

**Integrating indigenous food security strategies into climate change mitigation among women in
Moruleng.**

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DECLARATION

I, the undersigned, hereby declare that the work contained in this mini dissertation is my original work and that I have not previously, in its entirety or in part, submitted it at any other University for a degree.

Signed: MSPSi Date: 30 September 2015

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ABSTRACT

The overall objective of the study was to investigate and document the challenges women farmers face daily in dealing with climate change. They are expected to provide for families and to produce enough surplus for commercialization. The methods and strategies to deal with climate change are deeply rooted in grannies and young people around the world as these are communicated through the word of mouth and transmitted from generation to generation.

The study therefore covered a broad spectrum of areas whereby indigenous knowledge was previous and is still presently utilized. In the past people had their own way of maintaining and controlling the little that they had to last them for the day, month, year and future. Different methods were implemented for the ultimate success of these practices. Food was prepared in such a way that it could not be pesticed. Incantations were performed for rain to fall.

Knowledge preserved by our indigenous people enabled them to live longer and healthier in and around their environment. They were astrologically good in determining what the future could bring to them and they knew what, where and when to plough. Subsistence farming was mostly used for the sustainability of the family and food security for a long-term plan. Oxen were used to plough the fields and petlwana (hand-hoe) to plough in the small pieces of land. Girl child learnt all the tricks from their mothers as they worked hand in hand with them and still practised by others even today.

By adhering to those practices our indigenous communities had been able to retain economic independence and self-sufficiency, and ensuring that the diversity of plant and animal species remain high. The availability of food in the household level depended on many variables such as production, land, labour, knowledge and technology, preservation and storage, forests, grasses and livestock. In-depth information previously gathered from the elders and by being part of the community was implemented. Visitation of several households as a participant was also taken into consideration.

The study revealed that traditional agriculture is affordable as opposed to the high cost of modern agriculture. The study found that indigenous knowledge has lost its meaning, (others say (it is old fashioned) and is no longer used due to the alternative found in modern ways. There is still a lot to research on when comparing indigenous knowledge and modern techniques (Benneh, 2010). The vocality used to transmit indigenous knowledge made the world go round as things were done immediately instead of being sent to the labs for verification. Although the study did not focus on attitudes, it revealed that transmission from one generation to the next was a result of respect for parents and society, and adherence to strong values. Sustainability including conducive environment and Ubuntu were upheld to ensure food security through difficult climate change. Recommendations follow the findings.

CHAPTER ONE

INTRODUCTION TO BACKGROUND

1.1 INTRODUCTION

This chapter discusses the conditions that women farmers face and ways of handling their challenges. Ashley (2000) depicts that women farmers gradually experience vulnerable consequences due to climate change. Unreliable weather conditions reduce their economic wealth. Drought and over-flooding lower harvests caused by insufficient rainfall, environmental degradation, animal loss and mortality. Women's burdens become high due to damage caused by and resulting from climate change. Environmental overexploitation and desertification increase women's daily chores. Ashley further elaborates that their daily routine changes as they now travel to farther areas in search of water and wood. Bounded by responsibility to provide for the family, women end up looking for other methods of making their families survive. Depending on the current situation they are faced with, they sacrifice for their families, they would rather go hungry than seeing family members without food, hence the saying "*Ntime o mphele bana*" and "*Korwe ga ke je ke bapalela tsetse*" meaning everything that you are able to gather is for children no matter how hungry you may be. A woman is regarded as a "plan maker" hence the saying "*phokojwe go tshela yo o*

dithetsenyana". A woman would help others or find herself doing any job in order to get food for family members.

1.2 BACKGROUND

Eboh and Ogbazi (1990) share their ideas by highlighting that generally women farmers are connected to the environment more than men. They play a big role in preserving and sustaining families and ensure the survival of human race. They are more concerned hence are top performers in handling and providing through securing people's nutrition and safety. They contribute greatly to the economy and its stability, especially through food production. A huge number of these women farmers depend on ecosystems threatened by climate changes and prolonged droughts exposing them to emerging climatic extremes. The impact is mostly experienced on land, more specifically land degradation. It has a serious consequence on food security. Indigenous knowledge is a precious gift through which to curb disaster in manageable and reliable ways.

Ashwell and Hoffman (2001) are of the same sentiment that cropping and grazing areas are widely stricken by erosions caused by the highest recurring soil degradation. Land degradation is highly observed through the reduction in biomass productivity, water pollution, contamination, decline in air quality through suspended dust particles and emission of carbon, nitrous oxides and other greenhouse gases into the atmosphere. Women farmers have shown dismay in

the soil losing its texture and deteriorating soil quality yearly causes problems of not being able to cater for their families. Climate change has worsened the situation emerging from unpredictable weather patterns and droughts. Risk management measures should be put in place by combining different methods and approaches derived from both traditional indigenous knowledge and science and technology towards combating and averting the impact of climate change on farming.

The Holy Bible (Joel 1 vs. 16-18), talks about famine and drought. High temperatures caused seeds planted to perish under the ground. Again, everything looks weird when rain is no more and heat waves fan the land and dryness takes over until animals and plants cannot stand the high, dry temperatures any longer. Climate change is not a thing of the past. What happened was that the elders knew how to preserve. Joel 1 verse 19-20 confirms that veldt fires consumed all that was around including pastures. He who is the creator and overseer of heaven and earth; he is worthy to be praised and to be trusted. Crying, worshipping, fasting and praying whole-heartedly could change the situation and condition we find ourselves in. Isaiah (59 v 1) says *"He is not deaf to hear us, not blind to see us and his hand is not short to touch, turn and change everything"*.

The Beijing Declaration and Platform for Action adopted in 1995 at the Fourth World Conference on Women, concentrated on giving access to land equally to

women, especially those in rural areas. Women need access to useful resources such as land, technology and capital for bettering their situation whilst getting empowered and benefitting from education and health services. They could be allowed to make informed decisions on land and capital, including technology to use. For successful strategies women in rural areas need to be empowered as stipulated in The Platform for Action. Economically women farmers need to get credit at micro level and macro financial levels in order to get empowering instruments. The General Assembly at its twenty-third special session held in 2000 subsequently pointed out that the rights of women to own and inherit land is important.

Regassa (2000) shares the same feeling that food supply and cash income comes from the agriculture that woman farmers depend on. Selling cattle, local food from gardens such as green vegetables and food crops is their main source of income. Compared to worldwide women, women farmers in rural areas in Africa contribute a lot to achieving food security. For example, 60 to 80 percent of labour is shouldered by women farmers in sub-Saharan Africa in order to produce sufficiently for consumption and for selling. In Asia, women do 50 to 90 per cent of the work in the rice fields. Simultaneously women are able to sustain their livelihoods by performing multiple tasks such as working on farms and off-farm activities, as well as engaging in their maternal roles in terms of reproduction. No matter the poor social infrastructure, they are responsible for collection of water and wood fuel.

Few household producers still rely on subsistence farming in South Africa. If agricultural yield was enough, food items would be shared between families. Crop production for food differs according to the areas but this mostly depends on mixed, inter-planting and inter-cropping of food crops (Challinor, Wheeler, Galforth, Craufurd and Kassam, 2007).

Pretty (2011) also has experienced that environmental changes have made communities try different approaches to manage the resources due to alarming specific responses to the acute food shortages. The Wajir District in Kenya for example, harvests rainwater and practices tree planting. In Kalahari they now rely on manual watering of gardens rather than waiting for rain-fed cropping and they raise goats instead of cattle.

In the past, people had their own way of maintaining and controlling the little that they had to last them for the day, month and year. Without adequate food, people cannot live a healthy active life. The majority of African people live in rural areas and depend on agriculture for food and their livelihood. The African continent has different types of soil, topography and climatic conditions, which implies that agricultural production is carried out in a great number of microenvironments (Mactaggart, 2010).

According to Maarse (2010), local people, including farmers and cattle keepers uphold indigenous knowledge systems. This farming system is practiced often by individuals and involves the entire village. The indigenous African farming systems combine multiple crops that rely in intercropping and livestock. Historical cultural factors often associated with particular ethnic groups account for additional variations in farming practices.

Hassan and Nhemachena (2008) highlight that land can be reclaimed by natural vegetation and be converted for cyclical farming practices once found to be inadequate. Different methods were implemented for the ultimate success of these practices. Food was prepared in such a way that it would not be sprayed with pesticides. Knowledge preserved by indigenous people enabled them to live longer and healthier in and around their environment. They were astrologically good in determining what the future would bring them and knew what, where and when to plough. Subsistence farming was mostly used for the sustainability of the family and food security as a long-term plan. Girls learnt all the tricks from their mothers as they worked hand in hand with them and such upbringing is still practiced by others even today.

They believe that their indigenous methods are superior for their style of farming. Some of the farmers own large farms. Majority of these farmers practice subsistence farming, where the farmer only produces enough to feed and sustain his family. These farmers should be encouraged to promote and share their

knowledge with their communities. Agricultural officers and researchers should give support to these farmers and give them confidence and willingness to continue promoting their farming knowledge. This will automatically lead to agricultural development in rural villages like Moruleng. A holistic opinion on farming systems is that by combining socio-economic knowledge constraints and understanding of small farmers' conditions should provide solutions and strategies for promoting community food security and poverty eradication. In rural areas such as Moruleng (where Bakgatla-Ba-Kgafela reside, under the leadership of Kgosi Pilane), farmers practice this method of indigenous farming in their farms and backyards. In Moruleng, elders have great knowledge about indigenous farming. This includes the knowledge about the types of soil, seasons that are good for farming and harvesting, different types of crops and how much water or sunlight is needed for a particular crop (Convention on Biological Diversity Secretariat, 2010).

In discussions held with focus groups, one participant said: "We have been involved in land preparation for many years and we find it rather difficult, it is done manually using a hoe or a sharpened, wooden tool we have no other choice".

1.3 STATEMENT OF THE PROBLEM

1.2.1 What is the existing local knowledge on climate change among women farmers in Moruleng village, North-West Province, in South Africa?

1.2.2 In what ways do women farmers use local knowledge to determine how climate change affects food security?

1.2.3 What strategies do women farmers in Moruleng use to adapt and mitigate the effects of climate change?

1.2.4. What are the existing challenges that women farmers face in using these indigenous strategies and methods to ensure food security under current climate changes?

1.4 RATIONALE FOR THE STUDY

The livelihood of the people, especially women as farmers, largely depends on agriculture through subsistence farming. Agriculture is a very important sector in Southern Africa in terms of food security and employment. The time for sitting around a fire at night listening to elders' stories, their moral warnings and instilling knowledge in their grandchildren is gone.

