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# Effects of Climate Change on Human Security in Zvishavane District of Zimbabwe

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**Abstract:** The mixed methods research study examined the effects climate change, human security and coping mechanisms in rural communities in Zvishavane District. Zvishavane rural district communities are experiencing effects of climate change in the form of droughts and high temperatures and low annual rainfall that has culminated in low agricultural productivity. Climate change is threatening livelihoods, food security and water security in the district. Climate change is also altering significantly the relationship between people and their environments and undermines their source base upon which rural people have built their societies leading to human insecurity. The consequences of climatic change in the district are being exacerbated by the reliance of rural communities on rain fed agriculture as their main livelihood in Zvishavane District. The research objectives of the study were to explore the effects of climate change on human security in the Zvishavane district. The study used a descriptive research design with a sample of 71 respondents (*n=71)* chosen using simple random sampling method. Primary data was collected using questionnaire with a five point Likert scale, focus group discussion and interviews. The research results indicated that to a very great extent climate causes floods, droughts, storms and cyclones, fires, heat waves, and epidemics that cause loss of life and properties and it was also indicated that climate change causes poverty, inequality, market failures, and policy failures, the study showed that to a very great extent people in Zvishavane District adopted changes in planting dates, changes in harvesting dates, multiple cropping, intensive manure application, intercropping, and expansion of cultivated land area as coping mechanisms currently employed to mitigate the effects of climate change. The researcher recommended that people in the district should stop engaging in deforestation and sand-filling of natural water bodies such as rivers as a result of stream bank cultivation, as all of which singly and/or complementarily leads to climate change, the rural communities should do afforestation in their areas, farmers in the district should select and cultivate new well-bred animal and crop varieties with high yield potential and quality, superior, integrative stress resistance and wide adaptability and also select and cultivate stress resistant varieties with specific abilities of resistance to drought, high temperature and diseases and pest invasion and communities should stop agricultural activities such as bush burning, fertilizer application, fermentation among others, as anthropological influencers they, contributes to climate change, instead they can practise zero-tillage and organic farming using organic manure.
**Keywords:** Climate, climate change, human security.

## INTRODUCTION

Human security refers to an emerging paradigm for understanding global vulnerabilities whose proponents challenge the traditional notion of national security by arguing that the proper referent for security should be the individual rather than the state [1]. According to Adesiji and Obaniyi [2] human security holds that a people-centered view of security is necessary for national, regional and global stability. Climate change commonly is seen to threaten national and human security directly or through secondary impacts, e.g., causing resource scarcity [3]. Gemenne, Barnett, Adger and Dabelko [4] identify four key areas of investigation within the literature on climate change and security: violent conflict, forced (mass) migration, reversed causality, and risks to human security. These themes often can be found within the political discourse as well.

There is now widespread agreement that the changes now underway in the earth's climate system have no precedent in the history of human civilization

[5, 6]. As a macro-driver of many kinds of environmental changes such as coastal erosion, declining precipitation and soil moisture, increased storm intensity, and species migration, climate change poses risks to human security [7]. In most parts of the world, the impacts of climate change on social ecological systems will be experienced through both changes in mean conditions (such as temperature, sea-level, and annual precipitation) over long-time scales, but also through increases in the intensity and in some cases frequency of floods, droughts, storms and cyclones, fires, heat waves, and epidemics [8]. Outside of these short- and long-term changes, which are projected to occur with high levels of certainty, there also exist somewhat more unquantifiable risks of high-impact events. These include melting of glaciers and permafrost which may add several meters to global sea-levels, collapse of the thermo haline circulation which may cause significant regional climate changes in the northern hemisphere, and large scale shifts in the Asian monsoon and the El Nino Southern Oscillation phenomenon [9-11.

