ECONOMIC ANALYSIS AND PERCEPTION OF INTEGRATED WILDLIFE/LIVESTOCK FARMING AS AN ALTERNATIVE LAND USE OPTION IN RURAL AREAS OF MOPANI DISTRICT IN LIMPOPO PROVINCE, SOUTH AFRICA

by

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DEDICATION

This mini-dissertation is dedicated to my mother Lucy Mokete, my late father and brother (Jackson Ngoepe and Tlou Freddy). I further dedicate this to my lovely sister (Nare), my brothers (Samuel, Rodney and Moshe) and lastly my nephew (Potlako).

DECLARATION

I, **Machuene Sharlyn Cholo** declare that the mini-dissertation hereby submitted to the University of Limpopo, for the degree of Master of Science in Agriculture (Agricultural Economics) has not previously been submitted by me for a degree at this or any other university. This is my own work in design and in execution, and that all material contained herein has been duly acknowledged.

Cholo, M.S (Ms)	23 August 2017
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Surname, Initials (title)	**Date**

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ABSTRACT

Wildlife farming has become an important land use alternative, especially in most developing countries where there is an abundance of wildlife resources. In South Africa, integrated wildlife/livestock was mostly practiced by commercial farmers on a privately owned land but in recent years, potential for income generation in the industry has grown. Smallholder farmers are increasingly being assisted to explore practicing integrated wildlife/livestock on communal land after receiving land through restitution programme. The aim of the study was to examine costs and benefits associated with integrating livestock with wildlife in a smallholder agricultural context. Structured questionnaires were used to collect data from 71 respondents situated in Ba-Phalaborwa Municipality selected using multistage random sampling technique. Cost-benefit approach and weighted decision matrix were used for economic analysis and also to identify potential trade-offs. Furthermore, the study used descriptive statistical analysis to identify opportunities and challenges faced by farmers. Some of the livestock costs identified include feeds, vaccines and labour costs. Benefits of wildlife include income from trophy hunting and selling meat from wild animals. Cost-Benefit Ratio (CBR) as a tool of cost benefit analysis techniques, was used in order get 0.67 in livestock farming, this shows that the project may not be sustainable whereas that of wildlife farming was 1.13 which indicate that the project will yield positive outcome for community involved. There are trade-offs that farmers will have to consider when shifting towards integrated wildlife/livestock such as reduced livestock benefits and increased wildlife benefits. Livestock diseases, stock theft and others are the identified challenges associated with integrated wildlife/livestock. Descriptive results indicated that 40% of livestock farmers mentioned that they are strongly affected by stock theft and disease transmission. The identified opportunities of integrated wildlife/livestock were business and job creation for rural households. Given the findings, the study therefore, recommends that government and private sector should assist farmers with training in wildlife farming so that they can be competitive in commercial wildlife farming. Funds should be made available for setting up infrastructure suited for wildlife land uses.

Keywords: Costs and benefits, Integrated wildlife/livestock, Land use, Trade-offs

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ABSA Amalgamated Banks of South Africa
CBA Cost Benefit Analysis
CBR Cost Benefit Ratio
CPA Communal Property Association
DB Discounting Benefits
DC Discounting Cost
FAM Foot and Mouth
GLTP Great Limpopo Trans-frontier Park
IWL Integrated Wildlife-Livestock
IWLM Integrated Wildlife-Livestock Management
KNP Kruger National Park
NPV Net Present Value
LDARD Limpopo Department of Agriculture and Rural Development
LEDET Limpopo Economic Development, Environment and Tourism

CHAPTER ONE
INTRODUCTION

1.1 Background

South African agriculture is often characterized as being divided into two types: commercial agriculture and communal/subsistence agriculture. Subsistence use of land is generally viewed as destructive and economically unproductive in comparison to commercial production systems (Andrew *et al*., 2003). The communal land use system comprises of crop-livestock mixed farming, and generally results in low levels of productivity and low capital investments. Livestock production is the primary land use option in many rural areas of Limpopo Province and contributes to households' livelihoods in different ways (Dovie *et al*., 2006). Rural communities depend on agriculture, regardless of the constraints that they face. Livestock income plays an important role for most of the smallholder farmers in rural areas.

Livestock farming under communal tenure can lead to overgrazing or overexploitation of land. Stroebel (2004) argued that the effects of interaction between livestock and the environment can be influenced by humans as livestock owners when they try to respond to social, economic and policy factors. According to Chardonnet *et al*. (2002), the importance of wildlife to rural communities is currently being recognized globally in community-based or participatory natural resource management programmes. However, very little wildlife currently exists on communal land. Most of the wildlife exists inside protected areas such as Kruger National Park, which is separated from the villages only by a fence (Chaminuka *et al*., 2014a).

There are several concerns for rural communities with regard to integration of wildlife and livestock. The concerns include among others the risk of disease transmission between livestock and wildlife (Chaminuka *et al*., 2014a). In South Africa, livestock depredation and disease transmission have been identified as threatening conservation and rural development goals (Anthony, 2006). Fences have the potential to limit disease transmission by restricting contact between wildlife and livestock, whilst also protecting crops from wildlife destruction. Furthermore, if the community moves towards integrated wildlife/livestock, they forego some of the benefits that they used to get from livestock

farming only. There are trade-offs that are associated with net revenues between different options for land use. There exists competition between livestock and wildlife in terms of resource use. The space and time are some of the resources that are of utmost importance with regard to the relationship between the livestock and wildlife. Such competition can put other animals at risk through disease transfer and predation.

In South Africa more than two- thirds of wildlife is in private hands (Otieno, 2014), with commercial farmers dominating this sector since they have more resources than the smallholder farmers. Wildlife is viewed differently by rural people who live close to the protected areas, there are people who perceive it as a threat to their livestock and those who believe that it could increase their household income (Chaminuka *et al*., 2014b). Rural communities that are close to the protected areas need to be aware of the economic benefits that they can get from integrated wildlife/livestock. This can be achieved through economic analysis for costs and benefits of alternative land use options. The use of land for wildlife is an option with the potential to improve or provide sustainable economic development (Barnes, 1998). Wildlife utilization has high economic efficiency and it also has a high value as compared to the cattle, however; it depends on the good management and market options (Jansen *et al*., 1992).

The wildlife industry has grown greatly in South Africa. According to Child *et al*. (2009), tourism is important to South African economy however; the relative contribution of wildlife-related tourism is not known. Employment is one of the most important socio-economic impacts of the wildlife production industry. The industry creates more opportunities for semi-skilled and skilled labour while depending less on the unskilled labour (ABSA, 2003).

The owners of livestock and their herdsman have coexisted with wildlife for many years in different countries with fewer conflicts however; the potential for conflict over land use has increased in recent decades, following the intervention of modern governments in pastoralist lifestyles (Sandford, 1983). Anderson and Grove (1987), have indicated that some biologists and conservationists have concluded that pastoralists now compete severely with wildlife for food, water and living space as compared to previous years.

1.2 Problem statement

Livestock farming is one of the most important land uses in rural areas of Limpopo Province. However, there is a problem of competition for available grazing land due to drought and human population growth amongst others. Poor rural households are continuously involved in a struggle to make ends meet; ensure food security and covering family livelihood expenses. Despite the contribution of livestock production to the livelihood of most rural communities, several challenges still hinder the development of smallholder livestock systems in rural areas. Some of the challenges include limited market access, drought and livestock theft (Chaminuka *et al*., 2012). Limpopo Province is among the provinces that are prone to droughts, and cattle farmers can suffer losses of stock in times of droughts. Under such conditions, wildlife can complement livestock farming because wildlife can adapt to harsh conditions (ABSA, 2003).

In Ba-Phalaborwa Local Municipality some of the communities located adjacent to the Kruger National Park (KNP) are involved in wildlife farming, operating under Communal Property Association with the assistance of a strategic partner. The game farms in the area are mostly acquired through land reform programme. Despite a few communities in Ba-Phalaborwa practicing wildlife farming, there is limited information on economic benefits, costs and challenges currently faced by these communities, and that could potentially be faced by other rural communities who intend to consider wildlife/livestock as a land use option. Anthony *et al*. (2010), found that some of the communities at the borders of KNP were experiencing wildlife/livestock interaction due to abundance of wildlife in the park. Baloi (2015), showed that scope exists for integrating wildlife and livestock as land use option in the villages adjacent to Kruger National Park (KNP). It is therefore imperative to do a thorough assessment of the trade-offs between different land uses with regard to economic returns and livelihood benefits. Most smallholder farmers in rural areas still believe that some of the practices are meant for commercial farmers and therefore they are not willing to take the risk of diversifying or considering other land use options that can be beneficial hence the reason for this study.

1.3 Research questions

- What are the economic costs and benefits of livestock and wildlife farming as an alternative land use option?
- What are the trade-offs of the alternative land uses in rural areas?
- What are the opportunities and challenges for the integrated wildlife/livestock farming in rural areas of Mopani District?

1.4 Motivation of the study

Integration of wildlife and livestock is practiced by many white commercial farmers in South Africa. There is little or no information that is accessible to smallholder farmers about integrated wildlife/livestock in rural areas. The costs and benefits of the integrated wildlife/livestock are not well known or specified in order for smallholder farmers to consider it as a better land use option in the future. Smallholder livestock farmers are faced with many challenges in rearing their livestock, therefore the study was aimed at identifying the opportunities and challenges associated with integrating wildlife and livestock as an alternative land use option. The study was motivated by the reason that there is need to understand how wildlife farming can contribute economically to the welfare and livelihood of rural people. Wildlife could play an important role in food security and solving the financial problems in rural areas by generating incomes and enhancing sustainable natural resource use (Chaminuka, 2012).

Previous studies such as Chaminuka *et al*. (2012) have shown that wildlife farming has the potential to contribute to the livelihood of rural people. Smallholder livestock farmers needs to realize the potential of using land for wildlife since it could assist in addressing socio-economic problems such as poverty and unemployment that exists in rural areas (Tomlinson et al., 2002). Therefore, the study examined the economic viability of shifting towards integrated wildlife/livestock as a land use option by weighing its benefits against the costs. There exists a gap between smallholder farmers and commercial farmers since a number of commercial farmers are engaging in wildlife farming but the smallholder farmers are not.

1.5 Aim and objectives of the study

1.5.1 Aim

The aim of the study was to examine the costs and benefits associated with integration of wildlife / livestock in rural areas of Mopani District.

1.5.2 Objectives

The specific objectives are to:

1. Analyse the economic costs and benefits of integrated wildlife/livestock farming as an alternative land use option in Mopani District.
2. Determine the trade-offs of alternative land uses in rural areas of Mopani District.
3. Identify the opportunities and challenges for the integrated wildlife/livestock farming in rural areas of Mopani District.

1.6 Organizational Structure of the study

This subsection outlines the sequence of chapters that are discussed in the study. The mini-dissertation is organised into 5 chapters. Chapter 1 provides general introduction and background information of the study, problem statement, motivation, aim and objectives of the study, and lastly the research questions that are addressed by the study. Chapter 2 provides literature review which indicates the review of previous studies that have been conducted by other researchers in line with this study. Chapter 3 provides the methodology of the study which includes the study area, data set and analytical technique, it also includes the limitations of the study. Chapter 4 presents the results of the study and interpretation of the results. The last chapter of the study is chapter 5 which includes the summary, conclusion and policy recommendations.

CHAPTER TWO
LITERATURE REVIEW

2.1 Introduction

This chapter includes literature that was reviewed from different sources relating to the study of integrated wildlife/livestock farming. The chapter also provides an overview of the integrated wildlife/livestock farming in South Africa and other countries. There are studies that are conducted in different countries across the world and they provided information on the effect of wildlife on the livelihood of the people especially those in the rural areas.

2.2 Overview of the wildlife industry in South Africa

According to Child *et al.* (2012), South Africa has up to 14000 game ranches where about 10000 practice pure wildlife ranching and the remaining 4000 are involved in mixed wildlife/livestock ranching. Game ranching is mostly practiced on the privately owned land and is dominated by white people. Most of the smallholder farmers are targeting the land reform programmes for them to get access to enough land. Wildlife farming is governed by strict South African legislation as compared to livestock farming therefore, it becomes easier for smallholder farmers to engage in livestock farming.

According to EWT (2016) majority of wildlife ranches in South Africa have been converted from livestock farms after it became more economically viable to use wildlife for commercial purposes. National Parks are often found to be the most important areas where wildlife is kept for safety and for better access. These parks provide the opportunities for development in some communities around them. Van der Waal and Dekker (2000) estimated that game ranching in the Limpopo Province produced annual turnover of R221 million with local hunting as the largest contributor with R82 million; venison alone had an annual turnover of R7 million and foreign hunting contributed R48 million.

The culture of South African wildlife industry is based on sustainable use since it considers the environmental issues (Dry, 2013). The study further indicated that 16.8% of agricultural land is used for private ranching. According to Dry (2015) the industry has grown since 1960 when it had only three private game farms. Currently about 28 000 000

hectares of land is converted into sustainable land use option (Dry, 2015). South African wildlife activities include live game sales, trophy hunting, game meat production and eco-tourism. The industry benefits South African through economic contribution, transformation of marginal land, conservation of game species and other natural habitat (WRSA, 2016). Job creation and rural development are also realized by the South African communities when wildlife industry performs well economically. EWT (2016) identified sales of live animals, hunting and meat production as some of the economic importance of wildlife farming in South Africa and it generate more than 2.5 million for game ranchers.

2.3 Review of previous studies

2.3.1 Background of integrated wildlife/livestock farming in South Africa

According to Chaminuka *et al.* (2012) rain-fed agriculture under marginal conditions cannot sustain the development of rural areas and also improve completely the livelihood of the rural communities. The study further indicated that wildlife tourism can be used as an alternative land use in order to complement the current agriculture for rural people. In South Africa, the most common way of improving rural livelihoods is through crop-livestock combination which offers farmers more diverse source of food and income. The use of land for wildlife is not common in South African. Wildlife has been practiced on what has been used as the cattle rangelands in Southern Africa. In recent years, claimants of the land restitution on protected areas adjacent to the KNP have an opportunity to practice wildlife based land uses (Chaminuka, 2013). The possible wildlife based land uses include tourism, trophy hunting and game meat. The claimants of the land in Kruger National Park are now being compensated in the form of money due to the fact that the government needs to keep the Park operating in such a way that it will attract more tourists and enhance the economy of South Africa (The Presidency, 2016). Other community members of Makhushane, Mashishimale, Maseke and Seloane in Ba-Phalaborwa Municipality have lodged the claims regarding land that was previously theirs.

