

CLIMATE CHANGE, VARIABILITY AND SUSTAINABLE AGRICULTURE IN ZIMBABWE'S RURAL COMMUNITIES

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ABSTRACT

This article explores the impact of climate change and variability on agricultural productivity in the communal area of Bikita. The article further examines the adaptation and mitigation strategies devised by farmers to deal with the vagaries of climate change and variability. The sustainability of these is also interrogated in this article. This study juxtaposed qualitative and quantitative methodologies albeit with more bias on the former. A total of 40 farmers were sampled for unstructured interviews and focus group discussions. This article argues that the adverse impacts of climate change and variability are felt heavily by the poor communal farmers who are directly dependent on agriculture for livelihood. From the study, some of the widely reported signs of climate variability in Bikita included late and unpredictable rains, high temperatures (heat waves), successive drought, shortening rainfall seasons and seasonal changes in the timing of rainfall. The paper argues that climate change has compounded the vulnerability of peasant farmers in the drought – prone district of Bikita plunging them into food insecurity and abject poverty. It emerged in the study that some of effects of climate variability felt by communal farmers in Bikita included failure of crops, death of livestock and low crop yields, all of which have led to declining agricultural productivity. Findings in this study however established that communal farmers have not been passive victims of the vagaries of climate change and variability. They have rationally responded to it through various adaptation and mitigation strategies both individually and collectively.

KEY WORDS

Climate change; Climate variability; Food insecurity; Livelihood shocks; Adaptation; Drought-resistant crops.

This paper focuses on the impact of climate change and climate variability on the agricultural activities of the peasant farmers in Bikita. In light of climate change and variability, emphasis is put on how these climatic transformations are threatening the sustainability of subsistence agriculture in Bikita. It has been observed that there is a general consensus among scientists, economists, and policy makers that the entire globe is facing a real and serious long-term threat from climate change (Buckland, 1997; Kinuthia, 1997; Hansen et al, 2007; Matarira et al, 1995). Moreso, scientific evidence shows that mean annual temperature has increased; and it is expected to further increase at a rate of 0.05°C per decade, while rainfall has been erratic, decreasing on average at a rate of 5 to 10% per annum, with annual anomalies mostly below normal (Hulme et al, 2000). The phenomenon of climate change is one of the most fiercely contested and debated concept globally. To this end, as of yet there is hardly any consensus among academics and policy makers as to what climate change really is. It has been observed that climate change is often used synonymous with climate variability and yet the two are different. Manyatsi et al (2010) argued that climate change refers to the long-term significant change in the “average weather” that a given region experiences, while climate variability refers to variation in the mean state and other statistics of climate on all temporal and spatial scales beyond that of individual weather events (Bates et al in IPCC, 2007). Several scholars have noted that the impact of climate change has been extremely over – exaggerated, while others loathe on the whole idea of climate change as a rhetorical fad. However, for the purpose of this paper, climate change is defined as a process of global warming, in part attributable to the ‘greenhouse gases’ generated by human activity. It is the fundamental objective of this study to examine the impact of climate change whether real or perceived on agricultural sustainability as well as to explore the various responses at both community and individual level to the threats posed by

climate change and variability. Adaptation strategies to the vagaries of climate change will also be explored in this paper.

