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Climate Change Status in the Mutale Local Municipality: A Case Study of the Smallholder Farmers in Vhembe District, Limpopo Province

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ABSTRACT The Limpopo Province is one of the poorest province in the country, characterized by a high unemployment rate, poverty and lack of access to a range of resources that results in the majority of the people's not being able to secure their livelihoods. The primary aim of this paper is to highlight the status of climate change in the Local Municipality as in objective section. The following objectives were identified: (a) To describe the status of climate change in the Mutale Local Municipality and (b) To identify the determinants of climate change adaptation in the Mutale Local Mnicipality. A representative sample of 150 farmers aged between 18 and 60+ years (46% males and 54% females) participated in the study. The study was conducted in the Vhembe District, with special attention being paid to the Mutale Local Municipality. The following two villages visited included *Folovodwe and Rambuda.* The purposive sampling method used covered most of the productive farms in the two selected villages and also covered the uniform or homogeneous characteristics of farmers. The sample frame was designed to meet the objectives of the study and it had to adhere to the statistical specifications for accuracy and representation. The questionnaire was administrated to farmers, and included matters relating to climate variability and change. Data was coded, captured, and analyzed using SPSS. Descriptive and regressions analyses were conducted. The results show a positive association among the following variables: age, female, decreased rainfall, level of education, farming fulltime, climate change information, source of climate information, perception on climate change, climate change adaptation and formal extension.

INTRODUCTION

Climate variability and change is a reality and it is the greatest environmental challenge that has an impact on agricultural production in many ways (Maponya and Mpandeli 2012). Agricultural production depends on climatic conditions, such as temperature and precipitation. Climate is a primary determinant of agricultural productivity, and any significant changes in climate in the future will influence crop and livestock productivity, hydrologic balances, input supplies and other components of managing agricultural systems (Jayne et al. 2003). Global climate change results in reduced food production, leading to higher food prices, thus making food less affordable for poor people. According to the Intergovernmental Panel on Climate Change (IPCC) (2007), the global community is already facing the impact of climate change, and will continue to do so in the future. The most affected livelihoods are those in rural areas in developing countries, where poverty is widespread and agricultural productivity is low due to, amongst others, degrading natural resources, lack of markets and climate risks (Nhemachena and Hassan 2007). Climate change will severely affect those farmers who have limited water infrastructure for irrigation of their crops in rural areas.

The Vhembe District is a prolific fresh produce grower, with large-scale exports testifying to the quality of production and the efficiency of many farmers. The Vhembe District produces no less than 4.4 percent of South Africa's total agricultural output, including 8.4 percent of the country's subtropical fruits and 6.3 percent of its citrus fruits (DAFF 2011). Climate conditions are subtropical, with mild, moist winters and wet, warm summers. The annual rainfall per annum is about 500mm. The average annual potential evaporation in the Vhembe District is higher than

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the combined rainfall in almost all other districts in the Limpopo Province. However, the rates differ from place to place, depending on the topography. One of the areas with the highest rate of evaporation is around Musina. The annual rate of evaporation in Musina exceeds 2,700 mm (DAFF 2011).

Objectives

The primary aim of this study is to investigate the status of climate change in the Mutale Local Municipality. The following objectives were identified: (a) To describe the status of climate change in the Mutale Local Municipality, and (b) To identify the determinants of climate change adaptation in the Mutale Local Municipality.

METHODOLOGY

As shown in Figure 1, the Vhembe District Municipality is situated in the northern part of the Limpopo Province. The district is composed of four local municipalities, namely, Makhado, Musina, Thulamela and Mutale. The Vhembe District Municipality shares the borders with three southern Africa countries, namely, Botswana, Zimbabwe and Mozambique. On the eastern side, it shares the border with the Kruger National Park and covers 21,402 square kilometers of land (VDM 2011).

