

**EXPLORING THE RELATIONSHIP BETWEEN WATER
SCARCITY ON FOOD AND NUTRITIONAL SECURITY
IN RURAL HOUSEHOLDS IN THE NQGELENI
LOCATION, EASTERN CAPE**

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DECLARATION

I, Laura Novienyo Abla Dotse with student number (1272442), hereby declare that the dissertation for Master of Science (Geography and Environmental Studies) is my own work and it has not previously been submitted for assessment or completion of any postgraduate qualification to another University or for another qualification.

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Laura Novienyo Abla Dotse

DEDICATION

This dissertation is dedicated to my parents, Mr. and Mrs. Dotse, my husband, Felix Amoah and lovely children, Austin and Hans.

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I would like to thank the Almighty God for empowering and guiding me throughout the study. In particular, I would like to express my sincere gratitude and appreciation to the following.

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EXECUTIVE SUMMARY

After several years of political and economic successes made since 1994, South Africa continues to experience major challenges in water availability, increased poverty, high levels of unemployment and more recently, steep increases in food and fuel prices. The Eastern Cape Province of South Africa is one of the regions that have been negatively affected by changes in climate variability, thereby, increasing the vulnerability and subjecting a significant number of households to increased poverty; water scarcity and food insecurity. The situation continues and there is a need to address this.

This study sought to understand how the local households in the Eastern Cape Province in Nqgeleni location adapt to the extreme drought which impacts on their livelihood by exploring the different adaptive measures or systems that are implemented to cope with the climatic conditions in uplifting and providing food and nutrition security for sustainable growth and development.

The primary aim of this research was thus to investigate how water scarcity influences food and nutritional security on rural household in Nqgeleni location. To achieve this aim, three secondary objectives were formulated. Firstly, to establish the relationship between water scarcity on food and nutritional security of rural households in Nqgeleni location. Secondly, to identify the drivers of water scarcity in the area. Lastly, to create an inventory of coping mechanism employed by rural households with water scarcity, food and nutritional security.

An extensive literature review was undertaken to integrate prior findings and theories on water scarcity, food and nutritional security. The literature study revealed that water scarcity has a significant impact on food security. In addition, several factors such as demographic profile variables (population growth) and structural inefficiencies (infrastructure and management) were identified as potential drivers of water scarcity.

In order to address the objectives set for this study, a number of items were sourced from the literature and a structured questionnaire administered to respondents who were selected by means of a simple random sampling technique. Data was collected from 111 usable questionnaires. The mixed method approach was employed as a core research methodology. The responses obtained were subjected to statistical analyses. Cronbach-alpha coefficients were calculated to confirm the internal consistency of the measuring instrument.

The findings from this study are thus as follows. There was a significant relationship between water scarcity, food and nutritional security. Food security also has an impact on nutritional security. In addition, the drivers of water scarcity found in this study includes population growth, lack of infrastructure and poor management of water related issues by the municipality; all of which confirm findings in other studies. Furthermore, a number of respondents profile variables were identified as contributing factors to poverty, vulnerability, water scarcity, food and nutritional security in the Nqgeleni location. This includes lack of education, size of the household, and income level of the household.

Based on the above findings, an inventory of coping mechanism was recommended to assist the rural households deal with water scarcity, food and nutritional security. This study has added to the empirical body of water scarcity, food and nutritional security in South Africa and the world at large.

KEYWORDS: Water scarcity; Food security; Nutritional security; Eastern Cape; Nqgeleni location; South Africa

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CHAPTER ONE

FRAMES OF REFERENCES

1.1. INTRODUCTION

There is a growing global concern regarding the future of the world's water resources due to the increasing human pressure on the intricate and finite water resource which has led to water resources scarcity (Taha, 2010). The problem of water scarcity is expected to increase significantly in the coming years, unless a sustainable awareness of resources management emerges (Ayenew, 2007). According to Förch and Thiemann (2004), water resource is not only a basic need, but is also a center-piece of sustainable development and a crucial part of poverty alleviation. The Dublin Principles and the Earth Summit's Agenda 21, (Global Water Partnership, 2000) also emphasise the need for integrated water management, recognising water as one of a number of natural resource elements that needs to be managed in a sustainable manner (Figueraes, Rockstrom & Tortajada, 2003).

According to the United Nations Development Program (UNDP, 2006), one-sixth of the world's people get drinking water from unapproved sources, and in many developing areas, progress in expanding clean water coverage is few. In Sub-Saharan Africa, the proportion of the population that depends on unapproved sources has dropped from 52% in 1990 to 44 percent in 2004 (UNDP, 2006). The unavailability of safe drinking water in most rural locations in South Africa is one of the main causes of diarrhoea among children under the age of five. The negative health impact of contaminated water is exacerbated because more than 90 percent of households consume this water untreated (CSA, 2006).

According to Conway (2012), food is a fundamental human need and efforts to secure this food have been intimately interwoven with the evolution of many societal structures such as laws and regulations, customs and ceremonies, and

trade and commerce arrangements. Conway (2012), highlighted that, food can reveal relationships between the past and the present, reflect epochal transformation, and mark changing identities of various groups of people through new ways of appropriations. The continued increase in demand for irrigation water over many years has also led to changed water flows, land clearing and therefore deteriorated stream water quality (Khan & Hanjra, 2009). Addressing these environmental concerns and fulfilling urban and industrial water demand will require diverting water away from irrigation. This will reduce irrigated area and its production and impact on future food security.

The challenges of water scarcity are worsened by the increasing costs of developing new water sources (Hanjra & Gichuki, 2008), land degradation in irrigated areas (Khan & Hanjra, 2008), groundwater depletion (Shah, *et al.*, 2008), water pollution (Tilman *et al.*, 2002), and ecosystem degradation. With current water utilization practices, a fast growing population, and a nutritional transition towards diets that rely more on meat (Popkin, 2006), global water resource limits will be reached sooner. In Sub-Saharan Africa (SSA), there is a growing concern over water resources. This situation is serious in shared drainage basins where political conflicts has heightened (McCartney, 2000) and it is not any better in South Africa because the problem has persisted over the past 30 years.

Another concern regarding the impact of water scarcity relates to agriculture. There are about 80% of populations that were involved in farming in the Southern African region (Odhiambo, 2013) but agricultural productivity remains low in the region due to a variety of reasons including water scarcity. This has affected food and nutritional security over the years. Water scarcity is therefore, a major threat to food and nutritional security (Postel, 2008).

1.2. STATEMENT OF THE PROBLEM

After several years of political and economic successes made since 1994, South Africa continues to experience major challenges in water availability, increased

poverty, high levels of unemployment and more recently, steep increases in food and fuel prices. The Eastern Cape Province of South Africa is one of the regions that have been negatively affected by changes in climate variability thereby increasing the vulnerability and subjecting a significant number of households to increased poverty; water scarcity and food insecurity. These adverse conditions have placed ordinary South Africans, already struggling to meet their basic household needs, in an ever more vulnerable situation (Labadarios, *et al.*, 2009). Surprisingly, these problems are becoming increasingly visible in most of the rural communities in the province. Furthermore, most rural communities in the Eastern Cape are plagued by a severe lack of infrastructure, a shortage of water and local employment opportunities. This has led to high levels of migration, as well as grossly inadequate educational and health facilities, not to mention probably the worst administrative inefficiency in the country (Statistics South Africa, 2010).

According to The South African Index of Multiple Deprivation (Wright & Noble, 2009), the Eastern Cape Province has the highest proportion of the population living in households that are income and/or materially deprived, as well as the highest rate of employment deprivation, and the second highest proportion of the population experiencing living environment deprivation. It is therefore not surprising that Greg Ruiters calls the Eastern Cape the “most stressed” and the “most deprived” province in South Africa (2011). Those most adversely affected are usually the rural poor, in particular women, the elderly and young children. Furthermore, the Eastern Cape has the third largest number of HIV-positive people in the country, and the epidemic continues to grow rapidly (Nicolay, 2008). HIV/AIDS is known to have an adverse effect on the food security status of households (de Klerk, *et al.*, 2004).

Reports from the General Household Survey of 2009 indicates that 21.4% of households in the Eastern Cape have either ‘severely inadequate’ or ‘inadequate’ access to food, and 92.6% of the agricultural production in the province is for household consumption, not the market. In addition, 26.4 % of households in the Eastern Cape receive social grants. The Eastern Cape is also

the province with the lowest percentage of households with a connection to the mains electricity supply (69.8 %) and (75 % of households) have the poorest access to piped water (Statistics South Africa, 2014).

Nqgeleni, a town in the Eastern Cape province of South Africa is no exception to the problems stated above. The area is characterized by high long-term unemployment and poverty. The area is also faced with infrastructure backlogs (e.g. water, electricity and good roads) and fewer job opportunities. As a result, the majority of them are beneficiaries of the government welfare programmes like taking of grants. The main form of livelihood in this location is subsistence agriculture. Few are formally employed. Occupation of the people changes with the season, mainly depending on the availability of water. Fraser, et al. (2003) found that agricultural activities are vulnerable to climate change and this put the lives of the poor at risk. Since agricultural production is mostly dependent on rainfall, extreme drought or excess rainfall may have significant impact on the local people to produce their vegetables and also in maintaining their home gardens. When there is more or less rain, it will show in their harvest. In contrast, if the foodstuffs quality is lacking, this will have an effect on their health as well.

In view of the above mentioned problems, this study investigated how the local households in the Eastern Cape Province in Nqgeleni location adapt to the extreme drought on their livelihood by exploring the different adaptive measures or systems that are implemented to cope with the climatic conditions in uplifting and providing food and nutrition security for sustainable growth and development.

1.3. RESEARCH QUESTIONS

In view of the above problems at Nqgeleni, the following questions were developed to guide the research process

- i. In what ways does water scarcity affect food and nutritional security of the rural households in Nqgeleni location?

- ii. What factors contribute to increasing scarcity of water resources in the study area?
- iii. In what ways does the local population cope in response to the increasing water scarcity on food and nutritional security in the study area?
- iv. What is the extent of food insecurity amongst the rural households and what coping strategies are adopted?

1.4. RESEARCH AIM AND OBJECTIVES

The aim of this research project was to investigate how water scarcity influence food and nutritional security on rural household in Nqgeleni location. To achieve this aim, the following specific objectives have been identified:

- i. Establish the relationship between water scarcity, food and nutritional security of the rural households in Nqgeleni location.
- ii. To identify the drivers of water scarcity in the area.
- iii. To create an inventory of coping mechanism applied by rural households in addressing water scarcity, food and nutritional security.

1.5. THEORETICAL CONSIDERATIONS AND LITERATURE REVIEW

In South Africa, water is becoming a scarce resource and a crucial one; particularly because both people and industries need water and electricity for their survival. However, moving water over long distances from dams or rivers to sustain lives and people living in rural areas and towns is no easy task, due to the fact that such dams are not conveniently located (Stone, 2009). This section presents the theoretical approach to water scarcity, food and nutritional security. The concepts will be discussed below.

Water scarcity is a global problem and has affected farming and other socio-economic activities over large parts of the world. One region in Africa where water scarcity has been severe over decades of year is the Sub-Saharan Africa. This region records one of the most severely affected countries of water scarcity in the world (Asim, Vains, Yousaf & Ramzan, 2012). This has affected

food production in the region and it is estimated that the problem will persist and cause hardship in the next five years (Asim *et al.*, 2012). For example Mozambique is a country that has experienced acute water shortage. In 1981-85 and further in 1991-1992, the country suffered the worse water shortage which had a direct impact on the rural population, subsistence farming, and resulted in food insecurity (Midgley, Dejene & Mattick, 2012).

While approximately three quarters of the earth is covered by water, only a small proportion is available as freshwater. Of the available fresh water supplies, nearly 70% is withdrawn and used for irrigation to produce food and the demand just keeps growing (United Nations, 2007). Water scarcity should not simply be limited to its definition as its significance goes beyond several key factors such as the health or economy or even population growth. Water is the input that serves in the production of goods and services by a particular business or within the government directly and indirectly (Peterson & Kepler, 2007). The utilization of water also contributes to the effectiveness of a country and the economical scarcity of a country. Urban areas and agricultural areas are recycling and sharing the same water sources without any form of filter or sanitary devices, particularly in African countries (Molle & Berkoff, 2009). Based on the positive outcomes of available water supply on one side and the potential challenges with water scarcity on the other side, there is the need for a global strategy to ensure that fresh water is constantly available for the population.

Food security as defined by Hendriks and Msaki (2009) is a situation where all people have physical, social and economic access to sufficient, nutritious, healthy and safe food at all times to meet their daily food dietary needs and preferences. Averbek and Khosa (2007) indicated that, household food security should be adequately accessed by all household members at all times to promote a healthy and productive life. On the other hand, FAO, (2010) shows that 'food security exists when all people, at all times, have physical and economic access to sufficient, safe and nutritious food to meet their

dietary needs and food preferences for an active and healthy life'. The proposed study adopted the definition by both Hendriks and Msaki (2009) and FAO (2010). In contrast, nutrition security refers to access to an appropriately nutritious and or balanced diet to ensure a healthy and active life for all household members (FAO, 2012). Agriculture is an important sector that promotes food security, rural development and poverty eradication.

1.6. SOUTH AFRICA'S FOOD SECURITY CONDITION

South Africa produces enormous food to feed its population, but experiences rapidly increasing rates of household food insecurity (Van der Berg, 2006). Although employment has risen in the country, it has not attained the level where it can significantly address the issue of income poverty (Aliber, 2009). Even though, the national government provides social grants which help to minimize the rate and effect of food insecurity within the country, 40-50% of South Africans live in poverty (Machethe, 2004 citing Terreblanche, 2002). Approximately, 35% of the total South African population experience hunger and under-nutrition and majority of them are children, women and the elderly (Hawkes & Ruel, 2011). Recently, prices of wheat and maize, which form part of the staple foods in South Africa, have increased in world markets (Heady & Fan, 2008). This development worsens the food insecurity condition as households now faces more difficulties in procuring food items from their earnings.

Heady and Fan (2008), highlighted what the Food and Agriculture Organisation (2009) pinpointed that landless and female-headed households, from both the rural and urban poor, constitute the major groups most affected, and this situation is likely to persist over the next decade. Other factors contributing to the food insecurity situation of South African households are increases in the cost of electricity and oil prices. The electricity price is set to increase by 100% between 2008 and 2011. Regular increases in oil price resulted in higher prices for food items and fertilizer, the production of which petroleum forms an indispensable input. The cost of transportation also increases, forcing food

prices to increase proportionately (Altman, *et al.*, 2009). The World Bank (2010), gave an estimation in 2008 that, 39.26% of the total South African population lived in rural areas. Further, 65% of those identified as "poor" and 78% of those identified as "chronically poor" reside in rural environments. These statistics suggested that interventions to combat food insecurity in South Africa should be largely directed to rural communities (Woolard & Leibbrandt, 2010).

1.7. RESEARCH METHODOLOGY

This section outlined the area under investigation, sampling procedures, data collection and data analysis used.

(i).Paradigmatic assumptions and perspectives

Maree and van der Westhuizen, (2007) argue that "Research is about understanding the world, and one's understanding is informed by how you view the world, what you view understanding to be and what you see as the purpose of understanding". Researchers incorporated different types of paradigms, namely: positivism, post-positivism, constructive-interpretivism and critical-ideological perspectives to conceptualise guide and classify research (Ponterotto, 2005). The paradigm not only forms a set of basic beliefs, but also a set of interrelated assumptions about the social world and provides a philosophical and conceptual framework.

Basic paradigm beliefs not only guide the investigation in terms of choices of design and method but also in its ontology (nature of reality and being) and epistemology (nature and scope of knowledge) (Saunders *et al.*, 1997). The ontological perspectives involve asking what the researcher sees as the very nature and essence of things in the social world (Mason, 2003). The epistemological position of the researcher (what is regarded by the researcher as knowledge or evidence of things in the social world), is based thereon that views, perceptions and the constraints which result there from, are "knowable

and it is possible to generate knowledge about the evidence for them” (Mason, 2003). These three perspectives will guide the researcher in the current study to arrive at a conclusion that is reliable.

This study made use of both quantitative and qualitative research methods. The mixed approach involves collecting both quantitative and qualitative data (Creswell, 2012). One of the strengths of the mixed approach is that it provides a more complete understanding of a research problem than employing either approach in isolation. This method was appropriate for the current study because it assisted in offsetting the individual limitations associated with qualitative and quantitative approaches. Moreover, this method has been selected to enable the researcher answer the same research questions but in different ways from different angles. This research method is also referred to as concurrent triangulation (Creswell 2014, Welman 2005, Morgan 1998).

1.8. RESEARCH DESIGN

To gather qualitative and quantitative data for analysis and interpretation to answer the research questions and to obtain the current situation concerning the relationship between water scarcity on food and nutritional security at Nqgeleni location, the study used both descriptive and exploratory research designs. The exploratory research was used to study events, issues, or problems about what has not previously been studied and attempts to identify knowledge, insights, understanding, and meanings to explore factors related to the topic. Next, the purpose of descriptive research was to provide the perceptions and views of the respondents about the phenomenon studied (Babbie, 2011).

(i). Description of the study area

Nqgeleni is located approximately 27 km west from Mthatha. It has a population of about 1334 people and there are about 415 households in the area and the place is partly overcrowded (Statistics South Africa, 2011). It is predominantly a rural district depending on subsistence farming. It falls under

the Nyandeni Municipality in the Eastern Cape Province. Nqgeleni location faces severe problems when there is either too little or too much rain because when there is little rain, food crops suffer and when there is too much rain, it also turns to destroy a lot of crops and this bring diseases to the community as it took time for the rains to come. These will affect food and nutritional security, health and employment of the rural Nqgeleni location.

Nqgeleni, which lies between Mthatha and Libode, has a fair climate and the temperatures ranges between 10 and 35 degrees in summer. In winter temperatures are very cold. There is less rain in winter making most areas very dry during that season. While the rain is welcomed by the villagers to boost their crops, the rain also brings death as human and animal faeces are washed into and contaminate various water sources. Dry periods also draw cattle to the drinking sources, causing contamination.

(ii).Target population and sampling procedure

According to STATS SA Census (2011), there are about 415 households in Nqgeleni location with a population of about 1334 people (Statistics South Africa, 2011). A target population is a group of potential participants that the researcher intends to use to generalise the results or achieve the objectives of the study (Houser, 2008). The target population for the current study consisted of two groups of respondents: subsistence farmers and residents from the location with different occupations.

The fundamental objective of sampling was to identify the unit of analysis, the target population and sampling frame, as well as appropriate sampling techniques (Welman, *et al.*, 2009). Researchers often use non- probability sampling or a probability sampling in selecting the target population (Creswell, 2014). Non-probability sampling is recommended when a complete list of members of the population that would be included in the study is normally not available (Babbie, 2011). On the other hand, a probability sampling procedure is ideal when the researcher has established the population in the chosen study

area and can determine the population that will be included in the study (Creswell, 2014). Considering the nature of this study and the objectives set, the study employed the simple random sampling procedure (probability sampling) to select the target population.

A total of 30% samples size of 125 were drawn from the 415 sampling households of the population in Nqgeleni rural area. This was done by counting five households from the first household that was sampled until the total number of 125 samples is reached. The researcher also conducted in-depth interviews with two officials at the government level. Key informants were from the Department of Water Affairs, Department of Agriculture, and a community leader who has firsthand knowledge about the community was also interviewed. This was an attempt to solicit information on the problem of water issues and the relationship between agriculture in Nyandeni local Municipality which will help in the study

(iii). Data collection procedures and instruments

In order to identify, assess and achieve the research objectives, the researcher used multi-disciplinary approach in this study to collect data. In-depth interviews, Observations and questionnaires were some of the approaches that were used to collect data.

a).Interviews

One of the data collection methods utilised by the researcher is structured interviews. Two official from the government departments, thus (Department of Water Affairs and Department of Agriculture), and one community leader from the area were interviewed for the study. This was done in order to receive the views and in-depth understanding of water services delivery issues and how these affect agriculture products within the Municipality.

b).Questionnaires

A self-administered paper based questionnaire was also used to collect data. In addition, the questionnaire was structured to accommodate both open-ended and close-ended questions. Open-ended questions are questions that allow the respondent to freely express their opinion. By contrast, close-ended questions allow respondents to choose from a range of answers (Babbie, 2010).

c).Observation

Direct observations were also used to collect data. The researcher observed the way of life of the people in Nqgeleni in terms of their livelihood approaches, for example, when some respondents were going to fetch water from the river, the researcher used observation to obtain data. Through observation, the researcher was able to obtain data pertaining to how people fetch water from the river in the location and the nearby village for their household uses.

This helps to clarify the researcher's understanding of the practical constraints and possibilities, and also to create a basis for understanding the background for the corporative and conflictive events that is taking place in the study area. Observation also enabled the researcher to gather information to validate the data acquired through the interviews (dialogue). Plate 1 shows one of the streams from which the people in the location obtain water.