Climate change has of late presented insurmountable challenges to the agricultural sector as well as agricultural sustainability in many developing countries like Zimbabwe. Slater, Peskett, Lundi & Brown (2007) argued that projections suggest that, by the end of the 21st century, climate change will substantially impact on agricultural production and hence on the scope for reducing poverty. With about two thirds of Zimbabwe comprising arid and semi – arid lands, adaptation and mitigation strategies to climate change is a priority since the majority in these areas are dependent on agriculture. They further noted that the short term impacts of climate change, particularly changes in the frequency and severity of adverse weather events, remain uncertain, but their impacts on many developing countries are likely to be negative. Mahiya & Gukurume (forthcoming) argued that widespread poverty and food insecurity in African countries are inextricably linked to low agricultural productivity aggravated by climate change and variability. Thus, with the vagaries of climate change already visible, considerable uncertainty surrounds the agricultural sector in many rural communities like Bikita. Moreso, of note is the fact that due to the impact of climate change food security in semi – arid regions may diminish and expose many people to abject poverty. In Zimbabwe research and literature on the impact of climate variability on agricultural productivity as well as the adaptation strategies devised by the rural poor is scant if not non – existent. This paper sought to fill this knowledge gap by exploring the impact of climate change and variability on subsistence agriculture and the adaptation strategies devised by peasant farmers in Bikita. McGuigan, Reynolds & Wiedmer (2002) argued that although there is still a lot of uncertainty in scientific predictions, levels of vulnerability and the ability to adapt, these are all clearly urgent issues for developing countries, particularly because it will be the already poor and marginalized populations who will be most affected by climate change and variability. It is paradoxical that while there is voluminous literature on climate change and variability, little has been done to understand the impact of these climatic transformations on the rural poor especially in marginalized communities like Bikita. It is against this backdrop that the author observed paucity on research that focuses on the impact of climate variability on the agricultural activities of the rural poor as well as the adaptation strategies that these rural poor devise to cope with the catastrophic effects of climate variability like food insecurity. Moreso, the majority of studies pertaining to the effects of climate change and variability on the agricultural sector have been carried out for and in either industrialised countries or urban areas, thereby ignoring specific impacts of climate change and variability in the rural communities of the developing world that often proffer more complex and different realities of the phenomenon of climate change and variability. Of note is the fact that the few studies that have tried to understand the impact of climate variability on agriculture have tended to be biased towards how climate variability affects cash crop production. This paper however takes a paradigm shift by looking at how climate change and variability impact on food crops that are critical for food security in marginal areas like Bikita. It has been further noted that most of the research on climate variability and agriculture has been carried out within climatic or agricultural fields. Consequently, the sociological or social aspects have largely remained a grey area in as far as climate change and variability is concerned. Thus, the fundamental endeavour of this study is to conceal this knowledge gap through an in – depth exploration of the impact of climate change and variability as well as the various adaptation strategies that are devised by the rural poor in response to the climatic transformations. The increasing frequency and severity of droughts and floods, the periodic shift in onset of the rains, and increasing intensity of mid-season dry spells in the last 50 years have been identified in the Initial National Communications (1996) and other recent studies (for example Tadross et al, 2008) as a major consequence of climate change.

According to Diouf (2003) in Food and Agriculture Organisation report), Agriculture currently accounts for 24% of world output, and uses 40% of land area. Moreso, the agricultural sector is highly dependent on the climate and human dependence on agricultural livelihoods, particularly by the poor, is high, and so agriculture has been a focus of those

modeling the impact of climate change on poverty (Slater et al, 2007). Adoption of the rights based approach in response to climate change has thus been advocated so as to strengthen the negotiating position of the rural poor as well as to reinforce their livelihood assets, capabilities and entitlements (Slater et al, 2007; Mahiya & Gukurume, forthcoming). Developing countries tend to suffer more from the impact of climate change and variability, yet they are least able to adapt to new climatic conditions. Vulnerability thus manifests itself in poorer countries and communities due to a lack of resources or entitlements and lack of capability to respond or adapt to climate variability. It should be underscored that the ability to adapt and cope with climate variability hazards depends on economic resources, infrastructure, technology, and social safety nets (Slater et al, 2007). However, developing countries like Zimbabwe often do not have the requisite resources for these and thus are ill-prepared to deal with climate change and variability. It is worthy alluding to some influential studies conducted, such as that by Rosenzweig & Parry (1994) which examined world food supply, food prices and the number of people at risk from hunger in developing countries. Most of these studies arrived at a general conclusion that the effects of climate variability are worst felt by individuals or groups whose rights protection is already weak. Such a scenario thus traps the rural poor in a vicious cycle of poverty vulnerability which is extremely difficult to escape. Against such a backdrop, it has been argued that climate change and variability is a serious risk to poverty reduction and in fact threatens to undo decades of development efforts. The Johannesburg Declaration on Sustainable Development states that, "the adverse effects of climate change are already evident, natural disasters are more frequent and more devastating and developing countries more vulnerable." The impacts of climate change and variability, and the vulnerability of poor communities to these, vary greatly, but generally, climate change is superimposed on existing vulnerabilities. It has been further underscored that climate change and variability will further reduce access to drinking water, negatively affect the health of poor people, and will pose a real threat to food security in many countries in Africa (Chino et al, 2010). According to Ellis (2000) in sub-Saharan Africa reliance on agriculture tends to diminish continuously due to the effects of climate change that have undermined the sustainability and reliability of the agricultural sector. It has also been noted that the anthropogenic signal of climate change has been detected in Africa and Asia with strong statistical significance, making mitigation strategies a sensible option, especially in sub-Saharan Africa, where the highest concentrations of rural poor relying on agriculture reside. As such, agriculture is extremely critical in sub-Saharan Africa in terms of subsistence, contribution to the GDP (about 35 percent), employment (70 – 80 –per cent of total labourforce) and foreign exchange earnings (about 30 percent) (Abalu & Hassan ;1998). What is more is that in Bikita agriculture is the main source of livelihood and by extension food security.

