (2006A, 2007B, 2008C). But it has also been encounter at Udzungwa mountain national park, Marshall A.R. (2007) also assert that due to the disturbance the habitat of primate and other animals in Udzungwa national park has been destroyed, as the result of habitat destruction the animals raid on crop near by the park for food and also shelter.

#### **2.2 Crop Raiding by the Wild mammals and Birds**

Crop damage caused by raiding wildlife is a prevalent form of human-wildlife conflict along protected area boundaries (Treves, 1998). The individual economic losses suffered from crop raiding can be relatively high in developing countries, because farmers are poor and rarely compensated for their losses (Sekhar, 1998; Rao *et al.*, 2002). In many developing countries, wildlife is not of interest to rural population (Hough, 1988; Vincke



& Sournia, 1989). As crop raiding by wildlife led to incidences of loss of human life, injury to humans, destruction of crops and farm infrastructure (Hill, 1997; Treves, 2001), indeed frequently they incur the costs of living with wildlife without receiving any benefit from it (Sibanda *et al.*, 1996 cited on Thorton *et al.*, 2006).

The problem of crop raiding is thus a national and an international problem for which no perfect long term solutions have yet been found. In some National Parks and forest reserves in Tanzania, quite a number of measures to minimize crop raiding have been implemented includes, guarding crops against damage by wildlife. This is a common practice across the agriculture wild-life interface (Salafsky, 1993; Hill, 2005).

### **2.3 Common Wild mammals and Birds Involved in Crop Raiding**

When crop raiders cross into a farm to raid crops, they are typically viewed as “pests”, “weeds” or “ecological” dislocates (Sawarkar, 1994). Crop raiding is seldom incorporated into theoretical studies of primates feeding ecology or behavior because of an emphasis on evolved plant –animal interactions (Richard, 1985).

Red-billed queleas are capable of destroying entire crops, over areas up to 1000 ha (Ibrahim, 2007). An individual quelea consumes an average of 18 grams of grain per day. It is not unusual for flocks to number into the millions, so a flock of 2 million birds can eat up to 50 tonnes of grain in a day, or 1500 tonnes within 30 days, which is worth approximately US\$600 000. The east African countries of Somalia, Kenya, Tanzania, Ethiopia, and Sudan suffer an annual total loss of grain worth US\$15 million (Pimentel, 2002).

Despite bird's species, crop raiding by wild animals has persisted as a problem in most of the areas surrounding Protected Areas in Tanzania to the detriment of surrounding communities' livelihoods. In Udzungwa mountain national park, the problem animals include non-human primates, elephant warthog and buffalos can cause significant crop damages outside the park (Harrison *et al.*, 2007).

#### **2.4 Type of Crops Most Affected and Extent of Damage**

Crop raiding may be greatest during harvest season, but it does occur throughout the year. In particular maize seems to be targeted and damaged throughout its growing cycle, from the newly sown seed to the time the cobs are mature. Damage sustained at any stage can cause severe crop losses, but these are most serious when crops are mature (Sillero-Zubiri, 2001).

In Tarangire- manyara ecosystem the most damaged crop was maize (57.1%), followed by lablab beans (22.1%), green gram (8.8%), beans (6.2%), cowpeas (1.8%), sunflower (1.3%) and sorghum (1.3%). At village level, maize was the most damaged crop in Loborsoit A (92.5%) and in Lolkisale (57.4%). In Naitolia, maize and green gram were the most damaged crops (31.6% each). In descending order, the most damaged crop was lablab beans in Lolkisale (31%) and Naitolia (17.5%) and beans (5%) in Naitolia noted from GEF Project, (2006a; 2007b, 2008c).

#### **2.3.1 Increase in human population**

Rapid population growth with a national average rate of growth of 2.7 percent per annum for Tanzania during the intercensal period 2002-2012, compared to 2.9 percent per annum in the previous period 1988-2002, (THDR 2014). Where by in the case of Kilombero

district population increase at a rate of 2.5 per annum and also through migration into the Kilombero area which causing not only land shortage but is also increasing cultural diversity (REPOA, 2003). Because of increasing demand for land and the declining productivity of the already cultivated land, human communities are looking to virgin lands especially forests, which they believe to be more fertile than their own land, for increasing agricultural productivity (Kyalisiima, 2012).

### **2.3.2 Changes in agricultural methods and techniques**

Through high population pressures, the rise in demand for land for cultivation means that in many areas much of the suitable arable land is already cultivated. More marginal land is therefore tilled and farming goes right up to boundary of wilderness and protected areas. Pest species are likely to flourish along the edges of natural habitat and agricultural lands, where they can eat both the food available in undisturbed habitats and the crops growing in the adjoining farmland (Sillero and Switzer, 2001).

