PERFORMANCE OF THE COMMUNITY MARKETS FOR CONSERVATION (COMACO) MODEL IN SHIWANG'ANDU DISTRICT

BY

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A Dissertation Submitted to the University of Zambia in Partial Fulfilment of the Requirements for the degree of Master of Science in Environmental and Natural Resources Management

THE UNIVERSITY OF ZAMBIA

LUSAKA

2017

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Declaration

I, Promise Chenjelani Zulu declare that this dissertation is a result of my own archival and field research. I further declare that all figures, and tables, except for those whose sources have been acknowledged are original and that this work has not been submitted to any University for any academic award.

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This dissertation by Promise Chenjelani Zulu is approved as a partial fulfillment of the requirement of the award of the degree of Master of Science in Environmental and Natural Resource Management of the University of Zambia.

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Abstract

This study aimed at developing an understanding of the performance of the Community Markets for Conservation (COMACO) in Shiwang'andu district of Muchinga Province, Zambia. The rationale of the study was to obtain information that would guide the government and other stakeholders in agriculture on how to utilize market linkages to encourage conservation among smallholder farmers. The study employed both qualitative and quantitative approaches during the research process. Purposive sampling was used to select two COMACO officials and five lead farmers while simple random sampling was used to select the 143 households from the farmer's lists under COMACO. Data collection instruments used included structured and semi structured interviews, focus group discussions and field observations. Qualitative data were analysed using content analysis by generating identical themes while quantitative data was analyzed using Chi-square tests and measures of central tendency.

The study revealed that COMACO is engaged in a lot of activities which are contributing to the sustainable management of natural resources through the promotion of Conservation Agriculture (CA). Among the prominent activities were transformation of charcoal producers, poachers and *Chitemene* farmers into CA farmers, bee keepers, fish farmers and horticulturalists. The research also revealed that 67 percent of the households under COMACO were willing to continue practicing CA as long as COMACO keeps providing a market for their crop produce. The level of CA adoption which entails simultaneous implementation of the three principles of CA was as high at 72% and analysis showed a significant relationship between market linkages and levels of CA practice (x^2=143.0 ; Df= 1;$p \leq 0.0001$). Consequently participating communities experienced an increase in income levels as well as livelihoods due to market linkages provided by COMACO. The study further showed that the improvement in livelihood status is highly linked to CA since members receive market incentives for engaging in environmentally sustainable practices. It was noted that despite registering improved livelihoods and incomes the households faced some challenges. Prominent among the challenges was some members still sticking to conventional way of farming. Lack of beneficiaries' participation in decision making and planning was also cited a major challenge. The study conludes that COMACO activities can lead to the protection of the natural resources especially land, forests and wildlife in the long term. Therefore the study recommends that in order to make CA an efficient farming system and facilitate its adoption process there is need for COMACO to strengthen its extension services and allow all stakeholders to participate in decision making and planning process.

Dedication

To my late mother Monica Zulu. I wish she was here to witness my success. May her soul rest in eternal peace.

Acknowledgements

My research project, out of which arises this report, owes its success to the following people who encouraged me in various ways. Firstly my thanks go to my Supervisor Dr. B. Umar for her tolerance, good guidance and for accepting to be my supervisor. To you I am profoundly indebted. Secondly I would like to thank all the lecturers in the Department of Geography and Environmental Studies as well as my classmates for their support academically. I would also like to extend my sincere gratitude to the following; Mr. J. Nyirenda the regional manager of COMACO, Mr. E. Hamalila, the project coordinator for COMACO, Mr. K. Mutale, the senior lead farmer and the people of Shiwang'andu district for their time and information provided for this study.

Special thanks also go to Dr. P. Nyanga for allowing me to have access to the GPS which was used to collect the coordinates of the areas understudy and the headmen of the six villages where the study was conducted from. I also thank Messers. A. Mbuta, M. Kangwa and C. Chimfwembe who were my research assistants during data collection.

I also thank my family for its patience and the support rendered to me during my whole study period. Last but not the least I thank Mr. D. Chimangeni my room- mate for allowing a conducive atmosphere for the compilation of this dissertation and Mr. M. Chikampa for the use of his vehicle during data collection. I thank you all. God bless you all.

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List of Acronyms and Abbreviations

ACP	Agricultural Commercialisation Programme
ACT	African Conservation Tillage
CA	Conservation Agriculture
CAP	Conservation Agriculture Programme
CF	Conventional Farming
CFU	Conservation Farming Unit
COMACO	Community Markets for Conservation
COMESA	Common Markets for Eastern Southern and Africa
CRBs	Community Resource Boards
EU	European Union
FAO	Food Agriculture Organisation
FGD	Focus Group Discussions
GART	Golden valley Agricultural Research Trust
GMAs	Game Management Areas
GRZ	Government of the Republic of Zambia
ICRAF	International Centre for Research and Agro Forestry
IFAD	International Fund for Agriculture Development
IPCC	International Panel on Climate Change
MACO	Ministry of Agriculture and Cooperatives
MAL	Ministry of Agriculture and Livestock
MFTC	Monze Farmers Training Centre
MOF	Ministry of Finance
NGOs	Non-Governmental Organisations
NORAD	Norwegian Agency for Development Cooperation
NRM	Natural Resources Management
PES	Payments for Ecosystem Services
PRSP	Poverty Reduction Strategy Programme
QDA	Qualitative Data Analysis
SCAFE	Soil Conservation And Fertility
SIDA	Swedish International Development Agency

SPSS	Statistical Package for Social Sciences
SSA	Sub Sahara Africa
USA	United States of America
USAID	United States Agency for International Development
WCS	World Conservation Society
WFP	World Food Programme
ZAWA	Zambia Wildlife Authority
ZNFU	Zambia National Farmers Union

List of Definitions and Concepts

Conservation Agriculture

African Conservation Tillage (2014) defines CA as a management system based on three principles that should be applied in a mutually reinforcing manner: minimum physical soil disturbance, permanent soil cover with live or dead plant material, and crop diversification in space and time. Based on this definition CA is characterized by the following elements:

(a) Minimum soil disturbance. In practice this means at most producing a narrow seeding slot in the soil.

(b) Permanent organic soil cover with living or dead plant material. This means leaving as much crop residue as possible on the soil surface; incorporating cover crops into the cropping sequence; and/or associating crops particularly legumes, with cash or food crops.

(c) Practising rotations and associations. Rotating different types of crops (especially legumes and non-legumes) has long been recognized as a natural way to combat pests and diseases. Crop associations are recommended for soil fertility enhancement both in annual and perennial crops (Sims *et al.,* 2012).

CHAPTER ONE
INTRODUCTION

1.0 Background

Most of the soils in Africa are of poor quality mainly due to inappropriate land use, poor management and nutrient mining which have led to declining productivity (FAO, 2009). The soils are at risk as they are commonly undergoing degradation due to use of new technologies such as chemical fertilisers, synthetic herbicides, pesticides and farm machinery like tractors. The goal behind the use of these external inputs is to improve agricultural productivity so as to feed the ever expanding human and livestock populations.

The use of chemical fertilisers, synthetic herbicides and pesticides has dramatically influenced the environment by increasing pollution. The pollution of the soil has resulted in the lowering of soil quality (FAO, 2011). The use of farm machinery like tractors has led to physical soil degradation due to compaction, sealing and crusting. In addition, the practice of shifting cultivation in the context of increased population and lower fallow periods have also contributed to lowering the quality of soils. When these practices (either low or high input) are combined with drought and periodically heavy rainfall, the result is gradual degradation of soil quality and subsequently declining ability of the soil to sustain agricultural production (Hobbs *et al,* 2008).

Therefore, approaches to halt and reverse degradation as well as boost agricultural productivity have gained increasing interest in Africa and the world at large. Conservation approaches particularly through Conservation Agriculture (CA) has been hailed as being able to contribute significantly to reducing land degradation and increasing food security (FAO, 2012). According to Drechsel*et al,* (2001) CA appears to offer great potential to address the above mentioned problems Based on past and ongoing experiences there is need to determine the specific bio-physical and socio-economic circumstances that could encourage the adoption of CA by small, medium and large scale farmers in Africa.

According to its proponents, CA aims to sustainably improve productivity, profits and food security by combining the three principles namely; minimum mechanical disturbance, permanent organic soil cover and crop rotation (FAO, 2010). It is claimed that crop rotation allows for the inclusion of crops that contribute to increased soil fertility (e.g. nitrogen-fixing legume) (FAO 2010). Crop rotation system under CA are particularly resistant to pests and disease, since those

that are crop specific have no host in the intervening years. As a result the soil became resistance to pathogens hence pesticide use may also decrease (Hobbs *et al.*, 2008). Further it is claimed that permanent organic soil cover contributes to the elimination of water loss by runoff (ACT, 2006). Likewise CA is believed to increase crop yields and production diversity if all the three principles are followed (FAO, 2011). Hence CA practices can greatly help to overcome land degradation problems.

Conservation Agriculture has been promoted by many international and national organizations to smallholder farmers in Sub-Saharan Africa (SSA) as a solution to soil degradation and low production (Giller*et al.*, 2009). Despite the general consensus on the three principles, the practice of CA across SSA is diverse given its highly heterogeneous bio-physical, socio-cultural, economic and institutional environment. Therefore this study seeks to determine the performance of COMACO in implementing CA activities in Shiwang'andu district. The next section presents a brief overview of CA in Zambia.

1.1 Conservation Agriculture in Zambia

Zambia has emerged as one of the pioneers in promoting CA in Africa (FAO, 2011). Of the 600,000 ha estimated to be under CA in Africa, it can be estimated that close to 25 percent of it is practiced by Zambian farmers and land users (approximately 150,000ha) (FAO, 2011). The emergence of CA in Zambia in 1990's accompanied ecological and economic challenges. With the abrupt ending of subsidies for maize, fertilizer and farm machinery following the collapse of copper prices, Zambian farmers found themselves trying to cultivate heavily degraded soils without the extra inputs they had been using for three decades (Aslan *et al,* 2013). The experiences of farmers with CA in the U.S. and Zimbabwe helped commercial maize farmers in Zambia to become interested in CA. The promotion of CA started as a response to low agricultural productivity on degraded soils which was thought to be caused by intensive tillage, lack of soil cover and burning of crop residue (Baudron *et al.*, 2007).

Conservation Agriculture as promoted in Zambia involves dry-season land preparation using locally tailored minimum tillage systems; retention of crop residues; micro-dosing of inputs such as seeds, lime, mineral and organic fertilizers; nitrogen-fixing crop rotations; timely sowing of crops; and the management of the leguminous tree winter thorn or *Faidherbiaalbida* (Umar *et*

al., 2013). According to Umar (2012) the recommended practice of manual CA in Zambia suggests digging basins with a length of 30cm, a width of 15cm and a depth of 20cm. The basins are interspaced in a 70cm x 90cm matrix resulting in 15 850 basins per hectare. At 0.045m2 per basin, the total area covered by basins is 713 m2 per hectare, representing 7% of soil disturbance. Traction CA prescriptions involve making furrows that are 15cm-20cm deep at 90cm spacing. This is equivalent to tillage on approximately 10% -12% of the land (Umar *et al.*, 2011).

In Zambia CA is espoused as being a solution to reducing land degradation and increasing agricultural productivity and food security. Haggblade and Tembo (2003) note that the development of CA can be traced from the late 1980s and early 1990s. The first project in Zambia on CA was the Soil Conservation and Fertility (SCAFE) project that started in 1985 in the Eastern province. Later on the project expanded to include Lusaka funded by the Swedish International Development Agency (SIDA) (Baudron*et al*., 2007). In the late 1990s the Ministry of Agriculture and Cooperatives (MACO) adapted CA as an official priority which was followed by an increase in the number of CA projects funded by various institutions (Chomba, 2004). In addition the Norwegian Agency for Development Cooperation (NORAD), FAO, World Bank, World Food Programme (WFP) and the European Union (EU) have promoted CA in Zambia.

At policy level, the government of the republic of Zambia through the Ministry of Agriculture and Cooperatives and the Ministry of Finance (MOF) have developed the Agricultural Commercialisation Programme (ACP) and Poverty Reduction Strategy Programme (PRSP). These programmes seek to promote the development of an efficient, competitive and sustainable agricultural sector that would enhance food security and increase income for the farmers. Regarding CA, the government of Zambia has since the mid-1990s affirmed that it would continue to promote CA practices to the farming population (MACO, 2004). In a series of donor supported projects and programmes, Conservation Agriculture Programme (CAP) is the most recent. The first phase of CAP was implemented by CFU from 2007 to 2011 funded by the Norwegian Ministry of foreign affairs (CFU, 2006). All these programmes ended at merely pronouncing CA based on its agronomic merits.

In 2003 a novel programme commenced which went beyond mere promotion of CA but also included market linkages. This is the Community Markets for Conservation (COMACO) programme. Within a single generation, Zambia has seen much of its land transform under

growing agricultural pressure to feed people and satisfy demanding export markets for crops such as cotton and tobacco. No longer can Zambia say its land is boundless and able to sustain food security for all. For the Smallholder farmers, the need for soil conservation is greater than ever, (Lewis, 2009). But so is the need for markets for agricultural produce. The next section provides as overview of COMACO whose design is specifically meant to achieve the twin goals of conservation and market provision.

1.2 Community Markets for Conservation in Zambia. .

COMACO is a model for rural development that uses inputs, improved techniques and markets to help smallholder farmer communities achieve increased food security and incomes and more effective conservation of the natural resources. According to Lewis (2009) the model works on the premise that households will reduce destructive uses of the natural resources if their basic food and income needs are met in ways that remove the need to rely on destructive resource use practices. According to USAID (2011) COMACO also recognizes that people accustomed to bad practices often require incentives to change behaviour and this process can take time and may require disincentives if change does not follow.

