

**VULNERABILITY ASSESSMENT OF AGRICULTURAL DROUGHT
HAZARD: A CASE OF KOTI-SE-PHOLA COMMUNITY COUNCIL,
THABANA MORENA, MAFETENG DISTRICT IN LESOTHO.**

By

Bernard Moeketsi Hlalele

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Study Leader: Mr Johannes Belle

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DECLARATION

I **Bernard Moeketsi Hlalele** hereby declare that the work in this dissertation is the original product of my own efforts. All sources used and discussions made have been acknowledged with complete references. This work is submitted in partial fulfillment of the Master's Degree in Disaster Management and I also declare that this work has never been submitted in any form or anywhere else for any degree.

Signature *B.M. Hlalele* Date 01/02/2015

BERNARD MOEKETSI HLALELE

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DEDICATION

This is dedicated to God Almighty, for His grace in providing me with passion and strength to complete this degree. To my lovely wife, daughter and son, Malithebe Malahleha-Hlalele, Sebatso Precious and Kamohelo Einstein Hlalele respectively, who were my reason for studying this degree to inspire them.

ABSTRACT

Over 80% of Lesotho populations' livelihood is dependent on rain-fed agriculture, and during droughts communities suffer most from the drought impacts. This study's main focus was to assess vulnerability to agricultural drought at Koti-Se-Phola Community Council (CC) in order to determine the conditions of vulnerability and who and what is exposed to drought, to examine coping mechanisms used against drought and to provide relevant decision makers with information on drought for effective interventions. The study followed both quantitative and qualitative methodology where 5 villages were sampled in the study. The selected sample comprised of both working and non-working respondents. The total sample size considered in this study was 102. Questionnaires were distributed to household heads. An interview was held with agriculture official at Agriculture Project at Ha Bofihla for an expert opinion and to validate responses from household members. Data was entered in Microsoft Excel for analysis and SPSSV16 for reliability testing, the Cronbach alpha coefficient was found to be 0.764. From the selected drought indicators, a composite vulnerability index was established.

Main findings of this study were that this community council was found to be vulnerable to drought with emerging issues such as high unemployment, elderly residents whose alternative income is old-age pension at M450 a month. Government responses to drought were found to be inadequate. Very few livestock especially cows were used for draught power in ploughing. However, many have devised means to cope with drought, through stockpiling of maize stalks, feeding of *lekhale* and *torofeiye* as well as chicken droppings to cows during droughts. Socially, some members have been sent away for job seeking and others picked up piece jobs as shepherds to reduce food consumption and pressures in the families. The general Agricultural Vulnerability Index was 0.4874. Suggestions were made by the respondents that employment-generating and poverty alleviation projects be put in place such as, the installation of irrigation systems at Makhaleng River and agricultural conservation projects to harness soil erosion. Given the current drought vulnerability situation, the researcher strongly recommends diversified livelihoods such as increased agricultural conservation where unskilled community members would earn a living in dry spells.

KEY WORDS: Agricultural drought, Vulnerability, disaster, coping capacity

TABLE OF CONTENTS

	PAGE
DECLARATION	ii
ACKNOWLEDGEMENT	iii
DEDICATION	iv
ABSTRACT	v
TABLE OF CONTENTS	vi
LIST OF FIGURES	x
LIST OF TABLES.....	xi
LIST OF ACRONYMS AND ABBREVIATIONS	xii
CHAPTER 1: ORIENTATION OF THE STUDY	1
1.1 INTRODUCTION	1
1.2 SIGNIFICANCE OF THE RESEARCH	2
1.3 BACKGROUND AND RESEARCH PROBLEM	2
1.4 DESCRIPTION OF STUDY AREA.....	3
1.5 OBJECTIVES OF THE STUDY	5
1.5.1 Main objective	5
1.5.2 Sub-objectives	5
1.6 RESEARCH METHODOLOGY	5
1.6.1 Research Design	5
1.6.2 Population and sampling	6
1.6.3 Data collection	6
1.6.4 Data analysis	7
1.7 LIMITATIONS.....	7
1.8 ETHICAL CONSIDERATIONS	8
1.9 CHAPTER OUTLINE	8
CHAPTER 2: LITERATURE REVIEW AND CONCEPTUAL FRAMEWORK.....	10
2.1 INTRODUCTION	10
2.2 DEFINITION OF TERMS.....	10
2.2.1 Drought	10
Meteorological drought	10

Hydrological drought	11
Agricultural drought	11
Socio-economic drought	11
2.2.2 Hazard	12
2.2.3 Vulnerability	12
2.2.4 Susceptibility	13
2.2.5 Exposure	13
2.2.6 Coping capacity	14
2.2.7 Adaptive capacity	14
2.2.8 Resilience	14
2.2.9 Preparedness	15
2.2.10 Mitigation	15
2.3 DROUGHT VULNERABILITY AND SUSTAINABLE DEVELOPMENT	15
2.4 RELATIONSHIP BETWEEN DISASTER RISK, HAZARD, COPING CAPACITY AND VULNERABILITY	16
2.5 FACTORS CONTRIBUTING TO VULNERABILITY TO DROUGHT	17
2.6 DROUGHT VULNERABILITY ASSESSMENT	18
2.7 EXPOSED AND SUSCEPTIBLE ELEMENTS TO DROUGHT	19
2.8 COPING CAPACITY AND MITIGATION AGAINST DROUGHT	21
2.9 DROUGHT RISK MANAGEMENT	23
2.9.1 Drought preparedness and planning	23
2.9.2 Land use planning	24
2.9.3 Risk mapping	25
2.10 DROUGHT MANAGEMENT POLICIES AND LEGISLATIONS	25
2.10.1 International drought management, policies and legislations	25
2.10.2 Lesotho drought policies and legislation	29
2.11 INTERNATIONAL IMPACTS OF DROUGHT	32
2.12 DROUGHT MANAGEMENT IN LESOTHO	35
2.13 CONCEPTUAL FRAMEWORK (BBC VULNERABILITY MODEL)	37
2.14 APPLICATION OF THE BBC MODEL TO THE STUDY AREA (MAFETENG DISTRICT)	39

2.14.1 Hazard	39
2.14.2 Exposed and vulnerable elements	39
2.14.3 Coping capacities against drought in Mafeteng district.....	41
2.14.4 Drought preparedness measures	41
2.14.5 Emergency management	42
2.14.6 Intervention System	42
2.15 SUMMARY	43
CHAPTER 3: RESEARCH METHODOLOGY	45
3.1 INTRODUCTION	45
3.2 RESEARCH DESIGNS	45
3.3 SELECTION OF INDICATORS AND THEIR CHARACTERISTICS	45
3.4 SAMPLING	47
3.5 DATA COLLECTION.....	48
3.5.1 DATA COLLECTION TOOLS	48
3.6 DATA ANALYSIS	49
3.7 VALIDITY AND RELIABILITY	49
3.8 ETHICAL CONSIDERATIONS	50
CHAPTER 4: DATA ANALYSIS.....	51
4.1 INTRODUCTION	51
4.2 DEMOGRAPHICS OF THE RESPONDENTS.....	51
4.3 EXPOSED ELEMENTS	53
4.4 COPING CAPACITY	62
4.5 ADAPTIVE COPING MECHANISMS	68
4.6 DROUGHT INTERVENTION SUGGESTIONS.....	69
4.7 AGRICULTURAL DROUGHT VULNERABILITY INDEX	71
4.8 SUMMARY	77
CHAPTER 5: CONCLUSION AND RECOMMENDATION	79
5.1 INTRODUCTION	79
5.2 SUMMARY OF THE FINDINGS	79
5.2.1 Exposure to drought.....	79
5.2.2 Coping capacities	79

5.2.3 Vulnerability conditions to drought	80
5.3 CONCLUSION.....	80
5.4 RECOMMENDATIONS	81
5.5 RECOMMENDATIONS TO THE GOVERNMENT	81
5.6 DIRECTION FOR FURTHER STUDIES	81
5.7 CONCLUDING REMARKS.....	82
REFERENCES	83
APPENDIX A: A permission letter to conduct the study	92
APPENDIX B: Ethical clearance letter	93
APPENDIX C: A Letter from the editor	94
APPENDIX D: Questionnaire	95

LIST OF FIGURES

	PAGE
Figure 1.1: Mafeteng District Community Councils.....	4
Figure 2.1: Relationship between hydrological, meteorological and agricultural drought... 12	12
Figure 2.2: BBC Vulnerability Model.....	38
Figure 4.1: Home Language	51
Figure 4.2: Household size distribution by frequency	53
Figure 4.3: Households with agricultural field.....	54
Figure 4.4: Main source of water	55
Figure 4.5: Education level.....	56
Figure 4.6: Waterborne diseases.....	56
Figure 4.7: Loss of human life in dry periods.....	58
Figure 4.8: Employment status	59
Figure 4.9: Loss of income due to droughts impacts	60
Figure 4.10: Water quality	62
Figure 4.11: Drought warning to the public	63
Figure 4.12: Conservation agriculture methods implemented.....	64
Figure 4.13: Other sources of livelihood other than rain-fed agriculture.....	65
Figure 4.14: Planting of drought-tolerant crop cultivars	66
Figure 4.15: Good rangelands management system.....	67
Figure 4.16: Community members struggling for water from taps at Ha Konote, Thabana Morena.....	67
Figure 4.17: Fodder stockpiling from different villages at Koti-Se-Phola Community Council (CC).....	68
Figure 4.18: Mr Matea’s cabbage field at Ha Bofihla Thabana Morena.....	69
Figure 4.19: Abandoned community Vegetable Project at Ha Ngoae.....	69
Figure 4.20: Eroded fields between Ha Ngoae and Khubetsoana, Thabana Morena and Maralleng respectively	70

LIST OF TABLES

	PAGE
Table 1.1: Chapter outline	8
Table 2.1: Sectors and people most at risk of drought.....	20
Table 2.2: Lesotho vulnerable sectors and associated vulnerability.....	21
Table 2.3: Sectors in Lesotho and their adaptation measures to climate change	31
Table 2.4: Drought impacts across the world and their consequential damages.....	32
Table 2.5: Adaptation measures in Lesotho in various sectors	36
Table 2.6: The percentage distribution of the economically active population by District, Employment Status and Sex- 2011/2012 CMS.....	40
Table 4.1: Distribution of gender by age	51
Table 4.2: Marital status	52
Table 4.3: Distribution of main animal population	54
Table 4.4: Migrated household members to other places	57
Table 4.5: Water conflicts during dry periods.....	57
Table 4.6: Animal feed price increase over last two years	58
Table 4.7: Household income level per month	59
Table 4.8: Food production decline over 2 years.....	60
Table 4.9: Serious soil erosion in the communities' fields.....	61
Table 4.10: Loss of traditional medical plants	61
Table 4.11: Public awareness by government	62
Table 4.12: Government response to drought and the extent of response.....	64
Table 4.13: Livestock insured against droughts impacts.....	65
Table 4.14: Summary of both coping and intervention strategies at Koti-Se-Phola.....	70
Table 4.15: Normalisation vulnerability equations.....	71
Table 4.16: Selected drought indicators and their description.....	73
Table 4.17: Raw selected indicators data per village and their functional relationships vulnerability	75
Table 4.18: Normalized indicators scores.....	76
Table 4.19: Various stages of vulnerability.....	77

LIST OF ACRONYMS AND ABBREVIATIONS

ADVI	Agricultural Drought Vulnerability Index
AIACC	Assessment of Impacts and Adaptation for Climate Change
BOS	Bureau of Statistics
DMA	Disaster Management Authority
DRM	Disaster Risk Management
DRR	Disaster Risk Reduction
FAO	Food and Agriculture Organisation
IFRC	International Federation of Red Cross
IPAL	Integrated Project in Arid Land
IRIN	Integrated Regional Information Networks
ISDR	International Strategy for Disaster Reduction
LDC	Least Developed Country
LMS	Lesotho Meteorological Services
LVAC	Lesotho Vulnerability Assessment Committee
NDF	National Drought Fund
NDMP	National Disaster Management Plan
NGO	Non-Governmental Organisation
NSDP	National Strategic Development Plan
UN	United Nations
UNDP	United Nations Development Programme
UNDPCC	United Nations Development Programme Climate Community
UNECA	United Nations Economic Commission for Africa
UNESCO	United Nations Educational, Scientific and Cultural Organisation
UNFCCC	United Nations Framework Convention on Climate Change

UNICEF	United Nations International Children's Emergency Fund
UNISDR	United Nations International Strategy for Disaster Reduction
WFP	World Food Programme
WHO	World Health Organisation

CHAPTER 1: ORIENTATION OF THE STUDY

1.1 INTRODUCTION

Drought and desertification are serious challenges and threats that are facing sustainable development in Africa and these have far-reaching negative consequences on human health, food security, economic activities, physical infrastructure, natural resources and the environment (UNECA, 2008). In 2011, the Horn of Africa needed humanitarian assistance following drought that affected 13 million people (Action Aid, 2011). Lesotho has not been an exception and although Lesotho's per capita income has increased, poverty is still one of the major challenges facing this country, which is attributed to adverse effects of drought on agricultural production since agriculture is the backbone of Lesotho's economy (African Development Bank Group, 2013:8).

In a report by the Lesotho Department of Planning (2008), whose title was "*the Compilation of Crucial Information for the Mafeteng District*", Koti-Se-Phola was found to be a community council with the highest percentage, namely 7.8%, of people that needed food aid (Department of Planning, 2008:12). This council has 2 754 households with an average size of 7 people per household. In terms of the number of the households that have Agricultural plots, it ranks number three with 2158 plots in total and with an average plot of 1.6 hectares per household in the district (Department of Planning, 2008:12). This council is one of the largest in terms of agricultural land ownership which, when hit by drought is likely to affect people in large numbers. The current study aims at assessing drought vulnerability in Koti-Se-Phola, Mafeteng, Lesotho, using both quantitative and qualitative methods of research in order to; provide relevant decision makers and NGO's with information; and to determine groups at risk and the coping mechanisms of communities and to suggest strategies to improve on the current coping mechanisms on drought. This chapter presents the significance of the study, background and research problem, description of the study area, objectives, research methodology, research design, population and sampling, data collection, data analysis, limitations and ethical considerations.

1.2 SIGNIFICANCE OF THE RESEARCH

FAO, (2011) shows that drought is considered the most severe cause of food shortages in developing countries, and most reports and research in Lesotho indicate Mafeteng as a poor district and the most vulnerable to climate change in the country. However, none of these studies are drought-specific and approach vulnerability assessment in this district from community council level. Vulnerability is said to be dynamic in nature varying from one place to another over a specific period of time (Birkmann, 2006:9). In the light of the above statements, the current study assessed the vulnerability conditions at Koti-Se-Phola community council since there is little information from the previous research studies on drought vulnerability assessment on this same community council. Moreover, results from this study can be used by government and authorities in planning against drought and building of community resilience to drought.

1.3 BACKGROUND AND RESEARCH PROBLEM

In 2012, the Prime Minister of Lesotho Thomas Thabane declared a state of emergency due to food crisis in Lesotho and made an appeal to the international community for assistance (WFP, 2012). It is reported that more than a third of the population was in a food crisis and about 230 000 people were judged to be more vulnerable to hunger since the maize production, the country's staple food, was negatively impacted upon by drought; it was also estimated that domestic agricultural production would contribute less than 10% of the annual national cereal requirements for the years 2012/2013 (WFP, 2012). In 2011 and 2012 Lesotho experienced more than a 70% drop in domestic agricultural production due to late rains and floods (UNICEF, 2013:2). The report states that Mafeteng was one of the four districts that were mainly affected. *"I have come here today because we don't have enough food at home," says Masenate Bereng, a mother of four. "This is the second year in a row that we haven't had a good yield from our land. This year the rains came too late."* (WFP, 2012:1). Red Cross Food security officer, Debra Nkoane-Pokothoane said that a project in conjunction with the Ministry of Forestry and Land Reclamation and the District Disaster Management Team was initiated in Mafeteng district's worst affected villages which benefited over 800 people in the district. People were given food (50kg maize meal, four litres of cooking oil and 8kg beans every month) for work done by planting trees (Maphathe, 2013). This project lasted only four months (Maphathe, 2013). Despite

this intervention, the project provided a short-term relief to community members leaving a question of sustainable development, as to how these affected community members will sustain their livelihood throughout the prolonged drought period and beyond. The current study assesses drought vulnerability at Thabana Morena Constituency, particularly at Koti-Se-Phola community council, in Mafeteng District, in order to assess the drought vulnerability conditions of Koti-Se-Phola community, determine groups at risk, analyze their coping mechanisms and suggest mitigation strategies to drought impacts. These will provide relevant decision makers and NGO's with information for improvement on systems or intervention to manage droughts in the area.

1.4 DESCRIPTION OF STUDY AREA

Lesotho is a lower-middle income country comprising an area of 30,000 km² and it is ranked number 158 out of 186 countries according to 2012 UNDP Human Development Index. (WFP, 2013). Lesotho is said to be one of the most vulnerable countries to drought with Mafeteng being one of the districts that is hard-hit by prolonged erratic seasonal rainfall patterns (WFP, 2013). Lesotho is divided into ten administrative districts; Maseru, Berea, Leribe, Butha-Buthe, Mokhotlong, Thaba-Tseka, Qacha's Nek, Quthing, Mohale's Hoek and Mafeteng (fig. 1.1). Moreover, Lesotho is further categorized into four distinct agro-ecological zones namely: lowlands, foothills, mountains and Sengu River Valley. These zones are characterized by distinct differences in climatic and ecological conditions. Mafeteng district comprises mainly lowlands and only a small portion consists of foothills. In these zones, the top soil is sandy and susceptible to both wind and water erosion due to overgrazing (BOS, 2010:1). Lesotho has a temperate climate with very cold winters and hot summers. Temperatures get down to -7 °C in the Lowlands in winter. The yearly precipitation is between 600 and 1 200 millimetres in the Lowlands whereas the annual precipitation in the country is between 700 and 800 millimetres. This large variance in rainfall leads to periodic droughts (BOS, 2010:1). The districts are further subdivided into 128 district councils. Mafeteng District is subdivided into twelve community councils, namely; Koti-Se-Phola, Makaota, Makholane, Malakeng, Malumeng, Mamantsi'O, Monyake, Mathula, Metsi-Maholo, Qibing, Ramoeletsi, and Tajane. Koti-Se-Phola is found in the south of this district and is partly lowlands and foothills. Within this community council area, there is the Makhaleng River which runs in close proximity to Maholong and Ha Masupha villages. The secondary school enrolment in Mafeteng district in the years 2008, 2009 and 2010

stood at 10.4%, 11.4% and 10% respectively (BOS, 2010: 26). In 2011/2012 the unemployment rate in the second quarter for Mafeteng district was 16.1% for people aged 15-64 (BOS, 2013:4). The majority of the communities in Lesotho depend on agriculture for a living, which when hit by drought leaves communities in food insecure conditions. Koti-Se-Phola is made up of 41 villages from which the study sampled information (Department of Planning, 2008:11). Mafeteng district has a population of about 192 977 out of which the Koti-Se-Phola community council has a total population of 12391 people. In this community council, there are 6119 and 6274 men and women respectively. 7.8% of this population receives food aid. Members of the community receive agricultural support from the Ministry of Agriculture and NGO's (Red Cross, World Vision and Catholic Relief Services). In terms of trade and commerce, there are 48 cafes, 2 supermarkets and 6 bars with no banking facilities (Department of Planning, 2008: 11- 18).The figure below shows the location of the study area.

