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Climate change and variability perceptions in Ga-Dikgale community in Limpopo Province, South Africa

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Abstract

Purpose – Perceptions of climate change and its threats to rural communities are among major challenges faced by scientists around the world. A few studies prove that these communities are aware of change in climatic conditions and their impacts on people's livelihoods. Climate change is usually perceived as increasing warming days, erratic rainfall patterns, ecological variability, biological change and their adverse effects on human beings. This study aims to assess Ga-Dikgale community's perceptions on climate change and variability.

Design/methodology/approach – A qualitative research method was adopted and community members of age 60 and above in GaDikgale community were purposively selected as participants in the study. Data were collected through in-depth interviews, and thematic content analysis was used to analyse data.

Findings – The study found that the community perceives climate change and climate variability based on changes in temperature patterns, erratic rainfall patterns, seasonal change, depletion of biodiversity, decline in subsistence crop production, change in water quality and cessation of cultural activities.

Originality/value – The study concludes that community's perceptions of climate change are largely centred on variations in temperature and rainfall patterns. It has been established that knowledge of climate change in rural communities is of paramount importance in as far as adaptation to climate hazards is concerned.

Keywords Temperature, Climate change, Changes in rainfall patterns, Seasonal changes

Paper type Research paper

1. Introduction

This paper assesses climate change and vulnerability perceptions in the South African rural community of Ga-Dikgale. Perceptions of climate change and its threats to rural communities are among major challenges faced by scientists. Fewer studies prove that rural communities are aware of change in climatic conditions (IPCC, 2007). According to Bhusal (2009), local people share experiences of climatic conditions, ecosystem function and process

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and biological systems. Climate change is perceived as increasing warming days, changes in rainfall patterns, ecological variability, biological change and their adverse effects on human beings. Other studies indicate that warm days are rapidly increasing, rainfall pattern is unpredictable, seasons are changing, incidents of drought are increasing, hailstorm occur abnormally and water resources are decreasing (Kruger and Shongwe, 2004; IPCC, 2007; Gurung and Bhandari, 2009).

The study explored the community's perceptions of climate change. It demonstrates the community's awareness of change in climatic conditions in the form of increased temperature and changes in rainfall patterns. Research on local communities' explanations of climate change and their potential for adaptation to climate change hazards is limited, however. There is very little attention given to the rural communities in which livelihoods are mostly climate-dependent. There are assertions from fewer studies that climate change and its negative impacts are mostly felt by poor and rural communities whose livelihoods are dependent upon favourable climatic conditions (Bhusal, 2009; Chaudhary and Aryal, 2009; Mugambiwa, 2018).

1.1 Rural communities and climate change

Indigenous societies are largely excluded from climate change policies and decision-making processes as shown in a virtual lack of references to the existing traditional knowledge on climate change in the global, national and local climate change discussions. To date, valuable insights held by rural communities globally about direct and indirect impacts of climate change, as well as mitigation and adaptation approaches, remain largely unrecognised. Bhusal (2009) attests to this observation that stressful climatic extremes leave local communities searching for solutions to minimise climatic and social threats to their livelihood (Smith and Reynolds, 2005; Brohan *et al.*, 2006; Caesar and Alexander, 2006). In local communities, community members have developed indigenous and culture-based mechanisms of coping with harsh weather conditions, which negatively affect their subsistence economies, cultural rituals and festivals, health conditions and the natural environment from which they derive their livelihood (IPCC, 2007; Jianchu *et al.*, 2007; Mugambiwa, 2018).

Furthermore, it is reported that rural communities' explanations of climate change are largely based on variations in temperature and rainfall patterns (Jianchu *et al.*, 2007). Rural communities are aware that devastating changes in their living conditions such as malnutrition, poverty, water and air contamination, increased risks of disease, floods, soil erosion and depletion of biodiversity are as a result of climate and environmental variability. The increase in temperature has been a major concern for local farmers (IPCC, 2007). Observed change in rainfall and temperature patterns is supported by annotations of drastic increase in temperatures with negative impacts on the livelihood patterns of rural communities. These approaches to measure climate change are important in planning mitigation measures and to adapt to climate change (FAO, 2007).

