USING COMMUNITY BASED STRATEGIES ON DROUGHT MITIGATION IN KUTAMA-SINTHUMULE (MAKHADO MUNICIPALITY)

BY

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DEDICATION

I dedicate this work to my family, my wife, Tendani, my children Vhutshilo, Lufuno, Khuthadzo and lastly, my only boy child Mpho Mugogovhali, for the courage they gave me from the beginning until the end. I also pray that they must work very hard in their studies and love books in order to get knowledge. Knowledge is power.

I have fought the good fight, I have finished the course
and I have kept the faith.
~ 2 Timothy 4:7 ~

Now there is in store for me the crown of righteousness, which the Lord,
the righteous judge, will award to me on that day-and not only me,
but also to all who have longed for his appearing.
~ 2 Timothy 4.8 ~

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T.V. MUGOGOVHALI

BLOEMFONTEIN

DECLARATION OF ORIGINALITY

I, Tshililo Victor Mugogovhali, hereby present for consideration by the Disaster Management Training and Education Centre for Africa (DimTec), within the Department of Agricultural Economics, Faculty of Natural and Agricultural Sciences at the University of the Free State (UFS), my dissertation in partial fulfilment of the requirements for the degree of Masters in Disaster Management.

I sincerely declare that this dissertation is a product of my own efforts. No other person has published a similar study from which I might have copied and at no condition shall this work be published without my consent, as well as that of the Disaster Management Training and Education Centre for Africa (DimTec).

Views, opinions and proposals expressed herein should be attributed to the author, not to the Disaster Management Training and Education Centre for neither Africa nor any of the sponsors who were acknowledged.

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1.1 BACKGROUND AND INTRODUCTION

Drought is an affliction which may occur in practically any part of the world and is largely unpredictable in its incidence in both space and time. Governments and people are unprepared for it (Cooke, 1978). Although drought is thought to be caused basically by poor rainfall, there are many other physical factors which may increase drought susceptibility. Water which falls as rain may be absorbed into the soil to be used by the plants, may penetrate more deeply through the soil into ground storage or may run off on the surface into streams and rivers. There are differences in soil moisture resources, ground water resources and stream flow characteristic in various parts of the country, which are basically due to differences in the soil and to the underlying materials through which and into which the water may pass (Cooke, 1978).

It is a chronic problem in sub-Saharan Africa and apart from climate, human activity is one of the major factors responsible for environmental degradation and desertification, which has already damaged nearly a third of the word‘s arable land (Calow, 1998).

Drought is one of the most important climate phenomenon that the county faces; it threatens the existing cultivation of more hectares that are rainfed. The most vulnerable groups would be traditional rainfed (dryland) farmers, groups least resilient to climate-related shocks. In terms of Section 24(b) of the Constitution of the Republic of South Africa, 1996, everyone has the right to have the environment protected for the benefit of present and future generations, with measures that secure ecological sustainable and use of natural resources, hence drought, which is a normal phenomenon, calls for the development of a risk management system (White paper on Agriculture, 1996).

According to the above context, managing drought is central to the success of farm practices; farming communities need access to information regarding on-farm and off-farm risk, education on disaster management and training in farm management. Experience has shown that the annual cost of drought reduction programmes is far less than the annualised cost of post-disaster recovery and rehabilitation and the prevention is better than cure (Bruwer, 1990).

In South Africa, Farmers have the benefit on the assistance schemes for livestock in terms of fodder Supply from the Department of Agriculture; however farmers should take pro-active

measures to mitigate drought. It is well accepted that drought is likely to occur more often in the future as a result of global warming and climate change. Therefore planning for future droughts will enable drought to be better managed and the damage minimised (NDA, 2005).

Kutama–Sinthumule form part of Makhado Local Municipality of Vhembe District in the Limpopo Province and is situated in the western part about ±25 km away from the CBD area. It is a warm and semi-arid area and usually prone to drought. The temperature is always high, ranges from 34℃ maximum and 22℃ minimum in summer . Temperature in winter drops little to 28℃ maximum and 18℃ minimum. It mostly receive s 250 mm to 350 mm of rainfall per annum (SA Weather, 2009).

In South Africa and Kutama-Sinthumule in particular, farmers have the benefit on the assistance scheme for livestock feeds in terms of fodder supply from the Department of Agriculture; however, farmers should take pro-active measures to mitigate drought. It is well accepted that drought is likely to occur more often in the future as a result of global warming and climate change. Therefore planning for future droughts will enable drought to be better managed and the damage minimised. Assistance to farming communities should be in accordance to the disaster management framework and for the community to quality for the assistance, they should have applied prevention and mitigation strategies as well as utilising the early warning information in their planning (Brown, 1987).

Due to the drought condition of the area, farming in crop production is practiced at a minimum rate. The majority of small-scale farmers are embarked on livestock farming in a communal land grazing system. The challenge that they are facing is the loss of livestock during drought periods. Drought usually occurs as early as from May up to September or November depending on the onset of rain.

The Department of Agriculture make a provision of feeds as an intervention to assist the farmers with feeds at a very minimum cost (subsidised feeds). This kind of support is not sustainable because the provision of such feeds is always available for a short period and it usually came later after the dry season has passed due to the logistics challenges. To sustain the livelihood of the farmers of Kutama-Sinthumule, community based strategies need to be introduced by the farmers themselves.

Planning ahead to mitigate drought gives farmers and decision makers the chance to relieve the most suffering at the least expense. A plan that has strategies and tactics for before drought, during drought and after drought is essential. Drought planning can be done at farmers, village, region, State and at the Country levels. It is best to involve everyone who is affected in the planning process, including farmer families and farm workers.

1.2 AIM OF THE STUDY

Recurrent losses as a result of drought in the area undermine the livelihood of communal farmers and therefore necessitate further studies that can lead to improvement in dealing with drought in the area.

Drought is a major feature of the climate of South Africa and often has a devastating impact. The government needs capacity and expertise to respond timely and effectively to drought across various farming communities, especially those with poor resources. Most rural households depend on agriculture as their source of food and income. Agriculture plays an important role in stabilising the rural communities. When drought strikes these communities are often left without their investment in agriculture (NDA, 2005).

One way to better understand vulnerability is through a livelihood approach. The essence of a livelihoods approach is that it puts people at the centre of analysis. And it is cross-sect oral, taking into account economic and political, social and cultural factors. The goal is to obtain new approach to improve drought management plan which places people on the understanding of the natural hazards and human exposure to climatic extreme as well as a better understanding of the micro and micro context of people‘s vulnerable to drought (Elasha *et al.*, 2005).

The above scenario calls for a comprehensive approach to drought management. To be effective, an approach is required by the community to participate and to plan for appropriate mitigation strategies on dealing with drought. This is the point of departure.

1.3 PROBLEM STATEMENT

Local people have relevant traditional knowledge about their environment and indigenous coping mechanisms to deal with challenges of drought. But such knowledge is not utilised hence they rely on the government for assistance in terms of fodder for livestock during drought period.

When dealing with drought as a disaster, there is a serious administrative and logistic deficiency in national and provincial authorities regarding the provision of water and food (feeds in the case of livestock). Another shortcoming is the lack of information system that allows continuous assessment of the effective drought measures. A lot of challenges were encountered during the 1992-1993, 1997-1998, 2004-2005 droughts, such as lack of information and communication for the community to be resilient (Raedani, 2010).

1.4 RESEARCH OBJECTIVE

To investigate community based strategies for drought mitigation in Makhado Municipality (Kutama-Sinthumule area) on livestock communal farmers. The study will embark on the improving of early warning systems and establishing programs for risk reduction including preparedness, prevention and mitigation.

The primary aim of the study was to determine how community-based strategies can be used to mitigate drought and to determine the use of indigenous knowledge to reduce the impact. One way to better understand vulnerability is through a livelihood approach. The goal is to obtain new approach to improve drought management plan which places people on the understanding of the natural hazards and human exposure to climatic extremes as well as a better understanding of the micro and micro context of people ‘s vulnerable to drought.

Sub-objectives will include

- To identify communities‘ vulnerabilities
- To determine how farmers network (share information) among themselves
- To determine the understanding and use of indigenous knowledge to assist the farmers.

1.5 DIRECTION TO THE STUDY

The following hypotheses give a direction to the study:

- Lack of community participation on decision making for drought mitigation planning
- Lack of early warning information, education and training increases the vulnerability to drought
- Lack of community involvement in drought management plans result on the ignorance of potential local resources that the community possesses such as local indigenous knowledge e.g. the use of traditional drought indicators, etc
- A poor traditional farming method reduces more livestock during drought condition.

1.6 DISCUSSION OF THE STUDY AREA

Vhembe District Municipality is located in the far north of the Limpopo Province and has four local municipalities. Makhado Local Municipality hereafter referred to as MLM is the study area and is the largest of the four municipalities. Kutama-Sinthumule area, which is located on the western part of the municipality, will be the focus area of this study. According to the Integrated Development Plan (IDP, 2006:34) of the MLM, the entire population is 583 491 and is growing at about 1.4% per annum. It is composed of 53.1% female and 46.9% male.

The municipality wards were increased from 35 to 37 in terms of the new demarcation that was done before 1 March 2006 and with 279 total numbers of villages. The statistics and reports in the Department of Agriculture (DOA) of Vhembe District Municipality have shown that, subsistence agriculture is mainly practiced in the area of which crops are planted at a minimum rate. This is the most seriously affected area by drought because of its arid and semi-arid lands which by definition drought prone, mostly receives 250 mm to 350 mm of rainfall per annum (SA Weather). Agriculture has remained the most important sector in the African economy, with 70% of Agricultural inputs coming from small-scale farmers.

The research was done to 17 numbers of villages and for 465 farmers with 4 069 cattle. The following villages were considered in the study and they are: Madombidzwa, Magau, Tshikwarani, Tshikhwani, Ravele, Makhitha, Ramantsha, Midoroni, Maebani, Madodonga, Zamkomste, Muduluni, Tshiozwi, Manavhela, Gogobole, Muraleni and Madabani.

1.7 LIMITATION OF THE STUDY

The study was limited to Kutama-Sinthumule area here referred to as K-S and focused on drought mitigation strategies on livestock communal farmers. Due to the limited time, the study did not deal with the social and economic impact of drought and other commodities like crops. According to the local Extension Officer, there are 465 farmers in the area who occupied 17 villages and the rest are not farming on livestock. Small stock units (goats) are not considered on this study as they are more resistant to drought than large stock units (cattle).

The following goals will be of help to the communities;

- To obtain strategies to improve drought management plan for the communities and to understand the drought hazard and vulnerabilities.
- To investigate the road of understanding of local situations, culture of communication, co-operation and common understanding of issue, establish networks and partnerships for disaster reduction.
- To erase misunderstanding about drought and society's capacity to mitigate its effects

To convince policy and other decision makers that investments in mitigation are most cost effective than post-impact assistance or relief programs.

1.8 RESEARCH METHODOLOGY

The study was conducted on both qualitative and quantitative to get the best result. According to Marshall and Rossman (1995:46) a guideline on the situation will be provided where the

qualitative approach would be preferred such as research that cannot be done experimentally for practical reasons, but quantitative approach will applied when it comes to the number of population and the sample size.

In this case, the number of farmers and the number of livestock per village were considered. Quantitative research in this case was applied only when dealing with things that are counted, e.g number of cattle per farmer and data collection procedures are applied in a standardised manner, for example all the participants may answer the same questionnaire as according to Fortune and Reid (1999). However, it is again a qualitative type of study because it will be an intentional way of learning about peoples' feelings, thoughts and experiences. Information obtained can be shared with others as reports. It is a case study type of research in a qualitative approach, information are obtained through in-depth interviews and observations as a form of data collection. According to Mcroy (1995:2009-2015), the qualitative refers to research that elicits participant accounts of meaning, experience or perceptions.

1.8.1 RESEARCH DESIGN

The case study consisted of both theoretical and empirical design and it was achieved by studying a various theories of community-based disaster mitigation and identifies its application within the community of Kutama-Sinthumule. The following was the design for the research:

1.8.1.1 Sampling methods and sample size

It is difficult to give precise rules on which sample size is suitable. The suitable sample does not depend on the size of the population nor does it have to include a minimum percentage of that population. However, Bless and Higson-Smith (1995) argue that one of the major issues in sampling is to determine samples that best represent a population as to allow to an accurate generalisation of results. A sample is a small portion of the total set of objects, events or persons, which together comprise the subject of our study (Seaberg, 1988:240). It is generally stated that the larger the population, the smaller the percentage of that population the sample needs to be and vice versa (Neuman, 1997).

A heterogeneous sampling method was employed as an operational tool for data collection and 94 participants were selected at Kutama-Sinthumule. This sampling method was defined by Mitchell and Jolley (2001:497). The desired number of persons is selected proportionally within each of the different strata. This means drawing each sample according to the number of persons in that stratum, i.e. larger samples from larger strata and smaller samples from smaller strata. Selection within the different strata still occurs randomly. Hoinville *et al.* (1978:62) refers to this proportionate stratification.

In this study, Kutama-Sinthumule has 17 villages and 470 farmers and therefore the sample method to be used is Stratified random sampling as the number of farmers per village is not equal. For example, Village 1 has 60 farmers with 525 cattle, Village 2 has 39 farmers with 310 cattle, Village 3 has 27 farmers with 272 herds of cattle, etc. Because of the larger population, if the number of the farmers per village divided by 10% to obtain the simple size, only 47 farmers will be interviewed and that would be a small population size, hence the 20% will obtain a bigger number and enough population sizes. This means that the higher percentages used in a population the higher the sample size. For example: 60 farmers at Village 1 if divided by 10% will give the sample size of 6 and if divided by 20% will give an average of 12 people. In this case only 94 farmers will be interviewed at Kutama-Sinthumule. Larger samples enable researchers to draw more representative and more accurate conclusions to make more accurate predictions than in smaller samples, although this is more costly (Bless and Higson-Smith, 2000:93). This type of sampling is suitable for heterogeneous population because the inclusion of small subgroups percentage-wise can be ensured.

The following is actual sample sizes for each village and in a table format.

Table 1.1: Actual sample sizes for each village

Number of Village	Number of farmers	Sample Size (No of Cattle)	Percentages	No. farmers to be interviewed
1. Ramahantsha	60	525	20%	12
2. Gogobole	39	310	20%	8
3. Ravele	27	272	20%	5
4. Madabani	31	275	20%	6
5. Muraleni	12	113	20%	3
6. Manabela	37	232	20%	7
7. Zamekomste	7	111	20%	1
8. Maebani	8	57	20%	3
9. Muduluni	49	331	20%	10
10. Tshiozwi	24	206	20%	5
11. Tshikhwani	16	204	20%	4
12. Madombidzha	32	240	20%	6
13. Magau	12	143	20%	2
14. Tshikhwani	22	158	20%	4
15. Madodonga	61	498	20%	12
16. Makhitha	16	154	20%	3
17. Midoroni	17	157	20%	3
TOTAL	**470**	**3986**		**94**

1.8.1.2 Data collection methods

The methods of data collection in this design are primarily interviews and questionnaires, with a detailed picture of an individual's life being the product of the research. This is a case study type of research and the collection of data include interviews, questionnaires, observations or archival records, as such the researcher needs access to and the confident of the participants. The product of this research is an in-depth description of a case or cases. This implies, as

Babbie (2001) pointed out, that case researchers, in contrast to grounded theorists, seek to enter the field with knowledge of the relevant literature before conducting the field research.

Data collection methods to use are as follows:

- Administration of questionnaires

Babbie and Mouton (2001:233) mention that the term questionnaire suggest a collection of questions, a typical questionnaires probably contains as many statements as questions, especially if the researcher is interested in determining the extent which respondents hold a particular attitude or perspective. In this case the questionnaires will be delivered by hand by the field workers (Agric extension officers) to the farmers and they will also assist on the compilation which involves the interpretation of the language. After the questionnaires are completed they will be collected from the manager‘s office in the municipality.

- Types of questionnaires to be used include the following:

- Open questions give the respondent the opportunity of writing any answer in the open space. According to Neuman (1997:279) open questions may be best for the researcher to learn how the respondent thinks and to discover what is really important.
- Closed questions give the respondent the opportunity of selecting one or more response choices from a number provided (Strydom *et al.*, 1998)
- Multiple-choice questions must be used in the beginning; they are normally utilised to obtain information that can be logically divided into hard and fast categories.
- Ordinal questions are used to assign values to a series of aspects by placing them in a certain order of importance, urgency or seriousness.

- Interviews and observations

This is a data gathering method within the qualitative approach for which interview schedules are necessary. This will be combined with observations which will show the respondents agreeing on the answer. The interviews will be conducted during the village meetings and the schedule is indicated below.

- Data collection procedure

Participatory rural appraisal (PRA) will be followed to raise awareness and to obtain approval to conduct the survey in the selected villages and with the individuals representing the survey in the selected villages and with then individuals representing the village. The local extension officer will be invited to accompany the interviewer during the interview with individual households.

The following groups will be interviewed.

- Extension officers who will be facilitating the mobilisation of livestock farmers.
- Village traditional leaders and civic representative – group interviews
- Livestock farmer's committee member's representative- group interviews
- Lastly, will be the 20% of the farmers per village – group interviews

Morgan (1997:6) describes focus groups as a research technique that collects data through group interaction on a topic determined by the researcher.
Why the use of focus groups, there are three basic uses for focus groups (Morgan, 1997:2):

- They are used as a self-contained method in studies in which they serve as the principal source of data.
- They are used as a supplementary source in studies that rely on some other primary method, such as a survey.
- They are used as multi-method studies that combine two or more means of gathering data in which no one primary method determine the use of the others.

The purpose of focus groups is to promote self-disclosure among participants. It is to know what people really think and feel (Krueger and Casey, 2000:7) focus groups are useful when multiple viewpoints or responses are needed on a specific topic. These can be obtained in a shorter period of time than individual interviews. However, focus groups should be avoided if:

- You want people to come to consensus
- If you are asking for sensitive information that should not be shared in a group
- You need statistical projections
- You cannot ensure the confidential of sensitive information.

A schedule for time frame of the research will be as follow:

The first Meeting – April 2009	**May - June 2009- meeting with the Traditional leaders, village structures and Farmers**	**The third Meeting for Gathering of Data by July 2009**	**July and August 2009**
One meeting already held with the local technicians for them to understand the aim of the study.	1st week - Traditional leaders and civic structures 2nd week - Livestock Farmers' committees 3rd week - 20% of farmers for 7 villages 4th week - 20% of farmers for 8 villages	Questionnaires to be given to the farmers to answer, on the assistant of the Agric technicians	Data to be analysed, interpreted and research writings.

1.8.1.3 Data analysis and interpretation

Data interpretation and analysis for the study would be carried out in a combination of qualitative (descriptive) and quantitative (numerical) methods (Mouton, 2001).

The first meeting will be conveyed for the Agricultural extension officers to understand the type of study.

1. The aimed result is to have at least all the village representation come up with an approach to combat drought for their livelihood sustainability.
2. The study will start with two meetings, one with the traditional leaders and the representatives of the village local structures to explain the purpose. This will give a point of departure, the second meeting supposed to be held in the community hall with 5 representatives from each village to outline the research process.
3. The next meetings are to be held on the villages, at least one meeting per village. Interviews and questionnaires will be developed from there.
4. The final report of drought mitigation will be presented in the community hall for the community to adopt their best approach.

Much of the result and recommendations will be indicated in the research content based on the problem statement. Followed by the discussion of and analysis of the collected information, there will also be a critical examination of alternative solutions.

1.9 DEFINITIONS USED IN THE STUDY

1.9.1 **Drought** - Three types of drought has to be defined to give a better understanding of the concept:

- Meteorological drought has defined by Twigg (2004) as shortage of rainfall that dropped below a certain level.
- Hydrological drought refers to deficiencies in surface and subsurface water supplies. It is measured as stream flow and as lake, reservoir and groundwater levels.
- Twigg (2004) again defined Agricultural drought as the combination between the two kinds of drought (meteorological and hydrological drought) which occurs when there is inadequate precipitation and soil moisture to sustain crops or forage production systems.

1.9.2 **Hazards** - A potentially damaging physical event, phenomenon and/or human activity, which may cause the loss of life or injury, property damage, social and economic disruption or environmental degradation.

1.9.3 **Vulnerability** - This is the degree to which an individual, family, community or region is at risk of a particular hazard. Furthermore Blaikie *et al.* (1994) defined Vulnerability as the characteristics of person or group and their situation that influences their capacity to anticipate, cope with, resist and recover from the impact of a natural hazard.

1.9.4 **Mitigation** - Is defined by Blaikie *et al*. (1994), as structural and non structural measures undertaken to limit the adverse impact of natural hazards, environmental degradation and technological hazards.

1.9.5 **Disaster** - A disaster refers to "a progressive or sudden, widespread or localised, natural or human-caused occurrence which:

a) causes or threatens to cause:
   i) death, injury or disease;
   ii) damage to property, infrastructure or the environment; or
   iii) disruption of the life of a community; and
b) is of the magnitude that exceeds the ability of those affected by the disaster to cope with its effects using only their own resources" (Disaster Management Act: Act 57 of 2002).

1.9.6 **Risk** - Defined as a probability that negative consequences may arise when hazards interact with vulnerable areas, people, property and environment.

1.9.7 **Disaster Mitigation** - The concept of mitigation refers to "measures which can be taken to minimise the destructive and disruptive effects of hazards and thus lessen the magnitude of a disaster. Mitigation measures can be of different kinds, ranging from physical measures such as flood defences or safe building design to legislation, training and public awareness" (Maskey, 1989:39). It is important to note that mitigation is an activity which can take place any time: before a disaster occurs, during an emergency or after disaster, during recovery or reconstruction of areas. Mitigation should therefore be integral to on-going development programmes and projects of any authority. The Ministry of Home Affairs of Nepal (1999:350) adds that there is a need for a strong political determination, pragmatic policy formulation and quick decision making. This is so because mitigation measures often require structural changes in the set up of community facilities and may require relocation which often becomes contentious and costly.

1.10 PRELIMINARY LITERATURE STUDY

Managing drought is central to the success of farm practices; farming communities need access to information on-farm and off-farm risk, education on disaster management and training in farm management. Experience has shown that the annual cost of drought reduction programmes is far less than the annualised cost of post-disaster recovery and rehabilitation and the prevention is better than cure (Bruwer, 1980).

It is important to reiterate the fact that failure of a rainy season does not constitute drought and drought does not always lead to famine. In the some way it must be clear about the conceptual distinctions inherent in disaster management and risk assessment literature. Hazards may exist without causing disaster if precaution (mitigation) measures are in place. For example, drought may or may not result in widespread livestock deaths, which would be considered a disaster. The livestock deaths may or may not be serious enough to warrant for the declaration of an emergency, but only if the measures are in place.

Drought is a major feature of Southern Africa and often has devastating impact. Thus the South African government needs capacity and expertise to respond timely and effectively to drought across various farming communities. Currently, responses to drought are reactive due to the lack of proactive measures (White paper on Disaster Management, 1999).

Drought management is a shared responsibility of all levels of government, the farming community, the private sector and civil society. In addition, the effect of drought on SADC countries must be taken into consideration, since drought has no respect for borders. The objective of the drought mitigation should be in line with the Disaster Management Act (57 of 2002).

It is an affliction which may occur in practically any part of the world and is largely unpredictable in its incidence in both space and time. Governments and people are unprepared for it (Cooke, 1978). Although drought is thought to be caused basically by poor rainfall, there are many other physical factors which may increase drought susceptibility. Water which falls as rain may be absorbed into the soil to be used by the plants, may penetrate more deeply through the soil into ground storage or may run off on the surface into streams and rivers. There are differences in soil moisture resources, ground water resources and stream flow characteristic in various parts of the country, which are basically due to differences in the soil and to the underlying materials through which and into which the water may pass. Therefore traditional farmers rely on rain for their animals and crops in a fragile environment which are economically marginalised and therefore remain poor (Bruwer, 1990).

CHAPTER 2: LITERATURE REVIEW

Global perspective around strategies to mitigate drought

2.1 BACKGROUND ORIENTATION

Absence of a precise and universally accepted definition of drought adds to the confusion as to whether it exists and if it does the degree of its severity, thus drought, is often forgotten once it ends and everybody seems to be caught unaware again by the next one (ISDR, 2002).

Most of the drought definitions have therefore been application (impact) specific. The discussions of drought here focused on the three types and they are Meteorological, Agricultural and Hydrological. During the coming decade and century, it is expected that drought occurrence will increase, mainly due to the development pressures, population increases and environmental degradation that could itself lead to climate change. Several efforts therefore have been made at international, regional and national levels to address drought challenges (Anderson and Woodrow, 1989).

Drought has been a recurrent feature in most parts of Southern Africa, with five major periods of drought since 1980, 1982-1983, 1987-1988, 1991-1992, 1994-1995 and 1997-1998. Three of these events were regional in scale, with the 1991-1992 droughts considered the “worst in living memory,” placing more than 20 million people at serious risk (ISDR, 2002).

Community participation in drought mitigation is important to enhancing local technical skills, transfer of expertise at a local level e.g. early warning systems and procedures suited to small-scale requirements. For community to enhance skills, mechanisms should be developed for community participation in decision-making and information sharing to reduce the risk. The involvement and participation of farmers in all technical development needs to be encouraged by creating inclusive discussion forums.

The local community is the primary focus (in disaster reduction) since that is the common unit, which affected by disaster and more importantly, responds to deal with the event through participatory approach. Communities must be aware of the importance of disaster reduction for their own well-being. It then becomes necessary to identify and implement essential skills that can translate risk. Community participation has been recognised as the additional element in disaster management necessary to reverse the worldwide trend of exponential

increase in disaster occurrence of and loss from small- and medium-scale disasters, build a culture of safety and ensure sustainable development for all (Victoria,1991).

Participatory approach is of important for drought mitigation in the communities as it allow the people to explain their vulnerability and priorities. Participatory risk reduction initiatives are likely to be sustainable because they build on local capacity; the participants have ownership of them and have long-term development plans (Twigg, 2004:114). An approach is required to develop activities that can strengthen communities' capacities to cope with hazards and more broadly to improve residents' livelihoods. The process of working and achieving things together can strengthen communities. It reinforces local organisation, building up confidence, skills, capacity to cooperate. Participatory strategies build up a resilient community. A resilient community is one that takes intentional action to enhance the personal and collective capacity of its citizens and institutions to respond to and influence the course of social and economical change. It is clear from the literature that communities must act as follows to ensure that they are resilient (UNDP, 2004):

- They must take intentional action to increase their own resilience.
- They must develop their resilient profile
- Resilience communities have the ability to adapt to change or influence change.

