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Climate Variability and Change as Perceived by Rural Communities in Swaziland

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Abstract: The objective of the research was to determine the perception of climate variability and change by rural communities in Swaziland. Interviews were conducted to a total of 60 members of three rural communities (20 from each community) selected from Middleveld, Lowveld and the Lubombo ecological zones. The reported signs of climate variability included late rains, low rains, drought and famine. The effects of climate variability felt by community members included failure of crops, death of livestock and low crop yields. The majority of the community members did not provide any scientifically proven causes of climate variability. The causes cited included that of community not keeping Swazi customs, supernatural powers and that of being an act of God. Community members did not have adequate information on climate variability and change. The limited information accessible to many communities was through the local radio in the form of daily weather forecast. The information was found to lack details and of a very short term nature. The feelings of the community members were that weather forecast should provide medium to long-term information. The weather prediction focused on major towns, and was of less relevance to many rural communities. Communities suggested an effective early warning system to operate at constituency level. They specified need for weather stations at community levels in order for them to monitor and record weather data.

Key words: Adaptation, climate variability, climate change, coping strategies, food security

INTRODUCTION

Background information for country: Swaziland is the smallest country in southern Africa, covering an area of 17,364 Km^2. It has a population of about 1,120,000. It is surrounded on the north, west, and southern sides by the Republic of South Africa and on the east by Mozambique (Fig. 1). The two major towns/cities in the country are Mbabane and Manzini, with Mbabane being the capital city. Agriculture contributes 16.2% of Gross Domestic Product (GDP), with industry and services contributing 43.2 and 40.5% respectively (CIA, 2005). About 77% of the population live in the rural areas, with 23% in urban areas (Government of Swaziland, 1997). About 30% of the population faced food shortages in 2005/2006, and relied on donated food. The country has been faced with persistent drought and erratic rainfall over the past 15 years resulting in crop failure and loss of livestock.

Climate variability and change: Climate change is often used synonymous with climate variability and yet the two are different. Climate change refers to the long-term significant change in the "average weather" that a given region experiences, while climate variability refers to variation in the mean state and other statistics of climate on all temporal and spatial scales beyond that of individual weather events (IPCC, 2007).

The high vulnerability of Africa to various manifestations of climate change and variability has been confirmed in reports of the IPCC and other publications (IPCC, 2007; FAO, 2007). African countries are prone to greater impacts of climate change and variability partly because they often lack adaptive capacity. However, Africa's, total contribution to emissions of greenhouse gases is less than 7% of the world's greenhouse emissions (Olsen, 2006). In the context of Swaziland, the sectors that are sensitive to climate change and climate variability and hence highly at risk are the water resources, agriculture and food security, natural resources and biodiversity, and health (vector-borne diseases). Abnormal changes in temperature and rainfall, and the increasing frequency and intensity of droughts and floods have long-term implications for the viability and productivity of world agro-ecosystems (FAO, 2007). Agriculture is the sector most affected by changes in climate patterns and will be increasingly vulnerable in the future. Developing countries are particularly at risk as their economies are highly dependent on agriculture and

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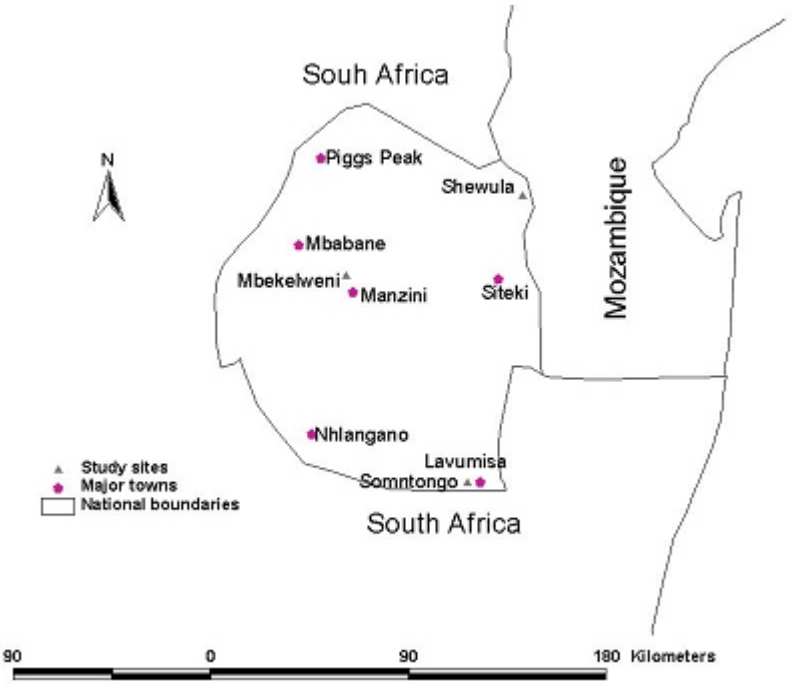