PLATE 1

CHILDREN COLLECTING WATER FROM A STREAM IN THE LOCATION



(SOURCE: AUTHOR'S OWN).

1.9. DATA ANALYSIS

A structured questionnaire, focus group interview, and observations were used to obtain needed information from respondents. Thereafter, attempt was made to find common themes from the responses provided. Both descriptive and inferential analysis was used in the present study. After the data has been collected, the data was captured on a computer excel sheet and a Statistical Package for Social Sciences (SPSS) version 19.0 was used to analyse the data.

As emphasised the current study attempted to establish whether there is a relationship between water scarcity on food and nutritional security. The Pearson Product Moment of correlation analysis was used to establish whether there is a relationship that exists between the constructs (Keller, 2008).

1.10. ETHICAL CONSIDERATION

Ethical consideration is defined by Creswell (2014) as the obligation that the researcher should have to respect the rights, needs, values and desires of respondents who participate in the study. The following ethical considerations were observed during the data collection process.

- The researcher obtained necessary permission from the respondents after thoroughly and truthfully informing them about the purpose of the interview and the investigation.
- The respondents were assured the participants that information provided would remain confidential.
- The researcher ensured that the respondents participate voluntarily and thus the respondents have the right to withdraw at any time, so that the individual is not being forced into participating.
- The respondents were also given the right to ask questions, obtain further clarity to the questions, and indicate the purpose of the study, so that the respondents understand the nature of the research and its likely impact.

A detailed discussion of the ethical considerations observed in this study is provided in section 3.8 of this study.

1.11. ORGANISATION OF THE THESIS

This dissertation comprised of six chapters. **Chapter one** focuses on frames of reference and addressed the research aims, objectives, research problem and significance of the study. **Chapter two**, a theoretical considerations and literature review is furnished on water scarcity, food and nutritional security. The methodological considerations are discussed in **Chapter three**. This comprises the methods that were employed in collecting the data for the research. In **chapter four**, the empirical evidence is presented for the study. **Chapter five**, the results obtained through this study are presented with a detailed discussion thereof and **Chapter six** reports on the concluding discussion, findings, and the recommendations for future studies.

CHAPTER TWO

THEORETICAL CONSIDERATIONS AND LITERATURE REVIEW

2.1. INTRODUCTION

This chapter is dedicated to a discussion on literature review. Emphasis will be on engaging with contemporary literature that has examined the relationship between water availability, food and nutritional security. Furthermore, various concepts which will often be mentioned in this study will be clarified, and finally highlighting the gaps that exist within the body of contemporary literature on water scarcity, food and nutritional security.

To achieve the core aims mentioned above, the chapter is structured into the following sections. Section 1 will be used to define key concepts of the study; Section 2 will address the literature on the relationship between water availability, food production and nutritional security. Section 3 will be used to explain the implications of water scarcity on food and nutritional security. Finally, the summary and conclusion of the Chapter will be provided in Section 4.

2.2. DEFINITION OF KEY CONCEPTS

The following key concepts are defined in order to eliminate misunderstanding about the conceptualization of terms that will often be used in the study.

(i). Water Scarcity

According to Falkenmark (2007), "Water scarcity refers to a situation where there is insufficient water to satisfy normal human water needs for food, feed, drinking and other uses, implying an excess of water demand over available supply". In the current study, water scarcity is defined as a period of little or no water.

(ii). Food Security

Food security exists when all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life (FAO, 2010). In the context of the current study, food security may be viewed from macro and micro perspectives. The macro level refers to large players such as governments and regional bodies, while the micro level refers to households.

(iii). Nutrition Security

Nutrition Security is defined as adequate nutritional status in terms of protein, energy, vitamins, and minerals for all household members at all times (Quisumbing, 1995). For the current study, nutrition security refers to people with all dietary intakes in the right proportion that is needed by the body.

2.3. WATER SCARCITY, FOOD AND NUTRITION SECURITY: A GLOBAL SITUATION

It has been more than 13 years since delegates from more than 189 countries, including South Africa; met and agreed on the universal declaration to eradicate extreme poverty and hunger by 2015 in Rome, Italy. These countries have been mandated to monitor their own progress with the assistance from the United Nations offices (Shoaf Kozak, *et al.*, 2012).

Across 47 countries of sub-Saharan Africa, scientific evidence reveals that economic growth has been observed for the period of 2000–2009 (Charmes, 2012); particularly in countries with relatively stable political systems (Spiess, *et al.*, 2013). However, high rates of unemployment and food insecurity, skewed economic structure, limited basic infrastructural facilities in all sectors of the economy and chronic poverty continue to govern the African region (Ikenna, 2009; Oni, *et al.*, 2011; Sasson, 2012). In 2006, the Food and Agriculture Organisation (FAO) outlined that sub-Saharan Africa is the region with the highest percentage of people suffering from serious hunger and living

on less than US\$1 per day (FAO, 2006; Shoaf Kozak, *et al.*, 2012). For instance, the situation is worst in other parts of Africa such as Malawi where 74% of the population lives on less than US\$1.25 a day, according to the International Federation of Red Cross and Red Crescent Societies (IFRCRCS, 2013). According to Lorenzana and Mercado (2002), nations, regional and local governments in developing countries are working together to resolve problems of poverty, food insecurity and malnutrition since the World Food Summit declaration of 1996. From a global perspective, an estimated 2 billion individuals are affected by the declining access to fresh water. This has often resulted in the reduction of food production, which affected human health and slowed economic growth (Brels, Coates & Loores, 2008).

To have a good water resource management practice, water resources should be adequately allocated to each of the demanding sectors (Taigbenu, Ncube & Boroto, 2010). This is not the case in Nqgeleni location, as the demand for water for agriculture is not being met. The Department of Water Affairs (2012), has been able to reduce water supply backlogs in South Africa from 41 percent to 50 percent during the past 18 years. Despite these impressive efforts, there are still several communities lacking potable water in Eastern Cape. These water backlogs are more obvious in the rural areas of Eastern Cape, which covers about 60 percent of the province's land mass.

Eastern Cape is traditionally known to be the major province dealing with agricultural produce but with an insufficient water supply for agricultural purposes. Water shortage has been a major constraint on development in this sector (World Wildlife Fund, 2011), as water is the life blood of agriculture. The shortage of water over the years has undoubtedly adversely affected rural development, as water supply is important for farming. Water is a shared resource that interconnects the environment, food security, the generation of energy and many other sectors. Lack of water stifles socio-economic growth of any country (FAO, 2012). Water is an important resource in all sub-sectors in the economy as well as a life supporting resource. Water is one of the most basic human needs; with impacts on agriculture, energy, health, and

livelihoods. The impending water crisis as a result of water scarcity is being recognized as a growing concern for many countries around the globe. For instance, the World Economic Forum warns that “water security (whether it be the challenge of too little water over long periods of time, or too much water all at once) is one of the most tangible and fastest-growing social, political and economic challenges faced today. It is also a fast-unfolding environmental crisis. In every sector, the demand for water is expected to increase and suggests that the world will face a 40% global shortfall between forecast demand and available supply by 2030” (World Economic Forum, 2012).

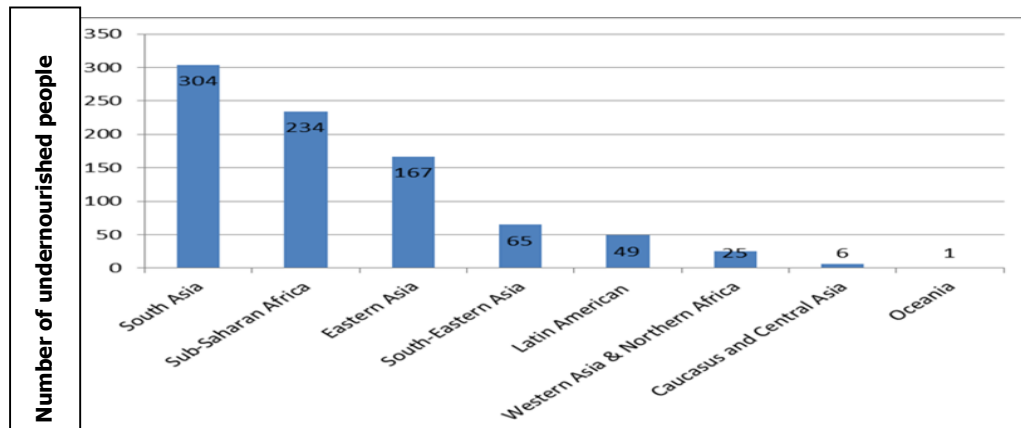
According to the United Nations Development Report (2003), water is critical for food production. Providing water for productive uses can enhance people’s livelihood options by making significant additions to household food security and nutrition while generating income as well. Bonti Ankoma (2001) defines food security as access by all households at all levels to adequate safe and nutritious food for a healthy life. South Africa produces sufficient food, but this does not in any way ensure food security at individual household level. According to Matla (2008), access to food depends on the adequate stable local food supply, which is influenced by many interacting factors. The most frequent factors are access to land, livestock ownership, food garden availability, accessible to safe water supply, access to food shops, stable climatic conditions and cash (income). Food security can be divided into two components which are, the ability to be self-sufficient in own food production and second the ability to purchase food items. Ensuring access to food security at household level depends not only on secure food supplies, but also on stable demand and purchasing power (FAO, 2009).

As a measure to monitor sustainable food security; the FAO has been tracking the progress of a number of undernourished people across 152 developing countries over the last 13 years (FAO, 2006). A recent report reveals that the number of undernourished people remains absolutely higher than 40 years ago and it could increase in the near future (FAO, 2012; Sasson, 2012). World-

wide between 868 and 925 million people were chronically undernourished in 2010–2012 due to extreme poverty. In this number, it has been scientifically acknowledged that the vast majority of undernourished people live in developing countries, particularly in sub-Saharan Africa (Bashir & Schilizzi, 2013; FAO, 2012; Meade & Rosen, 2013; Rosen, *et al.*, 2012; Shoaf Kozak, *et al.*, 2012), most of them in rural areas and in outright poverty (FAO, 2013). It has also been documented that these people depend directly or indirectly on agriculture for their livelihoods and food entitlements (Bashir & Schilizzi, 2013; Meade & Rosen, 2013).

Research studies in South Africa have shown that the role played by agriculture towards poverty reduction and achieving food security is imperative and effective (Machethe, 2004; Kyei & Gyekye 2011; Musemwa, *et al.*, 2013). There are many examples of food insecurity in sub-Saharan Africa and some of them have reached chronic and catastrophic dimensions (Sasson, 2012). Therefore, various scholars argue and emphasise that various programmes targeted to alleviate poverty and food insecurity should be developed (e.g. Omotesho, *et al.*, 2010). However, this is not to say that those that have been implemented are not achieving their objectives.

FIGURE 2.1.DISTRIBUTION OF NUMBER OF UNDERNOURISHED PEOPLE (MILLION)



Source: Food and Agriculture Organisation (2012)

Figure 2.1 presents the most widely cited food insecurity figures for “undernourishment” generated by the FAO and derived from recent national-level food balance sheets (Barrett, 2010). Based on this estimation, developing countries account for 98 per cent of the world’s undernourished people. These figures clearly show that food insecurity is a concern world-wide. Most of the countries particularly in sub-Saharan Africa are trying various food security programmes to mitigate the situation (Mwale, *et al.*, 2012). Akerele, *et al.* (2013) argue that policy-makers need to pay more attention to the undernourished people because they have the potential of transforming a nation into a developed state, but due to their nutritional deficiencies this remains a challenge. That is why the countries that met in Rome agreed that eradicating extreme poverty and hunger should be the first objective to accomplish the achievement of food security for all (FAO, 1996, Lorenzana & Mercado, 2002). Regions such as East Asia and the Pacific have achieved Sustainable Development Goals (SDGs) 1 by decreasing the proportion of people living under extreme poverty from 54.7% to 16.8% between 1990 and 2005 (Shoaf Kozak, *et al.*, 2012).

Given the current food security status presented in Figure 2.1, the complexity of food security and the range of factors (e.g. water scarcity) that affect food supply, many scholars now conclude that many countries will not achieve MDG

1 by 2015, particularly countries located in South Asia, Latin America, the Caribbean and sub-Saharan Africa (FAO, 2006, 2012; de Graaff, *et al.*, 2011; Sasson, 2012; Shoaf Kozak, *et al.*, 2012; Margulis, 2013). For many years, Africa has been looking for various alternatives to solving these fundamental challenges (Omotesho, *et al.*, 2010). However, empirical evidence shows that sub-Saharan Africa would remain the most vulnerable and food insecure region even in the next years, (Smith, *et al.*, 2000; Meade & Rosen 2013) unless some drastic measures are taken to ensure peace, improve governance and achieve the economic development required to reverse the current trend (FAO 2006; Turyahabwe *et al.*, 2013). Food security can be described as being multifaceted, as it consists of various concepts and determinants including those that fall into the environmental, social and economic spheres (Arshad & Shafqat, 2012).

To clarify the concepts of food security as well as the determinants of food security, Ericksen (2007) uses the term food systems which additionally combine the pillars of food security. The Food and Agricultural Organization (FAO) suggests that food security is based on pillars or consists of dimensions (FAO, 2006). Although the term to describe the foundation on which food security is based differs, Erickson's food systems and the pillars suggested by the FAO (2006) are similar in content. Each bases the notions of food security on three main concepts: food availability, accessibility and utilisation. An additional concept is often but not always included as a fourth pillar namely, stability. For the purpose of this study, the pillars and dimensions of food security will be used as a concept rather than food systems.

To further elaborate on food security, Tomlinson (2013) argues that "hunger, starvation and malnutrition are a problem of global food security" and solving them needs a better global food system". This implies that over-emphasizing a supply-side approach to addressing future food needs could prove disastrous, as this only addresses the challenge in part. By implication, food security cannot be treated as a short or medium term challenge but could be

devastating for future generations given the damning effects of water scarcity (Tomlinson, 2013). Sebola (2000), conducted a research in his masters dissertation titled, "The water supply schemes, scarcity and development projects. A case of Taaiboschgroet, Northern Province." This research found that water scarcity in the Taaiboschgroet village impacted negatively on both the gardening and the brick making projects. It is common knowledge that projects such as gardening and brick making demand a lot of water for survival. These projects provided employment for some people in the Taaiboschgroet village but collapsed because of water scarcity. The collapse resulted to unemployment for the people who earned a living from these projects. The livelihood of the community in this village was negatively affected due to water scarcity. This study may even probe the existence of local economic livelihoods that some rural households in Nqgeleni may be depending on for a living. These may include even the backyard vegetable gardens that some families might be depending on before the problem of water scarcity. It is commonly known that backyard or subsistence gardens may reduce poverty to a certain degree. Subsistence farming is defined as "the production of sufficient food and fiber to satisfy the needs of the farming family". It was a common practice in the past where large numbers of farmers produced only what they required. They collected fuel and building materials in their community and played little part in the cash economy (Spedding, 1979 cited in Wim Van Averbeke, 2008).

According to Goldchild (2011), subsistence farming is a localised form of agriculture which requires primitive or less-advanced farming tools. He adds that subsistence farming has three basic characteristics. Firstly, it deals with less-advanced technology. Secondly, subsistence farming is expected to be water-efficient. This implies that the municipality is not expected to provide water for this form of farming. Thirdly, subsistence farming mainly deals with a vegetarian way of life. Subsistence farmers often focus on crop production and are hardly involved in animal rearing. The Department of Agriculture, Forestry and Fisheries (DAFF) further expounds that the main features of subsistence farming revolve around crop production, stock rearing and similar

activities for (farmer's) household's consumption. However, these activities are characterised with uncertainty and low productivity. According to Spedding (1979 cited in Wim Van Averbeké 2008), subsistence farmers produce mainly for household consumption and not for sale. However, Janvry and Sadoulet (2011) are of the opinion that subsistence farmers sell some of their produce. They identified the production of sufficient food to feed the household as the primary objective of subsistence farming, while earning some cash income and accumulation of savings were secondary. Calzadilla, Zhu, Rehdanz, Tol and Ringler (2013) argue that subsistence farming plays a vital role amongst the rural populace, particularly in the former homelands. Calzadilla, et al. (2013) assert that more than 37 per cent of the rural populace is gainfully employed through this mode of farming. In addition, they highlighted that women who were older than their counterparts were working as subsistence farmers in the formal and informal sector of the former homelands in South Africa.

According to Challenge 20/20, (NYP), "the predicament of water scarcity limits public health, industry and agriculture". To mention a few, daily consumption by households, agriculture and industries, all demands water. And for this reason water scarcity will lead to poor socio-economic status of communities and job losses due to poor agricultural and industrial production. Water scarcity may damage economies by diminishing production in both the agricultural and the industrial sectors. Ultimately job losses will lead to poverty which has a negative impact on the society. Drinking unhealthy water due to scarcity leads to health and social problems. Scarcity of water may also lead to fewer crops, a situation that has a negative impact on the communities. Put simply, there will be hunger (Challenge 20/20, NYP). Shortages of rainfall have resulted in the decrease of crop production.

The use of manure does not help crops if there is no water to decompose such. The negative impact of water shortage may lead to poverty. For example, in Pakistan, there was a reduction of yields for wheat during 2002-2003; this was due to water shortage. The wheat farm target lowered from 22 million tons to 19 million. In the same season, the Pakistan textile manufacturing had to

import cotton. This result in a poorer yield will lead to poverty and retrenchments (Problems of Pakistan, 2010). Similarly, Nazare, Mdluli, Babugura and Banda (2005) agreed that, shortage of water can cause diseases, mortality and also hunger. Plants, animals and human beings are negatively affected by the shortage of water. Also in terms of the above explanations, shortage of water directly affects livelihoods in many ways; people may be left with nothing to eat because, maize and other crops will perish as a result of scarcity of water.

The above discussions also point to the fact that; the relationship between water, food and nutrition security is complex and significant. Water is a fundamental resource for crop and animal production, and aquaculture. Irrigation can contribute to the intensification and the diversification of food supplies. Better access to water, a concerted and sustainable management of water resources, including the sharing of water among its various uses, is essential to increasing crop and animal production, and their availability. Moreover, water is required for food-processing. Hence, an effective food processing sector needs a regular supply of good quality water to guarantee the food safety of final products.

2.4. WATER SCARCITY, FOOD AND NUTRITION SECURITY: THE SOUTH AFRICA SITUATION

South Africa is considered as a food secure country that produces enough of its food staples and has the capacity to import any food deficits when the need arises in order to ensure its population meets their basic energy and nutritional needs (IFSS, 2002; ITC, 2010). Altman, *et al.* (2009) argue that the same cannot be said about the rural households since many of them are food insecure. The agriculture sector in South Africa is considered as highly dualistic since it is made up of a highly capitalized commercial sector as well as a subsistence sector (Baiphethi & Jacobs, 2009). According to May and Carter (2009), subsistence agriculture is mainly located in the areas which were part of the homelands during the apartheid regime. The general household survey

of 2009 in South Africa utilized the household food insecurity access scale in assessing food access in the country. The results from the survey indicate that 20% of South African households have inadequate or severely inadequate access to food.

The FAO, (2012) statistics indicated that in 2012 less than 5% of South Africans were undernourished and food insecure. Although this figure appears to be low; with a total population of 51, 7 million in 2011 (Stats SA, 2012a), it may be suggested that approximately 2, 6 million individuals were undernourished and food insecure. The Sustainable Development Goals (SDGs) 2011 report indicates that although progress has been made towards better food security, hunger remains an issue in many households in South Africa. A nation may be classified as being food secure, but if some of the individual households are food insecure, it may be incorrect to assume that nation is indeed food secure (Pinstrup-Anderson, 2009). If food security refers to sufficient food production to meet national demands, South Africa may be food secure. However, if it refers to self-sufficiency of "individuals and households" access to enough food to sustain energy and dietary requirements, then a re-evaluation of the definition of food security and the extent to which it is implemented should be investigated (Pinstrup-Anderson, 2009). South Africa is an example of a country where the definition, in conjunction with measurements of food security has gone astray (Aliber & Hart, 2009; Jacobs, 2009).

Food security has been a global issue for the past several years, with South Africa highlighting the issue in 1994. In Section (26) and (27) of the South African Constitutional law, the basic principles of food security state that, each individual is entitled to adequate access of available, safe and sufficient sources of food and water on a national as well as household level (Du Toit, 2011; Pinstrup-Anderson, 2009). Due to unsettled arguments about defining a unique food security concept, there are more than 200 descriptions and 450 indicators in the literature that define food security (Hoddinot, 2001, cited in Abdu-Raheem & Worth, 2011). These definitions are consequences of

interactions of socio-economic and biological factors that constitute the concept of food security (Riely, *et al.*, 1999, cited in Shisanya & Hendriks, 2011) that change over a period of time (Modirwa & Oladele, 2012). These factors differ significantly across countries, regions and social groups, and even within the rural areas of South Africa. Scholars differ with each other about the understanding of this concept.

