Indigenous approaches to maize production and soil Management in Msinga KwaZulu-Natal, Province

By

Agnes Nyiraruhimbi

Submitted in fulfilment of the academic requirements
for the degree of Master of Agriculture
Agriculture Extension and Rural Resources Management

School of Agricultural, Earth and Environmental Sciences
University of KwaZulu-Natal,
Pietermaritzburg, South Africa.

January 2012

DECLARATION

I, Agnes B Nyiraruhimbi, declare that:

1. The research reported in this thesis, except where otherwise indicated, is my original research.

2. This thesis has not been submitted for any degree or examination at any other university.

3. This thesis does not contain other person's data, pictures, graphs or other information, unless specifically acknowledged as being sourced from other persons.

4. This thesis does not contain other person's writing, unless specifically acknowledged as being sourced from other researchers. Where other written sources have been quoted, then:

   (a) Their words have been re-written but the general information attributed to them has been referenced.

   (b) Where their exact words have been used, then their writing has been placed inside quotation marks, and referenced.

5. This thesis does not contain text, graphics or tables copied and pasted from the Internet, unless specifically acknowledged and the source being detailed in the thesis and in the Reference section.

Signature	Date

As the candidate's supervisor I have approved this thesis/dissertation for submission.

Dr. Steven Worth		
Name	Signature	Date

As the candidate's co-supervisor I have approved this thesis/dissertation for submission.

Mr. J.S. Polepole		
Name	Signature	Date

ABSTRACT

This study explored and examined indigenous knowledge IK in the process of maize production and soil management by farmers in Msinga in central KwaZulu-Natal. This study was qualitative in nature. Two methods were used for data collection: focus group discussions; and individual semi-structured interviews.

The study found that the Msinga farmers have a range of techniques and strategies to produce maize and manage the soil; they have been relying on this knowledge for generations. However, many farmers have also begun to adopt elements of western science such as the use of hybrid seeds, fertilizers and pesticides – albeit access to them is a major problem. It was also found that these indigenous knowledge and techniques have also suffered as result of different factors, including the climate conditions as result of the growing drought in the area, the passing on of elders with knowledge, and the breakdown of social cohesion. Communities' indigenous knowledge has been rendered ineffective to, alone, address their maize production and soil management issues. As a result, indigenous knowledge is dying in this community and the farmers are not able to produce sufficient maize to meet their needs.

In the face of these pressures, the Msinga farmers also lack any meaningful external assistance either from the government or private agencies. They have no access to extension. This means that communities have to fend for themselves, and where indigenous knowledge has failed they have no other alternatives that will help them to adjust to their environment.

Finally, the study found that as a result of this stasis, the Msinga farmers and their families are poor and lack the basic means for their daily survival; food shortages are frequent. The consequence is that they appear powerless and unable to cope with challenges.

The study recommends an integrated approach to address issues of reconstructing indigenous knowledge; social cohesion; environmental matters; poverty eradication; external support and integrating indigenous knowledge and western science.

ACKNOWLEDGEMENTS

Most importantly, I thank the Lord Jesus Christ, who has been my strength and guide, for it is only through him that I can do all things.

I would like to offer my sincere thanks to Dr. Steven Worth for his guidance, dedication, invaluable help, encouragement, motivation and constructive criticism as my supervisor. His patience and support have been greatly appreciated.

I would also like to thank Mr. John Polepole for his continuous support, encouragement and constructive comments as my co-supervisor.

In particular, I would like to thank my parents for supporting and understanding me since day one when they gave birth to me, and throughout my education.

A great thanks is also owed to my family; particular, Nsengiyunva Isidore, Mukunzi Emerence, Rukema Joseph, Umubyeyi Beatrice, Kamanzi Eric, Ndorimana Denyse, Hakiza Darius, Jambo Julienne all brothers' children for supporting me spiritually and materially, and my Brothers and Sisters in the Lord for their prayers and patience.
I would also like to thank the University of KwaZulu-Natal, Pietermaritzburg for providing me with financial support to conduct field research.

A word of thank you goes to the people from Msinga, in particular Simbongiseni and Precious who gave of their valuable time and participated in the research process up to the end.

ABBREVIATIONS

ANC:	African National Congress
COSH:	Church of Scotland Hospital
CBO:	Community Based Organization
FG:	Focus Group
NRC:	National Research Council
IK:	Indigenous Knowledge
IDP:	Integrated Development Plan
IRIN:	Integrated Regional Information Networks
IFP:	Inkatha Freedom Party
SA:	South Africa

TABLE OF CONTENTS

FIGURES

LIST OF TABLES

CHAPTER ONE: INTRODUCTION

1.1. Introduction

The aim of this study was to explore and examine community IK in Msinga, Mabaso village with regard to maize production and soil management. This introductory chapter presents the background of the study, the problem statement, the aims and objectives of the study, the research questions and the significance of the study. It also outlines the content of the thesis, chapter by chapter.

The study was conducted among smallholder Zulu farmers in the village of Msinga, in central KwaZulu-Natal, South Africa. The farmers who participated are engaged in what is generally considered 'traditional' farming, primarily using knowledge and technologies that have evolved largely within the community over many generations. The focus of their agricultural activities is household food consumption with sales of surpluses when they occur.

1.2. Background of the study

Maize remains one of the major food staples in developing countries worldwide, and in Africa in particular. In Africa, maize is produced mainly through the use of IK (Hart & Vorster, 2006:1). In Africa, as in many other developing countries, the assumption is that agricultural development cannot succeed if does not follow the kind of development model which assumes that a country's social and economic development must be externally induced (Hart & Vorster, 2006:1). This assumption ultimately ignores the roles of those who hold indigenous knowledge and the impact they can have in the process of agricultural development (Hart & Vorster, 2006:2).

While IK has been marginalized by many in modern times as ineffective and backward, it is, however, still practiced by the majority of the population in developing countries and remains one of the main tools used in the process of making a livelihood (Mwaura, 2009). IK still finds a high degree of acceptability among its custodians (Kamara 2007). IK is found to be important in many areas of

development, including agriculture, environment management, health and many other areas of critical importance in societies (Mwaura 2009). In agricultural practice, for example, 80% of rural farmers in developing countries use indigenous knowledge. The production from these farmers accounts for a significant amount of food production (Hart & Vorster, 2006).

Marginalization of indigenous knowledge in development in modern times leaves one to question the sustainability of livelihoods of the billions of people who depend on in IK for their survival. 'Ineffective' and 'backward' or not, IK is worthy of study. It is on this basis that this study attempts to explore and examine the use of indigenous knowledge in the process of maize production, and how, in such a process, the soil is managed. It is hoped that the results from this study will give a clearer picture of the use of indigenous knowledge in the study area and thereby shed more light on the relevance of indigenous knowledge in modern times, where globalization and the use of new, more sophisticated and so called 'modern' technology is rapidly spreading.

1.3. Problem statement

As will be explained in greater detail in Chapter Five, maize is one of the major food staples in rural KwaZulu-Natal, including Msinga. The production of maize in Msinga faces many challenges. These include the lack of arable land for producing maize, frequent droughts, the lack of external support from the government and other agencies, lack of government investment in agriculture, such as provision in water supply for irrigation, giving small loans to farmers, the lack of extension workers in the area, a high level of unemployment, and poverty among the population of Msinga (Maurice Web Race Relations, 2007, IRIN) 14 June, 2007 and formal discussions with members of the community, 2011). All these factors combined provide a reason to believe that, because maize production forms a primary part of their livelihood system, community members of Msinga have unsustainable livelihoods. This becomes evident in Chapters Three and Five.

In addition, the communities in the area of study have no other options or external support in the process of maize production and soil management and therefore have

to rely on IK to produce maize and manage the soil. Given the factors indicated above, there is also a reason to believe that the strength of IK is limited and, therefore, there is a need to supplement IK with modern technology and public policy in order to respond effectively to the challenges faced by the Msigna farmers who currently rely solely on IK.

1.4. Aims and objectives of the study

The aims and objectives of this study are:

1) To identify and understand the approaches used by maize producers in Msinga in the process of producing maize, and their related soil management practices.
2) To investigate the effectiveness of these practices; and
3) To suggest ways in which farmers in Msinga can be assisted.

1.5. Research questions

The study investigates the farmers' approaches to maize production and soil management in Msinga. In order to achieve this main objective, the study addresses, amongst others, the following specific questions:

1. What indigenous approaches are used in the process of maize production in Msinga?
2. How does the process function, from the seed selection to the final harvest?
3. What techniques are employed to manage the soil in the process of maize production in Msinga?
4. How effective are these approaches and techniques from the perspective of the farmers in Msinga?

1.6. The significance of the study

This study was conducted in post-apartheid South Africa, where the government, according to published policy, is striving to promote the use of indigenous knowledge

as a means to curb the scourge of poverty prevailing among the rural population. In addition, the driver behind the implementation of the plans and strategies of the Department of Rural Development to uplift rural communities is the mission to build on what people in rural areas have in place. This study can contribute to this undertaking by providing greater understanding of rural farmers' practices with regard to maize production which is so central to their livelihoods. It is hoped that the findings of this study will assist decision-makers to implement their plans more effectively by grounding their decisions in peoples' experience and action, which this study will record. This study also has the potential to help the farmers in Msinga retain, restore and rebuild their indigenous knowledge where it has perhaps waned or is disappearing.

1.7. Thesis structure

This thesis is made of six chapters.
Chapter One: Is the introductory chapter and presents the background of the study, problem statement, aims and objectives of the study, research questions and significance of the study.

Chapter Two: Reviews literature on indigenous knowledge. It presents different discourses on indigenous knowledge and how this is applied in the process of maize production and soil management.

Chapter Three: Presents the study area and provides geographical, ecological and socio and economic information about the study area.

Chapter Four: Presents and discusses the research methods used in this study and explains the process through which data were collected and analyzed.

Chapter Five: Constitutes the core findings of the study. It outlines the findings of the key informants and group discussions, and provides an analysis of these findings.

Chapter Six: Presents a summary of the findings and a deeper analysis, resulting in conclusions and recommendations that emerged from the study.

CHAPTER TWO: REVIEW OF LITERATURE

2.1. Introduction

Central to this study is the concept of indigenous knowledge, and in particular indigenous knowledge relevant to maize production and soil management. As stated earlier, the study was conducted among farmers in Msinga in central KwaZulu-Natal province.

This chapter is divided into five major sections. Section one review the discourse on IK It explores definitions of IK, the importance of IK in agriculture, the challenges facing IK, and the link between indigenous knowledge and sustainable livelihoods. It discusses the importance and limitations of IK, the importance and limitations of western science, and the integration of IK and western science, including challenges in integrating IK with western science and public policy.

Section two discusses indigenous techniques in the process of maize production. It includes a review of literature on techniques employed by indigenous farmers from the selection of maize for seeds up to harvest. Section three reviews literature on the indigenous techniques used by farmers in managing soil in the process of maize production.

The final section provides concluding remarks which help frame the theoretical context for the study.

2.2. Definition of indigenous knowledge

The concept of IK is multi-dimensional and has been attributed a number of definitions. While the concept of IK may have different definitions, proponents of this concept agree that IK is specific to communities and to local environments and therefore can be understood and defined through the social, cultural and human environment in which is contextualized (Mwaura, 2009; Potteir *et al.,* 2003; Green, 1994). Examining IK, Langill (1999, cited in Mwaura, 2009) asserts that understanding IK does not require knowing whether people under the study are

original inhabitants of a specific area. What is most important is to understand how people found in a specific environment interact with their own environment and how they make sense from it.

While people may share the same knowledge of their environment which could be understood to be a form of IK, Potteir *et al.* (2003) argue that it is important to go beyond how people interact with their environment. While the concept of IK appears to be complex, it can however be summarized into three definitions which are local memory, local practice and local science (figure 1).

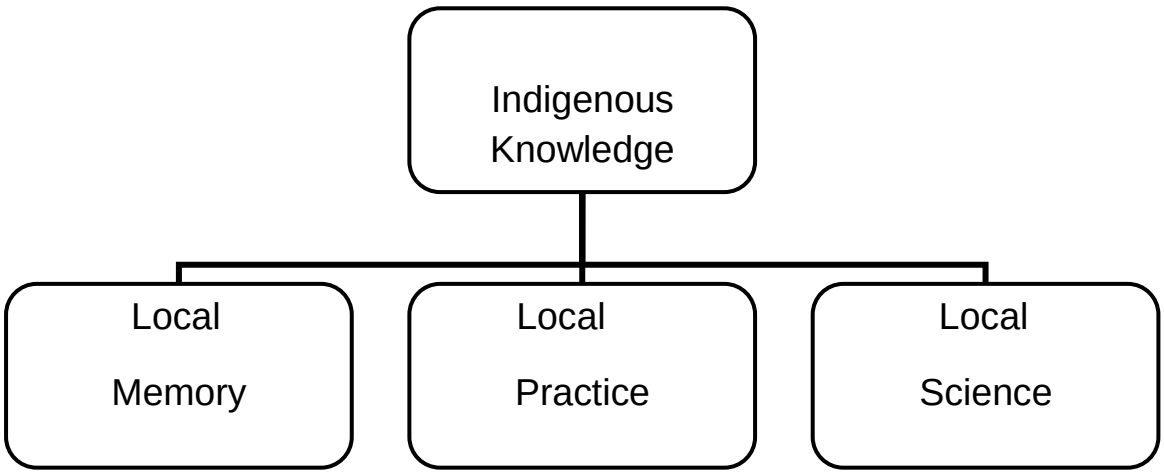

Figure 1: Different aspects of indigenous knowledge
Source: Adapted from Opoku (2007).

As presented in figure 1, IK can be defined as local memory when it combines a set of values shared by a particular group of people. These can be in forms of customs, traditions and spiritual beliefs, and these are transferred from generation to generation, evolving as new knowledge is transferred along with these understandings through oral traditions of folklore and folk songs. These lie at the root of historical and cultural memories, which continue to remain fresh in the memory of the next generation and continue to carry essentially the same message, even if it has been modified in practice (Mwaura, 2009). It is posited that local memory also comprises values and practices that have been discarded in favour of other values and practices, but which are remembered by the current generation.

Similarly, IK is understood as local practice when the knowledge has been accumulated over generations within a specific culture and region. Such knowledge evolves from years of experience and trial-and-error based on resources available within the community (Green, 1994). The argument here is that the practice is done with a limited degree of consciousness about why the practice is used. It is not supported by any 'evidence' or record of reason – it is done without one's knowledge and being aware that it has been done.

IK is defined as local science when it is considered to be a conscious place of knowledge and technologies, existing and developed around specific conditions of populations and communities, situated in a particular geographical area. Such knowledge is built on material and non-material possessions which enable individuals or communities to adjust to changes in their living conditions (The National Research Council (NRC), 1991). Local science does not necessarily imply adoption of formal (e.g. western) scientific methods. It is suggested that it is the issue of consciousness that makes local practice local science. It is taken as science when a technology (e.g. a method or tool) has been adopted through a conscious and deliberate process of learning, innovation and/or experimentation.

In this regard, Green (1994) argues that IK can be defined as a set of combined knowledge and skills mainly aiming at helping the community or individual to withstand external shocks, such as natural disasters, and adjusting living conditions under changing environments. The skills held by the community can be utilised through the use of natural resources, which in turn can assist individuals to make and sustain their lives. There is reason to believe that the combination of technology and skills and the beliefs surrounding such practices are often embedded in culture, are attributed specific meaning and place in a society, and are kept for the next generation (NRC, 1991).

While it is often the case that IK is specific to a particular group in a particular environment, it is however important to note that IK is dynamic and can be influenced by a number of factors. Local practice and knowledge can come from various sources, especially from traditions handed down through family, clan or tribe. It can be learnt from neighbours. In the case of farmers, it can be learnt from sources

including farmers using western methods, extension agents or sales representatives and the media (radio and magazines). Once these are acquired, they are embedded in local settings and values (Mwaura 2009).

2.3. Linking indigenous knowledge to sustainable livelihoods

Maize remains one of the major sources of livelihoods in Msinga. Therefore, the need to understand its sustainability is crucial. While the concept “sustainable livelihoods” remains complex and difficult to define, proponents of this concept such as Johnson (2000), argue that sustainable livelihoods involves a range of material and non-material assets and social relations upon which individuals and households draw, whether during normal times or in times of uncertainty, for their livelihood and survival. It is the ability to draw upon these assets in times of uncertainty that demonstrates the measure of sustainability. In every society or community, every member has access to some form of livelihood – although it may not be adequate or sustainable. This livelihood will be based on either or both their material and non-material assets. This premise is presented as starting point for strengthening adaptive capacity and sustainability (Dixon, 2005).

IK is a livelihood asset and, therefore, plays an important role in the sustainability of the livelihoods. One can thus argue that IK and sustainable livelihoods are intertwined and play interlinking roles to maintain the well-being of a particular family, group, community (Grenier 1998; Thrupp 1989).

2.4. The IK debate

Much has been said about IK. On the one hand, people who use IK view it as effective as it helps them deal with their daily activities and allows them to make and sustain their livelihoods. On the other hand, modern theorists view IK as irrelevant. Its importance is lost in the modern and globalised world and it is offered a lesser position in development processes. This debate will be explored by discussing the following themes: challenges facing IK; the importance of IK in agriculture and its limitations; and the importance of IK in rural communal agriculture and its limitations.

2.4.1. Challenges facing Indigenous knowledge

While IK has been demonstrated, in some instances, to be effective and relevant to its custodians, it faces numerous challenges (Seepe, 2001; Ngubane, 2006; Maila, 2007; Hoppers, 2002). The first is that it is marginalized in modern times. Second, the segmentation and amalgamation of cultures has led to a situation where the knowledge of a specific group has become either diluted or absorbed (Seepe, 2001). The lack of validation and support from formal institutions such as the government, decision-making bodies, and training and learning institutions, such as universities, has limited the advancement of IK (Hoppers, 2002).

Furthermore, IK is labelled with negative connotations and is often associated with backwardness (Seepe, 2001; Ngubane, 2006; Maila 2007; Hoppers, 2002). Modern development ideology sees IK as an obstacle to development (Seepe, 2001 cited in Ngubane, 2006). This has resulted in IK not having been given a place in development processes; IK continues to be held in low esteem in development. Most importantly, as indicated earlier, what makes IK to not have been clearly understood is that institutions of higher learning, which are supposed to recognise and validate IK as a legitimate form of knowledge, have failed to recognise IK in this way. Where attempts have been made to do this, scientists have failed to provide a clear direction and framework on how IK could be integrated into the education system (Hoppers, 2002).

Consequently, scholars differ on whether indigenous knowledge systems are evolving or are static, and on whether IK has or lacks the potential for universal usage. Often IK is associated with (African) culture rather than being seen as a science. Scientists fail to understand or accept it as another form of science which needs to be explored and understood and possibly integrated with conventional, so-called modern science. As a result, it leads to a situation where IK is not recognized as a form of science or source of technology (Hoppers, 2002; Maila, 2007). Thus the suggestion of viewing IK in terms of local memory, local practice and local science

was developed to contribute to a more objective understanding of the often politicised or emotionalised concept of IK.

2.4.2. Importance of IK in agriculture and its limitations

Despite the persistent low status of IK, numerous studies have demonstrated that indigenous knowledge plays a very critical role in agricultural development (Lwoga, Ngulube and Stilwel, 2010; Mascarenhas, 2004). For instance, in developing countries, which account for a large portion of the world's population, 80% of rural farmers practice low-input agriculture, drawing on their IK (Mella, Kulindwa, Schechambo & Mesaki, 2007; Hart & Vorster, 2006) and depend on IK for crop production and food supplies. Indigenous farming methods have been acquired from preceding generations, including the transferring of skills to observe problems arising during farming and to seek solutions to adjust local environment conditions (Prasad, 2009). In such cases these would likely be mostly local practice.

Examining IK-supported forms of agriculture, the International Development Research Centre (2003) indicated that rural farmers in developing countries produce 20% of the world's food, largely without external inputs. For example in India, tools and knowledge used are specific to a particular group or community (Singh & Sureja, 2008). It is evident that farmers' knowledge, innovations and practices have provided the basis for thousands of years of agriculture among rural communal farmers (International Development Research Centre, 2003). The same can be applied into Msinga, where the knowledge and tools are locally relevant.

While IK has been demonstrated to be effective in the process of agriculture and has been relied up on for many generations, it is however important to indicate that IK has limitations. Mass starvation continues to be felt in many parts of developing countries where IK alone is applied. Ecological conditions, especially the growing level of drought in many countries mainly in Africa, limit the efforts of IK (Grenier 1998).

2.4.3. Importance of western science in agriculture and its limitations

Western science is the knowledge generated by scientific institutions such as universities and research institutes (Warren *et al.*, 1991). It is largely motivated by the values and cultures of western civilization. The use of modern technology derived from western science in agriculture has resulted in mass production of food and has guaranteed food security in many countries; especially in the so-called developed world where access to such technologies is afforded by many farmers and facilitates the prediction of good planting season and help identify correct type of fertiliser to be used (Brodnig & Mayer-Schønberger, 2000). Not only has the use of western science in agriculture proved to be useful in terms of mass production, but it has also facilitated the transfer of such technology to developing countries, including South Africa, where this technology is adapted. Food security is guaranteed and the surplus is directed to neighbouring countries such as Lesotho which remains dependent on South Africa, Swaziland, Zimbabwe and Mozambique that cannot afford such technology (Hart & Vorster, 2006). Western science, through its technology, has increased the economic growth of many countries.

While it has been demonstrated that western science has improved agricultural productivity and increased food production, it too has a number of limitations. In some instances it has become a threat to agriculture and its sustainability remains questioned. For example, the use of inorganic fertiliser in agriculture has led to infertility of the soil (Gowing et al,. 2004).

IFPRI (2002), noted that the rapid introduction of production technologies resulted in a number of social, economic and environmental problems including widening economic inequalities. The institutes argues that introducing western science can have positive impacts if certain conditions are met: “(1) a scale-neutral technology package that can be profitably adopted on farms of all sizes; (2) an equitable distribution of land with secure ownership or tenancy rights; (3) efficient input, credit, and product markets so that farms of all sizes have access to modern farm inputs and information and are able to receive similar prices for their products; and (4) policies that do not discriminate against small farms and landless labourers (for

instance, no subsidies on mechanization and no scale biases in agricultural research and extension)" (IFPRI 2002:3).

2.5. Integrating IK, western science and public policy

Scientific studies have shown that there are similarities between indigenous and scientific knowledge systems (Ferguson & Messier, 1997; Huntington, 1998). According to Barrera-Bassols and, Zinck 2003), and Krasilnokov & Tabor (2003), this implies that knowledge systems are based on the same principles and goals. Both IK and western science have strengths and weaknesses. Both IK and western science use technology and they aim at improving the situation of people.

However, there has been more emphasis on research into the differences between the two systems than on the similarities (Tsuji & Ho, 2002). These have been pointed out as epistemological differences in knowledge attainment and substantial subject matter differences (Agrawal, 1995; Stevenson, 1996).

In spite of these differences, the preceding discussion has suggested that there is a need to integrate IK, western science and public policy in order to achieve sustainability of agricultural systems (Briggs & Sharp, 2004). In this regard, both IK and western science forms of knowledge are best regarded as complementary or parallel systems of knowledge, rather than as fundamentally incommensurable forms of knowledge. Therefore, if well integrated and supplemented by sound policy, IK and western science can yield desired results and enable communities and individuals to adjust to their own environment (Briggs & Sharp, 2004).

While the integration of indigenous knowledge and western science is supported by many, proponents of IK are, however, concerned that the modification of indigenous knowledge to fit the scientific approach can cause much degradation of IK (Habarurema & Steiner, 1997; Winkler Prins, 1999; Cools *et al*., 2003; Gowing *et al*., 2004). To counteract this, proponents of integrating IK and western science share the view that while integrating IK and western science is important, western science, which has been adopted as focal point of development in Africa and around the world, should not dilute the essence of IK. They believe that both forms of knowledge

must supplement each other in a form of transferring knowledge and responsibility (Gowing *et al*., 2004; Hoppers, 2002; Briggs 2005; and Opoku, 2005).

In the view of the researcher, the position presented by these authors is problematic in that it expresses, in the form of a caveat, an implicit belief that IK is somehow static and immutable, to be preserved from any change at all. In presenting the fear of dilution, these authors relegate IK to fixed knowledge which is the very antithesis of science. This does not serve the IK cause well as it contributes to the very dichotomy the proponents of IK seek to remove. It is for this reason, among others, that IK is presented in its three forms of local memory, local practice and local science as discussed earlier. Whatever value there was in a particular IK practice (whether a memory or a current practice), it is when it moves out of the realm of blind imitation into the realm of conscious experimentation and choice that IK will find its real power to contribute to development, including agricultural development.