The COMACO model was developed by the Wildlife Conservation Society (WCS) in partnership with Zambia Wildlife Authority (ZAWA), District Councils and Community Resources Boards (CRBs). Since 2001, COMACO has operated in Game Management Areas (GMAs) of the Luangwa Valley (WCS, 2004). COMACO has built its business around helping poor farmers and buying the commodities they produce. The company applies a combination of input support, training and market linkages to influence farming practices as a basis for safeguarding soils, forests and wildlife (Simasiku*et al.*, 2010).

COMACO Ltd, became a Zambian registered, limited-by-guarantee, non-profit company in 2009. COMACO operates two distinct, separately funded operational units: a farmer support services division and a commercial enterprise that manufactures and sells value-added food products under the brand, It's Wild! Prior to that and since 2003, it operated as an NGO-piloted project. Through its Articles of Association, COMACO is mandated to target the poor, food-insecure farmers who are most prone to resort to poaching, charcoal-making, and other

environmental vices to compensate for poor farming results. Recent research by Simasiku *et al*., (2010) claim that COMACO model focuses on biodiversity threatening activities such as charcoal production and poaching by building capacities for locals involved in these practices. Additionally, Lewis *et al*. (2011) state that expected outcomes of the model include promoting and sustaining sustainable land-use and Natural Resource Management (NRM) activities which should lead to both direct and indirect conservation of biodiversity. Simasiku *et al*, (2010) indicate that COMACO measures of success include enhanced human welfare, government saving of resources as well as better food security and generation of income.

Since 2003, COMACO has grown its farmer membership base to 89,102 (2013 farmer register) at an approximate rate of about 21 percent per annum (Lewis, 2009). These farmers are supported by a workforce of 56 COMACO- salaried extension staff and 1,650 lead farmers who assist with year round training activities and target no more than two to three registered farmer groups. These groups consist of 15 to 20 farmers where each member signs a conservation pledge and agree to be governed by the approved by-laws. It is through these farmer groups, with their respective elected leader that COMACO channels its farmer support services in the form of training, inputs and market support. To date COMACO supports 3,939 producer groups, 52 percent of its farmer members each representing their respective household, are women (Lewis 2009). Therefore this study will seek to determine performance COMACO regarding CA practice in Shiwang'andu district.

1.3 Statement of the problem

The Zambian government as well as the donor community has been promoting CA in Zambia and millions of dollars have been invested into the dissemination of CA technologies (Chomba 2004). Despite its promotion over the years, adoption of CA in Zambia is relatively low (Arslan *et al.,* 2013). Continued allocation of large amounts of resources with competing needs to CA programmes with no guaranteed results is a challenge that has plagued agricultural development.The problem of accurate assessments of how market linkages for legume can be used to enhance Conservation Agriculture as pinpointed by Umar (2011) is still a challenge as well as a research gap. As earlier noted, while COMACO is not the onlyactor promoting conservation agriculture in Zambia; the COMACO approach is quite unique fromother similar

attempts. Mfune *et al,* (2015) say that this is because in promoting conservation agriculture, most actors are

mainly concerned with increasing crop yields, efficiency in agro-resource use and buffering cropbased agriculture against climate related risks. In this regard, conservation agriculture still remainssingle-sector centered (i.e., focusing on the agricultural sector alone). Further, the promotion of CFmostly focuses on the production side and is delinked from other components of the agricultural valuechain such as value addition and marketing. Hence this study investigates how COMACO is performing in terms of CA implementation given that it has added market linkages to its package which other promoters of CA have not done.

1.4 Aim

The aim of this study was to determine the performance of COMACO in terms of CA implementation by examining its successes and challenges in Shiwang'andu district.

1.5 Objectives

1. To determine the achievements of the COMACO model in Shiwang'andu district since its inception.

2. To assess the benefits accruing to smallholder farmers under COMACO in Shiwang'andu district.

3. To investigate the challenges faced by COMACO in Shiwang'andu district.

1.6 Research questions

1. What results has the model yielded since its inception in Shiwang'andu district?

2. What benefits do the smallholder farmers under COMACO derive from COMACO activities in Shiwang'andu district?

3. What challenges are associated with COMACO model since its inception in Shiwang'andu district?

1.7 Hypothesis

The hypothesis to be tested is that market linkages as provided by COMACO to farmers have had no significant effects on levels of CA practice.

1.8 Significance of the study

The combination of approaches used by COMACO such as input support, training and market incentives to influence farming practices as a basis for conservation are potentially useful to other promoters of sustainable agriculture approaches. The results from this research would guide the government and other stakeholders in agriculture on how to utilize market linkages to encourage Conservation Agriculture among smallholder farmers.

1.9 Organisation of chapters

The dissertation is divided into seven chapters. Chapter one describes the background to the study and provides the research problem, questions and objectives. Moreover, it presents the scope and significance of the study in view of research findings. The second chapter is a review of literature on the concept of CA in the world, Sub Sahara Africa and Zambia in particular. Chapter three explains the study area in relation to geographical location, climate, agro-ecological and socio-economic characteristics. A description of the methodology with respect to research design and other aspects is also provided in chapter four. Chapter five presents the research results and is followed by chapter six which discusses the results. Chapter seven consists of conclusions and recommendations.

CHAPTER TWO
LITERATURE REVIEW

2.0 Introduction

This chapter reviews literature on the origins and dynamics of CA from a global perspective. The chapter also looks at CA from the African perspective, its benefits as well as challenges. Also included in this chapter is CA as practiced in Zambia highlighting its successes and challenges.

Conservation Agriculture is a resource saving farming system that strive to achieve acceptable profits together with high and sustained production level, while conserving the environment based on an integrated management of soil, water and biological resources combined with external input (FAO, 2008).Conservation Agriculture is not 'business as usual', based on maximizing yields while exploiting the soil and agro-ecosystem resources. Rather, CA is based on optimizing yields and profits, to achieve a balance of agricultural, economic and environmental benefits (IFAD, 2011). CA advocates that the combined social and economic benefits gained from combining production and protecting the environment, including reduced input and labour costs, are greater than those from production alone (ACTS, 2012). Therefore this implies that with CA, farming communities become providers of more healthy living environments for the wider community through reduced use of fossil fuels, pesticides, and other pollutants, and through conservation of environmental integrity and services

2.1 Global trends in Conservation Agriculture.

Historically, CA was born out of ecological and economic hardships in the United States (U.S.) caused by catastrophic droughts during the 1930s and became more popular among farmers due to rising fuel prices during the 1970's (Haggblade and Tembo 2003). Large commercial farmers took up minimum tillage technologies to combat the drought-induced soil erosion and save on fuel costs. Around 35 percent of total area in the U.S. was cultivated using minimum tillage technologies during 1980's (Haggblade and Tembo 2003). The CA experience in the U.S. gave impetus to the CA movement in South America (mainly Brazil) and Southern Africa (mainly

South Africa and Zimbabwe), where government agricultural research centres established conservation tillage programmes to actively promote CA.

There are rising concerns worldwide about loss of soil productivity and the broader environmental implications of conventional agriculture practices. The concerns have emerged mainly because of the aftermath of repeatedly tilling the soil either by the use of ploughs, disc harrows or hoes. This has compelled some governments and farmers to search for alternative production methods that can maintain soil structure and productivity while at the same time protecting and enhancing the water and soil land resources on which production depends (Aagaard, 2005).

In many parts of the world, CA practices have been widely adopted by farmers. The most extensive adoption is found in the southern cone of Latin America, especially in Argentina, Brazil and Paraguay, and in North America and Australia (ACT, 2006). Adoption is proceeding to other regions as well, such as Eastern Europe, East Asia (including China) and even some parts of Africa. African Conservation Tillage (2014) estimates that CA is now spreading at an annual rate of some 10 million hectares and covers over more than130 million hectares globally.

Conservation Agriculture has been the most successful when its three fundamental principles have been fully adapted and tailored to local circumstances by groups of stakeholders. In Latin America, an innovation process has been documented that is best described as the co-evolution of CA technologies together with stakeholder capacity to innovate and test new options. The Latin America experience also illustrates the importance of farmer to farmer organization leadership in technology design and testing. In this way CA practices have been developed that are suitable for smallholder as well as large scale commercial farmers (ACT, 2014). The International Fund for Agriculture Development (IFAD) has successfully supported one of these initiatives in southern Brazil (ACT, 2006).

Adapted CA practices are often found to be a practical means for fostering sustainable improvements in agro ecosystem productivity. In China for instance, the region of Beijing had planned to develop CA on 80 percent of their agricultural land by the end of 2009. This was based on clear facts of the impacts of CA on: (i) reduction of wind erosion by 50 to 60 percent; (ii) runoff by 80 percent; (iii) and yield increasing from 0.6 to 32 percent (FAO, 2009). In USA,

60 percent of farmers from Tennessee practice CA for cotton, wheat, maize and soya bean production. The National Agricultural Bill of 2005 included erosion control and therefore encouraged CA development. A "No-Till" day is organized each year and attracted 1 000 participants in 1995 and 4 000 in 2005 (Aagaard, 2005). The trend in the US was now to move from erosion control, to soil quality conservation. USA is leading with over 25 million hectares leading to soil protection. In Latin America, particularly in Brazil, 23 million hectares at commercial farm levels are under CA; Paraguay was in 2009 the leading country in the world in terms of percentage of no-tillage adoption. In India, through integrated watershed management programmes, CA is becoming better known (FAO, 2009).

2.2 African view of Conservation Agriculture

Conservation Agriculture is not a new agricultural production system in Africa. While many people perceive CA to be a product of the late 1900s, the evolution of such systems can be traced far into the past of Africa's agricultural practices when food was produced using pointed sticks to punch holes into the ground to prepare land for planting (ACT, 2014). Agricultural production changed drastically due to colonial powers and missionaries who introduced mechanization and tillage implements with extensionists and learning institutions promoting the hoe and plough. However, not all of Africa's farmland was put to mechanization, or to the deep-till hoe, and pockets of CA farming still exist (ACT, 2006).

Conservation Agriculture has been spreading rapidly in Africa in recent years as a response to the ever increasing food insecurity, unsustainable farming and climate change challenges (ACT, 2014). Conservation Agriculture programmes have in the past complemented efforts by African governments to address the food security solutions. The use of CA technologies which addresses both land and water management and productivity issues, has the potential to minimize the impact of some of the major causes of food insecurity, thus contributing to the success of food security initiative at national, regional and the continental level (Ngoma, 2014).

Giller *et al*., (2009) observed that CA is claimed to be a panacea for the problems of poor agricultural productivity and soil degradation in sub-Saharan Africa (SSA).They further asserted that CA is actively promoted by international research and development organisations, with such

strong advocacy that critical debate is stifled. Claims for the potential of CA in Africa are based on widespread adoption in the Americas, where the effects of tillage were replaced by heavy dependence on herbicides and fertilizers. Conservation Agriculture is said to increase yields, to reduce labour requirements, improve soil fertility and reduce erosion. Yet empirical evidence is not clear and consistent on many of these points nor is it always clear which of the principles of CA contribute to the desired effects (Giller *et al*., 2009).

Although cases can be found where such claims are supported, there are equally convincing scientific reports that contradict these claims. Concerns include decreased yields often observed with CA, increased labour requirements when herbicides are not used, an important gender shift of the labour burden to women and a lack of mulch due to poor productivity and due to the priority given to feeding of livestock with crop residues. Despite the publicity claiming widespread adoption of CA, the available evidence suggests virtually no uptake of CA in most SSA countries, with only small groups of adopters in South Africa, Ghana and Zambia (FAO, 2011). Critical constraints to adoption appear to be competing uses for crop residues, increased labour demand for weeding, and lack of access to, and use of external inputs.

Conservation Agriculture is being practiced in a number of countries as traditional soil and water conservation practices by specific communities or at pilot project scale throughout the continent. Despite these difficulties faced in the first years of implementation, benefits from this practice have shown great potential in boosting agricultural production and diversifying livelihood incomes. But its level of adoption is still very low and the total area of coverage could be estimated to be less than one percent of the continents land (FAO, 2009). Ngoma (2014) also says the levels of adoption of CA in Sub Sahara Africa are still low. The next sections presents an over view of the benefits of CA.

2.3 Benefits of CA

2.3.1Environmental benefits of CA

According to Knowler and Bradshaw (2007) not incorporating crop residues and not tilling the soil for several years considerably increases the organic content on the top layer of soil. Wolkowski (2003) also states that CA improves the physical and chemical properties of soil.

Likewise according to Chivenge (2007) CA increases biotic diversity and higher soil organic matter content from constant addition of crop residue. This in turn provides a much greater mobilization of nutrients, permitting a significant reduction in fertile doses over medium/long term.

As soil recovers from decades of tillage, and cover crops and residue add organic matter and nutrients, soil fertility, soil moisture, the systems resilience to environmental pressure improves dramatically (Hobbs *et al.,* 2008). Conservation Agriculture increases soil moisture retention, while sharply reducing run- off (and therefore chemical pollution of nearby waterways), erosion by wind and water, and soil surface temperature (helping to protect soil bacteria from extreme heat). As the health of soil fauna improves, soil organisms naturally till the soil, drawing nutrients from the surface down into the root zone, reducing soil compaction (thereby facilitating root penetration and water infiltration) and breaking down organic matter to make nutrients steadily available for crops (Hobbs *et al.*, 2008).