United Nations Centre for Regional Development (UNCRD, 2007:3) notes that community based disaster management approach promotes a bottom-up approach working in harmony with the top-down approach to address hazards challenges and difficulties. It is their view that, for this approach to be effective, local communities must be supported into analyzing their hazardous conditions, understanding their vulnerabilities and capacities (Tau, 2007). Through CBDM (Community Based Disaster Management), vulnerable groups and communities to be transformed to resilient communities, which can withstand and recover from stresses and shocks. CBDM covers a broad range of interventions, measures, activities, projects and programs to reduce disaster risks, which are primarily designed by people in at risk locations and are based on their urgent capacities of vulnerable groups and communities to cope with, prevent or minimise loss and damage to life, property and the environment (Maskey, 1989).

2.2 PRINCIPLES OF COMMUNITY BASED PARTICIPATION (CBP)

Community based planning (CBP) is a form of participatory planning to promote community action and to link to the integrated development plan (IDP). Since this methodology developed in various countries such as Uganda, Zimbabwe, Ghana and South Africa, Kutama-Sinthumule Community can also adapt it (Maskey, 1989).

The principle of community approach developed to analysis of the institutional challenges in trying to promote sustainable livelihood, the aims are to address and empower the community to plan for itself (Wates, 2000).

The key principles that this approach to CBP are based on include:

- To ensure that poor people are included in the planning in order to make sure that people are identified and their livelihood analysed.
- The system needs to be realistic and practical; the planning process must be implementable using available resources.
- To build on strengths and opportunities.
- To promote mutual accountability between community and officials (upward and downward accountability is critical).
- To make sure that there is commitment for both the farmers and the community at large.

2.3 DROUGHT COPING STRATEGIES

Drought is a known risk in pastoral areas, for which pastoral people have developed coping strategies that, while not fully protecting either human life of livestock resources, have historically enabled the maintenance of livelihood and recovery in the post drought period. Over the last century, the efficacy of these chronic strategies has deteriorated. Many pastoral zones across the world are now approaching a state chronic vulnerability to humanitarian disaster. Government and donor communities have developed a range of responses to drought including destocking, animal health, livestock nutrition and re-stocking strategies. However, in the absence of sufficient warning, most are reactive rather than pro-active to disaster and hence fail to protect pastoralists from loss of livestock and their key asset. What is clear though is that the cost of inaction is much greater than cost of pre-emptive response, particularly destocking, even if disaster does not ensue (Pantuliano and Wekesa, 2008).

Drought has been the constant companion of humanity (Yevjevich *et al.*, 1983a). There is no single region where drought has not affected people‘s activities in one way or the other. Over the years, drought has been a problem in agriculture, urban water supply, industry, recreation and a host of other activities related to water and society. Strategies to mitigate drought impact may use two types of measures, proactive and reactive (Yevjevich *et al.*, 1983a).

The proactive measures defined as all measures, conceived or prepared by the conscious and systematic actions that may in the alleviation of drought consequences. The reactive measures defined as those measures that improved once a drought is set on. These reaction measures includes also the alternative of doing nothing, usually applied under the conditions

that individuals or organisations have enough resilience to sustain impacts and a post drought recovery.

The proactive strategy measures have three basic phases (Yevjevich *et al.*, 1983b):

- The first phase of the preparation of various measures, for example, intended to make water users more resistant to water shortages. The second phase of the proactive strategy, namely the measures undertaken during the ongoing droughts.
- The third phase of the proactive strategy measures, namely the measures undertaken in the post drought period, minimise the spread of drought impacts beyond the unavoidable geographic areas.

The reaction measures are related only to time of ongoing drought and post drought periods. Pastoral (Rural) communities have mechanisms for coping with drought such as livestock mobility, herd splitting or sharing, etc. Other mechanisms include household livestock diversity, trade and other linkages to the wider economy. Understanding these strategies and practices is essentials for the economy. Understanding these strategies and practices is essential for the development of policy, infrastructure and support services that enhance their ability to cope with drought (Barton *et al.*, 2001).

Fluctuations in livestock holdings and subsistence production and income during drought are inevitable. Government and donors should, therefore, seek to support pastoral households through the development of appropriate policy; such a policy should have three components (Yevjevich *et al.*, 1983a).

- Policy to support drought resilience
- Early warning
- Drought contingency planning

2.4 STRATEGIES TO REDUCE THE IMPACT OF DROUGHT

Different countries developed various strategies to reduce the impact of drought. Few countries selected and their strategies indicated for a better comparison with the study.

2.4.1 STRATEGIES IN THE INTERNATIONAL COUNTRIES

2.4.1.1 The country of Hawaii

Hawaii has undertaken the development strategies to mitigate the effect of drought. Droughts are one of most obstinate and pernicious of natural disasters that at its most severe form decimate crops and livestock; erode the landscape, damages territorial and aquatic wildlife

habitat, contributes to widespread wildfire and manifests after months of below normal precipitations and recovery requires much more than one good rainfall. Drought results from both climatic conditions and from human activities, which increases demand for water.

Drought can lead to a tough decisions regarding allocation of water, stringent water used limitations in large urban areas, problems in ensuring safe drinking water and adequate water supplies for fire fighting efforts. In the past, drought was addressed as a temporary emergency. Actions were taken in response to impacts in a reactionary fashion. The most important lesson learned in recent years is that the best time to reduce the impacts of drought is before they occur. Therefore, it was important for Hawaii to develop strategies to mitigate drought.

The Hawaii drought committee has decided to met regularly and works cooperatively towards implementing the mitigation projects identified during the workshops. The preparation of country drought mitigation strategies is a part of a larger state-wide drought-planning framework.

2.4.1.2 The Hawaii drought plan

The Hawaii Drought Plan also refers as HDP provides coordinated and consistent program and framework for integrating federal, state and country and private sector actions to reduce drought impacts. The HDP includes a description of historical drought occurrences, current monitoring programs by federal, state and local agencies, climatologically statistics and risk assessments of susceptibility and vulnerability to drought. The plan emphasises the identification of pre-and post- drought preparedness and mitigation measures for implementation by government agencies, stakeholders and public.

The plan anticipate that CLDCs (Country/Local Drought Committees) be the first initial implementation of mitigation activities and generally be the first to respond to and manage public health, safety and fire related issues.

2.4.1.3 The disaster mitigation Act of 2000

The Act requires the development of local or country plans for that particular country to be eligible for post-disaster funding. The purpose of these requirements was to ensure that these re local programs and projects in place that will help minimise the loss of life, property and total cost of disaster.

2.4.1.4 Drought mitigation strategies

In order to develop country-specific drought mitigation strategies, the Commission on Water Resource Management conducted a series of workshops within each country. The expected outcomes of the country workshop include the following:

- Identification of current mitigation measures and existing data gaps in drought information
- Transition from emergency response to early post proactive mitigation
- Improve post-drought impact assessment and validation of drought response/ mitigation measures.

Planning for drought mitigation activities is a key function of the Hawaii drought committee. The responsibility of the committee is to carry out activities in pursuit of the following:

- Further refinement and/or delineation areas of drought risk.
- Application, receipt and administration of funds for the implementation of identified projects and
- Provision of oversight and management of project implementation.

2.4.1.5 Hawaii drought committee

The Hawaii country/local drought committee is comprised of representatives from key government agencies, non- government organisations and major landowners with an active interest in drought – related issues. Based on participation in drought workshops, the present members include the following:

- Hawaii civil defence agency
- Department of water supply
- Hawaii fire department
- Department of Agriculture
- Department of Land and Natural Resources, Division of Forestry and Wild life and many others.

2.4.1.6 Institutional Arrangement (Relationship to state drought leadership)

The Hawaii drought plan establishes a drought leadership structure that in addition to the country/local drought committees consists of the Hawaii drought council, the state drought coordinator and the water resources committee. The purpose of each of these groups/entities and their relationship to the Hawaii drought committee is as follows:

- Hawaii drought council, which is the steering group that oversees the state-wide coordination of drought- related activities.
- The drought council currently functioning within existing agency authorities and responsibilities and facilitates access to services and/ or assistance to lessen the impacts of drought.
- The drought council serves as the liaison between the various entities involved with drought planning / response, including the Hawaii drought committee and the leading role of the governmental drought response coordination and media information releases.
- State drought coordinator is responsible for coordinating drought- related actions and communications between federal, state and country agencies, stakeholders and the general public. The drought coordinator position resides in the commission on water resource Management.
- The state drought coordinator will serve as the principal liaison between the Hawaii drought committee, the Hawaii drought council, Water Resources Committee and other government agencies.
- The Water Resources Committee monitors all available climatological data, reservoir storage levels, ground water conditions, weather forecasts and other analyse the necessary status and forecast level of drought conditions throughout the state.
- Information gathered by the Water Resources Committee will be available to the Hawaii drought committee through the state drought website and reports distributed by the state drought coordinator.

In short, the Hawaii drought plans involve monitoring programs by federal, state and local agencies, climatologically statistics and risk assessments of susceptibility and vulnerability to drought. The plan also dealt with emergency response to early post proactive mitigation. It emphasises the identification of pre-and post- drought preparedness and mitigation measures for implementation by government agencies, stakeholders and public.

Institutional arrangement of the stakeholders with regard to the drought management was the key principle of Hawaii State. Each stakeholder has its own task to participate and there are different committees that liaise with the others on matters dealing with drought, e.g. Water Resources Committee responsible with the water resource, monitors all available climatologically data, reservoir storage levels, ground water conditions and weather forecast.

2.5 DROUGHT MANAGEMENT IN INDIA

India has witnessed drought in its rainy season from time immemorial and from the ancient period, policy was always in place to mitigate the adverse impacts of drought on availability of

food. Even the local community and individual family mechanisms had traditionally evolved to support a community or a family from the misery of a drought situation.

It was in the 19th century in the British period, when the incidence of regional/all India droughts increased in which socio-political conditions might have also contributed, that the British Government, with the recommendations of the three Famine Commissions during 1880-1901, put in place a policy to combat famine or scarcity conditions. The Government took upon itself the responsibility to save lives and reduce starvation deaths by offering gratuitous relief and providing short-term employment on public works as far as possible near the habitat of the affected population (Cazri, 1979).

Drought of 1999 affected livestock due to drastic scarcity of water, fodder and feeds, subsidised wheat straw and water distributed at different places as a relief measures. The goats proved to be hardy and comparatively less affected. The selling price of sheep and goat was much lower Rs.200-250 compared to Rs.500-1000 in a normal year. The fodder deficit in the Western Rajasthan accounts for 30- 50% of the requirements in normal rainfall years but in the drought years the deficits could be very high. It was observed that nearly 78% of the livestock migrated from the Barmer District followed by 70% from the Jaisalmer and 20% from the Jodhpur Districts (Govt of India, 1988).

Livestock is most resilient livelihood for adapting to drought and other calamities all over the world. Animals can be out migrated, fed on stored fodder or can be liquidated under most adverse conditions. To feed nearly 185 million cattle heads and 97 million buffaloes along with large number of sheep and goats in the prevailing drought condition seems extremely challenging. A large number of unproductive male and female cattle are bound to suffer badly as farmers will prioritise saving their productive animals and all available resources will be deployed for their feeding.

2.5.1 DROUGHT MANAGEMENT STRATEGY

i) Seasonal migrations of animals from lower to higher hills or from one region to other is an old practice or safety net. However, there was a need for halting large-scale migration of livestock from drought prone states to other states due to emerging interstate concerns or disputes especially on quarantine considerations.

Migration of the animals to higher Himalayas or other hills and from Rajasthan to Madhya Pradesh and Uttar Pradesh was an old drought escaping strategy. Fodder grasses were transported from surplus to deficit states and restrictions were not imposed. Irrigated states like Haryana, Punjab and Western Uttar

Pradesh were not sparring fodder for arid regions because of the sub-normal fodder production in their own territory.

Immediate efforts were needed to grow fodder crops like oats, barley, *kasni* and *lucern* etc. in the canal command areas. Farmers were compensated for abandoning food or commercial cash crop to meet contingent fodder requirements.

ii) Resorting to alternate day watering to camel, sheep and goats.

iii) Avoiding long distance grazing as tired animals need more and frequent watering.

iv) Since stall feeding adversely influences the breeding efficiency in case of sheep, therefore, sheep should always be resorted to natural grazing.

v) Special care required for productive, lactating and pregnant animals. Animals are supplemented with additional concentrates and fodders.

2.5.2 PERENNIAL AND NON-CONVENTIONAL FODDER

i) Deep rooted bushes, trees, grasses and modified plants of cactus are highly drought tolerant and will be a durable adaptation to climate changes. Perennial component of vegetation may be enhanced in arid and semi-arid regions. Improve natural pasture/grazing lands by *in-situ* rainwater conservation, reseeding, inclusion of leguminous component such as stylo, sirato etc. and introduction of top feed fodder trees and bushes such as *Prosopis cineraria, Hardwickia binata, Albizia* species*, Zizyphus numularia, Colospermum mopane, Azadirachta indica, Ailanthus excels, Acacia nilotica* etc.

ii) Introduction of fodder spineless cactus as alternate source of green fodder especially in arid regions of Rajasthan and Gujarat requires international partnerships. They can be cultivated in very low rainfall areas and are highly drought resistant evolutions.

2.5.3 IMPROVED LIVE-STOCKING, BREEDING AND MANAGEMENT

i) Livestock shall continue to be the backbone of livelihood due to ever increasing population and shrinking per capita resources availability. Livestock rearing generates 4-5 times more employment as compared to rising of crops, which is

essential due to demographic growth. Decrease population of unproductive animals in drought prone areas through castration/controlled breeding is necessary. However, while implementing it, the socio-cultural conditions of different areas of the country should be considered. Cattle/livestock insurance schemes need to be more effective.

ii) In livestock improvement, introduction of exotic blood particularly in Rajasthan must be discouraged. There is a need for state level breeding policy for the livestock. Tharparkar cow which can graze under high temperature and produce higher milk during hot summers, needs scaling up.

iii) It has been reported that more deaths of livestock occur due to dehydration than because of non-availability of fodder. The animals are forced to drink saline water. There is also a need to identify livestock species/breeds having moderate body weight and resistance for prolonged dehydration Livestock based water management strategy, which focuses on recycling of water, de-contamination, washing, etc. needs to be developed.

iv) Establishment of permanent sites for cattle camps and fodder depots in drought prone areas. This is important because large-scale migration of livestock from, drought-affected areas to non-drought areas puts pressure on economy of those areas and subsequent problems. Cattle camps should be established in irrigated areas, where the supply of water to raise fodder crops is available. During drought condition, there should be safe provision for disposal of dead animals.

v) Because of shortage of fodder and feeds, animals are forced to graze on non–palatable and poisonous miscellaneous vegetation. There is, therefore, an urgent need of inventory of anti-quality factors in all kinds of plants growing naturally in drought prone areas.

2.5.4 EARLY WARNING AND FORECASTING OF DROUGHT

Drought in the Indian region has been monitored from the progress of onset and withdrawal of southwest monsoon. Weather forecasts broadly can be classified into three categories viz., (i) short range forecast (validity for less than 3 days), (ii) medium range forecast (validity from 3-10 days period) and (iii) long range forecast (validity for more than 10 days). These forecasts are issued by the India Meteorological Department through All Indian Radio, Doordarshan, private channels and various Newspapers. The National Centre for Medium Range Weather Forecast in the department of Science and Technology disseminates weather related information through its network of 82 Agro-met Advisory Service (AAS) units located mainly in

State Agricultural Universities and ICAR institutes. The ICAR funded All India Coordinated Research Project on Agro-meteorology is operative at 22 centres in the country. The main objectives of this project are: characterisation of climate, crop-weather relations, crop weather modelling, Weather related warning of incidence of diseases and pests and agro services to the farmers. Some private companies are also collecting and trading weather information to bankers, insurance and forward trading agencies (Govt of India, 1988).

2.5.5 OTHER STRATEGIES

In-situ rainwater conservation

Land shaping (if the soil depth permits), contour cultivation, field, contour bunding, tie ridging, digging of trenches, ridges and furrow system of sowing, raised on sunken beds are important rainwater for realising higher productivity.

Tank and farm pond

Ground water stored in self-sealing or lined ponds can be used for irrigation if there is long break in the rainfall or for pre- sowing of the *rabi* crops to ensure proper germination.

Contingent cropping

Relative more droughts tolerate, deep rooted and short duration crops, varieties and cultivars are available for different agro-ecological and rainfall situations. If the rain is excessively delayed or main, crop has failed cultivation or re-sowing with fodder is the best option. Fodder can be harvested at any stage keeping in view sowing of the next *Rabi* season crop.

2.5.6 SHORT SUMMARY OF DROUGHT STRATEGY IN INDIA

Local community and individual families are involved to support a community or a family from the misery of a drought situation. This is a community-based strategy of mitigating the impact of drought. Migration of the animals to other areas during drought condition was a mechanism applied by many farmers in India. The other strategy was to decrease the population of unproductive animals in drought prone areas through castration and controlled breeding.

The introduction of fodder trees, bushes and grasses as rehabilitation option on all kinds of wasted and abandoned lands. Deep-rooted bushes, trees, grasses and modified plants of cactus are as highly drought tolerant and durable adaptation to climate changes. There was an improvement of natural pasture/grazing lands by *in-situ* rainwater conservation, reseeding, inclusion of leguminous component such as stylo, sirato etc. Like many countries, livestock feeds and seeds provided to farmers by government as a relief measures but on different conditions depending on the drought management policies.

There is an establishment of permanent sites for cattle camps and fodder depots in drought prone areas and the creation of drinking water facilities. Lastly, early warning information like weather forecast disseminated to communities and farmers. Various universities and the Department of Meteorology are in the forefront of disseminating information.

2.6 DROUGHT MITIGATION IN PAKISTAN

2.6.1 DROUGHT PROFILE (CURRENT STATUS AND OPTIONS FOR FUTURE STRATEGIES)

Droughts are typical in Pakistan as in most of Southwest Asia and continue causing multiple adverse impacts. Pakistan frequently experiences several droughts. The Punjab Province experienced the worst droughts in 1899, 1920 and 1935. The North-West Frontier Province (N2FP) experienced the worst droughts in 1902 and 1951, while Sindh had its worst droughts in 1871, 1881, 1999, 1931, 1947 and 1999 (Ahmad, 2001).

The most severe droughts at the national scale were perhaps the most recent, which occurred in 1999-2000 prolonging up to 2002. The rainfall is erratic and river flows have dropped. Water in the Tarbela dam reaches the dead level in late February or early March almost every year. The current live reservoir capacity in the Indus Basin has been reduced due to situation. The recent drought has also exposed the Vulnerability of the Indus basin irrigation system and environmental issues in deltaic (Ahmad, Bari and Muhammad, 2003).

Agricultural growth suffered a severe setback during 2000-2001 as result of drought while major crops registered a negative growth of almost 10%. The overall agricultural recorded a negative growth of 2.6%. The drought persisted throughout 2001-2002, resulting in water shortage of up to 51% of normal supplies as against 40% of the previous year. In the Baluchistan Province as a whole, winter rains were reduced by 60% to 73% in some years. The situation is particularly serious in areas where ground is either deep or brackish and no surface- water resource is available. Other factors that increase the adverse impact of drought include overexploitation of groundwater in violation of groundwater regulations, deforestation, depletion of grazing pastures due to lack of management, poor farm water management and lack of controlled cropping patterns (Ahmad *et al.*, 2003).

The prevailing livestock production systems offered resilience and choices to shift between summer and winter quarters. This coping mechanism has shrunk largely due to reduction in range feed resources because of drought. Kachhi plains and canal-irrigated areas of the Naseerabad Division were traditionally home to large nomadic/transhumant herds during winter. However, these areas have very little to offer during drought years.

Dropped leaves, fruits and weeds extracted out of orchards constituted an important source of supplementing the feed available for grazing. With 40% orchards in upland Baluchistan dried, cut and sold as fuel, this source of supplementary feed has virtually disappeared in several areas. The livestock feed resources have further reduced due to stoppage of fodder intercropping in orchards because of water scarcity. This has happened particularly in Panjgour and Turbat where date and pomegranate orchards have been traditionally intercropped with berseem and lucerne during winter (FAO/WFP 2000a; 2002b).

2.6.2 COMMUNITY PARTICIPATION

Farmers in Pakistan undertook various measures to minimise their adverse effects. This include judicious use of water, exploitation of groundwater, purchase of water from tube wells, improvements in cultural practices and better overall management. As a result, overall agriculture registered a growth of 1.4% in 2001-2002 as against a decline of 2.6% during 2000-2001. The stored water was used for supplement irrigation and other consumptive uses. In no irrigated areas, the majority of farmers are still practicing traditional water-harvesting systems.

The institutional arrangements are reasonably well defined for the drought-relief activities, but there is hardly any institutional mechanism for drought preparedness and mitigation to address the long-term issues (Kazmi, 2001).

2.6.3 MITIGATION STRATEGIES RECOMMENDED FOR PAKISTAN

The existing system of monitoring drought and its impacts on various sectors was weak. There was a need to develop a policy for access to information related to drought and water management. Sharing and exchange of information regarding drought monitoring and impact assessment are also limited among the countries of the region.

Pakistan can provide a unique opportunity to share the experiences of the watercourse improvement program, laser levelling, furrow-bed irrigation, skimming wells and salinity management. A regional research and development program for drought and water management seems justified for exchange of experiences to build future activities.

Farmers were encouraged and motivated to use indigenous water- harvesting system. These systems of water spreading if integrated with recharging the groundwater provide cost-effective interventions for mitigating the drought impacts.

Due to the excessive exploitation of ground water coupled with the success drought, water tables in different parts of the Sindh and Baluchistan have considerably declined. Communities should be directly involved in the recharging the aquifers and in the conjunctive use and management of surface water and groundwater resources. The majority of farmers are still practicing traditional water harvesting systems, which dated back even to 3000BC. Traditional water- harvesting and conservation practices are common in the provinces of Baluchistan and Sindh are briefly described below.

2.6.3.1 Karezes

The *karez* or *ganat* is one of the oldest traditional irrigation systems of Baluchistan (as well as in the neighbouring Afghanistan), which was devised as means of tapping ground water supplies using gravity flow. A gently sloping tunnel conveys water from below the water table to the ground surface. It consists of a series of dug – wells and tunnels that collect ground water and discharge it to the command area. Each *karez* delivers water to the fields of shareholders, who have contributed money and labour for its construction. The *karezes* are typically 1 to 5 km long, but have been as long as 50km in the past. *Karez* is the primary mechanism for water harvesting and delivery in Baluchistan. Once a *karez* is established, it can be used for years. A census in 1998 revealed that there were 493 *karez* in Baluchistan (IUCN, 2000). An average *karez* can irrigate 10 and 20 ha. It is a perennial source of water for both domestic and irrigation purposes.

2.6.3.2 Sailaba or Rod-Kohi system

The *Sailaba* or *Rod-Kohi* system is widely practiced in the Sindh and Baluchistan Provinces. The *Sailaba* cultivation is done by diversion and spreading of intermittent flows of hill torrents. As water comes down the hill, is checked by a series of earthen diversion bunds. To meet their local irrigation needs, small communities have constructed diversion bunds on a number of smaller streams for irrigation. The water thus checked allowed to seep slowly down into the soil. Water rights have been historically determined. Water can only go through the main, predetermined channel. It flows out of the side water channels only when there is excess water. Relatively large fields, each over 3 ha, may be irrigated in this system and deep-rooted crops are usually recommended (Khan, 1994).

2.6.3.3 Khushkaba system

The *khushkhaba* system comprises in- situ conservation of incidental rainwater and catching runoff from large uncultivated blocks and it to cultivated fields. Fields receive water directly from precipitation or from localized runoff. The *khushkhaba* is merely a chance cropping with

a successful crop being raised on average once in 5 years. The main difference between the khushlands and the sailaba lands is that the catchment area of the former is small and is often not bigger than the field enclosed by the embankment or bund. Embankments are made facing the hills, so that the natural gradient within the bunded area helps collect the runoff above the embankments (GOP, 1980, 1990 and 2000).

2.6.3.4 Tarai

The most common type of water conservation in the arid regions of Sindh is a dugout commonly called *itarai. Tarais* collect rainwater for water supply and are filled from the water drained from a level watershed and collecting area. They could be dug cheaply in low-lying areas with clay soil where there is some runoff. The depth of water in a *tarai* is normally 3 and 4 m. The water from *tarais*, which is less than 3 m deep, is fast lost through evaporation. The evaporation rate is relative to the amount of runoff received and its frequency during a year. The evaporation rate in drought prone areas is significant, as there are prolonged dry spell with no rainfall or runoff received during the dry year, therefore, the *tarai* depth is normally twice the annual evaporation in the area. They are dug so deep as to hold water for long periods. A *tarai* has sloping sides so that livestock can have access to water. Desilting is needed after 3 and 4 years (Appell, Baluch and Hussain, 2003).

In short, Pakistan has a unique opportunity to share the experiences of the watercourse improvement program such as furrow-bed irrigation, skimming wells and salinity management. Communities are directly involved in the recharging the aquifers and in the conjunctive use and management of surface water and groundwater resources. The majority of farmers are still practicing traditional water harvesting systems. This is showing that Pakistan farmers are also using traditional methods to combating drought and the communities as a whole are more fully involved. Community at Kutama-Sinthumule can learn more on Pakistan on the use of traditional knowledge and community participation in general.

2.7 MANAGING DROUGHT IN THE US

The following aspects considered in the US for the management of drought.

- Impact of the resent drought
- Vulnerability to future drought
- Estimation of drought risk
- Drought hazard and prediction of the future

The economic, environmental and societal impact of drought is severe and extremely costly. For 1988 alone, the climate prediction centre calculated that drought cost the US $9 billion.

Vulnerability to drought - a routinely occurring part of the natural hydrologic cycle is increasing in all parts of the United State due to; Population growth and population shifts, especially in the Western state and in the Southeast (Patzek, 2004).

The US population has increased by about 50% since 1970. Land use changes due to development and other activities reduce water storage and degrade water quality. Global climate change directly and indirectly affects the hydrological cycle, reducing water availability and vulnerability to drought in many regions of the United State. Increased demand comes from all sectors such as Agriculture and Municipal uses, energy, ecosystem habitat maintenance and recreation. Considered together, all of these factors call for development of collaborative, science- based and risk- informed water resource assessment in pursuit of effective drought management and mitigation in the United State (Wilhite and Buchanan-Smith, 2005).