Fig. 1: Map showing study areas and major towns in Swaziland

have fewer resources and options to combat damage from climate change and variability. Hundreds of millions of people in developing nations will face natural disasters, water shortage and hunger due to the effects of climate variability. Extreme weather events are likely to become more intense and more frequent, while higher global temperatures could affect crops and water supplies and spread disease. Matondo *et al*. (2005) reported that there will be reduction in runoff under changed climatic conditions in Swaziland, and the available water resources will be less in the future. Adopting land use practices in agriculture such as conservation agriculture would help to maintain significant amounts of carbon in the soil (FAO, 2007).

Evidence of climate variability and change in Swaziland: Climate variability is evident in Swaziland, as it manifests itself in hydrological disasters, change in rainfall regime as well as extreme weather conditions. The periods at which droughts occurred and the number of people affected are shown in Fig. 2. The most severe ones occurred in 1983, 1992, 2001, 2007 and 2008. It was reported that over 500 people lost their lives due to the drought of 1983. During that time the government was ill prepared, and there was no formal structure to coordinate emergencies (Government of Swaziland: United Nations, 2008). In 2007, close to 50% of the population needed food aid, as they did not have sufficient food due to failure of their crops.

The effect of drought is usually very severe on cattle; in 1992, about 90,000 died in the country (20% of the total herd). According to the 2004/05 crop and food supply assessment, jointly conducted by the United Nations Food and Agricultural Organisation and the United Nations World Food Programme, production of the country's staple food, maize, was on a long-term decline, dropping by 70% over a period of five years in some areas. This was due to the fact that much of the arable land was not cultivated because of delayed rains, high risk of making a loss from agriculture and shortage of seeds for alternative crops among others (IRIN, 2007). In the 2004/05 cropping season the Lowveld farmers ploughed only 10% of their arable land (IRIN, 2007).

The other climatic disasters in recent years include incessant lightning during rainy seasons, cyclone Domonia in 1984, and torrential rains and floods in 2000 (IRIN, 2007). Cyclone Domonia affected over 400,000 people (about 40% of the population) and caused damage worth US$ 54 million (Government of Swaziland: United Nations, 2008). Houses and fields were flooded and washed away and a number of people drowned. Infrastructure such as roads, electricity and telephone lines were damaged. The country was severely affected by torrential rains, which led to flooding in many parts of the country in January 2000, with an estimated total of 272,000 people (21% of total population) affected (IFRC, 2000). The winds of 1984 affected over 630,000 people, and the fires of 2007 affected over 270,000 people (Fig. 3).

