# IMPACT OF A GOAT PASS-ON SCHEME ON GOAT MANAGEMENT AND PRODUCTIVITY IN CHIPINGE DISTRICT

**BY**

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(*BSc. Agric. Hons UZ*)

A thesis submitted in partial fulfilment of the requirements for the degree of

**MASTER OF PHILOSOPHY**

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**August 2015**

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## ABSTRACT

### Impact of a goat pass-on scheme on goat management and productivity in Chipinge district, Zimbabwe

A goat production intervention was implemented in Musikavanhu communal lands Chipinge district by Action Contre La Faim (ACF). This was done by means of a pass-on scheme, where does were passed from one beneficiary to the next following kidding. Data to determine the impact of the pass-on scheme on goat management and productivity in the study area was collected through questionnaires, key informant interviews with stakeholders of the project and these included beneficiaries, Community Based Animal Health Workers, AGRITEX, ACF trainers and other Non-Governmental Organisations. Impact of the ACF goat intervention was determined by comparing management practices and productivity indices before and after the intervention. The goat pass-on scheme had a positive impact on goat management in the study area. There was a 23% increase in contributions of one United States dollar by each beneficiary per month towards animal health care. This saw a 56% increase in the use of commercial drugs for goats by beneficiaries. There was also a significant difference in beneficiaries attending training carried out by ACF staff ($P<0.05$). The increase in the number of does goat numbers ($P<0.05$) in the study area indicated that the pass-on scheme had a positive impact on goat productivity. There were significant differences in pre-weaning and post-weaning mortalities before and after the intervention ($P<0.05$). There were no significant differences however in kidding rate, kidding interval and abortion rate ($P>0.05$). The ACF goat pass-on scheme had a positive impact on goat management and productivity in the study area. It is recommended however that future interventions promote goat marketing channels to promote favourable producer prices for beneficiaries and goat farmers alike. To maximise on productivity, it is recommended that future interventions assist beneficiaries with improving fodder/ forage banks for goats and

improving breeding management as high levels of inbreeding have a negative impact on productivity.

## ACKNOWLEDGEMENTS

I would like to thank my supervisors Dr P. H. Mugabe, Dr T. E. Halimani and Dr E. Torquebiau for their patience, support and encouragement in the preparation of this thesis.

I wish to acknowledge Action Contre La Faim (ACF) and the Centre for Agricultural Development (CIRAD) Research Platform for funding this project and allowing me to participate in this useful study. I am grateful to ACF staff in Harare and Chipinge for transportation to and from the field, in the field as well providing accommodation in Chipinge. I am also grateful to ACF trainers in Chipinge as well as the beneficiaries I worked with who were always eager to assist with my research. I would also like to acknowledge with gratitude the extra funding I received for my research from the German Academic Exchange Service (DAAD).

CIRAD provided the Research Platform that helped with my paper writing through presentation and poster competitions. I am grateful to have been part of the Research Platform as I gained invaluable training in Statistics and Geographic Information Systems.

I would also like to acknowledge the Department of Animal Science that has nurtured me to this point in my education.

Catholic Relief Services (CRS) and AFRICARE provided support and cooperation in my data collection; I am grateful to them.

My family gave me support, encouragement and inspiration throughout my research and writing of this thesis; I am indeed indebted to them.

## DEDICATION

To my parents, husband and angels Shona and Savannah with love.

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## ABBREVIATIONS

| | |
|---|---|
| ACF | Action Contre La Faim |
| AGRITEX | Agricultural Extension Services |
| AIDS | Acquired Immuno Deficiency Syndrome |
| ANF | Anti-Nutritional Factors |
| ANOVA | Analysis of Variance |
| CA | Conservation Agriculture |
| CAFOD | Catholic Agency for Overseas Development |
| CAHW | Community Animal Health Worker |
| CBAHC | Community Based Animal Health Care |
| CIRAD | Centre for Agricultural Development |
| CRS | Catholic Relief Services |
| DAAD | German Academic Exchange Services |
| DFID | Development Fund for International Development |
| FAO | Food and Agriculture Organisation |
| FCTZ | Farm Community Trust of Zimbabwe |
| HFS | Household Food Security |
| GONBS | Goat Open Nucleus Breeding System |
| GPS | Global Positioning System |
| HIV | Human Immuno Deficiency Virus |
| IDE | International Development Enterprise |
| IFAD | International Fund for Agricultural Development |
| ILWIS | Integrated Land and Water Systems |
| LIFIN | Livelihoods for Improved Nutrition |
| NDVI | Normalised Difference Vegetation Index |
| NFN | Natural Farming Network |

| | |
|---|---|
| NGO | Non-Governmental Organisation |
| PRA | Participatory Rural Appraisal |
| PRP | Protracted Relief Program |
| RAAKS | Rapid Appraisal of Agricultural Knowledge Systems |
| RDC | Rural District Council |
| RRA | Rapid Rural Appraisal |
| SADC | Southern African Development Committee |
| SNV | Netherlands Development Organisation |
| SPSS | Statistical Package for Social Sciences |
| UN | United Nations |
| VBH | Values Based Holistic Approach |
| WVI | World Vision International |
| WFP | World Food Programme |

# CHAPTER ONE

## 1 INTRODUCTION

Food security occurs when all people, at all times, have physical and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preference for an active and healthy life (FANTA, 2007). This definition is based on four related pillars. Pillar 1 refers to food availability which is food supply. Pillar 2 is food access which means the ability of people to obtain food when it is available. As both availability and access must be stable, the third pillar, stability, refers to ensuring adequate food at all times while the fourth, utilization, incorporates food safety and nutritional wellbeing (Mcleod, 2011). Food insecurity arises when any of these elements is compromised. The threats to food security arise from a combination of factors which individually and collectively place food systems under stress; these include climatological, ecological, socio-economic and political factors (Ankomah, 2011).

Food insecurity may be chronic or transitory. Chronic food insecurity is a long-term or persistent inability to meet minimum food consumption requirements, while transitory food insecurity is a short-term or temporary food deficit (FANTA, 2007). Donor agencies working to promote food security must therefore attend to both chronic and transitory food insecurity at the same time (Pingali et al., 2005), because individuals and communities facing chronic food insecurity lack safety nets and are highly vulnerable to transitory problems (Mcleod, 2011). In Zimbabwe, food insecurity is a result of multiple stressors which include soil degradation, policy and political factors, land redistribution and access, macro- economic challenges, growing poverty and the HIV and AIDS pandemic (Gandure, 2007). According to Rukuni *et al*., 2006, food insecurity in Zimbabwe is most prevalent in rural areas particularly those that lie in agro-ecological regions IV and V. This is where approximately 69 % of the

population lives, that is about 7. 8 million people (FEWSNET, 2010). In 2012, 1 million people were estimated to be food insecure in Zimbabwe's rural areas with the highest concentrations being recorded in the southern tip of Chipinge district, Rushinga, Mashonaland Central and Mashonaland West Provinces (FEWSNET, 2012).

Due to limited capacity, the Government of Zimbabwe has faced challenges in addressing the food insecurity situation in these areas. Non-Governmental Organisations (NGOs) and donor input support programmes have intensified as a result of the increase in the number of vulnerable households owing to the economic hardship and droughts. These NGO/donor programmes, which are rendered as emergency relief aid, mainly support the production of staple cereal food crops such as maize and small grains (Mujeyi *et* al., 2010). In the 1990s and early 2000s security interventions involved the distribution of seeds and fertilisers for cropping as well as cereal grains and pulses for food stuffs (SNV, 2011; AFRICARE, 2011). However, food aid alone does not provide long-term development solutions that support the livelihoods of poor people. Donor and government response to food insecurity in emergency situations has mainly focused on cropping interventions, often ignoring livestock (Freeman *et al*., 2008).

Livestock are crucial to the livelihoods of about 60% of households in Southern Africa: it is a key productive asset, a store of wealth and provides transportation and other social functions. Yet, its role in food security and emergency response has not been fully exploited (Freeman, *et al*., 2008). In recognition of the importance of livestock to the livelihoods of the poor, donors, governments and NGOs have channelled resources to the livestock sector (Heffernan, 2004). Apart from the advantages that livestock offers to poor households such as providing a ready source of protein in the form of meat, milk and eggs; the recognition of the importance of livestock may have been brought about by climatic variability that has led

to frequent crop failure. Changes in annual rainfall and temperatures, soil quality, and weather patterns have greatly affected the Sub Saharan African region and have compounded recent food challenges (Radamacher, 2008). With about 70% of rural populations depending on rain fed agriculture, crop failure often spells hunger for them (Mwaniki, 2005).

In the face of climate change livestock have the potential to alleviate poverty often in areas were few other options exist (Kristjanson *et al*., 2010). Development agencies including Non- Governmental Organisations have therefore been pushed to think out of the box in terms of their food security interventions. In addition, the growing realisation of the need for long term solutions to food security interventions have resulted in development agencies looking for innovative sustainable measures.

Livestock development interventions have therefore become popular with NGOs such as Action Contre La Faim (ACF), Heifer International, and Catholic Relief Services (CRS). In Chipinge district located in the South- eastern lowveld of Zimbabwe, ACF implemented the Livelihoods for Improved Nutrition (LIFIN) Project which comprised of a conservation agriculture component as well as a goat production component. This was done to provide a balanced diet complete with starch and vegetables from seeds that were distributed for the conservation agriculture intervention and protein in the form of meat and milk from the goats that were distributed. The livestock intervention was implemented by means of a pass-on scheme, where the first recipients of the goats were expected to pass-on the original goats to the next community member in line following kidding. Other forms of livestock interventions include direct distributions and livestock fairs. Action Contre La Faim has been operating in Zimbabwe since 2002 helping some of the most vulnerable communities in the country to regain nutritional self-sufficiency. Despite food security interventions by ACF in the project area, which include conservation agriculture, goat production and guinea fowl

production, the communities in Chipinge district are still vulnerable to food insecurity. Carletto *et. al*., (1999) state that development agencies have moved from just giving food aid, to promoting development by assessing the impact of their interventions in the lives of the target population.

Development projects aimed at improving goat production must take into account the challenges of communal goat production. Gwaze *et al*., (2008) pointed out that low levels of management and high disease prevalence which affects productivity are some of the constraints that communal farmers face when rearing goats. Goat management and productivity are key parameters that influence the success or failure of goat production enterprises in communal areas. There is therefore need to evaluate the effectiveness, efficiency, sustainability and impact of the goat intervention on goat management and productivity in the study area as well as its impact on the target population.

### 1.1 Problem Statement

There is need to identify the research gap as there is scanty knowledge on effectiveness of goat production interventions on improving management practices such as disease control, housing and feeding and the subsequent impact of the interventions on goat productivity.

### 1.2 Justification

The purpose of this study was to investigate the performance of the ACF goat pass-on scheme by assessing its impact on goat management and productivity in the study area as these parameters are key to successful goat production and thus the intervention as a whole. By so doing, this study will provide information for future livestock interventions.

### 1.3 Research hypotheses

The research hypotheses were:

1. The ACF goat intervention had an impact on goat management in the study area;
2. The ACF goat intervention had an impact on goat productivity in the study area

### 1.4 Objectives

The broad objective of this study was to assess the effectiveness, efficiency, sustainability and impact of the ACF goat intervention. The specific objectives were to:

1. Investigate the effectiveness of the implementation of the ACF goat production intervention;
2. Identify problem diseases and drivers of their transmission and evaluate the effectiveness of community based animal health care against them;
3. Characterise the goat management and feeding practices
4. Determine the impact of the ACF goat intervention on various productivity indicators and
5. Assess the provisions made for the continued and improved goat production after the ACF intervention.

# CHAPTER TWO

## 2 LITERATURE REVIEW

### 2.1 Introduction

The decline in the cattle population by 75% from 1996 to 2004 due to recurrent droughts and the fast track land reform (Homann, 2006) created an opportunity for the small stock industry for example poultry, pork and goat meat, as they served as an alternative to beef (Nyathi, 2008). The goat population increased, with more than 90% of the goats owned by small-scale farmers (Sibanda, 2005). The collapse of the commercial livestock sector in Zimbabwe provided a unique opportunity for small scale farmers to make use of existing infrastructure, local and regional markets to commercialize goat production (van Rooyen and Homann 2008).

The increase in goat rearing in the small holder farming sector may have also led to the increase in food security interventions involving goats by the Government and Non-Governmental Organisations (NGOs). Homann and van Rooyen (2007) indicated that during times of need, smallholder farmers may be reluctant to sell their cattle whereas disposing goats is less risky (they reproduce faster and are drought resilient) and in this way goats are critically important to food security directly through meat and milk and indirectly through cash.

The purpose of this literature review therefore is to assess the advantages of goats in food security interventions, their importance to smallholder farmers and how goats contribute to small holder farmers' food security. The various approaches used in food security interventions involving goats are assessed as well as the methods that are used to evaluate

them. This is done to show the importance of evaluating food livestock intervention projects as this provides baseline information for future interventions. Constraints to goat production are also assessed as well as the opportunities for increasing goat production in smallholder farming areas.

### 2.2 Livestock species used in development interventions

Many livestock development interventions in Zimbabwe have mostly involved cattle such as in the national herd rebuilding programs, herd rebuilding loan schemes, Heifer international pass-on schemes, cow– calf loan schemes, cow finance loan schemes (Khombe, 2002). Small stock such as goats, chickens, guinea fowls, rabbits, ducks and turkeys have also been found to contribute greatly to livestock interventions. This is largely due to their small size, higher prolificacy and short generation intervals; and, compared to large stock, small stock such as goats are easier to destock and restock as required (Kamau, 2004). Small animals act as "starters" in a development process in contrast to larger animals (Dolberg, 2001). Small stock such as goats have therefore taken precedence in livestock development projects in communal areas compared to cattle. In addition goats have low input requirements (Olivier *et al*., 2005) making them less difficult to keep compared to large livestock such as cattle. This allows the participation of women, children and the elderly in rearing goats in communal areas (Maphosa, 2008). Therefore goat production is a means to empower women and Human Immuno Deficiency Virus (HIV) affected households providing quality food and income (Makodza, 2008).

It is for these reasons that goats have entered the agenda of emergency and relief programs, and are being distributed to promote recovery from shocks and stabilize livelihoods (Homann *et al*., 2007; ACF, 2010; CRS 2011).

## 2.3 The importance of goats in smallholder farming systems

Of the 3.3 million goats in Zimbabwe, 97% are found in smallholder farming systems and the majority of them are indigenous (Dube, 2008; Hove *et al*., 2008). Smallholder farming systems are particularly found in developing countries and are characterised by a poor resource base such as land and capital, low income, poor food security and mixed crop livestock systems with labour being provided by family members (de Sherbinin *et al*., 2008). In these communities, goats are kept for meat, milk, skins and manure (Kindness *et al*., 1999, Kusina *et al*., 2000); and are utilized to supplement household food requirements and sold to purchase food items and fund educational expenses (Homann et al., 2007). Goat skins can be used to make mats, water or grain containers, tents and drums (Peacock, 2005). Goat manure is sometimes used in low input gardens thus complementing the mixed crop livestock systems characterising smallholder farming systems. Studies by Mavengahama and Mapanda (2012) revealed that smallholder farmers regard goat manure to be rich in nutrients. Under the same management as cattle manure, goat manure was found to be of better quality when applied to the field for the macronutrients Nitrogen, Phosphorus and Potassium (Wuta and Nyamugafata, 2012).

In addition to providing livestock products, goats play traditional roles in smallholder farming systems. They are used to settle debts (dowry, loans, and fines) as well as representing savings, wealth and security against risk and uncertainty (Kamau, 2004). Also due to their hardiness goats are able to utilise marginal land that characterises most small holder faming systems and have been said to be useful in controlling bush encroachment in these areas (Alexandre and Mandonnet, 2007; Saico and Abdul, 2007). Although goats have many uses in small holder farming systems direct and indirect, Gwaze *et al*., 2008 reported that the actual contribution of goats at household level is not well known because the current

evaluation systems which are based on monetary standards often ignore the non-monetary contributions of goats to households for example acting as a buffer against shocks such as crop failure.

## 2.4 Goat productivity in smallholder farming systems

While goat numbers have increased in the drier areas in Zimbabwe over the past 20 years, goat productivity is hindered by high kid mortality and low growth rates (Sikosana *et al*, 2001). Goats reared in semi-arid areas generally kid all year round, but kidding is mainly concentrated in the dry season (Kindness *et al*,1999). This greatly reduces goat productivity as kid mortality is highest during the dry season due to nutritional stresses; and during the early wet season where sudden drops in temperature and drenching rain stresses both kids and does (Sikosana *et al*, 2001). High kid mortalities in the wet season may also be due to worm burden that may be high in does at that time (Joshi *et al*., *2004*).

Ndlovu (1999) showed that the productivity of indigenous goats in the small holder farming systems differs according to breed and location (Table 2.1).

*Table 2.1 Productivity indices of indigenous goats in smallholder farming systems*

| **Area** | **Nyanga North** | **Gwanda South** |
|---|---|---|
| **Goat breed** | **Small East African Goat** | **Matebele Goat** |
| Trait | | |
| Age at first kidding (days) | - | 606 ± 25.85 |
| Weight at first kidding (days) | - | 27.5 ± 0.78 |
| Kidding intervals (days) | 370 ± 21.90 | 311 ± 5.28 |
| Preweaning growth rate (grams/ day) | 43.5 ± 0.30 | 54 ± 0.87 |
| Weight at 150 days (kg) | 9.25 ± 0.16 | 11.50 ± 0.11 |
| Litter size | 1.30 | 1.19 |
| Pre-weaning mortality (%) | 41 | 36 |
| Peak kidding months | March April; September to December | July, September to December |

Management also plays a crucial role in small holder goat production as explained under the following sub heading.

### 2.5 Constraints to goat productivity in small holder farming systems

The major constraints to goat production in small holder farming systems include high disease and parasite prevalence, low levels of management, limited forage availability and poor marketing management (Gwaze *et al*., 2008; van Rooyen and Homann, 2008). Low genetic potential, inadequate research and extension services, lack of economic incentives leading to reduced offtake and lack of a central database are other constraints to goat production (Makodza, 2008). Potential interventions in goat production must include the evaluation of the constraints to goat production to increase goat productivity.

#### 2.5.1 Diseases and parasites

Poor health is a key limiting factor to goat productivity in the tropics (Kosgey *et* al., 2008). Diseases and parasites are major constraints to communal goat pr+oduction (Nwosu *et al*., 2007; Gwaze, 2008). Loforte (1999) and Kindness *et al*.,(1999), ranked diseases and parasites as the major constraint to goat production in Mozambique and Bubi district in Zimbabwe respectively. Tick borne diseases such as heartwater cause significant losses to goat populations in the tropics as well as the gastro-intestinal helminths, *Haemonchus contortus*, that causes anaemia (van Wyk, 2006). Diseases and parasites are responsible for mortalities and abortions, as well financial losses in goat production enterprises.

### 2.5.2 Low levels of marketing

According to Assan (2011), the major constraints in the improvement of small holder goat production with regard to markets are a poor marketing system due to underdeveloped infrastructure, inadequacy of market space and unavailability of market information. Communal farmers resort to the informal way of marketing their goats where pricing is based on an arbitrary scale, with reference to visual assessment of the animal (Gwaze *et al*., 2008), resulting in subjective pricing. Low goat productivity and poor goat quality however result in small numbers of marketable goats thus attracting a few buyers (Nengomasha, 2008). There is need therefore to improve the quality of goats as an incentive for market improvement. Increasing goat productivity can be done through improved breeding strategies. These will help increase the goat output thereby sustaining the developed markets (Assan, 2011).

