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Climate Change And Adaptation In Third World Africa: A Quest For Increased Food Security In Semi-Arid Zimbabwe

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Abstract:

Africa is one continent that has been badly affected by climate change over the past few decades. In this continent, and in particular Zimbabwe, most of the poverty stricken people are predominantly located in the semi-arid regions (Bird and Shepherd, 2003) of the country where they heavily rely on rain fed agriculture for their subsistence. Yet the limits and barriers to successful adaptation to a changing climatic environment which includes scarcity of arable land, modern technology expansion limitation, lack of sound knowledge on the current climatic changes across the globe, erratic rainfall and frequent dry spells, have all over the years, caused a sharp decline in crop productivity in the aforementioned regions resulting in food scarcity and sometimes extreme poverty. At a different level, there has been poor dissemination of knowledge at grassroots by researchers, academics and policy makers. That said, this paper is an attempt to examine the adverse impacts of climate change and vulnerability of small holder farmers in semi-arid areas of Africa. The paper adopts Chivi and Zvishavane semi-arid areas of southern Zimbabwe as its case study, and suggest possible ways for adapting to climate change.

Keywords: *Climate change, vulnerability, adaptation, food security, semi-arid Zimbabwe, Africa*

1. Introduction

Recent studies reveal that the world is undergoing serious climate change as global temperature is ever increasing (Mawere 2011: 874). The Third Assessment Report of the Intergovernmental Panel on Climate Change (IPCC, 2001), for example, revealed that the global average temperature will increase by 1.4° C to 5.8° C between 1990 and 2100 if the levels of greenhouse gas emissions are not reduced. As further revealed by the same report, the increase in temperature is largely attributed to the anthropogenic activities especially the global use of fossil fuels. On the other hand, developing countries especially in Africa are even more vulnerable due to their dependence on burning fuels.

While developing countries especially in Africa have contributed less than any other region to the greenhouse gas emissions that are widely held responsible for global warming, they are more vulnerable due to their dependence on rain-fed agriculture and natural resources for their livelihoods (Mawere 2011). As pointed out by Mawere (2011: 874), “the impacts of climate change in Africa are generally manifested in human health and in the agricultural sector worsening the existing levels of poverty and undermining all development efforts in the continent”. The other consequences include adverse impacts on Africa’s varied livelihood systems and the unique biodiversity of its ecosystems.

In the face of the climatic problems the world is currently facing, Africa’s contribution to the mitigation of greenhouse gas emissions will always play a significant role. However, Africa’s major focus is on issues of adaptation. Successful adaptation depends upon technological advances, institutional arrangements, availability of financing, and information exchange (Watson et al, 1996). Also, several barriers prevent available climate and weather information (eg research, forecasts etc.) from filtering down to potential users. These include scientific jargon, inadequate dissemination channels to reach the most vulnerable people, and poorly formalized institutional frameworks at a national level. As a matter of consequence and especially in developing countries such as Zimbabwe, this has created a gap between scientists, researchers, policy makers and the communities yet all these are in fact supposed to be working together to ensure that climate change and its impacts is well understood and interpreted by everyone for the good of the [local] communities, nations, Africa and the world at large.

Focusing on Zimbabwe and in particular Chivi and Zvishavane semi-arid areas, one would notice that a significant proportion of the population is largely dependent on exploitation of environmental resources for their livelihoods and subsistence farming for their sustenance. Unfortunately, the past two decades have seen the nation experiencing pronounced increases in temperature, recurrent droughts and unpredictable rainfall patterns, all of which have exacerbated suffering among the people of Zimbabwe—

especially in the rural areas, where majority of the population resides. The reliance of the vast majority of Zimbabweans on rain-fed agriculture and the sensitivity of major sectors of the economy to the climate make Zimbabwe particularly susceptible to the negative impacts of climate change.

That said, this paper examines the impacts of climate change as well as the vulnerability of small holder farmers in semi-arid areas of Africa, and in particular the Chivi and Zvishavane semi-arid areas of southern Zimbabwe. The adoption of Chivi and Zvishavane semi-arid areas is not by accident but has been motivated by the fact that for the past two decades, the aforementioned areas, among others in Zimbabwe and beyond, have witnessed pronounced increases in temperature, recurrent droughts and unpredictable rainfall patterns, yet people in these areas mainly depend on rain-fed agriculture and natural resources for their livelihoods. The paper goes further to suggest ways in which people in semi-arid areas such as Chivi and Zvishavane can adapt to climate change for the betterment of lives and immediate environments.