Land availability is one of the constraints that the smallholder farmers in rural areas are facing since the area is in the hands of traditional leaders. Farmers only own a small portion of land, where they practice agriculture and they use the communal land to graze

their livestock and sometimes this leads to conflicts among livestock owners. It is challenging for some of the farmers to consider engaging in wildlife land uses due to several reasons. These include lack of knowledge regarding wildlife, lack of capital, diseases, depredation, wildlife damages and insufficient land. According to Lindsey *et al.* (2013) livestock has been the most widespread land use that generates the most income on the households. However, livestock number has been declining due to degradation caused by overgrazing and wildlife-based land use in some areas. The economic contribution of wildlife and tourism on freehold land may already exceed that of livestock despite policies and subsidies favouring the latter (Lindsey *et al.,* 2013).

2.3.2. Costs and benefits associated with integrated wildlife/livestock

The potential costs and benefits of protected areas to community livelihoods is well documented (Coad *et al.,* 2008) and there are a number of case studies that assess these costs and benefits at an individual level. The benefits of protected areas can range from the ecosystem services protected within the forest area, to direct and indirect benefits from protected area management. In the case of the former, such benefits include watershed and soil erosion protection, and provision of forest resources. Some of the benefits identified by Chaminuka *et al.* (2012) include the employment opportunities, small business development and the discounted entrance fee into the national park. Macmillan and Phillip (2008) also indicated that there are opportunities and benefits associated with wildlife and these include its contribution to the rural economy through job creation, income and profits generation from different enterprises that rural people engage in.

Palmer *et al.* (2006) found that the total gross income for game ranches was R1650 per hectare and that of livestock was R100 per hectare in South Africa. These findings indicate that livestock on its own provides low returns which can be a disadvantage when it comes to combating food insecurity and poverty in rural areas of South Africa. Wildlife farming has consumptive and non-consumptive uses that benefit the users. Some of the uses are identified by van der Waal and Derrek (2000) as live sales, trophy hunting and venison. The study also found that 43.3% of commercial farmers in Limpopo Province practiced mixed farming by combining cattle production and game farming. Previously smallholder

farmers were not involved in game farming as the owners but only as labourers in the privately owned land.

According to Lindsey *et al.* (2013), wildlife-based land uses are popular among younger farmers and the projections of earnings from wildlife are projected to be 60% that is less affected by climate change than those from livestock. There are also social benefits that include the employment creation for communities. The study also found that in Namibia, employment was found to be negatively related to the income from the livestock and positively related to the income from ecotourism. This means that income received from the ecotourism is able to pay labourers as compared to the income received from livestock farming.

The benefits associated with wildlife include earning of income through sales of live animals, sale of horns, sales of animal skin and meat sales. According to Erb (2004) the industry of live game ranching in South Africa and Namibia has shown good growth. The study further indicated that in year 1991 South Africa was able to sell 8929 animals in the auctions whereas in the year 2000 the country was able to sell 17702 live animals at the auctions for R62.9 million. Cloete and Rossouw (2014) concluded that wildlife ranching sector in South Africa has the potential to make a more meaningful contribution toward economic growth, employment creation and poverty alleviation as compared to other sectors.

Game farming requires sound financial management since most of the people are currently considering it as a business for a land use rather than a hobby. Economic consideration is very important for decision makers in the public sector regarding this industry. Financial profitability, economic yield and environmental sustainability are dominant factors for decision makers and individuals dealing with wildlife (Chardonnent *et al.,* 2002). Wildlife can play different roles in human kind and this includes the economic role, nutritional value, ecological role and its socio-cultural significance.

A study by Barnes (2001) on the returns and allocation of resources in the wildlife sector found that wildlife in Botswana could contribute positively to national income. The author used different models including the cost-benefit analysis approach to achieve these

findings. Wildlife's contribution to the national income may differ from one country to another, considering different resource availability. However, the study further indicated that non-consumptive tourism on high quality wildlife land use provide good returns. The analysis in this study took into account the activities that communities were engaging into. Such activities included game viewing, cattle ranching hunting and others. The activities that take place in wildlife and livestock farming are similar in most developing countries.

According to Barnes and De Jager (1996), consumptive uses of wildlife benefit the beneficiaries and also contribute to the national income. In Namibia cost-benefit analysis models were developed and used to analyse economic and financial efficiency of land use involving wildlife on private land. Findings were that the financial profitability of both wildlife production for consumptive use and livestock production for non-consumptive were generally low, however these activities appeared to be economically efficient as the contributed to the national income.

Economic characteristics of wildlife use activities are varied in such a way that they depend on the availability of land (Barnes, 1998). Again, Ashley and LaFranchi (1997) found that for livelihoods in rural communities, commercial wildlife use activities contribute much needed cash and as such are often complementary to other household coping strategies such as livestock keeping and crop production. Barnes (1998) showed that commercial wildlife utilisation has high economic efficiency in specific areas within southern Africa, particularly those that are close to or in areas where wildlife conservation is practiced.

According to Lindsey *et al.* (2013), wildlife-based land use in Namibia occurs over 287,000 km^2. The study further indicated that employment is positively related to income from ecotourism and negatively related to income from livestock. Employment is one of the benefits that are received by communities living close to the protected area especially the rural areas. Also, Erb (2004) reported tha wildlife industry grew highly in Namibia from the year 1993 to 2003 which represented a real growth of 20.7% per annum. This industry in Namibia is dependent mostly on trophy hunting as in South Africa. Wildlife is often found to be the engine of economic and social benefits (Machlis and Field, 2000). In the past,

national parks have been considered to be the integral part of the economy in Carlsbad area of Carlifornia (Machlis and Field, 2000).

2.3.3. Challenges and opportunities of integrating wildlife with livestock

According to Brahmbhatt *et al.* (2012), disease is one of the biggest challenges faced by people who live at the boundaries of the protected areas. Wildlife was indicated to be the major source of disease transmission to the livestock and also to the community members. In South Africa there are diseases that are often challenging to the livestock farmers especially those who live near the protected such as KNP. For example, in 2015 The Department of Agriculture and Rural Development officials from different areas were deployed at Vhembe district due to the outbreak of foot and mouth. Kukielka et al. (2016) showed that the potential transmission of diseases at the wildlife–livestock interface can have a huge economic impact due to losses in animal production, and the need of implementing expensive preventive programs.

According to Palmer *et al*. (2006), cattle farmers residing in the marginal semi-arid and arid regions of South Africa have encountered many challenges such as loss of stock due to theft, high costs of disease control, high labour costs and lastly the deregulation of agricultural markets. Due to these challenges farmers are becoming very discouraged to pursue livestock production. Sikhweni and Hassan (2013) pointed out that livestock predation and lack of marketing channels reduce the potential of livestock in enhancing the household income.

Wildlife can generate lot of jobs for rural areas since it is mostly practiced on a bigger land and it has more activities that need more people to perform different duties. Van der Waal and Derrek (2000), found that game ranches in Limpopo province was able to employ 13 700 permanent workers and they further indicated that the game ranches provide not only direct job opportunities but also involve job opportunities in the fields of ecological and veterinary services, game capturing and transportation, meat processing, fencing, building and construction industries among others.

Livestock-herding people and wildlife have co-existed in African rangelands for many hundreds of years, though with few of the tensions existing today. In most cases the

livestock-wildlife conflicts are primarily focused on access to grazing and water resources. In some cases of Amboseli National Park and the Maasai Mara Reserve in Kenya, these are the most known and considered conflicts, but predation and disease from wildlife are also significant issues for livestock-owners (Bourn and Blench, 1999). The management of livestock, wildlife and environment at the interface presents a challenging scenario in the integration of development and environmental conservation in Sub-Sahara Africa.

In Kenya Integrated Wildlife-Livestock Management (IWLM) was introduced to manage issues surrounding conservation and interaction of people, livestock and wildlife in the country. Boyd *et al.* (1999) indicated that in the past, human and livestock populations were relatively small and widely dispersed and domestic animals were managed to minimise the risks of predation and disease transmission. However, competition for scarce grazing area and water resources is increasing and the potential for conflicts between wildlife managers and livestock owners is growing as pastoralists and agro-pastoralists move into new areas and/or live in the vicinity of protected areas. The study further indicated that the main factors driving this transformation are increasing demographic pressure, the expansion of cultivation and the reduction in rangeland resources, through privatisation for commercial agriculture and ranching.

According to Stroebel *et al.* (2011), cattle production on its own also provides tangible and non-tangible benefits for livestock keepers. Some of the benefits include the use of livestock as a transport, ploughing, manure, milk and meat among others. On the other hand, wildlife also contributes to the livelihood of communities involved in it by generating income through different activities such as trophy hunting, tourism and also job opportunities. It has potential to exceed the economic benefits realized from the livestock production.

Human-wildlife conflict is explained as the product of complex interactions between ecological, socio-economic and political systems (Anthony *et al.,* 2010; Thorn *et al.*, 2015). Bath and Enock (2003) indicated that people and wildlife's close proximity in the natural parks leads to interactions that can pose threat and cause direct injury to wildlife. This interaction can also lead to injury to people and damage to the community property if the management is not containing it. At wildlife and livestock interface disease transmission

has the ability to impact human health and cause economic loss in the country (Shwiff *et al.,* 2016). The study further indicated that in addressing the issue, benefit-cost analysis decision framework was developed to help users make informed choices about wildlife and livestock populations.

The interaction between wildlife and human beings causes more conflicts in most of the communities staying in the borders of National Parks. Wildlife conflicts increases with the existence of agricultural encroachment and the competition for space (Chardonnet *et al.,* 2002). In this manner it makes the control of problematic animals to become a major issue. NDA, (2002) mentioned that it is critical to follow control measures so as to reduce the chance of disease transmission from wildlife to livestock and human. Failure to do so, can lead to a negative impact on the country's economy. It is further indicated by (Thorn *et al*., 2015) that carnivores in Africa exist outside the protected areas where they pose a threat on people's lives and livestock.

2.3.4. Trade-offs associated with integrating wildlife with livestock.

Klapwijk *et al.* (2014) defined trade-offs as the exchanges that occur as compromises, that are ever-present when land is managed with multiple goals in mind. On the other hand trade-off analysis is defined as a process that enables policy makers to quantify the trade-off between agricultural development and a wide range of possible sustainability indicators (including productivity, environment, and human health) (Stoorvogel, *et al.,* 2001). Livestock farming is currently assisting smallholder farmers and households with income to cover the costs of living however it is not sufficient to improve completely their living standards. This can be due to the fact that most of the famers keep small number of livestock and they also lack the market for their livestock.

Crops, livestock production and natural resource subsystems are also interrelated through competition for land and labour resources. Wildlife competes with livestock for available grazing area while on the other hand water is used for tourism rather than crop production. It is also important to consider that access to forest areas for gathering wild products is reduced due to declaration of exclusive wildlife or tourism areas therefore the trade-offs are highly experienced in this case. According to Ashley and Roe (1998) trade-offs with

agriculture are particularly severe not only due to competition for land, but also due to wildlife damages to agriculture. Smallholder farmers survive by engaging into different agricultural activities to sustain their livelihood but uncontrolled wild animals damage the crops and reduce the income of the household. The existence of wildlife and livestock has different conditions that are associated with competition and this includes the shared resources and the negative influence of one user on the available resources (Niamir-Fuller *et al.,* 2012).

According to World Bank (2005) there can be conflicts that are associated with wildlife such as wildlife causing damage to crop and transmitting diseases to the livestock when there is an intensive livestock to the park boundaries and agricultural cultivation. However, it is also argued that the potentially conflicting interest arising from this problem can be bridged by integrating wildlife with the extensive livestock management. Different parties such as the local government, communities and private ownership needs to understand the trade-offs involved in different land use scenarios that will affect the people and the wildlife conservation (World Bank, 2005).

The decision matrix allows individuals to choose from different options available. According to Zevenbergen (2016) decision matrix is one of the methods that can be used when farmers or households have different options especially with land uses that they should choose from. The study used the six criteria for decision that enabled the author to make the final decision in what to use in the trade-off analysis. In this study however, only two criteria were used which is the costs criteria and the benefits criteria since the study was based on only the quantitative data.

According to Stoorvogel et al. (2004) trade-off analysis shows that for a given set of resources and technologies used to attain a certain favourable outcome will lead to a less another desirable outcome. Stoorvogel et al. (2004) further indicated that, economic performance in terms of annual net returns, present discounted value of returns and etc. are used as some of the indicators in analysing trade-offs in different land use options.

2.4. Chapter Summary

The main purpose of the chapter was to provide an overview on previous studies regarding integrated wildlife/livestock farming. Different studies have been conducted in South Africa and internationally regarding wildlife conservation and its attributes in rural communities. Most of the researchers indicated the cost and benefits associated with wildlife and livestock separately. It is indicated that each researcher has the different findings regarding the costs incurred due to existence of wildlife and also the benefits that are received. Other studies have indicated the identified challenges and opportunities that are experienced by farmers and other local communities within the vicinity of protected areas in different areas of South Africa and around the world. Literature reviewed indicated that most of the identified challenges in different study areas are common. This chapter also highlighted the findings on trade-offs and economic analysis of integrated wildlife/livestock from other researchers.

Several previous studies (Chaminuka et al. 2014a and b; Barnes, 1998) considered integration of wildlife and livestock as an important factor to the livelihood of rural households since it generate more income and employment. However, lack of information and skills still hinder the benefits that rural households can get from integrated wildlife/livestock. Therefore, it is important to study the economic benefits and cost that are associated with integrated wildlife/livestock as an alternative land use option.

Commercial wildlife farming has received attention in previous years as compared to small scale and this is due to poor wildlife farming by most communities (Van der Waal and Derrek, 2000). In South Africa more than two- thirds of wildlife is in private hands (Otieno, 2014), with commercial farmers dominating this sector since they have more resources than the smallholder farmers.

CHAPTER THREE
RESEARCH METHODOLOGY

3.1. Introduction

This chapter provides an overview of the methods and techniques that are used in the study. It includes the study area where the research was conducted and the methods that are used to identify the respondents. The chapter also indicates the tools that are used to analyse the data gathered and the techniques that assisted in addressing the objectives of the study.

3.2. Study site

The study was conducted in the rural communities of Ba-Phalaborwa local municipality in Mopani District of Limpopo Province. Limpopo Province is located in the northern part of South Africa and is divided into five municipal districts. Mopani District is one of the five municipal districts found in Limpopo Province and it is divided into five local municipalities namely; Ba-Phalaborwa local Municipality, Greater Giyani local Municipality, Greater Tzaneen local Municipality, Greater Letaba local Municipality and Maruleng local Municipality. Ba-Phalaborwa local Municipality is situated in the north-eastern part of Mopani district, less than a kilometer from the eastern border of Kruger National Park. About 95% of the population resides within a 15 km radius of Phalaborwa town. The municipality is 220 km from Polokwane town and Nelspruit (Statistics South Africa, 2011).