According to Nengomasha (2008), competitive goat enterprises in Zimbabwe can be achieved through the integration of improved production and marketing systems in combination with the development of efficient and sustainable support services and the creation of an enabling policy environment as shown in the Figure below:

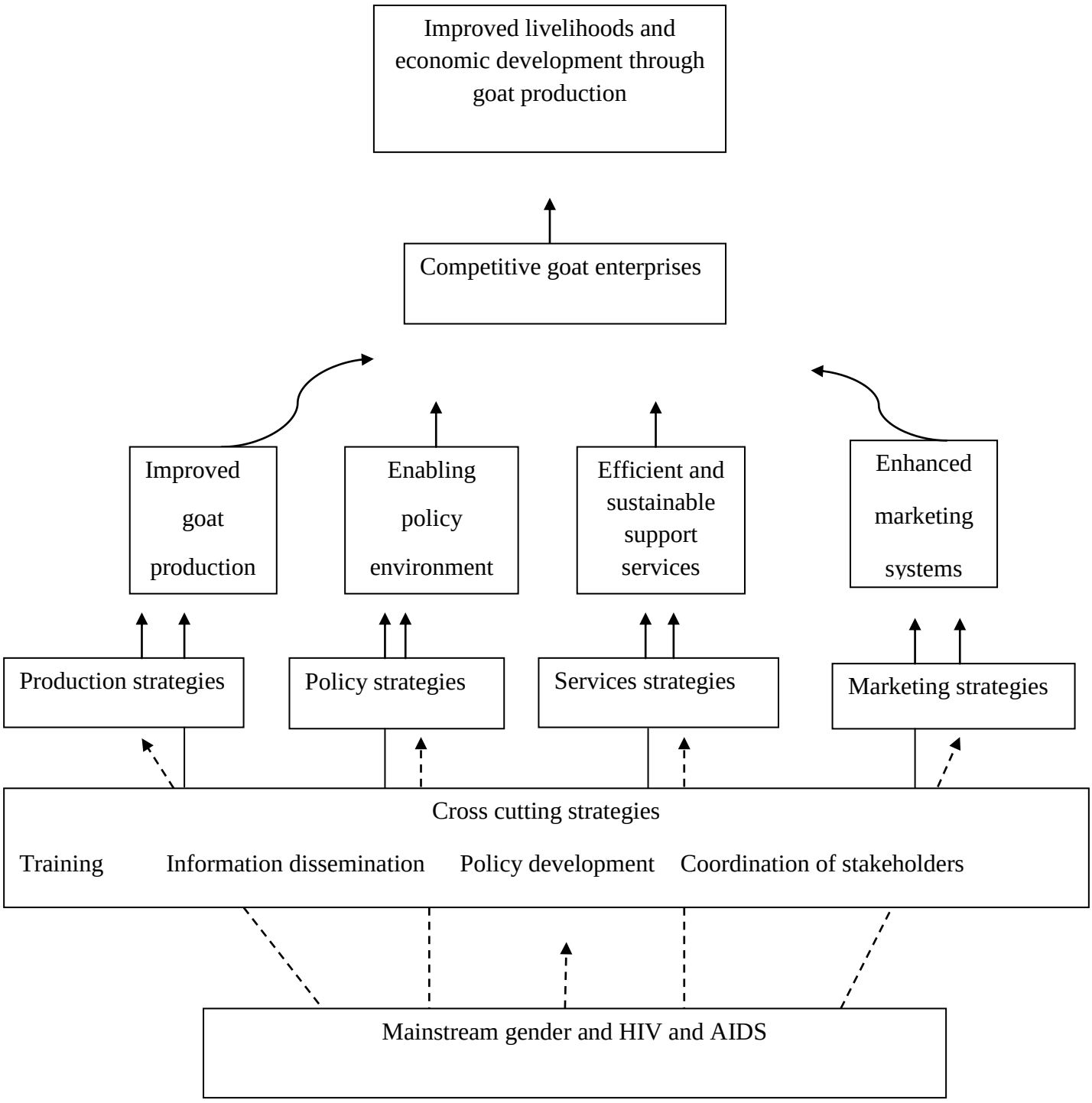


*Figure 2.1 Strategies for the improvement of goat production and marketing (Nengomasha, 2008)*

This figure shows that for goat marketing to improve there should be an integration of improved output in terms of goat production. Improved services and favourable prices for chevon producers will in turn act as an incentive for increased output. Issues of gender and HIV and AIDS must also be taken into account because of women's roles in small ruminant production and the nutrition of their families. Despite rural women's essential economic, productive and care-giving roles, their access to services and assets continues to be disproportionately low (Malhotra, 2004). Research has shown that women play a big role in the rearing of small livestock such as goats (Kindness, 1999; IFAD, 2006; Maphosa 2008; Kristjanson *et al.*, 2010) and that in HIV affected homes, goats are a good source of protein in the form of meat and milk. Since women are the main caregivers in HIV affected homes coupled with their participation in goat rearing, there should be increased attention given to women to improve goat production and ultimately goat marketing.

### 2.5.3 Low levels of management

Low goat productivity in communal areas can be attributed to minimal management. Poor housing exposes kids to predation and to unfavourable weather conditions. Poor housing negatively impacts on goat productivity particularly kids as they are vulnerable when exposed to extreme weather conditions (Gwaze, 2008; Sikosana, 2008). Foot rot is a common problem during the wet season when goats are housed in muddy or water-logged conditions and dry, well-ventilated housing has been proven to be highly effective in reducing deaths during the wet season (Sikosana, 2008).

Also, farmers in communal areas rarely offer pregnant and lactating does any form of supplements, despite the fact that rangelands offer feed such as leguminous trees as acacia pods and leaves (Kindness *et al*., 1999). These could be useful as protein supplements during the dry season to prevent metabolic disorders such as pregnancy toxaemia. Pregnancy

toxaemia is a metabolic disorder that affects does during the last period of gestation, occurring most frequently in twinning does (Rook, 2000). Pregnancy toxaemia is a condition characterised by mobilisation of body reserves to the growing foetuses by an undernourished pregnant doe (Chikwanda, 2004). It often results in high mortality rates and thus loss of productivity.

Sikosana (2008) discusses the importance of good breeding management in goats. Breeding in communal areas is uncontrolled which compromises planning for mating periods and as a result goats kid any time of the year. Under controlled mating, kidding could coincide with periods of better feed availability or planned supplementary feeding. Uncontrolled breeding makes it difficult to keep reproduction records and promotes inbreeding lowering growth rates (Gwaze *et al*., 2009).

Goats are normally seen as a source of meat, and are seldom dipped or vaccinated in communal areas (Bryson *et al*., 2002). This greatly increases mortality rates. For effective disease prevention and treatment, farmers' need access to information on farm-level disease management and they also need access to relevant support services (animal health care clinics) and inputs (vaccines, dipping, dosing and medical care). This will require increased investment in personnel, infrastructure, and input supply by Government or donor agencies (Sikosana, 2008).

### 2.5.4 Limited forage availability

In Zimbabwe, a large number of goats are kept in marginalised areas that receive low and erratic rainfall and the erratic climate and frequent droughts often result in dry season feed shortages and high mortalities (van Rooyen and Homann- Kee Tui, 2009). This compromises goat productivity as they lose body condition due to nutritional stresses. This is particularly

stressful to pregnant does resulting in low birth weights and sometimes abortions of kids. Most of the goats in the drier regions kid in the dry season and in the smallholder sector farmers can lose more than 50 per cent of goat kids born in a year (Sikosana *et al*., 2001). Reduction in nutrient supply adversely affects the body condition of the animals and this also has a long-term effect on the performance of the younger animals (Joshi *et al*., 2004). Kids that are born during the rainy season (from December to April), when feed quantity and quality is high, show good health and survivability (van Rooyen and Homann- Kee Tui, 2009). This suggests a link between nutritional status of the doe and kid mortality, which in turn affects goat productivity.

Alleviation of feed scarcities during the dry season would improve the livestock production and reduce mortalities, thus generating more income for farmers. Also livestock that are given supplementary feeding of a protein nature and are in good condition have been shown to be less affected by worms than livestock in poor condition (Vatta *et al*., 2003). The possible interventions in alleviating feed scarcities during the dry season can be increasing tree fodders, increasing fodder production, improved management of feed resources, improved utilization of feeds and providing external inputs (Joshi *et al*., 2004). The *Acacia* thornveld is the main feed resource for goats in the semi-arid areas of Zimbabwe (Mlambo *et al*., 2004). Collection of fruits during the wet season for use in the dry season may help provide a protein supplement for goats feeding on low quality roughage during this time (Mlambo *et al*., 2004). However caution must be taken in the quantities fed to the animals due to the presence of anti-nutritional factors (ANFs) that are found in most browse species.

### 2.6 Approaches used in livestock interventions

Various approaches have been used in livestock development projects worldwide. Some have taken the form of micro credit schemes, some aim to improve animal health and or

production while others aim to improve market availability. According to Simpkins (2005), there are no blue prints that exist when approaching livestock development interventions as the needs of target populations may vary in space and time. As a result such interventions must be of appropriate technologies, appropriate institutional arrangements, policies and human capabilities (Dolberg, 2001).

### 2.6.1 Microfinance schemes

Micro financial services provide small loans that may range from $50- $1000 to the poor (those earning less than $2 a day) (van Rooyen *et al*., 2012) and savings opportunities to those who have traditionally been excluded from commercial financial services (CBN, 2005; Nikkah and Redzuan, 2010). Known collectively as microfinance, these services include micro-credit, micro-savings, micro-insurance, and money transfers, and have been attributed with enabling micro-entrepreneurs to build businesses as well as improving the general economic wellbeing of the poor (van Rooyen *et al*., 2012).

Due to lack of collateral that is required by most financial institutions such as banks, poor populations are unable to access loans that may help them generate income. Micro credit is to cater for those borrowers who are unable to meet the stringent requirement by banks; of which the most notable requirement is collateral (Mishi and Kapingura, 2012). Poor communities possess the capacity to implement income-generating activities but the main limitation to their initiative is lack of access to capital (Oni, *et al*., 2010).

Micro credit schemes services are considered a key development tool, particularly for women who are the target of most micro credit programmes (Guérin, 2006; Nikkah and Redzuan, 2010). The Bangladesh country portfolio evaluation estimated 75% of all credit funds are taken up by women and 38% used for livestock as livestock activities can be treated as a complement to their activities around the homestead (Malhotra, 2004). Women often start by

investing in livestock and then move on to other profitable activities (Malhotra, 2004). However, micro credit is not easily accessed by women entrepreneurs' maybe due to prejudice or because of lack of knowledge or information (Malhotra 2004; Mishi and Kapingura 2012). As a result micro credit interventions by development organisations such as the International Fund for Agricultural Development (IFAD) in countries such as India and Bangladesh, encourage the participation of women to gain access to credit (Malhotra, 2004). IFAD methods of group lending and gender sensitisation have frequently produced very favourable results when combining credit for livestock (Malhotra, 2004).

In Zimbabwe NGOs such as AFRICARE and Natural Farming Network (NFN) are involved in microcredit schemes to resource poor farmers. Formal micro finance institutions have high interest rates that create an unending vicious debt cycle (Chavan *et al*., 2002; Nwosu *et al*., 2007). Therefore this type of intervention is not for the poorest, it may sometimes make the situation worse (Maholtra, 2004).

### 2.6.2 Market interventions

Improving markets through which livestock can be sold is yet another approach of livestock development interventions. In Zimbabwe, Non-Governmental Organisations such as the Netherlands Development Organisation (SNV) have introduced market driven interventions for small livestock such as goats through goat auctions. This has been implemented in areas where there are high goat populations that are spatially distributed but with poor marketing channels such as in Matebeleland. Before market interventions were introduced in Matebeleland, formal markets did not exist for goats, most farmers either sold their goats directly to butcheries or consumers (Homann *et al*., 2006). Providing favourable producer prices for goats also provided an incentive for goat farmers to increase goat production. The market intervention enhanced bargaining ability of the farmers and improved their ability to

sell as producer groups. There are challenges however that are associated with this type of intervention. These include the lack of carcass grading system for goats, unlike cattle that can be weighed and graded; there is no unit of measurement for goats. The intervention was implemented by SNV in partnership with relevant stakeholders such as local authorities and Agricultural Extension (AGRITEX) and the Rural District Council (RDC) in order to promote sustainability of the intervention within the community.

### 2.6.3 Pass-on schemes

Heifer International Nepal follows a Values-based Holistic Community Development (VBHCD) approach which is not just about distributing inputs but also building communities, producing deeper level impact and transformation (Mahato *et al*., 2009). Mahato *et al*., (2009) tells of a story of 50 women in Belsi village, Nepal, who organised themselves into two groups (Pravat and Prakash Women's group) to receive goats from Heifer International. Before receiving the goats they built goat shelters, planted grass and fodder and participated in trainings on goat management. They received 72 goats and 1 buck for breeding. The obligation to those who received the goats was to pass on the 'gift' which were the goats to another needy family following kidding. Income from the goats and group management training helped them to initiate monthly saving and credit schemes. Group saving opened the door for other income generating activities; and so began a pathway out of poverty. Through this approach, Heifer Nepal brought lasting social and economic empowerment in the lives of food insecure Nepal families (Mahato *et al*., 2009).

In Zimbabwe and throughout the African continent, small livestock pass on schemes have been implemented by Non-Governmental Organisations (NGOs) such as Action Against Hunger, Catholic Agency for Overseas Development (CAFOD), Farm Community Trust of Zimbabwe (FCTZ) and Heifer International whose major cornerstone of livestock restocking

activities is passing on the gift (Maposa, 2008). Some NGOs stipulate that two kids be passed-on by a beneficiary household to one other household (CAFOD), while other NGOs stipulate that the two offspring would go to two different households (FCTZ) (Ndengu and Sibanda, 2008). Action Against Hunger pass on schemes in Zimbabwe involve passing on the doe (s) to the next household in line to receive the goat (s) following kidding. The pass on process follows a pass on tree, which is a list of up to four beneficiaries waiting in line to receive the goats. The pass on tree was constructed by beneficiaries and Action Contre La Faim trainers.

### 2.6.4 Other approaches to livestock interventions in Zimbabwe

Some development organisations may distribute goats with no stipulations that the offspring or doe be passed on to another community member. This is called direct distribution. This approach has been used in various communal areas in Zimbabwe by Catholic Agency for Overseas Development (CAFOD), International Development Enterprise (IDE) and World Vision International (WVI) under the Protracted Relief Program (PRP) of the Development Fund for International Development (DFID) (Ndengu and Sibanda, 2008). Goats can also be distributed through livestock fairs. Development organisations such as the Catholic Relief Services (CRS) have conducted livestock fairs involving goats. The fairs are carried out by buying goats from local members of the community and distributing them to those identified as vulnerable. The advantage of this is that goat farmers fetch favourable prices for their goats, thereby acting as a market; and the goats are redistributed locally in the area they are already acclimatised to.

Other small livestock interventions include dip tank rehabilitation. This work has been carried out by World Vision International (WVI) in Insiza districts Matebeleland (Ndengu and Sibanda, 2008).

Other prospects for goat interventions include improving goat breeds. This is known as the Goat Open Nucleus Breeding Scheme (GONBS). This involves a group of small scale goat producers agreeing to pool their high performing animals; the larger the group of animals the more successful the program due to a wider genetic pool (Assan, 2011).

## 2.7 Methods used in evaluating livestock development interventions

In recent years, there have been increasing demands to measure the effectiveness of international development projects largely due to concerns that development agencies report their outputs rather than outcomes and the need to show the results of the channelled resources in the lives of target populations (Bamberger *et al*., 2010). Governments, donors and other practitioners in the development community are keen to determine the effectiveness of programs with far reaching goals such as lowering poverty (Khandker *et al*., 2010).

Qualitative methods of collecting data such as key informant interviews, focus group discussions and tape recording of interviews as well as quantitative methods of collecting data such as questionnaire administration and collecting of records are used to collect information that is used in the monitoring and or evaluation of development projects. Evaluations tell us how well a project worked while monitoring is done as the project is on-going, allowing the project to learn by doing and to adjust design to ground-level realities (Bamberger *et al*., 2010).

### 2.7.1 Monitoring and Evaluation

Khandker *et al*., (2010) discussed the difference between monitoring and evaluation. A monitoring system involves setting goals, indicators and targets for programs; the resulting information can then be used to evaluate the performance of program interventions. By

comparing program outcomes with specific targets, monitoring can help improve policy design and implementation as well as promote accountability and dialogue among policy makers and stakeholders. In contrast, evaluation is a systematic and objective assessment of the results achieved by a program. Often, monitoring and evaluation are used together and are commonly known as M and E. M and E can include process evaluation, which examines how programs operate and focuses on problems of service delivery. Cost-benefit analyses, which compare program costs against the benefits they deliver and impact evaluations, are usually done by the implementing agency (Khandker *et al*., 2010).

There are different types of evaluation that can be employed to evaluate development interventions. This project utilised both monitoring and evaluation, although more emphasis was placed on evaluating the impact of the project on the study population and area.

### 2.7.2 Types of evaluations used in development interventions

Evaluations provide Government agencies, NGOs and any interested parties with feedback on implemented policies, programs or projects (Morra Imas and Rist, 2009). This helps to inform the implementation of future interventions.

#### *2.7.2.1Operational evaluation*

Operational evaluation examines how effectively programs were implemented and whether there are gaps between planned and realized outcomes and to identify lessons to be learned for future project design and implementation (Khandker *et al*., 2010). Operational evaluations are also known as formative evaluations (Morra Imas and Rist, 2009). Formative evaluations focus on project, program and policy implementation and improvement (Morra Imas and Rist, 2009). This kind of evaluation can be based on interviews with program beneficiaries and with officials responsible for implementation (Khandker *et al*., 2010). Such evaluations,

however, have a systematic positive bias (Bamberger *et al.*, 2010) because the short period that consultants are in the field frequently means that only project beneficiaries and agencies directly involved in project implementation are interviewed and most of these tend to have a favourable impression of the project (as they are the people who have benefited directly) (Bamberger 2009).

#### *2.7.2.2 Impact evaluation*

Impact or summative evaluation studies have to do with whether or not the changes in the well-being are indeed due to the program intervention and not due to other factors and is usually carried out at the end of the project (Khandker *et al*., 2010; Morra Imas and Rist, 2009). To determine whether or not impact is due to the program intervention, a counterfactual is required. A counterfactual is what might have happened to participants was it not for the project (Morgan and Winship 2007); a comparison between what actually happened and what would have happened in the absence of the intervention (White, 2006). This involves selecting a control group with which certain indicators can be compared. The problem of using a counterfactual is, however that, it leads to bias (Khandker *et al*., 2010; Morra Imas and Rist, 2009; White, 2006). Bias may arise from selecting the counterfactual; for example, because communities are not homogeneous, it may be difficult to find participants who might have had similar conditions to those that were under the intervention. This leads to bias in the comparison results obtained.

Impact evaluations are therefore time and resource extensive and should be applied selectively. They should be used when the program intervention is innovative and of strategic importance and when the exercise contributes to what works and what does not for example when carrying out pilot programs that may be implemented on a large scale in the future

(Khandker *et al*., 2010). Impact evaluations enable decision making regarding continuity, replicating, scaling up or ending a given project (Morra Imas and Rist, 2009).

### 2.7.3 Methods of collecting data for evaluations used in development interventions

Qualitative (informal) and quantitative (formal) methods of collecting data can be used to gather information for evaluation of livestock development projects. Informal methods are based on semi- structured or unstructured interviews, participant observation, or on visualisation to stimulate an active role of the people involved in the intervention such as in Participatory Rural Appraisal (PRA) (Hawkins, 2009). Rapid Rural Appraisal (RRA) is also a qualitative method of collecting data and it involves a quick assessment of the needs and conditions of the target group (Bergeron, 1999). Qualitative methods are called informal because of the absence of any formal protocol for the collection of the information (Hawkins, 2009). Qualitative methods of collecting data may also involve video and tape recording of participant interviews as well as focus group discussions (Khandker *et al*., 2010).

Quantitative methods of collecting data refer to survey based methods based on some form of random sampling and standardised questionnaires measuring the same type of information for all units in the sample (Hawkins, 2009). This combination allows extrapolation or inference of the results to the population from which the sample was drawn (Hawkins, 2009).

Used together, qualitative and quantitative methods are known as mixed methods of collecting data (Bamberger *et al*., 2010; Khandker *et al*., 2010). Mixed methods may be useful in gaining a comprehensive view of an intervention's effectiveness, as often qualitative information such as understanding the socio-cultural and institutional context as well as intervention and participant details is essential to making a sound quantitative assessment.

## 2.8 Analytical framework

Kristjanson *et al*., (2010) hypothesised that there are three pathways that livestock can be used as a vehicle out of poverty. The three pathways are that interventions must assist in: securing current and future assets, that is the livestock, sustaining and improving the productivity in which livestock are important and, facilitating the participation of the poor in livestock related markets. While these pathways are distinct, each requiring its own set of strategies, developers must attend to all three pathways if they hope to sustain and optimise development of livestock-based enterprises Kristjanson *et al*., (2010).

This study employed this framework to evaluate the effectiveness of the ACF goat pass on scheme. The figure below is an illustration of the analytical framework:

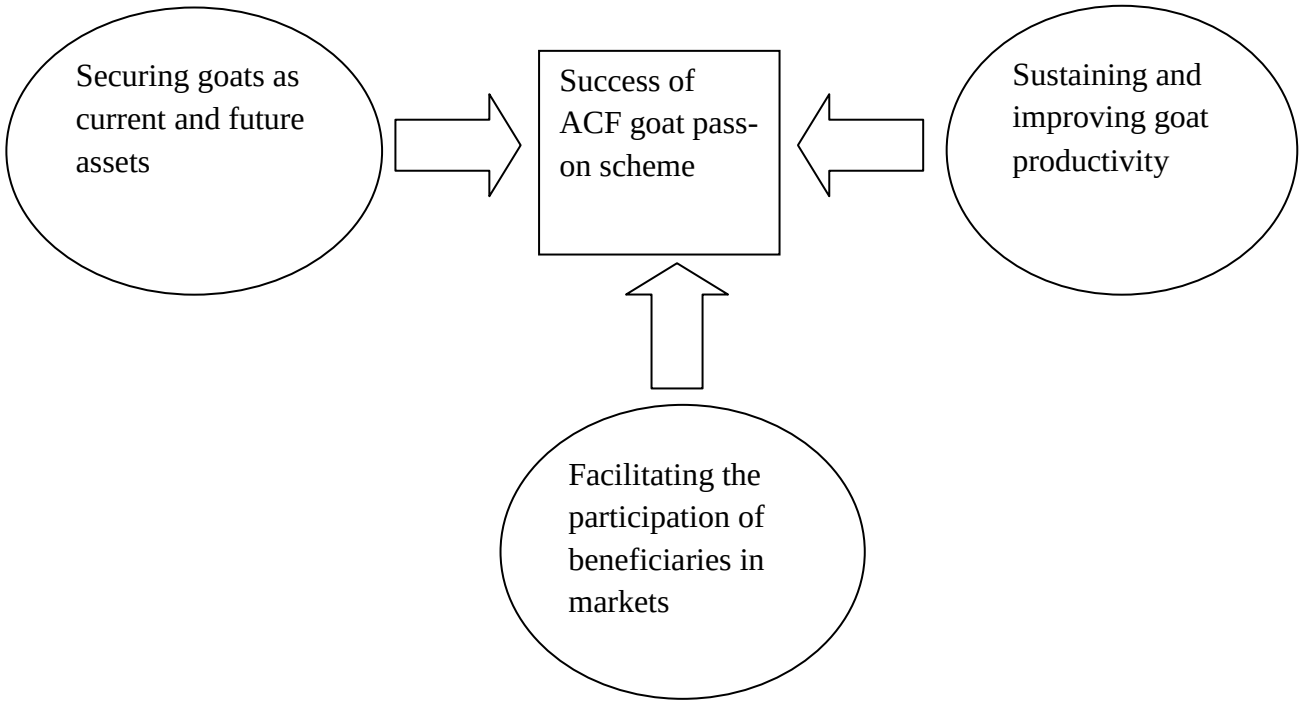


*Figure 2.2 Analytical framework for study*

According to the analytical framework, the success of the ACF goat pass-on scheme depends on goat distribution, sustaining and improving goat productivity and improving markets.