Examining the integration of IK, western science and public policy, Opoku (2005) observes some forms of complementarity in the process of decision-making, despite the fact that such collaboration has been eroded with increased globalization.

He suggests an approach for the integration of IK, western science and public policy as set out in figure 2 which suggests that, in the process of integrating IK, western science and public policy there is a need to establish a commission board, and this must be established at the community level. This must bring together experts from community with local ecological value-sets and those academic experts who are in a position of decision making (Opuku, 2005).

The researcher notes that the arrangement suggested in figure 2 very structured and formal. It raises a number of questions. What is the concern here; that western science will over-run IK? And this is to be solved with a formal commission? Such a structured solution, while appearing to provide a bridge between the two knowledge systems, again points to reinforcing the false dichotomy and, in a sense, pits the one against the other in an arbitration setting. It is suggested that through education and the creation of objective collaboration based on mutual respect and acceptance of a conscious process of engaging with scientific enquiry such an adversarial solution could be mitigated.

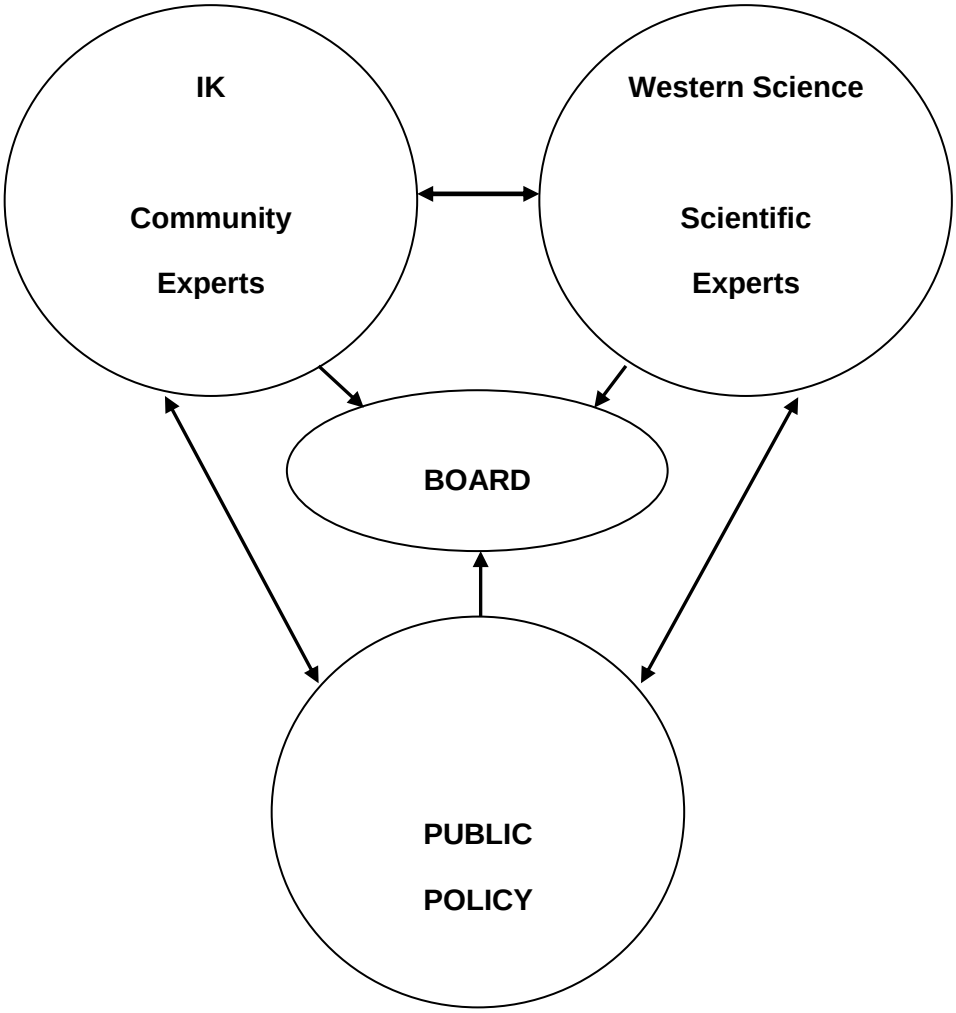

Figure 2. How IK, western science and policy can be integrated.
Source: Adapted from Opoku (2005).

2.6. Challenges in bridging IK, western science and public policy

A number of challenges have been identified in the process of bridging IK, western Science and public policy. One of the challenges is how to overcome the entrenched attitude of contemporary scholars and policy makers regarding IK and its relevance in development and to modern time. They fail to perceive the intrinsic value of indigenous knowledge and its contribution in development. Another challenge is the "rapid loss of indigenous knowledge worldwide, in part due to the spread of a global consumer culture and the effects of western education on both adults and the younger generation" (Hoppers, 2002:27). This is exacerbated by "ignorance and

linguistic barriers" which "make it difficult for indigenous people to participate effectively in hearings conducted in English and other foreign languages" (Hoppers, 2002:14).

2.6.1. Conclusions from the IK debate

While IK has been demonstrated to be effective and much utilised as means of making and maintaining livelihoods, the question that remains is how this form of knowledge is going to continue to survive where the speed of globalisation is brought along with western culture. If IK is to survive there is a need for it to regenerate itself.

2.7. Applying indigenous knowledge to agriculture

In developing countries, small-scale farmers have adopted different methods and techniques to produce various crops including maize. These techniques and methods can be divided into two major categories. The first category involves the seed from its selection up to harvest and the second category involves classification and management of soil, from the planting of the seed up to harvest. This section will discuss different steps taken by indigenous farmers in the process of maize production from the selection of the seed up to harvest, followed by soil classification, preparation and management of maize production.

2.7.1. Indigenous methods of maize production

This section provides different techniques and strategies used by indigenous farmers in the process of maize production. It highlights what rural farmers do in the process of maize production from the selection of seed up to harvesting of maize.

2.7.1.1. Seed selection

The selection of seed for planting involves a range of processes and is specific to each particular group of farmers (Araslan, 2007). Most farmers select seed for the next season on the basis of cob weight, length of the husks and the absence of pests and diseases in the seeds (Louette & Smale, 1991). Additionally, indigenous

farmers choose seeds for planting using multiple criteria which include softness of the dough, ease of shelling the grains, colour and taste (Canpacho & Ageal, 2005). The most important performance criteria for the seeds include yield stability in undependable weather conditions. Furthermore, indigenous farmers' seed selection is based on a range of end-use criteria; namely, undamaged seed, free from pests, desirable size, taste and colour. Others include aroma, cooking quality, storability, large cobs/heads and good health of the parent crop. In selecting seed, farmers have to balance this range of values (Berlin et al., 1974). Similarly, other criteria used to select seed maize involves the colour of seeds on the cob, uniformity of seed as arranged on the grain cob, good/uniform grain filling, i.e. cobs with no shrivelled grains, and cobs that are free from pest infestation (Araslan, 2007). Seeds meeting these criteria are believed to have good yield and the desired taste quality of maize.

2.7.1.2. Post-selection handling of seed maize

Once suitable seed is selected what follows is to have it stored under certain conditions. Indigenous farmers have numerous methods of storing crops for seeds. Methods commonly used by indigenous farmers involve hanging cobs for maize seed on bamboo sticks or rope just below the roof above the fireplace. They separate the seeds from the cobs a few days before planting (Prasad, 2009). Another method includes sun drying seeds before sowing. Seeds are exposed to the sun several times. This practice is expected to kill harmful organisms such as insect egg masses, fungi and bacteria. It also reduces the moisture content of grains, which improves storage (Prasad, 2009).

Indigenous farmers also keep seed maize cobs without removing the husks. The mature and dry cobs selected from the fields are hung in the house in a dry place. The idea behind this is to preserve the capacity of germination of the seed. This method of restage is to avoid the damage to grains from pests and keep its longevity and viability of germination (Prasad, 2009). To preserve seeds from storage pests, some farmers make storage bins made of bamboo sticks pasted with clay and cow dung. Pasted clay and cow dung prevents insect attack from outside (Dempsey,

1996). Post-selection handling ensures farmers that seeds are kept in good condition and ready for planting when the planting season comes.

2.7.1.3. Weed control

Numerous studies have indicated that weed control plays a very important role in the process of crop production. Weed control reduces the competition for water between crops and weeds; it also provides soil nutrients and light (Katinika *et al.,* 1996, Nuwagaba *et al*., 2000; & Efa, 2005). There are two factors which are taken into account when weeding the fields. One is the quality of the crop that has been planted and second, the recommended time for weeding varies by location (Handawela, 1985).

Generally, the most sensitive period to weeds is in the early stage of growth of the crops. The most critical time is generally when the crop is between about the 3 and 6 leaves stage. Removal of weeds during this time can lead to improved yields within this period (Blackwell, 1968). Competition for light, moisture and nutrients (particularly nitrogen) can affect the growth of crops where weeds grow rapidly (Blackwell, 1968).

Traditionally, farmers have different methods to control weeds. Some indigenous farmers combine both western and IK methods for controlling weeds. For instance, some farmers use the mould-boad plough as the main means of producing a clean seed-bed in which the cereal crop is sown (Black Well, 1968). Weeds are kept in check by the combined effect of herbicides and cultural operations carried out at very different times from year to year (Black Well, 1968).
While the study is on South Africa, there appear not to be any studies that have conducted in the field of South African IK on maize production by small scale farmers.

2.7.1.4. Pest and disease control

Numerous studies have found that indigenous farmers have vast knowledge of controlling maize pests and diseases. These studies focused on protection against storage pests, which cause serious losses, and protection against pests affecting the

growing stage of maize in the fields (Michael *et al*., 2009; Efa, 2005). It is, however, indicated that these various pests and disease control methods focus on a range of botanical pesticides such as plant extracts or pastes, as well as mechanical processes. In terms of botanical pesticides, indigenous farmers using IK practices generally use ash for pest control (Kamatenesi *et al.,* 2008).The latter method plays the role of both pest control and weed control (Michael *et al*., 2009). In some instances, red pepper mixed with tobacco leaves has also been identified amongst the methods employed by rural farmers in Tanzania and Kenya. Red pepper fruits are ground and mixed with a ground tobacco (*Nicotianatabasum*) leaves. The mixture is then soaked in water, left for two days and then filtered. The filtrate is sprayed as an aqueous solution onto crops at a rate of two litres per acre (Michael *et al.,* 2009:76).

2.7.1.5. Avoiding bird damage

Indigenous farmers using IK practices have developed numerous techniques to avoid birds damaging their crops. Some of these techniques involve erecting bamboo sticks tied with bird feathers in the field (Prasad, 2009). It is commonly believed that birds do not feed in fields where bird feathers are present. Several indigenous farmers erect sticks and pieces of cloths made in human features in order to scare away birds. This method is considered by farmers to be cheap and effective in keeping birds away from damaging crops in the fields (Prasad, 2009).

While these are indigenous methods of avoiding bird damage of crops, the fact is that the materials used are borrowed from western science, therefore showing that indigenous practices and western science can complement each other and bring about sustainable agriculture. This indicates that in modern time, with new technology, IK can still play an important role in development.

Another technique used by farmers in India and Tanzania, for instance, is one where farmers stand at the centre of the field on an erected platform (in India called a *mancha*) and beat an iron drum or use a catapult, locally called *Mujareti* (in Tanzania) to scare birds during the grain maturity stage until harvesting (Prasad,

2009; & Rahman, 2009). These methods have been found to be simple, effective and rational (Prasad, 2009).

2.7.1.6. Crop harvesting

The age at which maize is harvested is determined by the variety of maize and the season. For example, on average, hybrid maize is harvested after 95 to 96 days in the wet season, and after 93 to 94 days in the dry season. Local varieties can be harvested after 135 days (Djauhari & Soejono, 1987). Harvesting maize is not so closely tied to a particular time as with other cereals. Generally, the harvest of maize has to coincide with the dry season as a part of the strategy to protect the grain from rotting, the growth of mold, or germination on the cob (Chanpacho & Ageal, 2005). For most farmers using IK practices, harvested maize is usually left out for further drying. This is to eliminate excess moisture. Maize is then stored in open cribs or in sacks (Katinika *et al*., 1996).

Prior to harvesting, there is the tendency of lodging (falling) of matured maize plants, due in combination to the weight of developed grains in the ear head, wind, and loosening of heavy soils after heavy rains. When lodging, ear heads come in contact with soil. This can cause the quality of the grain to deteriorate, and/or the ear heads to be damaged by rats or pests, thus causing loss to maize production and value (Katinika *et al*., 1996; Canpacho & Ageal, 2005).

2.7.1.7. Conclusion

IK plays an important role in the process of maize production. However, it is important also to note that with the advancement and spread of western technology, IK cannot work in isolation and therefore needs to be complemented with modern science, where IK has failed to meet its objectives in agriculture. The question that remains is how the two forms of science and technology can work together in order to achieve sustainable agriculture, mainly in developing countries. While this question seems to be a challenge to answer, one would argue that there is a need to identify the strengths and weaknesses of sciences, IK and Western science and to determine where one would begin and where the other would end.

2.8. Indigenous soil management

This section discusses indigenous methods of soil management in the process of Maize production. This section covers the following: indigenous soil classification, Land clearing, soil fertility, crop rotation, intercropping and erosion control.

2.8.1. Soil management

According to Talawar & Rhoades (1998), indigenous soil management is primarily concerned with managing natural processes (e.g. erosion, nitrification, etc.). Using indigenous knowledge, farmers have managed to develop sustainable land use management practices to improve subsistence farming (Nuwagaba & Mangheni, 2000; Talawar & Rhoades, 1998).

Talawar and Rhoades (1998) argue that the management of soil is the first, and most important, step in the process of any agricultural activity. They believe that the ability of subsistence farmers to maintain agricultural production greatly depends on their efforts towards maintaining soil productivity through proper management of the soil resource.

Nuwagaba and Mangheni (2000), examining communities' indigenous soil management in Uganda, Kenya and Malawi, assert that indigenous soil management is often governed and influenced by cultural and individual assessment of benefits in order to avoid investment in risk. Meaning that cultural influence in the process of soil management allows indigenous farmers to evaluate and determine the soil's suitability to produce crops. As demonstrated earlier on, indigenous soil management, as part of broader IK soil management and classification, is greatly influenced by accumulated knowledge from many generations of farmers cropping the same fields and passing on their experience to the next generation in order to maintain a reasonable harvest and hence the welfare of their families (Mikkelsen & Lagohr, 2004).

Such knowledge is handed down within the families or the community for generations, as an important factor in the management of soil and in the selection of

crops and their rotation (Mikkelsen & Langohr, 2004). For example, Grant (1981), examining soil characterization, management and fertility in Malawi, found that farmers classify soil based on what they have learnt from many previous generations, knowledge that continues to be applied even today.

2.8.2. Soil classification

Studies have also indicated that subsistence farmers use various methods and techniques in assessing soil and land suitability for crop production (Odongo, 1999). These methods include the colour of the soil, taste and texture. For example, in Kenya, farmers classify soil suitability for agriculture on the basis of colour, texture and coarseness or a combination of any of the three (Macharia & Nganga, 2005).

In Kenya, farmers consider dark soil to be suitable for crops such as maize, sorghum and beans, while red and rocky soil are suitable for producing cassava and sweet potatoes. Farmers assume that dark soil is ready for cultivation and probably reflects an increase in soil organic matter (Macharia & Nganga, 2005). In general, dark soils are considered to be more fertile than light soils because darkness of the soil is associated with organic matter content (Macharia & Nganga, 2005; Marten & Vityakon, 1986; Powell *et al*., 1991). Red, white and yellow soils are most commonly considered to be poor for crop production (Saitoa *et al*., 2006).

Assessing soil suitability, the Yoruba people in Nigeria, for instance, rub soil between two fingers to tell whether it is "*Yanrin* (sandy), *Bole* (clay), or *Alaadun* (loamy), or textures in between such as *Bole alaadun* (loamy clay)" (Pwell *et al*., 1991:30). Any soil that causes itching is regarded as "injurious not only to human beings, but also to plants" (Osunade, 1989:4).

Wienstock (1984) conducted a study and reviewed the soil classification of some traditional agriculturalists in Southeast Asia and found that farmers in Malaysia differentiate soil by taste. The taste of a particular soil can determine what kind of crops or plants need to be cultivated in a particular environment. Soil colour and taste in combination with climatic conditions can provide enough information about

fertility and can determine the kind of crops to be planted and rotated (Mikkelsen & Lagohr, 2004).

Both the quality of the soil and climatic conditions play an important role for indigenous farmers in ascertaining the good productivity of crops, and maize in particular.

2.8.3. Land clearing

Land clearing is the first step that farmers undertake in the process of crop production. Land clearing requires substantial amounts of labour in order to prepare a fine tilled seedbed (Tumuhairwe *et al*., 2001). Indigenous land clearing processes involve numerous activities. For instance, for some farmers, if the field had previously been cropped, the clearing process involves the use of fire to burn 'trash' (e.g. crop residue and weeds) that remained behind during cultivation (Arslan, 2007), Burning as means of land clearing presents both negative and positive consequences. For some farmers, burning is perceived to be an easy and cost effective operation because it does not require the purchase of inputs, nor is it labour intensive, and leads to increased crop yields. On the other hand, while burning is viewed to be effective, it can also result in deteriorating the soil, leading to it becoming not fertile (Tumuhairwe, 2001).

According to Regmi (2005), many farmers in northern Uganda said that the exposure of bedrock was a problem for tilling and managing soils. Traditional ways of ploughing the land are common; because of the steepness of the slopes, using modern equipment like tractors and planters is almost impossible.

2.8.4. Soil fertile

Soil fertility is the point of departure for agricultural farming (Smaling & Oenema, 1997). Soil fertility has a profound influence on agriculture, not only on yield but also on the kind of crops that can be cultivated in a particular environment (Rwehumbiza *et al*., 2003). Literature examining the topic concludes that soil fertility and its management is complex due to many interacting factors such as farming practice in

a particular environment, the kind of crops that need to be cultivated, the ability of farmers to access fertilizers and cultural influences (Johansson, 2001).

While soil fertility may have different approaches, indigenous fertilizing methods involve a range of practices, with organic fertilizing as a common element (Jerie & Mugiya, 2010). Indigenous fertilizing methods also include the "application of compost manure, planting tree species and leguminous plants, incorporating crop residues during land preparation, leaving fields to fallow as well as applying inorganic fertilizers" (Grant, 1981:27). Finally, mulching has also played a very important role in the process of soil fertilization and in some instances in the management of the erosion. It helps to retain soil moisture and facilitates germination of the crops as well as helping to reduce weeds (Kishore & Denzogpa, 2009).

These indigenous fertilizing practices, especially the use of organic fertilizer, have been shown to be environmentally sustainable and cost effective, because they serve as fertilizer and simultaneously help prevent erosion. This is because maintaining high levels of "infiltration, reducing temperature fluctuation, improves soil moisture regimes, soil structure and, porosity" (Marten & Vityakon, 1986:37).

2.8.5. Crop rotation

Crop rotation involves the planting of different crops in a recurring sequence (Watson *et al*., 2002). This affects the entire soil-plant ecosystem by altering the quantity and quality of organic residues. It restores soil moisture reserves and the quality of soil, and increases the availability of nutrients (Amede *et al.,* 2001). Among many farmers using IK practices, crop rotation is best described as a system of managing the soil, when a particular crop has exhausted soil nutrients (Brust & King, 1994). Crop rotation presents more advantages than disadvantages.

The advantages of crop rotation: Crop rotation increases crop yield and controls crop diseases and pests (Nuwagaba *et al*, 1999). It is effective in restoring lost nutrients and improving soil properties (Belay, 2001). For example, some crops, such as sorghum, have a negative effect on soil because of its tendency to exhaust soil

nutrients and water reserves, while others, such as fava beans, improve the quality of the soil (Nuwagaba *et al*., 1999).

Some of the disadvantages of not rotating crops: Numerous studies indicate that monoculture results in an increase in crop-specific pests and diseases, often observed over time. Continuously growing the same crop on the same land will tend to exploit the same soil root zone which can lead to a decrease in available nutrients for plant growth and to a decrease in root development (Regmi, 2005).

The disadvantages of crop rotation: Some of the disadvantages of crop rotation or limitations are that when crops are rotated in one field, it results in different kinds of weeds growing in the field, therefore requiring indigenous farmers to intensify labour and use different methods for weeding (Regmi, 2005).

2.8.6. Intercropping

Intercropping is a production system where two or more crops grow simultaneously on the same field (Zhang & Long Li, 2003). Intercropping is recognized as a major traditional soil management practice which increases food production (Tumuhairwe, *et al*., 1999). indigenous farmers perceive intercropping as inexpensive because it does not require other inputs such as labour, and less time is invested in growing more crops on a single plot than would have been required for different crops in separate plots (Crawley, 1997). However, numerous studies conducted on intercropping systems indicate that this practice has both advantages and disadvantages (Jensen, 1996; Willy, 1979; Marten & Vityakon, 1986).

Disadvantages of intercropping are that it can lead to low crop yields, especially where farmers use intercropping without taking into consideration other agronomic factors such as proper timing, spacing and appropriate crop combinations (Jensen, 1996). Jensen (1996) also believes that intercropping can expose land and make it more susceptible to soil erosion and soil infertility if not properly managed. Therefore, intercropping poses the risk of crop failure as some of the intercropped crops may not have same ability to adapt to the same environment (Jensen, 1996).

Some of the benefits (advantages) from intercropping derive from the fact that a mixture of crops can be more economic per size of the land. Intercropping uses water and nutrients more effectively than single crop planting (Marten & Vityakon, 1986; Willy, 1979). Intercropping has been shown to bring significant increases in mineral nutrients and soil organic carbon as compared to mono-cropping (Richards, 1985). For instance, intercropping legumes with cereal has been reported to use soil nutrients and soil moisture more efficiently and sustainably (Richards, 1985).

A recent study conducted by Zhang and Li (2003) demonstrated that intercropping, apart from increasing crop production, can also be beneficial to erosion control because it adds a protective cover to the ground. For example, in Indonesia, small farmers intercropped upland rice with maize and cassava. The result demonstrated that there is a recovery of nutrient uptake and growth after harvest of the earlier maturing species. The later-maturing species compensated for impaired early growth once the early species was harvested (Zhang & Li, 2003). Intercropping can also contribute to weed control (Dahmardeh *et al*., 2010).

Intercropping is not only for the management of soil properties but also for weed, pest and disease management. When these cropping systems are employed, they act as a defence against the build-up of disease-causing organisms (Gray, 1998), and are important for weed management (Reznicek & Jost, 1998). If the intercropping is effective and competitive, it can discourage weed growth by rapid establishment of the crops planted, thereby overshadowing weeds. Each mixture of crops in the same field has different effects on the soil and. therefore affects the carrying capacity of the field differently this can also determine the kinds of weeds that will grow. In some instances, weeds do not grow given the species of crop cultivated in the field (Richards, 1985).

2.8.7. Erosion control

The loss of soil results in nutrient depletion and a decrease in soil fertility and productivity (Doanh & Tuan, 2004). However, indigenous farmers using indigenous knowledge systems have developed numerous techniques to prevent erosion. For instance, Everson *et al*. (2007) conducted a study on traditional farming methods in

the hilly Sichuan region of China. They found that farmers have developed erosion control techniques involving an excellent traditional drainage system adapted to the sloping land. Farmers also built trenches that separated their fields and which serve to capture sediments during rainy seasons. In addition to this technique being effective for controlling erosion, it also simultaneously produced organic fertilizers (Vigiak *et al*., 2005). Another study conducted by Doanh and Taun (2004) in Tay, Vietnam found that farmers used cropping systems such as intercropping and relay cropping to reduce erosion.

2.9. Conclusion

The literature showed that IK is old, universal and continues to play an important role in the process of making a livelihood and sustaining lives through agriculture, including maize production. The literature also indicated that IK is still popular among many farmers. Despite some of its weaknesses and limitations, IK is still relevant in modern times where the culture of globalisation and western sciences is rapidly growing.

It is suggested that the integration of IK and western science must and can be a win-win process where the two forms of knowledge complement and supplement each other. However, the integration of IK and western science is challenging. On one hand, the attitudes of contemporary scholars and policy makers are regarded to be an obstacle in such an exercise. Another constraint identified regarding IK was the rapid loss of indigenous knowledge around the world, partly due to the spread of a globalization and the effects of western education on both adults and the younger generation. Yet, ignorance and linguistic barriers make it difficult for indigenous people to participate effectively in hearings conducted in foreign languages.

It is suggested that one way to contribute to successful integration of the two knowledge systems is to understand more objectively the actual IK practiced among farmers. Sorting IK into the framework of local memory, local practice and local science will help to look objectively at different indigenous practices and methods while honouring the cultural and heritage aspects of these practices thus providing opportunities for integration without the need for one to be seen as superior as or

inherently better than the other. It suggested that this will help bring IK into the world of western science as a legitimate form of knowledge.