Ba-Phalaborwa local Municipality comprises of many rural areas and majority of the people practice agriculture as their main source of livelihood. This local municipality has a geographical area of 3004.88 km^2 that constitute 27% of the Mopani District (Ba-Phalaborwa municipality, 2011). It is also within the Oliphant river primary Catchment. The total population in this municipality is 150 637 (Statistics South Africa, 2011) whereby 93.6% of this population are black and 6.4% are white racial group. There are five traditional authorities in Ba-Phalaborwa municipality namely Makhushane, Majeje, Mashishimale, Maseke and Seloane. There are 23 villages and 4 towns (namely, Gravelotte, Namakgale, Lulekani and Phalaborwa) in the Ba-Phalaborwa Municipality. The

local municipality serves as a convenient gateway to the Kruger National Park and the Great Limpopo Trans-frontier Park (GLTP) through to the Mozambique Coast. There are 2275 households that are involved in livestock production in Ba-Phalaborwa local Municipality. Most of the land in this local municipality is under traditional authorities and 70% of it is under claims by the community members (Ba-Phalaborwa municipality, 2011). Ba-Phalaborwa has different game farms and ranches that can attract people from other areas. These include KNP, Letaba Ranch, Mashishimale Marakapula (Croch Ranch) and Bonlati game ranch (Ba-Phalaborwa municipality, 2015).

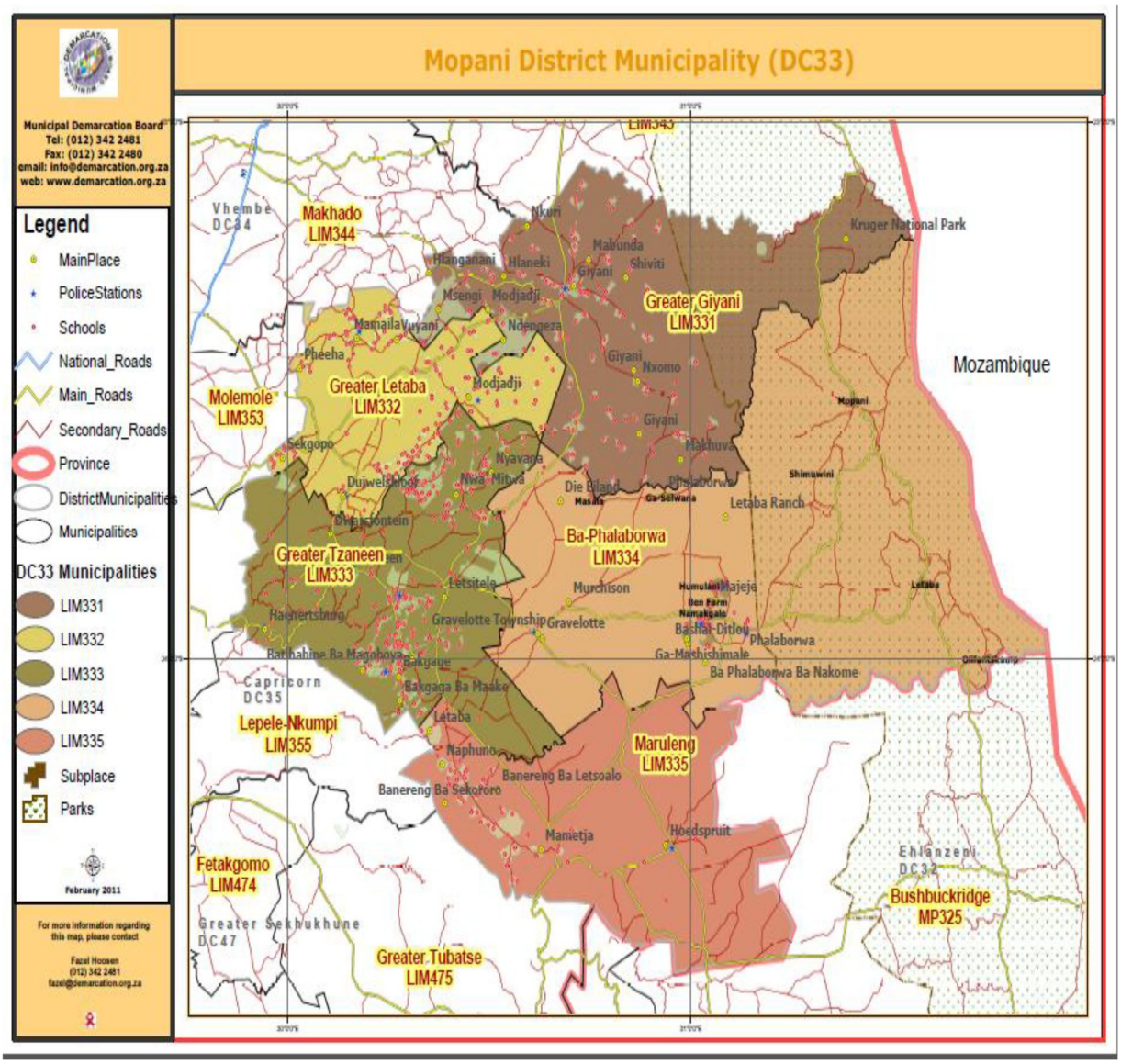

Figure 3.1: Mopani District map

Source: Mopani District Municipality, 2013

3.3. Sampling and data collection

The study has used multistage random sampling technique whereby households staying next to KNP were randomly selected to make up the sample size. The unit of analysis in this study is the household in the rural areas of Ba-Phalaborwa local Municipality. The sample of 71 rural households was selected from different rural areas adjacent to Kruger National Park (KNP) in Ba-Phalaborwa municipality of Mopani District using multistage random sampling technique. The first stage was to consult the Department of Agriculture and Rural Development where information about the extension officers responsible in different traditional authorities was provided. The second stage included random sampling of three traditional authorities that are next to KNP. The provided extension officers were contacted for assistance on the availability of livestock keeping households. Three extension officers were able to assist in each traditional authority as they work with the households on a daily basis. The final stage includes the random selection of households keeping livestock in the three traditional authorities. Random sampling is suitable since it gives equal opportunity for all parts of the population (communities next to KNP) to be selected.

3.3.1 Sampling frame

Ba-Phalaborwa Municipality was chosen as the study area since it serves as the main gate into the KNP and it also has few game farms that are owned by the rural community. Ba-Phalaborwa Local Municipality is made of five traditional authorities. Three traditional authorities in this municipality were randomly selected for the purpose of this study. The selected traditional authorities are Seloane, Makhushane and Mashishimale. From each traditional authority, households were selected randomly such that in Seloane the sample size was 30, in Mashishimale the sample was 21 and lastly in Makhushane the sample size was only 20. These traditional authorities were chosen due to their proximity to Kruger National park since they get the first-hand experience of interaction with wildlife. Seloane traditional authority belong to ward 18 with population size of 12326, Mashishimale traditional authority belong to ward 8 with population size 7874 and lastly is Makhushane which belong to ward 2 with population size of 6608 (StatsSA, 2011). The total population

size for the three wards was 26808. The sample size was calculated using the proposed sample size of 71 (i.e. 3% of the targeted three traditional authorities) where Seloane contributed 45%, Mashishimale contributed 29% and lastly Makhushane contributed 25% to the total sample size. This sample was influenced by the information on availability of livestock and wildlife in the selected areas. Information on the availability of households that keep livestock and where to find them was provided by the Department of Agriculture and Rural Development in Ba-Phalaborwa municipality. The extension officers assisted during data collection in a sense that they informed respondents about the study to be conducted in their village. One game farm owned by the CPA was randomly selected from Mashishimale traditional authority for the purpose of this study since it represents different households and it was received from the government through land restitution. Structured questionnaires were used to gather information from the respondents and it was prepared in English and converted to the vernacular which is Sepedi and Tsonga in order for farmers to understand the questions asked.

Mashishimale game farm that is found in Mashishimale traditional authority is one of the farms that were allocated to community through land restitution programme. Households use small areas of 1 to 3ha to keep cattle and small stock but they also use the communal open land to graze their livestock. The farm is a restitution farm and it has a strategic partner with more than 1000 beneficiaries. The key informants of the farm (the strategic partner and the chairperson of the farm) were interviewed with regard to the wildlife they keep and the background of the farm. A different questionnaire with mostly open ended questions was used to interview one of the representatives (chairperson) of the CPA to provide the necessary economic information of running a wildlife farm since the rest of the community involved did not have all the financial background of the farm. Further discussion was conducted with both the CPA representatives and the strategic partner who had a lot of information on the operation of their game farm. Households that are the beneficiaries in the CPA did not have more information on the economic issues of the farm, therefore, it was beneficial to conduct an interview with their representatives. The data used in the cost benefit analysis and decision matrix were extracted from the information provided by households in the selected areas and the representatives of the game farm.

3.4. Analytical techniques

3.4.1. Cost Benefit Analysis

Cost Benefit Analysis (CBA) is a powerful tool that aids decision making, taking into account the fact that it increases the probability of making a good decision (Dompere, 2004). Cost Benefit Ratio was used to find out if the households will benefit from the integrated wildlife/livestock land use option. This approach is used to address the first objective of analysing the costs and benefits of integrated wildlife/livestock as the land use option.

$$CBA = \frac{\sum B_n/(1+r)^n}{\sum C_n/(1+r)^n}$$

Where, CBA is the cost benefit analysis that is to be calculated,

$\sum B_n$ = Total benefits, (these are the total benefits in monetary terms that the farmers have gained when engaging in integrated wildlife/livestock farming and also in livestock only)

$\sum C_n$ = Total costs, (these are the total costs that the farmers have incurred when engaging into integrated wildlife/livestock farming and also in livestock only)

r = Interest rate

n = Number of years (Number of years that costs and benefits are to be calculated.

This study considered only two years which is 2013 and 2014 since it is difficult to get past information from smallholder farmers who do not keep good records of every activity they do. In both years the required information was from January to December. In some cases where the farmers could not recall the amount they would call their children to supply information and receipts if they have. Examples of the costs found in the literature include among others the fencing costs, vaccination costs and livestock depredation costs. For the purpose of this study data on the costs incurred was provided directly by the respondents and other costs were calculated using the information provided. For example, wildlife depredation and stock theft costs were calculated using the number of animals lost

multiplied by the price that they were supposed to be sold with. Other costs such as poaching were provided by the CPA representatives who mentioned that they considered the number of animals killed by poachers equivalent to their expected prices. Net Present Value was also considered after determining all the costs incurred and benefits received by the farmers in the two years. NPV assisted in the worth of the project and its sustainability in the future so as to make the informed and positive decisions. NPV was calculated from the results of cost benefit analysis for the project of integrated wildlife/livestock and livestock on its own.

Cost benefit analysis is a systematic approach assembling together the set of alternatives. It also helps in indicating a comprehensive accountability of implied cost and benefits of the alternative (Dompere, 2004). The CBA quantifies the costs and benefits of environmental services and enables quantification of trade-offs among ecosystem services. According to Jogo, (2010) CBA can be classified into three broad categories: those that use directly observed market prices for valuation; those that use surrogate market prices for valuation; and those that use survey techniques for valuation. This study focused on the last category of using survey techniques for valuation.

Table 3.1: Description of costs

Types of costs	**Description of the Costs**	**Unit of Measurement**
Vaccines	These are the medications that th farmers used to prevent the diseases that attack their livestock	Rand (Total amount used on vaccines)
Feeds	These are the feeds bought by th farmers for their livestock	Rand (Total amount used on feeds per month)
Loss due to depredation	These are the costs incurred due depredation of livestock	Rand (Number of cattle lost due to depredation multiplied by its expected price)
Loss due to diseases	These are the costs incurred due diseases attack and death of livestock	Rand (Number of livestock lost due diseases multiplied by its expected price)

Loss due to theft	These are the costs incurred due to loss of livestock through theft	Rand (Number of stolen livestock multiplied by its expected price)
Labour Costs	These include the total amount paid to the labourers for services of herding livestock and those incurred in game farm	Rand (Number.of labourers multiplied by monthly salaries)
Poaching	The costs due to loss of animals from poachers	Rand (Number of animals found dead due poaching multiply by their expected price (Rands)
Game counting	These are the costs incurred in every three years when counting the available wild animal in the game farm	Rand(The amount paid to experienced counters and airplane used)
Maintenance	These costs include the costs incurred in game farming when maintaining all the resources including fencing	Rand (Amount used in a month to maintain the farm)

3.4.2. Trade-off analysis (optimization approach).

Trade-off analysis is a process that enables policy makers to quantify the trade-off between agricultural development and a wide range of possible sustainability indicators (including productivity, environment, and human health) (Stoorvogel *et al.,* 2001). Collected data on costs and benefits for integrated wildlife/livestock and livestock production was used to analyse the trade-offs between alternative land uses option in the area. The returns received from the livestock only were, therefore, compared to those of integrated wildlife/livestock farming. This was done in order to determine trade-offs that took place in shifting towards another land use option. In performing trade-off analysis, attributes, uncertainties, options and scenarios were considered. Some of the attribute related to the study are the reduced costs of choosing the other land use option, improved services, reduced use of land.

$$\prod = \sum WB_n - \sum LB_n$$

Where $\prod$ = the profit (the return),

$\sum WB_n$ = the total benefits for integration

$\sum LB_n$ = the total benefits for livestock

These returns were calculated for both livestock and integrated wildlife/livestock in order to find the gap between the two returns. The calculations used data received from the respondents for the year 2013 (January-December) and 2014 (January to December). Some of the trade-offs that have been identified by previous studies include giving up the land for grazing to the wildlife farming. Values gained or lost under different resource-use options need to be considered if optimal decisions are to be made that yield economic efficiency (an overall net gain to society). Such decisions could be related to the trade-off between development and preservation of an area, or between two competing wildlife uses such as tourism and hunting. An individual farmer may face trade-offs between maximizing production in the short term and ensuring sustainable production in the long term. Within landscapes, trade-offs may arise between different individuals for competing uses of land (Klapwijk *et al.,* 2014). In this study the trade-offs were determined between the use of land for livestock only and for integrated wildlife/livestock. Weighted decision matrix was used to weigh the trade-offs between the existence of integrated wildlife/livestock and livestock farming on its own. The matrix was used considering all the costs and benefits incurred by livestock farmers and also by wildlife ranchers. The wildlife ranch represented wildlife farmers because it is a communal farm that is made of community members who are beneficiaries of land restitution programme.

