

*Full Length Research Paper*

# Climate change adaptation for rural communities dependent on agriculture and tourism in marginal farming areas of the Hwange District, Zimbabwe

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**The study analysed climate change adaptation for rural communities co-dependent on agriculture and the tourism industry in marginal farming areas in Hwange District, located in the north-west of Zimbabwe. The study was based on primary data collected from a cross-sectional household survey, key informant interviews and focus group discussion with rural communities. The results indicate that most of the respondents reported that most of their adaptation efforts to address the impacts of climate change and other stressors are primarily focused on agricultural crop activities. Deploying appropriate climate sensitive technologies and marketing innovations to make rural agriculture work better with climate change; is one possibility not yet fully exploited. Better access to climate change information and screening of appropriate technologies for climate change adaptation beyond seasonal climate adaptation and provision of technical and market incentives for farmers to invest in climate change compliant technologies should become the focus of African governments for semi-arid regions most vulnerable to climate change risk.**

**Key words:** Climate change, adaptation, agriculture, tourism, Hwange, Zimbabwe.

## INTRODUCTION

Local ecosystems provide the main source of livelihood for many of the world's poor. Most of the rural poor in sub-Saharan Africa rely for their livelihood and food security on highly climate-sensitive, rain-fed subsistence farming; or small-scale farming, pastoral herding and direct harvesting of natural services of ecosystems such as forests and wetlands (IPCC, 2007; Mitchell and

Tanner, 2006; Leary et al., 2005; Roach, 2005). The productivity of this livelihood base is highly vulnerable to climate-related stresses, such as changes in temperature, precipitation (both amount and variability), and increased frequency of droughts and floods. The vulnerability of the majority of the poor in Africa to climate-related stresses is worsened by widespread

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poverty, HIV/AIDS, lack of access to resources (e.g. land and water) and lack of management capabilities, wealth, technology, education, ineffective institutional arrangements, and lack of social safety nets (Leary et al., 2005; Nyong, 2005).

Further changes in climate are unavoidable even under stringent mitigation measures over the next few decades due to high concentrations of greenhouse gases (higher than pre-industrial levels) and high residual levels of greenhouse gases in the atmosphere (Klein et al., 2007; Houghton et al., 1996). Mitigation efforts to reduce the sources of or to enhance the sinks of greenhouse gases will take time. Furthermore, effective mitigation requires collaboration and commitment from many countries (Klein et al., 2007). Adaptation is therefore, critical and of concern in developing countries, particularly in Africa where vulnerability is high because the ability to adapt is low. Adaptation helps reduce the impacts of climate change in the short to medium term, and is motivated from local priorities or regional risks without requiring multi-country commitments (Hassan and Nhemachena, 2008; Nhemachena, 2009). The benefits of adaptation are realised in the short term and are felt at the local community level. Adaptation measures are, therefore, critical in the short to medium term, while in the long run mitigation efforts are required to reduce risks and create sinks for further greenhouse gas emissions. It is therefore imperative to help identify ways of strengthening adaptation capacity of local communities, and local and national systems to enable them to cope with climate change and variability thus contributing to social and economic progress of local vulnerable communities. Finding creative solutions and methods to deal with climate change and variability has become an urgent policy imperative on a local, national, and global scale. Much of climate change discussion have been concentrated at the global perspective, such as sea-level rise; temperature increase; negotiations and policies; global costs of adaptation and large scale modelling. However, although they may be extensive and severe, the impacts of climate change and variability (e.g. on human health) will be felt locally by individuals, families, villages and neighbourhoods. In addition, the most adaptation will happen at the local level - in ways that are usually unnoticed, uncoordinated and unaided by national governments or international organisations (Commission on Climate Change and Development, 2009).

The diversity of the effects of climate change and variability and how individuals, households, communities, governments and civil society deal with them is best understood through analysis of their local circumstances. While a lot of sectoral studies have been undertaken in the region (Kurkulusuriya et al., 2006; Nhemachena and Hassan, 2007; Hassan and Nhemachena, 2008; Kurkulusuriya and Mendelsohn, 2008a, b; Seo and Mendelsohn, 2008; Dinar et al., 2008; Nhemachena, 2009) including studies related to impacts and vulnerability from

climate change and variability and vulnerability in the region (Vogel and Misselhorn, 2009), limited integrated research has been conducted to address agricultural and tourism vulnerabilities from climate change and variability occurring at various levels (e.g. ecosystem, community, district, provincial, national). To address some of these concerns, the paper analysed climate change adaptation for rural communities co-dependent on agriculture and the tourism industry in marginal farming areas based on a study in semi-arid district of Hwange, located in the north-west of Zimbabwe. Therefore, the main objective of this paper was to identify local adaptation strategies used by rural farming communities, and factors affecting their choices to inform ways of strengthening local capacity to respond to impacts of climate change on agriculture and tourism-based systems.

