ANH Academy Week, Addis Ababa, Ethiopia, 20-24 June 2016

Adaptation to Climate Change and the Impacts on Household Food Security Among Rural Farmers in uMzinyathi District Municipality of Kwazulu-Natal, South Africa

(Shisanya S. and Mafongoya P. 2016)

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Introduction

Climate change is projected to increase with more frequent extreme weather events affecting all aspects of the hydrological cycle, with regions such as south Asia and Africa expected to be particularly vulnerable due to their large population, predominance of agriculture, and limited resource base (Aggarwal and Singh 2010). Heavy precipitation and related floods, landslides, storm surges; droughts and relatively higher temperatures have had devastating effects on agricultural systems in several parts of the world in recent years (Intergovernmental Panel on Climate change (IPCC) 2007). Southern Africa is experiencing inter and intra rainfall variability with shifts in tropical temperatures over the region (Usman and Reason 2004) Individuals, households, communities and nations will make deliberate changes and respond to these multiple climate change pressures through a process of adaptation with the intention of minimising the impacts of such threats (Adger et. al. 2005).

Objective

The study examines the adaptation to climate change among rural farming communities in uMzinyathi District of KwaZulu-Natal and the impacts on household food security. Three adaptation areas are considered for this study:

- Agricultural ecosystem
- Household livelihood system
- Farmers' agricultural livelihood system

Materials and Methods

- 200 households with household heads aged 40 years and above were considered for this study
- Quantitative data was collected through a questionnaire while qualitative data was collected through asking open ended questions to focus groups and key informants
- Key informants helped to give a general picture of the community and a reflection on past climate risks.
- Data was collected on demographic characteristics and socio-economic conditions of family/households which included a review on yields and incomes of household's from both agricultural farming systems and non-farm activities.
- Data was also collected on household responses to the vulnerability components: exposure, sensitivity and adoptive capacity in the context of household farming systems and adaptation to climate change. The Household Food Insecurity Access Scale was used to measure household food security.

Table 1: Percentage of Responses to Household Anxiety on Future Climate Change and Possible Impacts (n=200)

Household worry to:	Never	Rarely	Sometimes	Often
recurrent droughts	15.5	6.0	38.5	39.5
recurrent flood	12.0	24.0	38.5	25.5
crop failure	25.0	46.0	12.5	16.5
crop diseases	17.0	25.0	39.0	19.0
livestock diseases	19.0	24.5	33.5	23.0
price decline of farm products	51.0	18.0	20.5	10.5
soil fertility decline	49.5	20.0	17.0	13.5
price increase of inputs	51.5	22.5	18.5	7.5
late on-set of rains	18.0	32.5	32.5	17.0
shorter rainy seasons	17.5	22.5	38.0	22.0
climate variability	19.0	5.0	35.5	40.5

Household Anxiety on Future Climate Change and Possible Impacts

- Most households (69.0%) were not anxious that they may face price decline of their farm products.
- Household were not concerned about soil fertility decline (69.0%) and increase in cost of farm inputs (74.0%).
- Households were also anxious that they could face crop and animal disease outbreaks (58.0% and 56.5% respectively) with the anticipated future change in climate.
- Overall, households (76.0%) were anxious that they will face adverse change in climate in future.

Table 2: Results of the T – test of Adaption Methods Households will Employ with Climate Change (n=200)

