

The Effects of Climate Change and Variability on Food Security in Zimbabwe: A Socio-Economic and Political Analysis

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Abstract

The paper examines the widespread effects of climate change and variability on food security in Zimbabwe. Climate change has posed a serious threat on food security in developing countries in Africa. This has led developing countries to heavily rely on foreign aid in the form of food hand-outs to avert hunger. The shift in climatic conditions over the sub-Saharan region towards semi-arid to arid conditions has stemmed up a lot of concern as to whether Africa can feed itself. The past three decades have been characterized by an erratic rainfall pattern over Africa's sub-tropics and a significant decline in the amount of rainfall. This has resulted in droughts which have significantly affected agriculture and food production. Crops and livestock have failed to quickly adapt to these harsh climatic conditions. Research on the impacts of climate change in Zimbabwe shows that the country's agricultural sector is already suffering from changing rainfall patterns, temperature increases and more extreme weather events, like floods and droughts. Longer and more frequent droughts have substantially reduced crop yields and this has negatively impacted food production in the country. A shift in the country's agro-ecological regions has been observed and this shift has been attributed to climate change. The paper analyses the various drought mitigation measures that the government of Zimbabwe has put in place to avert the effects of climate change. It has become apparently clear that the only way Zimbabwe will be able to out-run the effects of climate change on food security would be to scale up production in the agricultural sector by setting up schemes to assist farmers so that they attain the maximum crop yields. These measures are analyzed, looking at their strengths and shortfalls. The paper takes an interesting turn as it analyses the social impact of climate change and its ability to influence changes in Zimbabwe's political landscape. The shortage of food and depletion of water resources has a greater chance of triggering the escalation of conflict which may influence shifts in the country's balance of power.

Key words: Climate change and variability, food security, agricultural sector, political landscape

1.0 Introduction

The increase in greenhouse gas emissions is raising the earth's temperature and the consequences include varying precipitation, extreme weather events (droughts and floods) and shifting of seasons. The rapid pace at which climate change is taking place, combined with the increase in global population and slow income growth, threatens food security globally. Agriculture has proved to be extremely vulnerable to climate change as seen by the drastic decline in food production over the past two decades. High temperatures that are being experienced in most parts of the globe will eventually reduce yields of desirable crops while encouraging weed and pest proliferation. The changes in precipitation patterns will significantly increase the likelihood of crop failures and production declines (Nelson et al, 2009: vii). Although scientific evidence proves that there will be gains in some crops in some regions of the world where the climate has shifted towards favourable conditions, the overall impacts of climate change on agriculture are expected to be negative, threatening global food security. Populations in the developing world, which are already vulnerable and food insecure, are likely to be the most seriously affected by climate change. In 2005, 2.5 billion people, contributing nearly half of the economically active population in developing countries relied on agriculture for their livelihood (Feyissa, 2007: 103, Nelson et al, 2009: vii).

In developing countries, agriculture is an important industry catering for the livelihoods of many people. 75% of the world's poor live in rural areas where agriculture is their main source of income and it is in these areas that the effects of climate change have been drastic because of lack of proper infrastructure such as irrigation systems (Nelson et al, 2009: vii). Developing countries continue to bear the brand for a crime that they have not taken part in committing. It is the developing countries who are emitting high volumes of greenhouse gases but it is the poor developing countries that will have to suffer ultimately because they lack adequate funds to engage in effective and efficient climate change mitigation programmes. The release of greenhouse gases by highly industrialized countries such as Japan, India, China and the United States of America has accelerated the depletion of the ozone layer leading to drastic climate changes that have affected food production across the globe.

Climate change and variability have resulted in a shift in the rainfall patterns in many parts of the world. Zimbabwe has not been spared of these drastic changes in the rainfall pattern. Zimbabwe's agro-ecological zones (AEZ) have shifted drastically due to the devastating effects of climate change and global warming. Zimbabwe comprises of five AEZs (Natural regions I-V) and most of the agriculture is done in natural regions I, II and III which have favourable climatic conditions for crop production. Regions IV and V are characterized by low annual rainfall activity and comprise of the country's low lying areas, known as the low veld. According to a research that was carried out by Mugandani (2012) major shifts have occurred in the drought prone Regions IV and V which have become drier than previously experienced. According to the research, significant changes have been experienced in the size, structure and composition of the five natural regions.

The two main food producing regions in Zimbabwe, that is, NR II and III have shrunk significantly. Region II has shrunk by 49% while region III has shrunk by 14%. These changes in size of region II and III point to a possible reduction in food production and thus problems of food security in Zimbabwe. The dry regions, that is, region IV and V have expanded by 5.6% and 22.6% respectively (Mugandani et al, 2012: 365- 367). What this shows is that Zimbabwe's climatic conditions are drifting towards relatively arid conditions that are not favourable for agriculture. Zimbabwe has an agro-based economy that heavily relies on agriculture. Climate change has greatly affected agriculture in Zimbabwe and this has consequently resulted in food insecurity, increase in unemployment and a reduction in foreign currency earnings which has greatly crippled the economy. The negative influence of climate change and variability on agriculture in Zimbabwe has culminated into a hydra whose effects have choked the country's economic growth.

The shifting of natural regions' boundaries observed in Zimbabwe strongly points to climate change and variability. The effects of climate change are evident in Zimbabwe's increasing variability in rainfall patterns, high average temperatures, increased frequency and extremity of droughts and floods. Despite other factors that have affected Zimbabwe's agricultural sector such as the agrarian land reforms, climate change has played a major role in destabilizing food production in the country. In the 2011/12 season, Zimbabwe was forced to import over 50% of its maize requirements (The Zimbabwean, 2012). This has mainly been attributed to a reduction in the amount of rainfall received annually which has greatly affected yields of the maize crop.

About 200 million people in sub-Saharan Africa lack adequate food for a healthy and active life (Feyissa, 2007: 103). This has been exacerbated by record food prices and drought which are pushing more people into poverty and hunger (Feyissa, 2007: 103, Nelson et al, 2009: 1). The effects of climate change have been grossly felt by African countries that are already grappling with scarce food reserves and poverty. This paper looks at the social, economic and political challenges arising from climate change in Zimbabwe. It also examines the various measures that the Government of Zimbabwe has adopted to mitigate the effects of climate change and assess their effectiveness in sufficiently dealing with the issue.

This analysis also looks at how socio-economic and political problems are disproportionately multiplied by climate change and variability. Climate change and variability amplifies stresses on the socio-political fabric because it affects the governance of resources which may result in social unrest within a country. The study links this social unrest to the weakened mitigation and adaptation capacity of societies that are already facing economic challenges such as rising food and fuel prices. Due to these challenges, society becomes highly vulnerable to climate induced conflicts which are exacerbated by poor central leadership and weak institutions.

2.0 Methodology

A holistic approach was assumed to evaluate the effects of climate change on food security in Zimbabwe. The paper explores social, economic and political challenges arising from climate change. A quantitative research approach was taken and this involved the use of unstructured interviews and general observations to obtain the relevant information on the impact of climate change. The areas covered in this study included resettlement farms (A1 and A2) and communal areas in Mashonaland Central, Mashonaland West and Matebeleland provinces. The survey was broad in its general assessments of the impacts of climate change on agriculture and food security in Zimbabwe. There was no constant in the experimental design to act as a control but comparisons between the results obtained from interviews that were conducted and observations that were made gave a concise analogy. Other relevant information pertaining to this study was obtained through documentary research from the World Meteorological Organisation (WMO) and Intergovernmental Panel on Climate Change (IPCC). Relevant literature from books, academic papers, journals, newspapers and the internet was also used. Statistical figures, graphs and tables were used to interpret and further explain the facts on climate change and food security.