### **Livelihood sources and climate change in Hwange district**

The main sources of livelihood for the rural communities in the Hwange District include a combination of rain-fed agricultural production and tourism, based on natural ecosystems. The rural tourism is sustained with the availability of the Victoria Falls, a main international and domestic tourist destination in Zimbabwe. However, the economic decline and political instability in Zimbabwe has had negative consequences on the tourism industry which has seen a remarkable decrease in the number of tourists visiting the country in the past decade. The situation is, however, reversing; and the increasing number of tourists would increase demand for harvesting of natural resources for the production of tourism artefacts by the rural communities.

The tourism industry based on the Victoria Falls is more resilient to climate change and variability because the Zambezi River gets its recharge from the Congo Basin and the north western Zambia region - both of which are projected to become wetter with climate change.

Thus, expected growth in the number of tourist arrivals at Victoria Falls and Hwange National Park would continue to present off-farm income generating and livelihood opportunities for rural agricultural communities in the form of sales of non-farm forest products (wood carvings, Tonga baskets and mats, eco-tourism, etc) to tourists. Forest timber resources adapted to the semi-arid agro climatic region of Hwange are more resilient to climate change than the drought prone crop and livestock farming system in the same agro-ecological region.

The Hwange District located in the north-western part of the country falls under natural regions IV and V. The region is characterised by very high temperatures ranging from 25° and above, and annual rainfall of less than 450 mm. The potential for agriculture is low due to the unfavourable climatic conditions, poor soils and other limiting natural and socio-economic factors. The Hwange District is highly vulnerable to climate change and

variability and this is worsened by the interaction of multiple stresses (such as endemic poverty; limited access to capital including markets, infrastructure and technology; ecosystem degradation, etc) occurring at various levels, and low adaptive capacity (Nhemachena et al., 2010; Hassan and Nhemachena, 2008). Furthermore, climate change is expected to reduce effective rainfall by 10 to 20% while temperature already at 35° will increase - thus further reducing effective rainfall to less than 300 mm while variability and incidence of extreme weather events of droughts and floods is expected to increase. Thus, maize-based mixed farming system will suffer a reduction in expected output per hectare which will further reduce the number of years in which smallholder agricultural communities will be able to sustain themselves from the food and livestock production system. In order to possibly decrease the negative impacts of climate change and variability and enhance resilience to change, it is necessary to understand the dynamics of these ongoing processes and their interaction.

## METHODOLOGY

The study was based on primary data collected from a cross-sectional farm household survey, key informant interviews and focus group discussion conducted in the Hwange District in February 2012. The different methods were applied to complement each other and increase the comprehensiveness of information gathered, as well as allow triangulation of findings. The study was designed to capture rural communities' livelihood activities, perceptions and understanding on climate change and variability, and their approaches to adaptation. Questions were included to investigate whether farmers have noticed changes in temperature and rainfall over the last five years or more, and reasons for the observed changes. Furthermore, some questions investigated whether rural households made some adjustments in their farming and other activities in response to long term changes in temperature and rainfall by adopting some particular strategies.

However, this paper focuses on livelihood activities and adaptation options and perceived constraints. The cross-sectional survey covered three purposefully selected wards (Chidobe; Nemananga; Jambesi) from which a sample of 150 randomly selected households were interviewed. Fieldwork activities were facilitated with the help of the Hwange District Administration, Environment Africa (a local NGO) and local agricultural extension officers. In addition, three focus group discussion were conducted, one from each ward, as well as key informant interviews with extension staff, local leaders, etc. The sampled households provide a fair representation of livelihood activities in the district. The data was entered and analysed in STATA and Microsoft Excel. Descriptive statistics mainly frequencies were used for empirical analysis.

## RESULTS AND DISCUSSION

### The climatic conditions and livelihood systems of the Hwange community

The results from focus group discussion on livelihood

activities indicated that agriculture-based livelihood activities are the main livelihood source despite the increasing incidence of drought. However, despite low use and adoption levels, non-farm production of forest-based craft products targeting the tourism industry and distant urban markets is recognised increasingly as an important source of income and livelihood resilience. Other reported sources of non-farm income livelihood are fishing and part-time employment in the hotel and catering services sector, as well as in the mining sector. With the waning of agriculture and the rise of roadside marketing targeting the tourist traffic, illegal activities such as prostitution and poaching have emerged as social vices.

