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Factors that Influence Choice of Drought Coping Strategies in Limpopo Province, South Africa

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ABSTRACT Strategies for effectively managing risks and adapting to climate change involve adjustments to current activities. The objective of this study was to investigate the association between the socio-economic profile of farmers and their choice of drought-coping strategies. Multinominal logistic regression analysis was used. Descriptive statistics showed low level of education and literacy among the farmers with three-quarters of the farmers being male. Most farmers had access to extension services, which is a positive finding. Results of the multinominal regression analysis on the link between farmers' socio-economic profiles and drought coping strategies showed that farm type and literacy level influenced the choice of drought-coping strategies. Improvement in literacy levels through extension or informal education should be prioritised to increase knowledge in drought-preparedness and mitigation. Particular attention should be paid to SLAG and communal land farmers.

INTRODUCTION

Drought is one of the most frequent and devastating phenomena that occur in South Africa (Austin 2008). Ngaka (2012) indicates that drought in South Africa is a major disaster in terms of total economic loss and number of people adversely affected. About half of the surface area of South Africa is arid and experiences highly variable rainfall and frequent droughts. The frequency and impact of natural disasters in the farming community in South Africa have increased significantly in the last decade, with drought notable as one of the most common type of disaster (Olaleye 2010). Nhemachema (2008) reports that Southern Africa is expected to experience increases in temperature and reduction in rainfall coupled with increased frequency of droughts and floods as a consequence of changes in climate conditions. According to Maponya and Mpandeli (2012), the World Bank has reported that South Africa has been getting hotter over the past four decades with increases in the number of warmer days and a decline in the number of cooler days. Agriculture, which is highly dependent on climatic variables of temperature, humidity and precipitation, is expected to be highly affected by these changes in climatic conditions (IPCC 2012). Exposure and vulnerability to climate extremes are dynamic, varying across temporal and spatial scales, and depending on economic, social, geographical, cultural, institutional, governance and environmental factors (IPCC 2012). People living in rural areas and resource-poor farmers, who are largely dependent on agriculture, are often cited as more vulnerable to the impact of drought (Olaleye 2010).

Drought losses have long been attributed to poor vegetation, soil and water management and the absence of a sufficiently complete management strategy has been pointed out as being responsible for exacerbating the negative impacts of drought (Seymour and Desmet 2009). Communities which inhabit drought-prone areas have demonstrated intricate and diverse adaptation strategies to drought. These communities respond to drought by evasion (seasonal migration) or endurance (for example, through forage management, changing livestock types and numbers, water and soil conservation and finding alternative sources of income (Seymour and Desmet 2009).

Improvement of drought management strategies by farmers, especially the resource-poor farmers, requires an understanding of the farmers' perceptions on drought and their drought-coping strategies. The factors that influence their perceptions and how they cope with drought situations need to be understood so that their drought mitigation plans could be enhanced and, as a consequence, preserve their livelihoods. The appropriateness and effectiveness of adjustments by farmers in response to drought situations depend on a number of factors, such as information, knowledge and skills of individual

farmers. An understanding of the socio-economic impact of drought and of farmers' coping mechanisms is critical in designing technological and policy interventions for more effective drought mitigation.

Objectives

The objective of the study was to determine if there is an association between the socio-economic profile of farmers and their choice of drought-coping strategies.

METHODOLOGY

Study Area

The study was conducted at five local municipalities (Molemole, Aganang, Blouberg, Polokwane and Lephalale) of the Limpopo Province.

Data Collection

The primary data was collected by using a structured questionnaire survey and focus group discussions. Information captured on the socio-economic characteristics of farmers included sex, age, education level, literacy level, farming experience, access to agricultural extension, farm income, off-farm income, farm organization, farm size, farm type and location (municipality). Purposive and random sampling procedures were used to select the sample.

Data Analysis

This study employed a multinominal logit (MNL) model (Greene 2003) to analyse factors influencing choice of drought-coping strategy. Multinominal logistic regression uses a linear predictor function to predict the probability that observation i has outcome k, of the following general form:

$$f(k, i) = \beta_{o,k} + \beta_{1,k}X_{1,i} + \beta_{2,k}X_{2,i} + \ldots + \beta_{M,k}X_{M,i},$$

where β_{mk} is a regression coefficient associated with the mth explanatory variable (age, sex, education etc) and the kth outcome (rank score). The regression coefficients and explanatory variables are normally grouped into vectors of size M+1, so that the predictor function can be written more compactly:

$$f(k, i) = \beta_{k} \cdot Xi,$$

where β_k is the set of regression coefficients associated with outcome k, and X_i is the set of explanatory variables associated with observation i. The dependent variables in the empirical estimation are adaptation strategies that are chosen by the sample households

The MLN has model has response probabilities:

$$p(v = j/x) = \frac{exp(x\beta f)}{1 + \Sigma^{j}_{k=1} exp(x\beta k), j = 1,.., j}$$

Where y denote a random variable taking on the values {1,2….j} for choices j, and *x* denote a set of conditioning variables. In this case, y represents the adaptation measure chosen by the livestock farmers while x represents a number of socio-economic characteristics of households and other factors.

