



Food Security and Coping Strategies of Rural Household Livelihoods to Climate Change in the Eastern Cape of South Africa

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Although governments across the globe have pledged resources and efforts to minimise the factors contributing to climate change, it is a concern that climate change continues to exert significant hardship on many rural communities of which South Africa is no exception. The Eastern Cape Province in South Africa is one of the driest provinces with prolonged water scarcity challenges. The purpose of this study is to investigate coping strategies adopted by the rural poor to build resilience against food insecurity. Primary data was collected from a total of 385 respondents in three rural communities using semi-structured questionnaires and interview. The findings suggest that farmers have been proactive in responding to climate change and food security. The study revealed that farmers are engaged in different coping strategies to ensure that there is enough food for the household. Although some of the coping strategies might assist, others would have severe consequences on the health of the population, especially children. Based on the findings, it is recommended that there should be regular engagement by the local municipality, the community and rural farmers on climate change events. The focus should be on the management of drought, heatwaves, flood, and soil erosion. The government within the local municipality should also focus on building a dam for rural farmers. The dam will serve as a reservoir of water for irrigation during drought.

Keywords: food security, coping strategies, climate change, rural communities, South Africa

INTRODUCTION

Climate change (CC) has now become recognised as a global challenge. Romm (2018, p. 2), for example, concludes that “the warming of the climate system is an unequivocal and consolidated fact”. There can be no contestation or denial of this fact. Climate change adversely affects families, communities and the economy in general and is also argued to be one of the major drivers of environmental change facing many countries, particularly those in the developing south, Samset et al. (2018), for example, have established that regions with high population growth experience greater variations in temperature, precipitation and extreme weather conditions and these combine to trigger environmental changes. In addition to environmental changes, Cunsolo and Ellis (2018) believe that changes in climate variability impact people’s mental health and well-being and this can adversely affect their ability to engage in productive activities.

Considering this observation, Kulkarmi and Leary (2007) support an urgent institutional and political response to reduce the impacts of climate change on both the biological and socio-economic sectors of a country's economy.

South Africa, as a country, has had its share of climate change induced challenges, among which include increased flood and drought episodes. These extreme related weather events have had a negative impact both on urban and rural productivity but the worst affected have been rural dwellers (Ngwenya and Simatele, 2020). Furthermore, Unganai (2009) observes that climate induced weather events have resulted in many natural disasters in South Africa and have contributed to increased food and water insecurities in many parts of the country, especially the Eastern Cape. He observes that the heavy dependence on climate-sensitive economic sectors, such as agricultural productivity and mining, makes South Africa vulnerable to any changes in climate (Unganai, 2009). In the context of the high poverty levels (56%) which the country suffers from, the impacts of climate change will have severe consequences on the rural poor people who are highly dependent on agricultural productivity for their livelihoods and income generation and have no or minimal assets portfolios to deploy and build their resilience and adaptive capacity (see Department of Environmental Affairs, 2013; Port Saint John's Municipality, 2018; Singh, 2019).

This paper, therefore, discusses the impacts of climate change on the livelihoods of the rural households in the Eastern Cape and the adaptation strategies which they employ to reduce or minimise the impacts of climate change induced extreme events. It is worth noting that many of the rural households in the Eastern Cape including in the study sites are dependent on rainfed agriculture to produce the food crops such as cereals (maize), vegetables and fruits (Port Saint John's Municipality, 2015, 2018). These crops are climate sensitive and any weather changes affect their yields.

SUSTAINABLE LIVELIHOOD FRAMEWORK (SLF)

This study is rooted in the sustainable livelihood framework (SLF). The SLF focus is on people-oriented ability to utilise their available assets to build capacity and to achieve life goals that are beneficial to their well-being (Karki, 2021; Woyesa and Kumar, 2021). Fundamentally, sustainable rural livelihoods address how the poor in rural areas can cope, secure and overcome the stress of shock (e.g., extreme weather condition) to better their lives (Chambers and Conway, 1992; Karki, 2021). Furthermore, livelihood is deemed sustainable when people can effectively adapt their assets (e.g., natural, physical, social, financial, and human) and emerge as victors to shocks such as changes to seasons without destroying the natural useful resource base (Karki, 2021). Based on the foregoing definitions, it can be argued that rural livelihood is built on a combination of factors such as effective subsistence agricultural methods employed by the household to produce and supply food; access to land; and access to the skills needed to create viable non-agricultural

