NATIONAL UNIVERSITY OF LESOTHO

CLIMATE-SMART AGRICULTURE AND FOOD SECURITY IN LESOTHO: CASE STUDY OF THABA-TSEKA URBAN COUNCIL

DISSERTATION SUBMITTED

BY

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DECLARATION

I, Motebang Tsese, declare that this dissertation: *Climate smart agriculture and food security in Lesotho: Case Study of Thaba-Tseka Urban Council* is the result of my own study and findings. A reference list has been provided, and sources other than my own have been acknowledged. And that this document has not been submitted at any University for award of any type of academic degree.

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Supervisor's name. **Dr M.T. Macheka** .Signature  Date **28 July 2023**

DEDICATION

To all smallholder farmers in Thaba-Tseka Urban Council.

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ABSTRACT

Climate change is the main issue affecting global food security. To address the effects of climate change on agricultural production and food security, Climate-Smart Agriculture (CSA) has been pushed as a solution. The purpose of this study was to get an understanding of how CSA contributes to food security in the Lesotho Thaba-Tseka Urban Council. Two theories, the Sustainable Livelihoods Framework and Resilience Theory, served as the theoretical foundation for this investigation. The theories' guiding principles supported how the results were interpreted. The study used a qualitative research methodology and the interpretivist paradigm. A case study design was used, and interviews were conducted with 30 purposively sampled smallholder farmers engaging in climate-smart agriculture in Thaba-Tseka Urban Council. According to the findings, implementation of CSA methods including keyhole gardening, conservation agriculture, water collection, suitable animal housing, and training by extension service providers have a big impact on food security. The findings also showed that, despite the existence of numerous tested, workable CSA response alternatives and related polices, Lesotho does not have a CSA policy. The study concludes that CSA helps to ensure food security and suggests that Lesotho develops a CSA policy. The study recommends that smallholder farmers use CSA techniques to the greatest extent possible in order to improve agricultural productivity and raise their prospects of achieving food security.

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ACRONYMS

CA	Conservation Agriculture
CSA	Climate-Smart Agriculture
CSAIP	Climate-Smart Agriculture Investment Plan
FAO	Food and Agriculture Organization
GDP	Gross Domestic Product
GHGs	Greenhouse Gases
IFAD	International Fund for Agricultural Development
IPCC	International Panel on Climate Change
LMS	Lesotho Meteorological Services
LTV	Lesotho Television
NDSP II	National Strategic Development Plan II (2018/19- 2022/23)
RSA	Republic of South Africa
SADP	Smallholder Agriculture Development Project
WAMPP	Wool and Mohair Promotion Project
WBG	World Bank Group
WFP	World Food Programme
WHO	World Health Organization

CHAPTER ONE: INTRODUCTION

1.1 Introduction

Among the most pressing issues facing people worldwide are food security and climate change. According to Arora (2019), climate change is one of the most defining concerns in recent years which is affecting the agricultural sector negatively. Climate change is affecting the agricultural output in different regions of the world, especially in developing countries and emerging economies, resulting in decreased levels of food security (Malhi et al. 2021). Therefore, it is essential to comprehend how smallholder farmers use climate-smart agriculture to maintain food security in the face of climate change. The study concentrates on the role that climate-smart agriculture (CSA) plays in ensuring food security in the Thaba-Tseka Urban Council. The purpose of the inquiry is to look into how CSA helps smallholder farmers who are practicing it to improve their food security. The study focused on how CSA contributes to food availability, food access and food stability.

1.2 Background of the study

Increasing food security has become a main goal of CSA on a global scale. Global agricultural expansion is being hampered by climate change, hence governments have promoted reorienting the agricultural production through CSA so as to adapt and mitigate the effects of climate change in order to enhance food security (Arora 2019). According to Lipper et al. (2014), climate variability has a greater propensity to have negative effects on agriculture than favourable ones. Food insecurity has worsened due to the increased frequency and severity of extreme occurrences like droughts, heavy rains, flooding, and high maximum temperatures, which has led several nations to adopt CSA as a new paradigm for boosting agricultural output and food security.

According to Nagothu (2016), CSA is a strategy that aims to address food security globally by assisting farmers and other agricultural sector stakeholders to sustainably increase agricultural

production while adapting to the effects of climate change and lowering greenhouse gas emissions. At the Hague Conference on Food Security, Agriculture, and Climate Change in 2010, the Food and Agriculture Organization (FAO) coined the concept Climate-Smart Agriculture (CSA) (Nagothu, 2016). According to Nagothu (2016), the idea was that in order to achieve sustainable agriculture and rural development goals, which if attained would contribute to food security and better environmental management, the agricultural sector needed to be climate-smart.

In Africa, smallholder farmers have been encouraged to utilize CSA as an adaptation and mitigation technique since climate change obscures their ability to achieve food security. African nations must improve their food security and make sacrifices to cope with the effects of climate change (Abeguande et al., 2022). In their study conducted in Northern Ghana, Akudugu et al. (2012) demonstrate how climate variability poses a serious threat to farming systems and households' ability to be food secure, particularly in rural areas. Smallholder farmers in Africa make their living mostly from farming. They must learn to be resilient and adapt to the effects of changing climatic circumstances in order to secure their livelihoods and ensure their food security.

In Southern Africa, climate change has also significantly contributed to the food insecurity of smallholder farmers and their households. According to studies, individuals in Tanzania, for instance, struggle to maintain their livelihoods and to be food secure because of climate change (Murray, 2002). However, the majority of smallholder farmers in Zambia are using CSA to ensure their food security despite dealing with the effects of climate change (Ariom et al. 2022). According to Ariom et al. (2022), conservation agriculture has been implemented by farmers in Zambia and has proven to be a suitable mechanism for strengthening food security and boosting resistance to climate change. Minimum soil tillage, continuous soil cover, and crop

rotation are all components of conservation agriculture, which has been primarily supported by non-governmental organizations (Ariom et al. 2022)

Lesotho is one of many nations in Africa that are suffering from the effects of climate change. As a result, many households now experience food insecurity. Agriculture continues to be the main source of food security in Lesotho (FANRPAN, 2017). Rantso and Seboko (2019) posit that in Lesotho the majority of agriculture is subsistence-based, with the main sources of food for households being rain-fed cereal agricultural production, vegetable production, and animal husbandry. However, the challenges that climate change has imposed on Lesotho's agricultural sector have devastating impacts on food security. In this light, Lesotho's CSA program is essential for ensuring food security for smallholder farmers. In line with (FANRPAN, 2017), CSA is supported in Lesotho as a strategy that might assist the agricultural sector in becoming more climate-adaptive in order to improve the nation's food security.

At the core of this enquiry is Thaba-Tseka Urban Council. It is worth noting that Thaba-Tseka has been the hub of agricultural production in Lesotho. However, because of climate change, agricultural production has drastically decreased. Scholars have written about climate change and food security in Lesotho, and there is limited scholarship on how contributes to food security in Lesotho. Despite the benefits of CSA highlighted in literature by scholars around the world, there is lack of evidence on the contribution of climate-smart agriculture to food security in Lesotho. Whilst CSA has been practised in other parts of the world, there is a geographical gap that this research intends to fill. There is a geographical gap because the practice of climate-smart agriculture in fairly new in Lesotho. This research will fill the gaps as it will provide more understanding on the contribution of climate-smart agriculture to food security in Thaba-Tseka Urban Council.

1.3 Statement of the problem

Scholars studying the relationship between development, climate change and food security, such as Zakari et al. (2022) and Rantso and Seboka (2019), have written about how climate change affects people's access to food and their ability to support themselves globally, in Africa, and locally. Many articles have been written regarding climate change and ways to lessen its effects. While it is clear that researchers have written about climate change all around the world, it is remarkable that the academic community in Lesotho has paid very little attention to CSA as a factor in food security. This is in line with the view of Gwimbi (2015) that CSA is a recent concept in Lesotho, and that there is limited scholarship on how coherent strategies for managing agriculture and food systems under climate change can be implemented.

. In Lesotho, studies indicate that climate change is taking place with adverse effects on the farm sector (Muroyiwa and Tselisang 2019). CSA is being promoted as a solution to address the impacts of climate change threats on agricultural production and food security. However, despite these efforts, little has been documented on prevailing CSA practices and policies. Therefore, this study attempts to fill this gap by exploring CSA initiatives and policies and how they enhance food security in Thaba-Tseka Urban Council in Lesotho. This study will add new knowledge on how CSA influences food security.

1.4 Justification of the study

The majority of academics who have written about climate-smart agriculture have not discussed how it helps Lesotho achieve food security. Some academics contend that using CSA strategies to increase food security is challenging. In light of this reasoning, the study seeks to determine the extent to which CSA enhances food security. The study's findings will add to the limited scholarly literature in Lesotho on CSA and food security.

The study's findings will contribute significantly in informing the Government of Lesotho (GoL) on whether CSA strategies have achieved their objectives or not. The findings of the research will also assist GoL, working through the Ministry of Agriculture and Food Security

(MAFS), in developing policies and legal frameworks geared toward climate-smart agricultural practices and increasing smallholder farmers' capacity for resilience and adaptation to the effects of climate change in order to enhance food security. The study would thus add to the present efforts being made by GoL and the related development partners to combat food insecurity through CSA, as this can be a crucial development strategy for underdeveloped nations like Lesotho that are being adversely affected by climate change.

1.5 Objectives

General Objective

- The main aim of the study was to assess the contribution of climate-smart agriculture to food security in Thaba-Tseka Urban Council.

Specific Objectives

- To investigate the contribution of Climate-Smart Agriculture to food availability and accessibility in Thaba-Tseka Urban Council.
- To assess how Climate-Smart Agriculture contributes to food stabilisation in Thaba-Tseka Urban Council.
- To proffer suggestion and policy recommendations on Climate-Smart Agriculture in Lesotho.

1.6 Research questions

- How does climate-smart agriculture contribute to food availability and accessibility in Thaba-Tseka Urban Council?
- To what extent does climate-smart agriculture contribute to food stabilisation in Thaba-Tseka Urban Council?
- What policy response measures can be implemented in Climate-Smart Agriculture issues in Lesotho?

1.7 Theoretical framework

Underpinning the research questions are two theories which will make the theoretical framework for the inquiry. These are the Sustainable Livelihoods Framework and the Resilience Theory. The guiding principles of the theories will reinforce the interpretations of the findings. It is stated by Kollamair and Gamper (2002) that the Sustainable Livelihoods Framework was developed by the scholars Robert Chambers and Gordon Conway in order to evaluate different contexts of vulnerability and to augment the efficiency of development. Serrat (2008) reiterates that the Sustainable Livelihoods Framework serves as a way to investigate the livelihoods of people experiencing poverty and deprivation, whist looking the main aspects of influence.

In this study, the Sustainable Livelihoods Framework facilitates the identification of practical priorities for action that can be implemented by smallholder farmers in Thaba-Tseka Urban Council to achieve food security whilst being confronted by climate change vulnerability. Agriculture is the predominant source of livelihood of smallholder farmers in Thaba-Tseka Urban Council. Most of them have their capital assets needed for agricultural production. They have the human capital, being the capacity to work and the natural capital being land for food production. However, climate change as a vulnerability context has threatened and exacerbated their agricultural production, resulting in food insecurity. In response to climate variability, GoL and other development partners have implemented CSA as a livelihood adaptation and mitigation strategy for farmers, so that they can achieve their livelihood outcome of food security. The Sustainable Livelihoods Framework will guide this study as it will show how the livelihood assets of smallholder farmers in the study area being land resources can be utilised to carry livelihood strategies, so as to attain livelihood outcomes of food security. From CSA perspective, access of farmers to land, water and other essential assets represent the foundation for sustainable livelihoods. The Sustainable Livelihoods Framework will show how access to

inputs and CSA resources by smallholder farmers can significantly affect food security in smallholder farmers' households.

The study would also be guided by the Resilience Theory. It is stated by Chillrud (2017) that the Resilience Theory was developed by Crawford Stanley Holling. This theory serves as a foundation for how agricultural systems which depend on ecological process can withstand the complexities of climate change. As stated by Better Evaluation (2014) the Resilience Theory tries to explore how the interrelating systems of people and the environment can best be managed in order to ensure a sustainable and resilient supply of the essential services on which human beings depend. Resilience is defined by Folke (2006) as the ability of a system to function, maintain structure and feedbacks in the face of difficulties and to recover from such difficulties. Resilience is further defined by Barrett and Constas (2014) as an ability to withstand external shocks and stresses and to bounce back from such shocks.

The Resilience Theory focuses on how a system responds to shocks and enduring change as well as on emergent properties and feedback among the components that make a system (Bernhardt and Leslie, 2013). In relation to this study, the agricultural system has to be adaptive and withstand the shocks imposed by climate change so that the outcomes of food security can be attained. Climate change imposes short-term and long-term shocks of extreme weather events which affect food security negatively. The ability of smallholder's farm sector to continue functioning in the increasing climate stress depends on their ability to adapt to climate shocks, so as to be food secure.