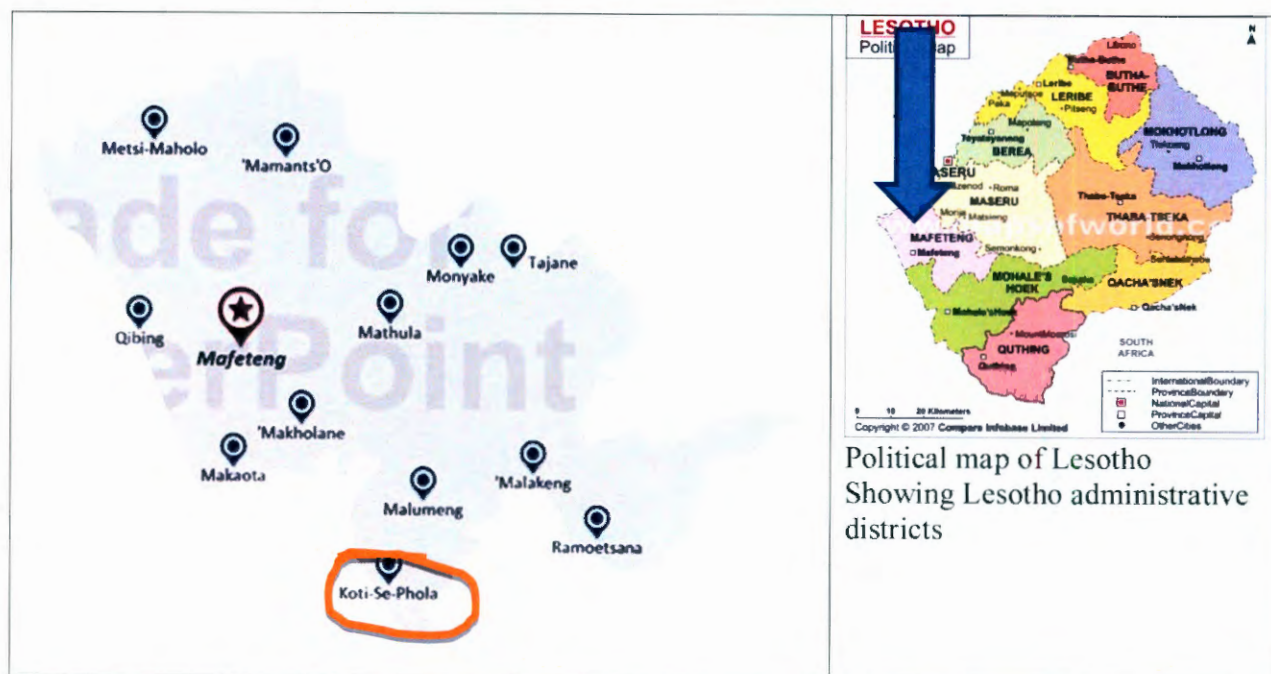


Figure 1.1: Mafeteng District Community councils
Source: Google map, 2014

1.5 OBJECTIVES OF THE STUDY

The objectives of this study are such that there is a main objective and sub-objectives

1.5.1 Main objective

To assess the drought vulnerability conditions of Koti-Se-Phola community and suggest strategies to improve their coping capacities.

1.5.2 Sub-objectives

To determine what and who is exposed and susceptible to drought

To determine and examine the effectiveness of the coping mechanisms of the community to drought conditions

To provide relevant decision makers with information regarding vulnerability conditions for possible better interventions measures

To determine the extent of vulnerability to agricultural drought at this study area through vulnerability index calculation.

1.6 RESEARCH METHODOLOGY

Research methodology is defined as a way to solve research problems systematically and there are various logical steps involved (Young, 2014:30). Under this section the following sub-headings are discussed; research design, population and sampling, data collection, data analysis, limitations and ethical considerations.

1.6.1 Research Design

This study followed a mixed-methods research design but was predominantly quantitative in nature. The quantitative research is advantageous in that findings can be generalised and replicated on many populations and predictions can be made from the information obtained. Data collection and analysis are relatively quick, when dealing with large samples (Anon., 2013). However quantitative designs are limited in terms of getting in-depth understanding of the phenomenon, therefore this will be coupled with qualitative design to cater for this gap. According to Creswell *et al.*(2011:70), qualitative research is an inquiry process of

understanding where the researcher develops a complex, holistic picture, analyses words, reports views of information, and conducts the study in a natural setting. The authors continue to say that the goal of qualitative research is to explore and understand a central phenomenon, which is the concept or process explored in a qualitative research study. This study needed an in-depth understanding of drought vulnerability conditions in Koti-Se-Phola community council in Mafeteng Lesotho and thus applied qualitative approach as well.

1.6.2 Population and sampling

Probability sampling was used in this study in which all elements in the population has a known, non-zero probability of being chosen, and the selection of these elements was purely random (Creswell *et al.* 2011:172). Cluster sampling was used where all 41 villages that fall under Koti-Se-Phola community council were considered as clusters, and was followed by simple random sampling to select the sample in terms of the villages. From the villages, an equal number of households were selected for data collection. Five (5) villages were randomly selected and from each village 21 household heads were also selected for the study. This council consists of 2 754 households out of which 98 are statistically appropriate to be 90% confident at 5% significance level. However, 102 households in total were selected to cater for a non-response rate. Out of 102 households two (2) respondents came from Thabana-Morena Agricultural Project and Sehlabeng, from a commercial farmer respectively for an expert opinion. Details of how the sample size was determined are reflected in Chapter Three.

1.6.3 Data collection

Data was collected by means of closed-ended questionnaires which enabled the researcher to easily analyse these data statistically in a short space of time. With closed-ended questions, less literate respondents were not at a disadvantage and there are fewer irrelevant or confused answers to questions (Anon, 2014). Moreover, because of financial constraints this method of data collection was the most appropriate to this study area since villages are spatially distanced from each other. Another method that was used for data collection was through observations. The strength of observations was that it gave the researcher direct access to social phenomena under study because they allow a researcher to observe and record the social behavior in order to avoid problems such as improper answering of questions (University of Strachclyde, 2014).

Interviews were also used in the collection of data. Dapzury and Shrivastava (2014), state that qualitative research interviews are aimed at describing the meaning of the main themes of the subject under consideration. The main aim of the interview is to understand the meaning of what interviewees say (Dapzury and Shrivastava, 2014). These interviews were only used to validate responses from respondents. Therefore only questionnaires and observations were used in data collection. A few open-ended questions were included in the questionnaire to capture qualitative data.

1.6.4 Data analysis

The collected data from questionnaires was analysed by descriptive statistics data analysis methods in which frequency and percentage distributions were used to display data. Data was analysed by using Microsoft Excel and SPSS. The collected data had been generated from drought vulnerability indicators chosen by participatory-relevant criterion, whose basis is on easy understanding and interpretation by policy and decision makers. This criterion asserts that indicators must be understood by users and be easily interpreted by common users since the majority may not be experts on the subject matter (Birkmann, 2006:11). The indicators from the three spheres of vulnerability to drought were chosen based on the BBC model, and as well as those of coping capacity. Moreover, qualitative data was analysed in themes that arose from the answers by respondents.

1.7 LIMITATIONS

Mafeteng district is divided into twelve community councils one of which is Koti-Se-Phola and consists of 41 villages in all. This study was therefore limited to only Koti-Se-Phola community council because of financial constraints and spatial location of the villages. The study was therefore further limited to only five (5) villages that were randomly selected from a population of 41 villages. Finally, the selected drought vulnerability indicators were given equal weighting in which case there is a likelihood of bias in the results. Due to the above-stated sampling, the results are only indicative not definite.

1.8 ETHICAL CONSIDERATIONS

The researcher asked for permission from the community leaders and village chiefs to conduct the study in the chosen communities. The project was verbally explained to both leaders and community members. The researcher also stressed that participation was not compulsory and participants could withdraw at any stage. Privacy and confidentiality was maintained to ensure that all information obtained during the study was not released to the outsiders where it might have had embarrassing or damaging effects. The identity of the household members was not under any circumstances revealed. Plagiarism was avoided through proper referencing.

1.9 CHAPTER OUTLINE

Table: 1.1: Chapter outline

CHAP TER	CHAPTER TITLE	CHAPTER CONTENT OVERVIEW
1	Orientation of the study	This chapter gives the study background which includes: Introduction, statement of the problem, Significance of the study, Description of study area, Objectives, Research Methodology, Research Design, Population and sampling, Data collection, Data analysis, Limitations and Ethical considerations.
2	Literature review and conceptual framework (BBC Vulnerability model)	This chapter presents a literature review from text books, internet, research reports, journals and other publications on: drought definitions and its types, definition of terms, drought vulnerability and sustainable development, relationship between disaster risk, hazard, coping capacity and vulnerability, factors contributing to drought vulnerability, drought vulnerability assessment , exposed and susceptible elements to drought, coping capacity and mitigation against drought, drought risk

		management preparedness, drought management, conceptual framework (BBC vulnerability model) and application of the BBC model to study area.
3	Research methodology	This chapter presents a detailed description of sampling methods, data collection, data analysis, validity and reliability and ethical considerations and a selection of drought indicators.
4	Data analysis	This chapter presents data analysis procedures used and details of the findings of the research. The findings are interpreted and data explained with the help of tables, frequencies and statistical information.
5	Conclusion and recommendations	This chapter gives the summary of the findings, draws conclusions based on both the literature review and the empirical investigation and makes relevant recommendations

CHAPTER 2: LITERATURE REVIEW AND CONCEPTUAL FRAMEWORK

2.1 INTRODUCTION

In this study the literature review was organised thematically with the purpose of reviewing the research done to date on this topic and establish the gaps that are needed to be filled by the current study. This review focused on research methodologies used in past research, that is, whether qualitative or quantitative methods were used in order to situate the current study. Vulnerability is said to be dynamic in nature, it varies with time and location, therefore the researcher found it necessary to review the research work in different locations at various times (Birkmann, 2006). The areas covered under this section include: definitions of terms related to the study, drought and sustainable development, relationship between disaster risk, hazard, coping capacity and vulnerability, factors contributing to drought vulnerability, exposed and susceptible elements to drought, coping capacity against drought, impacts of drought on communities, effects of drought on food security, drought vulnerability reduction measures and international drought policies to mention but a few. At the end of each theme reviewed, a conclusion was drawn that links the reviewed literature with the current study through the gap identification. The BBC framework for assessing vulnerability was discussed and applied to the selected study area.

2.2 DEFINITION OF TERMS

2.2.1 Drought

Drought is broadly defined as a deficiency in precipitation over a specific period of time leading to water shortages for some activities, groups and environmental sectors (UN/ISDR, 2007:5). However, drought is also defined further according to meteorological, hydrological, agricultural and socio-economic criteria.

Meteorological drought

Meteorological drought is defined as a short period of drought or dry spell when precipitation is far below the normally expected (Spasov *et al*, 2006:8). In a rain seasonal forecast conducted by

Lesotho Meteorological Services (LMS) in May to September 2010, Mafeteng district recorded the lowest cumulative rainfall compared to Qacha's Nek (Lesotho Meteorological Services, 2010). In December 2013, Mafeteng also had the lowest average number of rainfall days compared to the rest of the other districts in the country (Lesotho Meteorological Services, 2013).

Hydrological drought

Hydrological drought is defined as lack of runoff water into rivers, other surface water resources and into groundwater resources (Spasov *et al*, 2006:9). In 2007 springs and boreholes in populated areas in Lesotho dried up and the Department of Rural Water Supply showed also that about 60% of the boreholes dried up as a result of drought in 2007 (Consolidated Appeal Process, 2007).

Agricultural drought

Agricultural drought refers to insufficient soil moisture to sustain plants and livestock resulting in impaired growth and reduced yields (FAO, 2008:6). In 2006/2007 the average yields of maize and sorghum in Lesotho decreased by 42% due to severe drought in that year (FAO, 2007).

Socio-economic drought

Socio-economic drought refers to when human activities are adversely affected by reduced water availability and precipitation (FAO, 2013). Due to a severe drought experienced by Lesotho in the year 2006/2007, casual labour stopped and hence income earnings and opportunities to procure food from the markets declined (FAO, 2007).

From the above drought definitions, agricultural drought which is the focus of this study, is defined as lack of soil moisture to support agricultural activities (livestock and crop production). Figure 2.1 below shows the link between types of drought and their causes.

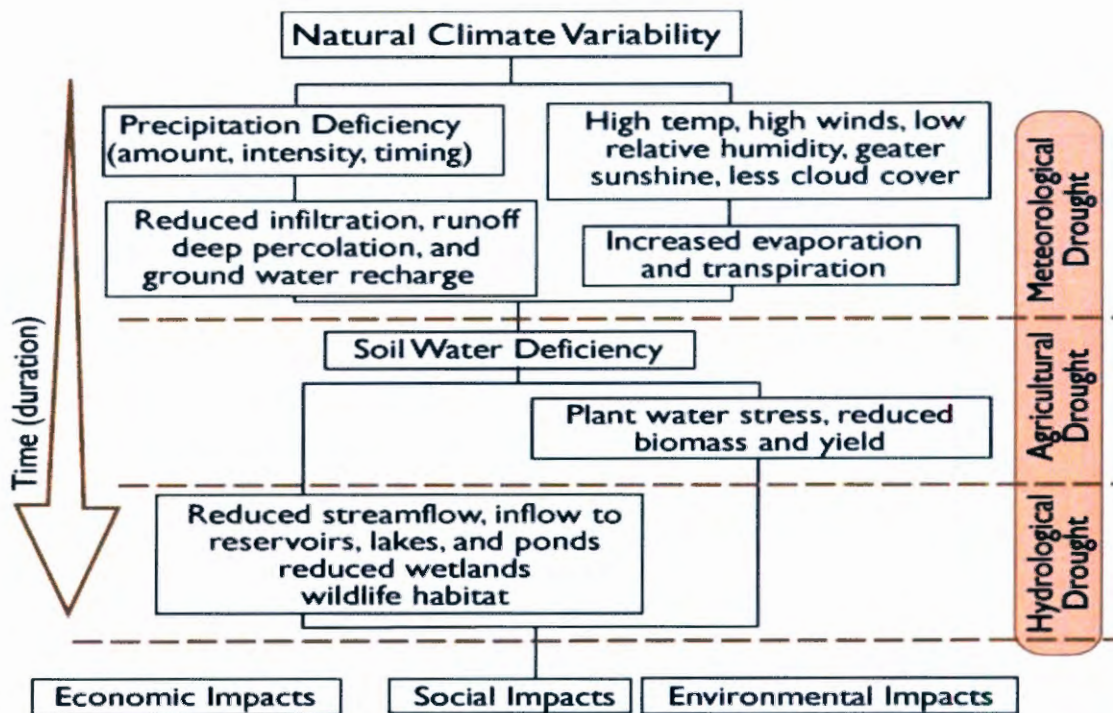


Figure 2.1: Relationship between hydrological, meteorological and agricultural drought
Source: UNISDR, 2009

2.2.2 Hazard

Hazard is defined as a dangerous phenomenon, substance that may have a harmful effect on human life, cause damage to property, negative impacts on health, cause disruption of social and economic activities and damage to environment as well as loss of livelihoods and services (UNISDR, 2009b). Drought is a natural hazard but which can be initiated by improper human activities. The food crisis in Lesotho in 2009 was increased by amongst other issues periodic droughts which led to crop failures, excessive soil erosion, declining rangeland conditions and chronic poverty (IFRC, 2009:1).

2.2.3 Vulnerability

Vulnerability refers to characteristics or conditions of a community or a system or asset that make it susceptible to damaging effects of hazards and these can come from various aspects such as social, economic and environmental factors (UNISDR, 2009b). According to IFRC (2008) vulnerability is defined as the diminished capacity of a group or individual to resist, cope with, and recover from adverse effects of natural or man-made hazard. Vulnerability refers to an inability to resist a hazard or respond to disasters when they happen and this depend on several

2012:12). Soils have lost fertility through soil erosion brought about by drought in Lesotho in which Mafeteng district is one of the most adversely affected. Livestock is also exposed to dangers of drought in Lesotho.

2.2.6 Coping capacity

This refers to the ability of people, systems, and organisations to manage adverse effects of disasters with the available skills and resources and this requires continuing awareness, resources and good management at all times, during normal times and especially during crisis periods (UNISDR, 2009b). The Department of Agricultural Research and its partners in Lesotho are currently engaged in the promotion of conservation agriculture in which workshops were held for extension officers and farmers on the best practices, such as no burning of residues as firewood from the last years' harvest. Planting dates are also used as strategies in mitigating adverse effects of climate changes such as drought; the conservation of traditional livestock and crops, crop rotation and intercropping of leguminous crops as a source of nitrogen and production of drought resistant varieties and cultivars are the options considered (Ministry of Energy, Meteorology and Water Affairs, 2013).

2.2.7 Adaptive capacity

Adaptive capacity is defined as the ability of a system to adjust to extreme climate changes to moderate potential damages in order to take advantage of opportunity or cope with the consequences (Care, 2001). According to Mekbib *et al.* (2011:30) in a study in Lesotho, respondents showed that they used mulching as a way of moisture conservation and some constructed small dams for irrigation during dry periods as well as avoidance of burning plant residues in order to retain moisture.

2.2.8 Resilience

This refers to the ability of a system, or community exposed to hazard to resist, recover from, accommodate and absorb adverse effects of hazards in a timely and effective manner (UNISDR, 2009b). Dorcas Aid International, (2013) called for proposals from other NGO's that work on alleviation and reduction of vulnerability to droughts to work in Lesotho and three South African

provinces to help in decreasing vulnerability to drought through increasing drought preparedness and resilience.

2.2.9 Preparedness

Preparedness is defined as skills, capacities by government, professional organisations, individuals and communities to anticipate, respond to and recover from hazards or negative impacts (UNISDR, 2009b). After the 2012/2013 food crisis in Lesotho caused by floods following drought, volunteers and subsistence farmers were trained in preparation for any future droughts and communities in Mafeteng district were encouraged to use drought tolerant crop seeds as a measure to prepare for adverse effects of drought (IFRC, 2013).

2.2.10 Mitigation

Mitigation is defined as the lessening of adverse effects or impacts of disasters (UNISDR, 2009b). The Department of Agricultural Research in Lesotho has embarked on conservation agriculture (CA), though at its infancy stage, that minimally disturbs the soil as a strategy to mitigate adverse effects of drought on people's livelihoods (Ministry of Energy, Meteorological and Water Affairs. 2013).

2.3 DROUGHT VULNERABILITY AND SUSTAINABLE DEVELOPMENT

Disasters have a potential to destroy development inputs in a very short period of time, which have been made over a number of years and can also delay future development due to loss of resources. These resources may need to be shifted to places of emergencies for response thereby retarding investment (Reed, 1997:15). Developments on the other hand, can increase vulnerability to disasters, for instance: when developments occur, population density increases, thereby increasing development of hazardous sites, environmental degradation, technological failures and imbalance of pre-existing natural or social systems (Reed, 1997:15). However, disasters do not only have negative effects but can also set a platform for new developments in that after disasters new buildings that adhere to building codes may be erected, hence creating a political and social atmosphere of acceptance for change. International aid is focused at the affected areas by disasters that finally results in development. In Kenya, after prolonged drought periods in the 1970s and 1980s national and international efforts were directed towards former

pastoralist populations in Marsabit district by organisations such as Catholic Church and Africa Inland Mission in settling nomads and developing small towns, while international efforts were effected by UNESCO's Integrated Project in Arid Lands (IPAL) through focusing on a range of conservation and improvement of livestock marketing. The sedentarization of pastoralists led to better access to education, health care and other social services as well as contributing to rural proletarianization and economic differentiation. Currently the situation in Kenya is such that the local economies are a combination of subsistence pastoralism, livestock marketing and wage-labor showing the process of sedentarization (Fratkin, 2007). In a study by Peduzzi *et al.* (2009) on global exposure and vulnerability towards hazards in which drought was amongst the selected hazards, it was found that human vulnerability had a direct link with a country's development and the quality of the environment. In Lesotho, the British Red Cross, in collaboration with Lesotho Red Cross, provided help to Basotho who were in desperate need of food; such assistance lasted for two days, in four districts in which Mafeteng district was one of districts affected (British Red Cross, 2013). One of the Lesotho government development goals in "Lesotho's Vision 2020" objectives is that, Lesotho shall have a healthy and well-developed human resources base, a well-managed environment, a strong economy as well as an established technological base. In his inaugural speech the Prime Minister Thomas Thabane affirmed that the government will commit itself to the goals as set out in the National Strategic Development Plan (NSDP); two of which are the reduction of vulnerabilities and reversing environmental degradation and adapting to climate changes (World Bank, 2014). From the above it can be deduced that Lesotho focuses on short-term responses rather than seeking a permanent or close to permanent solution to disaster response, which in turn may result in social development, through creation of jobs and other economic activities for sustainable development like countries such as Kenya.