METHODOLOGY

This study is largely grounded in qualitative methodology. This study was done in the fragile district of Bikita (Masvingo province) in Zimbabwe. The ecological fragility of Bikita determined the choice of research site given the nature of study on climate change and variability. The study period of this research extended from December 2011 to May 2012. Initial fieldwork was started in mid December 2011 and ended in May 2012. In soliciting information, the study utilised a triangulation of methods that included unstructured interviews with farmers, key informant interviews with NGO officials and agricultural experts, three focus group discussions with farmers and officials as well as secondary sources of data. A total of 40 farmers were purposively sampled for interviews while four experts were selected as key informants. Interview questions were reviewed by experts in climate change and variability for both content and validity. Secondary sources used to corroborate primary data included climate change publications, NGO publications and Government publications on climate change.

RESULTS AND DISCUSSION

Recurrent heat waves and their impact on Crops in Bikita. Bikita district being in agro-ecological region V experiences minimal rainfall and experiences successive bouts of heat waves and droughts. Mutekwa (2009) also noted that in some cases, floods and mid-season prolonged dry spells have been experienced during the same season. As such, it has been observed that climate change and variability has made rainfall frequency erratic and unreliable, making it extremely difficult for peasant farmers in Bikita to invest in agricultural activities. Moreso, increased frequency of extreme weather events in the province and particularly in Bikita are depressing yields by damaging crops at key growth stages. Due to recurrent and protracted heat waves, the author observed extreme wilting of crops in the fields which has exacerbated the food insecurity profiles of the farmers in Bikita. This finding is consistent with arguments made by Slater et al (2007) who posited that climate change is drastically reversing and slowing the poverty reducing capacity of agriculture, simultaneously eroding the source of income and livelihood for the rural poor. This has aggravated food insecurity and vulnerability to hunger and poverty in Bikita and surrounding districts. This trend is likely to persist and worsen as the district has witnessed perpetually declining agricultural productivity over the past four years. The general rise in temperatures has already brought enormous and varied changes in weather patterns with untold suffering ensuing for the poor rural farmers in Bikita. This scenario is worsened by the fact that most of the peasant farmers in Bikita have no adaptive capacity due to poverty and reliance on relatively basic technologies. It is against this background that the effects of climate change and variability have been felt disproportionately by poorer communities such as Bikita where the majority if not all of the people are dependent on agriculture for livelihood. It has been observed that Zimbabwe in general and Bikita in particular has witnessed marked transformations in the climatic conditions which are critical for sustainable agricultural activities. There has been a general increase in temperatures, declining rainfall, deteriorating soil moisture and fertility as well as the shortening of the crop growing season. All these have coagulated to impinge on agricultural productivity in Bikita and consequently making people vulnerable to food insecurity. This is corroborated by conclusions made by New et al (2006) who noted that there are glaring indications of decreasing total precipitation, showing a gradual slide towards drier conditions. Moreso, excessive heat waves have also caused poor crop germination which in turn forced peasant farmers to invest even more money by buying new seeds for replanting. A number of farmers interviewed acknowledged that they are making colossal losses due to climate change and variability. Moreso, it was noted that the dry spells in Bikita and surrounding areas have become more frequent and devastating in recent years. This has also led to the plunging of agricultural productivity in Bikita, thereby compounding poverty levels in the area. Loss of livestock in the area has also been very rampant due to poor pastures as a result of inadequate rainfall. This also further compounded the vulnerability of many rural households to poverty and other livelihood shocks. Moreso, it emerged that production of the country's staple food, maize, in Bikita has been on a chronic decline. This has largely been attributed to poor rains and subsequent heat waves that have compounded the wilting of grown crops and poor germination of planted seeds. Worst still, the decrease in precipitation coupled with an increase in temperatures has led to the nose – diving of agricultural productivity and deterioration of pastures for livestock. The situation has been intensified by the inherent dryness of the district.

Given the fact that water availability is a key component of agricultural productivity and by extension food security, erratic rainfall thus constrained the sustainability of agricultural activities especially in regions that naturally receives very low annual rainfall like Bikita. Worst still, semi-arid regions like those in agro – ecological region v where Bikita district lies are suffering even more reduced rainfall and increased evaporation, all of which have negative ramifications on the agricultural activities of the rural poor. Due to the unreliability of agriculture as a livelihood activity, most people in Bikita have adopted alternative livelihood activities such as firewood trade and brick moulding. This however even compounds the

problems that confront the rural poor since the cutting down of trees and excavating of the earth for brick moulding exacerbates the process of increased desertification and land degradation. This is largely because the successive droughts in Bikita have compelled villagers to unsustainable utilization of fauna and flora thereby exacerbating environmental degradation. This confirms findings made by Downing (1992) who argued that successive droughts, rocketing input and transaction costs combined with the inability of the formal institutional network to deliver services undermine the capacity to manage food security. Research has also shown that the effects of climate change and variability are significant for low input farming systems, such as subsistence farming that is located in marginal areas like Bikita.