3.0 Literature Review and Conceptual Framework

3.1 Climate Change

Climate change is the significant variation of the mean state of climate relevant variables such as temperature, precipitation and wind in a certain period of time, usually over 30 years (IPCC 2007: 96). These changes in the climate can be natural, resulting from the climatic system and its internal dynamics. But, climate changes can also be induced through external influences. The climate system evolves in time under the influence of its own internal dynamics and due to changes in external factors that affect climate (called ‘forcings’). External forcings include natural phenomena such as volcanic eruptions and solar variations, as well as human-induced changes in atmospheric composition (IPCC, 2007: 96- 97).

The United Nations Framework Convention on Climate Change (UNFCCC) states in Article 1 that climate change is a change of climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable time periods’ (<http://unfccc.int>). The term “climate change” is usually made in reference to changes that are induced by human activity, such as the emission of greenhouse gases and aerosols, which are shifting the atmospheric composition, causing what is commonly referred to as the greenhouse effect. Climate variability on the other hand is used in reference to naturally occurring changes in global climate, that is, changes caused without human activity. According to the IPCC (2007: 45), human impact on global climate since the beginning of the industrialization exceeds the natural processes of climate variability.

3.2 Food Security

“Food security exists when all people at all times have physical and economic access to safe and nutritious food which meets their dietary needs and food preferences for an active and healthy life” (World Food Summit, 1996). The concept of food security includes both physical and economic access to food that meets people’s dietary needs as well as their food preferences.

According to the World Health Organisation (2012), food security is built on three pillars which include

- Food availability: sufficient quantities of food available on a consistent basis.
- Food access: having sufficient resources to obtain appropriate foods for a nutritious diet.
- Food use: appropriate utilization of the available food based on knowledge of basic nutrition and care, as well as adequate water and sanitation.

Basically, food security is concerned with fulfilling each individual’s human right to food and it relates to issues of agricultural policy, economic development and trade (Garwe, 2008: 27-28). In some developing countries, the problem of under nourishment is often linked to the lack of access to food and poor distribution. The availability of sufficient food within a country does not indicate that every individual has access to sufficient food. Food security at an individual level implies that people either have a sufficient income to purchase food or they are capable of producing their own food through subsistence farming. There is a link between poverty and food security where the poor are more prone to food insecurity. Sufficient income is therefore a crucial factor in guaranteeing food security.

Poverty reduction in Africa will inevitably cascade to an improvement in food security. Since agriculture remains the largest employment sector in African countries such as Zimbabwe, there is need to boost this sector in order to alleviate poverty and hunger.

3.3 Economic impacts of climate change on Agriculture in Africa

Africa's vulnerability is a function of the sensitivity of agriculture to changes in climate, the adaptive capacity of the system, and the degree of exposure to climate hazards (IPCC, 2001: 89). The economic impact of climate change and variability on Africa is compounded by its agriculture-based economies, use of traditional technology and its dependence on small agricultural exports. Climate change is expected to lead to a 50% decline in agricultural output by 2020. This would not only endanger the food security situation but also increase the vulnerability of small-scale farmers in developing countries. The chronic hunger situation is expected to worsen due to declining water resources, resulting in a 5-8% increase in arid and semi-arid lands by the 2080s (IPCC, 2007).

Many food insecure countries in Africa are socially, economically and environmentally vulnerable and climate change has exacerbated the situation, making the realization of poverty and hunger eradication much difficult. Prolonged recurrent droughts have become a serious hazard affecting agriculture and water supplies. As droughts are becoming more common, widespread and persistent, many sub-humid and semi-arid regions in Africa now face great difficulties in sustaining viable agricultural systems. African countries have become more vulnerable to climate change because of their heavy dependence on rainfed agriculture, high levels of poverty, low levels of human and physical capital, and poor infrastructure. The unavailability of adequate irrigation infrastructure to avert the effects of droughts caused by climate change has negatively impacted the agricultural sector. The rainfall pattern over most African regions particularly the sub-tropics has become erratic and this has made rainfed agriculture less reliable in ensuring the attainment of optimum crop yields. The negative effects of climate change on crop production are especially pronounced in Sub-Saharan Africa, as the agriculture sector accounts for a large share of GDP, export earnings and employment.

Agriculture in the sub-Saharan Africa region is a leading socio-economic activity which sustains about 80% of the population. Agriculture accounts for more than 40% of exports, 30% of the GDP, 30% of foreign exchange revenue and 70% of employment making it one of the most important economic drivers (Feyissa, 2007: 103). The effects of climate change have been seen by the plummeting export earnings which have affected GDP and increased the rate of unemployment in sub-Saharan Africa over the past two decades. Climate change adaptation has become a popular agenda in research, policymaking, and program development in Africa as many people are becoming more aware that climate change is a real threat undermining social and ecological sustainability. In agriculture, it is imperative that governments engage in adaptation efforts focused on implementing measures that help build agricultural communities that are more resilient to climate change, variability and disaster (Nelson et al, 2009: 17 and Feyissa, 2007: 110). Africa's pursuit for sustainable development largely depends on its ability to adopt proper strategies that are aimed at mitigating the impacts of climate change and also on its ability to build capacity of adaptation to the new impacts. Adaptation to climate change should be prioritized by African governments as it is the only way to cushion the effects of climate change on food production (International Food Policy Research Institute [IFPRI], 2009)

4.0 Climate change in Zimbabwe

The Agriculture sector is the backbone of the Zimbabwean economy, contributing 15-20% to the GDP, 40% to exports, and 60% of the raw materials used by the domestic manufacturing industry (ZUNDAF, 2011: 9). In Zimbabwe, the past decade has seen an increase in food and nutrition insecurity at household and national levels emanating from reduced productivity and production of the main crops partly due to climate change and other socio-political events that were unfolding in the country. All this is attributed to the country's lack of a comprehensive agriculture policy framework.

Recent studies which use global circulation models show that from the current period up to the year 2080, Zimbabwe will face a general decrease in reliability and predictability of rainfall patterns while temperatures are expected to rise by 2°C (Bohle et al., 1994: 47). Such a change has a serious impact on the country's food security thus the need for contingency measures to be put in place. It is now universally agreed that climate change and climate variability are among the greatest challenges facing mankind in the 21st century.

In Zimbabwe recent concerns have been raised that no one is taking the responsibility to advise farmers on when to plant, what to plant and how to plant in line with the changing climate that has become a reality.