3.4.3. Descriptive statistics

Descriptive statistics was used to address the third objective of identifying the opportunities and challenges for the integrated wildlife/livestock farming in rural areas of Limpopo Province. This included the use of tables and graphs that demonstrate the percentages and mean values of the stated challenges and opportunities gathered from

the data collected considering farmers' perception. In identifying the challenges and opportunities, respondents stated their perception and their degree in which they were affected by stated challenges and opportunities since they were not affected the same way. Some of the questions in the questionnaire were structured on a five-point Likert type of rating scale of (5) extremely strong effect, (4) strong effect, (3) not effective, (2) weak effect and extremely weak effect (1).Scores on a Likert scale indicated the stated challenges and opportunities that were particularly relevant to them in order to enhance the assessment of this study. The extremely strong option was regarded as the positivity of the response of the farmer on a certain challenge.

3.5 Chapter summary

This chapter has provided an overview of the study area, data set and also the method used to analyse the data. The study used cost-benefit analysis, trade-off analysis to address the objectives of the study. The study intended to identify challenges and opportunities associated with integrated wildlife/livestock in Mopani District and also to determine the trade-offs associated with integration of wildlife/livestock.

3.6 Limitations of the study

Some of the household head interviewed in the study area were not able to remember costs incurred in the specified years, however they were assisted by their children who were involved in the day to day activities. There were no known individual smallholder farmers who engage in integrated wildlife/livestock on a private land. In this manner the study included those who engage in integrated wildlife/livestock on a communal land. Therefore, the study cannot conclude on individual perspective of the integrated wildlife/livestock since some of the costs were incurred jointly. Another limitation of the study is that it assumes that the same land can be used for livestock and wildlife, this is not always straightforward, and one would need to consider carrying capacity to do a more comprehensive analysis.

CHAPTER FOUR
RESULTS AND DISCUSSION

4.1 Introduction

The chapter presents and discusses results of the study emanating from analysis of the data collected. It includes the empirical results and the descriptive statistics. It shows how the set objectives were analysed for better understanding of the expected outcomes as weighed against the results. The Statistical Package for Social Sciences (SPSS) was used to give an analysis feedback of the perspective of the respondents regarding the integration of livestock and wildlife in their community. Excel was also used for calculations of all the costs and benefits that were incurred by the respondents due to the existence of livestock and wildlife. Most of the farmers did not incur some of the costs that were identified due to lack of enough income to buy resources such as vaccines for their livestock. Decision matrix together with the optimization approach was used in identifying the trade-offs of shifting towards integrated wildlife/livestock in rural communities by the smallholder farmers.

4.2 Socioeconomic characteristics of household head

Descriptive analysis was applied in order to understand the perception of smallholder farmers with regard to challenges and opportunities that are associated with wildlife/livestock integration. The socioeconomic characteristics of the farmers were also analysed in order to indicate the type of individuals who are more involved in livestock farming and also in integrated wildlife/livestock. Graphs, tables and charts are used to indicate the descriptive results. The results are shown in the form of frequencies indicating level of effect in which the farmers rated the challenges and opportunities.

Table 4.1: Age, gender, household size, schooling years, farming years, cattle owned by the respondents (n=71)

Variable	Mean	Std dev	Max	Min
Age in years	58.23	16.482	92	23
Household size	6.68	3.341	18	2
Schooling years	8.01	4.779	16	0
Farming years	12.44	9.039	56	1
No of cattle owned	12.90	9.390	45	2

Source: Survey data

Age of the respondents

Table 4.1 shows that the mean for age of the respondent is 58.23.This shows the average age of the household head who keep livestock. The minimum age of respondents who keep livestock is 23 years while the maximum age is 92 years. These findings on the age of household head are similar to the findings of Van der Waal and Dekker, (2000) who reported on game ranching in the Northern Province of South Africa. The mean age in their study was found to be 49 with the age range from 20 to 88 years. The age of the respondents can contribute to the benefits and costs associated with integration of wildlife and livestock since both generation have different views and agricultural operation methods.

Household size

The mean value for household size was calculated to be 6.68, which is the average number of members who live with the respondent in the same house. The smallest of the household size is 2 and the highest number of dependents is 18. These household size outcomes indicate the number of members who depends on the household head income.

Number of years in schooling

It is indicated further in table 4.1 that the mean value of the number of years that the household head attended school is 8.01. The highest number of years that the

respondents attended school is 16 and the lowest is 0 which implies that some of the household heads interviewed managed to reach tertiary level and there are those who did not attend school at all.

Farming years

The table further, shows the mean value for number of years the respondents has been into farming to be 12.44. This is the average number of years that the respondents have been in livestock farming. The minimum number of years that the household head have been involved in livestock farming is 1 year and maximum is 56 years. Older people have been in farming for many years as compared to youth whom have mostly inherited the livestock form their grandparents. Farming experience is important in addressing some of the challenges and taking advantages of some of the opportunities that are available.

Number of cattle owned by respondents

The number of cattle owned by the respondents was averaged at 12.90, the minimum number of cattle owned is 1 and the largest number of cattle owned by the respondents is 45. This indicates a huge gap in livestock owned by smallholder farmers. Some of the farmers are still new in the agricultural industry and in turn have fewer cattle than other farmers.

4.3 Cost-benefit analysis results

The ability of benefit cost analysis to illustrate the benefits of livestock production per rand spent allows for the determination of economic efficiency for alternative land use options (Shwiff et al., 2016). Wildlife in Ba-phalaborwa is only kept in fenced areas where they can be controllable. This makes the risks of human and wildlife interaction minimal. However, the interaction still exits since wild animals such as elephant destroy the fence on the side and go in neighbouring communities. Some of the beneficiaries of land restitution work in the farm as the labourers in order to ensure that they are hands on in different activities. From the interviewed farmers only those who are from Mashishimale were part of the game farm received from the land restitution programme. There are activities that take place in the big game farm such as trophy hunting, meat production and tourism.

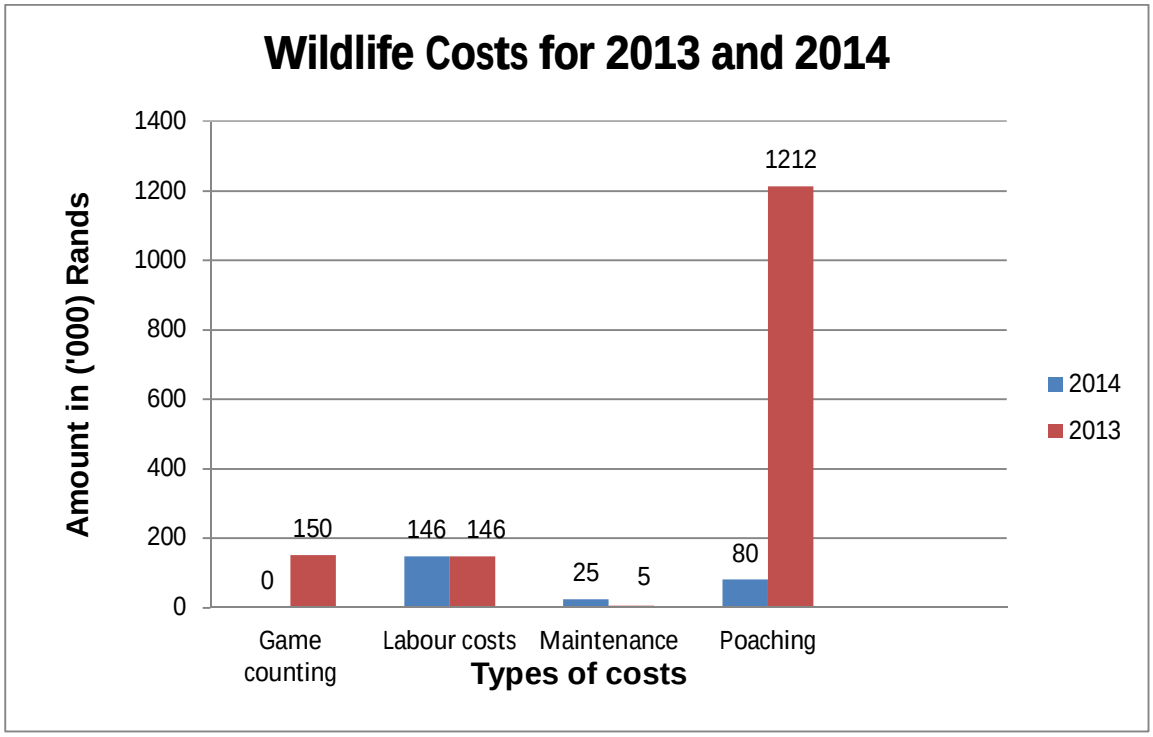

Figure 4.1: Wildlife costs for 2013 and 2014 (Jan-Dec)

Source: Survey data

Figure 4.1 indicates the types of costs that are incurred due to the existence of wildlife. The total costs were received from the CPA for wildlife farming in the year 2013 and 2014, January to December. It is indicated that in 2013 game counting costs were high at R150 000 and in 2014 there was no game counting costs incurred. This is due to the response of households who indicated that game counting is done once in three years, therefore the amount can only affect the year in which game counting occurred and in other years farmers will be able to save for the next counting. Poaching was costing farmers a lot because of the animals they lost in a year. The costs value mentioned by the respondents was explained to come from the number of animals found dead due to poaching. In 2014 poaching costs were lower as compared to 2013 since the game farm owners managed to come with a strategy of anti-poaching and hire people from outside who were trained to deal with it. High poaching and game counting costs incurred in 2013 has created a huge gap of costs between the two years since this costs were high in 2013 but not in 2014.

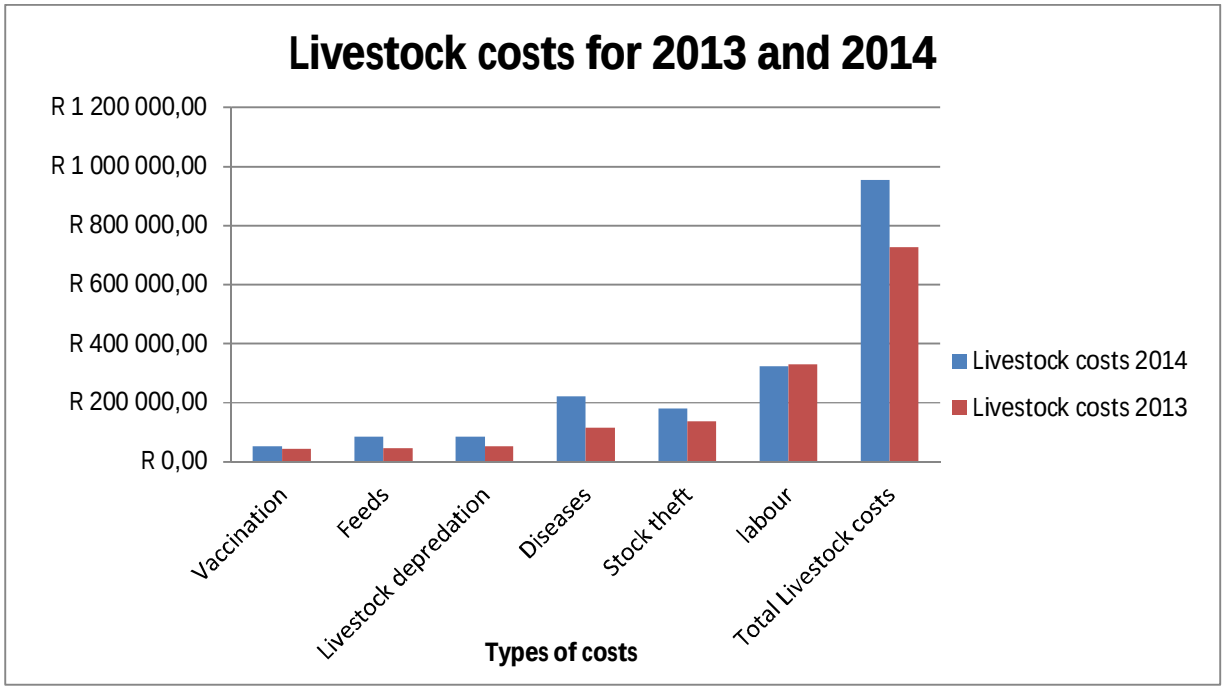

Figure 4.2: Livestock costs incurred by households in 2013 and 2014

Source: Survey data

Figure 4.2 shows the different costs that the households incur in raising their livestock in the rural areas near Kruger National Park. It is indicated that the highest overall costs that the interviewed households incur in a year is that of labour with more than R250 000 per year as combined for all households keeping livestock. The amount is the sum of labour cost incurred by all the respondents in the year 2013 and 2014. This can be due to the fact that some of the livestock owners are old to a point where they can no longer take care of their livestock. As a result they were using local herdsmen to take care of livestock and pay them. The figure further depicts that farmers spent less on the vaccination. Hundred percent of the respondents interviewed indicated that they got a lot of support from the government through agricultural extension services which benefited them through advisory support, inspection, vaccination and dipping programs. The total costs incurred by the livestock farmers in Ba-Phalaborwa municipality amounted to almost R900 000 for all the combined types of cost. Farmers incurred high costs in 2014 as compared to 2013 and diseases were one of the problematic challenges that contributed to the increased costs. Livestock were dying due to diseases; depredation and they are also stolen. In 2014 the costs incurred due to loss of livestock disease were reduced. This can be due to the fact

that farmers were well informed about the possible transmission of diseases from some of the wild animals that exists in the area, therefore, they used the relevant vaccination procedures. The number of cattle lost due to predation increased which led to high costs for the farmers in 2014.

Table 4.2: Maximum, minimum, average and standard deviation of livestock costs incurred by all interviewed households in the years 2013 and 2014.

Costs	2014 (Jan-Dec)				2013 (Jan-Dec)			
	Max	Min	Ave	Std dev	Max	Min	Ave	Std dev
Vaccination	6000	0	885.57	1224.705	5400	0	738	1058.961
Feeds	7200	0	1458.81	1936.573	4800	0	772.97	1196.749
Livestock Depredation	7000	0	1448.33	2337.732	12000	0	910.53	2227.977
Diseases	45000	0	369167	6725.466	15000	0	1974.54	3298.466
Stock theft	30000	0	3015.00	4710.925	12000	0	2275	3166.395
Labour	30000	0	5401.67	6713.868	30000	0	5521.67	6978.067

Source: Survey data

Table 4.2 indicate maximum costs incurred by households when rearing their livestock. It is indicated that one or more of the farmers lost R45000 in a year due to the diseases that attacked their livestock. The cost of R45000 was incurred due to more than 2 cattle that were affected by diseases and some of the diseases occurred due to the wildlife and livestock interaction. Animals from Kruger National Park destroyed the fence and came into contact with the domestic animals which then led to disease transfer and animal attack. The minimum value of zero for costs incurred is due to the fact that some of the respondents have not incurred those costs. Some of the households found it difficult to hire people to take care of their livestock due to lack of enough income therefore, they take care of their own livestock and also use their own family members who does not require payment in monetary form. However, there is an opportunity cost associated with the use

of unpaid/family labour, such as the corresponding wage rate that the unpaid family member would receive in the labour market with paid employment. Costs incurred by the farmers are also associated with the challenges that farmers are facing on a daily basis. For example, costs that occur due to livestock depredation are a challenge since farmers have to come up with a way of addressing it since they are staying next to wildlife.

