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The Role of Bushmeat in Household Food Security: A Case Study in Central Equatoria State, South Sudan

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Declaration

I, Doreen Achola Cornelius Langoya, declare that this thesis is a result of my research investigations and findings. Sources of information other than my own have been acknowledged and a reference list has been appended. This work has not been previously submitted to any other university for award of any type of academic degree.

Signature

Date: 15th May 2017

This proposal has been submitted for approval to the supervisor named below.

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May God bless you all.

WITHOUT YOU, I AM NOTHING.

Abstract

The study was done to understand the role of bushmeat for households' food security in the Central Equatoria State of South Sudan. A sample of 100 households were interviewed using a quantitative survey method, to assess the amount of their monthly consumption of bushmeat, frequency of consumption, income generated from bushmeat sale and challenges faced in using bushmeat as a food resource. The collected data were analyzed using SPSS software version 20.

The result showed that the most eaten bushmeat was wild mammals, followed by birds and insects. The majority of respondents did not consume reptiles, but a low rate of consumption of crocodile and python was documented. In terms of the type of bushmeat hunted, the most hunted bushmeat species were antelopes: Bohor reedbuck (*Redunca redunca*), Mongalla gazelle (*Gazella rufifrons albonotata*) and warthog (*Phacochoerus africanus*), followed by rodents (rats, porcupines and hares). Few hunted Hippopotamus (*Hippopotamus amphibious*) and a respondent who hunts more than two types of mammals mentioned reticulated giraffe (*Giraffa Camelopardalis*).

The amount of bushmeat consumed /kg/ month was significantly higher when compared with livestock's meat (Cattle's meat, goat's meat and sheep's meat).When compared with other food types, although it was lower than the amount of cereals and green vegetables consumed, still the quantity of bushmeat consumed was higher than the quantity of chicken and fish. Regarding the frequency of hunting between and within seasons, hunting for bushmeat was generally done seasonally and especially during the dry season. Concerning the contribution of bushmeat to households' income, on average bushmeat generated significantly higher income per month compared to other sources of income like charcoal making, firewood collection and salaries of the unclassified staffs (Unprofessional Staffs). The majority of respondents used the money generated from sales of bushmeat for buying additional food, and for paying children's school fees. Regarding the challenges for using bushmeat as a food resource, the challenges included insecurity, wildlife laws, lack of men in the family and harmful animals. 42.58% of the interviewees reported insecurity as the most challenging threat to hunting. It generally shows that bushmeat is very important for the food security and income of the households studied.

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CHAPTER ONE: Introduction.

1.1 Background.

Food security as defined by the world food summit 1996, is the ability of all people, at all times, to have both physical and economical access to sufficient, secure and healthful food to meet their dietary requirements and food preferences for a healthy and active life (Shaw 2007). However, although food access is the main determinant of nutritional security of a person, access to food is dependent of a variety of factors such as economic and social status. In developing countries and especially in Africa, hunger and dietary deficiency are important lifelong challenges that countries have to struggle with. Currently, millions of people in Africa are going to bed hungry every day, due to the extensive damage of the production systems, as a result of increasing human populations, unsustainable use of ecological resources, conflict and war.

South Sudan is undergoing food insecurity due to insecurity and civil war. The conflict in the country has interrupted livelihoods of lots of people, and has negatively affected food security situation. This conflict has also resulted into market interruption, population displacement and increase in food prices(WFP 2015). A recent survey by the UN indicated that half of the population of South Sudan is food insecure; that is, they do not have access to sufficient amount and quality of food for a healthy life. The effects of this on the population include malnutrition among children, stunted growth and inability to carry out physical work like crop cultivation.

Since the conflict started in 2013, the food security and nutrition situation in South Sudan as a whole has worsened more and more. The conflict of July 2016, following heightened tensions and renewed clashes throughout the country has further aggravated already overwhelming needs. An estimated number of 3.6 million people are expected to be severely food insecure between October and December 2016, the highest levels experienced in South Sudan at harvest time. Among this number, about 600,000 insecure people are in the main urban centres (like Gumbo and Joppa) across the country. The food insecure people has at least doubled in both rural (e.g. Rejaf and Terekeka) and urban areas, linked to the same time last year. The fighting in the country has led to economic decline, and lack of foreign currency. These have negatively affected the humanitarian situation. Conflict and insecurity spreading throughout the country have cut off trade routes and continue to hinder commercial imports. Economic activities have been affected

as households' access to farmlands has been restricted due to insecurity, worsening the food security situation across the country (WFP 2016).

Many stakeholders including conservationists and forest managers have realized how important wildlife products are for many people around the globe. Although still not wide spread, this realization has generated interest among the scientific community. In fact, several investigations have reported that, besides the diversity and ecological contributions of wild animals to the smooth functioning of the ecosystems, wild animals' meat (bushmeat) especially herbivores can contribute significantly to improving and sustaining the livelihoods of many people in both rural and urban centres (Stack et al. 2003, Sarti et al. 2015). Neumann et al. (2003), Fa et al. (2009), Golden et al. (2011) and Tanner et al. (2013) showed that bushmeat is critical to the diet and health of people in the tropical areas, but it is also a source of some of the deadliest zoonotic pathogens such as Ebola virus and bubonic plague(Weiss 2001).

1.2 Problem Statement.

Bushmeat trade and hunting is increasing in the African continent. It has been found that increased human population, rising urban population, declining rural incomes, and loss of cultural values are the causing factors (Caspary 2001).

In most of the areas of South Sudan that have wild animals, the meat of wild animals known as bushmeat is used as a food resource (source of protein). At the same time this bushmeat generates a good amount of income for the local and even some urban communities. This bushmeat plays a great role in the lives of many poor people in the country especially those who cannot afford other types of proteins and have no other means of earning money. Most of the rural communities, and some urban communities who cannot afford other types of meat, depend on this bushmeat as there only source of protein and income. Although it is a source of protein and income to some communities and the country as a whole, the utilization of bushmeat as food in South Sudan is regarded as an exploitation by wildlife conservationists, due to overhunting which creates pressure on wild animals(UNEP 2007). So, because the use of bushmeat is considered as an illegal act in South Sudan, there is total lack of data on the quantities of bushmeat being harvested annually through hunting, quantities consumed by households and the quantities being marketed. Therefore, its direct and economic contribution to household's food security and income is not known.

The policy statement on wildlife conservation in South Sudan is clear with regards to hunting of wild animals for food or trophy. However, there are many challenges involved in terms of putting into practice mechanisms and managerial tools to affect the policy. This is due to a number of factors including lack of trained personnel, institutional bureaucracy and apathy and generally insecurity due to civil strife; finally, there is lack of research.

1.3 Objectives of the Research.

The main objective of this study aimed to contribute data on the role of bushmeat for food security in South Sudan. While it's specific objectives were to determine:

1. The quantity of bushmeat and livestock consumed in the households per month.
2. The quantity of bushmeat and other food types consumed in the households per month.
3. The frequency of bushmeat consumption, hunting and status of species hunted in the households per month.
4. The amount of income generated from bushmeat and other sources in the households per month.
5. The challenges facing households in using bushmeat as a food resource.

1.4 Research Hypothesis.

1. H_0 : There is no difference between the quantity of bushmeat consumed in the households per month and that of other livestock (Cattle, sheep and goats).
 H_1 : There is a difference between the quantities of bushmeat consumed in the households per month and that of other livestock (Cattle, sheep and goats).
2. H_0 : There is no difference between the quantity of bushmeat consumed in the households per month and that of other food types (green vegetables, chicken, fish and cereals).
 H_1 : There is a difference between the quantity of bushmeat consumed in the households per month and that of other food types (green vegetables, chicken, fish, and cereals).
3. H_0 : The amount of income generated from bushmeat in the households per month is not different from amount generated from the other sources of income (charcoal making, firewood collection and salary of unclassified staffs).

H1: There is a difference between the amounts of income generated from bushmeat in the households per month and that generated from the other sources of income (charcoal making, firewood collection, and salary of unclassified staffs).

1.5 Justification of the study.

1. Given the current fragmented understanding of the ecological, socio-economic and cultural dimensions of the bushmeat harvest, enhanced technical information is crucial to understanding the inter-dynamics between hunters, game species and provisioning ecosystem services.
2. Bushmeat has the potential to enhance or constrain adaptive responses to socio-environmental change (Climate Change, Urbanization and Land use change).
3. Technical and scientific information is urgently needed in South Sudan for the design of appropriate monitoring tools and effective mechanisms for managing harvest, consumption and marketing of bushmeat.
4. Much of the existing data is not open-access and is generally owned by individual researchers and private conservation groups.

1.6 Significance of the study.

1. The study can help to understand the direct contribution of bushmeat as a food source to the household's food security in Central Equatoria State, and especially in the four study areas.
2. It will help contribute data on the economic contribution of bushmeat to household's income and food security.
3. The study will also help us know the challenges faced by the local communities and specially the studied communities, in terms of using bushmeat as a food resource. Thus, will help us find appropriate solutions
4. It will also help us understand the extent into which bushmeat is being hunted, and thus will help us find solutions to regulate it so as not to affect food security.

2.0 CHAPTER TWO: Literature Review.

Throughout Africa, bushmeat is a vital source of animal protein in both rural and urban households. From country to country, although the magnitude of exploitation and consumption differs and is mainly determined by its availability, it is also influenced by governmental controls on hunting. As a fact, in Africa bushmeat is an important food item due to lack of alternate source of protein, lack of money, and preference and cultural values. Therefore, it cannot be easily withdrawn or replaced without causing wide-ranging socio-economic imbalances, because it constitutes a valuable food resource (Ntiamoa-Baidu 1997). Bushmeat consumption is determined by economic development in some parts of the world.

High amounts of bushmeat are consumed by poor communities. In the Congo and Amazon Basins, it is consumed by rural communities (Nasi et al. 2011). In South America bushmeat consumption in the urban areas is very little, due to the presence of one of the most crucial livestock production systems in the world. Only few people and mostly indigenous and rural communities, consume bushmeat in South America. When they become richer, these communities prefer alternative source of protein. Therefore, due to the presence of this crucial livestock production in the country, bushmeat is likely to be replaced by domestic sources of protein (Nasi et al. 2011). The case is not the same in other parts of the world, whereby urban consumption is high.

In the Congo Basin, the urban consumption of bushmeat is very important. Additionally, urban populations in Gabon, Democratic Republic of Congo and Central Africa Republic, consume bushmeat on an average of 4.7kg/person/year; In Libreville (Gabon), bushmeat consumption is estimated at 7.2kg/person/year (Wilkie et al. 2005). According to Nasi et al. (2011), as the population of Central African countries becomes more urbanized, the urban contribution to the total bushmeat consumption is high, and likely to become higher, even if urban bushmeat consumption per capita is very lower compared to rural areas.