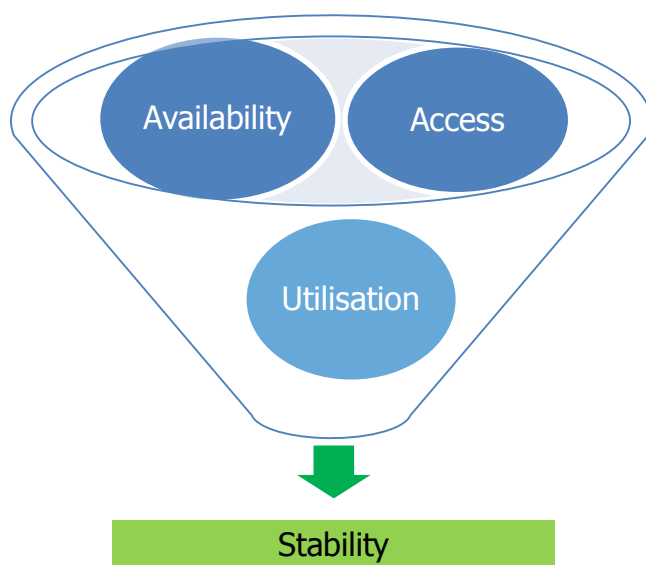
Some argue that the definition should be conceptualised as resting on three pillars, namely availability (physical presence of enough food to meet aggregate), access (ability to secure available food), and utilisation (Masuku & Sithole, 2009; Barrett, 2010; Bashir & Schilizzi, 2013). Other authors incorporate stability as the fourth pillar (FAO, 2006; Alemu, 2010; Drimie & Ruysenaar, 2010; Carletto, *et al.*, 2012; Misselhorn, *et al.*, 2012; Vink, 2012). No matter what the definition is, the interactions and combinations of these pillars represent food security (Vink, 2012). These four pillars further constitute the South African food constitution (Khoza, 2008). Section 27(1) (b), 28(1) (c) and 35(2) (e) of the South Africa constitution argue that food is a basic human need. Therefore, everyone needs it to survive and has a right to sufficient food and water; and social security (du Toit, 2011). An understanding of these pillars and dimensions associated with food security is necessary for policy development and food security interventions (du Toit, 2011).

Therefore, the government of South Africa has mandated various departments to implement programmes to fight food insecurity access problems with an expectation that food security levels would improve (Khoza, 2008). However, empirical evidence reveals that the majority of individuals and households, particularly in rural areas, continue to experience difficulties with accessing food to meet their adequate nutritional requirements (e.g. Hendriks, 2005; Modirwa & Oladele, 2012; Lehohla, 2012; D'Haese, *et al.*, 2013). Historically, the majority of the population has been living under these conditions (Rose & Charlton, 2002). As already mentioned, these conditions differ across rural areas of South Africa (du Toit, 2011). Therefore, different strategies and plans

are therefore necessary to address different levels of food insecurity. These are consequences related to structural poverty, unemployment and inequalities that distinguish South Africa amongst developing countries (Khoza, 2008; Manyamba, *et al.*, 2012).

Similar cases have been reported in the urban poor residing in cities of the Southern African Development Community (SADC) region (Crush, *et al.*, 2012) and in other developing countries (Vink, 2012). These examples show that food security pillars are hierarchical in nature such that “adequate availability is necessary, but does not ensure universal access to sufficient, safe and nutritious food, whereas access to food is most closely related to social science concepts of individual or household well-being” (Barrett, 2010); all three dimensions rely on the stability of food (Pinstrup-Andersen, 2009).

FIGURE 2.2.THE PILLARS OF FOOD SECURITY



Source (adapted from FAO/FIVIMS, 2008)

2.5. THE PILLARS OF FOOD SECURITY

According to Arshad and Shafqat, (2012); Barret, *et al.* (2010); Kalpana Sastry, *et al.* (2011), food pillars are the key determinants of food security, and consist of three dimensions or pillars. For the purpose of this study, availability, access

and utilisation of food are discussed. These pillars of food security are intertwined and interdependent so as to ensure food security. These pillars may also be identified as the key aspects of food security (Kalpana Sastry, *et al.*, 2011). Therefore, if food is not readily available or accessible to all individuals and safe to utilise, the pillars of food security are not functioning correctly; hence, the possible existence of household food insecurity. For example, in South Africa, the most severe cases of inadequate food access were indicated in the Eastern Cape Province with 33,5 % of households revealing inadequate access to food (Stats SA, 2010a), in the rural areas, suggesting that perhaps food access in the area is inadequate and that of food insecurity exists. In this study, stability is incorporated as a fourth pillar of food security and will be discussed as a necessary component to ensure sustainable food security.

(i).Food availability

Food availability is the first pillar of food security and is based on the capability of a nation or household to produce adequate food sources which are readily available (Drimie, *et al.*, 2009). The availability of food sources is dependent on food production and adequate distribution (Jacobs, 2011). Food production can be on a national or household level, otherwise known as subsistence food production. Subsistence production involves producing food sources on a small-scale, typically on a household level. Subsistence food production is said to be an important and possibly effective manner through which food security can be enhanced on household level.

It is however advised that although subsistence food production may enhance food availability and contribute positively to food security, it is not sufficient as a single component to ensure sustainable household food security (Drimie, *et al.*, 2009). Therefore it can be suggested that improving both food availability and food access may be more effective. Food availability on national or local level is proposed to be irrelevant if access by households is limited due to restricted factors, like water scarcity, unemployment and poverty (Pinstrup-

Anderson, 2009; Li & Yu, 2010) which are present in rural settlements (Sverdlik, 2011; Victor, 2009).

(ii).Food access

Food access on household level refers to the capabilities of households to obtain available food sources needed to adhere to nutritional requirements of the household (Du Toit, 2011, Ringstrom & Born, 2011). Adequate food access is suggested to contribute to enhanced food security (Feagan, 2007). Though access to adequate amounts of food is a basic human right, it is revealed that various South African households continue to battle accessing suitable amounts of food sources (Schumacher, *et al.*, 2011). A survey conducted in South Africa in 2010, found that 20% of households had inadequate access to food sources which increased their vulnerability to food insecurity (Stats SA, 2012). Sufficient food access is dependent on the allocation of available food sources to populated areas, the affordability of these food sources and the preferences of the consumers. The affordability of food sources plays an important part in food access, as food sources are not obtainable if households do not have enough financial resources to afford those sources (FFPP, 2007).

Food security is negatively influenced when food access is not optimal (Hodgson, 2012) as the health status of the consumer becomes compromised and nutritional demands are not met (Schumacher, *et al.*, 2011). Food availability and accessibility need to be accompanied by adequate utilisation to ensure sustainable food security as these three pillars need to function simultaneously (Diskin, 1995).

(iii).Food utilisation

Food utilisation in terms of food security is described as the ability to use food sources so that it may enhance well-being and productivity. This includes the safety of food sources, nutritional value of the food products and the social value these products add to the household (Swindale & Bilinsky, 2006). It is

suggested that although utilisation influences food security, little is known about how food is utilised in South African households, especially in rural areas (Montani & Omwega, 2002). Food security is said not to be only influenced by quantity but also the quality of food sources and how they are used (FAO, 2008). Food security not only exists when food sources are available and accessible but also when these food sources are safe to consume without causing illness to the consumer (FAO, 1996).

Terpstra, *et al.* (2005) mention that although the quality and safety of food is important contributors to adequate food utilisation, consumers on household level are poor implementers of food safety practices. This may be due to a lack of knowledge regarding food safety and quality (Kang, *et al.*, 2010). This is confirmed by Sanlier, (2009) who suggests that consumers do not have satisfactory knowledge regarding safe food practices during preparation and storage. According to research studies, no food preparation and storage guidelines are available at household level to contribute to adequate safety practices (Sanlier & Konakioglu, 2012; Unusan, 2007). The possible inadequate utilisation of food sources due to the lack of food safety knowledge and education may contribute to the decrease of household food security according to Taylor and Batz (2008) and Wenholt, *et al.* (2012). Food availability, access and consumption are considered to be sufficient components to ensure food security if developed and managed correctly (Kalpana Sastry, *et al.*, 2011). Household food security and the policies associated therewith focus on the relationship between food availability and access as well as food access and utilisation.

It was proposed that each of the individual components of the food pillars, excluding supplementary factors is dependent on the other to achieve the desired outcome, in this case, food security. A lack of income results in some households not being able to access food, which contributes to food insecurity although food may be available. Income is a prime example of such a supplementary factor, and a lack thereof will limit access, and consequently,

utilisation and food security (FFPP, 2007). In developing countries such as South Africa where underprivileged households exist, food utilisation is regarded as an obstacle due to poor access rather than inadequate food availability (WFP, 2005). Additionally, the food security pillars are dynamic as they are influenced by various factors such as water scarcity, increasing population demands, food production, markets and consumption, in addition to the overall state of the food economy (FAO, 2006; FAO, 2011).

(iv).Stability

Stability in this study refers to the ability of the food pillars to remain productive despite economic, socio-demographic changes and challenges. According to Thornton, *et al.* (2011), economic changes for the African continent to ensure food security by 2050 will require broad and integrated yet local context-specific institutional and policy responses. The authors continue by stressing the importance of the compliancy and stability of the pillars to prevent food insecurity for increasing populations in Africa through the use of integrated policies. Thornton *et al.*, (2011) mention that the adaptability of the food security pillars becomes increasingly complicated as it consists of components like water scarcity which stretch beyond the concept of successful food production as a single essential component.

The evaluation and measurement of food pillar adaptability to additional key components, which for example, include food distribution, water scarcity, storage and utilisation, are essential, as the efficiency of the food pillars directly affect food security (Thornton, *et al.*, 2011). Sustainable food security is reliant on the constant development of combined components. When the pillars of food security are managed independently within households in communities, they create an opportunity for inexpensive food source supplies that are sustainable (Environmental commons, 2008). With all the feasible outcomes and contributions of adequately managed local food security pillars, it may be suggested that food security sustainability in rural settlements such as the one explored within this study, is possible. Food security and household

well-being are affected by the failure or success of the food pillars (Kalpana, *et al.*, 2011).

Folke, (2006) highlights the importance of developing the pillars of food security, which are relevant on household level and which are adaptable and sustainable and less susceptible to failure. Scientific evidence shows that South Africa faces structural pervasive household food insecurity problems as a result of factors related to water scarcity, poverty, unemployment and lack of other sources of income (Abu, 2012; Altman, *et al.*, 2009; HSRC, 2007; Modirwa & Oladele, 2012; Manyamba, *et al.*, 2012; Tshuma & Boyana, 2013). According to Shoaf, *et al.* (2012), these issues may limit the country's progress towards reaching the Sustainable Development Goals. Therefore, these conditions argue that policies and programmes implemented to address food insecurity issues to be evaluated and monitored. Altman, *et al.* (2009) note that there are no regularized ways of monitoring food security situation in South Africa.

According to Mwale, *et al.*, (2012), this consequently leads to the inability to achieve household food security and poverty reduction objective. For the majority of South Africans the level of food insecurity has continued to increase since 1994. Food insecurity in South Africa is not only widespread and persistent; it is disproportionately rural. Therefore, specific knowledge about the province experiencing food insecurity is needed to improve the situation. Eastern Cape Province is a typical province characterised by a large percentage of rural dwellers. For example, out of the 90% of people residing in rural areas of Eastern Cape Province, 53% experience severe food insecurity conditions (De Cock, *et al.*, 2013). These render majority of the population to be poor (De Cock, *et al.*, 2013). These are the provinces that encompass the largest of the former homeland areas (Aliber, 2003; Neves & du Toit, 2013).

Given this situation, it is interesting to note that the more food insecure a household is, the higher its probability to depend on the informal economy (Crush & Frayne, 2010; Crush, *et al.*, 2012). For example, in a study conducted

across 11 largest SADC region cities, approximately 70% of the urban poor source their food from rural vendors (Crush, *et al.*, 2012). Modirwa and Oladele (2012) note that in South Africa, food insecurity is no longer a failure of food production at national level but a failure of accessibility at household and individual level. A similar ideological view was noted by Manyamba, *et al.* (2012). Table 2.1 illustrates the evidence of households experiencing food insecurity in South Africa at national level.

TABLE 2.1. PERCENTAGES OF FOOD INSECURE HOUSEHOLDS AT NATIONAL LEVEL

Year	Source	Percentage at national level
1999	Labadarios, et al. (2005)	52% experience hunger, 23% at risk of hunger, 25% food secure
2010	Alemu, (2010)	64% food insecure
2011	Du Toit, (2011)	20-52% food insecure

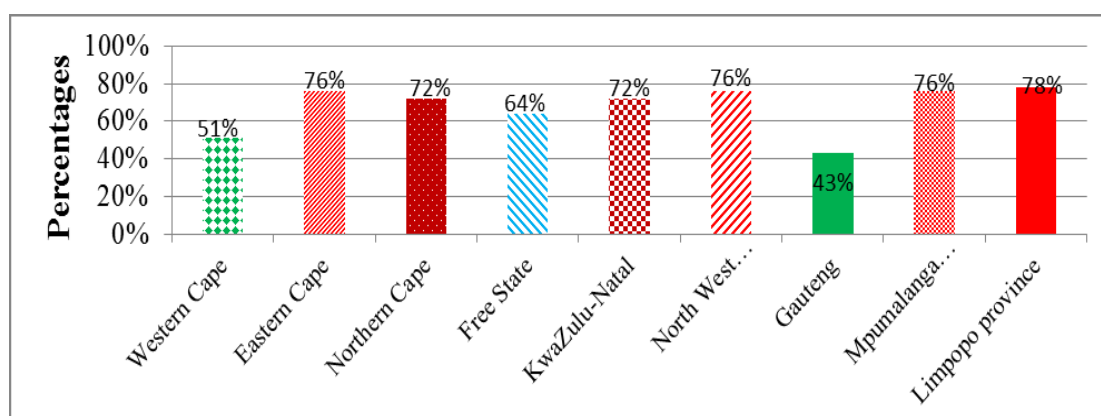
Although the percentages presented in Table 2.1 provide important information for policy-makers about food insecurity situation at the national level, but reliable representative information at the household level are not provided. Numerous studies conducted in South Africa demonstrated that food insecurity is unevenly distributed (Madzwamuse, 2010) in terms of spread and intensity and differs across geographical, race, gender and age groups (Stavrinides, 2002; Armstrong, *et al.*, 2008; Lehohla, 2012). Therefore, this important information could be gathered from small municipalities as their circumstances and vulnerabilities are substantially different from those of larger geographical areas (Gyekye & Akinboade, 2003; Toledo, *et al.*, 2012).

According to van Zyl & Kirsten, (1992), knowing those who are food insecure assist when designing policies or reviewing intervention on how to uplift their living standard and addressing problems they face. Alemu, (2010) used

monthly household expenditure to assess levels of food insecurity across nine provinces of South Africa and categorised the status of food insecurity in all nine provinces of South Africa (Figure 2.2). In the Eastern Cape Province, 76% of the households had food access problems. Other provinces that experienced problems of food access include Limpopo (78%), Mpumalanga (76%), KwaZulu-Natal (72%), Free State, (64%), and the Western Cape (51%). All these provinces are predominantly characterised by rural areas (Gyekye & Akinboade, 2003; Bhorat, *et al.*, 2012). This is because these provinces have remained largely underdeveloped since the advent of democracy. Interestingly, it has been noted that in all these provinces, large numbers of people rely on the informal sector to sustain their livelihoods (Wills, 2009).

Confirming the information established by Alemu, (2010), several studies concluded that the situation at community and household level was far less positive (Altman, *et al.*, 2009; De Cock, *et al.*, 2013), as they have to deal with the high risk of inadequate access to food (Gyekye & Akinboade, 2003; Ndhleve, *et al.*, 2012).

FIGURE 2.3. PERCENTAGE OF FOOD INSECURE PEOPLE BY PROVINCE IN SOUTH AFRICA



Source: Alemu, (2010)

In addition to accurately measuring and categorising household food security, it should be determined whether policies in SA are adjustable. Adjustability of household food security policies will accommodate the necessary changes brought forward by supplementary factors such as socio-demographics, insufficient staple food production and rising oil and food prices (Du Toit, 2011; Jacobs, 2009). When households are influenced by inadequate food production as well as water unavailability, they are more than likely to become vulnerable to food insecurity.

2.6. INDIVIDUALS SOCIO-DEMOGRAPHICAL CHARACTERISTICS ON FOOD SECURITY

According to Dauda, (2010), individual's socio-demographic status can be defined as the economic and social components of status that distinguish and characterize people and these include, sex, age, education, household size, marital status, and farming experience that could influence household food security. The three main pillars of food security have been discussed, but are not the only aspects that influence food security. Socio-economic factors constitute additional factors which contribute to food security by influencing the pillars.

The relationships between various socio-demographic variables and household food security have been examined in a number of studies, which have shown that socio-demographic characteristics significantly affect household food security, both positively and negatively (Duerr, 2007; Alemu 2010; Knueppel, *et al.*, 2009; Dodson, *et al.*, 2012; Gebre, 2012, Akerele, *et al.*, 2013; Baiyegunhi & Makwangudze, 2013). For this study only age, household size, income and level of education are examined and discussed.

2.6.1. Household size and Food security

Generally, large sized rural households are expected to supply labour required without difficulty for their crop production, basically due to abundance of their

own labour. As Basukuba (2007) points out, household size is normally seen as equivalent to family labour endowment. In addition, in situations where hired labour is costly to monitor, households with a greater endowment of labour are not only placed to farm their land more intensively but, also to conduct critical operation at the right time than is the case with households that are dependent on hired labour.

Therefore, larger households have more potential of obtaining higher yields and hence being more food secure than smaller households. According to Omotesho, *et al.*, (2007), food security is often determined by the size of a household and that a negative relationship exists between larger households and food security (Bashir, *et al.*, 2012; Bonti-Ankomah, 2001). In South Africa, the average household consists of approximately five individuals, where households larger than five individuals might be vulnerable to food insecurity (Bonti-Ankomah, 2001). The rural households relevant in this study is situated in the Eastern Cape Province, where the average household size for the province is between four and five, the second lowest average household size within South Africa (Stats SA, 2012a).

2.6.2. Household income and Food security

As indicated previously, a lack of income significantly influences food security by prohibiting adequate access and utilisation of food sources (Hallberg, 2009), and the inability to access and utilise food according to ones needs, suggests that food insecurity exists. In the review of PHSA, (2007), the relationship between food security and the level of income are discussed. A higher income enhances food security whereas a lower income is believed to encourage food insecurity, which is a direct outcome of poverty and lack of financial resources (Rosen & Shapouri, 2001).

Ericksen (2007) adds that in addition to affecting access to food, income is a direct determinant of food utilisation and food security. Therefore, the challenges that low-income households face with regard to inadequate access

to food is a matter worth considering when developing initiatives and programmes for improving food security (PHSA, 2007). A lack of financial resources is believed to be more dominant in developing countries and in low income communities, especially rural settlements, where food security is a direct outcome of poverty (De Marco & Thorburn, 2009; Hallberg, 2009; Rosen & Shapouri, 2001).

According to the 2010/2011 Income and Expenditure Survey (IES), the average household income for black African households was R 69 632 per year (Stats SA, 2012b:12). Black Africans form up to 76% of the South African population; however, they earn only 44.6 % of the total annual household income. According to the income deciles in South Africa, this population falls within the lower to medium income groups (Stats SA, 2012).

2.6.3. Level of Education

Education is very important in making decisions related to production and use of crop produce at the household level. Households with better education and other forms of human capital stand a better chance of accessing non-farm income and/or credit. As Idrisa *et al.*, (2007) point out an increase in one's education is likely to increase a person's related skills and, hence, the ability to acquire new skills. In addition, education is also associated with production of higher quality crops and greater participation in non-farm activities.

Therefore, educated people are able to manage food demands in their households; whereas farmers with low levels of formal education make the introduction of improved agricultural technologies by extension agents difficult. Children are indicated to be more vulnerable to food insecurity due to a lack of knowledge and access in comparison to older individuals. Baiphethi and Jacobs, (2009) specify that insufficient education not only influences utilisation, it also prohibits households from engaging in own food production activities, due to unsatisfactory knowledge. A lack of adequate education leads to higher unemployment rates and lower paying jobs, which affects the income

status of households (Stats SA, 2010b). The occurrence of insufficient education is a characteristic of low income areas and informal settlements and is therefore relevant to this study. The absence of education and knowledge ultimately influences a household's ability to optimally produce access and utilise food sources. Utilisation and access are pillars of food security and key factors in establishing individual well-being (Kalpana Sastry, *et al.*, 2011).

2.6.4 Household Age and Food security

The age of the household is expected to have an impact on the labour supply for food production (Babatunde, *et al.*, 2007). As one ages, so are factors such as farming experience influences food security status of the households. Therefore, the effects of age are likely to be either positive or negative. The positive effect and negative effects of age imply that as people get older the effect of age is stronger.