2. Geographical Description Of The Study Area And Justification Of The Study

Zvishavane and Chivi are located in the Midlands and Masvingo provinces of southern Zimbabwe which in terms of agro-ecological zones are under regions 4 and 5. The areas are low-lying and semi-arid as they receive low annual rainfalls of about 300mm. This is confirmed by the Food and Agricultural Organization, Zimbabwe, which averred that in semi-arid Zimbabwe, water is by far a greater constraint than land (FAO, 2005). Receiving low rainfall and experiencing high temperatures, these two areas are in one of the most vulnerable regions to climate change in Zimbabwe. This in itself means that the agriculture sector in the aforementioned areas is quite vulnerable with marginally productive areas probably shifting to non-agricultural use. This is in spite of the fact that Zimbabwe has ratified the UNFCCC, as indeed there is currently no clear national strategy on implementation of its provisions. Zimbabwe currently has no specific policy response to climate change besides fragmented responses implied in a set of sectorial policies, including those relating to environment and natural resources management, water resources management, agriculture and food security, and disaster management. In fact, delegates attending a climate change roundtable in 2009 noted the absence of a deliberate and focused policy response to climate change in Zimbabwe as they emphasized that climate change is currently not an issue in the parliament of Zimbabwe, and is therefore not adequately factored into the country's development plans (Report of a Climate Change Awareness and Dialogue Workshop for Parliamentarians, 2009). A conscious and deliberate effort to mainstream climate change adaptation thus has not been defined. The effort is only implied through the attempts of various government ministries and departments to ensure that people can live with the impacts of climate change; but lack of capacity to identify links between climate change and various social and economic sectors means that climate risks are not being adequately mainstreamed in national policy, budgets, government and other organizational programs and plans (Report of a Climate Change Awareness and Dialogue Workshop for Parliamentarians, 2009). Such lack of commitment and perhaps the will to deal with climate change issue is in spite of recent studies on Zimbabwe's climate in general which shows that if no action is taken to arrest the adverse effects of climate change, in the near future the results will be as follow:

- Increase of the mean air temperature by between 1.8 and 3.2 °C;
- Reduction of annual rainfall by 2 to 9%;
- Increase of the solar radiation from 2 to 3%;
- Increase of the evapo-transpiration by between 9 to 13% (Mozambican Initial Communication to the UNFCCC, 2006).

This study is a clear testimony that well defined measures should be put in place to curb climate change problems and lessens the gravity of their impact on the environment, agriculture sector and human beings in general. However, the Climate Change Office housed in the Ministry of Natural Resources and Natural Resources Management is in the process of drafting Zimbabwe's climate change policy. It is in light of this observation and realization that the present researchers were motivated to carry out research on the impacts of climate change in the semi-arid areas of Chivi and Zvishavane. Below is the map of Zimbabwe where the case study (Zvishavane-Chivi Communal Areas) are located (Figure 1).

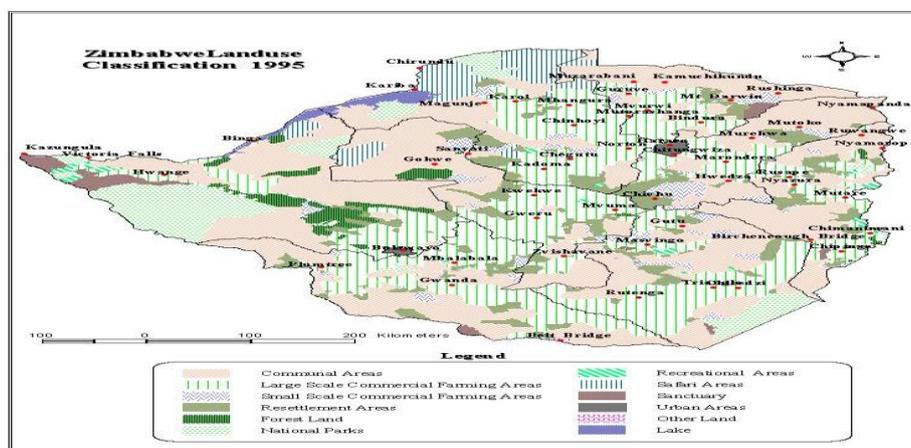


Figure 1: Adopted From Zimbabwe's Land Use Classification And Location Of Main Towns, 1995