Viljoen, Botha and Boonzaaier (2005), agree that living close to the natural resources empowers women farmers to identify changes and see how to solve these challenges before they go out of hand. All important signals of change in time and seasons are shown by different appearance and behaviours of certain animals.

Indigenous people have shown capability of predicting and prophesying about impending disasters through making the societies aware of what would happen in the future. These services were rendered free of charge. For example, old men would say that “when dogs yelped much, or fowls crowed at mid-day, ants and flies moved in unusual ways, such behaviours signaled that a nearby river would overflow its banks and destroy crops”. This would enable people to perform traditional sacrifices and strengthen their coping strategies. Reports on famine and epidemics that afflicted traditional societies were detected and reported before they occurred (Duner and Nordstrom, 2005).

United Nations Conference Trade and Development (2010a) illustrates clearly that in traditional communities, expensive western and sophisticated signals have been installed nowadays, but such scientific predictors cannot override the efficacy of some traditional practices that connect to food provision and security. On the one hand, women farmers are always deeply watching the environment, they develop intuition in reading cues about when, what, and where to plant, when to water different crops and when to harvest. Local knowledge possessed

by indigenous people helps them to know that if a cloud appears in one particular colour, it means hailstones are around the corner and they must prepare for cover. Prolonged drought causes thunderstorms and lightning that comes as the first rains (*kgogolammoko*) ending up in disaster. They could tell when a drought would affect their locale; they could predict how the sun or a specific bird cry near rivers would bring joyful and blessed seasons as it indicated the onset of the rainy season (Mukhopadhyay, 2009).

The extra hardship due to the impact of climate change has increased problems related to current levels of poverty. Droughts and poor soils have serious implications for indigenous people due to climate change. Women farmers are often frustrated by low agricultural productivity capacities as consequences of droughts. Unpredictable rain destroys crops. There is a saying among the Bakgatla people "*Wa e gapa o molato, wa e tlogela, o molato*", meaning "people do not know what to do anymore" (Garba, 2006).

Changing climate patterns and extreme weather conditions among Bakgatla individuals and communities are irrefutable. Relatively high fertility rates have contributed to continuing rapid population growth because due to the climate change people do not actually have anything to do. They are hungry and instead of concentrating on seeking answers to solve their problems, they regard sex as a way of keeping themselves busy and socializing. Ching (2010b) has noted that unexpected factors such as illness and unemployment affect women farmers'

wellbeing and their tasks of making food readily accessible and available for maintaining food security.

Extreme weather conditions affect and endanger the viability of agriculture. Food security is at risk. Food preparation cannot be hygienic if there is a lack of water. Floods and drought result in the disruption of people's livelihood and affects their ability to produce adequate food for their families. Sowing maize, beans and vegetables twice a year during the rainy and winter seasons was a reality before the drastic changes in climate patterns. Harvesting bounteous food resulted in abundance which could be sold for income to meet other household needs. Changes in climate have disrupted the capacity and aims of farming in the early 1990s which experienced frequent floods and droughts. Heavy floods every rainy season led to river banks bursting and the fields getting destroyed and as a result, food production dwindled (Intergovernmental Panel on Climate Change: IPCC, 2008).

Diseases such as cholera and skin infection increase in times of floods. The effects of climate change have a direct impact on the life of the communities. All this faded away due to the declining soil fertility, soil erosion and changes in rainfall patterns (Paul, Ernsting, Semino, Gura, Lorch, 2009).

United Nations Framework Convention on Climate Change, UNFCCC (2007), states that natural resources are affected by climate change. Previously there

were plentiful water supplies and fuel wood nearby in the Bakgatla area. Severe droughts have caused problems recently. People have abandoned their traditional farming practices due to prolonged droughts and they have started earning a living by making and selling charcoal and clay bricks. Men and boys in families use bicycles to transport this coal. Some men have migrated to cities in search of paying jobs though they do not have skills to qualify for professional jobs. Households are female-headed as they have no choice but to herd livestock (Mortimore, 2000).

Ching (2010a) makes a salient point that changes experienced in livelihood activities lead to variation in climate. He further expresses that this replacement shows that future food security will probably be controlled rather than offer opportunities to determine food accessibility. Traditional farmers have abandoned the practices and taken up urban employment in great numbers yearly and such change has transformed the farming practices that ensured food security. Withdrawing from farming for government employment may change the household style of living and could permanently transform the role that agriculture plays in development. Strategies to respond to climate change depend on resource availability and the ability to adopt new and innovative technologies, as well as changes in values regarding life goals and aspirations of the Bakgatla people.

Locatelli (2011) highlights that societies are able to cope with future uncertainty through adaptation. The right measures entail reducing negative effects and seeking appropriate adjustments to changes in climate change that include flood-proof houses and lowering water use in drought times. To manage and take advantage of such adaptive measures, interventions which are also a form of adaptation should take place to cater for losses emanating from climate change. For farmers to survive, some foundation in coping strategies during harsh times, should be provided as locally owned ideas.

As Moe-Wan (2010) stated, deforestation, forestland degradation, agricultural activities and the combustion of fossil fuels and other industrial activities have increased atmospheric carbon dioxide and other greenhouse gases thereby having a profound impact on climate and leading to extreme weather conditions. Agriculture and food systems are affected by directly through these most profound causes of climate change. Pests and diseases appear as drastic changes evolving frequently from extreme weather patterns impacting negatively on agriculture and food systems.

Tidaro & Cotter (2010) argue that food accessibility for women has been their major household role for the whole family and society. This unreliable situation put pressure on farmers output such as income for household usage. As Nellemann, MacDevette, Manders, Eickhout, Svihus, Prins and Kaltenborn (2009) posit temperatures in the region have risen and water supplies have

dwindled. Survival strategies should be well thought out for short and long term adaptation and sustainability. Eating less is seen as a beneficial coping and surviving strategy for the overall household existence though it puts women's health at risk.

Changnon, Changnon, Hewings (2001) clearly illustrate that higher temperatures and irregular rainfall decrease pasture and water bringing about animal and plant loss caused by hunger and disease. Collecting water has also become more difficult. Traditionally collection of water and firewood was a burden on women's chores. In areas experiencing conflict, men assist with water and firewood collection during extreme droughts. Donkeys provide a mode of transport, enabling men to collect plenty water and firewood, whilst on the other hand their counterparts could only carry a little because they put everything on their heads. By carrying more, at the end of the day, men are able to sell to other community members to supplement earnings. They further complement the usage of scarce resources such as water from boreholes that it could backup the households to survive for the moment.

According to Ishii-Eiteman and Reeves (2009) owning herds of animals shows wealth and power in setting for decision-making processes and therefore restrict livestock keepers to look for some alternative activities and destock. Overgrazing and destruction in water catchment areas happens as a result from destocking

leading as a result for women to walk long distances in search of water and firewood.

Pathak, Jain, Bhatia, Patel and Aggarwal (2011) points out that the greenhouse effect is emanating from the heat increase which result in climate change. The main characteristics of climate change are increases in average global temperature Global warming is the main characteristics of climate change increase in temperature. Changes in rainfall pattern are likely to bring changes that could lead to water shortages and flooding.

Prabhakar and Shaw (2008) have seen that developing many coping and managing ways to handle the risks of climate variability has helped women farmers a lot in the agricultural sector. The CGIAR has developed drought-resistant and abiotic stress-tolerant crop varieties to enhance the strategies of coping with climate change not forgetting soil and water on the other hand. Farmers, researchers and policy makers are now faced with a mammoth task of dealing with unprecedented magnitude of climate change. Researchers should put more effort on increasing current efforts towards options of adaptation and mitigation on climate change and agriculture since both complements each other and through their witnessed yielding results. Integration of both strategies is a prerequisite when addressing the issue.

Aguilar (2009) reports by alluding that at all levels women farmers are able to participate and though expected to take care of families and livestock, they should be part in all learning and decision-making processes on issues associated with climate change adaptation. Women as best managers of natural resources, they have a good knowledge of local systems which is best for climate change adaptation. Sharing information and networking could be important and lead to adaptation pathways among women farmers' groups.

This study therefore seeks to make a contribution to the practices of food security, preservation and beneficent agricultural practices by investigating such practices in the Bakgatla people of the Moruleng area in the North-West Province in South Africa.

1.5 STUDY AIM

The aim of this study was to integrating indigenous food security strategies into climate change mitigation among women in Moruleng.

1.6 SPECIFIC OBJECTIVES

This study aims to:

- 1.6.1 record the usefulness of indigenous food security strategies in unwelcoming climate changes.
- 1.6.2 help women farmers to cope with unreliable climate conditions.
- 1.6.3 identify indigenous food security strategies that can help in including agriculture in climate change policies.
- 1.6.4 identify policies and food systems adaptation and mitigation practices in rural livelihoods.

1.7 HYPOTHESES

The study was based on the following hypothesis:

Women farmers face many challenges when integrating indigenous food security strategies into climate change adaptation and mitigation.

1.8 SIGNIFICANCE OF THE STUDY

Climate change negative effects on indigenous communities go beyond immediate threats to food. Cosmology and religion within indigenous and traditional groups connect to environmental aspects. The environmental knowledge of Bakgatla people transcends technical notions such as carrying capacity and links ecology with cosmology and religious values. Land and its products are carefully utilized as a source of food, pasture and medicine to cure human beings and animals from various types of diseases. Prayers for rain are often administered during drought. The study contributes to the positive solutions with regard to the adaptations and mitigation that seek to promote the importance of integrating traditional knowledge on food management against the negative impact of climate change on food supply.

1.9 METHODOLOGY

This study used a qualitative survey method and focus group discussions. Personal observations were made during fieldwork. Secondary data such as books, journals and internet resources were also used to buttress the study. Findings demonstrate that women play a major role in producing and providing food for their households even with the risk of changed climatic conditions. Nearly half of the surveyed women respondents were under 50 years of age and were active farmers. The majority of the respondents were married.

The research was done in North-West Province, South Africa in Moruleng. Moruleng is a semi-arid place with annual rainfall of 450mm; the maximum temperature is about 37°C with average minimum temperature of 15 °C. North-West Province is primarily a region producing sunflowers and much of the country's maize and sorghum. Moruleng is a place with big morula trees.

The study reviews women farmers' responses to climate change and the measures they have applied to adapt to these changing seasons. Observation and past experiences of indigenous knowledge of farming communities concerning climate change impacts were recorded.

1.10 SCOPE OF THE STUDY

The study concentrated on women farmers in Moruleng for the reason that the researcher originates from the same community. Access to information was perceived easy and this also reduced research costs.