employment opportunities that would ensure the survival of the household over the long-term period (Bebbington, 1999). Rural livelihoods which is the focus of this study can be influenced by the spatial setting, social and economic (e.g., capital) conditions prevailing within PSJ Local Municipality (Eriksen et al., 2005). Most households at the three study sites namely Mgugwana, Manaleni, and Ndayini are expected to perform certain activities and adopt strategies to generate a livelihood. A household uses its livelihood capital to perform activities to generate income, garner social support, and gather resources to sustain itself. These activities include subsistence agriculture (involving but not limited to the growing of basic foodstuffs such as maize, cabbage, carrot), the collection of natural resources, livestock rearing and herding, and informal employment (e.g., hunting, carrying out shoe repairs, sewing and weaving, hawking).

CLIMATE CHANGE AND ADAPTATION STRATEGIES

CC has been explained as extreme weather conditions which extend for a prolonged period, ranging from months to years (World Meteorological Organization (WMO), 2016). Climate change has also been described as an "emerging stressor" that results from extreme weather conditions (Connolly-Boutin and Smit, 2016). It is mostly driven by natural or human influences or both (Cubasch et al., 2013). Human influence is characterised by factors such as population growth, economic activity, lifestyle, energy use, land use patterns, technology, and climate policy (Intergovernmental Panel on Climate Change (IPCC), 2014). Like many other parts of the world, research on climate change in South Africa is an environmental problem, rather than a developmental one. Despite the anticipated negative impacts of CC on the environment to both present and future circumstances concerning food security, existing literature proposes that numerous countries in Africa are not beneficiaries nor contributors of food assistance to the global effort on food security.

In South Africa, climate change does not only manifest itself in higher temperatures but also, in floods and persistent droughts (Turpie and Visser, 2013). It has been predicted that by 2050 and beyond under high emission scenarios, South Africa's weather conditions will show very significant warming, as high as 5–8 °C, over the interior (Long-Term Adaptation Scenarios flagship research programme (LTAS), 2013). A general pattern of risk of drier conditions to the west and south of the country and the risk of wetter conditions over the east of the country is also projected. Many of the projected changes of climatic conditions are high, raising many uncertainties such as extreme warmer or too much rainfall (e.g., flooding) (Long-Term Adaptation Scenarios flagship research programme (LTAS), 2013). These negative weather events, together with the country's already stressed water resources, are expected to affect the rural livelihood and the economy at large (Turpie and Visser, 2013). Although climate change and its effects impact both the wealthy and the poor, available scientific evidence suggests that the rural poor are the most hit (Kabir and Serrao-Neumann, 2020). The prevailing

projections of climate change events require an assessment of how the rural poor are exposed to climate change and their adaptive strategies.

Adaptation strategies are changes and strategies implemented to reduce the impact of climate change (Ford et al., 2015). Adaptive strategies include initiatives such as changes made to build environments, the delivery of government services, organisational mandates, or regulations in response to the impacts of climate change (Ford et al., 2015). Stock et al. (2019) argue that knowledge enhancement on adaptation strategies for farmers should be decentralised to community-level institutions. This practise will enhance their efficiency to address climate change risks more proactively. Knowledge by the community on adaptation strategies is of utmost importance to prepare for both long-term and short-term climate change risks (Clarke et al., 2019). Innovative farming practises is also important to minimise community vulnerability and escalate resilience in the long-term (Clarke et al., 2019).

Pinto et al. (2012) conducted a study in Ghana and offered four options on adaptation strategies. The first strategy relates to dealing with risk and uncertainty (e.g., this include indigenous knowledge, weather, and climate information services and early warning, crop insurance, raising of awareness and access to information). The second option relates to farming practises and technology (e.g., drought-resistant varieties, soil conservation and erosion control, crop diversification, and specialisation, irrigation). The third option involves off-farm practises and strategies (e.g., improve post-harvest, food storage practises, migration, empower communities, and females). The fourth option emphasises on national development policy on adaptation strategies to CC (e.g., agricultural intensification and land use policy, access to and governance of water, institutional reforms).