3. Research Methodology

This research is qualitative as the researchers undertook interviews, observations and focus group discussions with some farmers in Chivi and Zvishavane Communal Areas. This method was employed in a bid to understand, interpret and describe systematically a situation, problem or phenomenon, in this case, the impacts of climate change. This being the case, Participatory Rural Appraisal (PRA) techniques were used to conduct this research. PRA is used to describe a growing family of approaches and methods that enable local people to share, enhance and analyse their knowledge of life and conditions, to plan and to act (Conway, 1987; Mascarenhas et al., 1991).

The study began with a one day stakeholder workshop that was held on the 19th of April 2012 in Kadoma (Zimbabwe) during which participants were introduced to African Climate Change Adaptation Fellowship. The intended study "Climate change adaptation for increased food security in Semi arid Zimbabwe" and its objectives were also shared with them. The participants included farmers, local community leadership, civil society and relevant government departments as the policy makers. A multi-stakeholder research team was set up and the team was instrumental in determining the structured instruments for the study and administration of questionnaires which was carried out between April and June 2012.

The study covered two main agro-ecological (IV,V) zones in Southern Zimbabwe. Taking into cognizance the nature of the study, simple random sampling of farmers in Chivi and Zvishavane was done for 75 households and 2 focus group discussions were held. A total of nine key informant interviews was also conducted by the various government departments and civil society groups. Primary data collection was done using individual household and focus group interviews and secondary data was collected from existing climate science information and targeted government ministries working with communities to reduce the impact of climate change in Zimbabwe. Data cleaning was done and data collected was entered into the SPSS statistical package for analysis.

4. Participant Demographics

The Tables 1 and figure 2 below respectively contain details of the sex and age of people participated during the study:

	Frequency	Percent	Valid Percent	Cumulative Percent
Male	35	47.9	47.9	47.9
Female	38	52.0	52.0	100.0
Total	73	100.0	100.0	

Table 1: Sex Of Respondent

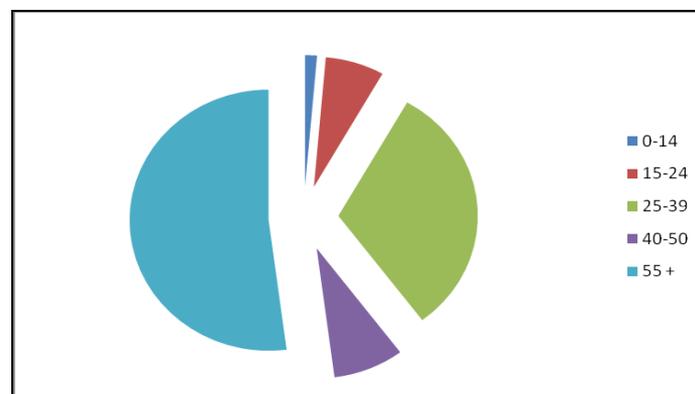


Figure 2: Chart Reflecting Age Of Respondents

5. Brief Description Of The Studied Households' Characteristics

As has been shown in Table 1 above, fifty two percent of the farmers interviewed are females and forty eight (approx) percent are males. The reason for having more female participants was that women are believed to be underrepresented in many researches on rural areas yet they constitute the majority. Also interesting to note is the fact that figure 2 above demonstrates that most of the respondents were above fifty five years. This age range defines the age of those who are left as custodians of field activities and households in the study area, and other such communal areas, considering the social, political and economic meltdown that Zimbabwe has experienced since the turn of the millennium.

6. Research Findings, Analysis And Discussion

It is worth noting that one important dimension of the community that contributes to effective transfer of knowledge/technologies from the government, academics, civil society groups to communities is the education status of individuals and communities at large. In the case of respondents in the study area, the majority which is fifty nine percent attained at least primary school education, followed by 33% who attained at least secondary education, 6 percent who had attained tertiary education, and 2 percent had no education at all. To fully explore the characteristics of the households and their possible capabilities to respond to changes in climate and resultant livelihood strategies, the following key areas were explored: a) household source of income, size

and the assets that an average household has in terms of livestock, b) weather Patterns and Climate Change Perceptions, c) Impact of climate change on agriculture and food security.