### **2.3.3 Increase in agriculture and encroachment**

Through high population pressures, the rise in demand for land for cultivation means that in many areas much of the suitable arable land is already cultivated. More marginal land is therefore tilled and farming goes right up to boundary of wilderness and protected areas. Pest species are likely to flourish along the edges of natural habitat and agricultural lands, where they can eat both the food available in undisturbed habitats and the crops growing in the adjoining farmland (Sillero -Zubiri and Switzer, 2001).

#### **2.3.4 Competition for resources between people and wildlife**

Overlapping land uses national park and game controlled area occupy most of the land in Kiteto, Monduli, Ngorongoro and other districts. And overlapping land use allows other activities like agriculture, settlements and ranching to take place simultaneously. Some of game controlled areas are critical habitat for wildlife in a given season. They also form wildlife migration routes during the seasonal rhythms brought about by climate change. Those areas have serious land use conflict and disputes. So far overlapping land uses like game controlled can only be mixed or combined with livestock keeping, (Tanzania land policy, 1997).

## **CHAPTER THREE**

### **3.0 RESEARCH METHODOLOGY**

#### **3.1 Description of the Study Area**

##### **3.1.1 Geographic location of the study area**

The study was conducted in the area surrounding Udzungwa mountain National park, which is located at 7°48'S 36° 41'E. Village studied was purposely selected, which are Mang'ula Msolwujamaa and Sanje villages.

##### **3.1.2 Climatic condition of the study area**

Mang'ula village, Msolwujamaa village and Sanje village is within Kilombero district which add to the other four district to form Morogoro region. Where by, Morogoro climate is moderate with slight variations, particularly in temperature, based on altitude. Whilst the average annual rainfall ranges from 600mm–1,800mm, certain localized areas of the district (TBBT Project, 2014).

##### **3.1.3 Economic activities**

Most villagers in Kilombero district including Mang'ula, Sanje and Msolwa ujamaa are involved in agricultural activities and many of the villagers work in the sugarcane farms. There is also plenty traditional farming for staples and it is possible to visit some of the local farms and see the ancient methods in practice. Most farmers in Kilombero district in large are engaged in paddy farming, maize is the second staple, although in this region, maize is only grown as a “safety net” in case the rice fail. Other crops cultivated in the region include sorghum, sweet potatoes, beans, cassava, millet, groundnuts, tomatoes,

fruits and vegetables. Some few people at Mang'ula has engaged in traditional dances for tourism industry (TBBT Project, 2014).

### **3.2 Research Designing**

Cross sectional research design was adapted in this research, whereby data was collected in one point at a time. Two group will be compared in each selected village that include household with wildlife damaged farm to household with non-wildlife damaged farms.

#### **3.2.1 Sampling techniques and sample size determination**

In this study, the villages around the park was selected purposively, where Mang'ula, Msolwa ujamaa and Sanje was selected. Village register was used as sampling frame from which households for interview was obtained. The approach allowed every household to have an equal chance of being selected (Kothari, 2004). Approximately 74 household head will be interviewed, 24 household from two each of village. From each village 12 household head with crop farms damaged by wild animals was interviewed and another 12 household head whose crop farms were not damaged by wild animals was also interviewed, which make total of 24 household interviewed in each village. But also the three study village a total of 36 household whose farms were damaged will be interviewed and another 36 household whose farms were not damaged will interviewed making the total of 72 household including the two household of the villages authority which make the total of 74.

### **3.3 Data collecting method**

Both primary and secondary data will be collected from this study.

### **3.3.1 Primary data**

Primary data can be defined as data collected direct from the field for the first time, data must be original. To get primary data from the field method included was observations and personal interview. Therefore in this study data collection was including direct observation and interview using the research tool.

### **3.3.2 Secondary data**

Secondary data can be defined as data that have been primarily collected by other researcher and documented already. To get this kind of data reading is required, therefore the data was collect through reviewing the past related materials such that from the internets, blogs, reading the text books journals report and publication of various associated materials connected to the impact of wildlife to the agricultural crop.

### **3.4 Data analysis**

Both qualitative and quantitative data was used. The data collected was analyzed by using Microsoft Excel (M-Excel) and statistical package for social scientists (SPSS). T-test was used to compare income from crop farm damaged by wild mammals and birds with income from crop farms not damaged by wild mammals and birds.

## CHAPTER FOUR

### 4.0 RESULT AND DISCUSSION

#### 4.1 Socioeconomic characteristics of respondent

##### 4.1.1 Respondents occupation

From statistics about 89.2% of the people in the study areas are farmer and their entire income of the household depend on crop production while the other 10.8% depend on other source of income. Many of them engage themselves in subsistence farming with the common crop grown including, Rice, Maize, Sugarcane, and bananas. The crop are mainly grown for food but the remaining surplus food crops are sold to generate household income, also some of the cash crop are grown with an example of sugarcane due to the presence of industries for sugar production (Kilombero sugar company).

##### 4.1.2 Background characteristics of the respondents in the area of study

Table 1 indicates gender of respondents where by 48.6% of the responses were received from males while 51.4% of the response were from females. This helped to avoid bias in data that were collected because they were so important to get views from both gender parties.