Furthermore, key informant interviews revealed that more than 75% of the rural community population in Hwange consider agriculture as their primary livelihood source, while up to 25% consider themselves fully or temporarily engaged and or employed in the tourism related sectors. Beyond employment benefits for a few members of the community, the local community believe that the tourism industry has not done enough to promote local supply chains for horticultural produce of fruits and vegetable and livestock, as many of the hotel chains continue to import the bulk of their supplies from big cities and from South Africa at the expense of the local economy. The community recommends greater policy and institutional efforts to integrate community-based horticultural production into the tourism sector.

### Agricultural production system and contributions to current livelihoods

The main agricultural activities are dry-land crop production, irrigated horticultural production and livestock rearing on the natural rangeland adapted to dry conditions of natural region V. Maize dominate dry-land crop production at the expense of small grains that are more adapted to drought conditions because of strong preference for maize as staple food grain; this after many decades of government policy of subsidised and centralised distribution of maize from the wetter northern region of Zimbabwe to the drier southern parts of the country at state subsidised pan territorial prices. Since the collapse of the Grain Marketing Board under the weight of grain trading losses, the emerging private grain marketing system hampered by lack of competition has left farmers in maize producing areas at the mercy of monopolistic traders. The higher than competitive prices for maize and lower than competitive prices for drought-tolerant small grains prevailing in the local markets continue to provide a tantalising incentive for subsistence farmers, who already have a strong consumption preferences for maize as their staple food crop. Thus, they continue putting an increasing acreage under maize, despite the increasing risk of maize crop failure confirmed by the community. Although, communities seem to be fully

aware of the drought resilience qualities of sorghum and millet, apparent lack of marketing opportunities for small grains explain current poor response to NGO efforts to promote production of small grains in dry areas. Even cowpeas, groundnuts and *mbambara* nuts with established markets in the major cities are locally considered subsistence food crops for women to produce because of poor linkages of the local farming economy to the national agricultural markets.

The exception to the poor integration of the local agricultural market to the national grid is the local livestock markets. Surging demand for beef in major cities continues to attract established long distance cattle buyers from as far as field of Harare and Bulawayo to attend local auctions in the Hwange and Lupane areas. However, the terms of trade are constantly moving in favour of maize traders because of poor integration of local maize market to the national and regional maize markets in which Zimbabwe remains a net importer. Hwange area is surrounded by maize deficit and livestock-surplus regions of the neighbouring countries, which further worsens the terms of trade for cattle against maize. In terms of dominance, Hwange district has more cattle livestock units than small livestock. Donkeys, goats and sheep as well as local indigenous poultry (chickens, guinea fowls, turkeys etc) are more resilient to drought than the indigenous cattle which are more vulnerable to scarcity of feeds and drinking water than the smaller livestock. Livestock production and ownership is also important in the district. The priority livestock includes cattle, donkeys, chicken, goats, sheep, guinea fowl, pigeons, turkey, and rabbits. Livestock is important as an income and food source (meat, milk); as well as for draught power, manure, skin hides, and also status. It was indicated that in the household both men and women had access to benefits from different livestock; however in terms of control, men tended to have more control on the larger livestock such as cattle and donkeys while women had more control on smaller livestock such as chicken. There are many factors that were noted to be limiting agricultural production in the district. These factors are high input prices, low output prices, inadequate rainfall, poor soils, poor access to farming inputs (e.g. fertilizers and credit), poor access to markets, lack of labour, lack of draught power, lack of skills, inadequate extension services, traditional norms, gender issues (e.g. unequal access and control of resources), wildlife, and pests. From these factors, inadequate rainfall and poor soils were highlighted as the main factors limiting agricultural production.

### **Forest resource utilisation management system and livelihoods contributions**

The main uses of timber in the community are wood carving (curios, crafts), infrastructure (roofing and

fencing), and firewood. The tree species mainly used for wood carving are: *mukwa* (*Pterocarpus angolensis*), *muvhumira* (*Kirkia acuminata*), teak (*Baikia plurijuga*), mahogany, *mopani*, red wood, iron wood, and olive wood. Some tree species such as *mukwa* and teak are greatly reduced in number, especially closer to the communities. Communities are mainly on one side of the highway road (Victoria Falls to Bulawayo), and across the road there is forest. The wood carvers now have to go deep into the forest to get wood for carving. It was noted that nowadays one can travel for about 2 km or more into the forest without finding a *mukwa* tree, and wood carvers travel for up to about 15 km to get logs for carving. Most of the tree species that are important for wood carving are getting exhausted, which has forced the carvers to use other tree species.