Statistical Package for Social Sciences (SPSS) was used for data analysis.

RESULTS AND DISCUSSION

The summary of descriptive statistics for socio-economic profiles of the farmers is presented in Table 1. The profile of the farmers is characterised by a large number of older farmers and low levels of education and literacy. Most of the farmers (over three-quarters) were male. Extension services seem to reach many farmers as 95% reported to have access to extension services. Ninety seven percent of farmers reported to have access to TV, which could be an indication of improved living standards. Few farmers had access to credit, which could be an impediment to growth and development of their farming operations.

The results of the association between farmer socio-economic profiles and drought-coping mechanisms are presented in Table 2. Most of the socio-economic characteristics of the farmers and associated farm characteristics (farm size, farm type) had no influence (P>0.05) on the farmers' choice of drought coping strategies. There is varying information in literature as to the influence of socio-economic profiles of farmers on their drought-coping strategies. Ajao and Ogunniyi (2011) found influence of age, farm size, access to extension, gender and non-farm income on the choice of drought coping strategies. The study by Moyo et al. (2013) observed few explanatory variables as having influence on the coping strategies. Household herd size, household total income and household access

Table 1: Descriptive information on farmers

Characteristic	*Percentage*
Age	
<30	1.2
30-40	4.8
41-50	1.7
51-60	32.7
>60	44.2
Sex	
Male	77
Female	23
Education	
No education	13.7
Primary	31.5
Secondary	35.8
Certificate	7.9
Diploma	10.9
Literacy Level	
Innumeracy	18.2
Illiterate	9.1
Partial Illiterate	30.9
Literate	41.8
Farming Experience (yrs)	
0-10	27.9
11-20	30.9
21-30	17.0
>31	24.2
Farm Size (ha)	
0-1000	38.8
1001-2000	13.3
2001-3000	11.5
>3000	36.4
Access to Agricultural Extension Services	
Yes	95.2
No	4.8
Access to Credit	
Yes	18.2
No	81.8
Access to TV	
Yes	97.0
No	3.0

to relief grazing farms affected choice of coping strategies while age, gender and education level had no effect. Nti (2008) observed that literacy level, membership with a farmer organization, household income, and location of households had positive and significant impacts on adaptation to drought.

Al Hassan et al. (2013) reported that the presence of markets, informal credit from friends and relatives, location of farmer, farmer-to-farmer extension, noticing of decrease in rainfall and noticing of increase in temperature, influenced farmers' choice of indigenous climate- related strategies in Ghana. In the study by Opie (2011), coping strategies were associated with household size, age, sex of household head and household assets such as land, livestock and other assets. Deressa et al. (2010) observed that adaptation to climate change was influenced by education, household size, gender, livestock ownership, access to extension service, availability of credit and environmental temperature. Smithers and Smit (1997) reported that the capacity of households to adapt to droughts was influenced by resource availability and government policy. In the study by Ofuoku (2011), the major barriers to climate adaptation were lack of information, lack of money and inadequate land.

However, the present study showed that farm type and literacy level had influence ($P<0.05$) on farmers' choice of drought mitigating plans. A unit increase in the variable literacy level (1.095) is associated with an increase of 2.99 in the log odds of farmers selling their assets to mitigate the effect of drought. This was also observed with respect to selling and culling of animals; a unit increase in the variable literacy level (3.14) is associated with an increase of 2.39 in the log odds of farmers selling or culling their livestock. With respect to farm type, a unit 'decrease' in this variable (-0.75^{*}) is associated with a decrease of 0.47 in the relative log odds of farmers opting to move their livestock. In this instance, farmers in LRAD (Land Redistribution for Agricultural Development) farms are less likely to adopt herd movement as a strategy to cope against drought effects. Most of these were farmers who were operating as individuals and not groups. Farmers in communal farms and farmer groups in SLAG (Settlement Land Acquisition Grant) farms were more likely to move their herds during drought periods.

The study by John et al. (2011) showed that farm experience, farm income and farm size had an impact on drought coping strategies while age, education level and extension had no effect. In a study on climate change adaptation strategies, Tazeze et al. (2012) observed that sex of the household head, age of the household head and education of the household head, family size, livestock ownership, household farm income, non/off-farm income, access to credit, distance to the market center, access to farmer-to-farmer extension, agro-ecological zones, access to climate information, and extension contact, had a significant impact on choice of climate change adaptation strategies.