Alemayehu and Bewket (2017) also studied smallholder farmers' coping and adaptation strategies to climate change and variability in the central highlands of Ethiopia. Their research involved 200 farm holders in three districts, three focus group discussions and three informant interviews in each district. In their findings, it emerged that various local farming adaptation strategies have been used by farmers. These strategies were grouped into four categories. The first category was land management (social and water conservation, tree planting, irrigation and fertiliser, and manure (dung) application). The second adaptation strategy was crop management (changing planting dates, crop diversification and the use of drought-tolerant and fast-maturing crops and improved seeds). The third adaptation strategy was livelihood diversification and adjustment (off-farm income, seasonal migration, change in consumption pattern, taking credit, land renting, and remittance). The fourth adaptation strategy was livestock management (decreasing the population of livestock, the use of cross-bred livestock and diversification). Their findings also revealed that the selling of livestock was the most widely coping strategy, followed by changing consumption pattern. Changing crop planting dates emerged as the most preferred adaption option. Only a few surveyed farmers (10%) utilised irrigation as an adaptation strategy.

In a different study on adaptation strategies, Epule et al. (2017) assert that because maize yields in the north of Uganda are more

vulnerable to droughts, there should be better ways of making maize production more resilient to the severity and continuous drought. Strategies such as agroforestry, irrigation, agro ecology-based organic nutrient inputs, research, training and innovation, and information diffusion was proposed as key adaptation strategies (Epule et al., 2017). Furthermore, Bawakyillenuo et al. (2016) explored the adaptation strategies to climate change and climate variability in selected villages in the rural northern savannah zone of Ghana. The villages were selected from the Savelugu Nanton, West Mamprusi and Kassena Nankana East Districts. It emerged from their findings that adaptation strategies used by the rural farmers include intensification of irrigation, integration of livestock production, changes in tillage practises, fertiliser and other inputs application on farms, shift from agriculture to non-farm jobs, seasonal migration and purchase of drought insurance for maize (Bawakyillenuo et al., 2016).

IMPACTS OF CLIMATE CHANGE ON FOOD SECURITY

Studies have confirmed that climate change undermines food security (Intergovernmental Panel on Climate Change (IPCC), 2014). This is significant in many parts of the world especially in developing countries (Magdoff and Tokar, 2010). In Africa, food insecurity is due to factors such as extensive reliance on rainfall for crop production, high seasonal variability, recurrent droughts, and floods that affect both crops and livestock (Boko et al., 2007). Climate change affects food production in several ways ranging from direct effects on crop production such as changes in rainfall leading to drought or flooding, or warmer or cooler temperatures leading to changes in the length of the growing season, as well as changes in markets, food prices and supply chain infrastructure (Intergovernmental Panel on Climate Change (IPCC), 2014).

MATERIALS AND METHODS

This study was conducted in three rural communities (**Figure 1**) in Eastern Cape, South Africa between 5 May and 18 October 2018 in three rural communities within Port St. John's Local Municipality. In order to select the rural communities for the study, a complete list of all the rural communities was sourced from the municipality's website. These communities had been grouped under various wards. The lottery technique was adopted and this resulted in Mgugwana, Manaleni, and Ndayini locations being selected for the study (see Cartography map of the marked study area in **Figure 1**). Although the lottery technique was used in selecting the study site, these communities have unique common characteristics such as poverty, high unemployment, and the fact that no research could be found that investigated the impact of climate change on these communities and their adaptations thereof in relation to food security. The lottery technique was employed to randomly select the study site and offered an equal opportunity for each location to be part of the study. The latter minimised the effect of being biased in choosing the study area.

