

## Water Scarcity and Food Security in Ngqeleni Locality in the Eastern Cape Province- South Africa

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### Abstract

South Africa in general and the Eastern Cape Province in particular face increasing water shortages. However, little empirical evidence exists on how rural households are affected by water scarcity and the impact thereof on food security. This paper discusses the relationship between water scarcity and food security in Ngqeleni, a rural location in Eastern Cape, South Africa. Through empirical evidence collected using techniques inspired by the tradition of participatory focus group research and self-administered questionnaires in Ngqeleni, it is argued that there is a significant relationship between water scarcity and food security. Results also reveal that population growth, lack of political will and commitment, inadequate water resource infrastructure, and weaknesses within the institutional framework are some of the causes of water scarcity. Until effective water management systems are identified and enforced, food security will continue to plague Ngqeleni.

**Keywords:** Water scarcity, food security, water management, Ngqeleni location, South Africa

### Introduction

The importance of water and food to mankind cannot be overemphasised. However, water resources have become a scarce commodity for the needs of humanity, especially those in agriculture (Das & Pal, 2020; Kummu, Ward, de Moel & Varis, 2014). Globally, the demand for food has increased exponentially over the past 10 years putting severe pressure on the agricultural sector (Barrera & Hertel, 2021; Duro, Lauk, Kastner, Erb & Haber, 2020; Alexandratos & Bruinsma, 2012; Tian, Engel, Qian, Hua, Sun & Wang, 2021). Research evidence further suggests that there is a continuous decline in water resources to cope with the expanding demand for water in the agricultural sector (Li, Sun, Liu, Singh & Fu 2021; Steffen, Richardson, Rockström, Cornell, Fetzer, Bennett, Biggs, Carpenter, de Vries, de Wit, Folke, Gerten, Heinke, Mace, Persson, Ramanathan, Meyers & Sörlin, 2015). The interplay between water and demand for food is an important concern that requires continuous effort for improvement. Many countries and families with severe water shortages are threatened with famine.

Since 1994, South Africa has encountered significant difficulties in water accessibility, increased poverty, significant levels of joblessness and even more as of late, steep increments in food and fuel costs. The Eastern Cape Province of South Africa is one of the regions in the country that has experienced severe changes in weather patterns and as such most households and families, especially those in the rural areas, are prone to extreme poverty, lack of water and food uncertainty. These alarming conditions have beset poor South Africans, battling to meet their essential family needs, in bad circumstances (Baudoin, Vogel, Nortje & Naik, 2017; Chakona & Shackleton, 2018; Labadarios, Davids, Mchiza & Weir-Smith, 2009). The majority of the rural communities within the Eastern Cape also lack access to proper infrastructure and

employment opportunities. This has resulted in the majority leaving the rural areas for the cities (Statistics South Africa, 2010).

The Eastern Cape Province in South Africa also faces other challenges. For instance, the region has the highest proportion of children in households who are deprived. The region has a high number of unemployed people, yet the second-highest percentage of the population who experience environment impairment (Morton, van Rooyen, Venter & Andersson, 2018; Wright, Noble, Barnes & Noble, 2009). The region is also categorised as a deprived or burdened region in South Africa. The most affected are the rural poor, women, the elderly and young children. The Eastern Cape is among the highest number of recorded HIV cases in the country (De Klerk, Drimie, Aliber, Mini, Mokoena, Randela, Modiselle, Vogel, de Swardt & Kirsten, 2004; Shisana, Rehle, Simbayi, Zuma, Jooste, Zungu, Labadarios, Onoya, et al., 2014). A survey report conducted in households in 2009 shows that 21.4% of households in the Eastern Cape barely get access to adequate and nutritious food, and 92.6% of the agricultural production is for family consumption. Also, 26.4% of households of the Eastern Cape receive government social grants (Aliber, 2009; Statistics South Africa, 2010). Most of the areas in the Eastern Cape do not have access to the electricity supply (69.8%) (Aliber, 2009; Statistics South Africa, 2010). Access to reliable and enough food, as argued by the United Nations Development Programme (UNDP, 2006), is essential for human wellbeing and socio-economic development.