In this study the Resilience Theory will describe how can climate-smart agriculture be an adaptive mechanism and strategy which smallholder farmers in Thaba-Tseka Urban Council can use in order to be food secure. As guided by the Resilience theory, in order for smallholder farmers in Thaba-Tseka Urban Council to achieve food security in the era of climate change,

their farm sector needs to withstand the hazardous and changing climate conditions. CSA as a resilient agricultural system and practice is considered as a pathway to achieving increased agricultural production and food security.

1.8 Definition of key terms

Climate-smart agriculture: CSA has been a notion without a singular definition since the publication of the FAO book "Climate Smart Agriculture- Sourcebook" in 2013 (Nagothu et al. 2016). However, attempts have been made to define it. Academics have provided a comprehensive definition of climate smart agriculture. According to Lipper et al. (2014),

CSA is defined by FAO (2010) as collaborative farming methods to advance food security and development objectives while boosting agricultural production and resilience. According to Adamides (2020), CSA is a strategy that intends to boost global food security as part of efforts to adapt to and mitigate climate change as well as to transform and build agricultural systems to survive the effects of climate change. In order to uncover synergies within food security, CSA promotes incorporating climate change into the design and execution of sustainable agriculture policies (Nagothu et al. 2016).

In keeping with its definition, CSA, according to Lipper et al. (2014), supports initiatives that advance food and nutrition security by incorporating key adaptation and mitigation measures. Nagothu et al. (2016) provide additional evidence that CSA incorporates on-farm income production as well as experience and knowledge in sustainable agricultural growth. In order to improve food security, adaptation, and mitigation strategies, Chandra et al. (2018) highlight that CSA emphasizes the use of low-income agricultural systems such conservation agriculture and best practices of minimum tillage. The researcher understands from the scholarly definitions above that CSA implies the application of adaptation and mitigation to enhance food security while confronted with climate change. For the purposes of this study, the research is going to use the definition of CSA by Adamides (2020) that CSA is a strategy that intends

to boost global food security as part of efforts to adapt to and mitigate climate change as well as to transform and build agricultural systems to survive the effects of climate change.

Food security: According to Mbukwa (2013), food security refers to everyone having access to enough food for an active and healthy life at all times. According to the researcher, food security is the extent to which food is readily available and sufficient in both quality and quantity to meet family members' long-term dietary needs.

1.9 Research structure

Chapter one is the introduction of the research problem and gives a brief introduction on the background of the study. It also relates to the statement of the problem and the objectives of the study on the research topic. Chapter two discusses the literature from various scholars with the aim of reviewing their research findings in relation to the proposed research topic. It involves critical amassing of literature and intensive engagement with scholarship on CSA and food security. Chapter three outlines the methodologies and tools that were used for data collection. It also discusses the population sampling, ethical issues, area of study and the resources that were needed for data collection. In chapter four the research findings are presented and analysed. The findings will answer the research questions and objectives as stated in chapter one. This chapter also presents the findings based on the literature review main arguments and the theoretical framework. Chapter five gives a conclusion on the findings of the study, on whether or not climate-smart agriculture contributes to food security. In this chapter the researcher makes recommendations based on the finding of the study and suggests areas for further related studies

1.10 Chapter Summary

The chapter discussed what the researcher is going to look at, and highlighted the main aspects of the study. The chapter highlighted the background of the study, problem statement, justification of the problem, objectives, research questions, theoretical framework, definition of key terms, limitations of the study, and the research structure. The following chapter will be the literature review where the empirical literature from studies conducted by other scholars on CSA and food security will be reviewed. The research questions will guide the literature review to determine the contribution of climate-smart agriculture to food security.

CHAPTER TWO: LITERATURE REVIEW

2.1 Introduction

This chapter will review the literature on CSA and food security. Different nations have had varying degrees of success using CSA to attain food security. This chapter offers cases from the literature to show how CSA has influenced food security. CSA and food security would be covered in the literature on a global, regional, and national level. The review would be in line with the objectives of the research and reveal new knowledge gaps in the body of prior work that the present research aims to fill. The chapter goes into great length into the elements of CSA, how they affect food availability, accessibility, and stability, and how climate change affects food security.

2.2 Climate-Smart Agriculture: A historical overview

In regard to the historical overview of CSA, this section examines scholarly developments and discussions brought up by earlier researchers. Farmers have long been vulnerable to the effects of climate change and have adopted CSA methods and technology in order to be food secure The CSA practices and instruments vary from region to region, thus it is crucial to talk about them in order to understand how smallholder farmers employed them to attain food security.

There are numerous early publications in the literature that demonstrate how climate change affects agricultural production and food security. The World Bank (2022) and Mbow et al. (2019) studies show that agriculture is the key to food security; but, because of climatic variability, most households, particularly those in developing nations, have been labelled as food insecure. According to Nagothu (2016), FAO developed the CSA concept as a means of enhancing agricultural production and ensuring food security while dealing with climate change. According to Nagothu et al. (2016), the FAO first used the word "CSA" in a document created for the Hague Conference on Food Security, Agriculture, and Climate Change in 2010.

According to Chandra and McNamara (2017), CSA must take into account the social, economic, and environmental facets of sustainable development in order to combat climate change and improve food security. In their analysis, Lipper and Zilberman (2018) note that CSA calls for attaining three key goals, including enhancing agricultural productivity and incomes to increase food security, improving ability to adapt to climate change, and lowering greenhouse gas emissions (GHGs). In their study, Eleblu et al. (2021) emphasize that CSA includes a variety of innovations, technologies, techniques, and laws that are utilized to counteract the negative effects of climate change and variability on agricultural output in order to maintain food security. For CSA to be fully adopted, more especially in the rural communities, Indigenous Knowledge Systems (IKS) have to be integrated into CSA practices so that smallholder farmers can be resilient to the effects of climate change. According to Amore and Gacheno (2021) indigenous knowledge is the institutionalised local knowledge built upon and passed on from one generation to another, usually by word of mouth. Amore and Gacheno (2021) are of the view that indigenous knowledge is critically important for scaling climate smart innovations in smallholder agriculture. They attest that policymakers and other stakeholders engaged in improving adoption of CSA innovations need to understand that rural communities have been adapting to climate change even before in various ways, and that external interventions can only be successful if they build on what already rural farmers have been doing to adapt to climate change.

CSA was designed to balance food production with environmental stability while not compromising either of the two. Chandra and McNamara (2017) go on to say that in order for agricultural systems to be more effective and resilient, management of natural and environmental resources is necessary. Wekesa (2017) states that CSA aims to boost agricultural production in a way that is both environmentally and socially sustainable, to help smallholder

farmers be more climatically adaptive and resilient, to lower agriculture's contribution to GHG emissions, and to increase soil carbon sequestration.

CSA was designed to balance food production with environmental stability while not compromising either of the two. Chandra and McNamara (2017) go on to say that in order for agricultural systems to be more effective and resilient, management of natural and environmental resources is necessary. Wekesa (2017) states that CSA aims to boost agricultural production in a way that is both environmentally and socially sustainable, to help smallholder farmers be more climatically adaptive and resilient, to lower agriculture's contribution to GHG emissions, and to increase soil carbon sequestration.

According to the literature, CSA is neither a novel agricultural system nor a novel set of strategies. CSA operations include a variety of farming techniques and methods, such as crop selection, soil management, and livestock management. According to academics, the application of climate-smart agriculture interventions varies by region and depends on the kind, location, and volume of production (Zakari et al. 2022). Venkatramanan and Shah (2019) provide support for the idea that CSA is a strategy to direct the necessary adjustments in agricultural systems so that they can support food security. This demonstrates unequivocally how important CSA is to achieving the Sustainable Development Goals of eradicating extreme hunger and halting climate change. Additionally, Sarker et al. (2019) say that the CSA takes into consideration the four dimensions of food security being availability, accessibility, stability and utilisation.

In numerous research, it has been disputed whether or not the CSA model increases food security. According to some academics, CSA has improved food security (Campbell, 2021). According to other academics, Climate Smart Agriculture undermines food security (Weseka et al. 2018). According to these academics, certain farmers, particularly those in distant locations, may not have the resources to get the supplies required for them to efficiently adopt

CSA. According to claims made by Chandra (2017), CSA aids in the development of both on- and off-farm income as well as sustainable livelihoods and food security. Weseka (2017) also makes the argument that people living in rural and low-income homes experience food insecurity and scarcity. However, CSA made a significant contribution in nations like Zambia. It has been noted that CSA has been successful in adaptation and mitigation to the effects of climate change on food security in research into CSA and food security carried out elsewhere in Africa (Defe and Matsa, 2021). The researchers looked into how CSA improves Zimbabwe's food security. According to their research, farmers who have used CSA have been able to maintain their livelihoods and be food secure despite the effects of climate change. Even with the introduction of CSA methods and technologies, some regions in other countries have not experienced food security, according to several research (Weseka et al. 2018). Despite the promise of CSA to promote sustainable agriculture and food security, these researchers believe that notwithstanding the potential of CSA to achieve sustainable agriculture and food security, there is lack of coherence among the components of CSA when it comes to implementation. This is reiterated by Sarker et al. (2019) who postulate that sometimes there is misunderstanding of CSA notion by various levels of parties involved.

According to Adamides (2020), CSA is a strategy that seeks to transform and advance agricultural systems based on technology with the goal of boosting global food security as part of efforts to adapt to and mitigate climate change. According to Braimoh et al. (2021), Climate Smart Agriculture integrates critical adaptation and mitigation measures in order to assist the promotion of food and nutrition security. Nagothu et al. (2016) provide additional evidence that CSA encompasses expertise and knowledge in sustainable agricultural development as well as the creation of income through on-farm activities

Lesotho is one of the nations affected by climate change. Extreme climate change-related phenomena like droughts, storms, and floods have been occurring more frequently in Lesotho.

(LMS, 2017). WHO and WBG (2018) claim that drought frequently hits Lesotho and has disastrous socioeconomic repercussions. The main reason for Lesotho's declining agricultural output has been attributed to drought; as a result, less grain and other staple crops have been produced recently, potentially reducing food security (IFAD, 2021). In Lesotho, decreased rainfall and frequent dry spells have a negative impact on agricultural production. As a result, CSA has been embraced by GoL as a strategy for both climate change adaptation and mitigation (IFAD, 2021). Through the Climate Smart Agriculture Investment Plan, or CSAIP, the GoL and the World Bank have developed strategies for changing the agricultural industry in Lesotho (World Bank, 2019). According to IFAD (2021), the World Bank and the government of Lesotho are integrating climate change into the agricultural policy agenda of the country through the CSAIP. The goal of the CSAIP is to determine which CSA initiatives have the most chance of transforming Lesotho's agriculture into a more effective, resilient, and low-emission industry.

Further research is required in Lesotho because there is little published material that deals with CSA particularly. Although similar studies have been extensively conducted in other African nations and around the world, they have typically neglected CSA in Lesotho and instead concentrated on climate change. This necessitates thorough research on CSA throughout the nation. Despite a study by Gwimbi (2015) that details CSA adaptation and mitigation techniques, there is still a shortage of understanding and information about CSA. A geographical gap also exists because there is no literature in Lesotho that focuses exclusively on CSA in Thaba-Tseka. As a result, this study will add fresh understanding about the Thaba-Tseka adoption of CSA techniques and technology.

2.3 Climate change and food security

This section reviews an extensive range of scholarship on the effects of climate change on food security in order to highlight the opinions and conclusions of pertinent studies and academics.

Weseka (2017:8) believes that because of the direct effects that climate change has on smallholder farmers' agricultural production and their capacity to produce enough food supplies, they are disproportionately affected because their ability to obtain enough food supplies from the farm sector is compromised. In the Philippines, Peria et al. (2016) performed research, and the findings revealed that smallholder farmers, whose livelihood depends mostly on agriculture, continually experience the effects of climate change.

The ability of agricultural systems to produce food is being significantly impacted by changes in the global climate, especially in the poorer countries (IPCC, 2014). The output of staple grains like maize and wheat, which provide food for a large portion of the world's population, has decreased as a result of the detrimental effects that climate change is having on agricultural systems.

Climate change significantly affects agricultural productivity and food security in Africa. According to a study by Muller et al. (2011), climate change is having an influence on Africa's agricultural production, and these industries need to be reformed and reoriented to be resilient to the new climate realities. Muller et al. (2011) found in another study that if effective adaptation and mitigation measures are not practiced, African agricultural systems may obtain reduced productivity, resulting in food insecurity. As a result, regional and local smallholder farmers' crop and livestock production may suffer greatly, exacerbating issues of food insecurity. Climate change is affecting a vast majority of African countries' food production systems, resulting in reduced levels of food security.