6.1. Household Source Of Income, Size And Assets

HH Source of income	Frequency	Percent
Farming	66	90.4
Wood carving	1	1.4
Firewood production	1	1.4
Other	5	6.8
Total	73	100

Table 2: Household Source Of Income

Table 2 shows that ninety percent of the community members depend on farming as a source of income and/or livelihood, and the remaining eight percent derives their livelihood from wood carving, firewood production and other activities such as buying and selling. Furthermore, research findings reveal that fifty one percent of the households interviewed generate a monthly income of USD50 per month and the least earning category (twenty-six percent) being less than USD20 per month. The average household size of the areas studied is eight people. All the households have small livestock in the form of goats, rabbits, chicken and guinea fowls. Twenty five percent of the population does not own a single cattle and the average number of cattle owned by the studied households is five. The household with the highest number of cattle has a total of fifteen representing one percent of the total population. In addition to cattle, which in Zimbabwe are a symbol of wealth, some households have donkeys that are used for draught power during farming season. The low average number of cattle owned by households in the studied areas, Zvishavane and Chivi, shows that the farmers in the referred areas are poor, hence their vulnerability to the adverse impacts of climate change. This owes to the reason that these farmers have the least capital, human and physical assets to adapt to climate change as they experience it.

6.2. Weather Patterns And Climate Change Perceptions

Giving a background to the weather patterns Agritex (Interview, 2012) revealed that the climatic conditions that have prevailed for the past five years or so in agro ecological regions 4 and 5 were very hot with dry conditions, rainfall below average (below 300mm/a) distribution poor and high chances of dry spells and other such natural disasters as floods. In the box 1 below is the response from one of the Agritex officials.

In the past, we used to have three groups of rainfall *bumharutsva* (in August), *hukurahundi* (in September) and *munakamwe* (in November) per year. These days, we only have one rainy season (*munakamwe*) which is also not predictable (Magwenzi Murisi KH)

Box 1: Rainfall Patterns Expected Source FGD 2012

A discussion with a group of farmers in the studied area confirmed similar observations. They revealed that the most important time in the calendar year for them was when the first rains (*munakamwe*) would come to allow them to prepare for planting. Fifty three percent of the household respondents reported that in the last planting season the first rains sufficient for seed germination were received in the month of October. For the majority of the farmers (66 %), in a 'good rainy season' would expect to receive the last rains in March, which no longer happens in these years. In the last planting season 2011/12 according to diagram 3.2 below October did receive some rainfall but it was not sufficient for seed germination therefore 62% of the farmers revealed that the first rainfall sufficient for germination was only received late in November. The rains came late and this disrupted their planting cycle. See figure 3 below which shows the rainfall pattern for the last season, 2011/2012:

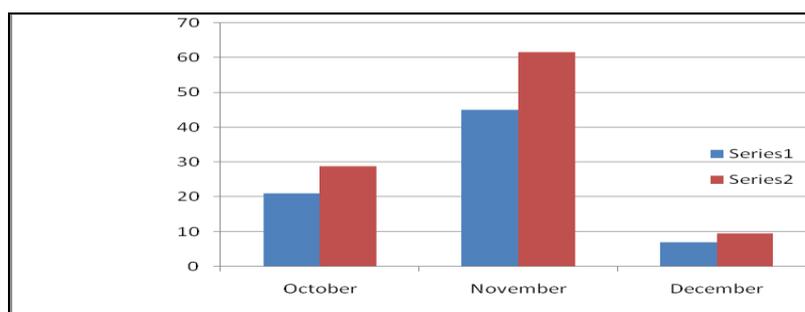


Figure 3: Showing When The Community Received Their First Rains Last Planting Season 2011/12

Interesting to note is the fact that the rainy season did not last for the expected duration as indicated by figure 4 below. Seventy three percent of the farmers indicated that they received their last rains in early march. Nineteen percent of the farmers revealed that they received rains in January. This percentage represents those farmers who are in the agro-ecological region 5 which is the region that is expected to receive the least rainfall in Zimbabwe .These results show that the rains came late and went before any crop could fully mature.