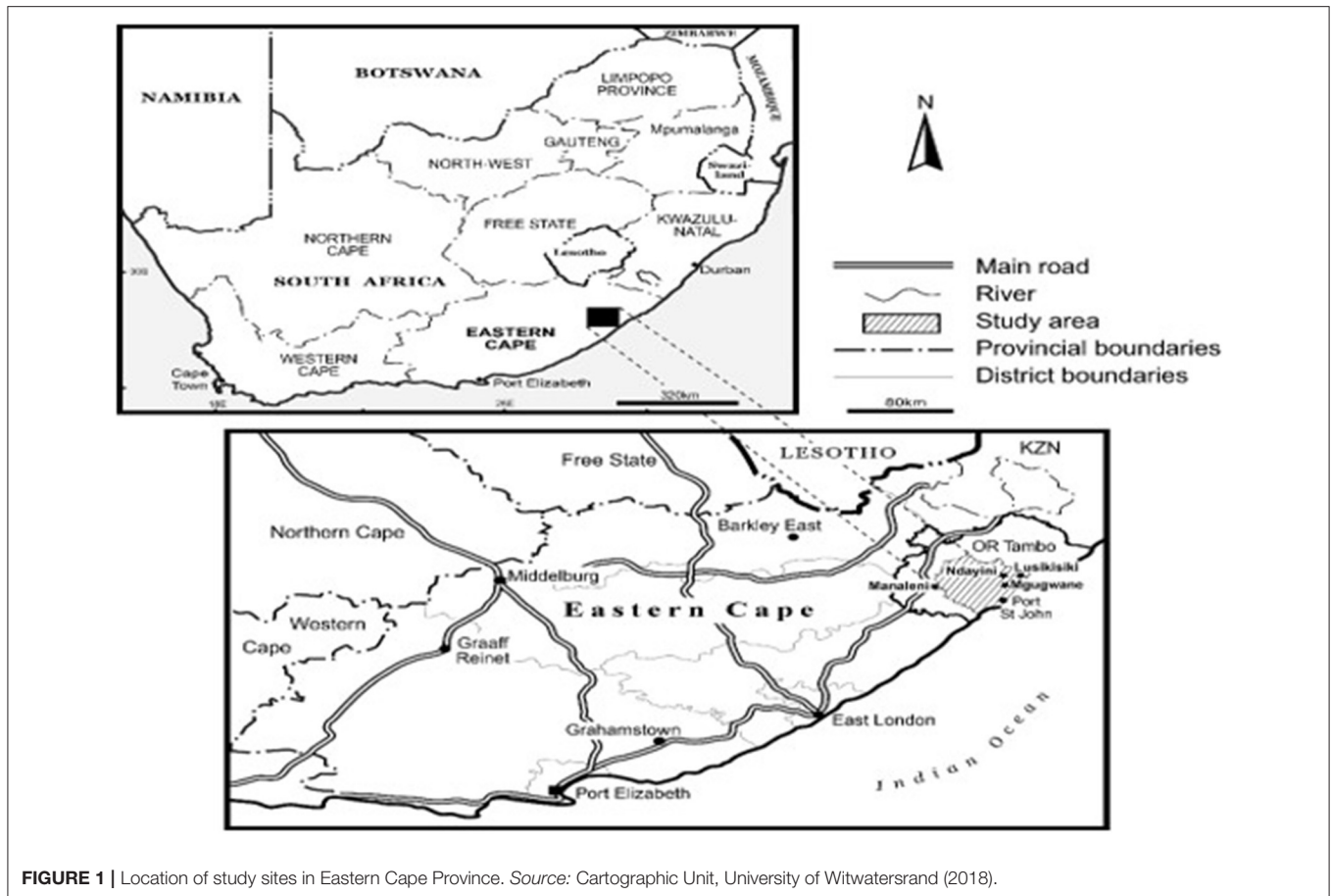


FIGURE 1 | Location of study sites in Eastern Cape Province. *Source:* Cartographic Unit, University of Witwatersrand (2018).

Both quantitative and qualitative research methods were employed in collecting and analysing the data in the study. The decision to combine both qualitative and quantitative research techniques were made to provide a more comprehensive understanding of the research problem (Creswell, 2014) and to compensate for the limitations of the other methods and thus provide a diversity of responses from the participants (Zachariadis and Scott, 2013; Creswell, 2014). The target population for the study involved all subsistence household farmers who reside at Mqungwana, Manaleni, and Ndayini locations. These farmers should have lived in the location for a minimum of 2 years and embarked on some form of farming in the location over this period. The nature of their farms could range from small backyard or compound farms to a large-scale subsistence farm. Both males and females were involved in the study but only those aged over 18–65 years were interviewed. Individual or household farmers were purposefully targeted.

The data were collected using semi-structured questionnaires, focus group interviews, and participant's observations. The semi-structured questionnaires were handed over to individual household farmers from the three study sites to be completed. Where necessary the researcher assisted participants, who could not read nor write to complete the interview questionnaire. Both open-and closed-ended question were used in the questionnaire.

Open-ended questions were included to enable participants to express their personal experiences regarding climate change, food security, adaptation strategies, and their impact on the community. Closed-ended questions provided some choice of answers for participants to select. Two focus groups interview was held in each of the three locations. The groups were relatively small and consisted of an average number of between 6 to 12 participants of which 50% were men and the other 50% were women. The groups comprised of both adult female and male participants aged between 19 and 65 years. All the members of each focus group were purposefully selected farmers from the locations. Permission was sought from them if they want to be part of the focus group interview. Two separate discussions were held. In the first round of the discussion, the women had their separate discussion and the men also had their separate discussions. The rationale of the separate discussions was to eliminate the potential possibility where men are assumed to be the head of the household in most rural communities and are only expected to talk during meetings. This would have compromised the intended objective of the group interview. In the second round of discussions, both sexes were brought together in one compound to express their opinions on the issue at hand in the area. Unstructured questions were asked throughout the discussions to allow members of the group to