**Table 1: Sex of respondent**

Sex of respondent	Frequency	Percent
Male	36	48.6
Female	38	51.4
Total	74	100.0



#### 4.1.3 Age of respondent

Table 2 shows the age groups of respondents whose responses were mainly got from persons of ages between 22-39years with (29.7%), 40-59 years with (48.6%) and 60-73years with (21.6%), as they are the majority living along the forest reserve and are energetic, conducting agricultural activities, among others.

**Table 2: Age of respondent**

Age categories	Frequency	Percentage
Youth age	28	37.8
Middle age	36	48.6
Old age	10	13.5
Total	74	100.0

#### 4.1.4 Marital status of respondent

Table 3. Show that responses were got from various categories of people of which 71.6% were married, suggesting that responses were from responsible and mature people. A small fraction of 20.3% of the respondents were single and only 8.1% have lost their partner in marriage. The bigger percentage of respondents were married, and therefore mature and are likely to require land for settlement and agriculture.

**Table 3: Marital status respondent**

Marital status	Frequency	Percentage
Married	53	71.6
Single	15	20.3
Widow/widower	6	8.1
Total	74	100.0

#### 4.1.5 Education Background of Respondent

Table 4 shows that 6.8% of respondents interviewed were illiterate 77% attended primary level, and those who had attended secondary school and tertiary education were 13.5% and 2.7%, respectively. Therefore the study results have indicated medium illiteracy of respondents meaning that the biggest percentage of population interviewed are involved in agriculture.

**Table 4: Education background of respondent**

Education level	Frequency	Percentage
No formal education	5	6.8
Primary education	57	77.0
Secondary education	10	13.5
Collage/university education	2	2.7
Total	74	100.0

#### 4.1.6 Household income generating activities

Field data shows that 89.2% of the respondents were subsistence agricultural farmers other occupations included drivers (1.4%),business (2.7%) self-employment (1.4%), and civil servants (5.4%) as shown in Table 5. These findings, show that crop raiding can affect the community most, since the majority of the respondents are engaged in farming (89.2%).

**Table 5: Household income generating activities**

Income generating activities	Frequency	Percentage
Farming	26	35.1
Livestock keeping	21	28.4
Business	19	25.7
waged person	8	10.8
Total	74	100.0

#### 4.1.7 Size of the land owned by respondents

Table 6 shows that 43.2% owned 2 to 3 acres of land, 28.4% owned 0 to 1 acres, 16.2% between 4- 5 acres of land, 8.1% owned 6 to 7 acres, about 1.4% are with 8 to 9 acres and only 2.7% owns over 10 acres. This shows that most of the respondents are affected as many of the people are engaged in agriculture.

**Table 6: Size of land (acres) owned by respondents**

Size of land (in acre)	Frequency	Percentage
0-1	21	28.4
2-3	32	43.2
4-5	12	16.2
6-7	6	8.1
8-9	1	1.4
10	2	2.7

Most of the farmers in the study have the landownership between two to three acres, taking in about 43.2% shown in table 6. From the result, it shows that crop raiding can adversely affect the livelihood of people in Kilombero district as they depend on agriculture farming

#### 4.2 Wild Mammals and Birds Damaging Agricultural Crops and Extents of Damage

In response to the first objective of the study; to identify animal species most involved in crop raiding/damage Udzungwa Mountain National Park to the people neighboring the park, respondents were asked through one to one interviews guided by questionnaires to identify the animals that mostly raid their Farms and destroy crops. The animals were ranked on order to see whether the primate, large mammal or birds are more involved.

#### 4.2.1 Wild mammals and birds involved in crop raiding

Table 7 shows that, primate are the most predominant crop raider at the three studied village around udzundwa mountain national park with 37.1%, followed by Elephants with 25%, then rodent and insect with 14.3%, then followed by birds in 12.8% and the last wild pigs with 7.5%.

**Table 7: Animal species involved in crop raiding**

Animal species	Frequency	Percentage
Primates	52	37.1
Rodents	20	14.3
Elephants	35	25
Birds	18	12.8
Wild pig	15	7.5
Total	140	100.0

Result show that primates are the most notorious crop raider especial Baboons, Vervet monkeys, Blue monkey and Colobus monkeys. These animals are typical forest dweller animals, whose life depend on entirely on the forest product, destruction of their habitat is one of the cause for their movement toward the human's farm to seek for food. The second group to it are large mammals as mentioned by the many respondent especial in Mang'ula A and Sanje village include Elephant as the most notorious and wild pig. Also Rodents such as Cane rat and Rats and the last groups are the bird especially *Quelea quelea*. The distance from the forest to gardens is also an important factor influencing the level of crop raiding. According to this research most of the farms are near to the park just demarcated by the main road to Ifakara. That is why animals reaches the farms easily, due to the presence of encroachment on their habitats, animals become destructive to planted crops.