Ngqeleni, a town in the Eastern Cape area of South Africa is no exception to the issues expressed above. The area has a high rate of unemployment and extreme poverty. The area is also confronted with infrastructure backlogs (for example water, electricity and good roads) and fewer work opportunities. A large number of people in the location are recipients of government social grants. The primary type of work in this area is subsistence agriculture. Few are formally employed. Most people move to other locations depending on the season, principally relying upon the accessibility of water. Agovino, Casaccia, Ciommi, Ferrara and Marchesano (2019) found that climate change affects agricultural activities and this puts the lives of the poor in danger. Since farming activities are generally subject to rainfall, no, little or too much rain affects the community's ability to harvest their vegetables and keep up their home gardens. Abundant rainfall will reflect in their agricultural produce and harvest. Conversely, less rainfall affects the quality of food produced and subsequently the wellbeing of the people. Based on this problem, this paper researched how rural households in the Ngqeleni area of the Eastern Cape Province deal with the impact of water shortage on their livelihoods by exploring the different coping measures that will help them to cope with the climatic conditions and ensure that food and nutrition security are uplifted for sustainable growth and development.

The purpose of this paper is twofold. Firstly, it explores the relationship between water scarcity and food security, and secondly, investigates the causes and effect of water scarcity on livelihoods in Ngqeleni location in the Eastern Cape of South Africa. The remaining sections of the paper are structured as follows; a review of related literature on water scarcity and food security from global to local perspective, the method and procedure followed, and the findings and discussion. The final section focuses on conclusions and recommendations, and limitations of the study and recommendations for future research.

### **Contextualizing the literature from global to local perspective**

There are many existing pieces of evidence that suggest that water scarcity arises when the available water within a country or a region deteriorates to below 1000m<sup>3</sup> per person per year (Pereira, Cordery & Lacovides, 2009). This situation becomes severe when people are living with less than 500m<sup>3</sup> per person per year (Pereira et al., 2009). Water scarcity also occurs when

there is a lack of rainfall over an extended period (in respect of agricultural production – a season or more) (Coles & Eslamian, 2017). Existing studies also posit that water is a critical resource that is needed to ensure food security. Food security represents food availability, accessibility, utilisation, and food stability (Erickson, 2008). Based on various studies done on water scarcity, it is evident that there has been an increase in the shortage of water (Veldkamp, Wada, de Moel, Kummu, Eisner, Aerts & Ward, 2015; Wada, van Beek & Bierkens, 2011).

Previous investigations on water scarcity pinpoint a few factors that add to water shortage and food security. According to Gerland, Raftery, Ševčíková, Li, Gu, Spoorenberg, Alkema, Fosdick, Chunn, Lalic, Bay, Buettner, Heilig and Wilmoth (2014); and Steffen et al. (2015), these elements include expanded population development and environmental change. Arshad and Shafqat (2012) also point out factors related to the environment, social and economic structure of a country. Hanjra and Gichuki (2008) also found elements presenting significant difficulties leading to water shortage and food security. These difficulties were linked to growing new water resources, land degradation in irrigated areas, groundwater depletion, water pollution and ecosystem degradation, current water utilisation practices and a fast-growing population. Due to these findings, the relationship between water scarcity and food security has attracted much attention. For example, Tomlinson (2013) found that water scarcity impacts significantly on food security. Rodriguez, Horowitz, Espinoza, Aguilera and de la Torre (2015) investigated the impact of the California drought on food security among rural families of Mexican origin. The authors adopted the mixed research method to understand the challenges that farmworkers endure during a time when production changes due to drought. Their findings were that drought has a significant impact on food security. Du, Kang, Zhang and Davies (2015) investigated the effect that scarce water has on China's food security and strategies that are employed towards developing a sustainable water resource. Their findings indicated that water scarcity significantly affects food production. Scarcity of water leads to fewer crops and causes hunger in rural communities (Challenge 20/20, NYP). Ebi and Bowen (2016) and Hunter, MacDonald and Carter (2010) contend that water scarcity causes diseases, mortality, and hunger. Hanjra and Qureshi (2010) established that the future of food security is hindered by the decline of water resources and climate change. This is arguably a risk to food production, especially where most rural farmers depend on the practice of rainfed agriculture. Similarly, Qureshi, Hanjra and Ward (2013) studied global food security and found that water scarcity and rising population growth impact on food and nutritional security.