share their opinions, ideas and reactions on climate change and its impact on their available assets. During the group interview, all participants were constantly informed that their inputs are valuable, and they can disagree with each other if it was necessary. The researcher compiled detailed notes that emerged during the discussions. An effort was made to create a tolerant environment in the focus group that would give confidence to participants to share perceptions, points of view, experiences, wishes and concerns without forcing the participants to reach an agreement. Another approach used in the study to observe the respondent's activities was transecting walks. This involved making unplanned visits to the study sites, walking around the farming sites and talking to rural farmers. Maximum effort was made to ensure that the researcher remained neutral during the participatory observations.

Based on the 2011 census data, it was documented that a total of 1,281 (750 + 252 + 279) respectively reside within the selected areas. Considering logistical constraints, it was purposefully decided that a 5% margin of error for a sample size will be suitable for each location. Using the Raosoft sample size calculator, resulting in a total of 296 samples at 95% confidence. However, the sample size was increased to 385 (225 from Mgugwana, 76 from Manaleni, and 84 from Ndayini) to enhance the reliability of the findings. A proportional ratio was used to establish the new sample size per study site. However, the selection of individuals and households were all drawn using the systematic sampling technique. The Raosoft calculator is used to provide a high degree of certainty regarding sample size confidence interval (Raosoft, 2004; Hightower and Scott, 2012; Paz-y-Miño-C and Espinosa, 2016). All the closed-ended questions and answers provided were organised in frequency tables and graphs. The open-ended and focus group aspects of the questions were analysed qualitatively which involved transcribing and identification of themes from the answers provided. Similar answers provided during the focus group interview were grouped and reported as a theme. In most cases, answers provided in the open-ended questions were also reported verbatim.

Reviewers and experts were engaged to help ensure content and face validity of the interview guide and questionnaire. Their suggestions offered valuable contributions to improving the overall measuring instrument. The first reliability procedure followed was to appoint a second person who was not involved in the research process to independently code the data. This allowed the achievement of interobserver reliability (Thyer, 2010). The second reliability procedure followed was to stay close to the empirical data and provide accurate descriptive, verbatim accounts and subjective meanings of the participants. Ethical clearance was obtained from the University of Witwatersrand before commencing with the data collection.

RESULTS

Impact of Climate Change on Food Security

According to Meteoblue (2021), the average precipitation of Port Saint Johns varies and ranges between 18 and 92 mm. The

TABLE 1 | Seasons that climate change becomes a severe problem.

	Mgugwana		Manaleni		Ndayini	
	Freq	%	Freq	%	Freq	%
Summer	162	72.0	49	64.5	71	84.5
Winter	59	26.2	26	34.2	10	11.9
Autumn	3	1.3	1	1.3	2	2.4
Spring	1	0.5	0	0	1	1.2
Total	225	100	76	100	84	100

Source: Fieldwork based data (2018).

TABLE 2 | Type of climate change affecting the rural households.

	Mgugwana		Manaleni		Ndayini	
	Freq	%	Freq	%	Freq	%
Floods	19	8.4	7	9.2	3	3.6
Drought and heatwave	206	91.6	69	90.8	81	96.4
Total	225	100	76	100	84	100

Source: Fieldwork based data (2018).

TABLE 3 | Influence of climate change on food security.

	Mgugwana		Manaleni		Ndayini	
	Freq	%	Freq	%	Freq	%
Yes, climate change influence food security	209	92.9	74	97.4	81	96.4
No, climate change does not influence food security	16	7.1	2	2.6	3	3.6
Total	225	100	76	100	84	100

Source: Fieldwork based data (2018).

average hot days is 38 °C. Cold nights are between 4 and 16 °C. Singh (2019) asserts that the region experience repeated adverse weather conditions, ranging from severe droughts to extreme precipitation and severe flooding that negatively impacts the lives of the poor.

The researcher asked questions that required the research respondents to state what kind of weather patterns they have experienced over the past 10–15 years. **Table 1** below presents the data obtained which shows that a large proportion of the respondents from the three study sites (Mgugwana 72.0%, Manaleni 64.5%, Ndayini 84.5%) view the summer season as the period where climate change becomes a serious problem to the household.

Furthermore, respondents were asked how they have experienced climate change in their farms. As reflected in **Table 2**, majority of the respondents (91.6% from Mgugwana, 90.8% from Manaleni, and 96.4% from Ndayini) considered drought as a major weather event that has occurred in the area.