The main tree species for firewood are teak and *mopani*. Recently, there has been increased demand for firewood in urban areas due to electricity power shortages. Generally, rural communities do not use forest trees for making furniture - except for roofing and fencing of homesteads. Household survey results showed that about 28 to 39% considered forest and tourism activities to be important sources of income for the households (Figure 1). In the last season about 18% reported that they have received income from forest based activities (Figure 2).

Focus group discussion and key informant interviews revealed that some of the constraints in the production of curios and artefacts include the need to get permission to cut trees, reduced quantity of timber sources and poor markets - which results in low prices and unfair exchange, e.g. second hand clothes in exchange for curios, and the reduced tourism activities. Some of the requirements that should be fulfilled before harvesting the timber include the need to get permits from the Forestry Commission, and also paying rent to the district council. The use of forest resources is governed by statutory instruments/requirements. These include the Forest Act (Chapter 19:05 of 1996) and Communal Lands Forest Products Act (Chapter 19:06); these statutory instruments apply mainly for commercial use of forest products, whereby users have to apply for a permit. The Forestry Commission, which is the main forests governing body, works closely with the rural district councils, the Environmental Management Authority (EMA) and law enforcement agencies such as the Zimbabwe Republic Police. One of the challenges in the management of forest products is that the fines are very low; usually offenders pay about US\$20 fine which is generally not prohibitive enough. The repeat offenders go to court and they can be sentenced to community service or get a jail sentence. Enforcement from traditional leadership is not effective because they usually also participate in the illegal harvesting of forest products. With the current harvest levels, most tree species will be exhausted because the management is poor. The communities are

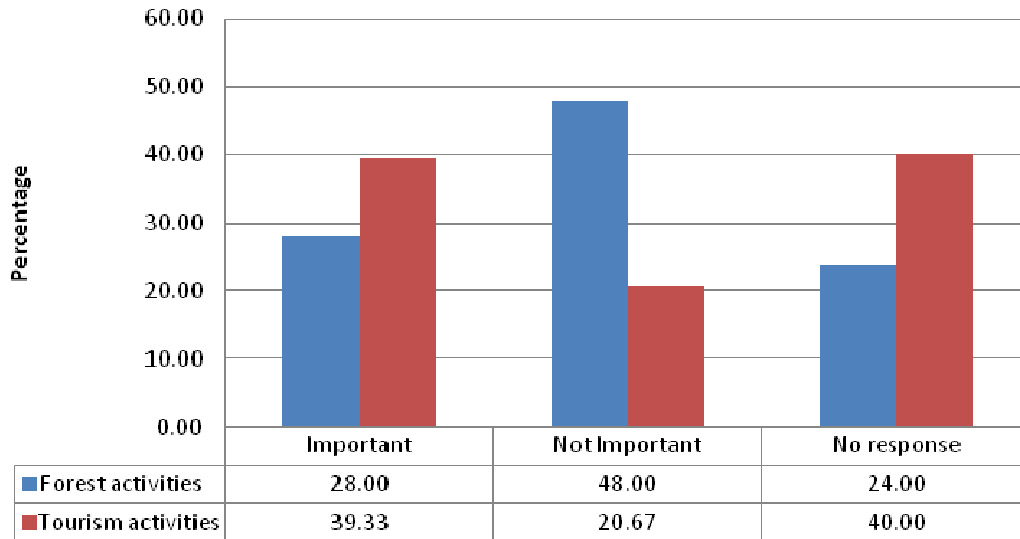


Figure 1. Importance of forest and tourism activities to household income.

