Chapter 9
An Assessment of Gender Sensitive Adaptation Options to Climate Change in Smallholder Areas of Zimbabwe, Using Climate Analogue Analysis

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Abstract Climate analogues can be used to assess climate–induced risks and adaptation options for smallholder farmers. Surveys were carried out in smallholder areas at two 2050s climate analogue sites to assess smallholder climate-induced risks, farmers' perceptions, and adaptation options, with a gender perspective. Pairs of sites selected had similar annual rainfall totals but differed in mean annual temperature by 2–4 °C. For drier areas Chiredzi was hypothesised to represent Matobo, and for wetter areas Kadoma was hypothesized to represent Mazowe/ Goromonzi 2050s climates. Differences in crop management strategies and gender issues vary across sites. At the drier analogue pair, higher proportions of households grew small grains in Chiredzi compared to Matobo. Implications are for increased uptake of small grains, in 2050s climates for Matobo farmers. Gender issues include labour for production and processing of the small grains, against a background of male labour migration. For wetter climates, soil and water management strategies are important options for smallholders. Accesses to draft power, labour, agricultural assets, social and financial capital in differently managed households are important for increasing adoption of effective crop management strategies.

Keywords Adaptation · Analogues · Climate-induced risks · Farming systems · Gender

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Introduction

The impacts of warmer climates by the middle of 21st century, i.e. 2050s on agriculture as a whole and on smallholder production in particular, are projected to be mainly negative (Hulme et al. 2001; Unganai 1996, Christensen et al. 2007). The rural poor, in particular women, are especially vulnerable to the effects of climate change. In Zimbabwe smallholder areas are predominantly semi-arid and rain-fed. Typically smallholders have small land holdings, mostly 2–3 ha of arable land, and are primarily semi-subsistence nature. They are in many instances poorly resourced and associated with low productivity (FAO/WFP 2008, 2010; Chimhowu et al. 2009; Ministry of Agriculture 2007, 2012). The uptake of technologies and interventions to reduce the impacts of bio-physical constraints, which include poor rainfall distribution and soil fertility among other factors, are low due to elements such as costs and skills. Increasing adaptive capacity and options for improved livelihoods in current and future climates for different smallholders requires an integration of methods which include multi-stakeholder processes. Identifying constraints and adaptation options through better understanding of perceived risks and opportunities, and mainstreaming gender issues, specifically women-specific, is important for climate change planning and adaptation.

According to some climate models, temperature increases of about 3 °C by the 2050s and ±5 to 15 % changes in mean annual precipitation are projected for the sub-Saharan African region (Christensen et al. 2007). The potential impacts of warmer temperature and rainfall changes on crop production are projected to be mainly negative (Matarira et al. 1995; Christensen et al. 2007; Thornton et al. 2011). Some direct effects of climate change on crop production include increased evapo-transpiration, water demand and heat stress and shorter growing seasons. Smallholder farmers, who already experience low productivity due to socio-economic and biophysical challenges, are particularly vulnerable to climate change effects. Rain-fed smallholder farmers cope with some of the associated stresses through use of tolerant crops and various soil and water management strategies. These efforts need to be reinforced for current and future climates. For both men and women farmers there is need for enhancement of capital assets i.e. natural, social, human, physical, and financial capital essential for sustainable production. Smallholder systems are heterogeneous. Livelihood options; gender roles, capital assets as well as climate induced-risks differ. Women headed households often achieve lower yields which in part may be due to socio-economic differences (Horrell and Krishnan 2007; Tiruneh et al. 2001). Mainstreaming gender issues in climate and agricultural adaptation require an in-depth understanding of asset ownership at farm levels, of the roles of women and men in the farming systems, as well as benefit sharing of farm profits. Building on existing knowledge and farmer practices is required for progressive adaptation.

Climate analogue analysis can assist in assessing climate-induced risks and their interaction with other capital assets in smallholder production. Spatial temperature analogue models assume that cooler regions will behave like the patterns observed

in other regions currently with warmer climates if they were subjected to a climate induced shift (Adams et al. 1998). Burke et al. (2009) demonstrated the existence of analogues for 2050s based upon growing season temperatures for maize, millet, and sorghum in several African countries.

Driven by the need to address the paucity of research on this topic, this paper outlines the use of climate analogues and farmer perceptions in identifying gender sensitive adaptation options in current and future climates for improved livelihoods in some semi-humid (wetter) and semi-arid (drier) smallholder areas in Zimbabwe. The hypothesis of the study was that climate-induced risks and adaptation options will differ by gender in different smallholder areas.