In Cameroon, wild animals are being hunted to complement staples such as corn, wheat and rice. The meat of these hunted wild animals contribute to food security in the country through providing people with calories, animal proteins, essential minerals and micronutrients like iron,

and also vitamins A, B, C,D and E. These micronutrients are very important, not only in creating a more secure and varied diet, but they also help in combating the effects of “hidden” hunger (Sneyd 2013).

Wild food, for example bushmeat, also offers important and consistent contributions to livelihoods in Cameroon (Ibid). Bushmeat trade contributes substantially to the livelihoods of about 150 million people and it also supports a rapidly growing informal economy (De Merode et al. 2004). Yet the informal and often illegal nature of bushmeat harvesting and consumption makes the degree and strength of poverty linkages unclear (Ashley et al. 2002).

In most of the food security literature, wild food consumption is described as a coping mechanism for increased household food security when there is poor harvest or economic crisis (Sneyd 2013). Apart from using wild animals as a direct food, their products are also used as condiments to make meals tastier, thus, improving the ability of people to eat adequate amounts of essential foods which are often tasteless and monotonous. For example, honey, produced by honey-bees is regarded as valuable product universally. It is used as food, sweetener and medicine (Ntiamoa-Baidu 1997).

2.1 The scale of the “Bushmeat” catastrophe.

Livelihood, is the right to use natural, physical, human, financial, and social capital, and as well as the actions that together define the living gained by an individual or household (Sunderlin et al. 2005). Due to poverty, the livelihoods of the people in tropical forests of Equatorial Africa are dependent on wildlife, from where part of their food as well as income comes from (Abbot 2000).

Although about 150 million people are benefiting significantly from the bushmeat trade in terms of income and food, still the amount and strength of poverty linkages are undistinguishable. This is because of the informal and often prohibited nature of bushmeat harvesting and consumption (Ashley et al. 2002).

In most of the African regions, the meat of wild animals is one of few sources of animal protein and it is a resource that is always available to everybody who hunts making it easier for the poor to survive on it. Due to its relatively cheaper price in comparison to livestock meat, bushmeat is always preferred to other meat types like the case of Cameroon, Democratic Republic of Congo (DRC), and Central African Republic (CAR) where it is very cheap compared to the price of

other sources of proteins (Wilkie & Carpenter 1999). Even when there are substitutes, it will be chosen because of the taste or cultural preferences (Bennett 2002). In fact, bushmeat is being seen as a cultural heritage luxury item by many urban elites and ready to pay a price premium (Wilkie & Carpenter 1999).

In many African countries, bushmeat trade encompasses huge quantities of meat and it makes substantial economic incomes. The scale of the African bushmeat trade is estimated at between 1 and 3.4 million tons per year which is very high (Bennett 2002). For example, in Tanzania every year a mean of 2,078 tonnes of bushmeat are harvested with a rate of >US\$50 million then in Mozambique every year, they consume 182,000–365,000 tonnes of bushmeat, with an economic cost of US\$365/730 million per year (Barnett 2002). Compared to the above countries, in Central Africa approximations of bushmeat harvest are even greater: Gabon 49,000 tonnes; Central African Republic 59,000; Cameroon 234,000; and Democratic Republic of Congo 1.7 million (Fa et al. 2003).

Barnett (2002) also found that in some countries like Mozambique and Tanzania, the economic value of the legal forms of wildlife hunting is lower than that of the illegal form (bushmeat trade). Therefore, although the illegal bushmeat trade is not permitted in many areas in Africa, there is an increase in the activity due to its economic importance.

According to (Davies 2002), the value of the illegal bushmeat trade in Central Africa, has been projected at US\$42-205 million/ year. On the other hand, he also found that in areas where lawful wildlife-based land uses are well advanced, like in Namibia and South Africa, the game ranching business on private land turns above US\$912 million and US\$166 every year respectively.

Brown and Williams (2003) have identified several positive features of bushmeat trade making it an attractive choice not for the rich but for poor communities. One of the first characteristic is that bushmeat has a low barrier to entry and offers high profits with minimal investments. It is also good for small farmers which labour is their foremost constraint. Secondly, it does not need high-level of extractive technology and can be undertaken flexibly all the year. Thirdly, bushmeat when dried, its storage qualities are tremendous and transportation is easy, with an extraordinary value to weight ratio. Fourthly, when it comes to the gender aspects of the trade, it is amazingly affirmative as men do the hunting, and the women do all of the processing activities and the

marketing. Lastly, a huge amount of meat value remains with the hunter due to its free and decentralized trade.

As shown in (Chaber et al. 2010), bushmeat trade is becoming less driven by survival needs, but rather commercial in nature. This is due to increasing market demand from both local people and distant urban centres, not excluding the international cities. Technologically advanced and complicated rural to urban trade supply linkages occur in a number of southern and East African countries, including Zambia, Malawi and Mozambique. On a fixed basis, substantial amounts of bushmeat enter urban centres such as Lusaka and Maputo. Commercially-orientated trade passages have advanced for the sale of bushmeat, for example the outdoor markets, chop-bars and butcheries in Kitui, Kenya. Most bushmeat traders in Southern and East African countries practice a twenty-four-hour commercial trade. For example, 34.3% of traders in the western Serengeti depend on bushmeat as their only basis of income, and they sell meat at markets about 200km away from home (Barnett 2002).

In central Mozambique, middlemen use bicycles or cars to transport the bushmeat they bought from hunters to re-sell in urban centres (Lindsey et al. 2012). In Cameroon, they use minibuses and trains to transport bushmeat from comparatively wildlife-rich savannah areas to urban centres (Edderai & Dame 2006). In order to preserve it for transport, bushmeat is normally dried or smoked first (Mendelson et al. 2003). The quality of enforcement and degree of risk related to the bushmeat trade is usually imitated by the degree of confidentiality with which bushmeat is traded. Bushmeat trade in rural Maputo District always happens in the outdoor markets, signifying that enforcement and fear of revenge among traders is negligible. Generally, in southern Africa, bushmeat is traded secretly; signifying that in most countries there is at least certain degree of enforcement (Barnett 2002).

Since many people are depending on bushmeat for income, more than 2 million tons of bushmeat is harvested yearly in Central Africa alone (Fa et al. 2003). In the present days, the misuse of bushmeat has increased due to the increasing human populations, greater access to undisturbed forests, introduction of harmful hunting technologies, and scarcity of alternative protein sources (Robinson et al. 1999). For example (Wilkie & Carpenter 1999) found that wildlife depletion and its significances have been of great concern in the rainforests of the Congo Basin. The number of people in the region has doubled since the 1920s at an average growth rate of 2.7% and is

expected to double again in 25-30 years. In less than half a century, bushmeat protein supply in the region may drop by 81% if people continue to hunt in the current rates of harvest. This may result in a dramatic increase in protein malnutrition, since bushmeat constitutes 30-80% of the protein consumed by forest-dwelling families (Fa et al. 2003).

Therefore, although bushmeat trade is a multi-million dollar industry in West-Central Africa, many policy makers are not seeing these positive qualities. However, in order to manage the bushmeat industry these qualities should be stated as important factors (Brown & Williams 2003). For the resource to be available for future generations there is a need for pursuing sustainable management of wildlife. Even though the scope is somewhat limited, one of the key mechanisms to engender support for attempts to make the trade more sustainable may be community wildlife management (CWM) models (Bowen-Jones et al. 2002). But the emphasis must be on improving the livelihoods of the local population. According to (Brown 2007), the human livelihoods focus is a moral fundamental, as well as a practical necessity.

2.2. The Value of Bushmeat.

Although many studies have been done concerning bushmeat harvesting, yet literature about the contributions of bushmeat to household economies, and food security value in the lives of the poor people is rare (Wilkie & Carpenter 1999). However, De Merode et al. (2004) have shown that bushmeat is a significant source of income for the poor. For example, it allows poor households to purchase medicines and obtain resources that will improve their livelihood strategies.

The price of bushmeat is linked to the distance of the market from harvestable wildlife populations. Bushmeat price comparative to alternative sources meat (livestock, and/or poultry and/or fish) is higher in urban areas than countryside areas. In some regions where bushmeat is transported 90 km or more from where it is being hunted, it costs almost 50% more than fish and chicken. Congruently, illegal hunters in areas nearer to urban centres sell a bigger quantity of their catch compared to hunters in the rural areas (Brashares et al. 2011).

Due to these tendencies, there seems to be constantly varying preferences for bushmeat meat among rural and urban buyers. Because of its availability and cheaper price, rural consumers typically prefer bushmeat to other sources of meat. However at town sites, preference for its taste

always affects the choice. Bushmeat consumers in rural areas suffer from food insecurity with high degrees of malnutrition, while urban consumers on the other hand, are richer and look at bushmeat as a luxury good higher to meat of domestic animals fish or meat from cattle (Barnett 2002). During Christmas season for example, the price of price of red duiker (*Cephalophus natalensis*) meat quadruples always go up since richer bushmeat users prefer bushmeat for the celebrations (Barnett 2002).

In strictly economic terms, Noss (1998) found that snare hunters in the Dzanga-Sangha special forest reserve in Central African Republic make between \$400 and \$700 per year. This amount is more than the lowest salary and comparable to the wage of guards working in the park. Two villages were found to make an income of \$300 per household per year from bushmeat trade in the CIB (Congolaise Industrielle des Bois) logging concessions in northern Congo. In Cameroon hunters could make \$250-\$1050 per year from bushmeat trade respectively and the yearly monetary profits to hunters is above the national average at \$330-\$1058 (Wilkie & Carpenter 1999). They further reported that the hunter netted 30% income from the sale, while the trader made 19% and the restaurateur 21%.

A very important research was done by De Merode et al. (2004), which tried to evaluate the importance of wild foods for 128 households in a community living in an extreme poverty (less than \$1 US per day) in the Democratic Republic of Congo. The research tried to answer three important questions: 1) Are wild foods are cherished in terms of household consumption as well as market sales? 2) Are wild foods more cherished in the lean season? and 3) Are wild foods more cherished among the poorest in the community?

They found that bushmeat has added very little value to the diet 0.04kg (3.1%) per capita per day, compared the result of (Wilkie & Carpenter 1999) which found 0.13kg/day which is the characteristic of the Congo Basin. For this discrepancy, two clarifications were offered. First, great number of people in the community may be unable to afford the tools to hunt, or even have the income necessary to buy other types of meat because they are living in extreme poverty. Secondly, people who have the ability to purchase hunting tools have a habit of selling them since there are insufficient alternative ways to make income. In fact, 90% of all bushmeat was sold at the market and comprised 25% of all household sales. When agricultural foodstuffs were scarce and households were very vulnerable to food shortage during the “lean season”, they

found that sale and consumption increased by 155% (though not statistically significant) and 75% respectively. This shows that bushmeat is regarded as a coping mechanism in such cases (De Merode et al. 2004) .

