

Full Length Research Paper

Rural households' awareness and preceptions to variability in climatic conditions in rural South Africa

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Accepted 15 May, 2013

Understanding climate variability is key to the reduction of human foot print and communal farming production. This study evaluates climate change awareness and perceptions of climate variability among the Eastern Cape communal farmers. A multi-stage sampling technique was used to select 130 heads of households across Ntabankulu local municipality for participation in the study. Data were collected through a pre-tested questionnaire. The study revealed that about 70% of the interviewed households knew about climate change. On the other hand, 80% agreed that the climate is changing, 70% were defiant that the change is caused by human beings and approximately 25% were convinced that the climate change is as a result of natural causes. The respondents fail to construe the causes of climate change and past trends climate. Factor analysis findsage, gender and years of education as having a positive significant effect on understanding climate change. The paper recommended for an extension service that would encourage the elderly and the educated to transfer information on climate change. South African weather services, extension workers, councilors, civil societies and other development agencies have a lot to learn from the investigated households.

Key words: Awareness, perceived changes, climate change, seasonal changes.

INTRODUCTION

Climate change refers to changes that alter the composition of the global atmosphere and which are in addition to natural climate variability observed over comparable time periods (United Nations, 1992). This phenomenon is undermining the achievement of the millennium development goals (MDGs) and the international communities' efforts to reduce extreme hunger and poverty. Climate change is a big threat to livelihoods, environment and biodiversity resource base. For rain fed agriculture, a 1% change in rainfall is likely to reduce South Africa's maize output by approximately 1% (Blignaut et al., 2009). The largest losses are predicted to

occur among rural households and smallholder farmers in Eastern Cape. These are more vulnerable due to predominance of rain fed agriculture, wide ignorance of the phenomenon, low adoption rate of adaptation measures and because of the low adaptive capacity. The losses will range from crop failure, livestock death, floods and other associated changes.

The broader public understanding of climate change is an essential ingredient for informed adaptation and mitigation strategies (Anderson et al., 2010). A critical element to climate vulnerability in rural South Africa is the the issue of awareness and adaptation strategies (Thomas

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et al., 2007). The level of awareness of climate change, particularly causes, climatic trends and adaptation issues, is varied among the South African public (Madzwamuse, 2010). Less knowledgeable communities are more vulnerable to climate change (Thomas et al., 2007). The vulnerability of most communities is exasperated by high dependence on rain fed agriculture, low literacy rates and proximity to the ocean which heighten the propensity of climate variability. Climatic risks, variable and sometimes agricultural output remains a daunting challenge in the Eastern Cape Province. Adding on to low purchasing power, a significant number households are faced with a challenge of providing their families through food purchasing only as crop failure, livestock death and lack of water make agriculture unreliable (van der Merwe, 2011). An estimated 25% of South African households have inadequate or severe inadequate food access (Du Toit, 2011).

The Eastern Cape habitats the highest proportion of unutilized land and the area is known for land degradation and food insecurity (Bank and Minkley, 2005). The proportion of land lying fallow could even increase if the environmental and social consequences of climate change continue to put agriculture at risk. Awareness about the climate change phenomenon is assumed to reduce the rate of climate change and improve adaptation, thus building a resilient agricultural community in the face of climatic risks (Anderson et al., 2010; Madzwamuse, 2010; Mandleni and Anim, 2011). Human activities and ignorance of the climate change phenomenon have been in most circumstances blamed for intensifying climate change in South Africa (Madzwamuse, 2010). These important linkages and the reported impacts of the phenomenon on agriculture in Eastern Cape by Blignaut et al. (2009) has fueled the urge to study the level of climate change awareness in the province.

The objectives of this study were to establish the extent of awareness of climate change in the area of study. Firstly, the study examines households' awareness of the climate change phenomenon. Secondly, the study seeks understand farmers' experiences and own perceptions of changes in climate over the past 20 years. The level of understanding of the climate change phenomenon by the resource-poor smallholder farmers and livestock farmers is an important area of concern. With the livelihoods at risk, it is important to understand how climate change is understood by farmers.