Nyon *et al*., [12] asserted that there is every reason to worry about the impacts of these changes on human systems given that the rate of change is unprecedented in the past 10,000 years, and that climatic variations have triggered large-scale social disruptions in the past. The association between El Nino events and famines that killed tens of millions across the tropics in the late 19th century has been well documented by Davis [13]. Davis [13] argues that famine was triggered by drought, but caused by the way political and economic colonization deprived people of their entitlements to natural resources. Most analyses of famines now identify poverty, inequality, market failures, and policy failures as the deeper causes of what ostensibly seem to be 'natural' disasters [14-16]. Davis's arguments about the ways climatic variations have combined with stressed social-ecological systems to result in dramatic social change is reinforced by Diamond [17], who examines many cases of catastrophic social change and finds that environmental change was a common factor in all of them, and climate change in particular was a cause of many.

According to Ingram [18] the vulnerability (potential for loss) of people to climate change depends on the extent to which they are dependent on natural resources and ecosystem services, the extent to which the resources and services they rely on are sensitive to climate change, and their capacity to adapt to changes in these resources and services. In other words, the more people are dependent on climate sensitive forms of natural capital, and the less they rely on economic or social forms of capital, the more at risk they are from climate change [19]. Yet Young *et al*., [20] argues that environmental change does not undermine human security in isolation from a broader range of social factors. These include, among other things, poverty, the degree of support (or conversely discrimination) communities receive from the state, their access to economic opportunities, the effectiveness of decision making processes, and the extent of social cohesion within and surrounding vulnerable groups [21]. These factors determine people and communities' entitlements to economic and social capital that in turn determine their capacity to adapt to climate change so that the things that they value are not adversely affected [22].

The way climate change can and does undermine human security varies across the world because entitlements to natural resources and services vary across space, and the social determinants of adaptive capacity are similarly varied [23]. Too many industrialised countries population are dependent on agriculture as their sole or main source of income, and the majority of the population is engaged in subsistence farming so people live below the poverty line [24]. There is no state-directed system of income support, but there may be customary and Church-lead processes whereby food (and in some places labour) is shared. There is a modest public education system and a very basic public health system [25]. Therefore, people have little or no alternative sources of food beyond their own production. Maize is the most important source of food supply, but nowhere is it an irrigated crop [26]. Therefore, in times of low rainfall maize production can be reduced by up to one-third, resulting in widespread hunger and child malnutrition [4]. If climate change results in less rainfall in the dry season, then this may negatively affect a number of resources that are of value, such as sufficient food and good health [27].

As pointed out in the paper prepared by the International Institute for Environment and Development [28], climate change will most severely impact upon vulnerable regions and vulnerable groups because of its effect as a threat multiplier and because of the inherent vulnerability to any addition risks by people whose human security is not assured. Conditions of pre-existing conflict, poverty, weak institutions, food insecurity and spreading diseases will leave communities unable to meet the challenges of adapting to climate change impacts and will exacerbate existing problems [1]. Climate change is particularly complex and it affects many aspects of international politics, economics, migration, human rights, development, trade, health and environmental systems and can act as a stressor making situations of instability, conflict, and humanitarian crises more likely and severe [29].

According to the study prepared by UNICEF's Innocenti Centre [30], children are central to the climate change and human security agenda. They are amongst the most vulnerable populations to climate change, and may be the greatest victims of its impacts [31]. At the same time, Diamond [17] believes that they are powerful protagonists for change and can contribute significantly to the collective effort to mitigate climate

change and its effects. There is a strong institutional basis for considering children's issues in the international climate regime [31]. Despite this, Cincotta [32] argue that there is yet no strong institutional framework for championing children's issues. For example, National Adaptation Programmes of Action (NAPAs) and other adaptation plans rarely, if ever, address the unique vulnerabilities and needs of children [33]. Similarly, they fail to draw on the unique knowledge, insights and capacity for meaningful change that children can and do offer [34].

The Women's Environment and Development Organization (WEDO) [35] argues that climate change is increasingly recognized as a major human security issue that poses serious global threats. Cramer [31] opined that although climate change affects everyone regardless of race, caste, ethnicity, sex and level of income, its impacts are more heavily felt by poor nations, communities and people, and climate change magnifies existing inequalities. For the world's poor the impact will be most severe, disproportionately affecting their livelihoods and security [36]. According to Cincotta [32] Women comprise 70% of those living below the poverty line. As a result, they are most likely to bear the heaviest burdens when natural disasters strike. At the same time, women are often overlooked as potential contributors to climate change solutions, and thus to the security of all human beings [37]. According to the United Nations University [38], migration whether permanent or temporary, whether national, regional or international has always been a possible coping strategy for people facing environmental changes such as sudden disasters or cyclical climate conditions.

