Human perception of climate change

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Background information

Climate change is a long-term shift in weather patterns, and it can be assessed by analysing temperature, humidity, wind flow and precipitation data over long periods of time (IPCC, 2013). Changes to climate patterns may arise from changes in any of these elements of weather (Uprety, 1998). Local-scale observations such as hotter summers and milder winters, prolonged periods of drought, and unusually frequent flooding are indications that climate change is occurring (Spence et al., 2011). The Intergovernmental Panel on Climate Change (IPCC, 2013) reports that temperature is a good indicator of changing environmental conditions, while precipitation may be of equal or greater importance because of its effect on human livelihood (Sterman and Sweeney, 2007; Leiserowitz et al., 2012).

There is a large amount of meteorological data to support the idea that climate change poses one of the biggest challenges to human life, from the level of the household to the global scale. The data are used to assess and understand climate variability, and knowledge of such variability can be used to ascertain the vulnerability of local communities (and their livelihoods) to changes in weather, as well as helping them adapt to the consequences of these changes (Downing, 1992). However, there is limited information available with regards to the local communities’ perceptions of shifts in climate, their own vulnerability, and their coping and adaptation practices. Bomuhangi et al. (2016) state that human perceptions of this change are worth exploring as they could provide insight into erratic nature of climate change. The knowledge gained from investigating how local populations perceive changes in weather could be used to develop community-specific adaptation strategies which address the most relevant effects of climate change (Slegers, 2008).

There is evidence that community members are conscious of changes in climatic conditions. The United Nations Framework Convention on Climate Change (UNFCCC, 1994) notes that humans are quick to observe any changes in their local environment because their livelihoods, culture, spirituality and social systems are connected to their local environment. Humans are aware of the variations in climate patterns and have a vernacular to describe and interpret the change (Bardsley and Liddicoat, 2008). Lynam and Brown (2011) hypothesise that indigenous peoples use their specific mental models, understood as representations shared by social groups, to observe and interpret changing environmental conditions (Boillat and Berkes, 2013). For Cortés and Chavero (2011) perceptions of variations in weather conditions are structured according to cultural and individual experiences, which are in turn tied to the annual climate calendar. Slegers (2008) and Ejembi and Alfa (2012) add that human perceptions of environmental changes are informed by experiences of how the changes influence people’s livelihoods. Water scarcity, poor crop yields, declining plant and animal life, drought, and increased temperatures are some of the ways in which changes in climatic conditions affect local communities (Macchi, 2011). Bomuhangi et al. (2016) assert that these types of people-centered effects cannot be examined through meteorological observation alone.

This investigation was conducted in the Mamone rural community in the Sekhukhune District Municipality of Limpopo Province, South Africa (Figure 1). Sekhukhune lies in the summer rainfall region of South Africa and has high levels of poverty (Quinn et al., 2011). Many members of this community derive their livelihods from indigenous resources such as rain-fed subsistence farming and animal husbandry (Masekoameng and Molotja, 2016). Bearing the above in mind, the present study explores community members’ perceptions of changes in the local climate, and how these changes influence the community’s indigenous livelihood resources. Community members were asked to report the types of changes in climate patterns they had observed over the past 22 years (i.e. the period 1993–2015; IPCC, 2013) advises that assessments of climate change should be conducted for long time periods). Evidence of changing weather patterns for Limpopo

Figure 1. Study location.
Human perception of climate change

Resources.

climate change on indigenous livelihood

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Data from interviews and focus group dis-

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you think are the main indications of climate

the community elders. The primary ques-

ceptions of changing weather patterns from

Tourism (LEDET, 2013) and the South African

Province – presented by the Department

Science and Technology (DST, 2010),

Limpopo Economic Development and

Tourism (LEDET, 2013) and the South African

Weather Services (SAWS, 2015) – was used
to corroborate the community’s perceptions

of temperature change.