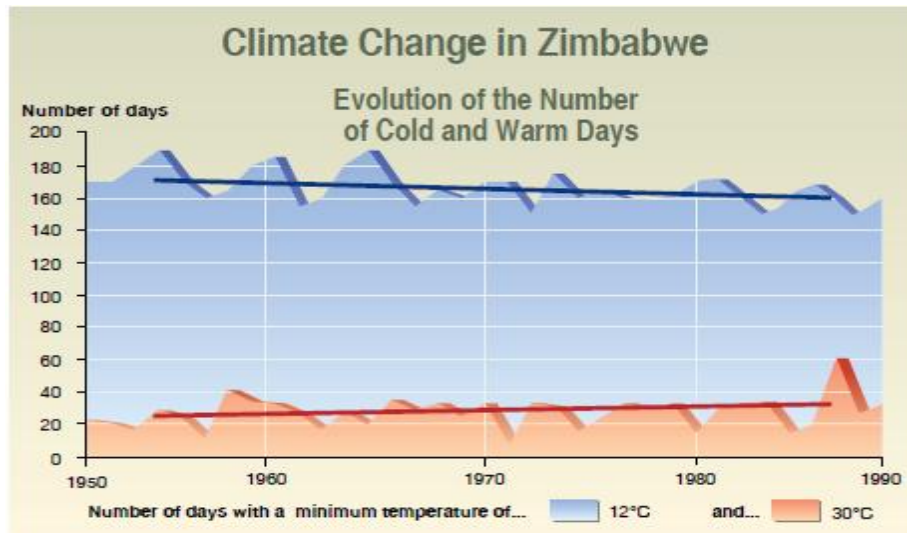


Fig 1. Climate change in Zimbabwe- Evolution of the number of cold and warm days(UNEP/GRIDA, 2002).

According to the Zimbabwe Department of Meteorological Services, Zimbabwe has increasingly seen more hot days between 1950 and 1990(UNEP/GRIDA, 2002). An increase in average temperatures by 2°C will likely cause a decrease of Zimbabwe's wetlands from 9% to 2.5% and a 4°C increase would reduce the summer water-surplus zones to less than 2% (Bohle et al., 1994: 47). This change in temperatures will affect the agricultural production, particularly for crop yields. An increase temperature of 4 °C in Zimbabwe will result in a maize yield decline by 20% in the north-east, and 27% in the south-east region, bordering Mozambique (Magadza, 1994:175).

Global climate change simulation models which include the National Center for Atmospheric Research (NCAR) model and the Commonwealth Scientific and Industrial Research Organization (CSIRO) model have revealed that the onset, cessation and duration of effective rainfall seasons have become more variable and unpredictable. In Zimbabwe, global warming has caused an increase in the average temperatures resulting in the shifting of the traditional farming seasons and agro-ecological zones (natural regions). During the 60s, 70s and 80s, droughts recurred after every 10 years. However, this trend has ceased due to the rapid changes in climatic conditions that have made the rainfall pattern across the country more unreliable and difficult to predict. By the mid-90s the frequencies of droughts and dry spells had increased to every 4-5 years and by the late 90s, the country began witnessing alternating wet and dry years every three years. Since 2000, the country's situation has worsened as droughts have become more successive from 2002-2003, 2004-2005 and 2007-2008. The successive occurrence of these droughts affected food production significantly since the government had not adopted concise adaptation measures to mitigate the impact of climate change. Month on month rainfall patterns indicate that there will be a reduction in annual rainfall during the summer (November to March) cropping season. This spells out the dire need for Zimbabwe's farming community to start adapting to changes in the climate.

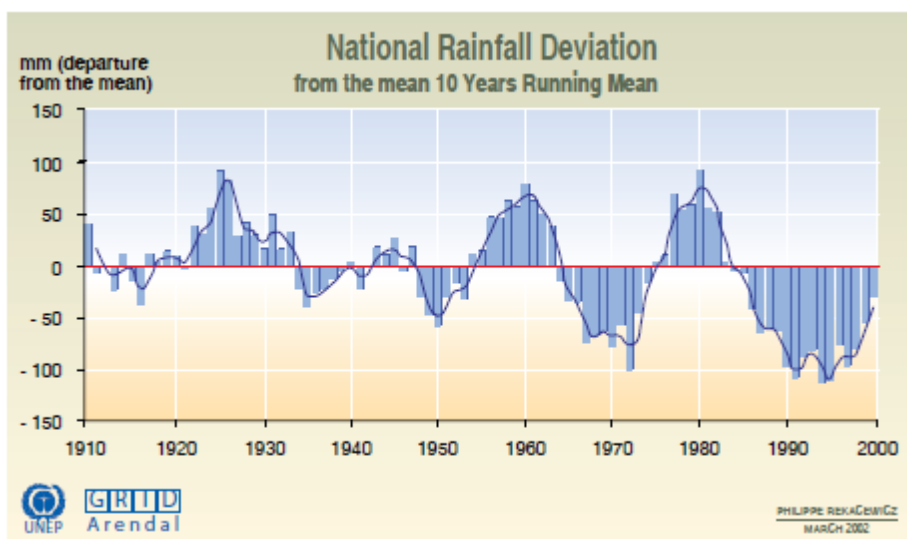


Fig 2. Graph showing Zimbabwe’s rainfall deviation from the mean (UNEP/GRIDA, 2002).

Projections are that climate change will significantly affect agriculture in Zimbabwe such that by 2080 there will be a general decrease in areas suitable for maize growing from 85% to 75% while some areas in the South Western part of the country will become totally unsuitable for maize growing (www.zbc.co.zw). In Zimbabwe, maize is the major cereal crop grown and the staple diet. This projection shows that if nothing is done to mitigate the effects of climate change, Zimbabwe will inevitably face a major food security crisis in the near future. The worst affected regions are in the drier parts of the country in the Midlands, Masvingo and Matebeleland provinces where precipitation has declined 15% since 1960 (Gogo, 2012: 8). An increase in deviation from the mean rainfall amount between the periods, 1985-2000 shows the extent to which rainfall patterns are changing across the country (Fig 2). What this implies is that there is need to promote the planting of small grains such as sorghum and millet to mitigate the effects of such changes and ensure food security.

Climate change poses a drastic threat on Zimbabwe’s agricultural industry that has continued to suffer from natural disasters and droughts recurrently. Erratic rainfall, droughts and cyclones which induced excessive rainfall and floods, contributed to poor agricultural performance in the country. In 2000, the country was wrecked by Cyclone Eline followed by Cyclone Japhet in 2003. These cyclones caused flooding in some low laying parts of the country such as Muzarabani in the Zambezi valley. Fig 3 below shows the hydrological disasters experienced in Southern Africa over the past three decades. An increase in the incidence of these disasters (cyclones) has been observed and all this is attributed to climate change. Floods associated with these cyclones as well as the droughts experienced in 2002 and 2008 also impacted negatively on agricultural production in Zimbabwe.

Table 1. Statistics of Hydrological disasters (cyclones; floods) experienced in Southern Africa from 1980-2009 (Swain et al, 2011: 43)

	No. of events			Persons affected		
	1980-89	1990-99	2000-09	1980-89	1990-99	2000-09
Angola	1	0	19	100 000	0	783 328
Botswana	1	1	3	12 000	3 500	112 603
Malawi	2	6	15	6 000	417 000	1 159 276
Mozambique	3	3	15	1 000 000	470 000	6 212 111
Namibia	0	0	9	0	0	474 300
Zambia	1	1	11	800 000	1 300 000	2 398 816
Zimbabwe	0	1	5	0	0	265 000
Total	8	12	77	1 918 000	2 190 500	11 405 434

The shifting of Zimbabwe's agro-economic zones is of great concern. The government has to engage in extensive research and offer efficient agricultural extension services to advise farmers on what crops to grow, when to grow these crops and where to grow them. Due to the absence of proper extension services to farmers, many farmers have kept up with their traditional farming practices which are no longer suitable taking into account the unpredictability of rainfall patterns across the country.