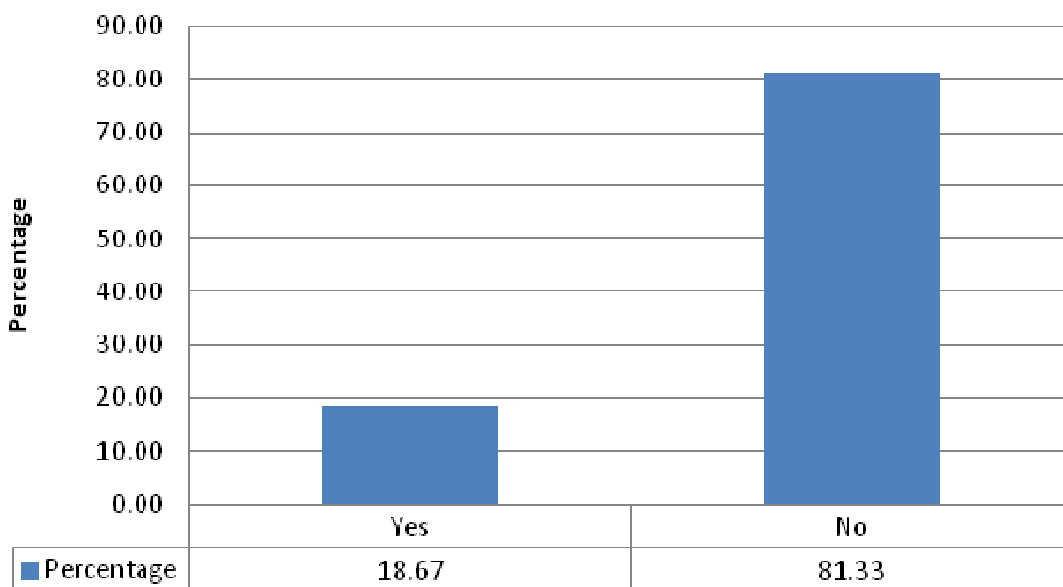


Figure 2. Percentage of households who received income from forestry based activities.

also realising that the current utilisation of forest resources and products is not sustainable. The prices that producers and marketers of curios get for their products are too low compared to the value of the timber (the true value of the timber/tree is not factored into the price).

Forestry and environmental organisations have been encouraging communities to plant tree species such as gumtree (e.g. during National Tree Planting day, which falls on the 7th December of each year), so that they can use it for poles and firewood.

**Adaptation strategies used by rural communities to adapt to climate change**

As noted above, the study was designed to capture rural communities’ livelihood activities, perceptions and understanding on climate change and variability and their approaches on adaptation. Although, this paper does not focus on perceptions to climate change and impacts on livelihoods, empirical results from the study showed that rural communities in Hwange perceive that the climate has changed and has contributed to adverse impacts on

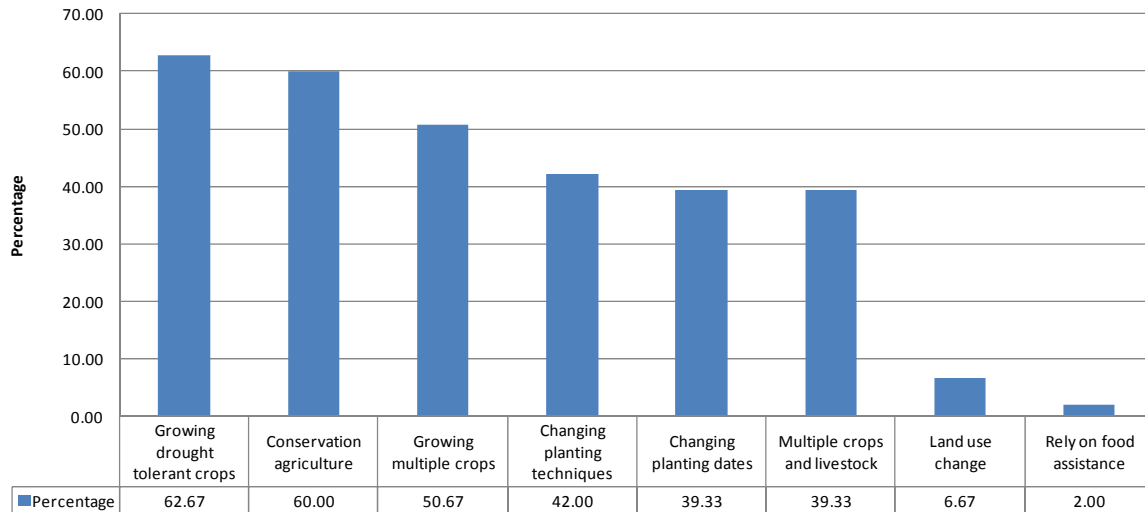


Figure 3. Crop-related strategies used by communities to cope with climate change.