Households incurred different costs when rearing their livestock in areas surrounded by wildlife. Not all farmers vaccinated or bought feeds for their livestock, hence, there was no costs incurred by them. Table 4.2 further indicate that farmers spent less money on vaccination and feeds since the highest amount spent on vaccination was 5400 while for feeds was 4800 for the whole year of 2013. These amounts were less as compared to the one obtained in 2014. Some of the households did not incur any costs in the year 2013. This was said to be a good year for them since their livestock were not attacked by wild animals and diseases.

Table 4.3: Total combined livestock benefits and income received by all households in 2013 and 2014 (Jan-Dec)

Benefits from livestock	Income received in 2014 (R)	Income received in 2013 (R)
Sale of livestock per year	572500	548400
Sale of manure	880	640
Sale of milk	700	4350
Total	574080	553390

Source: Survey data

Table 4.3 shows the income received from the livestock and its products. It is indicated that smallholder farmers benefit more from livestock by selling live animals. Manure and milk were only sold by few smallholder farmers. Hence, it did not provide more income to families keeping livestock. Manure was sold by few farmers at a lower price to other local farmers who are involved in crop production. In 2014 the total amount received from livestock by household was R572 500 which was few rand higher than the one in 2013.

The overall amount of these costs was used in the cost benefit analysis to determine the sustainability and profitability of the integrated wildlife/livestock.

Table 4.4: Total wildlife benefits and income received by wildlife respondents in 2013 and 2014

Wildlife benefits	Total income 2014	Percentage (%)	Total income 2013	Percentage (%)
Trophy hunting	1200000	88.9%	500000	88.5%
Meat sales	120000	8.9%	40000	7.08%
Accommodation	30000	2.2%	25000	4.42%
Total	1350000	100%	565000	100%

Source: Survey data

Table 4.4 indicates different types of benefits that were received by households that are engaging into wildlife in the rural areas of Ba-Phalaborwa specifically in Mashishimale village. The size of the game farm is 19000ha and the farm representative indicated that it is suitable to carry 40000 animals but due to financial constraints farmers have not yet reached this number. Trophy hunting was the main activity that generates more income for the farmers. This is mostly done in winter and spring by the international clients and some of the local clients. It contributed more than 80% of income to the total revenue received in a year as compared to meat sales and accommodation. Meat sales contributed only 2.2% to the overall revenue received in 2014. Van der Waal and Dekker, (2000) also found that local and foreign hunting as consumptive use of wildlife contributed 67.3% of the turnover for game ranchers in Limpopo Province. Some of the meat from trophy hunting was given to the local community to assist in combating household food insecurity. According to van der Waal and Dekker, (2000) the consumptive benefits that the wildlife game farmers were able to make in 1997 was R221 million for the whole of Limpopo Province. These benefits included local and foreign hunting, live sales and venison production. It is indicated that

there is a potential in game farming were farmers can make a living even if they engage in other land uses. Van Der Merwe *et al.* (2014) mentioned that hunting is one of major income generators for the game ranchers in South Africa. The CPA of Mashishimale has indicated that they received some of the benefits from KNP through the transfer of game from KNP to the CPA as a means to develop it. This included elephant bulls and zebras.

About 98% of the respondents indicated that they keep livestock for meat consumption in their households and also to sell them to the communities and at auctions. The total benefits in the study were income received from selling live animals and livestock products. The products received from livestock include milk, manure and meat. Manure and milk did not provide a lot of income since the highest income received from selling milk was R1000 per year whereas that of selling manure was R800. However, most of the farmers used their livestock for ploughing their own farms, produce milk for own consumption and lastly used manure for their own benefit without selling it. About 42.3% of the respondents kept cattle only whereas the remaining percentage of the respondents also kept small stock such as goats, sheep, poultry and pigs. This small stock is complementing the household income and assists with food security. According to Lindsey *et al.* (2013) livestock production was the most common land use and it generated large proportion of income in Namibia. The most common kept livestock are cattle with large percentage as compared to other small stock like goats and sheep.

$$CBA = \frac{\sum B_n/(1+r)^n}{\sum C_n/(1+r)^n}$$

Table 4.5: Project 1- Livestock farming

Year	Costs	Benefits	Discount factor (8%)	Discounted costs (DC)	Discounted benefits (DB)
1(2013)	R726 858,00	R553 390,00	0.926	673 070.51	512439,14
2 (2014)	R952 604,00	R574 080,00	0.857	816 381.61	491986,56
Total				1 489 452.14	1 004 426

Source: Survey data

NPV = -551992, r = 8% as per 2015 interest rate and N= 2 as number of years

$CBA_1=DB_1/DC_1$

$$CBA_1 = \frac{1\,004\,426}{1\,489\,452.14}$$

$CBA_1 = 0.67$

Table 4.5 shows the overall financial values that were gathered from the collected data. The results of the costs benefits analysis is based on amount provided by households on each of identified items related to the livestock farming and availability of wildlife in their community. These costs are indicated in table 4.2 to show the average of each cost incurred by different households. The cost benefit results for first project of livestock farming is less than 1 which shows that the project is not viable to improve the livelihood of smallholder households on its own. Since the households are currently engaging in livestock production only and produce for consumption purposes, the results suggests that they are not making enough income to sustain their livelihood in the long run. Therefore, in conclusion the economic benefits associated with practicing livestock are less that the costs in the study area. It is important to consider other land uses that can benefit the society as a whole including the farmers or households that are involved.

Table 4.6: Project 2- Wildlife farming

Year	Costs	Benefits	Discount factor (8%)	Discounting costs	Discounting benefits
1(2013)	251 000	1 350 000	0.926	232 426	1 250 100
2 (2014)	1 513 300	565 000	0.857	1 296 898	484 205
Total				1 529 324,1	1 734 305

Source: Survey data

NPV = 150700

$CBA_2=DB_2/DC_2$

$$CBA_2 = \frac{1734305}{1529324{,}1}$$

$CBA_2 = 1.13$

The cost benefit analysis results indicate that the project of integrated wildlife/livestock may be better-off for the smallholder farmers who are currently engaging only in wildlife. The results also show that CBA for wildlife farming is 1.13 which is greater than 1 and is considered to be viable as compared to the 0.67 found in project 1 of livestock. The benefits will however be realized by farmers if they get all the resources required to engage into wildlife. Barnes and De Jager, (1996) also found that livestock production and wildlife appear to be economically efficient and contribute to the national income of Namibia. Most of the wildlife game is practiced on the private land by individual owners who get all the benefits. Their study however used an internal rate of return and Net Present Value of five to ten years. Again, they used the estimated net cash income not the actual income from the respondents unlike this study. Currently households staying next to the protected areas benefit through getting employment and also through interactions with the tourists from other countries. The total benefits of integrated wildlife in this study were extracted from the information provided by the CPA representatives who provided the economic background of the farm.

The main economic benefits indicated by the respondents were from trophy hunting and meat selling to local and international clients and these benefits were also indicated by Chaminuka *et al*. (2014a). These benefits were realized mostly in winter and spring seasons when most hunters visit the area. The community received some of the social benefits from the farm. It is indicated that wildlife was indeed considered to be beneficial in terms of economic means this is supported by Niamir-Fuller et al. (2012) who highlighted that countries look to wildlife conservation as a means to increase gross domestic product (GDP), foreign exchange earnings from tourism, provide public amenities and promote

economic gain for local communities. Boyd et al. (1999) also found that IWLM has the potential to generate substantial income flows, and increase total income at the community level, depending on the status of the wildlife resources. It is, therefore, important to make the resources available for farmers who practice integrated wildlife/livestock in rural areas so that they can make it sustainable and improve their livelihood. Enhanced income generation may compensate for a reduction in food security, depending on food availability in, and access to, local markets. Some of the benefits indicated by the smallholder farmers engaging in wildlife were provision of meat to schools in the surrounding areas especially during winter school and also the fact that the community was allowed to get firewood from the game farm when they have events and funerals.

4.4 Trade-off analysis (Weighted decision matrix) results

This section represents the results obtained from the weighted decision matrix that was used to gather the extent of the trade-offs encountered by livestock farmers in shifting towards wildlife farming. Optimization approach was applied first in order to find out if the trade-offs will be positively related to wildlife or livestock. The benefits for wildlife included in the calculations were income received from trophy hunting, meat sales and tourism. In livestock farming some of the farmers benefited from the sale of milk, sale of manure and sale of livestock. The amounts in the table were from 2013 and 2014 data combined together.

$$\prod = \sum WB_n - \sum LB_n$$

$\prod$ = 1915000 - 1127470

$\prod$ = 787530

Table 4.7: Decision Matrix: Weighted Scores

Decision Matrix: Weighted Scores							
Options	Sale of animal	Accommodation	Meat sales	Manure sales	Milk sales	Trophy hunting	Total benefits
Wildlife	0	55000	160000	0	0	1700000	1915000
livestock	1120900	0	0	1520	5050	0	1127470
Criterion weight	0	0	0	0	0	0	

Source: survey data

The table above shows the trade-offs that were experienced by community members when moving to wildlife farming. The total benefits indicated in the table shows that wildlife on its own is generating a lot of income as compared to livestock. Choosing the integration of wildlife/livestock means that the farmers will have to let go some of the benefits received from livestock and this is indicated by the R0 amounts in the last row of the table. It is however clear that the opportunity cost of choosing to use the land for livestock was more than that of wildlife. The choice of livestock famers on one land use option determined how much they will lose or gain. Farmers choosing to stick with livestock production only would give up income generated from accommodation, meat and trophy hunting in wildlife. The results of trade-off calculations indicated that there was a positive difference between economic benefits gained from the wildlife and that of livestock only. In wildlife game farming the costs of operation was high as compared to keeping livestock. However, it gave better returns at the end. The trade-offs experienced by the households who are engaging in wildlife are bearable as it is shown that benefits are greater than that of livestock only. The amount of R787 530 shows the extra amount that the wildlife farmers are getting as compared to that of livestock only. Integrating wildlife and livestock will improve the returns if the farmers are well informed and follow all legislations that govern the wildlife farming. It was however, clear that the problem of cattle depredation and

diseases will always be part of the day to day dealings with wildlife since some of the wild animals like elephant are able to destroy the fence and move to the area where livestock is kept. Both the alternative uses have their own challenges and opportunities as opposed to each other. The table only indicate the economic benefits that will be received by the two different farmers depending on the type of farming they choose to engage in. However, there are other negative factors associated with both land use options that can affect the sustainability of the project and capability of the smallholder farmers to generate more income. The weighted decision matrix used data on households' benefits as it is indicated in table 4.3 and table 4.4. It is clear from the table that smallholder livestock farmers have not sold their live animals and this is due to the fact that they are still facing challenges in increasing the number of animals that they have. Engaging into wildlife will enhance the development of the surrounding communities through employment and other business opportunities since there will be many activities involved and different stakeholders.

4.5 Identified opportunities and challenges

4.5.1 Identified opportunities for integrated wildlife/livestock

The descriptive results on the opportunities and challenges are indicated in this section. Smallholder livestock farmers rated the opportunities on how important it is to them. They were also able to indicate the opportunities associated with being around wildlife and how important those opportunities are**.** These opportunities affect the perception of the individuals with regard to integrated wildlife/livestock since they will be able to identify the contribution of this land use option their livelihood.

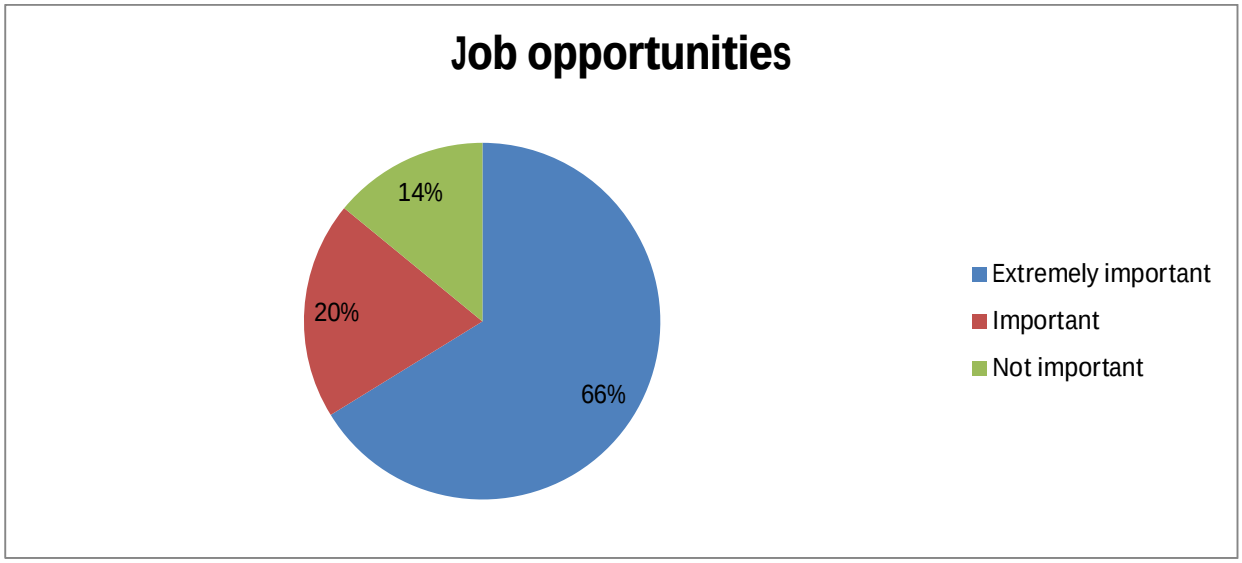

Figure 4.3: Job creation as an opportunity of integrated wildlife/livestock

Source: Survey data

Job creation was one of the most important factors that farmers have identified as the main opportunity that may arise due to the existence of the integrated wildlife/livestock in the area. About 66.2% of the farmers indicated that if they can integrate wildlife and livestock, there will be job creation for rural people and they saw it as extremely important for the improvement of their livelihood. Some of the respondents are currently employed at Kruger National Park. Therefore, they saw wildlife and tourism as an opportunity to learn new things and engage in new practice of improving their living standards. Erb (2004) found that wildlife-based tourism in Southern Africa can play an important role in bringing development and jobs in rural areas. This will alleviate pressures in urban areas that are currently accommodating a lot of people. Discussion with the Community Property Association (CPA) representatives revealed that the game farm had already employed 33 people who are from the community. The labourers perform different duties in the farm. Duties done by labourers in the farm includes lodge care takers to game ranchers, however, for anti-poaching, the farm employed people from outside to ensure protection and transparency. The cost benefits results shows that there is an amount attached to labour to show that the wildlife farming cannot operate without paid labourers since it require more man power to perform different duties.