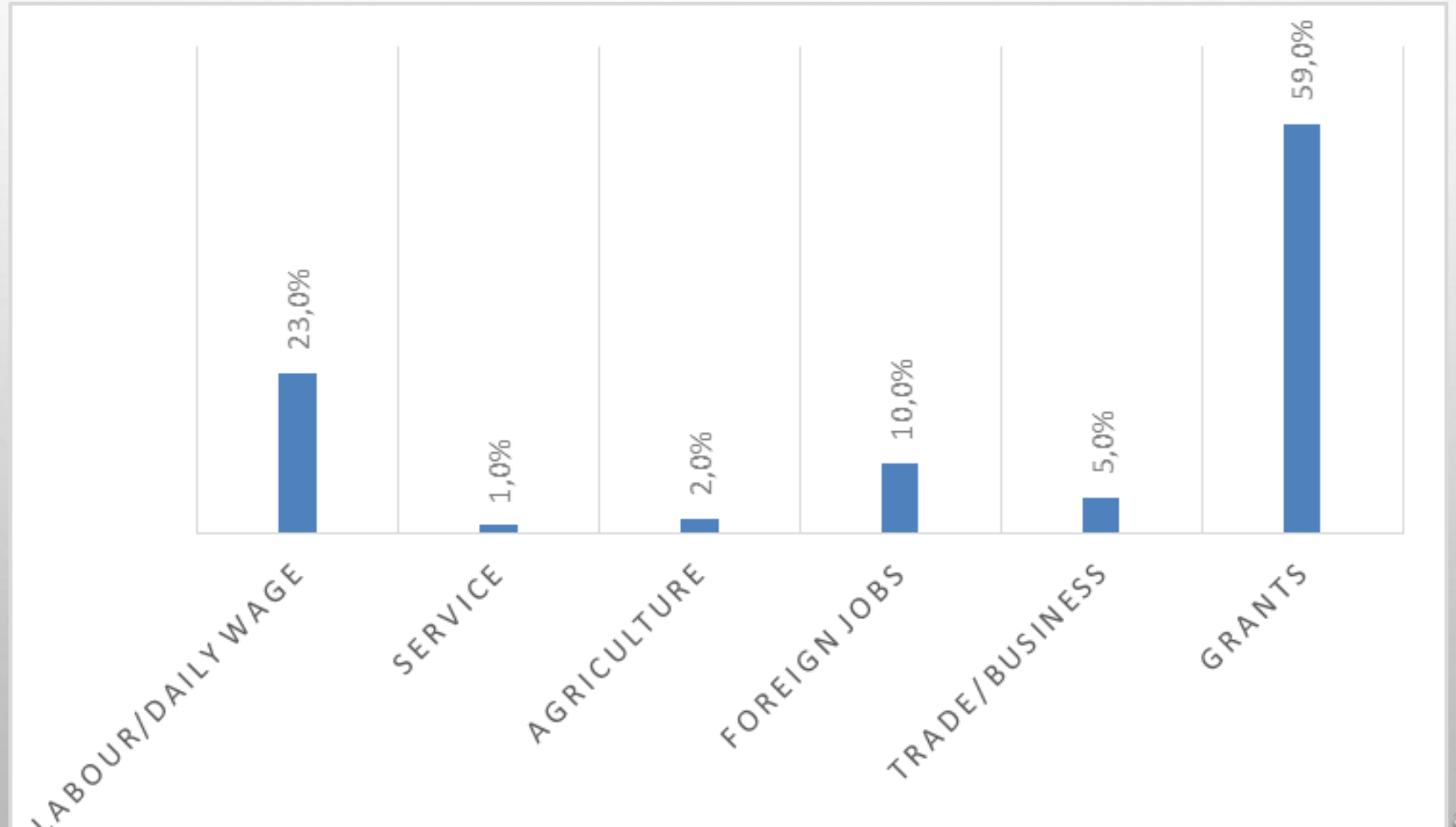
	t - value	df	*p* - value
Possible adaptation practice			
Crops management practices			
Intercropping	2.131	199	0.034
Cover cropping	7.857	199	0.000
Growing of different crop types	5.744	199	0.000
Growing of different crop varieties	6.035	199	0.000
Soil management practices			
Crop residual management	0.778	199	0.438
Minimum tillage	2.786	199	0.006
Different fields planted at different times	6.116	199	0.000
Annual crop rotation	2.156	199	0.032
Carry out mulching	0.390	199	0.697
Across slope cultivation	6.905	199	0.000
Using organic manure	-4.335	199	0.000
Living fields fallow	-2.524	199	0.012
Tree planting alongside crops	0.751	199	0.435
Water harvesting for irrigation	10.090	199	0.000
Cropping moist valley bottoms	-9.097	199	0.000
Land use extensification	-6.947	199	0.000
Land use intensification	-1.066	199	0.288
Out migration	-8.931	199	0.000
Carry on as usual	-8.931	199	0.000
Leasing out land	-8.289	199	0.000
Purchasing of insurance	-9.160	199	0.000

Adaption Methods Households will Employ with Climate Change

- In crop management adaptation practices, household will consider practicing cover cropping, growing different crop types and cultivating different varieties of crops ($t < 0.001$ in all the cases).
- Household indicated that they may use a variety of soil management practices to cope with a changing climate. these practices include; planting different fields at different times, planting crops across a slope, using organic manure to fertilize their crops, harvesting of water from roof tops for irrigation ($t < 0.001$ in all the cases).