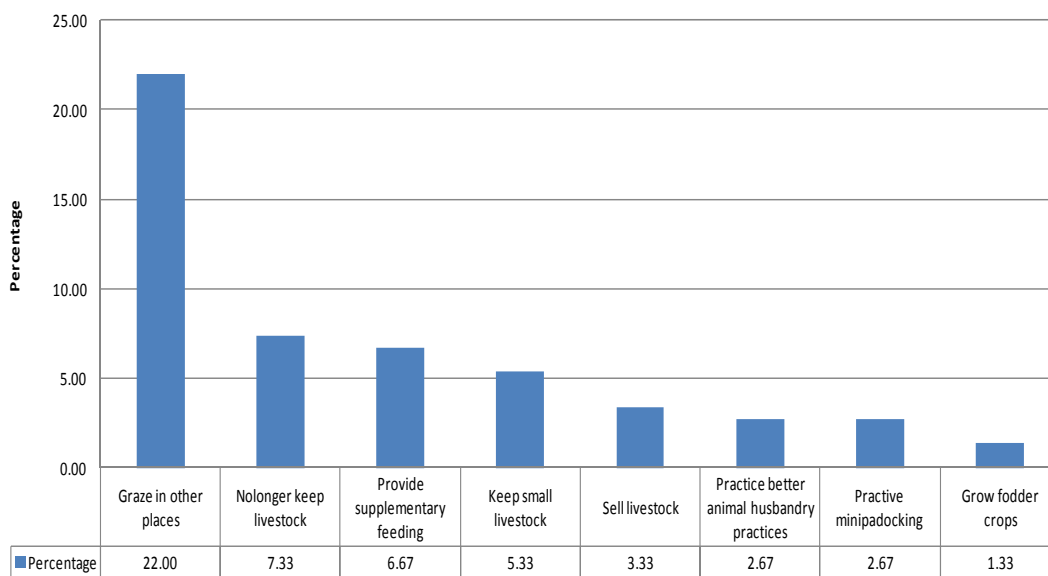
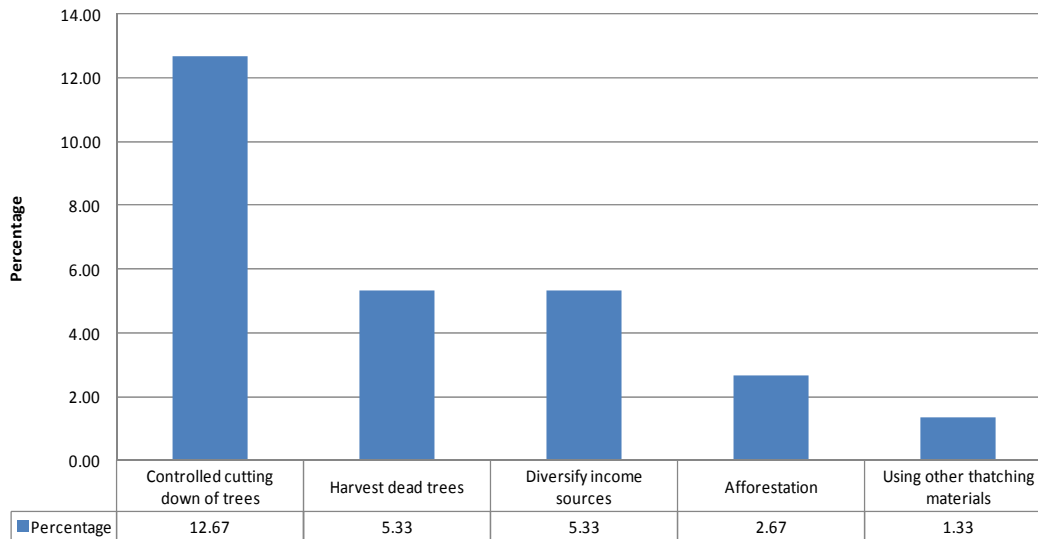


Figure 4. Livestock-related strategies used by communities to cope with climate change.

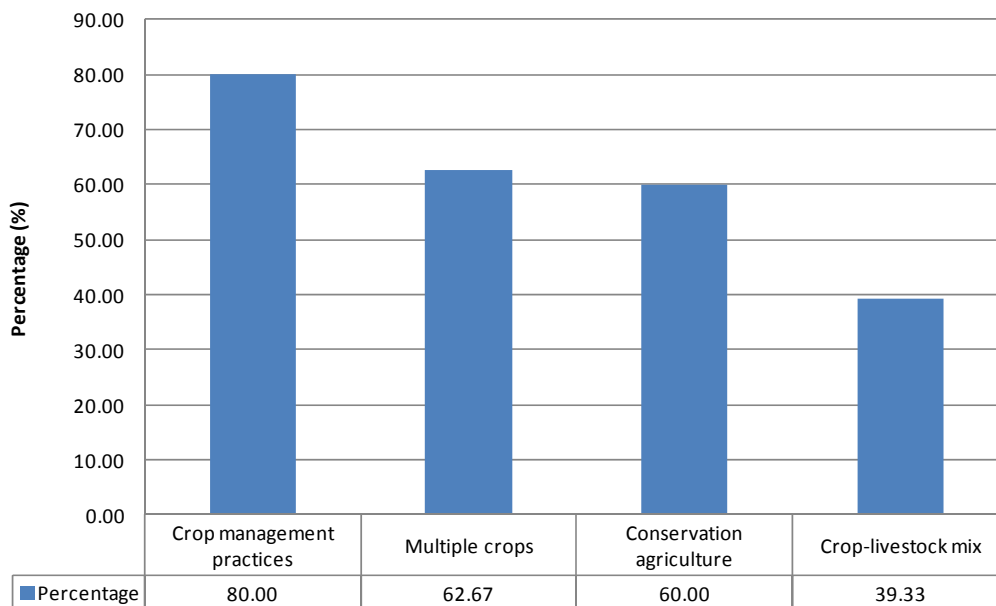
their livelihood sources, mainly agricultural activities and to some extent non-farm tourism based activities (Nhemachena et al., forthcoming). This section discusses adaptation strategies being applied by the rural communities in responding to perceived changes in the climate, its variability and impacts on their livelihood activities.