CHAPTER THREE: THE RESEARCH AREA

3.1. Introduction

This chapter presents information regarding the research area, to provide the context for the research discussed in following chapters in this thesis. It includes the geographical location of Msinga as well as its landscape, vegetation, climatic conditions and population. It briefly discusses policies of the past, livelihoods and forms of income generation, land rights, and social organization and identity. It provides a review of common property and resource use, housing, social services, education, employment and unemployment in the settlement.

3.2. Geographical location

This study was conducted in Msinga local municipality of Umzinyathi District Municipality. Msinga is located in northern KwaZulu-Natal province. It has five neighboring local municipalities. In the East are Nquthu and Nkandla, in the South, Umvoti and Msundusi, and in the West, Indaka (Msinga IDP, 2005/2006). Msinga covers an area of 2504km^2 of land (Msinga IDP, 2005/2006).

Figure 3 shows the location of Msinga local Municipality in relation to its neighbouring local municipalities in KwaZulu-Natal province.

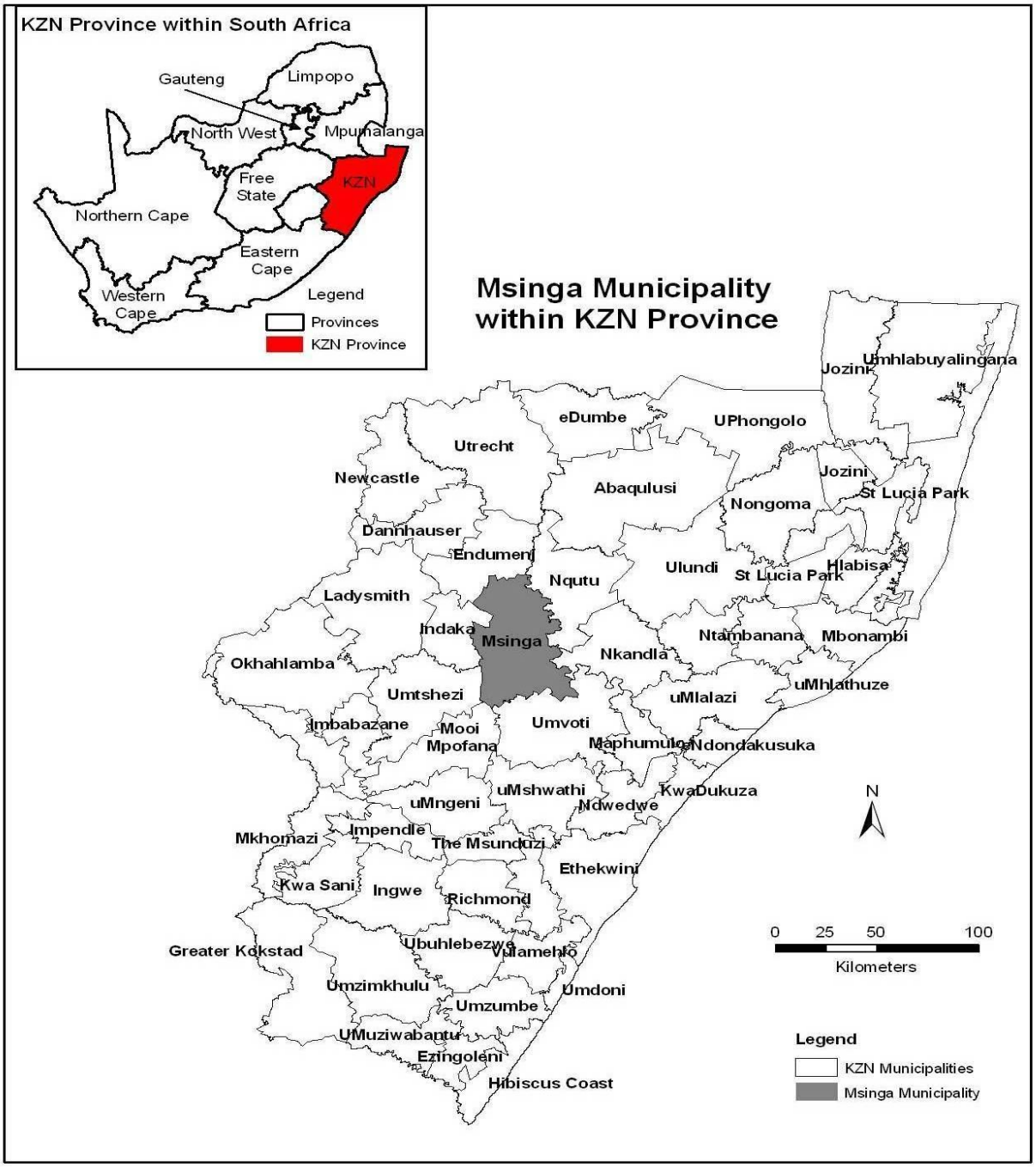

Figure 3: The location of Msinga Municipality in relation to its neighbouring local municipalities.

3.3. Ecological Conditions of Msinga

In Msinga, as in many parts of KwaZulu-Natal, during summer the weather is extremely hot; temperatures usually range between 31-37^{o} c.

During the winter, Msinga experiences severe cold with frost, particularly in the north; temperatures are between 4-8 degrees (Maurice Webb Unit & Race Relations, 2007; Department of Agriculture, 2000).

3.4. Landscape and vegetation

By observation, Msinga is dominated by mountains and rolling hills. The area has loose stones and rocks. The area is dry and with little green vegetation; natural vegetation of Msinga includes shrub trees, aloes and grasses on the rolling mountains.

Msinga has very little arable land; limiting the capacity of faming activities which nevertheless remain the main source of livelihood in the area. The little available land for farming has poor soil quality because of erosion and degradation due to over grazing. As a result, the land becomes unproductive. Taking into account the size of the entire region of Msinga, only 40% of the land can be utilized for agriculture (Msinga IDP Review, n.d.; Modi, 2003).

In addition to the above conditions, Msinga suffers from a shortage of water, for both domestic consumption and for agriculture. In Msinga, 99% of subsistence farmers have no access to irrigation. Only commercial farmers, numbering 1% of the population, have access to this facility (IDP Review, 2008/2009).

3.5. Rainfall in Msinga

In addition to ecological conditions making it difficult for agriculture, Msinga is subjected to recurrent drought. A study conducted by the Institute of Natural Resources in 2007 reveals that the area has a low rainfall which is between 600-700mm. This level of rainfall, according to the international standards, indicates drought of high magnitude (Institute of Natural Resources, 2007). In Msinga, normally the summer starts in August to April and the winter from April to July. Winter is cold and dry while summer the rain is expected. However the rainfall remains erratic and unpredictable in Msinga, making agriculture difficult, especially

maize which remains the major form of agriculture in the area (Drought Information Bulletin No 1/2004).

3.6. Population data

Msinga has a population of 170,000 (Census, 2001) resulting in a population density of 67 people/km.The population of Msinga is dominated by the African population group, constituting 99% of the entire population of Msinga. Table 1 shows the details of Msinga's population by a range of factors (Census 2001, cited in Maurice Webb & Race Relations, 2007).

Table 1. The population of Msinga by gender, race and age groups

Totals of Population		**Male**	**Female**	**African**	**Coloured**	**Indian**	**White**
168,031		70,245	97,786	167,686	103	95	147
100%	**Age groups**	41.9%.	58.2%				
		%	%	%	%	%	%
15	0-4	18	13	15	-	-	-
17	5-9	20	14	17	-	-	-
16	10-14	19	13	16	-	-	-
13	15-19	15	11	13	-	-	-
7	20-24	6	7	7	-	-	-
5	25-29	4	6	5	-	-	-
4	30-34	3	5	4	-	-	-
4	35-39	3	5	4	-	-	-
3	40-44	2	4	3	-	-	-
3	45-49	2	4	3	-	-	-
3	50-54	2	4	3	-	-	-
2	55-59	2	3	2	-	-	-
2	60-64	1	3	2	-	-	-
6	Over 65	3	8	6	-	-	-

Source: Statistics SA Census 2001 adapted from Maurice Web and Race Relations, 2007

Table 1 indicates that there is a significant gender disparity in the Msinga population. Females count 58.2% and males 41.9%. Considering the migration patterns of men, there is reason to believe that men may have migrated to urban areas in search and work opportunities and were not able to return home (Maurice Webb & Race Relations, 2007). Another observation from Table 1 is that Msinga has a large young population. The number of other races in Msinga is insignificant and those few

settling in the area are those working on commercial farms with others running business such as shops. According to Maurice Webb and Race Relations (2007), during the period 1996 to 2001, the total number of other race groups resident in Msinga diminished while the African population increased.

3.7. Msinga and policies of the past

Msinga was part of the erstwhile homeland of KwaZulu. The area inherited the legacy of the apartheid system which effectively entrenched poverty. In economic terms, Msinga has very little infrastructure. There is a shortage and lack of water for domestic consumption and no electricity or other basic facilities (Murray 2004). The lack of access continues to be felt up to date (Observation and formal conversation with members of the villages, 2011).There is a high level of unemployment, poverty, housing shortages and inadequate sanitation. These conditions make the area a reservoir of poverty as there are few opportunities created for this population (Maurice Webb & Race Relations, 2007).

3.8. Forms of livelihoods and income generation in Msinga

The sources of livelihoods in Msinga include subsistence agricultural farming, livestock, pensions and remittances (Maurice Webb & Race Relations, 2007). There are no local jobs available. Therefore employment remains very limited; the few who are employed are those working in commercial farms and those working in town (Maurice Webb & Race Relations, 2007) as domestic workers in town as Durban, and those working in mines in Johannesburg (Conversation with members of the Msinga villages, 2001). Stock farming is practiced for cultural purposes and not for commercial purposes. It is only under exceptional circumstances that cattle are sold (Msinga Municipality Report, 2010). Maize remains the main staple crop in the area. It is also supplemented by beans, sweet potatoes and groundnuts. Other crops include sorghum, millet, pumpkins, melons, beans, tomatoes, and cabbages (Modi, 2003).

Remittances from relatives who migrated to urban areas are another element of the livelihood strategies of many of the households (IRIN, 2007). There are also some

informal trading activities taking place in Msinga, including trading in fruit, snacks, and homemade foodstuffs such as fat-cakes (Maurice Web & Race Relations, 2007).

The quality of life in Msinga is very poor considering the activities that have to be undertaken in order to generate a basic livelihood. Such as afford basic commodities. Amenities and services required for an acceptable standard of living are very limited and often non-existent (Personal observation, 2011).

3.9. Social organization and identity in Msinga

Msinga is predominately inhabited by two tribes: the Mchunu; and the Mthembu. Both hold firmly to their culture and tradition. Land tenure in Msinga, as elsewhere in KwaZulu-Natal, is 'socially embedded', meaning that rights to own or use land and obligations attached to such ownership or use are acquired through social and tribal ties. Social units such as families' relations play an important role in determining who should have access to land. This means that social organization is a key to understanding land tenure in Msinga (Berry 1993; Peters 2004; Cousins 2007 & 2008).

While it is commonly believed that land allocation is based on social ties, this does not mean that every member of the family has access to the land. Access to the land implies that the applicant must meet certain criteria. Generally only married people have access to land. Single people cannot be allocated land, and therefore must reside with either their parents or other family members (Cousins & Hornby, 2009). However, under certain circumstances, for a single woman having children before marriage who requires her own land in order to cultivate, there is a provision for granting an allocation of land. This is at the discretion of the traditional and community leadership in consultation with selected heads of households (Cousins & Hornby, 2009).

In Msinga, as in most of rural KwaZulu-Natal, a man can have as many wives as he wants. Each wife has her own house and plot of land to grow food. However, the land and residence remain under the man's control, and the woman has no authority over the land, how it can be used or the right to transfer it to someone else.

Conversely the man may not dispose of the land used by one of his wives without proper consultation with his wife/wives (Cousins & Hornby, 2009).

3.10. Communities and land rights

In Msinga, as elsewhere in KwaZulu-Natal, according to the customary law on land holding and rights, the rights and obligations of acquiring land can also be based on descendants. Other people coming out from other areas who move to Msinga can be allocated land and be allowed to settle in the area if the proper channels and procedures have been followed, and it is approved by the area leadership (Cousins and Hornby, 2009). Right to land is mostly is based on accepted membership of the tribe (Hornby, 2000).

3.11. Common property and resources use

In Msinga, every member of the community has access to natural resources such as wood for fire, water and grass (Cousins & Hornby, 2009). However, the rules and regulations enabling such access are determined by the reigning tribal authority and therefore the rules and regulations may differ from one tribal authority area to the next (Cousins & Hornby, 2009). For instance, any tribal member who owns livestock can graze in the common area of the tribe he/she belongs to, without any restrictions on numbers. However, with the increase of over exploitation of the natural resources and the scarcity of natural resources, new restrictions are often put in place. For example, in the case of wood for fire, cutting living trees is prohibited in most of the tribal authority areas in Msinga (Cousins & Hornby, 2009).

3.12. Housing in Msinga

In Msinga, including in Mabaso where the study was conducted, the housing is predominantly traditional. Huts built with mud covered by grass roofs are the common form of housing found in the area. There is also some mud housing covered with metal sheets. Most of the houses are located the hills, and are grouped as family homesteads (Msinga ID Review, 2005/2006). According to Maurice Webb

& Race Relations (2007:27), the average family size in most of Msinga “ranges between three and six family members with four and five member families being the most prevalent.”

3.12.1. Households by population group and family size

Table 2 presents details about household sizes by population group. According to SA census 2001, in total there were 32,507 households in Msinga. African households counted 32.392, colored 30 households, Indian 27 households and white 58 households. The ratio of family size of one member is strong among white, coloured and Indian family, while for African family remains low. The same applies for the ratio of two members in family for white and coloured to have high number, while Indian and African family having equal number.

Family size of three members remains high among white, followed by coloured and African, while Indian family remains unrepresented in this category. Family size of four members per household, for Indian and white remains high, followed by African family, while colored family remains unrepresented in this category. In the category of five, six, seven and eight members per family, African family score high ratio, followed by Indian, coloured and lastly white family. This means that African family size is high, followed by Indian, coloured and lastly white.

Table 2: Households by population group and family size

Household size	Totals	African	Colored	Indian	White
Totals	32,507	32,392	30	27	58
Percentages	%	%	%	%	%
1 family Member	10	10	43	11	10
2 family Members	11	11	13	11	47
3 family Members	13	13	13	-	16
4 family Members	14	14	-	22	17
5 family Members	14	14	10	22	5
6 family Members	12	12	-	11	-
7 family Members	9	9	-	-	-
8 family Members	6	6	10	11	-
9 family Members	4	4	-	11	5
10 family Members	7	7	10	-	-

Source: Statistics SA Census 2001 adapted from Maurice Webb and Race Relations, 2007.

3.13. Social and economic facilities in Msinga

In Msinga, communities have limited access to social and economic facilities.

3.13.1. Running water

In Msinga, 63% of the population use unclean water from rivers and stagnant pools/dams (Msinga IDP Review, 2005/2006). Community members have to travel long distances to get water from rivers and the rest get water from communal taps. Women and children are responsible for fetching water. Few households have access to potable water facilities such as a stand-pipe, and these have a daily payment many households cannot afford (Maurice Webb and Race Relations, 2007; personal observation, 2011). “Over 80% of the households have no access to healthy sanitation; they make use of pit latrines, the bucket system or the open veldt” (Maurice Webb & Race Relations, 2007).

3.13.2. Electricity and energy

In Msinga, only five percent of the population has access to electricity. Gas and solar heating as fuel for heating is used by this five percent (Msinga IDP Review, 2005/2006). Out of the rest of the households (95%), 85% use wood as their source of fuel for heating (Msinga IDP Review, 2005/2006).

3. 13. 3. Refuse removal service

The refuse removal in Msinga is very limited; only 2% of the entire population has access to refuse removal. This small portion is only found in Tugela Ferry and Pomoroy (Msinga IDP Review, 2005/2006).

3.13.4. Telecommunications

In Msinga, access to telecommunication is limited with only 30% of the households having access to mobile phones as a means of communication (Maurice Webb & Race Relations, 2007). Another 30% of the households can access a telephone at a working distance from home (IDP Review, 2008/2009). The rest of the households, almost 40%, have no access at all to telephone services (IDP Review, 2008/2009).

3.14. Education

A recent study indicates that there are a growing number of schools in Msinga, with 170 schools accommodating a population of 61,605 pupils. Despite the growing number of schools, the level of attendance remains low. For example, there are 14,000 children aged between 5 and 19 who do not attend schools (IDP Review, 2008/2009 -10)

According to Table 3, 79% of the population in Msinga is illiterate. Only 2% of the population has gone beyond high school level (Maurice Webb & Race Relations, 2007).

Table 3: Education levels attained by Msinga population of 21 years of older by gender and race.

Level of Education	Total	Male	Female	African	Coloured	Indian	White
Totals	67,299	20,389	46,910	67,054	58	66	121
Percentages	%	%	%	%	%	%	%
Not applicable	-	-	-	-	-	-	-
Illiterate	68	58	72	68	-	-	-
Some primary	11	13	10	11	-	-	-
Completed primary school	3	4	2	3	-	-	-
Completed some secondary	11	15	9	10	-	-	-
Completed Std 10 (Grade 12)	6	8	5	6	-	-	-
Post Matric	2	3	2	2	-	-	-

Source: Statistics SA: Census 2001, adapted from Maurice Webb and Race Relations, 2007

Taking into account the gender disparities the attendance of females at school appears limited. A low level of school attendance for girls is mostly due to parental decisions and also influenced by cultural beliefs It is also commonly believed in the area, that educated women have no sense of housework and therefore girls should stay home and take care of the household (Cousins & Hornby, 2007). Chapter Five will show that parents prefer to send their boy children to school rather than their girl children.

3.14.1. Education Institutions attended

The Table 4 provides the information on education institutions attended by members of the Msinga villages

Table 4: Education Institutions attended

Education Institution	Total	Male	Female	African	Coloured	Indian	White
Totals	87,077	41,827	45,250	86,989	45	24	19
Percentages	%	%	%	%	%	%	%
No Schooling	31	27	35	31	36	13	21
Pre-school	3	1	2	3	7	13	-
School	66	70	63	66	58	75	79

Source: Statistics SA: Census 2001, adapted from Maurice Webb and Race Relations, 2007

3.15. Employment and unemployment

The level of unemployment in Msinga is high. This may due to the lack of job opportunities in the area. It may also be because the majority of the population has no formal skills to be employed. Table 5 shows the employment profile of Msinga.

Table 5: Employment status

Labour force	Total	Male	Female	African	Coloured	Indian	White
Totals	80,007	28,989	51,018	79,778	65	59	105
Percentages	%	%	%	%	%	%	%
Employed	6	8	6	6	-	-	-
Unemployed	23	26	22	23	-	-	-
Not Skilled labour force	71	66	74	71	-	-	-

Source: Statistics SA Census 2001 adapted from Maurice Webb and Race Relations, 2007

3.16. Health care facilities in Msinga

There are health care facilities in Msinga, with the only hospital being the Church of Scotland Hospital (COSH). COSH is located in Tugela Ferry. In addition to COSH, there are 14 state fixed clinics and two mobile clinics. Considering the number of the population and available health facilities, there is reason to believe that the health care system of the population in Msinga remains poor. In the case of serious and sudden illness, patients have to travel long distances to reach the hospital. This is particularly difficult for the many households that do not have access to public transport due to the lack of roads reaching their villages (Researcher observation, 2010, 2011 and discussions with members of the community, 2011 & IDP Report, 2005).

3.17. Summary

This chapter provided the information of the study area of Msinga. It included the geographical location and ecological conditions, the population and its socio, cultural and economic status. With regard to ecological conditions of the study area, the literature has shown that the ecological conditions of the settlement are not suitable for agriculture and even human settlement. It has been demonstrated that the area is rocky and the community has little arable land for agriculture. In terms of the population, the literature indicated that Msinga is predominantly inhabited by an African population who form the majority of the population in the area. With regard to culture, the area is dominated by the Zulu, specifically the Mchunu and Mthembu tribes, who are believed to be holding on to their tradition. In terms of economic status, Msinga is poor in terms of infrastructure. People are very poor and there are no job opportunities, making it difficult for people survive without any other sustainable alternative means of livelihood.

Given the socio-economic problems facing the community of Msinga, they remain vulnerable and do not show signs of recovering from the challenges they face, and unless some external support is brought in, the community will remain vulnerable.

CHAPTER FOUR: RESEARCH DESIGN AND METHODOLOGY

4.1. Introduction

This study seeks to explore and examine farmers' indigenous knowledge of maize production and soil management through a case study of Msinga villages in KwaZulu-Natal province. In order to achieve the objectives, a qualitative approach was employed, using mixed methods. Data collection procedures comprised two main stages: focus group discussions and semi-structured interviews. The focus group discussions and semi-structured interviews were supplemented by observation and unstructured interviews. This chapter outlines the research design that guided the research process, explains the tools and procedures used for data collection, present the selection and procedure of the sample population, describes the field work experience, language and data analysis, and discusses ethical considerations.

4.2. Research design

This study was a qualitative study using an interpretive approach based on intensive focus group discussions and individual interviews with 120 farmers from the Mabaso traditional authority area of Msinga. One hundred (100) of the farmers participated in the focus group discussions and 20 farmers participated in the semi-structured interviews. While it is important to provide total number of the population of Mabaso, there is no data available for this population. Before presenting the details of the procedures and methods employed in the process of data collection, the concept of qualitative research and its relevance to this study is discussed.

Qualitative research deals with a 'subjectivity' that encompasses a wide range of human behaviors, attitudes, and practices all which need to be explained and understood (Lincoln 2001). Qualitative research is best described as a commitment to understanding the social world, "a mental process of interpretation and interaction with the social context" (Lincoln 2001:75). Employing qualitative research methods such as interviews seeks direct input from participants about their opinions regarding

issues concerning and affecting their lives and allows for the expression of cultural values (Kitzinger, 1995)

However, research is not only a process of collecting, analyzing and interpreting data to answer questions; it must also have certain characteristics. It must involve the systematic, controlled, valid and rigorous establishment of associations and causation that permit the accurate prediction of outcomes under a given set of conditions (Kumar 2004). This is what this study is trying to establish.

In this context, and in order to answer to the above requirements, mixed methods were used for data collection. Using mixed methods is appropriate when attempting to understand human behavior through various perspectives. It allows one to understand human experience and actions, to interpret them through various ways, and to understand the meaning attached to every interpretation. In this study, using mixed methods allowed the researcher to capture and understand more fully the attitudes, perceptions and practices through different perspectives of rural men and women in Msinga and how these are attached to the process of maize production and soil management (Babbie & Mouton, 2001).

Overall, the qualitative approach helped the researcher derive meaning from the data by providing the bigger picture and converting the “raw” empirical information into a “thick description” (Henning, 2004:47). This means that going deeper and giving sense to the interviewee’s interpretation of his/or her own understanding of social actions.

A qualitative approach presents a number of advantages: it seeks in-depth examination of phenomena, it uses subjective information, and it is not limited to rigidly defined variables. It can examine complex questions that can be difficult or even impossible to examine with quantitative methods. It can deal with value-laden questions, explore new areas of research and help in building new theories (Babbie & Mouton, 2001).

While a qualitative approach presents advantages, it also presents some disadvantages. It is important to remember that when using any data gathering

technique, it is always useful to be aware of their strengths as well as their limitations. Qualitative methods, as with any other technique, have their own set of limitations. As qualitative data are not directly observable, it depends on participants' ability to reflect upon, discuss, and effectively communicate aspects of their experiences. Furthermore, reflection on an experience may serve to change the way an individual interprets his/her own experience (Polkinghorne, 2005). Additionally, as this is a qualitative interpretive study, it relies largely on the ideas and interpretations of the researcher (Polkinghorne, 2005). This means that the researcher needs to be aware and critically reflective of his or her own role and influence in the process, as well as his/her own constructed understandings (Patton, 1987).

To minimize such limitations, mixed methods were used in this study. This allowed the researcher to crosscheck the information gathered and to observe patterns and differences, and then to see how human behavior and interpretation of one event or phenomenon is interpreted in various ways (Babbie & Mouton, 2001).

4.3. Method of selecting sample

Due to the nature and purpose of qualitative research, participants of qualitative research studies are chosen, not because they meet statistical requirements, but rather in terms of their ability to add to and enrich the structure and character of what is being studied (Polkinghorne, 2005). In this study, participants were not chosen because they represented the whole population of Msinga and Mabaso in particular, but were because they have rich information in answering to the research questions and are indigenous farmers. Participants were identified with the help of traditional leaders in the villages and then the research with her research team had to motivate and encourage identified participants to participate in the study.