What should be underscored is that the perpetual decline in rainfall and skyrocketing water shortages in the region poses serious implications on rain-fed agriculture which predominates in Bikita district. Harvest failures are perpetual in most parts of Bikita. In their study in Zimbabwe Matarira et al (1995) established that maize yields, the most widely grown crop in Zimbabwe, decrease dramatically under dry land conditions in some regions (sometimes up to 30%), even under full irrigation conditions due to temperature increases that shorten the crop growth period. Moreso, empirical fieldwork data gives credence to McGuigan et al (2002) who argued that water is fundamental to many industrial activities (food processing, heavy industry, cooling) and hence water shortages could slow down the industrialization processes. Given their meager resources, the rural poor in Bikita acknowledged that they have limited capacity to cope with climate variability and extremes. It is against this background that without meaningful adaptation and mitigation policies in Zimbabwe, climate change and variability has presented insurmountable challenges in the agricultural activities of the villagers in Bikita. With these changes Bikita has suffered from endemic agricultural stagnation leading to chronic food crisis and poverty since the majority of the people are directly dependent on agriculture for livelihood. So serious is the climate variability problem in Bikita that without meaningful adaptation and mitigation strategies, the attainment of poverty eradication in Bikita and in the country at large will remain elusive. This is likely to have negative ramifications on the environment and sustainable development goals. Considering that the agricultural productivity is critical meeting the Millennium Development Goals (MDGs) and the reduction of poverty, climatic change and variability amounts to a serious obstacle to the attainment of MDGs especially those pertaining to poverty eradication. Worse still, these adverse climatic changes and variability have also coincided with the socio – economic and political quagmire as well as the negative effect on agricultural production of inflation, forex shortages and deepening market failures. As a result Zimbabwe has experienced a sharp decline in grain production shifting from being a net food exporting to a net food importing country. This is especially worse in regions like Bikita which are domiciled in the agro – ecological region V which naturally has high temperatures and receives very low annual rainfall. With declining agricultural productivity, most rural villagers in Bikita are vulnerable to a plethora of livelihood shocks since most of them are directly dependent on agriculture for livelihood and their ability to respond to risks and shocks is substantially weakened by compound and sequential shocks. In light of this, it has been observed that these shocks and other livelihood challenges have coagulated to lead to a steady depletion of households assets in most villages in Bikita. The author therefore asserts that climate change and variability in Bikita has emerged as a fundamental driver of poverty and vulnerability in this area. Bird & Busse (2007) argued that the hardship experienced by poor people due to the effects of climate variability will create 'irreversibilities' or deficits in capabilities and functionalities that will be difficult and expensive to later reverse or mitigate.

Due to unreliable rainfall and successive hot periods, there have also been consecutive droughts in Bikita which have aggravated the villagers' downward spiral of food insecurity. It has been further observed that rainfall and climatic regimes have been highly unpredictable for the past few years, characterized by recurrent droughts of varying severity. This finding confirms conclusions made by Mutekwa (2009) who argued that the unpredictability of precipitation presented more challenges to the farmers than any other climate change elements. The most serious droughts in Bikita tends to occur at a ten year interval with the

notably serious droughts being experienced from 1982, 1992 and 2002, with evidence of an even serious drought this year already visible. Due to prolonged hot periods there have been massive crop failures in Bikita and surrounding areas. There has also been lack of fodder for cattle which led to the death of livestock in Bikita. Such a scenario has made Bikita a chronically food – deficit region susceptible to declining per capita food production. This finding is in tandem with conclusions made by Chazovachii et al (2012) who noted that due to global warming, rainfall declined by 8% leading to increased mid-season dry spell durations in sub Saharan Africa. Such a scenario has meant that most smallholder peasant farmers in Bikita are directly threatened by food insecurity and poverty given their direct dependence on agriculture for livelihood. Needless to stress is that due to climate change and variability, there is a glaring mismatch on the amount of resources invested in the agricultural sector and the ultimate quantity and quality of yields obtained. What should be underscored is that climate change and variability has also tended to have secondary effects on the livelihoods of the people in Bikita who have resorted to selling livelihood assets like livestock to survive. This depletion of such important household assets thus makes them more susceptible to chronic food insecurity and consequently traps them in a vicious circle of abject poverty.