2.7.1 KEY OBSERVATIONS ABOUT PRESENT DAY DROUGHT AND VULNERABILITY TO FUTURE DROUGHT IN THE UNITED STATES

- Multiple severe drought since 1996 have had substantial economic, social and environmental impacts in many regions of the country. In the first half of the 2007, vast areas of the nation are experiencing severe to exceptional drought. The extent of drought was likely increased as water demand increase in the summer months.
- Global climate change expected to increase the frequency, intensity and duration of drought in the U S.
- Government was poorly prepared for drought; the drought management plans that do exist were often ineffective and tend to reinforce the status quo.
- Federal, state, local and tribal government needed to collaborate with water managers and water users in a shift from crisis base, reactive drought management to risk base proactive drought management, with greater emphasis on drought monitoring and early warning, prediction, mitigation and preparedness planning.
- Existing laws evolve in order to balance the needs of the public and agricultural uses while encourage conservation.

2.7.2 IMPACT OF RECENT DROUGHT IN THE US

At present, no comprehensive methods or database exist that can be used to assess long-term losses resulting from drought (Hayes *et al.*, 2004). Instead, based on case studies in 1995 the federal emergency management agency (FEMA) estimated that annual average drought cost to the United State ranges from US $6 to $8 billion (FEMA, 1995).

According to estimates by the Texas Agricultural extension service, the 1996 Texas drought was estimated to cost producers of US $9 billion, reducing the overall State economy by about US $5 billion. For 1988 alone, the climate prediction centre calculated that drought cost the united state nearly US $9 billion. The impact of drought largely depends on societal vulnerability and adaptive capacity at the time and place where drought occurs (Pielke *et al.*, 2005).

2.7.3 DROUGHT HAZARD AND PREDICTION OF FUTURE DROUGHTS

Drought hazard is the likelihood that an area affected by drought in the future. Virtually all parts of the United State are drought prone and drought occurs some where in the county each year (Seager *et al.*, 2007).

For many regions, drought has occurred for five or more consecutive years. Montana and surrounding states and portions of the Great Plains experienced severe drought for seven or more consecutive years. Arizona and New Mexico experienced five consecutive years of drought during this same period. In 2006, drought was particularly severe in the Great Plains region, extending from Texas and Oklahoma in the south to the Dakotas in the north. Parts of Nebraska have also experienced seven consecutive years of drought.

2.7.4 IMPACT OF GLOBAL CLIMATE CHANGE ON DROUGHT HAZARD

Global climate change recognised as a major factor considered in assessing future drought hazard. Climate has changed many times over earth history and climate will continue to change in the future. Higher temperatures tend to increase evaporation and vegetative demand for water (transpiration) and consequently are likely to reduce water available for stream flow and ground water recharge. Estimates for the Colorado River Basin that consider the influence of temperature range from small to quite significant reductions of flow (Nash and Gleick, 1991).

2.7.5 PROSPECTS FOR PREDICTING DROUGHT

Drought prediction can improve with intensive investigations of key processes that control or interact with climate. Better understanding in these areas may lead to more reliable, less uncertain predictions:

- More accurate predictions of soil moisture-based on predictions of precipitation demand for water by vegetation, infiltration and recharge-will be of great value in improving drought predictions. An integrated combination of models and

measurements is needed and higher spatial resolution will yield more answers that are reliable.

- Because the El Niño-Southern Oscillation (ENSO) changes the likelihood of precipitation in certain seasons and regions of the United States, improved understanding of ENSO can improve drought prediction.
- Because it is related to ENSO and other climate conditions, accurate predictions of ocean temperatures throughout its depth are integral to better drought prediction.
- Better model representation of the air-sea interaction in general is needed and is important to accurate depiction of phenomena that operate at time scales of 40–70 days. This behaviour is not well captured in most models and is absent in many.
- In winter, the presence or absence of just a few major storms can significantly alter the total seasonal precipitation, especially in the south-western United States. Better understanding of the "weather-climate connection" is widely thought to be important for weekly to monthly and seasonal forecasts.
- Improvements needed in connecting global and regional climate models with basin-scale and watershed-scale hydrologic models. Efforts made to couple of models in the Pacific Northwest, California and the Colorado Basin, but more work is required.

2.7.6 TIMELY AND CONTINUOUS DATA NEEDED FOR RELIABLE ASSESSMENT AND PREDICTION OF DROUGHT.

Data are the empirical basis both for understanding of present drought conditions and for prediction of the future drought risk. Longer records are usually more valuable than the shorter record. In the United State, the longest records are those from the National Weather Service (NWS) Cooperate Network (NRC, 2004) and from the stream gauge records of the U.S. Geological survey (NRC, 2004).

Data are collected in a consistent and well-documented manner to minimise uncertainty arising from methodological artefacts and to reduce the ambiguity of interpreting observed changes and variability. The spatial density of observations must be high enough to capture the spatial variability of the measured parameter. Beyond precipitation and temperature, it is desirable to measure quantities that are relevant to assessment of the impacts of drought such as soil moisture. Data collection should be automated and not require human intervention. Information becomes available in a timely manner. Drought should never arise as a surprise.

2.7.7 MAKING INFORMATION RELEVANT FOR MANAGERS

The challenge of communicating already- uncertain climate information is compounded by climate change. The main messages that managers given today are:

- It is definitely getting warmer (virtually all climate models agree on this)
- However, they expect that the hydrological cycle will be enhanced due to more energy in the atmosphere. Given this information, managers are reliable to respond with, '' I need more information before I will invest in adaptation activities – I do not know how to respond to this much uncertainty''.

2.7.8 UNDERSTANDING THE CONTEXT

- Information needs to be provided in ways that are accessible to decision makers through information channels that they find usable.
- A way to significantly enhance communication of scientific and risk-based information requires that users perceives the information to be salient (answering the right question) credible (coming from the trusted source) and legitimate (accurate).

2.7.9 ENCOURAGE MANAGERS TO ASSESS RELIABILITY OF REGIONAL PREDICTIONS

There are multiple ways of assessing the quality of climate predictions, one of the ways to measure confidence or reliability is to use skill scores. For example, the NQAA climate prediction centre produced monthly forecasts of climate conditions that focus on whether conditions will be wetter or drier, warmer or colder than the average condition in the past 10 years. It is possible to measure the accurate of these predictions using the skill scores. (In many cases, it has been found that these predictions have little skills). By being familiar with the skill scores, it is possible to know where in the country and in which season the predictions are most likely to be accurate (Hartmann *et al.*, 2002).

2.7.10 PUBLIC POLICY RESPONSES TO DROUGHT PAST PRACTICES AND FUTURE OPPORTUNITIES

From a scientific perspective, drought planning is most soundly implemented at the scale of watersheds and hydrologic basins because watershed and hydrologic basins often span multiple geopolitical jurisdictions including international boundaries. Drought planning can and should occur at local, state, federal and tribal levels.

- It consists of monitoring drought, understanding vulnerability and identifying measures to reduce the impacts of drought.
- The national drought mitigation centre advocates *"mitigation"* that is implementing measures to reduce vulnerability before drought occurs. This is mostly likely being effective when drought planning incorporated into other resources and water use planning and into agricultural policy.
- Resilient to drought can be enhanced through improved drought monitoring, including the creation of an integrated early warning, improved mitigation measures and preparedness plans that incorporate an organisational structure or frame work for improved coordination between government agencies.
- There is a need to analyse how public and its various segments, such as managers, politicians, farmers and others, react to forecasts and warnings of the imminence of drought and the progress of drought itself. Such attitudinal analysis is important in assessing the various aspects of drought impacts and responses. This reaction determines the feedback on actions taken for drought mitigation and adjustments to impacts (Yevjevich *et al.*, 1983a).

2.7.11 PAST POLICY CALLS FOR ACTIONS

There have been numerous "*calls for action"* for the development of drought mitigation plans and a national drought policy for the United States. These calls for action have come from prestigious organisations such as the Western Governors Association (WGA), General Accounting office, National Academy of sciences, Great Lakes Commission, American Meteorological society and the Interstate Council on Water Policy.

The National Drought Policy commission (NDPC) has the following goals:

- Incorporate planning and the implementation of plans and proactive mitigation measures
- Develop and incorporate comprehensive insurance and financial strategies into drought preparedness plans.
- Maintain a safety net of emergency relief that emphasises and self-help.
- Coordinate drought programs and response effectively, efficiently and in a customer oriented manner.

Additionally, the NDPC recommended that congress pass a national drought preparedness act that would establish a non-federal partnership through a national drought council.

In the United State, the drought of 1976-77 provided a variety of lessons learned, particularly in such states as California, Washington and Colorado. Abundant literature has pointed out that certain lessons linger as the drought ended by the beginning of 1978. In some areas

such as the Joaquin valley, California, the farmers made an impressive effort to overcome the drought and, agricultural production in 1977 soared, although at a significant cost of energy consumed to pump underground water supplies.

2.7.12 FINDINGS AND RECOMMENDATION

Despite repeated calls for action to move the nation towards a more proactive, risk-based management approach for drought and little progress has been made. Participants in the national conference urge Congress and the administration, along with state, local and tribal governments, to move forward immediately in implementing the ten recommendations identified below, thereby fostering a new paradigm for drought management.

1. Implement drought mitigation planning at the local, state, federal and regional (hydrologic basin) levels, as called for in the Report of the National Drought Policy Commission in 2000. Drought policies that foster a high level of cooperation and coordination at all levels of government can lead to greater social and economic security for the United States.
2. Include in drought risk mitigation planning, potential impacts from certain temperature rises due to global climate change.
3. Create a new “national water culture” that promotes sustainable water management practices to meet long-term societal needs. A broad educational initiative can foster partnership and collaboration among local, state, federal and tribal governments, educational and research institutions, energy and industrial users and the public. Increased public education may be the single most effective enabling element of long-term drought mitigation and water resources management.
4. Engage stakeholders within common hydrologic basins in development of water resource management plans and implementation of drought mitigation plans.
5. Foster place-based science with community stakeholder involvement as a part of public education and outreach. Place-based science can result in better understanding of local climate conditions and variability and can provide information at space and time scales relevant to resource decision-makers.
6. Maintain and enhance hydrologic and meteorological data collection capabilities and existing data sets and develop new data needed to improve assessments. Automate data collection to the maximum practical extent and collect data at the frequency and scale needed to support model analyses and decision-making. Fully fund and implement the National Integrated Drought Information System (NIDIS) passed by Congress in 2006.
7. Encourage the use of risk-based approaches for assessment of multiple potential future climate and water management scenarios in support of decision-making.
8. Support research that improves fundamental scientific understanding of drought. Enhanced understanding through better data and improved representation of

underlying physical, chemical and biological processes will lead to more reliable and more useful drought assessment and management tools.

9. Value water at its full worth in the development of water resource management and drought mitigation plans. That valuation must include recognition of water resource services in economic, environmental, recreational and public health contexts.
10. Harmonise roles and responsibilities of cooperating institutions and reduce conflicts in applicable policies in order to yield data that are more useful, more efficient analyses and more effective decision-making.

The ten steps planning process again published in the United States to serve as a methodology for plan development (Wilhite, 2000).

The ten-step process used for planning effective drought management strategies is outlined below and in brief.

Step 1: Appoint a drought task force
Step 2: State the purpose and objective of the drought plan
Step 3: Seek stakeholder participation and resolve conflict
Step 4: Inventory of resources and identification of groups at risk
Step 5: Establish and write the drought plan
Step 6: Identify research needs and fill institutional gaps
Step 7: Integrate science and policy
Step 8: Publicise the drought plan
Step 9: Develop educational programmes
Step 10: Evaluate and update the drought plan

In short, like any other countries, drought in the United State occurred for five and more consecutive years in the regions. The Federal, State, Local and tribal government collaborate with water management and water users with greater emphasis on drought monitoring and early warning, prediction, mitigation and preparation.
The existing laws that balance the needs of the public and agricultural uses and conservations were encouraged. Drought predictions have improved with intensive investigation of key processes that control or interact with climate. Relevant information become available to the managers and ways to access such information provided to the decision makers. Therefore, there were a numerous calls for action for the development of drought mitigation plans in the United States.

2.8 DROUGHT MITIGATION STRATEGIES IN AFRICAN COUNTRIES

The study will be limited to four countries case studies such as Namibia, Kenya, Ethiopia and South Africa.

In 2006, a particularly severe drought hit the greater Horn of Africa, plunging some 11 million people areas o the Ethiopia- Kenya –Somalia border were badly affected, with livestock losses of up to 70% and the mass migration of pastoralists out of drought –affected areas. The Humanitarian policy group (HPG) argues that such catastrophic effects can be averted if pastoralist livelihoods are supported with timely and appropriate livelihood- based interventions (Pantuliano and Wekesa, 2009).

Livelihood interventions, such as livestock, related initiatives (for example destocking) and water related interventions (including creating and rehabilitating wells and boreholes) contribute both to save lives and to strengthening pastoralist's resilience. By equipping communities with the ability to manage and respond to shocks in the early stages of a crisis, strategic livelihoods interventions, allow for more timely and appropriate responses to disasters than is possible with typical emergency relief assistance.

Planning for the occurrence of drought within an overall framework of assistance to pastoralist's means that dealing with drought becomes part of a long-term strategy to address pastoralists' vulnerability. Such framework would necessarily combine relief and development of policies and activities (Pantuliano and Wekesa, 2009).

2.8.1 LIVESTOCK COPING WITH DROUGHT IN NAMIBIA

A case study by Jim Sweet, 1998

Namibia suffered its worst drought in 1992-1993 and the biggest damage occurred in communal areas than the commercial farmers. Some emphasis was to put on considering the effects of drought on the rangelands, the options available to livestock keepers to contend with drought, but the majority of the rural populations of Namibia are agro-pastoralists, hence the implications of crop production are also covered (Sweet, 1998).

With a mean annual rainfall of approximately 270 mm, Namibia is rated to have the highest dried climate in sub-Saharan Africa. The communal areas are situated mainly in contiguous blocks in the north of the country while the commercial areas occupy most of the centre and the south of the country. The commercial farming sector is well developed while the traditional

or communal farming sector is subsistence-based and the cropping areas are normally allocated to individual households while the grazing areas tend to be shared by members of a community.

There are currently about 2.1 million cattle, 2.4 million sheep and 1.8 million goats in the country. However, numbers of cattle and small stock fluctuate considerably in response to high and low rainfall years. Grazing livestock are raised under extensive ranching conditions, relying on natural pasture. Beef cattle's ranching is the largest contributor commercial farming income. The production systems in the communal areas are based on pastoralism and the majority of the households are subsistence, rather than commercial. Production per hectare is more important than production per head and communal livestock owner's combination of objectives is met a policy of herd maximisation rather than turnover (Sweet, 1997).

Communal areas are by definition shared by many livestock owners. The boundaries and the users are clearly defined and the rights of the community to grazing and water resources are not exclusive. Communal livestock owners seldom consider overgrazing as an urgent problem. In good rainfall years, there is enough grazing and in poor rainfall years not; hence the condition of the rangeland is seen to be dependent upon rainfall rather than management or stock numbers per se (De Jager, 1993).

Range condition in the communal areas of Africa has tended to be evaluated from a condition ranching perspective, hence the frequent reports of poor status and overstocking. However, an increasing awareness that the characterisation of qualitative states such as range condition and range degradation should be in context of the management objectives (Behnke and Sweet, 1998).

More than half of the country expecting less than 300 mm annual rainfall and drought has tended to be an imprecise term in Namibia, with the median rainfalls being lower than the means; bad years are more common than good years. The most devastating drought experienced to date in the region occurred in the period 1982-1984 due to consecutive years of poor rainfall and the last one in 1992/93. Nonetheless, the Namibian government has continued to pay out drought relief subsidies in some part of the country every year since 1991 and a national drought declared again in 1996 (Central Statistics Office, 1996).

2.8.1.1 Mitigation strategies and previous drought relief measures

Prior to independence in 1990 Namibia was administered by the Republic of South Africa which by then had no definite policy or structure for dealing with drought in Namibia, but rather a series of *ad hoc* subsidies and relief measures applied as and when considered

necessary. This situation continued after independence and there was no official drought policy until 1997. The first government assisted drought relief measures in Namibia comprised a food-for-work scheme introduced during the drought of the 1930s, whereby white commercial farmer paid for manual labour on road and dam construction. Subsidies on fodders, licks and access to alternative grazing areas were first introduced in the early 1960s, when an outbreak of foot and mouth disease coincided with an extended drought, even though there was no policy. Before 1978, agricultural subsidies were granted almost exclusively to commercial farmers.

After 1978, with the introduction of the Transitional, Administration, drought relief subsidies for fodders and licks, destocking and transport to alternative grazing areas were provided and homelands were provided mainly by the ‘‘*second tier’’* ethnic administrations operating in context of the policy of apartheid. There was not a standard definition of drought and droughts were declared in an area on recommendation of the extension officers (Vigne and Whiteside, 1997).

Since 1981, commercial farmers have had to be stocked at not more than 60% of the official carrying capacity in order to be eligible for drought relief subsidies, although the subsidies were intended for drought relief, they became permanent measures for commercial farmers until 1987, when they were discontinued. From then on until the 1992 drought, commercial farmers had to apply to the Land Bank or the Agricultural Credit Board for loans in emergencies. During the 1989 drought, when about 150 000 people were severely affected in the communal areas, a National Drought Relief Committee was established, but it relied on the Council of Churches of Namibia (CCN) to register beneficiaries and to store and distribute food aid.

2.8.1.2 Community participation (Communal livestock farmers respond to drought)

The traditional response to drought by stockowners in the communal areas was to move their animals. Owing to the spatial variability of rainfall and the seasonal availability of surface water, seasonal movements are the norm, especially in the drier areas.

In most regions of the communal areas, there are localised concentrations of a permanent settlement, where crops fields are situated and other areas of relatively light grazing pressure – due mainly to lack of water quantity or quality. It is in these areas where many households own or share cattle posts centred on hand-dug wells and, occasionally, boreholes. These areas provide the first option for drought movement of livestock from settlement areas and it is in these areas that the government drills emergency boreholes. Unfortunately the drought boreholes tend to be closed at the end of the drought and so become cattle posts or

settlements and the grazing is no longer available from drought relief, so necessitating the drilling of new boreholes where grazing can be found in the next drought.

Many stockowners in the northern communal areas move their livestock across the border into Angola, where stock concentrations are lower. Communal areas have greatly restricted stock mobility, especially, for the smaller farmers who cannot split their herds and or do not have the labour resources to move their livestock (Sweet, 1998). Buying in fodder is seldom a realistic option in communal areas, where most of owners are subsistence farmers and cannot afford to buy feed and because in a situation of drought there is unlikely to be any space of fodder close at hand. The subsidised fodder provided by the government has reduced the need for farmers to buy their own feed. Livestock routinely graze crop residues in the dry season but in drought situations the stock yield as well as the grain yield tends to reduced.

Communal farmers are generally reluctant to sell animals during drought for a number of reasons including (Vogel, 1997).

- They are not commercially oriented and have different reasons for keeping livestock.
- The majority of herd and flock sizes are small
- They don't know how the drought will last
- By the period of drought, animals have lost conditions and their sales value reduced.
- The sale points tend to be far and stock loses further condition reaching the sale points.

There can also be a suspicion by communal farmers that they are being coerced by government to de-stock. From a communal perspective, livestock numbers are usually the best insurance against drought. With larger stockowners this form of insurance is often accompanied by herd splitting, either maintaining control (e.g. through herders) or distributing animals to poorer relatives to look after in return for milk, draft and dung outputs (Vogel, 1997).

2.8.2 DROUGHT MITIGATION IN KENYA

2.8.2.1 Factors influence the impacts of drought in livestock

Livestock production is a major source of employment in Kenya and makes a significant contribution to the economy. The livestock intervention programme that took place during 1999-2001 drought in Kenya‘s pastoral areas was the largest the country had ever seen. Donors made funds available than ever before; more types of intervention were carried out;

more agencies were involved in implementing programmes and a large geographical area was covered (Aklilu and Wekesa, 1999-2001).

Drought impacts on pastoralists are worse than meteorological or ecological drought in Kenya. This is often expressed as the increased vulnerability of pastoralists to drought. The ecological impact of climatic conditions over a year or run of years is depended on features of the pastoral productions system: these include the mix of grazing and water resources available may be more or less able to support successful responses to reduced rainfall.

2.8.2.2 Coping strategies and adaptive strategies

A wide range of responses to drought may occur in pastoral (rural) system, including changes in livestock and grazing management and changes in household economy and subsistence. Pastoral people have developed a variety of strategies to cope with the fluctuations in forage availability that is associated with drought. These include both responses to specific single – year and multi- year droughts and longer-term shifts in production strategies to increase resilience; categories often referred to as 'coping strategies' and adaptive strategies (Davies, 1996), but between which it is often hard to draw clear boundaries. Several major strategies, such as livestock mobility, livestock marketing and livelihood diversification show features of both coping and adaptive strategies.

Mobility

A major common element in response to drought is the long- distance livestock travel. In Kenya at least, animal movement actually proceeds through a series of recognised grazing areas, from local extended dry-season areas on the outer fringes of permanent water (until either water or grazing are exhausted), through the nearest and safest drought refuges, terminating in the most distant and risky refuges. In general, long- distance movement is avoided until necessary and pastoralists commonly report heavy losses of livestock if such movements have to be undertaken.

Sales of livestock

The other classic response to drought is to sell livestock. Some element of livestock sales forms an adaptive strategy in most if not all pastoralist societies, but the extent, regularity and rationale of marketing vary greatly and for some societies appear to be changing over the medium term (Barton and Morton, 2001). Livestock sales as a short- term coping strategy need to be understood within this context, but while regular adaptive livestock sales concentrate on surplus and cull females, drought-time livestock sales may, as drought impact worsens, include breeding females, thus eroding households' core assets.

Changing species composition of herds

Longer-term strategies for coping with drought include changing the species composition of herds. There has been a shift in northern Kenya towards keeping camels as opposed to cattle. Small stock (sheep and goats) may also have replaced cattle in some communities since cattle herds reproduce faster than camel herds and some camel-keeping ethnic groups have traditionally transferred surplus human population to cattle-keeping groups through marriage and adoption (Spencer, 1973), but under conditions of frequent and widespread drought these trends have been partially reversed. Camels are much more drought tolerant than cattle and need watering only once in two weeks and are therefore, able to graze ranges that are inaccessible to cattle.

Destocking / restocking

The Anglican church of Kenya–Marsabit Development office (ACK-MSO) submitted a proposal for destocking to the livestock sub-sector working group in may 2000. The destocking programme becomes a restocking programme following rains and a consequent change in the community's needs; about half of the funding allocation was spent on restocking.

- Destocking/restocking was the most successful livestock-related intervention because of the high level of community interest.
- More animals were offered for sale than the interventions could handle, indicates that pastorals were willing to sell their stocks at need.
- Restocking prevents pastoralists from falling out of the production system and becoming destitute. The key was to encourage small-scale community- implemented restocking targeting up to 50 families at a time.
- Female animals meant for restocking should be provided with feed until pasture is available. Restocking should supplement traditional system, not replace them.

The result was that a total, 6 026 male sheep and goats and 45 male cattle were purchased. The total amount of the money injected into the economy as a result Ksh3.84 ($51 208). After rains fell in some parts of the project area, the intervention was changed to restocking and a total of KSh8.2 m was spent on restocking poor households.

Lessons learnt – The community- based approach of the intervention made it more effective and more efficient in implementation. The ability to switch from destocking to restocking in response to changing needs was also critical. However, households were not given a choice in how they were paid for their stock during the destocking phase (i.e., in cash alone, or only in feed) nor could they sell old female animals not ideal for breeding (Aklilu and Wekesa, 1999-2001).

2.8.2.3 Early warning system and drought management mechanisms

The Drought Preparedness Intervention and Recovering Programme (DPIRP) developed Kenya's early warning and drought management system. This was an initiative funded by the Dutch, in cooperation with the Kenya government, between 1995 and 2000.

The drought –monitoring system has the following features:

- It covers selected drought–prone areas in depth, rather than aiming for coverage, which would be prohibitively expensive.
- The design of the monitoring system (i.e. what data to collect and how to interpret it) is based on a close analysis of local livelihoods, rather than the standard general indicators often collected by centralised national systems. Indicators are selected to pick up changes in the environment, local economy and human welfare.
- Information is collected through monthly ground monitoring by locally- recruited field monitors, at house hold and community level (random sample of households is used)
- Monthly bulletins classify the local situation, according to a comparison of indicators with the expected range of fluctuation, at one of four warning stages – normal, alert, alarm or emergency. In this way, decision- makers can immediately see which action is needed.

2.8.2.4 Traditional early- warning system

Pastoralists have been using their own traditional early-warning system for centuries and the following are some of the indicators used by Gari pastoralists.

- Forecasting from flowers – if some species of tree fail to flower or if the leaves do not turn green after flowering, this is an indication of the approach of drought.
- Forecasting from the seasons - Gari pastoralists divide the spring, Autumn, summer and winter seasons into eight, 15 and 50-year cycle.
- Astronomy – Traditional astronomers use the position of the stars to predict the future, if for example, the morning star does not reappear within seven days of its disappearance. This is taken as bad omen.
- Forecasting from animal behaviour – The belly of a freshly- slaughtered goat (usually the position of the intestine or the colour of the organs) is read to predict the future.
- Interpreting the call of the bararato (the rain angel) – the bararato bird, also called the rain angel, can be read as an indicator of drought or rain. Drought is likely to occur if such bird makes noise that sound like 'chichichi', if his followed by 'shashashasha' then the drought is likely to be broken**.**

2.8.2.5 The role of local coping mechanism

Through the drought crisis, pastorals and agro pastorals employed their own coping mechanisms this includes;

- Migration of animals
- Herd management, such as maintaining female dominated herds.
- Diversification of livestock species
- Keeping herd sizes large
- Supplementing livestock feeds using commercial feeds as well as shrubs, tree materials and crops residues where available.

2.8.3 IMPROVING DROUGHT RESPONSE IN PASTORAL AREAS OF ETHIOPIA

A case study of pastoral areas of Ethiopia indicates how pastoral people improve drought response and develop risk management strategies. The study initially looked at the causes of vulnerability in pastoral areas, Pantuliano and Wekesa (2008). The study has identified mechanisms, systems, capacities and institutions, which need to be strengthened in order to trigger more timely and appropriate livelihood-based response to drought. There was growing evidence that the impact of these problems on food security is underpinned by economic, social and political factors of vulnerability (CARE, 2003).