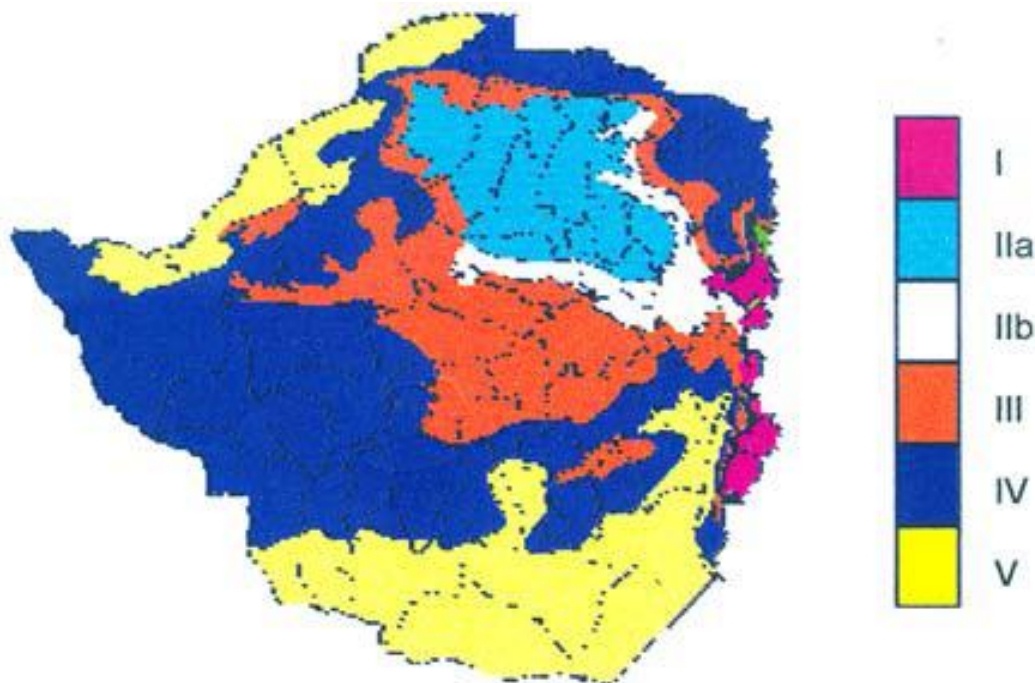


Figure 3. Map of Zimbabwe showing the Natural Regions by Vincent and Thomas (Surveyor General, 1984 In Mugandani et al, 2012: 365).

Natural Region I found in the eastern part of Zimbabwe is a highly suitable agricultural region for specialized and diversified farming. According to the agro-ecological classification conducted by Vincent and Thomas (1960) (Fig. 3), this region contributed only about 1.8% of the country's total area (7024 km²) but a recent study carried out by Mugandani et al, (2012: 366) has shown that the natural region has expanded and now covers an area almost 4% of the country's total area. Farmers in NR I grow a wide variety of high value crops which include coffee, tea and potatoes. The NR has increased by 106% (Mugandani et al, 2012: 365) but this increase does not have a significant positive influence on food production in Zimbabwe because the region is relatively small compared to the other major food producing regions such as NR II and III.

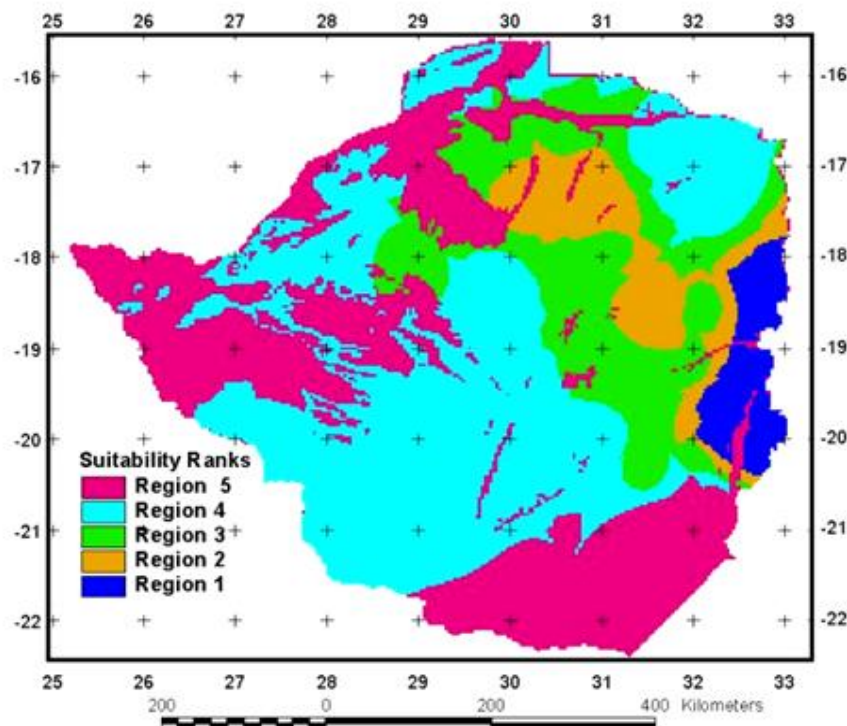


Figure 4. Map of Zimbabwe showing the new Natural Regions generated by Mugandani et.al (2012).

Table 2. Rainfall ranges for Zimbabwe’s five Natural Regions (Mugandani et al, 2012).

Parameter	Natural region				
	1	2	3	4	5
Rainfall	>1000	1000-700	700-550	600-450	<500

The area covered by NR II has drastically decreased by 49% from its previous 15% to a mere 7.6% of the country’s total area (Mugandani et al, 2012: 366) (Fig. 4). In terms of the annual rainfall amount this means that 49% of the areas which were receiving on average 700-1000mm are now receiving less than 700mm. NR II is one of the major farming regions in Zimbabwe which prides in intensive livestock production, maize, wheat, sugar bean and soybean production. This makes it a pivotal region in terms of its contribution to the country’s food security. The decrease in the size of this region has an unarguable direct impact on food production and food security in Zimbabwe.

NR III which covered 72975 km² equating to 18.7% of the country’s total area now covers 62,829 km² which translates to 16.1% of the country’s total area (Fig. 4). The area now occupied by NR III has decreased by 13.9% (Mugandani et al, 2012: 367). Farmers in NR III mainly concentrate on maize, tobacco, cotton, wheat and cattle ranching. NR II and III are pivotal in securing food for Zimbabwe as they account for a greater percentage of the country’s food production. Both regions have seen a significant decrease in size owing to climate change and this has driven some areas that were once part of these regions into NR IV and V which are characterized by low annual rainfall (<600mm).

Significant increases in the dry regions of the country have been observed where NR IV now covers 155 707 km² showing an alarming 5.6% increase in area (Mugandani et al, 2012: 367). The increase in size of NR IV is quite disturbing because the region is characterized by a low annual rainfall (450-600mm) and is relatively prone to droughts and dry spells.