Crop and Livelihood Diversification as an adaptation strategy to Climate change in Bikita. To reduce the risk of crop failure and livelihood vulnerability, peasant farmers in Bikita have not only resorted to diversification of crops but also diversified their livelihood activities. In this paper rural livelihood diversification is used to refer to ‘the process by which households construct a diverse portfolio of activities and social support capabilities for survival and in order to improve their standard of living’ (see also Ellis, 2000). It emerged that peasant farmers in Bikita responded to climate change and variability by diversifying their range of crops, switching to drought-resistant crops like rapoko, millet and sorghum. Crops like finger millet are more drought – tolerant and, therefore, insensitive to temperature rise which makes them attractive in drought prone areas like Bikita. This has also been corroborated by scholars like Chenje & Solar (1998) who posited that the risk and uncertainty brought by climate change such as drought, encouraged society to engineer a variety of contingent responses to drought using a combination of options and diversification of crop varieties and livelihood strategies. However, some of the adaptation strategies employed tended to have a backlash for instance some rural poor have been compelled to sell their assets in an attempt to cope with the food insecurity brought by climate variability. The author contends that such strategies are not sustainable in the long run and in fact can leave the poor without any alternative source of income and hence they become even more vulnerable to food insecurity and poverty like never before. In the wake of Bikita’s climate variability crisis, the author argues that crop and livelihood diversification could become a catalyst or basis for broad-based adaptation strategy for sustainable livelihoods thereby solving Bikita’s food security challenges and climate variability catastrophe. This is consistent with Gukurume et al (2010) who argued that with the advent of climate change the reduction of poverty has become one of the most compelling challenges of our time.

The researcher asserts that crop diversification is the panacea to climate variability challenges. This strategy has proved to be successful in Bikita with a number of respondents highlighting that they have moved to new crop varieties that are relatively drought resistant and hence can withstand the long dry spells that are rampant in Bikita. Moreso, small livestock production has also been on the increase in Bikita. It was observed that animals like goats, sheep, roadrunners and indigenous poultry are becoming dominant as people try to cope with droughts. These small livestock like the small grains are especially adapted to these drier areas, making them ideal for drought – prone areas like Bikita. Consequently, small grains and drought resistant crops like sorghum, millet and rapoko have become the most dominant crops in Bikita and the rationale has been that they are adaptable to both climate variability and poor soils. This finding has been corroborated by Chazovachii et al (2012) who argued that such crops are not only drought resistant but also tend to be resistant to pests and diseases that may threaten them. These crops are also vital for the people in Bikita given their socio – cultural and economic significance. Of note is the fact that

these aforementioned crops are used to brew traditional beer in Bikita locally known as “Ndari” or “7 days”. This traditional beer provided an alternative source of income for many people who brew it commercially. Moreso, this traditional beer is also brewed for traditional rituals such as rainmaking ceremonies (*mukwerere*), death rituals (*kurova guva*) and other community projects such as “*nhimbe*”, where the community collaborates collectively in their agricultural activities and then later on drinks this traditional beer. Given the shortage of agricultural labour in Bikita due to migration and the HIV and AIDS scourge, *nhimbe* becomes an effective strategy of pooling community labour in agricultural activities for many households in Bikita. These drought resistant crops have thus become extremely important to the local community given the fact that they double as both food and cash crops which enables the smallholder farmers to adapt to climate change and variability and attain sustainable livelihoods. Chazovachii et al (2012) argued that the 1996 regional workshop on climate change promoted the production of small grain crops such as sorghum, pearl millet, finger millet, cowpeas soya beans and groundnuts as panacea to counter the effects of drought that are a direct consequence of climatic variability. What should be underscored here is that small grains can endure long periods without rainfall and also require less plant food hence they tend to mature early. Diversification into various crop varieties thus offered a pathway out of poverty for many smallholders in Bikita. It emerged that the cultivation of legumes (such as beans) towards the end of the rain season has become popular in Bikita. The advantage of legumes is that they mature fast and hence would be hardly affected by such climatic variability and change. Moreso, mixed cropping has also been adopted by several farmers in Bikita in an attempt to adapt to the effects of climate change and variability. In response to shortening growing and rainfall seasons, a number of farmers interviewed highlighted that they are contemplating changing their planting and harvesting periods. In the quest to do this, accessibility to climate change information and timely weather forecasts becomes critical to assist farmers in timing the planting period to coincide with the onset of the rains.