Methodology

The study involved identifying analogue locations in semi-arid and semi-humid areas of Zimbabwe and assessing their perceived climate-induced risks and practices. The project "Adapting agriculture to climate change: developing promising strategies using analogue locations in Eastern and Southern Africa" (CALESA—Climate Analogue Locations in Eastern and Southern Africa) identified climate analogues for semi-arid and semi-humid agricultural areas in Zimbabwe using 30 years climatic data supplied by the Zimbabwe Meteorological Department. The sites selected consist of the wetter analogue pair Mazowe/Goromonzi (reference) and Kadoma (analogue) while the drier analogue pair consists of reference Matobo and its warmer analogue Chiredzi (Table 9.1). Analogue pairs have mean annual temperature difference of at least 2–4 °C.

Table 9.1 Description of selected sites

Surveys districts	Characteristics	Mean annual T (°C)	Mean annual rainfall (mm)	Soil types
Matobo	Cooler/Drier (reference)	18.4	567.1	Greyish brown sands
Chiredzi	Warmer/Drier (analogue)	21.3	541.2	Heavy clays, vertisols, sands, sandy loams
Difference		2.9	−25.9	
Mazowe and Goromonzi	Cooler/Wetter (reference)	18.2	842.9	Greyish brown sands and sandy loams
Kadoma district	Warmer/Wetter (analogue)	21.8	721.7	Greyish brown sands and sandy loams
Difference		3.6	−121.2	

The study involved characterizing farming systems, identifying climate induced–risks, and adaptation options using gender disaggregated data, through household surveys in smallholder areas. To this end, a household survey was conducted at the analogue sites to assess farming practices for the 2010/2011 cropping season. A total of 627 respondents representing different smallholder households were interviewed using semi-structured questionnaires at the study sites. These form the basis of the subsequent analysis presented in the next section.

Results

Characteristics of Households

The proportion of female households for the survey ranged from 26 % (Kadoma) to 43 % (Mazowe/Goromonzi). Greater than 80 % of these were de juri female headed households. De facto female headed households were about 17 % in Chiredzi (warmer, dry), and less than 10 % at the other sites. Higher proportions of female heads were full-time farmers compared to male heads.

Crops Grown at Study Sites During the 2010/2011 Season

In addition to small grains in Chiredzi, main crops grown at the dry sites Matobo and Chiredzi were maize, groundnut and cowpea (Table 9.2). At the wetter sites maize was the main crop.

Soil and Water Management Strategies Used by Households

The identified differences in the uptake and usage of soil and water management practices within and across analogues, are shown in Table 9.3. In general, higher proportions of households from wetter sites have used soil and water management strategies compared to those from the drier sites. At the drier sites, use was generally higher by Matobo households compared to Chiredzi households. The proportion of households that have used conservation agriculture (CA), tied ridges and winter ploughing, was higher in Matobo compared to Chiredzi households; and higher in Kadoma compared to Mazowe/Goromonzi. Soil fertility usage was higher in Matobo, Mazowe/Goromonzi and Kadoma compared to Chiredzi.

Table 9.2 Crop production characteristics at study sites during the 2010/2011 season

	Drier pair			Wetter pair		
	Matobo (cooler)	Chiredzi (warmer)	χ^2	Mazowe and Goromonzi (cooler)	Kadoma (warmer)	χ^2
N	159	165		153	150	
Crops grown by >20 % of households	Maize	Maize	N/A	Maize	Maize	N/A
				Groundnut	Cotton	
	Groundnut	Sorghum (red, white)			Groundnut	
	Bambara-nut					
	Cowpea	Groundnut				
		Bambara-nut				
		Cowpea				
		Pearl millet				
Crops grown by <20 % households	Sorghum (white, red)	Cotton	N/A	Bambara-nut	Sorghum (white)	N/A
		Sunflower				
				Finger-millet	Cowpea	
	Pearl millet	Sugar bean		Sugar bean	Bambara-nut	
				Cowpea		
		Soya bean		Cotton		
		Barley		Sunflower		
				Tobacco		
				Rice		
				Okra		
Proportion maize area (%)	79.2	37.6	N/A	89.4	53.1	N/A
Households with small grains (%)	11.9	92.1	208.823***	6.5	4.0	0.947

***Significant at the 0.1 % level
**Significant at the 1 % level
*Significant at the 5 % level

Discussion and Lessons Learned

The hypothesis of the study was that adaptation options will differ by gender and agro-climatic conditions of the smallholder farmers. Results confirm this hypothesis. The results from this study show that characteristics of household heads differ, as well as coping and adaptation strategies for crop production within and across analogues. Higher proportions of de facto female heads at the drier, warmer Chiredzi compared to Matobo and the wetter sites imply higher levels of male labour migration. De-juri female heads are mostly older than the de facto heads.