According to Rantso and Seboka (2019), climate change is a contributing factor to the growing threat to food security in African nations. According to the results of their study, climate variability has posed a threat to the agricultural output of smallholder farmers in African nations. They confirm that, in several African nations, there is a link between worsening food

security and climate change, particularly in rural areas where agriculture serves as the main source of income for the majority of households

The results of a study by Lima (2014) showed that because the majority of SSA countries depend on rain-fed agriculture and natural resources, the agricultural sector in SSA is particularly vulnerable to the effects of climate change. Low agricultural production is a result of the region's frequent floods, droughts, and changes in rainfall patterns brought on by climate change. However, Amadu (2018) investigation of the use of CSA technology and techniques in Malawi discovered that doing so led to a 90% increase in yields. The study's findings gave policy officials information they might use to promote CSA not just in Malawi but in other African nations as well.

In Kenya, Wekesa et al. (2018) conducted research on how climate change affects food security. According to the findings of their investigation, climate change-related pressures such severe rains, droughts, and temperature increases have a negative impact on food security. This is supported by a study done in Kenya in 2021 by Ngure et al. (2021), which shows that drought-related losses there amounted to 2.4% of the country's gross domestic product (GDP). According to the studies mentioned above, the majority of Kenya's smallholder farmers are strongly dependent on agriculture for their livelihoods. Increasing their capacity for adaptation and resilience to the shocks brought on by climate change is crucial for preserving their way of life and enhancing their food security. The study's results also showed that smallholder farmers resilience- its ability to withstand the effects of shocks and bounce back, determines their ability to deal with the effects of climate change.

Lesotho is one of the nations affected by climate change. Climate change threatens smallholder farmers' ability to produce enough food in both rural and urban areas by lowering agricultural output. WFP (2023) discovered that Lesotho is facing a severe food security problem as a result

of El-Nino-induced drought and protracted floods, which have negative effects on food production systems. Crop failure in successive years, low salaries, and high food costs have made the situation worse. Muroyiwa and Tselisang (2019) conducted a study in Lesotho to determine how climate change affects food security.

The study discovered that drought, which has already decreased crop yields and livestock, is having a significant impact on Lesotho's agricultural economy. The Lesotho Climate-Smart Agriculture Investment Plan (CSAIP) was created by the government of Lesotho in partnership with the World Bank to address the aforementioned issues and integrate climate change into the country's agricultural policy agenda (World Bank, 2019).

Lesotho has little academic research on the effects of climate change on food security. The study has not found any literature on how Lesotho's smallholder farmers are applying climate change adaptation techniques for secure food supply and sustainable agricultural productivity. There is a need for more academic research on climate change and food security, and this study will fill that gap by introducing new knowledge on the impacts of climate change on food security.

2.4 Climate-Smart Agriculture and food security

This section examines academic research and data that has been collected and verified by academics and international organizations on how CSA improves food security. Despite the fact that farmers using CSA techniques and technologies have increased their food security and climate resilience, the agricultural industry is still vulnerable to climate change globally (Mutengwa et al., 2023). Accordingly, a quantitative study conducted in Greece to examine how CSA affected cereal production revealed a favourable relationship between CSA and food security (Mavromatis, 2015). Another study conducted in the Czech Republic found that CSA has favourable long-term effects on the output of fruiting vegetables including tomatoes and

cucumbers (Potopova et al. 2017). FAO (2023) adds that it is critical to increase smallholders' capacity for adaptation.

According to Lipper et al. (2014), CSA prioritises food security while also addressing climate change mitigation. Braimoh et al. (2021) argue that improving traditional agricultural systems to make them more climate smart requires modification in agricultural practices. They content that CSA enhances not only local but also national and global food security. According to the analysis of a research paper by Murray et al. (2016), farmers who practice CSA experience greater food availability across the globe than farmers who do not.

El Bilali et al. (2020) state in their study that one of the biggest challenges facing humanity now is climate change. Their findings demonstrate hoe the availability of food is significantly impacted by climate change. Their findings demonstrate how the availability of food is significantly impacted by climate change. The unfavourable effects of climate change on crop yields, fisheries, and animal output have an impact on the supply of food. The majority of those who experience poverty and food insecurity reside in Sub-Saharan Africa and South Asia, where it is more severe (Stathers et al., 2020). It is obvious that food yields and the availability of cattle are declining as a result of climate change. Scholarly literature, however, demonstrates that there is a bidirectional relationship between CSA and food availability in several regions of the world.

Numerous studies have demonstrated how well the CSA works to increase food availability in African nations like Malawi, Tanzania, and Zimbabwe. According to a study by Kurgat et al. (2020) in Tanzania, the variability of the climate has led to a sharp decline in the availability of food. The study's conclusions showed that smallholder farmers who practice climate-smart agriculture have more access to food than smallholder farmers who do not. The adoption of climate-smart agriculture is one significant step toward bettering food supply and the wellbeing

of smallholder farmers dealing with climate change, according to a different study conducted in Zimbabwe by Mujeyi et al. (2021). The study's conclusions make it abundantly evident that CSAs assist farmers in supplying the nation's rising food demand.

The results of a study by Murray et al. (2016) on CSA technologies in Malawi show that the Malawian government, NGOs, research organizations, and donors have been working to increase the resilience of smallholder farming systems in the face of climate change, particularly in the rainfed agriculture sector. These initiatives include drought-tolerant crop types, conservation agriculture, and agroforestry systems (Malawi Government, 2015). According to published research, Zambia has greatly enhanced maize yields due to climate-smart farming techniques such crop rotation with legumes (cowpeas and soybeans) and as a result, food availability. The results of a study conducted in Ethiopia by Belay et al. (2023) show how CSA techniques like water conservation, irrigation systems, and conservation agriculture have aided in ensuring food security.

Other studies on CSA techniques in Kenya (Ogada et al. 2020) and an increase in grain output in Ethiopia (Wake and Habteiyesus, 2019) however, produced conflicting findings. For instance, Ogada et al. (2020) found that the adoption of CSA methods decreases farmers' income and food security since farmers must spend a significant portion of their income on the products and technologies required to practice CSA. As opposed to the amount of food security experienced by farmers who conduct traditional agriculture, Wake and Habteiyesus (2019) show that adopting CSA principles boosts farmers' food security. (2018) Hassan et al. looked on the effects of CSA adoption in Bangladesh. Their investigation covered a wide range of aspects of food security in the area. 17 CSA practices were discovered in the investigation.

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In this empirical assessment of the literature, the findings of various academic publications have shown a favourable association between CSA and food security both internationally and elsewhere in Africa, whereas other research have consistently shown an inverse relationship. Because CSA is still a relatively new idea in academia, there is little literature in Lesotho on how CSA affects food security. The majority of studies have concentrated on climate change and how it affects Basotho socioeconomic life, paying little attention to CSA and its role in ensuring food security.

Numerous researches have been conducted in Lesotho, and they show that climate change is occurring and having negative effects. CSA is being marketed as a technique for reducing and adapting to the effects of climate change on agriculture, as well as a way to maximize the

biological functions of the soil and minimize erosion. Nevertheless, despite these initiatives, there is little information available on the impact of CSA to the food security of smallholder farmers in Lesotho, and more specifically in Thaba-Tseka Urban Council. By examining how CSA affects food security in Thaba-Tseka Urban Council and identifying any gaps in laws and legal frameworks pertaining to CSA in Lesotho, this study aims to close this gap.

2.5 Chapter summary

This chapter presented a historical overview of CSA by examining the scholarly developments and trends brought by earlier researchers on the evolution of CSA. It was demonstrated that the concept of CSA was developed by FAO as a means of enhancing agricultural production and food security while dealing with the effects of climate change. Literature presented in the chapter revealed that CSA strategies includes a variety of farming technologies like crop section, livestock management and soil management.

The chapter also reviewed literature on the effects of climate change on food security in Lesotho and elsewhere in the world. It was unearthed that smallholder farmers' agricultural production and their ability to produce adequate food is compromised by the effects of climate change. Lastly, the chapter reviewed trends in scholarship on how CSA enhances food security. It was established by scholars that farmers who adopt CSA strategies and technologies are more food secure than those who do not adopt them.

CHAPTER THREE: RESEARCH METHODOLOGY

3.1 Introduction

This chapter concentrated on the research methodology. It first displays the study area, followed by the research approach and research design used. The population, the sampling technique, and the sample size come after this. Additionally, data collection techniques and strategies are covered in this chapter. The chapter also discussed ethical issues that were discovered during the course of the inquiry and data analysis.

3.2 Area of Study

The research was conducted in Thaba-Tseka Urban Council, in Thaba-Tseka District, which is 2219 meters above sea level (Phalatsi et al., 2023). Thaba-Tseka District is found in the Highlands ecological zone of the country and has 135,347 populations as of the 2016 Census (BOS, 2016). In Thaba-Tseka, the majority of the community residents are farmers who cultivate crops and rear livestock such as cattle, with only a tiny percentage of them employed in the formal economy. There are 13 community councils in the Thaba-Tseka district, but the Thaba-Tseka Urban Council was chosen for the study because it is one of those councils and because smallholder farmers engage in CSA practices.

3.3 Research Approach

This study used a qualitative research approach. Bhandari (2020) claims that a qualitative research approach entails collecting and analysing non-numerical data in order to understand concepts, attitudes, or experiences. The researcher used a qualitative research approach since it gave him a thorough grasp of the issues under inquiry, which is difficult to achieve using a quantitative approach. The respondents were free to speak openly about their experiences of CSA and how it improves food security. With this strategy, the researcher had the chance to follow up on the respondents' responses. Additionally, using a qualitative study approach allowed the researcher to obtain comprehensive statements from the respondents on CSA and food security.

3.4 Research Design

A research design is a framework of research methodologies and techniques selected by the researcher to carry out a study (Turale, 2020). Smallholder farmers in Thaba-Tseka Urban Council served as a case in this case study design. According to Creswell (2013), a case study is a thorough investigation of a person, a group, or an event in which every aspect of the subject's life and history is examined for patterns and probable behavioural explanations. A comprehensive research on how CSA improves food security was conducted in the Thaba-Tseka Urban Council. The goal of the study was to gain a knowledge of how CSA helps smallholder farmers in the research region maintain food security. Due to this study's emphasis on case studies, a case study design was adopted in this study because of its reliance on interpretivist paradigm which allowed interaction of the researcher with the respondents.

A case study was suited for this research as it gave the researcher the opportunity to gain concrete and comprehensive knowledge about the issue under inquiry. The case study gave the researcher the opportunity to gather more data related to the research questions. The study was able to identify the contribution of CSA to food security in Thaba-Tseka Urban Council because to this research approach. The case study demonstrated its adaptability by making it simple for the researcher to identify the respondents.

3.5 Study Population

The study population was made up of smallholder farmers practicing CSA in Thaba-Tseka Urban Council. A study population, according to Bobbie (2007), is a group of elements from which a sample is taken. Thaba-Tseka Urban Council is made up of nineteen communities. The Thaba-Tseka Urban Council's smallholder farmers were chosen mostly due to the fact that agriculture is the primary source of their livelihood. Therefore, it was essential to research how CSA affects those agricultural households' ability to be food secure. For the purposes of this research, the study population was made up of all smallholder farmers adopting CSA practices and technologies in Thaba-Tseka Urban Council.

3.6 Sampling Procedure

The study employed both purposive sampling and snowball techniques. A sample, in the words of Banerjee and Chaudhury (2010), is any subset of people (or groups) within a population. Since there are so many participants in research studies, it is challenging to obtain data from every person in the community. Only a sample of smallholder farmers who practice CSA were selected to participate in the study; not all smallholder farmers in the Thaba-Tseka Urban Council were included. A sample of 30 respondents was chosen from the CSA-practicing smallholder farmers in Thaba-Tseka Urban Council.

The key informants, who included three chiefs, five village leaders, and two agricultural extension officers in the study area, were selected through the use of purposive sampling. Purposive sampling, according to Obilor (2023), is a sampling strategy based on the researcher's judgment, in which the researcher only selects the respondents required to meet the study's objectives due to their unique traits and expertise. Purposive sampling refers to the process of selecting study participants because they can help with comprehending the study's main phenomenon (Creswell, 2013).

In purposive sampling, the researcher purposefully selected the key informant because of the knowledge they have. Purposive sampling was used by the researcher for the Agricultural Extension Officers since they are important key informants with in-depth knowledge and experience in CSA and food security. The chiefs and village heads were chosen on purpose because they had first-hand knowledge of the farming methods of their community members. Because they have first-hand knowledge of how climate change affects agriculture in their communities, community leaders are important CSA stakeholders.

The key informants shared their knowledge of the CSA adaptation and mitigation strategies used by Thaba-Tseka Urban Council to improve food security. This was in line with the notion that the choice of key informants in a qualitative study should be deliberate and enrich the

questions and goals of the study by deepening knowledge of the phenomenon being studied (Creswell, 2013).