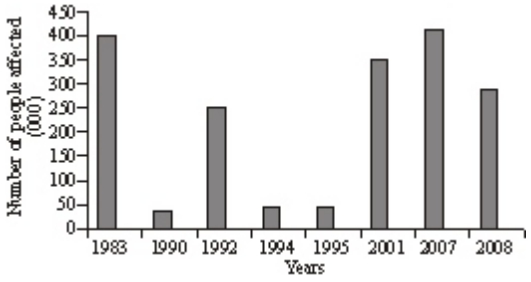

Fig. 2: Occurrence of drought in Swaziland and number of people affected Source: Government of Swaziland: United Nations (2008)

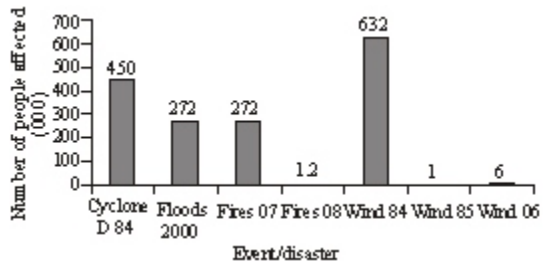

Fig. 3: Climatic disasters and the number of people affected Source: Government of Swaziland: United Nations (2008)

Hailstorms and strong winds are other common hydrological disasters frequently experienced in the country. They tend to occur during the months of September to April, destroying crops and property such as houses, electricity and telephone lines. Lightning is a common menace that kills scores of people every year in Swaziland. In a study conducted by Dlamini (2009), 123 fatalities from lightning were reported between 2000 and 2007. The average lightning fatalities for the eight year period was 15.5 per million people, a rate higher than the estimated 6 per million for southern Africa (Dlamini, 2009).

Climate change and variability are perhaps the most critical environmental challenges confronting the world in the 21st century, however crucial information pertaining to perceptions of climate change and variability by the masses is lacking. Successful implementation of mitigation strategies has a strong bearing on the changes in behaviour of the people whose individual choices may have huge collective impacts at global scale. There is, however, limited in-depth understanding of the perceptions of the public to climate change and variability. The knowledge and perceptions of communities about climate change and climate variability will influence the way they would respond to mitigation initiatives and climate policies. This study was necessitated by the need to know perceptions of climate change and variability by the masses so as to create a data base for among other things policy formulation in order to successfully mitigate negative impacts due to climate phenomena.

METHODS

Study sites and their description: The study was undertaken in three rural communities that were selected to represent three ecological zones of the country. They were Mbekelweni (Middleveld ecological zone), Somntongo (Lowveld ecological zone) and Shewula (Lubombo ecological zone) (Fig. 1). It was conducted in June 2008. The Lowveld zone has long term average rainfall of between 400 and 550 mm. The zone is mostly affected by drought with over 40% of the arable land not cultivated over the past 10 years due to poor rains. Large scale irrigation schemes are found in this zone, dominated by sugarcane irrigation. The irrigation schemes are mainly in privately owned farms. Rainfed agriculture is dominant in communal land where farming is for subsistence purposes. On the other hand the Lubombo zone and the Middleveld zone both have long term average rainfall of between 550 and 850 mm per annum.

Data collection: Interview guides were prepared and reviewed by a panel of experts in climate change and climate variability for content and validity. Seven research assistants with undergraduate qualifications (Bachelor of Science or Bachelor of Arts) were trained to conduct interviews. Interviews were conducted to a total of 60 members of the rural community (20 from each community). The information that was sought by the interviews included signs of climate change and variability as perceived by the communities, causes of climate change and variability, livelihood strategies to cope with climate variability, strategies to mitigate climate change and variability, and sources of information on climate variability and change. Focus group discussions were conducted in each of the communities to get information on livelihood strategies and coping mechanisms practiced by communities, as well as sources of information on climate variability and change.

RESULTS

Signs of climate variability and change and its perceived effects: The majority of the members of communities were aware of climate variability. The reported signs of climate variability included drought, poor rains, change in rainfall pattern and increase in temperature (Table 1). The observed effects of climate variability included inadequate food supply, poor crop yields and poor performance of pastures (Table 2). The perceived effects of climate variability were mostly personal or family centred, and they did not include those effects that were general such as destruction of biodiversity and other non-human phenomena.