South Africa is regarded as a country that is food secure because of the rate of production of staple foods to feed its people. South Africa also imports food for its citizens should the need arise to feed its population (IFPRI, 2002). However, Altman, Hart and Jacobs (2009) contend that most rural households in South Africa are not food secured. The agriculture sector in the country is divided into two, namely the commercial sector and a subsistence sector (Baiphethi & Jacobs, 2009). In most parts of South Africa, subsistence agriculture is mainly seen among areas that were part of homelands during the apartheid era (Sepuru & Dube, 2018).

South Africa with an absolute population of approximately 59 million has around 2.6 million people who are still undernourished and experience food uncertainty (Stats SA, 2020). The Sustainable Development Goals (SDGs) 2011 report also showed that even though progress has been made towards better food security, hunger remains an issue in many rural families in South Africa. A country might be food secure, yet if a part of the individual families is food uncertain, then it might be wrong to presume that the country is completely food secure (Pinstrup-Anderson, 2009). If food security implies adequate food for a country's citizens, South Africa might be regarded as such. However, if it means that "people and households" admittance to enough and nutritious food, then a re-assessment of the meaning of food security and the level to which it is made a reality ought to be researched (Pinstrup-Anderson, 2009).

According to Aliber and Hart (2009) and Jacobs (2011), South Africa is an example of a nation where the definition relating to food security is incorrect.

Consensus does not exist on the definition of food security as there are several indicators within the literature that outline food security. These indicators include interactions of socio-economic and biological factors that represent the idea of food security (Riely et al., 1999, cited in Shisanya & Hendriks, 2011) that change over time (Modirwa & Oladele, 2012). Some contend that the definition should be based on three concepts, namely availability (physical presence of adequate food to fulfil the requirements of everyone), access (capacity to make sure food is often accessible), and utilisation (Barrett, 2010; Bashir & Schilizzi, 2013; Masuku & Sithole, 2009). Other authors include stability as the fourth idea (Alemu, 2010; Drimie & Ruysenaar, 2010; Misselhorn, Aggarwal, Ericksen, Gregory, Horn-Phatanothai, Ingram & Wiebe, 2012; Vink, 2012). Irrespective of what the definition is, the four notions speak to food security (Vink, 2012). The South African constitution is based on these four notions (Khoza, 2008). Section 27(1) (b) and 35(2) (e) of the Republic of South Africa constitution asserts that food is a vital human need and as such, everybody is entitled to adequate food and water; and social security (du Toit, 2011).

Based on these constitutional Acts, the government of South Africa has instructed different departments to tackle the issue of food production and agriculture with the hope that food security levels would improve (Khoza, 2008). Although this is the case, most households, especially in rural areas, keep on experiencing challenges with access to food to meet their dietary necessities (for example D'Haese, van Rooyen, Vink, Kirsten, Staelens, Vandamme, Shonfeld, Remaut-Dewinter & D'Haese, 2013; Lehohla, 2012; Modirwa & Oladele, 2012). These conditions contrast across rural areas of South Africa (du Toit, 2011). As a result, various techniques and plans are used to deduce the degrees of food security concerns in the country. These are consequences related to structural poverty, unemployment and inequalities that distinguish South Africa amongst developing countries (Khoza, 2008; Manyamba, Hendriks, Chilonda & Musaba, 2012).