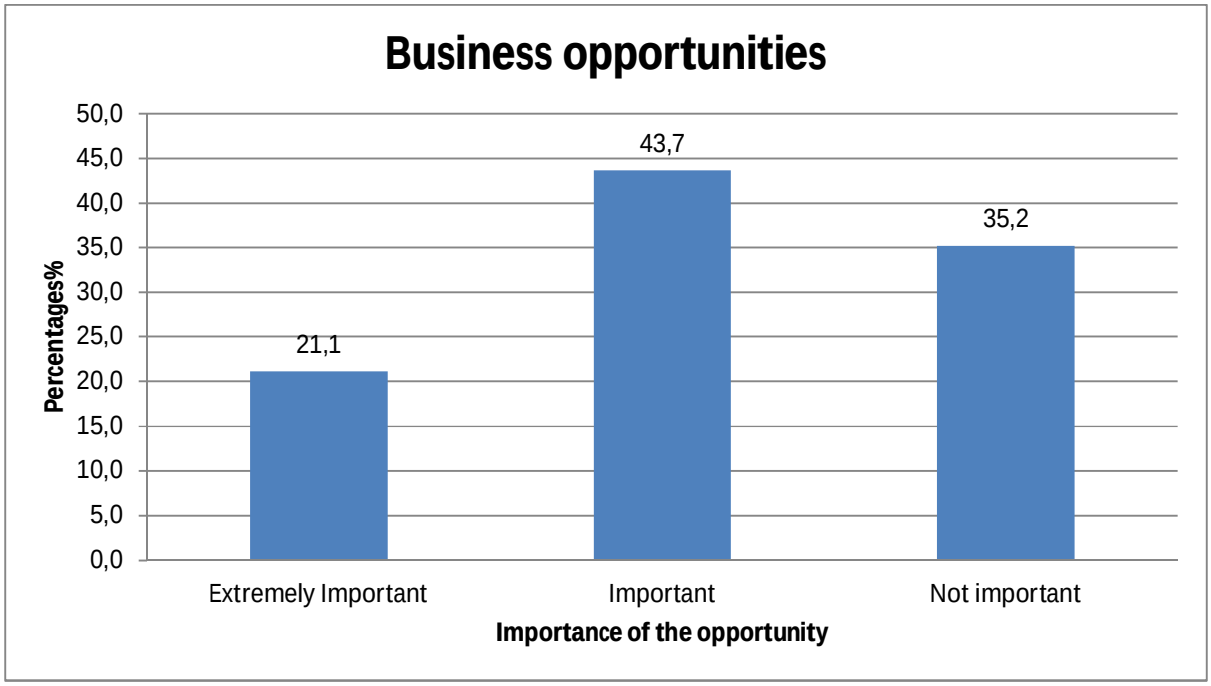

Figure 4.4: Business as an opportunity of integrated wildlife/livestock

Source: Survey data

Figure 4.4 indicates that farmers agreed to the fact that the involvement in the integrated wildlife/livestock can lead to creation of business opportunities for the people who are staying closer to the protected areas. Engaging into wildlife means that the involved community will be able to sell their live animals, horns, skins and also allow trophy hunt in their camps. This would be possible if the farmers take into consideration all legislation that governs the wildlife industry in the country. Community members can be able to start business for tourists who come to visit the wildlife. This includes selling crafts and other South African arts that are more attractive to tourists. This was supported by the data provided by the respondents who are currently into wildlife game farming since they were able to get income from providing accommodation to hunters and other tourist who came for viewing of wildlife. Macmillan and Phillip (2008) also found income and profits generation through different enterprises as an opportunity for some farmers in the wildlife surrounding areas. Individuals that have been in wildlife farming for a long period will have an advantage in exploring different route of making profits since they already know the kind of market they are operating into unlike to those who are still new to the market.

4.5.2 Identified challenges for livestock farming

There are challenges and problems that farmers are facing on a daily basis in an attempt to improve their output. The respondents have indicated how much they were affected by different challenges that came with staying in the border of the protected area. Likert scale was used to get the perception from the farmers on how strongly they feel about the presence of the challenges that came due to the existence of wildlife**.** Some of these challenges are however, occurring due to the inability of households to act before hand. Lack of information and the age of the respondents affect how each respondent perceive a certain challenge. Households staying in the same area are most likely to be affected in the same way. However, the closeness of these households to the protected areas will influence their perception of integrated wildlife/livestock.

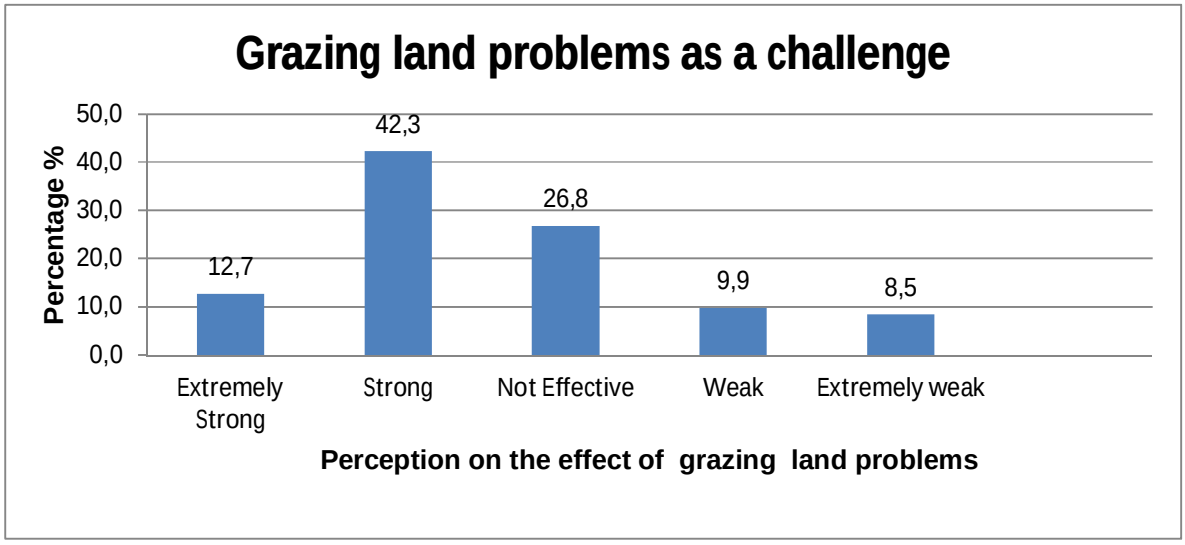

Figure 4.5 Extent of grazing land availability as a challenge

Source: Survey data

Figure 4.5 shows the way in which livestock farmers in Ba-Phalaborwa municipality see the poor availability of grazing land as a challenge. About 42, 3 % of the respondents were strongly affected by the poor grazing land which implies that the available land was not enough for their livestock. This is supported by Boyd et al. (1999) who indicated that livestock-wildlife conflicts are primarily focused on access to grazing and water resources. The lowest percentage was for those who believed that this has an extremely weak effect on them. In the past, grazing area was not much of an issue since population was not increasing as it does in this present time. Some of the famers did not see the existence of wildlife as a threat to the available grazing land. In rural areas, farmers depend on the land that is owned by the traditional leaders and they graze their livestock on communal land used by many farmers.

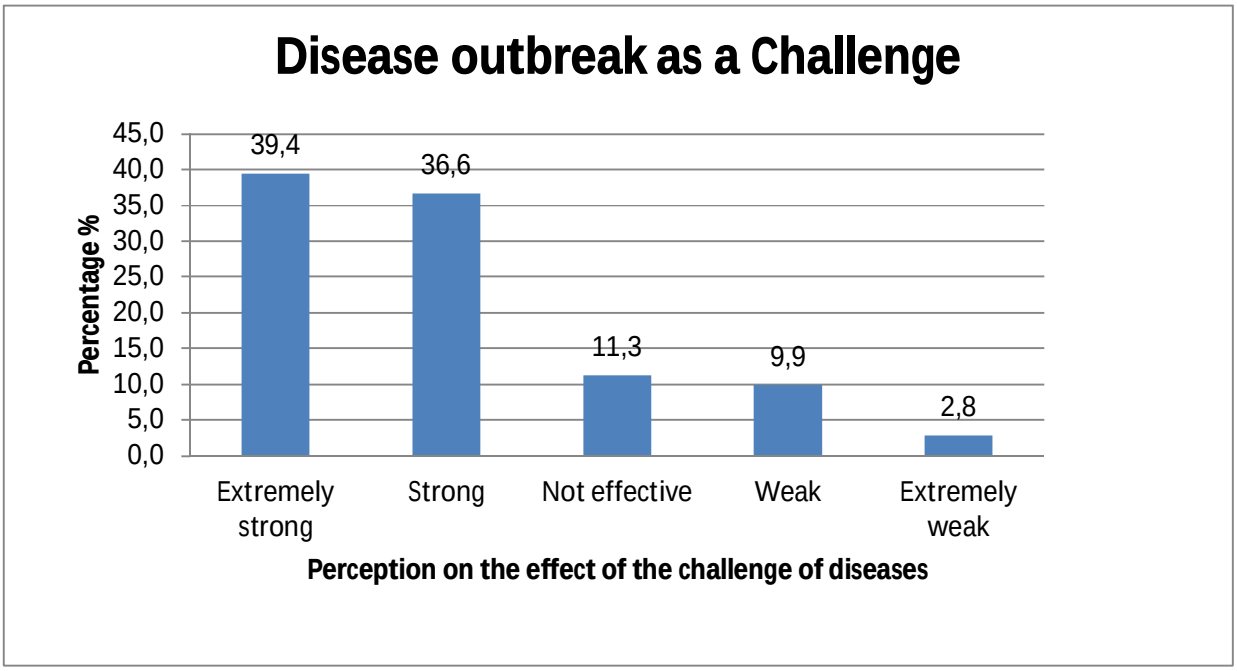

Figure 4.6 Livestock disease outbreak as a challenge faced by households

Source: Survey data

Disease was one of the challenges that pose a threat to the lifespan of the livestock especially when there was wildlife involved. From the figure above, it is indicated that a disease was an extremely strong challenge that most smallholder farmers in rural areas

and who stay next to Kruger National Park are facing. More than 60% of the respondents indicated that they consider a disease as a big challenge that affects their ability to raise more livestock. Some of the livestock died due to diseases such as foot and mouth which are transferrable from wild animals to the domesticated livestock. Brahmbhatt et al. (2012) also found that disease transmission is the major challenge faced by people living at human/livestock/wildlife interface. only 11.3% of the farmers believed that diseases can not have any effect on them therefore they did not see it as a major challenge at all. This can affect their decision to use the land for wildlife/livestock integration because of the fear of disease transfer and other great threat that wildlife is posing on the livestock. Some of the farmers indicated that they already observed the contacts between the livestock and wildlife that jump out of the Kruger National Park. The study by Sikhweni, (2014) also indicated that elephants frequently destroy the fence around the park and lead to buffalos escaping into communal land adjacent to the park where livestock graze and therefore transmit disease. Respondents also indicated that government officials from veterinary section are always on the lookout for diseases that are common to wildlife and livestock transfer. This is supported by (Brahmbhatt et al. 2012) who indicated that veterinary services and other government agencies are assisting in areas around the protected areas. Disease outbreak in rural areas may result in the death of livestock which means the households will lose. Again, households will incur costs in trying to prevent the spread of that disease in their community. Hence, costs associated with diseases as it is shown in figure 4.2 and table 4.2.

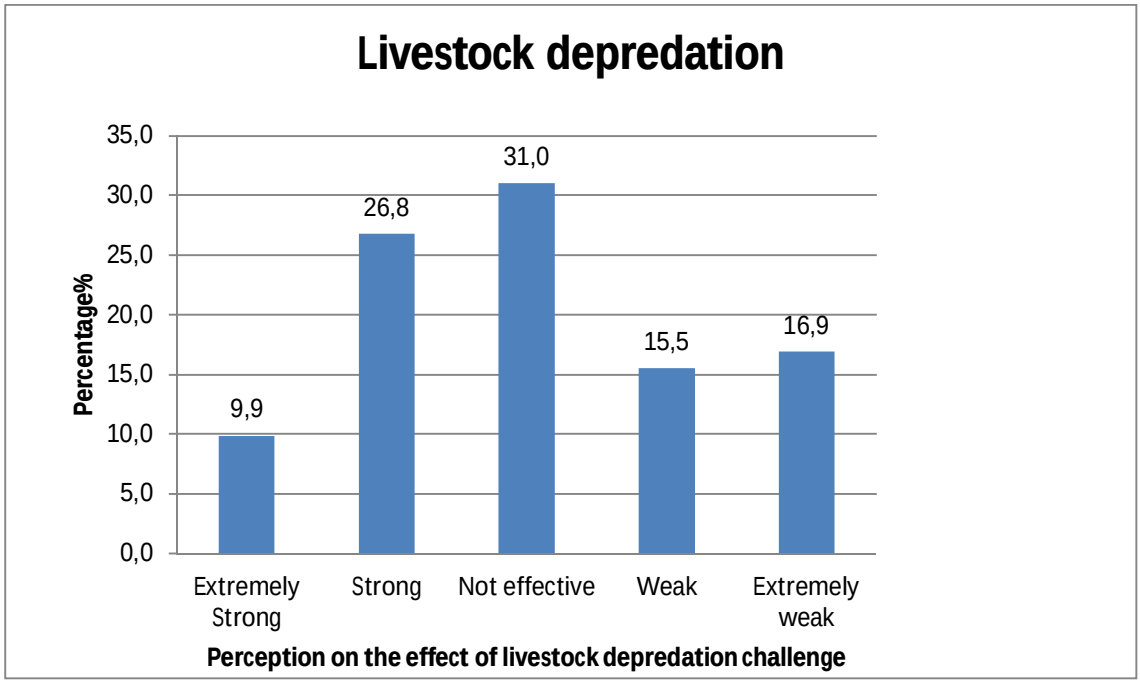

Figure 4.7: Livestock depredation as a challenge faced by the households

Source: Survey data

Figure 4.7 shows the wildlife depredation as a challenge that is faced by smallholder farmers in Ba-Phalaborwa municipality. More than 30% of the farmers perceived depredation by wildlife as not effective to their livestock. This means that most farmers have not experienced a problem with predation from the wild animals. Farmers did not foresee their livestock being endangered by the existence of integrated wildlife/livestock in their area. It was however, indicated that 9.9% and 26.8% of respondents considered wildlife depredation as a huge challenge since they ranked it as having a strong effect on them. It is indicated in table 4.2 that in 2014 the maximum costs incurred by the households due to depredation was 7000 which is lower considering that of diseases. Most of the studies indicated that depredation of livestock is one of the challenges that are faced by rural communities living near protected areas. For example, Chaminuka, (2012) also mentioned that 32% of households staying near Kruger National Park reported higher incidents of depredation of livestock as compared to those staying far from the park.