African Conservation Tillage (2006) also states that the benefits of CA regarding environmental consideration can be significant. These include carbon sequestration in soils, which contribute to improved water use efficiency, mineral balance, fertility, energy balance and biodiversity. FAO (2008) says under CA, 0.5 to 1 ton of carbon per hectare per year can be sequestered in humid temperate conditions, 0.2-0.5 in humid tropics and 0.1-0.2 in semi-arid zones. This makes a significant contribution to mitigation of climate change, which could be taken into account at farm scale (payment of environmental services) and/ or at the national scale in the environmental balances, as recommended in the Kyoto protocol (IPCC, 2014).

2.3.2 Economic benefits of CA

In economic terms, there is strong evidence that CA practices can be profitable, (eventual lower yields, mostly during the first years are compensated by lower operating costs (ACT, 2006). It should be noted that fertilization is one of the most important crop inputs/ expenses in the production situations and agrarian systems. Studies have shown that more energy, time and money are saved in CA in comparison to the conventional agricultural systems due to the absence of tillage (Garcia-Torres *et al.,* 2002, Foeler and Rockstome, 2001). Conservation Agriculture also reduces input costs by cutting fuel consumption in mechanical systems (planting

is done using single-pass machinery), seed costs (due to direct planting) and fertilizer inputs though herbicide use may increase (Knowler and Bradshow 2007).

When practiced in a comprehensive way CA improves crop yields over time and reduces the required quantity of most inputs (FAO, 2011). In non-mechanized systems CA may reduce labour inputs, though their finding has been variable across different studies (FAO, 2010, Giller *et al*., 2009). At the very least, CA requires less animal traction and may allow for labour inputs to be spread over a larger time frame, since permanent soil cover reduces erosion between preparation and planting, allowing for earlier preparation. African Conservation Tillage (2006) says that CA can also result in savings in labour due to the absence of tillage.

2.4 Challenges of Conservation Agriculture

Worldwide, the adoption of CA systems by smallholder farmers has lagged well behind the adoption on large, mechanized farms: only 0.3% of the area under no-till worldwide is on smallholder farms (Derpsch *et al*., 2010). This is not unprecedented as smallholders are less able to invest in new equipment, are more risk averse than large farmers, generally have fewer links to new information systems and, importantly, manage more complex farming systems, generally mixed crop–livestock systems (Wall, 2007). In the Americas and Australia the CA movement was largely driven by farmers (Ekboir, 2002), but smallholders generally do not have the resources or linkages that enable them to take hold of the reins of development.

Conservation Agriculture is widely-but not universally applicable. There are situations where circumstances are so marginal and resources so fragile that farming itself is simply not viable. This may be the case under very dry or very wet environments, where the challenge of maintaining resilience in natural processes cannot be overcome, even with the application of CA principles (ACT, 2006). Conservation Agriculture is usually associated with low yields in the first years. Giller *et al,* (2009) say that there may be an early reduction in yields and profit until soil fertility improves. This may necessitate the application of higher volumes of mineral fertilizer due to immobility of nutrients in the crop residue for the first few years.

Conservation Agriculture may also increase the incidences of weed infestation, requiring more herbicide or more labour for weeding (Giller *et al*., 2009). In practice, farmers have been found not to adopt all principles of CA due to various reasons such as limited access to inputs (herbicides, cover crop seeds), labour constraints or insufficient resources to grow cash crops (Kaumbutho and Kienzie, 2007). Where conventional tillage or residue burning may have previously provided regular non chemical weed control, farmers may increase their use of chemical herbicides under CA (Jat *et al.,* 2012). In mixed crop livestock systems, there may be competition for crop residues between soil cover and animal feed or fuel, where residues are used as an energy source. Farmers may be unwilling or unable to buy feed externally, and may therefore allow their animals to feed on residues (Giller *et al.,* 2009). This can result in reduced soil cover late in the dry season, affecting soil moisture retention, temperature and erosion. Animals may also compact the soil surface if they are left to roam freely, requiring loosening of the soil prior to planting (Hobbs *et al*., 2008).

The benefits of CA only fully accrue through years of rigorous application of the underlying principles. Some farmers may not apply the techniques consistently and may therefore risk jeopardizing the accrued benefits. For example, if a farmer is not consistent in minimizing tillage, soil fertility may be reduced through rapid mineralisation of soil nutrients after ploughing (Jat *et al.,* 2012). This is of great risk where farmers lack information and training and where extension officers are poorly trained themselves. Poor training can result in the incomplete application of CA techniques and may lead to lower yields than in conventional agriculture (Hobbs *et al*., 2008, Knowler and Bradshaw 2007).

2.5 Origins of Conservation Agriculture in Zambia

In Zambia, CA emerged to mitigate the impact of frequent droughts. Since the mid-1990s, several programmes were implemented by the Ministry of Agriculture and Livestock (MAL), the Conservation Farming Unit (CFU), Golden Valley Agricultural Research Trust (GART) the International Centre for Research in Agro forestry (ICRAF) as well as a number of NGOs. Programmes have focused on the promotion of CA as an avenue for increasing productivity, reducing soil degradation and lowering production costs. The MAL in Zambia has a vision to scale out CA to 600,000 smallholder farmers by 2015 as it is seen as a sustainable approach to

increasing farm productivity and production (Sims *et al.*, 2012). However, scaling out CA has been limited due to the need for constant intense extension to support adoption, as well as poor access to CA equipment and machinery by the majority of smallholder farmers.

Notwithstanding all others, effective CA promotion and development in Zambia has been championed by CFU which has influenced the farming community, Government, NGOs and donors. This is because CFU has consistently been present and also it has played a significant role in sensitisation, implementation and monitoring of CA activities (CFU, 2007). For example it is now government policy to promote CA as a way of farming but this requires developing appropriate strategies, implementation and dedicated tangible support.

2.6 Some successes of Conservation Agriculture in Zambia.

According to study by Haggblade and Tembo (2003) about 75,000 Zambian smallholder farmers practiced CA in 2002/03 season. Results in 2003 showed that planting basins can improve the possibility of maintaining some production with very low rainfall. The figure rose to 125,000 and then 175,000 in 2006 (CFU, 2006). In addition, the Langmead (2004) on-farm trials, farmers received the same quantities and types of inputs for the Conventional agriculture and CA tillage systems. Yields from CA fields were higher than those from Conventional fields.

Results from Monze Farmers Training Centre (MFTC) in 2009 confirmed that doing away with tillage and leaving soil covered by mulch leads to higher infiltration rates. Infiltration rates on residue protected, undisturbed soils were higher than on conventionally ploughed plots without residues. Higher infiltration resulted in higher soil moisture content which translated in higher maize yields in the direct seeded rotation treatment at MFTC. As a way of mitigating weeds GART (2007) reported that planting a cover crop (e.g. Cowpeas) within 10 days of the main crop resulted in effective weed suppression and high grain and biomass yields of both the main and cover crops.

Farmers have recognised the value of leguminous fertilizer trees for many generations (Garrity *etal*, 2010).*Faidherbia albida* (locally known as *Musangu*) is an indigenous nitrogen-fixing acacia species which has the remarkable trait of reverse leaf phenology. This means that it sheds

its (N-rich) foliage during the early rainy season as annual crops are being established; and only re-grows them at the end of the wet season. The integration of trees like *Faidherbia albida* in CA production systems provides extra benefits to the farmer. With rising fertilizer prices, today 69 percent of Zambia's smallholder farmers produce maize without mineral fertilization (Garrity *et al*., 2010).

2.7 Some challenges of Conservation Agriculture in Zambia.

According to Umar *et al,* (2011) weed management, crop residue retention, timely planting and soil fertility management were the most challenging for CA farmers especially those without reliable access to oxen. Weeds are a major bottleneck in annual cropping systems under CA in Zambia. CA Farmers are supposed to weed frequently and timely in order to prevent weeds from producing seeds. Sims *et al.,* (2012) also says weed control poses one of the major challenges to CA among smallholder farmers in Zambia. This coincides with Ehui and Pender (2005) who say that many agricultural systems in SSA find land preparation and weeding to be labour intensive and farmers lack cash to buy the needed herbicides. Smallholder farmers in rain fed agriculture generally believe that soil tillage is needed to control weeds and maximize crop yields. However there is abundant evidence that this can cause the degradation of physical, chemical and biological soil properties (Johansen *et al*., 2012).

Crop residue retention conflicted with the socio-cultural practices of the communities and was hardly practiced (Umar *et al*., 2011). For instance, crop residues were routinely fed to livestock. This was especially common in Southern and Central provinces. Even in cases where a household did not own livestock, its crop residues were still grazed by other households free range livestock. Traditionally, all fields became communal grazing lands after harvest. In addition crop rotation seemed difficult in light of the dominance of maize cultivation and lack of markets for crop legumes. Farmers have long understood the importance of crop rotations and they are an essential component of CA. Rotations are needed to prevent the build-up of crop-specific pests (especially nematodes) and diseases, to explore different soil strata for water and nutrients, and most importantly the inclusion of legumes in the rotation will add nitrogen (Thierfelder and Wall, 2010). The challenge for Zambia is that maize is still routinely grown as a monoculture.

Conservation Agriculture is therefore not an option but a must because its adoption is still low. Baudron *et al*, (2007) reported a 10% adoption rate as of 2003 among Zambian smallholder farmers. Adoption is problematic to delineate as some farmers only adopt some of the recommended practices, while those who adopt CA technology do not apply it on all their plots. Adoption rates are time sensitive as they tend to be tied to active promotion of technologies by NGOs and research institutions. Giller *et al*, (2009) claimed that most farmers revert to their former crop and soil management practices when project support ends and incentives are discontinued. .

Indeed, the study by Mfune (2014) found that there are severalfactors that hinder farmers' adoption of some of the CA practices, as well as limit CA's contribution to locallivelihoods and environmental protection. The first factor, the issue of labour, has already been discussed in thepreceding section. An important point to note here is that these new practices, such as mulching, use of improvedfallow systems and planting of trees, all place an extra demand on family labour requirements. Apart from thelabour problem, other factors that present challenges for CA implementation include: (a) a mismatch betweenprescribed CA practices and the organization of local actor's livelihoods system; (b) institutional constraints thatmediate local livelihood practices and (c) biophysical conditions.

Further missing in the link is effective farmer-led participation and ownership of the CA evolvement and development. Besides the ZNFU administrative gatherings rarely do farmers meet to discuss and share their success, challenges and progressive ideas (FAO, 2011). There are also does not seem to be synergies of driving the CA agenda forward (FAO, 2011). This is Zambia's challenge that will unroll full participation, development and ownership of the CA principle and practice. Baudron *et al*, (2005) notice that activities of the CA task force, the CA association together with those of CFU and other stakeholders do not seem to engage well. This is a challenge that CA farmers need to resolve once they too are more organised. Conservation Agriculture in Zambia is non- farmer driven and rather by an assortment of NGOs, Government and its partners. Effectively, CA must be advocated and demanded by farmers because it is their resource and livelihood that is at stake. That is why COMACO has empowered lead farmers to take a lead in organising and training of fellow farmers in CA activities.

2.8 Conservation Agriculture Gaps in Zambia

Most of the studies concerning CA in Zambia have concentrated on adoptions and impacts of CA on crop productivity or yields (Kabamba*et al,* 2009, Arslan *et al.*, 2013, Andersson and D'souza 2014). Nyanga (2012) looked at adoptions and areas under CA while Kabwe and Donovan 2005 looked at sustained use of CA practice. In addition most of these studies have been concentrated in areas where the Conservation Agricultural Programme (CAP) is operating from. These areas include: Eastern, Central, Lusaka, Southern and Western Provinces respectively (CFU, 2011). Likewise most of the CA projects done in Zambia concentrate on the dissemination of agronomic knowledge and neglect the market linkage which is being promoted by COMACO.

Mfune, (2014) notes that the huge gap between what is prescribed and what is practiced raises numerous questions about the process of translating conservation agriculture into practice. For example, it raises the question of the extent to which CA contributes to enhancing ecosystem services and increasing local actors' access to non-agricultural livelihood assets (e.g. firewood, construction poles and other products). At the moment, CA has not delivered on these promises. In particular, the ecological components of CA are the most neglected in the process, with CA farmers failing to integrate the prescribed trees and shrubs on the farm plots.

Umar (2011) also notes that one possible option for improving smallholder CA systems is market provision for crop legumes which COMACO is providing hence the need to examine the successes and challenges of CA under COMACO. One important issue is that this study will contribute to the knowledge gap on how to utilise market linkages to encourage conservation among smallholder farmers as promoted by COMACO. This will be in line with FAO (2011) who says introduction of CA is Zambia is not only a question of technology transfer, but needs to address bottlenecks related to access to input, integration in markets and access to credits.

2.9 Social enterprise company principles as COMACO model

"The social enterprise is an organisation that applies commercial strategies to maximize improvements in human and environmental well being which may include maximizing social impacts alongside profits for external shareholders (Prahalad, 2006). It is a trade to tackle social

problems, improve community, people life chances or environment. They make their money and goods in the open markets but reinvest their profits back into the business or local community. The social enterprise provided the framework for eradicating poverty through profits by enabling dignity and choice through markets (Prahalad, 2006). Prahalad 2006 argued that:

> *If we stop thinking of the poor as victims or as a burden and start recognizing them as resilient and creative entrepreneurs and value conscious consumers whole of new world of opportunity will open up*.'(Prahalad, 2006:1)

According to Prahalad, 2006 there is need for the better approach to help the poor,

> *'..an approach that involved partnering with them to innovate and achieve sustainable win-win scenarios where the poor are actively engaged and , at the same, time, the companies providing products and services to them are profitable,'* (Prahalad, 2006:3)

The COMACO model applied principles of social enterprise by focusing on the marketing; agro processing; distribution and selling of the agro based food products coupled with outsource for production of food crops to rural groups and lead farmers. COMACO has developed distribution network through chain stores and other shops." From the resultsof this study, there is no doubt that COMACO has scored some level of success in marketing thelabel 'It's Wild'. Today, 'It's Wild' products can be found in major supermarkets in Zambian citiesincluding Lusaka. For example, Shoprite and PickNPay, two of the leading supermarkets all stockthese products.