Materials and methods

This study is based on fieldwork carried out

over 24 months in the Mamone community

in Limpopo Province, South Africa to exam-
ine community members’ perceptions of

changes in weather conditions. Information

was collected through focus group discus-
sion with a carefully selected sample of 150

(88 men; 62 women) community members

who were born between 1930 and 1970,

and lived in the community between 1993

and 2015. According to Bomuhangi et al.

(2016) the interviewees would have good

experience of local weather conditions, the

effects of such conditions on the livelihood

of the community, and knowledge of the

community’s cultural values and customs.

A total of 10 focus group discussions were

conducted, followed by in-depth interviews

with 37 participants aged between 60 and

87 years, selected from the study sample.

The reason for conducting in-depth inter-

views was to obtain quality data about per-
ceptions of changing weather patterns from

the community elders. The primary ques-
tions asked were as follows: (i) How would

you describe climate change? (ii) What do

you think are the main indications of climate

change? (iii) What are the consequences of

these variations on the community’s indig-
enous livelihood resources? Data were

collected through direct interactions with

participants, which lasted for about 1.5h for

focus group discussions and interviews.

Data from interviews and focus group dis-
cussions were recorded and supplemented

by field notes. These data were transcribed
to facilitate analysis. A thematic approach

was used to analyse the data, by which com-

mon words and phrases were categorised

and grouped together to produce two main

themes – namely, perceptions of climate

change itself, and the perceived effects of

climate change on indigenous livelihood

resources.

Results and Discussion

Perceptions of climate change

Participants were first asked if they had

noticed any changes in climate conditions

over the past 22 years. Responses from

all participants revealed a general percep-
tion of changes in temperature and rainfall

over the past 24 years, with negative con-

sequences on the community’s indigenous

livelihood resources.

Perception of temperature variation

Responses from focus group discussions

show that there is certainty among par-
ticipants that weather conditions over their

area are changing. The majority (89%) of

participants had noticed changing patterns

in temperature variations since 1993, and

91% identified temperature variations as

a major indication of changing weather

patterns. The participants of the in-depth

interviews (25% of the study participants, ref-
tered to as ‘key informants’) mentioned

that long-term change in temperatures are

responsible for excessively hot and dry sum-

mers. A study by Shahi (2011) supports the

finding that human perceptions of climate

change are based on what people observe

in their local environment (such as chang-
ing temperature patterns in the case of the

present study). Moyo et al. (2012) add that

comparisons with actual climate measure-

ments show that community elders gen-

erally have reliable memories with respect
to their observations and experiences of

metrical phenomena. However, Lynam and

Brown (2011) believe that perceptions

of increased temperature are shaped by

observations of changing weather patterns.

Rainfall variation

From the focus group discussions, it was

found that 96% of participants believed

that decreases in rainfall were indicative of

changing weather conditions. Specifically,

the participants reported having observed

a change in the timing of rainfall, which

in recent years has occurred between

late November and January rather than

September and December. Rainfall unpre-
dictability is related to increased water

shortages and a reduction in biodiversity.

Participants’ reports of a decrease in rain-

fall were related to their perceptions of lack

of cloud formation, changing seasons, and

changes in the movement and position of

the sun.

Cloud formation. Participants reported

believing that an increase in temperature has

rendered cloud formation impossible (and

that clouds are formed by the interchange

of cold and hot weather patterns).

Changing seasons. Study participants

reported believing that summers are

becoming longer, while winters are

becoming shorter; they also stated that

winter is no longer cold, but is warmer, with

unusual precipitation.

Movement and position of the sun. The

participants also believe that there has

been a change in the positioning of celestial

bodies. They stated that the normal position

of the sun in summer is towards the south,

and in winter it is towards the north, and

thirty-two elders reported that the sun

remains towards the south until mid-winter,

when it is supposed to be in the north. This,
according to the elders, marks a change in

weather patterns.

Perceived effects of changing

climatic conditions on the com-

munity’s indigenous livelihood

resources

The Intergovernmental Panel on Climate

Change (2007) reports that communities

whose livelihoods are highly dependent

on natural resources are among the most

vulnerable to climate change. Evidence

from the 2007 study indicates that the most

important livelihood resources in the com-

munity are negatively affected by changes

in temperature and rainfall.