Damiba and Ables (1993) noted that production of highly palatable and nutritious seasonal crops such as maize, sugar cane and bananas, which attracts primates and other wild animals, involve heavy losses and therefore high guarding investments. In some instances farmers lose a whole garden particularly in areas highly infested with baboons, vervet monkeys, bush pigs and Colobus monkeys, which inflict heavy and potentially catastrophic losses. This therefore implies that community livelihoods adjacent to Forest Reserve are highly affected by crop raiders. The findings of this study also came to the same conclusion with Sillero-Zibiri (2001) research that across the globe, primates wherever they occur, are the most frequently identified crop raiding animals.

#### 4.2.2 Stage in growing cycles most preferred by crop raider

Table 8. Show that crop raiders prefer the time near by the harvesting of the crop about 50% of the respondent agree on that, 33.8% agree on the flowering time that when the process of reproducing start, 9.5% on fruiting and 6.8% on germination. The extent of raiding can be determined here as the farmer determine the amount to be harvest near harvesting and they can real see to what extend their crop have been ruined.

**Table 8:** Stage in the growing cycle's preference by crop raiders

Growing cycle	Frequency	Percentage
Germination/seedling	5	6.8
Flowering	25	33.8
Harvesting	37	50
Fruiting/rooting	7	9.5
Total	74	100.0

#### 4.2.3 Time of the year crop raiding occur

Table 9. Shows that during the beginning of the year 70.3% of respondent agree on crop raiding activities to be higher, 24.3% of them agree on the middle and the remain says it is on the end of the year.

**Table 9: Time of the year crop raided occurs**

Time of a year	Frequency	Percentage
Beginning	52	70.3
Middle	18	24.3
End of the year	4	5.4
Total	74	100

Beginning of the year is on between January to April, in morogoro region there is high rainfall in that season hence many of the animal move from their natural habitat to the outside and on the other side it is the time to when crops reproduce.

#### 4.2.4 Time of the day wild mammals and birds comes to the farms

Table 10. Shows that, 33.8% say at night is when crop raiding occur, 31.1% of them say it is at dawn afternoon, 29.7% says it is at the morning and only 5.4% say it is the evening.

**Table 10: Time in a day wild mammals and bird comes to the farm**

Time of the year	Frequency	Percentage
At dawn afternoon	23	31.1
Morning	22	29.7
Evening	4	5.4
Night	25	33.8
Total	74	100

#### 4.2.5 Causes of crop raiding by wild mammals and birds

Information was obtained by interviewing farmers, from table 11. It shows; Farmers response (27.0%) in kilombero district indicated proximity to the park as being the main reason as to why there is frequent crop raiding by wild animals, followed by lack of food in the park for the animals (23.8%), cultivation adjacent to the zero buffer zone area (19%) high population of people (12.7%) and due to increasing in animal population (3.2%).

**Table 11:** Causes of crop raiding

Causes	Frequency	Percentage
Lack of food	15	20.3
High population of wildlife	14	18.9
high population of people	8	10.8
Living near the national park	17	22.9
All of the above	9	12.2
Do not know	11	14.9
Total	74	100

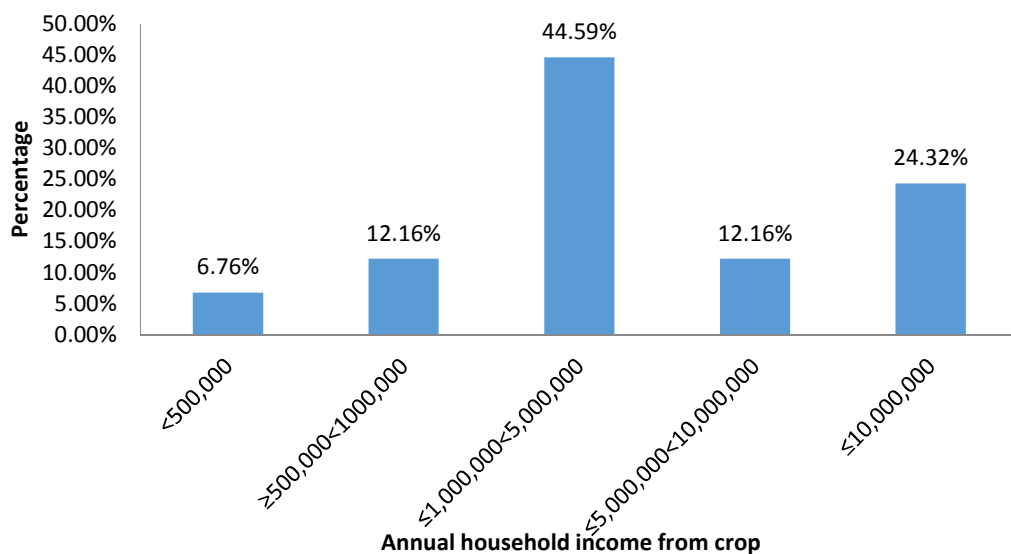
The administrators and technical staff on the other hand cited increase in the human population as the main reason ranked first, then improvement in conservation effort hence growth of animal population in the park which has increase completion, lack of land use pattern within the villages The extent to which the attack occur was assessed in term of the frequency of the attack and

#### 4.3 Total Annual Income of the Farmers Around Udzungwa Mountain National Park

In response to the second objective of the study; To determine crop farmers' annual income in the study villages. Whereby fluctuation in the income was observed, farmers income was affected by many factors including size of the farm, management of the farm, diseases and also crop raiding activities within an area.