Legesse et al. (2012) investigated the smallholder farmers' perception and adaptation to climate variability and climate change in Ethiopia and the results of the study showed that agro-ecological location, sex of household head, family

Table 2: Coefficients and odds-ratios of the association between socio-economic characteristics and drought-coping strategies

Explanatory variables	*Selling assets*			*Wait for government assistance*			*Relief grazing*		
	B coeff	*Std error*	*Odds-ratio*	*B coeff*	*Std error*	*Odds- ratio*	*Bcoeff*	*Std error*	*Odds-ratio*
Sex	1.39	4.76	4.035	0.185	1.24	1.20	-0.67	5.16	0.511
Age	0.75	5.42	2.1	-1.89	1.56	0.15	-0.39	4.17	0.68
Education	1.405	11.5	4.07	2.204	2.13	9.06	-4.35	5.31	0.013
Literacy level	1.095*	0.42	2.988	-5.92	2.97	0.003	-4.11	10.94	0.016
Access to agric extension	1.31	6.74	3.69	5.9	4.75	3.78	1.65	6.23	3.24
Access to credit	-2.043	5.35	0.13	-1.81	1.39	0.165	-3.63	5.81	0.026
Access to TV	-4.79	21.89	0.008	-6.04	10.14	0.002	-6.32	5.89	0.002
Farming experience	-4.712	4.94	0.009	-0.036	1.56	0.96	2.6	5.68	3.89
Farm size	-0.24	9.96	0.78	-2.13	2.33	0.119	-0.68	6.13	0.503
Farm type	0.41	13.13	1.501	3.07	3.00	1.54	2.06	5.89	7.88
Off farm income	0.62	2.16	1.86	0.077	0.44	1.080	-0.59	1.48	0.55
Farm income	-0.009	2.08	0.99	-0.15	0.57	0.86	0.58	1.81	1.79
Explanatory variables	*Herd movement*			*Feed supplementation*			*Culling and selling animals*		
	B coeff	*Std error*	*Odds-ratio*	*B coeff*	*Std error*	*Odds-ratio*	*Bcoeff*	*Std error*	*Odds-ratio*
Sex	0.601	1.48	1.9	-0.60	1.15	0.54	-1.45	1.26	0.23
Age	-0.903	1.56	0.405	-0.26	1.37	0.771	-0.152	1.44	0.85
Education	0.050	2.83	1.051	0.27	2.1	1.32	-1.37	2.25	0.69
Literacy level	-0.89	3.27	0.41	-2.71	2.73	0.066	3.14*	1.44	2.39
Access to agric extension	2.95	5.1	1.9	2.15	1.57	8.65	2.53	1.98	12.62
Access to credit	-2.55	1.75	0.078	-2.45	1.37	0.078	-1.99	1.46	0.13
Access to TV	-4.25	10.22	0.014	1.48	11.8	4.405	1.34	13	3.8
Farming experience	-0.70	1.99	2.01	-0.77	1.56	2.46	-0.504	1.71	0.604
Farm size	-0.83	2.78	0.43	-1.14	2.31	0.319	-0.83	2.38	0.44
Farm type	-0.75*	10.70	0.47	1.302	3.72	3.67	-4.32	2.42	0.013
Off farm income	-0.11	0.512	0.89	-0.38	0.39	1.46	-0.23	0.42	0.79
Farm income	0.027	0.712	1.028	-0.78	0.42	0.46	-0.540	0.59	0.58

size, off-farm income, herd size, frequency of extension contact and training, were determinant factors influencing adaptation strategies. Deressa et al. (2008) observed that wealth (on-farm income, off-farm income and livestock ownership) and household characteristics, such as level of education, age of household head and household size, increased the probability of adaptation to drought. Farm location also influenced farmers' adaptation to climate change.

Gunn et al. (2012) assessed farmers' psychological distress and coping in a time of drought and observed that age, gender and type of stressor had influence on the type of coping strategy. The authors concluded that it is critical to develop tailored interventions to assist farmers to cope more effectively during future droughts. This further supports the importance of attuning the mitigation strategies to socio-economic profiles of farmers.

CONCLUSION

Most of the socio-economic characteristics (sex, age, farming experience, access to agricultural extension, farm income, off-farm income, farm organization, farm size and location (municipality) were not important as predictors of choice of drought-coping strategies. This differs from other studies that observed relationships between most socio-economic characteristics (such as education level, age, farming experience, gender, farm income) and drought-coping strategies. However, farm type and literacy level showed an association between farmer profiles and drought-coping strategies.

RECOMMENDATIONS

The findings have extension and policy implications. Improvement in literacy level through extension or informal education (especially that the age profile of farmers showed that most of them were elderly), should be prioritised to increase knowledge in drought-preparedness and mitigation. Information on grazing management and drought preparedness should be shared with farmers especially those in communal and SLAG farming systems.

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