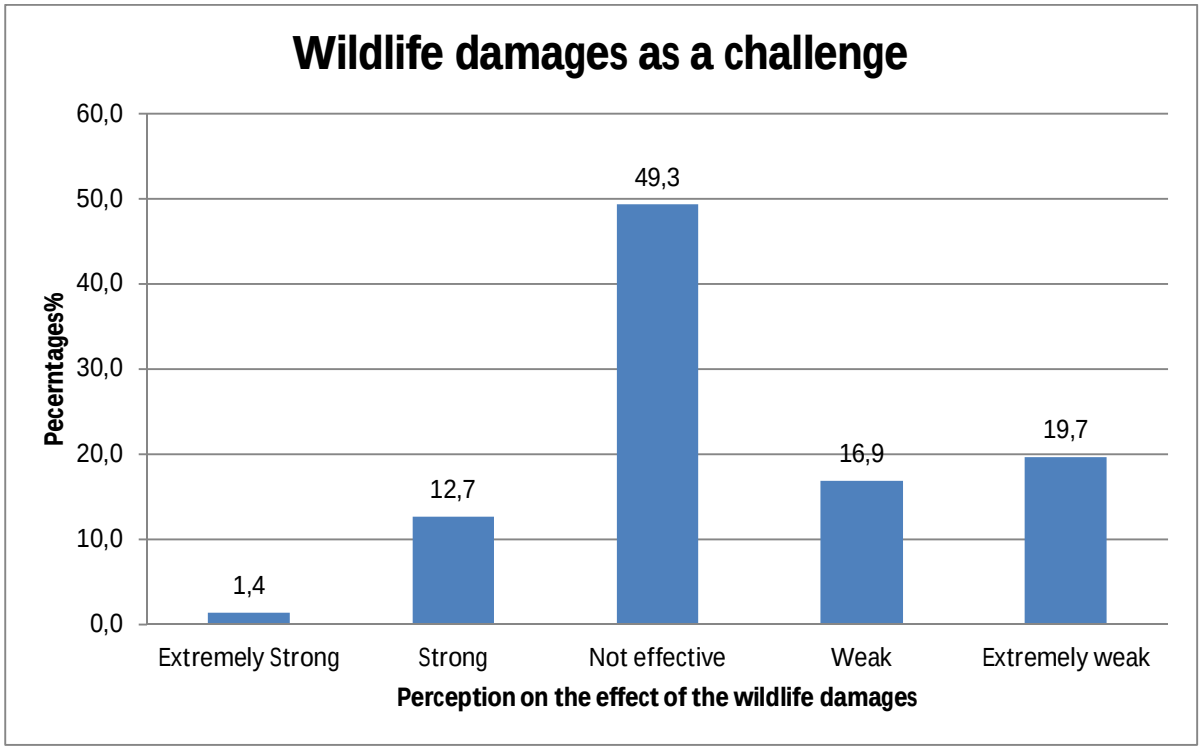

Figure 4.8: Wildlife damages as a challenge faced by households

Source: Survey data

Figure 4.8 shows the wildlife damages as a challenge that was faced by smallholder farmers in Ba-Phalaborwa municipality. More than 49% of the farmers perceived wildlife damage to crops problem as not impacting their farming activities and households. This means that most farmers have not experienced any damages caused by wild animals. Farmers did not foresee their area and other farming practices as being endangered by the existence of integrated wildlife/livestock in their area. However, it was indicated that 1.4% and 12.7% of respondents considered wildlife damages as a huge challenge since they strongly affect them. This challenge was not considered to be the most problematic for most livestock owners in areas next to Kruger National Park in Ba-Phalaborwa municipality. Chaminuka, (2012) also found that only 11% of the cattle owned households that stays next to Kruger National Park bear the effects of wildlife related damages. Anthony *et al*. (2010) found that between 2002 and 2004 more than 12% of household staying next to KNP experienced the damages caused by wild animals. The incidents were associated with their proximity to the park. Less than 37% of the respondents perceived wildlife damages as the least problematic challenge.

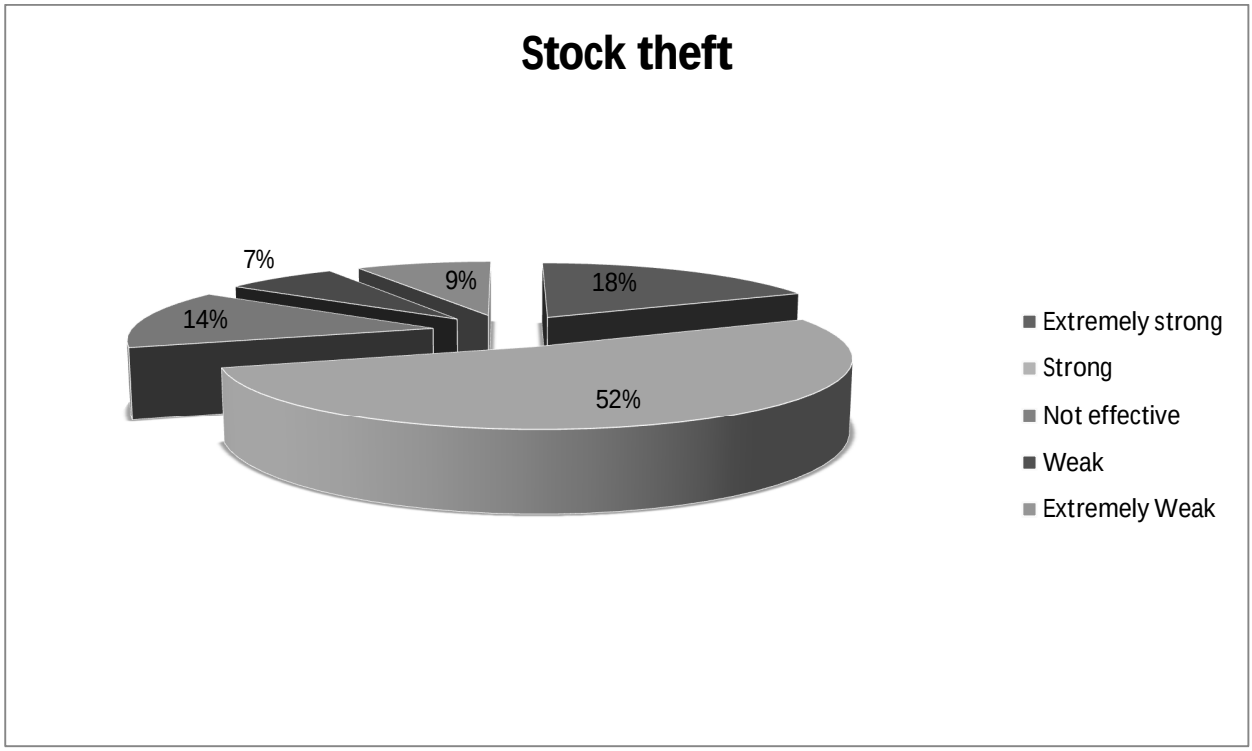

Figure 4.9: Stock theft as a challenge faced by households

Source: Survey data

Most of the smallholder farmers in rural communities are still facing stock theft as the greatest challenge. It was found that more than 50% of the respondents feel that they are strongly affected by this problem. About 14% of the respondents did not perceive stock theft as a worrying challenge. This is due to the fact that they were able to hire the herdsman who took care of their livestock during the day when they are out in the field grazing. The study conducted by Sikhweni, (2014) found that only 3% of the respondents living closer to Kruger National Park mentioned stock theft as one of the challenges that they were facing. However, this finding contradicts with the findings of this study.

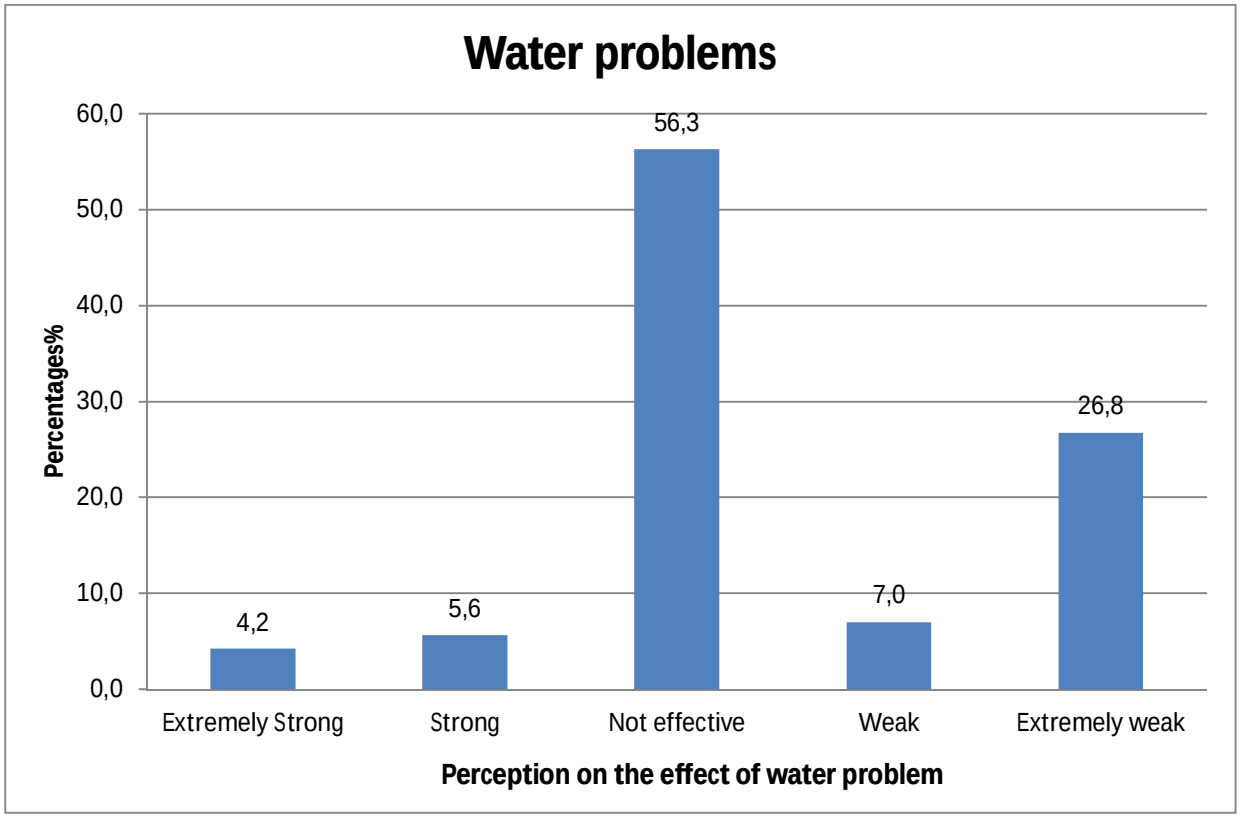

Figure 4.10 Water availability problems as a challenge faced by households

Source: Survey data

A large percentage of household heads who were interviewed do not have water problems since their livestock are using river water. Only less than 10% of the households consider water problem to have a strong effect on them when rearing their livestock. This shows that availability of wildlife in the area did not have an effect on water used for livestock. It was however, indicated by most of the farmers that during hot and drought years, rivers become dry to a point where competition of water use became high for households that keep livestock.

4.5.3 Identified challenges for wildlife game farming only

The respondents of game farm identified several challenges that they face in practicing wildlife. The Community Property Association (CPA) interviewed has indicated challenges such as financial problems to keep the project going, lack of support from the government structures such as LEDET and poaching from the local people. They further indicated that

they are facing challenges in the beginning of the project after receiving a game farm through land restitution programme because it needs more funds to start operating and to make it profitable and sustainable.

4.6. Chapter Summary

This chapter has outlined the findings of the study from the use of different approaches. It indicates challenges and opportunities identified, the costs incurred by the respondents and the benefits received. Lastly, the chapter showed the trade-offs that are associated with wildlife and livestock as a land use option. The results of this study are accompanied by research findings from other authors who conducted studies similar to this one.

CHAPTER FIVE
SUMMARY, CONCLUSION AND POLICY RECOMMENDATIONS

5.1 Introduction

The chapter provides an overall summary of the study and also give the conclusion. It further shows the policy recommendations based on the findings of the study that are indicated in Chapter 4 and literature from previous studies.

5.2 Summary of findings

The first objective of the study was to analyse economic costs and benefits of livestock and wildlife farming as alternative land use option in Mopani District. The results indicated that there are indeed costs that are incurred in the practice of integrated wildlife and livestock in the community especially for smallholder farmers. The farmers were asked to list the costs they incurred due to their engagement in livestock production and also due to availability of wildlife. The costs differed in terms of the number of livestock kept by the farmers. Costs such as Vaccines, death of livestock due to diseases, loss due to livestock depredation, stock theft and labour were recorded from all the interviewed farmers. It is, however, recorded that some of the farmers did not incur costs such as labour because they use unpaid family labour for their livestock. It is indicated that there are positive turn-out when it comes to the benefits that are received from the integrated wildlife.

Costs-benefit analysis technique was used for overall costs and benefits incurred in the years 2013 and 2014. The cost incurred in 2013 for all respondents who own only livestock amounted to more than R700 000 which is less as compared to that of 2014 which is more than R900 000. In 2013, the maximum cost incurred for vaccination was R5400, for loss due to depredation was R12 000, for stock theft was R4 800 and the maximum labour cost incurred by one of the farmer per year was R30 000. Some of the benefits associated with livestock are income earning through selling livestock products such as manure, cattle and goat milk and selling live animals. The highest number of cattle sold taking into account all smallholder farmers who made sales in 2013 was 4 at an average price of R5000 per cattle. Livestock farming also provide the social and cultural

benefits. About 98% of the farmers consider meat as their primary reason for them to keep livestock and is followed by selling live animals to the communities. Game farming comes with high costs but they also have good returns if the owners are able to use the resources efficiently. Costs associated with wildlife include game counting costs, maintenance, labour costs and costs incurred due to loss of animals from poaching. Benefits associated with wildlife include income received from trophy hunting, selling meat and income received from renting accommodation to international hunters.