Conceptual framework

The conceptual basis of this study considers understanding climate change as important to communal farmers. It is important for climate to be recognized, understood and appropriately reacted to (Thomas et al., 2007). This study is set on the premise that farmers should understand the magnitude of climate variability, frequency of event occurrence and rate of change within

climate systems. These are important attributes as they can affect farmers' ability to respond, cope and to adapt to climate change. Acquah (2011) posits that climate change is a challenge to farmers and further remarks that awareness and quality of knowledge on existence and issues relating to it could reduce its impact. This can be through several channels. The first channel assumes that the broader public understanding of climate change by the citizens is an essential ingredient for reducing human foot print. Secondly, public understanding of climate change has a significant role to play in preparing adaptation strategies and addressing the challenges it poses. Informed responses can significantly reduce yield loss. Awareness of the phenomenon increases households' risk bearing capacity and helps households in adopting and altering coping strategies. The third pathway is that public understanding of climate variability increases households' willingness to take action to mitigate the anticipated conditions (Anderson et al., 2010). People cannot accurately predict the next season and this is largely a factor of climate change (Molua, 2002).

After referring to a large body of literature, Anderson et al. (2010) posit that socio-economic factor have a differential influence on households understanding of climate change. As a sequential decision process, the household or its members should have to understand climate change before adopting different mitigation measures. Households' understanding of climate phenomenon will be determined by a number of factors. This study aims at investigating the level of awareness as well as the determinants. A better understanding of the determinants of awareness of climate change is important to inform policies aimed at promoting successful awareness campaigns. Therefore, this framework proves relevant to this study.

METHODOLOGY

Study area and sampling procedure

This study was carried out in Ntabankulu municipality of the former homelands. Ntabankulu stretches for about 122 km² and is an undulating area with very limited flat surfaces. The area lays approximately, 32°10'S 28°35'E. Ntabankulu is a dry area with mean monthly relative humidity and average rainfall of 92% and 730 mm, respectively. The area is endowed with natural resources ranging from abundant grazing land, thick landscape and many seasonal rivers and one perennial river. Less than 50% of households have access to tap water. These encourage people into animal husbandry, smallholder farming and gardening. Due to its location from the economic hubs of the province, substantial number of the inhabitants engages farming as the main economic activity for living and some are recipients of government's social grants.

A survey was conducted through a well-structured interview schedule which targeted households in Ntabankulu local municipality. A multi-stage random sampling procedure was used to select 150 communal farmers to be used for this study. To select the above sample, 5 wards were randomly selected from a total of 18 wards. Following which 30 communal farmers were randomly selected from each ward for the interview. A pre-tested structured questionnaire was the main instrument used for data collection.

Table 1. Description of variables.

Variable name	Variable description
Y_i	Climate change awareness 0 = Unaware of climate change 2 = Aware of climate change
X_{1i}	Age 1 = <30 years; 2 = 30 to 60 years; 3 = >60 years
X_{2i}	Gender 0 = Female 1 = Male
X_{3i}	Level of education 0 = No education, 1 = Primary education, 2 = Secondary education and 3 = Tertiary education
X_{4i}	Religion 0 = Other or none 1 = Christianity
X_{5i}	Farming as main occupation 0 = None farming household 1 = Farming household

Following data cleaning, a total of 130 responses were however found to be suitable for this study. The questionnaire encompassed demographic, households' socioeconomic information as well as information on climate change awareness.

Method of data analysis

The method of data analysis were based on the intend objectives. Descriptive statistics such as frequency, percentage, means and standard deviation were used to analyze important variables like household socioeconomic characteristics and knowledge on climate change. Data analysis also comprised of a comparative analysis of recorded patterns in climate data and the changes as perceived by respondents. Multivariate analysis was used to analyze the determinants of climate change awareness. The adopted model dichotomized the depended variable into 2 categories, those that are aware of climate change and those that are not aware of the phenomenon. A dummy variable representing the households that are aware of climate change is thus labeled 1, otherwise = 0. The model therefore identifies the important variables that best characterize understanding of climate change by households at the same time determining the marginal contributions and elasticities of some hypothesized variables on the dependent variable.