CHAPTER THREE

DESCRIPTION OF THE STUDY AREA

3.0 Introduction

This chapter presents description of the study area. It focuses on geographical location, political administrative structures, climate, soils, vegetation, drainage and socio-economic characteristics in order to understand how they influence the operations of COMACO.

3.1 Geographical Location

Shiwang'andu district is Located in the newly created Muchinga Province of Zambia (figure 1). It is located between longitude 32^0, $50^{'}$ east and 32^0, $30^{'}$ east and has a latitudinal range of 10^0, $30^{'}$ to 11^0, $40^{'}$. It is named after Lake IshibaNg'andu which means lake of the loyal crocodile in the local Bemba language. Shiwang'andu district is among the new districts that were created by the late President of Zambia Mr. Michael ChilufyaSata in 2012. It was initially part of Chinsali district. It is Located on the southern part of Chinsali district which is the provincial headquarters of Muchinga province. It is bounded by the Muchinga escarpment to the east and the Chambeshi River on the west. It shares its boundary with Mpika district to the south, Chinsali to the north, Kasama to the west, Mungwi to the northwest and Chama to the east

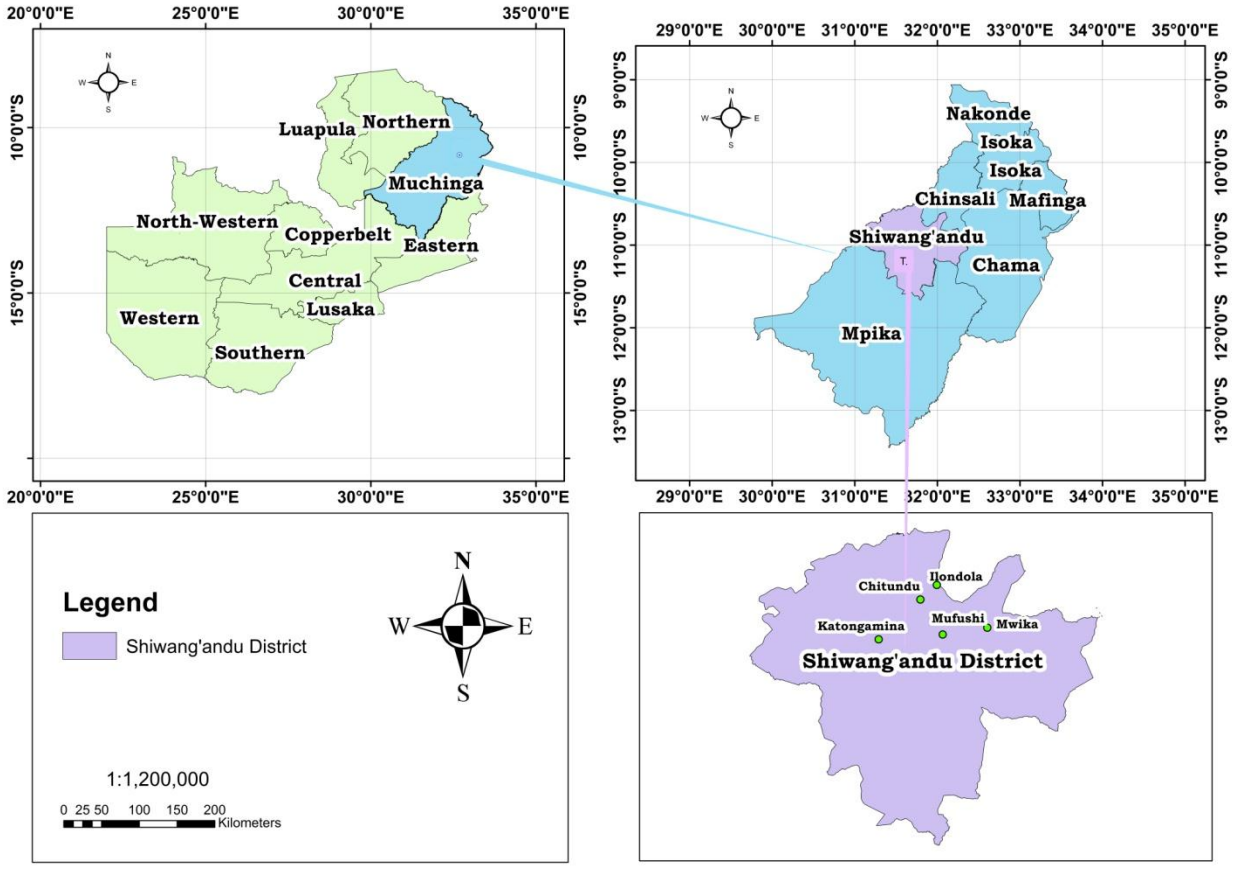

Figure 1 showing the location of Shiwang'andu district (Source: Author, 2016)

3.2 Political administrative structures

Shiwang'andu district is divided into 5 local Governments wards namely Chimpundu, Nkulungwe, Mwiche, Chamusenga and Konja. The wards are represented by elected ward councillors respectively. The district also has traditional rulers that include Chief Nkula and Mukwikile of the Bemba and sub chiefs Mwenge and Mwaba. Others are chief Chibesakunda, Kabanda and sub chief Mungulube of the Bisa speaking people. The dominant tribal groups are the Bemba's and the Bisa. The areas along the Great North Road (GND) and the shores of Chambeshi River are the most densely populated areas.

3.3 Selection of the study area

The research was conducted in Shiwang'andu district of Muchinga province. Shiwang'andu district was been picked by the researcher purposively because it is one of the districts where COMACO has been initiating the CA activities since 2008.

3.4 Physical characteristics

3.4.1 Relief

The district is part of the plateau sloping diagonally from north east to north-west at an altitude of between 1500m-1800m above sea level.

3.4.2 Climate

Shiwang'andu district experiences a tropical type of climate characterized by three distinct seasons. The cool dry season, which stretches from May to August, the hot dry season from August to November and the rain season from November to April. Temperature ranges from 18 to 24 degrees Celsius. The region receives more than 1000 millimetres of annual rainfall.

3.4.3 Soils

Soils found in the district are highly leached due to high rainfall received in the district. The soils are mainly acidic with very low content of calcium and magnesium. The type of clay they have, have very low capacity to hold nutrients, (Brammer, 1976). However, the district has some patches of fertile soils. Trapnell (1996) states that soils which occur in areas below the plateau level in the district are fertile for crops. These areas have soils which are deeply and strongly weathered than plateau soils.

3.4.4 Vegetation

According to GRZ (1968*), Miombo* type of woodlands tends to dominate in the district. The prominent tree species are that of *BrachystegiaIsoberlinia, Isoberliniapaniculata, BrachystegiaLongfolia and BrachystagiaHockii*. Trapnell (1996) says that *Hockii* becomes common in the northern parts of the district and southern parts towards Mpika. There is also Lake Basin chipya which is associated with the Chambeshi River and its flood plain. It is commonly surrounded by a band of much darker *Brachystagiaspeciformis* woodland, (GRZ, 1968). However most of the tree species mentioned above have been cut by Chitemene farmers.

3.4.5 Drainage

The major rivers in the district are the Chambeshi and Lubu. The Chambeshi forms the boundary in the west and flows into an extensive flood plain known as Nashinga. Other Rivers in the district include Manshya, Lwanya, Luchindashi, Chimpundu and Chinamabuwe.

3.5 Socio-economic characteristics

3.5.1 Livelihoods of people

The people of Shiwang'andu district work mostly in the service industry as government workers and a few in the parastatal companies like the Zambia Electricity Supply Corporation (ZESCO). Shiwang'andu district does not have any industries hence most of the people are engaged in informal businesses such as selling of groceries, fish caterpillars, mushrooms and other merchandise. Otherwise the most prominent economic activity among the local people is agriculture.

3.5.2 Agricultural activities

Historically, the people of Shiwang'andu district depended on rain-fed agriculture, fishing, domestic livestock and hunting to meet their nutritional needs. Accordingly, increase in the population densities has caused pressure on cultivated land, overfishing and poaching. However, the people of Shiwang'andu district have continued to be economically productive by engaging themselves in small scale farming of such food and cash crop such as maize (*Zea mays*), cassava *(manihotesculenta*), groundnuts *(Arachis hypogea*), beans *(phasedusvulgans*), soyabeans (*Glycine max*) and sweet potatoes (*Ipomoea batatas*) . They also engage themselves in small scale fishing in the waters of the Chambeshi and Lubu rivers. The Nashinga swamps provide very good fishing grounds.

3.5.3 Agricultural administrative structures

The district is divided into five agricultural camps each headed by the agricultural extension officer. The camps are Ilondola, Mwika, Kabanda, Matumbo and Shiwang'andu.The district however is headed by the District Agricultural Coordinator (DACO). Also, COMACO had one regional extension coordinator and two extension officers who provided extension services to all participating households.

3.5.4 Population

Shiwang'andu had a total population of 96,100 of which 47,408 were male and 48,702 were female (CSO, 2010).However, the study randomly selected 143 farmers from the farmers list under COMACO.

CHAPTER FOUR
METHODOLOGY

4.0 Introduction

This chapter presents the methods used in data collection from the primary and secondary sources. The methodology used included research approach, target population, sampling procedures and data collection instruments. It also outlines the data analysis that was conducted which consisted of descriptive and referential statistics.Secondary data was also collected through journal articles, published and unpublished reports of COMACO and books covering issues on CA and its implications on natural resources and rural livelihoods. This allowed for reviewing and critical analysis of scholarly and research findings of other authors concerning the importance of CA as well as the performance of the COMACO model in Shiwang'andu district.

4.1 Research approach

The study used both qualitative and quantitative approaches to enable the research gain in depth understanding and collaboration while offsetting the weaknesses inherent to using each approach by itself. The research approach adopted in this study was a survey. A survey study is an attempt to obtain data from members of the population (or a sample) to determine the current status of that population with respect to one or more variables.(Kombo and Tromp, 2006).

4.2 Target Population

The target population comprised the 357 registered COMACO households. It included households that joined COMACO from 2007 to 2013. This period was targeted in order to ascertain the sustainability of CA practices by COMACO. The working definition of a household in this study was a single home where a family member was a participant in the COMACO project. COMACO allows only one individual per household to register in the programme to avoid duplication of resources (Lewis *et al.,* 2011). In addition, the target population also included one coordinator from COMACO and five COMACO lead farmers. Therefore, this population was targeted because it included both public and private actors in COMACO making it possible to generate diverse views on the performance of the COMACO model regarding CA practice in Shiwang'andu district.

The coverage for this study included six villages from the two Chiefdoms of Nkula and Mungulube. Two out of four chiefdoms were selected in order to achieve sufficient representation of COMACO members since they made up half the total number of chiefdoms found in the area. The two selected chiefdoms are also spatially dispersed where Nkula shares a boundary with chief Mukwikile while chief Mungulube who is located further away shares boundary with chief Kabanda. Thus, monotony in responses was best avoided by spreading over a wider spatial area from which research participants were drawn.

4.3 Sampling Procedures

A sample was drawn from the 357 farmers who are currently farmers under the COMACO Programme. The sample size was 143 households arrived at using a *priori* power analysis of G power 3.1.9 software (Osmena, 2010). The medium effect size of 0.3, at 0.05 level of significance and probability power of 0.80 were used to arrive at the sample size. An effectsize is a quantified measure of the strength of a phenomenon (Erdfelder,1996).The 143 participants were selected using random numbers which were generated from Microsoft Excel to avoid biasness. Purposive sampling was used to select the five lead farmers and the project coordinator who were the key informants in order to get information concerning the operations of the company. Purposive sampling involves choosing participants considered to be knowledgeable and informed about the topic of the study (McMillan and Schumacher, 2006).

4.4 Data Collection Instruments

Four data collection instruments were used to collect both qualitative and quantitative data: semi-structured interviews; focus group discussions; and structured interviews (Appendices A, B, C and D). Semi-structured interviews were used in accordance with the suggestion by Gray (2009) that the instrument permits probing of perceptions or views in instances where respondents have to expand on their responses. In this way, it was possible for the project coordinator and the lead farmers to not only provide subjective meanings that they ascribe to performance of the COMACO model, but also give new insights that helped to achieve the research objectives.Semi-structured interviews were conducted with six key informants that included a COMACO official and five lead farmers, all purposively sampled. The interviews lasted for one

and half hours each and all the responses were entered in a note book before transcription for analysis.

Focus group discussions were conducted with five out of the seven farmer groups involved in the study. This is in line with the recommendation of Longhurst (2010) that this method allows respondents in a group to explore a topic from as many angles as possible while the researcher moderates the discussion to avoid delving into issues that are not of interest to his/her research. Moreover, Onwuegbuzie and Collins (2007) suggest that a study must have a minimum of three focus group discussions to generate sufficient data and this was applied in this research.