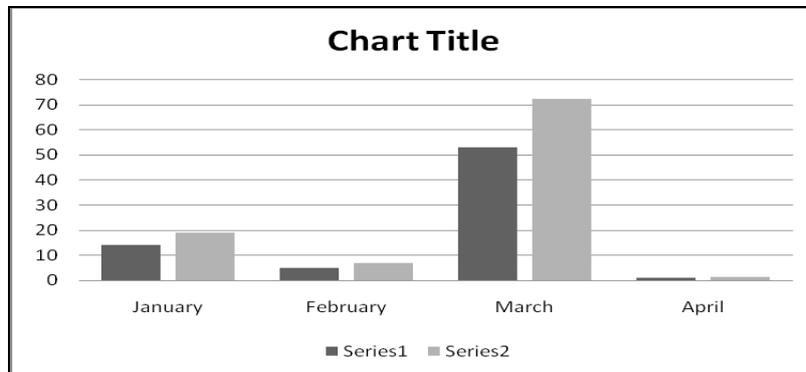


Figure 4: Showing When Community Received The Last Rains In The Last Planting Season 2011/2012

A further inquiry was made to check whether the farmers had knowledge or at least awareness with regard to the amount of total rainfall they received the previous season .The chart below shows that 60 percent of farmers received less than 200mm and 21% did not measure but they are sure the rains were insufficient. Fifteen percent confirmed that they received rainfall around 200mm and only three percent confirmed to have received rainfall around 300mm.

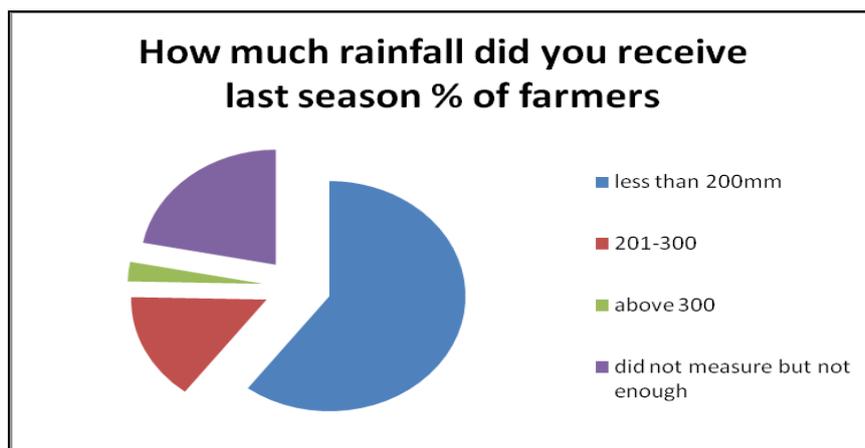


Figure 5: Amount Of Rainfall Received Last Season

Asked where they get information about current weather conditions, most farmers (52%) indicated that they had no access to any formal means. As such, they rely on the traditional knowledge systems (IKSs), which include prophecy, general observations and body feelings. According to the results presented below (Figure 6), 23% of the population, for example, revealed that they rely on observations of flora and fauna which is a common thing in the rural areas as very few have access to newspapers and radio weather forecasts.

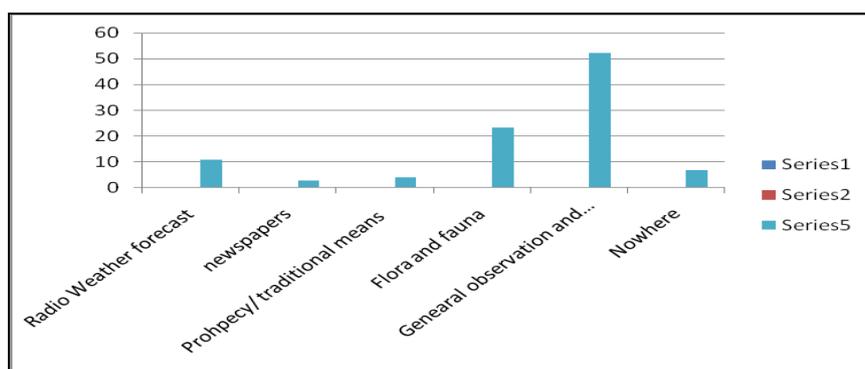


Figure 6: Access To Weather Information

Though access to information through formal means by a majority of the respondents was limited, 96 percent of the respondents acknowledged their awareness of the changes in their local weather pattern and climate change. Only 4% reported they were yet to notice the aforementioned changes. Majority (77%) revealed that they started noticing significant climatic changes and impacts in the year 2008. A number of visible signs were noted as indicators to climatic changes. These included: less and less rainfall leading to the current drought they are experiencing, dwindling farming seasons, unpredictable weather patterns, high temperatures, decrease in livestock and crop production, low fruit production of wild fruit trees and extinction of some area specific species. One respondent, for example, noted that while it has always been a fact that the coldest month of the year in Zimbabwe is June, it has become less cold and the hottest month, October, has become hotter than the previous years. In the box below are some of the perceptions expressed by respondents in Zvishavane and Chivi during research.