The model adopted in this study was used to identify those variables that best explain climate change awareness. In order to examine the relative importance of each independent variable, by controlling all the confounding factors, multivariate analysis in the form of binary regression was used. The binary regression analysis is commonly used for the purpose of predicting values of binary response variables from one or more predictor variables. The dependent variables for the study was awareness of that there is climate change, variable ranging from 0 (no aware) and one (aware of climate change).

Let Y_i represent the propensity of a farmer being aware of climate change rather than not. Then the relationship between the observed outcome Y_i and the response propensity can be written as:

$$Y_i = B_0 + B_1 X_{1i} + B_2 X_{2i} + \dots + B_K X_{K_i} + e$$

Where B stands for the coefficients, K denotes the number of predictor variables (factors explaining the dependent variables) and i denote 0 or 1. The variables (Table 1) were taken into account for the determination of climate change awareness.

Multivariate or univariate analysis estimates the marginal effects of household characteristics on whether the head of household is aware of climate change or not.

RESULTS AND DISCUSSION

Table 2 provides the socio demographic characteristics of

the total sample and stratified according to whether the households 'owned, managed, or contributed to any farming operations or not. Of the participants surveyed, 62% indicated that they practise farming either in the form of livestock husbandry, crop farming or operating a garden. This group was under-represented in the survey population when compared to Statistics South Africa (2012) data, which indicated people participating in agriculture to be 37% of Eastern Cape's rural provincial population. The over-representation of this group in the research could be attributed to the nature of the investigated communities and the economic structure of the Ntabankulu local municipality, which is highly orientated towards the agricultural sector and the service sector. In this regard, the research results are more appropriately generalized to the rural community and not necessarily the broader rural community as a whole.

The majority of survey participants were males (60.7%). This proportion was higher than recent estimates by Statistics South Africa (2012) of 44.7%. Male household members attend to surveys more than their female counterparts (Evans et al., 2011). As for the non-farming households, the males were slightly more than females. The representation of women involved in farming (38.5%) in the survey was much lower than the 61% reported by Altman et al. (2009). The results also conflicts with STATS SA (2012)'s finding that female headed households are more likely than male headed households to be involved in agriculture in rural areas.

The distribution of household size given on Table 2 reveals that both the farming households and none farming households have an equal mean household size of 7. The computed mean household size for all the respondents is 6, which is well above the mean at municipality level (4.4) (Statistics South Africa, 2012). This observation is supported by the finding that traditional communities favor large families than the modern societies.

The age distribution of all the household head indicates that majority of them are in the age group 30 to 60 years (63.4%). The aged, (+60 years) accounts for 27% and the youth account for insignificant proportion (6%) of the respondents. Similar proportions are also observed for the farming and non-farming households. The sample population's age distribution shows vast experience with both farming and climate change as experience is

Table 2. Household characteristics of the farming and non-farming households.

Characteristics	All respondents	Farmer households	Non farming households
Households size*			
Maximum	21	15	21
Mean (SD)	6 (3.2)	6.47 (2.7)	7.2(3.7)
Age of head of household			
<30 years	8 (6)	3 (2.3)	5 (3.8)
30-50 years	83 (63.4)	53 (40.7)	28 (21.5)
>50 years	35 (27)	24 (18.5)	13 (8.5)
Gender			
Male	79 (60.7)	30 (23)	27 (20.8)
Female	47 (36.2)	50 (38.5)	19 (13.1)
Education			
Not educated	49 (37.7)	37 (28.5)	10 (7.7)
Primary education	45 (34.7)	23 (17.7)	22 (16.9)
Secondary education	24 (18.5)	14 (10.8)	10 (7.70)
Tertiary education	8 (6.2)	6 (4.6)	4 (1.5)
Marital status			
Married	64 (49.2)	40 (30.7)	24 (18.5)
Single	33 (24.6)	20 (15.4)	13 (7.7)
Divorced	4 (3.1)	4 (3.1)	0 (0)
Widowed	25 (19.2)	16 (12.3)	9 (6.9)

Source: Result of data analysis * Actual figures and not measured in percentage.

approximated by age (Falco and Veronesi, 2012).