2.3. Bushmeat as Food Security.

The fundamental view is that bushmeat is a significant contributor to household food security (Fa et al. 2003). However, its role tends not to be recognized, and its importance to different social groups is not properly understood (Ashley et al. 2002).

Nevertheless, Bennett (2002) gives some vital understandings into the matter. Two different groups of people can be distinguished: those who do not depend on the bushmeat resource and those who depend on it. In most cases, those who live in urban areas and are working have no difficulties in affording other forms of protein, such as fish or domestic meat, if bushmeat supply is reduced. In this case, bushmeat is not so important to them in terms of food security, but it is a luxury item though its price may be more than that of domestic meat. Therefore, if bushmeat is no longer available, this group will not suffer nutritional hardship.

More outstandingly, many people of the traditional forest totally depend on bushmeat. When they lack protein substitutes, or the abilities and traditional setting with which bushmeat is being harvested or traded, these people will suffer. This is because they lack inaccessibility of markets, income, adjacent communities with whom they have a good association and can learn farming skills (Bennett 2002).

In between these two distinct groups, are the majority of consumers whose future lacking of bushmeat is poorly understood. Bushmeat serves an important safety-net function for many of these people, as well as an emergency supply of food in times of personal, environmental, or economic crises (Hart 2000). Hence, deterioration in bushmeat as a potential food source, offers food security threats in the long term for those people.

Hunting activities are more or less completely a male activity, while the butchering of the meat is more likely to be the work of women (LeBreton et al. 2006). Most hunters are between the age of 20s and 30s in Zimbabwe and Central Mozambique (Lindsey & Bento 2012). Illegal hunters are considered to be poor in most of the circumstances; they are less educated and own small number of livestock (Loibooki et al. 2002). However, in some cases hunting households tend to be richer

than those households who do not hunt and hunters seem to be those individuals that have time and chance to hunt, like in the case of the Serengeti ecosystem (Knapp 2007). As a result of their profession, hunters have higher social rank in some circumstances (Brown 2007). In some areas, for example in the Dande area of Zimbabwe and the Luangwa Valley of Zambia, hunters are being respected for providing meat to community leaders and to the capable, aged, or female-headed households (Barnett 2002).

Illegal hunting for wildlife functions on a scale, from getting meat for consumption or employment within the communities of hunters, to that extend for trade to native, indigenous, urban or even worldwide markets (Brashares et al. 2011). Illegal hunting is mainly practiced for sport in many of these cases. For instance, on ranches in Kwa-Zulu Natal in South Africa ‘taxi hunts’ are organized unlawfully where numerous hunters set off with dogs to hunt after placing bets on the consequence (Grey-Ross et al. 2010). In almost all cases, an illegal hunting activity offers a share of meat for hunters’ consumption and in some areas the meat offers an important impact to household food security. For example, 80% of households consume 14.1 kg of bushmeat per month in Kitui in Kenya, and 46% of households consume 18.2 kg per month in Kweneng in Botswana (Barnett 2000).

Nonetheless, most frequently within local communities some percentage of bush meat is also almost always sold. Bushmeat purchasers tend to be those with cash incomes, such as business people or teachers, or even local government officials and policemen in areas where bushmeat is bought near to the hunting ground (Lindsey et al. 2011). The cash obtained from bushmeat sale in areas near to the hunting grounds is usually used by hunters for buying soap, clothes, beer, or to pay for school fees (Brown 2007). In rural areas, hunters trade bushmeat for grain in some cases (Lindsey et al. 2011). Bushmeat buyers in the urban areas are probably richer compared to those in the villages due to the higher costs of bushmeat (Barnett 2002).

2.4 Alternative Sources of Protein.

Finding alternative source of animal protein to substitute bushmeat is a reasonable solution to try to control the dwindling wildlife population, as well as satisfying the needs of the human population. Unfortunately, this has been proven quite difficult for most tropical forest communities. The only reasonable substitutes are fish and domestic meat, since other crops (e.g. cassava, Gnetum leaves) may have high protein content, but do not have a full complement of

amino acids (Wilkie & Carpenter 1999). Not like in West Africa, seafood (fish) is really an option in Central Africa because CAR is land logged and has a fast growing human population (Bennett & Robinson 2000). This means that fish alone cannot serve as a substitute to bushmeat where there is large population. So there is a need for other sources of animal protein such as sheep, goats and chicken. And also for a big population to be depending on fish alone can result to resource degradation.

Bushmeat consumers living in areas near to wildlife populations or parks are often motivated to consume bushmeat due to the lack of alternative protein sources (Foerster et al. 2012). Lack of enough carbohydrates also contribute to illegal hunting of bushmeat, as the meat obtained is always sold and the money is used for buying grain or other food stuffs (Lindsey et al. 2011). Areas around parks or conservation areas are often not suitable for agriculture and has low levels of food security. For example, 93.8% of illegal hunters in South East Zimbabwe were forced to skip meals due to food shortages during the end of the year (Lindsey et al. 2011). Presence of tsetse fly and diseases in some areas like Central Mozambique, has decreased the productivity of livestock (Lindsey & Bento 2012), while in Newcastle a disease infected 60% of the chicken (*Gallus domesticus*) population (Lewis 2005). These intensified dependence on bushmeat due to lack of livestock. However, where livestock are also present, communities frequently keep cattle and other domestic animals as capital and cultural assets, and use bushmeat to satisfy their day-to-day protein requirements (Barnett 2000).

As a result of the above factors, bushmeat forms a crucial element of the foods of communities in many areas and contributes considerably to food security. For example in Central Africa, 30-80% of protein intakes of rural communities and almost 100% of animal proteins are provided through hunting (Nasi et al. 2008). However, the impact of bushmeat to food security is likely to be unmaintained due to deteriorating wildlife populations.

According to Fa et al. (2000), the only way to offer a sustainable source of food is the intensive farming of livestock, as well as other sources of domestic protein like chicken. In addition to this being together a logistical and an environmental challenge for thickly forested regions; substitution with domestic meat through livestock rearing encompasses a shift from a livelihoods-based activity, to a capital-intensive industry profiting commercial businesspersons. In many

cases, the economics of livestock rearing are simply too expensive for small-hold farmers (Brown & Williams 2003).

Domesticating wild animals has also been tried as a substitute to hunting. In arid Southern and East Africa, wild game farming is a recognized and growing industry. Most efforts in West-Central Africa have been met with economic, technical, and livelihood difficulties (Ashley et al. 2002) and as a result have failed, or at least failed to ease the problem (Bennett 2002). The Nazinga Game Ranch is an exception, established in 1979 in Burkina Faso. The number of ungulates was regenerated from 1000 to 20 000 individuals, and at the same time created income for the human population through cropping employment chances, beekeeping, cottage industry and other activities (Zeba 1998). A German Team of Zoology funded project in Benin involving huge cane rats has also had some success. Generally though, like livestock rearing, deficiency of capital, market entrée, and enterprise management skills are key difficulties to the taming of wild game, and therefore is not an on hand livelihood approach for the poor (Ashley et al. 2002).

2.5 Impact of the Wildlife Law on food security.

Hunting bushmeat is controlled in most of the African countries; the control of harvest is done through licensing and quotas systems. For example to regulate it, all SADC countries that permit hunting have procedures to be followed in order to control it (Morgera 2010). In most African countries, wildlife is owned by the state, except in some situations like in Botswana, South Africa, Mozambique, Namibia, Zambia, and Zimbabwe where restrictive user-rights are approved to private land owners (Bond et al. 2004).

Many communities in some of the African countries, have not been owed complete user-rights over wildlife resources, which makes it possible for indigenous people to hunt in ownership of the suitable permits, within definite limits and under certain circumstances (Taylor 2009). The rights to hunt on land that belongs to state and community, in many circumstances can be bought by private safari hunting outfitters (Lindsey et al. 2007). Exceptional hunting licenses are assigned to citizens in certain groups of land such as in Botswana, Tanzania and Malawi, for the purpose of attaining meat. Only in few countries and especially in forest dominated areas like in Malawi, Angola and Mozambique, it is free to hunt wildlife for survival requirements like food and income; subject to such harvest does not being harm the populations (Morgera 2010).

The time of year in which wild animals can be harvested has to be limited regularly by hunting laws (with the hassle of ‘closed-seasons’), limitations on shooting endangered species, bans on hunting young animals or pregnant animals, and exclusions on hunting within a national park and several other groups of protected areas (Morgera 2010). Always there are limits on the methods of hunting that can be practiced, and most of the methods practiced by bushmeat hunters such as snares or guns are considered not legal. Due to fluctuating combinations of reasons such as: use of licenses/permits in areas where hunting is prohibited, use of banned methods and the killing of threatened species, bushmeat hunting is considered as an ‘illegal hunting’.

2.6 Places and Times of Hunting.

There is a speedy disappearance of wild animals from unprotected areas, as a result of extensive range of threats and therefore, due to these threats, those hunters who are not using permits are gradually concentrating their efforts on areas that are protected (Newmark 2008). Inside protected areas, there is a widespread illegal hunting in areas near to the borders and human settlements (Wato et al. 2006 & Marealle et al. 2010). Hunters prefer hunting from these areas because distances are near so it doesn’t take them time to get the animals, they don’t loss energy and costs in finding the animals and transporting meat to their residences or market (HOFER et al. 2000). The little time they spent in hunting and transporting the meat from these areas , help them in escaping the risk of being sized by anti-poaching game scouts (henceforth referred to as ‘scouts’).

In Serengeti National Park, there was an affirmative connection between distance from the border and occurrence of buffalo during a period of high poaching intensity and low levels of enforcement, (Metzger et al. 2010). Similarly, in Sekoke Forest in Kenya, the further the distance from the boundary, the lower the occurrence of hunters’ traps (Fitzgibbon et al. 1995). Bushmeat hunters have a habit of focusing hunting efforts in areas close to water holes or along rivers, since these are the areas where wildlife are always found (Wato et al. 2006; Lindsey et al. 2011). Sometimes, hunting even happens in areas near to flowering or fruiting trees (Lindsey & Bento 2012).

The occurrence of bushmeat hunting has reliable sequential forms. In some areas when wild animals are concentrated around water sources, especially during the dry season or when there is no enough rainfall, this is when the peaks occur (Brown 2007 & Holmern et al. 2007). The arrays in farming activities which command the availability of food in the household, as well as the

available time for hunting affect bushmeat hunting (Muchaal & Ngandjui 1999). In the Serengeti National Park, the occurrence of bushmeat hunting decreases when it is not time for the passage of migratory wildebeest (*Connochaetes taurinus*) and vice versa (Holmern et al. 2007). In Zimbabwe, in the Savé Valley Conservancy and Munyawana during the season of moonlight, hunting increases with dogs, since during this period hunters can see clearly and on rainy nights, probably due to reduced risks of being detained (Lindsey et al. 2011).