Natural signs:

-“In the past, Mt Mupfure used to have wind storm signifying coming of heavy rains. This no longer happens. Storms used to signify rainfall as well as animals such as ducks, baboons, rain bird-blue bird (haya). All these animals are no more as they have moved to other areas in search of food”

-“Danhamombe hill sounding (mutinhiro) and natural burning used to signify the coming of rain. The fire would be put out by rainfall (heavy first rains). All these signs were advance signs for preparation of crops, seeds to be grown that year.” - (Mbuya Esnath Makuvidza)

-“We used to have wetlands and wells in the area including Magwenzi wetland but all these are no more as they have dried up. Because of these wetlands we used to grow crops throughout the year. We could grow twice per year i.e. winter crops and summer crops” (Murisi Magwenzi)

Here in Zvishavane, our cattle used to drink water in wells and wetlands around here (pointing) but these are no more and we have to fetch water for our cattle from distant places or sometimes our cattle are travelling long distances to find drinking water. We are now keeping food for our cattle and feed them like children because most of the grasslands are no longer existent.

Source FGD 2012

Box 2: Signs That The Climatic Conditions Are Changing

6.3. Impact Of Climate Change On Agriculture And Food Security

Though rainfall in Zvishavane and Chivi has become erratic, farmers in these areas remain dependent on farming as their main source of livelihood. The most common farming practices they engage in include ‘traditional’ and/or conservation agriculture. During this research, we observed that most farmers in these areas had knowledge of conservation agriculture techniques and were trying to implement them on their respective plots. However, despite the knowledge and land preparation eagerly done by the farmers with advice from civil society and Agritex officers, the rains let the community down. Given that the average household size is eight people and 67 percent of the households survive on at least 2 meals per day, the reduction in yield is already pushing many families into the 1 meal per day bracket, hence going against the achievement of Millennium Development Goal (MDG) 1 which seeks to eradicate extreme poverty and hunger.

Meals per day	Frequency	HH Percent
1	10	13.69863
2	49	67.12329
3	14	19.17808
Total	73	100

Table 3: Number Of Meals Per Household Per Day

It is worth noting that most farmers in the Southern parts of Zimbabwe are smallholders, they mainly produce for their households and therefore they do not have large tracts of land allocated to them. The land which they till is that which they inherited from their fathers. Those who benefited from the government land relocation exercises just benefited large tracts of infertile soils which are suitable for livestock production or wildlife. Of the farmers interviewed 45% own 2- 3.9 hectares of land, 27% own less than 1.9ha of land 21% owns about 4- 5.9 ha and 7 % owns more than six hectares. Given the type of soils and weather characteristics being experienced in Zvishavane and Chivi, 93% of farmers hardly produce enough for their families as it was revealed that only 7 % are able to produce a bumper harvest. Common seasonal field crops are maize, millet, rapoko, groundnuts, round nuts and cowpeas these are complemented by garden crops such as sweet potatoes, leafy vegetables and legumes such as beans. The farmers reported that small grain crops performed much better than maize in their areas though most farmers prefer growing maize, and many others can hardly secure the small grain crop seeds. A further analysis of the crops that did well in the previous farming season as revealed in table 7 confirms that the last planting season was just another drought for the inhabitants of Chivi and Zvishavane Communal Areas.