NR V registered a significant increase in area and now covers 32.5% of the country's total area from its previous 26.7% (Mugandani et al, 2012: 367). The increase in the size of NR V indicates that more than a third of the country is now marginally suitable for crop production due to the relatively arid conditions experienced in this region (Fig 6). This poses a serious threat to food security in Zimbabwe because people inhabiting this region are no longer able to engage in farming activities that can sustain their livelihoods. In October of 2012 reports from the Matebeleland region, which occupies a large part of NR V, indicated that people's livestock were dying due to lack of adequate pastures and drinking water while crops such as maize failed dismally to thrive in the predominantly arid conditions. All this is attributed to the drought conditions that are now prevailing over the region due to climate change. This analysis of climate change brings out the shocking truth that climate change is indeed a real threat whose devastating effects will inevitably undermine the government's consented efforts to ensure food security in Zimbabwe if stiff drought mitigation action is not taken.

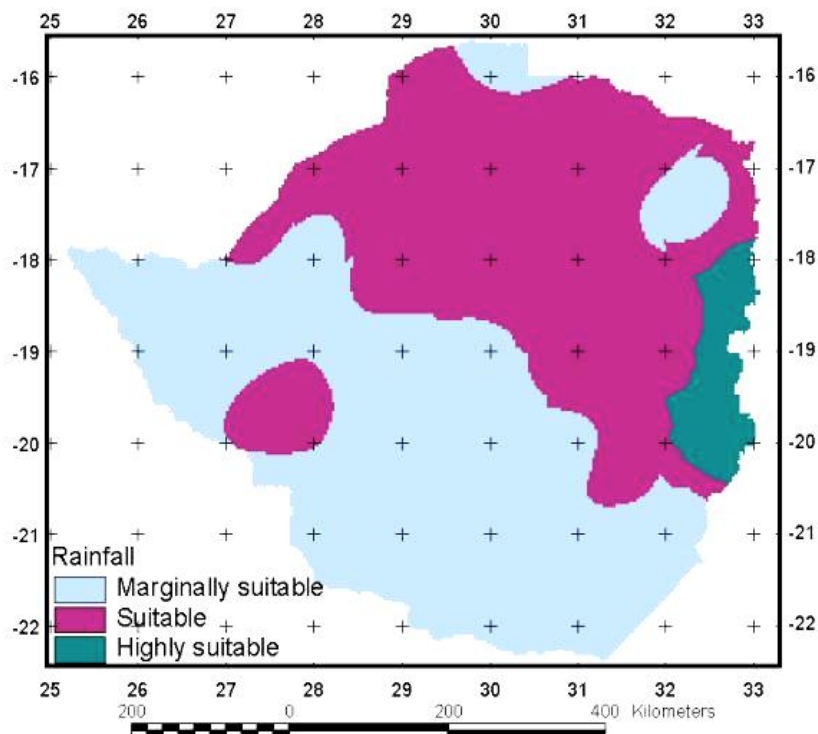


Fig 5. Map of Zimbabwe showing rainfall suitability zones (Mugandani, 2009)

5.0 Government of Zimbabwe's (GoZ) policies on food production

The Zimbabwe Agricultural Policy Framework (ZAPF) for the period 1995–2020 identified achieving food security as one of the priority national target areas. In Zimbabwe, food insecurity was only a household level concern among the poor and those without enough land to farm. However, food shortages at both national and household level have increased over the past two decades and the country has had to rely on food aid and commercial grain imports to meet its requirements. Although droughts caused by climate change and climate variability played an enormous role in inducing the country's food shortages, the general contraction in the economy coupled by the slow pace at which new resettled farmers commenced agricultural activities are also significant contributory factors (NIB, 2008: 1).

The ZAPF set out the long-term policy objectives for the agricultural sector. Under this policy framework, agricultural development was based on the following principles:

- Land and agrarian reforms to ensure productive use of land;
- Institutional development focused on efficient delivery of services to farmers;

- Increased production to ensure household food security; and
- Development of a public sector investment programme to support agricultural development (NIB, 2008: 4-5).

The Land Reform and Resettlement Programme (LRRP) of 2000 was part of ZAPF's objectives and it resulted in the broadening of the potential agricultural production base through land redistribution to more people. Under the programme, the GoZ acquired approximately 11 million hectares of land bringing to 14.4 million hectares in total of the land redistributed since independence (NIB, 2008: 5). Under the LRRP, the GoZ's aim was to resettle a total of 350,000 indigenous families under the A1 and A2 models. The process gave more prominence to the A1 settlement model in order to de-congest the marginal communal areas (NIB, 2008: 5).

5.1 Food security policy

Zimbabwe's agricultural policy on food security has not been clearly articulated with respect to climate change and drought mitigation. The current agricultural policy has proposed strategies aimed at establishing food security for Zimbabwe but implementation of this policy has been hampered by socio-economic and political challenges that have rocked the country for the past two decades. Government's strategies such as the ZAPF were affected by subtle social unrest and the volatile political atmosphere that prevailed in the country after the fast track agrarian land reform and resettlement programme (LRRP) of 2000. This resulted in significant inconsistencies in policy implementation whereby one strategy contradicted another with respect to food security. It is no secret that the fast track agrarian land reform programme had significant detrimental effects to the country's food security because it disrupted agriculture but the issue of land acquisition by the black majority was unarguably an issue that had to be addressed in post-independent Zimbabwe. The "land question" had to be addressed to solve the economic and social injustices perpetrated by Zimbabwe's former colonizers who owned most of the productive agricultural land, while the black majority remained segregated in the impoverished rural areas.

After having acquired land from the white commercial farmers, the GoZ lacked a sound food security policy and this resulted in the failure of previously adopted strategies such as the ZAPF to develop into a consistent framework for addressing food insecurity in the country. The government embarked on multiple schemes that were aimed at boosting the capacity of resource poor newly resettled black farmers. These schemes involved the distribution of subsidized farming inputs such as seeds, fertilizers and chemicals to the resettled farmers. The government also acquired farming implements such as tractors, planters, disc harrows and ploughs to equip its new farmers to avoid a backdrop in food production (Mudzonga and Chigwada, 2009: 6-7). However, due to the lack of a well-articulated food security policy, the government was blindly throwing arrows in the dark expecting to overcome the serious threats posed by climate change on the country's food security. The issue of sanctions imposed by Britain and her western allies to choke the economic progress in Zimbabwe and frustrate the gains of the LRRP also stifled government's efforts to ensure adequate food for its people. With the new farmers in place it became clear to the GoZ that apart from equipping farmers with cheap subsidized inputs they had to invent other mechanisms to cushion these farmers from the threats posed by climate change. This was after the realization that even after giving the farmers adequate farming inputs they still failed to attain the required crop yields due to the recurrence of droughts across most parts of the country.

5.2 Agricultural Schemes adopted by the GoZ to boost food production (2000- 2011)

5.2.1 Input Credit Facilities

- **GMB input scheme**

After the acquisition of land in 2000, the GoZ launched an input credit facility scheme which made it possible for the new farmers to buy seeds, fertilizers, machinery and agro-chemicals on credit terms. This government input credit scheme was run by the Grain Marketing Board (GMB) with the aim of promoting productivity on the farms and boosting farmers' confidence in the government's efforts to ensure food security for the country. However, this scheme failed to produce its intended results due to poor coordination in the distribution of these inputs. GMB was given the mandate to distribute the inputs but it had no clear criteria for selecting the beneficiaries of these inputs (Manyeruke and Hamauswa, 2012: 11) and this created opportunities for non-farmers to acquire inputs at government controlled prices and channel them on to the informal black-market. In some cases inputs were distributed along political lines not based on the farmer's ability to effectively utilize the inputs.