The history of changing temperature in South Africa's weather records over the past six decades indicate that the region's climate is shifting. Analyses of change in climatic conditions in South Africa show that, the country's average temperature is likely to increase by 1-3°C, with the interior experiencing the greatest increase (Kruger and Sekele, 2012). Nevertheless, there are assertions that climatic conditions are changing, and that these reflect trends elsewhere in the world (Mugambiwa and Tirivangasi, 2017). Observations of regional and seasonal variation in different parts of the country resulted in high rainfall regions, and seasons are recording increases in precipitation and becoming wetter, whereas low rainfall regions and seasons are recording decreases in precipitation and becoming drier

(Stern, 2006). The changed intensity and amount of rain positively correlate with the increase in water-induced disasters like floods. The water springs in the area have been drying up in the recent past (Gurung and Bhandari, 2009).

Kruger and Sekele (2012) attest that rural communities in Limpopo Province observe unusual phenomena such as fast maturity of maize, new types of pests, short stalk of rice and wheat. SAGUN (2009) believes that changes in temperature and rainfall are creating favourable environments for pests, diseases and invasive species to emerge, spread and encroach on agriculture and bushlands. Most people follow traditional cultivation practices that rely on seasonal rain water. Changes in rainfall patterns and hailstorm contributing to soil erosion, soil fertility loss and crop damage are having an adverse impact on livelihoods of most of these communities, thus increasing the risk to food security. Although drinking water is increasing because of availability of water storage tanks and water pipes, local people are facing more drought periods, resulting in decrease in natural springs and irrigation water. This may affect agriculture, and subsequently food security (Kruger and Sekele, 2012).

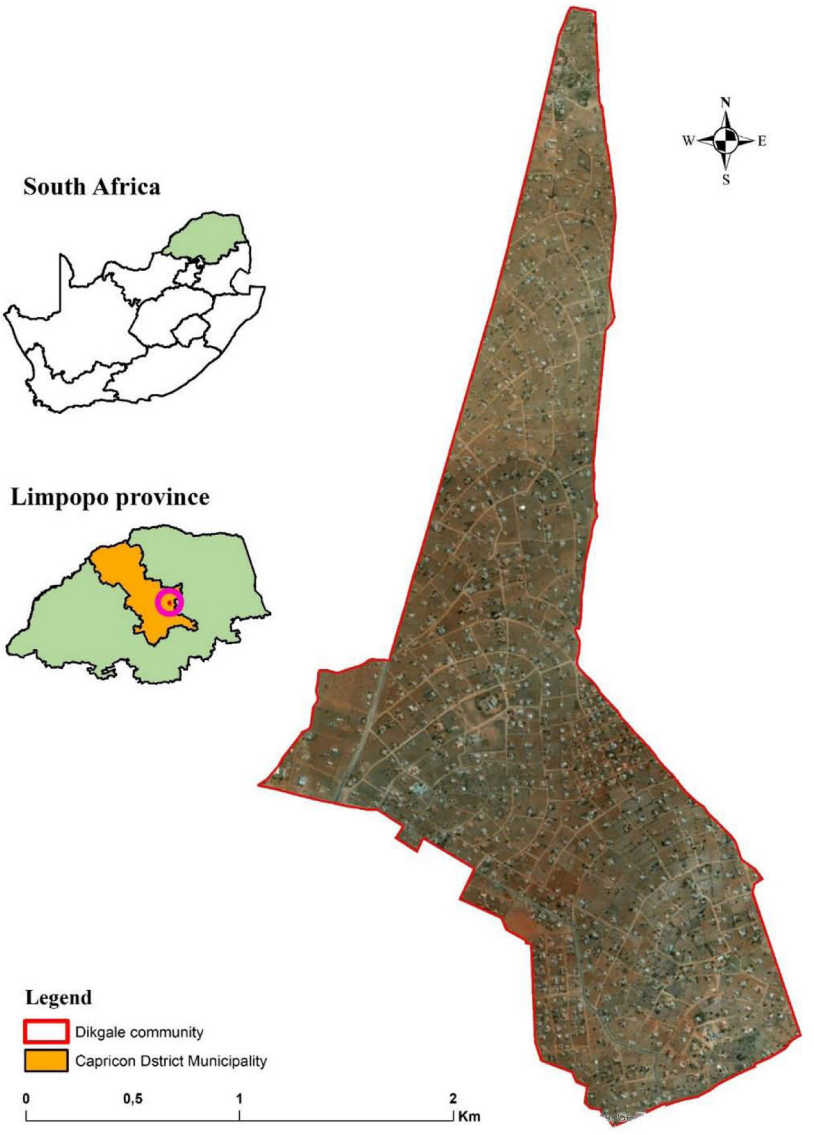
The Food and Agriculture Organisation [FAO] (2007) and Jianchu *et al.* (2007) reported that as climatic patterns change, habitats change and so do the spatial distribution of agro-ecological zones, distribution patterns of plant diseases and pests, which can have significant impacts on agriculture and food production. The forestry industry could probably tolerate a small increase in temperature, but a decrease in rainfall would reduce the area which supports plantations and the growth rate of the trees. A positive point is that rising carbon dioxide could help reduce water use by plantations. FAO (2007) predicted that in developing countries, 11 per cent of arable land would be affected by climate change, including a reduction of cereal production in up to 65 countries, about 16 per cent of agricultural gross domestic product (FAO, 2007). Changes in rainfall patterns, ecological variability and biological change have their adverse effects on human beings. There is observable increase in warm days, unpredictable rainfall, changing seasons, incidents of drought, hailstorm, wind and decreasing water sources, changes in flowering and fruiting time, invasion of new plant species and the reduction of some indigenous plants (Jianchu *et al.*, 2007).