Additionally, snowball sampling was utilized by the researcher to select smallholder farmers. Snowball sampling, according to Bhattacherjee (2012), is a sampling approach where the researcher chooses a small number of respondents who fit the study's needs and then asks them to recommend more respondents who also fit the researcher's selection criteria. The researcher was unaware of every farmer practicing CSA. As a result, the first few farmers the researcher spoke with directed her to additional smallholder farmers who were engaged in CSA. Thirty smallholder farmers made up the study's sample size.

3.7 Data Collection Methods

Qualitative data collection methods such as open-ended questionnaires, open-ended interview and documented data where used for the purposes of the study.

3.7.1 Documented Data

To completely familiarize the researcher with the discourses on CSA and food security, the study embarked on with an extensive review of the literature. Documentary sources from the National University of Lesotho library were used to gather secondary data. The study involved a critical amassing of literature on food security and CSA. Books from the NUL library, peer-reviewed journal publications, and policy documents on CSA and food security were used to conduct this extensive engagement with scholarship. A theoretical viewpoint on CSA and food security in Lesotho, Africa, and other parts of the world was provided using documentary sources.

3.7.2 Open-ended Interviews

Interviews, according to Adhabi and Anozie (2017), are qualitative data gathering techniques that focus on the researcher asking participants questions to acquire information more about a particular occurrence. For data collection, open-ended but relevantly guided face-to-face conversational interviews with one area chief, three village heads, and two Agricultural

Extension Officers were conducted with purposefully selected research participants. The participants were given the opportunity to express themselves during the open-ended interviews. Open-ended interviews made it possible for the researcher to interact more with the subjects, gain their trust, and acquire a better comprehension of their responses. Open-ended interviews were used to involve key informants such extension staff, the area chief, and village chiefs to share their experiences working with CSA-practicing smallholder farmers. Because they allowed for probing, open-ended interviews turned out to be effective. Once more, participants chose to express themselves verbally rather than write down their responses.

Smallholder farmers were also questioned by the researcher and given the freedom to provide general responses to the topics raised. This gave the participants freedom to respond anyway they desired. The participants who were asked questions on the research problem were in direct contact with the researcher. Due to the face-to-face nature of the interview approach of data collecting, the researcher was able to learn more in-depth information on the study problem

3.7.3 Open-ended Questionnaires

A questionnaire is a collection of thoughtfully written questions given to a group of respondents in exactly the same format, in order to acquire data on the topic the researcher is interested in (Roopa and Satya, 2012). Thirty questionnaires were given out by the researcher to CSA-practicing small farmers in the communities of Thaba-Tseka Urban Council. The respondents were given the same questions and the same alternative to answer them. The questionnaires were guided by the research questions listed in chapter one. The respondents were given the questionnaires and informed to complete them on their own to allow anonymity and confidentiality to the respondents, and to ensure that the researcher does not influence the responses to the questions. These questionnaires were crucial in understanding the opinions of respondents on how CSA enhances food security in Thaba-Tseka Urban Council.

Since the researcher was not there to influence their responses, a sizable number of respondents were involved, but they were not under any pressure to reply. The respondents were given the questionnaires, which were then collected after one or two days. In this study, the questionnaires had a number of benefits. Both in terms of time and money, they proved to be inexpensive, and the data flow was quick and involved many of responders. Additionally, questionnaires made data processing very easy and guaranteed respondents' privacy. Despite the benefits of questionnaires, there were some challenges because some respondents did not respond to all of the questions, which affected the study's findings.

3.7.4 Observation

The study also employed observation method of data collection. Observation is defined a method of qualitative data collection in which the researchers gather data by observing people and their behaviour in their natural setting (Smit and Onwuegbuzie, 2018). The researcher observed the farming activities and behaviour of smallholder farmers sampled for the study. This method allowed the researcher to record data about the farming environment and the behaviour of sampled farmers without having to rely on retrospective and anticipatory accounts of other researchers. While the farmers were engaged in farming practices such as cultivating crops in their shade nets, greenhouses and keyhole gardens, the researcher was able to see and record what the participants did not reveal. Through observation, the researcher was able to watch the farming activities and behaviour of smallholder farmers that would be difficult for them to describe.

3.8 Data Collection Procedures

To be able to carry out a study, the researcher sought authorization from the Thaba-Tseka Urban Council officials. These included the district administrator, local government representatives, and village heads. The university's introductory letter was used to introduce the researcher to the authorities and the research subjects. The researcher introduced himself to the participants and explained the aim of the study throughout data collection. Before

continuing to gather data, the researcher gave each participant a brief explanation of the study's objective.

The first step in conducting interviews was making an interview guide with an outline of the primary areas to be covered during the interview session. The interview guide acts as a reminder of the questions the researcher intended to ask and the responses he sought to gather. After the interview guide was created, the next stage was to determine who would be participating in the study. It was essential that the study include local chiefs, village heads, and agricultural extension officers as important informants, as well as a sample of the smallholder farmers who practice CSA in the study area. The key informants were interviewed for between 30 and an hour each.

The Agricultural Extension Officers in the study area helped the researcher to identify the first few smallholder farmers who were engaged in CSA during the data collection process. Following the identification of the participants, open-ended questionnaires were administered and interviews were held while maintaining to the ethical requirements of data collection. The researcher used snowball sampling so that the initial few smallholder farmers interviewed could lead him to other participants who were engaged in CSA. The researcher introduced himself to the participants during data collection sessions and explained the purpose of the study. The consent forms ware then signed by the participants and the researcher before the interview could begin. The interview answers were recorded using a cell phone recorder and then transcribed into text. During the interview sessions, the researcher made an effort to make the participants comfortable. Data was also collected through observation method. While the farmers were carrying out their farming activities, the researcher sought permission from them to take pictures of their CSA technologies and practices. This allowed the research to observe the crops they grow, their adaptation strategies and other technologies they are using to fight climate change.

3.9 Ethical Considerations

Several ethical considerations which included anonymity, confidentiality, and permission of approval from local authorities, informed consent and honest publication of the research findings were observed by the researcher.

3.9.1 Informed Consent

Informed consent, as defined by Bhattacherjee (2012), is a process in which the researcher explicitly informs the participants of their right to decline participation and to withdraw from the study prior to the interview. Before requesting participants to voluntarily participate in the study, the researcher briefed them on the purpose of the study. The participants were also informed of their right to discontinue participation in the study at any moment if they felt uncomfortable. When the participants agreed to take part in the study, consent forms were issued to them to sign together with the researcher.

3.9.2 Confidentiality and Anonymity

Anonymity and confidentiality are other significant ethical considerations that the researcher took into account when conducting the study. According to Babbie and Mouton (2001), confidentiality is ensured in research when the researcher can identify a specific respondent's response but agrees not to disclose the information publicly. Anonymity is achieved in research when neither the researcher nor the readers of the findings can link a given response to a specific respondent. The participants were reassured by the researcher that the information they provided would only be used for the study. All of the recordings and data sheets were stored in a computer file, and they will be deleted after the study is over. The details of every interview were kept confidential. The researcher was obliged to keep the promise made to ensure the anonymity and confidentiality of the participants.

3.9.3 Honest Publication of Findings

Another ethical concern that the researcher took into account was the honest publication of results. According to Louw (2014), in addition to being aware of the ethical concerns of the

respondents, the researcher also needs to be aware of the ethical concerns that have an impact on data analysis and reporting. Presenting deceptive data, falsifying data, and allowing prejudice to influence how results are viewed are some unethical behaviours. The researcher presented the findings in a manner that reflects the actual responses from the participants.

3.10 Data Analysis

The study gathered qualitative data in the form of words through interviews and open-ended questionnaires. The researcher utilized thematic analysis to examine the data he had gathered. Thematic analysis is a sort of qualitative analysis that is used to analyse categories and offer themes that are relevant to the data, according to Alhojailan (2012). The researcher thoroughly read over the data to become familiar with it, and then carefully coded the data to organize it. This was accomplished by using data provided by the participants to find commonalities and patterns. Themes were created by grouping together similar codes.

Because of thematic analysis, the researcher was able to compare an analysis of a theme's frequency with one of the content as a whole. The researcher was able to analyse the research findings in a manner that was more comprehensive, systematic, and reliable because of the application of thematic analysis. Themes from the data gathered included CSA practices, CSA potential, and CSA adoption challenges.

3.11 Limitations of the study

Some limitations and challenges were encountered in the course of data collection and writing-up of this research. Firstly, there were constraints in data collection and analysis. The study also employed observation as one of the methods of data collection. However, it is worth noting that observation presented some limitations to this inquiry. Smallholder farmers who participated in the study consciously or unconsciously changed the way they behave and carry put their farming activities when they realised that they are being observed, and therefore, observational accounts of some smallholder farmers were inaccurate representations of how they behave naturally and carry out their farming practices.

Moreover, other data collection limitations and biases included “strategic responses” in which there were perceived incentives of under or over reporting of agricultural production by smallholder farmers. For instance, during interviews some farmers chose to under report their CSA production because they believed that their responses may be linked to personal costs or gains. A solution to this limitation was to compare participants’ responses to the findings from observation of farming practices, and making informed opinions depicting exactly or closer to the reality.

In addition, during transcribing of interviews, there were challenges in picking up the right understanding of what has been said. There were some limitations in the use of questionnaires. High incidences of illiteracy among the respondents made it difficult to administer self-completion questionnaires. As a result, the researcher had to translate each question into Sesotho. Conscious efforts in research ethics were taken into consideration in this process.

3.12 Chapter Summary

This chapter highlighted the research methodology employed for collection of data. Various data collection methods have been discussed and justified as an indication that their use is applicable for this research. It also raised the population to be used and the sample which the researcher thought is representative. Aspects of data analysis were extensively emphasised in this chapter, and ethical issues were also covered. The next chapter will focus ono data presentation, analysis and discussion.

CHAPTER FOUR: DATA PRESENTATION, ANALYSIS AND DISCUSSION

4.1 Introduction

This chapter entails comprehensive presentation of data, analysis and discusses the findings of the study with reference to the data derived from interviews and questionnaires on CSA contribution to food security among smallholder farmers in Thaba-Tseka Urban Council. The first sub-section presents the results for the first objective whereby the study investigated the contribution of CSA to food availability and accessibility. Sub-section addressed the second objective of the study whereby it was identified how CSA contributes to food stabilisation. Finally, in the last sub-section, deals with informing policy in relation to CSA and food security.

4.2 Climate-Smart Agriculture (CSA) as a driver to food availability and accessibility in Thaba-Tseka Urban Council

This section will present the findings of the study on how CSA contributes to food security in Thaba-Tseka Urban Council. For the researcher to understand how the adoption of CSA contributes to food availability and accessibility, the smallholder farmers were asked whether they are knowledgeable about climate change and how is it affecting their agricultural production. Most of farmers who were interviewed highlighted that they are affected by climate change. They indicated that there are various ways in which they have known about climate change including meetings, experimental knowledge, radio, TV and their own personal observations. Most of the respondents explained that meetings and workshops by extension officers and Non-Governmental Organisations (NGOs) shed knowledge to them about climate change. Some smallholder farmers elaborated that they do not get information from the meetings only, but also from the media. Smallholder farmers also expounded on how is climate change affecting their agricultural production. They expressed that their farming practices are severely impacted by climate change. This is because Thaba-Tseka agriculture is rain-fed, and less rain results causes a shortage of irrigation water. They further explained that the dry spells have affected sources of water and the heavy rains and hailstorms damage their crops. They

stated that changes in climate patterns have led them to adopt CSA practices and technologies so as to be food secure.

The smallholder farmers were asked what they know about CSA. Farmers stated that they are aware that CSA is an effort to progress the assimilation of agricultural operations and climate responsiveness. They further highlighted that they know that CSA strives for enhanced food security under the changing climate conditions. They narrated that they have heard about CSA from Extension Officers, radios and Lesotho Television (LTV). Moreover, smallholder farmers indicated that their reasons for adoption of CSA practices are that there has been a decline over the past years in their agricultural production, resulting in increased level of food insecurity. One smallholder farmer explained:

> *a decline in our stable crops such as maize, beans, peas and vegetables forced us to adopt CSA practices and technologies so that we can be food secure (Farmer A, aged 56, Female).*

It was highlighted that the CSA made them to be resilient to the shocks imposed by changing climatic conditions. The resilience of smallholder farmers is in commensurate with the guiding principles of the Resilience Theory used in this study. The Resilience Theory looks into the best ways to manage how people and the environment interact to maintain a sustainable and resilient supply of the basic services that people depend on (Better Evolution, 2014). The climate-smart practices of smallholder farmers in Thaba-Tseka Urban Council proved to be in line with the Resilience Theory, as the smallholders' agricultural systems had the capacity to withstand and be adaptive to climate change shocks so as to produce the outcomes of food security. The smallholder farmers practicing CSA in Thaba-Tseka Urban Council proved to be resilient as they are able to be food secure even though they are experiencing climate change. Their agricultural systems can survive in more severe and unpredictable climate conditions.