2.4 RELATIONSHIP BETWEEN DISASTER RISK, HAZARD, COPING CAPACITY AND VULNERABILITY

From the equation below, it can be seen mathematically that only the presence of both hazard and vulnerability constitute disaster risk. This further says that hazard is directly proportional to disaster risk as well as vulnerability, which means that an increment in hazard and vulnerability results in a greater disaster risk. Hazard is said to normally include latent conditions that

represent future conditions that threaten and are of different origins ranging from geological, hydro-meteorological, biological and human induced (ISDR, 2002:96). Capacity has an inverse relationship with disaster risk; increased capacity has a reduced effect on disaster risk. Finally reducing vulnerability reduces disaster risk, which is the focal point of this study through vulnerability assessment to sensitize authorities to intervene through resource mobilisation and sustainable strategies in view of improving the quality of life of community members.

Disaster Risk = Hazard x Vulnerability/Coping Capacity (ISDR, 2002)

2.5 FACTORS CONTRIBUTING TO VULNERABILITY TO DROUGHT

Drought leads to both water and food shortages which finally is likely to have adverse effects on the economy, environment and health impacts on the population (WHO, 2014). The following are factors that influence drought impacts: demographic pressure on the environment, food insecurity, agricultural dependent economic systems, poor infrastructure (irrigation, water supply and sanitation systems), poor health status of communities before disasters, time of the year (the most critical being before the harvest), lack of warning systems, population displacement and other concurrent situations such as political instability, economic crises and conflicts (WHO, 2014). According to Reed (1997:100), drought is more severe in dry areas that have a limited amount of rainfall. There are also physical factors such as soil moisture retention, timing of the rain that influence the degree of crop loss during drought periods. Vulnerability is also increased by dependency on rain-fed agriculture, livestock-dependent communities with limited grazing territories and exhaustion of coping mechanisms that may lead to population displacement. Similarly, UNFCCC (2011), states that there is a lack of adaptive capacity and stable prosperous economy to respond to natural hazards in the Least Developed Countries (LDC). In a study undertaken by Swain and Swain (2011:55) in Western Orissa in India it was found that factors that contributed to drought vulnerability were amongst others, categorized into biophysical and socioeconomic with biophysical including rainfall variability, drought intensity and lack of water-holding capacity of soils; while socioeconomic includes low irrigation development and poor crop insurance coverage. The study again showed that there were lower coping capacity levels compared to levels of drought risk and vulnerability. Similarly, Lesotho is said to be chronically food-aid dependent with over 80% of the population dependent on rain-fed

agriculture for their livelihoods. The Department of Social Welfare is providing assistance to most vulnerable groups in the country, in which regular food transfers are made to school children, expectant mothers and lactating mothers, terminally ill individuals and chronically food-insecure people. This has been going on for a period of over 20 years (UNDP, 2014). Though vulnerability factors from various regions are almost the same, Lesotho's drought-vulnerability contributing factors can be summarized as poverty levels, health wellbeing of individuals and dependency on rain-fed agriculture.

2.6 DROUGHT VULNERABILITY ASSESSMENT

In his study, on drought preparedness, impact and response, Ngaka (2012) found that there was an inadequate support of the extension services with regard to early warning systems in the Eastern Cape and Free State provinces in South Africa. Vulnerability increases more in the absence of early warning systems, hence disaster risk. In another study, whose objective was to assess drought vulnerability in Western Iran, it was revealed that the farmers vulnerability was mainly influenced by economic, socio-cultural, psychological, technical and infrastructural factors, which are the main pillars in sustainable development (Kiumars *et al.* 2012:122). They further state that in comparison, some farmers were more vulnerable than others, which suggested that they needed intervention prior to others. Though this study was only quantitative in nature similar to the proposed study, it was carried out in Iran in 2012, in which case the results from the proposed study are likely to be different because of the fact that vulnerability is dynamic in nature and time-specific. Similarly, in a study by Jordaan *et al.* (2011) on drought risk assessment for extensive farming in the Northern Cape Province, one of the findings was that climate change was not the cause of drought but poor management of natural resources, such as over-grazing. Charusombat *et al.* (2011) assessed hydrological vulnerability in India where quantitative methods were used in order to rank regions in terms of vulnerability indices found that other regions were more vulnerable than others. However this study only relied on quantitative methods which only lead to lack of in-depth understanding of the phenomenon under study. According to Anjum *et al.* (2012) who carried out a study in Pakistan on the assessment of vulnerability, the extent and characteristics of drought hazard results indicated a continuing vulnerability to drought that was brought about by lack of contingency plans. In order to reduce this vulnerability, an integration of the available drought monitoring tools was essential

for Pakistan. Moneo (2005) conducted a study on drought vulnerability in Spain and Morocco also with the aim of ranking them in terms of which one is most vulnerable and suggests measures for mitigation. The indicators used were selected from human, institutional, economic and environmental components of vulnerability. However, findings revealed Morocco more vulnerable than Spain. This study followed quantitative methods in which drought vulnerability were used to rank regions. All the above studies are similar to this study in methods though different in countries with different economic levels. Alcamo, (2008) and Wang *et al.* (2013) both carried out studies in China which had the same purpose of assessing drought vulnerability following quantitative methods using Environmental Policy Integrated Climate model (EPIC); however none of these studies assessed drought vulnerability using a BBC model, therefore the current proposed study finds its way both methodologically and in location.

2.7 EXPOSED AND SUSCEPTIBLE ELEMENTS TO DROUGHT

Krömker *et al.* (2008) found that Indian households were most vulnerable to drought compared to Russian households. However, a study undertaken in Western Iran showed farmers being the most vulnerable to drought impacts which were mostly influenced by economic, socio-cultural, psychological, technical and infrastructural factors (Zarafshani *et al.* 2011: Zarafshani, & Sharafi, 2012). This is in agreement with a study undertaken in Maharashtra in India which also indicated that the most exposed and vulnerable elements to droughts and poverty are poorer households (Vatsa & Krishna, 2006). According to Dow (2010), the following were recognized as susceptible and exposed sectors: agriculture, livestock, water supplies to tourism and recreation, businesses, manufacturing and households. Conversely, women and children were identified as susceptible elements, through their health and nutrition respectively compromised by drought (Rossi *et al.*, 2005). In Lesotho, the Department of Social Welfare provides assistance to the most vulnerable groups: elderly people, war veterans, orphans, disabled persons and chronically ill people. The elders, assisted by a non-contributory universal old-age pension are those above the age of 70 years and many of these elders are caregivers to orphans (UNDP, 2014). The above findings can be summarized as follows:

Table: 2.1: Sectors and people most at risk of drought

What is exposed/susceptible element?	Who is exposed/susceptible to drought?
Agriculture	Women Children
Businesses	Farmers
Water supplies to tourism and recreation	Disabled persons Orphans
Spring water sources	Elders
Livestock	Ill persons
Manufacturing firms/businesses	

Source: UNDP, 2014

In addition to the above table, table 2.2 shows vulnerable sectors again but with associated vulnerability.

Table: 2.2: Lesotho vulnerable sectors and associated vulnerability

Vulnerable Sectors	Vulnerabilities
Water Resources	Ground water resources are negatively affected by shortened rainfall season. This will result in inadequate annual recharge of aquifers, lower water tables and drying up of springs. In the mountains, the wetlands are drying up affecting reliability of perennial streams.
Agriculture	Crop production is adversely affected by reduced rainfall and frequent drought occurrences. Drought and high temperatures exacerbate incidences of diseases and pests. Resultant crop failures lead to famine and food shortages.
Forestry	Rural communities depend on biomass fuels as a major energy source. The resilience and regenerative capacity of forest resources are negatively affected by extreme climatic conditions. A decrease in forestry resources negatively impacts on the stability of energy supplies for both cooking and heating.
Livestock & rangelands	Livestock production is deteriorating due to degradation of rangelands. The net effect is increased livestock mortality rate and quality of livestock products. Extreme weather conditions are conducive to disease and pest incidences.
Culture	The natural heritage and culture of the Basotho is closely linked to the environment. Their housing, clothing, medicine and other traditions are affected by climate change.
Health	Frequent drought occurrences result in limited availability and quality of water leading to disease outbreaks compounded by famine and malnutrition.
Energy	Climate change induced drought affects the generation of hydropower.
Soils	Climate change affects soil cover (range and forest resources) negatively. Soil erosion, desertification and land degradation are increased by incidences of drought and flooding. The end result is loss of soil fertility.

Source: Lesotho Meteorological Services, 2009:6

2.8 COPING CAPACITY AND MITIGATION AGAINST DROUGHT

According to Van Riet (2012) who undertook a study in 2012 in the Dr Ruth Segomotsi Mompoti District Municipality of the North West Province in South Africa, it was found that commercial farmers sold older cattle in order to buy fodder and feeds to feed younger and stronger ones. However others used pots, buckets, bowls and baskets to harvest water for use in times of drought. He continues to say that others used the “*Motopi*” tree which was cut down and ground for feeding. Rotational grazing was one of the strategies used by some people and others

took water to the cattle instead of them walking over long distances to accessible water sources. Over and above these strategies, some participants got rid of foreign shrubs which had negative consequences on the environment. Erasmus *et al*, (2012) state that the following are mitigation strategies for drought: promoting diversified livelihood, communities must not only depend on livestock but other strategies such as trade markets. For instance, they report that Moyale district in the Eastern Province in Kenya has this kind of market that attracts regional and international customers because of its location at a cross-border point. This market infrastructure reduced the dependency of communities on livestock and livestock products. Poor pastoralists who did not have capital and were handicapped by long distances were not able to access these markets hence creating more vulnerability pressure on them. A switch to drought-resistant livestock is another mitigating strategy that was exercised at Moyale district in Kenya; camels, renowned for their drought-resistance ability were kept mainly for their nutrient-rich milk (Erasmus *et al*, 2012). Regarding rangeland management, communities understood the difference between different traditional grazing practices, such as controlled grazing that helps in avoiding trampling and destruction of grazing areas. For conflict mitigation, traditional peace committees were organized where members of the community discussed and agreed on solutions to the conflict. With regard to increment in water availability, in Kenya there is a Water User Association which regulates the use of water and has increased the number of dams and underground tanks for use in dry seasons (Erasmus *et al*, 2012). In a study by Ndlovu, (2011) on coping strategies to drought, it was found that some household members skipped some meals, reduced the amount of food they used to eat, spent the entire day without food, ate unusual fruits, fed on premature crops, adults skipped meals in order to spare for the children, and assets and livestock disposal in exchange for food. However not all the strategies mentioned above may apply in Lesotho because of its geographical location, for instance, “*Motopi*” trees grow well in desert areas, in Lesotho there might be other trees, shrubs, and or vegetation that are used in times of drought such as prickly pear trees (*torofeiye*) and aloes.

Livestock dependent communities diversify their herds, by increasing animal numbers in good time as insurance against drought. After the 1984-5 and 1987 drought-famine, Ethiopia developed a national disaster plan that incorporated disaster preparedness to sustainable development through capacity building of the nationwide network. Various disaster reduction

projects were initiated for members of the communities to have diversified sources of income (Reed, 1997:102). The above preparedness strategies are in line with those Ndlovu (2011) found in his research in Zimbabwe when people ate less than they normally consumed and sold their assets. During droughts prices may be stabilized and food subsidies be provided. Water shortage is addressed by water rationing or curbing usage for non-drinking purposes. Communities are assisted with food through supplementary feeding schemes (Reed, 1997:103). The most dominant good practices in drought risk management are as follows: an integrated development approach that is centered around water/ land resources management practices, use of indigenous knowledge with communities, community awareness about drought-related issues, community-led participatory approach and use of community organisations where farmers form groups and there are water user associations to deal with sustainable natural resource management and diversification of livelihoods that include crops and livestock varieties and other income generating activities (Venton, 2012:25).

2.9 DROUGHT RISK MANAGEMENT

This refers to practices to lessen or transfer adverse effects of drought hazards and some other potential impacts of disasters through activities and measures for mitigation, preparedness and prevention (UNDP, 2014). The following are some of the activities used in drought risk management:

2.9.1 Drought preparedness and planning

Droughts must be planned for, in order to prevent and reduce impacts rather than focusing on relief assistance. The planning should however, use the existing political and institutional structures. The first step into drought planning is the establishment of a National Drought Commission. This plan should have the following components: a monitoring component that assesses the present and future water availability and moisture conditions, an impact component, this component mainly determines the economic sectors mostly affected by drought and how assistance may be targeted; lastly, a mitigation and response component that designs long-term programmes to reduce vulnerability and adverse effects of drought (Reed, 1997:102). Pereira *et al.* (2009:60) stress that predictions or forecasts regarding future shortages of water leading to drought would be of great importance in helping water managers and users to adjust their

controls as well as their activities in conserving water before drought hits, which will result in water availability during droughts. They continue to say that even short-time predictions are helpful in alerting water managers and policy and decision makers to enforce preparedness measures both before and post-droughts. The key point in dealing with drought effectively is drought preparedness. Preparedness for droughts necessitates institutional capacity at all government levels as well as more efficient coordination between various levels of the government. On the other hand, preparedness has the ability to increase the coping capacity of both individuals and communities (Sivakumar & Wilhite, 2002). A 10-step drought planning processes, which is used in the United States and can be used in any country at all levels of the state is as follows:

- Appoint drought task force
- State the purpose and objectives of the preparedness plan
- Seek stakeholder participation and resolve conflicts
- Inventory resources and identify groups at risk
- Develop organizational structure and prepare the drought plan
- Identify research needs and fill institutional gaps
- Integrate science and policy
- Publicize the drought plan, build public awareness
- Teach people about drought
- Evaluate and revise drought preparedness plan

Source: National Drought mitigation Center, 2014

2.9.2 Land use planning

According to Reed (1997:102), drought puts pressure on the land which leads to soil erosion, and other environmental degradation effects. Land use must be properly planned for, planting of grass and leguminous crops greatly prevent soil erosion. Animal stocking rates must be kept at appropriate proportions to the availability of pastures and water resources. Communities must be encouraged to plant drought-resistant crops and develop water reservoirs. On the other hand, land use planning when well done is able to contribute to three of the millennium development goals namely; *Goal 1: Eradication of extreme poverty and hunger*, this is through ensuring that sufficient land is reserved for food production; *Goal 3: Promote gender equality and empower*

women, land use planning gives a good opportunity for women to be involved in the planning and decision-making and thereby empowering them to take over responsibility in their communities and as a result, this is an effective contribution to sustainable development; and *Goal 7: Ensure environmental sustainability*, land use planning ensures environmental protection and rehabilitation of resources (Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ), 2011).

2.9.3 Risk mapping

Regions should be mapped in accordance with their levels of vulnerability and coping capacities. This aids targeting of areas that desperately need food relief assistance (Reed, 1997:102). In a study in Guatemala villagers and municipal technicians were brought together in a workshop where risk-prone areas for disasters were identified as well as infrastructure and production areas identified and marked as risk areas. This information was then at the municipality's disposal to make appropriate planning of infrastructure and protective measures at large against disasters (Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ), 2011).

2.10 DROUGHT MANAGEMENT POLICIES AND LEGISLATIONS

The following section focuses on drought management policies and legislation in various countries as well as those in Lesotho. According to FAO, (2014) drought management policies normally include the following sub-sections: drought resilience policies, early warning systems, drought contingency planning, rehabilitation measures, relief measures and drought mitigation measures.

2.10.1 International drought management, policies and legislations

Drought policy can take various forms ranging from, legislative acts, planning documents and other related programmes, or just an informal understanding amongst collaborators (UNISDR, 2009a:26). Policy drafted must have a clear set of principles, clear objectives and/or guidelines for the purpose of risk mitigation, preparedness, livelihood rehabilitation, response and early recovery. With its clear operating guidelines, a drought policy should aim at governing mitigation and management of drought and its impacts towards a preparedness plan development in order to achieve the set objectives (UNISDR, 2009a:27).

According to a study by Ye *et al*, (2012), on China's drought disaster risk management, the study revealed that the policies were appropriate for responses but there was a need to put more focus on the prevention measures to ultimately reduce adverse effects of drought rather than focusing on responses and recoveries.

In its history, India has experienced the most disastrous famine droughts and the following are some of the drought management practices that were used (Reeds, 1997:104):

Operation of early warning system - rains from June to September are closely monitored, the conditions of reservoirs and groundwater levels are also monitored. Early warning systems are set to enable response to a drought long before indicators occur.

Drought preparedness measures - communities are involved in the planning of drought management and relief. Institutions such as health-care, veterinary care, water resources and disaster management assistance get ready to provide their services during droughts.

Water conservation - India budgets for water during drought and additional water sources are developed for areas with chronic shortages.

Stabilizing crop production - alternative plans are developed to save crops from dying out, through planting of alternative crops, use of seed reserves, measures set to improve production on irrigated areas as well as during non-traditional seasons.

Assurance of access to food - surveys are conducted to identify areas and families with the greatest caloric deficiencies and hence food supplies are distributed to such families. The national Food Security System avails grain at reasonable cost and stabilizes market prices.

Preservation of famers' assets - to help famers from selling their livestock, fodder is transferred from places with surplus to places with a deficit. The Indian Government creates employment generation schemes to the rural communities in order to stabilize incomes.

In Australia, the national drought policy was developed in 1992, which focused on self-reliance hence minimizing government interventions through the promotion of pro-active risk management strategies. This policy put more focus on disaster preparedness rather than on disaster response. The Rural Adjustment Scheme (the main agricultural programme) was given

authority to decide when and which area needed financial aid and this scheme's focus was on improving risk management and encouraging farmers to have financial reserves in times of droughts (UNISDR, 2009a:32).

In the United States, there has never been any drought plans post 2006; it was only in 2006 that thirty-seven states had drought plans. However, the majority of these plans focused on drought response instead of drought mitigations (UNISDR, 2009a:32). Regarding Mozambique, in 1980 the government established a department of Prevention And Response to National Disasters that provided humanitarian assistance and coordinated disasters response and worked closely with provincial and local structures as well as NGOs and donors. There is still no formal drought policy in place as yet, the policy that guides the institutional arrangements and disaster management and other related issues is still under way (FAO, 2004). The majority of the above mentioned countries do not focus their efforts on drought preparedness and mitigation; however, preparedness and mitigation are proactive measures rather than reactive. The reactive measures result in huge amounts of costs in rehabilitation and reconstruction. Only the United States focuses on drought response, this is probably because of its stable economy and availability of resources. Moreover, Mozambique also focuses on drought response instead of preparedness and mitigation, in which case costs are likely to be higher than when focus was on preparedness and mitigation.

According to UNISDR, (2009a:30) in Uganda, the National Disaster Risk Reduction and Management Policy shifted its focus from relief and was directed towards disaster preparedness, mitigation and response. Districts authorities and, institutional frameworks were capacitated and strengthened in order to assess, coordinate and respond to disasters. Drought risk reduction is given high priority as its adverse effects can negatively impact on the general economy and human social well-being. However, it was found that the National Disaster Risk Reduction Policy had some gaps, especially in preparedness, resilience and prevention. The Department of Disaster Management, (2011:50) in Uganda also states that Uganda needs to strengthen both its disaster risk reduction (DRR) and disaster risk management (DRM) against climate change risks that include drought and the available legal and institutional framework for DRM is mostly on emergency response, not necessarily on risk reduction. It was during the 2010/2011 rainfall deficit that gaps in the framework were identified highlighting the need to increase

mainstreaming of DRM into policies and programmes at both local and national levels throughout all sectors.

In 1995, the Namibian government established a task force to draw up the national emergency and long-term drought management policy which made several consultations from the year 1996 until 2005 when the national drought policy was endorsed. The policy focused on developing a sustainable approach to drought management through shifting the responsibility from the government to farmers through financial assistance and food insecurity interventions only in extreme drought disaster cases (UNISDR, 2009a:31). The national drought policy in Namibia has drought-specific objectives against adverse effects of drought (UNDPCC, 2009). These objectives are as follows:

- To ensure that household food security is not compromised by droughts
- To support farmers and encourage them to be self-reliant to drought risks
- To minimize natural resources degradation during droughts
- To enable agricultural sectors and inhabitants a fast recovery from drought disasters
- To protect Namibians' health status against effects of drought
- To efficiently and effectively finance drought relief programmes through the establishment of an independent and permanent National Drought Fund (NDF)
- To preserve adequate reproductive capacity in livestock herds in affected areas during drought periods

The above objectives in this study were used as benchmark of what drought-specific objectives are supposed to be. Much time was spent by the South African government in the development of a cohesive national drought policy that directed its focus on drought planning with several stakeholders, and as a result, a new drought policy was established, that strove for assisting farmers with finance, protecting natural resources and promoting the best use of resources for individual farmers. In this policy farmers are supposed to adhere to specific resource conservation measures such as grazing capacities, in order to qualify for financial assistance. In 2002, agricultural risk insurance was developed in South Africa, the main aim of which was to supplement the most vulnerable agricultural producers of livestock and crops to natural disasters. However, the greatest challenge has been the maintenance of the policy, especially when it comes to large agricultural enterprises (UNISDR, 2009a:31).