Figure 1: Household Rain Water Harvesting for Irrigation

Figure 2: Percentage Distribution of Household Responses to Possible Household Livelihoods in Response to a Changing Climate (n=200).



Household Responses to Possible Household Livelihoods in Response to a Changing Climate

Although all of the households surveyed were involved in some form of agricultural production, only 2.0% considered practicing agriculture to be a possible source of livelihood, with (59.0%) considering government grants as a secure source of livelihood with a changing climate

Table 3: Results of Cramer's V Correlation Test of Pre-determined Household Vulnerability Index and Desired Adaptation Method to Climate Change (n = 200)

Adaptation method	Cramer's *V*	Adaptation method	Cramer's *V*
Growing different crop varieties	-0.294**	Different fields planted at different times	-0.239**
Rain water harvesting for irrigation	0.111	Diversifying farming to non-farming activities	-0.413**
Mulching	0.144	Praying for rainfall	0.289
Intercropping	-0.574**	Across slope cultivation	-0.378
Applying chemical fertilizers	0.440	Crop rotation	0.113
Applying organic manure	-0.337**	Cropping moist valley bottoms	0.255**
Leasing out land	0.168*	Leaving fields fallow	-0.284**
Mixed farming	-0.457**	Minimum tillage	-0.658**
Tree planting alongside crops	-0.518**	Land use extensification	0.029
Land use intensification	-0.118	Out migration	0.217
Carrying on as usual	0.310	Purchase of insurance	0.053

Household Vulnerability Index and Desired Adaptation Method to Climate Change

- The results show that households that were less vulnerable to climate change would increasingly prefer to undertake a number of adaptive method in response to a changing climate.
- significant negative correlations were observed for households who; preferred to grow different crops (v = -0.294, $p < 0.05$), preferred to grow their crops at different time(v = -0.239, $p < 0.05$), would diversify to other non-farming activities (v = -0.413, $p < 0.05$), would carry out intercropping (v = -0.574, $p < 0.05$), would undertake use of organic manure for their crops (v = -0.337, $p < 0.05$), would practice mixed farming (v = -0.457, $p < 0.05$), practice minimum tillage (v = -0.658, $p < 0.05$), plant trees along the slopes(v = -0.518, $p < 0.05$) and leasing out of land (v = 0.168, $p < 0.10$).

Table 4: Results of Spearman's (Rho) Correlation between Household Characteristics and Preferred Adaptation Method to Climate Change (n = 200)

Preferred adaptation practice	Household characteristic					
	Sex of household head	Age of household head	Highest level of education	Household head can read or write	Income from old age grant	Income from child grant
Intercropping	-0.018	-0.069	0.027	0.220**	-0.138	0.088
	0.799	0.330	0.702	0.002	0.052	0.215
Crop residue management	0.037	-0.065	0.060	-0.109	0.214**	-0.019
	0.598	0.360	0.397	0.124	0.002	0.793
Minimum tillage	0.186**	0.026	0.070	0.152*	0.194**	0.020
	0.008	0.720	0.325	0.032	0.006	0.781
Mulching	-0.027	-0.017	0.051	0.142*	0.060	0.007
	0.701	0.810	0.477	0.045	0.397	0.920
Across slope cultivation	-0.085	0.103	0.073	0.259**	0.051	0.153*
	0.233	0.148	.0306	0.000	0.469	0.030
Mixed farming	0.195	0.039	0.009	-0.135	-0.116	0.041
	0.006	0.588	0.898	0.056	0.101	0.568
Land use extensification	0.046	0.012	-0.036	0.090	-0.060	-0.087
	0.515	0.863	0.610	0.205	0.399	0.219
Leasing out land	0.025	-0.098	-0.070	0.054	-0.077	0.013
	0.728	0.166	0.323	.0448	0.280	0.850
Purchase of insurance	-0.055	0.221**	0.095	0.035	0.013	0.058