The distribution on educational status of the respondents indicates that 37.7 of the respondents are found to be illiterate, and of the illiterate, 75.5% are farmers and only 20.5 are not farmers. However, the remaining 62.3% achieved a certain level of education. Out of the 62.3%, 26.8% are farmers. The educated households are more likely to be aware of climate change and understand its impact on farming activities than the illiterate (Mandleni and Anim, 2011).

Past studies have drawn linkages between climate change awareness and marital status (Mandleni and Anim, 2011; Acquah, 2011). The majority of the respondents (75.2%) are married followed by single (9.3%), widowed (4.7%) and the rest divorced and they contribute smaller proportion of the respondents. The higher percentage distribution of the married households is not commensurate to the country's picture where about 40% of the rural households in South Africa are reported to be legally married (Statistics South Africa, 2012).

Households' awareness and understanding of climate change

The level of respondents' understanding of climate change and its causes is the first question examined. Figure 1

presents the percentages of all households who have knowledge about climate and the perceived causes.

Results of the household questionnaire survey indicate that a high proportion of the respondents (70%) know about climate change but few understand the phenomenon. In a study in Ghana, 87.2% were aware of the climate change (Acquah, 2011) and proportion of 28% for a community in South Africa is not encouraging after understanding that the COP17 was held in that same country and the investigated community is located less than 400 km from Durban. An important outcome emerged as 80% agree that the climate is changing, and the difference of 10% generate an impression that they have seen the changes but remain unknowledgeable of the phenomenon. Evans et al. (2011) and Mandleni and Anim (2011) posits that people remain unaware of climate change but recognize some changes in climate. The prominent feature of many people's attitude towards climate change is uncertainty, disbelief, ignorance and some believe climate change will not affect them. This finding illustrates that generally the respondents have little concerns about climate change which probably imply that they do not consider it as a major threat to their livelihood. The outcome suggests the need to promote greater public awareness of climate change. Further efforts should be on familiarizing farmers with the trends in climate and assist farmers in developing and adopting measures best suited

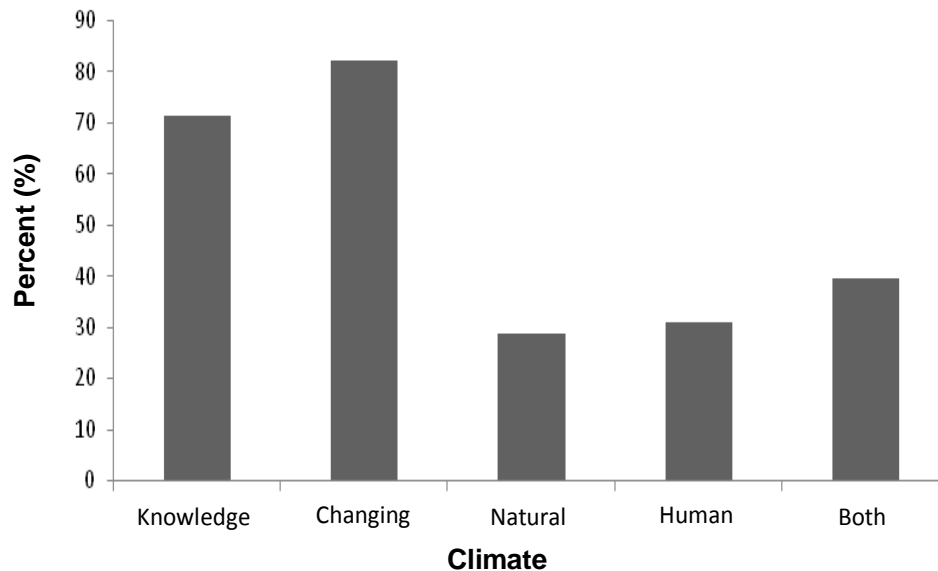


Figure 1. Levels of understanding of climate change.