2.7. RELATIONSHIP BETWEEN WATER SCARCITY, FOOD AND NUTRITION SECURITY

Food production is impacted hugely by water scarcity. Without water people do not have a means of watering their crops and, therefore, to provide food for the fast growing population. Water for food is one of the main global issues and irrigation is a limiting factor in agricultural production. Food supply is a vital human need and approximately 3% of overall global health and insufficient nutrition has been documented (WHO, 2014) and this further contributes to other diseases. While many factors contribute to this issue, reduced water availability caused by water consumption leads to reduced availability for food production and consequent yield losses. Little empirical evidence exists in the literature that has combined the issues of water scarcity, food and nutritional security. Table 2.2 shows the lack of knowledge in literature that has combined the issues of water scarcity, food security, and nutrition.

The results of the current study will thus close the gap and contribute to knowledge. An added advantage of embarking on this study is that, the results and recommendations emanating from the empirical findings could assist policy makers to understand the plight of the rural population in terms of water scarcity, food and nutritional security and devise appropriate strategies if not to totally eradicate future occurrences but to reduce the impact of water scarcity. This will also contribute to better the lives of the rural population.

TABLE 2.2. STUDIES CONDUCTED ON WATER SCARCITY, FOOD AND NUTRITION SECURITY

Author	Domain	Water scarcity (WS)	Food security (FS)	Nutritional security (NS)	WS, FS, NS
Belton and Thilsted, (2014:59-66)	Global South	×	√	√	×
Garrett and Ruel (1999: 1955-1975)	Mozambique	×	√	√	×
Gerbens-Leenes and Nonhebel, (2004:547-564)	Netherlands	√	√	×	×
Hanjra and Qureshi, (2010:365-377)	Global perspective	√	√	×	×
Hess, Andersson, Mena, and Williams, (2015:1-10)	United Kingdom (UK)	√	√	×	×
Kirwan and Maye, (2013: 91-100)	UK	×	√	×	×
Rasul, (2014: 35-48)	Hindu Kush Himalayan region (South Asia)	√	√	×	×
Van Ittersum and Giller, (2014:119-124)	Global perspective	×	√	×	×
Wachs, (2008: 48-60)	United states of America (USA)	×	×	√	×
Youn, Taylor, Lynch, Cowx, Beard Jr., Bartley and Wu (2014: 142-148)	Fisheries and inland waters	×	√	×	×

Explanation of keys:

√ means the sector has been researched

×

Despite this gap, prior studies have attempted to investigate separately the relationship between water scarcity and food security as well as between food and nutritional security. For example, in a study conducted by Rodriguez, *et al*, (2015) on the impact of the California drought on food security among rural families of Mexican Origin, the authors adopted both the quantitative and qualitative research methods to understand the challenges farm working families endured during a time when growers changed production due to drought. The authors found that drought has a significant impact on food security. In addition, the authors established that a positive relationship also existed between food insecurity and nutritional programs for women, infants, and children.

In another study by Du, *et al*, (2015), the authors investigated the effect of deficit irrigation and sustainable water-resource strategies in agriculture for China's food security. The authors documented that water scarcity significantly affected food production. Gebrehiwot, Mesfin and Nyssen, (2015) also found that there is a very high significant relationship between irrigation farmland and agricultural production which indicates that irrigated lands accounts for a substantial portion of increased yield. Cline, (2003) examined the impact of water scarcity on food production. The study concluded that water scarcity could reduce food production and would adversely impact food and nutrition security. Similar findings were also highlighted by the United Nations Development Programme (UNDP). It was concluded that lack of arable land will not worsen food and nutrition security but rather water scarcity which will risk the food security and limit the increased food production in the coming decades (UNDP, 2007).

Hanjra and Qureshi, (2010) has also examined the impact of water scarcity on future food security, and it was highlighted that future food security is being threatened by a constant decline in water resources, climate change, and energy shortfalls. Qureshi, Hanjra and Ward (2013) studied the impact of water scarcity on global food security. In their study, they found that water scarcity impact on food security. In addition, the study revealed that water

scarcity coupled with population growth, is defining the future of food and nutrition security. Furthermore, the transfer of water from agriculture put pressure on water demand and risks food security due to its shortage for agriculture. Therefore water is a critical natural resource for food security (Fedroff, 2010). Hanjra and Gichuki, (2008) also identified some factors that pose major challenges to water scarcity and food security. These challenges included increasing costs of developing new water resources, land degradation in the irrigated areas, groundwater depletion, water pollution and ecosystem degradation, current water utilization practices and the fast growing population. The impact of these factors on densely populated regions of the world such as the Mediterranean, the Middle East, India, China, and Pakistan was analyzed. It was revealed that growing water scarcity has implications for poverty, hunger, ecosystem degradation, climate change and world peace and security.

Molden, (2007) investigated the link between food security, water entitlements, inequitable food distribution and poverty. The study found that lack of water entitlements exacerbated food security. The widening gap between poor and rich under scarce water scenario will pose risks to food security. In Pakistan more than 80 percent people are living below the international poverty line of 2 and about 70 percent people are found to be food insecure (Oxfam, 2007). Therefore growing water scarcity, will decrease yields and worsen food and nutrition security. In sum, many literature cited has regarded water as an important determinant of food security. The constant decline in water resources will have an adverse impact on food and nutrition security.

2.8. CONCLUSION

A number of studies have examined the demographics profile of households in the Eastern Cape Province in general (Adong, 2012; Gyekye & Akinboade 2003; Mashau, *et al.*, 2012; Oni, *et al.*, 2011). However, little research has been done on exploring the relationship between water scarcity on food and

nutrition security on rural households in the area. In other provinces, much has been done in relation to water scarcity on food and nutrition security to bridge the existing gap and to provide policy-makers with recent information (e.g. Abdulla, 2008; Bantubonse, 2008; Sidzatane, 2011).

According to Alemu, (2010), a number of food security and water scarcity studies exist in South Africa. It is evident that the status of food security in South African households is a great concern. Food insecurity needs to be addressed effectively in order to prohibit additional or prolonged food insecurity in vulnerable households. Therefore, this study explored the pillars of food security as well as supplementary components which are believed to influence food security. Furthermore, food security and vulnerabilities in a rural settlement were explored to establish whether improvements are possible.

However, to the best of this author's knowledge, no study has specifically examined the prevalence of water scarcity on household food and nutrition security amongst households engaged in rural Nqgeleni location in South Africa. The overwhelming majority of studies concentrated on poverty rather than water scarcity; food and nutrition security (Alemu, 2010). These consequently lead to a lack of implementation of appropriate policy interventions. To fill the gap left by existing literature, this research project aims to increase baseline data that could assist sustainable development to achieve Sustainable Development Goals 1 and food insecurity reduction strategies. It further aims to identify gaps and quantify any constraints that still need to be addressed and explore possible interventions to improve water scarcity conditions within the area of study and elsewhere.

The study also aims to outline household food security status of rural people in Nqgeleni in order to provide sufficient data at the local level and to understand why some families are unable to meet their fundamental nutritional requirements. For strategic intervention to improve the livelihoods

of rural households, the socio-demographic characteristics of the population have to be understood.

CHAPTER THREE

METHODOLOGICAL CONSIDERATIONS

3.1. INTRODUCTION

This chapter is dedicated to methodological discussions and explores the different methods and steps that were embarked in the study. Methodology is important because it considers and explains the logic behind research methods and techniques (Welman, *et al.*, 2009). Several authors (Crowther & Lancaster, 2008; Khan, 2008; Kumar, 2014; Takhar-Lail & Ghorbani, 2015) argue that methodology is important because it outlines certain attributes of research procedure and methods that were employed in the study.

In view of this, the chapter is divided into the following order. The chapter commences with a recap of the research aim and objectives, followed by the manner in which research is conceived in terms of the research philosophy subscribed to. Next, the research design process followed in the current study is discussed. Thereafter, the study population and sampling is described. Other components of the chapter include data collection tools, data analysis, ethical consideration, and methodological reflections. The chapter ends with a conclusion synthesizing the entire chapter.

3.2. RECAPPING THE RESEARCH AIM AND OBJECTIVES

The overall aim of this research was to investigate how water scarcity influenced food and nutritional security on rural household in Nqgeleni location. The objectives formulated for the study are thus:

- to establish the relationship between water scarcity, food and nutritional security of the rural households in Nqgeleni location;
- to identify the drivers of water scarcity in the area; and

- To create an inventory of coping mechanism employ by rural households with water scarcity, food and nutritional security.

It is important that these aim and these objectives are stated because they have implications on the nature of the research philosophy and the methodology that were adopted for this study. The following section of this chapter explains the research philosophy applicable to the current study.

3.3. RESEARCH PHILOSOPHY

A research philosophy addresses the basic beliefs about the way in which data about a phenomenon should be gathered, analysed and used (Wahyuni, 2012). The basic philosophical assumptions guides and directs the thinking and action of the researcher (Mertens, 2010). The research philosophy also deals with the nature of knowledge and explores how to generate, understand, and use the knowledge that is deemed to be acceptable and valid (Mertens, 2010). Maree and van der Westhuizen, (2007) argue that “research is about understanding the world, and one’s understanding is informed by how you view the world, what you view understanding to be and what you see as the purpose of understanding”.

Researchers incorporate different types of paradigms, among which includes: positivism, post-positivism, constructive-interpretivism and pragmatism perspectives to conceptualise, guide and classify research (Ponterotto, 2005). The paradigm not only forms a set of basic beliefs, but also a set of interrelated assumptions about the social world and provides a philosophical and conceptual framework. Basic paradigm beliefs not only guide the investigation in terms of choices of design and method but also in its ontology (nature of reality and being) and epistemology (nature and scope of knowledge) (Saunders et al., 1997). The ontological perspectives involve asking what the researcher sees as the very nature and essence of things in the social world (Mason, 2003). The epistemological position of the researcher (what is regarded by the researcher as knowledge or evidence of things in the social

world), is based thereon that views, perceptions and the constraints which result there from, are “knowable and it is possible to generate knowledge about the evidence for them” (Mason, 2003). For the purposes of the current study, the different types of paradigms mentioned above are further discussed.

3.3.1. Positivism

Positivists believe that reality is stable and can be observed and described from an objective viewpoint without interfering with the phenomena being studied (Crowther & Lancaster, 2008; Mertens, 2010). This can be achieved through observation and measurement involving the collection of statistical data and reasoned analysis (Wright, 2006). Advocates of positivism contend that phenomena should be isolated and that observations should be repeatable.

This often involves manipulations of reality with variations in a single independent variable so as to identify regularities in, and to form relationships between some constituents’ elements of the social world (Neuman, 2011). In addition, advocates of positivism recommend the quantitative methodology approach, which is based on numerical measurements of specific aspects of phenomena that seek general descriptions or test causal hypotheses (Bryman & Bell, 2015; Newman, 2008). A quantitative approach involves the collection of numerical data that uses precise statistical analysis (Creswell, 2014).

3.3.2. Post-Positivism

The second research paradigm, post positivism, is the successor of the positivism ideology (Mertens, 2010). Post positivism believes in generalisation, but admits that knowledge is a result of social conditioning. This is called the critical realist stance, which understands that social reality needs to be framed in a certain context of relevant laws or dynamic social structures, which have created the observable phenomena within the social world (Wahyuni, 2012). Post positivism often employs either quantitative or qualitative methodologies in its approach.

Bryman and Bell, (2015) assert that the qualitative approach is one in which the investigator often makes knowledgeable claims based primarily on individual experiences, participatory perspectives, or both. The qualitative methodology involves using many empirical materials such as case studies, personal experiences, life stories, interviews, observations, and visual objects that describe the meaning in people's lives (Wilson, 2010). Qualitative research also employs strategies of enquiry such as narratives, phenomenologies, ethnographies, grounded theory studies, critical studies, or case studies (McMillan & Schumacher, 2006). Du Plooy, (2009) is of the view that adopting a qualitative research approach will allow researchers to "explore substantive areas about which little is known" and offer an opportunity to discover and identify the presence or absence of a problem, without the need to know what the researcher is going to discover.

3.3.3. Constructive-Interpretivism

Constructive-interpretivism represents the third research paradigm described in the current study. Interpretivists contend that only through the subjective interpretation of and intervention in reality can that reality be fully understood (Takhar-Lail & Ghorbani, 2015). The study of phenomena in their natural environment is important to the interpretivist philosophy, together with the acknowledgement that scientists cannot avoid affecting those phenomena they study (Khan, 2008).

Advocates of constructive-interpretivism admit that there may be many interpretations of reality, but maintain that these interpretations are in themselves a part of the scientific knowledge they are pursuing (Mertens, 2010). Interpretivism does not have a tradition that is no less superior to that of positivism, nor is it shorter.

3.3.4. Pragmatism

Pragmatism represents the last research paradigm in this study. Pragmatism incorporates the ideology of all the three beliefs namely, positivism, post

positivism, and constructive-interpretivism. Pragmatist supporters are influenced by their own values in obtaining desired knowledge. They emphasise that there is only one reality and that all individuals have their own unique interpretation of reality. Pragmatists believe that objectivist and subjectivist perspectives are not mutually exclusive. Pragmatist researchers employ a mixed methodology to better understand social reality (Wahyuni, 2012). A mixed method approach focuses on collecting and analysing data by combining both quantitative and qualitative data in a single and a series of studies (Creswell & Clark, 2011). The mixed method offers the benefits of triangulation techniques in which methods are combined to offset each other's inherent weaknesses with their respective strengths (Hesse-Biber & Levy, 2008).

Upon examining the arguments in the various research philosophies, the researcher's overall concern is that the choice of the research philosophy to be adopted should be both relevant to the research question and objectives, as set out in Chapter one, and should be rigorous in its operationalization. Overall, it is believed that the pragmatism philosophy is required for this research. This approach was selected based on the realisation that the mixed method criteria will be adopted for this study. The mixed method approach involved the use of both quantitative and qualitative research methods (Creswell, 2012). Primary data was sourced from a large number of respondents using structured questionnaire, key informants and focus group interviews. This afforded the researcher the benefit of applying various statistical methods to analyse and interpret the data of the study (Newman 2008), as well as to give an opportunity to respondents to express their opinions regarding the subject matter in this research.

The mixed method approach is appropriate for the current study because it offered the benefit of offsetting the individual limitations associated with qualitative and quantitative approaches (Creswell, 2014; Welman, *et al.*, 2009). Moreover, the mixed method approach was selected to enable the

researcher answer the same research questions in different ways and from different angles.

3.4. RESEARCH DESIGN

Research design refers to the structure, plan and strategy of investigation conceived so as to obtain answers to the research questions. It refers to a description of the format and theoretical structure under which the study was carried out (Mutambara, Zvinavashe & Mwakiwa, 2010). Jaka, (2009) also defined a research design as a plan to follow in answering a research objectives or framework to solve the objective problem. However, it acts as a blueprint for a study as it guides data collection and analysis. The rationale behind a research design differs from that of a research methodology. According to Welman, *et al.* (2009) the methodology describes the logic behind the research methods and techniques.

The research design in contrast captures the overall plan starting from the beginning of the research process through to the end or the conclusion of the research (Babbie, 2010). Research design indicates how the main parts of a research (e.g. samples, measurements, programs or tools) adopted are integrated into the study to address the research questions. This study used both quantitative and qualitative research design in nature as it seeks to explain the impact that water scarcity have on food and nutritional security in Nqgeleni location. Qualitative method was used to gather data pertaining to local perception and opinions on the lack of water scarcity on food and nutritional security of the local people using semi-structured questionnaire. Furthermore, the qualitative method enabled the researcher to find out what can be learned about some phenomenon of interest, particularly social phenomenon where people are participants.

The study used qualitative method because the researcher was interested in investigating the problem of water scarcity on food and nutritional security of the rural people of Nqgeleni location. Quantitative data on household's income

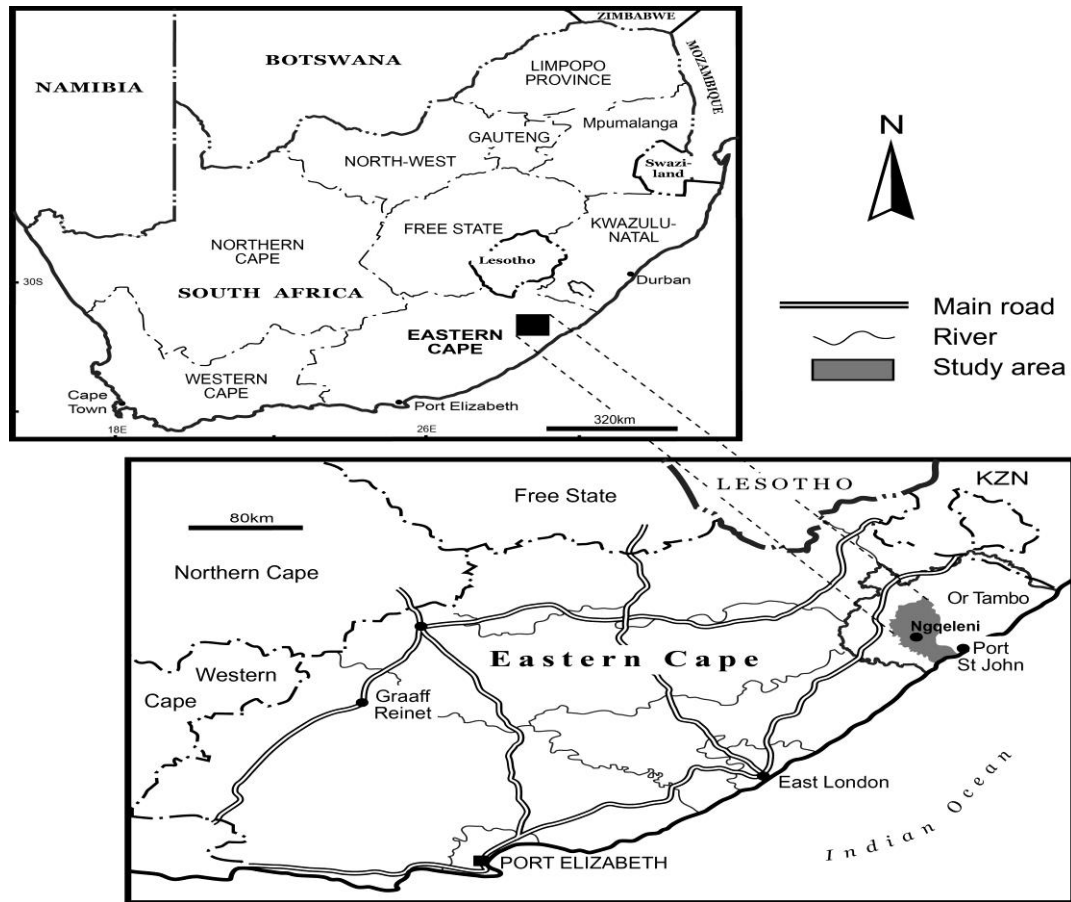
status, food security status, demographic characteristics and other basic information was collected from sample households using structured questionnaire. The quantitative method enabled the researcher to quantify data in terms of statistics, tables and percentages.

3.4.1. Description of the research site

The recent climate change projection in South Africa indicates that global warming will be severe than the global mean temperatures of all seasons (Christensen, 2007). The change in climate will impact on the viability and availability of water resources and consequently food security (GWP & DBSA, 2010). Increased drought will threaten water security and national development. Eastern Cape is one of the regions in South Africa. The region is among the hottest regions; it is prone to drought and receives little rain (ECSECC, 2012). Ngqeleni is one of the towns located in the Eastern Cape and served as the study site (Figure 3.1). It spans approximately 27 km west from Mthatha. It has a population of about 1334 people and there are about 415 households in the area. It falls under the Nyandeni Municipality but the Oliver Reginald Tambo District Municipality.

The town is partly overcrowded (Statistics South Africa, 2011) and it is predominantly a rural district relying on subsistence farming. Most people in the area are poor depending on government grants for survival. The area is among the hottest in the region; it is dry and faces severe water shortages. The impact of the drought affects the quality and sufficiency of food production by the subsistence farmers. It is a vulnerable zone and therefore it gives a good opportunity to undertake this research in the area to better understand what the relationship between water scarcity and food security is. The results of the study and its recommendations will inform policy holders and the government of the challenges facing the area and possible solutions to address those challenges

FIGURE 3.1: MAP OF STUDY SITE



Source: (Cartography unit of geography of the University of Witwatersrand, 2016)

3.5. SAMPLING DESIGN

Sampling design is an important aspect of research design. It aims at the whole population in a more cost-effective, less time-consuming way by drawing conclusions (Wiid & Diggines, 2009). A sampling design which is complete often involves a series of decisions made by the researcher with respect to the target population, sampling frame and methods, and sample size of the research undertaken.

3.5.1. Population Studied

According to Welman, *et al.*, (2009), a population is the full set of cases from which the sample is taken. A population consists of individuals, groups, organizations, human products and events, or the conditions to which they are

exposed (Welman, *et al.*, 2009). A target population can be depicted by a group of potential participants intended to use by the researcher to generalise results obtained or the objectives of the study (Houser, 2008).