1. Participants

The following constituted the sources of information.

Key persons in the community such as:

- Women farmers

- Local farmers, male and female from Moruleng
Elders of the village who have indigenous knowledge systems relating to cropping, seed preservation and other relevant practices
- Focus groups of 20 women farmers selected from community members.

Data was also collected from the villagers of Moruleng. They have vast experience in day-to-day farming life in their village. Women in Moruleng hold the traditional knowledge of seed varieties and could identify disease resistance in crops.

Key persons are well placed individuals in the community who have a wide knowledge and experience of the problem identified in this study. Fifteen elderly people (5 men and 10 women) participated in the study.

1.11 DATA COLLECTION METHODS

The research focused on quantitative and qualitative methods like interviews and observation to have an in-depth understanding of issues associated with the research problem.

Interviews

An interview is a direct method of obtaining information in a face-to-face situation (Behr, 1988a). In an interview, questions are to be asked and respondents should be interviewed within a limited time where an hour is recommended. Experts such as knowledge holders were visited for their input. Structured literature searches were conducted for an overall assessment of the impact of climate change on food security.

Focus group discussions were held to clarify concepts and problems. This method allows for the discovery of new aspects of the problem by investigating in detail some explanations given by respondents. It is also a combined element of both interviewing and participant observation. One of the respondents observed environmental changes within their territorial areas for quite some time. The disappearance of medicinal plants and herbs rang an alarm although the participant was unfamiliar with scientific data on climate change. Indigenous knowledge is jealously kept by information holders even though most of whom have died. Such indigenous knowledge was practically acquired and mostly through observation. It was passed down to new generations through the word of mouth. Others observed, demonstrated and also learnt from adults. It is difficult for people to raise their concern, comment in the form of writing or take part in discussions as referencing is a hiccup. In some instances, one

grew up under the supervision of grandparents and most of the things they learnt from them. Knowledge holders often die without writing this knowledge down in some systematic way (Howes, 1980).

An observation method was also employed. It is one of the oldest methods of data collection. It is an indirect method of collecting data because in most cases information is collected without the full knowledge of the respondents. According to Behr (1988b), this is a data-collection technique based on the direct observation of participants behaviours.

Questionnaires

Behr (1988c) defines a questionnaire as the most important primary source of data. It involves a series of questions to be asked. Both closed and open ended questions were used in this study to allow participants to freely give out information. This makes it easier to answer questions and classify information. To obtain more information an open-ended questionnaire is recommended.

1.12 ETHICAL CONSIDERATIONS

Proper arrangements were made on time to ensure sensitive handling of all information provided toward the research by the concerned individuals. The researcher ensured that the responses from the respondents were completely confidential and were not handed to any other party.

1.13 DATA ANALYSIS

Both qualitative and quantitative methods have been useful to collect the field data. The data was obtained from the examination of secondary data as well as from interviews with key people and other respondents who had a broad insight about indigenous farming and food security. Data analysis is about examining data collected to reach sensible conclusions, figure out causality, and make decisions. The information gathered was classified according to how the respondents tackled the questions. Design matching proved to be extremely appropriate for the study. Most of the data collected were qualitative (Berg, 2001).

1.14 STUDY LIMITATIONS

There are limitations in the research study. There are obstacles that the researcher can come across, and such obstacles can affect the research

outcomes. In this situation, the researcher provided participants with detailed information of herself that included origin, the purpose of the visit and how it might improve their life. Distributed questionnaires were not all returned and some of those returned were not answered. Respondents were reluctant to fill in the questionnaires. Though we agreed to meet on certain days, others were invariably absent. They wanted something in return for their participation in this study, which of course, would violate the ethics of such a research.

1.15 ORGANIZATION OF THE FINAL REPORT

Chapter One:	Provides the background, motivation of the study, aims and objectives, and methodology of the study.
Chapter Two:	Reviews related literature to the research problem.
Chapter Three:	Describes the challenges and impacts of climate change on indigenous food security.
Chapter Four:	Presents findings on achieving food security amidst climate change.
Chapter Five:	Gives conclusion and recommendations of the study.

1.16 DEFINITION OF TERMS

According to the Centre for Studies in Food Security (2008) Food security is when food is sufficient, produced and accessible in ways that do not compromise people's dignity, self-respect and human rights.

Natural environment is the climate, weather, and natural resources that affect human survival and economic activity

Ecology is the science that focuses on the relationships between living organisms and their environment

Loreau (2001) defines ecosystem as a biological environment consisting of all the organisms living in a particular area, as well as all the nonliving, physical components of the environment with which the organisms interact, such as air, soil, water, and sunlight.

Benhin (2006) explains that climate change is a change of weather distributing statistically and ranging over periods of time to millions of years.

Climate is the weather pattern average in a place. California which is in San Diego for example, has a "Mediterranean climate" whereby there is moderate temperatures year round, with rainfall limited and typical low humidity (FAO, 2008a).

Weather is the condition found at a particular time and place of the atmosphere measured in terms of wind, temperature, humidity, atmospheric pressure,

cloudiness and precipitation. Weather is uncertain in the sense that it can change anytime.

Environment is the existence of a surrounding place as an essential natural outcome.

Environmental science is an academic interdisciplinary field integrating physical and biological sciences, with the solution of environmental problems .

Natural environment is the natural resources affecting survival of human and economic activity.

Human ecology is the study of the relationship between humans and nature.

Indigenous knowledge is knowledge of subsistence whereas science is the knowledge of market economies (Mathias, 1995).

Bellarby, Foereid, Hastings, Smith (2008) see mitigation as any permanent long term risk action taken towards reducing climate change.

DFID (2008) elaborates by saying that taking advantage of opportunities and coping with potential consequences of damage for the system ability to adjust to climate change is known as adaptation.

Resilience is the magnitude of a disturbance a system can withstand without crossing a threshold into a new structure or dynamic (Nelson, Adger, Brown, 2007).

1.17 CONCLUSION

This chapter consolidates the submissions by Oxfam International (2007) which points out that women farmers should be encouraged to belong to an association as it makes it easier for them to obtain credit. Women farmers should promote access to adaptation techniques of water and soil conservation techniques. The usage of improved seeds, diversification of crops, composting and horticulture is seen as an important goal for all women farmers. Promotion of the use of organic fertilizer should be highly encouraged with the aim being to put food on the table at the end of the day. The Department of Agriculture should try to give women farmers training so that they can develop their adaptation skills so as to promote medium and long term strategic changes in order to achieve greater yielding. Entirely the income women farmers would earn from their productive activities will be used to meet the family's needs, the main one being food.

CHAPTER TWO

LITERATURE REVIEW

2.1 INTRODUCTION

This chapter looks at the different activities involved in the provision of food security supply per household among the Bakgatla people across times. The land where they grow their crops, either as a group or individually is usually of poor quality because they do not own these plots or invest in them. These plots produce low yields and are vulnerable to climate change because of having no fertilizers. Women farmers, as care givers, are known to be knowledgeable on information which could help to maintain household food security particularly in times of drought and famine. They are more vulnerable and the impact on their livelihood is great. Degradation of natural resources due to climate change has a drastic impact on women farmers' livelihood since they are more dependent on natural capital to make a living. Climate change has led to an increase in temperature, increased frequency and severity of extreme weather conditions and a general decrease in rainfall. Sectors such as water, agriculture and forests are most vulnerable to climate change. Food security and the national economy experience serious consequences when weather conditions change (FAO, 2010).

2.2 FOOD SECURITY, CLIMATE CHANGE AND WOMEN FARMERS

Tubiello (2008) suggests that climate change occurs by intensification and circulation of water around the surface of the earth that causes the frequent severe spreading of floods and drought. Rising temperatures increase the risks of frequent droughts resulting in devastating effects on agriculture due to inadequate water supplies necessary for human health.

Silverman (2000) states that literature reviews are information found by the researcher in reviewing the critical points of current knowledge on a particular topic. Most literature shows that adaptation and mitigation of climate change complement each other, the ultimate goal being to bring the reader up to date with current literature on a topic and it forms the basis for another goal, such as the justification for future research in the area. A literature review is an evaluative report of information found in the literature related to the researcher's selected area of study. It is emphasized that the review should describe, summarize, evaluate and clarify the literature. It should give a theoretical base for the research and help the researcher determine the nature of his/her research. Accordingly the purpose of the researcher is to convey to his/her reader what knowledge and ideas have been established on a topic, and what their strengths and weaknesses are. As a piece of writing, the literature review must be defined by a guiding concept (e.g., the research objective, the problem or issue that is being discussed).

The nature, extent and severity of environmental problems vary tremendously from one part of the world to another. Surrounding us is an environment including living and non-living entities. Land, water and air are non-living. Living elements includes are plants, animals and people. They are all capable of adjusting to the environment that they are born and live in. Environmental pollution is said to be any unfavorable change in the environment (www.protectoureenvironment).

Due to unequal access to land and food, child bearing increases daily while land distribution is minimal. Land allocation is decreased. Recently, yard measures for communal properties among the Bakgatla people range from 40 by 40 feet. This used to be 60 by 60 or, depending on how close you knew the headmen doing the allocation, one could easily have got some bigger acreage. People do not have access or are unable to plough in their backyard. The North-West provincial government boldly tells people to decrease their yard sizes so as to give others space instead of encouraging eating organic fresh produce from their yards. Instead of giving women farmers free seeds they would rather loan and expect pay-back, not considering the natural plight or disturbances these vulnerable farmers might come across (Walker and Jodha, 1986).

Ward councilors can at least inform or ask traditional leaders to increase wherever space is free and let people use such space for feeding their families. Fields are sold for business purposes and people are expected to buy. Lodges

and guest houses are mushrooming all over and these take up agricultural space. Some places are reserved; people are not allowed to collect firewood. Other places are fenced or protected as ancestral places where it could be better to use such for ploughing and herding. Instead of producing locally, food is imported and exported hence sicknesses and diseases have become exceedingly high. Underground mining operations cause land degradation through blasting which affects crops because the soil loses its potential. Food parcels are rather taken to other countries whilst hunger and poverty are escalating in South Africa (Anderson, 2005).

Agriculture is the basis of life in most African rural communities. Therefore, adaptation measures to reduce the potentially negative impact of climate change and enhance the positive impact of climate on agriculture in local communities' especially in arid areas, are of fundamental importance for achieving sustainable livelihood. Worldwide mankind is facing climate change that happens to threaten the environment with its direct impact on food (Ziervogel, Nyong, Osman, Conde, Cortes and Dowing, 2006).