In this study, the participants were homogeneous in terms of language, ethnicity, culture, and social and economic backgrounds. They were all heads of households living in the same environment. They were Zulu-speaking. In addition, participants in the focus group discussions were selected according to age and gender. The

minimum age of participants was19 years and maximum age was 80 years. Fourth male and sixty females participated in the study for focus group discussions.

In addition, key informants were selected according to their age. In this category, the age of the respondents was from 60 to 80 years. There were seven males and thirteen females. Respondents of this age were chosen because of their seniority and their experiences over a long period, as memory plays a significant role in documenting IK (Ellis & West, 2004). They were also chosen for the role each played in the community and the quality of information they might have which would be considered useful to this study. It is believed that elders might have rich information on how agriculture was practiced and how agriculture has changed over time. Respondents in this group would also provide useful information, history and timelines of agriculture and other events which may have influenced the agricultural practices in the settlement under study. Respondents in this category were also identified with the help of traditional leaders.

In both focus group discussions and individual interviews women were more re-presented. This was influenced by the factor that women are high population in Msinga (see chapter three).

4.4. The sample selected

Both respondents and participants were randomly selected from members of the villages in each age category. They were composed of women and men. The age, being farmers, and being heads of households were the three major criteria in the selection of participants for both the focus group discussions and respondents for semi-structured interviews. A total sample size of 100 members from Msinga was selected for focus group discussions, and semi-structured interviews involved 20 respondents. The sample for both focus group and semi-structured interviews was heterogeneous as it was composed of men and women. After the identification of potential participants and respondents, these were approached by the researcher and were asked to participate in the research process.

To preserve anonymity, no individual respondent's name is cited or mentioned; instead, codes were used. The coding has two elements: the respondent number

(e.g.1, 2, 3) and gender. Thus, for example, R1M refers to respondent 1 who was male. Seven (7) men were interviewed, coded R1M – R7M. Thirteen (13) women were interviewed, coded R8F – R20F.

4.5. Data collection procedures

This section discusses procedures and methods used in data collection. There were two major data collection procedures adapted to this study: focus group discussions and semi-structured interviews. These were supplemented by observation, and informal discussions.

4.5.1. Focus group discussions

Focus groups were chosen as an effective data collection method because they could give a wide scope of the population a voice regarding perceptions of indigenous knowledge and maize production which would provide data from different perspectives. Additionally, focus groups translate everyday experience within the community (Denzin & Lincoln, 2005). As well as providing direct access to the community's experience, they also reflect the social realities of a particular cultural group and understanding of attitudes and opinions regarding various social issues (McLafferty, 2004). Although focus groups may not "easily provide access for the researcher into individual biographies, they allow observation and understanding of how knowledge and ideas both develop and operate within a cultural context" (Kitzinger, 1994:5). This allowed the researcher to understand the shared experience, as well as to explore differences between people who may be initially perceived as homogeneous (Terre Blanche *et al,* 2006).

Focus groups are advantageous as they widen the range of responses, assist other participants in remembering forgotten details, and release inhibitions that may discourage participant disclosure of information (Catterall & Maclaran, 1997; Kitzinger, 1994). Focus groups (Kitzinger, 1994) are sometimes used as a cost-effective method of interviewing several people at once.

For this study, focus group discussions were important in providing useful information and responses of the research questions. They also provided the researcher of a clear understanding of cultural dynamic and the settlement and how it influences collective action in these communities.

However, there are some limitations to using focus groups as a means of data collection. Although they may promote discussion amongst participants, they may also threaten the possibility of open discussion by all participants, and prevent any deviation from the accepted focus of the group (Kitzinger, 1994). There is the possibility of what Janis (1982:12-13), referred to as the “groupthink” phenomenon – where it becomes difficult to extract individual perceptions and opinions from that of the group, and individual responses may be contaminated by the group.

Additionally, focus groups allow for the rich, in-depth understanding gained through semi-structured interviews (Janis, 1982). However, despite this limitation, focus group discussions were found to be appropriate for this study. The method allowed the researcher to explore consensus around the ideas and opinions expressed by the groups. During the focus group discussions, some members of the group were more vocal than others and, as a result, the researcher, through the help of the research assistants, encouraged those who were not actively participating to do so. As a means of engaging them, some of the follow up questions were directed to those who were not actively involved in responding or contributing to the initial round of questions. This approach helped those who were not active to become active as well. Participants in focus groups were able to provide their views with regard to maize production and soil management. They were again able to give agricultural calendar, which means, drawing line of major activities undertaken in a year with regard to maize production.

Participants were identified with the help of traditional leaders and two Zulu translators. The latter were members of the research team and were familiar with the area as well as the community. After being identified, the participants were invited to participate in focus groups. Due to the lack of community halls or other appropriate venues, most of the discussions took place in open spaces. Each group had between 8 and 10 members and there were 11 focus groups, which were composed

of both men and women. Discussions were audio recorded by means of a voice recorder, transcribed and then translated into English. However, in seven group discussions out of eleven, participants were unwilling to have their voices being recorded, in which case responses and discussions were written down. In these instances, research assistants were asked to instantly translate the responses into English. Care was taken to ensure that written verbatim recording was accurate. After the discussions, both translators' records were reviewed and compared to see whether there were discrepancies on how interviews responses were recorded. In most cases the written records were consistent. Where some inconsistence was found, a review of scripts and question sheets was undertaken.
Some interviews were conducted in winter, while others were conducted at the beginning of the summer.

There was a total 11 focus groups, each discussion lasting for about one hour and half to two hours. Prior to each focus group, consent forms were given to participants and confidentiality explained to them as were the process and reasons for the study. Ethical issues were also covered, both verbally and in the consent form.

4.5.2. Semi-structured interviews: key informants

Key informants interview involved 20 respondents with seven males and thirteen females of the age between 60 and 80 years. Questions addressed to key informants took the form of semi-structured interviews. This allowed individuals to respond on their own terms. In the semi-structured interview, questions are normally specified, but the interviewer is free to probe beyond the answers to seek clarification and elaboration. "These types of interviews are said to allow people to answer more on their own terms than the standardized interview permits, but still provide a greater structure for comparability over that of the focused interview" (May 2001:17).

Semi-structured interviews present both advantages and disadvantages. The advantages of semi-structured interviews is that they can present the opportunity for gaining access to mental representations as well as practices that are deeply ingrained in the peoples' minds and that can only rarely be expressed via a

questionnaire or in a group setting. Individuals' interviews are also a data-gathering method that is generally well accepted by the people and is particularly well suited to populations that are not literate (Sear & Stephenson, 1997).

Disadvantages of semi-structured interviews include the fact that they do not necessarily provide access to reality as, in many instances; there can be a gap between what one says and what one does. Another limitation is that a single interview cannot be applied to the wider community as it represents an individual view which may different from other members of the same community. An individual interview is also difficult to carry out, because people must be convinced to participate in the study and requires long time to be conducted (Fisher, Brennan & McCauley, 2002).

The instrument used to gather the data was an interview schedule presented to key informants selected from community members with the minimum age of 60 years and a maximum age of 80 years. These key informants were selected because of their potential to provide necessary information that is relevant to this study (Bouma, 1996). Twenty (20) respondents were chosen from among the elders of the community. As indicated earlier, it is believed that people of this age are a good source of the information because their experience allows them to interpret culture, practice and attitudes and to reflect on what could be the factors that have affected the culture or practices, in this case, maize production. Key informants were able to provide the agriculture calendar and historical timeline of events which may have affected the agricultural activities in the settlements. Interviews with key informants were conducted in their homes.

Most of the interviews were conducted in the evening. Only five out of 20 interviews were conducted during the day. Both evening and day respondents were asked to participate in the interview process. Meetings were set up and times agreed upon. For evening interviews, these were conducted after respondents and their families had taken their supper, and some of the interviews were conducted in the house of the respondents or outside of the house. Most of the interviews were written down. Where interviews were conducted at night, candles were lit to help the translator record interviews.

4.6. Observation

Direct observation was considered by the researcher to be a reliable method to establish resources available to the communities (Bernard & Russell, 1994). Observation involved establishing how communities store maize selected for planting, their access to water for irrigation, and means of income generation. The researcher visited forty households. 20 households for key informants and 20 from those who participated in the focus group discussions and during the visits members of the community showed her how they select seed maize for planting and how it is conserved. She also visited a number of agricultural activities where members of the villages were introduced to her, and showed her how they prepare the soil before planting. The observed activities broadened her understanding of agriculture and maize production in Msinga. The observed patterns and activities helped during focus group discussions and semi-structured interviews because it helped to probe into certain issues which were not clearly understood by the researcher during the phase of observation.

4.7. Unstructured interviews

Unstructured interviews took the form of informal conversations with members of the communities. Before the actual interview process, the researcher made contact with members of the villages and most of them were elders of the villages. Discussions with these people centered around their experience in connection with the production of maize in their settlements, the ways and means used in the production of maize and possible obstacles encountered. During informal conversations, the researcher was able to gather stories regarding agricultural timelines of natural and social events. For example, during informal conversation, its was learnt that there were varieties of maize used which were not indigenous which were introduced into the area due to climate changes, especially the rise of drought in the area. Informal interviews were useful in providing useful information which was also probed later in the focus groups and semi-structured interviews.

4.8. Field work experience

This research was not only an exercise of data collection, but also a learning adventure which made the researcher understand the dynamics surrounding life in Msinga. At the beginning of the field research, the researcher anticipated facing a number of challenges. These included not having an in-depth understanding of the population under investigation, not speaking their language or knowing well their culture and how these might have influenced their practice to maize production. As a junior researcher she thought it would not be possible to convince people to participate in the research process. Hence, she managed to devise ways to minimize these anticipated challenges.

After being registered for a Masters of Agriculture in Extension and Rural Resource Management in 2011, the researcher visited Msinga to understand further the situation of maize and its production and understand more fully the social and economic dynamics in the area. During this visit, relations with members of the area were strengthened.

With the help of Miss Precious Mkhize and Mr. Sibongiseni Mbatha, whom later became research assistants, the researcher managed to meet more members of Msinga, nurturing their interest to participate in the research process. Later, two more trips were made to the area before starting the formal research activities. Through these visits, many people in the area became interested to participate in the research process. In July 2011 and after ethical clearance for the research was approved and granted by the University, the field research for data collection commenced.

During the course of the fieldwork, the researcher learned that it takes more than simply knowing Mr. Sibongiseni and Miss Precious to be successful with the research. The researcher had to make her own efforts to get connected with traditional leaders and the communities as a whole. Permission was granted by traditional leaders, but the villagers and traditional leaders questioned the researcher's reasons for conducting the study. In one instance, the researcher was directly asked if this study had any political purposes and whether she was affiliated

to any political organization. On one occasion, after Precious explained to one of the traditional leaders why she and the researcher happened to be in his locality, he asked whether we were Inkatha Freedom Party (IFP) or the African National Congress (ANC) members. Miss Precious informed them that we were in the area for research purposes, nothing more and not part of any political organization.

As the area is very politicized and suffered political violence in the past, people in the area were suspicious of any outsider. The researcher informed them that this study was a class exercise that the researcher had to accomplish to get her degree. The researcher, as a student and junior researcher did not think there was any better way to explain to them that there was no link between the study and politics. However, the researcher felt there was a need to indicate that this kind of research had the potential to bring change in their lives by informing policy makers and society in general. Even when access was granted by the traditional leader, some of the research participants frequently questioned my presence in the area. They wanted to know who the researcher was, what she was doing and why she was in the area.

This kind of discussion often led to the questions the researcher anticipated, which frequently came up within this fieldwork: What would be the outcome of the research? Who was going to use this study? How would they benefit from it? In many instances, answering those questions was difficult for the researcher for the simple reason that the answers depended on factors over which she had no control. This became evident when she realized that answering those questions would influence her endeavors to establish rapport, relationships and trust that would, in turn, determine access to the group. Therefore, the researcher chose to maintain the researcher first position which was that this research would remain an academic exercise that would be kept in the University library, which would get to be reviewed by other academics and students.

Furthermore, research was conducted 300 kilometers away from the researcher's residence. The time needed to reach the research destination was long as the researcher relied much on public transportation. Villages where interviews took place have no access to the main roads; therefore the researcher had to travel long hours before reaching the place where the interviews would take place. Another constraint

relates to the timing of interviews. The original intention was to conduct interviews during the day. However, it soon became clear that the farmers were usually not accessible during the day, except on Saturday and Sundays. With the help of traditional leaders, interviews were conducted on either Saturday or Sunday and some in evenings. Other limitations hinged on failing memories of some respondents and transcription problems. Questions pertaining to the age of respondents were often met with blank faces and raised eyebrows due to illiteracy and failing memories. In these cases, the research assistants encouraged respondents to make estimations based on their knowledge of historical events in the country. In the planning stage, the researcher intended to use video recordings and photographs. However, participants were not willing to have their photographs being published. The reason being was the concern that their photographs could be used for political purposes even though they were assured that this was for academic purposes. This is understandable; the region has been affected by much political violence and wars. Mistrust between communities and government institutions are obvious even among members of the community themselves. Notwithstanding these limitations, the study uncovered very useful information.

4.9. Language and culture

In any cross-language research, the researcher must always bear in mind that language is tied to social reality; language is an integral part of conceptualization and understanding of inherited values and beliefs (Temple & Edwards, 2002). Qualitative interpretive research holds that there is more than one correct way to describe the world. This implies that although the researcher and participants may understand one another's viewpoints through dialogue, each is a producer of unique, individual accounts, understandings, and viewpoints (Temple & Edwards, 2002).

When such accounts are then translated into another language, it is important to be aware that communication across languages involves more than simply the transfer of information (Temple & Edwards, 2002). Further, translation of data from one language to another may distort meaning, thus changing how someone or something is perceived (Polkinghorne, 2005; Temple, 2006). Literature suggests that there is no

“one” correct translation; it should not be a case of word-for word matching; rather, there is an array of word combinations that can be used to convey meaning (Temple & Edwards, 2002). In addition to translating from one language to another, translators, rather than providing word-for-word translations, may need to convey concepts and ideas between the researcher and participants. How knowledgeable the researcher is about the participants' culture also plays a significant role in research findings (Tsai et al, 2004). Overing (1987) argues that this should not cause over-anxiety. However, researchers involved in cross-cultural and translation research should be wary of the challenges for the participants and/or the researcher when terms used are not understood cross-culturally (Babbie & Mouton, 2001).

In this study, the researcher was aware that the target population could only speak *isiZulu* and factored in the issues raised in theory. During the fieldwork, the Zulu-speaking research assistants did instant translation from English to *isiZulu* and back to English to record the responses. This was backed up through the use of tape recorders to capture what might have been omitted while translating. However, some participants opposed having their voices recorded and therefore responses were written down and instantly translated into English. Before the interview process, the research assistants underwent a three-hour briefing session on how to conduct interviews and provide instant translation. As a further backup, in addition to a tape recorder, the research assistants kept diaries to record significant statements or stories which were not necessarily translated during the interview.

4.10. Data Analysis

Data analysis was interpretive using thematic analytic methods which were used to understand patterns of shared understanding amongst participants, and any variability in those patterns *(*Terre Blanche et al., 2006). Since this is an interpretive study, it is assumed that meanings and perceptions of the participants are derived from experiences around them. That reality is subjective rather than objective, which also means that perceptions of experiences of the participants may differ from those of the interviewer. This has important implications for research analysis. Thematic

content analysis was therefore also used. Although the steps outlined by theorists largely overlap, the five steps outlined by Terre Blanche et al. (2006) were primarily used for analysis in this study, with some reference to other authors where applicable, and with NVIVO 8 computer software.

When analyzing the transcripts of the focus groups, the social context was considered. Thematic analysis focuses on searching within transcripts for the emergence of patterns of shared understanding and themes (Ulin et al., 2002).

The first step of data analysis was reading and developing an intimate relationship with the data. This involved becoming familiar and immersing oneself in the content to be analyzed. This means that by the time data analysis began, the researcher already had a preliminary understanding about the phenomena being explored (Terre Blanche *et al.*, 2006). Then, immersion again occurred in reading and rereading texts or transcripts of interviews and looking for emerging themes and developing tentative explanations. This step also involved noting the quality of the transcripts, including the portrayed neutrality in asking questions and responding to participants' answers, and the richness of detail in the field notes (Ulin et al., 2002). In this step, identification of patterns and recurring themes across focus groups also began.

In the second step, themes were identified. This was done using the same words, style, or terms used by participants themselves. These were then used to establish connections and infer general rules or classes from specific occurrences. Themes emerged from the text, rather than the researcher beginning with predetermined themes and fitting text to these themes. The identification of themes was more than simply summarizing content; it occurs with consideration given to processes, functions, tensions, and contradictions (*Terre Blanche et al., 2006*). Subsequently, the information relevant to this theme was displayed in detail, and then reduced to its essential points. Next, each theme was then examined in an attempt to discover the underlying core meanings and feelings of the participants, and then finally an overall evaluation and interpretation was done, assessing the emergent themes and how they relate to each other (*Ulin et al., 2002*).

The third step in data analysis, according *to Terre Blanche et al. (*2006), was coding. Data were marked at relevant instances as pertaining to one or more themes – these can be phrases, lines, sentences, or even whole paragraphs. The NVIVO 8 package was used for the initial stages of coding. This was a useful organizational tool which allowed the researcher to index segments of the text to particular themes, carry out complex search and retrieval operations quickly, and link research notes to coding (King, 2004).

Fourth, discussion occurred as data were broken down into themes and coded, and events and discussions no longer appeared linearly. Common topics, some of which were expressed in several ways, were grouped together under a single theme. Discussion then occurred as each theme was studied and considered in more detail. This allowed for the more subtle nuances to be seen (*Terre Blanche et al., 2006*).

The final step in data analysis, according to *Terre Blanche et al. (2006*), was putting together the interpretation of the data, and checking it. This is the written account, seen in subsequent chapters of this thesis, and presented under the themes used for analysis. This interpretation was reviewed, and identified weaknesses attend to. The researcher's personal role in the entire process was also once again reviewed and considered.

4.11. Confidentiality

All participants were assured of confidentiality. This was achieved through storage of audio recordings so that only the researcher had access to them, or other members of the larger research team, should they so require. Names and identifying characteristics of participants have been changed in order to protect their identity, and only altered names and characteristics were used in any written reports. Furthermore, participants were requested during the focus group to respect the confidentiality of other members of the focus group, and not divulge any information shared to others.

4.12. Ethical considerations

Permission for access to the community was sought through local traditional authorities (chiefs) with the help of the research assistants who are Msinga community members. After being briefed about the objectives of the study and its potential benefits for the local community, permission was granted and the chiefs promised co-operation throughout the study. The researcher, through the research assistants, assured participants that their rights were protected by informing them about the objectives of the study and providing assurance that their views would be kept confidential. Consent forms were handed to respondents who signed them and consented to participate in the interview process. It was stressed at the outset that interviewees could withdraw from the interview at any time, if they wish to do so, and that there was no obligation involved.

4.13. Summary

This study makes use of the qualitative research methodology, which allows for in-depth exploration and understanding of community indigenous knowledge of maize production and soil management. Semi-structured focus group discussions are utilized as they allow for the discussion and exploration of group norms, as well as the generation of new ideas. In addition, semi-structured interviews were used with a selected sample from members of indigenous farmers of Msinga villages. Interviews with selected members of Msinga allowed an in-depth understanding of the research problem.

CHAPTER FIVE: RESULTS AND RESEARCH FINDINGS

5.1. Introduction

This chapter presents and discusses the results from the research conducted amongst farmers in Msinga. It discusses the results from both semi-structured interviews and focus group discussions. The aim of both focus group discussions and semi-structured interviews was to explore attitudes, feelings and perceptions with regard to IK in relation to maize production and how in such process the soil is managed. It is hoped that the results from the semi-structured interviews and focus group discussions will help one understand the farmers' views from the different perspectives from which knowledge and practices are interpreted. In this chapter, arguments from both data sets are brought together, cross-checked for similarity or divergence and discussed.

Before embarking on presenting and discussing the results from the semi-structured interviews and focus group discussions, this chapter starts by presenting the demographic information of respondents who participated in the semi-structured interviews. It includes gender, age, level of education, and membership. It will further discuss sources of income, employment status, land entitlement, and access to water for irrigation and fertilization. The demographic and related information is followed by the seasonal agriculture calendar and historical timelines with regard to maize production and significant events that have happened in the study area. The agricultural calendar was discussed during both individual and focus group discussions. Timelines were provided by key informants who were able to recall major events that occurred, such as natural (i.e. drought, flood, famine), political and social events.

In order to explore the knowledge, attitudes, perceptions and practices in relation to IK used by Msinga farmers in the process of maize production and soil management, in-depth interviews with selected members of the community were conducted with both individual and focus groups. Respondents in the semi-structured interviews were elders aged 60 to 80 years old. To preserve anonymity, no individual respondent's name is cited or mentioned; instead, codes were used. The coding has

two elements: the respondent number (e.g.1, 2, 3) and gender. Thus, for example, R1M refers to respondent 1 who was male. Seven (7) men were interviewed, coded R1M – R7M. Thirteen (13) women were interviewed, coded R8F – R20F.

There were 100 participants in 11 focus group discussions. There were 8 to 10 participants per group. Each group was attributed a code for its identification. i.e. FG1 (focus group one) up to FG11 (focus group 11) followed by the year of research using this coding system. This coding system is also used when providing direct quotes from the respondents to illustrate findings.

Before going into more detail of the data from individuals' interviews, demographic information of key respondents is presented.

5.2. Demographic information of the key informants

The 20 key informants comprised 13 women and 7 men from two villages of Mabaso. Table 6 sets out the gender and age distribution of the key informants. The percentage is calculated in terms of the number by gender and then divided into the total number of respondents in each category (i.e. male 7 and female 13). Following Table 6, data about educational levels, membership, sources of income, employment, land entitlement, and access to water for irrigation and fertilization are presented.

5.2.1. Community in Mabaso villages

For semi-structured interviews, there were 20 respondents and these were categorized according to their gender. There were seven men and thirteen women. The majority of both male and female respondents were aged between 60-69 years (57% male; 54% female), 28% of males and 30% of females were aged between 70-79, and 14% of males and 15% of females were aged between 80 and above.

Table 6. Research participants in Mabaso villages

	Male		**Female**	
Age range	*Frequency*	*Percent*	*Frequency*	*Percent*
60-69	4	57	7	54
70-79	2	29	4	30
80- Above	1	14	2	15
Total N	7	100	13	100

Education: Table 7 presents the educational levels of the respondents. As anticipated in chapter three, overall, both men and women had very limited levels of education. Seventy-one percent (71%) of the male respondents and fifteen percent (15%) of the female respondents had a primary level of education. Sixty-five percent of the respondents (55% female; 10% male) never attended school.

Table 7. Level of education of respondents

Level of	**Male**		**Female**			
Education	Frequency	Percent	Frequency	Percent	Total	Percen*t*
Primary	5	71	2	15	7	35
Secondary	0	0	0	0	0	0
Tertiary	0	0	0	0	0	0
Never	2	29	11	85	13	65
Total	7	100	13	65	20	100

Analyzing the information from formal and informal discussions, parents prefer to send male children to school rather than females because it is commonly believed that it is not worthwhile educating a female because she will leave her family, get married and become part of another family. There is a common belief that educated women will not become good housewives. It was argued that educated women have no sense of family.

> We do not have the money to buy all these things they ask at school. If we have many children we only send the boy, because the girls have to assist us doing other things for the family. Again these girls who go to school, they do not behave well and do not make good family. Better to send the boy child to school then they can assist the family with money and the family name will remain even if the parents pass away (R14F, 2011).

Organizations membership: Table 8 presents the respondents' membership in various organizations. In relation to organization membership, the church seemed to have more members than any other organisation, with 25% of men and 65% of women belonging to churches. Church membership is followed by club membership with 20% of men and 20% of women belonging to these. Here club means the burial society. Members of the organisation are required to make a monthly contribution, which will allow associated members to bury their dead. Ten percent (10%) of men and 15% of women belonged to other organisations. Most of those who belonged to other organisations were members of a Cooperative or other community based organisations (CBO).

Table 8. Membership of respondents

Membership	**Male**		**Female**			
In	Frequency	Percent	Frequency	Percent	Tota*l*	Percent
Church	5	71	13	65	7	90
NGOs	0	0	0	0	0	0
Club	4	20	7	35	0	0
Other	2	10	0	0	13	65
Total	7	35	13	65	20	100

Sources of income: The respondents identified multiple sources of income. The major sources of income and livelihoods strategies among both male and female respondents were pensions and sales of crops harvested. Income is also derived from social grants, sale of livestock and remittances from relatives.

All of the men (100%) identified pension as a source of income and 71% of them identified sales of crops harvested as a source of income. Fifty-seven percent (57%) of the men identified both social grants and livestock as sources of income, while 28% of the men identified remittances as a source of income.