Subsistence food production

Most of the participants in this study (87%) reported that, under conditions of increased

temperature and reduced rainfall, subsist-

ence food production is declining. The vari-

ous methods of subsistence food production

– farming, gathering, hunting and fishing

– are essentially effected the same way by

adverse weather conditions. Observations

from 56% of participants revealed that a

drop in subsistence consumption is a result

of changes in temperature and rainfall pat-
terns, which have led to poor productivity

and harvest, and a shortage of indigenous

food sources. The participants who reported

that they still grow crops in home gardens

(49% of the study sample) mentioned that the

yields are low due to increased tem-

perature, lack of rain, and frequent wind

and storms that destroy crops. Macchi

(2011) asserts that unpredictable rainfall

and excessive heat are major climate haz-

ards and can destroy rain-fed subsistence

crops. A further observation, made by 49% of

participants, was that there has been a

decline in livestock production due to lack

of fodder and water, and that the use of fire-

wood for warmth and cooking has ceased
due to its rarity.

Miscellaneous

Eighty-six percent of participants reported

that plant species which were collected as

sources of fuel are rarely encountered as a

result of unpredictable rainfall. Additionally,

75% of participants confirmed that the com-

munity’s material culture has been eroded;

cooking and serving utensils, mats and huts

made by wood-carvers with knowledge of

the durability and workability of various

plant materials have become scarce as a

result of rainfall decreases. Moreover, 48% of

participants reported that many of the indig-

enous plants harvested to make preventive

and curative medicine are seldom encoun-
tered, also due to decreases in rainfall. Finally, 93% of participants reported that the temperature and rainfall variations that they had observed were responsible for reductions in the water levels of dams, rivers and boreholes. These perceptions of the influence of changing weather on the indigenous resources corroborate Halder and Sharma’s (2012) findings that marginalised communities depending on natural resources are vulnerable to the potential effects of climate change. Bomuhangi et al. (2016) and Israr et al. (2016) observe that increased temperatures and diminished rainfall are responsible for the death of pastures, the drying up of water resources and the failure of crops.

**Validation of community perception of rainfall and temperature variation**

Warming trends over the eastern and southern parts of Limpopo Province as reported by SAWS (2015) – and supported by the work of Kruger and Shongwe (2004) DEA (2011), and DST (2010) – validate the participants’ perceptions of increasing temperatures as an indication of changing weather patterns. These explanations are further corroborated by Tshiala (2011), Kruger and Sekele (2012) and LEDET (2013), who found that temperature trends for Limpopo Province over the past 50 years have not been consistent between the seasons. Tshiala (2011) adds that the province faces further temperature increases. LEDET (2013) and Kirby (2014) estimate that the province could face a potential 1–2 degC increase in temperature by 2035, more than 2 degC increase between 2040 and 2060, and a 3–6 degC increase between 2080 and 2100. In the study, all participants perceived unpredictable rainfall as an indication of changing weather patterns. The SAWS (2015) meteorological data show rainfall variation over the region of study from 200mm in the dry areas to 1500mm in the high rainfall areas, with the majority of the rainfall occurring between October and April. Malherbe et al. (2012) and LEDET (2013) suggest that there may be future decreases in rainfall in the region.

**Conclusions**

This article has explored how changes in local climate are perceived by members of the indigenous community of Limpopo Province, South Africa, as well as investigating how these changes influence the livelihoods and resources available to this population. The results show that unpredictable rainfall and increased temperatures have led to a perception of changing climate among members of the local population. These observations correlate well with meteorological temperature and rainfall data for Limpopo Province, which show patterns of decreased rainfall and increased temperatures. This study provides evidence in support of the belief that reduced rainfall and increased temperatures are responsible for the erosion of the community’s indigenous livelihood resources, such as subsistence food production, material culture, water and biodiversity. It can be deduced from the findings of this investigation that the community’s indigenous livelihood is climate-dependent, since subsistence food production, and systems of technology and healthcare are dependent upon favourable weather conditions.

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