Figures 3 to 5 present the adaptation strategies rural communities are using to cope with changes in climatic conditions and other factors. These are grouped as crop, livestock and forestry related adaptation strategies. The results show that most of the respondents reported that

most of their efforts to address the impacts of climate change and other factors are focused on agricultural crop activities. Although, livestock and forestry based activities are some of the key livelihood sources for the communities, much of their adaptation efforts are invested in crop related activities. The rural communities' crop related adaptation options can be classified as two main kinds of modification in the production systems: a) increased diversification, and b) protecting sensitive growth stages by managing the crops to ensure that these critical stages do not coincide with very harsh climatic conditions such as mid-season droughts. Based



**Figure 5.** Forest-related strategies used by communities to cope with climate change.



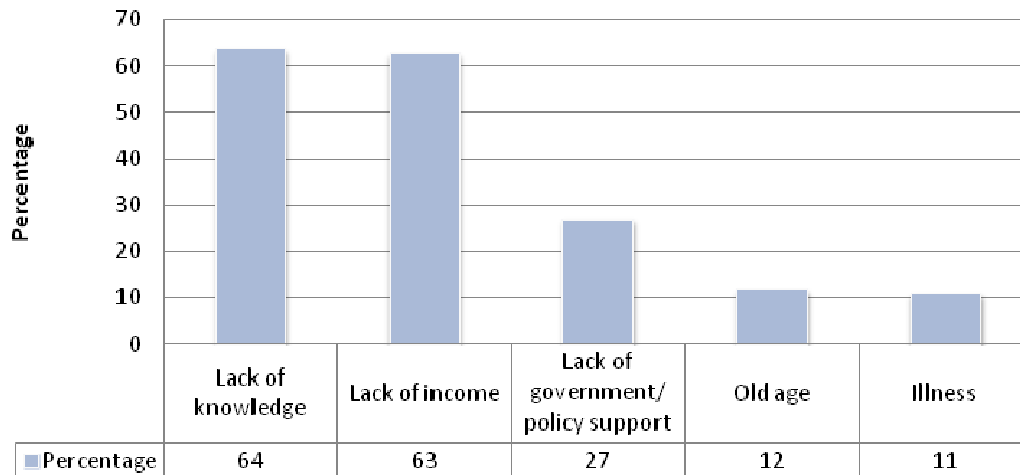
**Figure 6.** Main adaptation strategies used by rural communities.

on information provided on all adaptation strategies being used by rural communities, crop management practices, multiple cropping, conservation agriculture and crop-livestock mix were identified as the main adaptation strategies (Figure 6).

**Perceived constraints on the climate change adaptation capacity of the community**

This section discusses perceived constraints on

climate change adaptation in Hwange. Results from focus group discussion and the household survey indicated that some of the factors constraining communities to adapt to changes in climatic conditions and other factors include but are not limited to: financial limitations to acquire the required inputs to implement strategies; lack of technical knowledge and or poor access to information; lack of government policy and support related to climate change adaptation; limited access to markets, etc (Figure 7). Although, the communities reported that most of them have noticed changes in climatic conditions, lack of



**Figure 7.** Some of the factors that limiting the ability to cope in Hwange District.

knowledge was reported as a limiting factor. Discussion in focus groups and stakeholder interviews showed that rural communities require more information regarding the various adaptation strategies (their costs and benefits and how they can help improve their livelihood sources). In addition, the main focus of most of the interventions that are promoted and supported in the rural communities is not to address climate change impacts.