Fewer studies have addressed local community's experiences and challenges resulting from changing climatic conditions (Sillitoe, 1996; Seager, 2008). This may be because of the fact that while recent research on local ecological knowledge is propelled by concerns about environmental conservation and intellectual property rights; knowledge about climate cannot be managed, transferred, appropriated; or consumed the same way as cultural or natural resources. The current study, therefore, seeks to provide local perceptions of climate change and variability with the use of Ga-Dikgale community as a case.

2. Description of the case study location

2.1 Study area

Figure 1 presents the geographical location of Ga-Dikgale community, which falls under Capricorn District Municipality. The area is located in Limpopo Province in South Africa, approximately 40 km from Polokwane City, the capital of Limpopo Province. The main ethnic group in the area is the *Pedi Kone* of Ga-Dikgale. Other Northern Sotho groups in the area include the *Kgaga-Kone, Batlokwa, Kolobe, Hananwa, Babirwa, Nareng, Tlou, Pai, Phalaborwa* and *Hlaloga*. The primary language in the area is *Sepedi*. The area is on the Highveld Plateau, which is bounded in the south and south-east by the Strydpoort Mountains and in the east and north-east by the Wolkberge. Soils found in this area are more related to the parent material, which is granite. Topography of the area is



Location of Ga-Dikgale

Source: Authors

Figure 1.
Geographical location of Ga-Dikgale

characterised by irregular undulating lowlands with hills and low-lying mountains. It also has some moderately undulating plains.

Topography of the area is characterised by irregular undulating lowlands with hills and low-lying mountains. It also has some moderately undulating plains. The bushveld is made up of a combination of dense shrubby thickets and small trees of both acacia and broad-leaved species. Tall *Mountain Aloes, Aloemarlothii* are conspicuous and are characteristics of granite boulders and *koppies*, which give this habitat its unique appearance. These outcrops support a great variety of plant life including *Euphorbia Cooperi* and various Ficus, Combretum and Acacia species. The thickets consist mainly of *Acacia gerrardii, Dombeya rotundifolia, Cussonia natalensis, Pappea capensis* and several Euclea species. Many of these habitat types, however, have been lost because of deforestation and rural densification and they may be considered threatened (Limpopo Department of Finance and Economic Development [DFED], 2004).

Ga-Dikgale is a community of about 9,000 people and consists of 23 villages. According to the South Africa Community Survey (2011), Limpopo Province is accounted for approximately 5.2 million of the 48.5 million national population.