Khanal (2009) believe that the organic content in soil is increased by organic agriculture that avoids exploitation of nutrients. More water is stored and captured under organic agricultural soil. This observation implies that organic soil is less prone to effects from fluctuating climate patterns. Key consequences of climate change can only be addressed by reverting to organic agriculture.

Crop yields are strongly affected by topographical factors. Forest fires are due to increase in dry conditions and hot temperatures. Since 1970 the western part of the United States conifer forests has experienced different temperature increase erupting from frequent fires that burn up the conifer forests and thereby affect the characteristics of this space. Fields are left unattended and end up getting sold to people as settlements. Climate change may alter the environment leaving it like a desert. Sitting back will result in millions of people migrating as their homes and lands are experiencing adverse results from droughts and floods (Jones and Thornton, 2003).

Nzeadibe, Egbule, Chukwuone and Agu (2010) make contributions on advising farmers, especially women, that loss of organic matter is experienced from soil warming effect of climate change. This loss remains heavily significant on small farm production. The natural decomposition of organic matter quickens an acceleration in air temperatures and affects the rates of processing and rejuvenating soil fertility. Decomposition of organic matter and desiccated conditions are suppressed extremely. In some areas, severe soil erosion is caused by heavy rainfall and atmospheric moisture from stronger gradients of temperatures. Another concern is that farmers rob the land of its richness by drifting into marginal lands. They should practice multi cropping and rapid crop succession. Farmers have to rely on water resistant crops and on improved good irrigation schemes.

Soil erosion causes less productivity. Rainstorms and wind drives away exposed topsoil then the soil losses its strength. Gullies and cracks do appear as vital nutrients are removed by wind or water. The land may be waterlogged, and salts may build up if the water table rises due to inadequate drainage and poor irrigation practices. Earth's surface features such as croplands, pastures and forests are exposed to threats from increased climatic variability. Throughout the years people have been exposed to droughts, fluctuations in annual rainfall, extreme temperatures and floods caused by climate change. These have resulted in low and unstable food production, especially maize which is the staple food for many people in the Bakgatla area of jurisdiction (Akinro, Opeyemi and Ologunagba, 2008).

To reduce the negative impacts of climate change on agriculture in arid belts, specific adaptation measures are to be put in place to achieve sustainable livelihood for communities. Communities should employ traditional, local and indigenous knowledge (TLIK) based practices such as knowledge of indigenous plants, food preservation techniques, seed selection to avoid drought, disease control in livestock, among others in order to stand the impact of climate change (Gill and Smit, 2008).

Daily, frequent and increased attacks of pest and disease on crops is due to the adverse effect of erratic weather patterns resulting from climate change and this

leaves the Bakgatla people with no option but to depend largely on pesticides. Respondents in this study rely on ensured pesticides protection for the control of pests and diseases, even though these pesticides are harmful to the environment (Lobell and Burke, 2008).

According to the World Bank (2007), around 80% of agricultural emissions, including deforestation, occur in developing countries. There remains much untapped technical potential to reduce agricultural emissions and increase agricultural mitigation of emissions from other sectors, notably through reduced deforestation via changes in land use and agricultural practices.

According to Verchot, Noordwijk, Kandj, Tomich, Ong, Albrecht, Mackensen, Bantilan, Anupama and Palm (2007), hunger and disease leads to animal loss due to reduced pasture and water resulting from climate variability and change. Climate-induced conflicts resulting from pastoralist groups competing over land user and resources have been noted in drought-prone areas. Kothari (2002) illustrates that droughts and floods, including other extreme aftermaths, impact heavily on food accessibility and also destroys infrastructure such as roads. People cannot reach market places when roads are destroyed. An inconstant price pattern on such a market also affects food stability.

2.3 THE DISCONNECTION OF FOOD SECURITY AND CLIMATE CHANGE

Women farmers have observed environmental changes in their territories for many years. They are experiencing the disappearance of certain foods, medicinal plants and herbs and they have begun feeling that the changing climate is the reason for the changes in their daily interactions with the local environment. The constant increase in temperatures also contributes to crop failures. The excess heat also causes skin rashes and enhances mosquito breeding. Hot sun and excess heat causes fruits to fall off before maturity thus causing wastage and shortage. This leads to prolonged dryness and drying up of streams, accompanied by exceedingly hot climatic conditions all of which provoke poor agricultural performance, low output and the ecological disappearance of some species (Lovelock, 2009).

The negative impacts of environmental degradation have left women farmers vulnerable. Their dependence on natural resources to meet their basic needs is remotely in the past. To access seeds, water, fire wood, transport and even a small piece of land means money. Land is dry to a point whereby hand watering is no more effective. People are unable to walk barefoot. Infrastructure is demolished and destroyed as extreme weather patterns escalate daily. Floods and droughts have negative consequences on agricultural production leading to price fluctuations, forcing people to buy food expensively. The high mortality and

mobility experienced among the Bakgatla people is due to high temperatures that affect human ecological adaptation (Hassan, 2010).

According to Nelson, Roge grant, Palazzo, Gray, Ingersoll, Robertson, Tokgoz, Zhu, Sulser, Ringler, Msangi (2010), women gather vegetables from their backyards once or twice a day to prepare food for their family. They are also in charge of gathering firewood for cooking. During dry spells, 20 liters of water which used to be sold at R1.00 now costs R2.50 which increases the cost of living and compromises poor households' access to primary basic needs such as medication and school fees. This implies that in the event of climate change adverse impacts, people's capacity to deal with climate shocks becomes limited. Though they have plenty of tasks to perform such as responsibility of preparing, processing and preserving food, they are also expected to do household garden plots. The authors suggest also that their rich knowledge forms core existence and livelihoods of women farmers helped them to develop best practices and technologies never to be alienated from them in providing farming, healing, worship, and marketing their produce. In Moruleng, poverty alleviation is eradicated by promoting food security through indigenous farming for community survival. Optimizing these strategies shows that women farmers are at the fore front in relying on natural resources for their livelihoods and experiences which are strained by the vulnerability of their territories to impacts of climate change. Very often in most African rural communities, women farmers are the basis of

community livelihood who have learned over a long time how to adapt to climate variability and adaptation.

Due to expensive food, people end up eating not considering nutritious food daily intake. A body dehydrated and a weak immune system pushes one to enter the hospital whereby surviving chances are minimal. Instead of investing in land, people take another route of employment. Others work far whereby they could only visit home once a month or sometimes just send money home. In some instances a wife works away from the husband and they hire someone to take care of the children (Kuhnlein, Receveur, Soueida and Egeland, 2004).

Climate change overlaps into social activities. Livestock, especially cows, are used as dowry payment to the bride family. However, many men no longer have enough livestock for this and opt not to get married. This new experience results in family breakdown as the structures that sustained such practices are increasingly affected by emerging climate patterns. The consequence has been an increase in female-headed households. Female-headed households are vulnerable if they have no male members to herd livestock; the local culture limits their decision-making and ability to own assets (Khumbane, 1996).

2.4 CONCLUSION

According to the Intermón Oxfam (2008), women farmers should be involved in the planning and carrying out of climate change adaptation initiatives, adaptation plans and policies. There should also be awareness and information campaigns about climate change and its effects for those engaged in agriculture. The Department of Agriculture in South Africa is expected to promote awareness raising and training among women farmers locally and internationally with regard to the specific impact that climate change has on women. It should involve women farmers in the sustainable management of resources such as water and forests. Women farmers' access to land ownership must be improved. Government should promote access for women farmers to information about the climate, including weather forecasts, so that they can decide on the best time to plant seeds. It should also develop storage systems to enable women farmers to support families so that they do not have to sell their assets to buy food when market prices are higher.

CHAPTER THREE

CHALLENGES AND IMPACT OF CLIMATE CHANGE ON INDIGENOUS FOOD SECURITY

3.1 INTRODUCTION

In this chapter, the researcher shows how the challenges and impact of climate change can wipe away the good intentions of women farmers. Climate change is costly to communities, especially the vulnerable ones as studied in this research. It is one of the most serious environmental threats facing mankind worldwide. It makes bleak the future of many people. It affects agriculture in several ways, including its direct impact on food production. It has a life-threatening effect pushing to expand to other survival strategies. A Motswana invests in agriculture and livestock, even if you can have money in your bank account. Batswana practise agriculture in traditional ways, including some adaptations to modern scientific approaches and for them, livestock is such an integral part of their identity as a people, hence the saying that an indestructible Motswana Bank is livestock and agriculture. When the planet warms, rainfall patterns shift, and extreme events such as droughts, floods, and forest fires become more frequent resulting in poor and unpredictable yields, these make farmers more vulnerable. With this negativity in climate change it is better to sell off their livestock and invest the money instead of seeing them dying. It is better to keep a manageable number of livestock to easily control and feed until they have adaptive and

mitigative ways to control and handle the situation. Livestock and agriculture depend on each other. When agriculture is failing, livestock suffers a lot. Manure is needed to fertilize and modify soil and harvesting leftovers for feeding livestock. Employing different adaptive measures could ease the tension experienced and bring good health to people's lives. The effects of climate change are the same for all but women have different assets and resources at their disposal with which to tackle these effects. There is a reflection on the gathering and harvesting of food, equipment used and how they handled the environment although it was tough (Department of Environmental Affairs, 2011).

3.2 EFFECTS OF CLIMATE CHANGE ON FOOD SECURITY

Green, (2011) has pointed out how older people knew what the weather was like when they were young and can testify to what has changed leading a shift in the start of the rainy season. They were aware that the rain was often interspersed with dry spells and also knew that most crops grown by farmers like local varieties matured late and were affected by heavy rains and drought.

The effects and impact of climate change on women farmers is clearly multi-dimensional. Climate change tends to magnify the pressures and challenges already faced by women farmers in many rural areas of the North-West Province in South Africa. Their responsibilities of taking care of sick family members and of sourcing enough food for the family, especially during times of crop failure pose

additional burdens for women. It also limits the time the latter can spend to organize them and to assume more active roles within the community and in society in general (Kyomuhendo and Keniston, 2007).

Women also reported that the economic hardship from crop failure and from increased incidence of sickness and diseases often create a lot of tension within the household. Women reported that during times of crop failure or poor harvest due to droughts or storms, women could barely sleep as they worried about where to get food for their family hence they say "*ntime o mphela bana*" literally meaning, "instead of giving me [anything] you would rather give to my kids," and "*korwe ga ke je ke bapalela tsetse*", meaning, "whatever I gather is for my kids". It shows that during hard times where hunger stared them in the face, caring for the family and at least sharing whatever was available was the traditional order of the day (Long, 2007).