2.7 Wildlife (animals) Decrease and its impact on food security.

The current assessments have highlighted that in most of the African countries, there are sharp deteriorations in wildlife populations (Craigie et al. 2010) and illegal hunting has been found as main donating cause to this (Scholte 2011). For example in Kenya, illegal hunting and the bushmeat trade is considered as key driver for decreasing wildlife populations within the parks (Okello & Kiringe 2004), whereas in Zambia, commercial hunting of bushmeat has replaced hunting for trophy as the main threat to wildlife (Barnett 2000).

Illegal hunting of bushmeat in some cases has contributed to edge-effects and condensed wildlife concentrations close to park boundaries and/ or human settlement. For example, in areas near to boundaries in the Serengeti National Park, unlawful hunting has resulted to substantial deteriorations of resident herbivores (Hofer et al. 1996). In other cases, the use of fire by hunters intensifies the edge-effects associated with banned hunting (Lindsey & Bento 2012). The use of fire by hunters can cause loss of dry-season grazing, force wild animals out of protected areas in search of grazing and likely to impart negative effects on animals like rats and some snakes (Koppmann et al. 2005).

Wildlife population decrease in areas like Mozambique where illegal hunting has not been stopped to proceed or has little or no control (Hatton et al. 2001). In Zimbabwe during and directly after civil war, wildlife farms reduced resulting from clearance during land restructuring (Lindsey et al. 2012), as well as in the areas next to refugee sites in Tanzania (Jambiya et al. 2007). As a result there has been an intense decrease in population and local extirpations of numerous species due the overwhelming effects on wildlife. In the same way, apart from the well-known declines in the forest biome, the number of wild animals seems to be collapsing in many savannah areas in Central and West Africa (Wilkie et al. 2011). For instance, in northern Central African Republic the numbers of wild animals have dropped by 65% during 1985-2005,

mainly because of illegal hunting and diseases spread by livestock (Bouché et al. 2012). In the Comoé National Park in Ivory Coast, the number of wild animals dropped by 60-90% during the 1970s to the late 1990s due to illegal bushmeat hunting (Fischer & Linsenmair 2001).

Larger species are commonly targeted by illegal hunters because of their higher volumes of meat. Nevertheless, there is a decreasing occurrence of large-bodied species in bushmeat markets because of over-hunting across various places in East and southern Africa. Therefore to get the favoured species hunters have to travel further (Barnett 2002). For example in Malawi, bushmeat traders are depending on the smaller species that prosper in human-modified sceneries, such as rodents, birds and insects due to the loss of most large species (Barnett 2000).

In some countries, huge desert zones exist from which wildlife animals has been largely exhausted by unlawful hunting, causing the ‘empty forest’ syndrome (Redford 1992) and in the same way, obviously, the ‘empty savannah’ syndrome. For example, many of the game management areas in Zambia and hunting coutadas in Mozambique have very little wildlife although they have huge areas of undamaged habitat and low human population densities (Hatton et al. 2001 & Simasiku et al. 2008). Even though lack of documents makes it difficult to relate the severity of many threats, these examples stress that in a number of areas, the threats posed by habitat loss is less severe compared to illegal hunting (Wilkie et al. 2005). The threats of both extreme hunting for bushmeat and habitat damage in many areas such as the Maasai Mara, act synergistically with severe costs for wildlife(Ogutu et al. 2009). Severe costs for ecosystem services can result due to the loss of wildlife as a result of illegal hunting of the species.

3.0 CHAPTER THREE: Materials and Methods.

3.1 Study Area.

3.1.1 Geographic location.

Central Equatoria State is located between latitudes 4°35’ and 6°25’ N, and 30°23’ and 32°2’ E; and has common borders with Uganda and the Democratic Republic of Congo (Babeker et al. 2006). It is about 43,033 km² in size, and has a population of about 1.1 million people; it is the smallest of the South Sudanese states. Its previous name was Bahr al Jebel, named after a

tributary of the White Nile that flows through the state. The state's capital of Juba is also the national capital of South Sudan.

Central Equatoria State is characterized by tropical wet and dry climate as it is situated near the equator, maximum temperature reaches 38°C with an average maximum temperature of 34°C and a minimum and average minimum temperature of 20°C. The rainy season starts in April and ends in October or November with a total annual rainfall ranging from about 900 to 1,500 mm, and dry season starting from December and ends in March (Babeker et al. 2006).

Four localities were chosen for data collection of this study based on their proximity to protected areas (Badingilo National Park and Juba Game reserve, geographical location and accessibility. The areas were Rejaf, Gumbo, Joppa and Terekeka. Rejaf, is situated on the east and west bank of the White Nile. Gumbo is a small suburb east of Juba. It falls on either side of the Nile River and lies at N 4°45'8.0388" and E 31°34'18.7356". Its economy is primarily agrarian with emphasis on subsistence farming. Key crops cultivated include sorghum, maize, cassava, sweet potatoes, groundnuts and sesame. However, large and small domestic livestock are also reared specifically for socio-cultural and traditional purposes. Although livestock represents a source of quick cash, this is often dictated upon by family circumstances.

Gumbo is another village that is situated east of Juba at N 4°48'41.778" and E 31°37'58.0224". Unlike Rejaf whose population is predominantly from the Bari ethnic group, the population of Gumbo is a mixture of locals and other ethnicities. Major crops cultivated in the area include sorghum, maize, cassava, sweet potatoes, groundnuts and sesame.

Gumbo and Rejaf lies to the South of Badingilo National Park and constitutes the eastern borders of the Juba Game Reserve, Rejaf constitutes the South western extension of Juba Game Reserve and the entrance into Juba from the southern parts of the country. Joppa falls within the boundaries of Juba. Joppa is a suburb of greater Juba. It is situated west of Juba at N 4°51'14.9868" and E 31°33'18.0648". Like Gumbo, the population of Joppa is a mixture of locals and other ethnicities. Major crops cultivated in the area include maize, sorghum, sweet potatoes, cassava, sweet, groundnuts and sesame. Terekeka town lies about 85 km (53 mi) north of Juba on the west bank of the White Nile. Terekeka town is wooded savannah land located on both sides of the River Nile at N 5°26'28.5108" and E 31°44'9.924". Its western section is drained by

numerous seasonal and perennial streams and becomes swampy during the rainy season. Terekeka is a predominantly a Mundari area. Their economy is around herding of livestock (sheep, goats and cattle), small subsistence farming and fishing. Crops cultivated include sorghum, maize, and groundnuts.

3.1.2 Vegetation.

The vegetation of the area covers parts of the floodplains, savannah and forest with the dominant trees species that includes white thorn (*Acacia seyal*), pod mahogany (*Azalia quanzensis*), desert dates (*Balanites aegyptiaca*), stink wood (*Celtis sp.*), Sodom apple (*Calotropis procera*), Bush-willow (*Combretum sp.*), African fan palm (*Borassus aethiopum*), Bell-flowered mimosa (*Dichrostachys cinerea*), African ebony (*Diospyros mespiliformis*), Kaffir boom (*Erythrina sp.*), Fig (*Ficus sp.*), Sausage tree (*Kigelia africana*), Black plum (*Vitex doniana*), Christ thorn (*Ziziphus spina-christi*), Tamarind (*Tamarindus indica*), and Neem (*Azadirachta indica*) (Boitani 1981). The main types of grasses found in the area consist of swamp meadow, with dense low growing stoloniferous grasses, antelope grass (*Echinochloa pyramidalis*), and thatching grass (*Hyparrhenia rufa*).

3.1.3 Fauna.

The fauna of the park includes white-eared kob (*Kobus kob leucotis*), the tiang (*Damaliscus lunatus tiang*), the Mongalla gazelle (*Gazella rufifrons albonotata*), reticulated giraffe (*Giraffa camelopardalis*), zebra (*Equus burchelli*), Grant's gazelle (*Gazella granti*), lesser kudu (*Tragelaphus imberbis*), Beisa oryx (*Oryx beisa*), warthog (*Phacochoerus africanus*), Bohor reedbuck (*Redunca redunca*), lion (*Panthera leo*), spotted hyena (*Crocuta crocuta*), wild dog (*Lycaon pictus*), leopard (*Panthera pardus*) and black-backed jackal (*Canis mesomelas*) and several bird species (Fishpool & Evans 2001; Sinclair et al. 2003). The main species hunted for food are the gazelles, rodents, reedbuck (*Redunca redunca*), and some of the birds.

3.1.4 Agriculture.

The people of the area engage in shifting cultivation, and the food obtained is mainly for households consumption, however surplus are sold to generate income is used to cover for other needs of the households. They grow a variety of crops, including maize, cassava, sweet potatoes, sorghum, groundnuts, and beans which are harvested twice in a year in June or July and in November or December. They also keep cattle, goats and sheep (Noordwijk 1984, Babeker et al.

2006). Sorghum is the main crop cultivated with a wide range of local landraces. It is also the main staple food. Other cereal crops such as bulrush millet, finger millet and upland rice are also cultivated in certain locations. Yam, coffee, mango and papaya are also commonly grown with okra; cowpea, pumpkin and tobacco are also widely grown around homesteads. Vegetables such as onions or tomatoes are not commonly grown in rural areas, but are increasingly cultivated near cities to supply urban markets. More than 95% of agricultural production in the Central Equatoria State is rain-fed; however weather variability is a key factor in defining crop performance.

3.1.5 Food Security Situation.

About 33 per cent of the people living in Central Equatoria are severely food insecure.

After the eruption of the July 2016 conflict in Juba, numerous parts of the country experienced intensified tensions and fighting, including the Central Equatoria State where the study areas belong to. This state had been one of the most peaceful and stable state in the country, which serves as the main bread basket of the country.

3.2 Sampling design and data collection.

Data for this study was obtained from the information that the households in the four study areas (Rejaf, Gumbo, Joppa and Terekeka) have provided. Since this study was exploring a quantitative method, the data collection method used was in the form a questionnaire.

Structured questionnaires were used to collect data from a sample of 100 randomly selected households in the four named areas. The number of people interviewed in Rejaf, Gumbo, Joppa and Terekeka was 25, 25, 22 and 28 respectively. Within each of the four study areas, households' heads were randomly/ haphazardly selected and the respondents interviewed include both males and females. The households heads interviewed were 64 males and 36 females respectively.

The questionnaires generated personal data, data on amount of bushmeat consumed in the households, status of animals hunted, amount of income generated from bushmeat, and challenges affecting the households in hunting bush meat. Before the start of the interview, the interviewer explained what is needed from the respondents and clarified questions from the respondents during the interview. Tools used in the data collection were questionnaires, pens note books, field guide and a car.