The number of COMACO households that attended each focus group discussion ranged from six to seven. This is in line with the recommended size of between six and 12 participants (Onwuegbuzie and Collins, 2007; Longhurst, 2010). Each farmer group had 20 members but only nine members selected using simple random method were invited to the meetings. The researcher only wanted nine farmers from each farmer group hence the use of the random sampling that eliminates biasness. Further researcher facilitated the discussions and at the same time, took down notes in a note book. Inaddition, the researcher listened attentively, empathetically and allowed all individuals in each farmer group to contribute to the discussions irrespective of their specific positions in the group.

The issues addressed in the discussions included background to the formation of COMACO farmer groups, main activities under COMACO, their perception and attitude about COMACO. Structured interviews were targeted at COMACO registered households to collect data for quantitative analysis. Standardised questions were asked to all households and the responses were recorded on the same question schedule for each respondent. As recommended by Gray (2009) the researcher's tone of voice was the same for each question to avoid influencing responses. Moreover, photos were also used to capture the various activities in which households are involved with the COMACO model.

4.5 Data Analysis and Presentation

Due to the kind of data obtained from the study, both qualitative and quantitative methods of data analysis were used. Most of the qualitative data was analysed using content analysis. Content analysis involved recording the verbal discussion with respondents which was followed by breaking the recorded information into meaningful smallest units of information and

tendencies and presenting them as texts. QDA Miner, a qualitative data analysis software, was used to analyse results from FGDs and Interviews (Cuva, 2014). Quantitative data was analysed using Chi-square tests and measures of central tendency through the use of the Statistical Package for Social Sciences (SPSS) version 20 (SPSS, 2010). Results are presented in form of tables, pie charts and other graphs.

4.6 Ethical Considerations

Prior to the commencement of the research, the researcher sought permission from the Head of Department (HOD) Geography and Environmental Studies of the University of Zambia(UNZA). Before data collection in the field, the researcher obtained permission from the project manager of COMACO in Shiwang'andu district and also secured informed consent from all the respondents before starting to interviews. Headmen of the villages where the research was conducted from were all informed about the research to avoid suspicion. Respondents were not forced to answer questions that they were not comfortable with and they were all assured that their responses would be confidentially kept and for academic purposes only. In addition, the researcher has endeavoured to present the findings objectively and honestly at all costs without doctoring them.

CHAPTER FIVE

PRESENTATION OF RESULTS

5.0 Introduction

This study was undertaken with a view to broaden our understanding on the performance of the COMACO model in Shiwang'andu district of Muchinga province of Zambia. The study pursued multiple but closely related objectives as follows:

1. To determine the achievements of the COMACO model in Shiwang'andu district in since its inception.

2. To assess the benefits accruing to Smallholder farmers under COMACO in Shiwang'andu district.

3. To examine the challenges faced by COMACO in Shiwang'andu district.

This study has yielded mixed but interesting results as shown in this chapter.

5.1 Characteristics of sampled Households

5.1.1 Farmer Groups

The 143 farmers were drawn from seven farmer groups. Most of the farmers were from Katongamina (28 per cent) followed by Ketani farmer group which had 27 percent. Mufushi farmer group had 13 per cent while Mungulube farmer group had 12 percent. Thomas farmer group had 11 percent, followed by Ilondola and Chendesanga with eight percent respectively. Selected basic household characteristics are shown in Tables 5.1, 5.2 and 5.3.

Table 5.1: Gender of sampled households

Sex	**Number**	**Percentage**
Men	104	72.73
Women	39	27.27
Total	**143**	**100**

Source: (Field data, 2016)

Table 5.2: Age of respondents

Oldest respondent	72 years
Youngest respondents	19 years
Average age of men	29±14
Average age of women	29±14

Source:(Field data, 2016)

Table 5.3 Sampled household size

Largest household	14
Smallest household	03
Average size of selected households	6±10

Source: (Field data, 2016)

5.1.2 Levels of Education

Out of the 143 respondents 73 percent attended primary education (Grade 1-7) followed by 25 percent with secondary education (Grade 8-12). Only two percent had tertiary education

5.1.3 Land ownership

Land ownership among the respondents ranged from three hectares to 16 hectares with a third of the farmers under COMACO owning land of ten hectares and above, followed by those with 8 hectares who had 17 percent. Generally on average each selected household owned about seven hectares of land (Figure 5.1).Thus the study revealed that households under study do not own large amounts of land.

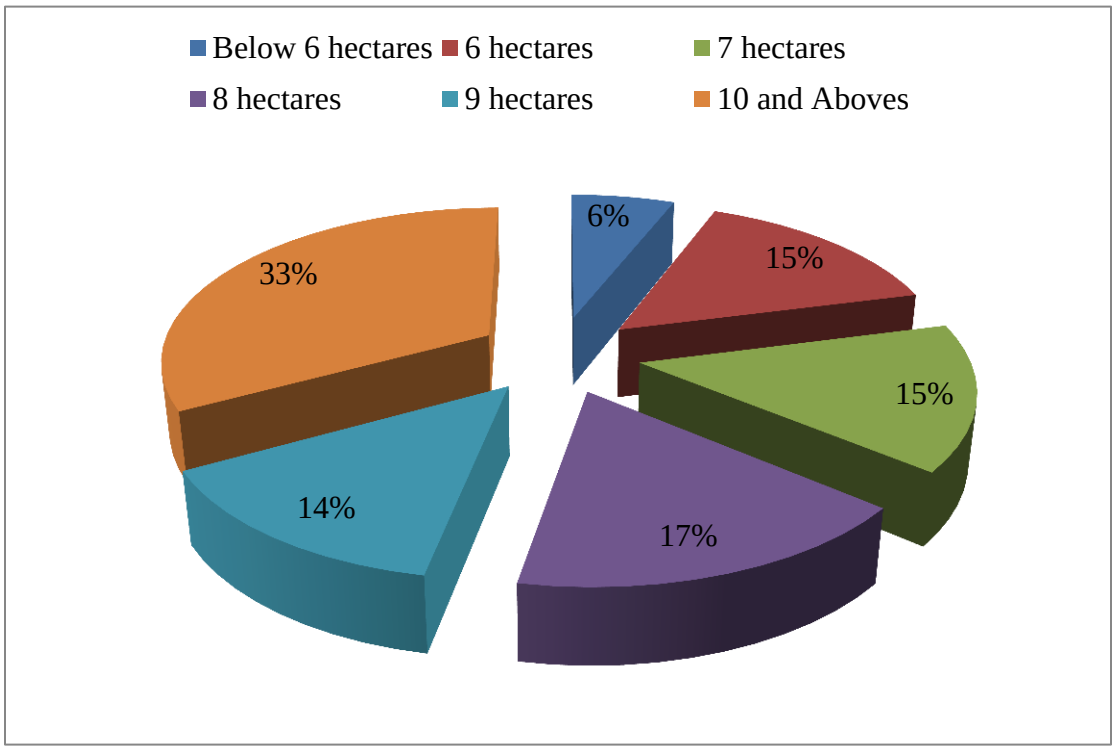

Fig 5.1 Land ownership in hectares among COMACO farmers in the study area (Source: Field data, 2016).

5.1.4 Livestock rearing

Out of the 143 COMACO respondents interviewed, only one percent reared cattle with a mean of 11 herds of cattle. Pigs were owned by 15 percent of the respondents, each of whom had a mean of 22. A mean of 30 goats' were owned by 21 percent of the respondents. Chickens were more common with a mean of 18 per household and accounted for by 63 percent.

5.2 COMACOs achievements in Shiwang'andu district

COMACO started its operations in Shiwang'andu when it was still part of Chinsali district in 2007. However, in 2012 it was declared a district but COMACO was not split. The households under study joined COMACO in different years. Upon joining, every new member signs a commitment pledge of abiding by the rules of sustainable agriculture. For instance, the research revealed that in 2007 only one percent of the interviewed households joined COMACO where as in 2008 the figure rose to 20 percent as shown in Table 5.4.

Table 5.4 Interviewed households who joined COMACO in Shiwang'andu district since its inception in 2007.

YEAR	FREQUENCY	PERCENTAGE (%)
2007	2	1
2008	28	20
2009	29	20
2010	36	25
2011	12	8
2012	15	10
2013	21	15
Total	**143**	**100**

(Source: Field data, 2016)

The COMACO households interviewed were able to state some of the activities that COMACO is engaged in with them. The 143 interviewed COMACO farmers stated that COMACO is involved in the training of farmers in various activities such as conservation agriculture, beekeeping, and gardening. Other activities include crop buying, poacher/ charcoal production transformation and input supply. Poacher transformation involves asking poachers to voluntarily surrender muzzle loader guns and snares in exchange for agriculture inputs. In the same way charcoal producers are given agricultural inputs for their compliance to the pledge they make when joining COMACO. Input supply is a regular activity by COMACO which involves the distribution of agricultural inputs (legume seeds, agricultural lime, empty grain bags etc) to the beneficiaries. Procuring farm produce from members is a mandate by COMACO and only crops produced as per COMACO recommendations are procured. In addition, the transformed poachers, charcoal producers and *chitemene* farmers are then organised into smaller groups where they are trained in CA and other skills as outlined below.

Plate 5.1 A CA trained farmer by COMACO in her Soya beans field in Katongamina Village of Shiwang'andu district. (Photo: Chenjelani Zulu).

COMACO organizes smallholder farmers into producer groups to learn better farming skills, beekeeping, gardening, carpentry, poultry, nutrition, food storage as well as family planning methods.COMACO is engaged in teaching farmers about family planning and nutrition because one of its targets is improved human welfare. It is strongly believed by COMACO that a bigger family with less income will lead to extreme poverty. Therefore if not controlled then natural resources such as forests, wildlife and land will be at stake since most of povertystricken communities rely directly on natural resources for their survival. Likewise nutrition is encouraged in that it enables a person to be healthy because a healthy person can carry out his duties effectively and efficiently. Training in small business management skills is particularly important as an adaptive management strategy. COMACO in Shiwang'andu district has included this component as part of its programmes. COMACO also provides extension staff to teach better farming practices and introduce new food crops. Extension officers inspect compliance to required farming practices like minimum tillage, fire breaks to protect crop residue and intercropping with legumes. In other words COMACO members are encouraged to abandon practices that are harmful to natural resources, the land, and their own future. Therefore

destructive activities such as making or selling charcoal, late burning, wasteful tree clearing or poaching of wild animals are discouraged at all costs.

A lot of the COMACO households interviewed (88 percent) noted that the services from COMACO were beneficial. However 12 percent of the farmers said that COMACO should increase the agricultural inputs given to them.

Results from FDGs on COMACO activities and the interviews with key informants on activities by COMACO were almost the same with those from COMACO households interviewed. However it was noted that prime on the COMACO agenda was educating the members on sustainable methods of agriculture particularly CA. Sustainable methods emphasized were maintaining planting stations using basins, use of organic manure as a fertilizer and growing cover crops like cowpeas intercropped with winter thorn *(Faidherbiaalbida*) or other appropriate plants/trees. Farmers are advised to make fire breaks around cultivated fields, not to burn crop residues as well as to practice crop rotation.

Out of the 143 COMACO households that were interviewed, 60 percent had been involved in Charcoal production, where as 30 percent used to practice *Chitemene* type of agriculture before joining COMACO. Ten percent of the members had been poachers. Upon joining COMACO almost three quarters(74 percent) of the interviewed COMACO households practiced rain fed crop farming (specifically CA) while 13 percent practiced both crop farming and beekeeping; 11 percent combined CA and gardening (irrigated crop farming) while one percent combined CA and poultry.

After joining COMACO the majority (60 percent) of the households abandoned charcoal production (Figure 5.2). *Chitemene* farming involves the cutting down of tree branches over a large area that are later burnt so as to produce ash which acts as a fertilizer.