Comparatively, 76% of the women identified pension as a source of income, but 100% of the women identified crop sales as a source of income. Seventy-six (76%) and 23% of the women identified social grants and livestock, respectively as sources of income, while 38% of them identified remittances as a source of income.

Household farming activities that were identified include field and livestock farming. For field farming, maize, sweet potatoes, sorghum and vegetables are grown. Livestock involved raising goats and cattle.

Table 9. Sources of income of respondents

Gender	**Male N=7**		**Female N=13**	
Source of Income	Freq	Percent	Freq	Percen*t*
Pension	7	100	10	76
Livestock	4	57	3	23
Field Harvest	5	71	13	100
Wages	0	0	0	0
Informal work	0	0	0	0
Child Support Grant	4	57	10	76
Relatives	2	28	5	38
Friends	0	0	0	0

Employment: As shown in Table 10, 100% of men and women were unemployed. While the majority of these respondents have reached retirement age, there is an indication that unemployment in Msinga is rife in the area (see Chapter 3). An interesting finding is that although most women are unemployed, they prefer to regard themselves as doing something, especially looking after the household needs and looking after their grandchildren. During the interviews, some of the female respondents indicated that they were not looking for job and were not interested in looking for one. Males indicated they are unemployed and some indicated they are desperate for work and are thus willing to work for any employment opportunity to make money.

Table 10. Employment status of respondents

Gender	**Male N=7**		**Female N=13**	
Employment Status	Freq	Percent	Freq	Percent
Employed	0	0	0	0
Unemployed	7	100	13	100
Self Employed	0	0	0	0

Land entitlement: As shown in Table 11, in relation to land entitlement, the study found that all the men and the women (100%) have access to a designated piece of land inherited from their parents. As discussed in Chapter 3, access to land is acquired through clan membership. In this study, those who claimed to "own" land are those whose grandparents were living in the same place and whose title of ownership is recognized by the King or traditional leadership. The Msinga people live in clans such as the Mchunu, Mthembu and the Mabaso, when the title is recognized by the King and approved by the head of the clan, the holder is recognized as the owner of the land. Examining gender and land occupation, it was evident that women can own land under her husband, or on her own. However, land owned by women can only be used for cultivation and while they can decide what to produce, the women have no decision-making power over if or how the land transferred to someone else when she is no longer using it

Table 11. Land entitlement of respondents

Gender	**Male N=7**		**Female N=13**	
What is your Land entitlement?	Freq	Percent	Freq	Percent
Owner	7	100	13	100
Rental	0	0	0	0
None	0	0	0	0

Crops grown by respondents: As shown in Table 12, in response to crops grown by the respondents, the findings demonstrated that maize is highly produced in Msinga. While there some variations across gender, the findings indicated that 100% of respondents grow maize, while 65% grow sorghum and 55% grow beans. It was also found that all of the farmers (100%) produce other crops such as vegetables, sweet potatoes and pumpkins

The study also found that 90% of the respondents produce maize exclusively for household consumption, while 10% produce maize for household consumption and sale. In the latter case, maize is sold only if there is a surplus. This indicates that

maize is an important crop for the people of Msinga, but primarily as a source of food as opposed to a source of income.

Seventy-six percent (76%) of the women and 42% of the men indicated they grow sorghum. Sorghum is used primarily for food and for brewing traditional beer. Surplus sorghum is sold.

Bean production is more evenly practiced by men and women, 53% and 57% respectively. Beans are both consumed and sold; no one produces beans only for sale, but they are used to trade for other food crops, especially vegetables.

Table 12. Crop grown by respondents

Gender	**Male N=7**		**Female N=13**		**Total**	
Crop grown	Freq	Percent	Freq	Percent	Freq	Percent
Maize	7	100	13	100	20	100
Sorghum	3	42	10	76	13	65
Beans	4	57	7	53	11	55
Other	7	100	13	100	20	100

Access to water for irrigation: As shown in Table 13*,* with regard to access to water for irrigation, none of the respondents have access to water for irrigation. There are water pipes passing through the villages for domestic use, this water is not available for irrigation use.

Table 13. Respondents' access to water for irrigation

Gender	**Male N=7**		**Female N=13**	
Access to water for irrigation	Freq	Percent	Freq	Percent
Yes	0	0	0	0
No	7	100	13	100

Access to fertilizer: As shown Table 14 the majority of both men and women have no access to fertilizer, with 75% of the men and 84% of women indicating no. Only a small number of both women of men have access to fertilizer, with 14% of men and 39% of women indicating yes.

Table 14. Respondents' access to fertilizer

Gender	**Male N=7**		**Female N=13**		**Total**	
Access to fertilizer	Freq	Percent	Freq	Percent	Freq	Percent
Yes	1	14	2	39	3	15
No	6	75	11	84	17	85

5.2.2. Agriculture seasonal calendar from Msinga.

During the interview process, community members in both focus groups and semi-structured interviews were able to construct their agricultural seasonal calendar. All 20 who participated in individual interview were able to provide useful information, while for focus groups, one member in each group, provided the information. The timeline was important in highlighting important activities undertaken by indigenous farmers of Msinga in the process of maize production. The results are presented in Table 15 followed by a discussion of the findings. The agricultural calendar included, among others things, the selection and conservation of seeds, preparation of the land, planting period, weeding, and disease control and harvesting. The actual timing of activities may vary from year to year or from farmer to farmer depending on a number of factors, which include the availability of seed, climatic condition.

Table 15. Agricultural seasonal calendar of the Msinga farmers

	Month											
Activity	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May
Seed selection												
Land preparation												
Planting												
First weeding & disease control												
Second weeding												
Harvesting												

Exploring agricultural seasonal timelines, the farmers indicated that usually the first step undertaken in the process of maize production is the selection and conservation of maize seeds for planting. While this process seemed to be shared by all respondents from both focus groups and semi-structured interviews, some of the respondents indicated that due to the shortage of maize, which is not even enough for the household consumption, seed is often purchased from the market or acquired from relatives. In such cases the timeline starts with the preparation of the land followed by acquiring seeds. The selection of seeds is usually done in June, just after harvest, and then immediately stored.

Except as noted above, the second activity is land preparation. The farmers indicated that once the seeds are selected they embark on the process of preparing the land. This involves clearing the land of grass and, where the land was cultivated previously, the removal of husks and other debris. This is usually done in the month of July up to August.

The third activity is planting. Respondents had different views on planting timing. This appears to be due to the unpredictability of rainfall. Usually the farmers get ready to plant in September just at the beginning of spring. Because of erratic rainfall, sometimes it starts later than that. Some of the farmers indicated that it happens that they start planting in October even sometimes in November due to the failure of the rain.

The fourth step is the first weeding. This activity also seemed not to have a precise time as to when it is done. Respondents indicated that the timing of weeding depends on when planting took place. Some indicated that if the planting takes place in September, then the first weeding will take place in December. It was indicated that the weeding phase also depends on what kind of maize has been planted. For instance, respondents indicated that there is a variety of maize cultivars grown in the area and all of them do not grow at the same pace. Some grow and can be harvested in five months, while others require six months. Respondents indicated that weeding is largely influenced by the kind of maize planted and the respective length of the growing period.

The fifth step is the second weeding. It emerged that most of the farmers weed twice before harvesting. The second weeding was also influenced by the kind of maize planted and therefore no fixed or even relatively fixed time could be determined for the second weeding. Normally the first weeding takes place between three and five weeks after planting and the second weeding takes place between seven and eight weeks.

The harvesting started March to April, When the tassels and leaves are dry; the maize is mature and ready to be harvested. In the case where maize is meant for immediate consumption, this is harvested white still fresh; while for grinding, maize is harvested when dry. The material used for harvesting is machete and keeping in the sack for transport to go home.

5.2.3. Historical timelines in Msinga

Providing timelines in this study was important as it allowed understanding of different events that occurred in the area and how they may have affected agricultural activities and social structure in the study area. In this study, the respondents were able to narrate important events that occurred in their area from as early as 1930. The timeline is presented in Table 16. The events are explored in intervals of 10 years.

Table 16. Timeline of major events in Msinga affecting agriculture in Msinga in ten years intervals

Period	Major event
1930-1940	War, famine
1940-1950	Famine and drought
1950-1960	War, famine and drought
1960-1970	War, death of cattle, human disease
1970-1980	Poor harvest, famine and death of cattle
1980-1990	Political violence
1990-2000	Severe drought and famine
2000-2011	Severe droughts

During semi-structured interviews, respondents were able to provide useful information on certain events that occurred in the area. These events included wars, political violence, and famine, death of cattle, droughts and poor harvests. To analyze these events in more detail, events of the same category are grouped together.

Respondents explained that between 1930-1940, 1940-1950, 1950-1960, 1990-2000, 2000-2011 there was inter-ethnic war, fought between different tribes in the area. This was accompanied by famine and severe drought in Msinga. They explained that these wars took the lives of men and women and children. According to the respondents in semi-structured interviews, wars fought during these times were the result of disputes over the boundaries of chiefdoms. Some of the statements read:

> "It was very bad at that time. People could not move from one place to the next. People were killing each other like animals. Houses were burnt, cattle killed. The war was very serious. You see up there Qwaka, more than 100 huts were burnt down. Seven people in one day were killed and many more were taken captive. The other group retaliated by killing 2 people from the Mchunu and taking away tens of cows. The fight lasted for about two days. One day we saw a helicopter flying in the area full of white soldiers. They are the ones who ended the war and life had to return to normal, but since then, conflict and hatred between the communities remained intense" (R7M).

Respondents who were able to narrate about the war in Msinga indicated that after the war, all sectors of the society were affected. Cattle were lost/stolen, agricultural production dropped sharply, granaries were burnt down and some looted as result. Respondents in this category indicated that as result of these events, there was a serious famine. An 80 year-old respondent recalled how people had to travel a long distance in search of food. Cases of disease and even death were recorded during the time of severe famine.

> I do not remember exactly which year was this, but I think that it was between 1945 and 1950. There was serious famine in this area. People were starving because they had nothing to feed themselves. People could eat anything they come across. It was a very desperate situation. At that time people had to travel long distances in search of food (R20F).

According to the respondents, war, famine and drought came simultaneously. The wars were again between people of different ethnicities, but also involved political tension between the IFP and the ANC. After the war, there was severe drought, which resulted in food shortages and famine.

> There was bloodshed. No one to blame; everyone was involved in the killing of one another. Famine was serious; children were dying from the malnutrition as result of lack of food. There was severe drought and there was nothing for cows to feed from. It was serious. People were moving to other places in search of protection from wars and hunger (R6M, 2011).

During the periods of 1960-1970 and 1970-1980, there were poor harvests, famine, death of cattle, and human diseases in Msinga. According to respondents telling story, there was important death of livestock. Cattle were dying from disease and there was not enough food to feed them. In the same period, there were serious human diseases affecting the community and, as a result, many people died. There was also poor harvest resulting in famine. One respondent recalled:

> People were dying from one to the next. It was a punishment from God, because people misbehaved by killing one another. Things were not good at that time. Sometimes, each family could bury their dead without help of anyone (FG3, 2011).

While exploring as to whether and how all these events have impacted on the agricultural systems, some of the respondents agreed that these events did impact on their agricultural systems. For instance, some of the respondents indicated that

during the war people were not able to go into the fields to cultivate their land. Some of the people migrated elsewhere, thus abandoning their land. People were no longer able to work or act collectively. There is reason to believe that war, drought and famine may have impacted on IK and collective efforts to act together.

5.3. Results from focus group discussions and individual semi-structured interviews.

This section discusses the finding from both focus group interviews and individual semi-structured interview. It is hoped that the findings from both focus group and semi-structure interviews will reflect the views of participants and respondents with regard to maize production from selection of the seed up to harvesting and the management of the soil in such process. Direct quote from participants are included and coded according to the coding allocated to each group of participants.

5.3.1. Indigenous identification and choice of maize seed suitable for planting

In response to the questions exploring identifying and choosing seed for planting, it emerged that all respondents from Semi-Structured Interviews and focus group participants possessed knowledge of identifying maize seed suitable for planting. The findings the study found that there were three major criteria applied by all those in individual interviews and focus group discussions in selecting and identifying maize suitable for planting: grain colour; seed size; and the presence of insects and disease. In terms of colour, white seed was preferred by all the respondents in both focus groups and semi-structured interviews. In terms of seed size, small size was preferred. In terms of insects and disease, seed completely free from insects and disease were preferred. White colour was preferred because of its taste, while small size grain was preferred because it was believed that they have more yields. Seeds free from disease and insects are preferred because they ensure good germination and good yields.

While these three criteria were common to all respondents, in the semi-structured interviews it was found, however, that out of the 20 respondents, five (5) had two additional criteria which they applied in the process of selecting seed for planting: the health of the mother plant; and taste of the seed. These respondents explained that while the mother plants were still standing in the field (i.e. before harvest), they were inspected for general health before selecting plants from which seed would be selected for planting the next season. According to these five respondents, once a suitably healthy plant is identified it is then marked with a sign, such as tying knots in the leaves and left to continue growing. When the time of harvesting comes, the marked plants are harvested and stored separately from the rest of the maize.

The second additional criterion identified by these five respondents was the taste of the seed. They believed that some maize does taste better than other maize and therefore, during the selection process this is also taken into consideration.

Respondents described these various criteria in their own words.

> Yes, there are different ways to identify good maize for plant and bad maize which need not to be planted again. You see people in the village like white maize, because white maize is tasty and produces good porridge. People do not like these grey or yellow maize, they do not taste good and the children do not like to eat porridge from those maize [varieties]. Anyway, I do not know where even it came from. I think that these other maize [varieties] was brought here because of drought (R5 M).

> It is important that you select good seeds, if you need to get good harvest. Sometimes people choose seed because of the color and taste or the size and other people prefer to choose seeds because of how they see the plant is growing in the field (R14F).

> People like white color when selecting maize for planting; because this maize is good for porridge; even the pap from this

> kind of maize is good. Some other people eat yellow [maize], but it is not common in this village (FG6).
>
> These days, people eat any kind of maize because of the shortage of food, but white maize is preferred in this community. White maize when planted can also give good results, even if the soil is not very fertile (FG8).

The researcher followed up with questions to find out whether the respondents had seen any change over time in the criteria they used to select seeds for planting. The majority of respondents from both focus groups and semi-structured interviews agreed there had been changes, while a few indicated that they did not see any changes from the practices of the past. The researcher probed further to find out what they thought were the causes of such changes. Some of the respondents indicated that it may be because of the climate change, especially with the growing incidence of drought in the area. Others indicated that it may be that people are no longer interested in knowing how things used to be done. Still others indicated that western influence and contact with people from other areas may have influenced the way people select seeds.

> Before, it was not just anyone who could select seed for planting. Not everyone in the village had the wisdom to know which maize can grow well or not. There were people who were specialized in identifying good seed and bad seeds. Sometimes you could find one person or two in the village; they were not many that time. So after the harvest, everyone had to take the harvest to that person, and then he could assist identifying good seeds for planting. But nowadays everyone can select. I think it is because people no longer have enough maize to spare up to the next season. They have to go and purchase maize from the market or other villages (R13F).
>
> I do not know how people used to select seeds for planting. For me when I was born, I found my parents doing very same things

> as we do today. What I can say has changed is that today you will see men also selecting seeds, but before selecting seeds was women job not men job. Men had to look after cattle and other important activities (R10F).

Examining how respondents acquired knowledge for selecting seeds, all respondents indicated that they learnt it from their parents and that the practices are what they found everyone doing in the villages as they grew up. They believed that such knowledge was shared by all members of the village. This implied that the knowledge and practices are shared and acquired through community, which is the centre of local practice, local memory and local and local science.

5.3.2. Conservation of seeds for planting

Examining methods used by the Msinga farmers to conserve selected seeds, the findings showed that the respondents used IK methods, but in some instances combined it with western science. They used different ways of conserving seeds. Two methods were most common:

- Keeping the seeds under the roof on top of fire where seeds are exposed to smoke; and
- Keeping the seed in a dry place which has also to be spread under the sun regularly.

These two methods were followed by that of keeping seeds in a container and mixing it with some modern chemical to prevent diseases and insects from damaging the seeds. Respondents indicated that during the conservation stage, constant checking on the state of the seeds is important because it allows farmers to ensure that their seed still in good condition before planting season. The following statements indicate how indigenous farmers conserve seeds:

> Many people in the village have different methods of conserving seeds. Here many people, after harvesting the selected seeds, these are put under the roof for some time till

> they get dark. You can think that will not grow again, but they are still ok. You have only to check if no insects interfered with them. Other people in the village conserve seeds in a basket or container, but people no longer have such maize to store in granaries like building small house for the maize. But before, people used to have a lot of maize; we could eat fresh mealies up to the next season. People were burying mealies underground till the next season (R4M).

> You cannot just keep seeds for planting and forget it till when it is time for planting. You need always to check and see if they are still in good condition. Sometimes you can keep it there and forget about it and when you come next time you find that rats, insects have damaged them. It is important to keep checking so you can be sure that you are ready for the next planting season (R5M).

> Seeds must be kept in a good place. Many people after harvesting and when they have selected good seeds for planting for the next season, these are kept under the roof or any other place where insects cannot reach. Sometimes you will find the seeds becoming too dark as result of smoke, but that is not a problem. It is good; because it keeps the core of the seed remaining fit to grow again. But these days, people do not produce enough. Some in our village do not even have enough to eat; they have to go and buy from the market to supplement the little maize harvested (FG8).

Examining whether indigenous seeds conservation has changed overtime, the majority of the respondents agreed seed conservation has changed, while few disagreed that seed conservation has changed. For those who said that the practices have changed, they argued, for instance, that there was no use of chemicals before. The common method before was to conserve selected seeds

under the roof, on top of fire. One of the respondents who indicated that the practices have not changed recalled the following:

> When I was still a child, my mother, after harvesting used to select some maize for us to eat and remaining maize for planting. Maize for planting was usually kept under the roof on fire place, so it could get dry. When I was also growing up it was the same thing that people were doing. In my views, I think that nothing has changed (FG6).

The researcher probed for the cause of changes in seed conservation methods, but found that none of the respondents had any idea as to what might have cause the change. Some of the respondents guessed that it may be that people no longer produce enough maize and, therefore, the way people conserve may have been affected as result.

> Now we no longer produce enough to keep. Before, people used to produce more than what was needed and therefore conservation was a challenge. Sometimes we used to dig a big hole and then cover with soil again. When a child needed mealies, the mothers just goes to the place and get it for the child and now no more. People produce what they can only consume (R1M).

Although the research was looking for insight into conservation of seed for planting, the respondents often spoke of seed for consumption at the same time. However, in respondents' discussions it was possible to differentiate between the conservation methods used when they were conserving for planting and when they were conserving for seed.

Examining how the knowledge of conserving seeds has been acquired, participants presented different views. The majority of those using chemicals to conserve seeds indicated that they learnt such techniques from others within the community and are not sure where such knowledge came from. Some guessed that the use of

chemicals may have been brought into the area by members of the community who were working in white commercial farms.

> I think that people who use this medicine to conserve seeds might have been working in white farms, like those in Dundee. People were not using this medicine before. It came, maybe in the last 10 or 15 years (R17F).

This shows that IK is dynamic and can adapt to new forms of knowledge. As we can see above, western science can also be used and be considered by indigenous farmers as being their own form of knowledge or science.

Probing to where the knowledge of conserving maize was acquired. The majority of the respondents indicated that they have learnt it from their parents. Those using chemicals for conservation indicated that they learnt it from neighbours and were not sure who exactly introduced such practices in the area.

5.3.3. How the maize crop is managed from planting to harvest

Enquiries into the management of the maize crop from planting to harvest found that there are five stages undertaken in the management process: Planting, removal of weeds; disease control; removal of unhealthy plants; and removal of some drying leaves, which are then used as nutrients for soil. The first stage involves in burying seed on the ground. The row gaps also matters in the planting. However, farmers do not have definite measurement of the gaps between one raw to the next. They indicated that row must not be very close or distant, but must have a fair distance to allow plant grow properly. The respondents indicated that weeding is important in agriculture because it can also determine the yields. They further indicated that if the weeding is not done on time, it can reduce productivity. They also pointed out that when the plants are growing, some are unhealthy and, if not removed, can affect the rest of the plants. The removal of unhealthy plants can give space to the healthy plants to grow well.

The removal of leaves was also important, but was not shared by all respondents. Some of the respondents did not mention this practice. Those who pointed out the importance of removing leaves indicated that this is done when the maize plant starts producing dry leaves. While weeding and removing dry and unhealthy plants, the Msinga farmers also make sure that no roots of the maize plants remain uncovered while weeding. This means that after weeding, enough quantity of soil is put around the plant so the roots remain covered to protect it from drying as result of the exposure to the sun.

Another plant management practice is the control of disease and insects. The respondents (or Msinga farmers) indicated that there is a need to consistently check if the plants are affected by any diseases. When affected plants are identified, remedial action can be undertaken.

Another method of plant management identified by farmers was protecting plants from birds. It is believed that when plants start bearing cobs, birds and/or other predators, such as monkeys, may damage the plants and therefore appropriate measures need to be taken. To avoid birds (and monkeys) from damaging crops, farmers erect human-like figures in the field. When these are seen in the field, birds or monkeys will not enter the fields (and therefore do not damage the crops) as they think that there are humans standing in the fields.

> You cannot just plant and forget about the crop. From the day you put the grain the soil, it is important to keep an eye and make sure that no birds interfere with the crop underground in the soil. Birds can also tell when there is something under the ground. If you are not careful, you will wait and wait and nothing will grow, because everything will be eaten by the birds (R7M).

> Weeding control is what can guarantee any farmers good or bad harvests. You cannot expect good harvest if you did not do weeding. Otherwise everything will remain just trees standing in the field. It is important that weeding is done on

time, sometimes after two months, but it is good to do it as early as possible, so plants can grow well (FG1).

Examining how plant management has changed overtime, all the respondents indicated that the practices have not changed. The way it is done now is the same way it used to be done in the past. Weeding, preventing birds from damaging crops, scaring of monkeys, and mulching practices have not changed.

Exploring how their plant management practices had been acquired, all the respondents indicated that the knowledge has been acquired from their parents and is the way they found everyone in the village doing it.

5.3.4. Methods used when plants are not growing well

When examining what is done when plants are not growing well, the study found that there are several methods and techniques employed by the Msinga farmers. First, farmers indicated that the response to poor growth will mostly depend on the causes identified which led to the plant not growing well. They indicated that in some instances the failure of plants to grow well may be due to the failure of rain, diseases or lack of nutrients. Once the causes are diagnosed, one of the several methods will be employed.

5.3.4.1. Irrigation

In the case where plants do not grow as a result of shortage of rainfall, respondents indicated that they will irrigate using water fetched from a stream. Sometimes they can do nothing but wait till the rain comes.

Those respondents who search for water to irrigate their plants expressed concern that fetching water is a difficult exercise and costly as some of the farmers do not own a donkey (or other means of transport) and have to hire one from neighbors. They indicated that in some instances, water can be fetched, but the irrigated plants do not improve. Further, there are some instances where the irrigated plants show

some improvement, but the production remains very low. The range of responses is captured in the following expressions from the respondents.

> You cannot do anything when maize is not growing well. If in a particular year maize does not grow well, it means that is bad to the farmers and [we] cannot do anything about it. We have to wait for good year (R17F).

> Yes, you can do something when maize is not growing well. You see now many families have a donkey and if you do not have one, you can hire one and fetch water from the river when they are not also dry. Sometimes, if you put water, maize can grow and sometimes doesn't work and we have to wait for a good season. In that case people have to starve for that particular year (FG4).

The following responses were given when the researcher probed to find out how effective this method of fetching water is:

> Sometimes it works and other time does not work. This thing sometimes is very difficult to make. You have to hire a donkey from someone and pay money. Also [you] have to travel long distance to get water, and in some instances rivers are dry as well. You cannot go and collect water from public tap and feed your plants. People cannot allow that and even tap water goes dry (R8F).

When the cause of plants not growing well is linked to a lack of or diminished soil nutrients, the Msinga farmers supply the soil with new nutrients such as cow dung and trees leaves. However, these practices proved not to be effective, especially under dry conditions.

> When plants are not growing well some people use cow dung and others use trees leaves to give the soil more nutrients. You see when soil is running out of nutrients is when you will see plants not growing well and leaves becoming yellow. When we realize this

> someone must take a decision immediately, but what do you do? There is nothing to make plant grow here. Before there was too much grasses all over. If you know that your field is not producing well, you should know how to feed it with natural nutrients (R3M).

5.3.4.2. The use of modern fertilisers

Another practice least used when plants are not growing well is using modern fertilisers. It was, however, found that this method is not popular and is used by only a few of the Msinga farmers and is mostly used when plants are not growing well as a result of diseases. When the researcher probed to find out what kind of chemicals are used when plants are not growing well, the respondents who did use chemicals seemed not to have a clear name of the chemical. They only pointed out that these are chemicals bought from a white man or Indian man's shop.