Household Characteristics and Preferred Adaptation Method to Climate Change

- The results show that males would prefer to carry out minimum tillage (*rho* = 0.186, $p<0.05$) in response to climate change.
- Households with older household heads would prefer to purchase insurance to minimise the impact of a changing climate (*rho* = 0.221, $p< 0.05$).
- Households with household heads who could read or write preferred a number of practices to respond to a changing climate; intercropping (*rho* = 0.220, $p< 0.05$), minimum tillage (*rho* = 0.152, $p< 0.10$), mulching (*rho* = 0.142, $p< 0.10$), across slope cultivation (*rho* = 0.259, $p< 0.05$).
- Households who received old age grants would respond to a changing climate by preferring to utilise crop residues (*rho* = 0.214, $p< 0.05$) and carrying out minimum tillage (*rho* = 0.194, $p< 0.05$)

Table 5: Household Responses to Household Food Insecurity Access-related Domains (n = 200)

Household Food Insecurity Access-related Domains	Percentage
1. Anxiety and uncertainty	100.00
2. Households with insufficient food quality	89.00
3. Insufficient food intake and its physical consequences	84.00

Household Responses to Household Food Insecurity Access-related Domains

- Household food security was assessed using the HFIAS procedure described by (Coates et al, 2007).
- All households (100%) in the study sample were anxious and uncertain about food supply.
- Most households did experience the other two food insecurity domains (poor quality food and inadequate quantity of food consumption (89% and 84%) respectively.

Table 6: Household Food Insecurity Access-related Conditions (n = 200)

Food insecurity conditions	Frequency of experience of food insecurity condition in past 4 weeks (%)			
	Once or twice	Three to ten times	More than 10 times	Total
Anxiety and uncertainty about food supply	12.00	36.00	52.00	100.00
Poor quality food consumption coping strategies				
Un-preferred kinds of food	14.50	25.50	60.00	100.00
Limited variety of food	16.50	26.50	57.00	100.00
Un-preferred food	15.00	23.50	61.50	100.00
Inadequate quantity of food coping strategies				
Ate a smaller meal than they needed	16.50	22.50	61.00	100.00
Ate fewer meals in a day	22.5	15.50	62.00	100.00
Experienced total lack of food due to lack of resources	15.50	59.00	25.50	100.00
Went to sleep at night hungry due to lack of food	18.00	67.00	15.00	100.00
Going whole day and night without eating anything due to lack of food	37.00	48.00	13.00	100.00

Household Food Insecurity Access-related Conditions

- The frequency of households experiencing anxiety and uncertainty about household food supply was high.
- Households consumed poor quality food by eating un-preferred kinds of food; they ate a limited variety of food and also ate un-preferred food at higher frequencies.
- Similarly households consumed inadequate quantity of food.
- Most households experienced the mild coping strategies more frequently like eating a smaller meal. as the quantity of food coping strategies progressed in severity, the frequencies experienced among households reduced with fewer households going whole day and night without eating anything (most severe) less frequently.
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Table 7: Proportion of Household in Each Food Security Category, uMzinyathi Farming Households (n = 200)

	Household Food security categories (Coates et al, 2007)			
	Food secure	**Mildly food insecure**	**Moderately food insecure**	**Severely food insecure**
Number of household in each category	0	0	6	194
Proportion of households in each category (%)	0.00	0.00	3.00	97.00

Table 8: Results of Spearman's (Rho) Correlation Between Household Agricultural Environment and Measures of Food Insecurity (n = 200)

Household agricultural climate environment	Measures of household food insecurity			
	Overall HFIAS Score	Quality of food	Quantity of food	Anxiety over food supply
Worried that household will face recurrent drought	0.191**	0.224**	0.150*	0.156*
	(0.007)	(0.001)	(0.034)	(0.028)
Worried that household will face recurrent floods	0.126	0.183**	0.115	0.075
	(0.076)	(0.010)	(0.105)	(0.291)
Worried that household will face late on set of rain	0.059	0.060	0.056	0.064
	(0.407)	(0.403)	(0.432)	(0.370)
Worried that household will face shorter rain season	-0.051	-0.019	-0.074	0.045
	(0.475)	(0.784)	(0.297)	(0.526)
Household vulnerability to climate change	-0.947**	-0.815**	-0.899**	-0.468**
	(0.000)	(0.000)	(0.000)	(0.000)
Worried that household will face soil fertility decline	0.343**	0.249**	0.321**	0.147*

Household Agricultural Environment and Measures of Food Insecurity

- Households who showed increased vulnerability to climate change experienced high food insecurity at all levels of household food insecurity measures.
- Households who were worried that they will face soils fertility decline experienced high levels of food insecurity measures.