## 2.9 Conclusion

Despite the potential of goats to alleviate food insecurity in communal areas, goat production in these areas faces constraints. These could include high disease and parasite prevalence, poor markets, low forage availability and low levels of management. While there are no hard and fast ways to approach livestock interventions, to improve livestock production, livestock developers must provide ways of overcoming the constraints that communal goat farmers face when rearing goats. They should also be gender sensitive and increase the participation of women in their interventions as women hold the potential to end rural poverty through livestock production.

Evaluations of livestock development interventions assist in ensuring that resources are being channelled effectively and the information obtained can be used to inform future interventions.

# CHAPTER THREE

## 3 Methodology

### 3.1 Study site

This project was carried out in Musikavanhu and Mutema communal lands of Chipinge district located in the South Eastern lowveld of Zimbabwe 20$^{o}$ 12’ S and 32$^{o}$ 37’ E. The villages that made up the study area are shown as triangles in Figure 3.1 below:

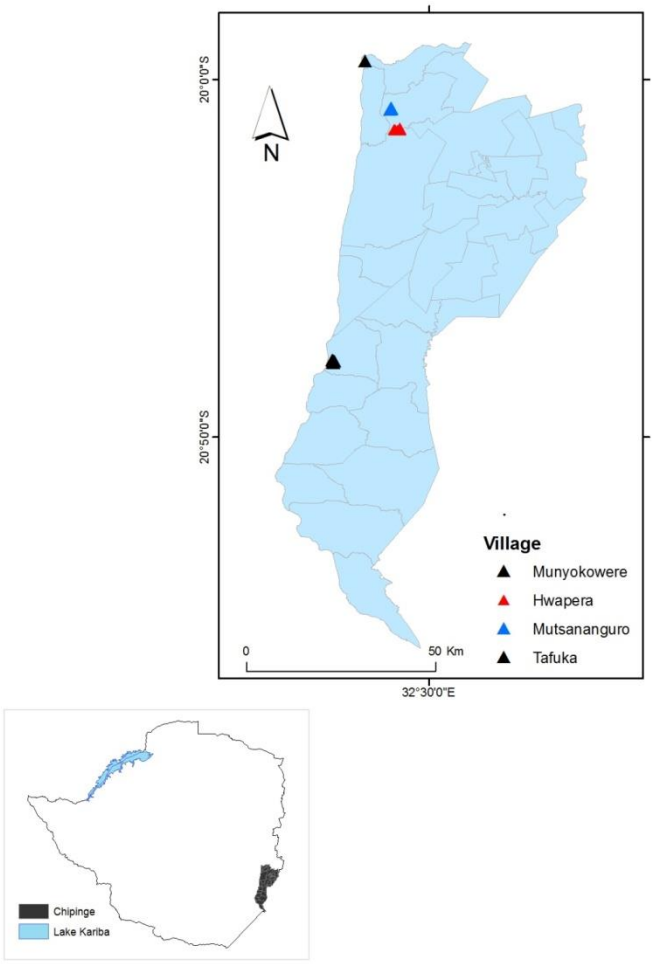


*Figure 3.1 Map showing study area*

The study area lies in agro-ecological regions IV (seasonal droughts and 450–600 mm average annual rainfall) and V (very erratic and less than 500 mm average annual

rainfall).

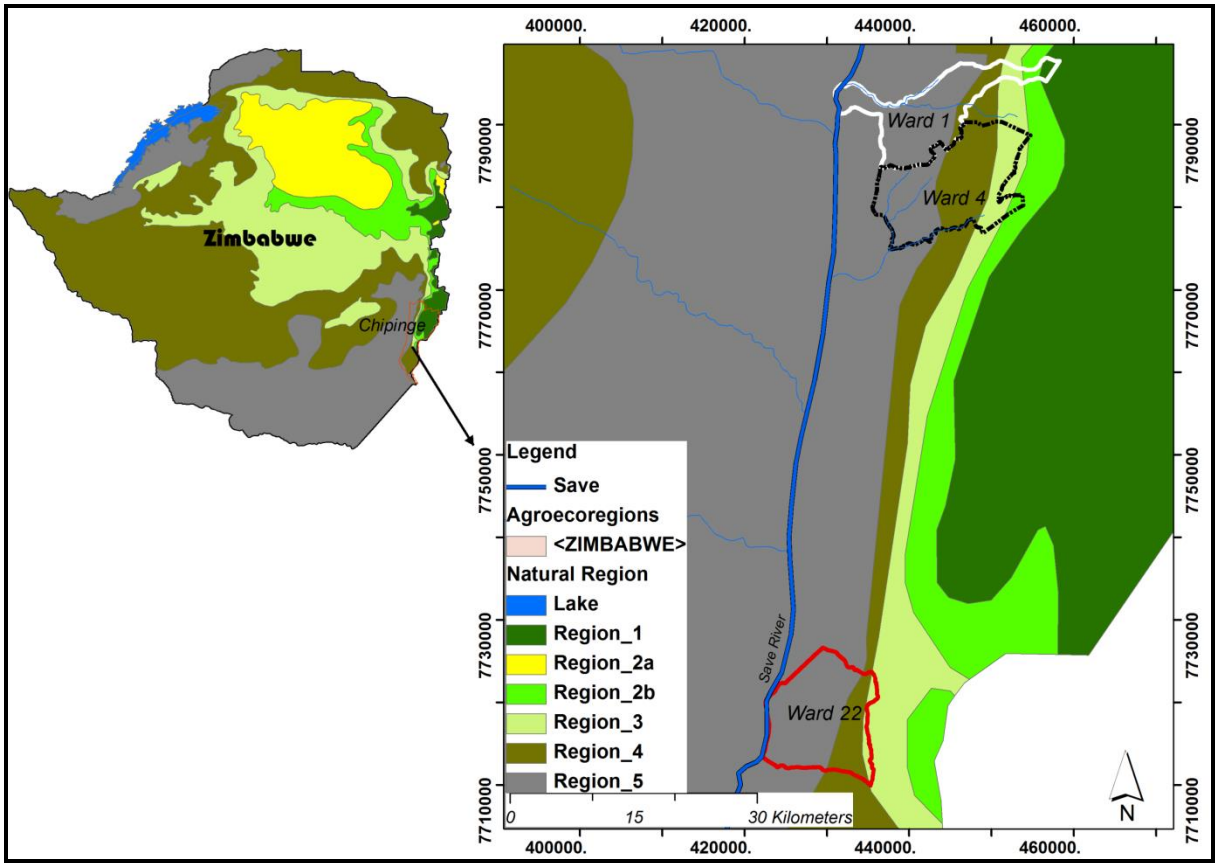


*Figure 3.2 Map showing agro-ecological regions in the study area*

Farming in these areas is based on mixed crop and livestock systems; however due to frequent droughts, the rainfall is insufficient for crop production (Rukuni and Eicher, 2006), resulting in cropping being a risky enterprise in these areas.

The study area is characterised by *Aristida-Dactyloctenium-Eragrostis* grassveld. It occurs in low lying areas below 600 m above sea level where annual rainfall ranges between 300 mm and 600 mm. This is sweetveld mainly in woodland or bush scrub savanna with mainly sparse short annual grasses. It has a grazing capacity of 1 LU: 12–20 ha. Common grasses are *Aristida adscensionis, Eragrostis viscosa, Dactyloctenium giganteum, Chloris virgata* and on deeper soils with more moisture *Urochloa* spp., *Panicum* spp., *Cenchrus ciliaris* and *Digitaria* species. Associated woody species are *Combretum celestroides, Adansonia*

*digitata*, *Commiphora* spp., *Schrebera* spp. and *Colophospermum mopane*. This woodland type is extremely sensitive to overgrazing leading to large areas of bare ground when overgrazed. Annual species increase in abundance in overgrazed veld. This is described by Rattray, 1957.

### 3.2 Description of ACF goat intervention

In Chipinge district, ACF selected 2000 households for their Livelihoods for Improved Nutrition (LIFIN) project which commenced in January 2010 and ended December 2012. The selection was based on vulnerability to food insecurity. The LIFIN project comprised of a goat pass-on scheme, where approximately 1200 goats were distributed, and a conservation agriculture component. This project was carried out in partnership with relevant stakeholders such as the Department of Livestock and Veterinary Services, Agritex and community chiefs and leaders. A goat pass-on scheme, which involved passing on 2 does 5 months after kidding, was put in place and implemented for the duration of the project. The pass-on intervention stipulated that each beneficiary was required to pass on two of the original does distributed by ACF to the next beneficiary in line. The pass on scheme followed a pass-on tree which was constructed by the beneficiaries and ACF trainers (Figure 3.3). The pass-on tree had 3 groups of beneficiaries. The first group consisted of the least vulnerable beneficiaries; these were the first recipients of the does. The second group consisted of those who were moderately vulnerable; these were the second recipients of the does whilst the third and last group had the most vulnerable beneficiaries and these were the last recipients in the goat pass-on process. This was done with the assumption that those who were the least vulnerable, previously owned goats and had knowledge on goat rearing, thus the goats had higher chances of survival with the first recipients of the pass-on scheme. Beneficiaries were trained on goat husbandry and in each village, a Community Animal Health Worker (CAHW)

was selected by the community based on knowledge on goat husbandry and reliability as they had to visit beneficiaries regularly and also collect contributions on veterinary care. Training of beneficiaires was done on a quarterly basis and training was on goat health, breeding, kid management, nutrition and housing. Community Animal Health Workers were trained three times during the first year on general goat management and disease identification.

### 3.3 Sampling method

The LIFIN project covered wards 1, 4 and 22 of Musikavanhu and Mutema communal lands. In each ward, two villages were selected randomly. In each village, 12 beneficiaries were selected through systematic sampling which involved selecting every fifth beneficiary from a randomised list of beneficiaries under the intervention. Due to the pass-on tree as shown in Figure 3.3 below, the total beneficiaries per village were 36. The total beneficiaries per ward were 72. Systematic sampling is simple and useful in complex sampling situations but can be tedious and time consuming with large populations especially when done manually (Rossi *et al*., 2013).

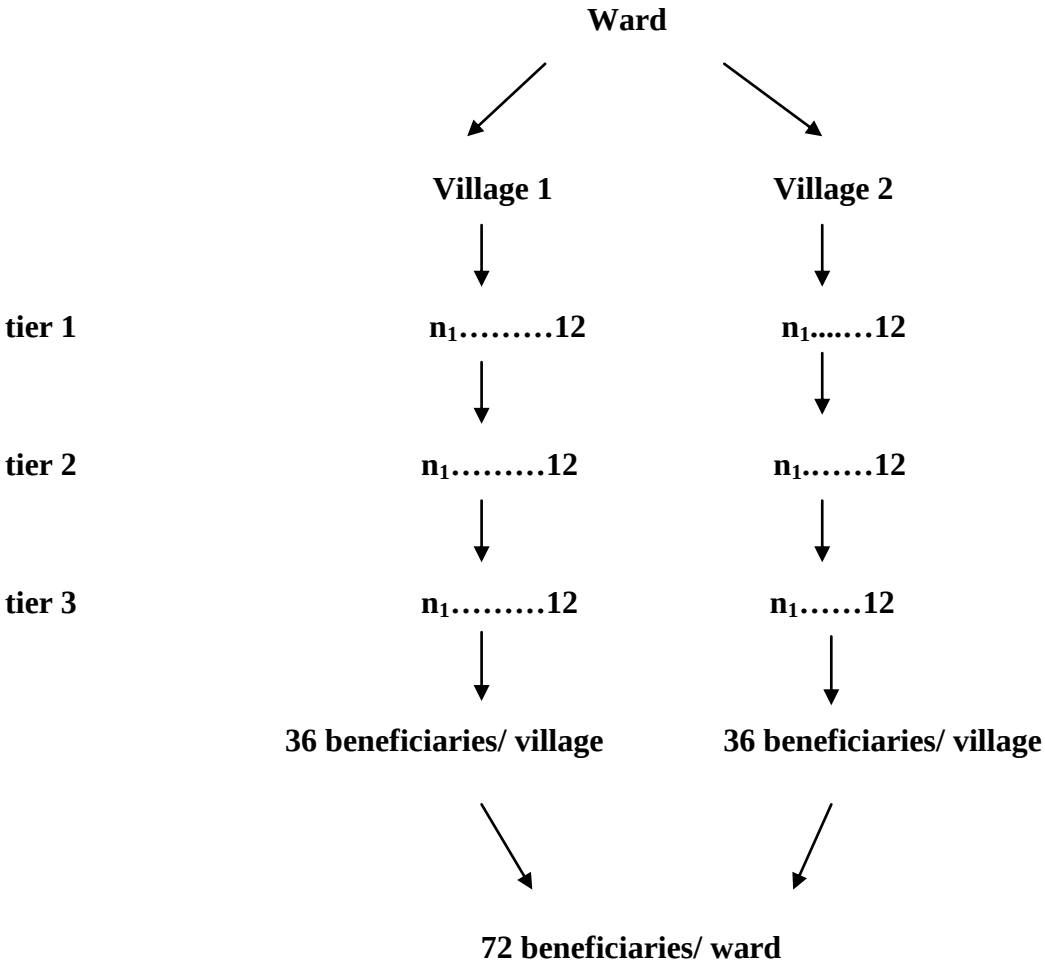


*Figure 3.3 Illustration of population sample and pass-on tree*

### 3.4 Data collection and analysis

A questionnaire survey was administered to 92 of the 216 beneficiaries under the study population. Only 92 beneficiaries were used for the questionnaire survey as some beneficiaries were located in accessible areas in the study area. The questionnaire survey aimed at collecting information on household demography, wealth status, flock structure and perceptions of beneficiaries on the ACF goat pass-on scheme. Key informant interviews were held with other NGOs (n=4) which included AFRICARE, the Netherlands Development Organisation (SNV), Catholic Relief Services (CRS) and Natural Farming Network (NFN) , ACF trainers (n=6) and AGRITEX officers (n=6). The questionnaire survey and key informant interviews generated mostly qualitative data that was summarised into frequencies in the Statistical Package for Social Sciences (SPSS) version 21. To corroborate the data collected from the questionnaires, informal interviews were carried out with project stakeholders and beneficiaries on occasions such as field days where the community would be gathered. Three focus group discussions with beneficiaries and AGRITEX officers were also carried out in each ward to substantiate the information gathered from the questionnaire survey. Data on feed management was also gathered from the focus group discussions.

The questionnaire survey also gathered information on goat mortality, goat productivity and goat management before and after the intervention. Comparison of means of management practices and productivity indices before and after the intervention was carried out using the T test in SPSS version 21 determine the impact of the ACF goat production intervention on goat management and goat productivity in the study area. Analysis of variance was used to analyse the changes in goat numbers amongst the tiers of the pass-on scheme. Goat productivity data was also collected from beneficiaries under the study population as the project was ongoing. This data was collected at field visits that were up to four times a year

and was used to compare with the initial productivity figures obtained from the questionnaire survey. This data made up mostly the quantitative aspects of the study.

Mixed methods of data collection described by (Bamberger *et al*., 2010) were therefore used for data collection for this study.

Data on goat predation was collected using Etrex Geographic Positioning System (GPS) device. This was used to record coordinates of the sites where beneficiaries said to have lost their goats. These were then analysed in Integrated Land and Water Information System (ILWIS). Overlay analyses were done with vegetation maps to determine whether predation was as a result of vegetation cover that allowed predators to sneak up on their prey whilst feeding.

### 3.4.1 Impact estimation

To determine whether or not impact is due to the program intervention or other factors, a counterfactual is required (Morgan and Winship, 2007). This involves selecting a control group with which to compare certain indicators in this case goat management and productivity. It was not possible however for this study to select a control group from neighbouring villages that were not under the intervention as they were not forthcoming with the information that was required. Transportation to wards that were not under the intervention was also a challenge and hindered the selection of a control group. This was the major limitation of this study. Impact of the ACF goat intervention on goat management and productivity was therefore estimated by comparing management practices and productivity before and after the intervention. This data was collected by means of a questionnaire.

# CHAPTER FOUR

## 4 The effectiveness of the implementation of the ACF goat production intervention

### 4 .1 Introduction

Worldwide, goats and other small ruminants are among the most popular and beneficial livestock for resource poor farmers (Devendra, 2006). Food security interventions involving livestock, particularly small livestock such as goats, have become popular in Zimbabwe and across the African continent because of the benefits of livestock amongst smallholder farmers. In the drier zones of Zimbabwe, crop production contributes to only a limited proportion of the total household income (Ndengu *et al*., 2008). Food security can be promoted through livestock interventions using micro livestock such as chickens and goats (Dolberg, 2001; Ndengu *et al*., 2008).

Goat numbers are steadily increasing in most Southern African Development Community (SADC) countries most probably because of their high intrinsic rate of increase, adaptability to various habitats and their relatively low purchasing prices compared to cattle (van Rooyen and Homann, 2009). Many goat restocking programs have been initiated in Zimbabwe mainly to sustain nutrition and income (Maposa, 2008). Goats are specially selected because they are hardy and adapt to a wide range of natural environments (Maposa, 2008). Livestock production plays an important role as a source of cash income and insurance, especially for poor households in drought-prone areas. Through cash from livestock products farmers alleviate seasonal food availability, thus enhancing their own food security (Homann and van Rooyen, 2007).

There are various approaches to livestock food security interventions; these range from simple livestock distributions to microcredit schemes to pass-on schemes (CRS, 2011; ACF,

2010; ARICARE, 2011). While various methods have been devised to assess the effectiveness of livestock interventions by Rushton, (2010), and Lemba (2009) which involve using a counterfactual group, little is known about the effectiveness of livestock interventions from the point of view of the recipients and stakeholders. The purpose of this study was to assess the perceptions of the various stakeholders that were involved in the project on the effectiveness of the ACF goat production intervention implemented in Chipinge district.

### 4.2 Material and methods

The Rapid Appraisal of Agricultural Knowledge Systems (RAAKS) approach by Engel and Salomon (1997) was used to determine the perceptions of the effectiveness of the ACF goat intervention by various stakeholders of the project. This approach involves looking at a development issue from the different perspectives of the various stakeholders involved (Hawkins, 2009). Key informant interviews were used to capture stakeholder's perceptions on the key aspects of the goat pass-on scheme which included training, animal health management, participation of stakeholders and goat productivity and interpreted using a Likert scale. The Likert scale developed by Likert (1932) measures participants' attitudes by using an attitude scale with five response alternatives: (1) strongly agree, (2) agree, (3) undecided, (4) disagree and (5) strongly disagree (Boone *et al*., 2012).

Quantitative analyses of goat dynamics were carried out to corroborate the findings from the survey on perceptions. Data on the pass-on tree was collected from all 216 beneficiaries under the study population.

#### 4.2.1 Data collection

A questionnaire was administered to 92 beneficiaries under the study population. The questions that were asked included their perceptions on the implementation of the project,

their expectations from ACF and from the intervention and the outcome (s) of the intervention over the duration of the project. Information on goat numbers before and after the intervention was also extracted from the questionnaire.

Key informant interviews were conducted with project stakeholders that included the local AGRITEX officers (n=6), Community Animal Health Workers (n=6), ACF trainers (n=6) and other NGOs (n=4) to determine their perceptions on the effectiveness of the ACF goat intervention.

### 4.2.2 Statistical Analysis

Frequencies of responses from the stakeholders were calculated using the Statistical Package for Social Sciences (SPSS) version 21. The generated responses from stakeholders were then interpreted using a Likert scale. The Chi square test of association was used to determine associations between perceptions and key informants. The significance level used was ($P$<0.05).

A T test was used to compare means of goat numbers before and after the intervention.