A number of NGOs like CARE International, Concern Worldwide and ActionFaim operating in Bikita have been introducing new crop varieties that are able to withstand the long and protracted hot spells that have become a daily reality not only in Bikita but countrywide due to climatic changes and variability. It is against this background that livelihood diversification has become fashionable in Bikita as a risk spreading strategy to the unpredictability of agricultural activities. Empirical evidence from a variety of different locations in Bikita points to the fact that rural households are indeed engaging in a plethora of livelihood activities and rely on diversified income portfolios. Given the perpetual plunge in agricultural productivity, it was observed that a number of households had resorted to a diverse livelihood means, rely on a multiplicity of economic activities within a year. Diversification of livelihood activities thus widened the smallholders’ sources of income and hence enhanced sustainable livelihoods and food security. A number of smallholder farmers are diversifying their livelihood portfolio to include activities like engaging in menial jobs “*maricho*”, petty trading, commercial brick moulding, firewood trading and beer brewing among many other activities. What is more is that diversification or working in different activities helps to spread risk and manage uncertainty. It was observed that insufficient returns from agriculture were the fundamental factor compelling a number of households in Bikita into livelihood diversification. Consequently, diverse activities are normally undertaken as an ex-post coping response to shortcomings in other activities such as agriculture which has been chronically characterised by failed harvest owing to drought emanating from climatic changes occurring in Bikita. It is against this background that the author argues that there is vivid evidence that points to livelihood diversification in Bikita as smallholder struggle to cope with the effects of climate change and variability on their agricultural activities. In light of the foregoing, Ellis (2000) asserts that livelihood diversification has become an effective and reliable survival strategy for rural households in developing countries. This is so because due to the effects of climatic change and variability, farming on its own is increasingly failing to provide a sufficient means of survival in rural areas. In the same vein, Ellis (2000) argued that considerations of risk spreading, consumption smoothing, labour allocation smoothing

and coping with shocks such as climate variability contributes more to the adoption, and adaptation over time, of diverse rural livelihoods. It has been observed that some of the activities devised by smallholder farmers as alternative livelihood strategies tend to have negative effects on the environment and environmental resources, thereby raising questions to the sustainability of such strategies. More often than not after crop failures, the poor smallholder farmers inevitably carried out extractive practices in local environments for survival. This is worsened by the fact that most environmental resources in Bikita are susceptible to open access by virtue of being common pool resources or communally owned resources. Such a scenario has been slowly degenerating into what Garret Hardin (1969) termed the “Tragedy of the Commons” whose backlash produces and reproduces vulnerability and poverty among the very same smallholders. It is against such a background that questions about the sustainability of these activities can be asked since these may ironically reinforce the poverty which smallholders are trying to escape from. The author’s general observation however concurs with arguments made by Ellis (2000) who notes that a diverse portfolio of activities contributes to the sustainability of a rural livelihood because it improves its long-run resilience in the face of adverse trends or sudden shocks such as climate change.

It was also observed that in Bikita, traditional knowledge and indigenous knowledge systems (IKS) has also been extremely useful in both adaptation and mitigation strategies devised by the smallholder farmers. It emerged that through meticulous study of plant and animal behaviour such as bird species like (*Dendera and Mafudzamombe*) people could easily predict the likelihood of a severe drought or low rainfall and thus would be able to adequately prepare in advance for the impending climatic catastrophe. These traditional coping strategies are largely based on experience that have been accumulated over the years and transmitted from one generation to the other. Mutekwa (2009) thus argued that lessons learnt from previous climatic stresses provide important entry points for social learning and enhanced adaptive capacity to both wetter and drier periods now and in the future. Moreso, traditional myths and beliefs were also of paramount significance in Bikita in the quest to promote sustainable utilisation of critical resources like water, wild fruits, pastures and other resources. For instance in Bikita it is taboo for one to harvest fresh trees as well as contaminating water sources. The study revealed that there are also traditional in-built mechanisms of adapting to livelihood shocks in Bikita. In time of agricultural catastrophe the “Zunde raMambo” system acts as a local social safety net for the poor and vulnerable members of the community. Zunde raMambo is a Shona phrase which means “the Chief's granary”. The Zunde was a common field designated by a chief for cultivating food crops by the community. The harvest was stored in a common granary under the direction of the chief. The primary aim of the Zunde was to ensure that a community had food reserves which could be used in times of food shortage (Mararike 2000). Zunde raMambo, provided for the contingency of famine and chronic poverty, and was useful in alleviating the plight of vulnerable members.

The “Dhiga Udye” Conservation farming project as an adaptation strategy to climate variability. The author also observed the emergence of new cropping systems as an adaptation to climate change and variability in Bikita and surrounding districts. New cropping systems such as zero tillage as well as minimum tillage have been widely introduced by various stakeholders such as NGOs under the name “*Dhiga udye*” or conservation farming. This new cropping system has been widely embraced by NGOs as conservation agriculture which enhances food security in drought prone regions like Bikita. Gukurume et al (2010) noted that the Dhiga udye conservation farming has been embraced as the antidote to the impact of climate change and variability on agriculture in drought prone areas like Bikita. To improve crop production in marginal rainfall regions, such as Bikita, rural farmers are consequently adopting farming practices that conserve fragile soils and improve its fertility. It is against this background that conservation farming locally known as *Dhiga udye* (Dig and survive) has been emphasised as an ideal adaptation strategy to climate change and variability in most drought prone areas in Zimbabwe like Bikita. Due to climate change and variability conservation farming is being promoted as a panacea to the agricultural