Table 1: Observed changes associated to climate variability as perceived by the community

Observed change	No. of responses	Ranking
Persistent drought	20	1
Poor rainfall	19	2
Very hot summers	17	3
Change in weather pattern	17	3
Extreme cold winters	8	5
Low river flows	4	6
Strong winds	4	6
Severe hail storms	4	6
Floods	3	9
Strong winds	2	10
Drying of swamps	1	11

Table 2: Effects of climate variability as observed by the community

Observed effects	No. of responses	Ranking
Inadequate food supply	10	1
Poor crop yields	10	1
Poor performance of pastures	10	1
Poverty	7	4
Death of livestock	7	4
Sickness due to extreme heat	6	6

Table 3: Causes of climate variability as perceived by community

Perceived cause	No. of responses	Ranking
Industrial pollution	22	1
Breakdown of tradition	12	2
Community disobeying God	9	3
Biblical manifestations	9	3
Supernatural powers	7	5
Destruction of nature	7	5
Car gas emission	6	7

Perceived causes of climate variability: The perceived causes of climate variability that were scientifically proven included industrial pollution, destruction of nature and car gas emissions. A significant number of respondents did not provide any scientifically proven cause of climate variability as they cited causes to include breakdown of tradition, God disobeying community, biblical manifestations and supernatural powers (Table 3).

Livelihood strategies to cope with climate variability: The livelihood strategies to cope with climate variability that were practiced by communities are shown in Table 4. They included selling of livestock in order to buy food, buying of water from those with boreholes, provision of food aid to community members by non governmental organisations and private sector, pooling of resources together and getting food rations from other community members.

Table 5: Strategies to mitigate effects of climate variability suggested by community

Strategy	No. of responses	Ranking
Provide community with water for irrigation	20	1
Pray for God's intervention	11	2
Reduce production of gases	9	3
Educate communities about climate change	8	4
Plant trees and control deforestation	6	5
Keep customs	5	6
Provide farming inputs to communities	2	7
Create employment opportunities to rural communities	2	7
Provide food aid to those in need	2	7
Plant drought resistant crops	1	10
Practise organic farming	1	10

Strategies to mitigate climate variability as suggested by communities: Twenty respondents suggested the provision of community with water for irrigation as a strategy to mitigate the effects of climate variability. The other strategies suggested included reduction of production of gases, educating communities about climate change, planting trees and controlling deforestation, providing farming inputs to communities, planting drought resistant crops and practising organic farming (Table 5). Sixteen respondents suggested non scientific proven strategies such as praying for God's intervention and keeping customs.

DISCUSSION

Perception of communities on climate variability and change: The majority of the respondents perceived inadequate food supply, poor crop yields and poor performance of pastures as the most important effects of climate variability and change. The results on perceived effects of climate variation and change were opposite to

Table 4: Livelihood strategies and coping mechanisms practiced by communities

	Ecological zone where practiced		
Strategy	Middleveld	Lowveld	Lubombo
Selling of livestock in order to buy food and to pay school fees	√	√	√
Buying of water from those with boreholes		√	
Provision of food aid to community members by NGOs and private companies	√	√	√
Getting food rations from other community members	√	√	√
Getting water from schools that have boreholes and other reliable water sources		√	
Water harvesting from roofs		√	
Water recycling		√	
Pooling of resources through societies	√	√	√
Elder people get social grant from government	√	√	√
NGOs provide seeds and other farming inputs to needy members of community		√	√
Mixed cropping and crop diversification	√		√
Growing of vegetables under irrigation	√		

those found by Leiserowitz (2006), where the majority of respondents in the United States of America were concerned about impacts of climate change on people around the world, and non human nature. In the study by Leiserowitz (2006), only 13% of the respondents were concerned about the impacts on themselves, their family or their local community. About 40% of Swaziland population faced acute food and water shortage in 2007. The majority of Swazi people are known to believe in tradition and supernatural powers, and the perceived non-scientific causes of climate change were a manifestation of their belief.