2.10.2 Lesotho drought policies and legislation

Poverty Reduction Action Plan 2006/7-2008/9 views climate change as a major source of poverty in Lesotho with a need of adaptation and mitigation measures (Machepha, 2010:15). Climate change is the main cause of drought, in which case drought causes a decline in crop yields, increase in food insecurity and depletion of water resources for human use, hence leading to poverty (Venton, 2012:1). According to the International Fund for Agricultural Development (IFAD) (2008) about 70% of the people live in the rural areas of Lesotho of whom more than one quarter is extremely poor due to unemployment and lack of income. Therefore a reduction in poverty leads to increased resilience to hazards such as drought.

National Adaptation Programme Of Action 2007 puts the country's adaptation as a priority need in order to provide a mechanism to reduce the adverse impacts of climate change, simultaneously enhancing adaptive capacity of the most vulnerable communities to adverse effects of disasters (Machepha, 2010:15). Similarly, adaption moderates drought impacts (UNISDR, 2009b: 4).

Environmental Act 2008 this act aims at the promotion of sustainable and health environment and reduction of carbon emissions and preservation of biodiversity, wetlands and trees which aggregate to mitigation measures (Machepha, 2010:15). Similarly, drought also impacts negatively on peoples' health and safety , for example: when people suffer from anxiety or depression due to economic losses brought about by drought (National Climate Data Center, 2014). Therefore promotion of health reduces impacts caused by drought and other climatic hazards.

Lesotho Water and Sanitation Policy 2007 and Water resources act 2008 both enable the management of water in a sustainable and trans-boundary manner and with a strong focus on water harvesting (Machepha, 2010:15). In this policy, it is stated that one of the strategies to ensure that water is available, is to develop and implement drought relief strategies as well as flood management measures for risk reduction and effective mitigation of impacts (Ministry of Natural Resources, 2007:2).

Disaster Management Act No. 2 of 1997

This Act states that the established Disaster Management Authority (DMA) shall act as the central planning, coordinating, monitoring institution for the disaster management and post-disaster recovery. DMA will also warn the public of the coming disasters which will also include their effects on the country. The DMA is given a mandate to formulate disaster preparedness, mitigation and responses strategies and action plans in consultation with the central, local government and NGO's and donor agencies (Disaster Management Act No.2 of 1997). In this Act a disaster is defined as a progressive or sudden, widespread or localised, man-made or natural event such as drought and others, therefore public warnings, disaster preparedness and mitigation include drought in particular. The Lesotho Disaster Management Act requires the DMA to plan and respond to drought disasters in cooperation with the lead ministries of Agriculture, Forestry and Land Reclamation and Energy, Meteorology and Water Services.

Vulnerability and adaptation policies in Lesotho

Lesotho has developed adaptation measures and strategies to address climate change issues whose objectives are: to enhance agricultural productivity, planting of trees, improvement of nutrition, accessing reliable and user-friendly sources of energy, arresting land degradation through appropriate use of water management and conservation measures and reduction of insects, pests and diseases (Ministry of Energy, Meteorological and Water Services, 2013:21). Climate change is defined as a change in climate as a result of human activities that alter global atmosphere composition and it is also brought about by climate variability over a certain period of time (UNFCCC, 2014). Climate change causes the progressively increase in frequency and severity of drought events (Carnicer *et al*, 2011:1474). Therefore reduction of and adaptation to climate change effects minimise frequency and severity of drought events. The following table depicts sectors in Lesotho and their adaptation measures to climate change as suggested by the above policy.

Table: 2.3: Sectors in Lesotho and their adaptation measures to climate change

Sector	Adaptation measures
Agriculture	Intercropping (Machobane system) Water collection and conservation for vegetables Allocation of land and planting of high value crops (e.g. mushrooms) .Planting of drought-resistant cultivars
Water resources	Rehabilitation of degraded wetlands .Clear policies to improve pastures and grazing lands to avoid persistent degradation of wetlands. Enforcement of Local Government Act to control water usage in urban areas
Forestry	Drought and pest tolerant trees Education and awareness campaigns on fire management strategies
Livestock and rangelands	Identification and strengthening of indigenous African (Sanga) breeds such as nguni, tuli, mashona which are disease and drought tolerant
Soils and land degradation	Afforestation, re-grazing, and conservation agriculture
Health	Development of surveillance and monitoring systems for health-related adverse conditions Promote roof water harvesting practices and conservation dams. Integration of drought in health policies and strategies

Source: Ministry of Energy, Meteorological and water services, 2013:21

Lesotho is mostly affected by the following hazards that are exacerbated by climate change: drought, floods and snow. As climate varies, high temperatures result in leading to increased

evaporation and finally to meteorological drought as depicted in figure 2.1 above. As these temperatures increase, water is lost from soil too, and plants wilt hence agricultural drought. From the above policies and legislation, Lesotho has a strong focus on sustainable development but drought does not explicitly feature in the development plans and policies previously developed and there is no drought policy in Lesotho; however, the only efforts that are underway are those for making climate change specific policies and strategies to support development partners (Ministry of Energy, Meteorological and Water Services, 2013:21). The above discussed policies are not drought-specific but address drought with other hazards under climate change.

2.11 INTERNATIONAL IMPACTS OF DROUGHT

The following table shows drought impacts across the world and their consequential damages:

Table: 2.4: drought impacts across the world and their consequential damages

Mortality and well being	In Mozambique, 1 040 deaths were reported by the National Disaster Center, and 18 deaths were reported in an international report. In the rural households, drought consequences resulted in increased poverty, reduced human development, adverse health impacts and increased income inequalities between 1990 and 2009.
Rural livelihoods, food security and agricultural production	In the Caribbean, there was a reduction in agricultural yields in tomatoes, onions, and bananas in 2009-2010. In Australia in 2003-2004, there was a loss of 2.4 billion in agricultural and economic sectors. In India in the 2002 drought, 29 million tons of grains were lost. In Mozambique, in 1990, 11.5 million people

	<p>were affected by drought which damaged 8 million hectares of crops.</p>
<p>Urban and economic development</p>	<p>In Zimbabwe, in 1992 there were 3 000 agriculture job losses valued at \$100 million.</p> <p>In the United States, 24 nuclear power reactors were threatened in 2008. There was lack of water for cooling systems.</p> <p>In France, in 2003, there was a reduction of 20% in hydroelectric production due to droughts</p> <p>Losses in production of crops, dairy and livestock and fisheries</p> <p>Loss of national economic growth and development</p> <p>Income losses from tourism and recreational business</p> <p>Loss of hydroelectric power and increased energy costs</p> <p>Loss of industries related to agricultural production</p> <p>Decline in food production and increased food prices</p> <p>Unemployment from drought-related production declines</p> <p>Revenue losses to government and increased strain on financial institutions</p>
<p>Migration and social effects</p>	<p>In the Syrian Arab Republic, the 2007-2009 droughts forced 1 million people to migrate to cities.</p> <p>In Mexico, in the twentieth century, half the rural population migrated to urban areas and</p>

	<p>other consequences were: increased debts, reduction in food consumption, unemployment, poor health status and increase in female-headed households and a change in public women responsibilities</p> <p>Food shortage effects (malnutrition, famine)</p> <p>Loss of human life from food shortage or drought-related conditions</p> <p>Conflict between water users</p> <p>Health problems due to reduced water flow</p> <p>Inequity in the distribution of drought impacts and relief assistance . Decline in living conditions in rural areas</p> <p>Increased poverty, reduced quality of life</p> <p>Social unrest, civil strife</p> <p>Population migration for employment or assistance relief</p>
Conflict	<p>In both India and Bangladesh, during the 1950s, migration increased conflict due successive droughts.</p> <p>In Mauritania and Senegal, in the 1980s and 1990s there existed ethnic conflicts on the borders. Migration and displacements caused by droughts increased competition over scarce resources.</p>
Environment	<p>In Florida, from 1999-2005 100 000 hectares of salt marches were lost.</p> <p>In Spain, forest fires, draining of wetlands and salt water intrusion increased by 63% in comparison with (1991-1995), and some of the drought consequences were habitat effects,</p>

	<p>water bodies effects, species vulnerabilities and migration due to loss of biodiversity and huge river ecological negative effects.</p> <p>Damage to animal and fish species and habitat</p> <p>Wind and water erosion of soils</p> <p>Damage to plant species</p> <p>Effects on water quality (salination)</p> <p>Effects on air quality (dust, pollutants, reduced visibility)</p>
Public spending	<p>In Kenya, about 70% of the population received food aid during 2007-2009.</p> <p>In Southern Africa, 10 countries spent a combined total of \$950 million on food and non-food assistance in 1991-1992.</p>

Source: Wilhite, 1992; UNISDR, 2011

UNDP (1997:101) also shows that adverse effects of drought can be categorized as follows: economic, environmental and social. The table below shows these effects.

2.12 DROUGHT MANAGEMENT IN LESOTHO

In 2012/13, a third of the population of Lesotho was in a serious risk of food insecurity which was due to prolonged drought in the country, and this led the Prime Minister to declare a state of emergency, seeking humanitarian assistance from the international community (WFP, 2012). In 2007, a report by Irin, showed that about 82% of the population of Lesotho living in the rural areas were worst affected by drought, in which case the UN appealed for US\$18.9 million to feed more than 500 000 rural people struggling to cope with food shortages. This was one of Lesotho's worst droughts in 30 years and the staple food (maize) production dropped by over half in comparison to 2006 (Irin, 2007). In some parts of Lesotho, initiatives such as manual conservation agriculture (*Likoti*) where a hoe is used to dig a small hole into which seed, fertilizer and other materials are put for food production, has been a success where the yield has doubled compared to parts where (*likoti*) were not practised (FAO, 2011:53). In a recent study

undertaken in Lesotho Mafeteng district, at Kolo and Ts'akholo by African Technology Policy Studies Network, (2013), it was revealed that farmers needed support from both government and NGO's for improved seeds, training and knowledge sharing. Though this study was conducted in Lesotho Mafeteng, it did not cover Koti-Se-Phola Community Council.

The following table summarizes how drought is managed through adaptation measures in Lesotho in various sectors currently.

Table: 2.5: Adaptation measures to drought in Lesotho in various sectors

	Impacts/sectors	Current adaptation measures
Crop sector		
	Delays in ploughing Crops stagnate in growing Increase in pests, insects Food insecurity and famine	Use of lime and fertilizers Short term reservoirs Conservative irrigation
Health sector		
	Outbreaks of waterborne diseases Poor quality of water Malnutrition	Introducing water purification programmes Sanitary services promotion
Culture sector		
	Medical plants and herbs extinction. Rare wild animals migration. Increased alien species. Decline in biodiversity	Policy reform through Environmental Act of 2001 Conservation and protection of plants
Rangeland and livestock		
	Poor rangelands High livestock death /mortality rates Drying up of water sources	Conservation dams construction Fodder keeping to feed animals

	Poor plants and livestock and their products (yields, wool, mohair and hides) Increased soil erosion and formation of gullies	Promotion of communal grazing systems Livestock registration
Energy sector		
	Water shortages and reduced hydroelectric power	Formulation of energy policy Development and promotion of renewable energy technologies(wind, solar, biogas)

Source: Ministry of Natural Resources, 2011:6

2.13 CONCEPTUAL FRAMEWORK (BBC VULNERABILITY MODEL)

The following section explains the BBC Vulnerability model through which this study was viewed as a conceptual framework. The BBC conceptual framework views vulnerability from three main pillars namely: social, economic and environmental spheres. The BBC Model accounts also for the environmental factors which are said to be difficult to assess. This does not only estimate deficiencies and assessment of disaster impacts but views vulnerability as a dynamic process in which vulnerabilities, coping capacities and potential intervention tools are simultaneously focused on, in order to reduce vulnerabilities (Feedback loop system) (Birkmann, 2006:35). Furthermore, unlike other models that separate coping capacity and exposure, the BBC framework model views vulnerability as susceptibility and a degree of exposure of elements at risk as well as their coping capacities (Birkmann, 2006:35).

This holistic approach links vulnerability reduction with sustainable development; moreover, through this framework problem-solving perspective is enabled by analyzing potential losses and deficiencies of different elements at risk, such as social groups as well as their coping capacities and possible intervention measures all from the three spheres. In this way the importance of being proactive is highlighted by reducing vulnerability before disasters strike. The BBC framework suggests that vulnerability indicators development must address susceptibility and exposure of various elements at risk within the three spheres namely: social, economic and

environment and should identify and assess coping capacities and their potential intervention tools (Birkmann, 2006:36). The following are some advantages of the BBC model; it is easy and takes a step-by-step approach into vulnerability assessment. All three spheres of sustainable development are taken into consideration namely: social, economic and environmental spheres. Vulnerability is reduced before and after the disasters strike which finally suggests an intervention system in order to reduce disaster risks (Simic, *et al.* 2010). The BBC model for vulnerability starts off with the hazard in question which in this study is drought, and then the hazard enters from three spheres namely: environment, social and economic spheres which hit exposed elements. Moreover, in the event that the exposed elements have little coping capacities, the vulnerability to the hazard in question increases leading to social, economic and environmental risks. At this point the BBC model considers preparedness measures to be taken to reduce adverse effects of risks, but when preparedness measures fail to completely reduce vulnerability, it progresses to risks which finally cause disasters which will ultimately need intervention measures to deal with such disasters.

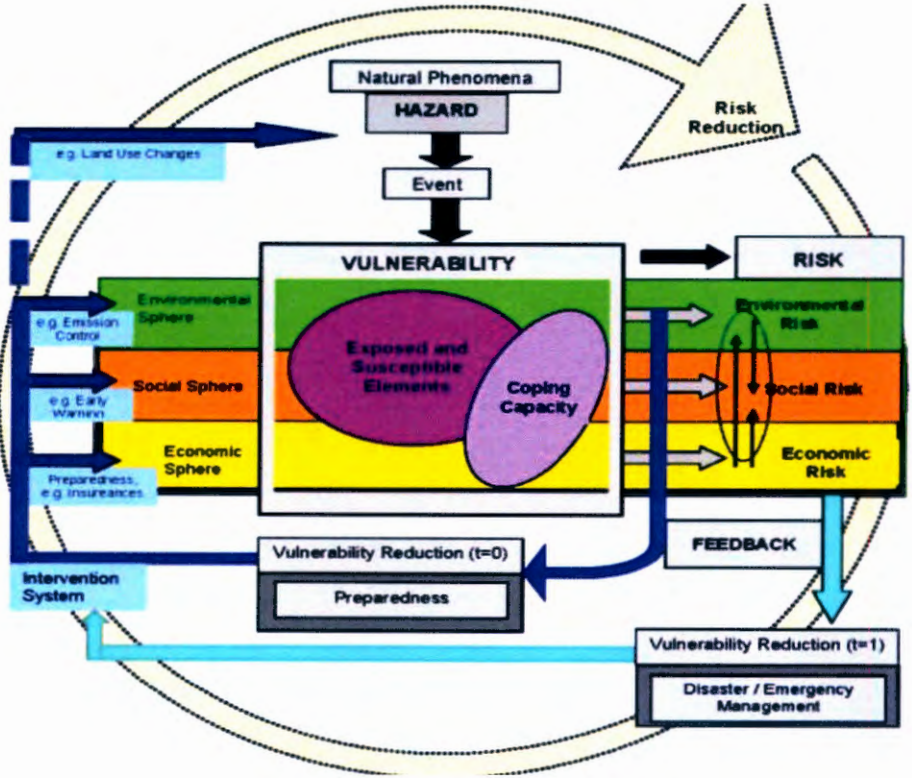


Figure 2.2: BBC Vulnerability Model
 Source: Birkmann, 2006:35

2.14 APPLICATION OF THE BBC MODEL TO THE STUDY AREA (MAFETENG DISTRICT)

The BBC Model has the following components: hazard, vulnerability - that consists of exposed and vulnerable elements and coping capacity, risk management before disasters hit (preparedness), risks that emanate from social, economic and environmental spheres should prepared measures fail, disaster/emergency management and an intervention system. The following is an application of the BBC model in the study area:

2.14.1 Hazard

In this study, the BBC Vulnerability Model starts off with drought as the selected hazard from which vulnerability is assessed.

2.14.2 Exposed and vulnerable elements

In this conceptual framework, vulnerability assessment addresses susceptibility and exposure of elements at risk within the environmental, social and economic spheres (Birkmann, 2006).

Environmental sphere

In Mafeteng district there is much soil erosion, which has been exacerbated by drought. However, the Ministry of Agriculture and Food Security is trying to promote Conservation Agriculture (CA) in which trees and grass are being planted in dongas in order to increase crop yield (African Technology Policy Studies (ATPS), 2013). Though water is found in abundance in Lesotho, drought has had adverse effects on the water quality, therefore there is a challenge to provide clean water to support livestock and human lives especially in Mafeteng district (IFRC, 2014). In Mafeteng, the farmlands and rangelands are degraded and more than 800 farmer were trained in soil and water conservation where demonstrations were given on how to construct small ponds (IFAD, 2014:6). In 2007 to 2011, Mafeteng district received the third lowest rainfall on average of about 696 mm to support agriculture, hence farmers are at risks due to lack of rain for their crops (BOS, 2012).

Social sphere

The majority of household heads involved in farming activities in Lesotho are in the age groups of 50-59, 60-69 and 70+ with Mafeteng district having majorities in these three age groups (BOS, 2013: 5). Basotho elderly people are predominantly females and constitute 61% of the total elderly persons and live in rural areas. Of the 61% females, 12% live alone which puts them at a higher risk of vulnerability to loneliness than their male counterparts (BOS, 2012:12). HIV/AIDS, chronic poverty, food insecurity and climate-related hazards such as droughts and weak governance systems, are Lesotho's major challenges. The HIV adult prevalence rate that is currently estimated at 23.2% places Lesotho among the three worst affected countries in the world and poorest of them all. Certain groups such as women, young adults and children are affected with sexually transmitted infections which are indirectly caused by droughts where women indulge in prostitution in pursuit of a livelihood (UNDP, 2009:5). In the agricultural year 2012/2013, Mafeteng district was number one of the ten districts with 5,821 hectares that were failed due to drought for harvesting hence putting agriculture-dependent farmers at risks of food insecurity (BOS, 2013:15).

Economic sphere

Table: 2.6: The percentage distribution of the economically active population by District, employment Status and Sex- 2011/2012 CMS.

District	Employed			Unemployed		
	Male	Female	Total	Male	Female	Total
Botha buthe	89.5	85.8	88	10.5	14.2	12
Leribe	82.7	81.6	82.3	17.3	18.4	17.7
Berea	88.5	85.1	87.4	11.5	14.9	12.6
Maseru	85.1	81.5	83.5	14.9	18.5	16.5
Mafeteng	81.3	79.3	80.6	18.7	20.7	19.4
Mohale's Hoek	93.3	95.6	94.1	6.7	4.4	5.9
Quthing	89.7	90.2	89.9	10.3	9.8	10.1
Qacha's Nek	92.2	93.9	92.8	7.8	6.1	7.2
Mokhotlong	95.4	93.7	94.9	4.6	6.3	5.1
Thaba Tseka	90.4	90.7	90.5	9.6	9.3	9.5
TOTAL	87.0	84.5	86.1	13	15.5	13.9

Source: BOS (2012)

From the table above Mafeteng district has the lowest percentage of employed people and highest of unemployed people at 80.6% and 19.4% respectively compared to all other districts. Similarly more women in this district are unemployed at 20.7% above all other districts in the country, indicating women as most exposed to drought impacts (BOS, 2012). Unemployment decreases resilience to drought impacts. Female-dominated communities are generally more vulnerable than male-dominated ones, therefore coupled with unemployment the situation becomes worse and such communities become severely prone to the damaging effects of droughts and other hazards (BOS, 2012).