## 4.3 Results

### 4.3.1 Perceptions of stakeholders on the effectiveness of the ACF goat pass on scheme

The perceptions of the various ACF project stakeholders on the effectiveness of the ACF goat pass-on scheme are shown in Table 4.1

**Table 4.1 Perceptions of stakeholders on the effectiveness of the ACF goat pass-on scheme**

| Key aspects | Stakeholders | | | | | |
|---|---|---|---|---|---|---|
| | AGRITEX | ACF trainers | CAHWs | NGOs | Beneficiaries | Chi-square SL |
| Training of benefiaries on goat management was effective | SA | SA | SA | SA | SA | NS |
| Animal health management was effective | A | SA | A | A | A | * |
| Project design was effective | A | A | A | U | U | * |
| Pass-on scheme increased goat numbers | A | A | A | A | A | NS |
| Goat breed distributed was widely accepted | A | A | U | A | U | * |

Scale

SA -Strongly agree, A- Agree, U- Undecided, D- Disagree SD- Strongly disagree

SL- significance level; NS: not significant ($P$>0.05); * significant difference ($P$<0.05)

While all project stakeholders agreed that the pass-on scheme increased goat numbers in the study area and training of beneficiaries on animal health management was effective there were significant differences in the perceptions on animal health management, the goat breed that was distributed and project design. Project design included the element of the total

number of beneficiaries under the goat pass- on scheme, passing on of goats, the inclusion of stakeholders in the decision making of the project, the requirement of one United States dollar contribution by each beneficiary per month towards animal health care and the implementation of the goat pass-on scheme as a package with Conservation agriculture. Project design also included the goat constitution which was a set of rules and regulations that each member of the goat pass-on intervention was expected to abide by.

### *4.3.2 Goat population before and after the ACF intervention*

The means of goat numbers before and after the ACF goat intervention are shown in Table 4.2.

**Table 4.2 Mean of goat numbers before and after the ACF goat intervention**

Table 4.2 shows the means of goat numbers before and after the ACF intervention.

| | mature buck | kid buck | mature doe | kid doe |
|---|---|---|---|---|
| mean ± s.d before intervention | 0.53±1.10 | 0.43±0.74 | 1.52±1.86 | 0.52±0.87 |
| mean ± s.d after intervention | 0.48±1.16 | 0.53±0.85 | 2.04±2.03 | 0.67±0.93 |
| T test SL | NS | NS | * | * |

SL: Significance level; NS: not significant ($P>0.05$); * significant difference ($P<0.05$)

There was a significant difference in the numbers of kid does and mature does before and after the goat pass-on scheme ($P<0.05$). There were no significant differences however in the numbers of kid buck and mature buck before and after the goat pass-on scheme.

### *4.3.3 Tiers and goat numbers*

There was a general trend of increase in goat numbers across all tiers (Table 4.3 and Table 4.4).

**Table 4.3 Means of goat numbers in different tiers before the ACF intervention**

| | mature buck<br>mean±s.d | kid buck<br>mean±s.d | mature doe<br>mean±s.d | kid doe<br>mean±s.d |
|---|---|---|---|---|
| Tier 1 n=52 | 0.67±1.18 | 0.46±0.77 | 1.60±1.86 | 0.42±0.75 |
| Tier 2 n=20 | 0.40±1.14 | 0.45±0.75 | 1.35±1.56 | 0.60±0.88 |
| Tier 3 n=20 | 0.30±0.80 | 0.35±0.67 | 1.50±2.21 | 0.70±1.12 |
| F test | | | | |
| SL | NS | NS | NS | NS |

SL: Significance level; NS: not significant ($P>0.05$); * significant difference ($P<0.05$)

There were no significant differences in goat numbers across the tiers before the intervention.

**Table 4.4 Means of goat numbers in different tiers after the ACF intervention**

| | mature buck<br>mean±s.d | kid buck<br>mean±s.d | mature doe<br>mean±s.d | kid doe<br>mean±s.d |
|---|---|---|---|---|
| Tier 1 n=52 | 0.63±1.32 | 0.65±0.92 | 2.48±2.06 | 0.65±0.86 |
| Tier 2 n=20 | 0.35±1.13 | 0.50±0.88 | 1.45±1.50 | 0.65±0.98 |
| Tier 3 n=20 | 0.20±0.52 | 0.25±0.55 | 1.50±2.21 | 0.75±1.11 |
| F test | | | | |
| SL | NS | NS | NS | NS |

While there was an increase in does as shown in table 4.2 there were no significant differences in goat numbers across the tiers after the intervention.

## 4.4 Discussion

The ACF goat production intervention was well received by all stakeholders because they were included in the project design and implementation. It is important for sustainability purposes that goat-keepers themselves assess the existing situation and they actively participate in defining their problems and developing realistic solutions (Peacock *et al*., 2005). Beneficiaries found the training they received from ACF trainers on goat rearing useful as well as the selection of Community Animal Health Workers (CAHWs) in each village. This may have been due to the lack of extension services in the area. Extension services have proven to be ineffective in delivering animal health services in Zimbabwe (Mutambara *et al*., 2013). Community Animal Health Workers on the other hand are readily available, cheap and offer multiple services such as record keeping (Ahuya *et al*., 2005). While beneficiaries felt that the monthly contributions of a dollar per member of the intervention were beyond the reach of many, Morand Fehr *et al*., (2004) state that strategies for improving goat farming involve farmers being aware that their decisions on the flock affect their standard of living and socio-economic status and that the future fate is in their hands.

All stakeholders agreed that passing on goats amongst beneficiaries assisted in involving a larger group of community members and developing a sense of ownership of the project amongst the beneficiaries. Passing on goats helps communities to manage resources for themselves (de Vries, 2008), thus promoting sustainability of such projects. Beneficiaries also preferred to pass-on the offspring as opposed to does although they had initially agreed in the goat constitution to pass on the does. This was because the first recipients felt they had invested more time and effort in the new goats as some were sickly and needed increased

attention. Heifer International follows a similar approach of encouraging beneficiaries to pass-on offspring to the next member of the community in need (de Vries, 2008; Mahato *et al*., 2009).

There was a significant increase in the number of does and kid does in the study area. The increase in the overall number of does compared to buck may have been due to the distribution of does for the pass-on scheme. There were high mortality rates of buck in the first year of the project this may have led to the decline in their numbers. Training of beneficiaries on improved animal health care may have equipped beneficiaries with knowledge on goat husbandry particularly for those that were in the third tier that did not previously own goats. In addition, the initial distribution of goats to those who previously owned goats in tier one, may have given an opportunity to those in subsequent tiers an opportunity to watch and learn thus improving the success rate of the pass-on scheme. There were no significant differences however in goat numbers across the tiers in the study population. This could have been as a result of the short duration of the project; goat numbers had only started to increase as the project was ending.

While some stakeholders were of the opinion that the conservation agriculture and goat components should have been split for optimal resource use, de Vries (2008) states that goat development strategies should provide options for activity diversification as this can reduce vulnerability. In Tanzania, combining goat rearing and intensive vegetable production raised farmer income from about $125 to $540-720 per year (de Vries, 2008).

Some Non-Governmental Organisations mentioned that the beneficiary population of 2000 was too large. The success of a dairy goat project in Kenya was attributed to, amongst other things, reasonable and manageable groups of 25 people (Peacock *et al*., 2011). This enabled the implementing team to focus on issues that were relevant to the respective areas and

therefore optimally use the resources available within the targeted districts (Peacock *et al*., 2011).

Beneficiaries and Community Animal Health Workers were undecided on the goat breed that was distributed for the pass-on scheme. They preferred the Matebele goat due to its perceived superior genetic qualities compared to their local breed, the Small East African goat. A survey by Kosgey *et* al., (2006) revealed that small holder farmers in Kenya considered the Small East African goat to be significantly smaller and to have poorer fertility and prolificacy compared to other pure breeds. Genetic improvement programmes are necessary to increase and sustain productivity of indigenous goats (Kosgey *et al*., 2005) and to improve the lives of some of the poorest farmers (Peacock *et al*., 2010).

### 4.5 Conclusion and Recommendations

Overall, the ACF goat production intervention was a success as all stakeholders agreed that the intervention had been successful in training beneficiaries on improved goat health and management as well as in increasing goat numbers through passing on of goats. Inclusion of stakeholders and participation of beneficiaries as a group in decision making and Community Based Animal Health Care were also said to have contributed to the overall effectiveness of the intervention. Breed improvement interventions are recommended for future interventions. It is also recommended that a follow up study be carried out to determine if goat numbers have continued to change in the study area since 2012 and if it is as a result of the ACF goat intervention. A control group would be required for these purposes.

# CHAPTER FIVE

## 5 Goat diseases and effectiveness of community based animal health care

### 5.1 Introduction

Strategies for improving goat production by development agencies in communal areas must take into account the constraints to goat farming for the communal farmer and provide long lasting solutions to overcome them. Disease and parasite prevalence as well as lack of extension services are amongst the major constraints to goat production in communal areas (de Vries, 2008; Gwaze, 2008; Mutambara *et al*., 2013). In Zimbabwe and other developing countries, traditional veterinary and animal production services cannot be provided cost-effectively to livestock farmers in villages due to financial constraints and scarcity of resources (Mutambara *et al*., 2013; Alexandre *et al*., 2005). In addition, Non-Governmental Organisations are aware that it is insufficient to give one or several young female goats, but that it is necessary to provide transfer of technology and an organisation of goat rearing (Morand-Fehr, *et al*., 2004). This has led to the concept of Community Based Animal Health Care (CBAHC) in communal areas. A group approach is necessary to overcome many of the constraints communal farmers face and NGOs can be instrumental in the formation of groups; helping them to develop rules or by-laws, capacity building through training leaders, developing accounting and reporting systems, and in networking them with other groups (de Vries, 2008).The ACF goat production intervention involved members of the community electing two Community Animal Health Workers (CAHW) for each village. Community Animal Health Workers provide first line help when there is a problem, constantly reinforce good husbandry practices, share information from farmer to farmer, and provide a bridge between the group and the local authorities and experts (de Vries, 2008).

The duties of the CAHW were to oversee the general health of goats under the intervention, purchase drugs from community contributions of one United States dollar per month, vaccinate and dose sick goats and to record births and deaths. The CAHW together with the community members under the intervention were trained by ACF field trainers on improved goat rearing practices and CAHW were given a veterinary kit to start off with that had vaccines and dosing medicines. The purpose of this study was to evaluate the effectiveness of CBAHC in the study area by using mortality as an indicator of success or failure. This was done on the assumption that improved goat rearing practices with the aid of Community Animal Health Workers would lead to reduced mortalities.

## 5.2 Material and methods

A questionnaire survey was administered to 92 out of 216 beneficiaries under the study population to determine diseases in the study area. The 92 beneficiaries were selected on the basis of accessibility to their homesteads. Faecal egg counts were carried out on under the intervention to determine gastrointestinal parasites in study area. Records of mortalities of all goats under the intervention were collected from ACF trainers.

### *5.2.1 Data collection*

In addition to the questionnaire survey, data on the major diseases in the study area and the possible drivers of their transmission was collected through focus group discussions with beneficiaries and through observation. Samples of ticks were collected underneath the tails of 30 goats under the intervention and were preserved in 10% formalin for identification at the Faculty of Veterinary Science, Department of Paraclinical Veterinary studies, University of Zimbabwe.

Faecal samples were collected from 30 goats under one year in June 2012 to identify internal parasites. Samples were placed in individually labelled airtight containers, preserved in 10% formalin and stored in a cooler box. Fecal egg counts were done from one to two weeks after collection at the Faculty of Veterinary Science, University of Zimbabwe using the Modified McMaster method. The faecal samples were mixed in15 ml of 100% sodium hydrochloride solution and crushed using a mortar and pestle. The mixture of water and faecal sample was strained using a tea strainer to remove the debris and remaining faecal particles. Identification of internal parasites was done by viewing the resulting mixture on a McMaster slide under a microscope.

Records of kiddings and mortalities of goats owned by beneficiaries under the study population were collected at field visits and from records of all goats under the intervention obtained from ACF trainers. The effectiveness of Community Based Animal Health Care was computed by comparing goat mortalities before and after the intervention. While this method of assessing Community Based Animal Health Care was not robust, mortality was the indicator chosen to assess CBAHC as this was the reason the Community Animal Health Workers were put in place.

### *5.2.2 Statistical Analysis*

Questionnaire data was analysed using Statistical Package for Social Sciences version 21 to obtain frequencies of the responses. Chi square test of association was used to determine if there was an association between disease and ward and between gastrointestinal parasites and ward. Records on goat mortality for the years 2011 and 2012 and faecal egg counts were analysed for significant differences using ANOVA in GenStat version 14 .

## 5.3 Results

### *5.3.1 Identified diseases*

Table 5.1 below shows the major diseases in the study area and the possible drivers of their transmission. The major diseases according to farmers' perceptions in the study area were reported to be heartwater, kid scouring, coughing, orf and cataracts.

**Table 5.1 Major diseases reported in the study area and the possible drivers of their transmission**

| Disease | Possible drivers of its transmission |
|---|---|
| Heartwater also locally known as 'chibhasikoro' | lack of dipping, 71% of beneficiaries do not dip their goats<br><br>delay in distribution may have caused spread of ticks in the pens where goats were being kept<br><br>proximity of the study area to game reserves, see Figure 5.1 below |
| Kid scouring | poor kid management, while 30% of beneficiaries dose their goats, 55% reported that they dose when the goat is sick |
| Coughing | poor housing |
| Orf / Sore mouth | lack of vaccination, the presence of *Parapoxvirus* in the environment |
| Cataracts | low immunity due to poor nutrition may have exposed goats to infection |

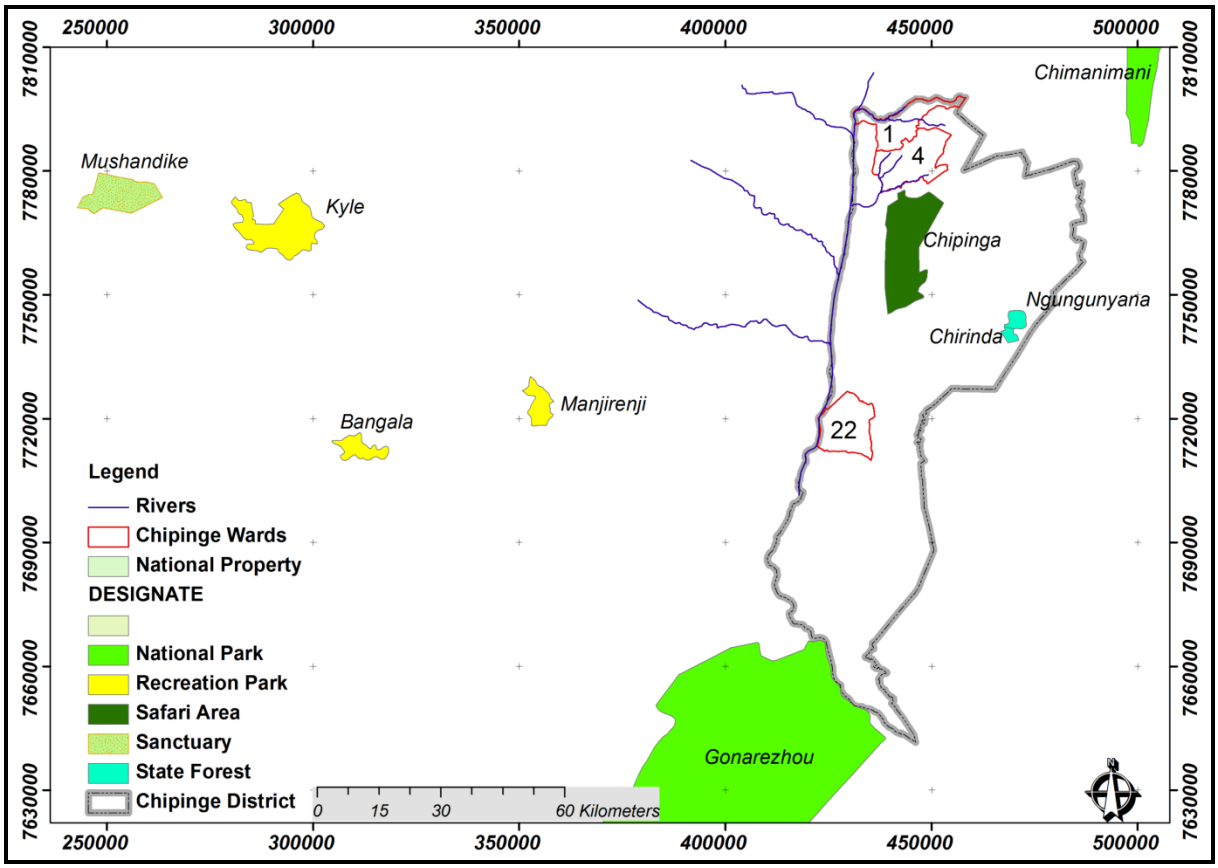


*Figure 5.1 The proximity of the study area to game reserves*

### *5.3.2 Identity of external and internal parasites*

The collected tick sample was identified as the *Amblyomma* species. Identified internal parasites included strongyle and coccidia oocyts. Tables 5.2 and 5.3 show the occurrence of strongyle eggs and coccidian oocysts in the study area.

**Table 5.2 Occurrence of strongyle eggs in sampled goats**

| parasite | Ward | Proportion of animals in which found % |
|---|---|---|
| Strongyle eggs | 1 n=10 | 25 |
| | 4 n=10 | 58 |
| | 22 n=10 | 17 |

There was no association between the occurrence of strongyle eggs and ward ($P$>0,05).

**Table 5.3 Occurrence of coccidia oocysts in sampled goats**

| parasite | Ward | Proportion of animals in which found % |
|---|---|---|
| Coccidia oocysts | 1 n=10 | 50 |
| | 4 n=10 | 33 |
| | 22 n=10 | 17 |

There was no association between the occurrence of coccidia oocyts and ward (*P*>0,05).

There were no significant differences in the occurrence of strongyle eggs and coccidia oocyts (*P*>0, 05).

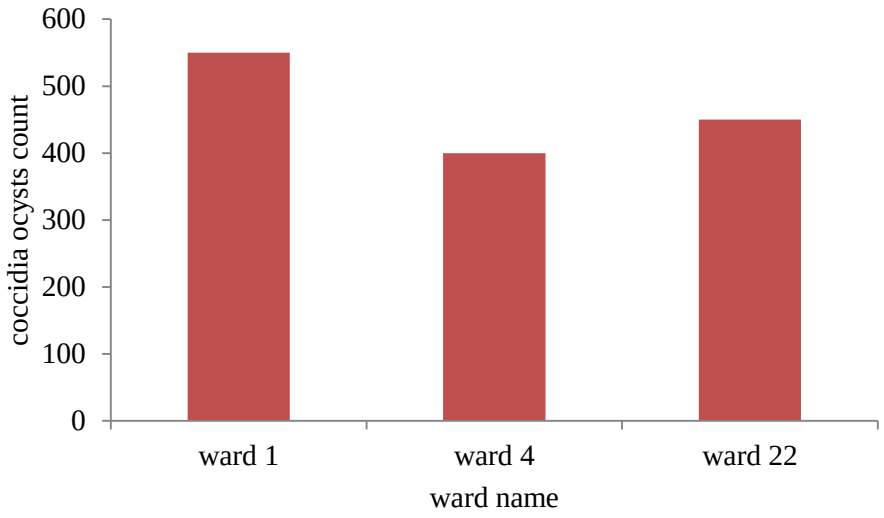


*Figure 5.2 Average coccidia oocysts count*

Highest average coccidia oocysts count was 550 units across the wards.

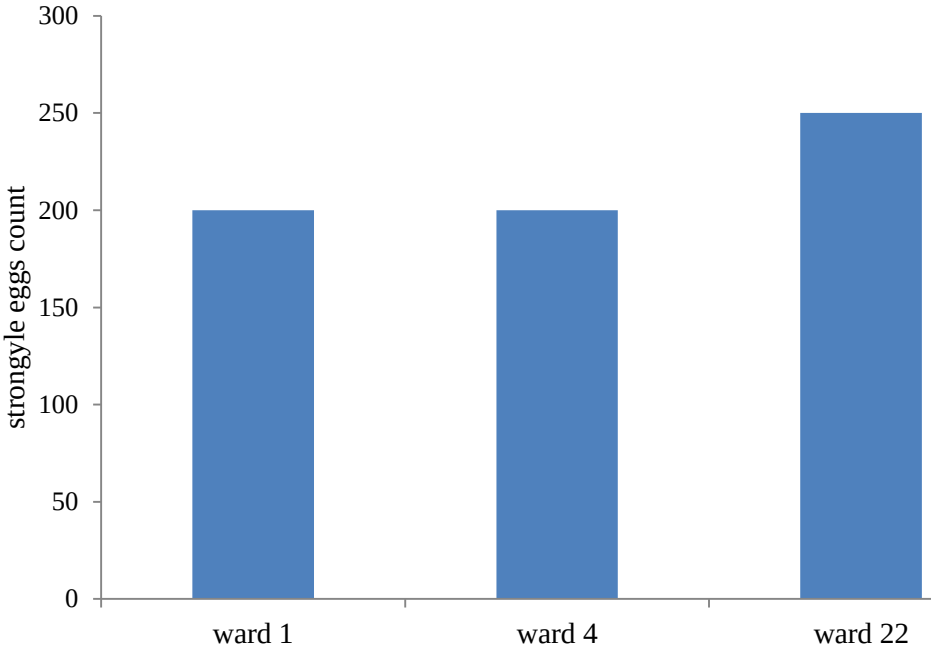


*Figure 5.3 Average strongyle eggs count*

Highest average strongyle eggs count was 250 units across the wards.