The site is peri-urban and most of its inhabitants belong to the Moria Zionist Church, which has a combination of Christian and traditional beliefs, while others belong to the Lutheran or Anglican churches. A large proportion of adults are migrant workers, some residing in the nearby mushrooming shopping complexes, while others work as farm labourers on neighbouring farms, or as domestic workers in nearby towns. Unemployment rate in the area is rather high (Stats SA, 2013).

The community is an impoverished rural settlement, made up of mixed formal and informal settlements, scattered around the periphery of the municipal boundary with improved services and infrastructure. Dwelling units consist of a mixture of shacks, traditional mud huts and conventional brick houses. Settlements patterns are conductive for development. Many examples of human ingenuity and creativity are evident, which have created the conditions for survival and enrichment (Alberts, 2008). There are four primary schools and three secondary schools in the study area. In all the schools, the classrooms are overcrowded and few educational amenities are available. The adult literacy rate is 79.8 and 73.6 per cent in males and females, respectively. A few households have water taps in their yards, but most residents fetch water from taps situated at strategic points in the villages. There are households that have pit latrines in their yards but there is no organised waste disposal (Stats SA, 2013).

The villages are electrified, but some of the residents cannot afford to pay for this service. A network of untarred roads connects these villages. The main road to the west of the area provides public transport to nearby Mankweng Township, where there is a government hospital and other urban facilities (Alberts, 2008). Provision of household services has increased between 2001 and 2011. The municipality has 46 health facilities in the form of hospitals and clinics, excluding private hospitals (Stats SA, 2011). One of the key social problems facing the Ga-Dikgale is poverty. Unemployment estimates in the Municipality vary between 45 and 70 per cent of the economically active population (people between the ages of 15 and 64 years). Establishing, improving and maintaining rural infrastructure in the form of water and power supplies, as well as reliable modes of transport will alleviate the burden on women and children who bear the brunt of inadequate infrastructure in the rural areas (Stats SA, 2011).

Fewer subsistence crops are grown around houses in the home gardens and ploughing fields. Agriculture has been identified as the main land use (more than 80 per cent) in the area. The agriculture sector contributes only 1.9 per cent to the local

economy and accounted for 9, 4 per cent of employment opportunities in 2004. Privately owned farms account for the bulk of production in the local agricultural sector. Other forms of farming in the community include urban agriculture and subsistence farming (Department of Rural Development and Land Reform [DRDLR], 2009). The most common subsistence crops are maize, beans, melons and sweet reed. Cattle and sheep are raised by fewer households.

3. Methodology

3.1 Research design

A qualitative research method and an exploratory design were adopted for this study. The study was designed to understand the perceptions of climate change.

3.2 Population and sample

The study population constituted of community members either aged between fifty and above or those who had general knowledge of climate change. Ga-Dikgale community was chosen based on the fact that it is one of the numerous rural communities in South Africa that are severely affected by the effects of climate change. This is because the community largely depends on the natural environment, and crop production and the rearing of animals constitute the people's means of survival. Hence, in the event of drought or excessive rainfall, as a result of climate change, their livelihoods are adversely affected. Purposive sampling technique was used to select the participants. This type of sampling technique ensured the exploration of the phenomena across genders to obtain experiences of climate change from male and female members of the community. An equal number of male and female participants was selected to take part in the study.

3.2.1 Sampling procedure. In this ethnographic research approach, the respondents were selected on the basis of their knowledge of the phenomenon being studied. For example, according to Cotton (1996), the respondents should have good, relevant knowledge of the domain of the study and should be able to interpret the meaning of their own cultural phenomena. Hence, before each interview, the respondents were asked if they had ever heard about climate change. If they had, the interview would continue and if they had not, the researcher would inquire about the other criterion which is their period of residence in the community.