2.14.3 Coping capacities against drought in Mafeteng district

In the year 2007 Lesotho was hit by the worst drought in 30 years which resulted in lack of soil moisture to support plants and animals and more than 1 000 residents and farmers had to sell their goats, sheep, horses, donkeys and hens as a coping mechanism. Some animals were reported to have died (IRIN, 2007). From a total of 5 028 people in 2008, who needed assistance of food aid, 964 of them came from Koti-Se-Phola, putting this community council at the first position. The second highest community council that needed food aid assistance also comprised of 652 people (Department of Planning, Ministry of Local Government and Chieftainship, 2008:10).

2.14.4 Drought preparedness measures

In Lesotho the Disaster Management Authority (DMA) makes forecast for cereal production in the country since this country is often impacted by droughts. The Meteorological services monitors drought and its intensity and issues warnings with DMA, Rangelands Division and Department of Water Affairs (UNDP, 2010:16). A National Disaster Management Plan (NDMP) was adopted in 1996 in which drought was included but no specific drought policies were established because drought is not considered an economic concern in Lesotho (UNDP, 2010:16). Lesotho lacks preparedness measures against drought and other climate change hazards through its Disaster Management Act, which is more response oriented than mitigation-preparedness oriented (UNDP, 2009:8).

2.14.5 Emergency management

Lesotho, through World Vision Lesotho in 2007, began a nutrition education programme for mothers of children identified as malnourished in Maphutseng, Mophale's Hoek district (World Vision Lesotho, 2007). Lesotho bought 47.2 million tons of maize from smallholder farmers from South Africa in response to help the most vulnerable Basotho who were food insecure (FAO, 2013). Lesotho declared a state of emergency in 2012 when over 725 000 Basotho faced chronic food shortages, and Britain provided help in five districts, in which Mafeteng was one of them. This help did not only directly offer food-for-work but also training to lead farmers, Lesotho Red Cross volunteers, care workers and community members (British Red Cross, 2013). The Ministry of Forestry and Land Reclamation, District Management Team and Lesotho Red Cross made a decision to assist Mafeteng community members in soil conservation by providing a food-for-work scheme to encourage them to do more. Activities carried out included the planting of 700 trees, grass planting, stone lines and silt traps built in Thabana Morena Villages that include, Linotsing, Maralleng, Lekoatsa Maserung and Thaba-Tsoeu Ha Shale (Maphathe, 2013). This initiative was able to reach over 800 people.

2.14.6 Intervention System

The intervention system encompasses measures to reduce frequency and magnitude of events as well as vulnerabilities (Birkmann, 2006:36). The following measures are those found in Mafeteng district to reduce drought vulnerability:

Conservation Agriculture

Conservation agriculture normally promotes optimization of yields and profits, at the same time ensuring provision of local and international benefits and services. Conservation agriculture's main pillars are zero tillage and soil conservation practices. Mafeteng district in Lesotho through the Ministry of Agriculture and Food Security and NGOs have embarked on the promotion of conservation agriculture in view of conserving the soil to improve crop production (International Federation of Red Cross and Red Crescent Society, 2006: ATPS, 2013). In a report by Lesotho Vulnerability Assessment Committee in 2013, 223 055 people were found to be at risk of food insecurity due to drought for four (4) months from October/November 2013 to January/February

2014. From these people Mafeteng district was number three (3) in numbers of people that are food-insecure (Lesotho Vulnerability Assessment Committee, 2013). However, one of the key recommendations was that the Ministry of Agriculture advocates a shift to drought-tolerant crops.

Crop diversification

Crop diversification is largely practiced in Mafeteng (UNDP, 2010). Many farmers are extremely aware of the crop diversity and mixed farming (livestock and crops) where farming risks that include climate change, are considered for protection of farming business (FAO, 2011). Large farming enterprises that have different cultivars of the same crop with differing drought and pest resistances are being implemented in Mafeteng district as a way of coping with drought impacts (IFRC, 2006).

Keyhole and Trench gardens

Care Lesotho, a Non-Government Organisation (NGO) has introduced two systems to cope with drought in Lesotho including Mafeteng, and these are Keyhole and Trench gardens (IFRC, 2006). Keyhole garden is a round raised garden that is supported by stones underneath; the first layer is soil that has been leveled covered with multiple layers of locally-made compost such as manure, organic waste, scrap metal, wood ash and others. A trench garden is a garden that is made by digging about 1 metre wide and 1 metre deep, and then filled with organic matter followed by soil till while watering. The organic matter and soil is alternated until the trench is filled (FAO, 2008). These two systems have proven effective with the following advantages: less labour is required, less water requirements, high moisture content, nourishment of soil to produce food for households (Weimer, 2008). Subsequently even the chronically ill, HIV/AIDS infected or, elderly persons are able to benefit from these systems without extensive labour or high costs (UNDP, 2010).

2.15 SUMMARY

In conclusion, the literature review was guided by themes generated from the research topic and other themes that were believed to have a significant contribution in the understanding of

drought vulnerability. The review started with definitions of relevant terms then drought vulnerability and development, which revealed that many countries spent large amounts of money in response to drought impacts which could instead be used to advance development. The link between vulnerability and disaster risk was reviewed where vulnerability has a positive functional relationship with disaster risk. On factors that contribute to vulnerability, poverty, health well-being and rain-fed agriculture dependency were the most evident in Lesotho. Drought vulnerability assessment that was conducted in different countries and regions focused on other types of drought other than the agricultural type; though some used both qualitative and quantitative methods they did not use the BBC vulnerability model as conceptual framework which approaches vulnerability assessment from a sustainable development perspective. Several sectors in Lesotho that range from agriculture, livestock and rangelands to mention a few, are more exposed to drought than others. For coping capacity strategies, several strategies such as diversification of jobs, sparing food for the young ones and eating less food were prominent in some communities; however in Lesotho, some people had no means to cope with drought effects especially Mafeteng district farmers and just waited for future developments regarding assistance. On preparedness and response, Lesotho was found to be more reactive than proactive in addressing drought disasters by providing food parcels for relief other than establishing sustainable development strategies. Moreover, the policies in Lesotho just address drought within the climate change perspective not specific to drought.

CHAPTER 3: RESEARCH METHODOLOGY

3.1 INTRODUCTION

This chapter presents a detailed description of sampling methods, data collection, data analysis, validity and reliability and ethical considerations. It also includes the selection of drought indicators as well as their measurements.

3.2 RESEARCH DESIGNS

Research design is defined as a plan or strategy that first starts off with philosophical assumptions or conceptual framework then to specifying the selection of respondents, data collection techniques and data analysis to be used in the study. However, the type of research design used depends on the researcher's research skills, assumptions and practices which then influence how data is normally collected (Creswell *et al.* 2011:70). Research designs are categorized into three main types; qualitative, quantitative and mixed research designs. Qualitative design is an inquiry process where a researcher conducts a study in a natural setting to develop an in-depth understanding of the phenomenon in question. In contrast to qualitative designs, quantitative designs rely on numerical data to test relationships between variables as well as describing trends from data sets. When used in combination within a mixed methods approach, qualitative and quantitative methods complement each other to allow a complete analysis of the research situation (Creswell *et al.* 2011:256). The current study used mixed methods approach in order to gain a complete analysis of agricultural drought vulnerability situation at Koti-Se-Phola community council.

3.3 SELECTION OF INDICATORS AND THEIR CHARACTERISTICS

There are several definitions for an indicator, however, a general one defines vulnerability indicator as an operational representation of a characteristic that is able to provide information about susceptibility, coping capacity and resilience of a system linked to a hazard (Birkmann, 2006: 57). The selection of vulnerability indicators is dependent on the purpose of the study in question and the research discipline under exploration and finally the application (Dwyer *et al.*

2004:14). Birkmann, (2006:57) stresses that indicators should not just be selected because of relevance and availability only but choice should systematically be based upon a chosen model and such indicators must be linked to the set goals and objectives. The vulnerability indicators development has to be based on some quality criteria so as to support a selection of good indicators (Birkmann, 2006:64). The following list shows standard criteria for indicator development;

- Measurable
- Relevant, representing an important issue of the topic
- Policy-relevant
- Only measuring key elements instead of all aspects
- Analytical and statistically sound
- Understandable
- Easy to interpret
- Sensitive and specific to underlying phenomenon
- Valid and accurate
- Reproducible
- Based on available data
- Data compatibility
- Appropriate scope
- Cost effective

The following drought vulnerability indicators were selected by the above standard criteria chosen with the aid of the BBC conceptual framework which considers vulnerability from, economic, environmental and social spheres.

Social drought vulnerability indicators:

Increased poverty

Human life loss

Population migration

Health problems

Education level

Household size

Economic drought vulnerability indicators:

Crop and livestock production reduction

Farmers' income loss

Increased feed prices

Insurances against drought

Diversified sources of income

Environmental drought vulnerability indicators:

Water quality

Water and wind erosion of soil

Plants damage

3.4 SAMPLING

Sampling is defined as a process, act or a technique that selects a representative of a population for a purpose of characterizing that particular population (Mugo, 2002). Sampling methods are categorized into two broad categories as probability and non-probability (Weiers, 2010:119). The current study has followed a mixed-method research design which is predominantly quantitative in nature, therefore both non-probability and probability sampling techniques were followed. The study started with purposive sampling where the researcher targeted 120 peasant farmers at Koti-Se-Phola council in Mafeteng district. Five (5) villages were randomly selected out of which 21 households per village from which data was collected. These households were also randomly selected. The random sampling was done with the aid of Microsoft Excel that was used to generate and assign random numbers to villages for the study. Two (2) officials from Thabana Morena Agricultural Project were interviewed for expert opinion and one (1) successful commercial farmer in Sehlabeng.

Sample size determination

The sample size for this study was determined from the following formula by (Israel, 2013):

$$n = \left[\frac{Z_{\alpha/2} \sigma}{E} \right]^2$$

Where:

n= sample size

$Z_{\alpha/2}$ = Z-Score at a specified confidence level and at a chosen level of significance α , chosen to be 0.05

σ = standard deviation and

E= Margin of error

Therefore, the chosen confidence level was 90% with a corresponding Z-value of 1.645. The standard deviation for unknown population size is normally estimated at 0.3 with a margin of error of $\pm 5\%$. Therefore, the sample size was calculated to be $n = (1.645 * 0.3 / 0.05)^2 = 97.42 = 98$. To cater for non-response rate, 120 respondents were given questionnaires to complete and only 102 respondents successfully completed the questionnaires.

3.5 DATA COLLECTION

WHO, (2014) defines data collection as an ongoing systematic process that involves analysis and interpretation of data necessary to design, implement and evaluate a prevention programme.

3.5.1 DATA COLLECTION TOOLS

Questionnaire was used as one of the data collection tools. A questionnaire is defined as a data collection instrument that is either filled in by a respondent personally, or administered and completed by a researcher and it may contain closed-ended or open-ended questions (Weiers, 2010:105). Questionnaires provide the following advantages; they are relatively quick in data collection, they offer more objective answers than interviews and large information can be collected through using this instrument (Milne, 1999). In this study, data was collected by

questionnaires that included both closed-ended and open-ended questions to capture quantitative and qualitative data respectively. These questionnaires were administered by the researcher and responses were recorded by the researcher himself. Other information was collected by means of observations on how people coped with drought in feeding their animals and, observations on how affected crops were in the fields. These observations were captured through notes and photographs in order to support the given responses in the questionnaires. The last two questions from the questionnaire were used as interview questions in this study to provide qualitative data to supplement the quantitative data.

3.6 DATA ANALYSIS

Responses from questionnaires were recorded in Microsoft Excel and SPSS was used for analysis. Descriptive statistics were used in analysing quantitative data, and results were presented by frequency distributions, pie charts and bar graphs. The qualitative data were coded and themes were generated to enable analysis. The results were represented in tables.

3.7 VALIDITY AND RELIABILITY

Validity is defined as the extent to which an instrument measures that which it is supposed to measure. Face validity refers to the extent to which an instrument looks valid and normally this is done by experts (Creswell *et al*, 2011:216). For this study, Dr Chikobvu (a senior statistician) was consulted to check and commend on both face and content validity of the questionnaire.

Reliability refers to consistency of a measure to measure the same results repeatedly (Cherry, 2014). Internal reliability which measures the degree of similarity among items that measure one common construct was employed through calculation of Cronbach's alpha coefficient (Creswell *et al*, 2011). The Cronbach's alpha coefficient measures inter-item correlation between items and ranges between zero and one (0 to 1) and if items are poorly formulated, this value is close to zero; on the other hand, if it is close to one, then there is a high degree of internal consistency of the instrument (Creswell *et al*, 2011). The calculated Cronbach's alpha was found to be 0.764, which is slightly above the minimum acceptable value of 0.7 (Reynaldo and Santos, 1999).

3.8 ETHICAL CONSIDERATIONS

A written permission was sought from the regional chief (Chief Makotoko Bofihla) to whom the intention of the study was verbally explained. From there, local chiefs from the selected villages were also consulted and asked for further permission into their villages to conduct the study. The purpose of study was also explained to respondents (household heads) from whom data was collected, and the researcher emphasized that their participation was voluntary and that they had a right to withdraw at any stage in the participation. Respondents were assured that their responses would be confidential and anonymous. Names of the respondents were not reflected in the data collection tool to ensure confidentiality and anonymity. Plagiarism was on the other hand avoided through complete reference of all sources used in the study.

CHAPTER 4: DATA ANALYSIS

4.1 INTRODUCTION

The chapter presents data analysis, and details of the findings of the research. The findings are interpreted and data explained with the help of tables, frequencies and charts. Microsoft Excel was used to record and analyse data then these data was imported to SPSS V16 calculation of Cronbach's Alpha coefficient for reliability testing.

4.2 DEMOGRAPHICS OF THE RESPONDENTS

This section presents the analysis of demographics of the respondents.

Table 4.1: Distribution of gender by age

Age	Female	Male	Grand Total
Below 18	17	10	27
18-24	0	0	0
25-39	11	4	15
40-49	0	0	0
50-59	3	1	4
60+	32	24	56
Grand Total	63	39	102

The table above shows a distribution of gender and age in which the majority of the respondents were females aged from 60 years and above. From this distribution, it can be deduced that this community is vulnerable mainly because of the majority being females. Literature shows that vulnerability increases in ages below 18 and above 65 and high among women than men. Children and older women are not able survive during dry spells (Pine, 2008:145).

The table below depicts marital status of the respondents. Married individuals are more resilient than single, widows, divorced and separated people during dry periods. Husbands are able to look for water for their households over long distances and as such vulnerability is reduced. Therefore from the table below it can be seen that only 30% of the respondents are married and 70% are without partners, hence an increase in vulnerability.

Table 4.2: Marital status

Row Labels	Count
Divorced	6%
Married	30%
Separated	5%
Single	25%
Widowed	34%
Grand Total	100%

The questionnaire wanted respondents to indicate their home language and from the figure below, 92 of 102 respondents indicated their home language as Sesotho, 9 Xhosa and 1 English. From information depicted by figure 4.5 where the majority has a primary education, it is concluded that a greater portion of these community members do not know English, which increases their vulnerability to droughts in terms of communication where most materials and forecasts are communicated in English.

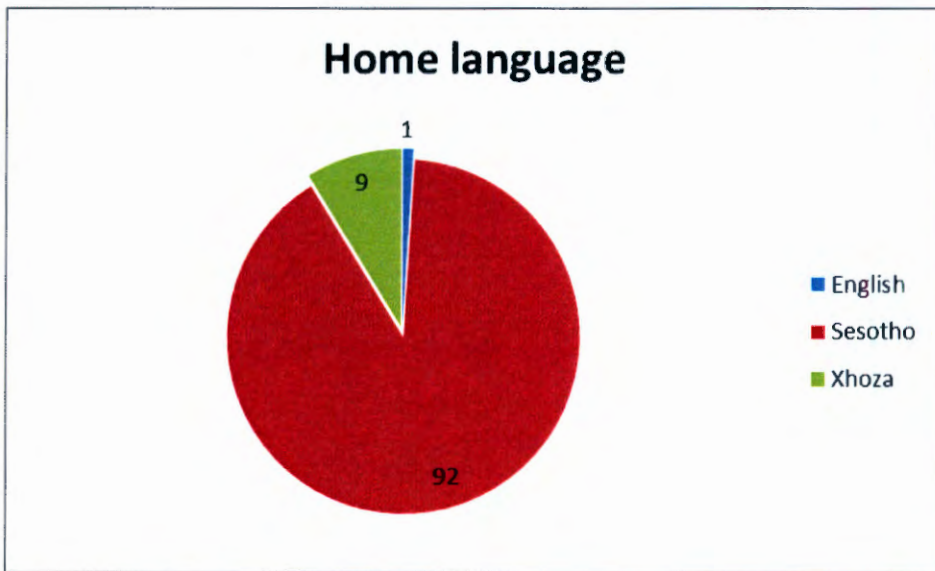


Figure 4.1: Home language

According to the Department of Planning (2008:90) the average household size for Koti-Se-Phola community council is 7 members. Similarly from the figure below, about 58 households have members equal or greater than 7 and 34 of these households have members ranging between 4 and 6. Only very few households have members in the range 1 to 3 members. The larger the household size the less capable that household is, to cope with drought impacts

especially when the source of livelihood is rain-fed agriculture and they have no other livelihood means. Literature has shown that large household sizes encounter difficulties in feeding. Given large household sizes and unemployment as shown by this current study, poverty levels increase hence put communities in vulnerable situation.

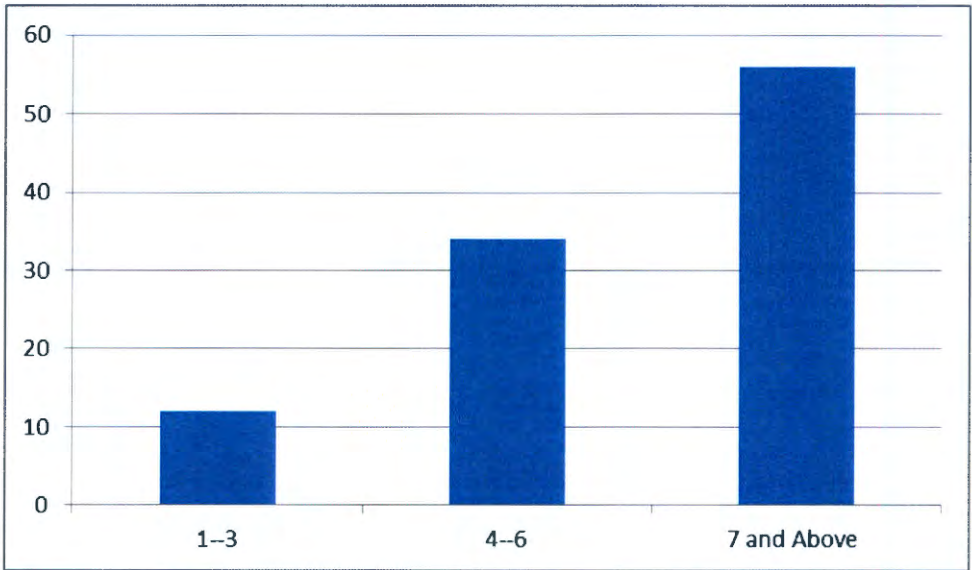


Figure 4.2: Household size distribution by frequency

4.3 EXPOSED ELEMENTS

In this section, elements that are exposed to drought impacts are presented and discussed. Table 4.3 below shows a distribution of main type of animals possessed by respondents and quantity ranges. It also indicates that about 47% of these respondents do not have any type of animals. The majority of those who had animals had cows, sheep and goats though in smaller numbers. These results are consistent with those found by BOS, (2009) in which cows, sheep and donkeys were the main livestock herded in this community. In this study donkeys did not come up clearly. Given that the livelihood in this study area is mainly dependent on rain-fed agriculture and majorities are not employed, small number of animals especially cows leads to increased poverty because cows are used for draught power for food production. Sheep and goats are sold in order to purchase food and other household necessities. When the number of animals is small, poverty increases, which then translates into vulnerability.

Table 4.3: Distribution of population of main animals

Main animal type	Estimated number of main animals					Total number of respondents not having and having animals (%)
	1-3	4-6	7-9	10-12	>13	
No animals	0	0	0	0	0	47%
Cows	12	6	1	0	0	19%
Donkeys	1	1	0	0	0	2%
Goats	2	2	0	2	0	6%
Horses	2	1	0	0	0	3%
Sheep	8	6	10	0	0	24%
Total						100%

The pie chart below shows agriculture field/plot ownership of households, and from it 62 of the respondents either owned a field or a plot for agricultural purposes. This is slightly lower than results found by the (Department of Planning, 2008:92) where 78% of the total residents owned fields for agricultural activities. Only 40 out of 102 had no fields to farm. Having a field reduces vulnerability for people are able to plough and produce food for their families. However, this becomes a problem during droughts when crops are exposed to negative drought impacts.