For the research in question, the population consisted of individuals residing in the Nqgeleni area of the Eastern Cape Province. The target population involved mainly subsistence farmers and individuals who are not farmers but engaged in petty trading. The sample population were furthermore low-income (R 1 – R 3 000) earning individuals, who are more prone to food insecurity and therefore suitable participants in this study. The majority of the population was black, Xhosa spoken due the location of the study site.

3.5.2. Sample unit and sampling method

As defined by Sekaran, (2006), a sample population refers to the population of interest or topic of interest that the researcher intends to base a study upon. According to Bless, *et al.* (2008), an effective sample should have three attributes; a well-defined population; an adequately chosen sample; and an estimate of how representative of the whole population the sample is. Cooper and Schindler, (2007) also defined a sample as a subset of a population or group of participants carefully selected to represent the population. The sampling unit or unit of analysis represents the case to which the variables under study and the research problem refer, and about which the data is collected and analysed (Collis & Hussey, 2003). The population in this study constituted subsistence farmers in the area and petty traders.

According to Gupta and Kabe, (2011), the sampling unit is a single element or group of elements subject to selection in the sample. As emphasised earlier, there are about 415 households at Nqgeleni location. To obtain a representative proportion of the total population, the sampling unit was based on a total of 30% of the 415 households in Nqgeleni rural area. The current study employed a simple random sampling to select the target population. The selection process involved selecting the first household for the interview.

Thereafter, the next household were obtained and interviewed after counting the sixth house. The process continued until the required number of respondents for the study was achieved.

As part of the inclusion criteria for this study, the individuals in this sample had to be older than 18 years, as they were able to participate in research without consent from another individual. An original sample of 125 respondents was determined. However, due to their varying time only 111 respondents were available for the interview. Although it is assumed females are the main preparers of food in the home, both men and women were engaged in the interview process as the men also provided valuable inputs from the experiences of the impact of water scarcity in the location. The sample size was acknowledged to be appropriate by the Statistical Consultation Services (SCS).

3.6. DATA COLLECTION TOOLS

For the purpose of this study, different data collection tools were used for collecting the data. These tools include questionnaires, key informants and focus group interviews. These collection tools are further discussed.

3.6.1. Questionnaire

According to Brace, (2008), a questionnaire is a medium of communication between a researcher and a participant of a study. It is often written and used for gathering relevant information for research. Brace, (2008) further mentions that questionnaires are suitable research instruments as they are cost-effective and serve as an easy means of data collection from a large group. Sekaran, (2006) also highlighted that a questionnaire that is well-structured should have simple wordings; themes and variables should be well organised; and it should also have a good appearance.

Rugg and Petre (2007) supported Brace's view when they mention that questionnaires are suitable tools for finding out the opinion of a widespread population or large group. Kumar, (2005) points out that a questionnaire has several advantages. These advantages include affordability as compared to interviews. Furthermore, questionnaires are a means of collecting fast and reliable data. They also offer anonymity and confidentiality. Face-to-face interaction between the researcher and respondent does not usually happen when using questionnaires. This has proven to be helpful when dealing with sensitive questions or issues. On the contrary, participants of a study might ignore the researcher by not completing the questionnaires. This invariably will result in a poor response rate.

Also, in some circumstances, respondents might provide biased information. Both the poor responses and biased information will definitely affect the reliability and credibility of such research (Kumar, 2005). In this study, questionnaires were distributed to 125 respondents. According to Torgerson, (2010), a poor response rate to questionnaires often reduces the statistical strength of the study as this could reduce the effectiveness of the sample size of the study. Fosnacht, Sarraf, Howe and Peck, (2013) also highlighted the importance of high response rates in survey research by stating that a low response rate threatens the source of information as well as the supposed utility of the data gathered. In the current study, of the 125 questionnaires distributed, 111 were completed by participants and returned.

The researcher used questionnaire similar to/ or based on questions used for other studies and this could compare results with other studies. The questions were clear and easy to understand because with self-completed questionnaire there is no one to explain the meaning of questions to respondents. The questionnaire was designed in order to collect both qualitative and quantitative data.

3.6.2. Questionnaire structure and construction

The questionnaire consisted of both open-and closed-ended questions. The first section pertained to basic household demographic characteristics, namely age, gender, monthly expenditure, household size, monthly expenditure and level of education. In most of the studies related to the rural locations, it has been documented that capturing the demographic information of the respondents enables the researcher to categorise respondents and draw comparisons between the different categories (Van Heerden, 2011).

These are some of the factors that influence household food access (Musemwa, *et al.*, 2013), contributing significantly to the causes of food insecurity in South Africa as recommended by Manyamba, *et al.* (2012). The second section of the questionnaire sought information concerning water scarcity, household food and nutrition security situations. All the questions were developed by the researcher based on literature.

3.6.3. Focus Group Discussions

Focus group interviews were used as control for the interview that was conducted but also an additional way of obtaining qualitative information. Struwig & Stead (2011), also stated that group interviews are based on qualitative data collection and that the participants should be tasked with setting the ground rules at the beginning of the session so that no one would be hindered or feel offended by the discussions.

The researcher used focus group discussions which involved gathering of collective perceptions on water and food security issues. Focus group discussions were conducted between three men and three women to solicit their views about the way water scarcity have an impact on their livelihoods in the area. The researcher then put together the three men and women as they expressed their views on the issues at hand in the area. Discussions were held and series of unstructured questions were asked to the members who freely

shared their opinions, ideas and reactions about water, food and nutrition security issues and its challenges. The researcher had two sessions with the participants. One session was between the men and women separately and the other between the two groups together. In focus groups, all participants were encouraged by the researcher to feel that their contributions were worthwhile and they were allowed to disagree with each other in the safe environment created by the researcher if it was necessary. The researcher took detailed notes. The researcher created a comfortable and safe environment in the focus group which gave confidence to participants to share perceptions, points of view, experiences, wishes and concerns without forcing the participants to reach agreement.

The limitations of utilising focus group discussions are that generalising to a population is not possible given the small sample size; as participants may be unwilling to disclose all their thoughts on the topic, and the facilitator may be biased in directing the discussion (Struwig & Stead, 2007).

3.6.4. Interviews

In conducting this research, the researcher travelled on numerous occasions to interview individuals. Interviews were conducted with two officials from the regional office of the Department of Water Affairs and Department of Agriculture and a community leader from Nqgeleni location. All interviews conducted in this study were face to face interviews.

3.7. DATA ANALYSIS

The analysis of data involves organising the collected data in a way to answer the research question and objectives of the study (Houser, 2008). To ensure the quality of data analysis and interpretation, the raw data was firstly inspected and cleaned (Aaker & McLoughlin, 2007). The questionnaires received from respondents were carefully checked for illegible answers, possible errors (example double marking for the same question) and

incomplete answers. After the questionnaires had been inspected, the questions and answers provided were organised and coded in a computer excel sheet. The open-ended aspects of the questions were analysed qualitatively. The close-ended questions were subjected to several statistical analyses. The statistical analysis involved both descriptive and inferential and are explained.

3.7.1. Descriptive Statistics

According to Rule and John, (2011), without descriptive analysis of the phenomenon and its context, explanatory or evaluative analysis of the results does not make sense. Descriptive statistics involved a report on the demographic characteristics of the respondents, mean scores, medians, mode, and standard deviations. The normality of the data was also assessed through skewness of the data. In all cases the data obtained was presented in frequency tables and graphs and descriptive analysis was created out using the software package SPSS version 19.0.

3.7.2. Inferential Statistics

Inferential analysis was used to test for significant relationships among the items identified for the study. The Pearson Product Moment of Correlation was used in the current study to examine the relationship between water scarcity on food and nutritional security in rural households in the Nqgeleni location, Eastern Cape.

The Pearson Product Moment of Correlation was selected because it indicates the strength and direction of a relationship. According to Bryman and Bell, (2011) the coefficient of a relationship will certainly lie between 0 and 1. Zero coefficients imply that there is no relationship between the two variables. A coefficient of 1 implies a perfect relationship. The closer the coefficient is to 1, the stronger the relationship; and the closer the relationship is to 0, the weaker

the relationship. The coefficient will be either positive or negative to show the direction of the relationship (Bryman & Bell, 2011).

3.8. ETHICAL CONSIDERATION

Drew, Hardman, and Hosp (2008) define ethics in research as a moral obligation to protect participants from harm, unnecessary invasion of privacy, and the promotion of well-being. Harm in the context of research ethics; include extreme physical pain or death, psychological stress, personal embarrassment or humiliation that may affect participants in a significant manner (Drew, *et al.*, 2008). Prior to the data collection process, the questionnaire together with the methodology were subjected to ethical scrutiny by the Ethics Committee of the University of Witwatersrand to determine whether the study met ethical requirements pertaining to humans (see Appendix A).

Confidentiality of information obtained was regarded as an important component of the current research. During the survey process, the researcher ensured that all interactions with respondents' and the completion of the questionnaires were based on respondents' choice to disclose information to the researcher. In addition, effort was put in place during the construction of the questionnaire to ensure that personal details of respondents' were not disclosed in the final report. The respondents were also assured that their responses to the study would be treated with high level of confidentiality and that all information collected was for academic purposes and for the improvement of the water scarcity problem at Ngqeleni location in future.

Another equally important ethical issue observed in the current study was to obtain the informed consent of participants. The last ethical consideration observed in the current survey was voluntary participation.

3.9. METHODOLOGICAL REFLECTIONS

The researcher experienced a problem of time constraints. Since most people sometimes worked until late and also needed time to clean their houses, cook and rest, the interviews were conducted in the afternoons or evenings, but due to distance from the researcher's place of residence. Often, only a maximum of five interviews could be done in a day. As the study was conducted in the winter season, it became dark early. This resulted in a limited number of interviews conducted.

Time was a limiting factor as the researcher did not have sufficient time to investigate if there were other similar projects on impact of water scarcity on food and nutritional security in the area, which would have given the study another dimension of relevance. Also, the study is limited only to one area amongst the Nyandeni Municipality. Furthermore, this study is confined to subsistence farming and households engaged in petty trading. This implies that the findings of this research may not necessarily be applicable or extrapolated to other modes of farming, such as commercial farming.

3.10. CONCLUSION

In this chapter, the research design and methodology used in the current study were discussed. The mixed method research methodology was adopted for the current study. Non-probability sampling methods was utilised in the current study to select the respondents for the study. The study employed the simple random sampling to select the target population. The data obtained was analysed and presented using both descriptive and inferential statistics analysis.

CHAPTER FOUR

EMPIRICAL EVIDENCE

4.1. INTRODUCTION

This chapter presents the empirical evidence resulting from the data collected. The Chapter starts off with a presentation of the respondents' profile, followed by the characteristics of the data. Thereafter, a report of the reliability of the data is provided. Furthermore, the relationships between water scarcity, food and nutritional security are explored. The final section of the chapter is dedicated to provide a summary of the entire chapter.

4.2. RESPONSE RATE AND RESPONDENTS' PROFILES

4.2.1. Response Rate

A total of 125 questionnaires were distributed. One hundred and eleven usable questionnaires were received, representing a response rate of 85.4% on which the analysis of the data is based.

4.2.2. Respondents' Profile

4.2.2.1. Gender

Table 4.1 presents the gender of the respondents involved in the survey; 55.9% of the total respondents were males. Below is Table 4.1.

TABLE 4.1

RESPONDENTS' GENDER

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Male	62	55.9	55.9	55.9
	Female	49	44.1	44.1	100.0
	Total	111	100.0	100.0	

4.2.2.2. Age

The age of the respondents are displayed in Table 4.2. The results show that majority of the respondents were between 31 and 40 years (42.3%) followed by those between 41-50 years (32.4%). Out of the 111 respondents, only one respondent was older than 60 years.

TABLE 4.2

RESPONDENTS' AGE

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid 18 - 30 years	19	17.1	17.1	17.1
31 - 40 years	47	42.3	42.3	59.5
41 - 50 years	36	32.4	32.4	91.9
51 - 60 years	8	7.2	7.2	99.1
Older than 60 years	1	.9	.9	100.0
Total	111	100.0	100.0	

4.2.2.3. Occupation of the respondents

Figure 4.1 reports on the occupation of respondents who participated in the survey. The majority of the respondents were self-employed (37.8%) and about 18.0% of the respondents were unemployed. The majority of whom were self-employed are in the informal sector.

FIGURE 4.1

OCCUPATION OF RESPONDENTS

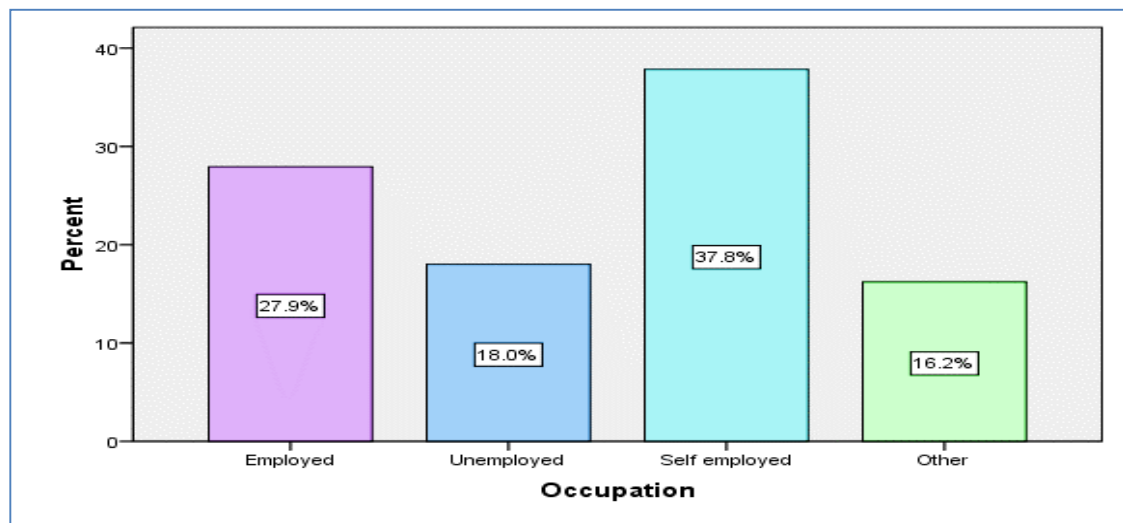
**4.2.2.4. Determining whether respondents are farmers**

Table 4.3 indicates the status of farming. The result shows that 58.6% of the respondents were not farmers. Although, a smaller percentage of respondents (41.4%) in the survey were farmers, their experiences regarding the impact of water scarcity on their food produce served as important evidence in the current study.

TABLE 4.3

ARE YOU DOING ANY FORM OF FARMING?

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid Yes	46	41.4	41.4	41.4
No	65	58.6	58.6	100.0
Total	111	100.0	100.0	

4.2.2.5. Quality of food produced during water scarcity period

Respondents who are farmers were requested to indicate the quality of food produced during the water scarce period. The results are displayed in Table 4.4. The majority of the respondents (representing 35.1% of the farmers) were of the view that the quality of the food produced during water scarce periods were poor. This may have adverse effect on the nutritional security of food consumed by the household. The results suggest that water scarcity affect the nutritional security.

TABLE 4.4

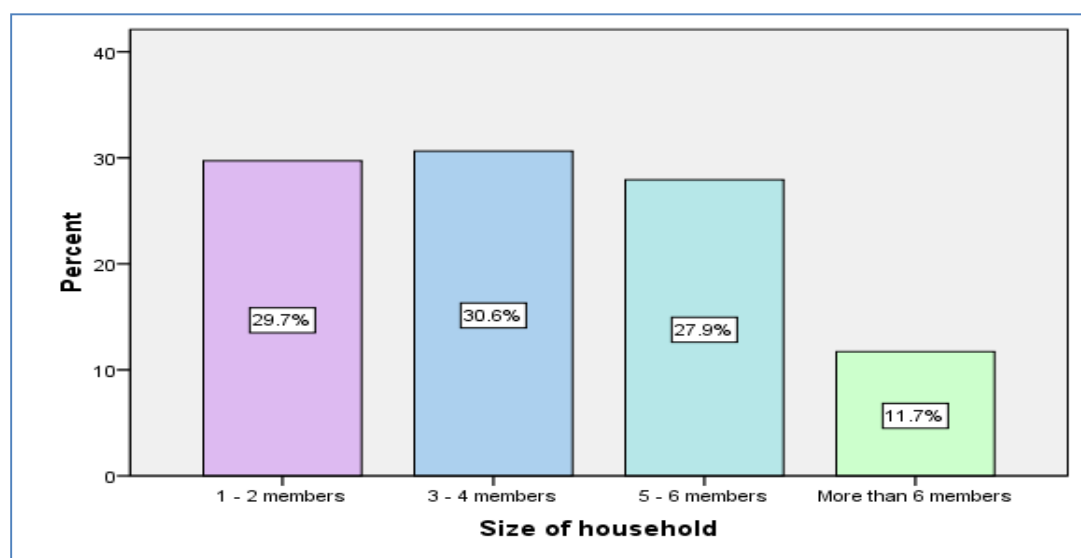
QUALITY OF FOOD PRODUCED DURING WATER SCARCITY PERIOD

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid Very poor	3	2.7	5.5	5.5
Poor	39	35.1	70.9	76.4
Good	10	9.0	18.2	94.6
Very good	3	2.7	5.5	100.0
Total	55	49.5	100.0	
Missing System	56	50.5		
Total	111	100.0		

4.2.2.6. Size of household

The size of the household and its composition are important factors which influence the usage of water. The size of the household for respondents who participated in the survey is displayed in Table 4.2. Over 39% of the respondents had more than five members in the household with only 29.7% of the respondents who had a maximum of two members in the household. On average each household had two members or more suggesting that the members will need regular food supply as well as enough water.

FIGURE 4.2
SIZE OF HOUSEHOLDS



4.2.2.7. Household members' monthly income

Table 4.5 below indicates the household members' monthly income. The results show that 86.5% of the respondents earned a maximum of R2000 per month. Only 13.5% of the respondents earned an income of more than R2000 clearly indicating that the average monthly income for household is low suggesting that majority of the respondents could be classified as poor.

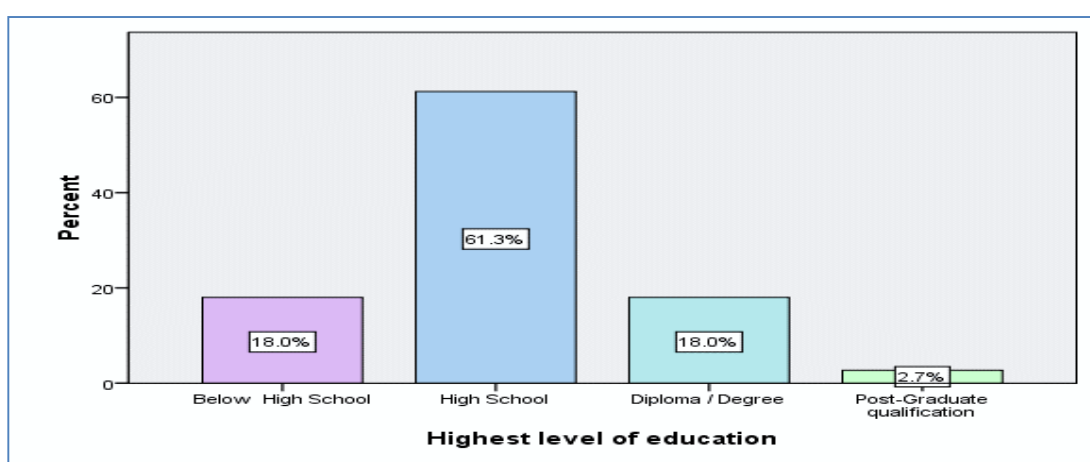
TABLE 4.5
HOUSEHOLD MEMBERS' MONTHLY INCOME

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid R500 and below	16	14.4	14.4	14.4
R501 - R1000	25	22.5	22.5	36.9
R1001 - R1500	28	25.2	25.2	62.2
R1501 - R2000	27	24.3	24.3	86.5
R2001+	15	13.5	13.5	100.0
Total	111	100.0	100.0	

4.2.2.8. Respondents educational background

It is evident from Figure 4.3 that 61.3% of the respondents had only attained a high school certificate. Only 2.7% of the respondents' possess post-graduate degree. The results shows that the majority of the population in the study area are poorly educated. This could result in over-reliance on government subsidies and provision of basic social amenities such as social grant and water.

FIGURE 4.3
EDUCATIONAL BACKGROUND OF RESPONDENTS



4.3. DESCRIPTIVE STATISTICS FOR ITEMS MEASURING WATER SCARCITY, FOOD AND NUTRITIONAL SECURITY

4.3.1. Water scarcity periods

Respondents were requested to indicate the seasonal period when water becomes scarce. The response obtained is indicated in Table 4.6. The results show that the vast majority (71.2%) of the respondents share the view that water becomes a scarce resource during the summer season followed by far fewer respondents for winter season (27.0%). The results suggest that during summer seasons, the community may need more access to water and food availability to survive.