3.3 Data collection

Data were collected through in-depth interviews and field observations. In-depth interviews help the researcher to achieve the same level of knowledge and understanding as the study respondents. The technique is generally used when detailed information is needed from individuals in the study population (Walter, 2006). Respondents frequently provided additional information regarding their knowledge of climate change. Interviews, which were tape-recorded, were conducted concurrently with observations. These were conducted in the households of the respondents and they were conducted in the local language (*Sepedi*) to encourage free disclosure. Transect walks were taken to the nearby bushes to view indicators of climate change as explained by the respondents.

A list of climate associated questions was developed in order to pose the same questions to all the respondents. Open-ended questions were put to the respondents, but they were also given the opportunity to discuss issues which they deemed relevant. Throughout the research process, the respondents were asked for further explanations

as new issues arose. The interview schedule commenced with biographical information of the respondents such as age, gender, educational level and marital status. These were followed by open-ended questions, which focussed on the respondents' perceptions of climate change and its impact on the livelihood of the community. The interview guide comprised the following questions:

Q1. What is your understanding and knowledge about temperature, seasons and rainfall?

Q2. Are temperatures, seasons and rainfall patterns in your area the same as during the time when you/your parents/your grandparents were born?

Q3. Are you noticing any change?

Q4. What are the indicators of change in temperature, seasons and rainfall patterns?

Q5. Are you noticing any change in the cultural activities as a result of change in temperature, seasons and rainfall patterns (as a result of climate change)?

Q6. Which cultural activities are mostly affected?

Q7. Are there seasonal rituals and celebrations affected by this change?

The time allocated for each interview was an average of 1 h and 30 min. Interviews were conducted in the households of the respondents where they were most comfortable and local language (*Sepedi*) was used to encourage them to speak and discuss the issues freely and easily.

3.4 Data analysis

The collected data were translated from Sepedi into English by a language expert and transcribed by the researchers. Thematic content analysis was employed to analyse data, which was organised into categories on the basis of themes, concepts or similar features. The researcher developed new concepts, formulated conceptual definitions and examined the relationship among concepts. Data from the field consisted of infinite number of possible answers and were carefully managed, read, compared, categorised and recorded. Furthermore, data were organised into different themes according to the study objectives.

4. Findings and discussion

This section presents the findings of the study and discussion thereof. The section begins with biographical information of the participants followed by their knowledge of climate change, changes in temperature, changes in rainfall patterns, depletion of biodiversity, decline in subsistence crop production, change in water quality and cessation of cultural activities. The findings were supported accordingly with the relevant existing literature.

Table I presents biographical information of the study participants. Collection of information about gender statistics was to determine the males' and females' knowledge of climate change. The rationale for capturing data about the age of the respondents was to find out which age group in the study area was more likely to possess knowledge about climate change and the adaptation measures to cope with the impact of climate change on their livelihoods. A larger percentage of the respondents (55 per cent) falls between the age group of 60 and 69 years. Only 8 per cent of the respondents were older than 80 years. This

shows that a large number of community members who participated in this study stayed in the community for more than fifty years. The reason for probing the educational qualifications of the respondents was to find out whether community members were able to read information given in the media about the impact of change in temperature, seasonal and rainfall patterns and how these affect socio-economic and health conditions. The researchers also wanted to establish whether community members were capable of participating in debates about climate related issues affecting their community.

4.1 Knowledge of climate change

The community understands climate change on the basis of change in temperature and rainfall patterns. The respondents observed that the summers were extremely hot while the winters were warm with little unusual precipitation. It is, however, important to mention that climate change in the study is explained as change in temperature and rainfall patterns. When asked about their understanding of climate change, most of the participants referred to drastic increase in temperature patterns traced back about 10 years. For instance, one respondent had the following to say:

> My understanding of climate change is that there is a severe shift in weather conditions that we have gradually witnessed over the years. In the previous ten years or so the seasons have changed in that it is now extremely hot in summer and such high temperatures have dire effects on our crops and domestic animals. During the same period we have received little amounts of rainfall (Occupation: Farmer; Age: 60; Gender: Female: Moduane village).

It is reported that rural communities' explanations of climate change are centred on variations in temperature and rainfall patterns manifest as rising temperature trends and scarce rainfall (IPCC, 2013). Rural communities are aware that devastating changes in their living conditions such as malnutrition, poverty, water and air contamination, increased risks of disease, floods, soil erosion and depletion of biodiversity are a result of climate and environmental variability (Gandure *et al.*, 2013).