3.3 Data analysis and interpretation.

One-way ANOVA was used to:

1. To determine if there was no difference between the quantity of bushmeat consumption per annum in the household and that of other sources of animal protein (Birds, reptiles, cattle, Sheep and goats).
2. To determine if there was no difference between the frequency of bushmeat consumption and that of other food types (Green vegetables, chicken, fish & cereals).
3. To determine if there was no difference between the economic contribution of bushmeat to households' income and income generated from other sources (charcoal making, firewood collection and salary of unclassified staff).
4. Descriptive statistics was used to determine the frequency of consumption and status of animal species hunted per household and month.
5. To determine challenges for using bushmeat as food resource in households, pie charts was used to visualize the proportions of different challenges.

All the analyses were done using SPSS 20 software.

3.4 Research ethics.

Research ethics were followed during the study. First an approval to conduct the study was obtained from the county authorities under whose jurisdiction the study site falls, and from the traditional authority e.g. chief on the ground. Second, before the consent of the person to be interviewed was obtained, he or she was informed about their right to refuse to be part of the study, the purpose of the study, the procedures to be followed, and the possible risks and benefits of participation associated with the study. Finally, it was made clear to them that participation in the study was voluntary (Beezhold et al. 2016).

3.5 Limitation of the study.

Since the study was a case study and was a survey questions, it had two limiting factors. First, casual inferences from the study could not be generalized because alternative explanations could not be ruled out. Second, questionnaire survey involved an individual respondent's or person's whose behaviour cannot be generalized as it does not reflect group behaviour (Simon & Goes 2013).

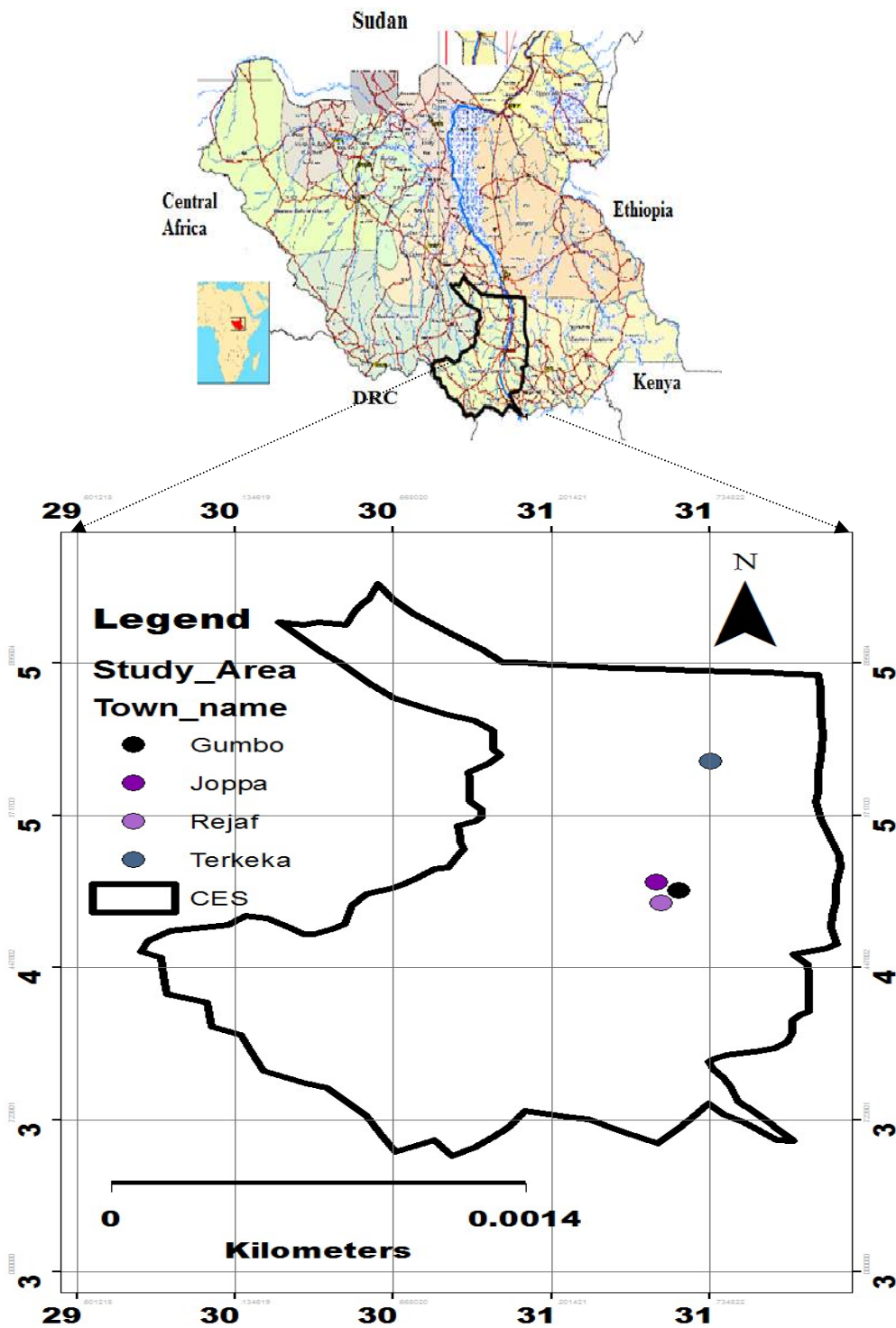


Figure 1: Map of Central Equatoria State showing areas sampled (Source: Developed from map by, OCHA 2012).

4.0 CHAPTER FOUR: Results & Discussion.

4.1 Quantity of bushmeat and livestock meat consumed.

Quantity of bushmeat (Bohor reedbeek, Mongalla gazelle, warthog, giraffe, rats, porcupines, hares, giraffe and hippopotamus) and other animals (insects, birds and reptiles) or domestic animals consumed per household and month was measured. The results are shown in figure 1.

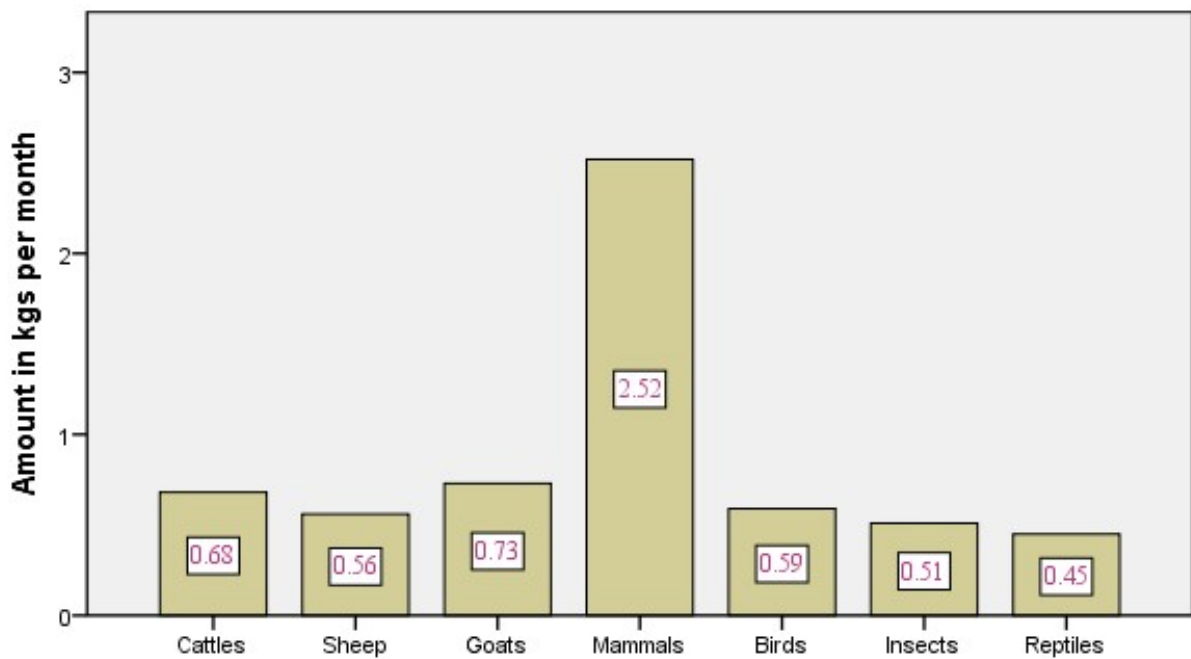


Figure 1: Monthly consumption of kg animals' meat per household in Central Equatoria State.

The figure shows the category of bushmeat and other domestic animals most eaten per month per household in the study areas. The most eaten bushmeat was wild mammals (2.52 kg), followed by birds (0.59 kg), insects (0.51 kg) and the least was the meat of reptiles (0.45 kg)

From the domestic animals consumed, the most eaten was the meat of goats (0.73 kg), followed by cattle (0.68 kg) and the least was sheep's meat (0.56 kg).

Independent sample Kruskal-Wallis test showed a highly significant difference in the amount of meat consumed across all categories (Cattles, sheep, goats, wild mammals, birds, insects and reptiles) at the $p < 0.001$ level of significance ($H = 130.5$ (6), $p = 0.0001$). Thus, the null hypothesis of 'no difference' between the quantities of meat consumed was rejected.

The results showed that bushmeat is consumed to a greater extent than domestic animals and other types of wild meat (birds, insects and reptiles). There seems to be no preference between meat of domestic animals and that of other wild animals (birds, insects and reptiles).

This finding is in agreement with Barnett (2000) who found that in areas where communities keep livestock, households often prefer retaining cattle and other domestic animals as capital and cultural assets and use bushmeat to meet their daily protein requirements. However, the 2.52 kg of meat eaten by a household per month reported in this study is somewhat low in contrast to earlier studies of agronomists in the Congo Basin which indicate that a figure of 0.13 kg per day/ 3.9 per month may be a characteristic for rural dwellers in the region (Wilkie & Carpenter 1999). The observed differences in the quantities of meat eaten may be due to; firstly, all of the households interviewed in the four study sites are very poor in terms of livelihoods and most of them cannot meet the expense of the equipment essential to hunt bushmeat or have money to buy the bushmeat. Secondly, lack or few alternatives sources of getting money due to the country's political instability is causing most households to sell the meat, although they can afford the equipment. Finally, most of the households are restricted by the wildlife laws and especially the insecurity in the country, to hunt freely.

However, the result found in this study, is relatively very high when compared to the study carried out in the Congo, which reported that quantity of bushmeat consumed in the area was the

least (1.2 Kg/ month) after fish (1.8 Kg/month) and other wild plants(3.3Kg/month) (De Merode et al. 2004). The reason for the high bushmeat consumption in these four study sites of the Central Equatoria State can be explained in the following ways: First, the economic crises in the country that let to high prices of food items is causing many households not to be able to purchase other sources of meat such as sheep, goat, and fish. Secondly, although there are laws concerning bushmeat hunting in the country, these laws are not even being followed or put into practice by the department in charge. As a result to this, hunters get chance to hunt any time they want to and any animal species they want. Thirdly, taste and cultural believes also play great roles in bushmeat consumption, because some people like the taste of bushmeat, and some also believe that bushmeat should be eaten in some of the cultural celebrations. Finally, the conflict and insecurity in the country has caused some difficulties for some of the households who live far from the town to access markets. Therefore, they keep on using bushmeat as their only source of protein since it is not easy to get other meat.