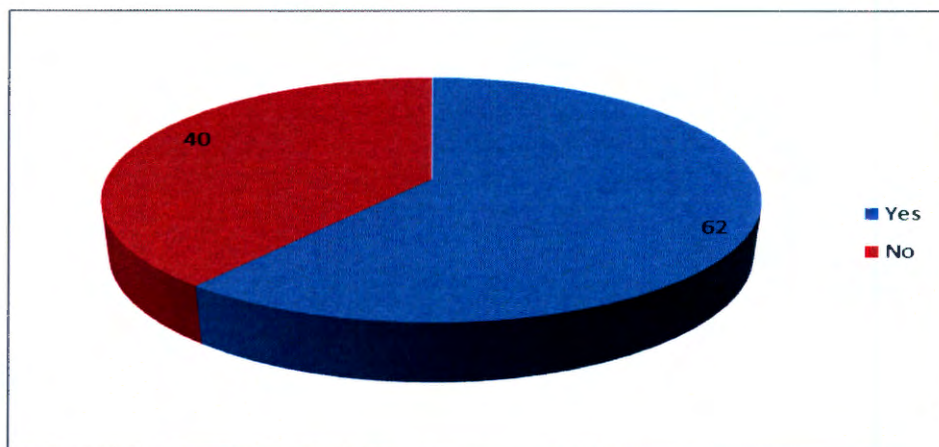


Figure 4.3: Households with agriculture field

Figure 4.4 shows the source of water from which community members draw water for both household and agricultural purposes. About all members have got taps from which they draw

water. Only a few individuals have boreholes which are used as supplement for water in order to save water from taps and they are used as alternative sources during dry periods.

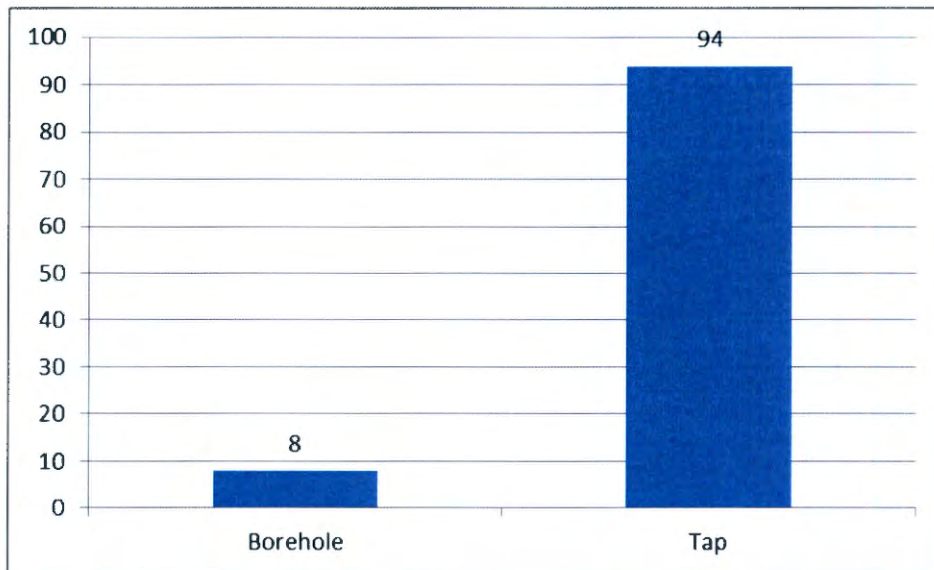


Figure 4.4: Main source of water

Another social vulnerability indicator that was used was the level of education. Frankenberg *et al*, (2013) in their study found that better educated individuals are more likely to survive disasters than those with little education. Figure 4.5 shows a distribution of education levels of Koti-Se-Phola community council members and it is evident that “No schooling” and “Primary school” levels account for 60 out of 102 respondents. The remaining 40 respondents fall within a category of secondary and tertiary education. Most people seem to have primary education, which could be a result of free primary education introduced in Lesotho. However, education reduces vulnerability indirectly through a number of means, such as improvement of socio-economic status that also increase earnings, ability to afford insurances, access to weather forecasts and finally high educated individuals have diversified communication links and access to very useful information (Muttarack and Lutz, 2014).

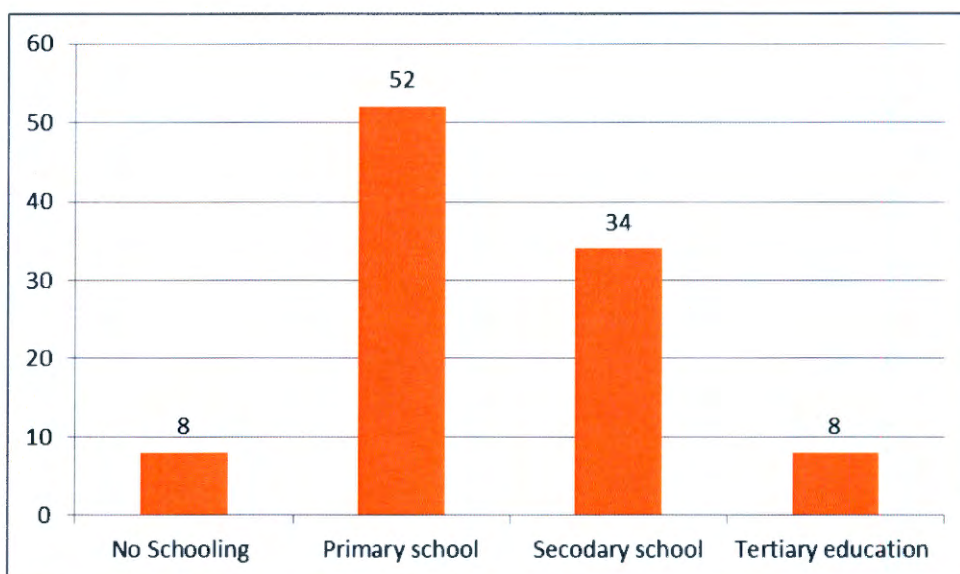


Figure 4.5: Education levels

Figure 4.6 shows a distribution of waterborne diseases that are likely to prevail in this study area as shown in the literature review. A large number of community members have never suffered from any waterborne diseases related to drought in the past 2 years and about 28% suffered from diarrhoea. There were only 4 households that recorded cases of cholera. This is probably because many households have taps as shown in figure 4.4 above.

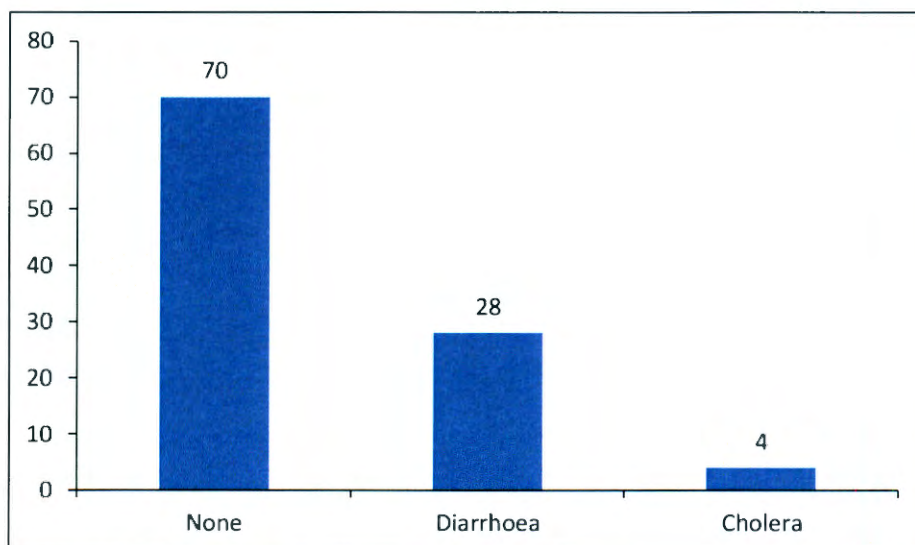


Figure 4.6: Waterborne diseases

Table 4.4 indicates 83% of the respondents agreeing that there has been at least one member who left the household for another town in pursuit of a livelihood, due to drought impacts. Only 17%

disagreed that their household members left. This is in agreement with table 4.1 which showed the majority of the respondents being those in the ages 60+ and below 18, showing that young adults are the ones leaving for other places for probably a better living. In this situation, vulnerability increases as coping capacity decreases, hence leading to risks of disasters.

Table 4.4: Migrated household members to other places

Did any member migrate?	Frequency	Percentage
No	17	17%
Yes	85	83%
Grand Total	102	100%

Water conflicts are not a problem in this council where 91 out of 102 respondents indicated that they have never had any conflicts over water issues in dry periods. In general, this shows that there has never been any conflict over water, though 11 of the respondents showed that they had some conflicts over water issues. However, the question just wanted a *Yes* or *No* answer not the extent and nature of conflicts people had. This must be as a result of the availability of the taps in this community council.

Table 4.5: Water conflicts during dry periods

Water conflicts	Frequency
No	91
Yes	11
Grand Total	102

Figure 4.7 below reveals that in over 87 households, there has not been any loss of life due to adverse effects of drought. The results are in line with figure 4.6 where the majority of these respondents never suffered from any water-related diseases. However, between 1975 and 2000 98% of deaths were linked with drought in Ethiopia, Sudan and Mozambique (Elmi, 2006). Fortunately in the current study area there has not been any deaths caused by droughts.

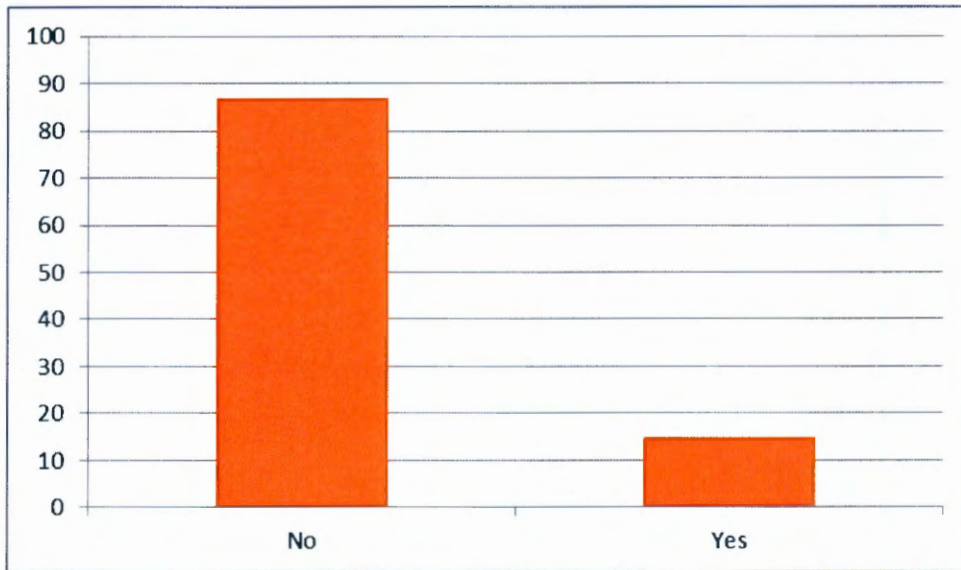


Figure 4.7: Loss of Human life in dry periods

Table 4.6 below shows 68 respondents agreeing that animals feed prices increased in the past two years. This puts more financial pressures on the majority of residents since they do not work and those who do, do part-time jobs and agriculture-related jobs which, during dry periods, suffer the most.

Table 4.6: Animal feed price increase over last two years

Animal feed price increase	Frequency
Strongly Disagree	0
Disagree	17
Neutral	0
Agree	68
Strongly agree	17
Grand Total	102

Figure 4.8 indicates that there are about 70 people that are unemployed, followed by those that are informally employed. The researcher could realise that those who were full-time employed were miners in South Africa. On the other hand table 4.1 showed the majority of respondents being elders aged above 60 years, in which case this figure confirms exactly that they are unemployed.

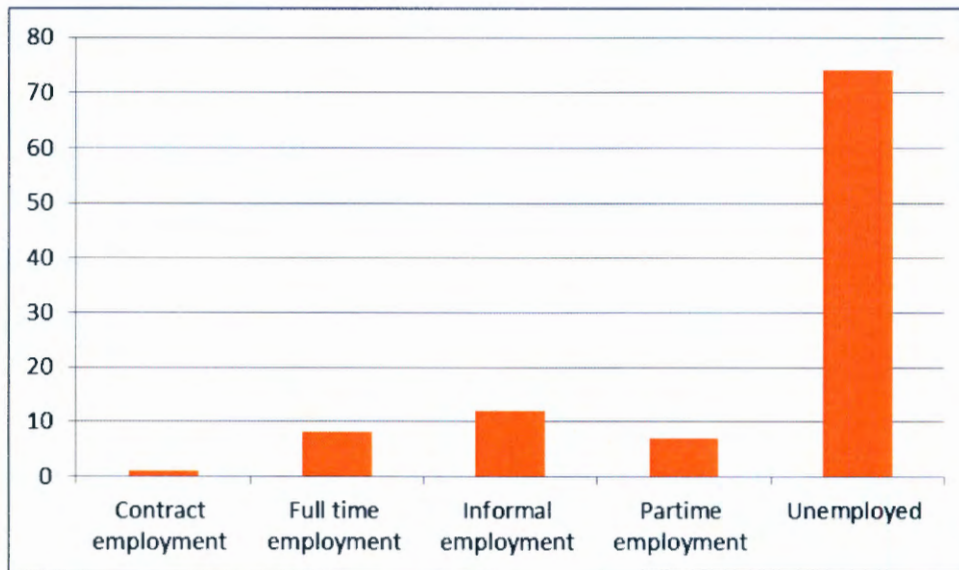


Figure 4.8: Employment status

In the table 4.7 below very few people are earning over M1 000 per month and 79 of these respondents are earning in the range of 0-500 a month. Since the majority of the respondents are found to be over 60 years of age, this implies that their earnings are from Government old-age pension, which started in Lesotho in 2005 as M150 per month and to date, that is earned by only people aged over 70 (Pelham, 2007). With a lower income, vulnerability increases since people are not able to financially cope with drought impacts.

Table 4.7: Household income level per month

Income level per month	Frequency
0-500	79
501-1000	5
1001-3000	9
3001-5000	6
5000+	3
Grand Total	102

Around 60% of the respondents agreed that they lost some income over the past two years due to droughts impacts. In this community, animals and crops are sold as livelihood means as the majority of the residents are not working. This is shown in figure 4.9 below.

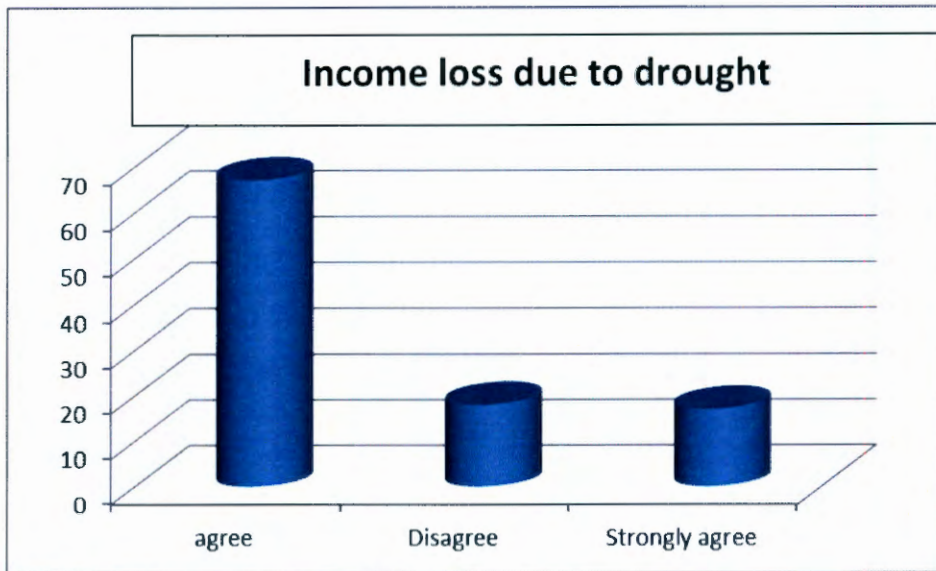


Figure 4.9: Loss of income due to droughts impacts

Table 4.8 indicates households agreeing that there has been food production decline over the past two years. This could be a result of increased elderly population and children below 18 years who may not be economically very active and that is exacerbated by drought impacts. However there were still a few whose food production seemed not to have been affected by droughts in the past two years and this could be because of the minority that are working in decent jobs.

Table 4.8: Food production decline over 2 years

Food production decline over past 2 years	Frequency
Agree	64
Disagree	19
Strongly agree	19
Grand Total	102

From the table below soil erosion seems to be a serious issue in this community whereby the farm and rangelands are extremely eroded. This is confirmed by the pictures taken by the researcher during the fieldwork as shown in figure 4.20. No respondent disagreed or stayed neutral with the statement that there is serious soil erosion in the farmlands and rangelands.

Table 4.9: Serious soil erosion in the communities' fields

Soil serious erosion	Frequency
Strongly disagree	0
Disagree	0
Neutral	0
Agree	92
Strongly agree	10
Grand Total	102

Certain plants are used for medical purposes and from table 4.10 it is clear that respondents are of the opinion that plants they use for medical purpose have been impacted upon by droughts hence a reduction of health and livelihood status.

Table 4.10: Loss of traditional medical plants

Traditional medicine plants loss	Frequency	Percentage %
Strongly disagree	12	12%
Disagree	0	0%
Neutral	0	0%
Agree	90	88%
Strongly agree	0	0%
Grand Total	102	100%

There are no signs of contaminated water drawn from taps as figure 4.10 below shows that many respondents disagreed and strongly disagreed with the statement that dark water flows from taps indicating no possibilities of contaminated water from sources. This is consistent with the finding from figures 4.4 and 4.6 respectively, where the source of water was taps and the majority of the respondents did not suffer from any waterborne diseases.

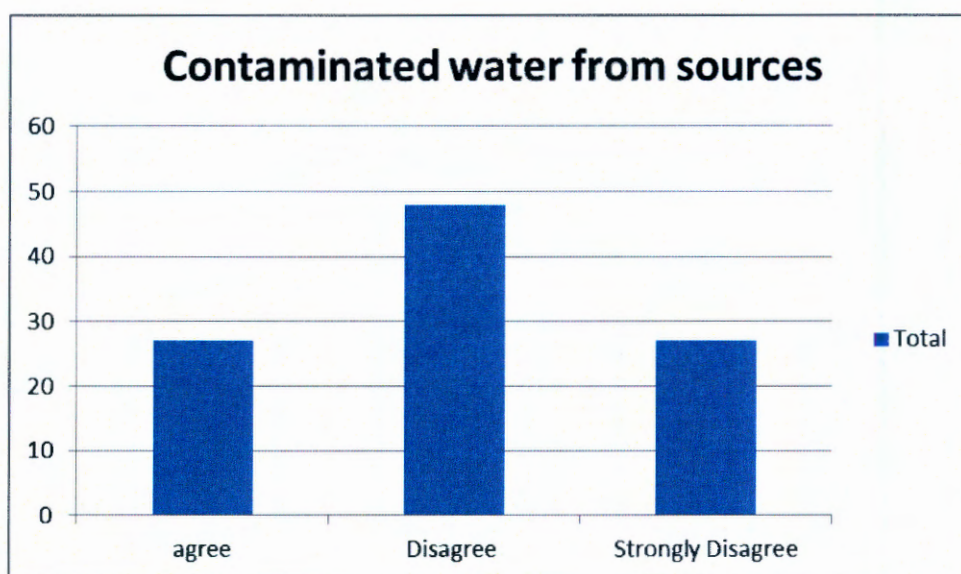


Figure 4.10: Water quality

4.4 COPING CAPACITY

The following section discusses findings with regard to coping capacity against drought impacts.