Respondents were also asked whether climate change influence food security in the area. It emerged from **Table 3** that

92.9% of respondents from Mgugwana, 97.4% from Manaleni, and 96.4% from Ndayini were of the view that climate change has an influence on food security in their respective locations. The large representation of the respondents thus suggests that climate change has an impact on food security.

Furthermore, respondents were requested about their experience of climate change since they embarked on farming in the past 15 years. The data received are displayed in **Table 4**.

A closer examination of the data presented in **Table 4** revealed that a large proportion of the respondents from Mgugwana (92.9%), Manaleni (84.2%), and Ndayini (84.5%) experience increase recurrence of drought. It was also found from the three study sites that planting date often changed for most crops cultivated by the respondents. For instance, at Mgugwana (59.1%), Manaleni (51.3%), and Ndayini (57.1%) respondents agreed that their planting date for most of their crops changed due to climate change. An increase in several pests or rodents also emerged as a major problem to farmers during extreme weather conditions. Furthermore, most of the respondents from all the study sites were of the view that there has been a decrease in the recurrence of floods. There were mixed indications on the issue of more heavy rains. Many of the respondents from Mgugwana (61.8%) disagreed that there has been more heavy rainfall over the past 15 years. However, at Manaleni (63.2%) and Ndayini (61.9%) respondents agreed that there has been more heavy rainfall over the past 15 years.

The evidence gathered also shows that majority of the respondents from the three study sites were unanimous that temperature in the locations is increasing instead of a decrease in temperature. Many of the respondents from Mgugwana (83.1%), Manaleni (77.6%), Ndayini (78.6%) were also of the view that they obtain rain later than normal. The above data point to the view that climate change influence food security within the study context.

The impact of climate change on food security was also vividly described by participants in the focus group interview. One of the participants, a female aged 54 years and resides at Ndayini stated:

Our biggest problem as peasant farmers in this area over the years has been continuous dryness, heatwaves, and less rainfall. As you can see, we depend on rainfall in our farms. Our farm production depends on rainfall. Most of our crops wither, damaged (dry) due to severe sunshine or high temperature (humidity). We sometimes do not get anything from what we planted, absolutely nothing to harvest from these crops. We do not have irrigation facilities which we can use to get water from the river. Hunger is a common problem here. Because of drought in our community, farming is no longer attractive, especially to the youth.

To build on this observation, another female farmer aged 46 years and a single parent of two children highlighted:

We farm but we do not get anything from farming because of drought. Our food production has reduced drastically due to high temperature. On some days I must beg my neighbours for food before I and my children can eat.

A male farmer from Mgugwana aged 49 years also indicated that:

Last year two of my cattle died because of dryness of the grass and hunger. Our livestock is severely impacted by high temperatures. They do not get greener pastures to feed on, lose weight and sometimes die.

Another male farmer aged 52 years from Manaleni recalled and shared this:

In 2014, there was heavy rainfall continuously for more than 3 days. Our crops were affected because the water settled on the land resulting in most of our crops getting rotten.

The evidence presented above suggests that climate change impacts food security, especially in the three study sites.

Respondents were also asked to indicate to what extent does climate change affect food production on the local people's livelihood. A large proportion of the respondents (see **Table 5**) (Mgugwana 90.7%, Manaleni 72.4%, Ndayini 89.3%) consider climate change as highly affecting their food production.

Adaptation Strategies to Ensure Food Security

In order to obtain data on adaptation strategies, several questions focusing on adaptation strategies were posed to the respondents. Firstly, the researcher asked whether participants have changed any of their farming practises in order to adjust to climate change. In **Table 6**, the evidence gathered from the three study sites revealed that majority of the respondents from Mgugwana (85.3%), Manaleni (93.4%), and Ndayini (78.6%) have changed their farming practises during extreme weather conditions. The findings expressed suggest that climate change influence farming practises. Lack of knowledge of alternative farming practises will negatively influence food security.