### *5.3.3 Effectiveness of community based animal health care*

#### *5.3.3.1 Community Based Animal Health Care activities*

Community Animal Health Workers (CAHWs) visited beneficiaries weekly assessing the overall health of goats under the intervention. CAHWs were responsible for record keeping of kiddings and mortalities, identifying diseases, administering drugs and vaccines and giving advice to beneficiaries on goat health. CAHWs replaced the local extension officers in the study area. Local AGRITEX officers were reported to visit once every two to three months and in some cases it was reported that they did not visit at all.

Goat mortalities for the duration of the project are summarised in the line graph below:

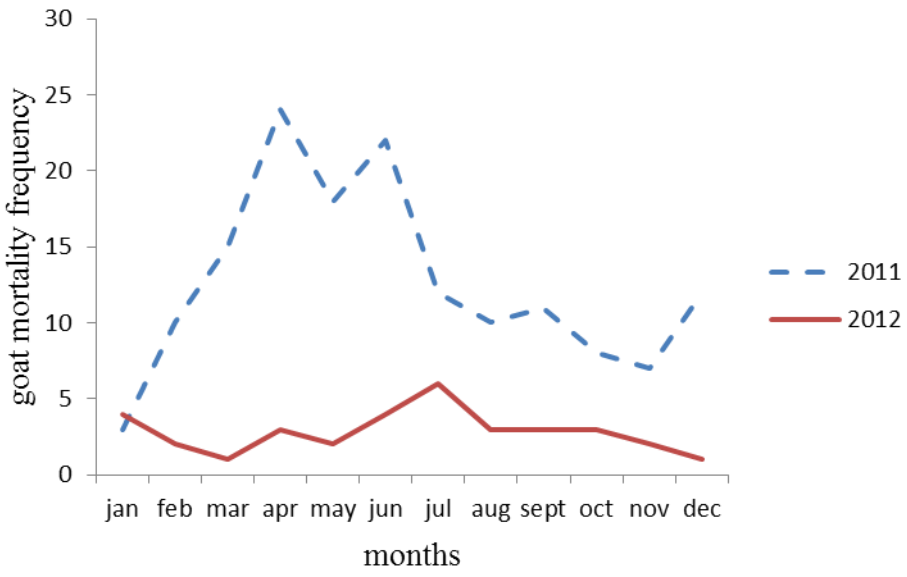


*Figure 5.4 Goat mortalities in the study area during the duration of the project*

There was a significant difference in mortalities between year 1 (2011) and year 2 (2012) (*P*< 0, 05); community based animal health care may have therefore been effective.

### *5.3.3.2 Causes of mortality in the study area*

Causes of mortality were reported to be disease, predation, abortion and road accidents and these are as shown in figure 5.5

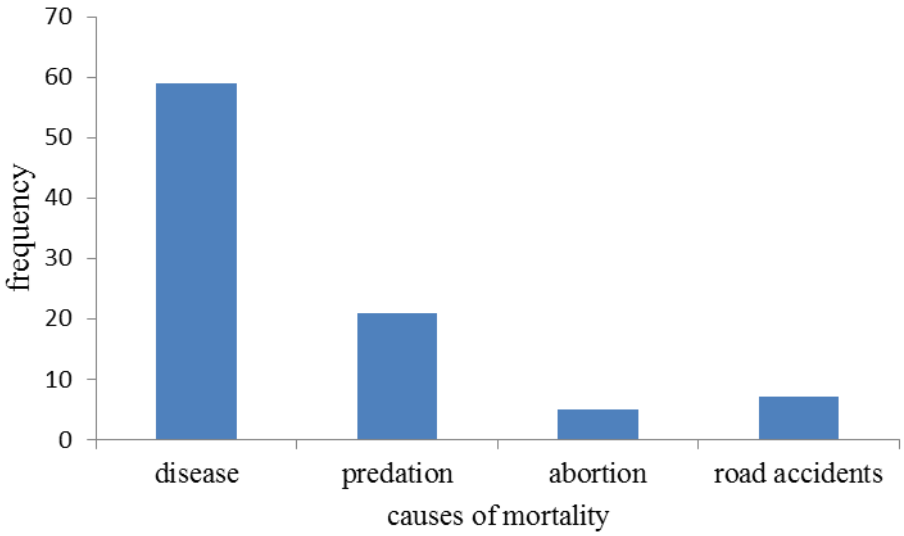


*Figure 5.5 Reported causes of mortality in the study area (%)*

Disease was perceived to be the major cause of mortality in the study area. There was no association found between cause of mortality and wards ($P>0.05$).

## 5.4 Discussion

High disease incidence was reported to be the major cause of mortality in the study area. A disease popularly known to the locals as 'chibhasikoro' due to cycling motion of legs done by the goats while on their back and frothing at the mouth was said to be the most common disease. 'Chibhasikoro' otherwise known as heartwater may have resulted in high goat mortalities in the first year of the goat production intervention and this may have been due to the lack of control of ticks. Tick control on goats is not a common practice in Zimbabwe's communal areas (Hove *et al*., 2008). This may be due to the mistaken perception that goats are resistant to disease (Poku, 2009). Ticks belonging to the *Amblyomma* species carry the parasite *Ehrlichia ruminantium* that causes heartwater (Bath *et* al., 2005; Hove *et al*., 2008). Studies by Bryson *et al*., (2002) and Hove *et al*., (2008) showed that *Amblyomma* species of ticks were the most prevalent and abundant on the indigenous goats of communal areas in South Africa and Zimbabwe. Heartwater is a major constraint to programmes aimed at improving indigenous goat breeds in Africa (Bryson *et al*., 2002). Wild animals may also be a reservoir of ticks for livestock. The proximity of the study area to national parks and reserves such as Chipangai and Gonarezhou may have resulted in goats and cattle grazing and browsing where wildlife also feed. Informal discussions with beneficiaries revealed that villagers often herded their cattle in reserves in search of better grazing land. This may have resulted in cattle picking up ticks while grazing and then spreading them to goats at homesteads. Pathogens that cause tickborne diseases such as heartwater are often carried by wild ruminants, guinea fowl and scrubhares; and some also cause zoonotic disease in humans (Bath *et* al., 2005; Anderson *et al*., 2013).

Goat mortalities were generally higher from January to July in 2011 probably because these were the initial months of distribution of intervention goats. Transportation of goats from

points of purchase in Buhera and Mount Darwin may have induced stress and made the goats susceptible to diseases. Mortality rates were in general lower in 2012 probably because the goats had acclimatised to their new surroundings and improved Community Based Animal Health Care.

Kid scouring may have been due to gastrointestinal parasites. Prevalence of gastrointestinal nematodes is more evident in young animals prior to the development of some immunity (Bath *et* al., 2005; Molento *et al*., 2011). The main source of infection is faecal contamination the water or feed trough (Bath *et* al., 2005) and adult goats could be regarded as sources of contamination (Kimbita *et al*., 2009). Kids infected with gastrointestinal parasites may suffer from diarrhoea, inappetance and reduced net movement of proteins from production sites to defence functions (Hoste *et al*., 2005). This leads to reduced productivity and low immunity. Gwaze *et al*., (2009) and Mbuh *et al*.,(2008) identified strongyle infections in goats in South Africa and Cameroon respectively, with infections in up to 93,8% of goats examined (Mbuh *et al*.,2008). Coccidiosis is an important cause of mortality in goat kids (Kimbita *et al*., 2009). Kids are the future of goat enterprises, and high kid mortalities compromise the growth of goat flocks in communal areas. Coccidia oocyts have been identified particularly in young goats in Tanzania and South Africa by Kimbita *et al*., (2009) and Gwaze *et al*., (2009) respectively. It has been shown that malnourished goats are more susceptible to gastrointestinal parasites and suffer more severely from their effects (Bath *et al*., 2005).

Strongyle egg counts and coccidia oocyst counts were both up to 250 and 550 units respectively. These figures are generally low for internal parasite infestations in communal goats. Das *et al*.,(1994) recorded infestations of up to 2000 units in communal goats. The relatively low numbers may have been due to the period of the year that the faecal samples

were collected. Faecal samples were collected during the dry season when faecal egg counts will be lower.

Poor housing particularly ground pens without roofing may have been the cause for goats coughing in the study area due to exposure to weather elements such as wind and rain. Goat mortalities may result from cold weather (Bath *et al*., 2005). Orf in the study area which was characterised by lesions on the mouth may have been as a result of a lack of vaccination against the disease. It is not common practice to vaccinate goats in communal areas, but it may be worthwhile to curb diseases such as orf. Orf is easy to spread, the disease could have been passed from one goat to another during feeding and watering. Contagious ecthyma is an acute, contagious, debilitating and economically important zoonotic disease that affects domesticated and wild ruminants (Nandi *et al*., 2011). Orf may occur in people who are in close contact with goats such as herders, veterinarians, butchers and those who handle hides (CFSPH, 2007). Orf is listed as a zoonotic disease occurring in Zimbabwe (Berger, 2015). Three quarters of emerging infectious diseases of humans are zoonotic and most are originating from wild life (Taylor and Latham, 2001; Jones *et al*., 2008). Diseases that arise from the livestock- wildlife interface are therefore of importance (Siembieda *et al*., 2011) and as such accurate quantitative data describing the spatial distribution, population structure and density of animals at the livestock- wildlife interface is essential (Miller *et al*., 2013). Cataracts may have been due to poor nutrition. The new goats were particularly susceptible. This could have been as a result of the foot and mouth disease warning that saw goats being held in holding pens for up to a month during the distribution period of the project. Although browse was available through cut and carry by ACF trainers, the stress of being moved from one area to another and being restricted may have contributed to poor nutrition. Malnourished goats are often susceptible to infection (Hoste *et al*., 2005).

Low mortalities by up to 60% reduction in the second year of the intervention may have been due to improved goat rearing practices through Community Based Animal Health Care. Successes in goat development have been achieved where there is farmer participation, representation and organisation (Peacock, 2005). In Kenya the success of a dairy goat project was largely attributed to CAHWs (Ahuya *et al*., 2005).

## 5.5 Conclusion and Recommendations

Heartwater was reported to be one of the major constraints in goat production in the study area. Control of ticks is necessary to reduce mortalities and improve productivity of goats in communal areas. Improved tick management is recommended. Improved goat housing as well as separate housing for kids is also recommended to reduce infections caused by moist and soiled floors in goat pens. Improved goat nutrition, particularly protein nutrition, may also reduce infections through improved immunity.

# CHAPTER SIX

# 6 Impact of the ACF goat intervention on goat management and productivity

## 6.1 Introduction

Goats have the potential to contribute to improved livelihoods for resource poor farmers (Alexandre *et* al., 2010; Ahuya *et* al., 2005; Bett *et al*., 2009; Lebbie, 2004; Lu *et al*., 2010) and uplift people onto a path of improved welfare and prosperity (Peacock, 2005). To unlock this potential, it is important to understand goat farming practices in small holder farming systems. Poor goat productivity in the tropics may be due to poor understanding of the production system as a whole (Tsegaye, 2009) and inefficient management (Devendra, 2010). Characterisation of goat farming systems and their management help to identify critical constraints and opportunities which could impact on the potential expansion of goat farming activities (Mahanjana and Cronje, 2000). Meaningful system description involves a multidisciplinary analysis including environmental (availability of herbaceous sources), economic (stability, alternative sources of income) and socio-political (land-tenure, control over resources) aspects (Alexandre *et* al., 2010). Through system characterisation interventions targeting on improving goat production will be relevant and be able to respond effectively to the needs of goat farmers (Tsegaye, 2009). The purpose of this study was to describe the goat management practices in the study area and the impact that ACF has had on them during the duration of the project.

## 6.2 Material and methods

A questionnaire was administered to 92 beneficiaries under the study population to determine goat management and productivity before and after the ACF goat intervention. This was done to measure the impact of the ACF goat intervention on goat management practices and productivity in the study area.

### 6.*2.1 Data collection*

Three focus group discussions were carried out in each village with the beneficiaries to determine the roles played by men, women and children in goat management and to construct a feed seasonal calendar. The data was triangulated using the questionnaire that was administered to beneficiaries under the study population and informal interviews with AGRITEX officers (n=6) and CAHW (n=6). Information on household demography was also collected from the questionnaire.

Before and after intervention goat productivity data was collected by means of a questionnaire administered to the study population and goat productivity data collected from beneficiaries under the study population as the project was on going. This data was collected for approximately 90 goats. The goat numbers were recorded from when the intervention began in January 2010 to December 2012 when it ended. Observations were also carried out on goat productivity in the study area to corroborate the information gathered from beneficiaries.

### *6.2.2 Statistical Analysis*

Household demography and frequencies of responses on goat management obtained from the questionnaire survey were analysed using Statistical Package for Social Sciences version 21.

A Chi square test of association was used to determine association between ward and different goat management practices in the study area. A T test was used to compare goat management practices before and after the intervention in SPSS version 21.

Goat productivity data before and after the intervention was analysed using the T test in SPSS version 21.

## 6.3 Results

### *6.3.1 Goat management*

Goats were reared extensively in the study area where labour was provided by family members. Participatory research findings on the roles played by men, women and children in goat rearing in the study area are summarised in Table 6.1:

**Table 6.1 Gender and goat management in the study area**

| Characteristic | Ward 1 n=37 | 4 n=35 | 22 n=20 | Chi-square SL |
|---|---|---|---|---|
| % Female heads | 45[a] | 42[b] | 35[c] | * |
| % male respondents | 11 | 18 | 35 | NS |
| % female respondents | 89 | 82 | 65 | NS |
| % Age distribution | | | | |
| <30 | 30 | 37 | 22 | NS |
| 30-50 | 43[a] | 28[b] | 29[b] | * |
| >50 | 32 | 51 | 16 | NS |
| % Herding | | | | |
| women | 40 | 20 | 40 | NS |
| children | 60 | 80 | 60 | NS |
| men | 0 | 0 | 0 | NS |
| % Kraaling | | | | |
| women | 30 | 20 | 20 | NS |
| children | 60 | 60 | 60 | NS |
| men | 10 | 30 | 20 | NS |
| % Decisions on selling and vaccinating | | | | |
| women | 30 | 40 | 10 | NS |
| children | 0 | 0 | 0 | NS |
| men | 70 | 60 | 90 | NS |
| Goat health and day to day management | | | | |
| women | 70 | 60 | 80 | NS |
| children | 20 | 10 | 10 | NS |
| men | 10 | 30 | 10 | NS |

SL- significance level; NS: not significant (P>0.05); * significant difference (P<0.05)

[abc] values within a row showing different superscripts are significantly different (P<0.05).

Herding and kraaling activities were dominated by children across the wards while women were more involved in the day to day welfare of the goats. Men were responsible for the decision making on whether to vaccinate or sell goats.

### *6.3.2 Housing*

Some goats were housed in elevated goat pens made with branches whilst some were housed in pens on the ground Figure 6.1.

a. A ground pen b. An elevated pen

*Figure 6.1 Goat housing in the study area*

Beneficiaries were required to build elevated goat pens by the ACF goat intervention so that goats were protected from moist ground conditions that cause diseases such as foot rot and from predators.

### *6.3.3 Animal health management*

Locally available medicines of soot (chin'ai), salt, plant extracts and water were used to treat sick goats. Goats were treated when showing signs of sickness such as refusal to feed, diarrhoea, and loss of condition. There was an increase by 56% in beneficiaries using

commercial drugs for dosing their goats as a result of the intervention. These were administered by Community Animal Health Workers and were bought from the one United States dollar monthly contribution required of each beneficiary under the intervention.

### *6.3.4 Breeding management*

Breeding was uncontrolled. Twenty nine percent of beneficiaries kept their goats in the breeding stock for over four years, up to 12 years for does, while 52% reported to keep their goats up to a maximum of 3 years. Factors affecting longevity were sales 78%, theft 12%, hunger 78%, predation 58% and good mothering ability 61% and are shown in figure 6.2

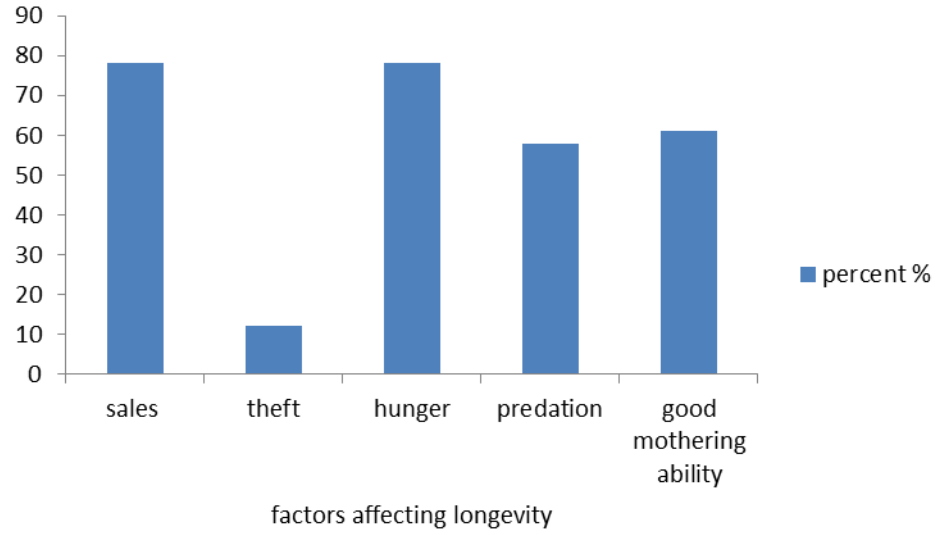


*Figure 6.2 Factors affecting longevity of goats in the study area*

### *6.3.5 Feeding management*

Goats were left to graze and browse in the communally owned grazing lands. Goats were penned till midday when children returned from school to avoid losses through theft, predation and road accidents during feeding. A feed seasonal calendar was constructed through focus group discussions with beneficiaries and is as shown in table 6.2

#### *6.3.5.1 Feed seasonal calendar*

Data on the sources of feed during the year was used to construct a feed seasonal calendar shown in table 6.2

**Table 6.2 Feed seasonal calendar in study area**

| | Wet season | | | | | | Dry season | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| season / feed source | nov | dec | jan | feb | mar | apr | may | jun | jul | aug | sept | oct |
| crop residues (sorghum, millet) | | | | | | | | | | | | |
| graze | | | | | | | | | | | | |
| browse | | | | | | | | | | | | |
| cut and carry (weeds from irrigation areas, tree leaves) | | | | | | | | | | | | |

Some browse tree species collected for cut and carry are listed in Table 6.3:

**Table 6.3 Browse tree species used to feed goats in study area**

| Local name | Scientific name | Parts used |
|---|---|---|
| Mopane / musharu | *Colophospermum mopane* | Leaves |
| Mushuma | *Diospyros mespiliformis* | Leaves |
| Muchecheni | *Ziziphus mucronata* | Leaves |
| Muuyu | *Adansonia digitata* | Fruit |
| Musau | *Ziziphus mauritiana* | Fruit and leaves |
| Moringa | *Moringa oliefera* | Leaves |
| Muunga | *Acacia* | Pods |

While the benefits of feed supplementation were known as evidenced by cutting and carrying of twigs and small branches and feeding penned goats, feeding goats according to different physiological conditions such as pregnancy and lactation was not practiced.

#### *6.3.5.2 Predation*

Goats particularly kids under one year fell prey to predators in the study area mostly when they were released for feeding. Kid predation was most prevalent in wards and 4 and 22 and least in ward 1 as shown in Table 6.4

**Table 6.4 Predator occurrences (%) in the study area**

| | baboons | wild dogs | lions | hyena | common dog |
|---|---|---|---|---|---|
| ward 1 (n=36) | 24 | 8 | 0 | 3 | 5 |
| ward 4 (n=35) | 71 | 60 | 0 | 0 | 3 |
| ward22(n=21) | 5 | 5 | 85 | 0 | 3 |

A Chi Square test of association was carried out to determine association between type of predator and ward. There was an association between ward and predator occurrence ($P<0.05$). Baboons and wild dogs were prevalent in ward 4 while lions were prevalent in ward 22.