The meat of these hunted wild animals provide people with calories, animal proteins, essential minerals and micronutrients like iron and iodine, and also vitamins A, B, C,D and E and contribute to food security. These micronutrients are very important, not only in creating a more secure and varied diet, but they also help in combating the effects of “hidden” hunger (Sneyd 2013). Any reduction in amount of bushmeat intake, will affect those households who depend on it as a food resource and have difficulties in affording other forms of protein, such as fish or domestic meat.

Although, this result cannot be generalized to the whole country, since the households interviewed are very few However, the result still means that most of the households interviewed depend on bushmeat as their source of protein, and therefore it plays a great role for their food security.

4.2 Quantity of animal and other protein sources consumed.

The amounts of different food types consumed per household and month (bushmeat, green vegetables, chicken, fish and cereals) were compared to one another, and the outcomes of the comparative analysis are shown in figure 2.

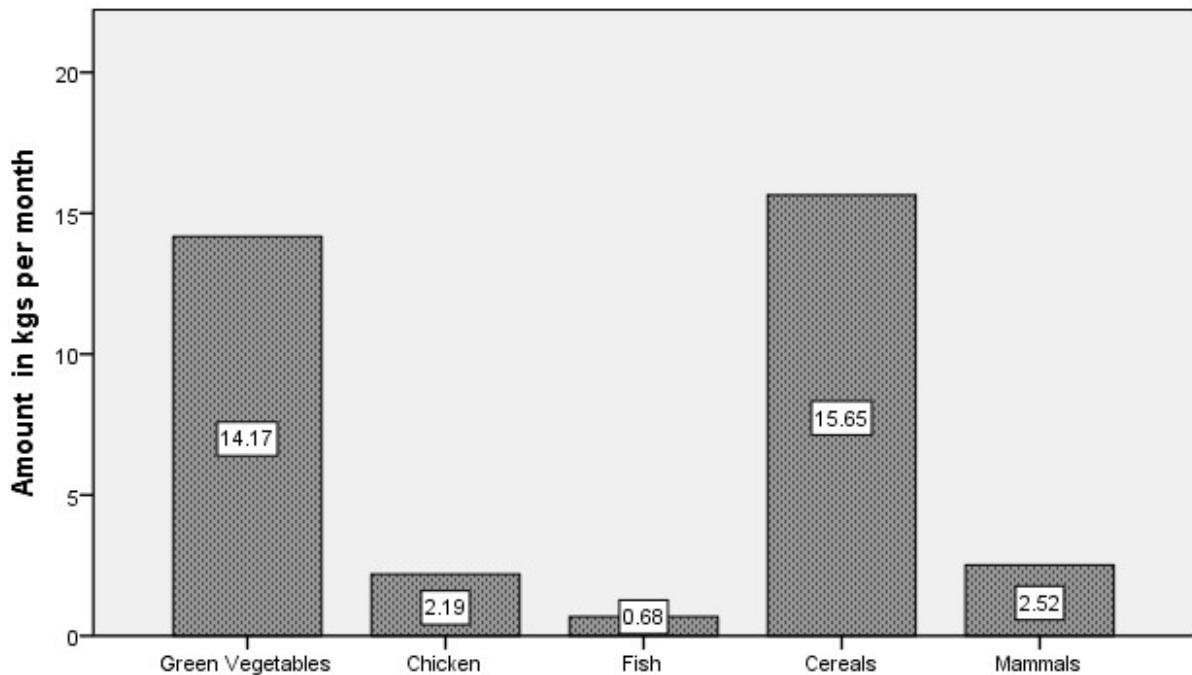


Figure 2: Amount (kg) of mammals (bushmeat), green vegetables, chicken, fish and cereals consumed per household per month in Central Equatoria State.

Comparatively amount of bushmeat consumed per household per month was lower than that of cereals and green vegetables. However, quantity of bushmeat was higher than the quantity of chicken and fish consumed. One-way ANOVA test indicated a highly significant difference in the monthly amount (kg) of bushmeat consumed per household and that of green vegetables, chicken, fish and cereals ($F(3, 396) = 14.16, p = 0.0001$) (Tab. 1). As such the null hypothesis of no difference was not accepted.

According to the above result, the reason to high consumption of bushmeat compared to the other protein sources like fish and chicken can be explained in the following way. First, not all the

households hunting bushmeat are keeping chickens. Secondly, it takes time for the chickens to grow so as to be ready for food while bushmeat can be hunted at any time. Thirdly, the fishing industry in the country is under developed therefore, fishermen are lacking fishing skills. Fourthly, due to the political instability in the country, fishermen lost access to fish. Lastly, due to the current economic crisis only very few households are able to purchase chicken and fish from the markets because most of the chicken and fish in the country are being imported. Therefore, this result disagrees with the study done by (Olupot et al. 2009), which found that households in Uganda consume more chicken and fish.

Table 1: One-way ANOVA of amount (kg) of bushmeat, green vegetables, chicken, fish and cereals consumed per household per month in Central Equatoria State.

Amount consumed (kg)

	Sum of squares	df	Mean square	F	Sig.
Between groups	18381.088	3	6127.029	14.162	0.000
Within groups	171324.010	396	432.636		
Total	189705.098	399			

Post hoc comparisons using the Tukey HSD test indicated that the mean score for the green vegetables ($M = 14.17$, $SD = 29.305$) was highly significantly different from chicken ($M = 2.19$, $SD = 4.092$) and fish ($M = 0.68$, $SD = 2.490$). Likewise, mean score for chicken ($M = 2.19$, $SD = 4.092$) was highly significantly different from cereals ($M = 15.65$, $SD = 29.134$). Similarly, fish mean score ($M = 0.68$, $SD = 2.490$) was highly significantly different from cereals ($M = 15.65$, $SD = 29.134$). Also, mean score of quantity of bushmeat (wild mammals) ($M = 2.52$, $SD = 2.231$) consumed was significantly different from that of green vegetables ($M = -11.650$, $SD = 2.635$) and cereals ($M = 1.840$, $SD = 2.635$). However, green vegetables ($M = 14.17$, $SD = 29.305$) did not significantly differ from cereals ($M = 15.65$, $SD = 29.134$), and chicken did not significantly differ from either fish ($M = 0.68$, $SD = 2.490$) and wild mammals ($M = -0.330$, $SD = 2.635$).

4.3 Frequency of hunting, consumption and status of bushmeat species.

Frequency of hunting for bushmeat per household was measured on daily, weekly, monthly and seasonally. The results are shown in table 3.

Table 3: Frequency of hunting for bushmeat in the study area

Time	Frequency	Percentage	Valid percentage	Cumulative percentage
Daily	6	6	6	6
Weekly	28	28	28	34
Monthly	7	7	7	41
Seasonally	49	49	49	90
Do not hunt but buy	10	10	10	100
Total	100	100	100	

Regarding the frequency of hunting between and within seasons, hunting for bushmeat was generally done seasonally (49%) followed by weekly (28%) (Table.3). South Sudan has two main seasons, dry and wet seasons, therefore seasonally means either dry or wet seasons.

According to the result, great number of respondents from all the four study sites reported that they always hunt seasonally and that is during the dry season. In accordance with this finding Holmern et al. (2007) found that in the Serengeti National Park of Tanzania, most hunting activities happen during the dry season. This is because during this season there is always large number of migratory ungulates crossing the villages going to the park. Van Vliet et al. (2010) also found that, during dry season it is easier for hunters to hunt great number of animals. According to their study, during the dry season hunters usually gather along the streams because the wet soil in these areas easily show the foot prints of the animals and these areas do not have dry leaves to make noise.

In contrasts with this study, Nuno et al. (2013) found that in the Serengeti National Park where these other studies were also done, hunting takes place in both seasons. According to Thirgood et al. (2004), the migratory ungulates are being protected from poachers by the protected areas and allocated to areas less accessible to hunters and unsuitable for using snares during the rainy season (Campbell et al. 2001). For the case of South Sudan, hunters prefer hunting during the dry season because that is when grasses are dry and it makes it easier for them to catch more animals. Although they prefer dry season, this preference has been affected by the conflict and

insecurity in the country. At the moment, hunters can't walk for examples more than five miles from the capital city Juba to carry out their hunting activities. This restriction in movement, especially during the hunting season (dry season) has affected and will continue to affect food security for many households unless the conflict ends.

In this study, frequency of bushmeat consumption per house and month was also analysed. For the rainy season, the results are shown in table 4.

Table 4: Intra-rainy season frequency of bushmeat consumption in the study area

Time	Frequency	Percentage	Valid percentage	Cumulative percentage
Twice a week	12	12	12	12
Once a week	16	16	16	28
Once a month	47	47	47	75
Other	25	25	25	100
Total	100	100	100	

Regarding the frequency of consumption, results indicated that during rainy season, 47% of the respondents consumed bushmeat once a month and 25% did it on 'other' category (those who don't know the number of days they eat bushmeat).

According to the findings, during the rainy season most people consumed bushmeat only once every month. The reason for this low consumption is clear since during the rainy season, hunters get difficulties to hunt a lot of animals.

Also for the dry season, how often bushmeat was consumed was determined, and the results are shown as in table 5.

Table 5: Intra-dry season frequency of bushmeat consumption in the study area

Time	Frequency	Percentage	Valid percentage	Cumulative percentage
Daily	10	10	10	10
Twice a week	57	57	57	67
Once a week	13	13	13	80
Once a month	10	10	10	90
Other	10	10	10	100
Total	100	100	100	

Results showed that within the dry season, most (57%) respondents consumed bushmeat twice a week and 13% consumed it once a week.

The result shows that, more bushmeat is consumed by the households during the dry season. Therefore, that means bushmeat serves as a coping mechanism because during this season there are no harvests from the fields or only little is harvested. The reason for this high percentage of household's consumption of bushmeat during the dry season might be due to availability of the animals and easy access of the hunting areas by hunters. Therefore, this confirms the studies which say that hunting is mostly done during the dry season (Holmern et al 2007, Van Vliet et al. 2010).