Table 1: Summary characteristics of sample

Sample	*Number of farmers*	*Percentages*
Number of Farmers per District		
Vhembe district	150	100
Total	150	100
Number of Farmers per Local Municipality		
Mutale local municipality	150	100
Total	150	100
Number of Farmers per Village		
Folovodwe	125	83
Rambuda	25	17
Total	150	100

The research used both, a quantitative and a qualitative approach for data collection. The permission to conduct research was granted by the Vhembe District Municipality. The research targeted 150 farmers in the Mutale local Municipality out of 500 selected farmers in Vhembe district, with special attention being paid to the Rambuda (25 farmers) and Folovhodwe (125 farmers) villages, as shown in Table 1. The sampling size is more than ten percent of the population (500 selected farmers in Vhembe district). A pur-

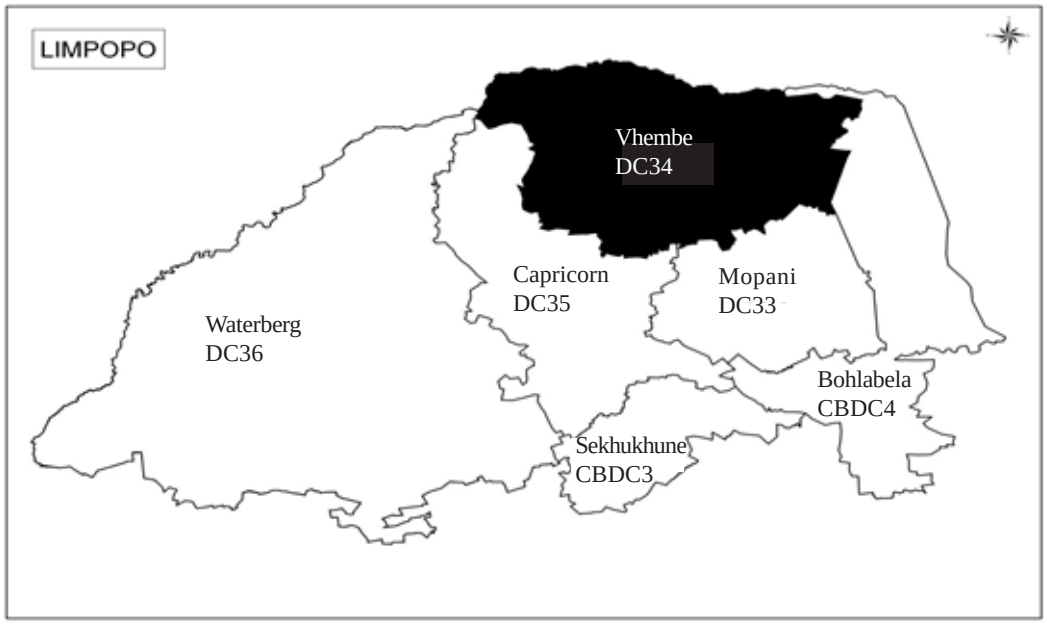

Fig. 1. Vhembe District Municipality Map

posive sampling method was employed to select farms in the district. The method was used to assess uniformity and homogenous characteristics, that is, status of climate variability and change, and the socio-economic characteristics of the farmers.

Data was captured and analyzed using the statistical package for social sciences (SPSS version 20). Descriptive Analysis was used to describe data and Univariate Regression Analysis was conducted to demonstrate the relationship and association of variables. The following econometric model was used to determine association of variables (Molla Bauzza et al. 2005):

Wi = _ + _Xi + _i (1)

Wi is the dependent variable value for person i (2)

Xi is the independent variable value for person i (3)

_ and _ are parameter values (4)

_i is the random error term (5)

The parameter _ is called the intercept or the value of W when X = 0 (6)

The parameter _ is called the slope or the change in W when X increases by one (7)

RESULTS AND DISCUSSION

The results from Table 2 showed that 6.7 percent of the farmers in the Mutale local municipality are between the ages of 18 and 35, and this percentage is very small. The results also showed that youth or young people are not actively involved in agriculture issues in the municipality. This was also highlighted by Maponya and Mpandeli (2012) in the study done in the Capricorn and Sekhukhune Districts in Limpopo Province. Table 2 also showed that the majority of farmers (37.3%) that are actively involved in agricultural activities in the Mutale local municipality were over the age of 60. Similar results were also indicated by Mpandeli (2006). Table 2 also showed that at least 44.7 percent of the farmers that are involved in agricultural activities were between the ages of 46 and 60.