CSA as a resilient agricultural system and practice is considered as a pathway to achieving increased agricultural production and enhancing food security.

The respondents highlighted how CSA impacts food availability and accessibility and presented different CSA practices as response options and coping mechanisms to climate change. They demonstrated hoe climate change has impacted their food security and agricultural production. However, with the adoption of CSA strategies they have been experiencing food accessibility and availability. The following subsections will discuss the highly practiced and accepted CSA strategies, and they include: keyhole gardening, conservation agriculture, shade nets, intercropping, changing planting date, greenhouses and water harvesting.

4.2.1 Keyhole gardens

The study established that keyhole gardens support sustainable livelihoods and food security of smallholder farmers, as vegetables can be grown for household consumption and to be sold in the markets. A keyhole garden is a round raised garden made with stones. This type of garden has a wedge-shaped outlet along one side to allow easy access to the centre of the garden. When making a keyhole garden, at the bottom of the structure the top layer of soil is dug up and covered with a variety of locally made compost. At the centre of a keyhole garden in a central basket made with sticks and filled with grass and leaves which is used for irrigation purposes. A small path leads to the centre of the garden, allowing the farmer to work the garden with easy without bending. Keyhole gardens are further defined by Allen (2018:8) as garden beds built with raised stones or concrete with a composting area in the middle, that are often circular and have a path carved out to the centre. These gardens are constructed in a distinctive manner that offers smallholder farmers the most effective gardening conditions. Figure 4.1 below is the image of keyhole garden

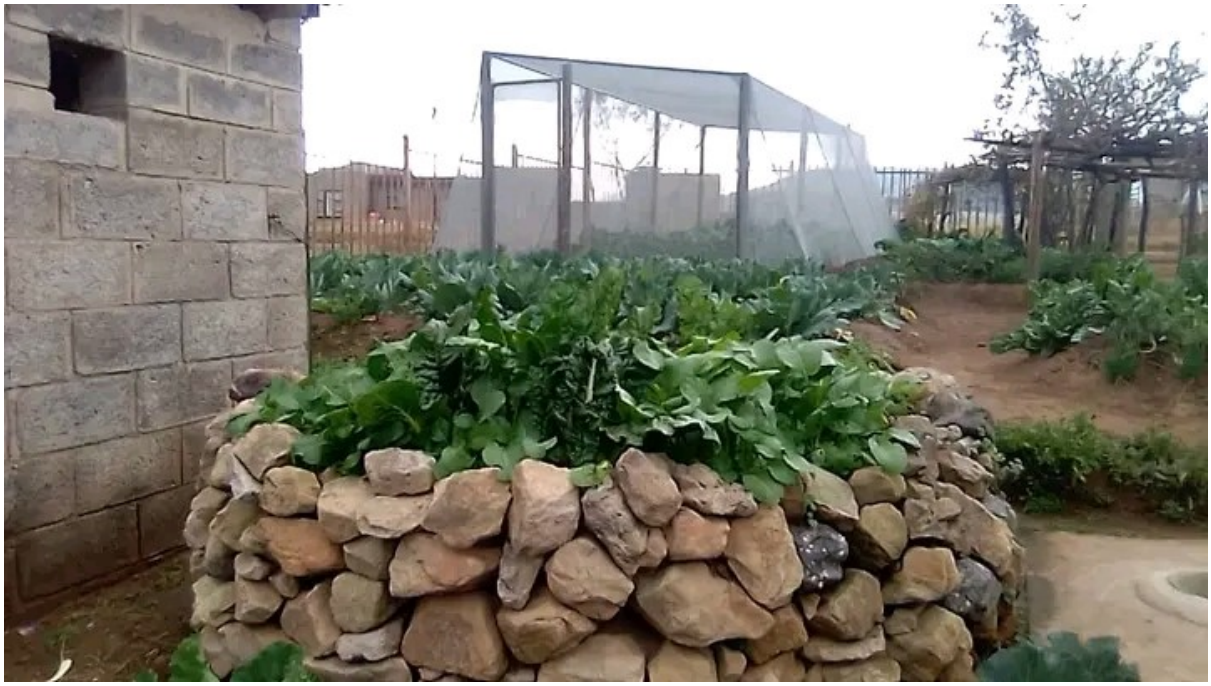

Figure 4.1: Keyhole Garden

Source; Picture taken by researcher during fieldwork

The farmers who have keyhole gardens in the village of Thabong 1 explained that the keyhole gardens have helped them to produce a variety of vegetables all year round as compared to when they were practicing conventional agriculture. The farmers narrated that keyhole gardens retain moisture, replenish organic matter, which permits vegetable production with minimum irrigation.

One farmer in Hillside village explained that prior to the adoption of keyhole gardens she acquired low yields from her home garden due constant changes in the climate patterns, such as long periods of drought, extreme heat and heavy rainfall. However, with the adoption of a keyhole garden as a CSA practice, she has experienced increased yields in vegetables since keyhole gardens are resilient to drought and low temperatures of Thaba-Tseka. The same farmer further revealed that before using keyhole garden, she had to spend most of the monthly remittances sent by her daughter to buy vegetables. She further explained that her keyhole

garden has brought hope to her household as she can now produce vegetables such as spinach, carrots, beets and cabbage for her family continuously. It was revealed by another smallholder farmer that this type of garden is efficient and resilient to climate change shocks as it could easily be covered to protect crops from winter frosts, extreme summer heats and the effects of high winds. The smallholder farmer responded that the keyhole garden is the only readily available source of diverse range of vegetables for her household of herself and three grandchildren whose mother is a domestic worker in Republic of South Africa (RSA). She explained:

> *My keyhole garden is really helping my family as I can grow vegetables for an extended period of time even when we are experiencing harsh climate conditions such as heavy rains and dry spells. This type of garden makes my family to be food secure as I can grow vegetables such as spinach, rape, mustard and cabbage all year round. (Farmer A, aged 56, Female).*

As the findings of the research on keyhole gardens reflected, there is a relationship between keyhole gardening and food security. Keyhole gardening as a CSA practice is contributing in larger margins to food accessibility and availability in Thaba-Tseka Urban Council. The use of keyholes gardens by smallholder farmers in Thaba-Tseka Urban Council is due to the resilience of farmers as they are still able to produce food for their households under the prevailing circumstances of climate change. All the sampled smallholder farmers agreed that keyhole gardening is the way forward to achieving food accessibility and availability, and it should be practiced by other farmers so as to be food secure. Therefore, the study acknowledges keyhole gardening as a resilient CSA practice that can be used to achieve food security and sustainable livelihoods.

Literature is replete with work that shows that keyhole gardens helped smallholder farmers to achieve food security as they require limited labour to produce. A study by Sekaleli and Sebusi (2013) found that keyhole gardens are a growing CSA adaptation strategy in Lesotho. These gardens have proved to be an effective practice to produce vegetables all year round as they nourish the soil and retain moisture. A study carried out in Samoa by Allen (2018) points to the similar results- that keyhole gardening makes smallholder farmers to be resilient and adaptive to changing climatic conditions, and that utilising these gardens provide households with essential fresh vegetables

4.2.2 Conservation Agriculture

It was established that most of the smallholder farmers in Thaba-Tseka Urban Council are practicing conservation agriculture (CA). Conservation agriculture is an agricultural system that that increases the sustainability of crop cultivation by preserving and safeguarding soil, water and biological resources through minimum soil tillage and soil cover (Page et al. 2020). Figure 4.2 below is the image of cabbage grown through conservation agriculture:

Figure 4.2: Conservation Agriculture

Source; Picture taken by researcher during field work

Farmers revealed that they prefer conservation agriculture as it involves efficient use and conservation of resources through less ploughing and maintains a constant soil cover of mulch, green manure and cover crops. The sampled smallholder farmers said they basically practice conservation agriculture to produce grains such as maize, beans and sorghum in the fields. One farmer from the village of Ha Motsepa was interviewed on the practice of conservation agriculture, and explained that he digs potholes in the fields and directly plant seeds together with fertilizer those potholes without tilling the soil in the fields. The participant further explained that he has been experiencing high yields when practicing conservation agriculture as compared to when he was practicing conventional agriculture. He articulated that:

> *Conservation agriculture has proved to be a promising strategy to increasing yields and conserving soil and water resources. This type of agriculture reduces soil erosion, which means there is a large area of land that can be used for planting, resulting in increased agricultural production (Farmer B, aged 48, Male).*

The participants in the villages of Thabong 2, Ha Motsepa and Ha Laka highlighted that the implementation of conservation agriculture as CSA strategy has enabled them as farmers to increase their maize, beans and sorghum yields. They also highlighted that CA has helped them in reducing soil erosion. This is because before using conservation agriculture, they planted the whole fields, resulting in soil being washed away by heavy rains. However, since they are now digging potholes in the fields and place seeds and fertilizer, they have been cultivating high yields of grains resulting in the improvement of their food availability and accessibility status. In addition, the sampled smallholder farmers stated that conservation agriculture can withstand droughts as the potholes hold moisture for longer periods of time. They also stated that conservation agriculture increases soil fertility and plant nutrition because fertiliser or manure is poured directly in the pothole together with the seeds, resulting in increased agricultural produce.

One key informant indicated that they have been providing training to farmers on conservation agriculture, and that such training has had positive impact on smallholder farmers' production, as their produce has increased through conservation agriculture compared to when they were practicing conventional agriculture. Again, smallholder farmers are aware of what needs to be done to address the effects of climate change. It was highlighted by the key informant:

> *I believe that changing agricultural methods from conventional agriculture to conservation agriculture has benefited the majority of smallholder farmers. They are getting more yields and they are able to survive (Key informant- Agricultural Extension Officer, Male).*

The study comes to the conclusion that using conservation agriculture as a CSA practice provides long-term advantages for food and coping with climate change shocks. As a result, smallholders all across the nation ought to be encouraged to practice it because it offers beneficial synergies for both adaptation and mitigation. The findings of this study are in agreement with those of a study Sesoai et al. (2019) carried out in Roma Valley, Lesotho. According to their research, conservation agriculture is a key strategy for resolving the issues that smallholder farmers in various regions of the nation confront. Their study revealed that good results have been attained where conservation agriculture was practiced using planting basins. Their study indicated that crop stands have been good as moisture is retained by not disturbing the soil, and harvests have increased as compared to harvests in fields managed under conventional agriculture. Studies show that conservation agriculture can increase productivity, incomes and food security. Zhao et al. (2023) conducted an inquiry in China comparing conventional agricultural practices and conservation agriculture. Their study revealed that there was a yield gap between the two agricultural practices. There was high yield of crops produced through conservation agriculture as compared to crops produced through conventional agriculture.

4.2.3 Appropriate livestock housing

The outcomes of the study indicated that building appropriate housing for animals such as sheep, pigs, chicken and goats was the main adaptive strategy for the participants producing livestock in Thaba-Tseka Urban Council. In order to minimise the impact of heavy rain, snow, heat and extreme winds, smallholder farmers stated that they designed pig cages in high concrete wall with roofs to protect their livestock from extreme weather condition. The participants also stated that they design sheep housing using corrugated iron and cheap available resources such as trees and stones. It was also stated by the smallholder farmers that they keep poultry in proper shelter mater from corrugated iron sheets. These CSA practices have of livestock housing have been acknowledged by the participants as playing an important role in enhancing the ability of livestock to withstand climate change induced shocks. It was explained by one farmer that the roofed housing for his sheep, is a resilient practice as his livestock is protected from the extreme weather conditions of Thaba-Tseka. The smallholder shed light on the matter:

> *Thaba-Tseka is known for heavy snows in winter which contributes to loss of livestock. However, after the construction of improved housing for my sheep, they are now protected all climate threats, which makes my family to be food secure. I normally sell wool and use the income from wool sales to buy seeds to plant and other food stuffs (Farmer C, aged 62, Male).*

Therefore, proper housing of livestock is a CSA strategy that contributes to food availability and accessibility of smallholder farmers in Thaba-Tseka Urban Council. The outcomes of the study concur with Galama et al. (2020) where they state that livestock housing needs to protect animals from all climatic extremes, so as to ensure survival of animals for continued production and reproduction.