In 2006, a particularly severe drought hit the Greater Horn of Africa, plunging some 11 million people into crisis. The pastoral areas on Ethiopia, Kenya and Somalia border were badly affected, with livestock losses of up to 70% and the mass migration of pastoralists out of drought-affected areas (Sara, 2009). In the Borana zone, livestock accounts for more than 90% of the local economy, and the marketing of livestock and livestock products generates more than 60% of household income. The Damte family lives in Magado in the Borana zone in Ethiopia. Before the drought, the family's 30 cattle and 25 sheep and goats had provided a regular source of milk and meat. The drought left the Damtes with two weak cows and one goat (CARE, 2003).

2.8.3.1 Risk management strategies for Ethiopian Farmers

It is important to understand how pastoralist communities managed the risks they face. Diversification is a method whereby the communities exchange products or assets into another format that has a minimal risk, e.g. cattle can be transferred into monetary value.

2.8.3.2 Diversification of livestock strategies

The poor farmers felt that they had insufficient livestock assets to diversify, while the middle class and the wealthy felt that their main constraint was lack of information on the available options.

2.8.3.3 Use of informal transfer

Informal transfer (changes of food system) include the redistribution of food and cash, mainly through remittances or soft loans and the redistribution of productive resources such as livestock and sorghum seeds. These food changes systems were developed in a participatory manner involving all community or clan members and are highly respected and adhered by all.

2.8.3.4 Employing coping strategies

Mobility was a primary way of managing livestock related risks. Communities also adjusted to the composition of their herds to the external environment. For example, communities in Oromiya village have been predominantly cattle owners. However, there is evidence that camels, which are more drought-tolerant, are increasing in number. Herd diversification also enables pastoralists to minimise losses from disease.

The ability of pastoralists to market their livestock products in a timely fashion and a fair price is essential to improve risk management at the household level; it fosters monetisation, savings and investment and lessens the threat of environmental degradation through overgrazing.

Over whelming, populations in pastoral areas want to improve their access to markets through construction of access road to markets and provision of water along livestock routes. The response to drought in Ethiopia in 1993 was regulated by the Government, National Disaster prevention, preparedness and management. The focus was on the investing in structural development and building local resilience (Hogg, 1992). This entails investment in fodder production, pasture development, water supplies, veterinary care, markets and mobile abattoirs.

Types of external intervention in response to the 2005/2006 drought were as follow:

- Drilling of boreholes
- Rehabilitation of water sources
- Water tracking

- Livestock vaccinations and treatment
- Commercial destocking
- Supplementary feeding of livestock with concentrate feeds
- Supplementary feeding of livestock in feeding camps.

2.8.3.5 The drought early warning system

Community's own traditional early warning system; based on experience and observation of seasonal rainfall levels, bird behaviour and condition of pasture, water and livestock, pastoralists are able to detect risk. However, there was an official early warning system defined as livestock early warning system (LEWS)

- The livestock early warning system subproject in the USAID Global livestock CRSP aims to provide information in a timely manner to allow pastoralists and national and international agencies to respond to drought condition.
- The LEWS technology suite utilises weather satellite site to acquire temperature and precipitation data. This is linked to a forage production model to create a detailed map showing plant species, soil conditions, livestock levels and movement. The system can generate data for a 30-year period (TLEWS, undated).

2.8.3.6 In conclusion

The problems pastoralists face in the Horn of Africa are structural and protecting, building and rebuilding their livelihoods assets requires an integrated approach to risk management that addresses the underlying causes of vulnerability. Drought seen as a normal and often predictable event and efforts must be focused on strengthening response capacity while at the same time continuing long-term development effort. Pastoralist themselves recognise the vital importance of early activities to prepare for drought*. My husband and I were not well prepared for the 2006 drought and that is why we lost so much; concluded Dik* (Ogwell, 2009).

By supporting pastoralists at an early stage and ensuring that this support is sustained long enough to help them recover from catastrophic effects of drought on their lives and livelihoods, the suffering of millions of pastoralists like the Damtes will be significantly reduced.

2.9. DROUGHT MITIGATION WITHIN THE SOUTH AFRICAN CONTEXT

South Africa has long been recognised as a country subjected to recurring drought of varying and temporal dimensions. The 1923 final report of drought investigating commission remains a classic publication on the subject, while the great droughts of the 1930s, which coincided with the great depression, have been the local drought benchmark for decades (Bruwer, 1990). Droughts are a regular feature of the weather pattern of the southern tip of Africa, the incidence of drought (broadly defined as less than 70% of normal precipitation being about once in three years.

In terms of Section 24(b) (111) of the constitution of the Republic of South Africa, 1996 everyone has the right to have the environment protected, for the benefit of present and future generations, through reasonable legislative and other resources that secure ecologically sustainable development and use of natural resources while promoting justifiable economic and social development". Hence drought, which is a normal phenomenon (White paper on Agriculture, 1996*)*. Calls for the development of risk management system, the features of which are captured in the White paper on Disaster Management (1999). These features are: prevention or reduction of disasters, mitigation, preparedness, response, recovery and rehabilitation.

The above legislative framework is the basis for a drought management plan. Such a plan must also reflect the vision of the Agricultural sector plan, namely a united, non-racial and prosperous agricultural sector, as well as those elements of the strategic plan of the Department of Agriculture that have a direct bearing on the support of beneficiaries of the department.

Drought management plan proposed in the white paper based on the four key performance areas (KPAs), namely institutional arrangements, integrated institutional capacity, disaster risk assessment and reduction planning, response and recovery. The following enablers are seen to drive drought management: information and communication; education, training, public awareness and research; and funding (NDA, 2005).

Drought is a major feature of the climate of South Africa and often has a devastating impact. Thus the South African government needs capacity and expertise to respond timely and effectively to drought across various farming communities, especially those with poor resources, currently, respond to drought are reactive due to the lack of active resources.

2.9.1 DROUGHT MITIGATION

Factors contributing to drought disaster in South Africa remain low average rainfall, Lack of land ownership, lack of education and subsistence agriculture or marginal land lead to

deforestation and environmental degradation, malnutrition and unemployment, all of which heighten vulnerability (Agricultural policy on drought, 1996).

The priority of drought mitigation is the protection of the critical resources and systems or which communities depend. Drought mitigation has four basic components:

- Awareness
- Avoidance
- Early warning
- Rehabilitation

Fund made available to the affected provinces for drought/ fire assistance in the form of repairing of agricultural infrastructure in communal areas, for livestock fodder and the transportation of fodder to the depots. The cost of fodder and transportation subsidised at a certain percentages. Farmers has to commit themselves and to comply with certain prerequisites before they qualify for assistance such as reducing their livestock up to a certain number required by the scheme and to apply by writing to the Department of Agriculture.

2.9.2 RECIPROCATION

Reciprocation is the commitment of farming communities to satisfy certain prerequisite; before drought assistance may be accessed. This implies that the government will provide assistance on condition that mitigation procedures are followed. The aims of reciprocation are to promote resource conservation and long- term sustainability of economic farm production.

2.9.3 INSTITUTIONAL ARRANGEMENT FOR DISASTER MANAGEMENT

The Department of provincial and Local Government is responsible for the execution of the Disaster Management Act 57 of 2002 (NDA, 2005). Drought management is the responsibility of National, Provincial and local government, Farming communities, the private sector and civil society.

2.9.4 NATIONAL DEPARTMENT OF AGRICULTURE

According to drought management plan (DMP) August 2005, The National Department of Agriculture makes the following strategic interventions to reduce drought risk:

- Setting up and maintaining a comprehensive national drought plan and a system of information management, monitoring and evaluation
- Conducting research in drought –prone areas
- Assisting provincial Departments of Agriculture with drought assessments;

- Implementing and improving early warning systems.

Sourcing allocated funds from the National Treasury for disaster drought assistance programmes and service delivering and others.

2.9.5 PROVINCIAL DEPARTMENT OF AGRICULTURE

- Lead education and awareness campaigns;
- Conduct drought assessments and compile reports;
- Appoint and pay service providers to deliver services to affected farming communities;
- Ensure that the farming communities implement risk reduction measures and
- Implement disaster assistance scheme for affected farming communities to mention but few.

2.9.6 FARMING COMMUNITIES

Farming communities are assisted according with the Disaster Management Framework but in order for them to qualify for assistance they should applied the following.

- Applied prevention and mitigation strategies such as de-stocking
- Utilised early warning information in their planning.
- The planning of drought tolerant crops
- And the use of available insurance products.

2.9.7 PLANNING FOR DROUGHT: A 10 STEP PROCESS DEVELOPMENT

South Africa also adapted the 10 steps of drought planning process developed by Wilhite (2000) and explained in brief as follows:

Step 1: Appoint a drought task force
Step 2: State the purpose and objective of the drought plan
Step 3: Seek stakeholder participation and resolve conflict
Step 4: Inventory of resources and identification of groups at risk
Step 5: Establish and write the drought plan
Step 6: Identify research needs and fill institutional gaps
Step 7: Integrate science and policy
Step 8: Publicise The drought plan
Step 9: Develop educational programmes
Step 10: Evaluate and update the drought plan

2.10 CONCLUSION

In conclusion, most of the international countries have more or less the same strategies to cope with drought. Hawaii plans involve monitoring programs by federal, state and local agencies. The plans dealt with emergency response to early post proactive mitigation. The country emphases the identification of pre and post drought preparedness and mitigation measures for implementation. Institutional arrangement of the stakeholders concerning the drought management was the key principles of Hawaii State.

In India, the local community and individual people are assisting each other from the misery of a drought situation. The strategies of decreasing the population of unproductive animals in drought prone are the prerequisite. Early warning information disseminated to communities and to the farmers in particular. Pakistan has a unique opportunity to share the experience of the watercourse improvement program such as furrow- bed irrigation and skimming wells. The majority of farmers are still practicing traditional water harvesting systems and conservation practices such as *Karees, Sailaba or Rod-Kohi system, Tarai and etc.*

United States developed the following recommendations as strategies to mitigate drought:

- Development of policies that foster a high level of cooperation and coordination at all levels of government that can lead to greater social and economic security for the United State.
- A new national water culture to be promoted for sustainable water management
- Engagement of stakeholders' participation for development of water resource management plans.
- Lastly, institutional co-operation for reducing conflict for effective decision-making.

In the African countries, the majority of farmers affected by drought are mainly communal as they do not have grazing camps and their farming methods are more traditional. They have the status of having more livestock than the carrying capacity of land.

Drought is seen as a normal and often predictable event and efforts were to focuses on strengthening response capacity while at the same time continuing long-term development effort.

The Government regulated the response to drought in Ethiopia in 1993, National Disaster prevention, preparedness and management. The focus was on the investing in structural development and building local resilience (Hogg, 1992).

In Namibia, destocking becomes a restocking programme following rains and a consequent change in the community's needs; about half of the funding allocation spent on restocking.

Destocking/restocking was the most successful livestock-related intervention because of the high level of community interest.

The other classic response to drought in Namibia is to sell livestock. Some element of livestock sales forms an adaptive strategy in most if not all pastoralist societies, but the extent, regularity and rationale of marketing vary greatly and for some societies appear to be changing over the medium term (Barton and Morton, 2001).

In Kenya for example**,** mobility was a primary way of managing livestock related risks. Communities also adjusted to the composition of their herds to the external environment. The traditional response to drought by stockowners in the communal areas was to move their animals. The role of local coping mechanism in drought crisis were that pastorals and agro pastorals employed their own coping mechanisms which include, migration of animals, herd management such as maintaining female dominated herds and diversification of livestock species.

2.10.1 TRADITIONAL EARLY- WARNING SYSTEM

Pastoralists have been using their own traditional early-warning system for centuries such as

- Forecasting from flowers – if some species of tree fail to flower or if the leaves do not turn green after flowering, this is an indication of the approach of drought.
- Astronomy – Traditional astronomers use the position of the stars to predict the future, if for example, the morning star does not reappear within seven days of its disappearance, this is taken as bad omen.
- Forecasting from animal behaviour – The belly of a freshly- slaughtered goat (usually the position of the intestine or the colour of the organs) is read to predict the future.
- Interpreting the call of the bararato (the rain angel) – the bararato bird, also called the rain angel, can be read as an indicator of drought or rain. Drought is likely to occur if such bird makes noise that sound like 'chichichi', if his followed by 'shashashasha' then the drought is likely to be broken**.**

To conclude, the local community is taken as the primary focus, since is the common unit that can be affected by drought. Response to deal with the events is through participatory approach. Community participation has been recognised as the additional element in drought management. It is of most important to consider strategies employed by other countries on dealing with drought. African countries in general are further encouraged to continue on their drought management strategies and Kutama-Sinthumule in particular has to copy.

CHAPTER 3: DATA INTERPRETATION AND ANALYSIS

3.1 INTRODUCTION

A heterogeneous sampling method was employed as an operational tool for data collection and 94 participants were selected at Kutama-Sinthumule. The sampling method was defined by Mitchell and Jolley (2001:497). The desired number of persons is selected proportionally within each of the different strata. This means drawing each sample according to the number of persons in that stratum, i.e. larger samples from larger strata and smaller samples from smaller strata. Selection within the different strata still occurs randomly. Hoinville *et al.* (1978:62) refer to this proportionate stratification.

The schedule for data collection consisted of three (3) phases, namely:

Phase 1:

The researcher had outlined the purpose of the research to the extension officer who assisted during the interview and again described how the questionnaires are to be completed and interpreted to the farmers. At least four extension officers agreed to assist on the completion of the questionnaires.

Phase 2:

Meetings were held in the two territorial councils i.e. for Kutama and Sinthumule to brief the farmers and the whole process of data collection. In that meeting the purpose was explained and farmers were satisfied and accepted the way the research will be conducted.

Phase 3:

The interviews were scheduled to be conducted in two days for 94 livestock farmers. The interview started on the 4th of August 2010 at Kutama Agricultural office and lasted for four hours. 54 farmers were interviewed and 54 questionnaires were completed. The process continued at Sinthumule territorial council the following day and 30 farmers were interviewed. Farmers didn't turn up as expected on the second day because of pension pay out. Ten (10) farmers reported to Madombidzha agric office for the last interviews. 94 questionnaires were completed as arranged.

The primary aim of the study indicated in chapter one was to determine how community-based strategies can be used to mitigate drought and to determine the use of indigenous knowledge to reduce the impact.

When referred to the objective of the research in chapter one, the researcher wanted to investigate community based strategies for drought mitigation in Makhado Municipality (Kutama-Sinthumule area) on livestock communal farmers. The study will embark on the improving of early warning systems and establishing programs for risk reduction including preparedness, prevention and mitigation.

In Chapter 2, the researcher demonstrated the way international countries have tried to combat drought while working together with farmers. Community based approach introduced by many and the management of livestock was improved.

A good example is in India, where local community and individual family are involved to support a community or a family from the misery of a drought situation. This is a community-based strategy for mitigating the impact of drought. Migration of the animals to other areas during drought condition was a mechanism applied by many farmers. Another strategy was to decrease the population of unproductive animals in drought prone areas through castration and controlled breeding.

In Pakistan, communities are directly involved in the recharging the aquifers and in the conjunctive use and management of surface water and groundwater resources. The majority of farmers are still practicing traditional water harvesting systems. Community for Kutama-Sinthumule can learn more on Pakistan and India on the use of traditional knowledge and community participation in general.

3.2 DATA PRESENTATION AND ANALYSES

3.2.1 GENDER

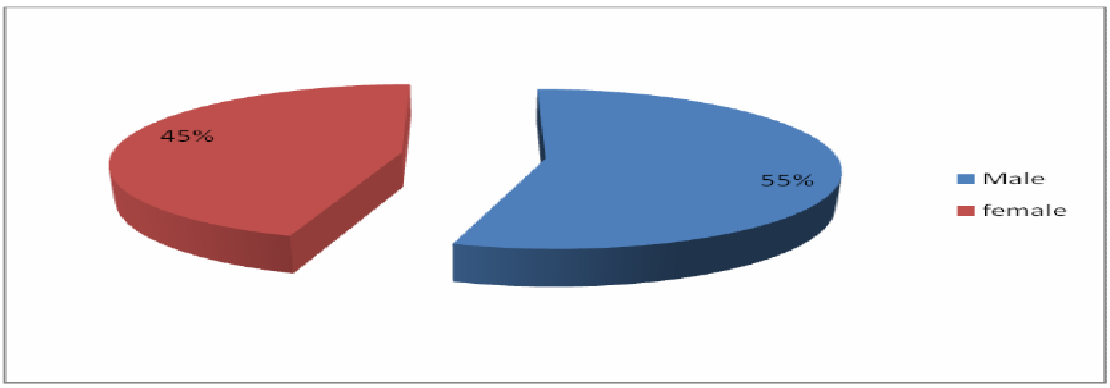

Figure 3.1: Gender

Figure 3.1 indicates the outcome of the interviews that 55% of the participants were males, whereas the rest of participants were females. This also indicate that in Kutama-Sinthumule (K-S) there are more male farmers than female who are engaged in cattle farming. Traditionally and in the past, men were farming with livestock whereas women were embarked on crop production and again responsible for household activities. The result is a true reflection that the system is still being practiced.

3.2.2 AGE OF FARMERS

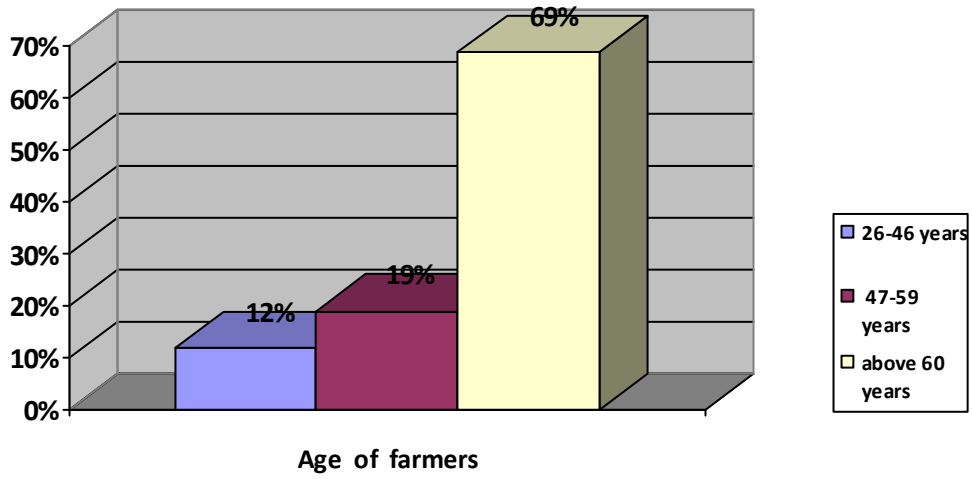

Figure 3.2: Age of farmers

Figure 3.2 indicates the ages of farmers who took part in the interviews. The majority of farmers in (K-S) are more than 60 years. In most rural villages, farming in livestock is carried out by old people while young people are working in cities and others are at schools far away from homes. This might be the reason why drought mitigation in the area are not taken into account while considering the age of the farmers. The result indicated that 69% of the farmers are 60 years and older. These ages of people on the other hand can play a vital role on the provision of indigenous knowledge and on issues dealing with drought forecasting and early warning system. Farming by adult people is most common in the rural areas and cattle are taken as assets in the house hold.

3.2.3 LEVEL OF EDUCATION

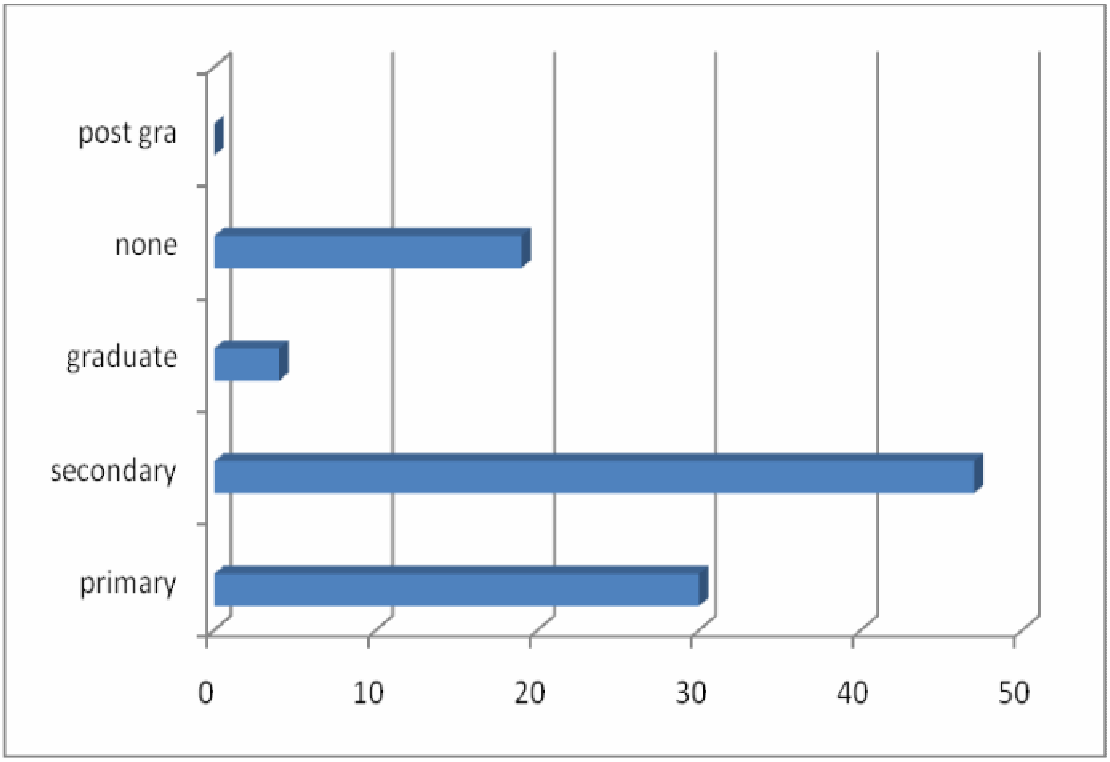

Figure 3.3: Level of education

The most important information in this figure is to determine an educational level of the farmers, as most of agricultural massages are disseminated via newsletters and magazines such as Farmers Weekly. As far as the focus is of concerned, the majority of farmers understood the context of the study immediately as it was explained to them during the first day, because they have approached secondary level, the majority dropped out from standard 6 and 8 (Grade 8 and 10) Figure 3.3 indicates that 47% of the farmers conducted some secondary education followed by 30% of them with only primary education.

3.2.4 TWO WAY CONTINGENCY GRAPH COMPARING GENDER AND LEVEL OF EDUCATION

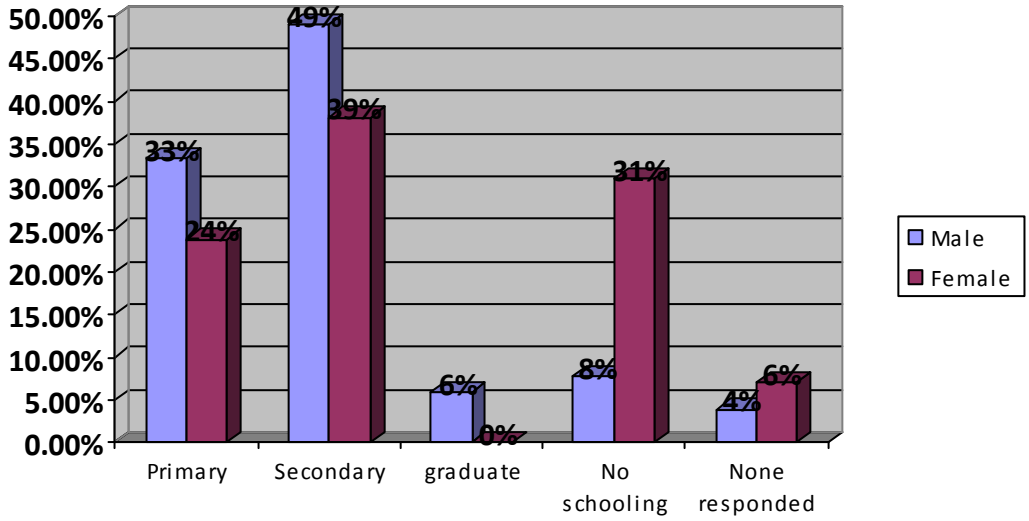

Figure 3.4: Two way graph for comparing gender and education

Figure 3.4 is a two way contingency, showing the comparison between gender and level of education. It was found that the majority of farmers attended secondary education, 49% were with males and 39% were females. On primary level, male's farmers were at 33% and female farmers at 24%. Graduate were found to be only 4% males and female farmers never went to tertiary schools. 4% of the males did not responded to the question and 6% were female farmers. Females were historically forbidden to go further to high schools. They had to get married as early as 16-18 years and bringing cattle in the family. (Information received from one elderly farmer in the area).

3.2.5 MARITAL STATUS OF THE FARMERS

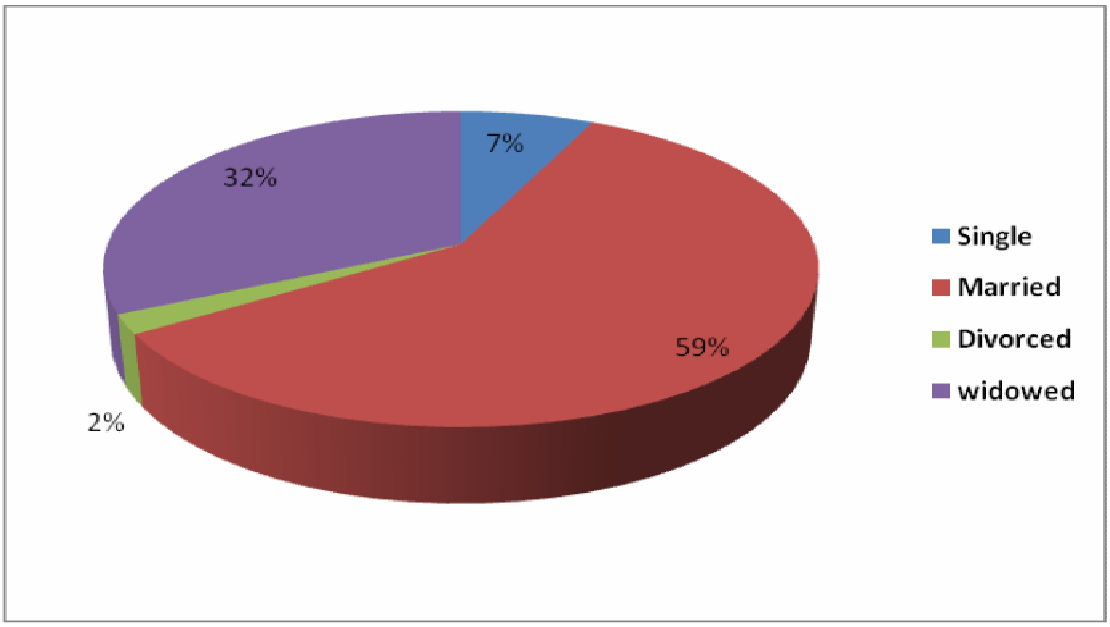

Figure 3.5: Marital status of the farmers

The results shown above are that 59% of the farmers are married and 32% are widowed. This was useful for the study that married people are likely to have diverse sources of income which can enable them to cope and recover quickly on drought incidences. They can assist each other using indigenous knowledge in term of drought mitigation.