This result disagrees with the study done by East et al. (2005) in the Equatorial Guinea about bushmeat consumption, which found that in the dry season households eat less bushmeat than in the rainy season. According to them, the problem is not the lack of animals to hunt, but they found that households do not prefer eating bushmeat saying that it is an unclean meat. And another reason is that the meat is very expensive in the restaurants for those who want to buy. Similarly, across West African region, larger quantities of bushmeat are mostly consumed during the rainy than dry season (Falconer & Koppell 1990). Likewise, the result obtained in this study also disagrees with Olupot et al. (2009), who reported that bushmeat hunting occurred year around with peaks in both dry and rainy seasons in Uganda. This discrepancy may be due to the fact certain bushmeat species are mainly common during one season or year around depending on the region (Falconer & Koppell 1990, Olupot et al. 2009).

Besides the frequency of bushmeat consumed, respondents were also asked about the circumstances under which they consumed bushmeat, and results are shown in table 6.

Table 6: Occasions and frequency of bushmeat consumption in the study area

Occasion	Frequency	Percentage	Valid percentage	Cumulative percentage
Funeral	4	4	4	4
Rituals	10	10	10	14
Festivals	53	53	53	67
Others	20	20	20	87
No preferred occasion	13	13	13	100
Total	100	100	100	

Concerning circumstances under which bushmeat was consumed, 53% of the respondents said they ate bushmeat during festivals only (e.g. religious or national holidays), and only 4% said they consumed bushmeat during funerals.

This finding is in line with van Vliet et al. (2014), who stated that bushmeat is being used for the preparation of traditional dance rituals or festivals celebrated in the urban and peri-urban areas of the Latin American countries; Brazil, Peru and Colombia.

Regarding the composition of wild meat consumed, and whether the meat consumed was of a fully protected animal or not, for the mammals the results are shown in table 7.

Table 7: Number of respondents and categories of species of bushmeat hunted in the study area

Category/ Bushmeat species	Number	Percentage	Valid percentage	Cumulative
Antelopes	23	23	23	23
Rodents	17	17	17	40
Hippopotamus	4	4	4	44
Antelopes and Rodents	47	47	47	91
> Two mammal species	1	1	1	92
Not Consuming mammals	8	8	8	100
Total	100	100	100	

In South Sudan, there is a law concerning hunting of wildlife species although it is not being put into practice. According to the law, wild animals are divided into three schedules: First, there is schedule I. Species under this schedule are totally protected wildlife species that means they are not supposed to be hunted no matter what. Secondly, there is schedule II. Animals under this schedule should not be hunted unless with a valid permit provided by the director general of the park. Finally, there is schedule III. Animals under this schedule should be hunted freely but without the use of firearms.

According to the result, bushmeat species mostly consumed by residents of the study area were antelopes. In order of use from the most to the least hunted they are namely Bohor reedbuck, Mongalla gazelle, warthog and giraffe in order of decline use, and rodents (rats, porcupines and hares) (47%) followed by antelopes only (23%), then rodents only (17%). Giraffe and

hippopotamus are totally protected (schedule 1) wildlife species in South Sudan. Mongalla gazelle is a schedule II wildlife species (specially protected). Bohor reedbuck and warthog are schedule III wildlife species (protected species).

This result is supported by Jenkins et al. (2011), who found that many protected species were being consumed. Although the species reported consumed in the two studies were different, nevertheless in both cases, they are protected species. In addition, the result on the consumption of protected animal species is corroborated by Ripple et al. (2016), who found that out of the 1169 terrestrial mammals listed as endangered by the International Union for Conservation of Nature (IUCN), 301 mostly ungulates are threatened by humans.

For the composition and status of insects consumed, the results of the survey are displayed in table 8.

Table 8: Number of respondents and insect species consumed/ hunted in the study area

Species	Frequency	Percentage	Valid percentage	Cumulative percentage
Locusts	15	15	15	15
White ant	36	36	36	51
Locusts and white ant	7	7	7	58
Have not consumed insects before	42	42	42	100
Total	100	100	100	

Results of the survey indicated that, 42% of the respondents did not consume insects, and 36% and 15% consumed white ant and locusts respectively.

Although this study found that few respondents reported eating insects, the practice of eating insects is not unique to Central Equatoria State. Van Huis (2003) and Van Huis et al. (2013), found different insects are being eaten across the globe. Besides, Van Huis et al. (2013) reported that locusts and white ant are among the insects being consumed worldwide. The small of respondents that reported eating insects observed in this study may (Ramos-Elorduy et al. 1997) be attributed to socio-cultural differences among ethnic groups. In fact insects' consumption is considered disgusting and a primitive practice by many people (Rozin & Fallon 1987, Ramos-Elorduy et al. 1997).

Concerning birds, analysis of the composition and status of bird species consumed was done. The results of the analysis of the survey data are shown in table 9.

Table 9: Number of respondents and bird species consumed/ hunted in the study area

Species	Frequency	Percentage	Valid percentage	Cumulative percentage
Ostriches	7	7	7	7
Guinea Fowls	23	23	23.3	30.3
Have not consumed birds before	69	69	69.7	100.0
Total	99	99.0	100.0	

Concerning birds, results showed that most respondents did not eat birds (69%), whereas 23% and 7% of the respondents reported eating guinea fowl and ostriches respectively (Tab. 9).

Ostrich is a schedule I wildlife species, i.e. it is a totally protected species, and guinea fowl is a specially protected wildlife species (schedule II) in South Sudan.

The result of this study on birds consumed is concordant with Bennett Hennessey (1995) who found that large-bodied birds were being eaten. Similarly, the study agrees with Ceppi and Nielsen (2014) who reported that guinea fowl was among bird species eaten.

Similarly the composition of species of reptiles' meat consumed was undertaken. Table 10 below shows the results.

Table 10: Number of respondents and reptile species consumed/ hunted in the study area

Species	Frequency	Percentage	Valid percentage	Cumulative percentage
Nile crocodile	12	12	12	12
Pythons	12	12	12	24
Crocodiles and Pythons	7	7	7	31
Have not eaten reptiles before	69	69	69	100
Total	100	100	100	

In relation to reptiles, majority (69%) of respondents did not consume reptiles. However the Nile crocodile and pythons were eaten in equal proportions (12%) while 7% of the respondents said

they ate both the Nile crocodile and pythons (Tab. 10). Both the Nile crocodile and pythons are wildlife species that are totally protected, i.e. they are not supposed to be hunted.

This result shows that, even if there is Wildlife laws concerning types of species to be protected, hunters still get chance to hunt the species.

The observed result on reptiles is in accordance with the findings by Bennett Hennessey (1995). Likewise the result is in line with Magnino et al. (2009), who found that crocodiles are among the reptiles consumed. The result on the consumption of the Nile crocodile and the python underscores the view that animals listed as protected and endangered locally or internationally by the IUCN were also being consumed (Jenkins et al. 2011).

4.4 Economic contribution of bushmeat to households' income.

On average bushmeat generated the highest (1, 688 SSP) monthly income per household, followed by income from charcoal making (281 SSP) with firewood collection generating the least income (58.15 SSP) (Fig. 3).

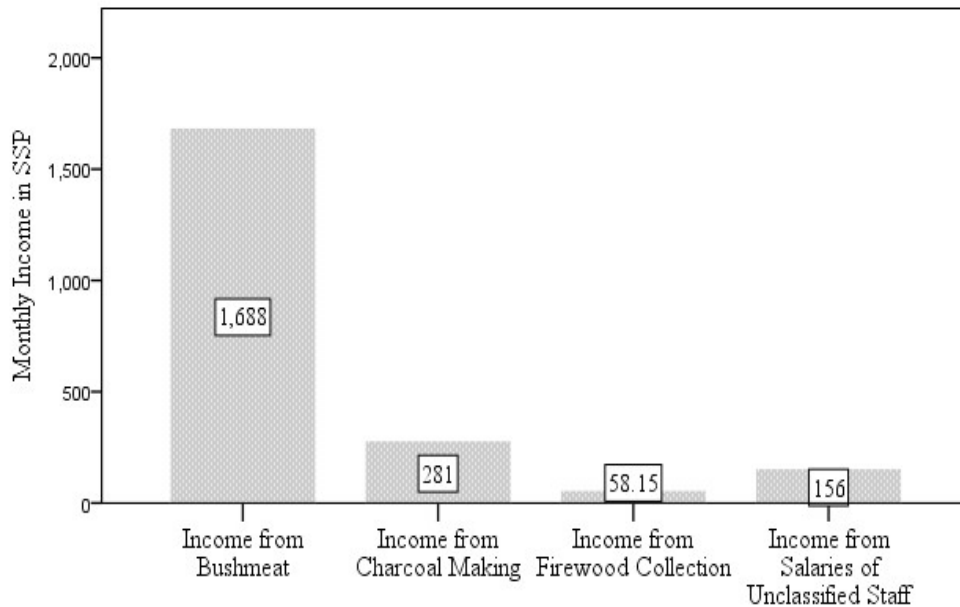


Figure 3: Mean monthly income from sales of bushmeat, charcoal, firewood and salary of unclassified staffs.

Contrary to the null hypothesis of no difference between the income generated from the sales of bushmeat, charcoal, and firewood in addition to salary of unclassified staff, one-Way ANOVA test showed a highly significant difference between the cash income generated from selling bush meat, charcoal, firewood and salary of unclassified staffs ($F(3, 396) = 55.719, p = 0.0001$). The results of the one-way ANOVA are shown in table 11.

Table 11: One-way ANOVA of income (SSP) generated from sales of bushmeat, charcoal and firewood, and salary of unclassified staff per household per month in Central Equatoria State

ANOVA

Amount generated (kg)

	Sum of squares	df	Mean square	F	Sig.
Between groups	176334441.688	3	58778147.229	55.719	0.000
Within groups	417742407.750	396	1054905.070		
Total	594076849.437	399			

These results suggest that the average amounts of money obtained from sales of bushmeat, charcoal, and firewood in addition to salary of unclassified staff are not equal. Some are more or less than others. Put together, these results suggest that people made a lot of money from sales of bushmeat compared to that from sales of charcoal and firewood, and salary of unclassified staffs.

Even though many studies have been done regarding bushmeat harvesting, yet literature about the contributions of bushmeat to household economies is scarce (Ashley et al. 2002; Brown & Williams 2003).

This (Ashley et al. 2002)(Ashley et al. 2002)(Ashley et al. 2002)(Ashley et al. 2002)study showed that, bushmeat plays an important role by being an essential source of income to the communities, just as it is a source of food. According to the result, bushmeat tends to generate much income to the communities (1, 688 SSP/ month) compared to the other sources of income like charcoal making, salaries of unclassified staffs and firewood collection (see Fig. 3). However according to this result, the amount of income that the households generate from selling bushmeat which is 1, 688 SSP/Month (180 USD/year), is a bit lower when compared to the result of the study carried out in the two villages in Congo by Wilkie and Carpenter (1999). In the two villages according to the study, a household generates 300 USD/ year from bushmeat trade. The result also seems to be lower compared to two other studies carried out in Cameroon and in the Congo (Wilkie & Carpenter 1999). Their studies found that hunters could make \$250-\$1050 per year and \$650 per year from bushmeat trade respectively.