production challenges confronting rural smallholder families in Bikita, in particular, and Masvingo province, at large. This gives credence to Gukurume et al (2010) who argued that conservation farming practices hold the promise of providing both a strategy for mitigating climate change and also working as an adaptive mechanism to cope with climate change and variability. Conservation farming has likewise promoted the introduction of small grains drought resistant crops like rapoko, millet and sorghum in Bikita. On top of these transformations in cropping systems, there has also been emphasis on short – season crops that mature earlier than the maize varieties which normally takes a long time to mature. Mayhew & Penny, (2008) blatantly asserts that maize varieties dominant throughout the country by virtue of being the staple are too physiological and take between 90 to 200 days to mature hence during drought periods they do not do well as compared to small grains. Thus, Dhiga udye has promoted zero tillage conservation farming and the planting of drought resistant small grains as the antidote to the food insecurity challenges confronting most villagers in Bikita and surrounding areas. Under this Dhiga udye programme, CARE International provides smallholder farmers with inputs, mostly seeds and fertilizers. A number of farmers argued that advice from both Agricultural Extension Officers and NGOs that are involved in various food security activities in Bikita have been of paramount significance to them in adapting to climate change and variability. Mutekwa (2009) noted that conservation tillage, for instance, is a useful option for improving the storage of rainwater in the soil and can help mitigate agricultural drought. However, it is paramount to note that it requires adequate draught power, appropriate machines, and good training of farmers to be effective. This unfortunately has not been forthcoming from the NGOs in question. Against such a background, Mutekwa (2009) asserts that conservation farming is only for those farmers who are endowed with more livelihood assets that mainly adopt conservation tillage as compared to those with limited assets. Consequently, while conservation farming as an adaptation strategy has been successful in other parts of the country, it should be underscored that in Bikita conservation farming has not adequately yielded its desired results. Of note is the observation that in Bikita the provision of farming inputs under CARE International’s “Diga Udye” Conservation farming project has not shown any meaningful improvement in agricultural productivity. It has however been observed that the number of households practising Conservation farming in Bikita is increasing due to the increasing threat posed by climate change and variability as highlighted by Figure 1 below.

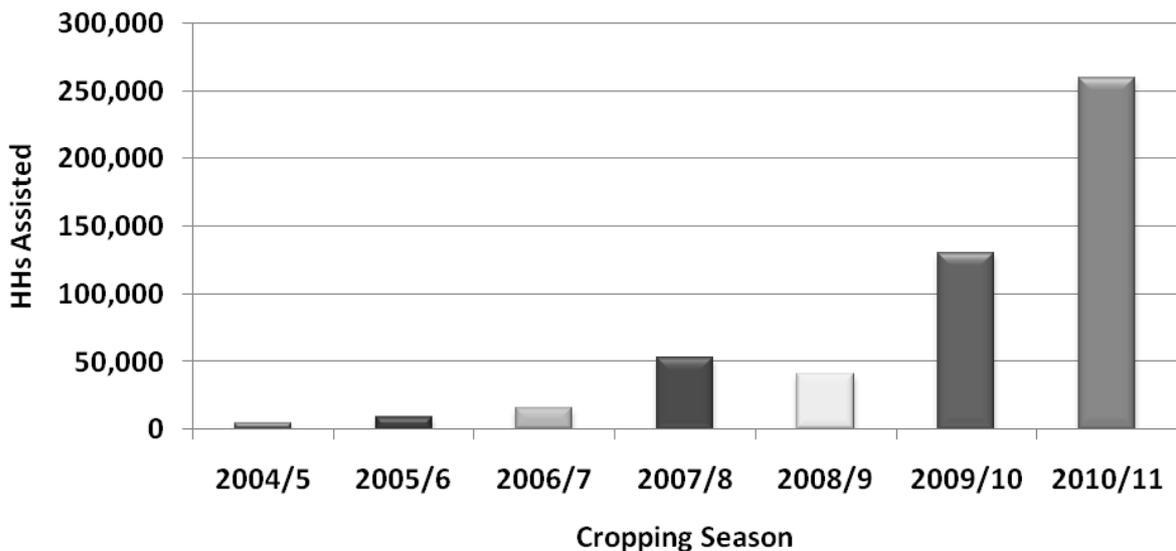


Figure 1. Trends in number of Households (HHs) Practising Conservation Agriculture in Zimbabwe since 2004/5

Source: Mvumi GRM International Transforming Livelihoods Document

This increase can be partly attributed to the assistance availed by the various stakeholders promoting conservation farming in drought prone areas like Bikita. In some parts of Bikita, a number of NGOs have been providing food aid rations to offset food shortages due to the recurrent poor harvests. However, it should be highlighted that provision of food handouts tends to create a chronic dependency syndrome as peasant farmers get reluctant to grow their own food crops, knowing fully well that they will get food rations in the subsequent seasons. Nutrition gardens locally known as "*Mishandirapamwe*" have also been revived and are being supported by a number of NGOs in Bikita in an attempt to improve food security and adapt to the negative effects of climate change and variability on food security.