Juana, Mangadi and Strzepek (2012), clearly illustrate that agriculture indexes primary climate change as a severe impact phenomenon and that other sectors in the economy are also impacted in a snowball effect because of the induced effect from the agricultural sector. The reality is that 20% reduction in water availability in South Africa due to climate change will lead to a 12% decline in agricultural output. Because of the backward and forward linkages between agriculture and the other sectors of the economy, this 12% decline in agricultural output will lead to about 8% decline in gross sectorial output.

Wisner, Blaikie, Cannon and Davis (2004) all say that land is always an important basic natural resource. It is a dynamic and complex combination of geology, topography and hydrology. Every sphere of human activity is influenced by flora and fauna. Different sectors including agriculture, industry, infrastructure, and power projects put forth competing demand for land. Subsistence farming practices, accelerated soil and water erosion, erratic rainfall, increasing population, and high density of livestock population have all contributed to unsustainable land use that has led to degradation in the Morula area. Land resources can suffer degradation from human activities affecting water and biological resources. Often, land degradation weakens the ability of communities to depend on their environment for their livelihoods. Activities that contribute to land degradation include: soil erosion, denudation, pollution, loss of organic matter, fertility and vegetation cover, invasive plant and insect species, habitat conversion (whether urban or agricultural) and aquifer degradation.

Barrett (2010) maintains that at the same time, important forms of land transformation among the world's most critical environmental issues are linked intricately to food security, poverty, climate change, and biodiversity are degradation and desertification of land. It is better to use natural fertilizer such as animal dung or organic matter including resting the land to build up nutrients for yearly quality food crops than to use chemical fertilizers and compounds that react with soil quality and texture, leading to prolonged dessication of soil quality.

Specific economic conditions result from inappropriate land laws or customs over land usage.

The food price crisis of 2008 illustrated how widespread and prolonged commodity price rise and food instability per location is triggered by climatic shocks. A protracted drought in Australia, stagnant production in global rice and wheat supply was affected by this protracted drought. Food reserves globally are very low due to the climate changes identified in this study. Domestic price controls and export bans often put constraints and eventually these lead to national prolonged high price reactions. This also leads to protests in a number of places that have no money to take care of the family hence ending up in undernourishment, as has been reported in the area of study here. A poor household spends a larger percentage of its income on food.

Bruinsma (2009) strongly believes that a world of growing population and changing diets under climate change is a major challenge for sustainable food security. In 2050, though the global population will be 9 billion, production of food also has to increase to 70%. Women, who straddle the food security chain face the challenge to access and purchase, store, prepare and consume sufficient food as these largely depend on socio-economic factors and agriculture to provide diverse balanced food basket (Spelman, 2010).

Orlove, Roncoli, Kabugo and Majugu (2009) agree that adaptation is an essential climate change response. Climate mitigation change when limited will be an urgent future challenge. The productiveness of the earth system has one dynamic element which is climate.

Kolstad (2000) maintains that the biosphere's global environmental change, in addition to biogeochemical and physical changes in the environment is either caused naturally or by human influenced activities. Investigating the interactions among biospheres has a holistic approach in understanding the global environmental processes and outcomes. The alliance will provide more context-specific (e.g. ecosystems and farming systems) alliances with more specific context that will provide predictive accurate data and information in enhancing the scenarios and effective climate change interventions.

3.2.1. Agricultural redress on climate change policy

IFPRI (2004) believes that for developing countries, good adaptation and good development policies are very strongly intertwined and it is right that climate change should now become central to national planning processes and to development assistance. Indigenous communities' adaptation to climate change and their inclusion in policy processes are currently rather scarce. Achieving food security is a fundamental goal of a development policy worldwide. Institutions, in attempting to procure increase in local

food, are faced with cost, inconsistency and quality challenge. Local farmers, when supplying food to institutions, are faced with different barriers of regulations, safety requirements and delivery constraints. Institutions, farmers and distributors should take action in addressing identified challenges by revising procurement processes and collaborative action amongst themselves with the aim to change the systems and improve the infrastructure. Guaranteed large buyers, such as institutions, provide incentives for farmers to invest in infrastructure from large guaranteed institutional buyers that drive increased consistency, dependability and low cost.

Herren, Binns, Najam, Khan, Halberg, Cim Li Ching, Treyer, Lal, Atapattu, Kodituwakku, Tamo, Neuenschwander, Fernandez, Bassi, Kassam, De Fraiture, Kingamkono, Perfecto and Khan (2011) expresses similar views by noting that policies and strategies with regard to food ought not only address the growing food problem, but also incorporate measures from other disciplines such as health, education that may have direct and indirect impact on food availability and entitlements. For example, the healthier and better educated are able to produce more food output, because of their higher labour productivity, thereby increasing the availability of locally grown food. They are also able to earn higher incomes, improving their entitlements to food. Additional to the present population, they suggest that a broader perspective should be put on

those to implement policy to be aware of and recognizably make future adjustment when planning. Unemployment as one major aspect linked to food insecurity should be taken into consideration and kept in mind always and permit employment policies to cater for this.

3.2.2. Policy

Policy needs to recognize and support the key role of women in achieving food security. This requires national and provincial policy acknowledgement of the value of backyard plots in providing food security at the household level and the development of policy support to help maintain productivity and reduce threats to backyard plots (Stolze, 2010).

3.2.2.1 Forum for Agricultural Research in Africa (2006) applauds traditional food practices of conservation and processing by mentioning that indigenous knowledge embedded in culture has to be sustained by practice and experience taking into account policies and food security goals. Development interventions contributing to women farmers' empowerment is thorough incorporating specific indigenous knowledge elements and interventions.

3.2.2.2 Rights based-policy

There is a need for a rights-based perspective to 'invest in women' that include improving women's access to timely and adequate information regarding extension and marketing; increasing women's literacy; improving their access to new agricultural technologies and productive resources; and improving their access to credit and health services. This highlights the importance of mainstreaming gender concerns across sectorial areas, including education, agriculture, health, poverty alleviation and development. Efforts to improve access to credit are vital according to Feder, Murgai and Quison, (2004) and there is an implied connection between such an empowerment drive and the realities of the area researched in this study. .

3.2.3 Moruleng, indigenous technology and farming

Moruleng belongs to the Bakgatla-Ba-Kgafela tribe and they are a Setswana speaking group that established itself in the area between 1700 and 1750 coming from chief Maselwane's area in Hammanskraal near Pretoria. For some time they paid tribute to the Batlhako tribe, which ruled the area, until the Bakgatla-ba-Kgafela won the war between themselves

and the Batlhako over not wanting to pay tribute any longer (Tlhagale, 2004).

The Bakgatla farmers have adapted their cropping systems to the local Moruleng environment by developing traditional and new strategies and activities that could contribute to maintaining and enhancing crop productivity. These strategies include animal manure, inorganic fertilizer, crop rotation, a five-year fallow period and extensive cropping systems. Land tenure arrangements between landlords and migrants affect strategies that can be applied to maintaining soil fertility (Osunade, 1994).

The hand-hoe (*petlwana*) is the farm tool mostly used in all the farms in Moruleng. It is the most commonly known farming equipment that is used by women farmers in the area. The hoe is a hand tool used in the farms or home gardens. A hoe is a heavy steel metal with a sharp blade in-front and hole at the back for putting the long handle made of wood. There are some homemade hoes made from iron metal and tied around the long medium sized wood from a strong tree with a hard wire. The farmers consider the hoe as a basic, essential hand-farming implement.

Smil (2003) considers it as traditionally designed to offload women farmers' burden of bending. Though women can carry their little ones at back they can work without feeling any severe back pain. They prefer to

use it to remove unwanted weeds on the surface of the soil. They also use the hoe dig and move the soil when harvesting root crops like potatoes and also to pile the soil around the base of the plant. It is said that of all their tasks on the land, weeding with a hand-hoe is highly recommended and saves time. It is said that the quality and durability of the hoe is greatly appreciated. It is still a fact that tractors are the most common agricultural equipment used by new farmers in the village especially for big plots to till the land. Individual household farmers with enough cash hire tractors to plough their home gardens. Local women farmers in Moruleng use different types of implements to cultivate the soil with a tractor. Subsistence farming produces enough food for the needs of the family and succeeds with limited resource inputs in a small area. Commercial intensive agriculture and industrial agriculture includes high level of mechanization with large fields' inputs resource.

According to Bernd and De Gruyter (1981), the smallest unit of agricultural space, areas, zones and regions are in every case the farms. A farm is understood to be an economic enterprise in the realm of primary production, consisting of both the residence of the operator and the agriculturally utilized area. They think that, the economic goal on all farms is primarily the satisfaction of the needs of the farm operator (which is the farmer), his co-workers and his family. Under conditions of little

agricultural development, farms assume a domestic, subsistence character.

Wang, Vinocur and Altman (2003) have noted that farming is the key to development in Africa, and by extension in South Africa. It encompasses many roles in national development including contribution to households and national food security, and it provides raw materials and breeds export earnings. Farming is also a chief source of livelihoods for rural communities especially the poor, for example two thirds of the African population depends on agriculture. Farming guides the administration of natural resources including land, forest and genetic bio-diversity.

3.2.4 Managing change in the farm

Ozor (2009) stresses that when climate change is managed carefully, climate adaptation strategies can have environmental aids for some countries. The Canadian agricultural sector has recognized 96 different adaptation measures, including: alteration in topography of land (11measures), use of artificial systems to improve water availability and protect against soil erosion (29), change farming systems (21), change timing of farm operations (2), use of different crop varieties (7), governmental and institutional policies and programmes (16), and new research technologies (10).

Amongst others Stringer, Dyer, Reed, Dougill, Twyman and Mkwambisi, (2009) believes that the Least Developed Countries with their strong reliance on economic natural resources and rain fed agriculture encounters climate change variability. Dry lands or mountains marginal areas have limited management challenges in reduce impacts for its people. In terms of the speed adaptation circumstances, climate strategies should reflect response and the choice of options.

Acharya (2009) adds that to promote overall development growth and improve farmers' access to different spheres of resources adaptation strategies must be put in place. This implies that the right information should get to the right people such that "investments, policies, and extension services delivery through targeting the most vulnerable and less educated such as subsistence farmers, women and the poor vulnerable due to climate change are in place. In the more industrialized countries much of the know-how of traditional systems has been lost especially within the last generation more over there is fortunately still a vast of farming know-how in store for many of the less developed countries. Appreciate by researchers is the fact that many in the developing world, traditional farmers still practices balanced farming methods within their ecosystem.