Some other studies done in the Vhembe District, for example, Makhura (2001), Mpandeli (2006) and Maponya and Mpandeli (2012) indicated that the majority of farmers are not getting enough support from the Provincial Department of Agriculture, especially on market access, climate change information, access to technology, and capacity building. At least 11.3 percent of farmers in the Mutale local municipality are involved in agricultural activities. This group of farmers was between the ages of 36 and 45. It is important to highlight the fact that to address the issue of food security, farmers need to be empowered with knowledge, technology, financial support and market access. The Mutale local municipality has very good climatic conditions, which are suitable for farming, and thus it is important to set up a good institutional system in order to assist the majority of farmers, especially smallholder farmers, in order for them to produce products for both household and commercial purposes.

Table 3 showed that at least fifty-four percent of farmers in the Mutale local municipality were women. Mpandeli (2006) highlighted that most of the men in the Mutale local municipality are involved in non-farming activities, that is, working in the construction industry, or mining. It was also highlighted by Maponya and Mpandeli (2012) that the majority of men migrate to other provinces, like Gauteng, and North West, for better employment opportunities. The majority of these women remain the heads of the households. However, it was noted that when these women take decisions they are supposed to consult with their husbands first. Van Averbecke (2013) mentioned that the majority of women that are involved in farming do not have land ownership documents in the Vhembe District. This is very disturbing due to the fact that these women are finding it difficult to invest in infrastructure as a result of the lack of land tenure security.

Table 2: Age of farmers

Age	*Number of farmers*	*Percentages*
18 - 35	10	6.7
36 - 45	17	11.3
46 - 60	67	44.7
60 >	56	37.3
Total	150	100

Table 3: Gender of farmers

Gender	*Number of farmers*	*Percentages*
Male	69	46
Female	81	54
Total	150	100

The number of years in farming by farmers in the Mutale local municipality varies. Table 4 showed that 49.3 percent of the farmers in the Mutale local municipality have been farming for more than 10 years (11-20 years). The results in Table 4 are interesting due to the fact that the government has been renting land to smallholder farmers for a maximum period of about 20 years. This arrangement is carried out by local chiefs and the district department of agriculture. At least 3.3 percent of the farmers have been farming in the area for not more than 5 years. The results in Table 4 also showed that 14.7 percent of the farmers have been farming in the area for not more than 10 years (6 -10 years). Table 4 also showed that 14.7 percent of the farmers in the area have been farming for less than 50 years, and these are mostly farmers who are more than 60 years old and these are the farmers who are on pension. These types of farmers are also relying on social grants in order to sustain their livelihoods. At least eighteen percent of the farmers in the area have been farming for more than 20 years (aged 21-49 years).

Table 4: Number of years in farming

Years	*Number of farmers*	*Percentages*
1- 5	5	3.3
6-10	22	14.7
11- 20	74	49.3
21 - 49	27	18
50 >	22	14.7
Total	150	100

Table 5 shows that the majority of farmers (91.3%) in the Mutale local municipality are farming full-time, and that the majority of these farmers were women. It is important to note that even though the majority of these farmers were farming fulltime, the size of land is between 1-2 hectares. At least 3.3 percent were farming part-time.