Diamond [17] supported that pre-history and history are marked by (episodic and localised) human movement from one climate zone to another, as people have sought out environments that would support both survival as well as aspirations to a more stable existence. Migration in the past may have been accompanied by some sense of despair that familiar landscapes no longer provided safe or supporting habitats for people [39]. Rachels and Rachels [40] averred that, environmental change, including climate change, presents a new threat to human security and a new situation for migration. Environmentally induced migration has the potential to become a phenomenon of unprecedented scale and scope [41]. Its effects on the global economy, international development, and national budgets could be profound, with significant implications for almost all dimensions of human security, in addition to political and state security [24].

According to Waever and Buzan [42] the largest body of research has been done on the connections between climate change and violence. Specifically, this type of research considers if and how "climate change may increase the risk of violence" as well as "the potential mechanisms through which climate change may increase human insecurity" [43]. While some scholars have made strong claims about causal connections between climate change and increased risk of violent conflict [44], others remain critical to that connection and have found little evidence to explain convincingly the relationship between climate and conflict [45]. Thus, instead of portraying climate change as a direct cause of conflict it has often been referred to as a „threat multiplier" instead [46].

According to Trombetta [47] climate change may cause forced (mass) migration and also climate-induced migration might cause and spread violent conflict. Major decreases in living conditions or loss of territory due to rising sea-levels could trigger mass migration in various regions [48]. Similarly, Kerr [49] averred that climate change is considered a substantial threat to the security of states and people. However, some scholars point out that a clear-cut connection between climate change, migration and violent conflict is hard to establish empirically [43]. "Conflict is a powerful driver of vulnerability to climate change" [43]. While it remains contested to which extent climate change can directly or indirectly cause violent conflict, some scholars are certain that it is violent conflict that renders people more vulnerable and exposed to climate change [27]. This body of literature considers that this reversed causality applies to migration as well, as migration actually is an important mechanism of adaption to climate change [41].

The causal connections between climate change and human security increasingly are considered and some studies have concluded that "climate change poses risks to livelihoods, communities, and cultures" [43, 4]. Human health and security can be affected directly or indirectly by various impacts of climate change, such as more intense natural disasters, decreasing natural resources, loss of geographical space etc. A common critique to this human security approach, however, is that it is too all-encompassing and offers little advice on realizable policy-making [26].

Climate change is seen to particularly influence development by posing multiple challenges to the Millennium Development Goals (MDGs) [50]. Especially "goals related to human security and poverty, gender equality and environmental sustainability" are considered to become more difficult to achieve [24]. Overall, the field of development needs to take climate change into account, due to its impacts on resource availability, infrastructure, disease, and development costs [51]. The direct and indirect implications of climate change also are acknowledged as it is assessed that climate change can affect people through natural hazards, environmental degradation, and sea-level rise, but also through adverse impacts on food productivity/security, health, and sustainable

livelihoods [52]. Furthermore, in contrast to the UNHCR, the UNDP strongly emphasizes the heightened vulnerability for poorer communities and the various risks climate change bears for these communities [53].

Busby [54] outlined that climate change exacerbates the risks of hunger and under-nutrition through two main mechanisms: extreme weather events under climate change, the frequency and intensity of some disasters such as droughts, floods and storms could increase, with an adverse impact on livelihoods and food security. Climate-related disasters have the potential to destroy crops, critical infrastructure, and key community assets therefore deteriorating livelihoods and exacerbating poverty [55]. Long-term and gradual climate risks Sea-level will rise as a result of climate change, affecting livelihoods in coastal areas and river deltas [56]. Accelerated glacial melt will also affect the quantity and reliability of water available. Under warming trends, glacial melt could accelerate, and the melt season would begin earlier in the year.

In the light of the above observations made in previous studies that were context specific and culture-bound, the researcher sought to investigate effects of climate change on human security in Zvishavane District of Zimbabwe.