It is expressed boldly that answers to fundamental problem elements in organic soil matter is through developing soil structure calmingly to grip greater water quantities with no surface run off affected, leading to flooding in the downstream.

El-Hage Scialabba and Müller-Lindenlauf (2010) have realized that during extended droughts organic soil matter absorbs a lot more volume of water. Low soil tillage is thus encouraged by FAO for permanent soil cover resulting in a low impact of erosion and winds on the soil quality. Soil excess temperatures are protected by mulch surface cover and 30 percent of water crop requirements reduced. In extreme events trees and shrubs could remarkably play a mitigating role in securing food. Accordingly the objective of indigenous farming is mainly for subsistence, but also commercial in part, to satisfy the farmers needs for money and for good services. He further argues that, indigenous farming works with nature rather than against it. Indigenous farming recognizes the fact that nature has many complex processes, which interact to control pests, disease and weeds and regulate the growth of plants. Indigenous farming aims to ensure quality in the environment.

Anim (1999) points out that, this practice of indigenous farming not only yields more per acre but also protects the soil from heavy leaching of its nutrients and erosion of the top soil. It employs more people; and feeds

more people with a fresh, balanced diet. Soil fertility maintenance is dependent on nutrient cycling and biological processes, such as nitrogen fixation and nutrients accumulation in biomass during the fallow period, for restoration of soil fertility. Manures and household refuse are used to maintain soil fertility, especially in home gardens. Manure from animals is used in fields to help maintain soil fertility. Under the monoculture system, the farmer has to provide most of his family's nutritional needs by depending on other sources, such as foreign imports, even though he might have the same resources to provide those needs locally. Therefore, the farmer in a rural environment cannot depend on a mono-cultural system. Accordingly generations have practised indigenous systems of cropping that meets the population growing food requirements. Sowing of more than two crops in one is referred to as mixed cropping and remains Africa widespread technique for small farmers.

Edgerton (2009) has noted with great concern that mixed cropping has been shown to have many advantages such that more moisture is retained in the soil, rooting soil systems exploit soil different level profile for nutrients and moisture. To meet protein and fat requirements farmers mixed oilseed and legume crops. Farmers avoided failure risks by growing more than two crops in a single food, whereas recommended agronomy practices suggest mono-cropping. Crop rotation is a system of regularly shifting the variety of crops grown regularly in a piece of land. To avoid

insect and fungal pests a particular order to build is utilized to add soil nutrients for planting such crops. Various crops seek crop rotation for balancing fertility demands of soil nutrients and to avoid excessive nutrient depletion in the soils. Alternating deep-rooted and shallow-rooted plants can improve soil fertility and structure. Re-growing in one place decrease and depletes soil fertility. Farmers practicing crop rotation continuously produce having not spent on fertilizers and lay fallow.

Idel (2010) says that in arable and pastoral farming, mixed farming can also be carried out. It is regarded a lower strategy risk than monoculture. These systems of farming are classifiable in various ways such as on land size, types of crops and animals. Mixed farming can be through mingling within crop and animal systems. This type refers to conditions where multiple cropping is practiced, and different types of animals are kept together on a farm.

3.2.4.1. Shifting cultivation

Onyeneke and Madukwe (2010) says that women farmers are familiar with and desire the use of traditional grains such as millets and sorghums that are extra drought-resistant than maize and therefore give a good yield even with very little rain. Worldwide shifting cultivation has been and is still

practiced to manage soil fertility. Shifting cultivation includes a rotation between crops and long-term fallow forest. Burned forests turn into ash which is a 'fertilizer' or 'lime' for the soil. It is clear in this traditional practice that declining soil fertility or invasion of weeds or pests disturbs crop yields. The fields are then abandoned and the farmer clears another piece of forest. The farmer returns to till the fallow field after several years of abandonment and fertility has been naturally rebuilt. Different crops are planted in seasonal progression and this practice is characterized by shifting cultivation which affords differing nutrients in the cultivated soil. When the land is exhausted farmers moves to places.

Braun (2008) agrees by saying that the Arctic recognizes the indigenous people value of traditional knowledge and observations on climate change. The report released after a four year study in November 2004 on Arctic Climate Impact Assessment (ACIA) is beneficial with the traditional people inputs. It state too that traditional knowledge supplement good to the enrichment of scientific data. Mitigation and adaptation integrating into climate change completely is not a new idea. Local populations have the potential of providing guide on how to address climatic events currently and in

future by using their traditional knowledge. Little has been done to incorporate mitigation and adaptation strategies though the importance of indigenous knowledge is realized through the designing and implementation of sustainable development projects into climate change.

Herren (2010) argues by pointing out that climate and sustainable development are intertwined. Sustainable development is the effective way of framing mitigation question and dimension of impacts of climate change and adaptation. Incorporating indigenous knowledge into climate change policies would lead to cost-effective mitigation and adaptation strategies.

The challenges of adapting food systems to ensure food security in the face of climate change must be addressed. An eye should open be kept across all levels when addressing challenges aimed at ensuring food security. Policies worldwide support the change. Rainwater tanks subsidized by national policies encourage directly and reduce demand of water sources by households whilst supporting adaptation (Women's Bureau, 1999). Ellis (2000) highlights that water harvested from roof and natural springs

sidetrack are placed in big tanks. This guarantees water is enough stored up such that in the event of drought it will cater for months.

Altieri and Koohafkan (2008) are of the same notion that improved information on how to manage climate-related risks can create greater choice for a short- or long-term. In early warning systems improvements could reduce extreme events impact if prepare in advance. Users often battle to access information on climate change and how to interpret downscaled scenarios in their limited distribution.

World Food Summit in November (2009) reported limited incidence. To get responses international organized on food aid and policy reform is vastly difficult. There is the mistrust constraining the trade talk's reform and WTO completion of the Doha Round between countries with deep historical roots and power issues. Without the resolution of this, it will be very hard to persuade Developing countries to focus on increasing markets self-sufficiency rather than put trust globally on food security issues.

Grossman (2010) has a concern that limited public private partnerships lack integrated response in supporting food security despite the dominant role in distribution and retail of food by private sector. They engaged only where there are business opportunities on climate change. Partnering on food security and working with designers has related multiple opportunity options that includes reducing gas emissions from greenhouse and by marketing local products suited for climate. Continue to make a contribution by saying that the vital successful part of improving food security in the region is through "harnessing the assistances of building climate resilience in cross-sectorial infrastructural development that enriches growth, productivity, trade, and distribution. Investments in climate-resilient infrastructure development, such as land management, water supply, roads, shipping ports, and coastal development, can increase regional and national connectivity, productivity, and food security. The production and provision of adequate safe and nutritious local food should be further supported and encouraged, especially since the region's current free trade approach to development tends to increase imports of processed foods often calorie-rich and nutrient-poor which could weaken food security".

According to Godtland, Sadoulet, de Janvry, Murgai and Ortiz (2003) says that in ensuring and improving food security strategies and programmes have roles to play concerning climate change resilience. Improved ways of disseminating data and information for public awareness and understanding the impacts of climate change on food production and security issues is critical.

Local communities have to make efforts to adapt in mitigating climate change. Effective disaster management and emergency response systems are an important aspect in enhancing food security. Often targeted and freely distributed to victims of natural or human made disasters, disaster and emergency food assistance warrants proper governance implementation programme including institutional accountability and transparency should be distributed to victims of natural disasters. Other methods to predict short to long term climate changes and to avoid the risks and to survive climatic extremes includes using of early warning systems (Adamo, 2001).

According to De Lima (1982) to improve fragile soils and to cope with adverse climate change effects, women in local communities should employ best indigenous knowledge practices such as water harvesting technologies and water conservation techniques to retain water in fragile soils. Food fermentation and preservation techniques can ensure food security.

Food security in local communities has been heavily threatened by recurrent droughts, and most food shortages occur in dry lands. Under the Convention on Combating Desertification and Mitigating the Impacts of Drought (CCD), African countries have come up with national action programmes that include research in dry-land management (e.g., regarding dry-land crop and livestock varieties) and coping strategies for dry-land residents. The CCD also looks at how biodiversity conservation can reduce land degradation and mitigate drought, and at how climate change can make dry lands even drier (International Maize and Wheat Improvement Centre, 2008).

3.2.4.2 Food production

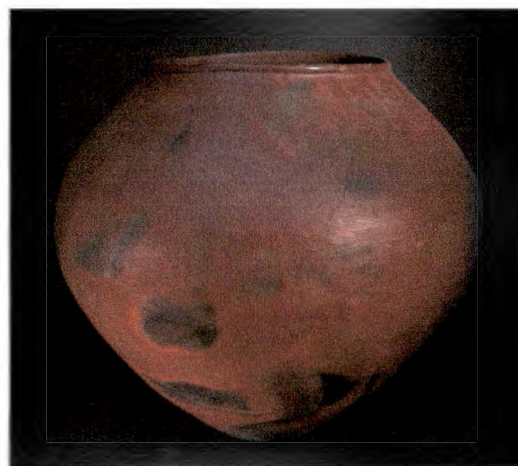
Farming and food production activities often started with the ploughing season in October, always marked by the beginning of the New Year after the first rains called "*Kgogola Moko*". Kraal manure/mosutele from cattle, goats, sheep and donkeys are scattered throughout the fields in preparation for ploughing. During this time all crop wasted from harvesting decomposes, and seed grains scattered all over after thrashing the corn germinates. In preparing the fields for ploughing and wild green vegetable (*morogo*) grows in the fields. *Morogo* was cooked in a big pot, placed on a corrugated iron sheet for five days to dry. When dried it is then put in big clay pots and then sealed with fresh cow dung for storage and to prevent pest encroachment. Other people stored their "*morogo*" in sacks (*kgetse*). Some "*morogo*" were scattered on a corrugated iron sheet uncooked to dry up and some also kept in sacks known as "*maswaswa*" (Den Hartog, Van Staveren and Brouwer, 2006).

Women are seen in the fields (*tshimo*) carrying babies on their back and busy. They start with "*golema*" (ploughing,)

then comes “*go tthagola*” (hoe out weeds) and lastly “*go kotula*” (harvesting). During “*go tthagola*” and harvesting they do “*letsema*” and you will love it as they sing melodious songs. “*Letsema*” is when the farmer (*molemi*) goes around the village and asks for those who are willing to help with harvesting and promises to give them a bag of maize, a bucket of beans depending on how much he or she has produced (Farnworth and Hutchings 2009).

3.2.4.2.1 Food Preservation

Women farmers, including other community members, implemented “ex situ” and “in situ” formal conservation strategy methods. They used traditional facility storages such as clay (*dinkgo*), traditional gribs and sacks to conserve and preserve local variety crop types (Lundy, 2006).