3.2.6 TYPE OF FARMERS

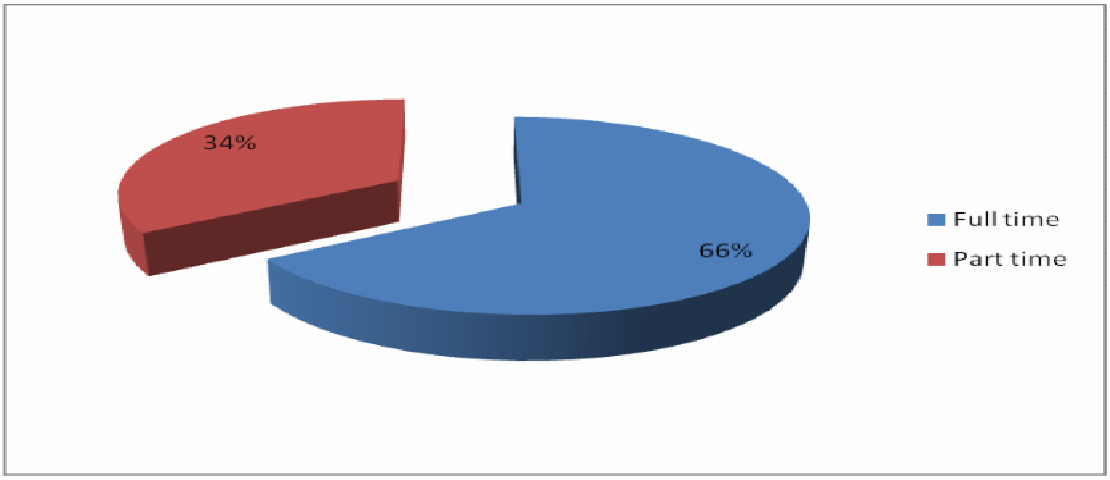

Figure 3.6: Type of farmers

The results in Figure 3.6 indicate that 66 % of the people are full time farmers and not having other activities besides farming. The understanding was that if farming was most important for

them they should have adapted more strategies to combat drought and to practice farming as a business.

3.2.7 SOCIAL GRANTS

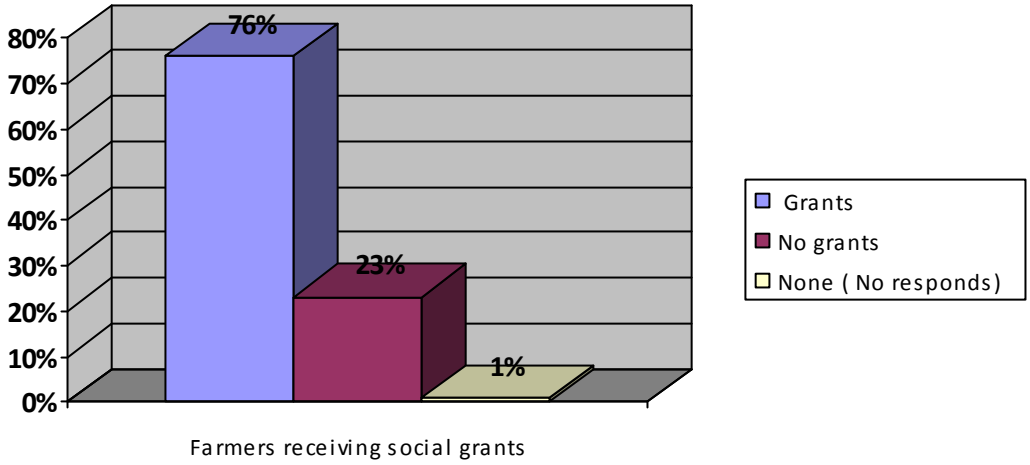

Figure 3.7: Social grants

The aim of this question was to determine the level of social assistance that participants are receiving from government. 76% of the farmers are above 60 years, thus making them eligible to receive social grants and this is likely to hinder investment in drought management strategies as most farmers depend on this grants. The result also shows that 23% of the participants are not getting social grants and unemployed.

3.2.8 TWO WAY GRAPH COMPARING MALES AND FEMALES FARMERS GETTING GRANTS

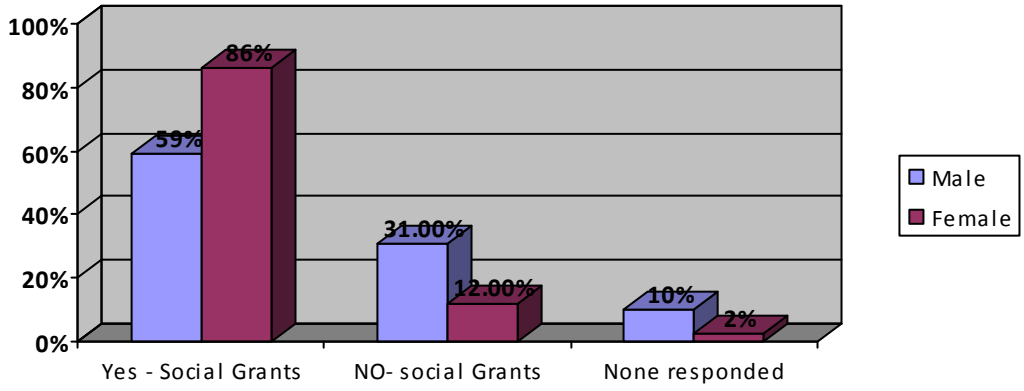

Figure 3.8: Two way graph comparing males and females farmers getting grants

The focus to this figure was to compare the males and females farmers who are getting social grants. The result shows that 86% were females and 59% were males. Farmers who were not receiving social grants were 31% males and 12% females. None responded were 10% males and 2% females. The result demonstrated that more female's farmers are receiving social grant than male farmers.

3.2.9 HOUSEHOLD MEMBERS EARNING INCOME

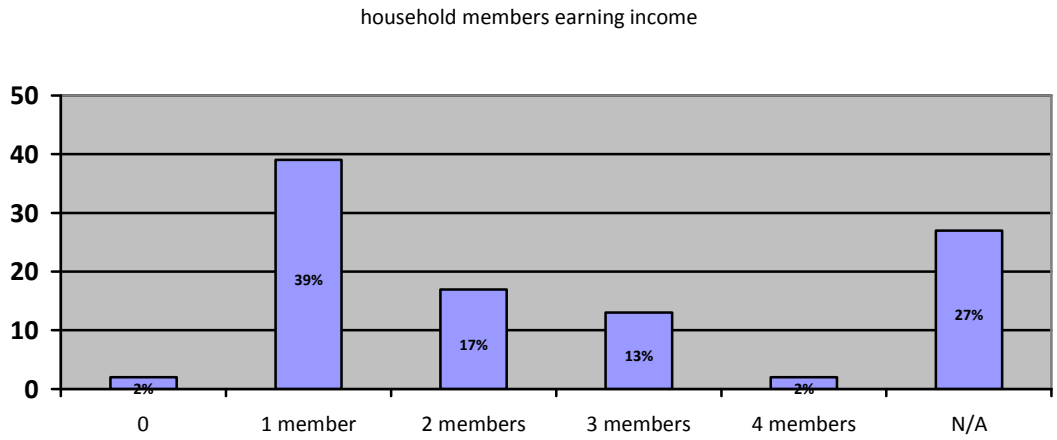

Figure 3.9: Household members earning income

The results as indicated on Figure 3.9 shows that 39% of the farmer's households have one member earning additional income followed by 17% of the farmers having two members, 13% of the households have three members and 2% of the households have four members each who are earning income. 27% of participants are not receiving any form of income. The results of this question point to the fact that an overwhelming majority of respondents do not have adequate income to mitigate drought on their own.

3.2.10 TOTAL MEMBERS OF PEOPLE IN THE FAMILY INCLUDING THE FARMER

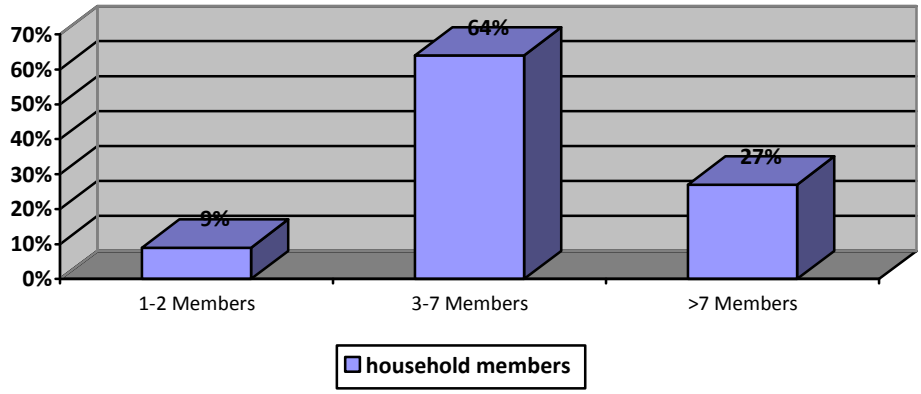

Figure 3.10: Household members

The outcome of Figure 3.10 shows that 64% of the farmers have between 3-7 people in the household followed by 27% having more than 7 members in the household. 9% of the households are having 1-2 members. The result in Figure 3.9 demonstrated that the more the members, there are adequate incomes that can likely to assist during drought as family members naturally, share tasks required in the household.

3.2.11 FEEDING OF LIVESTOCK

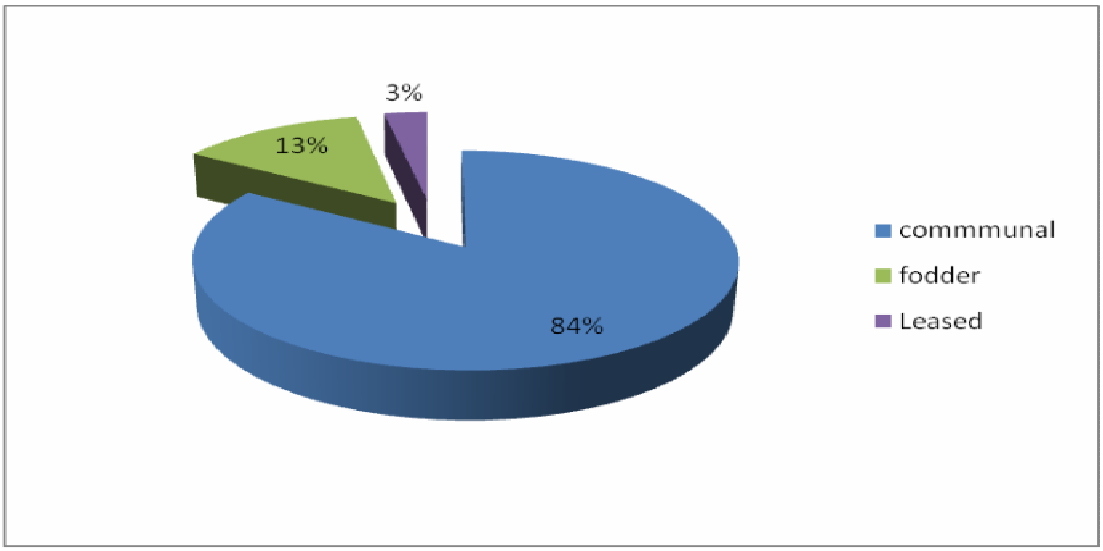

Figure 3.11: Feeding of livestock

The results shows that 84% of the livestock are under communal grazing and most farmers do not feed cattle on their own. Only 13% of farmers responded that they can be able to feed their cattle during drought condition and 3% has cattle leased to commercial farms. One can conclude that based on this result that the majority of the farmers depending on communal grazing will unable to feed their livestock and this make them more vulnerable to drought.

3.2.12 ACCESSIBILITY FOR LIVESTOCK WATER

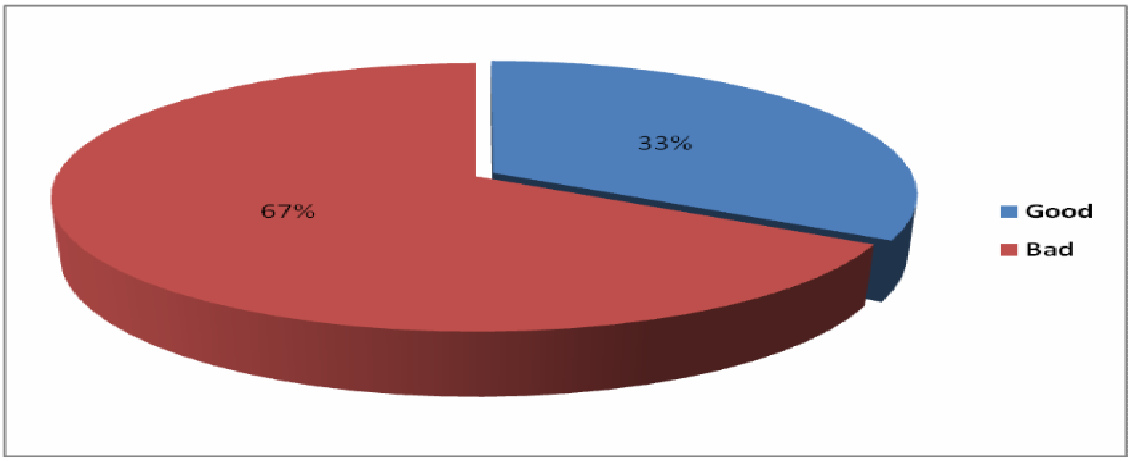

Figure 3.12: Livestock water

The available result would determine water accessibility for livestock and Figure 3.12 shows that water supply is inadequate as shown by 67% of the respond participants. It is therefore important that during drought period, water supply should be targeted at the most vulnerable as experience has shown that water availability is more critical than feeds.

3.2.13 SOURCES OF WATER SUPPLY

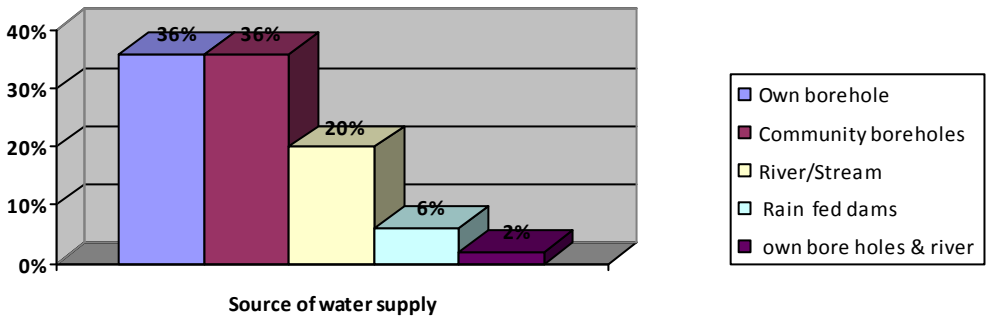

Figure 3.13: Sources of water supply

The result shows that 36% of the farmers own boreholes and there are also community boreholes available for both human and animal consumption. It was mentioned in the interviews by farmers that most boreholes dried up during period of prolonged drought. It also emerged on the results that 20% of the area has river/streams and rain fed dams at 6% and 2% of the farmers who own boreholes depends on river stream and rain fed dams for livestock drinking water.

3.2.14 NO OF LIVESTOCK SOLD PER YEAR

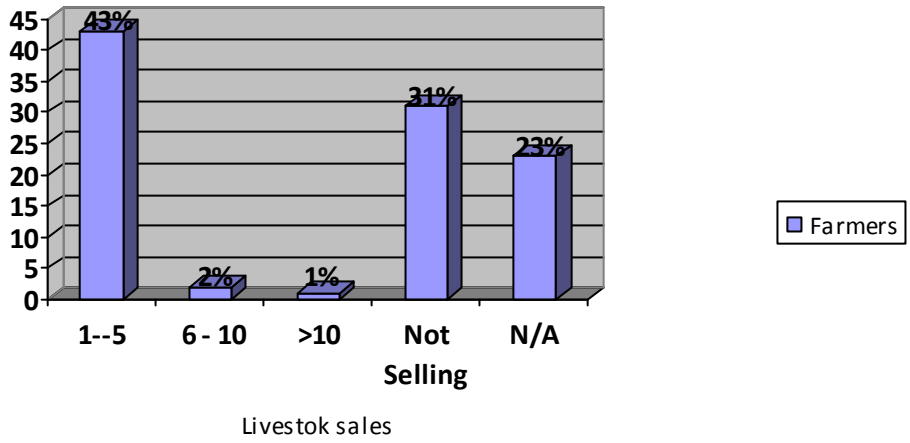

Figure 3.14: Livestock sales

The result shows that 43% of the farmers can sell at least one cattle per year whilst 31% do not sell their livestock, 2% of the farmers can sell 6-10 cattle and only 1% can sell more than 10 cattle. 23% of the farmers did not respond to the question. Traditionally, selling of cattle by farmers is not preferred option as elderly people are not considering farming as a business as cattle are regarded as assets in the family, when drought come losses are severe as a result of large stock volume. (*The government wanted to establish a livestock feeding scheme two years ago said an extension officer)* (f*eedlot*). Farmers rejected fearing that they cannot have ownership as the system was going to be controlled by all the farmers as a group.

3.2.15 OPINION ABOUT FEEDLOT

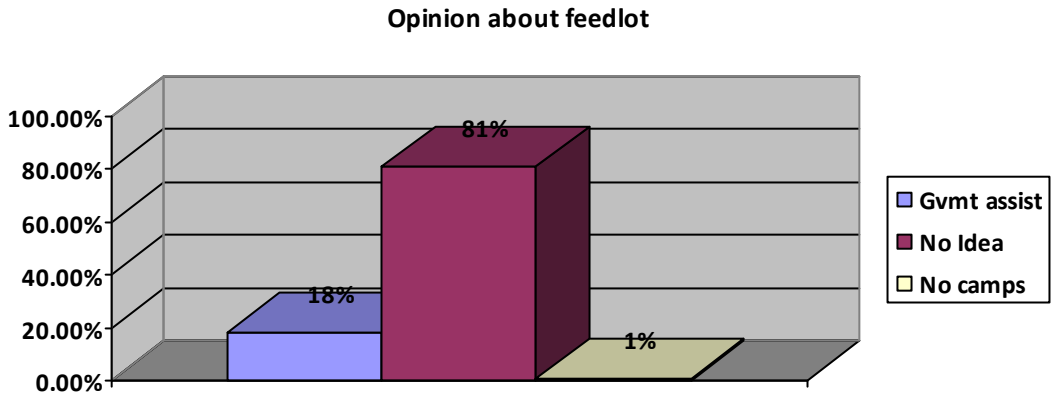

Figure 3.15: Opinion about feedlot

The result shows that 81% of the farmers had no idea about feedlot and 18% needed the government to assist but could not comprehend how the process works. 1% of the farmers indicated that the feedlot cannot work as there are no grazing camps. It is therefore important that drought mitigation strategies needs to include education and awareness on applicable mechanisms such as feedlot.

3.2.16 THE AMOUNT OF SELLING LIVESTOCK

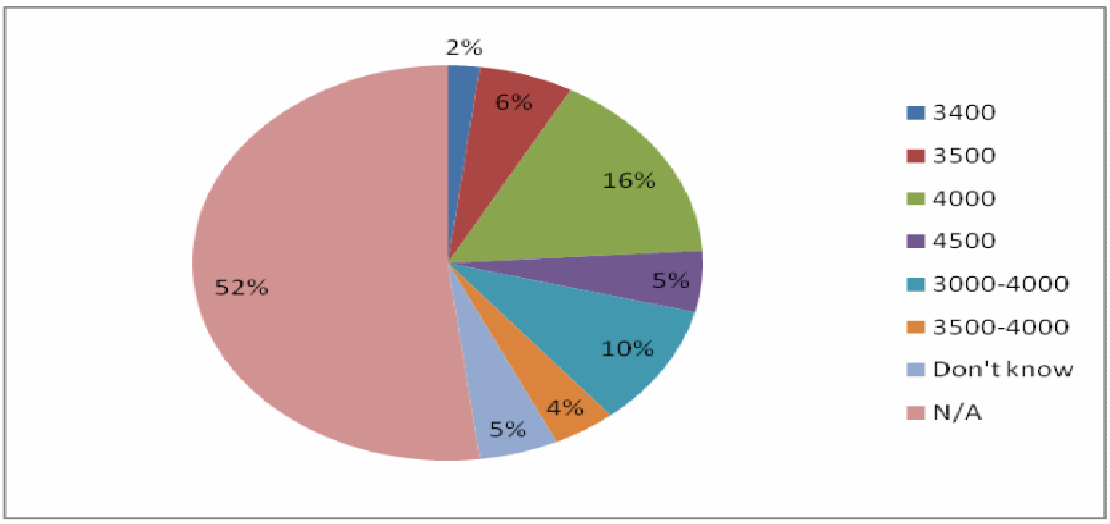

Figure 3.16: Amount of selling livestock

The results shows that 16% of farmers are selling cattle at around four thousand rand (R4 000.00) each and 52% of the farmers do not sell their livestock. The rest of the farmers are selling cattle from three thousand four hundred rand (R3 400.00) up to three thousand five

hundred rand (R3 500.00). The information obtained from few farmers who sell cattle indicated that they banked the money and reserve for purchasing other cattle during favourable condition

3.2.17 THE EXISTENCE OF A FORUM

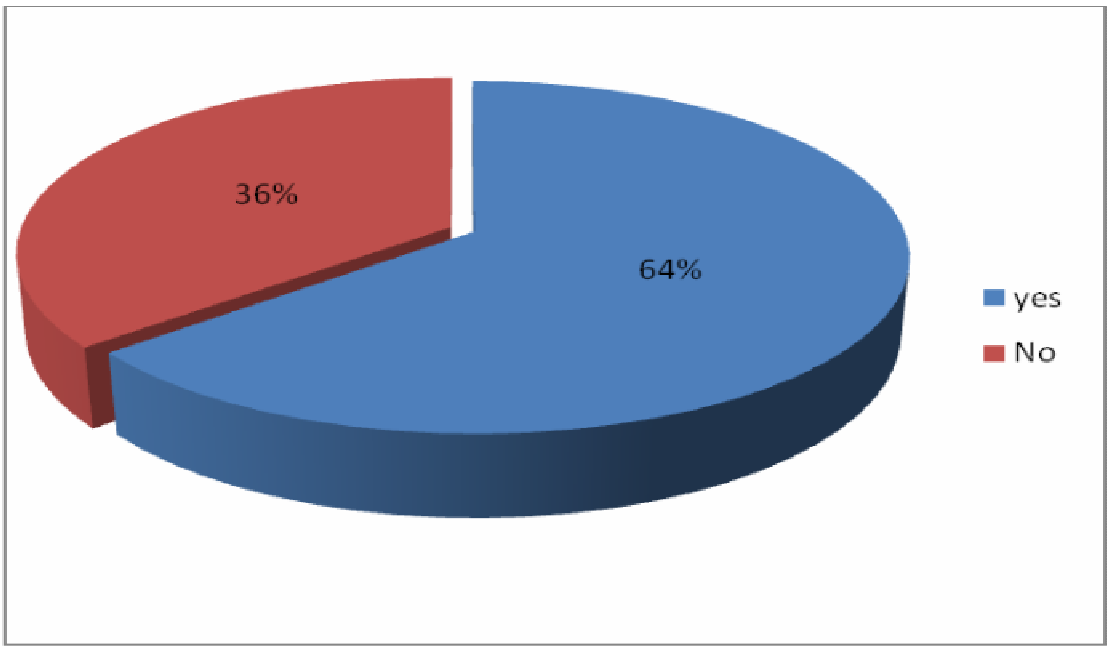

Figure 3.17: Existence of a forum

The result of the above figure shows that 64% of the farmers responded that they have farmer's forum in the area to discuss the farming matters. 36% of the farmers responded that they do not have farmer's forums. It is therefore difficult for such farmers to cope with drought as they do not share information. Information is properly disseminated or shared by common organised groups.

3.2.18 FORUM ALIGNED TO LIVESTOCK COMMODITY

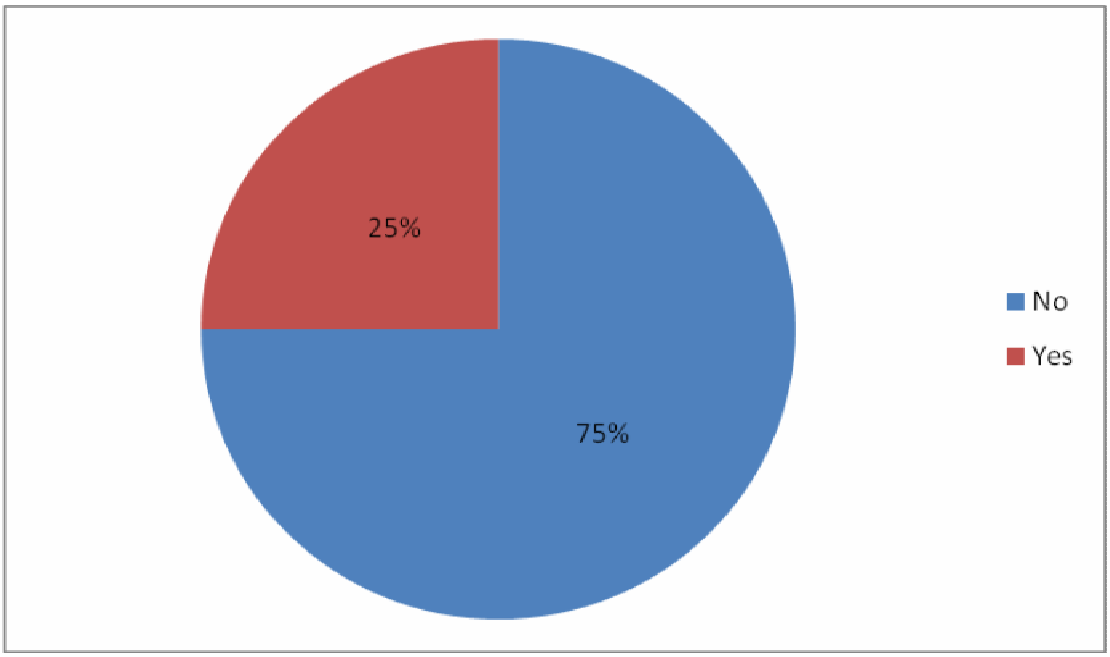

Figure 3.18: Forum alignment to livestock commodity

The observation of the result indicated that 75% of the farmers responded that the forums are established for livestock production but not considering issues like drought mitigation. One elderly farmer mentioned that. When considering the number of losses and less number of cattle sold per annum, one can presume the fact that mitigation strategies is not taken into account or that farmer are not aware of the need for incorporating drought mitigation in their livestock forums meetings.