Livelihood and mitigation strategies: Some of the strategies that are practiced as a coping mechanism for climate variability in Swaziland are not sustainable, and lead to further problems. An example is the selling of livestock (mainly cattle) to buy food and pay for school fees. The majority of small-scale farmers in Swaziland rely on cattle as a source of draught power for ploughing and collection of firewood and domestic water from rivers and dams. The kraal manure from livestock is used to fertilise the fields, and milk from cows is a source of proteins. In the event where the cattle are sold, the farmers are forced to rely on hiring of tractors and oxen for draught power. They may not have the money to hire tractors and oxen, and under such circumstances they will not cultivate their fields, leading to a cycle where they will have food shortage in the subsequent seasons. The communities receiving food rations tend to develop a dependency syndrome, and get reluctant to grow their own food with the hope that they will get food rations in the subsequent seasons (Afrol News, 2008).

The sustainable strategies that reflected adaptation to climate variability were water harvesting from roofs, mixed cropping and crop diversification, and growing vegetables under irrigation. In a similar study undertaken by Kadigi *et al.* (2007) in Great Ruaha catchment in Tanzania, the dominant livelihood strategies and coping mechanisms were collective labour arrangements, and lending and borrowing mechanisms. The other livelihood strategies that are practiced in other countries in southern Africa include rainwater harvesting to enhance water productivity of rainfed agriculture (Kahinda *et al*., 2007), minimum tillage and mulching (Kosgei *et al.*, 2007; Mupangwa *et al*., 2007). However such strategies that have been effective in other countries have not been effectively promoted and adopted in Swaziland. Water harvesting from roof tops was reported in the Lowveld only, as a result of the intervention and promotion by World Vision (World Vision, 2009).

Intervention by government and NGOs: The provision of seeds and other farming inputs by NGOs have not shown any tangible improvements in the production of food by communities as it did in Malawi where such programme turned the country from food deficit to food surplus. In Malawi, the government introduced a coupon system giving small-scale farmers access to fertilisers and seeds at half the commercial price (Afrol News, 2005). The programme in Malawi covered all the small-scale farmers, unlike in Swaziland where the seeds and fertilisers were distributed only to households that were regarded to be relatively needy. Some of the households that received the farming inputs sold them for cash to meet their immediate demands such as food. The Government of Swaziland introduced social grants for the elders in 2007. The grant of E170 (US$ 23) per month is given to every person who is over 60 years, and who is not getting any other payment in the form of pension or salary. The social grant has been beneficial to those households that could have been severely affected by climate variation.

Source of information on climate variability and change: Community members did not have adequate information on climate variability and change. The limited information accessible to communities was through the local radio in the form of daily weather forecast. The information was found to be inadequate and of a very short term remedy. The feeling of the communities was that weather forecast should provide medium to long-term information. The weather prediction focused on major towns, and was of less relevance to many communities in rural areas. Seasonal forecasting may increase the warning time for climatic hazards and it may be used to minimise risk (Murphy *et al.*, 2001). Communities suggested an effective early warning system to operate at constituency level. They specified need for weather stations at community levels in order for them to monitor and record weather data. An automatic weather station was installed by the Swaziland Meteorological Services with the aim of providing climatic data to the Somntongo community. However, the weather data from the station was sent remotely to the offices of Swaziland Meteorological Services at Mbabane, and the community did not benefit directly from it. Members of the community had the perception that the station was not functional.

CONCLUSION

Like many countries in the region, Swaziland is experiencing a number of natural disasters that include drought, occasional floods, cyclones, hailstorms, windstorms and wild fires. About 40% of Swaziland's population is facing acute food and water shortage due to the prevailing drought. Climate variability is a national pressing issue that is hindering development and even undoing the modest gains in economic growth that the country had achieved in the past few years. The majority of the community members were aware of climate

variability and indicated that they were affected by it. However a significant number attributed the climate variability to non-scientifically proven causes such as breakdown of tradition, biblical manifestations and supernatural powers. In formulating measures to mitigate the effects of climate variability, the beliefs and concerns of the community need to be taken into consideration. There is need to educate local communities to appreciate the scientific basis of climate variability and change so that when coupled with beneficial traditions the community may be able to mitigate the adverse effects of climate change using locally available resources.

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