Nkgo/Clay pot

Beans and maize are cooked and dried for ensuring future food supply and to control pests. The people in the households could re-cook the preserved food whenever it was needed (Bhat & Rhubuluza, 2002).

Vorster, Jansen van Rensburg, Van Zijl, and Venter 2007) share the same sentiments of grain preservation methods differing from grass baskets. Its freshness is not changed by being soaked in the manure though it has caught the smell.



Traditional grib

3.2.4.4 Food Processing

Tran, Golob, and Fuseini (2001) elaborate on how grain is processed through the use of grinding stones (lelwala) and mortar (kika) to get a variety of products from the whole embryo maize rich

in protein, oil and mineral salts to feed young babies. Other products are maize-meal, samp and mealie-rice. They further highlights that cowpeas, melon pips and peanuts were processed into powder and stored away in clay pots. When mixed maize meal together milk it turns into a nutritious dish for children. Peanut butter when mixed with morogo is a delicious and tasty side dish.



Maize grinding stones

3.2.4.5 Drying of Meat

Nguni & Mwina (2007) agree that fresh meat was consumed differently and some would be dried as a way of preserving it for tough times. Usually the bigger muscles would be detached from the meat. Salt and pepper were buffed and cut into thick or thin long strips about 30 cm depending on the size one desires. It would be hanged outside or placed on a flayed hide to dry up. The prepared strips (*digwapa*) were taken outside the house for weeks for the salt coating to penetrate and meat to dry out. They were hanged in a partly shady and sunny area during the day and some

people hanged them in the mud house and a strap was used to hang them on. Extra meat was cooked and seasoned with salt, broken into small pieces and splattered on a solid earthen or rock surface to dry up in the hot sun. After ten days or when dried, it was put in a sack and placed away until needed. It was referred to as "*kunwa*".

3.2.5. Informal seed supply system

Indigenous people always managed to produce quality food for future usage. In the interviews conducted they claim that they used their own technology to keep their seeds safe and the method used was an informal seed supply system aimed at sustainable indigenous farming system. Quality seed was one of the many primary requirements for established food security to farmers. Seeds were supplied through seed-making activities and local disseminating mechanisms constructed on indigenous knowledge platforms. The method like retaining on-farm seed from former harvests were kept for planting in the next season and in exchange network seed by farmer-to-farmer (Edgerton, 2009).

3.2.6 Seed storage and processing

Firmly, Binns (2007) articulates with great concern that communities employ various handling system skills in supplying informal seed but administer similar processing methods of storage. The size and colour of maize cobs seed were chosen during harvest time. Cobs were hung under trees covered with wood ash to prevent rodent attack. Local and different modified seed grains were separately stored. Big sacks were usually used to store maize cobs as it was believed that air would infiltrate and discolour corn cobs in polypropylene sacks, leading to poor sprouting at the early stage due to over-heating. Often cobs were thoroughly checked for infestation soon after the harvest, and immediately before the shelling for seed prior to planting. After harvest, groundnuts were left in the field to dry out whilst cowpea was left outside the house especially in the sun to dry. Indigenous knowledge such as ash and tobacco aromatic herbs were vigorously applied to protect insect attacks of the cowpea seed.

Pender (2009) alludes that over few decades, around the world people of different nations reckoned with and shared different knowledge about the encroachment of environmental degradation. Nevertheless, women feel excessively the undesirable environmental degradation impacts as they held such changes responsible for environmental deterioration and a threat to community survival. Throughout the developing world, "women

regularly depend on natural resources to meet community and household basic needs through agricultural production and gathering resources essential for household maintenance, such as water, firewood, and wild plants for consumption and medicine". In their argument: "they believe that most resources and development policies do not address the questions of impact on women; especially the issue of capacity building to deal with climate change. Climate change has negative effects on women and local communities go beyond immediate threats to food supply. They encompass aspects of health such as susceptibility to diseases and epidemiology which are affected by environmental factors".

According to Adejuwon (2006) the desire is to improve the climate change and food security for sustainable development. The capacity of the society also has the impact in climate change through the use of land and cultural practices. The problem is the extent to which these efforts address the issue of women and their role in using indigenous knowledge system in ensuring food security for their households and communities. The effects of climate change are destroying livelihoods across Africa in semi-arid areas like North-West Province in South Africa. These areas have less than 600mm of rainfall annually. Traditional ways of survival including herding animals and hunting are being affected by frequent drought conditions as animals and plants die due to lack of water and destruction

of biodiversity. All these lead to yield cultivation being negatively affected by frequent weather.

Botkin, Saxe and Araujo (2007) elaborates that global climate change is the most serious of threats today towards biodiversity risks to ecosystems. The ground air pollution increased by air temperatures aid insects in carrying and spreading diseases. The above affects the livelihood of communities, especially women and their dependents as the most vulnerable groups in poor communities. This knowledge developed in local communities is continually renewed and improved upon. Women have for centuries used Indigenous knowledge to adapt to and mitigate the effects of changing climatic conditions through indigenous traditional education based on gender and age.

Rosegrant, Cline and Valmonte-Santos (2007) strongly agree that food security is being able to provide enough and maintain a healthy living for all. It was a rested system that people highly recommended as meeting long-term food needs. Indigenous people had adequate gathering practices enabling them to address food security despite fluctuations that developed over years. The fluctuations experienced, came forth with the idea of securing the little they had for future use. Hence the saying, "*Phokoje o rile ga bose ga ngwe*" (meaning "there is still tomorrow; therefore always think of tomorrow"). By adhering to those practices the

Bakgatla indigenous communities have been able to retain economic independence and self-sufficiency, and ensure that the diversity of plant and animal species remained high. The availability of food in the household level depended on many variables such as production, land, labour, knowledge and technology, preservation and storage, forests, grasses and livestock.

3.3 CONCLUSION

It is suggested that with this kind of climate change it is better for the agriculturalists to sell off their livestock and invest the money instead of seeing them dying. It is better to keep a manageable number of livestock to easily control and feed until they have adaptive and mitigative ways to control and handle the situation. Women farmers, including community members, should work together with governments to ensure their environments are protected and it would be good to develop programs to support traditional food security in their communities. The changes in the availability and accessibility of scarce resources are not only an issue of food security but also one of cultural preservation that deserves serious recognition by governments. Protection and preservation of the indigenous food system is traditional knowledge of great importance and has to be incorporated within community members. Women farmers and other women should develop the desire and passion to contribute

towards households' food security, job creation and economic development (Duerden, 2004).

CHAPTER FOUR

ACHIEVING FOOD SECURITY AMIDST CLIMATE CHANGE

4.1 INTRODUCTION

Venema and Cisse (2004) both are in one accord that the past and present situation opened the hanging cloud over women farmers to see blunders that they have done. Articles read and workshops regularly attended showed the farmers ways of maintaining and controlling their environment to produce more food. Women farmers during dry seasons preferred sowing crops early. This reduced labour and financial constraints that women usually experienced. They dug fishponds in between their plots or cleared a space near the farm to retain water. These programmes were aimed at women farmers since they were the ones responsible for growing food within the existing social structure. The adaptation projects, initiatives and programmes aimed at women that have been identified during this research are projects that seek to diversify income generating activities. These projects attempt to offset the harvest losses caused by climate change with other productive activities. The subsequent analysis of adaptation practices designed for women farmers deals primarily with women's practical needs.

4.2 DETERMINANTS OF CROP GROWTH

Under the present climate change, food will be produced under different climatic conditions in altered ecosystems, which will alter agricultural conditions and be compounded by adaptations to such change. Conditions may be further altered through initiatives from the food industry to mitigate against climate change. Women farmers' journey in the agricultural field taught them to resort to the system of raising crops with minimal disturbance to the soil while retaining crop residues on the soil surface known as conservation agriculture. In order to keep the production system in different land situations sustainable and conservation agriculture based on no-till system is an alternative to reconcile traditional agriculture with its environment and overcome the imposed constraints of climate change and continuous inputs cost (McCalla and Revoredo, 2001).

Sharma and Acharya (2000) point out that information is regularly circulated to notify women farmers that to produce more and nutritional food, women farmers before taking the decision to cultivate should take into consideration land structure, soil type, soil moisture and water management. Soil moisture deficiency is one of the primary limiting factors to efficient crop growth in the drier savanna areas. Even in the more humid areas, the seasonal distribution of rainfall described earlier is an important determining factor for crop growth, depending on the moisture-storage capacity within rooting depth of the particular soil. Women farmers practicing mulching could beat food shortages. Mulching

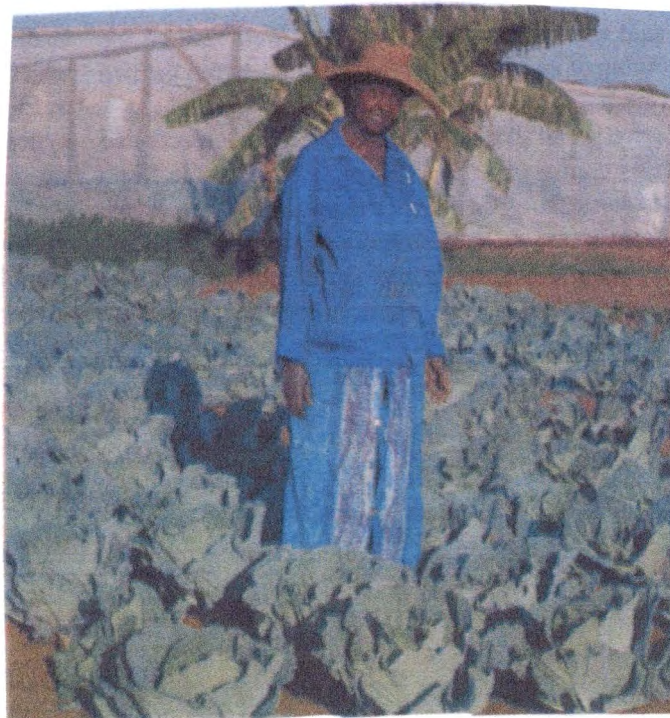
scientifically decreases the energy of raindrops and protects erosion of soil. Mulching prevents excessively high soil temperatures. It prevents premature seedling emergence. Seeds are able to germinate without any harsh conditions. It increases soil water storage. The soil is not exposed to hot temperatures and always undercover. Weed infestation is decreased. Crop production is highly maintained and well planned and for an area such as Moruleng, such practices would enhance both productivity and food security aspects.