Similar cases have been considered among the urban poor who reside in cities of the Southern African Development Community (SADC) region (Crush, Hovorka & Tevera, 2012) and other developing countries (Vink, 2012). These examples show that food security concepts are meant to ensure that everyone has basic access to food, yet does not guarantee global access to sufficient, safe and nutritious food (Barrett, 2010).

About 37% of rural communities in South Africa experience severe to extreme drought (Mandela, 2019). The Eastern Cape of South Africa is affected by severe drought (Graw, Ghazaryan, Dall, Gómez, Abdel-Hamid, Jordaan, Piroska, Post, Szarzynski, Walz & Dubovyk, 2017). The impact of drought on the livelihood of the people is dependent on the ability of farmers to cope with drought related conditions. While commercial farmers might have the capacity to irrigate their farm produce, subsistence farmers largely depend on rainfall for their farm produce (Graw et al., 2017). The Eastern Cape and OR Tambo district municipality, where the study was conducted and where over 96 000 employees depend on agriculture for their livelihood, has been declared a disaster area due to increased water scarcity (Mandela, 2019). This indicates the severity of water scarcity that many households and farmers experience. This study will thus contribute to current and future policy development that will benefit the residents of the study area to cope with the drought and to ensure food security.

## **Method and procedure**

This paper is based on a study conducted in Ngqeleni location, a rural community in the Eastern Cape of South Africa (see Figure 1). Ngqeleni is approximately 27 km west of Mthatha. The study area falls under the Nyandeni Municipality. The town is partly overcrowded (Statistics

South Africa, 2011) and predominantly rural, relying on subsistence farming. Most of the households are poor and they depend on government social grants. The area is among the hottest in the region. Because of the high humidity and temperature of the area, it is often prone to drought which therefore serves as the reason for this investigation.

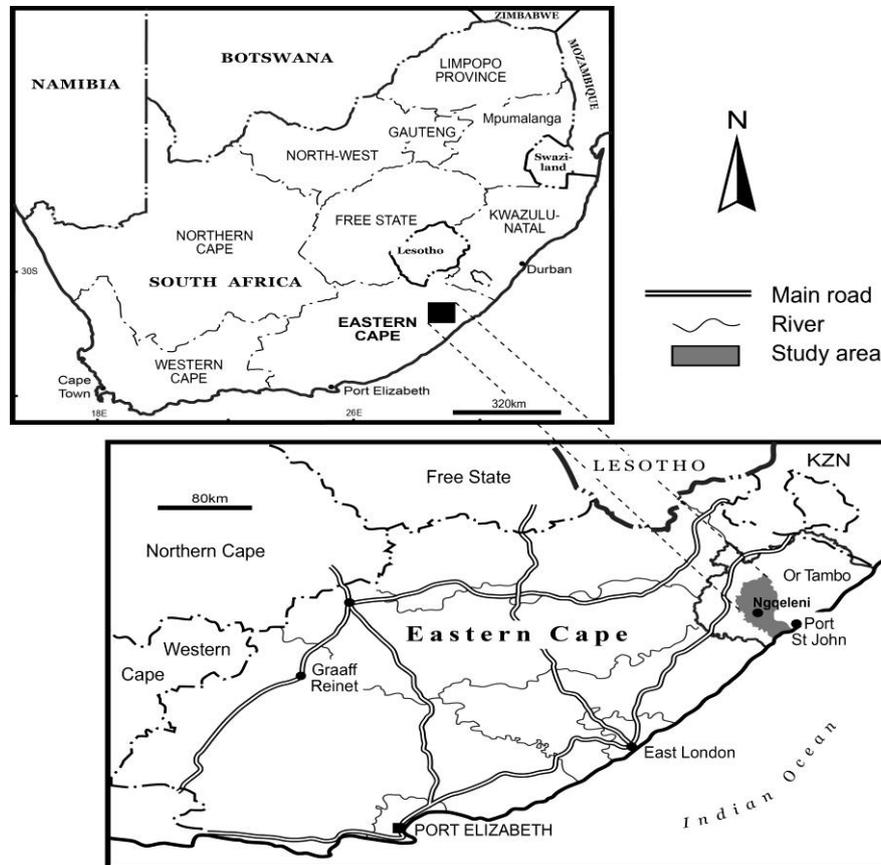


Figure 1: Map of the study site  
Source: Cartography Unit of the Geography Division of the University of Witwatersrand (2016)