The rural communities reported that usually interventions are focused on addressing more pressing issues such as food security. Climate change adaptation interventions should therefore be mainstreamed into broader developmental programmes to increase their adoption and use by rural communities. The current constraints faced by rural communities (e.g. financial limitations to acquire the required inputs to implement strategies; lack of technical knowledge and or poor access to information, etc), contribute hugely to those communities' vulnerability to climate change. An understanding of how best to support these farmers who are highly vulnerable to climate stress is therefore vital, given expected changes in climate variability.

### **Community preferred interventions to strengthen adaptation to climate change**

Following on from the constraints to implementing climate change adaptation measures, respondents were asked what assistance they would require to strengthen their ability to cope with changes in climatic conditions and other factors. Some of the key identified interventions include:

- i. Increasing climate change awareness and information dissemination,
- ii. Promoting and supporting income generating activities

such as gardening and forestry and tourism-based activities,

- iii. Training in technologies to adapt to climate change,
- iv. Sustainable forest-based activities,
- v. Timely provision of weather related information as well as crop production information,
- vi. Creating market access and linkages,
- vii. Increased support for conservation agriculture and drought tolerant crops,
- viii. Active involvement of communities in planning and implementing programmes that address their needs,
- ix. Support in fencing of fields and household areas,
- x. Drilling of boreholes for irrigation activities,
- xi. Increased support of small livestock activities and pasture management,
- xii. Targeting of vulnerable groups such as elderly and sick (such as HIV and AIDS patients) when supporting communities with livelihoods improving programmes. Key informants indicated that they were not aware if there was any policy instrument or institutional framework that seeks to address challenges posed by climate change at both national and local level. In addition, participants in the focus groups indicated that they were not aware of initiatives that were being undertaken to reduce the direct effects of climate change at the local level. However, it was indicated that there were organisations working in the district that seek to address challenges related to climate change, but not necessarily climate change. Some of the organisations are engaged in agricultural, environmental and developmental activities. These include Environment Africa, AGRITEX, GMB, Veterinary Department, Environmental Management Agency (EMA), African Centre for Holistic Management (ACHM), CAMPFIRE, National Parks, Matopo Research Station, ORAP, Cadec, Mvuramanzi, Lead Trust, and Caritas Roman Catholic.

The support from these organisations is diverse; it



includes technical knowledge dissemination and training; promotion of conservation farming/minimum tillage and controlled grazing; agricultural inputs provision; promotion of small grains (sorghum, millet); income generating projects promotion (gardening, bee keeping); and food aid. To a limited extent, some of these organisations were involved in infrastructural development such as construction of toilets, clinics and schools. Within the communities, there were also some network organisations such as burial societies which provided funeral assistance to members in terms of money and physical help, thereby strengthening the social capital in the community. One of the important issues that come out of the discussions was that there were poor linkages between developmental organisations in implementing their projects. Mainstreaming and strengthening current climate change adaptation interventions in the work of these organisations can provide an important platform for supporting adaptation activities of the rural communities.

## Conclusion

The paper analysed drivers and barriers of household-level climate change adaptation for agricultural and tourism sub-systems in Zimbabwe. The main objective was to identify ways for strengthening local capacity for the rural communities to adapt and deal with the impacts of climate change and variability.

The results indicate that current and future climate change poses significant risks to maize-based food production in this region. Warming and drying, especially in summer, pose the highest risk. Further, the results show that the majority of the respondents reported that most of their efforts to address the impacts of climate change and other factors are focused on agricultural crop activities. Although, livestock and forestry-based activities are some of the key livelihood sources for the communities, much of their adaptation efforts are invested in crop related activities. Key adaptation strategies being used by rural communities include the crop management practices, multiple cropping, conservation agriculture and crop-livestock mix.

The health and vitality of many agriculture- and tourism-based livelihoods is already affected by climate change and the impact is likely to accelerate, with local and global negative consequences that will possibly outweigh growth increases linked to climate change. Given future projections of climate change for this region, farming systems are expected to undergo profound changes in order to adapt. Awareness of actual and potential impacts from climate change, assessment of uncertainties and inclusion of risks should form the backbone of climate change policies in agriculture- and tourism-based livelihoods management planning. Better training and access to information, markets, and extension and credit services were identified as critical for helping rural communities adapt to climate change. Policy

options and investment strategies focusing on enhancing technical knowledge of climate change and its responses, access to climate change adaptation-related information, markets and credit - including technological and institutional methods - will greatly benefit poor rural communities.

## Conflict of Interests

The authors have not declared any conflict of interests.

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