Exploring how the practices have changed over time, all the respondents in this category agreed that it indeed has changed. For example, an 80 year-old respondent explained:

> When I was still a child, maybe up to the age of 15, before I got married, I used to see my mother and neighbors, when maize was not growing well, they used certain plant leaves. These were ground and spread over the plants once or more times. You could see that maize would start growing well. We cannot find those plants anymore in this area. After this, people changed and started using cow dung. It also worked for some times because, at that time, everyone had two or ten cows to get dung from. Now many people no longer have any cows and can't do anything even if their plants do not grow well (R20F).

When probing into the factors that might have influenced such changes, the respondents in the category of key informants indicated that the disappearance of plants previously used as remedies is what forced people to look for other means to use when maize plants do not grow properly. The change was also affected by the diminished number of cattle owned by a household.

When probing further into the main causes of the disappearance of those remedial plants, the respondents in the category of those indicated the causes provided two main reasons. They suggested that the disappearance of the plants might be due to climatic changes, such as high incidence of drought in the area. They also suggested that the plants disappeared as a result of overuse of the plants to the extent that it was extinguished.

Similarly, some of the respondents attributed the diminished number of cattle held by households in the area to the lack of suitable pastures and lack of people to look after the cattle. Other respondents indicated that many people are no longer interested in farming cattle; they are rather interested in investing in property, especially those working in towns.

When asked how such knowledge and practices used when maize does not grow well were acquired, all the respondents agreed that knowledge of the remedial plants was passed on from parents. They did not appear to know how or by whom the use of chemicals was introduce. Some of respondents guessed that it might have been brought by people from Msinga working on white farms.

5.3.5. Methods to prevent insects and diseases from affecting maize

The study also explored the Msinga farmers' methods of preventing insects and diseases from affecting maize. The respondents indicated that for these threats, they had no option but to wait and see what happens. However, in all group discussions, and semi-structured interviews few respondents indicated the use of insecticides as a means of insect and diseases control. But this method remains unpopular in all groups and some were not aware of its utilization. Examining whether there were no other methods used before to prevent insects and diseases from affecting maize, some of the respondents in focus groups and semi-structured interviews indicated that there were plants which were used to prevent insects, but today those can no longer be found in the area.

5.3.6. Methods used to harvest maize

The investigation in the methods used for harvesting maize found that the Msinga farmers have common methods of harvesting. The respondents indicated that once maize is matured, they will embark on harvesting. However, the maturity of maize was understood differently by respondents. Some of the respondents indicated that the maturity of maize is when they have reached the stage when they can be consumed. Other respondents indicated that the maize is mature and ready for harvesting when they are dry.

Those respondents who indicated that they harvest maize when they are dry further indicated that "dry" refers to the dryness of tassels and leaves of the plants. Hence, when the tassels and leaves are dry, the maize is mature and ready to be harvested. However, it is also important to note that harvesting depends on what it is meant to be used for. In the case where maize is meant for immediate consumption, this is harvested white still fresh; while for grinding, maize is harvested when dry.

Whichever definition of maturity or "harvest ready" is used, once the maize is ready to be harvested, the maize is harvested by hand using a sharp tool such as a machete. The duration of harvesting depends also on the size of the field and purposes of maize. For example, those with big fields indicated that maize can be

used for two or three purposes, i.e. immediate consumption while maize is still fresh, grinding and for sale of surplus. In this case, the harvesting may take longer as opposed to those with small fields.

Examining whether and how harvesting methods have changed over time, as with other methods, most of the respondents in the category of semi-structured interviews indicated that they have changed, while many in focus group discussions indicated that they have not changed. Those who indicated that they have changed explained that before, there was plenty of maize and people would not harvest all the maize before it gets dry. They indicated that now, in some instances, due to lack of food, people harvest maize when it is still too young. They indicated that the shortage of food has changed the way people harvest.

In addition to the harvesting process, other elements related to harvesting were raised by the respondents. It is during harvesting that seeds for the next season are selected. When suitable seeds are identified, they are harvested separately and kept to one side. Some of the respondents in both individual interviews and focus groups indicated that as a part of the harvesting process, the stems are cut off using a sharp tool such as a machete and spread in the field and used as compost in the field. Still other respondents indicated that, after harvesting maize, they leave the stalks standing in the field. These are removed when re-cultivating the field for the next season.

Exploring where the knowledge of harvesting has been acquired, all respondents indicated that they acquired such knowledge from parents and is what they found everyone doing in their community

5.3.7. Methods of conserving crop/seeds after harvesting

In response to how the Msinga farmers conserve maize after harvesting, the study found that respondents had different methods. The choice of post-harvest maize conservation methods usually depends on for what purpose the maize will be used: e.g. for household consumption, for making beer or for sales. Maize intended for

sale, for consumption and for making beer are kept together, and maize for seeds are kept aside as they will be used for planting.

> Many people do not produce much maize to the point they have some maize to keep. When you have produced much maize for a particular season, you cannot use all for just consumption. You have to keep some for planting for next season and sometimes if you produced enough for that particular year you can sell the extra. But that does not often happen. Some people keep maize in sacks, but you to be careful where these are stored. Because if you store it in a cool place you will find it damaged by the insect (FG10).

> Some people keep harvested maize in the same house where they live. Others conserve maize in a small house. Because people no longer produce much, but before used to build small house only for maize, but today you cannot get that kind of maize. People produce what they can eat and finish (R4M).

While all respondents seemed to have conservation methods, they were, however, concerned how maize could remain in good condition because of the insects affecting the seeds.

5.3.7.1. Maize for seed

The respondents indicated that maize is kept either on top of the roof or above the wooden fire to keep insects from affecting the crop. They indicated that placing maize in the path of smoke not only helps maize from being affected by insects, but can also help the core of the maize to remain intact. They said a well-kept seed will also guarantee a good yield. Some of the respondents also indicated that they use ash to keep insects away from affecting the crop. Ash is mixed together with the maize seed; it is checked regularly and the ash is replaced from time to time.

5.3.7.2. Maize for consumption and sale

The farmers indicated that this maize is kept either in a sack or any other container and must be checked regularly for insect damage. They also indicated that it is important to keep spreading the crop under the sun. Which means that maize is taken out of the bags and are spread under the sun. They believed that the heat absorbed from the sun will keep the maize dry and therefore will remain free from insects as result.

Again, there were differing views among the respondents as to whether, how or why conservation methods had changed over time. However, those who indicated that the methods have changed over time were not able to explain exactly what changes had taken place or how these changes occurred.

5.3.8. Soil management systems

In this section, the findings from both focus group discussions and semi-structured interviews on how they manage soil in the process of maize production are discussed. Three key questions were asked to examine how the Msinga farmers managed the soil in the process of producing maize. The first question looked at methods related to soil properties used to identify and choose land for planting. The second question explored methods related to soil fertility and the third question explored methods and techniques used to make soil productive if the soil is not fertile.

5.3.8.1. Identification and choice of soil suitable for planting crops

Examining farmers' practices in identifying and choosing soil/land suitable for planting revealed that communities have few techniques and methods for identifying and choosing land suitable for planting maize. The common technique for identifying soil suitable for planting maize was the color of the soil. This is used through a simple observation of the soil and in some instances; some indigenous farmers dig and seek advice from some members in the village who seem to have more knowledge. Respondents believed that black soil is more fertile than any other soil color. However this type of soil seems to be difficult to find in the Msinga area. The

area is dominated by red and rocky soil, which respondents described to be unsuitable for cultivation of maize.

> Black color [of soil] is good for maize. For those people who have good land with black color, they produce more maize than those with soil of other type. In this area, many people do not have this kind of soil. As you can see, the area is full of rocks, and it's difficult to find black soil. And those who have a small plot with black soil they over cultivate it and as result they do not get good yields (R20 F).

> Black soil is good for maize. But the problem is that only few people have access to the land with black soil. That why you see people not producing much as a result. In other areas, people can produce much because they have good land *(*F4G).

When the researcher probed to find out to whether the method of identifying soil suitable for planting has changed over time, the respondents had mixed views. Some said that it did not change, while others said it did change. The two views are captured thus:

> No, this has not changed. It used to be done the same way as before. The problem is that before we used to produce too much maize in this place for those who had good land with black soil. But today, nothing, even for those with good land. The rain is becoming a problem. Sometimes we plant and no rain is coming (R6M).

> Here we had many people who were good in identifying good soil. Mkhulu Mazibuko was one of those people who could tell you if the soil is good or bad. And if you listen to their advice you could get very good harvest. Sometimes you could find that your soil is not good and in that case you would get good advice. By

> that time they were lot of cows all over the village. You could go and gather cow dungs and dump in your field for about three to four months and then when you could have good harvest. But now these people are no longer with us (FG3).

Those who indicated that the method has changed, upon further probing, said that before they used to indentify soil with the help of a village expert who could tell whether a given soil was suitable or not. They noted that not everyone had the skills to identify suitable soil for cultivation. Probing as to whether there are experts still alive with the knowledge of identifying soil, it was indicated that there is no expert in the villages of study, but there is one in a distant village.

The researcher asked where such knowledge has been acquired. All the respondents in the category of semi-structured interviews indicated that they learnt soil identification from their parents and from people in their villages.

5.3.8.2. Preparation of the soil/ land for planting

Indigenous preparation methods of pre-planting soil preparation are common to all respondents. The findings from semi-structured interviews indicated that these methods include cutting down grass and then turning the soil with hoe. Where the land has been repeatedly cultivated, the husks are removed from the field and buried under the soil or spread around the field. Burying the husks under the soil is believed to be used as way of giving the soil more nutrients.

> We start preparing the land in July, some people start early just after harvesting. Those who do it at the late stage are those who have money. Maybe they can hire people and give them money and then they can cultivate a field in one day or two. Once we harvest the maize, maybe in June, we clear the land. We take away the grass and husks. If in that particular season you did not get a good harvest, it is important to think and know what the causes of poor harvest were (R9F).

> The planting of maize usually depends on the rain. If the rain does not come on time, then the planting will be delayed. People have different methods of preparing the land before planting. Most of people in this area do not have good land, so, just after harvesting they remove the grass growing in the field and then wait and when it is about to rain, then they turn the soil up, so it remains soft and ready for planting (FG5).

Examining as to whether land preparation has changed over time, respondents again had different views. Those who said land preparation practices had changed indicated that before they used to burn the bush as a means of cleaning the land and today, because of the laws introduced prohibiting people from burning the bushes, such practices no longer take place. They further indicated the burning of the bushes was positive because burned fields were able to produce more, and also, fewer insects were found than on un-burned fields.

> We used to burn bushes before planting. At the time, people were producing much more than they produce today. But today you can no longer burn the bush. It you burn the bush; the government will put you in jail (R2M).

> Yes, the way people prepare the soil has changed. Before, some of the places had many trees. You had to use axes before cultivating. Now no more than three people just remove the grass and start planting, and sometimes, there is no grass to remove; we just plant the same place where we harvest (FG9).

Exploring how these land preparation methods were acquired, all the respondents agreed that they acquired such techniques from parents or from a member of the community. This means that local practices are shared by all members of the village.

5.3.8.3. Methods of soil management; managing soil productivity

Examining indigenous methods to keep soil productive, the researcher found that all respondents use the same two main methods. The first involves leaving grass and other debris in the field to get rotten. The second is to supply the soil with nutrients through cow dung and other organic matter. However, it emerged that many people in the area no longer have cows and the area is becoming a dry zone. To get grass or other natural nutrients is becoming problematic.

> People do not want to buy that medicine from the shop to keep the soil fertile. People say if you put that medicine in your field you are killing it and you cannot grow more maize. Some people who have cows, sometimes they can supply their fields. But the problem is that people no longer have as many cows as they used to be before. Today you find that many families do not have even a single cow, it is a pity for those people. How will they survive? (R13F).

> Not much people can do to keep the soil fertile. What some people do, to make sure that their soil will produce more, is to supply the soil by putting grasses for a certain time. But here you can no longer find grasses; you have to travel long distances (FG5).

Examining whether such practices have changed over time, all the respondents agreed that they have changed. Probing to how such change came about and how it is measured, the respondents indicated that the number of cows has decreased, the high incidence of drought has reduced grass, and, now, some people in the villages who have the money are going for the chemical fertilizing method. They indicated that chemical fertilizing presents a number of challenges. These include affordability and its impacts on soil which result in soil becoming infertile.

> It [soil fertility management] has changed because before we used to put cow dung in the field when we realize that the soil is

> not fertile. The rain was also enough, but nowadays, no rain and people no longer have cows, so some in the village are going for those white men's medicine. But we do not like it and does not produce good maize with good porridge; people in this village like porridge too much, and using those medicines they make maize not tasting good (R1M).

The researcher followed up on the effectiveness of the methods used by the respondents. The majority of the respondents believed that the methods are effective, but was concerned with the diminished availability of nutrients used for keeping the soil productive.

Exploring how respondents acquired their knowledge of managing soil productivity, all the respondents indicated that is the way they found their parents and everyone in the village doing it.

5.4. Summary of findings

Tables 17 and 18 attempt to consolidate all of the IK explored and discussed with the Msigna farmers regarding maize production and soil management respectively. In presenting this consolidation an effort has been made, through interpretation of the data presented by the participants, to codify the information into the three categories of IK suggested in the literature review in chapter two: Local memory; Local practice; and Local Science.

This study has shown that in order to understand the role and significance of IK, it is important to understand how the identified knowledge has been acquired. The two questions asked are: what makes it knowledge? And what makes it indigenous? Using the proposed IK information system of local memory, local practice and local science helps to answer these questions.

Local memory was defined as practices used in the past in agriculture, but which are no longer used. In this case, participants would recall a particular practice or method that was used in the area. It may have

been used when they were children, but it has since disappeared from use. It may also be that the practice or method was already out of use by the time they were born, but that they were told of its use in times long past.

Local practice was originally defined as any practice or method that the farmers used currently, but for which they could offer no basis for using other than simply accepting it as “the way it should be done”. The study has revealed that this needs to be amplified. Local practice is adopted from two main sources: inheritance, and external influences. External influences include extension services, the media, other farmers (with experience outside the village), and sales representatives and commodity agents. Inheritance is knowledge and practices handed down from generation to generation as part of family or community culture.

Local science was defined as any practice used by a farmer which has been adopted through personal experimentation or conscious trial and error. It implies that the farmer has deliberately and consciously engaged in figuring out what works and what doesn’t. It is the fact that his learning was deliberate and conscious and was based on his own efforts to experiment that makes it ‘science

Table 17: IK identified by the Msinga farmers related to maize production

Practice or methods identified	Source of the knowledge	Categorization			Brief summary of the perceptions	Comments on change
		LM	LP	LS		
Selection of the seeds	From parents and community	LM	LP		Three criteria applied by farmers: size, colour, Free from insects. Small seeds and white seeds are preferred. No western science.	Mixed views: some respondents indicated that there are changes, others disagreed. Because before it was the women job but now everyone is selected.
Conservation of seeds	From parents and community	LM	LP		There were three methods employed by IK farmers. These include keeping seeds under the roof, spreading it under the sun and in containers, and mixed seeds with chemical in the sack. No western science	With regard to changes, there were two views, some argued that the practices have changed and others disagreed. The people said it is changing because before they were not using chemical for conservation seeds but today they do using it.
Crop is managed from planting to harvest	From parents and community	LM	LP		There were three stages considered in the management of seeds. First were weeding, second diseases or insects control and third fertilization. No western science	There were two views. Some believed that it has changed and others believed it has not changed. There is change because before people were not using chemical for fertilizer but today they have got money to buy and using it.
Methods used when plants are not growing well	From parents and community	LM	LP		Respondents had few options when plants are not growing well Depend on the causes. They indicated that in some instances the failure of plants to grow well may be due to the failure of rain, diseases or diminished soil nutrients. No western science	There were two views. Some believed that it has changed and others believed it has not changed. About those who said it has changed is because before nothing was done if the plants were not growing well, but now they are using organic, control diseases or insects using insecticide, people have the money. For lack of rain nothing to do.
Diseases and insects control	From parent and community				There are few options for diseases and insects control. Few western science	Diseases or insects. One is to kill them by hand and use few western chemical or do nothing.
Harvesting and conservation	From parents and community	LM	LP		Ready for harvesting when they are dry and when the tassels and leaves are dry	Some believed that it has changed and others believed it has not changed. For the people who believed it has changed because before maize was not left dry properly for lack of food to eat.

LM: Local memory; LP: Local practice; LS: Local science

Table 18: IK identified by the Msinga farmers related to soil management

Practice or methods identified	Source and categorization of knowledge				Brief summary of the perceptions &	Comments on change
	Brief indication as to how they acquired the knowledge	LM	LP	LS		
Identification of soil	From parents and community	LM	LP		There were two major methods use in soil identification of soil. Colour, texture. No western science	There were two views. Some believed that practices have changed and others believed did not change. Before there were experts in villages, but now everyone can identify soil on his/her own.
Land/soil preparation	From parents and community	LM	LP	LS	Methods used in land preparation included, cutting down grass and then turning the soil with hoe and burying the husks under the soil to give soil nutrients. No western science.	There were two views. Some believed that practices have changed and others believed did not change. Before they were burning the bushes for land preparation, but now they only use hoe and machete for cleaning the land for planting and then plant.
Manage soil productivity	From parents and community	LM	LP	LS	Methods used involved leaving grass and other debris in the field to get rotten. No western science	There were two views. Some believed that the practices changed and others believed did not change. Before there were no chemical used, but now some of the farmers use chemical.

LM: Local memory; LP: Local practice; LS: Local science

5.5. Conclusion

This chapter started by examining demographic information of respondents, followed by a discussion of the Msinga farmers' seasonal agricultural calendar and a broad historical timeline from the study area. It emerged from both individuals and focus group discussions that farmers in Msinga have knowledge of producing maize and managing the soil. However, this knowledge is not clearly understood the same way by those who participated in the research.

There seemed to be contradictions among the respondents regarding their indigenous knowledge of the process of maize production and soil management. In addition, according to respondents' views, there is reason to believe that the knowledge and methods used were considered by the participants to be ineffective in enabling members of the community to produce maize effectively.

Another important point to note was that the local knowledge is dying and this has been supported by the findings of the study. Some of the methods employed in the past and which seemed to have been effective in the process of maize production, are no longer available. Some of the former local experts in maize production in parts of Msinga can no longer be found in the area and none of current Msinga members inherited the knowledge.

Another important finding by the study is that, according to respondents observation the climatic conditions have been changing in the area and making it difficult for agriculture and maize production. The shortage of land suitable for agriculture has also hampered community efforts to effectively produce maize.

It also emerged that there is no longer external help from any source, either from the government , such providing the basic services (see chapter 3).. The presence of hybrid seed, fertilisers, pesticides and similar western science technologies imply that some agency was present at brought these technologies to the Msinga farmers.

Currently there are no extension workers in the areas to support communities with new methods of agricultural.

CHAPTER SIX: CONCLUSIONS AND RECOMMENDATIONS

6.1. Introduction

The aims of this study were to explore and examine the use of indigenous knowledge in the process of maize production and soil management in the case of Msinga in central KwaZulu-Natal province. This chapter provides conclusions to the study and recommendations. First it will answer each of the original research questions. This is followed by summary conclusions in the two critical areas of IK and the position of the Msinga farmers in their production of maize. The thesis concludes with recommendations for addressing the situation in Msinga.

6.2. Research questions

6.2.1. What indigenous approaches are used in the process of maize production in Msinga?

With regard to indigenous approaches used in the process of maize production in Msinga, the results demonstrated that there are two major steps undertaken by indigenous farmers in this process of maize production. One is seed management from its selection up to harvesting and the second step is soil management. The first step involves the selection of the seed, storage. It is followed by weeding, insects and diseases control and harvesting.

6.2.2. How does the process function, from the seed selection to the final harvest?

In relation to how IK function, from seed selection to the final harvest, the results demonstrated that the function of indigenous knowledge are embedded into two major steps indicated in question one. For instance, selection of seed for planting includes the size of the seed, colour and free from insects and disease. The storage of selected seed involves keeping selected seed in containers, under the roof and spreading it under the sun. Maize management include weeding. Weeding is done twice before harvesting. While insects and diseases control can be done by mixing

methods. For instance for those with access to modern insecticides can use it and those with no access can either kill insects with hand or do nothing till the insects or diseases are over.

6.2.3. What techniques are employed to manage the soil in the process of maize Production in Msinga?

With regard to soil management in the process of maize production, the study indicated that indigenous farmers have three techniques which include the identification of soil suitable for cultivation and this involves the colour of the soil, moisture and texture. The second technique is the preparation of the soil and this involves of clearing of the bushes. The third technique involves maintaining soil productivity or supplying the soil with nutrient where it is non-productive or has run out of productive capacity.

6.2.4. How effective are these approaches and techniques from the perspective of the farmers in Msinga?

Measuring the effectiveness of IK in the process of maize production, the results demonstrated that despite that IK remains one of the methods used by indigenous farmers in Msinga, IK remains is limited. A number of factors have been identified limiting the effectiveness of IK. Among the factors, include the loose of IK among young people, climatic conditions in the area and the quality of land available to the community.

6.3. Conclusions

This section first draws conclusions regarding the status of IK . It then discusses the resulting situation of the Msinga farmers being trapped in a cycle of insufficient maize production.

6.3.1. The status of indigenous knowledge

It has been indicated throughout the study that IK still exists in many communities and developing countries in particular. Its importance and effectiveness has been demonstrated in many areas of the society including agriculture, environment, disaster management, and many other areas of critical importance in society.
Examining the use of IK in the process of maize production and soil management in Msinga, the study found that the transfer of knowledge within the surveyed community is mainly passed on by parents or members of the community to the rising generation. This is consistent with the pattern of IK transfer discussed in Chapter 3.

With specific reference to the Msinga farmers, the study found that farmers still rely, at least in part, on IK to produce maize and manage their soil. However, IK in the production of maize and soil management in Msinga remains complex as members of the community do not define the indigenous knowledge in the same way. While it is important to note that participants shared the same or similar views in many areas, it is however shown throughout the findings that participants differed in some areas of IK and its use in the production of maize and soil management. This indicated that there is some level of breakdown in the exchange of knowledge between the participants and their predecessors who would be the source of their IK. The study found that IK is fluid and relative depending on who perceives the knowledge. Older participants, not unexpectedly, see greater change and movement away from the practices and methods of maize production an soil management than do the younger ones. In some cases, the ‘way it has always been done’ depends on what one found being practiced from one’s childhood. The use of chemical herbicides, for example, may have been new to the older farmers, but was always there to the younger farmers. This supports the contention that one element of IK is the concept of local practice; local practice what is currently practiced irrespective of how it came to be practiced.

Further evidence that IK is dying was presented at many points in the various discussions held. For instance, where participants were asked whether they see any changes in practices of maize production and soil management, the majority of the

responses confirmed that indeed practices have changed. This was also clear in participants' views. Again, key informants, who happened to be older, from 60 to 80 years, appeared to know many practices which are no longer practiced nowadays. These include identification of soil suitable for cultivation, conservation of the soil and the whole process of maize management, from selection up to harvesting. Such practices fall into the category of local memory; practices used in the past, but which are no longer being practiced. This suggests that the transfer of skills and knowledge from generation to generation has been superseded by other factors. What was local practice slips into local memory.

The results of the study suggest that social disintegration may also be at the centre of this breakdown of social cohesion which interrupts the preservation of IK. The social and political tensions within the community of Msinga outlined in Chapter 3 might have influenced the breakdown of the exchange of information among members of the community.

6.3.2. Trapped in a cycle of insufficient maize production

Maize production in Msinga is hampered by a plethora of factors. The growing level of climate change, especially the increase in the occurrence of drought in the area, makes it difficult for the community to effectively grow maize and manage soil in the process. The lack of access to arable land, exacerbated by the worsening climatic conditions has led to the use of IK in the process of maize production. Lack of access to irrigation also contributes to the situation.

Further, the results showed that there is a lack of external support. This is compounded by poverty and an absence of extensions workers who would be able to assist in transferring knowledge and new technology to the community. This is also compounded by the fact that there are no existing structures within the communities themselves capable of organizing people in the exercise of maize production. And this is further compounded by the fact that the people in Msinga are not able to purchase fertilizers and other inputs enabling them produce maize -where indigenous knowledge has failed.

Climate change, the failing of IK, the lack of adequate knowledge about and access to alternative technologies, the lack of external support and the inability to organize themselves to mitigate their situation, results in maize production in Msinga being unsustainable. This leaves the community with no options. Intervention is required, it appears that the intervention must be must be multi-faceted, integrated and addressing a range of issues beyond merely providing technological answers to their immediate production and soil management problems.