The Government does not make the public aware of drought issues. However, some respondents agreed that there is some awareness from Government in relation to drought. This information is depicted in table 4.11 below where a total of 75 respondents are those who disagreed or strongly disagreed with the statement that there was public awareness by government pertaining to drought issues, while only 27 are of the opinion that the government makes them aware. However the overall conclusion based on the respondents' answers is that there is generally little or no public awareness given to community members, hence a decreasing coping capacity to deal with adverse drought impacts.

Table 4.11: Public awareness by government

Public awareness	Frequency
Strongly Disagree	27
Disagree	48
Neutral	0
Agree	27
Strongly agree	0
Grand Total	102

From the information presented in figure 4.11 below, 78 out of 102 respondents confirmed that there were no drought warnings regarding what to expect so that community members could engage in preparedness measures. Some of the preparedness measures may include the selection of drought-tolerant crop cultivars and stockpiling of fodder for use in dry periods.

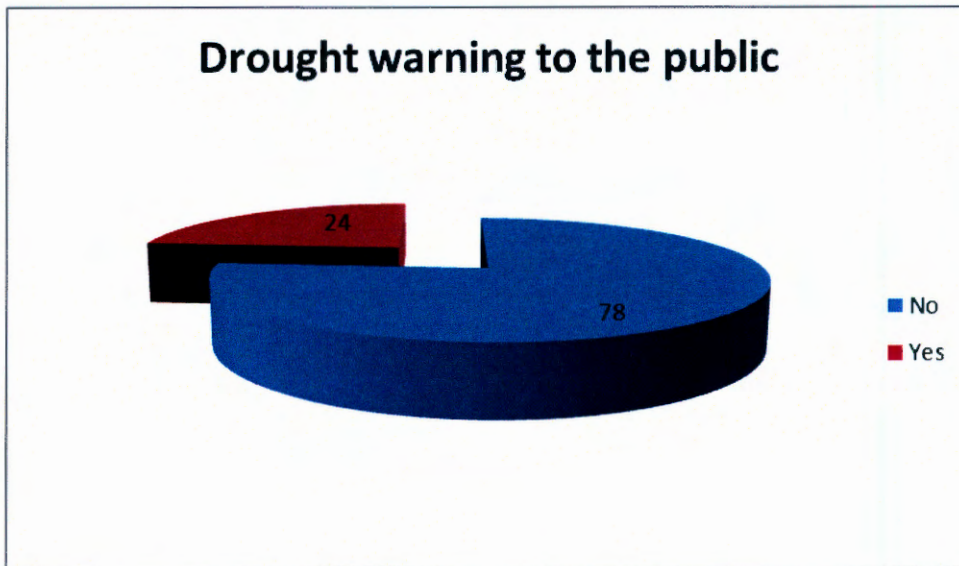


Figure 4.11: Drought warnings to the public

In some villages conservation agricultural methods were implemented at a stipend; however, 81 out of 102 households showed that there have never been such measures taken at their villages. This is confirmed by figure 4.20 below where the researcher went out into the fields to observe and take pictures of the conditions of the fields. In 4 out of 5 sampled villages, there was no evidence of agriculture conservation activities. Conservation agriculture improves soil structure and protects the soil from being eroded, and likewise less water is used in crop production due to increased infiltration and high water-holding capacity from crop residues and materials used. Materials and mulches used, to protect the soil from extreme temperatures greatly reduce surface evaporation (Department of Agriculture and Life Sciences, 2014). Demographics section showed a large proportion of this study area consisted of community members being elders with low education levels. This has effects on conservation agricultural strategies implemented, where some members would not take any initiatives to practise conservation agriculture due to lower knowledge levels. Others are likely to expect the government to initiate conservation agriculture

on a payment basis. Figure 4.12 below shows responses on whether there were conservation agriculture methods implemented.

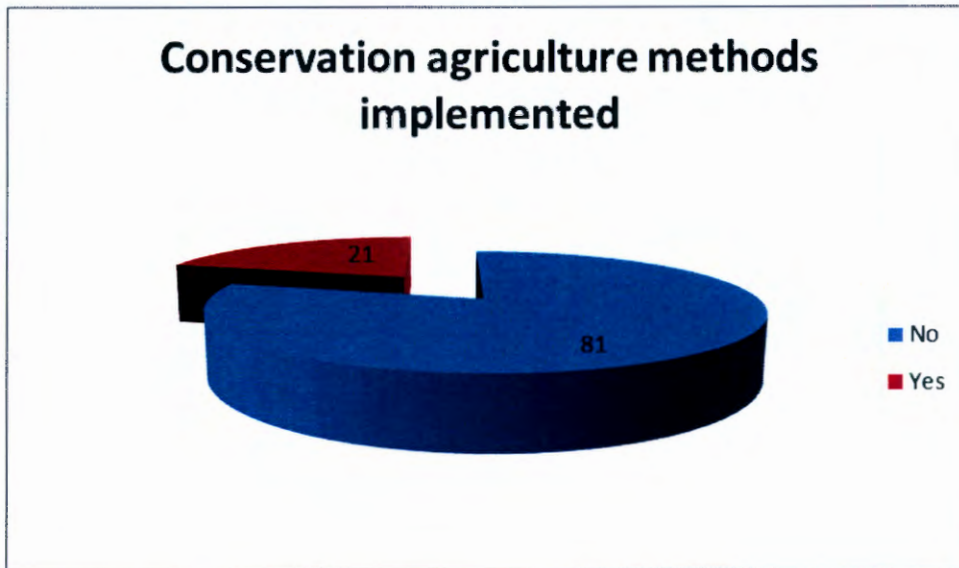


Figure 4.12: Conservation agriculture methods implemented

From table 4.12, respondents acknowledged that Government does respond during dry periods though the response is not satisfactory. All respondents agreed that there is a government response but many (61) said it was poor. Only 20 out of 102 respondents showed government responding in a satisfactory manner during droughts. However, the overall implication was that the government does not respond satisfactorily during dry periods.

Table 4.12: Government response to droughts and the extent of response

	How Government responds during droughts
Good	20
Moderate	21
Poorly	61
Grand Total	102

Based on the information shown in table 4.1 and figure 4.8, the majority of the respondents are females aged from 60 and above and are unemployed. Figure 4.13 shows these respondents having other sources of livelihood other than rain-fed agriculture, which leads us to conclude that these are actually aged above 70 years and are old-age pensioners earning in the range of 0-500

as the current old-age pension in Lesotho is M450 per month. This situation has an increasing effect on vulnerability with less or little financial coping capacity.

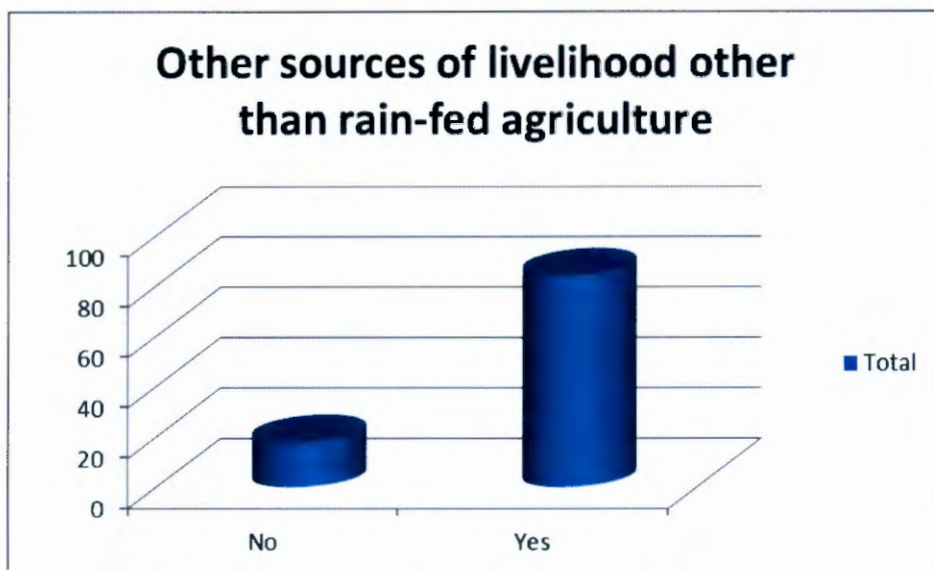


Figure 4.13: Other sources of livelihood other than rain-fed agriculture

Table 4.13 shows clearly that farmers have not insured their livestock against droughts impacts. This is also complemented by the fact that many have very few animals in the range of 1-3 cows and 4-6 sheep and that they are unemployed, so this makes it difficult for them to pay insurance premiums. However, insurances play a number of roles ranging from eliminating dependencies on one livelihood source and therefore having an insurance serves as a way of sharing and mitigating risks (Anonymous, 2012). If droughts strike communities are able to claim for damages from their insurance brokers.

Table 4.13: Livestock insured against droughts impacts

Livestock insured against droughts impacts	Frequency
Yes	0
No	102
Grand Total	102

Figure 4.14 below depicts no planting of drought-tolerant crop cultivars where 77 respondents answered “No” while 25 answered “Yes” to the question of whether they plant drought-resistant

crops. Drought-tolerant cultivars require little water for survival thereby resisting drought. In the event when non-drought-tolerant cultivars are planted, production is totally lost when drought strikes, therefore, planting drought-tolerant crop cultivars ensures food availability in the households and saves money to be used probably during drought disasters. This area being a rural area, with low levels of education and income, the community members do not know and cannot afford if they knew, to buy drought-resistant crop cultivars.

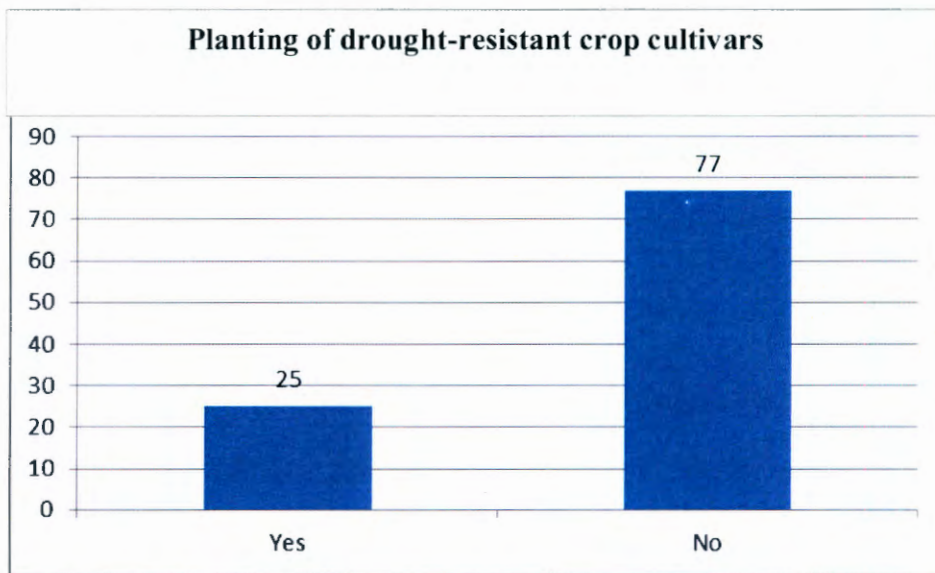


Figure 4.14: Planting of drought-tolerant crop cultivars

As shown in figure 4.15 below, there is a greater proportion of people that disagree that there is good rangelands management in this study area. Good rangelands management includes rotational grazing to avoid overgrazing that leads to soil erosion, and implementation of stringent land control measures such as fines, should animals be grazed where they are not allowed. However, there is very few who agree that rangelands are well managed. Poorly managed rangelands lead to soil erosion through exposure of soils, which in turn impacts negatively on crop growth and animals.

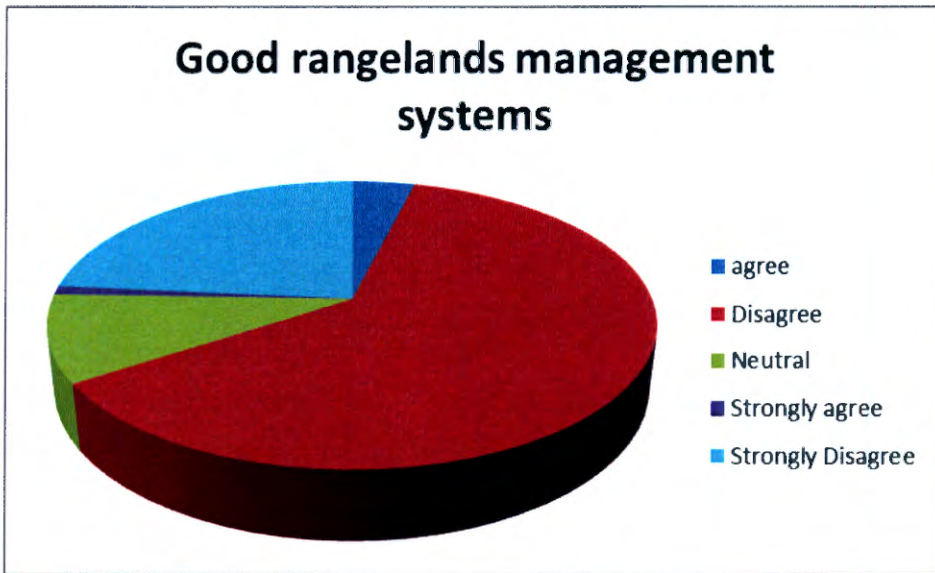


Figure 4.15: Good rangelands management system

Figure 4.16 below shows an elderly community member and a young man from another household queuing for water from a community tap for hours at Ha Konote. This comes as a drought effect in this community council. This picture was taken during the researcher's field work observation. This is an indication that community members struggle for water in this council.



Figure 4.16: Community members struggling for water from taps at Ha Konote, Thabana Morena

4.5 ADAPTIVE COPING MECHANISMS

Some of the coping mechanisms were that animals were fed with (*Lekhale and torofeiye*) aloe and prickly pear trees. Chicken droppings are also used as feed whereby only feathers are removed for the animals to eat. Most of the farmers have stockpiled maize stalks as fodder to use during dry periods as illustrated in figure 4.17. Very few farmers that are economically capable stockpile lucerne for feeding. Other farmers have installed their own irrigation systems to promote vegetable production. Boys aged around 14-30 are used as shepherds to reduce food consumption in the household and adults go out for job seeking in towns. Keyhole gardens are other measures used to cope with drought in this community council to grow vegetables for household consumption. This information was collected by the researcher during the field work and is consistent with the findings from literature review made in chapter 2 where animals were fed with ground “*motopi*” trees in the North West Province of South Africa.



Figure 4.17: Fodder stockpiling from different villages at Koti-Se-Phola Community Council (CC)

Farmers such as Mr Matea at Ha Bofihla have set up an irrigation system that waters cabbage field during dry winter seasons. Cabbage from this field is sold out to communities as another means of livelihood, figure 4.18 shows Mr Matea’s field at Ha Bofihla Thabana Morena.



Figure 4.18: Mr Matea's cabbage field at Ha Bofihla Thabana Morena

In other villages such as Ha Ngoae, members of the community have abandoned the community vegetables project as depicted in figure 4.19 below. This project was set up by the government to alleviate poverty but drought has left members with no option but abandon it.



Figure 4.19: Abandoned community Vegetable Project at Ha Ngoae

4.6 DROUGHT INTERVENTION SUGGESTIONS

Strategies suggested by respondents and experts were that, there should be an irrigation system that draws water from Makhaleng River. This will not only help crop and vegetable production but counteract the present unemployment rate at this community council. Dongas in the fields

created by soil erosion that were exacerbated by drought should be harnessed through tree planting and construction of silt traps whereby members will be earning some wages during the period they are working. This will not only prevent soils from being eroded but improve livelihoods as well and ultimately reduce vulnerability to droughts impacts.

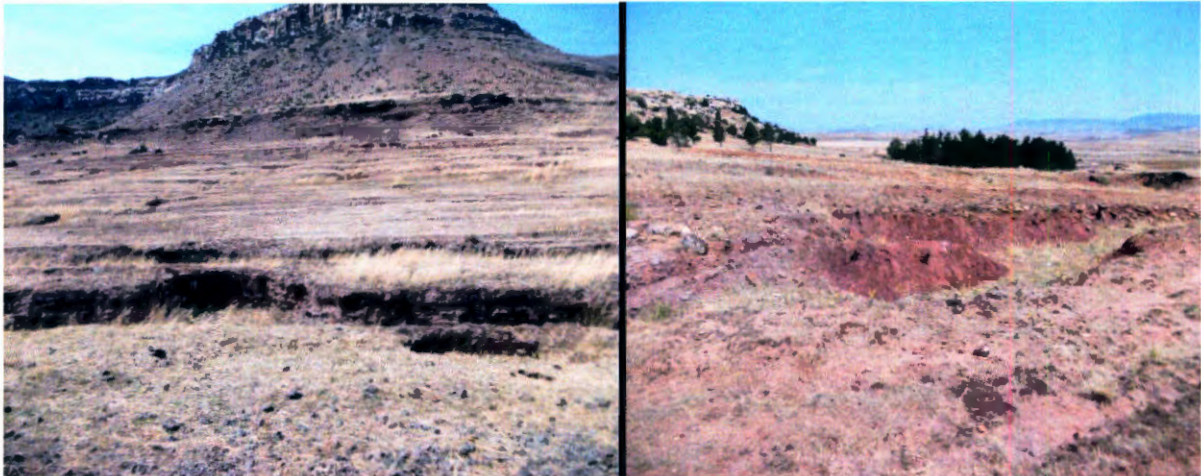


Figure 4.20: Eroded fields between Ha Ngoae and Khubetsana, Thabana Morena and Maralleng respectively.

Farmers also indicated the need for a local market to be created by Government at which their products should be sold. Though there is sometimes a government subsidy for ploughing and seeds, the effort is not enough and therefore there is a need to strengthen this subsidy to cover all villages. Rangelands management system is to be strengthened through high fines in cases when people graze their animals in the demarcated areas for use in dry periods. Finally boreholes must be drilled and installed in villages for use in dry periods.

Table 4.14: Summary of both coping and intervention strategies at Koti-Se-Phola (CC)

Coping Strategies	Intervention Strategies
Feeding with <i>Lekhala</i> (aloe)	Irrigation systems (Makhaleng River)
Litlhaka (Maize Stalks)	Increased Conservation Agriculture
Individual Irrigation Systems	Creation of Local market
Keyhole gardens	Intensified Rangelands Management
Household size reduction (Shepherds)	Borehole drills installation
Migration to towns	Government subsidies

	Creation of employment
--	------------------------

4.7 AGRICULTURAL DROUGHT VULNERABILITY INDEX

To calculate the vulnerability index, only the most important indicators were selected. From each indicator the dominating response was considered to represent the indicators or other responses if such an indicator was selected but dominating response was insignificant, for example, if in gender most respondents were females, then females' % was selected to represent gender which has a decreasing functional relationship with drought vulnerability. Then the scores were normalised using the following formulae;

Table 4.15: Normalisation vulnerability equations

Formular for increasing functional relationship with vulnerability	Formular for decreasing functional relationship with vulnerability	Formular for Vulnerability index
$x_{ij} = \frac{X_{ij} - \text{Min}\{X_{ij}\}}{\text{Max}\{X_{ij}\} - \text{Min}\{X_{ij}\}}$	$y_{ij} = \frac{\text{Max}\{X_{ij}\} - X_{ij}}{\text{Max}\{X_{ij}\} - \text{Min}\{X_{ij}\}}$	$VI = \frac{\sum_j x_{ij} + \sum_j y_{ij}}{K}$

Source: (International Crops Research Institute for the Semi-Arid Tropics, 2009)

Where;

x_{ij} and y_{ij} represent normalised indicators scores

X_{ij} denotes the value of indicator “j” corresponding to Village “i”.

$\text{Min}\{X_{ij}\}$ is the minimum value of indicator “j”

$\text{Max}\{X_{ij}\}$ is the maximum value of indicator “j”

Example; in table 4.17, indicator “age” has the value 17 in “V1” where Maximum and minimum values are 61 and 17 respectively, therefore the normalised score would be $17-17/61-17 = 0.0000$ using Formula for increasing functional relationship with vulnerability in table 4.15 above.