Harnessing of social capital as an adaptation strategy to climate change and variability. Social capital is the third form of capital employed by the people in Bikita to adapt to the effects of climatic variability. As used by Putnam (1993) social capital refers to networks of repeated social interaction that reinforce social norms, especially trust. Moreso, social capital entails the quality and quantity of associational life and the related social norms (Narayan and Pritchett, 1999). The concept connotes complex sets of relationships between members of social systems at all scales, from interpersonal to international. Networks were created between the rural poor and various stakeholders such as civil associations and NGOs that are assisting the people with adaptation and mitigation strategies such as new cropping systems introduced by Action Faim and CARE International in Bikita and other surrounding districts like Zaka and Chivi. Social capital in Bikita fostered community cohesion within many villages which enabled the communities to withstand the effects of successive droughts. Community cohesion in this paper refers to the aspect of togetherness and bonding exhibited by the people of Bikita, the "glue" that holds a community together. This includes features such as a sense of common belonging or homogeneity. The various collective adaptation strategies salient within the research point to the fact that community cohesion/solidarity helped in adaptation as well as absorbing shocks that confronted the peasant farmers in Bikita. Community cohesion in Bikita was manifesting through the sharing of scarce resources such as water, wild fruits and food. It emerged that some community members with boreholes and wells would allow other members to fetch water free of charge. Thus, in this case, the author argues that social networks constituted a 'productive adaption resource' to the peasant farmers in Bikita since being embedded in webs of social relationships, peasant farmers gained access to niches of sustainable livelihoods. As a result social networks enabled them to be dynamic and highly adaptive in the face of livelihood threats like successive droughts and subsequent food insecurity. Despite the fact that the peasant farmers in Bikita were enmeshed in a vicious circle of mutually reinforcing traps in which they seemed to have no discernible route to escape, social networks enhanced the 'ontological security' of these peasant farmers through offering assistance in adapting to these climatic changes and variability. Against this background it thus becomes paramount to argue that social capital is a crucial resource for the rural poor in their adaptation and mitigation strategies to climatic changes and variability. The Zunde raMambo practice mentioned before in Bikita is also testimony to the significance of community cohesion. This is corroborated by Dhemba et al (2002) who argued that historically; Zunde raMambo was used not only to produce communal crops for food security, but also as a social, economic and political rallying-point for the community. It should thus be argued that the Zunde raMambo ensured protection in the event of drought or poor harvests. All these bear testimony to the significance of social capital in adapting to climate change and variability.

CONCLUSION

The foregoing paper highlighted that climate change and variability has posed insurmountable stress on the sustainability of agricultural productivity among peasant farmers in Bikita. While a greater number of the communal farmers expressed ignorance about the threats posed by climate change and variability, most of them acknowledged drastic changes occurring in their areas that have had negative ramifications on agricultural

productivity. Some of the farmers noted that they had already adopted some adaptation strategies to the harsh climatic conditions that have prevailed over the years in their areas. It was argued in the paper that communities in marginal areas like Bikita have already started to experience the negative ramifications of climate change and variability. It was observed that there are drastic changes in the rainfall patterns and temperatures and these changes have adversely affected agricultural productivity in Bikita. This inevitably threatened the sustainability of agriculture as a livelihood activity for many peasant farmers. Inasmuch as climate change and variability is impacting on the agricultural activities of communal farmers in Bikita, it should be underscored that these farmers have not remained as passive victims. In fact, they have responded by adopting drought – resistant crops, short –season crops, conservation farming strategies like zero tillage as well as harnessing indigenous knowledge systems to predict climatic patterns among other adaptation strategies. Traditional myths and beliefs as well as other indigenous knowledge systems (IKS) were also crucial in enabling sustainable utilisation of critical resources in Bikita like water, pastures and other natural resources. There was a general consensus among many farmers in Bikita that climate change and variability being experienced is leading to significant agricultural transformation especially reductions in agricultural productivity. It is argued that these climatic transformations are threatening the sustainability of the agricultural activities in Bikita. Moreso, the fact that Bikita lies in agro – ecological region v has meant that without availability of water there is hardly any agricultural activity possible. As such, shifts in seasonal precipitation being experienced have adversely affected productivity. It was revealed in the study that there is an increase in the distress sale of household assets like livestock in an attempt to cope with the effects of climate variability. However, this tended to have a backlash as it eroded the critical assets thereby plunging many people in a vicious cycle of poverty and food insecurity.

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