6.4. Recommendations

Based on the foregoing conclusions, this study makes recommendations in the following areas: reconstruction of indigenous knowledge; social cohesion; environmental matters; poverty eradication; external support; and integrating IK and western science. While these are presented individually, it is intended that the recommendations be pursued concurrently and in an integrated fashion. To implement one without the others would likely prove fruitless.

Reconstruction of IK: As demonstrated earlier, indigenous knowledge is dying and, therefore, there is a need to set up programmes which will again promote the use of IK within the community. First, this can be done by identifying people or elders who still hold this form of knowledge who then can impart it to the young people. While, the study found that IK, alone cannot cope with the current requirements of maize production and soil management, it does have a place in the on-going efforts of the Msinga farmers to carry out their livelihood.

Social cohesion: The breakdown in social cohesion, including the wars and political unrest in Msinga has contributed to the current inability of the Msinga farmers to move from the stasis that characterises their lives. It is important that social cohesion is again rebuilt. This can be done by creating platforms of discussion between members of different clans, where issues of common knowledge are shared and relationships restored. This will again enable communities to share knowledge in different areas, including knowledge of maize production.

Environmental matters: The results confirmed that Msinga is affected by high levels of drought, that there is not enough land suitable for agriculture, and that people in the area do not have access to water for irrigation. Therefore it is recommended that projects be implemented in the area to deal specifically with climate change. Among these should be programmes to provide the Msinga farmers access to irrigation. This will require forging partnership programmes bringing together the government, other agencies of development and the communities. It is submitted that no one of these three partners alone can deal adequately with environmental problems in the area.

Poverty eradication: The study also confirmed that the level of poverty is high among members of the community in Msinga. Therefore, it is important that programmes eradicating poverty are put in place. Honouring the heritage of the Msinga farmers these should focus on income generation through of agriculture. The programme will have to be linked to establishing access to inputs and bridging credit as well as provision of adequate extension and information services. Given the limitation of their land, income generation programmes should also include post-harvest processing and value-adding.

External support: The study clearly highlights the need for government to intervene in providing the support which the Msinga farmers require. In support of the poverty alleviation programmes suggested above, the provision of extension through an active corps of extension workers is vital in order to transfer and develop skills and knowledge and to assist the Msinga farmers with identifying and developing or acquiring technologies that are relevant to their circumstances. This will assist the farmers to supplement IK where it has failed to meet their needs in agricultural processes. The support must, however, be done in genuine partnership between the community and government and agriculture agencies – and not merely an exercise of technology transfer.

Integrating IK and western science: It has been demonstrated that IK is limited in its affect in the study area. Therefore, there is a need to supplement it with western science to assist where IK is lacking. This is, of course, linked to the provision of extension support which should approach its work in the context of shared exploration of the two knowledge systems. Integrating indigenous knowledge and

western science can further be achieved through the formation of partnerships between farmers and institutions of higher learning like universities and other organizations of development focusing on agriculture. It is important that this partnership involves the experts from the communities as well as the experts from formal institutions.

REFERENCES.

Abraham, A. B. (2000). The use of indigenous knowledge by farmers in Ethiopia when storing grains on their farms. *16th Symposium of International Farming, 27-29 November 2000.* Chile: Association Santiago.

Agrawal, A. (1995). Dismantling the divide between indigenous and scientific knowledge. *Development and Change*, 26, 413-439.

Amede, T., Belachew, T. and Endrias. G. (2001). *Reversing the degradation of arable land in the Ethiopian Highlands*: managing Africa's' soil No.23.

Arslan, A. (2007). How much are landraces worth to farmers? The case of traditional maize in Mexico. Available at:<http://www.reap.ucdavis.edu/research/Farmer Valuation.pdf> [Accessed 24 July 2011].

Babbie, E. and Mouton, J. (2001). *The practice of social research* (First ed.). Cape Town: Oxford University Press.

Barrera-Bassols, N. and Zinck, J. A. (2003). Ethnopedology: A worldwide view on the soil knowledge of local people. *Geoderma, 111*, 171-195.

Basch, C. E. (1987). Focus Group Interview: An underutilized research technique for improving theory and practice in health education. *Health Education Quarterly, 14*, 411 - 448.

Belay, A. (2001). Effect of direct nitrogen and potassium and residual phosphorus fertilisers on soil chemical properties, microbial components and maize yield under long-term crop rotation: *Biology and Fertility of Soils, 35:420-427.*

Berlin, B. D.E. Breedlove, and P.H. Raven., (1974). *Principles of Tzeltal plant classification.* New York: Academic Press.

Bernard, H. and Russell, B, (1994). *Research methods in anthropology: qualitative and quantitative approaches* (second edition). Walnut Creek, CA: AltaMira Press.

Berry. S. (1993). *No condition is permanent. The social dynamics of agrarian change in sub-Saharan Africa.* Madison: University of Wisconsin Press.

Black well, A, (1968). *Weed control handbook*: 5th edition. Oxford, Edinburgh, Blackwell Scientific.

Bollig, M. (2006). *Studies in Human Ecology and Adaptation. Risk Management in a Hazardous Environment: A Comparative Study of Two Pastoral Societies.* London: Springer Science.

Bouma, D. G. (1996). *The Research Process*. Third Edition. Oxford: Oxford University Press.

Briggs, J. and Sharp, J. (2004). Indigenous knowledge and development: a postcolonial caution. *Third World Quarterly* 25: *661–676.*

Brodnig, G. and Mayer- Schönberger, H (2000). Bridging the Gap: The Role of Spatial Information Technologies in the Integration of Traditional Environmental Knowledge and Western Science: *The Electronic Journal on Information Systems in Developing Countries, 1, 1-16.*

Brust, G.E and King, L.R. (1994). Effects of crop rotation and reduced chemical inputs on pests and predators in maize agro ecosystems: *Agriculture, Ecosystems and Environment* 48: 77-89.

Busha, H. C. and Harter, P. S. (1980). *Research Methods in Librarianship Techniques and Interpretation.* London, Academic Press.

Catterall, M. and Maclaran, P. (1997). Focus group data and qualitative analysis programs: Coding the moving picture as well as the snapshots. *Sociological Research Online,* 2(1). Available at: <http://www.socresonline.org.uk/socresonline/2/1/6.html> [Accessed 21 June 2011].

Census. (2001). Statistics SA Census Department of Provincial and Local government South African Weather Services *KwaZulu-Natal Stationnt.Availabl at: http://www.southafrica.info/about/government/govlocal.htm.[Accessed 25 Jun,2011].*

Cools, N., De Pauw, E. and Deckers, J. (2003). Towards an integration of conventional land evaluation methods and farmers' soil suitability assessment: A case study in north-western Syria*. Agriculture, Ecosystems and Environment,* 95: 327-342.

Corbeels, M. Shiferaw, A. and Haile.M. (2000). Farmers' knowledge of soil fertility and local management strategies in Tigray Ethiopia: Managing Africa's' soil No.10.Nottingham,Russell Press.Available at: http://www.iied.org/doc/drylands/soil-10.Pdf [Accessed 12 May 2011].

Cousins, B. and Hornby, D. (2009).*The land laws of Msinga and potential impacts of the communal Land Rights Act :* Church Agricultural Project and the Learning and Action Project. Paper prepared at the conference of the Department of agriculture.

Cousins, B. and Hornby, D. (2007). 'More than socially embedded: the distinctive character of 'communal tenure' regimes in South Africa and its implications for land policy', *Journal of Agrarian Change*, 7 (3): 281-315.

Crawley, M.J. (1997). *Plant Ecology*, Oxford: Blackwell Scientific.

Dahmardeh, M., Ghanbari, A., Syahsar, B.A. and Ramrodi, M. (2010).The role of intercropping maize (Zea mays L.) and cowpea (Vigna unguiculata L.) on yield and soil chemical properties: African Journal of Agricultural Research Vol.5(8), pp.631-636.available at:> http://www.acadimicjournals.org/AJAR [Accessed at 29.july 2011].

Dempsey, G.J. (1996). *In-situ conservation of crops and their relatives: A review of current status and prospects for wheat and maize.* NRG Paper 96-08, CIMMYT, Mexico, DF. 33.

Denzin, N.K.and, Lincoln, Y.S.(2005). *The Sage Handbook of Qualitative Research* (3rd Ed). United Kingdom: Sage Publications.

Department of Agriculture.(2000). National Provision against Drought. Reprinted from Farming in South Africa, June and July, 1941. *Bulletin No*. 235.

Department of Science and Technology. (2004). Indigenous Knowledge Systems. Pretoria: Government Printer.

Dixon, A.(2005). Wetland sustainability and the evolution of indigenous knowledge in Ethiopia. *The Geographical Journal,* Vol.171, pp. 306–323.

Djanhari, A., Djulin, A., and soejono, I. (1987). *Maize production in Java prospects Farm-level production technologies:* Vol. 13 Bogor: The CGPRT Centre.

Doanh, L.Q. and Taun, H.D. (2004). Improving indigenous technologies for sustainable land use in northern mountainous areas of Vietnam. *Journal of Mountain Science*, 1: 270-275.

Drought Information Bulletin. (2004). Disaster Relief Emergency Fund (DREF): Available at: <http://www.sahims.net/doclibrary/2004/02>[Accessed 02 June 2011].

Efa.N. (2005). Implications of an extension package approach for farmers' indigenous knowledge: the Maize extension package in Southern Ethiopia. Ethiopia agricultural research organization Jima research centre v 12, N3.

Ellis, D and West, P (2004), Local history as 'indigenous knowledge': Aeroplanes, conversation and development in Haia, Maimafu, Papua New Guinea in Bicker, A., Everson, T.M., Everson, C.S. and Zuma K.D.(2007). Community based research and influence of rehabilitation techniques on the management of degradation catchment, water research commission report No. 1316/1/01. Pretoria. South Africa.

Ferguson, M.A.D. and Messier, F. (1997). Collection and analysis of traditional ecological Knowledge about a population of Arctic tundra caribou. Arctic, 50: 17–28.

Fisher, R. P., Brennan, K. H., and McCauley, M. R. (2002). The cognitive interview method to enhance eyewitness recall. In M. L. Eisen, J. A. Quas, and G. S. Goodman (Eds.), Memory and suggestibility in the forensic interview (pp. 265–286). Mayway, NJ: Lawrence Erlbaum.

Gowing, J., Payton, R. and Tenywa, M. (2004). Integrating indigenous and scientific knowledge on soils: recent experiences in Uganda and Tanzania and their relevance in participatory land use planning: Uganda Journal of Agricultural Sciences, 9: 184-191.

Grant, P.M. (1981). The fertilization of sands soils in peasant agriculture: Zimbabwe Agricultural Journal, 78:169-175.

Gray, A.M. (1998). *Alfalfa Stand Renovation: Reseed or Crop Rotation? Cooperative extension Service*, Laramie, Wyoming: University of Wyoming.

Green E.C. (1994). AIDS and STD in Africa. Bridging the Gap between Traditional Healing and Modern Medicine. Pietermaritzburg: University of Natal Press.

Grenier, L. (1998). *Working with indigenous knowledge: a Guide for Researchers*. Available at: Ottawa University international for Development research centre.>http://www.idrc.ca/openebooks/847-3.[Accessed 27 February 2011].

Habarurema, E. and Steiner, K.G. (1997). Soil suitability classification by farmers in southern Rwanda: *Geoderma,* 75: 75-87.

Hammersmith, J.A. (2007). Converging indigenous and Western Knowledge Systems Implications for tertiary Education. PhD. University of South Africa.

Hamersley, M. and Atkinson, P. (1983). *Ethnography Principles in Practice*: London. Tavistock Publications Ltd.

Handawela, J. (1985). Fertilizer management in upland rain fed maize in the dry zone of Sri Lanka. Paper presented at a Workshop on Fertilizer Use in Maize in SriLanka, Feb. 22, 1985.

Hart, T, and Vorster, I. (2006). Indigenous knowledge on South African landscape: potentials for agricultural development. Urban Rural and Economic Development Research programme occasional paper 1. Cape Town: Human Sciences Research Council. Available at: <htt://www.prolinnova.net/South-Africa/a%20-%20indigenous-knowledge7E952006100711AM1Pdf>at: [Accessed 23 Jun 2011].

Hennink, B and Simkhada, P. (2000). Sex trafficking in Nepal: context and process' Asia. Cambridge: University Press.

Hinsh J.M and Langohr, R. (2004). Indigenous about soil and sustainable crop production: a case study from the Guinea woodland savannah (Northern Region Ghana: geogrfissk Tidsskrift, *Danish Journal of Geography* 104 (2):13-26.

Hornby, D.(2000). 'Tenure rights and practices on a state-owned farm: the community of Ekuthuleni'. In *At the crossroads. Land and agrarian reform in South Africa into the 21st century*, ed. Ben Cousins, 311-17. Cape Town: Programme for Land and Agrarian Studies, University of the Western Cape and National Land Committee.

Hoppers, O.C. (2002). *Indigenous Knowledge and the Integration of Knowledge Systems. Towards a Philosophy of Articulation.* Edited by C.A.Odora Hoppers, Cape Town: New Africa Books (Pty) Ltd.

Huntington, H.P. (1998). Observations on the utility of the semi-directive interview for documenting traditional ecological knowledge. *Arctic* 51: 237–242.

IDP Review. (2008/2009). Msinga Local Municipality. Draft document. Available at < http://devplan.kzntl.gov.za/idp_reviewed_2008_9/IDPS/KZ244/Adopted/MSINGA%20NEW%20IDP%20200809.PDF> [Accessed 17 Jun 2011] Prepared by the Department of Provincial and Local Government.

IFPRI, (2002). Green Revolution: curse or blessing. International Food Policy Research Institute. Washington DC, USA.

Institute of Natural Resources. , (2007). Status Quo of the Agricultural sectors Msinga Local Municipality. Prepared for Department of Economic Development, Local Economic Development Unit. Institute of Natural Resources, South Africa.

International Development Research Center (2003). Facts and figures on Food and biodiversity. Available at: < http://www.idrc.ca/en/ev-31631-201-1-DO-TOPIC.html [Accessed 11 Marc 2011].

IRIN. (2007). Southern Africa: Vouchers to help drought-hit farmers: Available at: <http://www.alertnet.org/thenews/newsdesk/IRIN/aeef63cc4826b273be589e3dde40f2c3.htm>. [Accessed 14 May 2011].

Janis, I. L. (1982). *Groupthink: Psychological Studies of Policy Decisions and Fiascoes* (2nd edition). Boston: Houghton Mifflin. *Third World Quarterly,* 25, 661–676.

Jensen. E.S. (1996) Yield Symbiatic N2 Fixation and Intraspecific competitition for organic N in pea-barley inter crops*. Plant soil* 182: 25, 38.

Jerie .S, and Mugiya. P.(2010). The effectiveness of tillage on Maize production in the Semi-Aride Dayataya Ward of Southern Zimbabwe: journal of sustainable development Africa.

Johnson, L. (2000). *The sustainable livelihoods approach*: input paper for the integrated training course of north-south aeschiried, Switzerland 9. - 20. September 2002.

Johansson, L. (2001). Ten million trees later. Land use change in the West Usambara Mountains. *The Soil Erosion and Agro forestry Project (SECAP) in Lushoto District. 1981 – 2000. 163.*

Kagoda, A. M. (2009). Integrating appropriate indigenous knowledge in geography secondary schools of Uganda. *Current Research journal of social sciences* 1(3): 117-122.

Kamara, J. (2007). Indigenous knowledge in natural disaster reduction in Africa. Environmental knowledge for change. UNEP <http://www.grida.no/publications/et/ep3/page/2608.aspx> [Accessed May 2011].

Katinika, N.E,, Verkuijl, H., Mwangi, W. and Moshi, A.J. (1996). Adoption of maize production technologies in Southern Tanzania. Occasional Paper.

King, N. (2004). Using template in the thematic analysis of text, in Cassell, C. Symon, G. (ed) *Essential guide to qualitative methods on organizational research*, London: Sage.

Kitzinger, J. (1994).The methodology of focus groups: the importance of interaction between research participants. *Sociology of Health and Illness* 16(1): 103-121.

Khor, M. (2002). *Intellectual Property, Biodiversity and Sustainable Development. Resolving the Difficult Issues*: London and New York: Zed Books.

Krasilnokov, P.V and Tabor, J.A.(2003). Perspectives on utilitarian ethnopedology. *Geoderma,* 111: 197-215.

Kumar, R. (2004). *Analysis of qualitative and quantitative research*. London: Sage Publications.

Langill, S. (1999). *Indigenous knowledge: Resource kit for sustainable development researchers in dry land Africa*. Ottawa: International Development Research Centre.

Lincoln, Y. (Ed) (2000). Handbook of Qualitative Research. London: Sage Publications.

Louette, D. and Smale, M. (1991). Genetic diversity and maize seed Management in Traditional Mexico community: implications for in situ conservation of maize<:http//apps.cimmyt.org/English/docs/nrg-paper/nrgp9-03pdf> at [Accessed 16 Marc 2011.

Lwago, E.T., Ngulube, P. and Stilwell, H (2010). Managing indigenous knowledge for sustainable Agricultural development in developing countries*:* knowledge management approaches in the social context*. The international information and Library Review*, 42, 174-185.

Lwago, E.T. (2009). Application of indigenous management approaches and information and communication technologies to manage indigenous knowledge in agricultural sector in selected Districts of Tanzania (PhD thesis). Pietermaritzburg: University of Kwazulu-Natal.

Macharia, P.N and Nganga, L.W. (2005). Integrating indigenous and land classification systems in the densification of soil management constraints in the tropics: *A Kenyan case Study, Tropical and Subtropical Agro ecosystems,*

ano/vol.5, Numero, 002 Universidad Autonoma de Yucatan Yucatan, Mexico. 67-73.

Maila, W. (2007). *Indigenous knowledge and sustainable Development: Investigating the link*. Department of Languages and Social Sciences. Education. University of Botswana.

Makali, S., (2010). Indigenous knowledge related to climate variability and change: insights from droughts in semi-arid areas of former Makueni District, Kenya. *Climatic Change* 100:295–315.

Marten, G.G and Vityakon, P. (1986). *Soil management in traditional Agriculture. In: Marten, G.G.(Ed),* traditional Agriculture in Southeast Asia: A Human Ecology perspective, west view press (Boulder, Colorado).

Mascarenhas, A. (2004).Knowledge, indigenous knowledge, peace and development.Indilinga African: *Journal of indigenous systems vol 3 (1)1-1.*

Maurice Webb and Race Relations.(2007). Msinga profile 2007. University of KwaZulu-Natal.

May, M. (2001). Poverty, Shocks and School Disruption Episodes among Adolescents in South Africa. Johannesburg. CSDS Working Paper No 35

McLafferty, I. (2004). Focus group interviews as a data collection strategy. *Advanced Nursing 48:187*-194.

Mella, E.E., Kulindwa, K, Shechambo, F and Mesaki, S. (2007).The integrated assessment of organic agriculture in Tanzania: policy options for promoting production and trading opportunities for organic agriculture.available at: < http://www/unep-unctad.org/cbtf/publications/integrated%20Assessment%20o%20the%200A%20sector%20in%20Tanzania.pdf>.[Accessed 15 Marc 2011].

Mikkelsen.*J.H*. and Langogr. *(2004).* Indigenous knowledge about Soil and a sustainable Crop Production, a case Study from the Guinea Woodland savannah (Northern Region Ghana*: Geografisk, Danish journal of Geography 104(2):13-26.*

Modi, A, T. (2003). Development debate and practice. What do substance farmers know about indigenous crops and organic farming? Preliminary experience in KwaZulu-Natal. *Development Southern Africa Vol. 20-23-57.*

Mugisha-Kamatenesi M, Deng A.L, Ogendo JO, Omolo EO, Mihale MJ,Otim M, Buyungo JP,and Bett PK.(2008). Indigenous Knowledge of field insect Pests and their Management around Lake Victoria basin in Uganda. African Journal.of Environment Science and Technology*. 342-348.*

Michael M.J.,Deng A.L,Selemani H.O, Mugisha-Kamatenesi M. Kudukuli A.Wand Ogendo L.O.(2009). Use of Indigenous knowledge in the management of field and Storage pest around Lake Victoria basin in Tanzania: African journal of environmental science and Technology vol3.251-259. Available at: <http://www.academicjournals.org/AJEST.>: [Accessed. 27/May /2011].

Msinga Integrated Development Plan.(2005/2006). Msinga Local Municipality: Prepared by the Department of Provincial and Local Government.

Msinga integrated Development plan (2007). Msinga municipality. Available at:<http://www.docstoc.com/docs/72743204/Msinga-IDP >[Accessed 15 May 2011]. Prepared by the Department of Provincial and Local Government.

Msinga Integrated Development Plan, 2005/2006. Msinga Local Municipality

Murray. C.(2004). *South Africa's troubled royalty: traditional leaders after democracy*, Canberra: Federation Press in association with the Centre for International and Public Law, Australian National University (Law and policy paper; no. 3).

Mwaura, P.(2009). *Indigenous knowledge in disaster management in Africa.* Drought Monitoring Centre, Nairobi, Kenya.

National Consultative Forum on Drought. (1993). Indicators for poverty and drought. Thinking about the components of a food security monitoring system for South Africa, Johannesburg.

National Research Council, (1991). Indigenous knowledge at the interface with other Systems of Knowledge. Unpublished Report 5 (3): 18-45.

Ngubane, T.P.(2006). Development Deficiency in the Midst of Abundance: Indigenous knowledge and development in the Communities of Mpembeni and Mdletsheni Abutting Hluhluwe-Imfolozi Park. Master's.thesis, University of KwaZulu-Natal.

Nuwagaba J. M., Mangheni, M.N. and Tumuhairwe.J.K.(2000). *Farmers' Evaluation of Soil Management Practices Used In Mbarara District*, South Western Uganda. Makerere University. Not Published.

Obaa, B., Chanpacho, M., and Ageal, J. G. (2005). Participatory farmers' evaluation of maize varieties: A case study Nebbi District, Uganda: *African crop science proceedings, 7*, 1389-1393.

Odong. O.*J.(1999). Applied soil science research in a changing society: challenges for Uganda soil scientists in the new millennium. Proceedings of the 20th conference of the soil science society of East Africa (SSSEA). Kampala: SSSEA.*

Opoku, S. A. (2005). *The need for indigenous knowledge in environmental impact assessment. The case of Ghana.* New York. Edwin Mellen Press.

Osunade M.A. (1989). Optimization of traditional systems of soil resources inventory to achieve increased sustainable: Third world planning Review 11: 91-108.

Overing, J. (1987). *Translation as a creative process:* The power of the name. In Temple.

Patton, M. Q. (1987). How to use qualitative methods in evaluation. (2nd ed.) Newbury Park, CA: Sage Publications.

Pauw, C. N. D. (2003). Towards an integration of conventional land evaluation methods and farmers' soil suitability assessment. *342*(327-342).

Peters, Pauline. (2004). Inequality and Social Conflict Over Land in Africa. *Journal of Agrarian Change*, 4 (3): 269-314.

Polkinghorne, D.E. (2005). Language and meaning: Data collection in qualitative research. *Journal of Counseling Psychology* , 52: 137-145.

Potteirt, J., Bicker, A., and Sillitoe, P. (2003). *Negotiating local knowledge: power and identity in development,* London: Pluto Press.

Powell, E., A. Manu, S. C. Geiger, M. Ouattara, A. and Juo, S. R (1991). *Integrated management of agricultural watersheds: land tenure and indigenous knowledge of soil and crop management*:Texas. TropSoils Bulletin 91-04.

Richards, P.(1985). *Indigenous Agricultural Revolution. Hutchinson Publishing Group, Bergvlei*, South Africa.

Prasad M.V.,(2009).*Indigenous knowledge use in maize cultivation in Andhra Pradesh* :Indian Res. J. Ext. Edu.

Rahman.H., Kkichora K ,and Denzanypa R.(2009).Traditional Practices of ginger cultivation in Northeast Indian: *journal of Traditional knowledge vo,8(1) 23-28*

Regme, B. D. (2005). " Farmers' Approaches to soil –Fertility management in hills of Nepal Integrated Watershed Management: Studies and Experiences from Asia Edited by Michael Zoebisch, Khin Mar Cho San Hein Runia Mowla AIT. Nepal.

Reznicek, E. and Jost, T.(1998). Crop rotation. Sustainable Agriculture Management Guides. Kansas Rural Center, Washington, DC. Available at: <http://www.kansasruralcenter.org/publications/rotation.pdf>.[Accessed 15Marc 2011].

Richards, P., (1985*). Cultivation: knowledge or performance? In Hobart, M. (ed). An Anthropological Critique of Development: the Growth of Ignorance*. London, Routledge.

Rwehumbiza, F.B., Mowo, J.G. and Ngatoluwa, R.N. (2003). Soil fertility management options. Report prepared for the NRSP Project R8115, SWMRG (Soil Water Management Research Group), Sokoine University of Agriculture, Morogoro Tanzania.Repport R13.