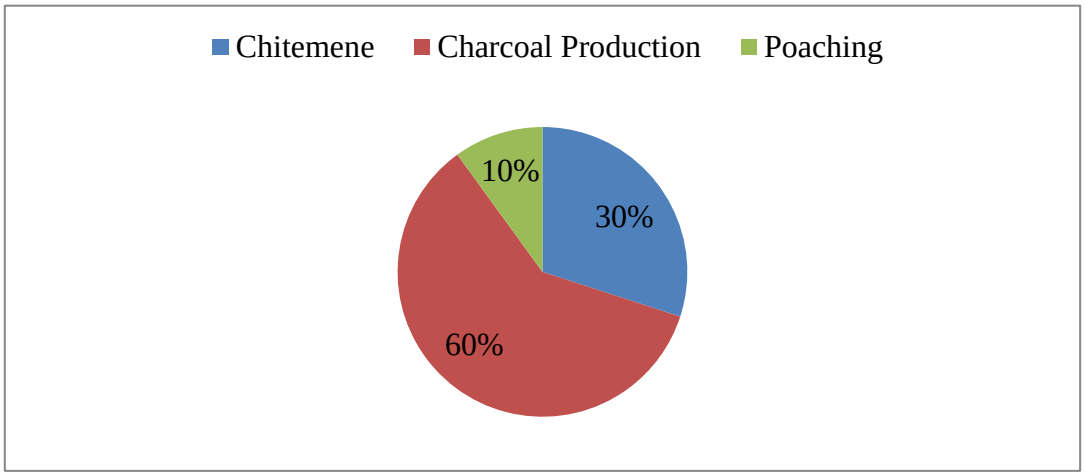

Figure 5.2 Abandoned activities after joining COMACO (Source: Field Data, 2016)

Over half (65percent) of the interviewed COMACO households said they experienced economic hardships in terms incomes before joining COMACO but after joining COMACO (54 percent) reported increased incomes while (19 percent) indicated improved livelihoods. The rest (27 percent) claimed that their joining COMACO has not had any effect on their livelihoods. With regard to food security more than half of the COMACO households indicated that their food security had increased after joining COMACO (Figure 5.3)

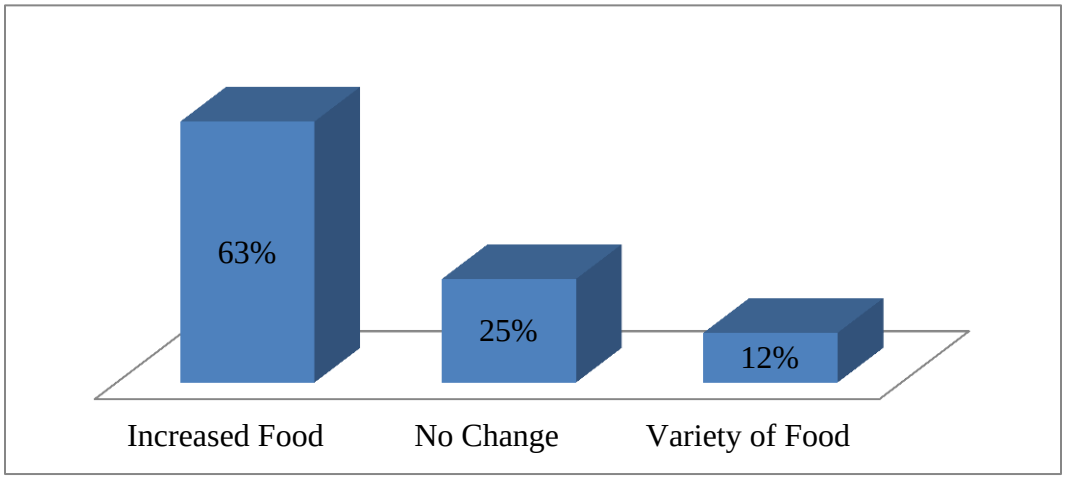

Figure 5.3 Food security Status of households after joining COMACO (Source: Field Data,2016)

All the 143 interviewed households indicated that they had the knowledge of CA because all of them were trained immediately they joined COMACO. For instance 38 percent of the households indicated that they first heard of CA from the Ministry of Agriculture officers while 34 percent said they heard of CA from COMACO officers. The remaining 28 percent indicated that the idea of CA was first heard from their fellow COMACO members.

The 143 COMACO households interviewed were trained in different years and by different officials depending on the time when they joined COMACO. For instance 41 percent of the households said they were trained before 2010 while 35 percent indicated that they were trained in or after 2012. It was noted that refresher courses for old members are conducted occasionally. A Quarter (25 percent) showed that they had their training in 2010 where as eight percent said they were trained in 2011.

Every year new entrants are trained in CA before receiving the agricultural inputs from COMACO. For instance 71 percent of the households were trained by COMACO extension officers while 20 percent were trained by lead farmers. Lead farmers are selected farmers from farmer group who are equipped with skills by COMACO so as to train their fellow farmers. The results from this research show that the extension officers from COMACO were present in Shiwang'andu district. Over three quarters (82 percent) of the COMACO households interviewed indicated that they were visited at least once in a month while 18percent indicated that they are not visited.

In order to test the levels of knowledge of COMACO households, the households were asked to mention some of the topics covered during their training by COMACO. Crop residue management was mentioned by 44 percent of the households, 25 percent mentioned minimum tillage, 18 percent crop rotation and 9 percent mentioned nutrient management. Weed management was indicated by four percent of the households.

Out of the 143 households interviewed 73 percent were still practicing CA where as 27 percent were no longer practicing CA. The study showed that 73 percent of COMACO farmers were using basins of length 30cm, a width of 15cm and a depth of 20cm as recommended by CFU.

The basins are interspaced in a 70cm x 90cm rows. Crop rotation and crop residue management through the use of fire breaks around the fields was also common.

There was a statistically significant relationship (x^2 =143.0; Df =1, p≤0.0001) between the benefits accruing to COMACO households and the levels of CA practice. For instance71percent indicated that they were practicing CA because of ready market for their legumes and agricultural inputs (Table 5.5)

Table 5.5 Reasons for practicing CA by COMACO households.

Reasons for practicing CA	**Percentage (%)**
Markets and agricultural inputs	71
Soil conservation	18
High yields	11
Total	**100**

(Source: Field data, 2016)

A total of 67 percent households indicated that they would continue practicing CA even if COMACO stopped giving them inputs while 33 percent said they would not continue.

During the focus group discussion members appreciated the role of COMACO in their livelihoods. Most of the participants indicated that their livelihoods have improved since joining COMACO. Because of continuous meetings members learn a lot of issues pertaining to their livelihoods. For instance issues to do with nutrition and family planning were highly appreciated by the members. The researcher also observed that recruitment was an ongoing process. CA adoption levels were also high among COMACO farmers as observed by the researcher during the period of data collection. The project coordinator indicated that hand hoe farmers were able to prepare their fields early before the rain season. He added that crop residue retention has been adopted which helps to enhance soil structure. He further said that there was drastic change in farmers abandoning their fields because they were able to rotate their crops which leaves their soils nourished. This was also confirmed by some COMACO members during the focus group discussions.

Most members of the FGDs indicated that markets of crops especially legumes was good in that there was no organization that was buying legumes in large quantities like COMACO does. With them, this was a much larger incentive than the inputs. They said they would continue being COMACO members as long as the markets for legumes were being provided. Some even indicated that even if COMACO stopped giving them inputs in form of seeds, they would continue being members provided markets for the legumes were being provided.

5.3 Assessment of benefits accruing to COMACO members

This research revealed that 42 percent of the interviewed COMACO households who sold ground nuts said they realised above ZMW900 where 33 percent said they realised between ZMW600-K900 as shown in Figure 5.4. During the 2014-2015 agricultural season COMACO was buying groundnuts at ZMW 3 per kg (ZMW 150 per 50kg) with the local traders buying at the same price.

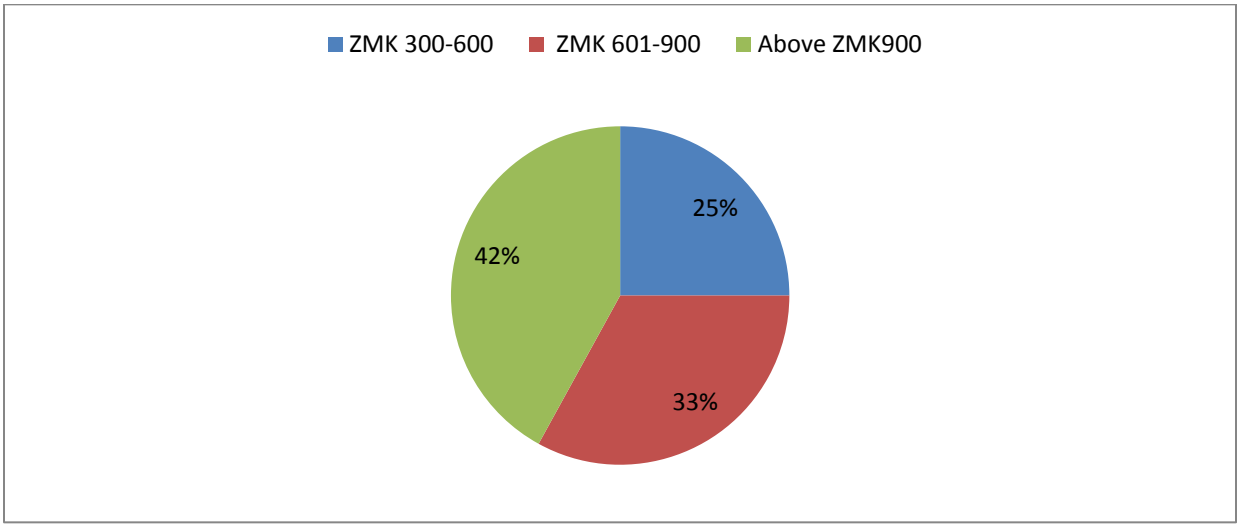

Figure 5.4 Income earned from groundnuts sale to COMACO during the 2014-2015 agricultural season. (Source: Field data,2016).

Over 95 percent of the interviewed COMACO households sold soya beans to COMACO during the 2014-2015 agricultural season and realized above ZMW 900. The rest realized between ZMW601 and 900. The price of soya beans offered by COMACO during the 2014-2015 agricultural season was ZMW 50.00 per kg (ZMW 250.00 per 50 kg) while private buyers were buying at ZMW 40.00 per kg (ZMW 200.00 per 50kg bag).

Almost half (49 percent) of the interviewed COMACO households who sold beans to COMACO during the 2014-2015 agricultural season realized between ZMW 300 and over ZMW 900 (Figure 4.7). The price of common beans offered by COMACO during the 2014-2015 agricultural season was ZMW40.00 per kg (ZMW 200.00 per 50kg). Other private buyers were buying at ZMW 35.00 per kg (ZMW 175.00 per 50 kg).

Therefore benefits associated with crop marketing include markets for legumes which are always available and that prices are better than those offered by other buyers for soya beans and common beans. The project coordinator indicated that the number of COMACO households who sell legumes has been increasing since its inception in 2007 due to ready market.

5.4 Challenges faced by both COMACO and its members

Interviewed COMACO households indicated destruction of crop residues either by livestock (pig and goats) or fire as a challenge. Sometimes their fields would be put on fire even if they had fire breaks by unknown people who would want to hunt rodents. In addition sometimes goats or pigs would invade the fields especially those that are close to the village. Some interviewed COMACO households complained that some COMACO extension officers are not doing much. They said most of the work is being done by them. For instance this research observed that there were only two extension officers at the time when the research was being conducted. Hence most of the farmers especially those who joined in 2012 and onwards are being trained by lead farmers. However, there were five agricultural officers from the Ministry of Agriculture in the area under study. Sometimes they participated in COMACO by conducting field days together and during some agricultural workshops organised by COMACO.

Lead farmers also complained of not being involved in the annual planning of activities and yet they were expected to implement what their supervisors planned. Lead farmers also indicated inadequate input supply as a major challenge that fellow farmers were facing. Sometimes the inputs received do not carter for all the members hence lead farmers use their discretion when distributing. This action makes those who are not given to stop being members. Further, lead farmers complained of receiving meager allowances. Each lead farmer receives ZMW450.00 per month as an allowance for facilitating farmer group meetings. Lead farmers want this amount to

be increased to ZMW1000. It was reported that the same small allowance is not received on time.

Results from the FDGs indicated input scarcity (shortage of inputs) as a major challenge as well as weed management. Members of the FGDs observed that although COMACO offered a better price for its produce, it usually delays to procure the produce. In most cases COMACO buys the produce around July/August when other private buyers start as early as April when crops are just being harvested. This makes some members to sell elsewhere due to urgent needs such as money for school fees.

The interviews with COMACO coordinator revealed that some members were still sticking to their cultural practices like *Chitemene* shifting type of cultivation and that some farmers were still maintaining the same small plots of cultivated land as they had since the villagers over relied on charcoal. Non-compliance of CA by some farmers was also noted as shown in plate 5.2 below.

Plate 5.2 A farmer still practicing conventional farming despite joining COMACO in his beans field in Ketani Village of Shiwang'andu district. (Photo: ChenjelaniZulu)

He further stated that there was over reliance on wood fuel and charcoal as a source of energy which threatened their conservation efforts. He also observed that the rate at which membership is increasing is not matching with funding hence the shortages of inputs in some instances. He also acknowledged the challenge faced in the course of buying farm produce as well as implementing CA. He indicated that some of the products from its members are bought by other traders who buy the products earlier than COMACO. With regard to challenges related to CA implementation the COMACO project coordinator indicated weed management as a challenge to most of the farmers.

CHAPTER SIX
DISCUSSION OF RESULTS

6.0 Introduction

Chapter six discusses the results of this study in the context of the research objectives and reviewed literature. The discussion on the activities that COMACO was engaged in with the smallholder farmers in Shiwang'andu District was done with emphasis on the achievements of the COMACO model since its inception in Shiwang'andu District. Focus has been on ascertaining the benefits accruing to COMACO members. The chapter ends with a discussion on the challenges characterising the model and the smallholder farmers under COMACO in Shiwang'andu district.

6.1 COMACOs achievements in Shiwang'andu District

6.1.1 Promotion of CA in Shiwang'andu District.

In Shiwang'andu district, COMACO has developed strategies that suit not only the climatic conditions of the region, but also conform well to the socio-economic characteristics of the local communities. In a region that has long been affected by heavy rainfall and poor soils (FAO, 2009), COMACO has promoted and encouraged its farmers to practice Conservation Agriculture (CA) methods. This is because CA practices promise higher crop yields and most importantly, lead to soil nutrient enrichment as noted in this study. Furthermore, there has been an encouragement to engage in agro forest. The technology being advanced involves integrating *Faidherbia albida* trees (USAID, 2011) as well as the promotion of *Gliricidia sepium*, which presents opportunities for farmers to enhance their agricultural productivity in Shiwang'andu district.

Since most rural communities in Shiwang'andu district depend on soils as a natural resource for agriculture, COMACO's approach of promoting both CA and agroforestry is compatible with sustainable exploitation of a natural resource that supports livelihoods of the poor. It is therefore, not surprising that communities that participated in the COMACO model have experienced an improvement in soil fertility and increases of crop yields in comparison to when they were not members.Both CA and agroforestry have been demonstrated by many authors to contribute to

high farm productivity and a reduction in the pressure to clear and open up more forest land that usually serves as habitat for wildlife (Jenkins *et al*., 2004; Giller *et al*., 2009; Rockstrom *et al*., 2009).