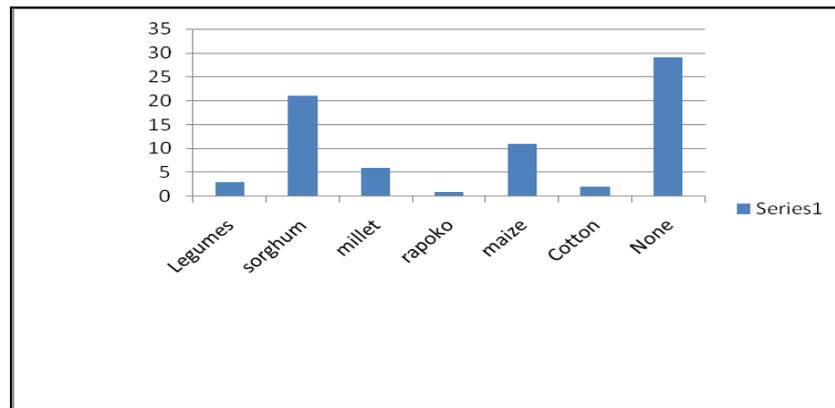


Figure 7: Crops grown successfully last season 2011/12

During our research, we asked farmers to estimate how much they harvested and have stored in their granaries as food and seed sources. This was touching as some farmers had harvested nothing because the crops did not mature. The general picture of this gloomy season is further elaborated in the pie chart (figure 8) below

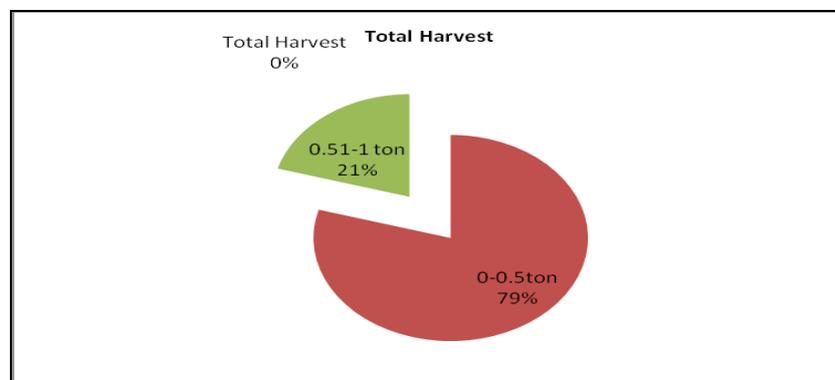


Figure 8: Showing General Trend On Total Harvest For The Last Farming Season

Besides the crop failure of the previous season, respondents indicated that the crop yield in Zvishavane and Chivi has been getting lesser and lesser since the last two decades. In fact, most of the harvests the farmers get from their fields can no longer sustain them for the whole year. Of interest are diseases that the community perceives to be associated with the changing climatic conditions in their areas. These include cancer, typhoid, fevers, chronic headaches, malaria, various types of heat rashes and cholera. As revealed by respondents, most of these diseases were rare, and some unheard of but in the past five or so years their occurrences have been on the rise and more and more people are dying from these diseases.

7. Towards Food Security In Semi-Arid Zimbabwe: Some Recommendations

7.1. Adaptation Strategies

Considering the research findings discussed in the preceding paragraphs, there is no doubt that a lot is desired to be done especially in semi-arid areas of Zimbabwe such as Zvishavane and Chivi. To this effect, we recommend that for farmers to be able to combat the adverse effects of rainfall variability, they employ either 'conventional', traditional or a mixture of conventional and/or traditional practices. This is taking into account the financial status and success of some farmers in Zvishavane and Chivi (and elsewhere in semi-arid regions) who are specialising in traditional and/or traditional farming practices.

The other adaptation strategy farmers in semi-arid areas such as Zvishavane and Chivi can use is intensive gardening. For a successful intensive gardening, farmers from the community should come together around a community garden where there is water source and each member household of the garden allocated a portion of land in that garden where s/he grow various crops for subsistence and surplus for sell. Alternatively, the farmers can come together and practice small livestock production such as poultry (rearing indigenous chickens or broilers), goats and sheep for subsistence and for sale. Such strategies will go a long way in helping the affected farmers to adapt to the changing climatic conditions in their respective areas.

7.2. Climate Change Awareness And Policy

Though farmers in Zvishavane and Chivi Communal Areas are aware of the changing climatic conditions, many still view its effects in the light of normal seasonal climatic variability. This calls into question the need by the government and civil society groups to raise awareness of climate change among farmers, with an emphasis on its implications to help inform their choice of farming methods, timing, and crop and seed varieties. In fact, government departments such as Agritex, Ministry of Environment and Forestry Commission, and EMA need to participate actively in raising awareness of this phenomenon in rural

communities. The survey revealed that only one government department and several civil society groups are at least trying to raise awareness to farmers about the changing environment and advise them on how best to adapt. Figure 9 below shows percentages of farmers who at least been advised about climate change by different agencies.