### 4.3.1 Annual household income from crop farming

Figure 1, shows that 44.59% of respondent obtain total income of Tzs 1,000,000 to Tzs 5,000,000 and the last group with 6.76% obtain below 500,000Tzs as their annual income. However the average annual household income was Tzs 5,888,865.



**Figure 1: Household income from crop farming**

Information on the total income of the household from crop farming was gathered in an attempt to answer the second objective of the research. The result indicate alteration in the income between the respondent, that fluctuation of the income is believed to mainly be caused by raiding activities. Despite that, other factors affecting crop cultivation including the size of the farm cultivated, annual rainfall, diseases and management of the farm activetiess. Effect on the annual income of the village also affect the nation in large. Despite other causes, crop raiding severely affect the income of the respondent as explained by the graphs and tables above.



Nchanji (1998), emphasized that crop raiding is a serious problem as wild animals can have a devastating impact on the standard of living of peasants whose entire survival is dependent on subsistence agriculture. Over fifty million is lost every year lowering the annual income of people within an areas.

#### 4.3.2 Livelihood effect

The result in table 12 shows that, 49% of the people raided crop says that poverty has increased in the last season due to the raiding encountered and another 51% are saying that due to the problem there is shortage of food within the house.

**Table 12: Livelihoods effect**

Effect encountered	Frequency	Percentage
lack of food	19	51
Poverty	18	49
Total	37	100.0

The findings of the study indicate that the destruction of crops in the farms contribute significantly to the food insecurity problem which further determines the livelihoods of the local people. It also affirms the fact that crop loss to animals has contributed greatly towards low income generation within communities.

#### **4.4 Comparison of Income from crop farm with or without damage from wild mammals and birds**

##### **4.4.1 Crops cultivated in the areas surrounding udzungwa mountain national park**

Table 13 shows that; Rice and sugarcane are the most grown crop at Kilombero district whom are also favored by the primate and all other animals mentioned by the respondent. Where 47.8% grow rice only, maize 29.4%, Bananas 13.2% sugarcane with 9.6% and fruit with 0.8%. Fruit are not grown in small or large scale but may be one tree by a person which are also much preferred by many of the crop raiders.

**Table 13: Crop cultivated in areas around Udzungwa mountain national park**

Crop cultivated	Frequency	Percentage
Maize	40	29.4
Rice	65	47.8
Banana	18	13.2
Sugar cane	13	9.6
Fruits	1	0.8
Total	136	100.0

Crop most preferred by many farmers in Kilombero district is rice and maize, which are also preferred by many crop raider as mention by many respondent

#### 4.4.2 Farming seasons

Table 14 shows, many of the farmers in kilombero district about 67.6% of them have only one farming season, followed by 27% with two season and 5.4% of farmer which use irrigation methods hence having three farming season. By this distribution we can see that crop raiding activities concentrate much only on one season that most farmers farm and less on the remaining part of the year.

**Table 14: Farming season per year**

Farming season	Frequency	Percentage
One	50	67.6
Two	20	27.0
Thrice	4	5.4
Total	74	100.0

#### 4.4.3 Frequency of invasion

Table 15 shows, crop raiding activities is almost twice per a week as suggest by almost 39.2% of the respondent, this shows that during the farming season this act is almost like everyday activities to the animals as it also followed by daily during farming season with 13% ending by 5.4% which says only once per a year

**Table 15: Frequency of invasion?**

Time of invasion	Frequency	Percentage
daily during crop farming season	10	13.5
once per week during crop farming season	6	8.1

twice per week during crop farming season	29	39.2
once per month during crop farming season	5	6.8
once per year	4	5.4
Do not know	20	27.0
Total	74	100

#### 4.4.4 Crop lost from crop raiding

Table 16, shows that, rice is the most raided crop by 33.8%, followed by maize raided by 5.4% then bananas with 4% the last one is sugar cane with 1.4%, this is due to its preference by many of the vermin. Noted that the respondent for raided farm are only 37.

**Table 16: Crop lost from crop raiding**

Crops	Frequency	Percent of raided crop
Maize	4	10.8
Rice	25	67.6
maize and rice	3	8.1
Banana	3	8.1
sugar cane	2	4.14
Total	37	100.0

Most of the crop damaged by wild mammals and bird are the palatable species. Animals feed on the rice most especial the primates due to the feeding behaviors, other crop affected include sugar cane, maize and banana. Invasion of the animals and bird into the farms depend on the farming season as many of the farmer have only one farming season, that make seasonal visits of the animal in the farm and that is between may to June. The finding show that farmers in the nearby Udzungwa Mountains experience animals invasion almost twice in a week per a farming season Table 4.11.