6.1.2 COMACOs approach of targeting individuals involved in unsustainable practices

COMACO in Shiwang'andu district has diversified streams of livelihood activities aimed at both achieving food security and protection of ecosystems. In tropical Africa and other developing countries, most rural communities living in rural areas largely depend on natural resources for their livelihoods (DeFries *et al*., 2007). These resources provide a wide range of foods and goods such as timber, medicines, fodder and wood fuel among others. In Shiwang'andu district, most rural communities relied on natural resources for their survival even when it meant obtaining them illegally (e.g., through poaching and charcoal production). It is interesting to note that findings of this study have shown that COMACO targets individuals who are involved in unsustainable livelihood practices (poaching, charcoal production and *Chitemene*) and provide skills training in activities such as bee keeping, livestock production, nutrition and gardening. The word *Chitemene* is a Bemba term which means 'cut over area' (Kadzombe*et al.,* 2006). This approach potentially gives COMACO participants an incentive to conserve soils and wildlife since they are kept off from practicing environmentally harmful activities.

The study demonstrates that COMACO's activities as promoted in Shiwang'andu district provides higher livelihood gains that are an incentive to protection of ecosystems. This is consistent with targeting vulnerable individuals who by virtue of their poverty are more likely to engage in ecologically destructive practices. Once these poor households are empowered through training in different skills and provided with equipment and agricultural inputs, they readily take up and adopt sustainable livelihood practices through which they produce more food and access income from COMACO. Therefore, it would not be very difficult for most of COMACO households to continue certain activities such as CA, bee keeping and poultry production once support is withdrawn. And obviously, resorting to overexploitation of natural resources would be the last option.

6.1.3 Buying of farm produce

Buying of farm produce (legumes) and bee keeping products was one of the major activities under CQMACO in Shiwang'andu district. The most interesting aspect of the COMACO model

in Shiwang'andu district is the provision of a ready market for the produce of farmers, bee keepers and gardeners. By providing markets for the crops and other produce produced by participating communities, incomes are channeled directly to individual households and this creates an incentive to conserve biodiversity (Scherr, 2000; Swinton *et al*., 2003).

Therefore, unlike other promoters of CA in Zambia that have been criticised for not being inclusive especially in remote areas due to high transaction costs, COMACO addresses these challenges by taking legume markets closer to where producers live. This is in line with Umar *et al*,(2011) who noted that one possible option for improving smallholder CA systems is market provision for crop legumes. To this effect, COMACO has extended its markets irrespective of the great physical distances away from major urban markets. In the process local depots have been established in all chiefdoms where COMACO is operating from to facilitate easy transportation of produce to processing plants and local green markets. Due to these efforts, COMACO was able to procure a total of 534 bags by 50kg of soya beans from the interviewed households, 419 bags of beans and 426 bags of groundnuts respectively during the 2014-2015 agricultural marketing season. In addition this also shows how the COMACO model eases government's financial burdens not only through the provision of food storage facilities and processing plants, but also through supply of inputs (e.g. lime, bee hives and crop seeds) to rural communities.

6.1.4 Poverty alleviation

Findings of this study reinforces the notion that natural resources conservation based models like COMACO can promote indirect involvement of resource-poor communities in sustainable management of natural resources through implementing substitute livelihood activities (Salafsky and Wallenberg, 2000; Ferraro, 2002). Although in other countries, sustainable natural resource management has been achieved through community based related projects (e.g., safari hunting and eco-tourism) the COMACO model in Shiwang'andu district offers a unique opportunity for its members to get 'self-employed' as observed from the results of this study. This has been attained through diversified small-scale livelihood activities such as bee keeping, blacksmithing, carpentry and promoting poultry of local chickens.

COMACO has been able to use livelihood activities such as CA, beekeeping, and gardening to act as a way to replace previous practices that negatively affects biodiversity (Salafsky and Wollenberg, 2000). That is why the study found that over 60 percent of the interviewed

COMACO households had abandoned activities like charcoal production, *Chitemene* farming and poaching. Other than waiting for implementation of community projects, COMACO participants at individual household level engage in livelihood activities that generate individualized benefits. The benefits including food and income become an incentive for conservation. Overtime, this is expected to protect landscape-scale ecosystems of Shiwang'andu district for a viable agricultural system that could contribute to national economic development.

Comparatively, the COMACO model seems ideal for promoting a positive link between Natural Resources Management (NRM) and poverty alleviation among its members in Shiwang'andu district. This is so because the study revealed that over 73 percent of interviewed COMACO respondents were practicing CA although some had small plots of conventional agriculture where sweet potatoes and cassava were grown respectively. Only 44 percent practiced exclusive CA. On average each interviewed COMACO households had one hectare of land under cultivation during the 2014-2015 agricultural season. This implies that households under COMACO do not cultivate large areas

6.1.5 Rural livelihoods under COMACO

Findings of this study indicated that participation in the COMACO project affects the livelihoods of most rural communities. In Shiwang'andu district for instance, a change in the livelihood status of most communities (74 percent) whose livelihood before joining COMACO was anchored on charcoal production, poaching and *Chitemene* farming is perceived as having been improved. This is because their participation in the COMACO project has guaranteed them of access to ready and better legume market which was previously not available in the absence of the COMACO model. Likewise, livelihoods are perceived to have improved on the basis of having more food (60 percent) as a result of diversified crop agriculture promoted by COMACO. Thus, unlike the trend in business-oriented models in South Africa (Ashley & Wolmer, 2003), where it is unclear on the effects on rural communities, in Shiwang'andu district, it is evident that most interviewed COMACO households have relatively become food secure as reported during this research.

6.1.6 Knowledge and perception of CA by COMACO Households

The study also indicated that all the 143 respondents under study had the knowledge of CA because all of them were trained immediately they joined COMACO. All the interviewed COMACO households were able to state the topics covered during training and appreciated that CA is good. Training of new entrants is mainly done by senior lead farmers as noted during research. This is because COMACO believes that CA should be driven by farmers themselves. This is in line with Baudron *et al,* (2006) who say that effectively; CA must be advocated and demanded by farmers because it is their resource and livelihood that is at stake. Likewise in Australia farmer to farmer learning has been a key feature of the adoption of CA (Bellotti and Rockocouste, 2014). Consequently over 70 percent of the respondents were trained by senior lead farmers and farmers under COMACO have taken up a leading role. To this effect, COMACO has even reduced the number of extension officers from six to two because lead famers are able to do most of the work.

6.1.7 Crop residue management and Crop rotation

Crop residue management was practiced by 73 percent of the interviewed COMACO households. Field observations indicated different levels of crop residues depending on the type of the crop that was previously grown. Crop residue management was good because all COMACO farmers are advised to make fire breaks around their fields thus incidences of crop destruction by fire were not very common. However, there were few incidences when some local people burnt the fields as they hunted for rodents. Further, the households under study are not pastoralists hence incidences of crop residue destruction by livestock are rare. Maize stalks, grass or weeds were used as cover (mulch) which was evident in the fields. This concides with the findings of Mfune *et al,* (2015) who noted that COMACO farmers in Chama district showed higher levels of adoption of other practices such as retention of crop residues on farm plot after harvest, use of animal manure, crop rotation, and intercropping. Crop residue retention is encouraged because it results in higher surface soil organic matter content and higher infiltration rates, reducing surface runoff and soil erosion.

With regard to crop rotation, the study found sufficient evidence from field observation that households practiced crop rotation where maize was grown in rotation with legumes (common

beans, soya beans and groundnuts). Almost three quarters (73 percent) of the interviewed COMACO households were practicing crop rotation. This is an indication that the inputs (legume seeds) and ready market for legumes as promoted by COMACO is encouraging the practice of crop rotation. Crop rotation was emphasised because it helps to replenish soil nutrients and break the cycle of pests and diseases. According to Sims *et al.,* (2012) rotating different types of crops (especially legumes and non-legumes) have long been recognized as a natural way to combat pests and diseases. Crop rotations are recommended for soil fertility enhancement both in annual and perennial crop.

Comparing the farmers' practices with the recommended ones showed that all the interviewed COMACO households showed to have the correct agronomic knowledge starting from land preparation to harvest. This could be because farmers received training in CA immediately they became COMACO members. However, the research noted that some interviewed COMACO households did not practice CA as per recommendation from COMACO. For instance, there were situations were some farmers used small ridges in their CA plots especially in the first year where basins were made. Then in the subsequent years, the principles of CA were adhered to. Therefore the principle of minimum tillage in the first year was not observed by some farmers. This was common in areas where lead farmers were not active as the case with Thomas village. The extension officers were aware of this trend by some farmers and were quick to say it is normal in an area with high amounts of rainfall. In fact some farmers were advised to be using the very method after five years.

6.2 Benefits Accruing to COMACO Members

There are a lot of benefits accruing to COMACO members which are not enjoyed by non COMACO members. In order to assess the benefits accruing to smallholder farmers under COMACO the following aspects were looked at; agricultural inputs type received and how they are distributed, markets and amounts realized from crops sold to COMACO.

6.2.1 Supply of agricultural inputs

Inputs given to COMACO members include seeds of crops such as beans, soya beans, groundnuts and cassava stems. A 10 kg bag of beans is given per household. The household is expected to pay back 13.5 kg. Likewise 15 kg of soya beans is given per household who should pay back 15.5 kg. 15 kg of groundnuts is given with a total repayment of 17.5 kg. Other inputs

are bee hives for beekeepers and garden tools. Agriculture lime is given to farmers that demand for it freely. The inputs are distributed by stake holders of COMACO. For instance 68 percent of the households got their inputs from their respective farmer groups while 30 percent got from their respectively lead farmers. Only two percent got from COMACO officers directly. If a member does not repay the loan that season he is given two other chances the following seasons but would have no access to the agricultural inputs after that.

The study noted that input benefits in form of seeds were only available for the first three years after joining COMACO. There after the farmer is graduated but continues enjoying other benefits like markets. The system seems to work very well among the interviewed respondents in that over 45 percent are still COMACO members but have no access to inputs but have access to markets. The inputs are distributed by COMACO extension officers in liaison with lead farmers. Lead farmers are mandated to disqualify fellow farmers who do not abide by the by-laws of COMACO. Therefore, COMACO farmers access inputs through their farmer groups upon recommendations from the lead farmer. Indeed the programme is farmer driven. This confirms the thinking of FAO (2011) when they said further missing in the link is effective farmer-led participation and ownership of CA evolvement and development.

6.2.2 Crop Marketing

COMACO buys crops only from its members. At the moment COMACO is only providing markets for legumes (beans, soya beans, groundnuts) and rice but it also encourages the growing of maize and cassava. However, it does not force its members to sell their produce to COMACO only. Members are free to sell their produce anywhere provided they pay back the loans as per agreement. COMACO buys crops that are grown as per their recommendation. (i.e. using conservation agriculture). Crops are bought at local depots and from the homes of households who are far from the local depots. Payments are made on the spot and transport is provided for members only. It was noted that COMACO does not buy crops from farmers who are still poachers, charcoal producers or *Chitemene* farmers (that is, non-compliant). COMACO is against these vices because they are destructive to the environment when conducted on commercial basis as noted during the study. In order to ensure compliance COMACO lead farmers are given bicycles to help them easy transport problems during monitoring. For instance

during the 2014-2015 agricultural season, 78 percent of the COMACO households interviewed sold their produce to COMACO while the remaining 22 percent sold to other private buyers. COMACO members managed to sell everything they wanted because COMACO had the capacity to buy all the produce from its members.

6.2.3 Premium Pricing Scheme

From the results of the study COMACO pays higher prices for the produce it purchases from its farmers who adhere to its farming recommendations. This is called premium pricing. Only those farmers who have stopped vices such as charcoal production, *Chitemene* and poaching to mention but a few benefit from the premium. This is because the said vices are against the principles of CA. Unlike the usual crop buying where money is paid on the spot, the premium is paid at the end of the crop buying season for every kilogram sold to COMACO. The premium seems to be working very well in that over half of the interviewed COMACO households appreciated this incentive. For instance an extra ZMW 0.05 per kg was added for every crop that qualified for the premium in the 2014-2015 agricultural season. Therefore every member aims at achieving the premium hence in the process more natural resources are conserved.

6.3 Challenges faced by both COMACO and its members

The challenges faced by COMACO and its members are discussed below.

6.3.1 Weed management

The high labour demand of CA was cited as the reason why the households that had disadopted CA had stopped practicing it. Members of the FGDs complained of hard labour especially during land preparation and weeding period. Respondents wanted COMACO to at least provide herbicides during the weeding period in order to ease this problem. However, the study noted that COMACO does not encourage the use of either chemical fertilisers or herbicides in that they pollute the soils. Therefore this still remains a challenge to most of the members. Primary constraints to CA adoption in Zambia are the use of crop residues for other purposes, labour constraints and the limited potential to grow cover crops during the dry season. Of these three constraints, a number of authors argue that labour constraint is the major constraint to CA

adoption in Zambia (Haggblade and Tembo 2003; Baudron *et al.* 2007;Umar *et al.* 2011). The labour constraint manifests itself during land preparation and weeding. Preparation of the planting basins is highly labour intensive and the hiring of labour is rarely feasible due to unaffordable daily wages at peak times (also because hiring is not widely accepted culturally) (Baudron *et al.* 2007; Mazvimavi 2011). Weeding requirements tend to be higher on CA plots (in the absence of herbicide use) creating another labour constraint (Umar *et al.* 2011).