Fieldwork was carried out between June and July 2015 employing the mixed research method. A structured questionnaire was designed in several sections. This covered information on demography, water scarcity and food security. Sections of the questionnaire designed for the current study were adopted from a farm household's questionnaire by Gbetibouo (2009). The questionnaire was administered to subsistence farmers and individuals who are engaged in petty trading in the area. Selection of the respondents was conducted via a systematic sampling method in which subsistence farmers and other petty traders who are 18 years or older with at least some years of farming experience were selected in each household for the study. The help of a field assistant in the area who knows the people very well was utilised. The selection process of the target population involved selecting the first household for the interview. Thereafter, the next household was obtained and interviewed after counting the sixth house. The process continued until the required number of respondents for the study was achieved. An original sample of 125 respondents was determined. However, only 111 respondents consented and completed the interview. Thus, the analysis of the data was based on 111 respondents. The structured questionnaire was self-administered to these respondents to source their experiences and perceptions of water scarcity and food security within the study area. From a household of more than one farmer, only one farmer was interviewed to avoid bias as observed by Kemausuor, Obeng, Brew-Hammond and Duker (2011). A focus group



participatory discussion using unstructured questions was also conducted with six subsistence farmers (three men and three women) to hear their views about the impact of water scarcity on their farms and livelihood. A conscious effort was made to establish a tolerant environment in the focus group that would give confidence to participants to share perceptions, experiences, wishes and concerns without forcing the participants to reach an agreement. The structured component of data gathered was processed and analysed using the Statistical Package for the Social Sciences (SPSS 16.0) software. The quantitative results were presented in figures, tables and percentages. The views of the focus group discussions were reported verbatim. Also, similar themes were extracted, translated and used to analyse the results.

## Results and discussions

### *Respondents' profile*

Socio-demographics are a mixture of sociological and demographic influences and include aspects like race, gender, income, level of education and household size (Abu & Soom, 2016). For the needs of this paper, the gender of participants, age, occupation, and income are discussed as they were contained in the questionnaire administered. Table 1 indicates that a large proportion of the respondents are males (55.9%). A large proportion (42.3%) of the respondents were 31-40 years old. The results of respondents' type of occupation show that most of the households are self-employed (37.8%). Table 1 also clearly shows that almost all the respondents within the Ngqeleni community earn a maximum of R2000 as income for a month.

**Table 1: Profile of respondents**

	Frequency	Percentage
<b>Gender:</b>		
Male	62	55.9
Female	49	44.1
<b>Age:</b>		
18-30 years	19	17.1
31-40 years	47	42.3
41-50 years	36	32.4
51-60 years	8	7.2
Older than 60 years	1	0.9
<b>Occupation:</b>		
Employed	31	27.9
Unemployed	20	18.0
Self-employed	42	37.8
Other	18	16.2
<b>Income:</b>		
R500 and below	16	14.4
R501-R1000	25	22.5
R1001-R1500	28	25.2
R1501-R2000	27	24.3
R2001+	15	13.5

Water is a basic human need and key to food security, which is required for food preparation, processing and production. Information was sought regarding the season when water scarcity arises in the community. The evidence gathered is displayed in Table 2. A large proportion (71.2%) of the respondents indicated that water scarcity occurs during the summer season followed by the winter season (27.0%). This seems to suggest that water scarcity happens primarily during summer in the study context. The findings can assist in the planning and implementation of strategies to minimise the adverse impact of water scarcity on society.