TABLE 4.6

WATER SCARCITY PERIOD DURING THE YEAR

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid Summer	79	71.2	71.2	71.2
Autumn	1	.9	.9	72.1
Spring	1	.9	.9	73.0
Winter	30	27.0	27.0	100.0
Total	111	100.0	100.0	

4.3.2. What are the drivers of water scarcity in the location?

This section of the interview questionnaire sought to obtain respondents opinion on the causes of water scarcity in the location. The responses were obtained by means of focus group and key informants interviews. The respondents provided several causes of water scarcity in the location.

Some respondents were of the opinion that, population growth has been rampant in the location. However, infrastructure to address the high demands of the population regarding water sufficiency had remained the same over the years. Less rain during some seasons of the year (summer), unfair distribution of water to various sections of the location by the municipality had also worsened the scarcity of water in the location. These were the views of most of the respondents.

4.3.3. Alternative means of obtaining water

Respondents were also requested to indicate other means available for them to obtain water during water scarce periods in Table 4.7. Forty four percent of the respondents relied on the nearest river or stream, 36.9% respondents travelled to neighbouring location or area for water. Surprisingly, 8.1% of the

respondents indicated that they do not make any effort to get water during water scarce periods. The results thus suggest that water scarcity in the location is a serious problem affecting the lives of the population.

TABLE 4.7
ALTERNATIVE MEANS OF OBTAINING WATER

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid Get water from stream and sometimes buy water	9	8.1	8.1	8.1
Travel to neighbouring location or area for water	41	36.9	36.9	45.0
Do nothing	9	8.1	8.1	53.2
Rely on the nearest river or streams	49	44.1	44.1	97.3
Fetch water from friends around the next location	3	2.7	2.7	100.0
Total	111	100.0	100.0	

4.3.4. Assistance received from the government during period of scarce water

The responses obtained are shown in Table 4.8 which shows that 91.9% of the respondents did not receive any assistance during periods of scarce water; only one of the respondents received assistance when water became scarce. The results suggest that the government and other charitable organisation have to be involved in minimizing the suffering of the community during scarce water

TABLE 4.8

ANY ASSISTANCE RECEIVED DURING THE PERIOD OF SCARCE WATER

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid Yes	1	.9	.9	.9
No	102	91.9	91.9	92.8
Unsure	8	7.2	7.2	100.0
Total	111	100.0	100.0	

4.3.5. Quality of water supplied by the municipality

According to Clasen and Boisson (2015), clean and plentiful water provides the foundation for prosperous communities. The community relied on water from streams, dams and rivers to survive. Dirty water poses a great health risk and threatens both quality of life and public health. Furthermore, according to the Children Institute (2009), unclean water can compromise children's health and hygiene. This study further sought to investigate the quality of water supplied by the municipality to the residents at Nqgeleni location.

The results are shown in Table 4.9 which indicated that 70.3% of the respondents were not impressed with the quality of the water supplied by the municipality. The result is worrying as dirty water supplied can affect the health status of the population in the location.

TABLE 4.9

QUALITY OF WATER SUPPLIED BY THE MUNICIPALITY

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid Yes	30	27.0	27.0	27.0
No	78	70.3	70.3	97.3
Unsure	3	2.7	2.7	100.0
Total	111	100.0	100.0	

4.3.6. How often do respondents obtain food during the water scarce period?

Table 4.10 shows how often respondents obtained food during the water scarce period. The majority of the respondents' (55.9%) or 62 did not often get food during the water scarce period. Only 28.8% of the respondents had access to food. The results suggest that water scarcity affects the availability of food supply in the community.

TABLE 4.10

HOW OFTEN DO YOU GET THE FOOD DURING THE DRY SEASON?

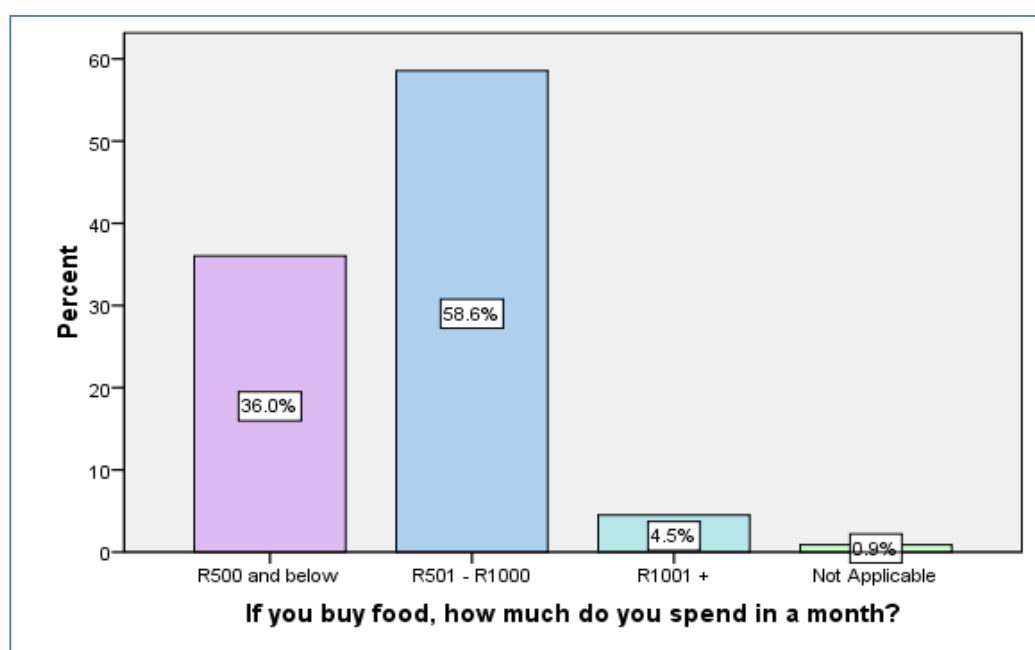
	Frequency	Percent	Valid Percent	Cumulative Percent
Valid More often	17	15.3	15.3	15.3
Less often	62	55.9	55.9	71.2
Regularly	32	28.8	28.8	100.0
Total	111	100.0	100.0	

4.3.7. Money spent in a month to buy food

Respondents were also requested to indicate the amount of money they spend in a month to buy food. The results are displayed in Figure 4.4. The results

show that out of the 111 respondents, 65 of them spend between R501 to R1000 on food in a month. This represents 58.6% of the respondents and they are the majority in the survey. The results further show that 36% of the respondents spend R500 or less on food in a month. The results thus suggest that most respondents can be classified as poor.

FIGURE 4.4
AMOUNT OF MONEY SPENT IN A MONTH TO BUY FOOD



4.3.8. Sufficiency of food produced during water scarce periods

The results show that out of the 46 respondents were farmers, 41(36.9%) of them were able to produce enough food for their household needs during water scarce periods. The results further suggest that water scarcity impacts negatively on farmer's ability to produce enough food.

TABLE 4.11

SUFFICIENCY OF FOOD PRODUCED

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	3	2.7	2.7	2.7
	No	41	36.9	36.9	39.6
	Unsure	2	1.8	1.8	41.4
	Not Applicable	65	58.6	58.6	100.0
	Total	111	100.0	100.0	

4.3.9. Effect of water scarcity on the community

Respondents were also requested to indicate whether water scarcity affect the community. The response received is shown in Table 4.11. The results show that 92.8% of the respondents contend that water scarcity affects the community. Only two of the total respondents were not sure of the effect of water scarcity on the community. The results thus suggest that most of the respondents have experienced the effect of water scarcity on the community and it is a strong indication that water scarcity affects the lives of individuals and the household in the community.

TABLE 4.12

EFFECT OF WATER SCARCITY ON THE COMMUNITY

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	103	92.8	92.8	92.8
	No	6	5.4	5.4	98.2
	Unsure	2	1.8	1.8	100.0
	Total	111	100.0	100.0	

4.3.10. What are the effects of the lack of water in your location?

The rationale for including this question in the interview questionnaire was to obtain information from respondents on the possible effects of water scarcity in the location. The responses were sourced from focus group interview and from the key informants.

Some respondents indicated that the location is a poverty stricken area because they are unable to cultivate their vegetable gardens any longer due to water shortage which propels them to use their little income to buy food/vegetables and which in turn draws the limited family budget. Other respondents were of the view that a lot of petrol is spent searching for water. Other respondents suggested that there are several diseases in the location due to lack of water. The farmer respondents also indicated that lack of water affected the quality of food obtained from their produce which compromise the nutritional aspect needed for the body.

4.3.11. Coping mechanism to address water scarcity, food and nutritional security

Some were of the opinion that new machinery can be acquired to construct water pipes. Others said that water tanks and boreholes could be constructed for the community. Usage of other dams was also suggested to support the current water supply in the location. Some respondents were strongly against what they considered was the unfair distribution of water among the residents and recommended that this attitude should be changed.

The respondents were of the conviction that the municipality has a responsibility to address the current challenges of water shortages in the area and should allocate enough budget to create modern and sufficient infrastructure to solve the problems.

4.4. CHARACTERISTICS OF THE DATA

This section summarises the characteristics of the data and the items measuring water scarcity, food and nutritional security. The central tendency and dispersion of the data are provided first, followed by an assessment of the normality of the data. Table 4.13 displays the central tendency and dispersion of the data as well as an assessment of the normality of the data.

4.4.1. Central tendency and dispersion and normality of the data

Table 4.13 presents a summary of the distribution of data obtained for the items in the questionnaire. This table indicates that all the mean scores were between 1.00 and 3.00 on the scale used. The standard deviations ranged from 0.000 to 1.339, the minimum values starts from 1.00, and the maximum values equalled 5.00. With the exception of very few items, the median values for all the items were slightly above the mean scores, implying that the data obtained is not symmetrical, but depicts a slightly negatively skewed data for some of the items and the responses obtained (Kline, 2011).

TABLE 4.13
CHARACTERISTICS OF THE DATA

	Respondents gender	Respondents age	Occupation	Are you doing any form of farming?	Size of household	What is your monthly income	Highest level of education
N Valid	111	111	111	111	111	111	111
Missing	0	0	0	0	0	0	0
Mean	1.44	2.32	2.42	1.59	2.22	3.00	2.05
Median	1.00	2.00	3.00	2.00	2.00	3.00	2.00
Mode	1	2	3	2	2	3	2
Std. Deviation	.499	.876	1.066	.495	1.004	1.265	.685
Skewness	.239	.306	-.094	-.352	.266	-.027	.449
Std. Error of Skewness	.229	.229	.229	.229	.229	.229	.229
Minimum	1	1	1	1	1	1	1
Maximum	2	5	4	2	4	5	4
Sum	160	258	269	176	246	333	228

TABLE 4.13

CHARACTERISTICS OF THE DATA (CONTINUED)

	Which periods of the year do you experience water scarcity, if all?	Does the community have other places to get water?	What are some of the other places the community get water? (If any)	Do the people get any support during the dry season?	Does the municipality provide the community with good drinking water?	How often do you get the food during the dry season?
N Valid	111	111	111	111	111	111
Missing	0	0	0	0	0	0
Mean	1.04	1.00	1.80	2.00	1.76	2.00
Median	1.84	1.00	2.00	2.67	2.00	2.14
Mode	1	1	2	2	2	2
Std. Deviation	1.339	.000	.630	.279	.490	.653
Skewness	-.997		.178	-.283	-.481	-.143
Std. Error of Skewness	.229	.229	.229	.229	.229	.229
Minimum	1	1	1	1	1	1
Maximum	4	1	3	3	3	3
Sum	204	111	200	229	195	237

TABLE 4.13

CHARACTERISTICS OF THE DATA (CONTINUED)

	What do people in the community do when there is little water available	If you buy food, how much do you spend in a month?	If you produce your own food, are you able to provide enough for the family	What proportion of household food do you obtain from the produce?	What is the quality of food you produce	Do you think when there is less water available, it affect the community?
N Valid	111	111	111	55	55	111
Missing	0	0	0	56	56	0
Mean	2.96	1.70	2.98	2.18	2.76	1.09
Median	3.00	2.00	4.00	2.00	3.00	1.00
Mode	4	2	4	2	3	1
Std. Deviation	1.119	.597	1.062	.547	.637	.345
Skewness	-.166	.473	-.196	3.613	-1.094	4.140
Std. Error of Skewness	.229	.229	.229	.322	.322	.229
Minimum	1	1	1	2	1	1
Maximum	5	4	4	5	4	3
Sum	329	189	331	120	152	121

4.5. RELIABILITY OF THE MEASURING INSTRUMENT

The 19 items used as a measuring instrument in the study was subjected to a reliability test. The result is reflected in Table 4.13. In Table 4.13, the Cronbach's alpha coefficient of 0.710 was obtained indicating that the measuring instrument is reliable.

TABLE 4.14
RELIABILITY OF MEASURING INSTRUMENT

Cronbach's Alpha	Number of Items
.710	19

4.6. CORRELATIONS AND RELATIONSHIPS BETWEEN WATER SCARCITY, FOOD AND NUTRITIONAL SECURITY

This section deals with the correlations and relationships between water scarcity, food and nutritional security. The results will help address Objective 1 of the study, namely to establish the relationship between water scarcity, food and nutritional security of the rural households in Nqgeleni location.

4.6.1. Relationships between water scarcity, food and nutritional security

Table 4.15 provides the results of the correlation between water scarcity, food and nutritional security. The correlation coefficients were all above 0.60. It is also clear that a strong positive relationship exists between water scarcity and food security as well as between water scarcity and nutritional security (correlation coefficients ranging from 0.732 and 0.709). The relationship between food security and nutritional security was also explored and the data indicates that food security has a positive relationship on nutritional security.

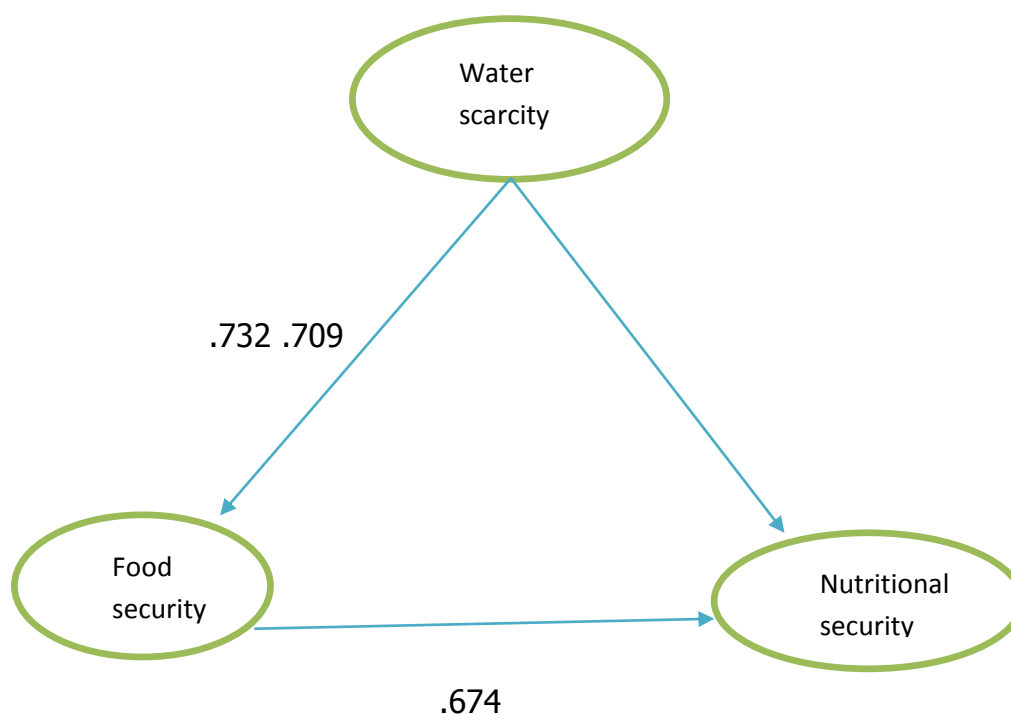
The results thus suggest that water scarcity affects food and nutritional security.

TABLE 4.15
CORRELATIONS AMONG WATER SCARCITY, FOOD AND NUTRITIONAL SECURITY

		1	2	3
1	Water scarcity	-		
2	Food security	.732	-	
3	Nutritional security	.709	.674	-

The above data can be summarised diagrammatically in Figure 4.14

FIGURE 4.5
RELATIONSHIP BETWEEN WATER SCARCITY, FOOD AND NUTRITIONAL SECURITY



Source: Based on Table 4.15

4.6.2. Practical and statistical significance of the relationship between water scarcity, food and nutritional security

Further empirical evidence was sought to establish the existence of practical or statistical significance among the relationship between water scarcity, food and nutritional security. The data obtained are reported in Table 4.16.

TABLE 4.16

PRACTICAL AND STATISTICAL SIGNIFICANCE OF THE RELATIONSHIP BETWEEN WATER SCARCITY, FOOD AND NUTRITIONAL SECURITY

Variable	Correlation	Level of significance
Sufficiency of food produced during water scarce periods	Pearson correlation	.732
	Significant (2-tailed)	.000**
	N	111
Quality of food produced during water scarcity period	Pearson correlation	.709
	Significant (2-tailed)	.001**
	N	111
Does food insecurity affect nutritional security	Pearson correlation	.674
	Significant (2-tailed)	.021*
	N	111

**Correlation is significant at the 0.01 level (2-tailed)

*Correlation is significant at the 0.05 level (2-tailed)

Table 4.16 shows that the relationship between water scarcity and food security is significant ($p=.000$). This is further an indication that water scarcity affects food security. The quality of food which in this study is deemed

appropriate to measure the nutritional aspect of the food produced was also examined. The data also shows that the relationship between water scarcity and nutritional security is significant ($p=.001$). There is also a significant relationship between food and nutritional security ($p=.021$). Overall, the data in Table 4.16 indicates that water scarcity significantly affect food and nutritional security.

4.7. CONCLUSION

The Cronbach's alpha was adopted to assess the internal consistency of the measuring instrument. The results showed that the scale used for the current study was reliable.

The relationships between water scarcity, food and nutritional security were also investigated in this chapter. It is confirmed that a significant relationship exist between water scarcity, food and nutritional security. Other components of the chapter involved exploring the drivers of water scarcity in the location, its effect and coping mechanisms necessary to address the water scarce problem in the location.

CHAPTER FIVE

ANALYSIS AND DISCUSSIONS

5.1. INTRODUCTION

The first objective to be analysed and discussed will be to establish the relationship between water scarcity, food and nutritional security of the rural households in Nqgeleni location. This will be followed by analysis and discussion of the drivers of water scarcity in the area; and finally analysis and discussions of possible strategies that can be used to create an inventory of coping mechanisms employed by rural households with water scarcity, food and nutritional security.

5.2. SOCIO-DEMOGRAPHIC INFLUENCES ON FOOD SECURITY

The four main pillars of food security have been discussed in chapter 2, but are not the only aspects that influence food security. Socio-demographic factors were also noted as constituting additional factors which contribute to food security and as such influence the pillars thereof. Socio-demographics are a combination of sociological and demographic influences and include aspects such as race, gender, income, level of education and household size (Abu & Soom, 2016). For the purposes of this study, the household age, size, income, and level of education are discussed as they were contained in the questionnaire administered to the respondents.

5.2.1. Household size

Household refers to a single or group of individuals residing together whereas the size of the household provides an indication of the number of individuals in the household (Stats SA, 2012). The size of the household determines the food security status of the households (Abu & Soom, 2016; Bashir *et al.*, 2012; Omotesho *et al.*, 2007). This could mean that as the household size increases,

there is larger number of people to be taken care of by the same source of income. According to the 2011 census in South Africa, the average household size have decreased to 3.6% but this is not the case in this study because the highest percentage (30.6%) of the respondents in the rural location of Nqgeleni had three to four members. The average size of the household implies more demand for water and food for sustainable livelihood. The household size at Nqgeleni location is thus important factor in providing food and ensuring regular supply to the area.

5.2.2. Income of household

According to the survey results in this study, it emerged that majority of the respondents earn an income of R1001 - R1500. This income threshold may have a negative influence on food security in the location. In comparison to the recommendations by several researchers (Kuwornu *et al.*, 2011; Akerele *et al.*, 2013) the current household income found this survey are inadequate and could affect food security in the Nqgeleni location. Income of the household represents the second socio-demographic factor that impact on food security. Household income refers to the sum of earnings of household members (Abu & Soom, 2016). With respect to this study, household income obtained by household members include among others, salaries, grants, and pension's. The more a household head engages in gainful employment, the higher he/she earns income and the greater the chances of being food secure.