DISCUSSIONS

The field survey data highlights that climate change becomes a serious problem for the rural poor during the summer season. Summer is a period where most South African farmers prepare the land and plant their crops or seeds. It is also a period where farmers expect rainfall to grow their farm produce. Farmers in all three study sites indicated that drought and heatwaves are climatic challenges affecting their farm produce. Given this finding, it can be argued that respondents from the three study sites know that summer is the season that farmers in the rural locations experience severe drought and heatwaves which adversely impact on their farm produce and their livelihoods. It is important therefore to sensitise rural dwellers and farmers within the study area to consistently prepare and build capacity during the summer season to address the impact of drought and heatwaves in the area. A significant number of respondents from the three study sites confirmed that climate change has a significant influence on food security in the community. The findings confirm the assertion made by Turpie and Visser (2013) that unfavourable weather events such as heat waves and drought affect the rural poor. Similarly, the findings are in line with the Intergovernmental Panel on Climate Change (IPCC) (2014)

TABLE 4 | Experience with climate change on farming in the past 15 years.

	Mgugwana		Manaleni		Ndayini	
	Yes	No	Yes	No	Yes	No
More heavy rains+	86 (38.2%)	139 (61.8)	48 (63.2%)	28 (36.8%)	52 (61.9%)	32 (38.1%)
Getting rain later than normal	187 (83.1%)	38 (16.9%)	59 (77.6%)	17 (22.4%)	66 (78.6%)	18 (21.4%)
Planting date change applying to most crops	133 (59.1%)	92 (40.9%)	39 (51.3%)	37 (48.7%)	48 (57.1%)	36 (42.9%)
Temperature of the area increasing	173 (76.9%)	52 (23.1%)	55 (72.4%)	21 (27.6%)	64 (76.2%)	20 (23.8%)
Temperature of the area decreasing	76 (33.8%)	149 (66.2%)	22 (28.9%)	54 (71.1%)	33 (39.3%)	51 (60.7%)
Decrease in recurrence of floods	123 (54.7%)	102 (45.3%)	61 (80.3%)	15 (19.7%)	59 (70.2%)	25 (29.8%)
Increase in recurrence of droughts	209 (92.9%)	16 (7.1%)	64 (84.2%)	12 (15.8%)	71 (84.5%)	13 (15.5%)
Increase in number of pests or rodents compared to previous years	126 (56.0%)	99 (44.0%)	43 (56.6%)	33 (43.4%)	52 (61.9%)	32 (38.1%)
Other	18 (8.0%)	207 (92.0%)	6 (7.9%)	70 (92.1%)	14 (16.7%)	70 (83.3%)

Source: Fieldwork based data (2018).

TABLE 5 | Extent at which climate change affect food production.

	Mgugwana		Manaleni		Ndayini	
	Freq	%	Freq	%	Freq	%
Least affecting	1	0.4	0	0	0	0
Affecting	20	8.9	21	27.6	9	10.7
Highly affecting	204	90.7	55	72.4	75	89.3
Total	225	100	76	100	84	100

Source: Fieldwork based data (2018).

TABLE 6 | Changed farming practises in order to adjust to climate change.

	Mgugwana		Manaleni		Ndayini	
	Freq	%	Freq	%	Freq	%
Yes, changed farming practises	192	85.3	71	93.4	66	78.6
No, never changed farming practises	33	14.7	5	6.6	18	21.4
Total	225	100	76	100	84	100

Source: Fieldwork based data (2018).

report which cautions that future climate events will be dominated by heat waves, droughts, floods, cyclones, wildfires and climate-related extreme impacts that can cause significant vulnerability and exposure to some ecosystems.

Drought emerged as a major climate change event experienced in the three study sites. The situation has caused many farmers to change their planting dates for most of their crops. Although changing planting dates can be a short-term remedy to adapt to climate change, delays in planting dates due to drought can affect food security. Whiles farmers are waiting for rainfall before planting, the likelihood of available food to depend on will be a huge challenge. Pests or rodents in farms were also found as a major problem affecting farmers during climate change and when there is drought.

Respondents raised several concerns about the impact of climate change on the community. These challenges include the

death of livestock, damage to crops, less food to harvest, hunger, and loss of hope to the farm are some of the effects of drought on the rural poor. In view of the above observations, it can be argued that climate change affects food security, rural poor communities. The above findings are in line with other previous studies which also found that climate change negatively impacts food security [Boko et al., 2007; Magdoff and Tokar, 2010; Intergovernmental Panel on Climate Change (IPCC), 2014]. It is important to state further that, respondents from the three study sites have the knowledge and are aware of the changes in weather patterns and the season that this weather becomes problematic to the community. This prior knowledge, if utilised well, can assist the community to build strategies before the occurrence of an extreme climate event.

It also emerged that rural households embark on different adaptation strategies to address the impact of climate change.