**Table 2: Water scarcity period during the year**

Season of the year	Frequency	Percentage
Summer	79	71.2
Autumn	01	0.9
Spring	01	0.9
Winter	30	27.0
Total	111	100.0

Information was sought from the community regarding how often they obtain food during the water-scarce period. Displayed in Figure 2, the results show that 56% of the respondents did not often get food during the water-scarce period. Only 29% of respondents regularly have access to food. These results further suggest that water scarcity significantly affects the availability of food supply in the community.

Respondents were also requested to indicate whether water scarcity affects the community (see Table 3). The response received was striking as 92.8% of the respondents contend that water scarcity affects the community. The result seems to suggest that most of the respondents have experienced the effects of water scarcity on their livelihood and it is an indication that water scarcity significantly affects the livelihood of households especially those living in rural areas.

**Table 3: Effect of water scarcity on the community's livelihood**

Response	Frequency	Percentage
Yes	103	92.8
No	06	5.4
Unsure	02	1.8
Total	111	100.0

The following results emerged from the participatory focus group discussion interview regarding the impact of water scarcity on food security. A male farmer who declined to indicate his age stated that:

We are unable to cultivate our small vegetable gardens and maize farms any longer due to water scarcity in the location. The little money that we get from the government social grant is used to buy food and vegetables which we could have produced on our own. This eventually affects our finances and contributes to poverty amongst our people. The situation is worse during the winter and summer seasons.

The views from the farmer seem to suggest that water scarcity affects the farm produce of small-scale farmers in the rural location. In addition, water scarcity has an impact on the income of rural households.

Another male farmer aged 42 years in the focus group discussion highlighted that:

Water scarcity is our major problem in this location. Lack of water in the location affects the quality of food we produce. This impacts on the nutritional quality needed for the body. Most of our crops (e.g. cabbage, carrots and maize) gets spoiled/rotten before they are harvested. Sometimes we are unable to harvest a basket of maize from our farms. This is discouraging us from farming.

It can be deduced from the above sentiment that available water plays a significant role in the livelihood of the rural people especially those at Ngqeleni location. Lack of water significantly

affects food security. A female farmer aged 46 years spoke about how water scarcity affects the health of farmers and the community at large:

We often battle with common illnesses and diseases (e.g. diarrhoea and cholera) due to lack of water in the area. Our rivers become dried-out and available water for drinking and cooking becomes a huge challenge.

The findings above support the notion that water scarcity affects the health of rural people. The responses thus suggest that the impact of water scarcity does not only affect food security but extends to other social and health-related problems. The participatory focus group interview also sought to obtain respondents' opinions on the causes of water scarcity in the location.

A male participant aged 53 years and a father of six children shared this:

I think our population in the location has increased. This is putting more pressure on the limited available water resources to the area. The situation has worsened in the past years.

This seems to suggest that population growth contributes to water scarcity in the rural area. A female participant and a mother of three children pointed out:

The government has done little to help our community. We face water problems every year but there is no effort or plan from the government to find a lasting solution to our water crises. There is corruption in the municipality. Infrastructure, skilled personnel and capacity to build pipe water seem to be a huge challenge for the municipality.

The view of the participant also seems to suggest the weak government intervention to build infrastructure that will address water crises in the area.

### **Discussion of results**

Water is a fundamental resource for humans, crop and animal production. In the past decade, water scarcity has become a severe problem on the African continent. While most African countries have adopted several strategies to address the water shortages thus far, water scarcity is still a serious matter that needs a long-term solution. South Africa is one of the African countries classified as a water-scarce country with high unemployment and poverty among its citizens. Several rural households in South Africa rely on subsistence agriculture for their livelihood, thus making water an essential commodity for their survival. However, many of these rural households find it difficult to cope with water scarcity and food security. The Eastern Cape faces severe water scarcity and has been declared a disaster area (Graw et al., 2017; Mandela, 2019). Therefore, the findings in the current study will assist current and future policy development on water scarcity and food security conditions in the Eastern Cape and South Africa at large. It has emerged in the current study that farmers and rural households experience water scarcity during the summer season followed by the winter season. These two seasons seem to result from natural causes for which a planned strategy can be developed to minimise the negative impact on the livelihood of the community.