Table 5: Employment status

Employment	*Number of farmers*	*Percentages*
Farming full-time	137	91.3
Working part-time	5	3.3
Unemployed	2	1.3
Student	5	3.3
Housewife	1	0.7
Total	150	100

These farmers are mostly involved in non-farm activities, that is, some are employed by government departments. Another 3.3 percent of the farmers also have other engagements outside of the agriculture sector and these are farmers who are still pursuing their studies on a fulltime basis. At least 1.3 percent of the farmers are involved in farming activities due to the fact that they are unemployed and farming is the only way that they can generate an income.

Education level is an important factor influencing decisions in response to climate change adaptation and mitigation. Most of the farmers in the study have completed their primary education (76%), while only a few farmers have secondary and post-secondary education (4.7%, respectively), as indicated in Table 6. According to Maddison (2007), educated and experienced farmers are expected to have more knowledge and information about climate change and adaptation measures to use in response to climate challenges.

Table 6: Education level

Education level	*Number of farmers*	*Percentages*
No schooling	12	8
Primary education completed	116	76
Some secondary education	8	5.3
Secondary education completed	7	4.7
Post-secondary education	7	4.7
Total	150	100

In all the areas where the surveys were conducted, farmers believed that dissemination of climate change information could add value and profit to their farming business by facilitating correct decisions and applying proper management strategies. The majority of the farmers interviewed in the study sites had a radio, so access to external forecasting or climate change information, relating to both daily weather forecasts and seasonal climate information, did not seem to be a problem if the information was made available through the local radio stations. It is not surprising to see that Table 7 showed that 3.3 percent of farmers had received formal extension services, and that forty-two percent of the farmers interviewed shared information amongst themselves (farmer to farmer). However, 52.7 percent of the farmers believed that climate change information is not available and they have not yet received the information. It can

also be seen from Table 7 that at least 0.7 percent of the farmers received climate change information from neighbors, family and municipal offices.

Table 7: Channel climate change information is received

Extension service	*Number of farmers*	*Percentages*
Formal extension	5	3.3
Farmer to farmer	63	42
Family support	1	0.7
Neighbours	1	0.7
Municipal office	1	0.7
Not available	79	52.7
Total	150	100

The climate of the Limpopo Province is usually hot and is characterized by hot summers and dry winters. The highest annual average rainfall (1612mm) recorded was in the year 2000. This resulted in flooding, loss of properties, loss of human life and also loss of agricultural production (Mpandeli, 2006). The lowest average annual rainfall recorded was 438mm in 1992. The Limpopo Province has been characterized by low rainfall and recurrent drought problems, especially in 1981-1982, 1988-1989, 1991-1992 and in 2004, and this hindered agricultural production in the Limpopo Province. According to Mpandeli (2006), the majority of farmers in 1992 lost high volumes of crops and livestock due to shortage of water as a result of drought during the year. Farmers in different areas in the Vhembe District have been experiencing poor rainfall distribution and due to unreliable rainfall, some of the farmers in areas such as the Rabali village, which is semi-arid, area are now trying to diversify their cropping systems in order to increase production even though they are farming in a dry land area and the rainfall distribution is very poor. The majority of these farmers indicated that groundnuts and cowpea grow well in dry land areas because these crops require less water compared to other crops, such as avocados and bananas. Groundnuts and cowpea also conserve moisture by covering the soil surface (Annandale et al. 2002).

The results in Table 8 showed that 32.7 percent of the farmers interviewed indicated that they were always experiencing frequent drought, and fifty-four percent of the farmers mentioned that for the past few years, the rainfall has been decreasing. At least 8.7 percent of the farmers indicated that rainfall is increasing in their area, and four percent of the farmers mentioned that changes in the timing of rainfall are becoming a norm recently. It is important to note that the Limpopo Province, in general, has highly extreme climatic events, climatic variability and change. Due to climate change in the Vhembe District, farmers have been obtaining low yields, experienced disease and pest outbreaks, and rainfall distribution is unreliable (Mpandeli 2006).