#### 4.4.5 Amount of money lost due to crop raiding

From the Table 17; Show that the money lost due to raiding of the rice is about 28,410,000Tzs each year, Banana is about 13,045,000Tzs, sugarcane is about 6,780,000Tzs and Maize is about 1,801,000Tzs lost each year. Which make the total of 50,036,000Tzs loss per annum with the total land size of 35acres raided each year.

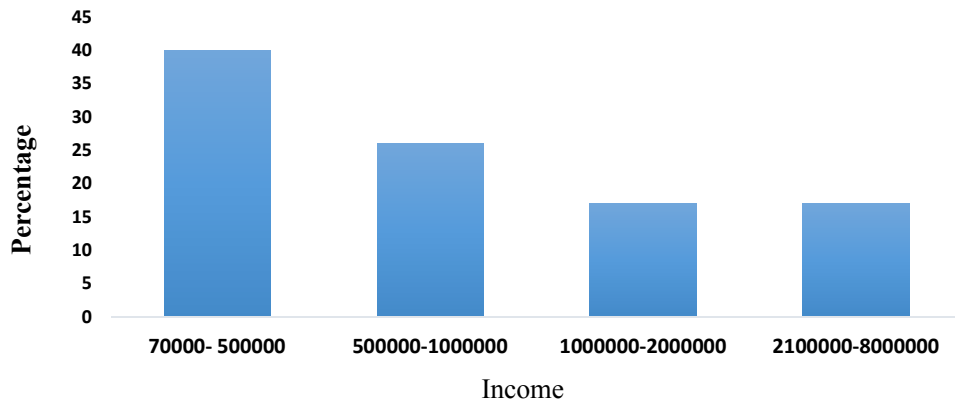
**Table 17: Amount of money lost due to crop raiding**

crop raided	size of the land (acres)	amount of money lost (TZS)
Maize	6	1,801,000
Rice	21	28,410,000
Sugarcane	3	6,780,000
Banana	5	13,045,000
Total	35	50,036,000

The finding shows that, about Tsh 300,167 is lost per year per acre of maize farm every year, also in case of rice about Tsh 1,353,000 is lost per year per acre, sugarcane lost about Tsh 2,260,000 per year per acre and banana lost Tsh 2,607,000 per year per acres. From that short description of the money lost from the previous year, it show how much people in the area suffers from crop raiding by both mammal and birds.

#### 4.4.6 Income from wild mammals and birds damaged crop farm

From the figure 4.2; the result of income from raided crop farm, the income descend from the lowest income to highest one. 40% respondent with 70,000 to 500,000Tzs income, 25% are respondent with 500,000 to 1,000,000Tzs income and 17% with 1,000,000 to 2,000,000Tzs and another 17% with 2,100,000 to 8,000,000Tzs.



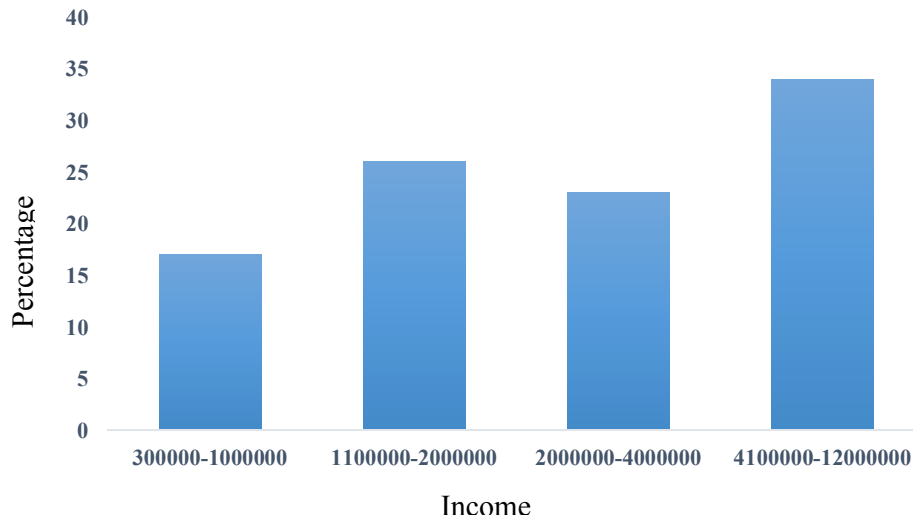
**Figure 2: Income from raided crop farms**

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From the graph above, we can see that the income from non-wild mammals and bird is very low as higher percent of people about 40% of the lay on the income in between seventy thousand Tanzanian shillings and five hundred thousand Tanzania shillings, which is equal less than to Tsh1400 per a day. This indicate the severity of the effect of crop raiding to the farmers.