Prior research studies found that households receiving high income have a greater probability of being food secure (Kuwornu *et al.*, 2011; Akerele *et al.*, 2013). In addition, these authors have found a strong statistical significant relationship between monthly expenditure and household food security. This implies that food security becomes less of a problem when household income is increased. For instance, Kuwornu *et al.*, (2011); Akerele *et al.*, (2013) found in their survey that, households earning income above R2000 were reported to be more food secured compared with households earning R500 or less in a month. Ericksen, (2007) argues that income is a direct determinant of food

utilisation and food security. Furthermore, it has been argued that low-income individuals have inadequate access to sustainable amounts of food due to water scarcity and higher prices of food (FFPP, 2007). Hallberg, (2009) posits that the efforts made to improve food insecurity, which is mostly caused by a lack of access to water scarcity, dietary sources, have been focused on unsatisfactory income and the distribution of food.

5.2.3. Education of household

Education is expected to have positive influence on household food security. As the level of education increases, the percentage of food secure household also increases. In many rural household establishments, it is evidenced that lack of education is a major problem as majority of the population have little or no formal education (Unusan, 2007). With reference to the impact of food utilisation, people's level of education is believed to affect their food security status (Unusan, 2007; Gundu, 2009). In a study conducted by Baiphethi and Jacobs, (2009), the authors indicated that insufficient education not only influences utilisation of food, it also prohibits household from engaging in their own food production activities, due to little knowledge.

Prior research studies have found that educational level of households significantly affects household food security in positive and negative directions (Akerle, *et al.*, 2013; Baiyegunhi & Makwangudze, 2013; Owino, *et al.*, 2013). Education is also widely recognised as a major determinant factor of food security; knowledge associated with primary education has been known to substantively make one improve household food security.

The results on the education level of the household in this study show that 61.3% representing majority of respondents had high school education, 18.0% also had degree/diploma education, which implies that the respondents of the household had a form of education, although majority of them were found to be holders of a high school certificate. This analysis seems to suggest that there is higher likelihood of household adopting agricultural technologies and therefore improve their crop production and hence become food secure if only

the problem of scarce water is also addressed by providing other alternative ways for the local people. Based on that, educational level of households plays an important role in making decision related to production of general commodities; production and agricultural products. For example, Urassa, (2009) argues that households with more education or other forms of human capital stand a better chance of accessing non-farm income or credit and they, therefore, could be more able to afford inputs. This point here is that such farming households may be more aware of the benefits of using various modern agricultural technologies and more efficient in their farming practices. Therefore, farming households with more education had the possibility of obtaining higher yields and become food secure.

5.2.4. Household Age

Age is also another variable that is expected to have an impact on food security. The age of household head is expected to impact on his or her labour supply for food production. Household heads who are young and energetic are expected to cultivate larger farms compared to older and weaker household heads. It also determines the ability to seek and obtain off farm jobs and income which younger household heads can do better. According to Knueppel *et al.*, (2009), age of the household plays a key role in enhancing household food security. Research studies also indicate that the physical, psychological, social and/or economic changes that may naturally occur in the lives of older adults increase the probability of their household being food insecure (Duerr, 2007; Idrisa, *et al.*, 2008). Age has been found to determine how active and productive a household would be. Age has also been found to affect the rate of household adoption of innovations, which in turn, affects household productivity and household improvement strategies (Amaza *et al.*, 2009).

The result from this study show that (42.3%) of the respondents were between the age of 31 and 40 followed by those above 40 years and those between the age of 18 and 30 (17.1%). Generally, most of the household respondents were in the active and productive age range of 31 and 40 years.

In the active age, individuals are expected to be very active on the farm activities and more responsive to agricultural extensive programmes. Surprisingly, only 41.4% of the respondents were found to be farmers in this study (see Table 4.3). This is actually a problem as majority of the active population might not be involved in food productions which will eventually affect food security.

In addition, a study by Idrisa, (2008) has also revealed that age, in correlation with farming experience has a significant influence on the decision making process of farmers with respect to risk aversion, adoption of improved agricultural technologies, and other production-related decisions.

5.3. THE RELATIONSHIP BETWEEN WATER SCARCITY, FOOD AND NUTRITIONAL SECURITY OF THE RURAL HOUSEHOLDS IN NQGELENI LOCATION

Adequate and available water resources are essential for economic development and household sustainability. In the same domain, insufficient water affects food security. In the 21st century, governments across the globe have prioritised water related issues and food security as engine of growth. Without water, people do not have a means of watering their crops and, therefore, to provide food for the fast growing population. Water for food is one of the main global issues and irrigation is a limiting factor in agricultural production. According to the WHO, (2014), food supply is important to human need and contributes to good nutrition needed for growth and good health.

Furtherance to this, nutritious food help prevents diseases and sicknesses. While many factors contribute to this issue, reduced water availability caused by water consumption leads to reduced availability for food production and consequent yield losses. Within the confines of South Africa, the issue of food security is enshrined in Section (26) and (27) of the Constitutional law that, each individual is entitled to adequate access of available, safe and sufficient sources of food and water on a national as well as household level (Du Toit, 2011; Pinstруп-Anderson, 2009).

Although, the issues of water, food, and nutritional security are crucial to every nation, little empirical evidence exists to establish its relationships. This study attempted to close this gap. In addition, establishing the relationship between water scarcity, food and nutritional security has helped to address Objective 1 of this study. According to the empirical evidence in this study, water scarcity has a strong positive relationship on food and nutritional security. Food security has an impact on nutritional security (see section 4.6). The results indicate that majority of the respondents who are farmers 41(36.9%) contend that they are unable to produce sufficient food during water scarcity periods.

This is a confirmation that water scarcity affects food production and food security. In addition, it thus implies that water scarcity impacts negatively on farmer's ability to produce enough food. The study has also revealed that locations particularly, poverty striking areas, are unable to cultivate their vegetable gardens due to water shortage which forces them to use their little income to buy food/vegetables and which eventually negatively affect the family budget. Furthermore, majority of the respondents representing 35.1% of the farmers showed displeasure with the quality of their food produce during water scarce periods. They indicated that water scarcity affects nutritional security. Also, 92.8% of the respondents indicated that water scarcity affect the community. Further statistical significant evidence was found between water scarcity, food and nutritional security (see section 4.6.2).

The above findings confirm that water scarcity affect food and nutritional security. This can also affect household food productivity, employment, health and even their livelihood. The findings are consistent with previous studies such as Duet *et al.*, (2015), Gebrehiwot *et al.*, (2015), Gichuki, (2008), Hanjra and Molden, (2007), Rodriguez *et al.*, (2015). These authors found that water scarcity affect food security.

5.4. IDENTIFY THE DRIVERS OF WATER SCARCITY IN THE AREA

The causes or drivers of water scarcity are important for decision making purposes and implementation of strategies. In addition, once the causes of

water scarcity have been established, policy makers can device alternative means to address any impact on the livelihood of the society. Prior research studies have identified numerous causes of water scarcity. This includes increasing costs of developing new water resources, land degradation in the irrigated areas, groundwater depletion, water pollution and ecosystem degradation, current water utilization practices and fast growing population (Hanjra & Gichuki, 2008).

The current study found that water scarcity occurs mostly in seasonal periods. Majority of the respondents representing 71.2% confirmed that water becomes scarce during the summer period followed by the winter period. These are natural phenomenon but strategies can be implemented to avert any negative impact. The results also show that rise in population growth, lack of infrastructure, and unfair distribution of water to all residents are the causes of water scarcity in the Ngqeleni location. The above findings are in line with Hanjra and Gichuki, (2008) assertion that population growth and cost of developing water infrastructure are some of the causes of water scarcity. The findings have also helped addressed objective 2 of this study.

5.5. CONCLUSION

This Chapter was dedicated to analysis and discussions of the empirical findings. A number of issues including socio-demographic influences on food security, the relationship between water scarcity, food and nutritional security, as well as the drivers of water scarcity have been addressed in this chapter.

There is a positive significant statistical relationship between water scarcity, food and nutritional security. This was supported by the establishment of a statistical significant relationship between the three variables.

CHAPTER SIX

CONCLUSIONS AND RECOMMENDATIONS

6.1. INTRODUCTION

Though it has been well documented that South Africa is regarded as a water scarce country, unemployment, poverty, skewed economic structure and structural food insecurity have continued to characterise the country even after democracy in 1994. In many developing countries, especially Sub-Saharan Africa, the population of rural households is enormous. Millions of these rural households in South Africa continue to venture into subsistence agriculture in order to escape these challenges.

However, majority of these rural households find it difficult to escape hunger, food and nutritional security due to limited important socio-economic services like water. Many communities do not have year-round access to adequate amounts of either fresh or processed staple foods, and their access to fresh vegetables and fruits tend to be seasonal. Households sell food because they need cash. They use different strategies to ensure continuous access to a variety of nutritious foods.

6.2. CONCLUSION

Several studies and government reports have suggested a number of interventions and policies to uplift the standard of living in rural areas in South Africa. The challenge now lies in transforming those policies into actions. Given the reality of rural dwellings and the complexity of their livelihoods, the following recommendations for future policies and interventions are important to improve the conditions where rural households live and operate. Numerous alternative policies can be pursued for improving rural areas to enhance

household food security. The researcher argues that any single policy will not necessarily solve the challenges facing the country. These suggest that policies and interventions for improving household food security must therefore go behind policies aiming to improve the conditions of households in the rural areas. This, based on the findings suggesting a few interventions that could be implemented to uplift the conditions in rural areas.

As suggested by many authors in the literature review, ending extreme poverty may require partnership of whom and which to ensure formulation of relevant policies. As various private sectors collaborate with the government of South Africa to eradicate poverty and food insecurity, both private and public partnership sectors should work hand in hand and support rural areas so that the sector can effectively contribute to water scarcity alleviation, poverty alleviation and fighting food insecurity. This dissertation demonstrated that, given the nature of water scarcity on food and nutritional security challenge in one village in Eastern Cape, which could be extrapolated to other rural households to find alternatives to escape drought and food insecurity.

In South Africa, it is documented that rural settlements is one of the fastest-growing sources of employment. The sector contributes 32.7% to the creation of non-agricultural jobs. With regard to the contribution of the sector to the GDP of South Africa, its contribution ranges between 7.1% and 11.1%. As noted in many countries, particularly those that are regarded as developing countries, the rural households is an important source of employment and of convenient provides affordable nutritious food for the urban poor and working classes, which contributes to dietary energy and protein intake, particularly for those who consume it often. However, the study area in Nqgeleni location does not have access to water and hence it impacts on their vegetable gardens and consequently hinders on their food production.

From the above discussion, it becomes evident that the importance of promoting sustainable development cannot be overemphasised. However, it is of utmost importance to note that with current drought conditions in South Africa, achieving food security within acceptable sustainable development

targets is a definite challenge. This study discusses water scarcity and how it impacts negatively on the food and nutritional security of people especially those in the study area. In order to bring the underlying issues to the fore, this study analyses phenomenon such as the impact water scarcity have on livelihoods, food production and on their health. Controversies surrounding water scarcity are slowly dissipating, as man gradually comes to terms with the reality that weather patterns are no longer as predictable as they were in the past.

The issue of food security has been critical in many parts of the developing world and in view of that; environmental crisis is not an arguable subject any longer as sceneries of climatic changes continue to occur globally. However, the effects of water scarce conditions vary from place to place, and these changes impact differently on human life. Due to differences in livelihoods, economic capabilities and physical environments, the impact of environmental change is experienced differently by different people. However, changes in the environment resulting from excessive human activity have led to a myriad of undesirable consequences for life on earth, with the most conspicuous effect being drought. Water scarcity has led to a number of environmental imbalances, such as a fall in food production, which has resulted in households in rural Nqgeleni being food insecure.

This phenomenon has led to unpredictable rainfall patterns and unprecedented droughts in certain instances. These developments continue to impact negatively on traditional patterns of food production. Despite various food security programmes implemented as part of interventions for creating jobs to improve income levels and improving access to food, the situation remains challenging in South Africa in spite of evidence that the country is producing enough food. The basic finding, and one which impacts directly on the food security of residents of the Nqgeleni rural settlement, is that the majority of them consisted largely of households that depended on casual employment, and were therefore classified as poor.

However, as a survival mechanism, some households that had gained experience in agriculture from rural areas have initiated home gardens, as well as group gardens. While progress has been made towards improving food security through improvements in crop production, the same cannot be said of nutrition security. Little attention has been paid to nutritional goals and linking them to agriculture programmes as well as the endpoint to improved human health and wellbeing in poor rural households. Consequently, poor rural households still suffer unacceptable levels of malnutrition despite the various interventions that have been made to improve their status.

Inadequate nutrition in poor rural communities is partly associated with lack of dietary diversity and limited access to and non-availability of nutrient dense foods. Programmes aimed at addressing food and nutrition security for improved human health has had limited successes. This is because of failure to clearly recognise the crucial linkages between water, food and nutritional security. There is a need for a paradigm shift which includes adopting the water-food-nutrition strategy approach. This will ensure that nutrition and health strategies are incorporated in critical strategic planning and formulation of policy. The latter will help address the knowledge gap.

The research thus concludes that rural households in Nqgeleni location are unable to reduce household food security vulnerability in the study area due to the issue of water scarcity. The findings reported in this study are coincident with other studies conducted on the rural households and food security in South Africa. Despite the significant progress toward the goal of eradicating extreme poverty, South Africa appears to lag behind in its efforts to achieve SDGs 1.

6.3. RECOMMENDATIONS TO IMPROVE WATER SCARCITY AND ENSURE THAT THE SECTOR CONTRIBUTES TO HOUSEHOLD FOOD AND NUTRITIONAL SECURITY EFFECTIVELY

6.3.1. RECOMMENDATIONS

The recommendations arise on the basis of the findings of the study and observations made during the study.

In Nqgeleni location, there is no potable water for the area. There are no borehole, pumps and reservoirs to store water as well. The people get water from rivers, streams and dams. The recommendation is, therefore that the Nyandeni district municipality together with the Department of Water Affairs and forestry should construct reservoirs for the rural location in Nqgeleni. They should also construct boreholes, pumps and pipe for households in the area which will improve access to water for both domestic and productive uses. This study recommends that the municipality should deliver water with trucks sometimes to the people. This practice will help the community members to have access to water in Nqgeleni.

Water storage at household level is likely to remain important, and most vulnerable households can be assisted to increase their water storage through rain water harvesting tanks. It is therefore, recommended that DWAF and the municipality help to construct cement rain water harvesting tanks for the vulnerable groups so that they will be able to have enough water for all domestic and productive uses. Water recycling is also one option that the communities can use to irrigate their gardens. It is recommended that the community instead of throwing away water after bathing and washing, they should use it to irrigate their backyard gardens.

Key informants have indicated that there was an intended water project to supply water to the community; but it never happened. It is recommended that the municipality speed up the process with preference to areas which are

dry and do not have sufficient water. Water is central to the realisation of human potential, without water households would never realize their potential. They would never be able to expand their options in order to secure their food, nutrition security and income. In conclusion, improved water access for both domestic and productive uses has a positive impact on human development.

6.4. LIMITATIONS OF THE STUDY AND RECOMMENDATIONS FOR FUTURE RESEARCH

The current study has been successful in contributing to the empirical literature on water scarcity, food and nutritional security in a selected location in South Africa. Inasmuch as certain areas have been explored and greater understanding attained, new avenues for research have also been revealed. Therefore, as in all empirical studies, certain limitations were identified which could serve as niche areas for future research.

The first limitation relates to the study site chosen for the study. Only one location at Nqgeleni location in the Eastern Cape Province was chosen to assess the issues relating to water scarcity, food and nutritional security. The researcher is convinced that the results could not be generalised to the entire Eastern Cape Province in South Africa. Future research can be focused on other locations in the Eastern Cape with the quest to generalise the findings to the Eastern Cape Province.

The second limitation concerns the target population. The target population involved mainly subsistence farmers and individuals who are not farmers but engaged in petty trading. The sample population were furthermore low-income (R 1 – R 3 000) earning individuals, who were more prone to food insecurity and therefore suitable participants in this study. Although this is not a major problem as the reliability of the measuring instrument was very good, it is however, recommended that future researcher may target only respondents who are not farmers.

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APPENDIX A: ETHIC CLEARANCE CERTIFICATE



Research Office

HUMAN RESEARCH ETHICS COMMITTEE (NON-MEDICAL)
R14/49 Dotse

CLEARANCE CERTIFICATE

PROTOCOL NUMBER: H15/06/22

PROJECT TITLE

Exploring the relationship between water scarcity on food and nutritional security in rural households in the Ngqeleni Location, Eastern Cape

INVESTIGATOR(S)

Ms L Dotse

SCHOOL/DEPARTMENT

GAES/

DATE CONSIDERED

19 June 2015

DECISION OF THE COMMITTEE

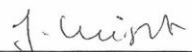
Approved unconditionally

EXPIRY DATE

02 July 2017

DATE 03 July 2015

CHAIRPERSON

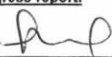

(Professor J Knight)

cc: Supervisor : Dr D Simatele

DECLARATION OF INVESTIGATOR(S)

To be completed in duplicate and **ONE COPY** returned to the Secretary at Room 10005, 10th Floor, Senate House, University.

I/We fully understand the conditions under which I am/we are authorized to carry out the abovementioned research and I/we guarantee to ensure compliance with these conditions. Should any departure to be contemplated from the research procedure as approved I/we undertake to resubmit the protocol to the Committee. **I agree to completion of a yearly progress report.**


Signature


Date

PLEASE QUOTE THE PROTOCOL NUMBER ON ALL ENQUIRIES

APPENDIX B: COVERING LETTER AND PARTICIPANTS INFORMATION SHEET

Invitation to the research on exploring the relationship between water scarcity on food and nutritional security in rural households in the Nqgeleni location, Eastern Cape

Good day Sir/Madam,

My name is Dotse Laura Novienyo Abla, an MSc student at the University of the Witwatersrand, Johannesburg. I am doing a research on **Exploring the Relationship between Water Scarcity on Food and Nutritional Security in Rural Households in the Nqgeleni Location, Eastern Cape.**

I would like to invite you to participate in completing this questionnaire based on the above study strictly for academic purposes. This exercise will require a maximum of 25 minutes of your time. Participation in this study is totally voluntary, and you are under no obligation to take part in this study. You are free to skip any question and withdraw from the study at any stage and this will not be held against you. If you decide to take part in this study, you will be invited to sign a consent form confirming that you understand and accept to be part of the study. You will also be given a copy of the information sheet to keep. All data collected will be kept confidential and used for research purposes only.

Your name or any identifying characteristics will not be available to anyone, other than me and my supervisor, at any point. There are no risks involved in participating in this study. On the other hand; it will help to contribute in improving on ways in uplifting sustainable growth and development in the Nqgeleni rural area.

For any queries regarding the research or the implication of your participation, please do not hesitate to contact me or my supervisor on:

Study Investigator

Dotse Laura Novienyo Abla

Phone No: 012 492 3216

E-mail: dotselaura@yahoo.com

Supervisor's Contact

Professor. Danny Simatele

Phone No: +27 0117176515

Danny.simatele@wits.ac.za

APPENDIX C: CONSENT FORM

Invitation to the research on exploring the relationship between water scarcity on food and nutritional security in rural households in the Nggeleni location, Eastern Cape

I agree to take part in the survey and that I have been informed by study investigator Ms. DOTSE Laura Novienyo Abla about the nature, conduct, benefits and risks of the study. I have also received, read and understood the participant information sheet regarding the study. I am aware that the results of the study will be anonymously processed and may, at any stage without prejudice withdraw my consent and participation in the study. I have had sufficient opportunity to ask questions and therefore; I declare that; I am prepared to voluntarily participate in the study.

I do agree to be audio-recorded /participate in the survey. ☐ (Tick if appropriate)

I do not agree to be audio-recorded / participate in the survey. ☐

Participants Signature ----- **Date**-----

I, DOTSE Laura Novienyo Abla, herewith confirm that the above participant has been fully informed about the nature and conduct of the above study.