**Statement of the Problem**

Climate change is inevitable the world over. The communities in Zvishavane District of Zimbabwe are not aware of the imminent experiences associated with climate change, yet they are smarting from the effects of climate change.

**Sub-problem**

The study was premised on the ensuing sub-question:

What are the effects of climate change on human security in Zvishavane District of Zimbabwe?

## MATERIALS AND METHODS

**Research Approach**

This study adopted both a qualitative and quantitative methodology approach. A quantitative approach to research mainly focuses on quantifiable data in terms of numbers and measures that can be analyzed statistically. "Quantitative researchers are more concerned about issues of design, measurement and sample because their deductive approach emphasizes detailed planning prior to data collection and analysis" [58. In quantitative research validity is concerned with whether or not the study indeed measures that which it is intended to measure and reliability with whether the study can be replicated by another researcher in the same context [57]. In contrast, a qualitative approach to research, in collecting the appropriate data, is not interested only in numerical data that can be used for statistical analysis. In support of this statement, Neuman [58] states that qualitative researchers are more concerned about issues of richness, texture and feeling of raw data because their inductive approach emphasizes developing insight and generalization out of the data collected. For the purposes of this study, the research decided to utilize both quantitative and qualitative research methods. A quantitative approach was used in the research because quantifiable data in terms of numbers and measures that can be analyzed statistically was collected. "Quantitative researchers are more concerned about issues of design, measurement and sample because their deductive approach emphasizes detailed planning prior to data collection and analysis" [58]. In contrast, a qualitative approach was used in this study research, in collecting the appropriate data, concerning about issues of richness, texture and feeling of raw data because their inductive approach emphasizes developing insight and generalization out of the data collected.

**Research Design**

According to Gliem, and Gliem [59], "a research design is a blue print with detailed information and it is used as a guide in completing the research objectives stated". The research design becomes a master plan that gives specific methods and procedures used in gathering and analysis of the collected data. In this research, descriptive survey research design was used on the study of on climate change, human security and coping mechanisms in rural communities in Zvishavane District. This design was chosen because it suitably addresses the research problem as well as the objectives. A well designed research has been of critical importance in finding a solution to the research problems because it enabled the researcher to get accurate and useful information [60]. Availability of accurate information enhanced reliable decisions to be made. The researcher kept this notion in mind when deciding on the best design to adopt for the purpose of this study.

**Descriptive Survey Research**

Descriptive research can be either quantitative or qualitative. Descriptive research design is one that will allow the researcher to collect data that is descriptive in nature and tells us more on what is going on [61]. This study was conducted using the descriptive survey approach. As a research design, the descriptive survey was used in obtaining information concerning the current status of a phenomenon. The method was chosen because it is more precise and accurate since it involves description of events in a carefully planned way [62]. Furthermore, descriptive survey design allows observation of subjects in a completely natural and unchanged environment and yields rich data that leads to important recommendations.

**Target Population**

Bhattacherjee [62] defines a population as, "all people or items with the characteristic that one wishes

to study". Furthermore, Kothari [61], Neuman [64] and Majumdar [65] defines population as the large group of cases or universe or canvas or total of the items or units within a defined space (geographical or social) from which the researcher draws a sample about which information is desired. The study targeted households, officials from ministry of agriculture, Zvishavane local authority and donor agencies operating in the district.

**Sampling Procedure**

This refers to the techniques that will be used in the selection of cases to be considered for the research. Saunders *et al*., [66] refers probability sampling as a sampling technique where the samples are gathered in a process that gives all individuals the chances of being selected. Random selection of the sample enables the researcher to generalize results from a sample to a larger population. The study used simple random sampling to select respondents representing households and a census for officials from organisations that was included in the study. During the simple random sampling, the names of all the households from 3 wards (589) were written each on a small piece of paper and placed in box. The names were then pick at random. The use of simple random sampling implies that every member under the study will have an equal chance of being selected [67]. The major advantage of census is that it provides a true measure of the population therefore, no sampling error.