3.2.19 COMMON DISASTERS IN THE AREA

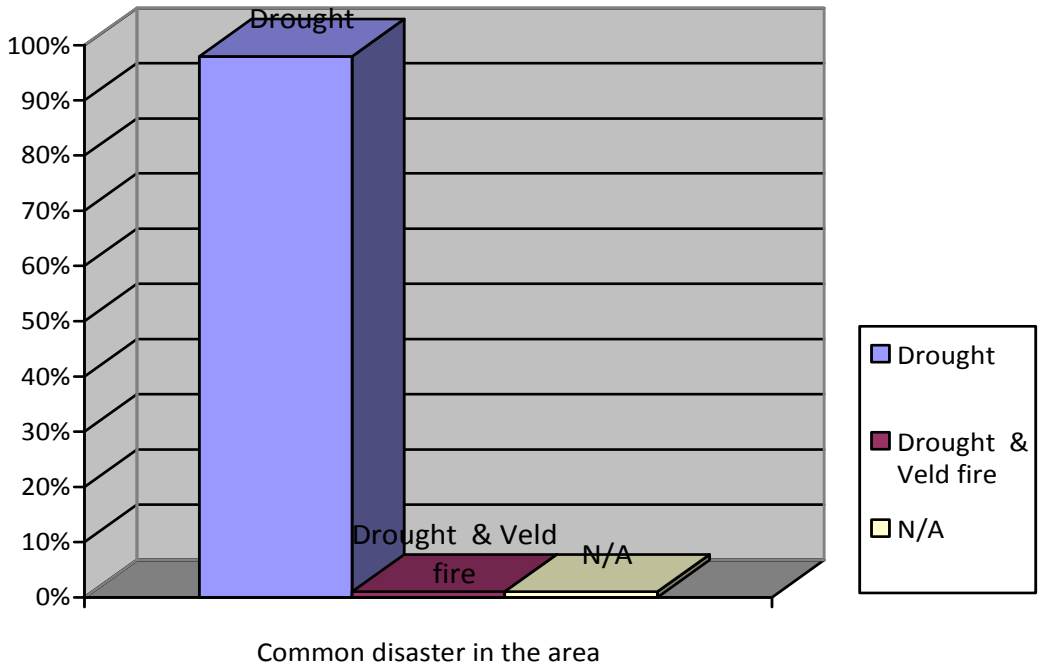

Figure 3.19: Common disaster in the area

The result shows that 98% of farmers responded that drought is the most challenging hazard unlike veldt fire which is 2%. This shows that farmers in future would find it necessary to prioritise and address challenges that are having more impact on their livestock. The focus was to identify whether the farmers could include drought mitigation as one of the aspect in their forum meetings in order to understand the type of hazards that are commonly occurred in the communities.

3.2.20 YEARS THAT FARMERS EXPERIENCED SEVERE DISASTER

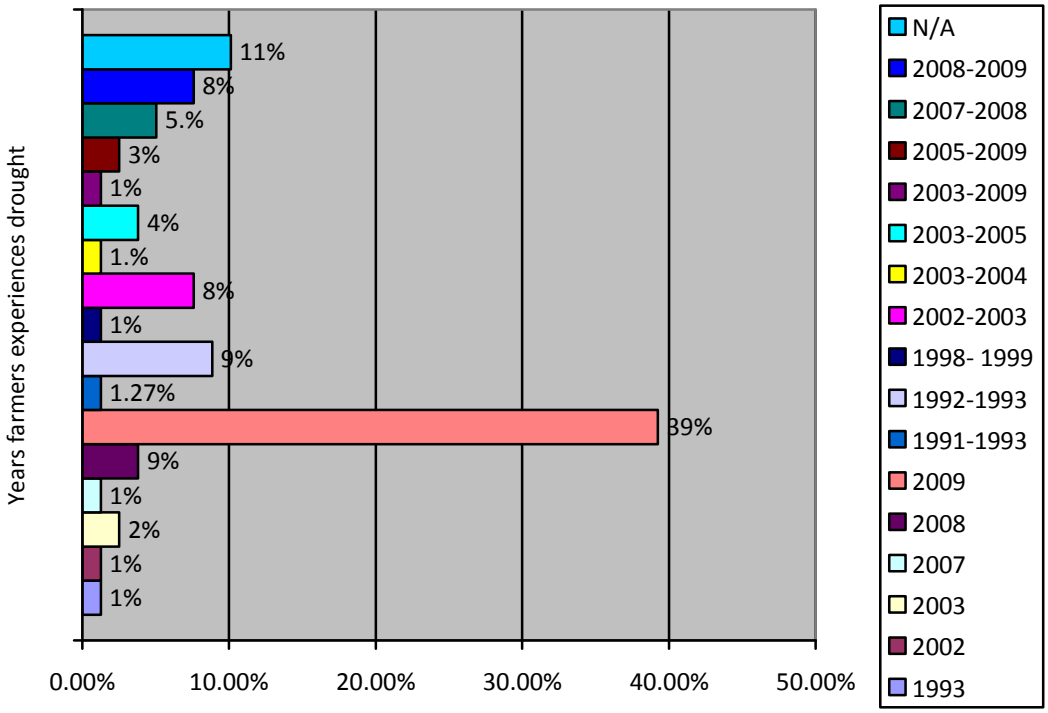

Figure 3.20: Farmers experienced drought

Figure 3.20 above is to indentify years that were having the highest prolong drought and the results demostrated that 39% of the farmers responded that drought was more severe during the year 2009 followed by 1992-1993, 2002-2003,1998-1999 respectivley. This was also coupled by the number of livestock losess occured.

3.2.21 THE OCCURRENCE OF DROUGHT

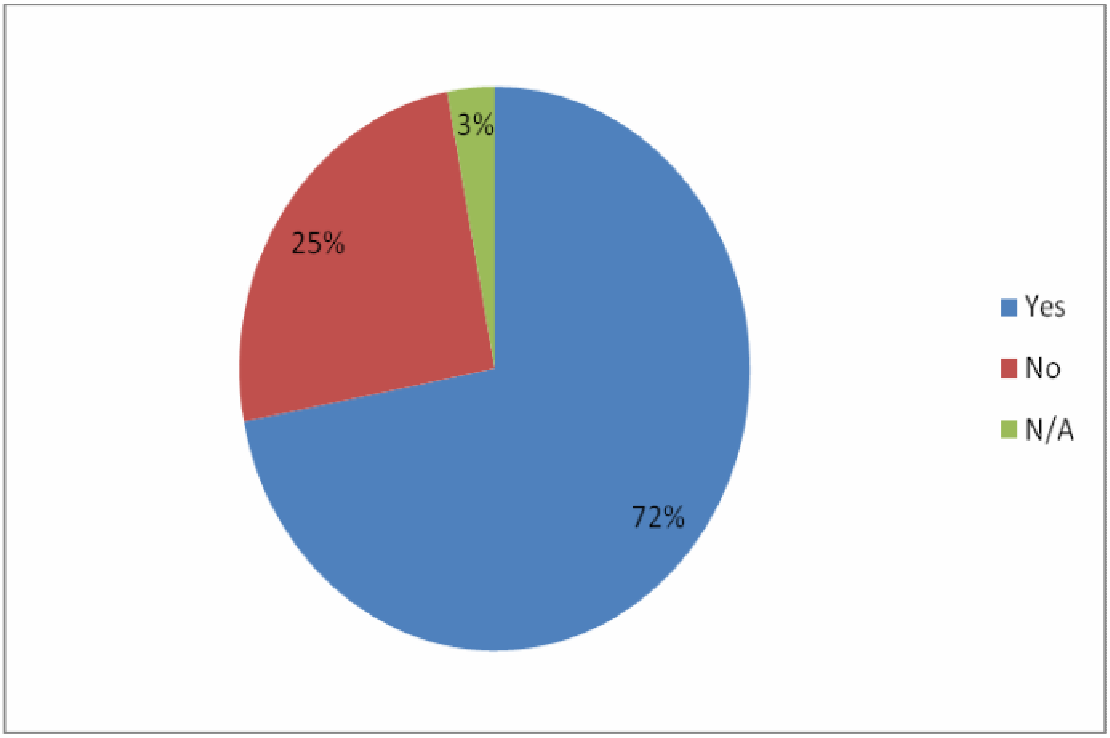

Figure 3.21: Occurrence of drought

The question was necessary in order to determine the occurrence of drought in the area. The result was that 72% of the farmers responded that drought occurs quite often. The purpose was to show farmers the need to prioritise drought mitigation and to deal with its challenges in the community.

3.2.22 NUMBER OF LIVESTOCK LOOSES OCCURRED DURING THE PREVIOUS DROUGHT

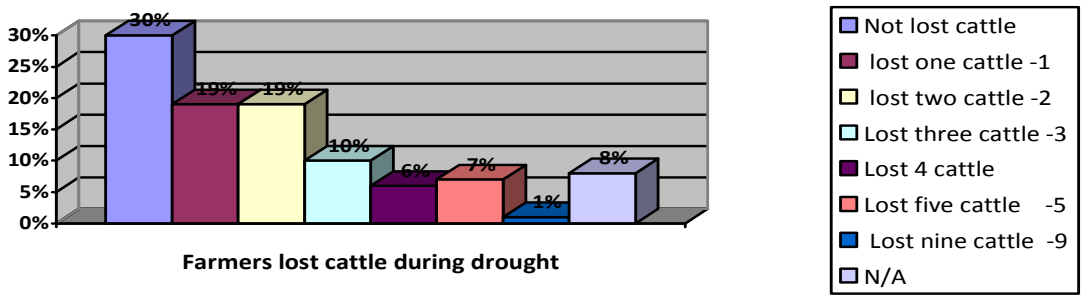

Figure 3.22: Livestock looses

The result in the above graph shows that most of the farmers lost one and two cattle during the previous droughts. Figure 3.22 indicated that 19% of the farmers lost one cattle and again 19% of farmers lost two cattle. Due to the fact that the number of farmers are many looses are increasingly to every drought.

3.2.23 UNDERSTANDING OF DROUGHT CAUSES

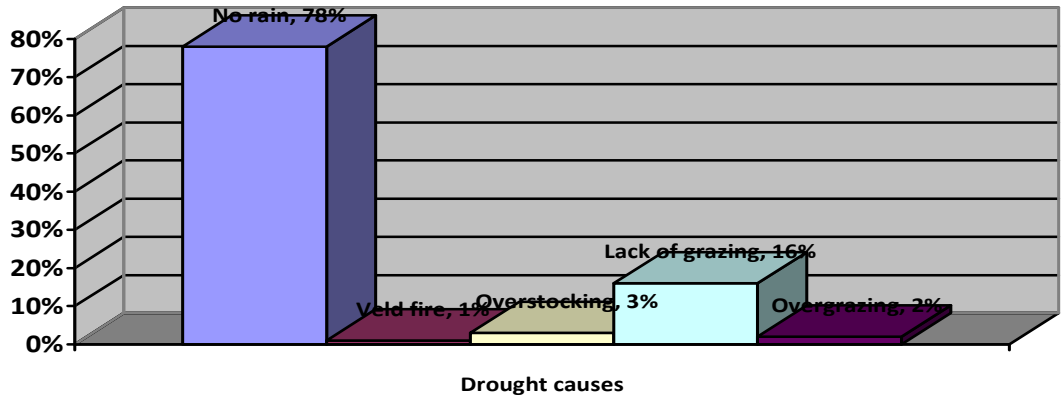

Figure 3.23: Understanding of drought causes

The result indicated above shows that 78% of the participants responded that the cause of drought is lack of rainfall. It is likely to be true because the area is a warm and semi arid, usually prone to drought. The temperature is always high, ranges from 34℃ maximum and 22℃ minimum in summer. Winter temperature drops little to 28℃ maximum and 18℃ minimum. The area mostly receives 250 mm to 350 mm of rain fall per annum in dry years (Weather SA, 2009). It is obvious that in such condition a shortage of rainfall is more likely to occur.

3.2.24 HOW OFTEN DO FARMERS SEE ANIMAL HEALTH OFFICER?

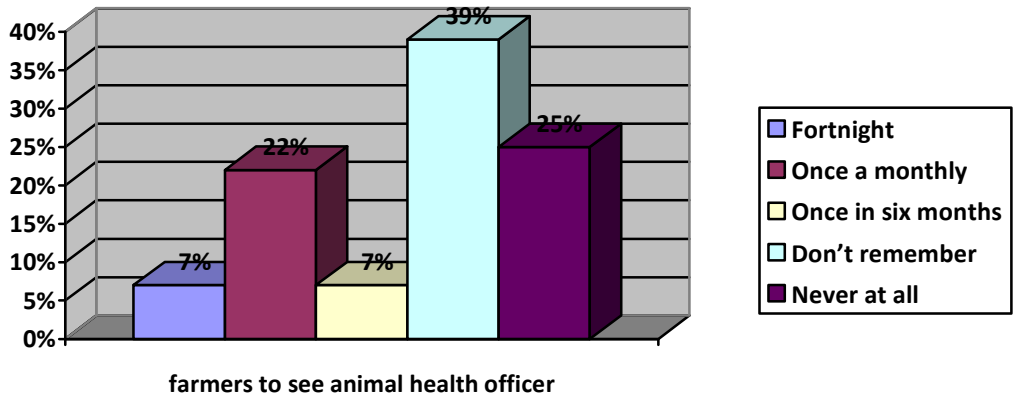

Figure 3.24: Farmers to see animal health officer

Figure 3.24 is to identify whether the farmers are getting technical assistant in terms of the livestock production and to can address the technical skills on the proper management of livestock nutrition as a method of risk reduction. The result shows that the respondents do not remembered as to when they saw an animal health officer at 39%. One can assume that the farmers in the area are not getting any technical assistant.

3.2.25 FARMERS MEETINGS

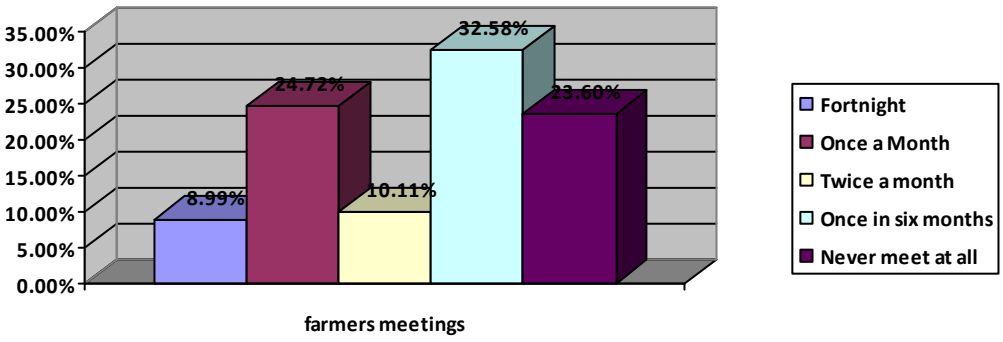

Figure 3.25: Farmers meetings

Figure 3.25 was to determine the period of meeting intervals that the farmers held. The results demonstrate that the highest percent (33%) was that of once in six month followed by once in two months time. Community based participation for livestock farming require a small period of intervals on scheduling meetings. It is therefore important to have regular meetings for addressing drought strategies while in groups.

3.2.26 WHERE DO FARMERS MEET?

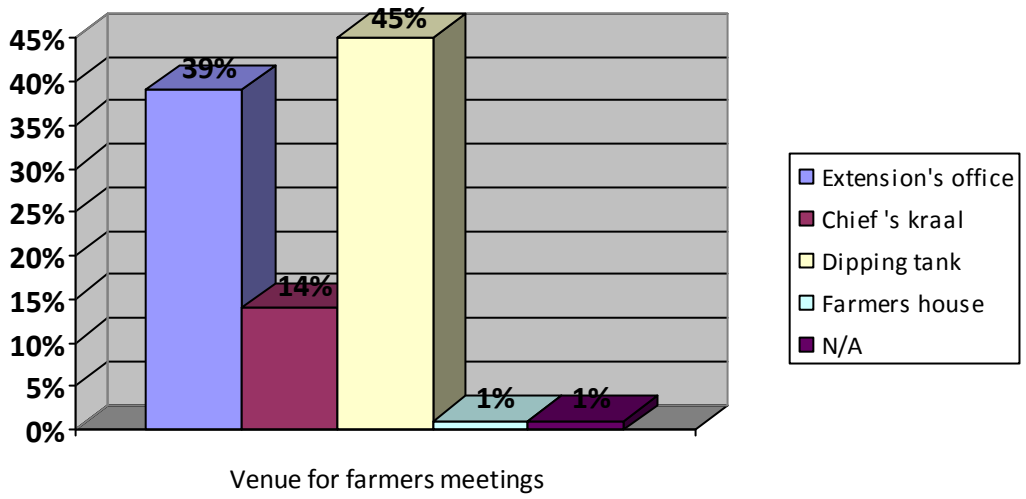

Figure 3.26: Venues for farmers meetings

Figure 3.26 was included in order to know the venue of farmers meetings, as venues play an important role on dealing with common issues. For instant, if the venue is at the chief's kraal, the meeting can be attended by people who are not having cattle and as a result they can diverge the deliberation without considering the seriousness of the issues. The results demonstrated that farmers usually meet at the dipping tanks at 45%, followed by 39% of farmers who responded that they gather at the Extension office. It is likely to be true that common people discuss similar issues which can lead to common goals.

3.2.27 THE AVAILABILITY OF DROUGHT MITIGATION PLANS

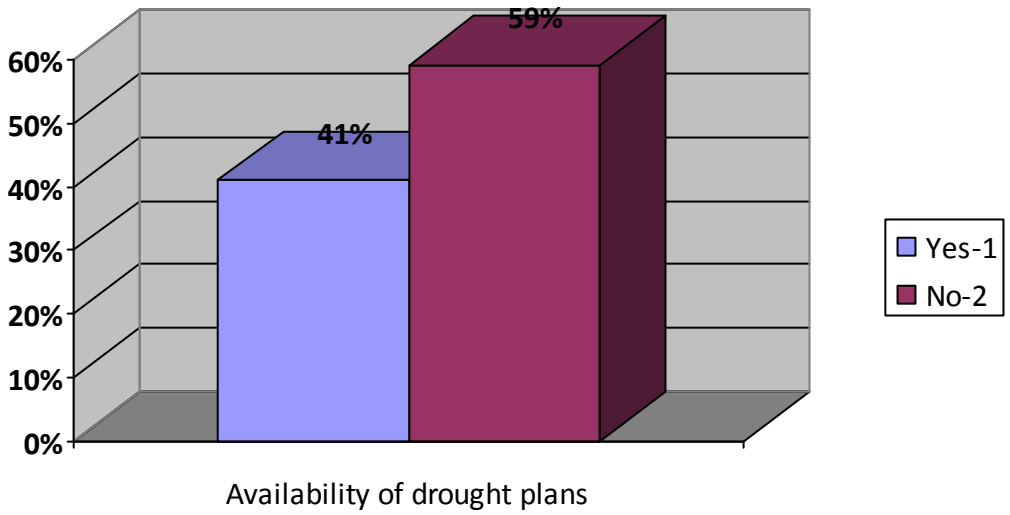

Figure 3.27: Availability of drought plans

The above figure was to determine the availability of drought plan in the community for farmers to be on the safe side during drought. The result was that 59% of the farmers responded that there is no drought plan in the area. It is therefore to assume that even a minor drought can cause a severe impact because there is no drought strategies plan in place.

3.2.28 IF YES, HOW ARE YOU INVOLVED ITS FORMATION?

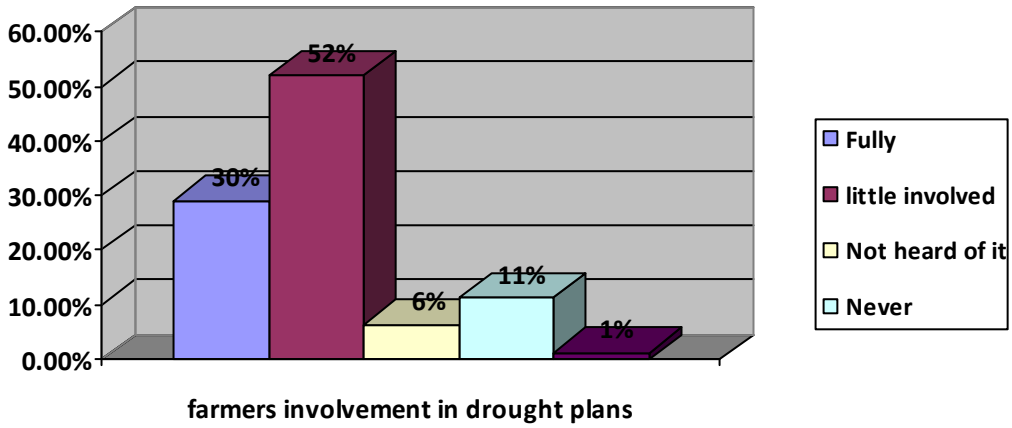

Figure 3.28: Farmers involvement on drought planning

The result of Figure 3.28 shows that 41% of the farmers responded **yes** on Question 25 at Figure 3.27 that they have drought plans in their areas while a follow up question was to evaluate how those farmers are involved in the formation of such plans. The result demonstrated that 52% of farmers are little involved in the plans.

3.2.29 EXISTENCE OF LOCAL STRUCTURE TO ASSIST DURING DROUGHT

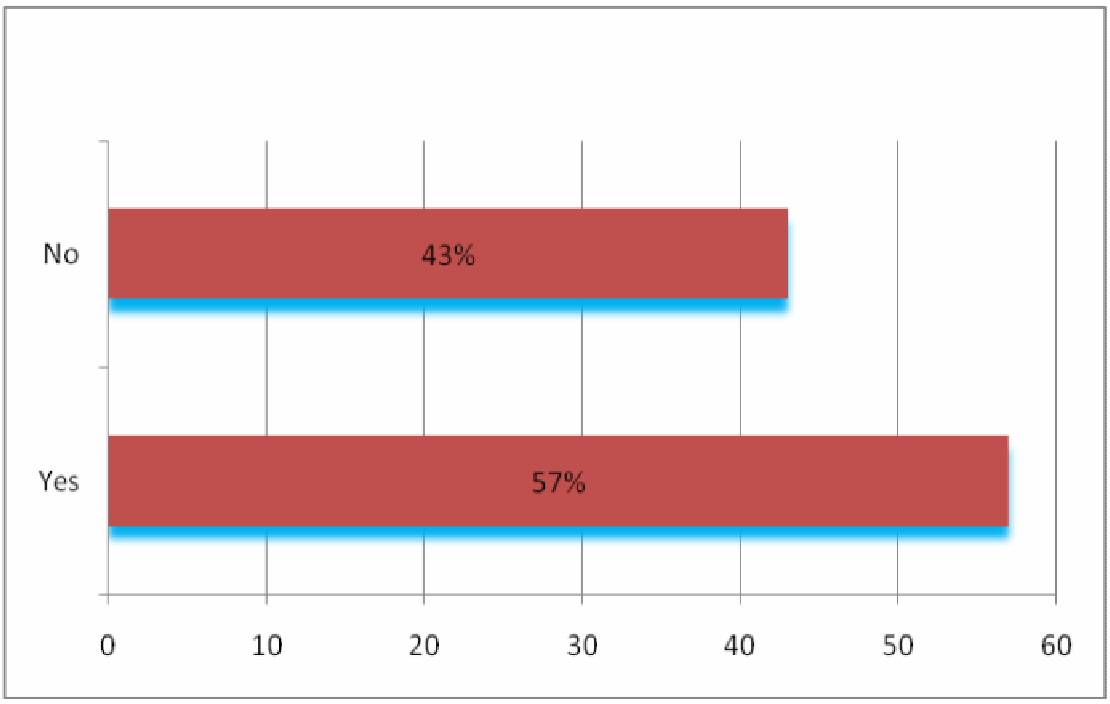

Figure 3.29: Existance of local structures

Fifty seven percent of the farmers responded that they have existing local structures in their areas, which do not assist in drought planning. The researcher wanted to know the availability of the structures and the result shows 57% of the farmers responded that there are local structures in the villages.

3.2.30 STRUCTURES THAT PROVIDE ASSISTANCE ON DROUGHT MITIGATION

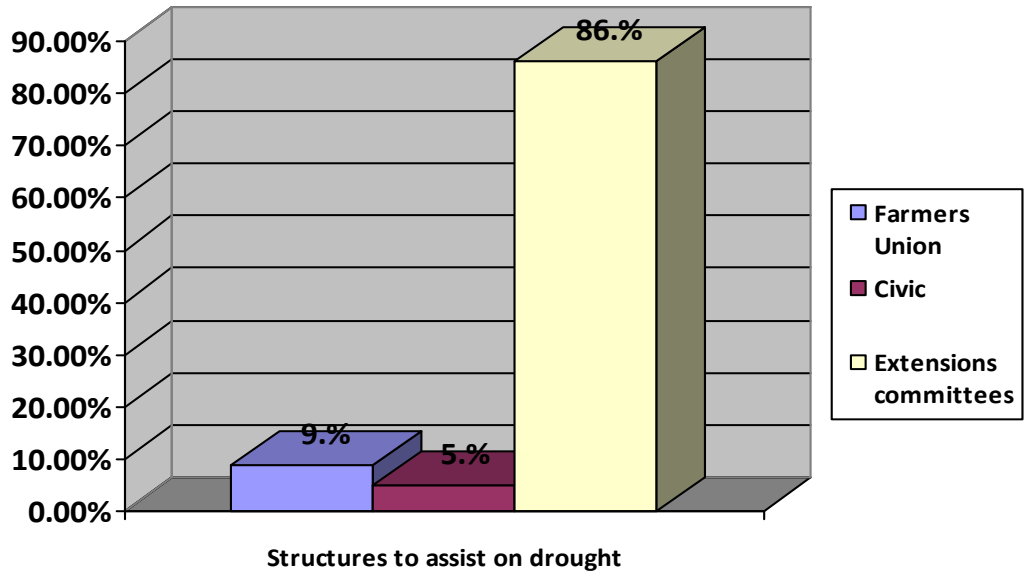

Figure 3.30: Provision of assistance on drought mitigation

The result on Figure 3.30 shows that 86% of the participants responded that the available structures are those formed through the facilitation of local extension officers and they only assist on the relief measures during the drought relief scheme. 9% is for organised farmers union. 5% is for civic organisation. The result further shows there are smaller numbers of farmers which belong to farmers union. According to a local extension officer, structures available do not render assistant in terms of drought mitigation.