All this frustrated the government's efforts to support farmers who were already beginning to experience the effects of successive droughts that had significantly crippled attempts to increase production on the farms.

- **Agricultural Sector Productivity Enhancement Facility Development (ASPEF) loans**

This credit facility was created by GoZ and involved the participation of commercial banks such as CBZ and Agribank who had received credit allocations from the central bank to assist farmers. Before the introduction of the multi-currency system, these credit facilities had slightly relaxed interest rates which made it possible for farmers to pay back their loans. Failure by farmers to pay back loans has greatly hampered the continuity of this scheme.

5.2.2 Operation Maguta

Operation Maguta was a government programme that sought to promote food production in agriculture and it was spearheaded by the Zimbabwe Defence Forces (ZDF) in collaboration with the Ministry of Finance. Operation Maguta was launched in 2005 and it was aimed at boosting food security at the same time strengthening the national strategic grain reserves (Manyeruke and Hamauswa, 2012). Under the scheme farmers were given fertilisers, seeds and herbicides in order for them to grow targeted crops such as maize and wheat. The programme targeted mainly A1 farmers and communal farmers. The farmers were required to pay back after harvesting their produce at an interest rate of 50% but also had an option of paying in the form of produce (through the GMB) or cash. Under the scheme, each beneficiary got 300 kilograms of compound D, 200 kilograms of ammonium nitrate fertilizer and 25 kilograms of maize seed (Mudzonga and Chigwada, 2009: 6). Again this programme lacked proper coordination and ended up failing to achieve its intended goals. Many farmers who benefited from this scheme did not pay off their loans and they side marketed their produce avoiding selling to the GMB whose reputation with farmers had soured due to late payments. This affected the continuity of this programme and led to its collapse.

5.2.3 Agricultural Mechanization Programme

This government programme was launched in 2007 and its aim was to support farmers by equipping them with farming implements which suited their needs. The programme was conceived as part of government's efforts to resuscitate and recapitalize the country's agriculture sector in the long term, at the same time strengthening the gains of the LRRP. Further the scheme significantly transformed the equipment and productive landscape of the agriculture sector by mechanizing both the communal and commercial farmers (Manyeruke and Hamauswa, 2012: 10-11). Under the programme, various farming implements such as tractors, ploughs, disc harrows and combine harvesters were distributed to selected resettled farmers across the country to enable them to produce at optimal levels and achieve food security and sustenance. This empowerment drive was intended to accelerate economic growth through increased productivity and greater returns from the empowered farmers (Mudzonga and Chigwada, 2009: 7).

However, the mechanization drive was not as effective as it was intended to be due to corruption and shortages of critical resources such as fertilizers and spare parts for the tractors. The distribution of the farming implements especially tractors and combine harvesters was marred by corruption and most individuals benefited because of their political muscles. Those farmers who were less politically active failed to benefit from this mechanization programme and this made the whole exercise seem like a political gimmick whose aim was to advance a political agenda. The problem that Zimbabwe faced and still faces is that of politicians within government circles who politicize every exercise aimed at increasing productivity in agriculture just to gain political mileage. This has been more pronounced in Zimbabwe's government of national unity (GNU) which has been characterized by mixed feelings and antagonistic views from politicians in ZANU PF and the MDCs on which sectors of the economy the government should prioritize. To ensure that every Zimbabwean has food on the table, the government has to prioritize agriculture by allocating a substantial amount of its fiscal budget towards enhancing production in the sector.

5.2.4 Accelerated National Irrigation Development Programme (ANIDP)

The GoZ realized that the lack of irrigation infrastructure and deterioration of existing irrigation systems and infrastructure was hampering food production.

This left the government with a major challenge of rehabilitating the irrigation facilities so as to minimize the effects of climate change and variability through programmes such as the Accelerated National Irrigation Development Programme (ANIDP)(Mudzonga and Chigwada, 2009: 7).The irrigation equipment and general infrastructure acquired during the agrarian land reform programme had crumbled due to lack of proper maintenance and this reduced production in the agricultural sector.Under this scheme farmers were given loans to procure irrigation equipment that suited their scale of production.

5.2.5 National Economic Recovery Programme (NERP)

The Government of Zimbabwe launched, the National Economic Recovery Programme (NERP) in 2003 after the realization that donor support had significantly dwindled. NERP was a multisectoral macro-framework which formed the basis for several strategic framework documents under which different government programmes were implemented. In the agricultural sector, NERP drew heavily from the ZAPF. NERP noted the severe socio-economic challenges facing the country and focused on measures for agriculture and rural development. The measures that NERP adopted that were of significance in cushioning farmers from the effects of climate change and ensuring food security were as follows:

- Promotion of effective land utilization
- Provision of farm input support
- Promotion of dairy farming
- Promotion of livestock development
- Promotion of irrigation development
- Assurance of food security through productivity growth and least cost import programmes.

Under the NERP, irrigation was identified as the most vital cornerstone for agricultural development and key to agriculture-led economic recovery, given the country's vulnerability to drought and the high risks associated with rainfed agriculture. To advance irrigation development NERP sought to create an enabling environment for irrigated agriculture by facilitating and encouraging the private sector to invest in irrigation development (NIB, 2008: 5-6).

6.0 Errors in strategy formulation

6.1 Treating smallholder (A1) farmers as a homogenous group

Despite the GoZ's measures to stimulate rural food production and incomes, food insecurity remains highly prevalent in the low rainfall communal areas in the NR IV and NR V. The strategies adopted by the government tended to treat the smallholder (A1) farmers as a homogenous group. The government's approaches of incentives did not deal with the unique technological and socio-economic needs of the farmers who were of different resource endowment. This was evident in the GMB input scheme where all A1 farmers were given the same number of inputs regardless of their specific needs as individuals. An A1 farmer in Tsholotsho was receiving the same small amount of fertiliser and seed as another A1 farmer in Bindura. Government's initiative lacked proper insight in considering that these farmers had different technological and socio-economic needs which had to be addressed in a unique manner. For instance a small holder A1 farmer may have enough capital to fund the procurement of his own seeds and fertilizer but may not have enough capital to procure irrigation equipment which may be key to the improvement of production on his farm. Taking a look at the various schemes that the GoZ embarked on, these schemes treated farmers as a homogenous group that had the same needs. What the GoZ failed to take into account was that different farmers across the country have different needs which have to be addressed uniquely. Instead of pooling all farmers into the same bracket of needs the government has to consider the individual needs of each farmer.

6.2 Lack of diversification in agriculture to encourage the growing of other food crops

In Zimbabwe there has not been much diversification from maize as the dominant source of food security. Due to recurrent droughts that have been experienced in Zimbabwe for the past decade, it has become relatively difficult for farmers to rely on maize as the major source of food security. This calls for the need to diversify the country's food security source by encouraging farmers to grow small grain crops such as sorghum and millet which can tolerate drought conditions better than maize. The government has not done much to fund the growing of small grain crops and this has left the country's small grain seed banks virtually empty.