Study Investigator

Dotse Laura Novienyo Abla

Signature ----- **Date**-----

APPENDIX D: QUESTIONNAIRE

WATER SCARCITY, FOOD AND NUTRITIONAL SECURITY

SECTION A: DEMOGRAPHIC INFORMATION

For all the questions below please put a cross (x) over the number indicating your choice

A1	Gender:	Male	1	Female	2
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A2	Age:	18-30	1	31-40	2	41-50	3	51-60	4	Older than 60	5
A3	Occupation	Employed	1	Unemployed	2	Self Employed	3	Other	4		

A4	Are you doing any form of farming?	Yes	1	No	2
----	---	-----	----------	----	----------

A5	What is the quality of food you produce?	Very good	1	Good	2	Very poor	3	Poor	4
----	---	-----------	----------	------	----------	-----------	----------	------	----------

A6	Size of the household	1-2 members	1	3-4 members	2	5-6 members	3	More than 6 members	4
----	------------------------------	-------------	----------	-------------	----------	-------------	----------	---------------------	----------

A7	What is your monthly income	Under R500	1	R501-R1000	2	R1001-R1500	3	R1501-R2000	4	R2001+	5
----	------------------------------------	------------	----------	------------	----------	-------------	----------	-------------	----------	--------	----------

A8	Highest level of education:	Less than High school	1	High school	2	Diploma/degree	3	Post-graduate qualification, e.g. Masters, PhD	4
----	------------------------------------	-----------------------	----------	-------------	----------	----------------	----------	--	----------

SECTION B: WATER SCARCITY/ FOOD AND NUTRITIONAL SECURITY

B1	Which periods of the year do you experience water scarcity, if at all?	Summer	1	Autumn	2	Spring	3	Winter	4
----	---	--------	----------	--------	----------	--------	----------	--------	----------

B2	What are the drivers of water scarcity in the location?
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B3	What are some of the other places that the community gets water? (If any).....						
B4	Do the people get any support during the dry season?	Yes	1	No	2	Unsure	3

B5	Does the municipality provide the community with good drinking water?	Yes	1	No	2	Unsure	3
----	--	-----	----------	----	----------	--------	----------

B6	How often do you get the food during the dry season?	More often	1	Less often	2	Regularly	3	Other(please specify)	4
----	---	------------	----------	------------	----------	-----------	----------	-----------------------	----------

B7	If you buy food, how much do you spend in a month?	Between R500	1	More than R501- R1000	2	R1001+	3	Not Applicable	4
----	---	--------------	----------	-----------------------	----------	--------	----------	----------------	----------

B8	If you produce your own food, are you able to provide enough during the water scarce period?	Yes	1	No	2	Unsure	3	Not Applicable	4
----	---	-----	----------	----	----------	--------	----------	----------------	----------

B9	Do you think when there is less water available, it affect the community?	Yes	1	No	2	Unsure	3
----	--	-----	----------	----	----------	--------	----------

B10	If yes, how?
-----	---------------------------

B11	What are some coping mechanisms that you engage in during water scarce period?.....
-----	--

Thank you for your time and cooperation

INTERVIEW SCHEDULE
(OFFICIAL FROM DEPARTMENT OF WATER AFFAIRS)

1. What are the main available resources of water for the people?

- Tap Water
- Wells
- River/ Stream

2. What does your department do to resolve water issues?

3. Please mention some ways in which your department works to overcome water shortage.

4. What are some problems your department face during the dry season?

5. What measures do you follow to resolve the water problems in the community?

6. Have you any collaboration with other organizations regarding water scarcity?

7. What type of working structure do you follow to work with other organizations?

8. Suggestions for the improvement of water management strategies (If any)

Thank you for your time and cooperation

INTERVIEW SCHEDULE

(OFFICIAL FROM DEPARTMENT OF AGRICULTURE)

1. What are the main available resources of water for the local people?

- Tap water
- River/ Stream
- Wells

2. Which of the above mention water resource is more convenient for their household activities?

3. Are you satisfied with the availability of water throughout the year?

- Yes
- No

4. To what extent does water shortage affect food production on the local people's livelihood?

- Least affecting
- Affecting
- Highly affecting

5. In which season do you face water scarcity problem the more?

6. What can you say are the main effects of water scarcity on the people's livelihood?

7. What strategies does your department and that of Water Affairs adopt to help the people in terms of scarce water and low productivity?

Thank you for your cooperation and time

COMMUNITY LEADER OF NQGELENI LOCATION

1. Role and Duties

a. What is your role in the community?

b. What are your duties?

2. Water / Food and nutrition issues

a. Where does the community get its water from?

b. How do the households get water, and what is the procedure to get water?

c. What are the uses of water in the location?

d. How does less water affect the community's food garden and livelihood?

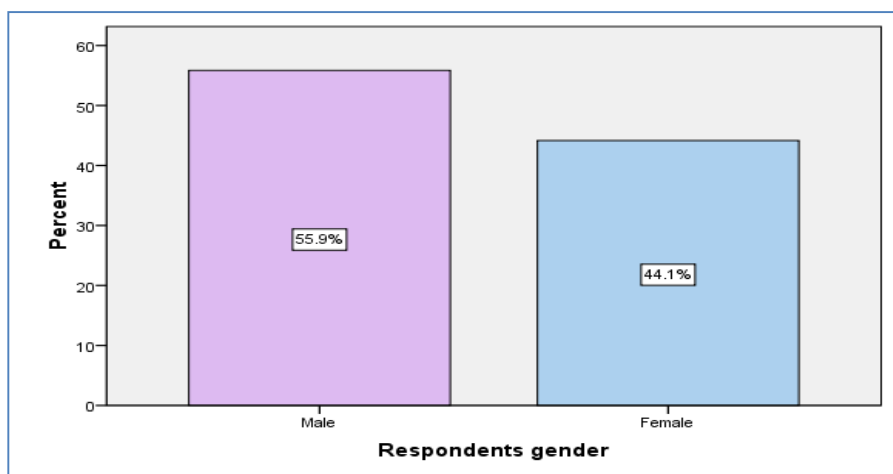
e. Do you as a community get any help from the municipality during less water and food?

f. Any suggestions for the improvement of the water problems on food in the area?

Thank you for your time and cooperation

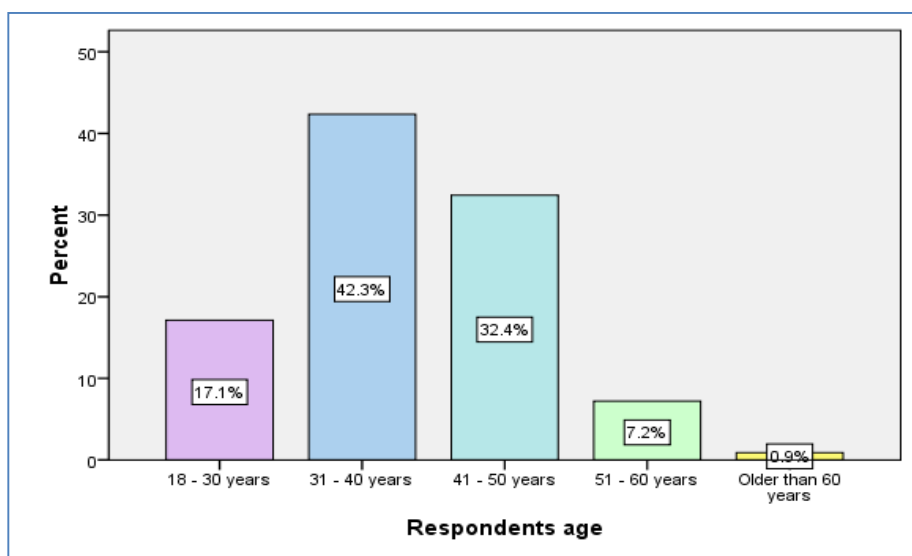
APPENDIX E: LISTS OF TABLES AND FIGURES

RESPONDENT'S GENDER



Source: Based on Table 4.1

RESPONDENTS' AGE



Source: Based on Table 4.2.

OCCUPATION OF RESPONDENTS

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid Employed	31	27.9	27.9	27.9
Unemployed	20	18.0	18.0	45.9
Self employed	42	37.8	37.8	83.8
Other	18	16.2	16.2	100.0
Total	111	100.0	100.0	

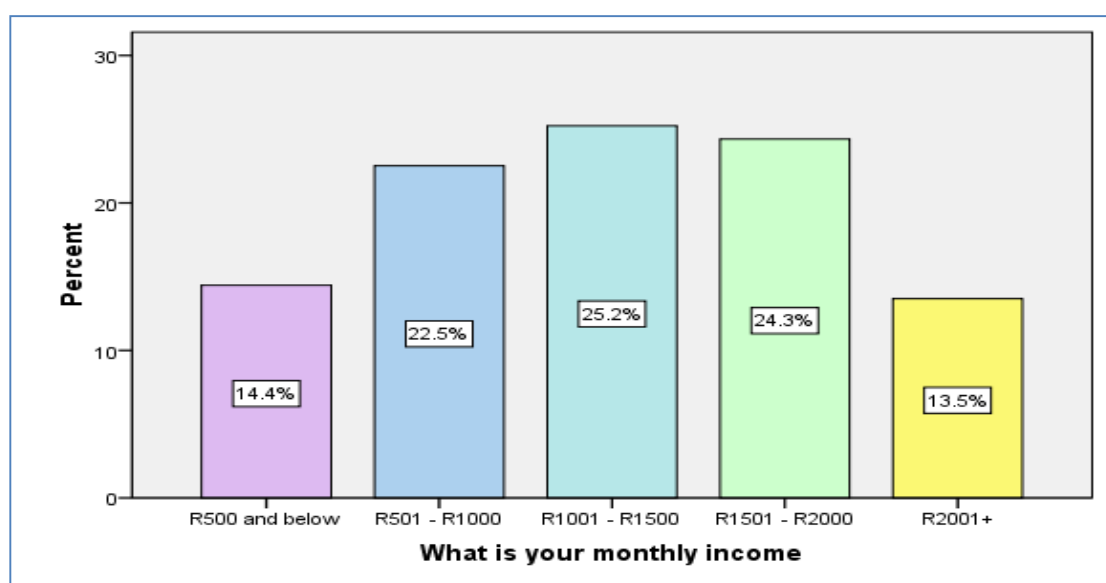
Source: Based on Figure 4.1

SIZE OF HOUSEHOLDS

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid 1 - 2 members	33	29.7	29.7	29.7
3 - 4 members	34	30.6	30.6	60.4
5 - 6 members	31	27.9	27.9	88.3
More than 6 members	13	11.7	11.7	100.0
Total	111	100.0	100.0	

Source: Based on Figure 4.2

HOUSEHOLD MEMBERS' MONTHLY INCOME



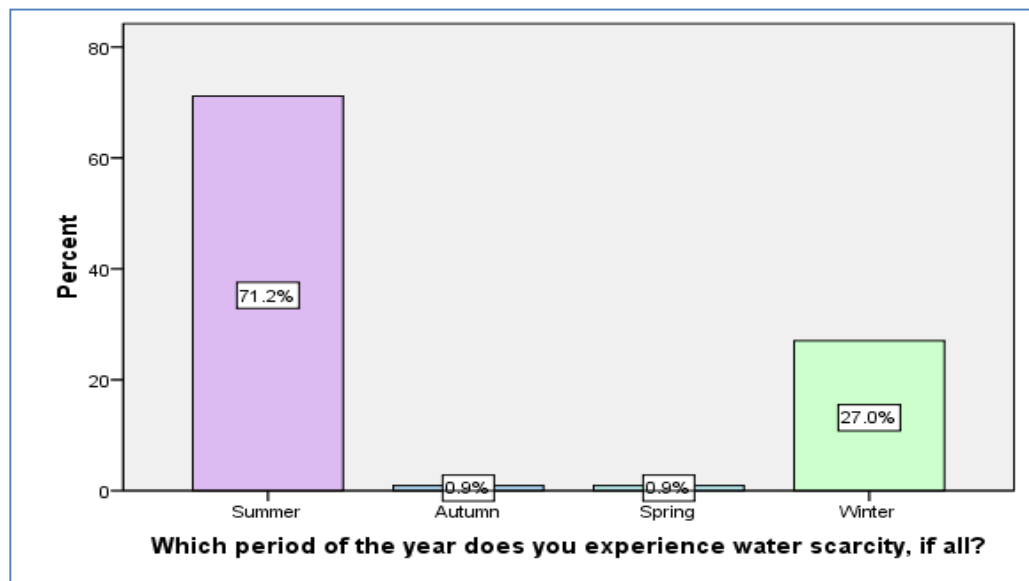
Source: Based on Table 4.5

EDUCATIONAL BACKGROUND OF RESPONDENTS

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid Below High School	20	18.0	18.0	18.0
High School	68	61.3	61.3	79.3
Diploma / Degree	20	18.0	18.0	97.3
Post-Graduate qualification	3	2.7	2.7	100.0
Total	111	100.0	100.0	

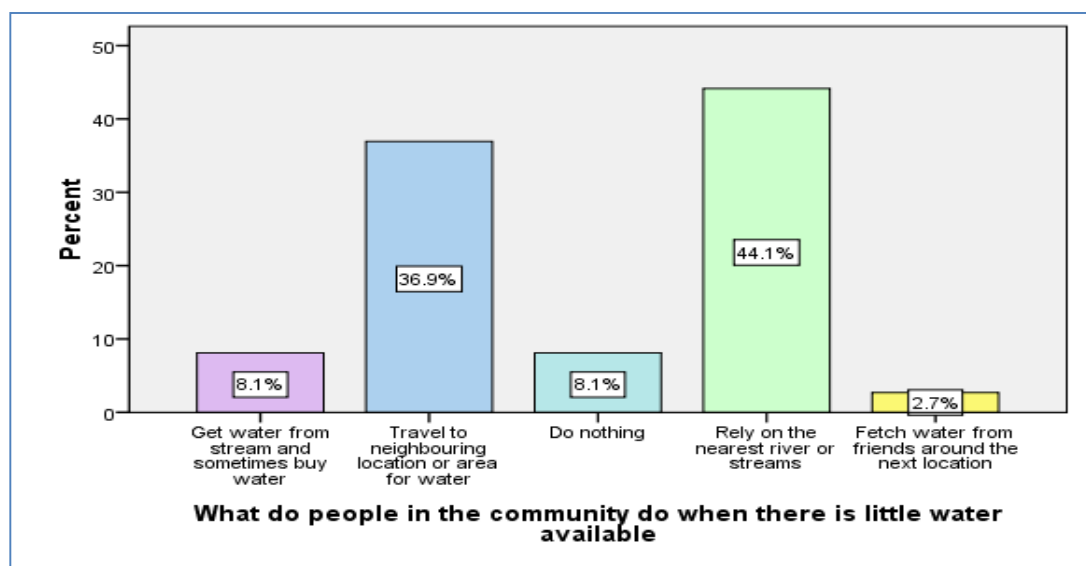
Source: Based on Figure 4.3

WATER SCARCITY PERIOD DURING THE YEAR



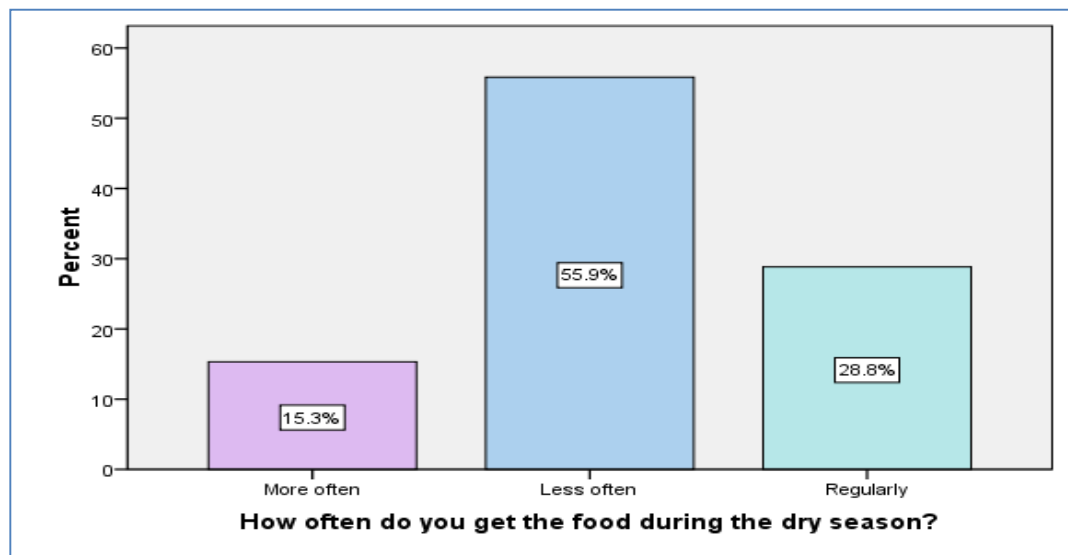
Source: Based on Table 4.6

ALTERNATIVE MEANS OF OBTAINING WATER



Source: Based on Table 4.7

HOW OFTEN DO YOU GET FOOD DURING THE DRY SEASON?



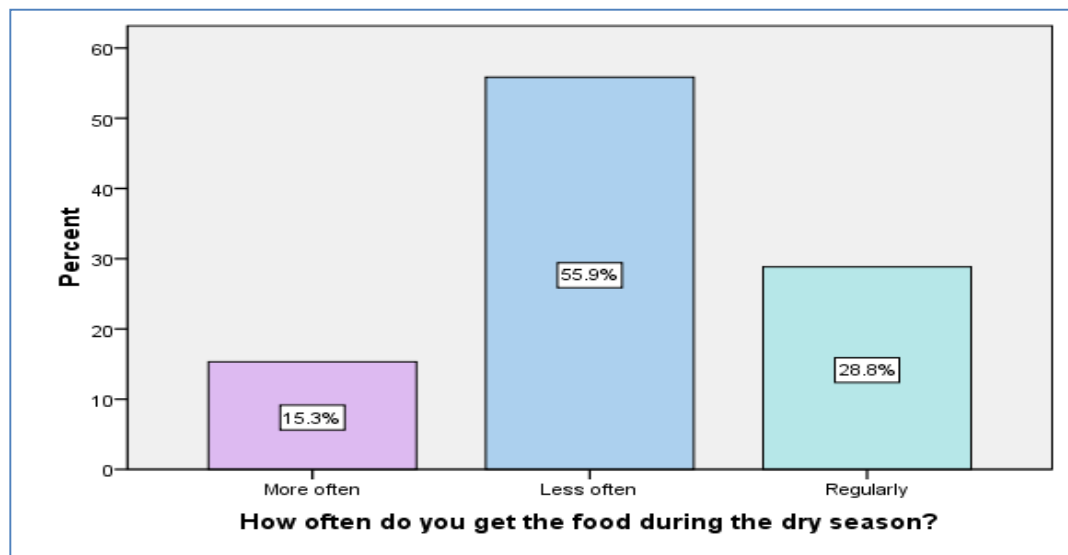
Source: Based on Table 4.10

MONEY SPENT IN A MONTH TO BUY FOOD

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid R500 and below	40	36.0	36.0	36.0
R501 - R1000	65	58.6	58.6	94.6
R1001 +	5	4.5	4.5	99.1
Not Applicable	1	.9	.9	100.0
Total	111	100.0	100.0	

Source: Based on Figure 4.4

HOW OFTEN DO YOU GET FOOD DURING THE DRY SEASON?



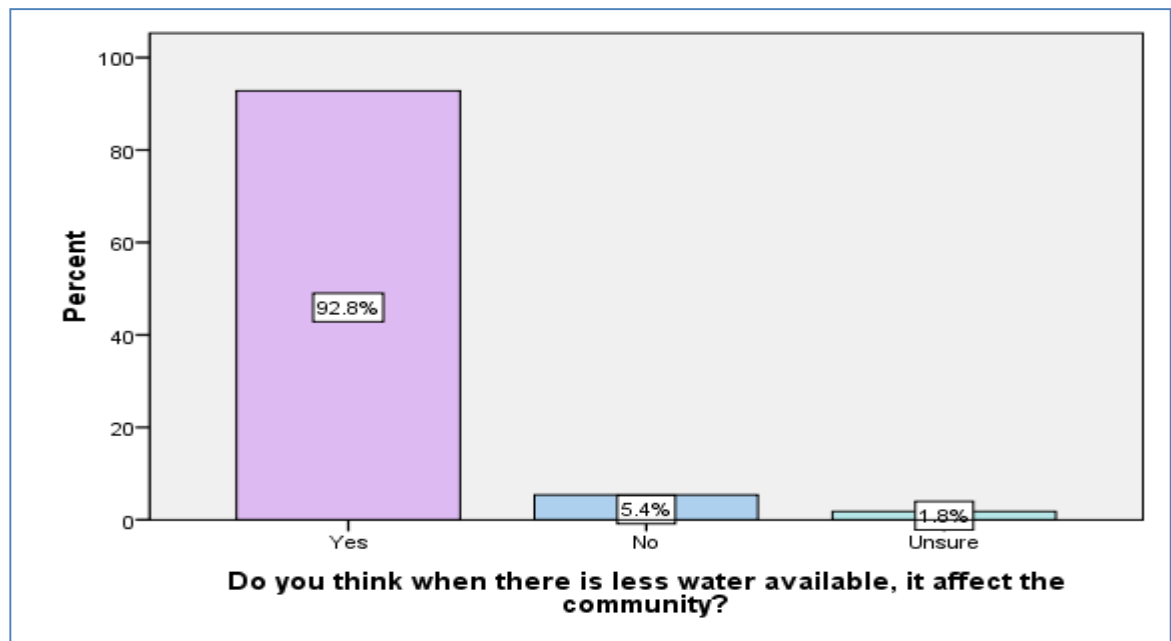
Source: Based on Table 4.10

MONEY SPENT IN A MONTH TO BUY FOOD

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid R500 and below	40	36.0	36.0	36.0
R501 - R1000	65	58.6	58.6	94.6
R1001 +	5	4.5	4.5	99.1
Not Applicable	1	.9	.9	100.0
Total	111	100.0	100.0	

Source: Based on Figure 4.4

EFFECT OF WATER SCARCITY ON THE COMMUNITY



Source: Based on Table 4.12