#### **4.4.7 Income from non-wild mammals and birds damaged crop farms**

From the figure 4.3; income from non-raided crop farms, result as indicated above. 34% gets income of 4,100,000 to 12,000,000Tzs, 26% gets income of 1,100,000 to 2,000,000Tzs, 23% gets income of 2,000,000 to 4,000,000Tzs and remaining 17% gets below 1,000,000 but not less than 300,000.



**Figure 3: Income from non raided crop farms**

From the graph above, we can see that farmer with non damaged farm by the wild mammals and bird have higher income compared to damaged crop farms as many farmer are in between four million Tanzanian shilling to twelve millions Tanzanian shillings.

This indicate the real figure of the farm with no damage, hence without crop raiding the farmer would have better living standard compared to the current situation.

#### **4.4.8 Average annual income from crop farm with and without damage from wild mammals and birds**

From Table 18 Above, the result show that there is significance difference between income from wildlife damaged crop farms to income from non-wildlife damaged crop farms, the average of non- raided crop farm is Tzs 3,498,421 while that of raided crop farm is Tzs 1,091,816 which make up the probability of 0.00049 for a null hypothesis approval which is  $P(T \leq t)$  two-tail less than 0.05. Therefore from the result we can

conclude that income from non-wildlife damaged crop farm is different from income from wildlife damaged crop farms.

**Table 18: T-test analysis of the hypothesis**

t-Test: Paired Two Sample for Means		
	Income from wildlife damaged crop farm	Income from non-wildlife damaged crop farms
Mean	1091815.789	3498421.053
Variance	3.59068E+12	1.03914E+13
Observations	37	37
Pearson Correlation	-0.086508979	
Hypothesized Mean Difference	0	
Df	36	
t Stat	-3.82549944	
P(T<=t) two-tail	0.000485603	
t Critical two-tail	2.026192463	

From the above result we can see that crop raiding severely affect people as the there is very big difference between the income from non- wild mammals and bird damaged crop farm to the income from wild mammals and bird damaged crop farms

## CHAPTER FIVE

### 5.0 CONCLUSION AND RECOMMENDATION

#### 5.1 Conclusion

The research indicated that Baboons, elephants Vervet monkeys, Blue monkey wild pig and Colobus monkeys were the most destructive crop raider in kilombero district. They cause heavy crop losses while squirrels Rats, butterflies, armyworms and Bird including *Quelea quelea* are also raider but with less effect compared to the first group. Food crop are most raided crop within the areas surrounding Udzungwa Mountain Nation Park



include, rice, maize, bananas and sugar cane this is due to its preference by many of the vermin. Other crop that have mention by the most villagers including fruit and vegetables on the small garden near home also coconuts and palm oil. There is a high incidence of crop raiding attributed mostly to neighboring the National Park. Furthermore increased habitat destruction, high population, poor guarding methods and lack of grazing have also contributed to increased crop raiding.

Annual income of household from a farming was Tzs 588,865. The main cause of poverty in neighboring village farmers to the park is crop raiding. People lose a lot of money per season to crop raiders. Nonetheless, food shortages and loss of income caused by crop raiders were not the only factors affecting people's livelihoods other factors like High population growth, over dependence on subsistence farming among others. Livelihood was directly associated with food security, income of household, leisure time of individuals and poor social relationship among neighbors.

On the other side of the coin, comparison between the incomes from non-wildlife damaged crop farm to that of wildlife damaged crop farm shows significance different Table 17. It indicate that wildlife damaged crop farms faces high loss in an income it about one million per acre each year. From this we can conclude crop loss to animals has contributed greatly towards low income generation within communities. Which direct affect people near by the park in general, therefor the problem of wild animals needs urgent attention to prevent more serious problems in the future such as loss of human life to wild animals

## **5.2 Recommendation**

Wild mammals and birds as agriculture pest including Baboon are threat to both conservation and agriculture. Therefore furthermore studies is needed on raiding activities at the places surrounding protected area on how to reduce the effect. This can be identification of more resistant crop from vermin animal, usage of paper three at the boundaries of the farms to scare away the elephant from their farms as the fear the smell of pepper.

Government and associated sector including TANAPA should work on the compensation mechanism to ensure that whenever the farmer are compensated for loss they incur due to crop raiding. The villages near the protected areas suffer a lot from the animal, therefore government making sure that people get what they deserve after any cost or disturbances they incur. Education and awareness should be given to the farmers and villagers in large on how to protect themselves and their crop from the wild animal and improve community conservation service.

Family planning method to control population growth, it is important in order to reduce the higher rate of growth in population in many different part of our country, to reduce thing like encroachment activities which result in disturbance of wildlife habitat hence raiding. If population is maintained at a standard level then less disturbance to the wild this will reduce the rate of crop raiding.

Land Use Planning relevance to the reduction of the impact of wild mammals and birds to the crop farms.



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## APPENDICES

### Appendix 1: Questionnaire for assessing economic impact of wild mammals and birds to agricultural production

Questionnaire no; .....