The prevalence of baboons in ward 4 compared to any other wards may have been due to vegetation cover. Predation hotspots of where kids had been reported to have been attacked were overlaid over the Normalised Difference Vegetation Index (NDVI) map of the study area Figure 6.3

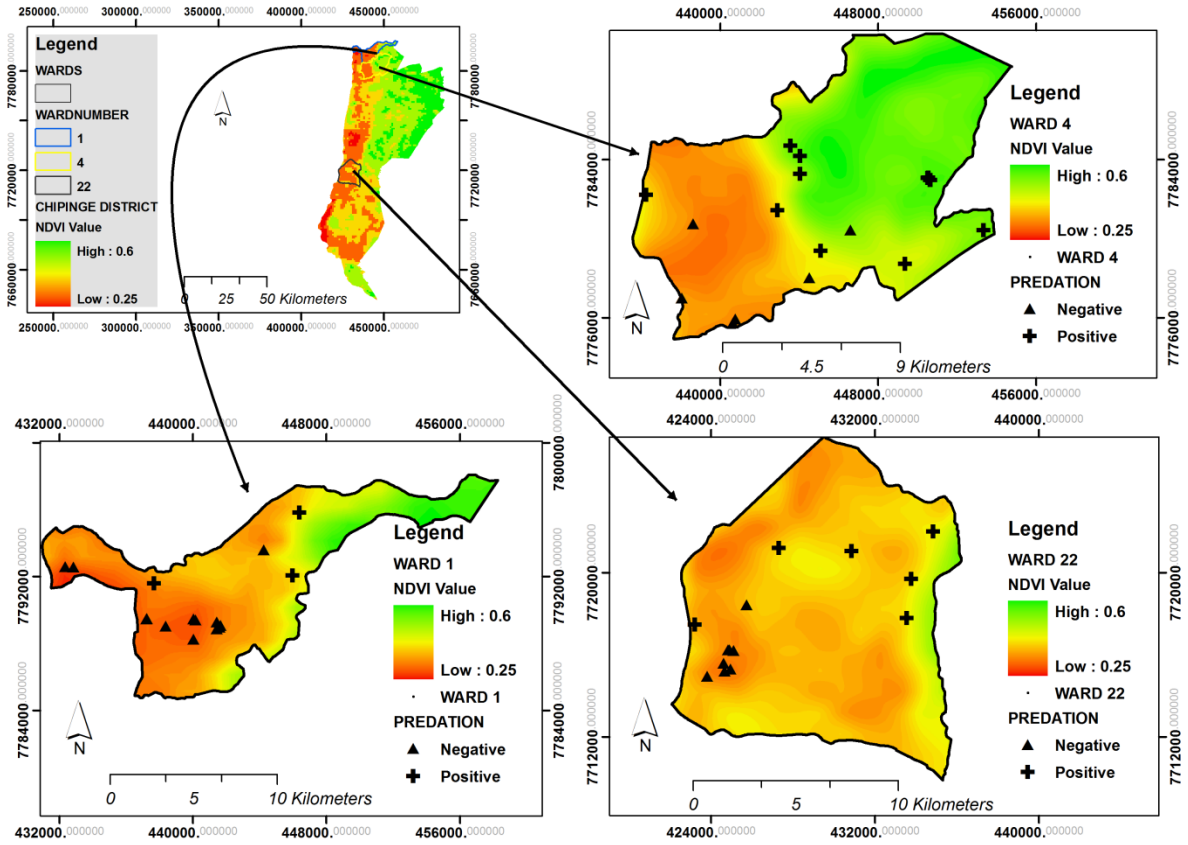


*Figure 6.3 Predation hotspots and NDVI of study area*

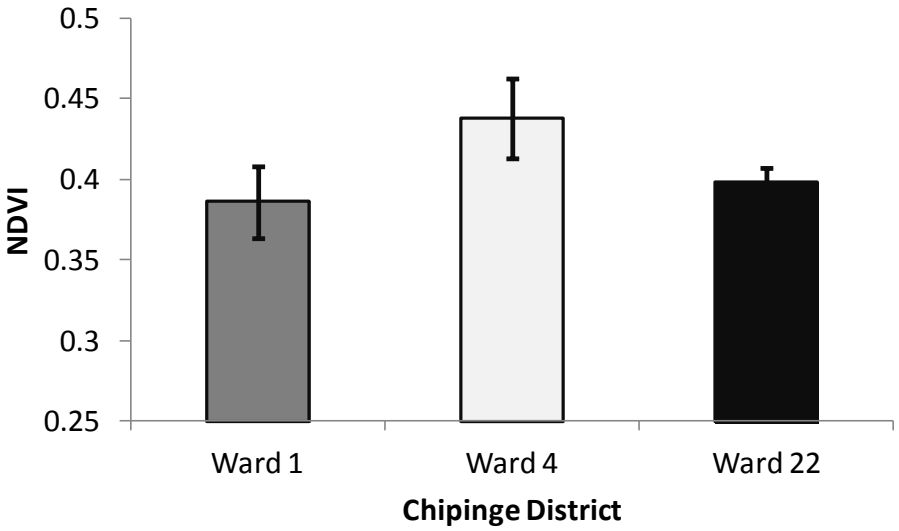


*Figure 6.4 NDVI in study area*

NDVI was significantly different amongst the wards *(P<0,05)*. Highest NDVI recorded in ward 4 while ward 1 and 22 NDVI values were not significantly different. NDVI is a measure of vegetation cover in an area. The figure shows predation occurring more where there is vegetation cover. Kids may have wandered from their mothers during browsing falling prey to baboons and wild dogs.

The prevalence of lions in ward 22 compared to any other wards may have been due to its proximity to Gonarezhou National Park and Chipangai Game Reserve.

### *6.3.6 Marketing management*

Sixteen percent of beneficiaries sold their goats to formal markets such as butcheries. The majority of beneficiaries barter traded their goats for goods such as grain and other foodstuffs in times of hunger.

### *6.3.7 The impact of ACF goat intervention on goat management in the study area*

**Table 6.5 Impact of ACF goat intervention on goat management in the study area**

| | Percentage using (%) | | T test |
|---|---|---|---|
| | Before intervention | After intervention | Significance level |
| Management practice | | | |
| Commercial drugs use | 9 | 65 | * |
| Contribute to veterinary care | 17 | 40 | * |
| Improved housing | 27 | 84 | * |
| Attend training on goat husbandry | 18 | 97 | * |
| Cutting and carrying of feed | 72 | 76 | NS |
| Goats sold to butcheries or formal markets | 13 | 16 | NS |

SL- significance level; NS: not significant ($P$>0.05); * significant ($P$<0.05).

There were significant differences in the monetary contributions made by beneficiaries to buy and use commercial drugs to treat sick goats in the study area. There were also significant differences in housing of goats and goat husbandry training attendance. There were no significant differences however in cutting and carrying of feed and goat markets in the study area.

### *6.3.8 The impact of the ACF goat production intervention on various goat productivity indices*

A comparison of goat production in the study area and communal goat production is shown in Table 6.4:

**Table 6.6 Goat productivity in study area before and after the ACF intervention**

| Productivity parameter | before intervention<br>mean ± s.d | after intervention<br>mean ± s.d | T test<br>Significance level |
|---|---|---|---|
| Litter size | 1.20 ± 0.63 | 1.15 ± 0.79 | NS |
| Kidding interval | 309 days ± 41.5 | 302 days ± 32.5 | NS |
| Pre-weaning mortality | 1.20 ± 0.47 | 0.82 ± 0.72 | * |
| Post-weaning mortality | 0.96 ± 1.14 | 0.63 ± 0.48 | * |
| Abortion rate | 40% | 38% | NS |

NS: not significant P> 0.05; * significant difference P<0.05

There were significant differences in pre-weaning and post-weaning mortalities in the study area. There were no significant differences however in litter size, kidding interval and abortion rate.

### *6.3.9 The impact of ACF on communal goat production in the study area*

At focus group discussions carried out in each ward in the study area, several farmers expressed their wishes to acquire wealth in the form of cattle through goat rearing. Before the intervention, little attention was paid to the health of goats, but through training, farmers were made aware of the benefits of improved animal health care. The ACF pass on scheme was also adopted by neighbouring villages in ward 21 that were not under the intervention. Villagers organised themselves in a group of 10 and each group member contributed to the purchase of two does. The resulting offspring were passed amongst group members. The intervention promoted the use of goat manure for the Conservation Agriculture (CA) component. Goat manure was used in place of fertilisers in field crops as well as in low input gardens.

## 6.4 Discussion

About half of the study population was characterised by female headed households and the majority of respondents were female. The male heads of household were reported to have travelled in search of employment to countries such as South Africa and Botswana and locally to Chiredzi to work in sugar plantations. Day to day goat management in the study area was gendered. Children were responsible for herding and kraaling at night and women were responsible for the day to day welfare of goats in the study area. Under small holder farming systems, labour is provided by family members (de Sherbinin *et al*., 2008) and the gender and age division of labour depends on ethnicity, tradition and class (Miller, 2011). Similar practices have been observed in South Africa by (Mahanjana and Crowe, 2000), in Gambia by (Jaitner *et al*., 2001) and in India (Nirmala *et al*., 2012). Herding responsibilities are often gendered; men usually herding larger animals while women and children herd sheep and goats (Miller, 2011). Men dominate decision making (Kohler- Rollefson, 2012). Decisions about moving animals to pastures or water sources, selling, gifting and slaughtering livestock are normally made by men (Miller, 2011). Men held the responsibility of decision making on whether to slaughter, sell or vaccinate goats in the study area.

Soot (chin'ai), water, salt and plant extracts were mixed together to treat sick goats in the study area. Studies by Luseba and Van De Merwee (2006) indicate that small scale farmers use plants extensively to treat livestock diseases. In most cases traditional health care practices are used in conjunction with conventional western medicines (Moonga and Chitambo, 2010). One of the impacts of the ACF goat intervention was to promote the use of commercial medicines for goats together with the traditional practices and this was noted by a

56% increase in beneficiaries using commercial dosing medicines as well as vaccines for pulpy kidney.

Uncontrolled mating as observed in the study area has also been observed in extensive goat farming systems by (Kosgey *et al*., 2008) and (Sikhosana, 2008). While Ndlovu (1999) states that uncontrolled breeding optimises goat productivity as does can kid all year round, Gwaze (2008) points out that uncontrolled mating promotes inbreeding and this subsequently lowers productivity. Does with good mothering ability were kept in the flock for up to 12 years in the study area. The majority of the respondents, 52%, disposed of their goats before 3 years of age by selling to meet cash and food needs. Similar findings were observed by Kosgey *et al*., (2008) in Kenya. Predation was also reported to affect the longevity of goats in the study area.

Goat feeding in the study area was mainly through free range grazing and browsing. Goat production in communal areas is dependent on rangelands (Kindness, 1999; Mukandiwa 2006; Pamo *et al*., 2006). There was a wide variety of feed during the rainy season providing goats with grazing and browsing options. Browsing dominated in the dry seasons as well as clearing off crop residues of sorghum and millet in farming fields. However the quality and quantity of forage material on rangelands is low as a result of long dry seasons and short rainy seasons (Pamo *et al*., 2006; Kosgey *et al*., 2006). Cutting and carrying of browse tree species as practised in the study area therefore becomes necessary to alleviate dry season feed shortages. Supplementing with protein based feeds during this critical period will enable better livestock production and, therefore, increased income to the rural families (Joshi *et al*., 2004). Urea based licks may be used as protein supplements while maize based fodder may be used as energy supplements (Bath *et* al., 2005). The use of maize based fodder as an energy supplement may however prove to be difficult in the study area due to the dry

conditions that do not support maize production. While farmers in the study area were aware of the benefits of feed supplementation, they did not give extra feed to pregnant and lactating does. Similar practice was observed by Kindness *et al*., (1999) in Matobo and Bubi districts. Acacia and mopane browse species are commonly used by communal farmers as goat feed supplements (O'Flaherty, 1997; Kindness *et al*., 1999; Mukandiwa, 2006). There were no significant differences in cutting and carrying of feed to give goats before and after the ACF intervention as this practice was carried out in the study area before the introduction of ACF goat intervention.

The lack of markets for farmers in the study area to sell their goats resulted in low selling prices for their goats. Kosgey *et al*., (2008) reported that few goat farmers in Kenya sell their goats to abbatoirs.

The ACF goat production intervention had an impact on the use of commercial drugs for treating sick goats. There was an increase in the use of commercial drugs by 56%. The stipulation that each member of the intervention had to contribute one United States dollar towards buying drugs for goats saw a 23% increase in the contributions for veterinary care. However less than half of the respondents were able to meet and fulfill this requirement due to reported financial hardships. There was also an increase in the number of beneficiaries attending training on goat husbandry. There were also no significant differences in formal market availability for goats. This could have been due to the limited time frame of the project. While there was a market research component under the Livelihoods for Improved Nutrition project which encompassed the goat intervention, the limited time period of the intervention could have resulted in the failure to implement the market research findings within the time frame of the project.

The ACF goat production intervention also had an impact on pre- weaning and post weaning mortalities in the study area. There were significant differences in pre-weaning and post-weaning goat mortalities before and after the ACF goat production intervention. This may have been due to Community Based Animal Health Care and the training of beneficiaries on goat health management. There were no significant differences however in litter size, kidding interval and abortion rate. This may have been due to the limited time period of the ACF goat intervention. While twinning and tripling were common in the study area, the majority of goats under the intervention had one kid in the first year. This may have been because the does were young and kidding for the first time. The high proportion of young goats may have resulted in the high incidence of abortions. Mellado *et al*., (2004) observed a similar trend of abortions in young goats in Mexico. Abortions may have also been due to poor nutrition. The corpus luteum in goats produces all the progesterone needed to maintain pregnancy, abortions can result from luteolysis when prostaglandin production is triggered by stress or malnutrition (Bath *et al*., 2005). Although kidding was observed throughout the year, it was mainly concentrated in April- May and September-November. This resonates with the work by Kindness *et al*., (1999).

Pre weaning mortalities could have also been reduced by improved kid management. Predation of kids by painted dogs (*Lycaon pictus*) particularly was common in the study area. Young kids are susceptible to predation and the Black- backed jackal (*Canis mesomelas*) as well as the Caracal (*Felis caracal*) has been reported to prey on young goats (Bath *et al*., 2005). Leopards (*Panthera pardus*), painted dogs (*Lycaon pictus*) and brown hyenas (*Hyaena brunnea*) have also been reported to prey on young goats in the Kweneng district of Botswana (Schiess- Meier *et al*., 2007). There were increased cases of predation in mountainous areas of Birirano in ward 4 and near the river Save in the study area. Studies by

Wilson *et al*., (2005) showed that predation of livestock by wildlife is concentrated where there is shelter or vegetation cover and a water source.

The use of goat manure is beneficial in mixed crop livestock systems. De Vries (2008) reported that one of the major benefits of a goat production project by Heifer International was the improved crop productivity due to the incorporation of goat manure. While the contribution of goat manure may be limited in terms of quantities, it is important where smallholder farmers cannot afford expensive fertilisers for use in their traditional low input crops (Lebbie, 2004).

### 6.5 Conclusion and recommendations

Characterisation of goat management in small holder farming systems is essential as it informs livestock developers of areas needing intervention to improve goat productivity. As beneficiaries relied on ethno-veterinary medicines for their goats in the early stages of the intervention, more research needs to be done on the use of plant extracts to treat livestock in communal areas as this may be sustainable and affordable for communal farmers. In-depth analyses of the available browse species as well as how their quantities may be increased to support goat production in the study area is recommended for future interventions. Improved nutrition is recommended for young pregnant does to increase productivity. To maximise on productivity it is recommended that future interventions assist beneficiaries with improving fodder/ forage banks for goats. Further research is recommended on the breeding management of communal goats to allow for breed improvement. High levels of inbreeding due to uncontrolled mating result in inferior livestock that fail to thrive. Nucleus breeding schemes described by Assan, 2011 may be employed where high performing goats in terms of prolificacy for example, are pooled and crossed to improve desirable traits. The resulting

buck would be used to improve the genetic make-up of the flock through controlled mating. It is recommended that future ACF interventions should promote improved goat marketing channels; this will in turn improve goat productivity as farmers will fetch better prices for their goats.

# CHAPTER SEVEN

# 7 An assessment of the provisions made for the continued and improved goat production after the Action Contre La Faim intervention

## 7.1 Introduction

The persistence of food insecurity in communal areas and the developing world at large has led to development organisations shifting their focus from just food aid, but to promoting projects that enhance the ability of communal farmers to sustain their own food production. Development projects have evolved in the last decades from a focus on providing physical and financial infrastructure to approaches with a focus on education, training, and capacity building in order to alleviate poverty and improve the livelihoods of local people (Merino and de lo Rios Carmenado, 2012). Development organisations have therefore evolved to promote sustainable development in their projects. Sustainable development is defined as development that meets the needs of the present without compromising the ability of future generations to meet their own needs (Bruntland Commission, 1987). Sustainability is multi-dimensional (Peacock and Sherman, 2010) and includes environmental protection including biodiversity and genetic conservation, economic growth and social equity (Peacock and Sherman, 2010; Hoffman, 2011, World Food Programme, 2008). Scoring methods have been used to determine sustainability in livestock development projects by Lemba (2009) and Peacock and Sherman (2010). The scoring method developed by Lemba (2009) involved scoring sustainability measures with a score from zero to five, with zero indicating poor provisions were made for sustainability and five indicating adequate provisions were made for sustainability of a particular development project. The weakness of this approach is that the

score given is subjective; it depends on the evaluator and therefore may differ from one individual to another. The purpose of this study was to assess the extent to which ACF promoted sustainable goat production in the study area using a scoring card developed by Peacock and Sherman (2010). The scoring card is comprised of four elements that must be met if sustainability is to be realised. The four elements include environmental, economic, social and institutional sustainability; these must be considered and provisioned for long term continuity of development initiatives.

## 7.2 Material and methods

### *7.2.1 Data collection and analysis*

Data on the environmental, economic, social and institutional sustainability was collected through review of the ACF goat project documentation and through observation of some sustainability indicators such as feed and disease control as the project was ongoing.

A sustainability score card adapted from Peacock and Sherman (2010) was then used to present the results. The score card indicates what needs to made available for environmental, economic, social and institutional sustainability for development projects. Against these indicators are the provisions that made ACF made for the sustainability of the goat pass-on scheme.

## 7.3 Results

A sustainability score card was used to determine if the ACF had made adequate provisions for sustainability of their goat production intervention in Chipinge district (Tables 7.1-7.4):

**Table 7.1 Sustainability score card for the Action Contre La Faim goat production intervention, environmental sustainability**

| Sustainability characteristic | Current state in study area | Provisions made by ACF where applicable |
|---|---|---|
| Environmental | | |
| • Source of bulk forage | Rangelands | Suggested the creation of forage/ fodder bank |
| • Proportion of supplementary dietary energy from external inputs | 0% | |
| • Proportion of supplementary dietary protein from external inputs | 0% | |
| • Source of water | Carried from boreholes | Some boreholes were drilled by ACF |
| • Trends in disease incidence causing epidemic morbidity | Risk from tickborne diseases and foot and mouth disease | Training of Community Animal Health workers and beneficiaries to curb disease spread |
| • Proportion of home grown breeding stock | 100%, though sourced from Buhera and Mt Darwin, the breed of goats was the local Small East African goat | |
| • Source of improver genetics | None | Suggestions of the local Matebele goat were made to improve genetics |
| • Use of non-renewable energy | Little to none | |
| Overall environmental assessment | Good if overgrazing and rangeland degradation are managed and monitored. | |

**Table 7.2 Sustainability score card for the Action Contre La Faim goat production intervention, economic sustainability**

| Sustainability characteristic | Current state in study area | Provisions made by ACF where applicable |
|---|---|---|
| Economic | | |
| • Nature of market for live animals | High potential but is not fully exploited | Research project on the current status of markets underway |
| • Nature of market for products | High potential but is not fully exploited | |
| • Profitability trends | High through improved management and good markets | |

**Table 7.3 Sustainability score card for the Action Contre La Faim goat production intervention, social sustainability**

| Sustainability characteristic | Current state in study area | Provisions made by ACF where applicable |
|---|---|---|
| Social | | |
| • Time goats have been kept in location | Decades | Selection of the goat could have been because it is an integral part of communal areas, the well as the pass on scheme promoted sense of ownership of the project |
| • Availability of labour, family, employed, skilled, unskilled | Women and children provide unskilled labour and indigenous knowledge of goat rearing | |
| • Existence of cultural activities involving goats (social significance) | Goats used in traditional ceremonies and goat skins and hides are used in handcrafts | |

**Table 7.4 Sustainability score card for the Action Contre La Faim goat production intervention, institutional sustainability**

| Sustainability characteristic | Current state in study area | Provisions made by ACF where applicable |
|---|---|---|
| Institutional | | |
| • State of skilled support services- research, training | Poor, AGRITEX visits are once every three months | Included a research component in the implementation of the project<br><br>Beneficiaries and CAHWs were trained on improved goat rearing |
| • Existence / state of membership organisations involving goat keepers | Non- existent | |
| Overall sustainability assessment | ACF made adequate provision for the sustainability of the project, feed and markets however still needed to be addressed | |

## 7.4 Discussion

The lack of an established forage/ fodder bank for goats in the study area resulted in goats relying on the rangeland for their nutritional requirements. It is estimated that 60% of the total feed requirements for small ruminants is met by rangelands (Devendra *et al*., 2000). The absence of expensive commercial feed as feed supplements for goats is a way of promoting sustainability of goat enterprises Peacock and Sherman (2010) but overgrazing and rangeland degradation are a cause for concern (Dubeuf, 2011; Devendra, 2010). Also, since extensive goat production systems are totally dependent on natural resources, climatic variability may have an impact on long term forage availability and may reduce overall sustainability, both from a social–economic and from an ecological perspective (Nardone *et al*., 2010). Although small ruminant production systems are low input production systems with lower environmental impacts, they face desertification and less water availability, genetic erosion, soil degradation, rangeland degradation and competitions for land use (Dubeuf, 2010).Some beneficiaries were observed coppicing trees to support regrowth and conservation of tree species. Boreholes in the study area met the water requirements for goats.