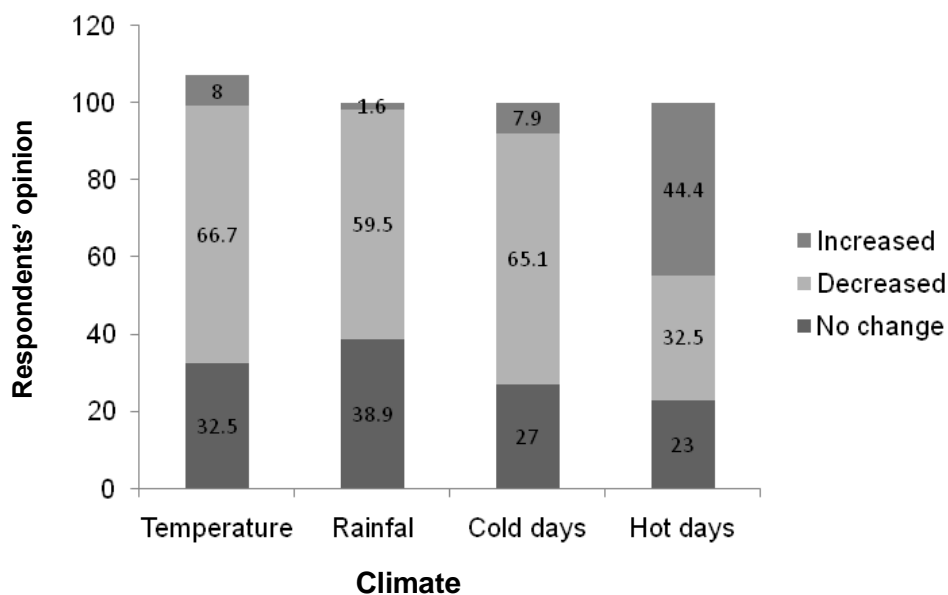


Figure 2. Respondents' opinion of climate over the past 20 years.

for reducing its adverse effects.

Further enquiry however; show that very few understand the causes as 28% stated that climate change is due to natural causes, 30% stated that it is caused by human beings and 40% stating that climate change is caused by both human and natural causes. In another critical level of conceptualization, one of the respondents perceives the changes to be a result of God's punishment to the human race for disobedience. The respondent even quoted a section in the Bible (Amos 2). The data presented illustrate unwarranted misunderstanding of climate change by rural folks. Most of the respondents were unsure

whether human activities are responsible for climate change.

Knowledge on past trends in climate could help in more formal assessments of climate. After understanding that 80% of the households agree that they have seen some changes in climate, the study went on to sort to understand the respondents' perceived changes. Figure 2 shows the summarized statistics of the respondents' opinion of the past trends in temperature, rainfall, cold days and hot days. Remarks by Acquah (2011) substantiate knowledge on past changes in climate and uphold that information on past knowledge on changes in

Table 3. Binary logistic regression of the factors influencing household climate change awareness.

Variable of interests	Odds ratio	P value
Age		
<30 years ^c	-	-
30 to 60 years	1.1730	0.084*
>60 years	1.348	0.023**
Gender 0 ^c = Female, 1 = Male	1.024	0.025**
Education		
0=No education ^c	-	-
1=Primary education	0.069	0.042**
2=Secondary education	1.45	0.168
3=Tertiary education	1.339	0.0943*
R Squared	0.45	

*, **, Significant at 0.10 and 0.05, respectively; ^cReference category of the categorical variable.

local climate contribute to better understanding of present weather and climate variability.