3.2.31 HOW EFFECTIVE ARE THE STRUCTURES?

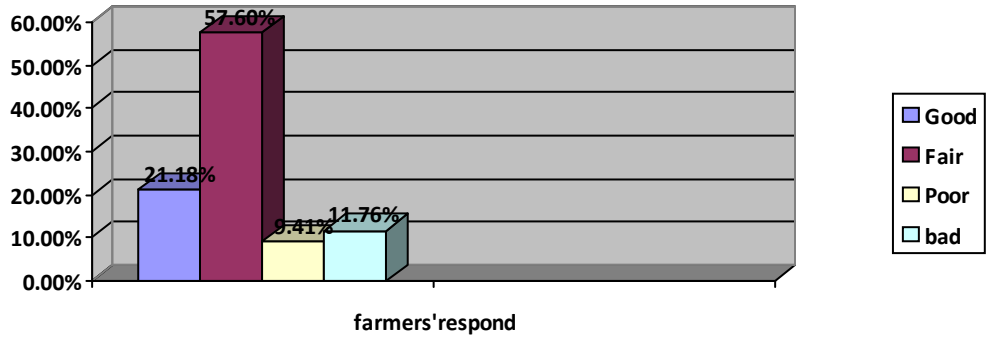

Figure 3.31: Effectiveness of the local structures

Figure 3.31 is to determine the effectiveness of the available structures on matters dealing with drought. The results shows that the participants responded 58% as fair and 21% as good followed by 12% bad and 9% poor, respectively. One can assume that the structures that exist are not responsible for drought mitigation and even not effective for other matters pertaining livestock production.

3.2.32 CONSIDERATION OF INDIGENOUS KNOWLEDGE FOR FORECASTING DROUGHT

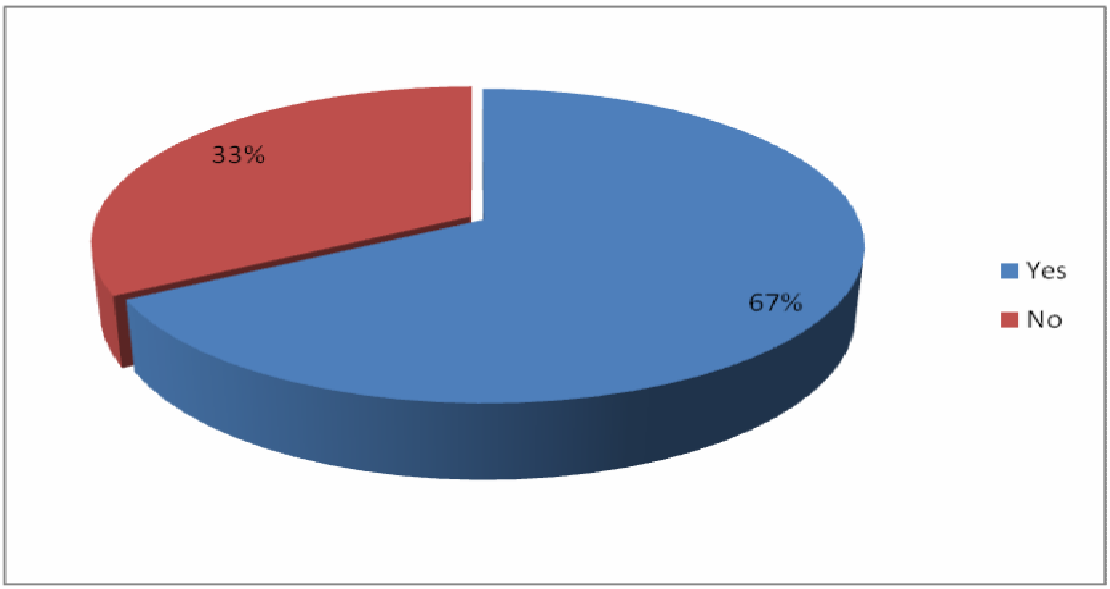

Figure 3.32: Indigenous knowledge for forecasting drought

The above graph was to show how farmers have indigenous knowledge on forecasting drought with the understanding that they can able to mitigate drought on their own. The result shows that 67% of the farmers rely on certain types of trees flowering (the abundant flowering of Mbubulu tree) on forecasting drought. But droughts still affect them because they do not have plans and resources to combat drought.

3.2.33 IF YES, INDICATE THE TYPE OF INDIGENOUS KNOWLEDGE

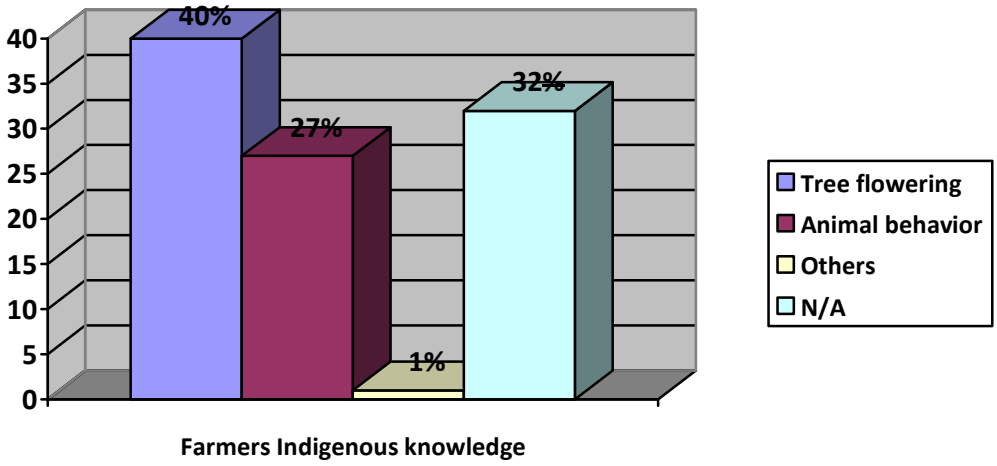

Figure 3.33: Indigenous knowledge

The results demonstrated that 40% of the farmers responded that certain type of tree flowering is an indication of the oncoming drought followed by Animal behaviours at 27% e.g. an unusual jumping of donkeys. 32% of the participants did not respond to the question.

3.2.34 FEEDING OF LIVESTOCK

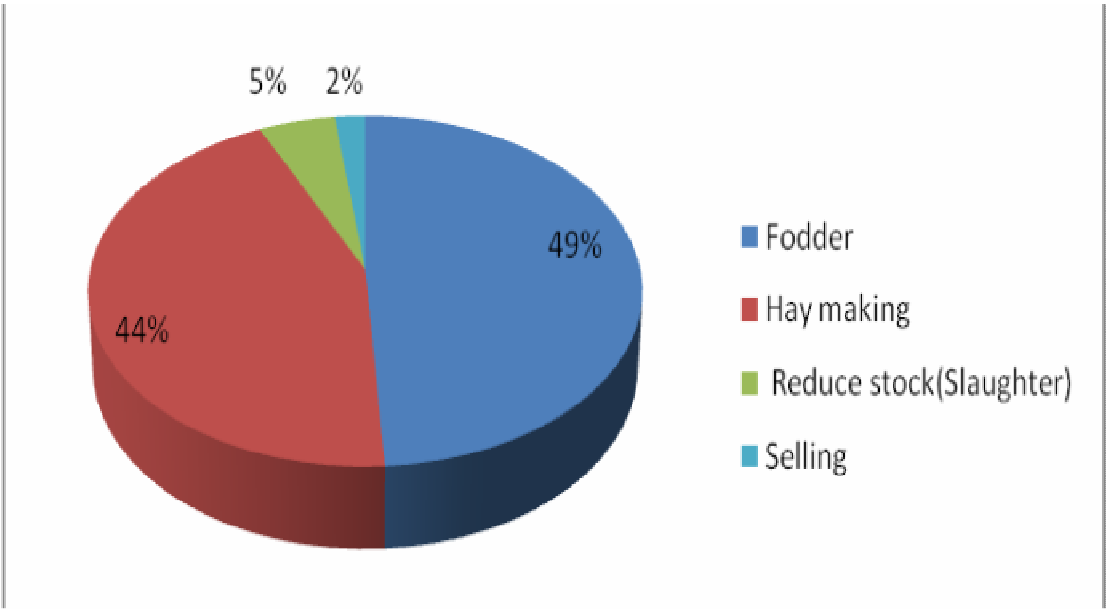

Figure 3.34: Feeding of livestock during drought

The majority of the farmers (49%) responded that they only benefited by fodder from the government. 44% of the farmers responded that they make hay (cutting of grass) before the

drought, this method assist for a short period and during a prolong drought such farmers are also affected. The researcher wanted to determine whether farmers are making any precautions before or during the drought. The result indicated above shows that 44% of the farmers are just cutting grasses for the survival of their livestock. One assumes that if farmers be trained they can establish a fodder bank on their own. This can be an effective strategy for drought mitigation.

3.2.35 USING COMMUNITY BASED PARTICIPATION

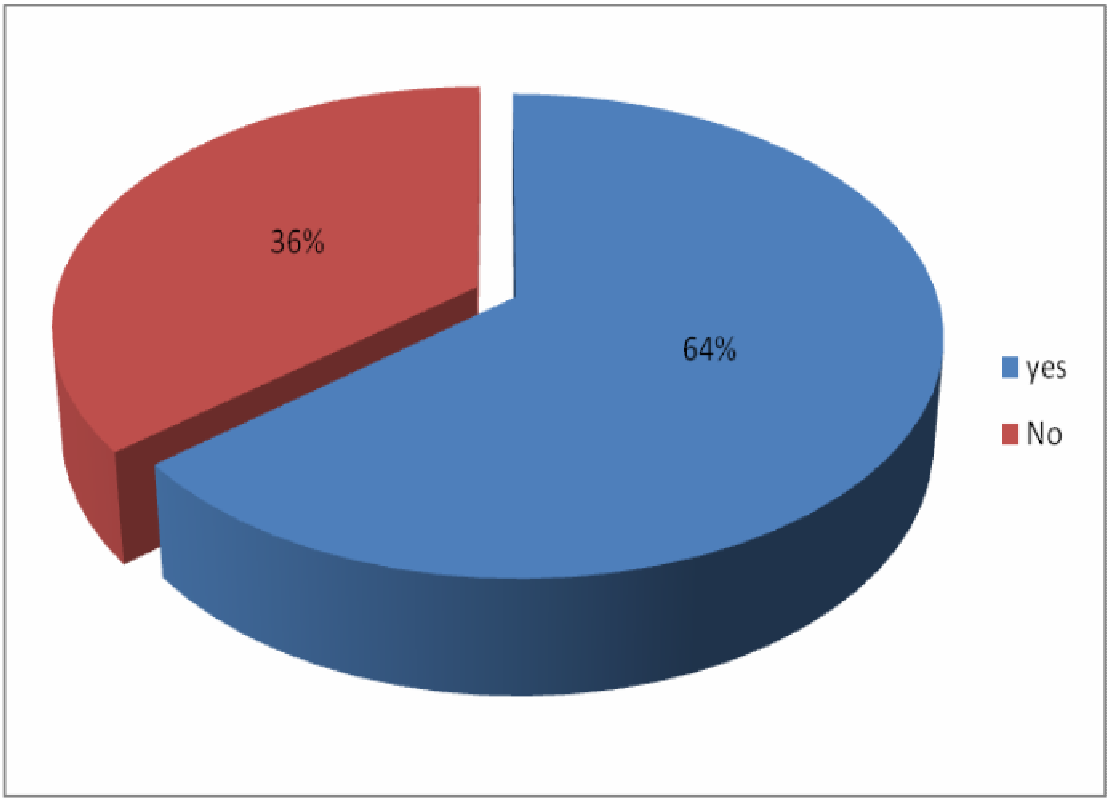

Figure 3.35: Using community based participation

Community participation is an extension tool to address farming challenges in most of the rural areas. The question was included to determine whether farmers are engaged on sharing information through community based participation. The result shows that farmers at Kutama-Sinthumule are participating as they have livestock forums. 64%% of the farmers responded that they are forming part of community based participation and 36% of the farmers are not part of the participating groups

3.2.36 EARLY WARNING INFORMATION

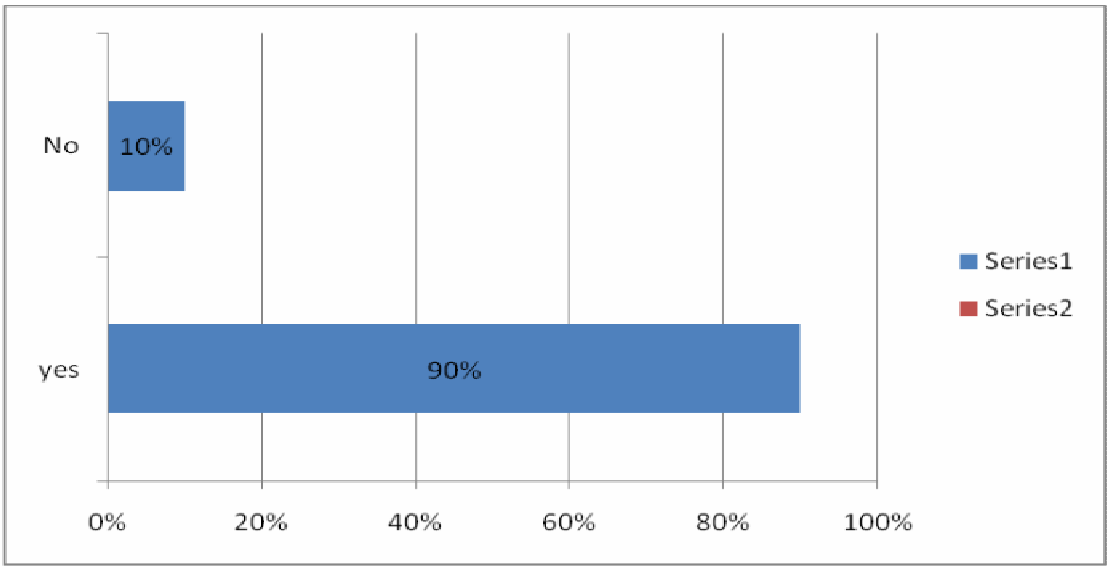

Figure 3.36: Early warning information

Figure 3.36 above was to determine the type of early warning that farmers received in their areas. The result has indicated that most of the farmers received early warning information and are at 90%. Early warning is taken as a good strategy on drought mitigation and it is therefore necessary for that farmers take precaution measures before the drought.

3.2.37 TYPE OF EARLY WARNING INFORMATION THEY RECEIVE

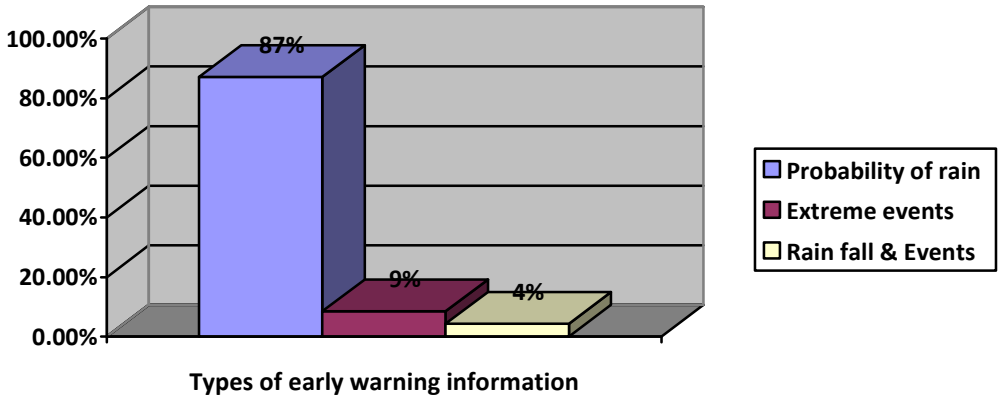

Figure 3.37: Types of early warning information

It was of important for a follow up question to find out the type of early warning information that the farmers received. The result shows that 87% of the farmers responded that they normally receive the probability of rainfall information. This is an indication that weather

information is disseminated to various communities and can assist on the drought mitigation strategies.

3.2.38 MEDIUM OF COMMUNICATION

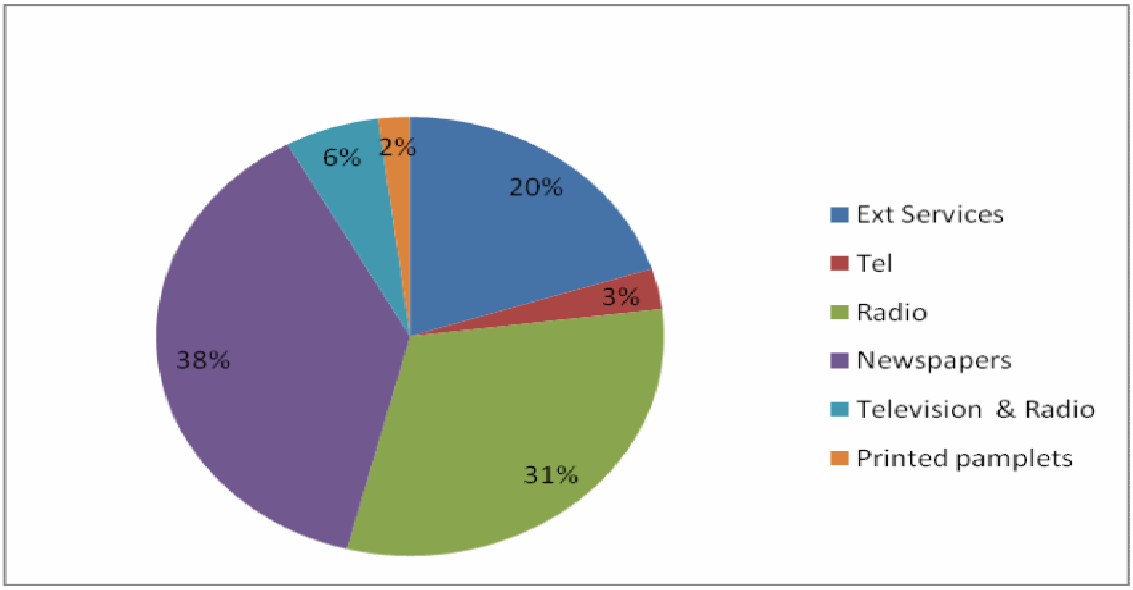

Figure 3.38: Medium of communication

The most important strategy for disseminating information is through newspapers and radios based on the results obtained; they are as follows 38% Newspapers, 31% Radios, 20% is through Extension services, 6% for Television and Radio combined and lastly 2% for printed pamphlets One can assume that every farmer can be able to get early warning information whilst considering that most farmers are having radios in their households and further more they can obtain various newspapers around local shops.

3.2.39 OTHER ADDITIONAL ASSISTANCE BESIDE THE DROUGHT RELIEF SCHEME

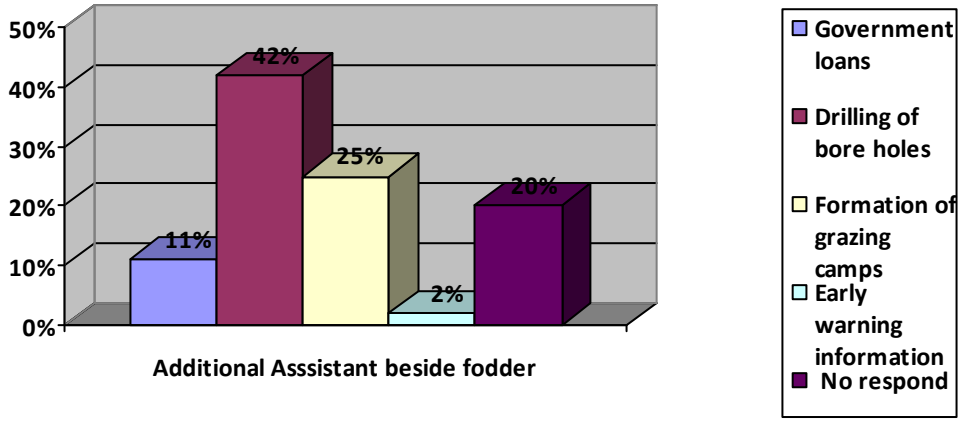

Figure 3.39: Additional assistance beside fodder

The result demonstrates that 42% of the farmers responded that they require boreholes and 25% of the farmers need grazing camps for the animals to rotate. Rotational grazing is a good strategy for drought mitigation as cattle cannot overgraze in one area. Proper management can be achieved while cattle are in camps and drought impact minimised.

3.3 SUMMARY

The most important aspect in the research is that all the participants are farmers in Kutama-Sinthumule and they responded freely on the questionnaires and in their own languages. The issue of gender and age were considered and form part of the study. The results are indicating that farmers in the area are over 60 years and this demonstrates the fact that they are inactive to learn more farming technology. Communal farming is more traditional and when drought comes, loses are more severe.

Large number of farmers responded that they are not fully involved in drought planning and the following aspects are having a challenge as far as the management of livestock during drought is concerned.

- Farmers can be able to predict drought on their own but cannot plan for the oncoming drought.
- They are not knowledgeable on drought preparedness and mitigation
- They do not sell cattle; their farming is not for business orientated.
- In farming meetings, they do not discuss drought mitigation strategies.
- The type of early warning received is for short period.
- Local structures are available but they are not involved in drought aspects.

- Farmers have traditional indicators on forecasting drought but they do not have resources to combat drought on livestock.

The following are some challenges that the farmers encountered on the area;

- Lack of stock watering
- Lack of enough grazing camps. The Department of Agriculture, Forestry and Fisheries is in the forefront on fencing some of the land for livestock grazing. But this is not enough as the number of farmers entering in farming is increasingly.
- Most farmers have boreholes. They become dried up during drought periods due to lowering of water table.
- Community based participation is not fully practiced. Farmers, livestock in particular become vulnerable.

As a result, the way farmers manage livestock during drought is inadequate and they rely on the government relief schemes. Instructional arrangements, public education and training programmes are not in place and this increases the vulnerabilities.

CHAPTER 4: CONCLUSIONS, FINDINGS AND RECOMMENDATIONS

A literature study was conducted to obtain more knowledge regarding drought mitigation. For the purpose of the investigation, questionnaires were developed and data collected. Data was analysed for the purpose of getting the results which will be compared with the hypotheses. Literature study has demonstrated the main purpose of the study. The key elements of community based strategies on drought mitigation were explained in Chapter 2. Community participation in drought mitigation is important to enhancing local technical skills, transfer of expertise at a local level e.g. early warning systems and procedures suited to small-scale requirements. Communities must be aware of the importance of disaster reduction for their own well-being. The most importantly, is to ensure local ownership and sustainability of their projects and in this case drought mitigation is aimed to reduce the impact on livestock (cattle).

4.1 DROUGHT COPING MECHANISM

Indigenous knowledge and coping strategies are the objective of the research. Natural hazards are not new and people have been living in hazard prone areas for centuries- in some cases for thousands of years. People have inevitable, devised their own methods for protecting themselves and their livelihoods using their own skills and resources, as well as their experiences and usually referred as indigenous knowledge. The application of indigenous knowledge in the face of hazards and other threats is referred to as coping mechanism or coping strategy (Twigg, 2004).

4.2 RESEARCH PROBLEM, RESEARCH QUESTIONS AND THE AIM OF THE STUDY

The problem that directed the study is to investigate the community traditional knowledge and to find out as to how such knowledge can be utilised in drought copping strategies. Using community based strategies is the only tool or method in implementing disaster preparedness and mitigation and the application of disaster management in general. The aim of the study was to determine how community- based strategies can be used to mitigate drought. To obtain the best results, a number of questions were asked from the research problem and few are as follows.

- How do you feed your livestock (cattle)?
- Do you have a forum where you discuss your farming activity?
- Which disasters are common in your area?
- Is there any drought plan in the area?

- How are you involved in the formation of it?
- Is there any other existence of local structures to assist during drought?
- Do you consider indigenous knowledge on forecasting drought?
- Using community based participation, do you normally assist your selves to reduce
- Te impact of drought?
- Do you receive early-warning information?

The answers of the above questions were explained in Chapter 3. Based on the stated research problem, research questions and the aim of the study, the following conclusions are formulated.

4.3 FINDINGS

The results obtained in the empirical investigation demonstrate the fact that drought is the most common hazard occurring in the area. In the investigation the communities are marginalised group and are more vulnerable to various kind of disaster including drought. Their marginalised depend on gender, age, education and income level. Female farmers were found to be very few in cattle farming compared to male farmers. They tend to be more vulnerable during drought; the process of moving animals from one place to another is difficult, as is a cultural and traditional belief to prevent women from travelling far from homes alone. This, as a result causes more severe impact to livestock headed by female farmers, as their cattle will rotate on the overgrazed land and eventually died.

The other aspect patterning female farmers (based on my observations) are that there are more concentrated on household activities and this limit opportunity for being with livestock. It was indicated in Chapter 3 that the majority of female farmers were not educated. This limits them to take proper decision and again not to have more understanding on various natural disasters. Again in the interview, female farmers were not giving out the actual answers and which demonstrate that decision making is still largely under male control.

Age is another aspect which needs to be considered in farming. The result was that the majority of farmers are above 60 years. Learning is more difficult to elderly people. They take farming as tradition and cannot consider selling as a strategy for risk reduction. The best advantage for elderly people is the experience and traditional knowledge they possess on forecasting drought. Local knowledge of drought indicators and famine is used effectively as a component of early warning systems. It was found that certain type of trees can act as an early warning when it flowers and bear more fruits more than expected (*Mbubulu* tree, a local name) and unusually behaviour of donkeys. They considered it as a year of Mbubulu fruit and there will be no rain during that season.