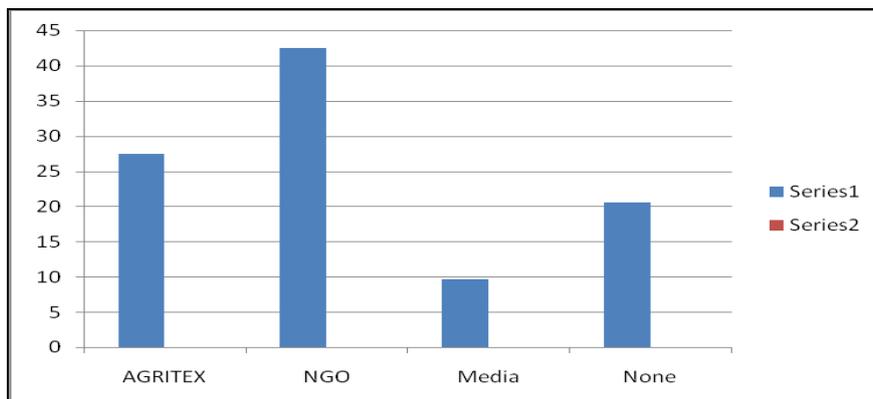


Figure 9: Showing Percentages Of Farmers Who Have At Least Been Advised About Climate Change By Different Agencies.

The ministry responsible for agriculture and food security in the nation according to the results of the research has managed to reach just about 27% of the farmer population with regards to advice and raising awareness on climate change and resultant impacts on food security. Non-Governmental Organisations seem to be more effective in playing this very crucial role, with at least over forty percent interaction with farmer population. Also, other forms of media in the form of newspapers, radio, television, academic papers, books and posters are playing a fundamental role in raising awareness among farmers. However, research results revealed that there is still a reasonable percentage (21%) of farmers who profess to have heard nothing from any reliable source with regards to changing climate conditions and its impact in southern Zimbabwe. Considering that climate change is real and farmers are suffering from the impacts thereof, the government should ensure that climate change issues are mainstreamed in all government departments and implementation of various strategies should be informed by the national Country Strategy Document/ Policy on Climate Change.

7.3. Climate Change Policy And Institutional Arrangements

The research has revealed that communities still need to be informed more on climate change. However, Zimbabwe government departments responsible for disseminating this information to small holder farmers and the nation at large has had its challenges in trying to reach out rural communities. In Zimbabwe all districts are managed by Rural District Councils which then report to the Provincial Council. All government departments in the rural areas are housed at the main district office under the supervision of the district administrator. Key informant discussions indicated that currently there is no climate change policy for the two districts/areas under study except some by-laws that were formulated by the environment and Agriculture committees that were still awaiting approval. However, a key informant from one of the government ministries responsible for environmental issues highlighted a very important point that the present researchers think should be conveyed to farmers in semi-arid areas. See box 3 below.

Environmental issues in terms of spatial coverage, entails the involvement of the whole planet. It is therefore the responsibility of everyone everywhere to ensure that the environment is protected. EMA personnel alone no matter how many cannot be adequate. The effectiveness of the Environmental Management ACT on issues to do with climate change can only be accomplished through the combined efforts of all relevant players, agriculture department inclusive.

*Box 3: Government Effort To Raise Awareness And Mitigate Climate Change
Source KI 2012: Environmental Management Authority(EMA)*

8. Conclusion

This study has examined climate change and the impacts it has on the environment and people in Zvishavane and Chivi Communal Areas. It has revealed that the agriculture sector is quite vulnerable to the adverse impacts of climate change with marginally productive areas probably shifting to non-agricultural use. In view of these research findings, we have suggested to the farmers in semi-arid areas that where crop production becomes non-viable, intensive gardening and small livestock production such as poultry (rearing indigenous chickens or broilers), goats and sheep may be developed as major agricultural activities. For those farmers who want to continue growing cereal crops, it has been suggested that they switch on to more drought tolerant and disease resistant crops such as rapoko and sorghum, among others.

More importantly, the study has recommended the need for the government and civil society groups to play an active/pivotal role in educating rural farmers on climate change by conducting awareness raising campaigns. To this end, relevant departments have to be on the forefront in educating the local farmers on issues such as selecting appropriate crops and cultivars; planting methods; minimum tillage; providing irrigation equipment and timely irrigation and water harvesting techniques.

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