6.3.2 Crop residue management

Burning of crop residues was not really a major challenge among the COMACO members in that making of fire breaks around cultivated fields was one of the conditions in order for one to access inputs from COMACO. However, there were few incidences when non COMACO members would either deliberately burn the fields as they hunted rodents (a common local practice) or accidentally burnt by those practicing *Chitemene* farming. In such incidences a COMACO member would still access the inputs since it was not done intentionally. Likewise destruction of crop residue by livestock was not as serious as noted by most authors as in southern province and eastern province. In Shiwang'andu district only about one percent of the interviewed respondents reared cattle and not on commercial basis. Likewise most of the interviewed COMACO households live in communal villages with their farms located over two kilometers away from the respective villages. Livestock such as goats and pigs are kept within the vicinity of the villages, thus they have no access to crop residues.

6.3.3 Late buying of crop

Some interviewed COMACO households complained of late buying of farm produce by COMACO. COMACO usually buys the farm products around July while private buyers start buying as early as April. Therefore some COMACO members sell off some crops to private buyers due to pressing issues. However, the research revealed that actually COMACO does not buy the crops late because like FRA they wait for the appropriate moisture content. Therefore those interviewed COMACO households who decide to sell the farm produce as early as April should not call this as late buying instead they are just desperate

6.3.4 Non Compliance by some COMACO Members

Interestingly findings of this study revealed that over 50 percent of the interviewed households practiced both conventional and conservational agriculture. Conventional farming was mainly practiced by those who grew cassava and sweet potatoes as these required raised mounds for them to do well. This is concordant with the findings of Umar *et al.,* (2011) who reported that almost all farmers (out of 129 interviewed) practice both conventional and conservation farming on different plots. Usually COMACO farmers maintained small plot ranging from one hectare to four hectares where different types of crops are grown in rotation system. However, COMACO does not discard such members but instead continues to encourage them to practice CA on all plots. The study noted that 44 percent of the interviewed COMACO households practiced exclusive CA.

The study observed that despite COMACO offering free training in various activities like CA, beekeeping, gardening among others, the major interest of its members were access to agricultural inputs and markets. COMACO seems to be perpetuating a dependency which is not good for poverty reduction. This research also observed that some COMACO members were selling the agricultural inputs especially seeds. Others were converting the seeds like common beans into relish. This was common in areas were lead farmers were weak such as Thomas Village.

CHAPTER SEVEN
CONCLUSIONS AND RECOMMENDATIONS

7.1 Conclusions

The study shows that it has achieved all the stated objectives. It has also shown that COMACO is engaged in a lot of activities with its smallholder farmers in Shiwang'andu district aimed at protecting the natural resources especially soils, wildlife, water and forests. Among the activities include training in various activities such as CA, beekeeping, nutrition, carpentry, food security and many more, crop buying, input supply and poacher/charcoal producer transformation. COMACO targets the rural poor and individuals with harmful practices (poachers, charcoal producers and Chitemene farmers). All the interviewed COMACO households had knowledge about CA starting from land preparation to harvest. Thus the performance of COMACO in Shiwang'andu district in terms of poverty alleviation was satisfactory in that COMACO households had diversified livelihood activities which kept them busy from involving in destructive activities. In addition accrued benefits especially market linkages for legumes and agricultural inputs have made many COMACO households to remain with COMACO because markets act as incentives.

This study shows that market linkages as promoted by COMACO have great potential to enhance CA practice and natural resources management in Shiwang'andu district. The potential lies in the ability of involving individual households with harmful habits into sustainable livelihood activities. Sustainable livelihood activities centred on agriculture are likely to thrive under conditions where commitment to conservation is strengthened by market mechanisms. In Shiwang'andu district the COMACO model has shown that promoting and supporting activities such as CA to grow both food and cash crops would provide food security to rural communities. Additionally, providing a market for rural community produce is the surest way to encourage local community involvement and adoption of CA practices and natural resources management that may lead to soil fertility enhancement. Further, and in the context of rural livelihoods, COMACO efforts contribute to attainment of food security and direct channeling of incomes to individual households under the programme.

The combination of approaches used by COMACO such as input support, training and trade incentives to influence farming practices as a basis for safeguarding soils, forests and wildlife have helped to protect the natural environment in areas where the programme is operating as observed during research. Thus for a country rushing to grow wealth and prosperity like Zambia particularly in urban settings where wealth is mostly concentrated, failure to support the needs of rural farmers and recognize their critical relationship to the land will raise the economic stakes for ignoring the social and environmental consequences. Consequently the dream of achieving sustainable land management will not be achieved thus the need to draw some lessons from the COMACO project. Therefore, this study concludes that COMACO activities enhances CA practice and natural resources management by targeting individual households with unsustainable practices who are then trained and supported to engage in environmentally sustainable practices.

7.2 Recommendations

1. The study recommends that: In order to make CA an efficient farming system and facilitate its adoption process there is need for COMACO to strengthen the capacity of extension service provision and an institutional arrangement to allow all stakeholders to participate in decision making and planning process
2. COMACO should strengthen capacity building programmes that transform local communities from absolute dependency on external support by imparting more sustainable entrepreneurship skills in all the members for continuity in case market provisions are discontinued.

7.3 Further research

Arriving at major conclusions on the performance of COMACO based on one district was not easy. It is, therefore, recommended that a much broader study be undertaken that would cover more districts where COMACO is operating from.

I would suggest further research on the transformative aspect. Research questions such as Do the farmers genuinely transform?;Do they not go back to their old practices?; Would they transform without incentives?; How sustainable is incentive based transformation?; should be investigated further.

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APPENDIX A

Questionnaire for COMACO Households

Iam Promise Chenjelani Zulu from the University of Zambia (UNZA) doing research for my Master of Science degree in Environmental and Natural Resources management. I am here to gain an understanding of the Performance of the Community Markets for Conservation (COMACO) model in Shiwang'andu district. You have been randomly selected to be interviewed. Any information you will provide will be kept strictly confident and will only be used for academic purposes.

PARTICULARS

Name of farmer group……..

Sex of household head [1] Male [2] Female

Age of household head: [1] 15-25 [2] 26-35 [3] 36-45 [4] 46-55 [5] 55and above.

Level of education of head of household: [1] no formal [2] primary [3] secondary [4] Tertiary

Number of household size: Specify e.g. 8 ……

Total acreage of land under household control: Specify e.g. 2……..

Size of land in acres: [1] owned ……. [2] Being rented out……. [3] Under cultivation during the last agricultural season. …….

Type of land ownership. [1]. Customary [2] private-leasehold

Crops grown by households: [1] maize [2] groundnuts [3] cotton [4] beans [5] cassava [6] rice [7] others specify……..

For each crop grown by households under COMACO state the number of 50kgs bags produced in the 2014/2015 agricultural season

……

……..……..

State also the actual area planted for each crop in the 2014/2015 agricultural season.

……

……

……

State the actual number of livestock kept by each COMACO household: Specify e.g. pigs 10

……

……

……...…….

MEMBERSHIP.

When did you join COMACO? Specify the year e.g. 1999……

Where you engaged in any of the following activities before joining COMACO?

[1]Fishing [2] poaching [3] charcoal production [4] others specify…….

What livelihood strategies have you adopted after joining COMACO?

……

……

……

What livelihood strategy have you stopped after joining COMACO?

……

……

……

What effect has your joining COMACO had on your household?

……

……

……

Has your joining COMACO affected your household food security? Give reasons for your answers……

……

…….....

ACTIVITIES UNDER COMACO

What activities does COMACO engage in with farmers in their COMACO farmer groups?

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.....

.....

What are your comments on the activities that COMACO engages in with the farmers?

.....

.....

.....

What activities would you like COMACO to engage in that is not engaging in at present?

.....

.....

.....

KNOWLEDGE AND PERCEPTION OF CA

Do you have an agricultural extension worker from COMACO in this agricultural camp?

[1] Yes [2] No

How frequent does an extension worker visit you in a month? [1]Doesn't visit [2] once a month [3] twice a month [4] more than twice a month

Have you ever heard of CA? [1] Yes [2] No

If yes where did you hear it first? [1] Ministry of Agriculture [2] fellow farmers [3] COMACO [4] attended field day [5] others specify

Have you ever been trained in CA? [1] Yes [2] No

If yes in which year did you train? ……and by who……. What topics did you cover during your training? [1] Crop residue management [2] weed management [3] Nutrient management [4] others specify

……

……

LEVELS OF ADOPTION

Do you practice CA? [1] Practicing CA [2] no longer practicing CA [3] never practiced CA

What inputs did COMACO provide for you to start practicing CA?

……..……

……..……

……

How did you get your initial inputs to start CA?

……..……

……..……

……

Why are you practicing CA? [1] markets [2] soil fertility improvement [3] high yielding [4] low cost [5] low labour demanding [6] others specify

……

……

……

Would you still be practicing conservation agriculture if input support stops? [1] Yes [2] No

If no why would you not be practicing? [1] Expensive [2] labour intensive [3] low yielding (4) others specify……..

MARKETS

Where do you sell your produce such as maize, beans, groundnuts, millet etc?

.....

..... What are your comments on COMACO prices as compared to other buyers for each of the crops sold to them?

……..…

……...……

……

For each of the crops sold to COMACO specify the quantities sold to them in terms of 50kgs during the 2014/2015 marketing season.

……..……

……..……

……

How much did you realize from the sale of your products for each of the crops sold to COMACO in 2014/2015 agricultural season.

……

……

……

CHALLENGES

What challenges are you or did you encounter in CA? [1] input scarcity [2] equipment not available [3] destruction of residues by livestock [4] burning of crop residue [5] others specify……...……

……

Which would you say is more rewarding between CA and Conventional Farming (CF)?

[1] CA [2] CF

What are the reasons for your answer in the above question? [1] Low labour demanding [2] high yielding [3] soil conservation [4] soil fertility [5] others specify

……..……

……

What do you think should happen in order to promote adoption of CA? [1] train more farmers [2] establish CA groups [3] mount more on farm demonstration [4] hold more field days [5]conduct more farmer exchange visits [6] provide loans [7] make CA input available[8]other sspecify……

……..……

……

THANKYOU FOR YOUR COOPERATION

APPENDIX B

Interview schedule for COMACO administrators

What activities are under COMACO in Shiwang'andu district with the farmers?

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……

…….....

What is the current membership of COMACO farmers in Shiwang'andu district? .....

What criteria do you use when choosing your members?

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.....

.....

How many farmers have you trained in the last 5 years? .....

How many have graduated? .....

Among the graduates how many have continued with CA in the last five years?

.....

How would you describe their performance compared to when they were receiving inputs?

.....

.....

How does Conservation Agriculture contribute to management of land as a natural resource?

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.....

Could you describe both the positive and negative impacts of CA especially in relation to food security?

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.....

What has been the major land use practice that your organisation has been using?

.....

.....

What has been the trend in the adoption of these practices since inception?

[1] Adoption is increasing [ ] [2] going down [ ] [3] I don't know [ ] [4] others specify

.....

.....

Could you provide numbers of farmers under CA for the following years 2009……..2010……..2011……2012……..2013……..2014…….

Do you visit your farmers? [1] Yes [ ] [2] No [ ]

If yes how often do you visit them? [1] I don't visit them [ ] [2] once a month [ ] [3] twice a month [ ] [4] others specify

…….....

What kind of benefits are accruing to your members?

.....

.....

.....

Do you have rules and regulations that your members should abide by? [1] Yes [ ] [2] No [ ]

If answer is yes, what do you do to members who do not abide by your regulations?

……

……..

What criteria do you use when buying products from your members?

……

……

……

……..

Who determines the prices of the farm produce for your members?

……

…….....

How has market linkages helped you to maintain your members?

If answer is Yes or No, How?

……

……

……..

What challenges are you facing in the course of buying products as well as implementing CA?

.....

.....

.....

Have you ever experienced some farmers dropping out of CA programme? [1] Yes [ ] [2] No [ ]

If answer is yes were any follow ups made to find out why the farmers decided to drop out? [1] Yes [ ][(2] No [ ]

If yes what were the reasons for the drop out?

……

……

……..

What opportunities do you see can help to promote of CA in the area?

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.....

.....

If CA is to be enhanced what do you think should be added to the programme?

.....

.....

.....

What would you say are your main successes since the inception of your programme?

.....

.....

.....

.....

What would you say are the main Challenges?

……

……

…….

THANKYOU FOR YOUR COOPERATION

APPENDIX C

Interview guide for COMACO lead farmers

Could you explain how your groups were formed?

What role did you play during the formation of your groups?

How did you engage local communities during the formation of the group?

What criteria are used when choosing a lead farmer?

Who receives the inputs on behalf of the farmers?

Do you receive the inputs on time?

What type of inputs do you receive?

Who distributes the inputs?

What mechanisms are put in place to ensure accountability and transparency?

How often do you meet to plan and review performance of your group?

Do you participate in planning and decision making process?

If yes explain your contributions during the planning process

Who buys your products?

Are you happy with the prices offered by COMACO as compared to other buyers?

What benefits are you deriving under COMACO?

Mention the types of farming practice that you engage in CA

Which model between Conventional and CA is better in terms of food production?

Give reasons for your answer

What are the challenges of CA?

What should be added to the programme to improve its performance?

THANKS FOR YOUR COOPERATION

APPENDIX D

Focus group discussion for COMACO members

What activities are you engaged in under COMACO?

What would you say are the major achievements since you joined COMACO?

Why do you practice CA?

Where do you sell your products? And Why?

What benefits are you deriving from CA under COMACO?

What challenges are you facing?

What do you suggest should be added to the programme to improve its operations?