4.2.4 Shade nets and greenhouses

This sub-section will reveal the findings of the study on how do shade nets and greenhouses contribute to food accessibility and availability in Thaba-Tseka Urban Council. A shade net is a cloth that has been woven using specialised fabric which is used by farmers to provide shade to crops as well as to protect them from other environmental and climate hazards. Kotilaninen et al. (2018:2) define shade net as structures covered by agro-nets which have gaps to allow air and sunlight to pass through, and are used to cover lightweight trellis structures and garden beds. Greenhouses on the other hand are solid structures made up of plastic material in which crops are grown within the controlled temperature and humidity. According to Aznar-Sanchez et al. (2020) greenhouses are structure made of layers of plastic material or glass in which temperature and humidity can be controlled the cultivation and protection of the plants. Figure 4.3 and figure 4.4 below are images of shade net and greenhouse:

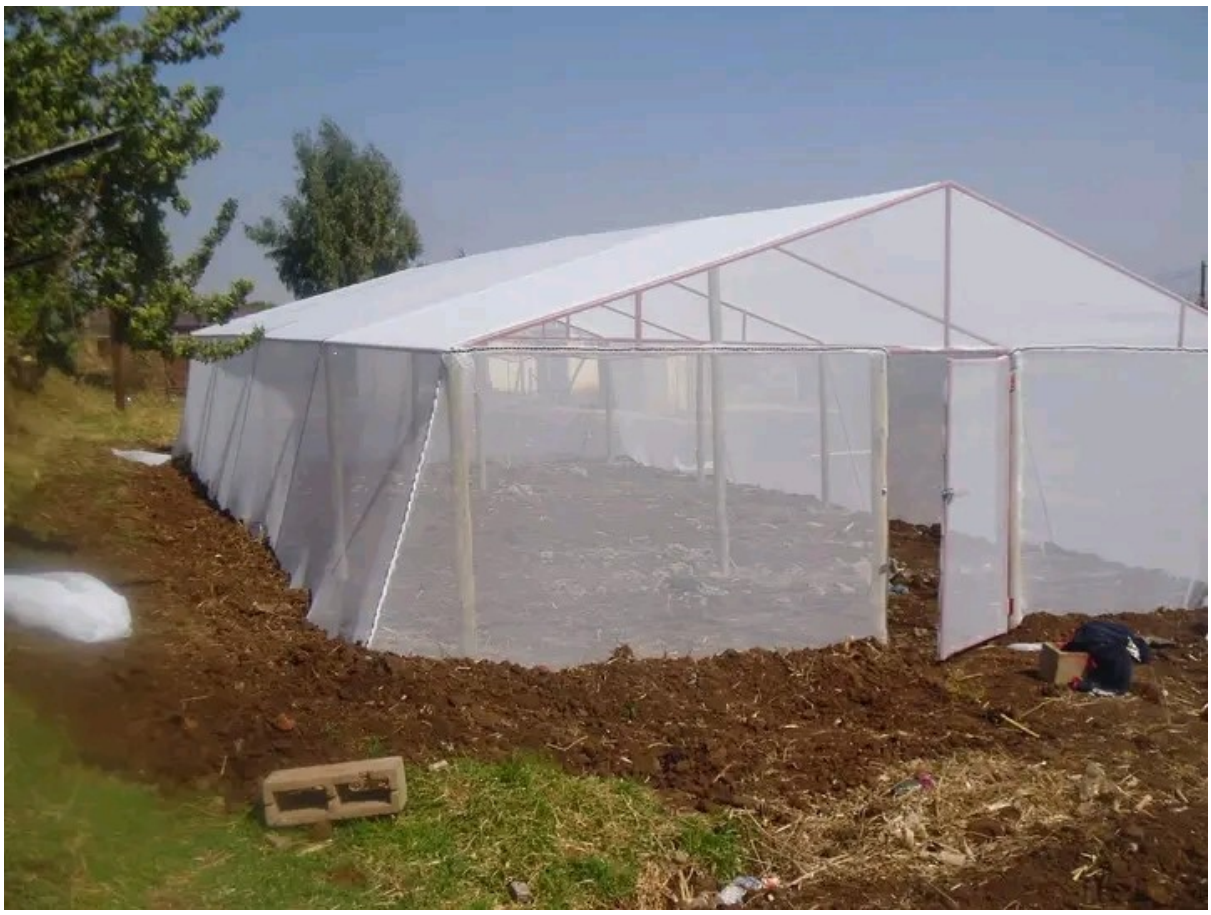

Figure 4.3: Shade Net

Source; Picture taken by researcher during fieldwork

Figure 4.4: Greenhouse

Source; Picture provided by Mehloli ea Lintle Lesotho

It was explained by one key informant that great effort has been made by the Government of Lesotho to help farmers adopt shade nets and greenhouses as CSA adaptation strategies. These shade nets and greenhouses as explained by the key informant were brought by Smallholder Agriculture Development Project (SADP) so that farmers can produce vegetables all year round and be food secure despite being affected by climate change. However, it was revealed by participants that not all smallholder famers in the study area practicing CSA have shade nets

and green houses. The smallholder farmers explained that most of them do not have shade nets and green houses, because they do not have the half of the money which is required by SADP for provision of greenhouses and shade nets. The two participants who have shade nets and greenhouses explained that since they have shifted from conventional agricultural practicing, to growing vegetables in protected environment, their production has increased, resulting in their households being food secure and also turning agriculture into business, they explained that the sell their vegetables to the local supermarkets and to the villagers. The participant who grows vegetables under the shade net narrated that:

> *With the shade net that was provided by SADP, I am able to protect my crops from frost. The shade net has allowed me to grow crops throughout the year despite the increases in the hailstorms and chilly weather that have come with climate change. I am now able to sell my vegetables to the local grocery stores (Farmer D, aged 37, Female).*

The participants highlighted that growing crops under shade nets and greenhouses has the advantage of protecting crops from severe climate vulnerabilities, as compared to conventional farming where crops are grown in open fields. The participant who is using shade net further expounded that:

> *Traditional farming exposes crops to environmental changes such as extended dry periods, water stress, and pests and diseases. Crops grown under shaded conditions are protected from harsh weather conditions, and have minimal exposure to pests and diseases. In fact, shade net and greenhouse crop production is the farmers' solution to the adverse effects of climate change (Farmer D, aged 37, Female).*

From the above findings, it has been established that not all smallholder farmers grow crops under protected environment, because they do not have the financial resources to secure

funding for shade nets and greenhouses from SADP. Therefore, the government should make it easy for smallholder farmers to be funded so that they can all practice protected crop production, so as to increase food security. Shade nets and greenhouses are the ideal technology that smallholder farmer need to employ to achieve food security.

Given that farmers are forced to deal with harsh climate conditions, the use of shade nets and greenhouse help them to deal with the climate stressors and maintain high yields of their agricultural production. A research conducted in Morocco by Chakir et al. (2022) revealed that crop production under shade nets greenhouses has helped farmers to have accessibility and availability of food all year round.

4.2.5 Irrigation systems and water harvesting

This sub-section presents the findings on how irrigation systems as one of CSA technologies contributes to food availability and accessibility in the study area. Water harvesting through various irrigation techniques were explained by the participants as becoming prominent in the study area to improve water availability for crop production. The participants highlighted that the most used irrigation system is water harvesting from the roofs through the tanks build near their houses. The participants using shade nets and greenhouses explained that they are using drip irrigation system. They said the benefit of drip irrigation method is that it distributes water to the plants roots only, not the entire garden. They further expounded that drip irrigation promotes food security as it conserves moisture for long time for the plants, resulting in increased yields. Figure 4.5 below is an image of water harvesting through a tank:

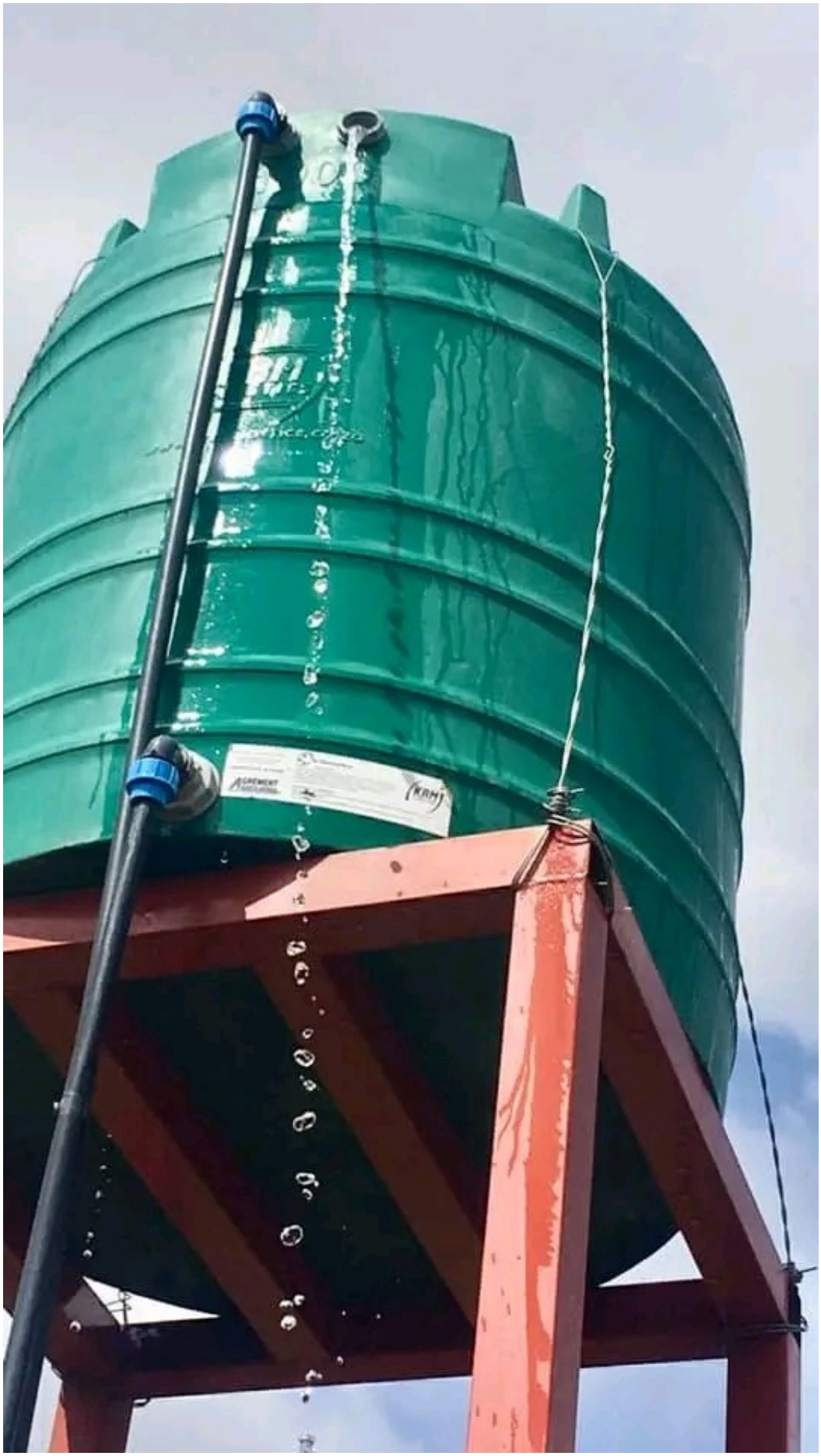

Figure 4.5: Water harvesting through a tank

Source: Picture taken by researcher during fieldwork

One participant who has drip irrigation system highlighted:

> *Drip irrigation system minimises water wastage, as the drip directly targets the roots of the plant. This enables me to mitigate the effects of climate change by increasing yields, resulting in my family being food secure (Farmer E, aged 53, Male).*

Therefore, adoption of irrigation systems and water harvesting as CSA technologies contribute to improved levels of food accessibility and availability of smallholder farmers, compared to using traditional methods of irrigation. It is evident that the adoption of irrigation systems as part of CSA strategies allow farmers to be resilient to the harsh climate conditions such as dry spell. The findings of the study on water harvesting and irrigation systems are in line with Mango et al. (2018) who discovered that irrigation systems enhance crop production resulting in increased levels of food security and sustainable livelihoods of smallholder farmer's households. Another study of the similar nature conducted in Ethiopia by Bojago et al. (2023), revealed that irrigation systems and water harvesting allow farmers to maximise their agricultural outputs, resulting in increased levels of agricultural productivity and in mitigating the effects of climate change such as droughts.

4.2.6 Training by extension services providers

On the issue of agricultural extension services, the findings revealed that not all sampled smallholder farmers practicing CSA are exposed to extension services and training. Those not exposed to extension services said they were using indigenous knowledge systems as they have not received any form of training from extension service providers. They put forward that they are using CSA practices such as mulching, conventional agriculture, water harvesting and changing planting dates. The smallholder farmers who had exposure to extension services

responded that they had higher preference of adopting other CSA. The following interview excerpt with one of the smallholder farmers shed more light on the significance of agricultural extension services in relation to CSA:

> *Extension services have assisted me as smallholder farmer to acquire the necessary knowledge, skills and attitude to apply CSA practices and technology effectively. Through extension services I have been trained on the usage of shade net, greenhouses and irrigation systems. This has contributed significantly to my household experiencing food accessibility and availability. The extension officers are passing CSA information to us as smallholder farmers, we then absorb this information and implement it in our farming practices with the aim of being improving food security (Farmer F, aged 56, Female).*

The results of this study support those of a study by Chege et al. (2018) conducted in Kenya, which found that extension services offer advice on CSA practices that support household food availability and accessibility. This is consistent with the findings of a study conducted in Ghana by Danso-Abbeam (2022), who noted that extension services are essential for educating smallholder farmers about how climate change affects agricultural production and how farmers can demonstrate resilience through CSA in order to achieve food security. According to the study's findings, the majority of smallholder farmers who received extension assistance had reliable access to food. Smallholder farmers' agricultural output and degree of food security increase by significant margins when they receive training from extension service providers.