The majority (66.7%) indicated that temperature had declined, 59.5% indicated that rainfall has decreased, 65.1% believe that cold days have decreased and 44.4% were convinced that the number of hot days have increased. According to Blignaut (2009), Eastern Cape's temperature has increased by 3% and rainfall has decreased by 6% over the past twenty years. The perceptions of 66.7% of the respondents and 44.4% of the respondents on temperature and rainfall, respectively, are in line with the finding by Blignaut et al. (2009) in Eastern Cape Province. The local understanding of temperature and rainfall trends over the past 20 years indicate that 55% are misinformed about trends in temperature and 33% are misinformed about the trends in rainfall. A significant proportion, 30% remain adamant that there have not been any changes in any of the 4 conditions. This result implies that communal farmers are unsure of the trend in important climate aspects. This probably illustrate that rural farmers are not benefiting from their past understanding of trends in climate, therefore are not in a position to respond to current variability in climate. However, this finding is against the standard understanding from all over the world showing that local resource users usually hold a great deal of climate relevant knowledge of a depth and detail (Marin and Berkes, 2013). This therefore implies that local and indigenous understanding of climate change in rural South Africa should always be treated with skepticism.

The respondents' level of understanding of past trends in climatic conditions is lower than that reported in other studies where a much higher percentage of respondents identified the correct trends in climatic variability. In a study in Limpopo, Gbetibouo (2009) found that 91% perceive an increase in temperature and 81% perceive a

decrease in rainfall. However, Gbetibouo (2009) posits that farmers' reports on climate variability over the past years are not necessarily correct as they are influenced by recent climate trends. The current research indicates various level of understanding of climate change and high degree of households' misinterpretation of the trends in important climatic aspects that occurred over the past 20 years. Despite the assumed knowledge on climate change by a higher proportion of the respondents, the level of understanding of the causes and past trends in climatic variability remains low among the investigated households.

Table 3 shows the results of the binary logistic regression of the factors influencing household climate change awareness. The coefficient for the variables age, gender and education was significant for climate change awareness. All the age group categories show a positive significant relationship with climate change awareness. The older age groups (30 to 60 years and > 60 years) were more likely more aware of climate change than the younger age group (<30 years). The possible reason was that the middle age group had individuals who are recent school leavers who had acquired knowledge on climate change through past experiences with climate variability and/or at school; which is currently part of their curriculum. The old age group has individuals who had stayed in the area of study for a reasonable amount of time to observe climate change. A study by Mongi et al. (2010) posits that households understanding of climate change depend on age and the level of education among other variables. Previous research Mandleni and Anim (2011) indicated similar results whereby education significantly affected awareness to climate change.

Also, respondents with tertiary education are more likely to have knowledge on climate change than respondents with no education and primary education. However chances are high that better among those with primary education that those without education at all. These results emphasize the importance of literacy.

The study showed that male headed households were more likely to be aware of climate change than their female counterparts. A similar study that was conducted by Mandleni and Anim (2011) conflict this results and however posits that male farmers are more responsive to adaptation to climate change.

The unwarranted misinterpretation of climate change calls for climate change awareness campaigns. Improving knowledge on climate change is a vital step towards reducing human foot-print and the adverse effects of climate change on agricultural production.

Conclusions

The paper provides important insights into the level of understanding of climate change by communal farmers and their perceived trends in important aspects of climate.

The results shed light on the importance of promoting community understanding of climate change. A large proportion of the respondents showed that they are not fully aware of the phenomenon threatening their farming livelihood. Local understanding of climate change is too general and inappropriate to positively influence adaptation. The study provide a case based evidence that extension workers, councilors, civil societies and other development agencies can use in enhancing public understanding of the climate change phenomenon. The importance of the elderly people in the community, education and the value of male was noted from this limited analysis of factors explaining climate change awareness. Improving knowledge on climatechange through financing education, carrying out some awareness campaigns and timely provision of scientific and instrumental data households could help.

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