Table 9.3 Proportion of households who have used soil and water management technologies

Intervention area	Strategy	Drier pair			Wetter pair		
		Matobo (%) hhds[1]	Chiredzi (%) hhds	χ^2	Mazowe (%) hhds	Kadoma (%) hhds	χ^2
1. Soil and water management	Conservation agriculture	53.5	9.1	74.700***	52.9	82.7	30.869***
	Mulching	28.9	15.2	9.7868	60.8	64	0.334
	Contour ridges	47.2	27.7	14.648***	32.7	4.7	38.917***
	Tied ridges	11.9	3.6	7.859**	11.8	21.3	5.033*
	Winter ploughing	10.7	1.2	13.181***	3.3	14.7	12.988**
	Water harvesting	3.8	2.4	0.493	5.9	2.7	1.907
	Pot holing	0.6	5.5	6.304*	6.5	0.7	7.458*
	Multiple weeding	1.3	4.8	3.490	0	0	
	Gulleys	0.6	1.8	0.939	3.3	0	4.984*
2. Soil fertility management	Chemical fertilizer	89.9	4.8	235.584***	99.3	96	3.758
	Animal manure	73	25.5	73.397***	85.6	75.3	5.678
	Compost	71.1	17.6	94.374***	73.2	64	2.980
	Crop rotation	35.2	25.5	3.660	54.2	63.3	2.580

***Significant at the 0.1 % level
**Significant at the 1 % level
*Significant at the 5 % level
[1] households

Higher proportions of female heads who are full time farmers imply higher contribution by rural women in domestic and agricultural production. Differences in household management also influence livelihood sources and access to agricultural resources.

Implications from this study are increased uptake of small grains such as sorghum and millets in Matobo and areas with similar rainfall and temperature characteristics in 2050s. Crop choices are one of the common coping and adaptation strategies employed by rain-fed smallholder farmers (Kurukulasuriya and Mendelsohn 2008). Gender issues for small grain production include labour for production, pest management, harvesting and processing, against a background of male labour migration. At the wetter sites implications are production trends influenced by 2050s market forces. The importance of soil water and soil fertility management particularly at wetter sites is illustrated by high proportions of smallholder farmers who use strategies to conserve soil moisture and increase soil fertility such as use of inorganic and organic forms of fertilizer. The choice of strategies is dependent on, among other factors, soil characteristics, crops grown, capital assets, and easiness to adopt. Nabikolo et al. (2012) showed that adaptation decisions of female heads depended on and were sensitive to more covariates in particular liquid household assets compared to those of male heads. Meanwhile Tazeze et al. (2012) showed gender, age and education level of the household head family size, livestock ownership, agro ecological zones, among other factors influencing adaptation strategies. Gender issues may include, in addition to labour for production, socio-economic factors such as asset ownership, sharing from proceeds after selling crops particularly in male headed.

Conclusions and Recommendations

Current and future projections on climate change and temperature increases in Africa as a whole, and in Zimbabwe in particular, means that there is a pressing need to seek adaptation strategies in agriculture, which may allow farmers to better cope with such changes. Due to a combination of lack of resources, skills and access to technologies, smallholder farmers, especially women, are vulnerable to climate change.

Preliminary results show that climate analogue analysis and involvement of stakeholders such as smallholder farmers through interviews, participatory evaluations can contribute in identifying adaptation options for smallholder farmers in different climates. Gender issues in climate change and agriculture differ and this suggests that differentiated approaches are needed so as to reach male and female farmers. Different preferences for crop management strategies imply gender issues for differently managed households will vary across sites, particularly between the dry analogue pair. In drier areas, implications are for increased uptake of small grains, in 2050s climates. There may be need for increased investment in water management research and development for drier areas. For wetter climates soil and

water management strategies are important options for smallholders. At drier sites gender issues include labour for production and processing of the small grains, against a background of male labour migration. At wetter sites access to draft power, labour, agricultural assets, social and financial capital in differently managed households are important for increasing adoption of effective crop management strategies.

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