Table 8: Changes in rainfall observed

Rainfall	*Number of farmers*	*Percentages*
Increased rainfall	13	8.7
Decreased rainfall	81	54
Changes in timing of rainfall	6	4
Frequency of drought	49	32.7
Not applicable	1	0.7
Total	150	100

The Mutale local municipality sometimes experiences extreme warming. When the temperature is high, there is also a high probability of evaporation during that particular period (Table 9).

Table 9: Temperature changes observed

Temperature changes	*Number of farmers*	*Percentages*
Increased temperature	144	96
Decreased temperature	4	2.7
No observation	2	1.3
Total	150	100

According to Mpandeli (2006), older farmers in the Vhembe District indicated that drought has been a recurring process since the 1950s. Some farmers stated that during the summer of 1992, the temperature was 45 degree celsius, as a result of the abnormal temperature. The Vhembe District experienced the worst drought, resulting in a shortage of grazing and crop failures in many parts of the Vhembe District. Livestock were slaughtered and farmers had to sell their livestock at prices as low as R5 per unit, which equates to less than USD 1. The drought impacts in 1992 increased farming debt and affected food exports in the Limpopo Province. Table 9 showed that ninety-six percent of farmers have observed that temperature is increasing in the Vhembe District. Only 2.7 percent of farmers in-

dicated that temperature is decreasing and this is understandable due to high climatic variability in the Vhembe District and the Limpopo Province, in general.

However, 1.3 percent of farmers indicated that they are not observing any changes. The combination of poor rainfall, increased temperature, poor vegetation and a range of other constraints, heightened during droughts, unfortunately also produce a range of additional stressors for farmers in the Mutale local municipality. Poor vegetation usually means poor grazing and therefore, poor cattle conditions. This can further translate to loss of livelihoods, as livestock in poor condition often receive low market prices.

Despite the apparent poor interactions with extension, the information collected in all the researched areas showed that the majority of farmers are not happy with the current channels of communication. As stated earlier, the current institutional arrangements for information dissemination needs serious re-evaluation. The Limpopo Department of Agriculture has started the Sub-Directorate Disaster Risk Management that disseminates information to different farmers through monthly news bulletins, such as the departmental website and the Farmer's Weekly. Despite this apparent positive intervention, information flow is still being hampered by delays in *prompt* delivery of information. Table 10 showed that 97.9 percent of the farmers in the Mutale local municipality rely on local radio stations, such as Phalaphala FM, Thobela FM, Univen Radio and Capricorn FM for information dissemination. The remaining group, 0.7 percent of farmers received information from magazines, flyers, and local newspapers.

Table 10: Source of information

Source of information	*Number of farmers*	*Percentages*
Flyers	1	0.7
Magazine	1	0.7
Local newspapers	1	0.7
Radio	147	97.9
Total	150	100

According to the results in Table 11, the odds of climate adaptation were 1.00 times higher for female farmers than for male farmers. This is true because women are the world's principal producers of primary staple foods (rice, wheat, maize), which account for up to ninety percent of the food eaten by poor rural populations throughout the world, and between sixty and eighty percent of foods in most of the less developed countries (UNDP 2009). According to Nhemachena and Hassan (2007), the possible reason for females to adapt is that in most rural smallholder farming communities, men are more often based in towns, they are mostly involved on non-farming activities, and much of the agricultural work is done by women. It was noted by Mpandeli (2006) that even though the majority of women are involved in agricultural activities in the Vhembe District, the decisions are taken by their husbands (men) all the time. The odds of climate change adaptation were 1.00 across all age categories. This is true because age is positively related to some climate change adaptation measures (Bayard et al. 2007). According to Maponya and Mpandeli (2012), most farmers in the Limpopo Province assume that old age is associated with more experience and they expect older farmers to adapt to changes in climate, while young farmers are expected to have longer planning horizons and thus are able to introduce long-term adaptation measures.