Income level, the majority of farmers is receiving various government grants of which the most is old age pension. The management of livestock during drought condition is difficult as farmers cannot buy

livestock feeds on their own; hence, they depend on subsidised fodder from the government. This also have a lot of challenges and the scheme normally come very late due to administration procedures.

It was again shown in Figure 3.15 on Chapter 3 that farmers are not knowledgeable about feedlot. The extension officer indicated that the scheme needed to became established, but farmers were reluctant to participate due the lack of ownership, as cattle will be controlled by the group. This was a strategy for fattening cattle before selling.

Community based participation

People‘s participation is essential in all phases of disaster management and contributes to building their capacities. Participatory approach is of important for drought mitigation in the communities as it allow people to explain their priorities. Participatory risk reduction initiatives are likely to be sustainable because they build on local capacity; the participants have ownership and have long-term development plans (Twigg, 2004:114).

The key principles that this approach to CBP are based on include:

- To ensure that poor people are included in the planning in order to make sure that people are identified and their livelihood analysed.
- The system need to be realistic and practical, the planning process must be implementable using available resources.
- To build on strengths and opportunities.
- To promote mutual accountability between community and officials (upward and downward accountability is critical.

A number of conclusions are indicated below to establish whether the aim of the study has been achieved according to the hypotheses:

- **Lack of community participation on decision making**

  Figure 3.25 in Chapter 3, farmers responded that they usually meet once in six month time. Community based participation encourage networking among the people. Better networking in the broadest sense of the term- is therefore essential. It improves access to and exchange of, information and expertise. Beyond this, it can help network members to maximise their impact through the synergy that comes from partnerships and greater cooperation (Twigg, 2004:72).

- **Lack of early warning information**

  Figure 3.36, 90% farmers responded that they normally receive early warning for the probability of rain fall. They receive such warning through the newspapers, local radio station and through extension services. Radio is a cheap and effective tool in disseminating information. The information received was for day to day warning and not suitable for farm planning. Drought is a slow natural hazard and the onset of it is totally unpredictable. The

radio alone cannot be effective, dissemination of farming information need even other communication strategy such as public information leaflets and posters, etc.

- **Poor traditional farming methods increases livestock looses.**
  In many remote areas, poor people‘s livelihood depend on livestock. This is most obviously true in the case of nomadic pastoralists. However, farmers may also rely heavily on livestock as it is a valuable asset, providing food, income and agricultural inputs (manure, pulling ploughs and carts). Farmers tend to keep more cattle than the available land (caring capacity). Traditional, grazing land is under threat from human settlement and other forms of development. With the increases number of farmers in the area, it is becoming harder for farmers to put effective coping strategies into practice.

- **Indigenous knowledge of weather forecasting can assist in drought planning.**
  The application of indigenous knowledge in the face of hazards and other threats is referred to as a ‘coping mechanism’ or coping strategy. Farmers at Kutama-Sinthumule (K-S) on Figure 3.33 responded that they normally consider certain type of tree flowering and animals behaviour for forecasting the onset of rainfall, whether it will become favourable or not. But the choice of skills, resources to be applied according to the nature of the hazard and planning of drought become a challenge.

- **Livestock sales**
  The results in Figure 3.14 shows that 43% of the farmers can sell at least one cattle per year whilst 31% do not sell their livestock. Traditionally, selling of cattle by farmers is not a preferred option as elderly people are not considering farming as a business as cattle are regarded as assets in the family, when drought come losses are severe as a result of large stock volume. It is based on researcher’s knowledge that selling can become a drought mitigation strategy if it can be done before drought condition. Money can be kept for purchasing cattle during favourable conditions.

4.4 RECOMMENDATION

Droughts of varying extent are regular occurrence in South Africa. The climate is semi-arid with an average rainfall of nearly 500 mm, which is highly variable while rainfall declines from above 800 mm/a in the East to below 200 m/a in the West. Although variations occur between years, clear cycles of approximately 9-10 years below average rain followed by above average rain, have been observed in summer rainfall areas (Tyson, 1987).

4.4.1 THEORETICAL FRAMEWORK FOR DROUGHT MANAGEMENT

From a theoretical perspective the procedure to determine effective strategies to manage droughts for a country or region can be summarised as follows:

- Determine the probability of droughts of different dimensions to occur in a country or region.
- Determine the extent and nature of the impact
- Determine the cost and effectiveness of different measures and application levels of measures as well as for different combinations of measures and strategies to reduce the negative impacts of different dimensions and probabilities.
- Integrate the above information within a cost-benefit or multi-criteria decision analysis framework to determine to determine the most effective combination and level of measures and strategy to manage the impacts of droughts optimally.

From this brief synopsis it should be noted that information about the impact of droughts and effectiveness of different measures to reduce the negative impacts of droughts are crucial for determining an effective drought management strategy.

4.4.2 CLASSIFICATION AND PROBABILITIES OF DROUGHT

Classifying droughts and attaching probabilities of occurrence to different drought events is necessary basic information for a scientific approach to effective drought management. This is because the extent and nature of impacts as well as the nature and effectiveness to manage droughts are related to dimensions (characteristics) and probabilities of different drought events. Different ways to define and classify droughts exist.

Conceptual definitions are mostly dictionary type definitions that define boundaries of the drought concept and are generic in their descriptions that phenomenon. Operational definitions identify the precise characteristics and the thresholds that define the onset, continuation and termination of drought episodes, as well as their severity, defining drought in the region-specific situations is important in understanding drought and its impacts. This will assist policy makers in taking the appropriate actions or policy decisions.

4.4.3 DROUGHT MITIGATION

Mitigation refers to measures to minimise the destructive effects of hazards, thus lessening the magnitude of disaster. Measures can be of different kinds, ranges from physical measures such as training and public awareness.

The priority of drought mitigation is the protection of the critical resources and system on which communities depend. Drought mitigation has four basic components:

- Awareness
- Avoidance
- Early warning
- Rehabilitation

4.4.4 INSTITUTIONAL ARRANGEMENTS FOR DISASTER MANAGEMENT

The Department of provincial and local government is responsible for the execution of the Disaster Management Act 57 of 2002 (NDA, 2005). Drought management is the responsibility of National, provincial and Local government, farming communities, the private sector and civil society. In drought management point of view, everyone has a responsibility to play. South Africa, like any other country has developed a drought plan document. The document was opened for discussion by August 2005. The following stakeholders or government spheres have strategies in drought management plan and are listed hereunder:

4.4.4.1 National Department of Agriculture

The National Department of Agriculture makes the following strategic interventions to reduce drought risk:

- The National Department responsible to compile veldt indicator maps to enable livestock farming communities to make informed decisions;
- To conduct research in drought- prone areas;
- To assist provincial departments of Agriculture with drought assessments;
- Implementation and improving priority risk and disaster management programmes for risk reduction;
- Sourcing allocated funds from National treasury for disaster drought assistance programmes and service delivery;
- Participating actively in risk and disaster management forums at regional, provincial, national and international levels.

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4.4.4.2 Provincial departments of Agriculture

The Provincial departments of Agriculture (PDA) have the competence to handle disaster programmes and projects. PDAs must use resources (capacity and funds) to coordinate and monitor drought act activities. The department of provincial local government plays a crucial role in mobilising resources and lead to the following activities such as:

- Education and awareness campaigns

- Conduct drought assessment and compile reports
- Ensure that farming communities implement risk reduction measures
- Measure vulnerabilities of communities so as to target priority assistance to ensure enough capacity for drought management.
- To ensure that the farming communities timely de-stock in seasons of decreased veldt and forage production.
- To prepare a provincial disaster management plan
- To make sure that early warning information must reach beneficiaries through community libraries, the internet (AGIS), agricultural development centres, extension service points, information days, farmers' days, etc.

4.4.4.3 Local government

Local government play a critical role in drought management, particularly in the mobilisation of local resources and should therefore:

- Act as conduit for information concerning drought disaster in the municipal area,
- Act as an advisory body on drought disaster issues,
- Incorporate early warning systems in its planning.
- Make recommendations regarding assistance initiate and facilitate efforts to make assistance available. The highest priority is the protection of the critical resources of farming communities.

4.4.4.4 Farming communities

Any assistance to farming communities will be in accordance with the Disaster Management Framework. In order for farming communities to qualify for the assistance they should have;

- Applied prevention and mitigation strategies, e.g. the planting of drought-tolerant crops, de-stocking and the use of available insurance products.
- Utilise early warning information in their planning

Farming communities must report their drought damages to their local authorities and advisory services. The following will be considered when stock farmers apply for assistance:

- A valid and updated stock card must be shown for each animal;
- A register of all stock must be kept, at least for past 12 months and updated quarterly.
- The maximum number of livestock to be considered for feeding during a drought disaster will be 50 cow units.

4.4.5 FACTORS THAT CONTRIBUTE TO THE SUCCESS OF DISASTER PREPAREDNESS AND MITIGATION MEASURES

4.4.5.1 Disaster risk assessment and planning

Vulnerability assessment – A community can form part of the vulnerability assessment activities in their locality are more to appreciate the magnitude of the disaster they face and accept any recommendations for achieving mitigation and preparedness.

Institutional frameworks – implementation of disaster preparedness and mitigation requires the establishment of structures for the coordination of plans and decision-making processes. These are in the form of disaster management ward forums, volunteer forums working closely with the ward committee. The farmers at Kutama-Sinthumule has once organised themselves and contributed funds for purchasing fodder but the management of it was critical. The money was not coordinated properly.

Information systems - are critical to disaster mitigation and preparedness as they serve to communicate information regarding impending disaster threats, disaster monitoring systems and evacuation mechanisms in responding to disaster.

Resource base – resources are necessary to cover all aspects of disaster relief and recovery. In this case, farmers have to be organised and establish a fodder bank for their livestock. As there is an irrigation scheme at K-S, the planting of fodder such as Lucerne, can stand a better chance to mitigate drought by the provision of livestock feeds during drought condition.

Public awareness, education and training – the development of increase public awareness about hazards and understanding of disaster risks are elements in any strategy for disaster reduction. Public awareness should be conducted in schools, in particular through the media, in the local structures and civic organisations and to the traditional local council (Chief kraal gathering). Training and educations should be emphasised and mostly be done by the extension officers during farmers' days and information days. It is not a question of public awareness; it is a question of local community groups having the chance of influencing decisions and managing resources to help reduce vulnerability and to cope with risks (ISDR, 2002).

4.4.6 THE ESSENTIAL ROLE OF COMMUNITY ACTION

To conclude and with the essential aim of the research which has now been achieved, is that disaster reduction is the most effective at the community level where specific local needs can be met. When used alone, government and institutional interventions often prove to be insufficient. They are inclined to ignore local perceptions and needs and the potential value of local resources and knowledge. It is

not surprising that relief assistance far exceeds resources invested to develop local disaster risk reduction capabilities.

Lastly, communities must be aware of the importance of disaster reduction (Drought mitigation) for their own well-being. It then becomes necessary to identify and impart essential skills that can translate risk awareness into concrete practices of sustained risk management. Such an approach needs to develop activities that can strengthen communities' capacities to identify and cope with hazards and more broadly to improve residents' livelihoods.

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APPENDIX A

Questionnaire: for the assessment of drought impact and its management of it at Kutama-Sinthumule (Makhado - Louis Trichardt)

Supply the correct information or make a cross (X) in the appropriate box where applicable. Anything you tell us will be kept to ourselves.

A. GENERAL INFORMATION

Province : _____
Local Municipality : _____
Name of place/village : _____
Questionnaire nr: : _____
Survey Date: : _____

Specify the area:

Urban	
Rural	
Semi-Urban	
Other (specify)	

Small-scale farmer	1
Commercial Farmer	2

B. FARMER'S INFORMATION

- **Social Indicators**

1) Gender

Male	1
Female	2

2) Age

Under 25 years	1
26-46 years	2
47-59 years	3
Above 60 years	4

3) Level of education (qualification)

Primary	1
Secondary	2
Graduate	3
Post-Graduate	4
None	5

4) Marital status of farmer

Single	1
Married	2
Divorced	3
Widowed	4

5) Type of farmer

Full-time farmer	1
Part-time farmer	2

Specify occupation _____

6) Do you receive any social grants?

Yes	1
No	2

7) How many people are earning income in the household? ☐

8) Total members of household including the farmer

1 – 2	1
3 – 7	2
> 7	3

C. LIVESTOCK

9) How do you feed your livestock (cattle)?

Communal grazing	1
Fodder	2
Own farm	3

10) How do you rate access to water for livestock?

Good	1
Bad	2

11) What is the source of water supply?

Own Borehole	1
Community Borehole	2
River/stream	3
Rainfed dams	4

12) How many livestock (cattle) do you sell per annum?

1 – 5	1
6 – 10	2
> 10	3

13) What is your opinion about feedlot?

_____

_____

_____

14) How much do you sell these livestock (cattle) for?

15) Do you have a forum where you discuss your farming activity?

Yes	1
No	2

16) If any forum, does it aligned to commodity like livestock?

Yes	1
No	2

D. DISASTER INFORMATION

- **General information on disasters**

17) Which disasters are common in your area? Tick below.

Drought	1
Flood	2
Snow	3
Veldt fires	4
Others (specify)	5

18) When last did you experience the severe disaster mentioned above?

_____

_____

19) Does it occur quite often?

Yes	1
No	2

20) How many livestock losses occurred during the previous Drought? Indicate the number of losses and the year (e.g. 10 cattle died in the 1992-1993 drought).

Losses _____

Year _____

- **Community participation and drought information**

21) What is your understanding of drought cases?

No rainfall _____

Veldt fire _____

Over stocking _____

Lack of grazing _____

Over grazing _____

22) How often do you see an animal health officer

Daily	1
Weekly	2
Fortnightly	3
Monthly	4
Once in six months	5
Don't remember	6
Never at all	7

23) How often do you meet as a Group of Farmers?

Fortnightly	1
Once a month	2
Twice a month	3
Once in six months	4
Never meet at all	5

24) Where do you meet as Farmers?

In the Extension Officer's office	1
In the Chief Kraal or Tribal Office	2
On the dipping Tanks	3
In one of the Farmers' house	4
In the department offices	5

25) Is there any drought plan in the area?

Yes	1
No	2

26) How are you involved in the formation of it?

Fully involved	1
Few farmers involved	2
Not heard about it.	3
Never involved	4
Only prominent farmers are contacted or involved.	5

27) Is there any other existence of local structures to assist with the drought?

Yes	1
No	2

28) If YES, what type of structures assist during drought?

Farmers unions	1
Civic Associations	2
Organised farmers	3
Traditional leaders associations	4
Extension officers associations	5
Other (specify)	6

29) How effective is the structure or farmer's participation?

Good	1
Fair	2
Poor	3
Bad	4

30) Do you consider indigenous knowledge on forecasting drought?

Yes	1
No	2

31) If YES, please indicate the type of indigenous knowledge, e.g.:

Trees blossoming	1
Animal behaviour	2
Others (specify)	3

_____

_____

32) The way you manage drought in the area would you conclude that it is properly done?

Yes	1
No	2

33) Using community based participation; do you normally assist yourselves to reduce the impact of drought?

Yes	1
No	2

34) Do you receive early warning information?

Yes	1
No	2

35) If YES, what type of early warning information do you receive?

Probabilities for rainfall	1
Warning on extreme events	2
Rainfall and Events	3

36) Is there any other additional assistance beside the drought relief scheme?

Government loans	1
Drilling of bore holes	2
Formation of grazing camps	3
Early warning information	4
Public awareness process	5

APPENDIX B

A letter to the manager requesting to operate on her jurisdiction

THE MANAGER
MAKHADO MUNICIPALITY
DEPARTMENT OF AGRICULTURE
P/BAG X2408
MAKHADO
0920

A REQUEST FOR ASSISTANT WITH REGARD TO THE COMPLETION OF QUESTIONNAIRES BY THE EXTENSION OFFICERS AT KUTAMA-SINTHUMULE

I, Tshililo Victor Mugogovhali, a Departmental bursary holder registered for the Masters Degree in Disaster Risk Management by the University of the Free State and now busy with the research project to can complete my studies by the end of this year.

I therefore humbly request the extension officers to assist me on the collection of data from the livestock communal farmers. Kutama-Sinthumule has 470 farmers in 17 villages with 4069 total number of livestock (Cattle). Recurrent droughts undermine the livelihood of communal farmers and therefore necessitate further studies that can lead to the improvement of drought condition in the area.

USING COMMUNITY-BASED STRATEGIES TO MITIGATE DROUGHT IN (KUTAMA-SINTHUMULE) MAKHADO MUNICIPALITY LIMPOPO PROVINCE

The data will be collected in the form of Questionnaires and stratified random sampling will be used as villages do not have the same number of cattle. In this study, only 92 farmers will be interviewed. The date to start collecting data is from the 09 up to 13 November 2009. The topic has been approved by the University and the Department of Agriculture in the province and will assist farmers in disaster risk reduction in terms of drought.

I will be highly appreciated if my request shall reach into consideration.

Yours faithfully

TV Mugogovhali
Cell: 0824907071

APPENDIX C

A letter to the respondents

INTERVIEW QUESTIONNAIRE

Dear Respondent

USING COMMUNITY-BASED STRATEGIES TO MITIGATE DROUGHT IN (KUTAMA-SINTHUMULE) MAKHADO MUNICIPALITY LIMPOPO PROVINCE

I, Tshililo Victor Mugogovhali (Student number: 2005021072), am currently registered as a Masters student in the Disaster Management Training and Education Centre for Africa (DIMTEC) at the University of the Free State completing a dissertation in partial fulfillment of the requirements of the degree: Masters in Disaster Risk Management. My dissertation topic is entitled "**Using community based strategies in drought mitigation at Kutama-Sinthumule Makhado Municipality Limpopo Province**". The general aim of this study is for the community to find ways to mitigate drought, to develop strategies for risk reduction using indigenous knowledge and again to reduce the vulnerabilities.

You have been selected to participate in the study on the basis of the fact that you have been a farmer and being affected by drought for many years. We therefore would like to assist each other to find ways for risk reduction in order to develop a resilient community as far as drought is concerned. Your extension officers in the area will assist you in the interpretation of the questionnaire.

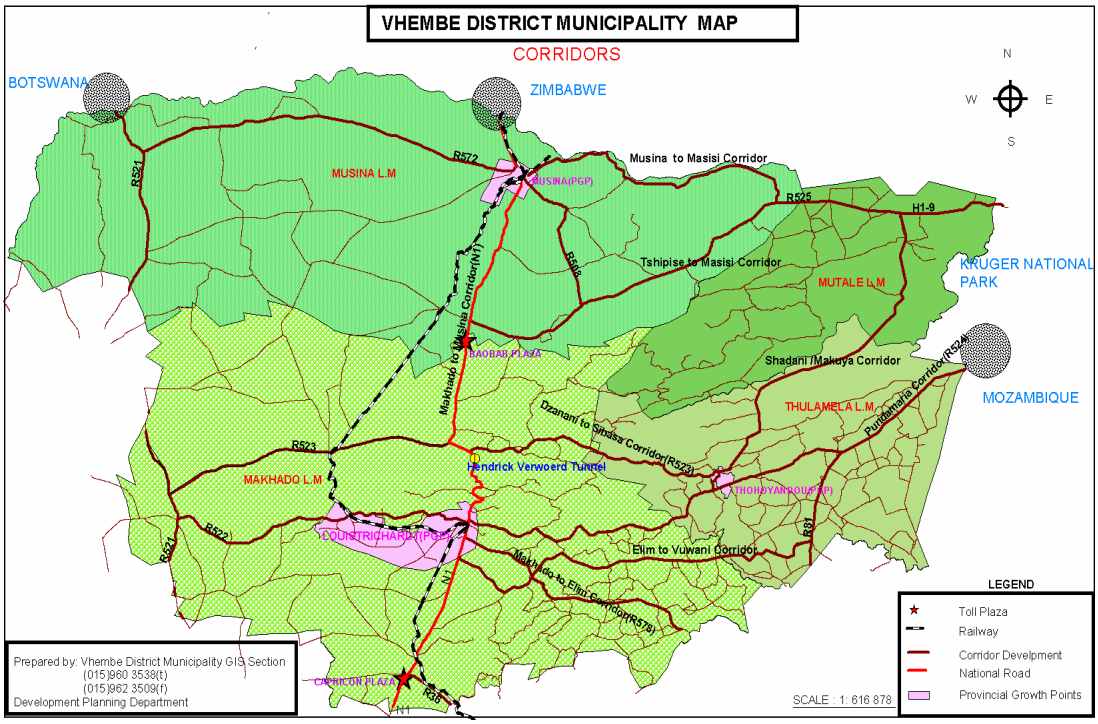
The main purpose of this interview questionnaire is to acquire information that will help us to find the causes of the recurrent drought and on the final stage will obtain measures to reduce the impact by having good results and recommendations. I therefore invite and encourage you to contribute to this study by responding to this questionnaire. Your answers and views are important and will be listened to.

For more information, do not hesitate to contact me on **082 4907071 / 015 516 5191**.

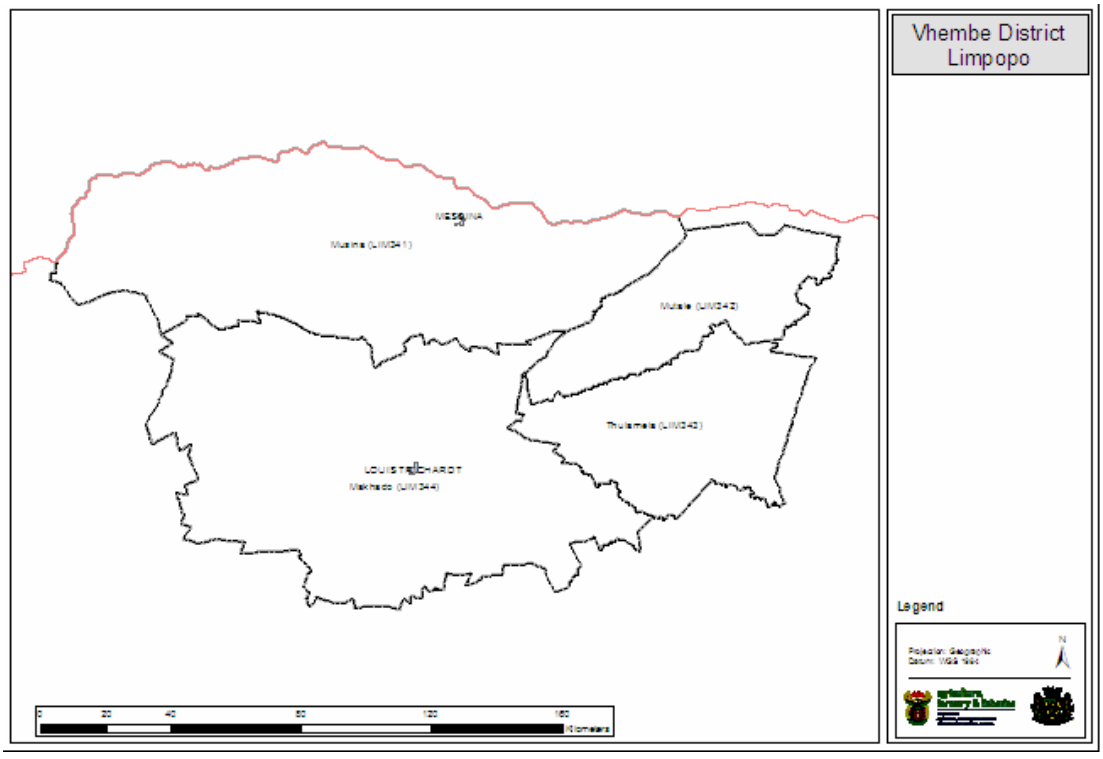
Yours sincerely

TV Mugogovhali

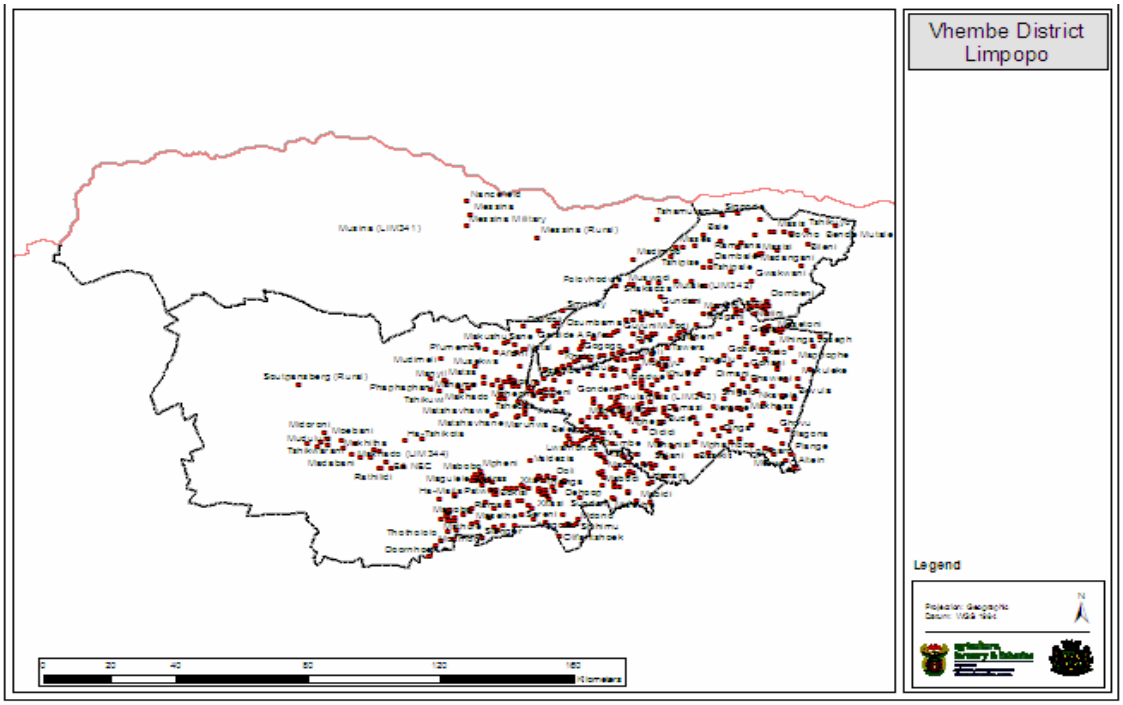
APPENDIX D



Map 1: Indicate the four local municipalities in red, Musina, Mutale, Thulamela and Makhado Municipality.



Map 2: Indicate the boundaries of Vhembe Local Municipalities



Map 3: Indicates villages in its municipality