The risk of disease outbreaks is a threat to any livestock enterprise. While ACF made provisions for disease control through providing CAHWs and beneficiaries with a veterinary starter kit and training on improved goat rearing, there was need for a more rigid regimen for the prevention of tickborne diseases such as heartwater. The study area is also at risk of foot and mouth disease due to its proximity to game reserves where wild animals such as buffalo are reservoirs of the disease. Veterinary officers however keep the disease at bay by restricting movement of all animals suspected of infection. For profitable and sustainable farming, the impact of disease problems has to be minimised by measures that are cost-

effective and appropriate (Bath *et al*., 2005). If diseases are not controlled, there may be high mortalities and therefore reduced productivity of goat flocks.

There were no exotic goat breeds in the study area. Conservation of the local goat genetic resources is important in ensuring sustainability of goat production. Locally adapted livestock are self-reproducing assets with an inbuilt self-replicating mechanism (Kohler- Rollefson, 2012).The Small East African goat was the most dominant breed. Action Contre La Faim had made provision for the improvement of the Small East African goat using the Matebele goat. Due to foot and mouth disease outbreak in the source areas of the Matebele goat, this could not be implemented during the duration of the project.

The pass-on scheme implementation approach by ACF gave beneficiaries a sense of ownership of the project. Beneficiaries were involved in the implementation of the project by helping to decide on the rules that each member of the intervention was expected to abide by namely, replacing dead or missing intervention goats, contributing to veterinary care and pass on was a requirement. This promoted social equity. Goats in the study area were used for traditional ceremonies, were sold to pay school fees and goat skins were used to make mats. As long as goats remain part of the integral system of the communal farmers, they will be reared for future generations to come (Peacock and Sherman, 2010).

The absence of formal goat markets in the study area threatened the sustainability of the ACF goat intervention. Favourable producer prices encourage farmers to increase goat production (Homann *et al*., 2008) Sustainable benefits can be made by designing goat improvement programmes that are market oriented (FARM Africa 2006; Bett *et al*., 2009). While ACF had made provisions for markets by including a research component on the state of and opportunities for markets in the study area, the results of the research could not be

implemented during the duration of the ACF goat intervention as both the research and intervention were carried out at the same time.

Due to the decline in extension services in Zimbabwe as a whole (Mutambara *et al*., 2013), the state of skilled support through research and training in the study area was poor. AGRITEX officers were reported to visit the study area once every three months. Coordinated research and development (R and D) supported by government and development organisations is necessary to bring technological change to smallholder goat farming systems (Iniguez, 2010). Action Contre La Faim made adequate provision for this by enlisting the help of a research platform to investigate the effectiveness, efficiency, sustainability and impact of their intervention. Training of beneficiaries and CAHWs also helped to strengthen the institutional aspects of the goat intervention.

### 7.5 Conclusion and Recommendations

Sustainable development involves using resources in a way that will make them available for future generations. It encompasses protecting the species, environment, supporting economic growth, promoting social equity as well as establishing and strengthening institutions that support sustainability. Action Contre La Faim made adequate provision for the continued and improved goat production in the study area through training (disease control), the pass on scheme and research components that would inform their future interventions. It is recommended however that ACF pursue the forage/ fodder bank projects to increase the capacity of the rangeland to support goat production in the study area as well as promoting formal goat markets.

# CHAPTER EIGHT

# 8 General Discussion, Conclusion and Recommendations

## 8.1 Discussion

Goats have been used widely across Africa and in the world in interventions aimed at alleviating poverty and improving food security (Peacock, 2005). This is because they are hardy, are easy to dispose of when need arises, have high prolificacy and can utilise marginal land that is not suitable for cattle production. Development projects aimed at improving goat production must however take into account the challenges of communal goat production. These include high disease prevalence, high worm burden, high kid mortality, inadequate feed resources, lack of markets and poor management. Solutions to these challenges must be the basis of goat production interventions so that goat productivity can be increased.

The ACF goat intervention provided solutions to some of these challenges by training beneficiaries and Community Animal Health Workers on improved goat husbandry including health and feeding. Perceptions of various stakeholders on the intervention were investigated and the major findings were that the ACF goat intervention was effective in training beneficiaries on goat husbandry and increasing goat numbers in the study area. There were significant differences in the perceptions on the project design and goat breed distributed. Forty percent of the stakeholders felt that the numbers of the beneficiary population was too large and the requirement for one United States dollar contribution was beyond the reach of many. Forty percent of the stakeholders also preferred the Matebele goat to the Small East African goat distributed.

The major causes of mortality that threatened the success of the ACF intervention included heartwater and high intestinal parasite prevalence. *Amblyomma* ticks that carry the causative agent of heartwater were observed underneath the tails of goats and in the ears. Heartwater has been said to be the one of the major constraints to goat productivity in communal areas. Identified gastrointestinal parasites included strongyle eggs and ccoccidia oocysts. There were no significant differences in the occurrence of strongyle eggs and coccidia oocysts and there was no association between ward and gastrointestinal parasites. Gastrointestinal parasites are amongst the leading causes in kid mortality. High kid mortalities result in fewer kids surviving to maturity thus compromising goat enterprises.

Predation of goats, particularly young goats, was observed in the study area. This was mainly as a result of wild dogs and prevalent in ward 4. Predation of goats may have been due to the proximity of the study area to national parks and reserves such as Chipangai and Gonarezhou. Predation could have also been as a result of lack of wild prey for wild animals as the study area is characterised by long, hot dry seasons.

The ACF goat production intervention had a significant impact on management practices in the study area. There was a 23% increase in beneficiaries contributing towards the purchase of commercial drugs for goats. This saw a 56% increase in the number of beneficiaries using commercial drugs for their goats. There were no significant differences on management practices such as cutting and carrying feed for goats. This may have been because beneficiaries had been cutting and carrying feed for goats before the intervention was introduced. There were no significant differences in the marketing channels for goats. This may be attributed to the limited duration of the project.

The ACF goat production intervention had a significant impact on pre-weaning and post-weaning mortalities. This may have been due to the collective effort of Communal Based Animal Health Care. There were no significant differences in litter size and kidding interval. This could have been due to the short duration of the project. The intervention had an impact on neighbouring villages that also initiated pass-on schemes amongst themselves.

The sustainability of the ACF goat project was promoted through the formation of Community Animal Health Workers (CAHWs) that replaced extension officers that were reported to visit beneficiaries once every two to three months. The CAHWs offered constant support and attention to sickly goats as well as giving advice to their fellow community members. The goat constitution that comprised of rules and regulations that each member of the intervention was expected to abide by also promoted sustainability of the pass-on scheme. Community members had a goat pass on committee that enforced these rules, in this way beneficiaries also had a sense of ownership of the project. Environmental sustainability is also essential for the future of goat production systems. Sustainability has been defined as the use of current natural resources in a way that will preserve them for future generations. Supporting regrowth of trees through coppicing by beneficiaries will help to protect the environment from degradation.

## 8.2 Conclusion

According to FANTA (2007), to achieve food security, the four pillars of food security which include food availability, food access, stability and utilisation must be addressed. By distributing goats to the study area, ACF increased food availability and access to beneficiaries. By training beneficiaries on improved goat husbandry ACF improved on the food utilisation aspect of food security. The introduction of Community Based Animal Health

Workers promoted stability of food security in the study area. The implementation of the ACF goat production intervention therefore touched on all aspects aimed at improving their goal of increasing food security in the study area.

In addition, in terms of livestock development projects, the ACF goat production intervention was effective in that it met two of the three pathways that livestock can be used as vehicles out of poverty as hypothesised by Kristjanson *et al*., 2010. The goat production intervention managed to secure the goats as current and future assets in the study area and also managed to sustain and improve goat productivity through training of beneficiaries on improved goat housing and feeding and through reduction in pre-weaning and post weaning mortality rates. While the provision for the research for the current state of markets and opportunities for market development was made, this did not materialise over the duration of the project. The third pathway of providing markets was therefore not fully met. Market establishment was important for the sustainability of the intervention.

### 8.3 Recommendations

Future goat production interventions that may be explored include construction of dip tanks for goats to combat ticks and tick borne diseases such as heartwater. This work has been done by World Vision International in Insiza districts Matebeleland.

Other prospects for goat interventions include improving goat breeds. This is known as the Goat Open Nucleus Breeding Scheme (GONBS). This involves a group of small scale goat producers agreeing to pool their high performing animals; the larger the group of animals the more successful the program due to a wider genetic pool (Assan, 2011).

It is recommended that a forage/ fodder bank be established to improve nutrition of goats and thus productivity. An intervention that focuses solely on improving the available feed

resources is also recommended as lack of feed has a negative impact on sustainability of goat interventions.

Market interventions can also be employed as these provide an incentive for goat farmers to increase productivity. This approach has been used widely by Netherlands Development Organisation (SNV) in Matebeleland where they have initiated goat auctions that give goat farmers a platform to sell their goats at favourable prices.

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**APPENDIX 1**

**Questionnaire for the Livelihoods for Improved Nutrition (LIFIN) Project**

AGRICULTURAL RESEARCH
FOR DEVELOPMENT

## Questionnaire for Livelihoods for Improved Nutrition (LIFIN) Project.

Household coordinates……..……

Enumerator……..……... . Date ……

Questionnaire number: Village: …… Ward: ……

This survey is conducted by the University of Zimbabwe (UZ) department of Animal Science in partnership with CIRAD. Its purpose is to monitor and evaluate a goat production intervention being implemented by Action Contre La Faim in wards 1, 4 and 22 in Chipinge district. This information is confidential and will be used to inform future ACF goat production interventions. Your participation will be greatly appreciated.

### A. GENERAL INFORMATION

1. Name of respondent (optional): ……... male/ female

2. Household size: ……..

3. Age distribution of household:

| >10 | 11- 19 | 20- 29 | 30- 39 | 40-49 | +50 |
|---|---|---|---|---|---|
| | | | | | |

4. Are you head of household **1=** Yes **0**= No ☐

5. If you are not head of household, who is?

**1=** mother, **2**= father, **3**= wife, **4=** husband, **5**= brother, **6=** sister, **7=** aunt, **8**= uncle, **9**= grandmother, **10**= grandfather ☐

6. Literacy level: **1=** primary **2=** secondary **3=** tertiary ☐

7a.Please rank your top three sources of income from the list given below:

**1 =** garden, **2=** casual work, **3**= live sales of livestock, **4** = sales of livestock products (milk, manure, other), **5**= cash cropping, **6=** formal work, **7**= remittance, **8**= crafts

……..

b. Other sources of income

……

**B. CROP AND LIVESTOCK PRODUCTION**

8. Please indicate the crops which you grow

| Crop(s) grown | **1=** Yes | **0**= No |
|---|---|---|
| maize | 1 | 0 |
| millet | 1 | 0 |
| sorghum | 1 | 0 |
| cotton | 1 | 0 |
| groundnut | 1 | 0 |
| cowpea | 1 | 0 |
| roundnut | 1 | 0 |

Other, please specify? ……

9. What size is the area of your cropping land in total ……

10. What challenges have you been facing in crop production in the last three years? Circle appropriate.

**1=** low rainfall, **2=** pests, **3**= theft, **4=** input shortages, **5**= labour constraints, **6** =land shortage, **7=** other, please specify……

11. How have you tried to solve these challenges?

a. ……..

b. ……...

c……

d. ……

12. Please indicate the numbers of the following livestock species that you own

| Farm animal | 0=no<br>1=yes | Number owned | Uses **1**=Yes, **0=** No | | | | |
|---|---|---|---|---|---|---|---|
| | | | food | wealth | manure | draught | sales |
| a. chicken | | | | | | | |
| b. goats | | | | | | | |
| c. cattle | | | | | | | |
| d. guinea f | | | | | | | |
| e. pigs | | | | | | | |
| f. donkeys | | | | | | | |
| g. pigeons | | | | | | | |
| h. rabbits | | | | | | | |

13. Where do your livestock graze / browse?

……

14. Is the grazing land / browse adequate? **1=** Yes **0** = No ☐

15. Do you have your own grazing land? **1**= Yes **0**= No ☐

16. How else do you feed your livestock?

**1=** cut and carry (in pen / tethered), **2=** commercial feed, **3**= other, please specify……. ☐

17. What challenges have you faced in the last three years in livestock production? For predation please name the predators in the space below.

**1**= feed shortage, **2=** disease, **3=** predation, **4=** lack of markets, **5=** shortage of grazing land,**6=** low offtake,**7**= theft, **8**=other, please specify ……

……

18. How have you tried to solve these challenges mentioned above?

a……..

b. ……

c. ……

d. ……...

**B. ACTION CONTRE LA FAIM INTERVENTION**

19. Are you a beneficiary of the ACF goat intervention **1=** Yes **0**= No ☐

20. Are you a beneficiary of the ACF conservation farming intervention?

**1=** Yes **0**= No ☐

21. How did you learn of this intervention?

**1**= ACF Field Officer / personnel, **2**= Agritex Officer, **3=** other farmers, **4**= field day **5=** other, please specify …… ☐

**GOAT PRODUCTION INTERVENTION AND GOAT PRODUCTIVITY**

22. Please indicate the numbers of the following:

| Before intervention | | | | After intervention | | | |
|---|---|---|---|---|---|---|---|
| Mature buck | Kid buck | Mature doe | Kid doe | Mature buck | Kid buck | Mature doe | Kid doe |
| | | | | | | | |

23. If number is less than or the same before intervention, please indicate the reasons why

**1**= intervention doe(s) died (disease/ predation), **2**= intervention kid(s) died, **3=** intervention does lost, **4=** intervention does stolen**, 5**= intervention does given away, **6**= intervention does slaughtered, **7=** other, please specify…… ☐

24. What is the kidding rate of your flock?

**1**= 1 kid per year, **2=** 2 kids per year, **3**= 0 kids per year, **4** other, please specify ……. ☐

25. In the past three years has there been any twinning? **1**= Yes **0** = No ☐

26. If your answer to the above question is yes, please indicate how many times

**1**= once, **2=** twice, **3=** three times, **4**= other, please specify…… ☐

27. What is the time period between successive kiddings?

**1=** 8 months, **2** =1 year, **3** =1 and half years, **4** =other, please specify …….. ☐

28. In the past year, how many of the kids born to your flock survived to reproduction age?

**1=** none, **2=**1, **3**=2, **4** other, please specify…… ☐

29a. What are the major challenges in the survival of kids to reach maturity?

**1=** disease, **2=** predation, **3=** kids sold young due to need for cash, **4**= kids slaughtered, **5**= other, please specify …… ☐

29b. Please list the major diseases that affect kids in your flock

a. …….

b. ……

c. …….

d. ……

29c. Please list the predators that prey on kids in the community

a. …….

b. ……

c. ……

d. ……

30. How many of the following die in a given year?

Does ☐ Buck ☐ Kids ☐

31a. What are the reasons for the mortalities?

**1=** disease, **2**= predation, **3=** poor nutrition**, 4**= other, please specify …….. ☐

31b. Please list the diseases that affect adult goats in your flock

a. …….

b. ……

c. ……

d. ……

31c. Please list the predators that prey on adult goats in the community

a. …….

b. ……

c. ……

d. ……..

32. On average, at what age do you normally slaughter your goats?

**1=** 8 months, **2**= 1 year, **3**= 1 and a half years, **4=** 2 years, **5**= never**, 6**= other, please specify…….. ☐

33. In a given year, how many goats do you slaughter?

**1=** none, **2=**1, **3**=2, **4** other, please specify…… ☐

34. Please indicate your reasons for slaughtering your goats?

**1=** consumption, **2**= sales, **3**= traditional purposes, **4**= other, please specify……. ☐

35. On average, what is the longevity of a goat in your flock?

**1=** 8 months, **2=** 1 year, **3=** 1 and a half years, **4=** 2 years, **5=** 3 years, **6=** other, please specify…….. ☐

36. What are the factors that affect the longevity of a goat in your flock?

a. ……

b. ……

c. ……

d. ……

**C. GOAT MANAGEMENT PRACTICES**

37. Did you receive training on goat husbandry? **1=** Yes **0 =** No ☐

38. If your answer to the above question is yes, please indicate who trained you

**1=** agricultural college, **2=** Agritex, **3**= NGO**, 4=** lead farmers, **5=** other, please specify …….. ☐

39. How do you feed your goats?

**1 =** tethered to a tree, **2 =** free range, **3 =** cut and carry, **4**= other, please specify …… ☐

40. Is there any special feed that you collect for your goats? **1=** Yes **0 =** No ☐

41. If your answer to the question above is yes, please indicate the material you collect

**1=** pods, **2=** tree leaves, **3=** twigs, **4=** other, please specify…… ☐

42. Where do you collect this material?

……

43. Please indicate the tree species that you collect?

a. …….

b. ……

c. ……

d. ……

44. What are the major feed sources in the, a, dry season

**1**= crop residues, **2**= kitchen left overs, **3=** browse tree species, **4**= grazing, **5=** commercial feed, **6**= other, please specify …… ☐

45. b, wet season

**1**= crop residues, **2**= kitchen left overs, **3=** browse tree species, **4=** grazing**, 5**= commercial feed, **6**= other, please specify …… ☐

46. Do you supplement feed for pregnant does? **1**= Yes **0**= No ☐

47. If the answer to the question above is yes, please indicate the supplement material that you use

**1**= crop residues, **2**= left overs, **3=** browse tree species, **4=** pods, **5**= commercial feed, **6**= other, please specify …… ☐

48. If the answer to question number 36 above is no, please indicate why

**1=** unavailability of feeding material, **2=** unaware of the importance, **3=** not necessary to supplement, **4=** other, please specify……. ☐

 ☐

49. Do you dip your goats? **1=** Yes **0**= No

40a. If the answer to the above question is yes, please indicate how often in

a. summer ……b. winter …….

50b. What do you use to dip your goats?

**1=** communal dip tank, **2=** spray chemicals, **3=** local medicines

**4=** other, please specify …… ☐

51. If your answer to the above question is response number three, please specify ……..

52. If the answer to question 39 above is no, please indicate why below

**1=** dip tanks inaccessible, **2=** unaware of the importance, **3**= not necessary to dip, **4=** labour constraints **5**= other, please specify …… ☐

53. If your answer to the above question is response number 3, please specify ……..

54. Do you dose your goats? **1=** Yes **0**= No

55a. If the answer to the above question is yes, how often do you dose your goats in a. summer ……b. winter ……

55b. What do you use to dose your goats?

**1=** local medicines (chin'ai), **2**= commercial medicines, **3**= other, please specify

…… ☐

55c. What are your reasons for dosing your goats?

a. …….

b. …….

c. …….

d. ……

56. If your answer to question number 39 above is no, please indicate why

**1=** unavailability of dosing medicines, **2=** unaware of the importance, **3**= not necessary to dose, **4**= labour constraints, **5**= other, please specify …… ☐

57. If your answer to the above question is response number three, please specify ……..

**D. ACF GOAT PASS ON SCHEME**

58. Which tier are you? ……

59. Have you received the ACF goats? **1**= Yes **0**= No ☐

60. What were you required by ACF to do before you received the goats?

| Activity | **1**= Yes | **0**= No | Status | |
|---|---|---|---|---|
| | | | **1=** done | **2**= not done |
| construct goat pen | | | | |
| attend training | | | | |
| contribute to vet care | | | | |
| cut and carry feed for new goats | | | | |

61. What were you required by ACF to do after you received the goats?

a. …….

b. ……

c. ……

d. ……

62. Did you fulfil all these requirements (e.g. construction of goat pens, contributions to veterinary care?)

**1**= Yes **0=** No ☐

63. If your answer to the above question is no, please state why below

a. …….

b. ……

c. ……

d. ……..

64. Where there any challenges in meeting these requirements?

**1**= Yes **0=** No ☐

65. If your answer to the above question is yes, please indicate what they were

a. ……

b. ……

c. …….

d. ……

66. In your opinion, in which areas has ACF done well in the goat pass on scheme?

a. …….

b. ……

c. ……

d……..

67. How many of the does that you were given by ACF did you pass on?

**1**= 1, **2=** 2, **3**= none ☐

68. If you did not pass on any of the does, what were your reasons for doing so?

a. ……..

b. ……

c. ……

d. ……..

69. If you passed on one doe, what were your reasons for doing so?

a. ……..

b. ……

c. ……

d. ……..

70. What was the time period before you passed on the doe (s)?



☐

**1=** 5 months, **2**= 8 months, **3**= 1 year, **4=**other, please specify

71a. How often did you receive extension support for goat rearing before the intervention?

**1=** once a week, **2**= twice a week, **3=** every fortnight, **4=**once a month, **5**= never, **6**= other, please specify……. ☐

71b. Please indicate who you received the extension support from:

**1=** lead farmers, **2=** Agritex officers, **3=** NGO field day**, 4**= other, please specify……...

……. ☐

72a. How often do you receive extension support for goat rearing after the intervention?

**1=** once a week, **2**= twice a week, **3=** every fortnight, **4=**once a month, **5**= never, **6**= other, please specify……. ☐

72b. Please indicate who you receive the extension support from:

**1=** lead farmers, **2=** Agritex officers, **3=** NGO**, 4**= other, please specify……...

……. ☐

73. What do the extension services support you with?

**1=** training, **2**= advice, **3**= disease diagnosis and treatment, **4=** other, please specify…… ☐

74. What would you have wanted the extension services to support you with?

a. ……

b. ……

c. ……

d.……..

75. In your opinion, what are the advantages of the goat pass on scheme?

a. ……

b. ……..

c. …….

d. ……..

76. In your opinion what are the disadvantages of the goat pass on scheme?

a. ……

b. ……..

c. …….

d. ……..