The study's findings also revealed that the sampled smallholder farmers' access to and availability of food is increased by the usage of CSA techniques. Keyhole gardens significantly boost food security in Thaba-Tseka Urban Council, according to the study's findings. The Ministry of Agriculture and Food Security and organizations are working together with farmers in the communities to promote keyhole gardens for ongoing food production. According to the

report, Conservation Agriculture (CA) is used by most smallholder farmers in the Thaba-Tseka Urban Council. Farmers said they favour CA because it maintains a continuous soil cover of mulch with crop residue, green manure and cover crops while utilizing resources efficiently and conserving them through minimal soil disturbance.

The results of this study demonstrate that climate change is a reality for Thaba-Tseka Urban Council. The majority of the farming community relies on rain-fed agricultural methods, therefore this is significant. Accordingly, this study concurs with Mathews et al. (2018) that smallholder farmers should adopt CSA techniques in order to achieve more sustainable livelihoods and increase their resilience. The results of this investigation are consistent with a study by Abegunde et al. (2022) on the impact of CSA on household food security in small-scale systems in South Africa, which showed that smallholder farmers who implemented CSA methods had higher levels of food security than non-adopters.

The results confirm that a variety of stressors affect food security and agricultural output in Thaba-Tseka Urban Council. CSA can therefore provide the farming sector in the study area with solutions. This research bolsters the idea that the farmland in Thaba-Tseka Urban Council is made up of naturally excellent quality soil and rangelands that are suitable for raising crops and caring for animals. Despite many smallholder farmers' ignorance of contemporary CSA methods and technologies, they did show a willingness to adapt and concur that more research into sustainable agricultural systems is necessary to increase the region's agricultural sector's resilience and guarantee food security.

According to the study's findings, smallholder farmers would gain more from the implementation of CSA because it combines benefits for adaptation, food security, and mitigation. The findings of this study in the Thaba-Tseka Urban Council imply that mainstreaming CSA would have an effect on smallholder farmers' livelihoods and level of food

security. The results of this study are consistent with the goal of CSA, as stated by Lipper et al. (2014), which is the development of food security through the improvement of resilient and sustainable agricultural systems to boost food production. Furthermore, according to Abegunde, Sibanda, and Obi (2022), climate change has a detrimental impact on food accessibility and raises food prices. Zhou et al. (2017) propose, however, that for smallholder farmers to have access to food in the era of climate change, they have to implement climate-smart agriculture practices.

4.3 The role of Climate-Smart Agriculture in food stabilisation among the smallholder farmers in Thaba-Tseka Urban Council

This section of the research will focus on how CSA has enhanced food stability of the smallholder farmers in Thaba-Tseka Urban Council. Although food security remains the major challenge in Thaba-Tseka Urban Council, progress has been made by smallholder farmers who practice CSA. It was revealed by the farmers that after they have shifted from conventional agricultural practices to CSA, they have experienced food stability as their households have had access to and availability of food for an extended period of time. The use of CSA strategies has resulted in the participants having a drastic drop in hunger and food insecurity. One keyhole farmer narrated that at times she would experience hunger and food insecurity, and be dependent on aid and handouts, but now that she is practicing CSA there is accessibility and availability of food in her household throughout the year because her keyhole garden provides a variety of nutritious vegetables over an extended period of time. She noted that:

> *Before I adopted CSA in 2017, my household could experience hunger even for 8 months. This has since improved as I now diversified my agricultural production through the keyhole garden. The excess produce from my keyhole garden are processed through drying so that I can have food in the future. I even sell the surplus vegetables so that I can meet other family expenses (Farmer G, aged 62, Female).*

The study revealed that smallholder farmers who are practicing CSA are having a high level of food stability as opposed to when they were practicing conventional agriculture. Interviews with sampled smallholder farmers showed that CSA practices such as shade nets, changing planting dates, keyhole gardens and water harvesting have contributed to them being food secure despite the changing climate conditions. Smallholder farmers explained that the use of CSA practices have made their households to always have access to adequate food in order to be food secure. One farmer who has a keyhole garden indicates:

> *Unlike when I was practicing conventional agriculture on a large piece of land which required a lot of irrigation, keyhole garden has proved to be resistant to drought, enabling me to produce food all year round (Farmer H, aged 59, Female).*

The results of this study further support the notion that Thaba-Tseka Urban Council is vulnerable to severe weather conditions that affect food security. Rain-fed agricultural systems provide the main support for the agricultural operations. Abegunde, et al. (2022) postulate that farmers should change CSA practices to maintain continuous availability of food production and to increase farmers' capacity for adaptation, which is in line with the findings of this study. The study's conclusions are in agreement that the stability of the food supply in Thaba-Tseka Urban Council is threatened by a number of stresses, including drought, excessive rainfall, and early frost. Evidence suggests that smallholder farmers are implementing CSA measures to maintain food availability and accessibility in a long-term and sustainable way as a reaction to climate change (Issahaku`, 2019). It is documented by Branca et al. (2020) that smallholder farmers who have adopted a variety of CSA practices including keyhole gardening, changing planting dates, growing drought-tolerant crops, water harvesting and conservation agriculture are experiencing high levels of food stability of their households. In China, Sattar et al. 2023), in their study reveal that CSA contributed up to four times more to food stability than normal agricultural practices. These findings confirm the results of the observations in South Africa

from a study conducted by Abegunde et al. (2022) which reveal that CSA adaptation increases households' food stability.

4.4 Climate-Smart Agriculture policy and response options for ensuring continuous food security in Lesotho

This section presents the main finding of the study on CSA-related policies, identifies policy gaps and proffers suggestions from the respondents on how the formulation of CSA policy would enhance agricultural production and contribute to increased food security while confronted with climate change. The government of Lesotho is committed to initiating interventions to advance agricultural production so as to enhance food security and poverty reduction through CSA practices and technologies. From the outcomes of the study, it is crucial to note that Lesotho does not have CSA policy at the moment. However, a wide range of proven practical CSA response options and related policies exist in the country. The Agricultural Extension Officer highlighted that the government has promulgated Climate Smart Agriculture Investment Plan (CSAIP), Lesotho Food and Nutrition Policy 2016-2025, National Climate Change Policy 2017-2027 and 2018/19-2022/23 National Strategic Development Plan II to provide legal specifications on the adoption of CSA in the country.

The key informant explained that such interventions and response options have long been applied in Thaba-Tseka Urban Council in an attempt to address the impacts of climate change on agricultural production and food security, and have yielded positive results. However, the participants explained that they cannot adopt some of the CSA response options as they require financial resources to be adopted. They stated that they policies and legal frameworks advocate for the use of hybrid seeds shade nets, greenhouses and irrigation systems, which they cannot procure as they do not have the financial muscle. Smallholder farmers explained that the absence of the national Climate-Smart Agriculture policy makes it difficult for them to fully implement CSA practices and technologies. They suggested that they should be informed and

participate in the formulation of the national CSA policy, because as farmers they know which technologies they need. One smallholder farmer suggested:

> *the government should involve us in formulation of agricultural and climate related policies, because as farmers were know the climate-smart farming practices that are suitable for our area (Farmer I, aged 42, Male).*

However, despite implementation of CSA related policies, the outcomes of the study unearth that farmers in Thaba-Tseka Urban Council have fewer options for fully adopting CSA practices, and to adapt to climate related stresses. It was highlighted by the participants that drought in summer months, heavy rains and snow in winter are the main challenges to their agricultural production. Smallholder farmers proposed that the government of Lesotho should formulate CSA policy which would be a baseline for their agricultural practices. They suggested that for them to fully incorporate CSA, they should be trained and assisted on practices such as household water harvesting, the use of crops that tolerate drought and building shelters for their livestock. The participants were clear on what they regard as their CSA needs, and they emphasised that there should be a CSA policy that guides them of proper adoption of CSA practices.

Smallholder farmers stated that they acknowledge the importance of irrigation as a CSA practice. However, little has been done in the study area to capacitate them with the implementation of irrigation systems. They narrated that most of them are practicing rain-fed agriculture because of the high costs of modern irrigation systems. They suggested that the government should provide them with the assistance for the construction of tanks that can collect water from the roofs.

The participants suggested that climate related policies for strengthening smallholders' adaptation capacity to climate change must recognize the farmers needs and align them with

inventions to create adaptive and sustainability of the agricultural system. National CSA policy should be formulated so as to address the barriers hindering smallholder farmers to fully adapt CSA practices. The participants recommended that there should be CSA policy which clearly guides them as smallholder farmers on how they can re-orient their farming approaches so that they can withstand the impacts of climate change.

The participants further suggest that policy-makers should encourage and enhance farmers' access to climate forecasting, farm-level technologies, access to credit and markets in order to promote CSA adaptation. Smallholder farmers stated that they are unable to fully implement CSA practices because some technologies require financial resources, which they do not have. They suggested that the government should formulate policies and legal frameworks which will enable them to have access to credit to buy CSA inputs. From the above suggestions by the participants, it is evident that the implementation of CSA practices and developing resilience of the agricultural sector to climate change requires credit provision to smallholder farmers. Therefore, the study recommends that smallholder farmers form cooperatives so as to have capital to finance their procurement of CSA inputs. Also the government should establish farmers' bank and formulate policies that enable farmers to get sustainable credit facilities.

CSA and food security demand clear policies and legal frameworks in order to for the expected outcomes to be achieved. Such legal frameworks include the Lesotho Land Act of 2010. As stated by Gwimbi (2015), the Land Act of 2010 is an instrument aimed at establishing greater land tenure security for all land occupants and to enhance gender equity in land ownership. However, while the government has reformed its land tenure to remove constraints imposed by customary law on agricultural practices, the national Constitution still retain clauses that override such reforms. The National Constitution of Lesotho stipulates that all the land belongs to the King and is held in trust by all Basotho male heads of households (Gwimbi, 2015). The Constitution prohibits gender discrimination in general but recognises exceptions on issues

relating to marriage, divorce and female inheritance where customary law is supreme. Section 18 (4) (c) of the Constitution prioritises customary law, which place women as minors under the custodian of their husbands, fathers, and sons (Lesotho' Constitution of 1993). Under customary law which gives priority to Section 18 (4) (c) of the Constitution, in the event where women inherit property, social norms require women to give up their inheritance rights in favour male members of the household,

The village head in Hillside area lamented that,

> *We are a traditional society and all the property in the families including the land belong to men because by custom they are the heads of the families. Despite the fact that most men are working in RSA and in Maseru, women cannot make decisions regarding land on their own* (Key informant- village head, Male).

Majority of women who participated in the study highlighted that they are living in a patriarchal society and that land is still regarded to be under ownership of men. The female respondents narrated that they are the ones engaged in agricultural activities more than men, but because of the customary law, they do not have full control over the land. They highlighted that they cannot even secure credit on their own to buy CSA inputs because the land is in the names of their husbands. It was suggested by the respondents that amendments be made in the national Constitution so that women can have full rights to the land which they are using for agricultural purposes. They study therefore, recommends that some sections of the Constitution relating to gender and inheritance be amended so that they align with the Land Act of 2010 and Lesotho Gender and Development Policy 2018-2030. Women remain incapacitated yet they are most disadvantaged group affected by climate change. Gender-blind sections of the constitution such as Section (18) (4) (c) restrict women's decision making and limit their opportunities and thus the practices to be adopted under CSA. It is worth noting that even though there are sectoral

laws made to address the gender imbalance, there is need for to amend the gender discriminatory sections of the Constitution and offer formulation of policies and legal frameworks that give women equal opportunities as men.

The CSA related policies in Lesotho are sectoral in nature, and causes a barrier for CSA technologies and strategies to be fully implemented by smallholder farmers. This points to the need of the formation of a national CSA policy. The absence of a CSA policy makes it difficult for smallholder farmer to fully incorporate climate-smart farming practices. This is because the available policies like National Climate Change Policy 2017-2027 lacks adequate instruments to achieve the goals of CSA. This is because the National Climate Change Policy is under the Ministry of Energy and Meteorology, and the agricultural policies are under the Ministry of Agriculture and Food Security (MAFS). There should be a CSA policy in MAFS because there is no clear connection between the two ministries, as the two ministries have different mandates. There is need for policy coherence to avoid conflicts as the current policies are sectoral. Policies in Lesotho suffer because of cross-sectoral coordination and limited means for implementation. Agriculture and climate change policies exist in the country, but without clear incentives to CSA. Freed et al. (2023) note that in case that multiple sectors are involved in policy implementation, efforts should be made to ensure corporation among sectors, and that government sectors seek harmony to avoid overlap and contradiction.