A significant number of respondents from the three study sites confirmed that they have changed their farming practises during extreme weather conditions. Basic knowledge of alternative farming practises is necessary for rural communities to overcome extreme weather conditions. It is therefore argued that this knowledge should be enhanced to equip farmers with alternative farming practises that can assist to build resilience against food security.

Farmers in all the three study sites also introduced new crop varieties, changed to shorter cycle crop varieties, and stopped cultivating some crop varieties. These practises are an indication that rural farmers from the study sites strive to incorporate different adaptation strategies to build resilience for climate change. The responses revealed that these adaptation strategies were implemented due to drought, rainfall variability, less rainfall, and increased temperature. The findings in the current study corroborate with Alemayehu and Bewket (2017) study which found that adaptation strategies used by smallholder farmers to manage their crops include changing planting dates, crop diversification and the use of drought-tolerant and fast-maturing crops and improved seeds. However, these adaptation strategies may be considered as a temporal solution for many households, therefore it is argued that rural communities should be assisted to develop structures and infrastructure that will contribute to long term solutions to manage extreme weather events.

While authors such as Bawakyillenuo et al. (2016), and Epule et al. (2017) have recommended irrigational practises as a strategy to manage drought-related issues in rural households, it was a major concern for the researcher to establish that many of the respondents from the three study sites did not have any mechanism in place for irrigation activities in their farms. This shows the communities overreliance on rainfall for their farm produce. Given these findings, it can be argued that food security can become a huge challenge for the communities in seasons where drought extends over a longer period. It is thus important to build proactive measures to increase the capacity of the rural communities to acquire irrigational facilities for their farms. More acquisition of irrigation equipment through government support and other non-profit organisations can help reduce the challenge and impact of drought in the area.

CONCLUSIONS

Although it is widely acknowledged that CC has become a global issue, there is little empirical evidence on the impact that the rural poor have experienced, and how the rural poor have responded and adapted to ensure food security. This study examined the impact that climate change has on rural livelihoods and their adaptation response to climate change in three rural communities in Eastern Cape, South Africa. Three rural communities namely Mgugwana, Manaleni, and Ndayini in the PSJ Local Municipality served as the focus area of the investigation. Findings from the study revealed that summer is the season that CC becomes a serious problem

for most rural households. Particularly this period is between December to February. During this season farmers experience drought, heatwaves, and less often flood which significantly affect food production. Many rural farmers from the study sites confirmed that climate change in the area has resulted in the death of their livestock, damaged their crops, resulted in less food to harvest, exposed most households to hunger, and rendered some farmers with no interest in farming. Considering the above research findings, it is argued that climate change significantly impacts the livelihood of rural people especially in their effort to ensure food security. The study further revealed that respondents from the three study sites have changed their farming practises, introduced new crop varieties, changed to shorter cycle crop varieties, and stopped cultivating some crop varieties to respond to extreme weather conditions. However, it became known from the study that these adaptation strategies did not help the communities to address the shortage of food experienced during extreme weather events.

It is against this background that the following recommendations are made. Firstly, the government through the department of public works, department of agriculture and fisheries should provide rural communities and rural farmers with regular engagement and education to sensitise them on possible climate change events. This education should focus on the management of drought, heatwaves, flood, and soil erosion. Secondly, the government should have a policy that will focus on building dams for rural farmers. The dam will serve as a reservoir of water for irrigation during drought. This can improve crop yield and ensure food security. Lastly, there should be a renewed management effort of adaptation strategies such as education on indigenous knowledge strategies (IKS) that should be discussed and implemented with the communities. It is recommended that the ministry of agriculture and fisheries should take the lead in this initiative.

This study has demonstrated an understanding of the impact of climate change and how rural households and farmers adapt to climate change. This study also provided useful evidence to assist the government and other stakeholders to develop policies in order to assist rural poor communities to overcome the impacts of climate change. While, there are recommendations offered in this study, other possible areas of research still must be done. This study focused on only three rural communities within the PSJ local municipality in the Eastern Cape of South Africa. There should be similar studies focusing on other rural communities in the Eastern Cape of South Africa at large. To provide a dual purpose of comparison, a comparative study on urban and rural households' farmers adaptation strategies to climate change can also be initiated.

DATA AVAILABILITY STATEMENT

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

ETHICS STATEMENT

The studies involving human participants were reviewed and approved by Jasper Knight. The University of Witwatersrand. The participants provided their written informed consent to participate in this study.

AUTHOR CONTRIBUTIONS

LA research the entire work as part of her PhD Thesis. MS supervised the work from the beginning to the end of the study.

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