Although the income generated from bushmeat in this study is low compared to the other studies, it still plays a great role in the lives of the households of the studied communities.

The reason for this low yearly income compared to the other studies can be explained in several ways. First bushmeat trade is considered as an illegal act in the country so hunters might be fearful in accessing markets. Second the economic crises in the country also contribute to this low price, since buyers may be lacking money to buy the meat. Thirdly, due to the conflict, hunters are also facing difficulties in accessing the animals.

To isolate the source of the difference, post hoc comparisons using the Tukey HSD test was done. The results are displayed in table 12 below.

Table 12: Post hoc Tukey HSD test of mean income (SSP) generated from sales of bushmeat, charcoal, firewood, and salary of unclassified staff per household per month in Central Equatoria State

Multiple Comparisons			
Dependent Variable: Income in South Sudanese Pound (SSP)			
Tukey HSD			
I) Monthly income generated from Bushmeat, charcoal making, firewood, collection and salary of unclassified staff in SSP Error	J) Monthly income generated from Bushmeat, charcoal making, firewood collection, and salary of unclassified staff in SSP	Mean Diff.	Std.
Income from Bushmeat	Income from Charcoal	1406.500**	145.252 .000
	Income from firewood collection	1629.350**	145.252 .000
	Income from salary of unclassified staff	1531.500**	145.252 .000
Income from Charcoal Making	Income from Bushmeat	-1406.500**	145.252 .000
	Income from firewood collection	222.850	145.252 .418
	Income from salary of unclassified staff	125.000	145.252 .825
Income from Firewood Collection	Income from Bushmeat	-1629.350**	145.252 .000
	Income from charcoal making	-222.850	145.252 .418

	Income from salaries of unclassified staff-97.850	145.252
.907		
Income from Salaries of Unclassified Staff	Income from Bushmeat	-1531.500** 145.252 .000
	Income from charcoal making	-125.000 145.252 .825
	Income from firewood collection	97.850 145.252 .907

** . The mean difference is significant at the 0.001 level.

Results of the post-hoc analysis indicated that the mean income generated for the bushmeat (M = 1687.50, SD = 1957.637) was highly significantly different from charcoal making (M = 281.00, SD = 468.383), firewood collection (M = 58.15, SD = 116.352) and salary of unclassified staff (M = 156.00, SD = 392.884). However, mean monthly income per household from charcoal making (M = 281.00, SD = 468.383) did not significantly differ from mean monthly income from firewood collection (M = 58.15, SD = 116.352), and salary of unclassified staff in Central Equatoria State (M = 156.00, SD = 392.884).

Analysis of how the money generated from sales of bushmeat is used was also done. Table 13 below shows the results of this analysis.

Table 13: Number of respondents and utilization of income generated from bushmeat sales

Case	Number of respondents	Percentage
Money earned used for paying school fees	42	26.9
Money earned used for buying other food stuffs	53	34.0
Money earned used for buying clothes	28	17.9
Money earned used for buying medicines	33	21.2
Total	156	100

The majority of respondents (34%) used the money generated from sales of bushmeat for buying other foodstuffs, and 26.9% of respondents used it for paying children's school fees. Only 17.9% of the respondents used the money for buying clothes.

According to this study, we have found that hunters in all the study sites use the income they earned from selling bushmeat for buying other food staffs, medicine, clothes and paying school fees. Most hunters (34%) use the money for buying other food staffs and only few (17.9%) use it for buying clothes. This result doesn't correlate with the result of the study done by Coad et al. (2010) which said that most successful hunters (men) used their income on alcohol and cigarettes instead of buying food or other items such as medicines or clothes compared to women. In this study both men and women used most of their income for buying food. Solly (2004) and Kümpel et al. (2010) also found that male hunters in Central African countries also used most of their income on alcohol and cigarettes and hunters households also consider bushmeat income as money that don't contribute to food security. The difference between this study and the others may be due to the fact that, the countries where the other studies were carried out are not food insecure as South Sudan, that's why hunters prefer using the income for alcohol and cigarettes than spending on food.

4.5 Challenges for using bushmeat as a food resource.

A survey of challenges facing the harvest and use of bushmeat was conducted, and the results are shown in figure 4.

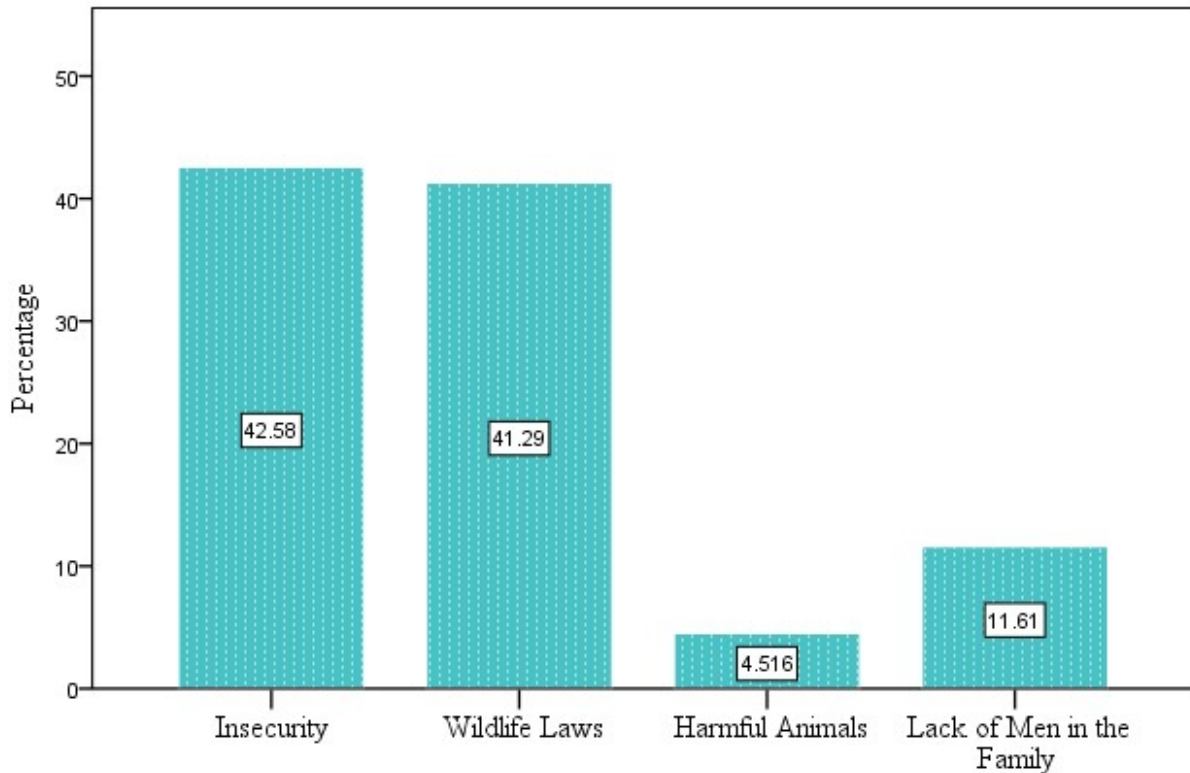


Figure 4: Challenges facing the harvest and use of bushmeat.

The figure indicated that the number of challenges facing the use of bushmeat as a food resource was four. These are insecurity, wildlife laws, and lack of men in the family and harmful animals. The most important challenge to the households was insecurity, in which 42.58% of the interviewees reported as a threat to hunting.

In most countries, insecurity does not affect hunting activities, but wildlife laws do. Even though hunters in those countries are controlled by the law, the punishment is not so hard for them to fear. For example, the gazetted penalties for poaching in many African countries do not provide sufficient restrictions and do not imitate the value of the resource being ruined (Barnett 2000). The common punishments given always comprise of small fines (often of low in value when compared to the animal hunted), community service or warnings (Barnett 2002; Demeke 2003). For example, no hunter have been arrested out of the 64 accused arrested for banned hunting in

northern Botswana. By contrast, illegal hunters are approved large (US\$485) payments in central Mozambique, which are not often collected (Lindsey & Bento 2012). Besides, there is no consistency in wildlife laws among the neighbouring countries, so loopholes can't be created for illegal hunters. In comparison, livestock offences are naturally granted higher precedence than offences involving wildlife, which has caused the growth of legal wildlife-based land uses. For example, imprisoned stock thieves in Zimbabwe, are approved six years custody for stealing a goat which is worth US\$20-30, whereas a poacher imprisoned of killing a sable antelope would be allowed a token fine, or community service or released with a warning even though the animal is worth US\$16,000 (Lindsey et al. 2011).

5.0 CHAPTER FIVE: Conclusion.

The results of this study provide some interesting insights into the role of bushmeat in household's food security in South Sudan, Central Equatoria State. Contrary to the null hypotheses, the study showed that there are significant differences in the amount of bushmeat and that of other food types consumed in the households per month as well as in the income generated from sales of bushmeat relative to the other sources of income. Specifically the study showed that first; bushmeat is consumed to a greater extent than livestock's meat (cattle, sheep and goat) and other types of wild meat (birds, insects and reptiles). Second, bushmeat was the third consumed type of food after cereals and green vegetables. Besides, the study showed that hunting of wild animals for bushmeat was done seasonally and mostly during dry season. In addition, it showed that overall more bushmeat was being consumed during festivals. Furthermore, while bushmeat provide valuable protein for many people in the study area, totally protected species also are being illegally hunted and thus becoming a major conservation issue. Third, the results of this study showed that bushmeat sales generated more money than the sales of charcoal and firewood, and the salary of unclassified staff. Some of this money is used for covering other costs, e.g. paying for school fees of children. Even though hunters have the chance to hunt wild animals for bushmeat during both the dry and wet seasons, or any time they want, they do face some challenges notably insecurity due to the current political instability, and wildlife laws.

The study is the first of its kind in South Sudan Central Equatoria to provide data on the direct contribution of bushmeat to household's food security and income. In addition, it contributed data on the extent into which bushmeat is being hunted, and the totally protected wildlife species being hunted for bushmeat. Thus necessitates a call for action by the wildlife authorities to find solutions to regulate bushmeat harvesting and consumption. However, since the results are from a case study and a questionnaire survey, it has some limitations in that casual inferences from the study could not be generalized due to availability of possible alternative explanations. In addition, the results obtained are based on responses of individuals or person's behaviour and therefore it cannot be generalized as they do not reflect group behaviour.

In the context of nutritional requirements and income generation for the poor communities in the study area, this study illustrates the need for a unified approach by the wildlife authorities, conservation agencies, academia and the public to generate data on and regulate bushmeat consumption. It also shows the need for further research to determine the contribution of bushmeat to food security and its impact on protected species at the scale of South Sudan as the current study was based on few sampling areas and limited spatial coverage.

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