The formation of a clear CSA policy will bridge the gap of financial constraints to smallholder farmers. At the moment, for smallholder farmers to get grant assistance from government sponsored Smallholder Agricultural Development Project, they are required to have a certain percentage of the total grant amount. This is a financial constraint as it restricts farmers' access to technology for enhancing CSA practices. CSA technologies such as shade net, greenhouses and irrigation systems remain expensive and inaccessible to most smallholder farmers.

The other policy and institutional framework gap that hinders CSA to be fully implemented is the gender imbalance. The study has revealed that it is mostly women who are adopting CSA technologies. However, the constitution of Lesotho explicitly discriminates against women in terms of access and use of land. Some aspects of Basotho culture in the customary law place women under custody and protection of men. In accordance with cultural norms, men are regarded as household heads, and they have control over household land. As a result, women are severely hampered in their access to land. There should be a policy which makes it easier for women to own land, as they are the ones who are more involved in CSA practices. There is need to amend the gender discrimination law and enforce policies that explicitly protect women against gender discrimination.

4.5 Chapter Summary

The research findings highlighted CSA adaptation and mitigation strategies that smallholder farmers in Thaba-Tseka Urban Council are practicing in order to be food secure. The chapter therefore brings to light the CSA technologies that contribute to food security among smallholder farmers. The main strategies identified include keyhole gardening, conservation agriculture, shade nets, greenhouses, irrigation systems and appropriate livestock housing and management. It was also revealed that extension officers provide farmers with CSA information.

The outcomes of the study further highlight that CSA is contributing to food stability of the smallholder farmers in Thaba-Tseka Urban Council. This was emphasised by smallholder farmers who said that since their adoption of CSA practices their households always have access to food and do not run the risk of losing that access as a result of climate change.

Lastly, the study unearthed that there is no CSA Policy in the country, but there are policies and legal frameworks that the government have been implemented to ensure that there is food security in the country even though citizens are confronted with climate change. However, it

was unearthed that there are policy gaps which hinder smallholder farmers to fully adopt CSA practices. There is clearly a need for improving gender policies to ensure that women have equal access as men to land and other resources that support CSA, more especially for female-headed households. The following chapter will be the conclusion and recommendations of the study.

CHAPTER FIVE: CONCLUSION AND RECOMMENDATIONS

5.1 Introduction

The study examined the contribution of CSA to food security in Thaba-Tseka Urban Council. Extensive fieldwork was done using qualitative methods that include key informant interviews, interviews and questionnaires, so as to address the objectives of the study. Qualitative research methods enabled the researcher to extensively understand the experiences of Thaba-Tseka Urban Council smallholder farmers is using CSA as an adaptation and mitigation strategy to food security in the era of climate change. The study unearthed that there is a symbiotic relationship between CSA and food security as smallholder farmers who practice CSA are more food secure as compared to farmers who practice conventional agriculture.

Underpinning this study, was a theoretical framework made of two theories being the Resilience Theory and the Sustainable Livelihood Framework. The theoretical framework proved to be more robust in explaining how CSA enhances food security in Thaba-Tseka Urban Council. The findings from the study make this theoretical framework more applicable because it was realised that the Resilience Theory serves as foundation for how agricultural systems which depend on ecological process can withstand the complexities of climate change. In this study, CSA proved to be a resilient adaptation and mitigation strategy, as through it, smallholder farmers are able to adapt to the shocks of climate change, so as to produce the outcome of food security. The ability of smallholder farmers to maintain producing in the increasing climate stress depends on their capability to be resilient under more extreme and variable climate conditions.

Also the Sustainable Livelihood Framework facilitated the identification of practical priorities of action that smallholder farmers in Thaba-Tseka Urban Council implemented to achieve food security, while being vulnerable to the impacts of climate change. Smallholder farmers in Thaba-Tseka Urban Council depend predominantly on agriculture as their primary livelihood strategy. This study reveals that majority of the smallholder farmers in Thaba-Tseka Urban

Council have capital assets needed for agricultural production. They also have the human capital, which is the capacity to work and the natural capital being land for agricultural production. However, climate change as a vulnerability context has threatened and exacerbated their agricultural production, leading to the implementation of CSA practices as adaptation and mitigation strategy so that they can achieve their livelihood outcome of food security.

5.2 Conclusion

One finding of this research was concerned with understanding available CSA policy and legal frameworks for ensuring continuous food security in Thaba-Tseka Urban Council. The study demonstrates that even though Lesotho does not have CSA policy at the moment, there are CSA legal frameworks and related policies implemented in Lesotho. There is a strong indication that there are policies and legal frameworks enacted by the government to enhance food security through CSA. The research established that such policies play a significant role in increasing smallholder farmers' ability to adapt to the effects of climate change. However, while this is commendable, there are gaps in policies, as such policies are sectoral, which acts as a barrier to CSA. This study therefore, concludes that smallholder farmers' adoption of CSA can be improved by developing a national CSA policy with full legal and budgetary support.

The study further explored how the implementation of CSA practices and strategies accelerates food accessibility and availability in Thaba-Tseka Urban Council. Smallholder farmers in Thaba-Tseka Urban Council are being adversely affected by climate change, and this has led to a decline in their agricultural production and food security. However, the study revealed that there are CSA practices and technologies which smallholder farmers are implementing in order to enhance food accessibility and availability. Such practices and technologies as keyhole gardening, shade nets, greenhouses, conservation agriculture and irrigation systems proved to be effective in contributing to smallholder farmers' food accessibility and availability. The study therefore, concludes that CSA practices and technologies enhance food accessibility and

availability, and smallholder farmers across the country should be encouraged to adopt such practices.

In relation to the objective of how CSA contributes to food stability in Thaba-Tseka Urban Council, the outcomes of the study highlighted that CSA is contributing to food stability of the smallholder farmers who are adopting it practices in Thaba-Tseka Urban Council. This was highlighted by smallholder farmers who stated that since their adoption of CSA practices their households do not lack access to food, and climate change does don't put them at the risk of losing food as compared to farmers who are not practicing CSA. There is need to enhance CSA practices and technologies, so that all farmers can adopt them in order to have food stability. Based on the outcomes of the interviews with the smallholder farmers, the study concludes that CSA contributes to food stability because CSA practices and technologies are consistent with increasing agricultural production in the long run and the agricultural system adaptive capacity to climate shocks.

5.3 Recommendations

- The majority of agricultural challenges are being encountered by the smallholder farmers of the Thaba-Tseka Urban Council. The smallholder farmers in this area have shown themselves to be resilient despite the fact that this area is exposed to climate shocks. Although there is still much to learn about CSA and climate change, it is advised that current strategies and available alternatives for responding be fully utilised in order to improve adaptive capacity and guarantee that food security is attained under the current conditions of climate change. Appropriate CSA strategies need to be developed and put into practice for smallholder farmers to be resilient and to sustain their livelihoods through the agricultural production. To do so, CSA policy needs to be developed and be efficiently implemented at national and local government level, and resources and budgets need to be allocated for proper implementation of CSA.

- It is recommended that smallholder farmers should be motivated to join and take part in various farmers' agricultural groups and forums in order to share information about farming and improving the usage of CSA practices. There should be regular information sharing by extension service providers in such groups. Doing so will enable the smallholder farmers to amass more knowledge on CSA practices, thus leading to increased food security and sustainable livelihoods.
- Also, smallholder farmers should be motivated and capacitated to adopt all CSA practices as much as possible so as to be more food secure. It is recommended that modern agricultural technologies and practices be promoted to smallholder farmers. To do so, the government and its development partners must make investments in agricultural modernisation countrywide through the use of CSA technologies such as irrigation systems, shade nets and greenhouses by all smallholder farmers,
- Again, smallholder farmers should be made aware by extension service providers of the importance of making productive agricultural investments so that they can mitigate the risks of climate change.

5.4 Areas of further research

The outcomes of this study have more than a few implications for future research. This research sought to investigate the contribution of CSA to food security in Thaba-Tseka Urban Council. The study found out that it was mostly women in the study area who are practicing CSA. Therefore, there is need to carry more studies on how climate change impacts women. Also future research should probe at other issues that affecting smallholder farmers, such as lack of markets for farmers to sell their agricultural produce. Other areas of future research will be to study barriers hindering smallholder farmers from implementing CSA practices and technologies.

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APPENDICES

APPENDIX I: INFORMED CONSENT FORM

Informed consent form

I _____ (*participant's full names*) hereby attest that I have read this document, am aware of the purpose of the research, and give my informed consent to participate in it.

I am aware that I may leave the research project at any moment if I want to do so. I consent to participate in this study because I am aware of its purpose. I've got enough time to ask questions, and I'm ready to take part in the study. I am aware that a research report will be created using the study's results in an anonymous manner.

I agree to have this interview recorded (*if necessary*).

I have been given copy of this consent form.

Full name of participant _____

Signature of participant _____ Date_____

Full names of researcher _____

Signature of researcher _____ Date _____

APPENDIX II: QUESTIONNAIRE

Questionnaire for smallholder farmers

Questionnaire No…….

My name is **Motebang Tsese**, a Master of Arts in Development Studies student at the National University of Lesotho.

The topic of my study is: *Contribution of Climate-Smart Agriculture to Food Security in Thaba-Tseka Urban Council*. This research seeks to assess how Climate-Smart Agriculture contributes to food security in Thaba-Tseka Urban Council. I kindly request your assistance by answering this questionnaire. I guarantee that the data which you will provide would be treated with utmost confidentiality and anonymity, and would be used only for the purpose of this research.

Section A

Biographic Details

Sex: Female □□ Male □□

Age: _____

Marital status: _____

Village: _____

Chief: _____/ Headman: _____

Date: _____

Section B

Please indicate your answers with a tick (√) where appropriate.

1. a) Is your agricultural production affected by climate change? Yes □□ No □□

b) If yes, have you adopted climate-smart agriculture practices in order to deal with the effects of climate change? Yes □□ No □□

2. Which climate-smart agriculture practices have you adopted?

Climate-Smart Agriculture practices	**Tick (√) where appropriate**
Mulching	
Keyhole gardening	
Shade nets	
Irrigation systems	
Greenhouses	
Intercropping	
Changing planting dates	
Other(s)	

3. a) In your view, do you think climate-smart agriculture makes smallholder farming households to be more food secure as compared to conventional agriculture? Yes □□ No □□

b) If yes, explain further_____

_____

_____

_____

_____

4. In your experience as smallholder farmer, how does CSA promote food security? _____

_____

_____

_____

_____

5. a) Does climate-smart agriculture has an impact on food accessibility? Yes □□ No □□

b) If yes, please explain how_____

_____

_____

_____

_____

6. a) Do climate-smart agriculture practices contribute to food stability in your area? Yes □ No □□

b) If yes, explain further _____

_____

_____

_____

7. What do you think should be done to enhance climate-smart agriculture practices so as to be more food secure in your community? _____

_____

_____

_____

_____

8. a) Did you get any form of training on climate-smart agriculture practices? Yes □□ No □□

b) If yes, which institution(s) provided you with training? _____

_____

THANK YOU`

APPENDIX III: INTERVIEW GUIDE

Interview questions for Agricultural Extension Officers

1. How is agriculture impacted by climate change in Thaba-Tseka Urban Council?

2. How do smallholder farmers in your area benefit from CSA?

3. What CSA technologies is your office putting in practice to help smallholder farmers to be food secure?

4. Are there any stakeholders and development partners financing climate-smart agriculture projects in Thaba-Tseka Urban Council?

5. How is the level of food security among farmers practicing climate-smart agriculture?

6. What policies and strategies have been put in place to ensure that climate-smart agriculture contributes to food security in your area?

7. How do you help smallholder farmers to be resilient to the negative effects of climate change?

18. Which agricultural projects has the government of Lesotho implemented in Thaba-Tseka Urban council to ensure that smallholder farmers are food secure in the midst of climate change?

9. Does your office monitor the climate-smart agricultural projects in your area to ensure that they meet their intended objective of contributing to food security?

10. Are smallholder farmers capacitated with appropriate technology and knowledge to help them implement climate-smart agriculture practices so as to achieve food security?

11. Does the CSA approach make the food production longer and difficult for smallholder farmers?

12. Are you expecting all farmers in Thaba-Tseka Urban Council to adopt climate-smart agriculture so as to enhance food security?

13. In what ways does your office specifically implement Climate-Smart Agriculture intervention plans?