This can be sighted as poor strategic planning on the side of government as it keeps distributing maize seed in areas that are prone to drought instead of encouraging people in these areas to grow small grain crops. In 2012 the GoZ declared potato a strategic food security crop but not much has been done to fund farmers and intensify production of this crop (The Herald, 2012). Many farmers have not taken up potato farming because it is a capital intensive crop that requires huge initial capital investment. The government has not done much to provide extension services to farmers who want to venture into potato farming and this has attributed to the reluctance by some farmers to enter into potato farming. Instead of encouraging farmers to grow potatoes only the GoZ should also encourage farmers to grow tubers such as sweet potatoes, cassava and yams which do not require huge capital to initiate production. To ensure food security in Zimbabwe in the wake of climate change there is need for the agricultural sector to diversify and start producing sorghum, millet, rapoko, sweet potatoes, cassava and yams at a large scale to meet the country's food requirements (Mudimu, 2003: 4).

6.3 Lack of strict laws curbing corruption in government managed schemes

Government programmes such as the GMB input scheme were derailed by rampant corruption at the GMB depots. The scheme provided farmers with farming inputs at subsidised prices set out by the Ministry of Finance, Industry and International trade. Unfortunately, due to corruption most people acquired more than they needed. In some instances, some of the people were not farmers and these took advantage of the cheap prices and took the inputs to the informal market. Corruption and abuse of the government schemes was also noted in the National Oil Company of Zimbabwe (NOCZIM) fuel facility, which provided farmers with cheap diesel at a time when the country was in a fuel shortage crisis (Manyeruke and Hamauswa, 2012: 11-12). The fuel facility was high-jacked by unscrupulous informal traders who bought the fuel at subsidized prices and then sold the fuel at higher prices on the informal market. Instead of farmers benefitting from this subsidized fuel, they ended up buying the fuel at high prices from the informal traders.

7.0 The Matebeleland Zambezi Water Project (MZWP)

This project is one of GoZ's major efforts to mitigate the effects of climate change by addressing the water challenges in the Matebeleland North province. Much of Matebeleland north lies in NR IV and NR V and is susceptible to droughts and successive dry spells which make the region unsuitable for crop production. The project seeks to put an end to the perennial water shortages affecting people in Bulawayo by establishing a 450km pipeline to the city from the Zambezi River (Sundaymail, 2012). Previous attempts to kick start this project were marred with a number of challenges, chief among these was the shortage of funds. The project consists of three phases which include:

- Phase 1; Construction of the Gwayi-Shangani Dam
- Phase 2; Construction of the pipeline linking Bulawayo to the Gwayi-Shangani Dam
- Phase 3; Construction of the Gwayi-Shangani Dam to Zambezi River pipeline

The construction of the Gwayi-Shangani dam is the core phase of this project and this commenced in September 2004. The slow pace in the construction of this dam has been attributed to GoZ's failure to adequately fund the project owing to the economic woes the country is facing. Recently in 2012 the Government of the People's Republic of China committed US\$1,2 billion to the MZWP and this has accelerated progress in the completion of phase 1 of the project. In an address the Minister of Water Resources, Samuel Sipepa Nkomo, pointed out to the fact that completion of this project will change the face of agriculture in Zimbabwe's arid south-western parts. Drought is perennial in this part of the country and hunger is endemic. Success of the MZWP will enable reliable irrigation infrastructure to be set up in the arid Matebeleland region. This is expected to turn this arid region into a "greenbelt of agricultural activity" (Sundaymail, 2012). Government now needs to start exploring the various opportunities for development in agriculture presented by the MZWP. To mitigate the effects of climate change that had ravaged people in this part of the country, the GoZ will have to facilitate the engagement of communities along the pipeline corridor with the corporate sector to initiate small and large scale irrigation schemes. This will significantly turn things around in the positive direction and enable the country to cement food security in its arid south-western part. However, the MZWP faces a lot of external challenges owing to Zambia's stiff resistance to allow Zimbabwe to draw water from the Zambezi River.

According to FAO data, the Zambezi basin accounts for 91.5 per cent of Malawi's, 76.4 per cent of Zambia's, 54.5 per cent of Zimbabwe's, and 20.2 per cent of Mozambique's total land area (Swain et al, 2011: 37).

With respect to this data Zimbabwe has to enter into dialogue with these countries and request permission to draw water from the Zambezi River based on mutually agreed terms. Fears are that MZWP will likely affect generation of hydroelectricity at Kariba and Cahora Bassa power stations due to a decrease in volume of water flowing in the Zambezi River. Apart from the issue of power generation, the drawing of large volumes of water from the Zambezi has many ecological impacts on ecosystems that rely on the Zambezi River. Zambia's continued resistance spells doom for the much touted MZWP which is seen as a lasting solution to the water woes of Matabeleland. Zambia's refusal to sign the Zambezi Watercourse Commission (ZAMCOM) Protocol has cast a dark shadow over the MZWP. ZAMCOM was established by the countries contributing to the Zambezi basin (Zimbabwe, Zambia, Tanzania, Mozambique, Botswana, Malawi, Namibia, and Angola) to corroborate the importance of resource sharing and the need to integrate management of shared water resources. The objective of this commission is to promote the equitable and reasonable utilization of the Zambezi Watercourse as well as efficient management and sustainable development (Mujoma, 2012).

To allow Zimbabwe to draw water from the Zambezi River, six of the eight SADC states named above have to sign and ratify the Zambezi Watercourse Commission (ZAMCOM) Protocol. To date only four countries have signed and ratified the ZAMCOM Protocol while three have signed and not ratified. Zambia is the only country that has neither signed nor ratified the Protocol. Zambia argues that 75% of the Zambezi River basin is in her territory and that she contributes 42% of Zambezi River water. Zambia wants this natural advantage to be factored in when it comes to water abstraction from the Zambezi River, something not currently considered in the standing Protocol (Hove, 2012). Unless Zambia eases her stance and ratifies ZAMCOM, the success of the MZWP might be jeopardized thus stifling Zimbabwe's efforts to mitigate the effects of climate change in the arid southern region.

8.0 Effects of climate change on politics in Zimbabwe

In countries like Zimbabwe where the effects of climate change on the socio-economic fabric are substantial, politics can act as a stressor or catalyst to create conflict. In this context, climate change can be viewed as a threat multiplier that interacts with socio-economic and political systems to create conflict. Socio-economic impacts emerge from climate change effects on food and water resources that are critical for livelihoods and survival. In Zimbabwe, areas that experience successive drought conditions such as the Matabeleland region and parts of the Masvingo province are prone to the risk of climate induced violent conflicts as competition for food and water resources rises. The geopolitical dimensions and socio-economic consequences of climate change pose a severe challenge to Zimbabwe's political balance of power. Already people in the arid Matabeleland region feel that the government has not done much to address their plight to have the issue of water availability resolved. From past experiences, government's failure to apportion a substantial amount of its fiscal budget towards solving the water challenges currently being faced by the people in Matabeleland has always stemmed up wide debates on whether the GoZ truly prioritizes the well-being of people in that part of the country.