4.2 Changes in temperature and rain patterns

The study found that the community experiences change in climate with increasing change in temperature patterns such as hotter summers and warmer winters. Lack of rain, withering of plant materials, deaths of livestock and cessation of subsistence crop productions as the consequences of excessive heat has also been reported. One of the participants said the following:

Table I. Biographical information

Biographical information			
Gender	Male	Female	
	34%	66%	
Age	60-69 years	70-79 years	80 years +
	55%	37%	8%
Employment	Farmer	Unemployed	Retired
	20%	40%	40%
Education	No formal education	Lower than grade 12	Tertiary education
	36%	60%	4%

Source: Authors

> The changes in climate is widely noticed through rapid increase in temperature patterns such as extremely hotter summer and warmer winters, severe changes between heat and cold in the same season. Also we have constantly received lack of sufficient rain which has resulted in withering of plant materials and the deaths of livestock (Occupation: Farmer; Age: 72; Gender: Female: Moduane village).

Correspondingly, Intergovernmental Panel on Climate Change [IPCC] (2007) asserts that remarkable changes in temperature patterns were reported between the years 1960 and 2009, where the mean annual temperature increased by at least 1.5 times the observed global average of 0.5°C over the past five decades. These variations are supported by observations and projections on climate alterations in the form of increased temperatures and changes in rainfall patterns by scientists worldwide. Increased temperature, drying up of soils, increased pest and diseases pressure, shifts in suitable areas for growing crops and livestock, floods, deforestation and erosion are the signs that climate change is happening and represents one of the greatest environmental, social and economic threats (IPCC, 2007).

Furthermore, temperature analysis for Limpopo Province provides a noticeable increase of 0.12°C per decade in the mean annual temperature for the 30 catchments, over the 50 year period (Kruger and Sekele, 2012). A non-uniform pattern of changes in temperature was evident across the different catchments; 13 per cent of the catchments showed negative trends while 87 per cent showed positive trends in their annual mean temperature. Moreover, 20 per cent of catchments showed negative trends, while 80 per cent of catchments showed positive trends in their diurnal temperature range. Seasonal trends showed variability in mean temperature increase of about 0.18°C per decade in winter and 0.09°C per decade in summer (Kruger and Shongwe, 2004). The overall consequences of temperature increase include greater water evaporation, plant stress, a decline in quality and availability of surface and ground water, overall drying, increased likelihood of fire conditions and unpredictability of weather events and seasonal conditions. Plants, in particular, cannot keep up with rapid climate change. Small, isolated plant populations could go extinct as a result. South Africa has about 10 per cent of all the plant species in the world, of which about half occur nowhere else on earth (Kruger and Sekele, 2012). Apart from the widely visible changes in temperature, the study discovered that rainfall patterns had also shifted.

4.3 Changes in rainfall patterns

There was a general perception of decrease in rainfall trends among the respondents. They observed that the last time they had good rain was about 35 years ago. Since that time, rain has become unpredictable. Recent winter rainfall is attributed to change in cooler winters and warmer summers. It was reported that the community used to receive the first rainfall in September, but in recent years the first rain falls between October and November marked by thunderstorm. Changes in rainfall patterns resulted in drought with debilitating effects such as decreased subsistence economy, depletion of biodiversity and water resources. It was also found that the incident of drought has been increasing and is linked with the untimely and unusual rainfall patterns over the past few years. One respondent articulated that:

> Previously rivers flowed all year round but today when the rains stop, most of the rivers in the area dry up. Also, summer rainfall is becoming unpredictable. In old times, there would not be rain during the dry season, and in the rainy seasons we had rain, sufficient rain but those things have changed. These changes have disrupted growth cycles (Occupation: Farmer; Age: 69; Gender: Female: Maselaphaleng village).

Climate change in the study is explained as change in temperature and rainfall patterns. There are observations of drastic increase in temperature patterns traced back about ten years which are responsible for excessively hot and dry summer and warm winter. The last period of good rain in the community has been the past ten years and since that time rain is unpredictable.