Date of interview; .....

Sub-village; .....

Village: .....

Ward: .....

Division: .....

District; .....

#### 1.0 INTRODUCTION INFORMATION TO THE RESPONDENTS

**My name is Masare Sarah J.** I am a student doing research from Sokoine University of Agriculture, Morogoro. I have come to Kilombero district to research on the economic assessment of the impact of wild animals in agriculture production to the areas surround Udzungwa Mountain National Park. I have by chance happen to select your household to discuss with you some issue regarding crop raiding and its impact. I kindly request your time to make this discussion possible. This exercise may take 30-45 minutes.

Name of respondent .....

Starting time ..... Ending time .....

#### A. Social-economic characteristic

1. Position in the house hold ..... Code: 1=head; 2=spouse; 3= both.
2. Marital status ..... Codes : 1=married; 2=single; 3=widow; 4=widower
3. Age ..... (years)
4. Sex ..... Codes: 1=male; 2=female

5. Education level..... Codes: 1=no formal; 2=primary school; 3=secondary school; 4=tertiary
6. For how long have you lived in this area? .....years.
7. How many members living in this household (people who share meals on daily basis). Total ..... (males ..... Females .....)
8. How many are children (below 18 years old). Total ..... (Male ..... female.....)
9. (a) Do you have other dependent in this house hold apart from children living in this household? Codes: 1=yes; 2=no (b) if yes, how many ..... please specify.....
10. What is your main occupation? .....
11. Please mention and rank according to order of importance your household's source of income in the table below

House hold income generating activities	Rank code: 1=very important 7= least important
Perennial crop cultivation	
Annual crop cultivation	
Livestock keeping	
Charcoal and firewood collection	
Tourism business	
Others (specify)	

### **B: Crop Farming and crop raiding**

12. Describe the land ownership of the household and it uses

	Code:	Answer
Land owned	1= purchased 2=Inherited	..... (quantity)
Land occupation	1=crops cultivation; 2=animals farm; 3= both ; 4=others .....(specify)	.....
Type of crops grown most	1=cash crops; 2=food crops; 3=both;	.....

13. Have you had or experienced [wild or domestic] invading crop farm and in some cases threatening people lives?

If yes [Go to question number 14] If no [Go to question number 15]

14. How often [number of times] do you experience these invasions? [ ] codes :

1=daily during the crop farming season;

2=once per a week during the crop farming season;

3= twice per a week during the crop farming season

4=once per a month during the crop farming season

5= once per a year

15. How many farming season per a year do you have? [ ] codes

1= once; 2= twice; 3=trice

16. What are the most common Animals involved in crop raiding?

S/No	Name of Animal

17. From your experience in this area which crops are raided by vermin and non-vermin animals?

S/N	Crop

18. Which crops are not mostly raided by vermin and domestic animals?

S/N	Crop



### C. Household Income and Cost

19. How much do you is total income from the farm, please indicate in the table below which crop you cultivated in the last 12 months:

NB: 1 ha=2.471 acres

S/N	Crops cultivated	Size of the land(acres)	Amount harvested (No. of bags, specify size) or kg	Use /year		Price (TZS)	Revenue (TZS/year)	Total crop harvested value (TZS/year)
				For food (quantity)	For business (quantity)			

20. What cost did you incur from crop farming?

Crops	Unit e.g. number, man-hour etc	Amount unit	Cost of cultivation (TZS/year)	Total cost/year

21. Please indicate other house hold income generating activities you may have

s/no	Types of IGAs	Cost	Annual income (TZS/YEAR)

**D. Crop Raiding and Extent of Practices**

22. What do you think are the causes of crop raiding by the wild animals?

S/N	Reason

23. How much loss is result from crop raiding? Please estimate the loss in the table below

S/N	Cultivated crops	Size of the land cultivated	Size of land damage (specify quantity/unit )	Amount of crop raided (quantity)	Value of crop (TZS/year)

24. Do you think people’s livelihood has been affected by crop raiding? [ ]

Codes: 1=yes; 2=no

If yes, How

.....  
 .....

25. Between birds and mammals which animal are mostly involved in attacking and destroying famer’s crops? Mention by their names .local names can be used

Mammals

- a).....
- b).....
- c).....

Birds

- a) .....
- b) .....
- c) .....
- d) .....

26. At what stage in the growing cycle are crops mostly damaged? [ ]

Codes; 1=germination/seedling; 2=flowering; 3=harvesting; 4=fruiting/rooting

27. In what time of the year are crop raided? [ ]

Codes: 1=beginning; 2=middle; 3= end of the year

28. How often do these attack happen monthly or annually? .....

29. What time do animals or birds mostly raid and destroy crops? [ ]

Codes; 1=at dawn afternoon; 2=morning; 3=evening; 4=night.

30. What do you suggests to be done in order to control and prevent crop raiding?

S/N	Suggestion.

**And this marks the end of this interview thank you very much for your cooperation.**