Microsoft excel was used in the computation of the normalised scores. After normalisation of the scores a simple average was applied to calculate the final composite vulnerability Index (VI) as

follows;
$$VI = \frac{\sum x_{ij} + \sum y_{ij}}{K}$$
 where K denotes the number of sampled village

Table 4.16: Selected drought indicators and their descriptions

<i>Selected Indicators</i>	Description
Demographic	
Gender	Females are more vulnerable than men, majority of the respondents were females
Age	Children, elderly people between ages; below 18 and greater than 65 respectively are more prone to damaging effects of drought than middle aged groups
Social	
human loss of life	High mortality rates leave the remaining communities psychologically affected, and more prone to further damaging effects of drought
population migration	Increased movement of people indicates how vulnerable such a community is.
health problems	High levels of disease prevalence results in reduced coping capacity against adverse effects of hazards
education level	A well-educated society is resilient to disasters, greater than matric level.
household size	The bigger the family size, the more unable that family is, to feed its members in times of dry periods
Economic	
Insurances against drought	Presence of insurances against property, crops and livestock ensures replacement in case of drought disasters.
Income sources	Communities with various sources of income are able to survive easily during and post disasters
Environmental	
water quality	Poor quality, dirty, contaminated water harbour disease causing microorganisms, therefore weakening such societies.

water and wind erosion of soils	Erosions reduce means on livelihood for rain-fed agriculture communities.
Coping capacity	
Rangeland management	Well-managed rangelands decrease vulnerabilities against drought
Presence of agricultural conservation methods	Decrease soil erosion, hence drought vulnerability
Good public awareness	If the public is aware of oncoming disasters, coping strategies are devised ahead of time and these decrease vulnerability to drought

Table 4.17: Raw selected indicators data per village and their functional relationships with vulnerability

Selected Indicators	Selected Village (V)					Functional relationship with Vulnerability
	V1	V2	V3	V4	V5	
Demographics						
Gender (female %)	19	38	11	16	16	↑
Age (estimated average age)	17	61	58	60	55	↑
Social						
population migration (Estimated number of people who migrated)	25	14	18	8	20	↑
health problems (No. of cases)	0	4	12	8	8	↑
Education level (< primary and no schooling)	20	8	10	12	10	↑
household size (>7 members)	8	9	12	15	13	↑
Economic						
Income level (Estimated average household income level)	460	658	401	586	640	↑
Environmental						
water quality (% of people who Disagreed and strongly disagreed)	16	14	10	8	28	↓
water and wind erosion of soils (number of households with eroded fields)	21	21	20	20	20	↑
Coping capacity						
Good rangeland management (number disagreed and strongly disagreed)	18	20	8	30	15	↑
Absence of agricultural conservation methods (Number of respondents)	16	19	18	17	11	↓
Good public awareness(% disagreed and strongly disagreed)	20	7	27	21	25	↑

Table 4.18: Normalised indicators scores

	Gender (female %)	Age (estimated average age)	population migration (Estimated number of people who migrated)	health problems (No. of cases)	Education level (< primary and no schooling)	household size (>7 members)	Income level (Estimated average household income level)	water quality (% of people who Disagreed and strongly disagreed)	water and wind erosion of soils (number of households with eroded)	Good rangeland management (% disagreed)	Absence of agricultural conservation methods (Number of)	Good public awareness(% disagreed and strongly disagreed)	Average village Vulnerability index per indicator
V1	0.2963	0.0000	0.0000	0.0000	1.0000	0.0000	0.2296	0.6000	1.0000	0.4545	0.3750	0.6500	0.3838
V2	1.0000	1.0000	0.3529	0.3333	0.0000	0.1429	1.0000	0.7000	1.0000	0.5455	0.0000	0.0000	0.5062
V3	0.0000	0.9318	0.5882	1.0000	0.1667	0.5714	0.0000	0.9000	0.0000	0.0000	0.1250	1.0000	0.4403
V4	0.1852	0.9773	0.0000	0.6667	0.3333	1.0000	0.7198	1.0000	0.0000	1.0000	0.2500	0.7000	0.5694
V5	0.1852	0.8636	0.7059	0.6667	0.1667	0.7143	0.9300	0.0000	0.0000	0.3182	1.0000	0.9000	0.53765
Total													2.4372

The composite Agriculture Drought Vulnerability Index (ADVI) = $2.4372/5=0.4874$

From the table 4.18, the Agriculture Drought Vulnerability Index (ADVI), was calculated to be 0.4874. Since vulnerability index can take any value from 0 to 1, a suitable continuous probability distribution was assumed (Beta distribution) which is generally skewed and takes values in the interval [0, 1]. Five (5) equal linear intervals were chosen so that each interval has the same probability weight of 20% as proposed in Iyengar and Sudarshan's method of vulnerability index calculation (International Crops Research Institute for the Semi-Arid Tropics, 2009). The calculated Vulnerability index fell in a vulnerable category as shown below. This calculated value complement the findings that the study area is vulnerable to drought impacts, however the choice of participating indicators to the index were subjectively selected by the researcher in which case if all indicators were selected to contribute to the calculated index, the results could have been quite different and better. Another aspect was that a simple average of the normalised scores with all indicators having equal weights was applied, in order to come up with a final composite vulnerability index.

Table 4.19: Various stages of vulnerability

Less Vulnerable	$0 < VI < 0.2$
Moderately Vulnerable	$0.2 < VI < 0.4$
Vulnerable	$0.4 < VI < 0.6$
Highly Vulnerable	$0.6 < VI < 0.8$
Very highly Vulnerable	$0.8 < VI < 1$

4.8 SUMMARY

In this chapter, data was collected by means of questionnaires, interviews and observations on vulnerability and how communities coped with drought. The collected data was first recorded in Microsoft Excel and later transferred to SPSS V16 for reliability test which was found to be 0.764. Descriptive statistics was used to represent data in bar and pie graphs as well as frequency tables for easier interpretation. The researcher made observations in the fields and in the villages to see how people coped with drought where photographs were taken in order to support data collected by questionnaires. From the selected drought indicators, the researcher further selected those which were believed to be more important to contribute to Agricultural Drought

Vulnerability Index (ADVI). This index was meant to give an overview of the vulnerability condition in this community council. The next and final chapter deals with the conclusion and recommendations.

CHAPTER 5: CONCLUSION AND RECOMMENDATION

5.1 INTRODUCTION

This chapter gives the summary of the findings, conclusion and recommendations. The conclusion is made based on the empirical studies and literature review conducted. Findings are summarized according to the sub-objectives of the study.

5.2 SUMMARY OF THE FINDINGS

5.2.1 Exposure to drought

Findings revealed that Koti-Se-Phola community council is composed in majority of older females over 60 years of age. The livestock is also exposed to drought dangers as quite a good number of respondents have cows, sheep and goats. The modal livestock population groups were 1-3 and 4-6. Agricultural sector is exposed as well, because 62 of 102 respondents answered “Yes” to the question that asked whether they had agricultural field/plot to farm on as shown in figure 4.2 above. The rangelands is another sector severely exposed to drought impacts as depicted in figure 4.20 above where there is a severe soil erosion in fields thereby reducing the crops and animal products quality. These findings are consistent with findings in Lesotho in 2009 as shown in table 2.2 as well as in table 2.1 from other countries.

5.2.2 Coping capacities

There is generally little or no coping capacities in this community as greater number of respondents showed that there are no public awareness, no early warning systems in place to alert the public of oncoming droughts so as to prepare accordingly in advance, poor government response during drought and little and short term conservation projects. No insurances to guard against livestock and crops failure, due to poor socio economic status and low education levels as revealed in the data. Many farmers just use any seed for planting without necessarily that seed being drought resistant, this maybe brought about by the fact that majority of the respondents are poor.

Stockpiling of maize stalks, feeding of cows with *torofeiye* and *lekhale*, lucerne buying, chicken droppings feeding are some of the coping strategies used in this community council during dry periods. Some construct keyhole gardens for vegetable growing for their households. Lucerne is purchased by those few who are financially viable to feed their animals. Families have sent away young members to towns for job seeking in order to reduce food consumption. Young boys sent away to work as shepherds, and this on the other hand earns their families a certain income.

5.2.3 Vulnerability conditions to drought

Unemployment is one of the major problems faced by this community council with bigger proportion being females of 60 years and above. The modal income level per household in a month in Maloti is M0-500. Similarly, the modal household size is 7 and above members in a family. The literature conducted showed that low income levels, large household sizes, unemployment all have exacerbating effects on drought impacts on community hence results in increased vulnerability conditions which finally lead to drought disasters. The selected drought indicators were quantified in order to compute a composite vulnerability index to measure the extent of vulnerability in Koti-Se-Phola community council area. From the normalised scores a simple average of the scores was computed to come up with a single index that was found to be 0.4874 that fell within a vulnerable category as shown in table 4.18.

5.3 CONCLUSION

This study aimed to determine what and who is exposed/susceptible to drought in Koti-Se-Phola community council in Thabana Morena, determine coping strategies to drought used in this study area and conditions of vulnerability to drought in order to alert policy makers and those in authority for possible interventions. This study area has been found to be vulnerable to drought impacts, though the index calculation might have been biased because a simple average method that assumed equal weights to indicators was used and the index value could have been better than the found value if the selected indicators were weighted. There is indeed a need for authorities to intervene in order to improve the livelihood of these community members through a variety of options as mentioned under recommendations below.

5.4 RECOMMENDATIONS

From the findings above, it is recommended that Lesotho government decreases the old age pension qualification requirements to 60 years rather than the current 70 years in order to help many residents since majorities are elders aged above 60 years. The majority of residents in this community are dependent on rain-fed agriculture for livelihood, with low income levels from their other livelihood sources. It is therefore recommended that irrigations systems that will draw water from rivers such as Makhaleng and other dams be installed to improve livelihood status and provide employment. Since there is serious soil erosion in the fields, agriculture conservation could be of great help in not only making savings in labour supply (in a dominantly low labour force community) but in also creating employment opportunities as well as reducing migration rate into towns and other places for livelihood. Stringent policies and laws to be put in place to restrict families in making young boys shepherds and make education free up to high school. The government must also invest in the early warning systems for drought management as majority of its people are dependent on rain-fed agriculture for livelihood.

5.5 RECOMMENDATIONS TO THE GOVERNMENT

Based on the empirical results of this study, young people from this community council have left probably for better greener pastures, which could be as a result of indirect drought impacts. From this statement, it is recommended that the Government and all other relevant stakeholders hold educational campaigns for the youth to encourage them to be involved in agricultural activities in this area. This could materialise when Government sponsors every child beyond primary schooling, creation of employment and through financial support for their animals and crops during dry periods. The government should help these community members through extension officers with training on food preservation and storage. Moreover, those living in severely eroded areas could be relocated to better areas where they access arable land.

5.6 DIRECTION FOR FURTHER STUDIES

From the findings of this study, one of the key aspects revealed were that, this community council is female dominated, majority of who are old. It is therefore recommended that further

research be conducted on the vulnerability of older females to agricultural drought. This will further propose strategies and policies to authorities, specifically suitable for elders to be resilient to drought impacts. In addition to the above, future research could also focus on psychological effects induced by drought. Further research with a larger sample size, more and weighted drought vulnerability indicators is proposed.

5.7 CONCLUDING REMARKS

Droughts have become a global challenge and threat to sustainable development and have had ripple effects ranging from; poverty, food insecurity, health, environment and socio-economic problems. The above mentioned problems have damaging effects on societies when such societies lack coping capacity leading to disasters. From this study it was clear that Koti-Se-Phola community council vulnerability situation is bad, posing a challenge to authorities to device strategies in pursuit of reducing drought disaster impacts. One of the key lessons learned in this study was that residents are low income earners, which in turn reduces their resilience against drought impacts. The government on the other hand offers little or no assistance to these 80% rain-fed agriculture dependent community. Drought is a slow onset hazard in nature that is able to affect thousands of people and which many countries do not treat as priority. This is evident in several counties that include Lesotho which do not have drought specific policies that maybe a reason for poor response to drought issues. Finally, this study therefore appeals to Government, NGO's and other relevant stakeholders to join hands to combating vulnerability to drought disaster impacts, particularly in Mafeteng district with the view of increasing resilience.

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APPENDIX A: A permission letter to conduct the study

4217 Station View

Thaba Nchu, 9780

Free State

South Africa

10/09/2014

Regional chief Makotoko Bofihla

Ha Bofihla Thabana Morena

Re: Permission to conduct a research study in your community council.

My name is **Bernard Moeketsi Hlalele**. I am a Masters student in disaster management at Disaster Management Training and Education Centre for Africa (DiMTEC) at the University of Free State and am conducting a research on DROUGHT VULNERABILITY ASSESSMENT AT KOTI-SE-PHOLA COMMUNITY COUNCIL, THABANA-MORENA LESOTHO in order to propose mitigation strategies and how coping capacities of the community to drought can be improved. This research is for academic purposes only however, the findings could be used to improve the current coping capacities of the community.

I therefore would like to be permitted to conduct this study in your area.

Kindly

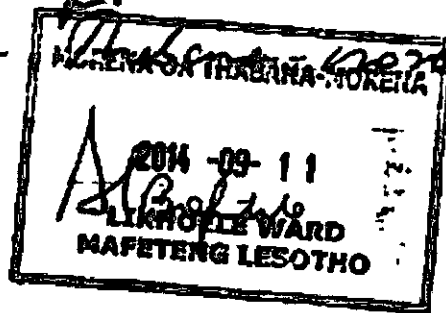
BM Hlalele (+27736 985 797)

BM Hlalele

Thabana-morona
Her. Bafitwa

Morona epe kupa epe ea thau
Makoabating Council.
Kea utumelien morona morona
ke ukopa ha amoketa motso
ka keeo cheny markete.
Bernard Hhutele maseteng ea hana
e thile ho thau eka boithuto
ka letaba tsa kornella e ameng
letaba. In rana. morona Thabana
morona.

Ra litumeliso
m. masitea for
morona ea



APPENDIX C: A Letter from the editor

Marie Engelbrecht

Tel: 27 51 – 4463133 (H)
Freefax: 0866373773 (H)
Mobile: 0832981685
E-pos/Email:
babengel@telkomsa.net

P O Box/Posbus 38327
LANGENHOVENPARK
9330

BANKING DETAILS:
M J ENGELBRECHT

Bank: ABSA BANK,

LANGENHOVENPARK, BFN.

Type of Acc: Current/Cheque

Acc Nr: 1011451779

Branch Code: 632005

SWIFT CODE: ZAJJ



May 18, 2015

TO WHOM IT MAY CONCERN

I, **Marie Engelbrecht** of Bloemfontein, hereby confirm that I have done the editing on the dissertation **VULNERABILITY ASSESSMENT OF AGRICULTURAL DROUGHT HAZARD: A CASE OF KOTI-SE-PHOLA COMMUNITY COUNCIL, THABANA MORENA, MAFETENG DISTRICT IN LESOTHO** by **Bernard Moeketsi Hlalele** (student nr: **2010094395**) submitted in partial fulfilment of the requirements for the Masters degree in Disaster Management at the UFS recently and that he has paid me in full for the work.

I trust you will find this in order.

M J Engelbrecht

Signed: **M J ENGELBRECHT**

APPENDIX D: Questionnaire



Questionnaire

My name is Bernard Moeketsi Hlalele. I am a Masters student in disaster management at Disaster Management Training and Education Centre for Africa (DiMTEC) at the University of Free State and am conducting a research on DROUGHT VULNERABILITY ASSESSMENT AT KOTI-SE-PHOLA COMMUNITY COUNCIL, THABANA-MORENA LESOTHO in order to propose mitigation strategies and how coping capacities of the community to drought can be improved. This research is for academic purposes only however, the findings could be used to improve the current coping capacities of the community. Information supplied here will be treated confidential and this questionnaire may take around 15 minutes.

INSTRUCTIONS

Please answer all questions and where indicated mark with an “X” or and write your answer in the spaces provided.

Respondent number

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--	--	--

Date

SECTION A

DEMOGRAPHICS

1. Gender

Male	
Female	

2. Age of the household head

1) Below 18	
2) 18 - 24	
3) 25 - 39	
4) 40 - 49	
5) 50 - 59	
6) 60+	

3. Marital status

Single	
Married	
Widowed	
Divorced	
Separated	

4. Home language

Sesotho	
English	

Other (specify)	
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SECTION B

EXPOSURE/EXPOSED ELEMENTS

5. Livestock: Do you own any type of livestock?

Yes	
No	

6. If your answer is Yes from (6) above, what is the main type of livestock do you own?

Cows	
Sheep	
Goats	
Donkeys	
Horses	
OTHER-(Specify)	

Of the livestock you have, how many do you have for each type?

7.a. Cows

1) 0	
2) 1-3	
3) 4-6	
4) 7-9	
5) 10-12	
6) ≥13	

b. Sheep

1) 0	
2) 1-3	
3) 4-6	
4) 7-9	
5) 10-12	
6) ≥ 13	

c. Goats

1) 0	
2) 1-3	
3) 4-6	
4) 7-9	
5) 10-12	
6) ≥ 13	

d. Donkeys

1) 0	
2) 1-3	
3) 4-6	
4) 7-9	
5) 10-12	
6) ≥ 13	

e. Horses

1) 0	
2) 1-3	
3) 4-6	
4) 7-9	
5) 10-12	
6) ≥ 13	

f. Other-Specify

1) 0	
2) 1-3	
3) 4-6	
4) 7-9	
5) 10-12	
6) ≥ 13	

8. Agriculture

Does your household own any field for agricultural purposes?

Yes	
No	

9. Water supplies: What is your main source of water?

Borehole	
Tap	
Other-(Specify)	

SUSCEPTIBILITY

Social factors

10. What is the size of your household?

1-3	
4-6	
7 and above	

11. Highest level of education

No schooling	
Crèche/Preschool	
Primary school	
Secondary school	
Tertiary education	
Other-specify(.....)	

12. Have you or anyone in this household suffered from any of these diseases?

Cholera	
Diarrhoea	
Other (specify)	
None	

13. Is there any member of this family who has left in search of employment to lesson family pressure?

Yes	
-----	--

No	
----	--

14. Have you ever experienced any conflicts over water in this community?

Yes	
No	

15. Has there been any loss of human life from food shortage or drought related conditions in this family?

Yes	
No	

Economic factors

16. Kindly state your employment status.

Informal employment	
Full time formal employment	
Part time formal employment	
Contract employment	
Unemployed	
Other (specify)	

17. Total income level for household (combined income from all members) per month.

None	
R100-R500	
R501-R1000	
R1001-R3000	

R3001-R5000	
Over R5000	

18. What is your opinion on the statement that “There has been an increase in animal feed Prices in the past 2 years”.

Strongly disagree	
Disagree	
Neutral	
Agree	
Strongly agree	

19. Income has been lost due drought in the past 2 years.

Strongly disagree	
Disagree	
Neutral	
Agree	
Strongly agree	

20. There has been a decline in food production and increase in food prices in the past 2 years.

Strongly disagree	
Disagree	
Neutral	
Agree	
Strongly agree	

Environmental factors

21. Animals have died due to effects of drought on rangelands.

Strongly disagree	
Disagree	
Neutral	
Agree	
Strongly agree	

22. There is a serious erosion of soils in our community

Strongly disagree	
Disagree	
Neutral	
Agree	
Strongly agree	

23. Plants used for traditional medicine have died due to drought.

Strongly disagree	
Disagree	
Neutral	
Agree	
Strongly agree	

24. We often draw contaminated (dark-coloured) water from our sources.

Strongly disagree	
-------------------	--

Disagree	
Neutral	
Agree	
Strongly agree	

COPING CAPACITY

Social coping factors

25. What is the overall public awareness by government of drought to this community?

Good	
Moderate	
Poor	

26. Is there any warning or prediction by the government or NGOs that drought will occur?

Yes	
No	

27. Are there any conservation methods provided by the government to manage drought in this community?

Yes	
NO	

28. Does government respond in any way during droughts?

Yes	
No	

29. If Yes, How well do they respond during droughts

Good	
Moderately	
poorly	

Economic coping factors

30. My household has other sources of livelihood other than depending on rain-fed agriculture.

Yes	
No	

31. Is your livestock insured against negative impacts of drought?

Yes	
No	

Environmental capacity factors

32. Do you plant drought resistant crops in times of dry seasons?

Yes	
No	

33. There is good rangeland management for animal grazing

Strongly disagree	
Disagree	
Neutral	
Agree	

Strongly agree	
----------------	--

34. What are your coping mechanisms during dry periods?

35. What interventions/projects should the government engage in, to reduce the adverse effects of drought?