The second objective was to determine the trade-offs of alternative land uses in rural areas of Mopani District. There are indeed the trade-offs that exists when farmers decide to change their land use option. Smallholder farmers will have to give up some of the benefits when they decide to integrate wildlife and livestock in the same area. There are tangible and non-tangible benefits that smallholder farmers have indicated to be goods that they have given up in order to keep up with wildlife. Trade-offs includes moving from their owned small area that they have to keep livestock to use a large area that they do not have individual ownership which is communal land. Other trade-offs identified were the fact that involvement of farmers in wildlife means that their livestock have to share the available grazing area with other grazers and browsers animals. The Communal Property Association spends more money on fencing and its maintenance since some of the big animals such as buffalo destroy it when trying to escape. Number of labourers in the game farm is many as compared with that of livestock only, hence, high costs. The cost of wildlife outweigh that of livestock because livestock graze on an open land and most of the smallholder farmers herd their livestock therefore, labour costs are reduced or eliminated.

It is however, clear from the trade-off analysis that the benefits of wildlife are much more than that of livestock production therefore; the trade-off of shifting from livestock production towards integrated wildlife/livestock may be a better decision to increase the income of smallholder farmers in rural areas. Most of the farmers have indicated that they are willing to participate in integrated wildlife/livestock provided they can get assistance from the government. They however, still believe that the responsible party for the wildlife practice is the government because as farmers they do not have experience and resources to maintain a game farm. Those who received game farm through land

restitution programme are currently engaging in wildlife with the help of the strategic partner who assist with skills transfer to the beneficiaries.

The last objective meant to identify the opportunities and challenges for the integrated wildlife/livestock farming in rural areas of Ba-Phalaborwa Municipality, Mopani District, taking into account the perspective of each interviewed livestock farmer in the area. Different challenges were identified by the respondents and they also indicated how strongly these challenges affect them. Likert scale was used when preparing questions to improve the results of the study. Challenges such as disease attack, livestock depredation, theft, poor grazing area and poor water availability were identified and they were found to have different effects on the respondents. Lack of grazing area and diseases are the most common challenges in the area of Ba-Phalaborwa with high percentages of people who are strongly affected by it. More than 50% of the livestock farmers are strongly affected by livestock diseases and poor grazing area. Jobs and businesses are identified as the most important opportunities that the respondents in Ba-Phalaborwa Municipality perceive.

There is still a problem of market access since most of the farmers are only able to sell to the community and sometimes at auctions. At the end, this results in smallholder farmers receiving lower prices for their animals. Wildlife farmers indicated different challenges which they face when working with wildlife in the community. The challenges identified by the respondents are lack of support from government bodies such as Limpopo Department of Economic Development, Environment and Tourism, lack of grants for beneficiaries of land restitution after receiving the land and the problem of receiving a game farm without wild animals in it. The study found that few smallholder farmers are knowledgeable about the integration of wildlife and livestock.

5.3 Conclusion

The purpose of the study was to assess the economic benefits associated with integrated wildlife and livestock. There are costs and benefits that are found to be associated with integrating wildlife and livestock. Farmers incur cost in producing livestock and also those who engage into wildlife incur more costs. Some of the costs identified include labour costs, vaccination costs, feeds costs, costs due to livestock theft, cattle depredation and

lastly loss of livestock due to diseases. Those who are already engaging in wildlife farming indicated costs such as game counting, labour costs and maintenance of fences, costs due to poaching and other social costs. From the cost benefit analysis approach, it was found that livestock on its own does not enhance the living standards of smallholder farmers in rural areas. It can however, be complemented by the inclusion of wildlife in the area where the benefits will be increased. Therefore, this study conclude that wildlife together with livestock may be a way forward for smallholder farmers to improve their livelihood however, this will yield positive results if government intervene in developing this farmers.

The second research question asked about the trade-offs that exists when integrating wildlife and livestock. The study found that there are trade-offs that are associated with integrated wildlife/livestock. The decision matrix indicated with the zero amount that some benefits would be forgone when changing land-use option from livestock to wildlife. Livestock production on its own provides benefits such as income from selling live animal, manure and milk. This however, was evident to provide a low income therefore, they give up fewer benefits as compared to that of wildlife.

Agricultural practice is one of the land-use option that rural household consider for their livelihood sustainability. The results have shown that there are lots of challenges that livestock farmers are currently facing in taking care of their livestock and due to some of these challenges, the living standards of the farmers are not sustainable. Smallholder farmers get benefits associated with their proximity to KNP some of the benefits include job opportunities, creating small businesses for tourists and also get access to the wildlife viewing at discounted prices. Game farm on its own is able to create more jobs for the surrounding communities. Game farms that are owned by black people in Ba-Phalaborwa Municipality are received through land restitution programme that is intended for community development. Those who are already engaging in wildlife have indicated that they lack support from the government and they face challenges of poaching by some of the community members.

The existence of wildlife and livestock at the same time is possible but they cannot be kept in the same area due to problem of diseases. Some of the respondents consider it difficult to benefit from integrated wildlife/livestock since access to market is not easy. There is a question of labour, water and natural resources competition that exists when engaging in wildlife and also livestock.

Smallholder farmers and other community members need to be fully involved in decision-making regarding wildlife use and allocation of benefits for their own well-being. This study has shown that only land restitution beneficiaries farmers engage in wildlife on a communal land. The benefits are shared among all the beneficiaries and it cannot be the same as those of individual commercial farmers who farm on their private land. Kruger National Park plays an important role in developing smallholder farmers who engage in wildlife by providing some of the needed animals to keep the farm going after the farmers are allocated game farms. Famers can also use support from different role players such as government institutions and traditional leaders so that at some point they will be able to operate on their own without strategic partners.

5.4 Policy recommendations

- Households involved in wildlife should be capacitated with more knowledge on how well they can benefit from it and reduce the costs incurred
- Job creation and business developments are some of the opportunities identified by smallholder livestock farmers in Ba-Phalaborwa municipality therefore, it is important to ensure that the government engage with those farmers and other households in the area so that this opportunities become reality. As such this will improve the employment rate in South Africa and also contribute the local and national economy.
- Government bodies such as LEDET should get more involved in the development of game farms in the communal land because they are currently facing challenges in trying to develop awarded farms.
- The study found that smallholder livestock farmers are affected by challenges such as diseases that they are unable to control whereby they end up losing their

livestock. Therefore, government in partnership with the private sector can assist farmers on how best they can control different diseases without incurring high costs.

- From the result of trade-off analysis, it is shown that the communal property association (CPA) that was involved in this study was not able to sell the live animals which would have brought more income to them. Therefore, it will be beneficial for government together with other private companies to support these farmers in terms of marketing their wild products and attract more investors.

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Annexure A: Questionnaire

UNIVERSITY OF LIMPOPO (Turfloop Campus)

Faculty of Science and Agriculture

School of Agricultural and Environmental Sciences

Department of Agricultural Economics and Animal Production

ECONOMIC ANALYSIS AND PERCEPTION OF INTEGRATED WILDLIFE/LIVESTOCK FARMING AS AN ALTERNATIVE LAND USE OPTION IN RURAL AREAS OF MOPANI DISTRICT IN LIMPOPO PROVINCE

Name of the enumerator _____

Municipality name _____

Name of the village _____

Questionnaire number _____ Date of the interview _____

Section A: Socio economic characteristics of the household head

1. Age _____
2. Gender 1. Female [ ] 2. Male [ ]
3. Household size _____
4. Number of years of schooling _____
5. Do you have access to extension services: 1. Yes [ ] 2. No [ ]
6. If yes, what kind of services do you receive _____
   _____
7. Primary occupation: Farming [ ] Trading [ ] Public salaried job [ ] Private salaried job [ ] Craftsman and artisan [ ] Other [ ] specify_____

8. Household income sources: crop income [ ] livestock income [ ] agricultural wage income [ ] non-agricultural wage income [ ] self-employed [ ]remittance [ ] other [ ] specify_____
9. Annual income _____
10. Do you have access to credit? 1. Yes [ ] 2. No [ ]
11. If yes, what is the amount of credit received? _____
12. Type of farming you are engaging in: Crop [ ] Animal husbandry [ ] Both [ ]
13. If you keep livestock, how long have you been keeping livestock (years)? _____
14. Which of these livestock do you have? Complete the table below:

Livestock type	Do you own this livestock 1 Yes, 0 No	Number owned	Main productive use (use key 1)	Source of water for these livestock (use key 2)
1. Cattle				
2. Donkeys				
3. Sheep				
4. goats				
5. Poultry				
6. Pigs				
7. Other (specify)				

Key 1: 1=meat; 2=milk; 3=eggs; 4=manure; 5=Ploughing; 6=transport; 7=other (specify)

Key 2: 1=River; 2=wetland; 3=Dam 4=deep well; 5=other (specify)

15. Ownership of the land: 1. Title deed [ ] 2.lease [ ] 3. PTO [ ] 4. Other [ ]
16. Price of the land per month if rented: _____
17. Farm size (ha) : _____
18. What are the challenges you facing when rearing your livestock? _____ _____

19. What are the opportunities associated with livestock keeping?

    _____

    _____

20. Number of calves born in 2014_____ and 2013_____
21. Where do you graze your livestock _____
22. Is there enough grazing area for your livestock? Yes [ ] No [ ]
23. What other ways do you use your grazing area? Hunting [ ] Picking herbs [ ] Grass cutting [ ] Firewood [ ] Other [ ], specify _____
24. What kind of government support do livestock farmers receive? _____

    _____

Section B: Wildlife farming information

25. Are you currently engaging in wildlife? 1. Yes [ ] 2. No [ ]
26. If no, why? _____

    _____

27. If yes, Name available wild animals that you have:_____

    _____

28. Where did you get your wild animals? _____
29. Do you integrate wildlife with livestock? 1. Yes [ ] 2. No [ ]
30. If yes did you get information about integrating wildlife with livestock? _____
31. Farm size after integration of wildlife and livestock (ha): _____
32. How was the land acquired _____
33. Do you practice wildlife integration on 1.communal land [ ] or 2. private land [ ]
34. Do you have the rights to sell the wild animals? 1. Yes [ ] 2. No [ ]
35. Number of the beneficiaries on the wildlife land _____
36. What is your perception on the challenges that you are facing with regard to integrated wildlife/livestock farming? (Name the challenge and rank it according to its effect on you).

Type of the challenge	Extremely strong	strong	Not effective	weak	Extremely weak

37. What are the opportunities associated with integrated wildlife/livestock rearing (name the opportunity and rank it according to the its effect on you)

Type of the opportunity	1) Extremely important	2) moderately important	3) Not important

Section C: Costs and benefits

38. Do you have paid labourers 1. Yes [ ] 2. No [ ]
    a. If yes, How many were they in 2014 _____ and 2013_____
    b. If yes, how much are they paid per month 2014_____ 2013_____
39. Are you employed in Kruger National Park? 1. Yes [ ] 2. No [ ]
40. Benefits associated with proximity to KNP: _____
41. Costs associated with proximity to KNP: _____
42. In the year (2014) did you lose any livestock due to the following?
    Death due to predators: 1. Yes [ ] 2. No [ ], Death due to diseases: 1.Yes [ ] 2. No [ ], Theft: 1. Yes [ ] 2. No [ ], other, specify_____
43. In the year (2013) did you lose any livestock due to the following?
    Death due to predators: 1. Yes [ ] 2. No [ ], Death due to diseases: 1.Yes [ ] 2. No [ ], Theft: 1. Yes [ ] 2. No [ ], other (specify) _____
44. If you answered yes in 42 &43, answer 45 & 46
45. How many livestock did you lose per year? 2013_____ 2014_____

46. How much did it cost you due to this loss? 2013_____ 2014_____
47. Do you vaccinate your livestock? 1. Yes [ ] 2. No [ ]
48. If yes, how much do you spend on vaccination per month? _____
49. What was total vaccination cost in 2014 R_____ and in 2013 R_____
50. Do you buy feeds for your livestock? 1. Yes [ ] 2. No [ ]
51. If yes, how much do you spend on feeds per month? _____
52. What was total feeds cost in 2014 R_____ and in 2013 R_____
53. Costs associated with integrated wildlife/livestock farming?

Type of costs	Total costs per month in 2014 (R)	Total costs per year in 2014 (R)	Total costs per month in 2013 (R)	Total costs per year in 2013 (R)
1) Water resources				
2) Vaccination				
3) labour costs				
4) Livestock depredation				
5) Wildlife damages				
6) Fencing costs				
7) Wildlife				
8) Information costs				
9) Transportation cost				
10) Disease costs				
11) Maintenance cost				
12) Poaching costs				
13) Game counting				
Other, Specify				

54. Economic benefits associated with integrated wildlife/livestock farming.

Type of benefits	Total income per month in 2014 (R)	Total income per year in 2014 (R)	Total income per month in 2013 (R)	Total income per year in 2013 (R)

55. List social benefits associated with integrated wildlife/livestock farming _____

_____

_____

_____

56. What are other contributions of integrated wildlife/livestock to the livelihood of the household? _____

_____

_____

57. What and how much have you given up in order to get involved in integrated wildlife/livestock farming? _____

_____

58. What are the things that you are willing to give up in order to get involved in integrated wildlife/livestock farming? _____

_____

_____

59. Which wild animals are most problematic in your area _____

_____

60. In your opinion, who should be responsible for wildlife in your area?

_____

Section D: Marketing of livestock and wildlife

61. Do you sell your livestock? 1. Yes [ ] 2. No [ ]
62. If yes, where do you sell your livestock? Local community [ ] Formal market Informal market [ ] other [ ] Please specify…….....
63. . Do you transport your products to the market? 1. Yes [ ] 2. No [ ]
64. How many cattle did you sell in 2014 _____ and 2013 _____?
65. Price per cattle sold in 2014 _____ and 2013_____

66. Did you sell other livestock? 1. Yes [ ] 2. No [ ]
    a. If yes, How much did you make from other livestock sold in 2014_____ and 2014_____
67. Do you sell your wildlife? 1. Yes [ ] 2. No [ ]
    a. If yes where do you sell? _____
    b. What kind of wild products do you sell_____
    c. Name the products and the income received from it in 2014 and 2013:

Product description	Income received in 2014	Income received in 2013

    d. Which time of the year do you sell your wild products 1. Summer [ ] 2. Winter [ ] 3. Spring [ ] 4. Autumn [ ]