Saito K, Linquist B, Keobualapha B, Shiraiwa T, and Horie T. (2006).Farmers' knowledge of soil in relation to cropping practices: A case study of farmers in upland rice based slash-and-burn systems of northern Laos*. Geoderma* 136:64-74.

Sear, L., and Stephenson, G. M. (1997). Interviewing skills and individual characteristics of police interrogations. In G.M. Stephenson and N. K. Clark (Eds.), Procedures in criminal justice: Contemporary psychological issues. Leicester:The British Psychological Society.

Seepe, S.(2001). Indigenous knowledge Systems Can Benefit Everyone. In Ngubane, T.P. 2006. Development Deficiency in the Midst of Abundance: Indigenous knowledge and development in the Communities of Mpembeni and Mdletsheni Abutting Hluhluwe-Imfolozi Park. Master's.thesis, University of KwaZulu-Natal.

Singh,. R,K. and Sureja K. S. (2008). Indigenous knowledge and sustainable agricultural resource management under rain fed agro-ecosystem: Indian. *journal of traditional knowledge , (7). 642-654.*

Sillitoe, P and Pottier,J. Eds, (2004) Investigating local knowledge: new directions, new approaches: UK. Ashgate Publishing,HantsSmaling E.M.A. and, Oenema

O. (1997*).*Estimating nutrient balances in agro- ecosystems at differenent spatial scales*:229-252.*

Smaling E.M.A. &, Oenema .O. (1997*).*Estimating nutrient balances in agro-ecosystems at differenent spatial scales*:229-252.*

Stevenson, M.G., (1996) Indigenous knowledge in environmental assessment. *Arctic, 49: 278–291.*

Talawar, S. and Rhoades, R.E.(1998). Scientific and local classification and management of soils. *Agriculture and Human Values, 15: 3-14*.

Temple, B. and Edwards, R., (2002). Interpreters/Translators and cross-language research: Reflexivity and border crossings. *International Journal of Qualitative Methods,*1(2):Article1available at:<http://www.ualberta.ca/~ijqm/backissues/1_2/pdf/temple.pdf> [Accessed 16 June 2011].

Terre Blanche, M., Durrheim, K. and Painter, D.(2006). *Research in practice: Applied methods for the Social Sciences. South Africa:* University of Cape Town Press.

Thrupp, L. A. (1989). Legitimizing local knowledge: form displacement to empowerment for Third World People. *Agriculture and Human Values* 6(3): 13-24.

Tikai, P. and Kama, A. (2004). A study of indigenous knowledge and its role to sustainable agriculture. Proceedings of the 2003 National Environment Forum, Samoa. Available athttp//mnre.gov.ws/documents/forum/2004/11%20Kama.pdf.[Accessed 17 June 2011].

Tsai, JH, Choe, H, Chen Lim, J, Acorda, E., Chan, N, Taylor, M and Ping Tu, S.,(2004). Developing culturally competent health knowledge: Issues of data analysis of cross-cultural, cross-language qualitative research. *International Journal of Qualitative Methods*, 3(4): Article 2. Available at<http://www.ualberta.ca/~iiqm/backissues/3_4/pdf/tsai.pdf> [Accessed 22 July 2011].

Tsuji, L.S. and Ho, E.(2002). Traditional environmental knowledge and western science: in search of common ground: The Canadian Journal of Native Studies, XXII: *327-360.*

Tumuhairwe J.K. and Nkwiene C.(1999). Assessment of agro-diversity in the Dissected High Plateaux of Mbarara, Uganda. (PLEC Technical rep). Makerere University. Not Published.

Ulin, P.R., Robinson, T.R., Tolley, E.T., and McNeill, E.T.(2002). Qualitative methods: A field guide for applied research in sexual and reproductive health: *North Carolina Family Health International. 234-247.*

Vigiak, O., Okoba, B.O., Sterk, G.and Groenenberg, S.(2005). Modelling catchment scale erosion patterns in the East African Highlands: *Earth Surface Processes and Landforms, 30: 183–196.*

Von Kotze, A., (2002). Producing Knowledge for Living. Studies. *Continuing Education*, 24:45-76.

Warren, D.M., Slikkerveer, J. and Brokensha, D. (1991). *Indigenous Knowledge Systems:* The Cultural dimensions of Development. London. Kegan Paul International.

Watson, C.A., Atkinson, D., Gosling, P., Jackson, L.R and Rayns, F.W.(2002). Managing soil fertility in organic farming systems. *Soil Use and Management, 18: 239-247.*

Weinstock, J.,(1984). Getting the right feel for soil. Traditional methods of crop management The *Ecologist 14(4):146-149.*

Willey RW., (1979). Intercropping – its importance and research needs. Part 1.competition and yield advantages: Field Crop Abstr. 32, 1–10.

WinklerPrins, A.M.G.A.(1999). Local soil knowledge: A tool for sustainable land management. *Society and Natural Resources*, 12: 151-161.

Zhang, F. and Li.L (2003).Using competitive and facilitative interactions in intercropping systems enhances crop productivity and nutrient-use Efficiency. *Plant and Soil* 248: 305–312.

APPENDICES:

Appendix 1: Individual interviews questionnaire / Indigenous Knowledge Maize Production Msinga

KEY QUESTIONS FOR INDIVIDUAL INTERVIEWS

Part 1: Demographics

1. Name of community/Village		
2. Age (at last birthday)		
3. Gender		
4. Highest level of education completed (e.g. Grade)		
5. Organisational membership (e.g. church, NGO, club) [Be specific]		
6. Sources of income	Primary	
	Secondary	
	Other	
	Other	
	Other	
	Other	
	Other	
	Other	

7. Employment status	☐	Employed	☐	Unemployed	☐	Self-employed

8. Access to land	☐	No access to any land

		Access to grazing land		Private		Communal
		Access to cropping land		Private		Communal
		Other (explain)				

9. Crops grown	Primary			Only for food/household consumption only
				Primarily for food/household consumption AND sale of surplus
				Primarily for sale AND some food/household consumption
				Only for sale
				Other:
	Secondary			Only for food/household consumption only
				Primarily for food/household consumption AND sale of surplus
				Primarily for sale AND some food/household consumption
				Only for sale
				Other:
	Other			Only for food/household consumption only
				Primarily for food/household consumption AND sale of surplus
				Primarily for sale AND some food/household consumption
				Only for sale
				Other:

10. Access to irrigation		Yes		No
	If yes, which crops are irrigated?			

11. Access to fertiliser		Yes		No
	If yes, which crops are fertilised?			

12. What are the agriculture activities undertaken in the year and when (i.e. month, week etc				

13. What are the major events that may have happened in your area (i.e. Diseases, war, famine, drought, floods) and may have these affected the people and agriculture in Msinga?				

Maize production system

Theme	Key Question	Answers	Source of knowledge	
1.	How do you identify and choose maize seed suitable for planting?	**Primary answer**		Handed down from parents/grandparents
				Learned from others within the community
				Extension officer
				Media (Radio, TV, Magazine, etc)
				Through personal experience/ experimentation

				Other
		Why		
	Follow up question How has this practice changed over time? Why?	Primary answer		
	Follow up question	Primary answer		
	Follow up question	Primary answer		

Theme	**Key Question**	**Answers**		**Source of knowledge**
2.	How do you conserve seeds that are used for planting?	**Primary answer**		Handed down from parents/grandparents
				Learned from others within the community
				Extension officer
				Media (Radio, TV, Magazine, etc)

				Through personal experience/ experimentation
				Other
		Why		
	Follow up question How has this practice changed over time? Why?	Primary answer		
	Follow up question	Primary answer		
	Follow up question	Primary answer		

Theme	**Key Question**	**Answers**	**Source of knowledge**	
3.	How do you identify and choose	**Primary answer**		Handed down from parents/grandparents
				Learned from others within the community

	soil/land suitable for planting crops?			Extension officer
				Media (Radio, TV, Magazine, etc)
				Through personal experience/ experimentation
				Other
		Why		
	Follow up question How has this practice changed over time? Why?	Primary answer		
	Follow up question	Primary answer		
	Follow up question	Primary answer		

Theme	**Key Question**	**Answers**	**Source of knowledge**

4.	How do you prepare the land before planting?	**Primary answer**		Handed down from parents/grandparents
				Learned from others within the community
				Extension officer
				Media (Radio, TV, Magazine, etc)
				Through personal experience/ experimentation
				Other
		Why		
	Follow up question How has this practice changed over time? Why?	Primary answer		
	Follow up question	Primary answer		
	Follow up question	Primary answer		

Theme	Key Question	Answers	Source of knowledge	
5.	What methods or techniques do you use to manage soil so it remains productive?	**Primary answer**		Handed down from parents/grandparents
				Learned from others within the community
				Extension officer
				Media (Radio, TV, Magazine, etc)
				Through personal experience/ experimentation
				Other
		Why		
	Follow up question How has this practice changed over time? Why?	Primary answer		
	Follow up question How effective are these techniques in the process of	Primary answer		

	producing maize; How do you know?		
	Follow up question	Primary answer	

Theme	Key Question	Answers	Source of knowledge	
6.	What methods or techniques do you use to manage soil so it remains productive?	**Primary answer**		Handed down from parents/grandparents
				Learned from others within the community
				Extension officer
				Media (Radio, TV, Magazine, etc)
				Through personal experience/ experimentation
				Other
		Why		
	Follow up question How has this practice changed over	Primary answer		

	time? Why?		
	Follow up question How effective are these techniques in the process of producing maize? How do you know?	Primary answer	
	Follow up question	Primary answer	

Theme	**Key Question**	**Answers**		**Source of knowledge**
7.	Describe how you manage the crop after planting up to harvesting? (weeding, irrigating, draining, etc.)	**Primary answer**		Handed down from parents/grandparents
				Learned from others within the community
				Extension officer
				Media (Radio, TV, Magazine, etc)
				Through personal experience/ experimentation
				Other
		Why		

	Follow up question How has this practice changed over time? Why?	Primary answer	
	Follow up question	Primary answer	
	Follow up question	Primary answer	

Theme	**Key Question**	**Answers**		**Source of knowledge**
8.	What do you do when the plants are not growing well?	**Primary answer**		Handed down from parents/grandparents
				Learned from others within the community
				Extension officer
				Media (Radio, TV, Magazine, etc)
				Through personal experience/ experimentation

				Other
		Why		
	Follow up question How has this practice changed over time? Why?	Primary answer		
	Follow up question	Primary answer		
	Follow up question	Primary answer		

Theme	**Key Question**	**Answers**		**Source of knowledge**
9.	What do you do to prevent insects and diseases from affecting your	**Primary answer**		Handed down from parents/grandparents
				Learned from others within the community
				Extension officer

	maize?			Media (Radio, TV, Magazine, etc)
				Through personal experience/ experimentation
				Other
		Why		
	Follow up question How has this practice changed over time? Why?	Primary answer		
	Follow up question	Primary answer		
	Follow up question	Primary answer		

Theme	**Key Question**	**Answers**	**Source of knowledge**	
10.	What methods do you use to	**Primary answer**		Handed down from parents/grandparents

	harvest your maize?			Learned from others within the community
				Extension officer
				Media (Radio, TV, Magazine, etc)
				Through personal experience/ experimentation
				Other
		Why		
	Follow up question How has this practice changed over time? Why?	Primary answer		
	Follow up question	Primary answer		
	Follow up question	Primary answer		
Theme	**Key Question**	**Answers**	**Source of knowledge**	

11.	How do you conserve the crop/seeds after they are harvested?	**Primary answer**		Handed down from parents/grandparents
				Learned from others within the community
				Extension officer
				Media (Radio, TV, Magazine, etc)
				Through personal experience/ experimentation
				Other
		Why		
	Follow up question How has this practice changed over time? Why?	Primary answer		
	Follow up question	Primary answer		

	<u>Follow up question</u>	Primary answer	

Soil management system

Theme	**Key Question**	**Answers**				**Source of knowledge**
1.	When identifying and choosing land for planting maize, which soil properties do you use?	**Primary answer**				Handed down from parents/grandparents
			Colour	Explain how		Learned from others within the community
			Moisture	Explain how		Extension officer
			Depth	Explain how		Media (Radio, TV, Magazine, etc)
			Texture	Explain how		Through personal experience/ experimentation
			Other	Explain		Other
		Why				
	<u>Follow up question</u> How has this practice changed over time? Why?	Primary answer				

	Follow up question Which soil is good for maize production?	Primary answer	
	Follow up question	Primary answer	

Theme	**Key Question**	**Answers**		**Source of knowledge**
2.	How do you determine soil fertility? (Do you use visual inspection)	**Primary answer**		Handed down from parents/grandparents
				Learned from others within the community
				Extension officer
				Media (Radio, TV, Magazine, etc)
				Through personal experience/ experimentation
				Other
		Why		
	Follow up question How has this	Primary answer		

	practice changed over time? Why?		
	Follow up question	Primary answer	
	Follow up question	Primary answer	

Theme	Key Question	Answers		Source of knowledge
3.	What methods or techniques do you use to make soil productive if the soil is not fertile?	**Primary answer**		Handed down from parents/grandparents
				Learned from others within the community
				Extension officer
				Media (Radio, TV, Magazine, etc)
				Through personal experience/ experimentation
				Other
		Why		

	Follow up question How has this practice changed over time? Why?	Primary answer	
	Follow up question How effective are these techniques in the process of producing maize; How do you know?	Primary answer	
	Follow up question What kind of external help would you need to make the soil more productive	Primary answer	

Theme	**Key Question**	**Answers**		**Source of knowledge**
12.		**Primary answer**		Handed down from parents/grandparents
				Learned from others within the community
				Extension officer
				Media (Radio, TV, Magazine, etc)

				Through personal experience/ experimentation
				Other
		Why		
	Follow up question How has this practice changed over time? Why?	Primary answer		
	Follow up question	Primary answer		
	Follow up question	Primary answer		

Theme	**Key Question**	**Answers**	**Source of knowledge**	
13.		**Primary answer**		Handed down from parents/grandparents

				Learned from others within the community
				Extension officer
				Media (Radio, TV, Magazine, etc)
				Through personal experience/ experimentation
				Other
		Why		
	Follow up question How has this practice changed over time? Why?	Primary answer		
	Follow up question	Primary answer		
	Follow up question	Primary answer		

Theme	Key Question	Answers	Source of knowledge	
14.		**Primary answer**		Handed down from parents/grandparents
				Learned from others within the community
				Extension officer
				Media (Radio, TV, Magazine, etc)
				Through personal experience/ experimentation
				Other
		Why		
	Follow up question How has this practice changed over time? Why?	Primary answer		
	Follow up question	Primary answer		

	Follow up question	Primary answer	

Theme	Key Question	Answers	Source of knowledge	
15.		**Primary answer**		Handed down from parents/grandparents
				Learned from others within the community
				Extension officer
				Media (Radio, TV, Magazine, etc)
				Through personal experience/ experimentation
				Other
		Why		
	Follow up question How has this practice changed over time? Why?	Primary answer		
	Follow up	Primary		

	question	answer	
	Follow up question	Primary answer	

Theme	Key Question	Answers	Source of knowledge	
16.		**Primary answer**		Handed down from parents/grandparents
				Learned from others within the community
				Extension officer
				Media (Radio, TV, Magazine, etc)
				Through personal experience/ experimentation
				Other
		Why		
	Follow up question	Primary answer		

	How has this practice changed over time? Why?		
	Follow up question	Primary answer	
	Follow up question	Primary answer	

Appendix 2: Focus group discussion / questions

Indigenous Knowledge Maize Production Msinga

Agriculture calendar

Theme	**Key Question**	**Answers**		**Source of knowledge**
1	What are the agriculture activities undertaken in the year and when (i.e. month, week etc	**Primary answer**		Handed down from parents/grandparents
				Learned from others within the community
				Extension officer
				Media (Radio, TV, Magazine, etc)
				Through personal experience/ experimentation
				Other
		Why		
	Follow up question How has this practice changed over	Primary answer		

	time? Why?		
	Follow up question	Primary answer	
	Follow up question	Primary answer	

Maize production system

Theme	Key Question	Answers		Source of knowledge
2	How do you identify and choose maize seed suitable for planting?	**Primary answer**		Handed down from parents/grandparents
				Learned from others within the community
				Extension officer
				Media (Radio, TV, Magazine, etc)
				Through personal experience/ experimentation
				Other
		Why		

	Follow up question How has this practice changed over time? Why?	Primary answer	
	Follow up question	Primary answer	
	Follow up question	Primary answer	

Theme	**Key Question**	**Answers**		**Source of knowledge**
3	How do you conserve seeds that are used for planting?	**Primary answer**		Handed down from parents/grandparents
				Learned from others within the community
				Extension officer
				Media (Radio, TV, Magazine, etc)
				Through personal experience/ experimentation

				Other
		Why		
	Follow up question How has this practice changed over time? Why?	Primary answer		
	Follow up question	Primary answer		
	Follow up question	Primary answer		

Theme	**Key Question**	**Answers**		**Source of knowledge**
4	How do you identify and choose soil/land suitable for planting crops?	**Primary answer**		Handed down from parents/grandparents
				Learned from others within the community
				Extension officer
				Media (Radio, TV, Magazine, etc)

				Through personal experience/ experimentation
				Other
		Why		
	Follow up question How has this practice changed over time? Why?	Primary answer		
	Follow up question	Primary answer		
	Follow up question	Primary answer		

Theme	**Key Question**	**Answers**	**Source of knowledge**	
5	How do you prepare the land	**Primary answer**		Handed down from parents/grandparents

	before planting?			Learned from others within the community
				Extension officer
				Media (Radio, TV, Magazine, etc)
				Through personal experience/ experimentation
				Other
		Why		
	Follow up question How has this practice changed over time? Why?	Primary answer		
	Follow up question	Primary answer		
	Follow up question	Primary answer		

Theme	Key Question	Answers	Source of knowledge	
6	What methods or techniques do you use to manage soil so it remains productive?	**Primary answer**		Handed down from parents/grandparents
				Learned from others within the community
				Extension officer
				Media (Radio, TV, Magazine, etc)
				Through personal experience/ experimentation
				Other
		Why		
	Follow up question How has this practice changed over time? Why?	Primary answer		
	Follow up question How effective are these techniques in the process of producing maize; How do	Primary answer		

	you know?		
	Follow up question	Primary answer	

Theme	Key Question	Answers	Source of knowledge	
7	What methods or techniques do you use to manage soil so it remains productive?	**Primary answer**		Handed down from parents/grandparents
				Learned from others within the community
				Extension officer
				Media (Radio, TV, Magazine, etc)
				Through personal experience/ experimentation
				Other
		Why		
	Follow up question How has this practice changed over time? Why?	Primary answer		

	Follow up question How effective are these techniques in the process of producing maize? How do you know?	Primary answer	
	Follow up question	Primary answer	

Theme	**Key Question**	**Answers**		**Source of knowledge**
8	Describe how you manage the crop after planting up to harvesting? (weeding, irrigating, draining, etc.)	**Primary answer**		Handed down from parents/grandparents
				Learned from others within the community
				Extension officer
				Media (Radio, TV, Magazine, etc)
				Through personal experience/ experimentation
				Other
		Why		

	Follow up question How has this practice changed over time? Why?	Primary answer	
	Follow up question	Primary answer	
	Follow up question	Primary answer	

Theme	**Key Question**	**Answers**		**Source of knowledge**
9	What do you do when the plants are not growing well?	**Primary answer**		Handed down from parents/grandparents
				Learned from others within the community
				Extension officer
				Media (Radio, TV, Magazine, etc)
				Through personal experience/ experimentation
				Other

		Why		
	Follow up question How has this practice changed over time? Why?	Primary answer		
	Follow up question	Primary answer		
	Follow up question	Primary answer		

Theme	**Key Question**	**Answers**		**Source of knowledge**
10	What do you do to prevent insects and diseases from affecting your maize?	**Primary answer**		Handed down from parents/grandparents
				Learned from others within the community
				Extension officer
				Media (Radio, TV, Magazine, etc)

				Through personal experience/ experimentation
				Other
		Why		
	Follow up question How has this practice changed over time? Why?	Primary answer		
	Follow up question	Primary answer		
	Follow up question	Primary answer		

Theme	**Key Question**	**Answers**	**Source of knowledge**	
11	What methods do you use to	**Primary answer**		Handed down from parents/grandparents

	harvest your maize?			Learned from others within the community
				Extension officer
				Media (Radio, TV, Magazine, etc)
				Through personal experience/ experimentation
				Other
		Why		
	<u>Follow up question</u> How has this practice changed over time? Why?	Primary answer		
	<u>Follow up question</u>	Primary answer		
	<u>Follow up question</u>	Primary answer		
Theme	**Key Question**	**Answers**	**Source of knowledge**	

12	How do you conserve the crop/seeds after they are harvested?	**Primary answer**		Handed down from parents/grandparents
				Learned from others within the community
				Extension officer
				Media (Radio, TV, Magazine, etc)
				Through personal experience/ experimentation
				Other
		Why		
	Follow up question How has this practice changed over time? Why?	Primary answer		
	Follow up	Primary		

	question	answer	
	Follow up question	Primary answer	

Soil management system

Theme	Key Question	Answers			Source of knowledge	
13	When identifying and choosing land for planting maize, which soil properties do you use?	**Primary answer**				Handed down from parents/grandparents
			Colour	Explain how		Learned from others within the community
			Moisture	Explain how		Extension officer
			Depth	Explain how		Media (Radio, TV, Magazine, etc)
			Texture	Explain how		Through personal experience/ experimentation
			Other	Explain		Other
		Why				
	Follow up question How has this	Primary answer				

	practice changed over time? Why?		
	Follow up question Which soil is good for maize production?	Primary answer	
	Follow up question	Primary answer	

Theme	**Key Question**	**Answers**		**Source of knowledge**
14	How do you determine soil fertility? (Do you use visual inspection)	**Primary answer**		Handed down from parents/grandparents
				Learned from others within the community
				Extension officer
				Media (Radio, TV, Magazine, etc)
				Through personal experience/ experimentation
				Other
		Why		

	Follow up question How has this practice changed over time? Why?	Primary answer	
	Follow up question	Primary answer	
	Follow up question	Primary answer	

Theme	**Key Question**	**Answers**		**Source of knowledge**
15	What methods or techniques do you use to make soil productive if the soil is not fertile?	**Primary answer**		Handed down from parents/grandparents
				Learned from others within the community
				Extension officer
				Media (Radio, TV, Magazine, etc)
				Through personal experience/ experimentation
				Other
		Why		

	Follow up question How has this practice changed over time? Why?	Primary answer	
	Follow up question How effective are these techniques in the process of producing maize; How do you know?	Primary answer	
	Follow up question What kind of external help would you need to make the soil more productive	Primary answer	

Theme	**Key Question**	**Answers**		**Source of knowledge**
16		**Primary answer**		Handed down from parents/grandparents
				Learned from others within the community

				Extension officer
				Media (Radio, TV, Magazine, etc)
				Through personal experience/ experimentation
				Other
		Why		
	Follow up question How has this practice changed over time? Why?	Primary answer		
	Follow up question	Primary answer		
	Follow up question	Primary answer		

Appendix 3: Ethical clearance

UNIVERSITY OF
KWAZULU-NATAL
INYUVESI
YAKWAZULU-NATALI

Research Office, Govan Mbeki Centre
Westville Campus
Private Bag x54001
DURBAN, 4000
Tel No: +27 31 260 3587
Fax No: +27 31 260 4609
mohunp@ukzn.ac.za

26 April 2011

Ms A Nyiraruhimbi (210556936)
School of Agriculture Extension and
Rurual Resource Development
Faculty of Science and Agriculture
Pietermaritzburg Campus

Dear Ms Nyiraruhimbi

PROTOCOL REFERENCE NUMBER: HSS/0174/011M
PROJECT TITLE: Indigenous systematic approaches to Maize production and soil management in Msinga villages in KwaZulu-Natal province

In response to your application dated 18 April 2011, the Humanities & Social Sciences Research Ethics Committee has considered the abovementioned application and the protocol has been granted **FULL APPROVAL.**

Any alteration/s to the approved research protocol i.e. Questionnaire/Interview Schedule, Informed Consent Form, Title of the Project, Location of the Study, Research Approach and Methods must be reviewed and approved through the amendment /modification prior to its implementation. In case you have further queries, please quote the above reference number.
PLEASE NOTE: Research data should be securely stored in the school/department for a period of 5 years.

I take this opportunity of wishing you everything of the best with your study.

Yours faithfully

.....

Professor Steven Collings (Chair)
HUMANITIES & SOCIAL SCIENCES RESEARCH ETHICS COMMITTEE

cc. Supervisor: Dr S Worth
cc. Ms M Francis

1910 - 2010
100 YEARS OF ACADEMIC EXCELLENCE
Founding Campuses: Edgewood Howard College Medical School Pietermaritzburg Westville