Table 9: Results of Spearman's (Rho) Correlation Between Household Agricultural Ecosystem and Measures of Food Insecurity (n = 200)

Agricultural Ecosystem	Measures of household food insecurity			
	Overall HFIAS Score	Quality of food	Quantity of food	Anxiety over food supply
Worried that household will face crop disease	-0.001 (0.989)	-0.020 (0.778)	-0.032 (0.655)	0.072 (0.309)
Worried that household will face price decline of farm products	0.281** (0.000)	0.198** (0.005)	0.281** (0.000)	0.093 (0.192)
Worried that household will face price increase of inputs	0.316** (0.000)	0.212** (0.003)	0.319** (0.000)	0.097 (0.174)
Worried that household will face livestock disease	-0.214** (0.002)	-0.173* (0.014)	-0.226** (0.001)	-0.066 (0.350)

Discussion

- Household have real fears about a changing climate and will do what is within their means to prepare for it
- Adaptation to climate change is taking place at household level and that adaptation will contribute significantly to the reduction of the negative impacts of climate change
- This research went beyond providing a list of possible adaptation options and it showed that household are proposing current methods on crop and farm management to adapt to climate change but the effectiveness of the adaptation options was not studied
- Access to affordable credit and insurance will give farmers greater flexibility to modify their agricultural production strategies in response to climate change.

Discussion cont’d

- Households will be limited in the way they would respond to climate change requiring that households are exposed to new and proven methods that have worked in other communities in responding climate change.
- information is going to play a greater role in contributing to households’ effective adaptation. This manifested in this study as households who could read and write suggesting a variety of methods in response to a changing climate.
- External factors are going to determine how households will respond to a changing climate, in case of this study, government grants. This may be looked at as a short-term response that exposure to different stimuli will influence household adaptation to climate change.
- Although households were involved in agriculture, due to inappropriate agricultural practices and limited arable land for cultivation, limited food was realised from agricultural production. Food from agricultural activities was also unreliable due to the erratic nature of weather experienced in the area. Generally the area is agriculturally marginal as a result of the imbalance distribution of land by the apartheid system which resulted in black African communities occupying marginal land.

Recommendations

- Extension services to communities should incorporate community adaptation systems taking care of local context with a strong community engagement, including geographic, demographic, social, economic, and infrastructural
- Policy interventions should focus on strengthening household crop production through mitigating and coping practices aimed at reducing the damages from climate change.
- policies that support adaptation strategies at the household level should encourage ownership of income generation and asset holding that will enable households cope in the event that government changes its policy on giving grants
- Climate change mitigation policies should consider building the capacity of communities to effectively adapt to a changing climate.
- Research should be conducted to establish context specific adaptation interventions that are incorporating local knowledge in planning and formulation of responses to climate change.
- Adaptation to climate change will come with a cost attached for effective responses. communities should be prepared to put in place mechanisms to meet the costs required for adaptation.

CONCLUSION

This paper has argued that households were concerned about their agricultural climate environment, overall represented by household vulnerability to climate change and this had direct impacts on household food security. providing farmers with information on good agricultural practice, including water and soil management had direct impact on reducing the level of household food insecurity. Such information included coping mechanisms with regards to adverse climatic conditions hence the need for farmers' access to appropriate extension services. Farmers' preparedness for adverse climate outcomes was necessary given that out of their experience they knew of some of these outcomes including outbreak of crops and animal diseases. Boosting household incomes played an important role in reducing the impacts of climate risks to household food security. Diversifying from farming to non-farming activities was important for the households needed incomes. Households that received government grants showed higher resilience to climate risk impacts on household food security. Mechanisms to protect farmers from higher inputs prices and lower farm product prices need to be put in place to increase farmers' flexibility in dealing with the challenges of climate risk.

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THANK YOU