As indicated in Table 11, the odds of farmers who agreed that rainfall has indeed decreased were 1.10. This showed a positive relationship

Table 11: Univariate regression analysis of factors determining climate change adaptation

Variable	*Total*	*(%)*	*OR [95%CI]*
Females	81	54	1.00 [0.2345.103]1
Age	150	100	1.00 [0.158-2.4]1
Decreased rainfall	81	54	1.10 [0.575- 2.9]1
Education	150	100	1.20 [0.126-14.9]1
Farming fulltime	137	91.3	1.00 [0.127–2.1]1
Climate change info	148	98.7	1.01 [0.76–3.555]1
Source of climate info	150	100	1.12 [0.376-2.5]1
Perception on climate change	150	100	1.10 [0.50-3.011]1
Formal extension	5	3.3	1.20 [0.68–3.44]1

OR= Odds ratio; 95%CI = 95% confidence intervals; 1< = no association; 1> = association

between decreased rainfall and climate change adaptation. Farmers who experienced decreased rainfall recognized the need for climate change adaptation because decreased rainfall altered climatic changes and frequency of droughts. This shortage of water will have a negative impact on agricultural production, livelihoods and the farmer's income. There was a positive relationship between education, extension service, climate change information, source of information and climate change adaptation, which suggests people with education are more likely to be responsive to climate change, and improvements in education gives farmers the skills, technical know-how and knowledge to be better prepared for, and better recover from climate change.

Adesina and Forson (1995) recognized that of the many sources of information available to farmers, an extension service is the most important for analyzing adaptation decisions. This is important because of extension service links between farmers and the community of practice. It was noted during this study that the majority farmers in the Rambuda and Folovhodwe villages recognized the importance of the access to sources of information, and can only access limited information through local chiefs and tribal authorities. As indicated in Table 11, there is a positive relationship between being fulltime farmers and climate change adaptation. This was further emphasized by Maddison (2007), who said that being a fulltime farmer is key to stimulate local participation in various adaptation measures and natural resource management initiatives.

The odds of farmers who perceived climate change differently and climate change adaptation were positive, as indicated in Table 11. This is true, as several studies conducted to examine perceptions of farmers on climate change have shown that farmers had different perceptions on climate change adaptation. According to Maponya and Mpandeli (2012) and Nhemachena and Hassan (2007), some of the farmers perceived adaptation strategies to include: (a) soil management strategies, (b) water management strategies, and (c) other strategies, like the use of subsidies and use of insurance.

CONCLUSION

The majority of farmers in the Mutale local municipality were women, as shown in Table 3. Most of the men in the Vhembe District are involved in non-farming activities, such as working in the construction industry, or mining, and the majority of these men abandoned their farms during year 2000 floods due to the lack of financial support in areas such as Tshiombo, Rabali, and Sekhukhune. The majority of men migrate to other provinces in the country to go and look for better employment opportunities, especially in provinces such as Gauteng, North West. As indicated in this paper, climate change has contributed to changing patterns of extreme weather in the Rambuda and Folovhodwe villages, including decreased rainfall and increased temperatures. While natural variability continues to play a key role in extreme weather, climate change has shifted the odds and changed the natural limits, making certain types of extreme weather more frequent and more intense. It is evident from the climate change status in Rambuda and Folovhodwe that extreme weather may become even more extreme than anticipated, and that extreme weather is on the rise, and the indications are that it will continue to increase, in both predictable and unpredictable ways. The researchers concluded that there was a positive association among the following variables in the Rambuda and Folovhodwe villages: age, female, decreased rainfall, level of education, farming fulltime, climate change information, source of climate information, perception on climate change, formal extension and climate change adaptation.

RECOMMENDATIONS

Farmers need adequate knowledge about the importance of climate variability and change. Hence, transfer of climate knowledge to support vulnerability and adaptation measures should be a priority for the government. To accomplish these, the farmers should use different information sources like the media both, print and electronic, research institutions such as the Agricultural Research Council, Agricultural Extension Services and Civil Societies for the dissemination of the climate change, climate advisory information across smallholder farmers in South Africa.

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