The competition for scarce water resources in Matabeleland has caused internal conflicts within and amongst village communities. As the droughts have become more frequent the water situation in Matabeleland has worsened and fears are that if government does not address this issue with urgency it risks the escalation of conflict within the Matabeleland region. Sentiments of disgruntlement have been echoed continuously by people in this arid region who feel government is marginalizing them by not prioritizing their basic rights to water. What this means is that any political party approaching these people promising them a quick end to their water woes will be voted for resoundingly. Even if that party's set of policies do not adequately cater for the people's needs in the long run, people will still vote for it because they want to see a swift end to their problems. Nonetheless, it is the direct impacts on people's livelihoods that is most worrying and chief among these are the human security factors. One of these human security factors is food security, which will be highly affected through the multiple impacts of climate change.

Climate change and its economic impact are not isolated events. Interactions between these economic changes, and existing political, economic, social and security environments might result in further indirect economic impacts. For instance, scientists predict that climate change will reduce the water flow in the Zambezi and Limpopo basin by 10% (Swain et al, 2011: 42). This will have a direct impact on crop yields and this will consequently lead to food insecurity. As the saying goes, "A hungry man is an angry man," the escalation of conflict is highly probable when there is food insecurity in a country.

Weak and partisan political structures such as those found in Zimbabwe's Government of National Unity (GNU) adversely affect the governance of natural resources, and hence, are linked to a weakened mitigation and adaptation capacity of societies to the negative effects of climate change. Weak government institutions cause problems such as failure to distribute certain goods and services such as food, water and medicine to affected communities thus increasing feelings of neglect and uncertainty amongst local communities. Matebeleland North is amongst the poorest parts of the country and most vulnerable to climate change as seen by sharp declines in food production over the past two decades owing to recurrent droughts. A decline in agricultural production combined with political stressors thus amplifies the real potential for violent conflict in this region which can have an adverse effect on the country's political landscape.

9.0 Regional and Global efforts to minimize the impact of climate change

There is need for regional blocks such as the Southern Africa Development Community (SADC) to exert concerted efforts towards attaining food security in the region. SADC should prioritize on improving its food security by facilitating and implementing of the 2004 Dar-es-Salaam Declaration and Action Plan on Food Security and Coordination on Transfrontier Conservation Areas. This declaration is part of SADC's climatic change adaptation and mitigation measures which will see all countries in the region adopting measures aimed at minimizing the effects of climate change. Zimbabwe cannot fight climate change on her own, given that the effects of climate change are affecting the whole region. Recently in Maputo, Mozambique, SADC leaders declared and reinforced the need for the region to finalize the Protocol on Environment, and the implementation of the SADC-EAC-COMESA Climate Change Adaptation and Mitigation Programme, together with the coordination of the regional position on how to tackle the issue of climate change and greening the environment as a matter of urgency. SADC member states were urged to support the Regional Action Plan for adaptation to climate change to save agriculture within the region as this is the only way that will ensure food security (Chronicles, 2012).

Global concerted efforts to fight climate change have been made with the enforcement of treaties such as the Kyoto Protocol which came into force on the 16th of February 2005 (Kyoto protocol, 2012). The Kyoto protocol aims to reduce greenhouse gas emissions and minimize the impact of climate change. It is sad to note that developed countries are dragging in their commitment in mobilising adaptation and mitigatory funds under the Kyoto Protocol to the United Nations Framework Convention on Climate Change (UNFCCC) of 1992, to reduce the Green House Gas emissions in the world by at least 20% (Chronicles, 2012). While developed countries drag their feet many people in the developing world, particularly Africa, are suffering from the negative impacts of climate change. Under the protocol, in exchange for meeting their targets, developed countries were expected to invest in low cost abatement opportunities in developing nations (Chronicles, 2012). However, to date not much has been done by developed nations to reduce carbon emissions into the atmosphere as this move has been seen to negatively affect their economies. Which leads us to the question, "Should Africa and the rest of the developing world continue to suffer for a crime they have not been accomplices to?" No, that cannot be. Developed countries should own up to their pledges under the Kyoto protocol and reduce Green House Gas emissions. There is also need for both developed and developing countries to adapt to cleaner development mechanisms through use of cleaner technologies without compromising their development as stipulated by the Kyoto protocol.

The UNFCCC also identified least-developed countries as being highly vulnerable to climate change and this prompted the setting up of funds aimed at financing climate change adaptation measures. The adaptation measures have been facilitated through development of National Adaptation Programmes of Action (NAPAs). For the NAPAs to be effective, countries should identify priority activities aimed at addressing urgent national climate change adaptation needs (IPCC, 2007: 731).

10.0 Climate change adaptation strategies

The adaptive capacity of a system refers to its ability or potential to respond successfully to climate variability and change. This includes adjustments in agriculture, natural resources management and technology development. Adaptive capacity is necessary for the design and implementation of effective adaptation strategies. These adaptation strategies include proactive measures such as crop and livelihood diversification, seasonal climate forecasting, community-based disaster risk reduction, famine early warnings systems, insurance, water storage and supplementary irrigation.

Proactive practices to adapt to climate variability have advanced significantly in recent decades with the development of operational capability to forecast weather events as well as improvements in climate monitoring and remote sensing to provide better early warnings on complex climate-related hazards (IPCC, 2007: 721). Some countries in Asia and the Americas have developed mechanisms to facilitate proactive adaptation to seasonal and inter-annual climate variability. Mexico and Argentina have adopted proactive adaptation strategies to mitigate the effects of droughts caused by climate change. These adaptation strategies include adjustment of planting dates and crop variety (planting of drought-resistant plants such as agave and aloe), accumulation of commodity stocks as economic reserve, spatially separated plots for cropping and grazing to diversify exposures, diversification of income by adding livestock operations, provision of crop insurance and creation of local financial pools as an alternative to commercial crop insurance (IPCC, 2007: 722).

In Asia the Philippines have established impressive adaptation practices to mitigate the effects of climate change related drought stress. These include a shift to drought resistant crops, use of shallow tube wells, rotation method of irrigation during water shortage, construction of water impounding basins, construction of fire lines and controlled burning, adoption of soil, water conservation measures for upland farming, rainwater harvesting, leakage reduction and hydroponic farming. Adaptation to climate change in Africa is taking place at a very slow pace yet countries in Africa are the most vulnerable to climate change related stresses. Countries like Sudan have adopted drought mitigation practices which include the expanded use of traditional rainwater harvesting and water conserving techniques (IPCC, 2007: 722). The adoption of climate change strategies in Africa is greatly hampered by lack of adequate funding to finance the adaptation measures.

11.0 Conclusion

Climate change poses a grave threat to Zimbabwe's ability to ensure food security for its people. Zimbabwe needs to focus on extensive research and development (R&D) programmes to facilitate swift responses to climate change before it seriously cripples agriculture. Currently there are no institutional policies focusing on climate change and the response framework is very disjointed because it lacks policies to support its implementation. There is need for government to formulate a clear and articulate policy on climate change that comprises of a concise response framework to mitigate the effects of climate change. Unless the government prioritizes the establishment of effective irrigation and water harvesting schemes to assist farmers in averting droughts, Zimbabwe's chances of beating the effects of climate change on agriculture are very slim. Government should also revisit its Food Security Policy and make amends that ensure that every Zimbabwean gets sufficient food on the table. Since agriculture contributes 15-20% (ZUNDAF, 2011: 9) to the country's GDP, more of the government's fiscal budget should be allocated to the agricultural sector to enable the country to realize sound economic growth and cement food security for its people.

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