4.4 Depletion of biodiversity

Ga-Dikgale is rocky with patches of infertile sandy soil. Cattle in the area are responsible for bush encroachment, thus reducing grass cover and subsequently leaving the area exposed to bush fire occurrences. This process leads to reduced biodiversity, which most villagers complain about in their area. The respondents are of the view that the indigenous trees together with wild animals are perceived as nuisances by farmers and are therefore usually removed. The respondents observed that there had been a rapid loss of vegetation because of drought; the species under-grow and wither. Most affected indigenous species are the sources of medicine, fuel and fodder, which are overharvested with little chance of regrowth as a result of excessive heat and rainfall scarcity, as articulated by one of the respondents (Occupation: Farmer; Age: 75; Gender: Male: Ntsima Village).

Respondents' knowledge of climate change vis-à-vis depletion of biodiversity is consistent with the farmers' knowledge of changing climatic conditions in the Sahelian region of West Africa where they point to shrinking water bodies, disappearing plants and crops and changing settlement patterns as evidence of reduced rainfall over the past three decades of the twentieth century (Tschakert and Dietrich, 2010). Further explanations of climate change are persistent rainfall hazards such as drought which result in loss of livestock, fallow fields and deteriorating water levels in the rivers and boreholes, soil erosion, dust and depletion of biodiversity. The IPCC (2007) point out that rural communities are aware that devastating changes in their living conditions such as malnutrition, poverty, water and air contamination, increased risks of disease, floods, soil erosion and depletion of biodiversity are as a result of climate and environmental variability.

4.5 Decline in subsistence crop production

A decline in the subsistence economy is a major observable change reported by the respondents. Unpredictable rainfall patterns led to a decline in crop and livestock production. In the previous 10 years, the community depended on rain-fed crops. Recently, the community produces crops from home gardens which last for one season. In view of these variations in precipitation patterns and changes in crop production, community members use kraal and poultry manure to fertilise the soil to improve production. Evidence of decline in subsistence economy is also reflected in the fallow fields, cessation of cultural rituals and festivals, brewing of traditional beer and communal labour. Cattle, goats and sheep are produced by fewer households, and production is dependent upon stock feed bought from local white farms.

Community members have opted to switching from raising cattle to sheep and goats as a result of drought. The latter have lower fodder demands and thus do not require lush pastures that would only be available with abundant rainfall. A clear decline in sources of livestock fodder in the form of grass, leaves, fruits and pods is attributed to a decrease in grazing land because of new settlement patterns, changes in rainfall patterns, drought and changing weather conditions. One respondent asserted that:

> Because of unpredictable rainfall patterns, crop and livestock production has greatly declined. In the previous ten or so years, the community depended on rain-fed crops but now the community

> produces crops from home gardens which last for at least one season (Occupation: Farmer; Age: 68; Gender: Female: Ga-Tjale).

Based on the narratives of the respondents, rural communities are aware that devastating changes in their living conditions such as malnutrition, poverty, water and air contamination, increased risks of disease, floods, soil erosion and depletion of biodiversity are as a result of climate and environmental variability (Gandure *et al.*, 2012). Rural communities' explanations of climate change are centred on variations in temperature and rainfall patterns manifest as rising temperature trends and scarce rainfall (IPCC, 2013).

4.6 Change in water quality

Most of the respondents noticed that stream flows have dramatically changed in recent years, making it more challenging for livestock rearing. Drinking water supply is maintained through water storage tanks and the municipal water supply system. Although there is a clear consensus among the respondents that there is water shortages because of inconsistent running water, water conservation practices are not clear. For example, community members with storage tanks for water storage drain off the water from these and pour fresh water into them. Why? The water supply system faces major challenges in terms of operations of reservoirs and maintenance of facilities such as pumps and pipes. Commenting on this issue, one respondent pointed out that:

> It is apparent that stream flows have dramatically changed in recent years and it has since become increasingly challenging to rear livestock. We also experience severe water shortages due to inconsistent running water. Even though there are facilities in place to provide us with water, the system faces major challenges in terms of operations of reservoirs and maintenance of pumps and pipes among other things (Occupation: Retired; Age: 70; Gender: Female: Sefatong Village).