The current study also revealed that water scarcity significantly affects food security especially among those living in rural areas. Many farmers are unable to produce enough food during periods when water becomes scarce. Farmers and rural households' inability to produce enough food during water scarcity periods affects the health and living standard of the people especially children. The above findings corroborate with previous studies such as Du et al.

(2015), Qureshi et al. (2013) and Rodriguez et al. (2015) who found that water scarcity affects food security.

Information regarding the causes of water scarcity is important for decision-making purposes and implementation of long-term sustainable strategies. The current study found that water scarcity occurs mostly in certain seasonal periods. The results also show that population growth, lack of and deficient infrastructure and lack of 'government will' to effectively manage water resources are some of the causes of water scarcity in Ngqeleni location. Previous studies have found similar causes of water scarcity namely, rising costs of developing new water resources, land degradation in the irrigated areas, groundwater depletion, water pollution and ecosystem degradation, current water utilization practices and growing population (Gerland et al., 2014; Hanjra & Gichuki, 2008; Steffen et al., 2015).

## Conclusions

The impact of water scarcity can be catastrophic if measures are not implemented to address it. Available data will assist government intervention to minimise the effect of water scarcity in rural communities. It is against this background that the current paper sought to investigate the relationship between water scarcity and food security and secondly, to examine the causes and effects of water scarcity at Ngqeleni location, a rural community in the Eastern Cape, South Africa.

The current study found that water scarcity significantly affects food security. Farmers and rural households are not able to produce enough food to feed themselves and their families during water scarce periods. Scarce water becomes a problem during the summer and winter seasons. The study also found that water scarcity affects the health of the rural people who solely depend on water for their livelihood. Population growth, skilled personnel, lack of and deficient water infrastructure and lack of 'government will' to assist the rural poor to find a lasting solution are some of the causes of water scarcity that emerged from the study. These challenges will require more coordination and foresight from decision-makers. It is therefore recommended that Nyandeni municipality should focus on increasing access to water supply and improved water resource management. This might improve agricultural production within the study area. Based on the foregoing findings, it is contended that without effective and sustainable water resource management systems, food security in Ngqeleni will worsen. In the Ngqeleni location, most residents do not have access to pipe-borne water supplied to the area. Furthermore, a large proportion of the residents obtain water from rivers and streams. To ensure an effective water management and food security strategy, it is recommended that Nyandeni district municipality together with the Department of Water and Sanitation (DWS) should construct water reservoirs for the rural location in Ngqeleni. They should also strive to construct water boreholes and pumps, and pipe water for households in the area. This will make accessibility to water for both domestic and agricultural production purposes possible. This study also recommends that the municipality provides water trucks to central areas where the community can source water during water-scarce seasons such as summer and winter. This should be a proactive activity implemented and monitored by government officials. Water storage at the household level is likely to remain important, and most vulnerable people can be assisted to increase their water storage through rainwater harvesting tanks. It is, therefore, recommended that the Department of Water and Sanitation and the municipality should assist the community to construct cement rainwater harvesting tanks for the vulnerable groups so that they will be able to have enough water for domestic and productive uses. Irrigation can contribute to the intensification and the diversification of food supplies. In the long term, the government should invest in projects such as constructing a water dam for the community to access water for irrigation purposes for their farms during water-scarce periods. It is also

recommended that the municipality should recruit and train skilled personnel who will assist in the management of water resources in the area.

The current study has been successful in contributing to the empirical literature on water scarcity and food security in a selected rural location in South Africa. In as much 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, namely, Ngqeleni location in the Eastern Cape Province, was chosen to assess the issues relating to water scarcity and food security. Therefore, the results could not be generalized to the entire Eastern Cape Province in South Africa. Future research should focus on other rural locations in the Eastern Cape in an effort to generalise the findings to the entire Eastern Cape Province.

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