77. Do you have any other comments on the ACF goat intervention?

a. …….

b. ……

c. …….

d. ……

Thank You For Your Time!

## APPENDIX 2

**Chi square tests of association between stakeholders and perceptions**

**Stakeholders' perceptions on effectiveness of training of beneficiaries**

| | Value |
|---|---|
| Pearson Chi-Square | .[a] |
| N of Valid Cases | 52 |

a. No statistics are computed because training effective is a constant.

**Stakeholders' perceptions on effectiveness of animal health management**

| | Value | df | Asymp. Sig. (2-sided) |
|---|---|---|---|
| Pearson Chi-Square | 42.411[a] | 4 | .000 |
| Likelihood Ratio | 27.514 | 4 | .000 |
| Linear-by-Linear Association | 8.844 | 1 | .003 |
| N of Valid Cases | 52 | | |

**Stakeholders' perceptions on effectiveness of project design**

| | Value | df | Asymp. Sig. (2-sided) |
|---|---|---|---|
| Pearson Chi-Square | 52.000[a] | 4 | .000 |
| Likelihood Ratio | 67.083 | 4 | .000 |
| Linear-by-Linear Association | 44.010 | 1 | .000 |
| N of Valid Cases | 52 | | |

**Stakeholders' perceptions on effectiveness of pass-on scheme**

| | Value |
|---|---|
| Pearson Chi-Square | .[a] |
| N of Valid Cases | 52 |

**Stakeholders' perceptions goat breed distributed**

| | Value | df | Asymp. Sig. (2-sided) |
|---|---|---|---|
| Pearson Chi-Square | 52.000[a] | 4 | .000 |
| Likelihood Ratio | 64.193 | 4 | .000 |
| Linear-by-Linear Association | 32.208 | 1 | .000 |
| N of Valid Cases | 52 | | |

## APPENDIX 3

**Gender and goat management**

**Association of ward and household age under 30**

| | Value | df | Asymp. Sig. (2-sided) |
|---|---|---|---|
| Pearson Chi-Square | 1.646[a] | 2 | .439 |
| Likelihood Ratio | 1.951 | 2 | .377 |
| Linear-by-Linear Association | .110 | 1 | .740 |
| N of Valid Cases | 92 | | |

**Association of ward and household age 30-50**

| | Value | df | Asymp. Sig. (2-sided) |
|---|---|---|---|
| Pearson Chi-Square | 12.406[a] | 2 | .002 |
| Likelihood Ratio | 13.877 | 2 | .001 |
| Linear-by-Linear Association | 5.235 | 1 | .022 |
| N of Valid Cases | 92 | | |

**Association of ward and household age over 50**

| | Value | df | Asymp. Sig. (2-sided) |
|---|---|---|---|
| Pearson Chi-Square | 3.676[a] | 2 | .159 |
| Likelihood Ratio | 3.638 | 2 | .162 |
| Linear-by-Linear Association | .412 | 1 | .521 |
| N of Valid Cases | 92 | | |

**Female head of household chi square test with ward**

| ward name | | Value | df | Asymp. Sig. (2-sided) | Exact Sig. (2-sided) | Exact Sig. (1-sided) |
|---|---|---|---|---|---|---|
| | Pearson Chi-Square | 10.799[b] | 2 | .005 | | |
| | Likelihood Ratio | 8.774 | 2 | .012 | | |
| ward 1 | Linear-by-Linear Association | 6.786 | 1 | .009 | | |
| | N of Valid Cases | 37 | | | | |
| | Pearson Chi-Square | 4.828[c] | 1 | .028 | | |
| | Continuity Correction[d] | 3.026 | 1 | .082 | | |
| | Likelihood Ratio | 6.943 | 1 | .008 | | |
| ward 4 | Fisher's Exact Test | | | | .061 | .033 |
| | Linear-by-Linear Association | 4.690 | 1 | .030 | | |
| | N of Valid Cases | 35 | | | | |
| | Pearson Chi-Square | 10.769[e] | 1 | .001 | | |
| | Continuity Correction[d] | 7.912 | 1 | .005 | | |
| | Likelihood Ratio | 13.681 | 1 | .000 | | |
| ward 22 | Fisher's Exact Test | | | | .003 | .002 |
| | Linear-by-Linear Association | 10.231 | 1 | .001 | | |
| | N of Valid Cases | 20 | | | | |
| | Pearson Chi-Square | 19.774[a] | 2 | .000 | | |
| | Likelihood Ratio | 25.370 | 2 | .000 | | |
| Total | Linear-by-Linear Association | 18.788 | 1 | .000 | | |
| | N of Valid Cases | 92 | | | | |

**Chi square test of association between sex of respondent and ward**

| | Value | df | Asymp. Sig. (2-sided) |
|---|---|---|---|
| Pearson Chi-Square | 8.642[a] | 6 | .195 |
| Likelihood Ratio | 9.023 | 6 | .172 |
| Linear-by-Linear Association | .532 | 1 | .466 |
| N of Valid Cases | 92 | | |

+

**Gender and goat management in the study area**

**Chi square test of association between women herding and ward**

| | Value | df | Asymp. Sig. (2-sided) |
|---|---|---|---|
| Pearson Chi-Square | 1.200[a] | 2 | .549 |
| Likelihood Ratio | 1.262 | 2 | .532 |
| Linear-by-Linear Association | .169 | 1 | .681 |
| N of Valid Cases | 30 | | |

**Chi square test of association between children herding and ward**

| | Value | df | Asymp. Sig. (2-sided) |
|---|---|---|---|
| Pearson Chi-Square | 1.200[a] | 2 | .549 |
| Likelihood Ratio | 1.262 | 2 | .532 |
| Linear-by-Linear Association | .169 | 1 | .681 |
| N of Valid Cases | 30 | | |

**Chi square test of association between men herding and ward**

| | Value |
|---|---|
| Pearson Chi-Square | .[a] |
| N of Valid Cases | 30 |

**Chi square test of association between women kraaling and ward**

| | Value | df | Asymp. Sig. (2-sided) |
|---|---|---|---|
| Pearson Chi-Square | .373[a] | 2 | .830 |
| Likelihood Ratio | .363 | 2 | .834 |
| Linear-by-Linear Association | .134 | 1 | .714 |
| N of Valid Cases | 30 | | |

**Chi square test of association between children kraaling and ward**

| | Value | df | Asymp. Sig. (2-sided) |
|---|---|---|---|
| Pearson Chi-Square | .000[a] | 2 | 1.000 |
| Likelihood Ratio | .000 | 2 | 1.000 |
| Linear-by-Linear Association | .000 | 1 | 1.000 |
| N of Valid Cases | 30 | | |

**Chi square test of association between men kraaling and ward**

| | Value | df | Asymp. Sig. (2-sided) |
|---|---|---|---|
| Pearson Chi-Square | 1.250[a] | 2 | .535 |
| Likelihood Ratio | 1.297 | 2 | .523 |
| Linear-by-Linear Association | .021 | 1 | .885 |
| N of Valid Cases | 30 | | |

**Chi square test of association between women vaccinating and ward**

| | Value | df | Asymp. Sig. (2-sided) |
|---|---|---|---|
| Pearson Chi-Square | 2.386[a] | 2 | .303 |
| Likelihood Ratio | 2.616 | 2 | .270 |
| Linear-by-Linear Association | 1.841 | 1 | .175 |
| N of Valid Cases | 30 | | |

**Chi square test of association between children vaccinating and ward**

| | Value |
|---|---|
| Pearson Chi-Square | .[a] |
| N of Valid Cases | 30 |

a. No statistics are computed because children vaccinating is a constant.

**Chi square test of association between men vaccinating and ward**

| | Value | df | Asymp. Sig. (2-sided) |
|---|---|---|---|
| Pearson Chi-Square | 4.845[a] | 2 | .089 |
| Likelihood Ratio | 6.919 | 2 | .031 |
| Linear-by-Linear Association | 4.055 | 1 | .044 |
| N of Valid Cases | 30 | | |

**Chi square test of association between women goat health and ward**

| | Value | df | Asymp. Sig. (2-sided) |
|---|---|---|---|
| Pearson Chi-Square | .952[a] | 2 | .621 |
| Likelihood Ratio | .966 | 2 | .617 |
| Linear-by-Linear Association | .578 | 1 | .447 |
| N of Valid Cases | 30 | | |

a. 3 cells (50.0%) have expected count less than 5. The minimum expected count is 3.00.

**Chi square test of association between men goat health and ward**

| | Value | df | Asymp. Sig. (2-sided) |
|---|---|---|---|
| Pearson Chi-Square | 1.920[a] | 2 | .383 |
| Likelihood Ratio | 1.813 | 2 | .404 |
| Linear-by-Linear Association | .270 | 1 | .603 |
| N of Valid Cases | 30 | | |

**Chi square test of association between children goat health and ward**

| | Value | df | Asymp. Sig. (2-sided) |
|---|---|---|---|
| Pearson Chi-Square | .577[a] | 2 | .749 |
| Likelihood Ratio | .549 | 2 | .760 |
| Linear-by-Linear Association | .208 | 1 | .649 |
| N of Valid Cases | 30 | | |

## APPENDIX 4

**ANOVA table for goat mortality rates for the years 2011 and 2012**

| Sample | size | mean | Variance | Standard deviation | Standard error of mean |
|---|---|---|---|---|---|
| 2011 | 12 | 12.750 | 38.39 | 6.196 | 1.789 |
| 2012 | 12 | 3.083 | 1.72 | 1.311 | 0.379 |

Test statistic F = 22.32 and 11 d.f.

Test statistic t = 5.29 on approximately 11.98 d.f.

Probability < 0.001

**Chi square tests for association between cause of mortality and ward**

**Chi square test of association between disease and ward**

| | |
|---|---|
| Pearson Chi-Square | .[a] |
| N of Valid Cases | 92 |

a. No statistics are computed because disease is a constant.

**Chi square test of association between road accidents and ward**

| | Value | df | Asymp. Sig. (2-sided) |
|---|---|---|---|
| Pearson Chi-Square | 2.803[a] | 2 | .246 |
| Likelihood Ratio | 2.937 | 2 | .230 |
| Linear-by-Linear Association | 2.709 | 1 | .100 |
| N of Valid Cases | 92 | | |

**Chi square test of association between abortions and ward name**

| | Value | df | Asymp. Sig. (2-sided) |
|---|---|---|---|
| Pearson Chi-Square | 3.839[a] | 2 | .147 |
| Likelihood Ratio | 3.873 | 2 | .144 |
| Linear-by-Linear Association | .036 | 1 | .849 |
| N of Valid Cases | 92 | | |

**Chi square test of association between predation and ward**

| | Value | df | Asymp. Sig. (2-sided) |
|---|---|---|---|
| Pearson Chi-Square | 9.175[a] | 2 | .010 |
| Likelihood Ratio | 9.324 | 2 | .009 |
| Linear-by-Linear Association | 2.150 | 1 | .143 |
| N of Valid Cases | 92 | | |

**Chi square test of association between predator and ward**

**Chi square test of association between ward and common dog occurrence**

| | **Value** | **df** | **Asymp. Sig. (2-sided)** |
|---|---|---|---|
| Pearson Chi-Square | 1.503[a] | 2 | .472 |
| Likelihood Ratio | 1.838 | 2 | .399 |
| Linear-by-Linear Association | .488 | 1 | .485 |
| N of Valid Cases | 92 | | |

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**Chi square test of association between ward and baboon occurrence**

| | Value | df | Asymp. Sig. (2-sided) |
|---|---|---|---|
| Pearson Chi-Square | 32.110[a] | 2 | .000 |
| Likelihood Ratio | 38.272 | 2 | .000 |
| Linear-by-Linear Association | 9.797 | 1 | .002 |
| N of Valid Cases | 92 | | |

**Chi square test of association between ward and hyenas**

| | Value | df | Asymp. Sig. (2-sided) |
|---|---|---|---|
| Pearson Chi-Square | 1.578[a] | 2 | .454 |
| Likelihood Ratio | 2.136 | 2 | .344 |
| Linear-by-Linear Association | .696 | 1 | .404 |
| N of Valid Cases | 92 | | |

**Chi Square test of association between ward and wild dog occurrence**

| | Value | df | Asymp. Sig. (2-sided) |
|---|---|---|---|
| Pearson Chi-Square | 34.138[a] | 2 | .000 |
| Likelihood Ratio | 37.675 | 2 | .000 |
| Linear-by-Linear Association | 4.570 | 1 | .033 |
| N of Valid Cases | 92 | | |

**Chi Square test of association between ward and lion occurrence**

| | Value | df | Asymp. Sig. (2-sided) |
|---|---|---|---|
| Pearson Chi-Square | 75.072[a] | 2 | .000 |
| Likelihood Ratio | 71.148 | 2 | .000 |
| Linear-by-Linear Association | 72.298 | 1 | .000 |
| N of Valid Cases | 92 | | |

**Kruskal Wallis one way ANOVA for strongyle and coccidia infections**

Value of H = 0.03415

Adjusted for ties = 0.04047

| Sample | Size | Mean rank |
|---|---|---|
| Coccidia oocysts | 30 | 30.92 |
| Strongyle eggs | 30 | 30.08 |

Degree of freedom = 1

Chi square probability= 0.841

**Chi square test of association between coccidia oocysts and ward**

| | Value | df | Asymp. Sig. (2-sided) |
|---|---|---|---|
| Pearson Chi-Square | 3.333[a] | 2 | .189 |
| Likelihood Ratio | 3.452 | 2 | .178 |
| Linear-by-Linear Association | 2.754 | 1 | .097 |
| N of Valid Cases | 30 | | |

**Chi square test of association between strongyle eggs and ward**

| | Value | df | Asymp. Sig. (2-sided) |
|---|---|---|---|
| Pearson Chi-Square | 5.833[a] | 2 | .054 |
| Likelihood Ratio | 5.938 | 2 | .051 |
| Linear-by-Linear Association | 1.700 | 1 | .192 |
| N of Valid Cases | 30 | | |

## APPENDIX 5

**Goat numbers before and after the intervention**

| | | Paired Differences | | | | | t | df | Sig. (2-tailed) |
|---|---|---|---|---|---|---|---|---|---|
| | | Mean | Std. Deviation | Std. Error Mean | 95% Confidence Interval of the Difference | | | | |
| | | | | | Lower | Upper | | | |
| Pair 1 | mature buck before intervention - mature buck after the intervention | .054 | .542 | .057 | -.058 | .167 | .962 | 91 | .339 |
| Pair 2 | kid buck before intervention - kid buck after the intervention | -.098 | .664 | .069 | -.235 | .040 | -1.413 | 91 | .161 |
| Pair 3 | mature does before the intervention - mature does after the intervention | -.522 | 1.084 | .113 | -.746 | -.297 | -4.616 | 91 | .000 |
| Pair 4 | kid does before the intervention - kid does after the intervention | -.152 | .610 | .064 | -.279 | -.026 | -2.392 | 91 | .019 |

**ANOVA table showing changes in goat numbers in different tiers**

| | | Sum of Squares | df | Mean Square | F | Sig. |
|---|---|---|---|---|---|---|
| please indicate the number of mature buck before intervention | Between Groups | 2.460 | 2 | 1.230 | 1.009 | .369 |
| | Within Groups | 108.442 | 89 | 1.218 | | |
| | Total | 110.902 | 91 | | | |
| please indicate the number of kid buck before intervention | Between Groups | .186 | 2 | .093 | .164 | .849 |
| | Within Groups | 50.423 | 89 | .567 | | |
| | Total | 50.609 | 91 | | | |
| please indicate the number of mature does before the intervention | Between Groups | .887 | 2 | .444 | .125 | .883 |
| | Within Groups | 316.069 | 89 | 3.551 | | |
| | Total | 316.957 | 91 | | | |
| please indicate the number of kid does before the intervention | Between Groups | 1.264 | 2 | .632 | .831 | .439 |
| | Within Groups | 67.692 | 89 | .761 | | |
| | Total | 68.957 | 91 | | | |
| please indicate the number of mature buck before the intervention | Between Groups | 3.149 | 2 | 1.574 | 1.170 | .315 |
| | Within Groups | 119.808 | 89 | 1.346 | | |
| | Total | 122.957 | 91 | | | |
| please indicate the number of kid buck after the intervention | Between Groups | 2.383 | 2 | 1.191 | 1.644 | .199 |
| | Within Groups | 64.519 | 89 | .725 | | |
| | Total | 66.902 | 91 | | | |
| please indicate the number of mature does after the intervention | Between Groups | 22.895 | 2 | 11.448 | 2.887 | .061 |
| | Within Groups | 352.931 | 89 | 3.966 | | |
| | Total | 375.826 | 91 | | | |
| please indicate the numbers of kid does after the intervention | Between Groups | .148 | 2 | .074 | .082 | .921 |
| | Within Groups | 80.069 | 89 | .900 | | |
| | Total | 80.217 | 91 | | | |

**Impact of ACF goat intervention on goat management in study area**

| | | Paired Differences | | | | | t | df | Sig. (2-tailed) |
|---|---|---|---|---|---|---|---|---|---|
| | | Mean | Std. Deviation | Std. Error Mean | 95% Confidence Interval of the Difference | | | | |
| | | | | | Lower | Upper | | | |
| Pair 1 | goat markets before - goat markets after | .03261 | .47926 | .04997 | -.06664 | .13186 | .653 | 91 | .516 |

| | | Paired Differences | | | | | t | df | Sig. (2-tailed) |
|---|---|---|---|---|---|---|---|---|---|
| | | Mean | Std. Deviation | Std. Error Mean | 95% Confidence Interval of the Difference | | | | |
| | | | | | Lower | Upper | | | |
| Pair 1 | commercial drugs use before - commercial drugs after | -.23913 | .54207 | .05651 | -.35139 | -.12687 | -4.231 | 91 | .000 |

| | | Paired Differences | | | | | t | df | Sig. (2-tailed) |
|---|---|---|---|---|---|---|---|---|---|
| | | Mean | Std. Deviation | Std. Error Mean | 95% Confidence Interval of the Difference | | | | |
| | | | | | Lower | Upper | | | |
| Pair 1 | training before - attend training on goat husbandry | .79348 | .40703 | .04244 | .70919 | .87777 | 18.698 | 91 | .000 |

| | | Paired Differences | | | | | t | df | Sig. (2-tailed) |
|---|---|---|---|---|---|---|---|---|---|
| | | Mean | Std. Deviation | Std. Error Mean | 95% Confidence Interval of the Difference | | | | |
| | | | | | Lower | Upper | | | |
| Pair 1 | cutting and carrying before - did you cut and carry | .17391 | .58570 | .06106 | .05262 | .29521 | 2.848 | 91 | .005 |
| Pair 2 | did you have raised pens before intervention - did you build raised goat pen | .57609 | .51853 | .05406 | .46870 | .68347 | 10.656 | 91 | .000 |

| | | Paired Differences | | | | | t | df | Sig. (2-tailed) |
|---|---|---|---|---|---|---|---|---|---|
| | | Mean | Std. Deviation | Std. Error Mean | 95% Confidence Interval of the Difference | | | | |
| | | | | | Lower | Upper | | | |
| Pair 1 | contributing to vet care before - did you contribute to veterinary care | .21739 | .58977 | .06149 | .09525 | .33953 | 3.536 | 91 | .001 |

**Impact of ACF goat intervention on goat productivity**

| | | Paired Differences | | | | | t | df | Sig. (2-tailed) |
|---|---|---|---|---|---|---|---|---|---|
| | | Mean | Std. Deviation | Std. Error Mean | 95% Confidence Interval of the Difference | | | | |
| | | | | | Lower | Upper | | | |
| Pair 1 | Post weaning mortality before - kid mortality postweaning after intervention | .31868 | 1.29854 | .13612 | .04825 | .58912 | 2.341 | 90 | .021 |

| | | Paired Differences | | | | | t | df | Sig. (2-tailed) |
|---|---|---|---|---|---|---|---|---|---|
| | | Mean | Std. Deviation | Std. Error Mean | 95% Confidence Interval of the Difference | | | | |
| | | | | | Lower | Upper | | | |
| Pair 1 | Pre weaning mortality before – pre weaning mortality after | -.36957 | .84798 | .08841 | -.54518 | -.19395 | -4.180 | 91 | .000 |

| | | Paired Differences | | | | | t | df | Sig. (2-tailed) |
|---|---|---|---|---|---|---|---|---|---|
| | | Mean | Std. Deviation | Std. Error Mean | 95% Confidence Interval of the Difference | | | | |
| | | | | | Lower | Upper | | | |
| Pair 1 | kidding before intervention - kidding after intervention | .04348 | .69398 | .07235 | -.10024 | .18720 | .601 | 91 | .549 |
| Pair 2 | abortions before - abortions after | .13043 | .78750 | .08210 | -.03265 | .29352 | 1.589 | 91 | .116 |

| | | Paired Differences | | | | | t | df | Sig. (2-tailed) |
|---|---|---|---|---|---|---|---|---|---|
| | | Mean | Std. Deviation | Std. Error Mean | 95% Confidence Interval of the Difference | | | | |
| | | | | | Lower | Upper | | | |
| Pair 1 | successive kiddings before - successive kiddings after | 7.29348 | 59.19172 | 6.17116 | -4.96478 | 19.55174 | 1.182 | 91 | .240 |