The shifts presented by the respondents ignite a situation in which water resources are less dependable, with significant social and economic ramifications. In addition to the runoff and spilt water that creates water-logged conditions around the communal taps the drainage problem worsens because of the lack of proper washing areas near the communal taps that have adequate drainage. It is evident that some community members have to travel to fetch water from communal water pumps where the distance is not within the rural development plan standards. Rainfall and precipitation over the country will also change. Summer rainfall is likely to be delayed. Temperature inversions are likely to become more severe, resulting in increased pollution issues. These effects will negatively impact the country and its citizens (Muhlenbruch-Tegen, 1992; Karl, 1993; Jones, 1994; Kruger and Shongwe, 2004; Kruger and Sekele, 2012).

4.7 Cessation of cultural activities

There were observations that cultural activities such as traditional beer-brewing, communal labour, division of labour and cultural dances have ceased to exist as a result of unpredictable rainfall. These activities are dependent upon subsistence crop production, which has been characterised by low produce as a result of unpredictable rainfall since the year 2006. In total, 80 per cent of the respondents indicated that there were changes in the livelihood patterns such as gathering and making crafts for festivals, rituals and income generation. In the off-season, diversified activities provide a way to use labour and other resources to earn income. One respondent asserted that:

> I can ascertain that numerous cultural activities such as traditional beer-brewing, communal labour and cultural dances have ceased to exist. This is largely because of unpredictable rainfall.

> These activities rely on subsistence crop production, which since 2006 has been characterised by low production as a result of unpredictable rainfall (Occupation: Unemployed; Age: 70; Gender: Female: Sefatong Village).

Fewer respondents showed that payment of *lobola* (bride price) used to be in the form of cattle, but recently cattle are replaced by cash payment. Collection of roofing grass, firewood, timber and river reed have also ceased to exist. Huts are retained by fewer households. Maintenance of huts is a challenge as the beams, walls and floors have to be maintained by using cow-dung and fresh timber. Cessation of these livelihood patterns is a major challenge to sustainability of cultural values of Ga-Dikgale community members. Elderly respondents considered rainfall as a supernatural gift and there were popular cultural rituals performed to request for rain from ancestral spirits. However, it was reported that these practices have gradually disappeared as people have lost faith in such rituals; they understand rain scarcity as a problem caused by the changes in climatic change. Rankoana (2016) attests to the fact that climate change is explained in terms of cessation of cultural activities and important livelihood patterns. These include consumption of traditional fruits and vegetables, brewing of traditional beer, production of traditional crops and livestock, celebration of the first-fruit rituals, communal labour and hunting and fishing. It was mentioned that rain-induced diseases such as cholera, bilharzia and dysentery are becoming common in the community as a result of use of contaminated water, drought and excessive heat. Also, a study by Mugambiwa (2018) on climate change indigenous adaptation measures used by a Zimbabwean community demonstrate that cessation of cultural activities is a critical issue. The study emphasises on the vanishing of numerous cultural activities because of inconsistences in rainfall patterns and other changes in weather conditions. For instance, celebrations of first rains and fruits are no longer practised because of the shifts experienced in weather conditions which consequently affect farming activities. Correspondingly, Corlew (2012) studied the cultural impacts of climate change in Tuvalu and discovered that the community's culture, history and traditions were affected by the changes and shifts in weather conditions. Hence, cessation of cultural activities is a serious issue that results from climate change in many communities around the world.

5. Conclusion

In conclusion, the study has established that Ga-Dikgale community members have a fair understanding of climate change. Also, community members are aware of the devastating changes in their living conditions such as poverty, water and air contamination, floods, soil erosion and depletion of biodiversity, which make them easily understand the changes occurring in weather conditions. The increase in temperature has been a major concern for the community; hence, knowledge of climate change in rural communities such as Ga-Dikgale is of paramount importance in as far as adaptation to climate hazards is concerned. This is because communities can only craft adaptation strategies for the climatic hazards that they are aware of.

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