Pretty, Morison and Hine (2003) all agree that women farmers should employ different production strategies that could at least guarantee monthly income per family. In Moruleng, they have identified climate resilience interventions to help promote food security. The best option is to promote organic farming. The system and composition of sunflower intensification, among others, is regarded as strategies to help increase farmers sustainable agricultural manner. They suggest that new crops development and livestock bred can only survive by mitigating and adaptation against climate conditions. It is believed that potatoes and pork has a long elastic term supply.

Nema, Nema and Roy (2012), saw it fit that women farmers should sit down and agree to come together to sustain the community. There are women who believe in the saying "*kgetse ya tsie e kgonwa ka go tshwaraganelwa*", meaning "working together brings great results". Women plough big fields and different ideas employed make it possible at the end of the day. One woman farmer in a

newspaper article said she did it by herself, looking at improving her life and those of others around her. She depended on herself and managed to produce at the end. She had workers and was capable of living happily knowing that people have eaten.

According to Gould, Saupe and Klemme (1989) no conservation and tillage method is done haphazardly. Seeds are scattered by hand and sometimes may be grouped in one place. Conservation tillage significantly improves water availability to crops. Through a zero-tillage technology, farmers can harvest



Woman Farmer

higher yields and production cost is reduced by up to 10%. Zero tillage also improves soil and fertility status. No-tillage and retention of crop residues initiate

processes leading to improved soil quality and overall enhancement of resource-use efficiency.

The increase in water conservation and water-use efficiency obtained by no-tillage system has tremendous effects on yield improvement and production stability in agriculture. Even though crop residues have high value and only a small amount is left after harvesting, a build-up over the years and a change in the farmer's behaviour towards residue management as a long-term investment on soil quality has been noticed in the farmer's field. Moreover, improvement of grain and straw (*lotlhaka*) production encourages farmers to leave more residues in their fields and ensure the long-term benefit of the no-till system (Green and Raygorodetsky, 2010).

During the late 1800s people consumed food from a larger geographical area hence the goiter reduction. Greater quantities of food grown on allotments (a small portion of usually public land made available for low-cost rental to allow individual food cultivation) could be of concern because of their often urban nature and greater risk of contaminated soil from earlier industrial use or atmospheric deposition. If individuals change to a locally sourced diet to mitigate against climate change, then they are likely to find it difficult to achieve a year-round supply of fresh fruit and vegetables (Papritz and Reichard, 2009).

4.3 CONCLUSION

The chapter dealt with various food security strategically ways that women farmers attempted in promoting the production of adequate food to meet local needs. It showed that it promotes sustainable agricultural, generates employment opportunities and agricultural income. Women farmers should be encouraged to grow crops according to their ecological suitability and be highly motivated on rotating crops to produce more yielding. Women farmers should employ different soil and water management methods in order to improve crop production.

They should lightly turn to old traditional ways of terraces to conserve soil moisture and to increase soil-water availability to plants to improve crop production including mulching from the crop residues left from the previous season. They should also rely on pitting method of sowing as it collects runoff during the early growing crop stages. People, especially women farmers, should be greatly motivated to do savings mobilizations as a way of helping communities address the problem of indebtedness resulting from crop failures due to extreme weather conditions associated with climate change. Women must promptly jump into organizing other women to know about all the benefits in understanding that having more children translates to less food security. Today, organized women are lobbying for more information and trainings on family planning as a way of empowering themselves to control childbirth (Niggli, 2010).

Mohono (2013) accordingly women farmers should at all-time engage with the Department of Agriculture and Rural Development to get updated on household newly introduced less labour method. According to MEC Desbo Mohono's speech the method will provide nutritious essentials food to last for long. She said "Earth boxes will produce vegetables for household consumption because the soil in some of the areas in the Province, including Boitumelong location in Bloemhof, is not suitable for planting". "This is an economically viable method of vegetable production which is not labour intensive, saves water and enables vegetables to grow faster". She further said that earth boxes as one of the inputs production the Department donate. For a period of twelve months the soil is reusable.

CHAPTER FIVE

CONCLUSION AND RECOMMENDATIONS

5.1 INTRODUCTION

Food security strategies have moved from mostly preserving locally produced food to a mix of local and imported food. Adult women do not have access to farmer training or to adequate training to carry out their work. There is no more direct way to addressing climate change than building successful food security systems. Women farmers should enhance productivity by improving sustainable ways that are economically and socially empowering. Traditional knowledge, local skills and resources should be put resuscitated. There should be farmer to farmer networking and information sharing. The rural population, who produce more than 70% of the food eaten nationwide are disproportionately poor and face challenges of malnutrition and disease. Government should drive this sector through consistent policies, robust funding and infrastructure development. They have failed to accord this climate change problem the priority it deserves. In addition, there should be an explicit national agricultural policy framework, adequate provision for irrigation, drainage, weather forecasting and other agricultural technology infrastructure. An incentive must be put aside for training in agriculture, participatory and on-going capacity building for women farmers.

Women farmers should be empowered on drought resistant and integration of short duration high yielding crop development (Holdren, 2008).

5.2 RECOMMENDATIONS

It is recommended that the government should not only decentralize its programmes on poverty/HIV-AIDS and agricultural research (funding and activities), but should make them participatory. In addition, there should be an explicit national agricultural policy framework, adequate provision for irrigation, drainage, weather forecasting and other agricultural technology infrastructure, an incentive for training in agriculture, participatory and on-going capacity building for farmers, on drought resistant and short duration high yielding crops development, integration of indigenous and modern knowledge systems on climate change adaptation, strengthening of the extension services, and encouragement for the formation of farmer groups. It is a challenge for policy makers to integrate future climate predictions into their policymaking now, particularly when they are already faced with imminent and certain threats to food security in the present (FSA, 2012).

Challenges include how to integrate responses to poverty and hunger with international calls for action to improving climate change adaptation in developing country communities, while assessing which populations are most at risk and where they are. At the same time, there may be more contextualized and

definitive responses to climate change that tap on indigenous knowledge systems (Bruinsma, 2009).

Comaroff (1985) expresses with great concern that discrimination based on legal and institutional factors limit women ownership and inheritance of land hence allocated a small portion of land to till as compared to their counterparts. Though countrywide allowed owning property legally, traditions and customs still deny them of their entitlements of ownership thus experiencing low productivity in farming. They lack information on how to operate and use new technology, and on land issues including on getting funding. To raise productivity in farming, especially using field extension female workers, some basic training and extended services are to be put in place. By-laws down pinning women access to production should be diminished. "Actions must be technically relevant and be suited to the socio cultural and religious precepts of the farming community and the resources of the community."

Impact climate change and food production underscores the fact that government and civil society's interventions to promote and sustain food security in Bakgatla of Moruleng village must necessarily be a factor in the challenges brought by weather long term patterns. It also emphasizes urgent stakeholders to develop a national policy and strategy aimed at helping men and women food producers adapt to this global phenomenon. In developing this strategy, it is important to target the emerging changes in the climate. These are the small agricultural

producers, especially women farmers, living in the poorest districts of the province in Moruleng (Ellis, 2000b).

Hertel, Burke and Lobell (2010) suggest that greenhouse plantations could benefit women farmers a great deal. It should be a house enabling size that could allow a person to enter for watering purposes and feeding the plants.

According to Garí (2001), internationally it is of great concern for women farmers to get together aiming to train and workshop each other. For instance, to cope with climate change, Sub-Saharan African groups have developed effective measures of handling seeds, mitigation and using the adaptation process for protecting available food. Recommendations are that women farmers should exchange ideas as well as drought tolerant seeds to see if they can survive during climate change. Mali for example, has the Fonio plant that is an ancient African crop that has proved resilient to adverse climatic changes. It is drought resistant and can grow in low fertility soils.

Clark, Kristjanson, Campbell, Juma, Holbrook, Nelson and Dickson (2010), predict that food security in the coming decades is threatened by a number of factors whose future trends are uncertain. These uncertainties pose major challenges to research, to policy formulation and to resource management related to food security. Agricultural production and resource management under climate change demand new ways of thinking about risk, about vulnerability and

about resilience. It requires people to question what is needed in terms of policies, institutions and governance to support these changes, rather than to maintain the status quo.

Farmers should develop a self-image as producers of food, custodians and managers of agricultural. There should be governmental contributions to removing international policies and treaties which constrain the free exchange and planting of seeds through intellectual property rights.

5.3 CONCLUSION

Scrutinizing the literature revealed that much has been done on several fronts dealing with the “ghost” of climate change. Its effects have demoralized people and often led to risky decisions having to be made with regards contingent measures. They are not intended to give up but rather keep on trying. Mechanisms should be improved to predict the weather in a more accurate and timely manner, and to quickly disseminate relevant and updated weather information to women farmers (Rundgren, 2011).

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QUESTIONNAIRE

5.4

SECTION A

Demographic characteristics of Respondents. Mark the correct box.

AGE

20-35 ☐ 35-45 ☐ 45-55 ☐ 55-65 ☐ 65-75 ☐

GENDER

Female ☐ Male ☐

OCCUPATION

Employed ☐ Unemployed ☐

MARITAL STATUS

Married ☐ Single ☐ Separated ☐ Divorced ☐ Widow ☐

RELIGIOUS AFFILIATION

Christian ☐ Other, specify _____

LEVEL OF EDUCATION

Primary School ☐ Secondary School ☐ High School ☐ Tertiary ☐

SECTION B

FARM SIZE

Less than 1 hectare ☐ 1-2 hectares ☐ 2-3 hectares ☐

Farming methods used in Moruleng.

1. What are the different farming methods/ practices used on your farm?

Mixed cropping ☐ Crop rotation ☐ shifting cultivation ☐

2. What is the main aim of the above practice(s)?

Home consumption only ☐ Income generation only ☐

3. What are the main farming tools used for cultivation?

Hoes ☐ Spades ☐ Ploughs ☐ Animal traction ☐ Tractors ☐

4. What are the main crops grown in your community?

Maize ☐ Sorghum ☐ Beans ☐

5. What form of fertilizers do you use on your farm? _____.

6. How do you prevent diseases from attacking your crops? _____.

7. Do you receive any form of assistance from the government?

Yes ☐ No ☐

SECTION C

CLIMATE CHANGE CHALLENGES

Have you come across climate change materials or information that is especially useful to women farmers in the area?

What changes have you seen on your farm or around your community those that are as a result of climate change?

Soil erosion or land degradation	☐	Destruction of crops or buildings	☐
Forest fires and animal loss	☐		

What events or disasters are frequently associated with the climate?

What do you think should be done by the government in order to ensure sustainable food security in your area?