**Sample size**

Kothari [68] states that sampling frame is a physical representation of the target population which comprises of all units that are potential members of a sample. Neuman [64] defines a sample as, "a small set of cases a researcher selects from a large pool and generalizes to the population". Furthermore, Silverman [69] avers that sampling, "allows you to estimate the representativeness of the cases you study, and thereby the degree of confidence in any inferences you draw from them". The researcher obtained number of wards to draw the sample size by multiple total number of wards (22) in the district by 0.1 [70]. Hence the number of wards considered for drawing sample size was 3. Simple random samplings were carried out on the population of the 3 wards and then obtain 10% of the population. According to Saunders [71] 10% of the total population can be used to collect data where the population is large. In this case sampling was advantageous in that it saved time as well as financial and human resources.

**Table-1: Sample size**

| | Population size | Sample size |
|---|---|---|
| Household representatives | 589 | 59 (10% of population) |
| Ministry officials (agriculture and local government) | 4 | 4 (census) |
| Development agencies officials (Action Aid and Christian CARE | 8 | 8 (census) |
| Total number of sample representatives | | 71 |

**Research Instruments**

These are tools used for the collection of data that is relevant for finding solutions to the research problem. Creswell [72] defines research instruments as tools or devices used to make measurement of responses. In this study the researcher used questionnaires, interviews and focus group discussion as data gathering tools so as to come up with results that can be generalized to the whole population.

**Questionnaires**

The primary instrument for data collection in this research was semi-structured questionnaires, which contained a mixture of close ended and open-ended questionnaires. Kumar [73] states that a questionnaire is a written list of questions, the answers to which are recorded by participants, in a questionnaire, participants read the questions, interpret what is expected and then write down the answers. Self-administered questionnaires were used to gather data because of their ability to enhance data collection from a big sample in a short space of time. Advantages of this method is low cost 'free from bias, respondent have adequate time to give well thought out answer, and large sample can be made. This instrument was also chosen due to the fact that it is easy to administer and also makes it possible for much data to be collected within a short time. The questionnaires were structured in accordance with the objectives of the study. The first section collected the demographics data of the respondents, whiles the remaining sections were divided accordingly into each objective.

**Key informant interviews**

Daniel [74] argues that an interview is planned and directed conservation. Key informant interviews were conducted from 3 key informants, each from AGRITEX department, DA office and Veterinary services department representative to corroborate with farmers' experiences, perceptions and knowledge regarding climatic changes. The research purposively interviewed the DA, as the office allowed interaction with local community on every day basis assessing their livelihoods in the face of climatic changes. Information required from DA was, the number of households under treat of food insecurity, the extent to which the climate change have affected food security and coping measures that have been used for community to cope with climate changes. Information required from the AGRITEX officer and Veterinary officer include the

effects of climate change on agriculture production (livestock and crop production), measures which have been used to cope with climate changes, challenges associated with coping strategies and their recommendations on the adaptive measures. Recommendations on possible strategies that can improve resilience capacity were also collected. The interviews allowed probing for information from interviewees.

**Focus group discussions**

The study conducted two focus group discussions. Focus group discussion is one of the most popular qualitative research methods. It is a discussion guided by the moderator according to the prepared interview guidelines [68]. The survey is carried out in several groups of 8 to 10 persons selected in accordance with the research aims [75]. In focus group discussions, the researcher can get information from non-verbal responses, such as facial expressions or body language. Information is provided more quickly than if people were interviewed separately. The research used focus group discussions to obtain information from the households' representatives in Zvishavane District.

**Validity and reliability of the instrument**

Polit and Beck [76], state that validity is the quality criterion referring to the degree to which inferences made in a study are accurate and well founded in measurement, the degree to which an instrument measures what it is intended to measure. Polit and Beck [76], state that reliability is the degree of consistency or dependability with which an instrument measures an attribute. Reliability is the ability of a research instrument to provide similar results when used repeatedly under similar conditions Kumar [73]. The data collecting instrument, the questionnaire, was reviewed by the supervisor to ensure that the questions to be asked are appropriate for the study participants. The questionnaire was pretested among fifteen participants for language appropriateness, average duration of administration and sensitivity of questions. The findings from the process were used to modify or reformulate questions to adapt to local conditions.

**Data analysis and presentation**

Data gathered was analyzed using both qualitative and quantitative analysis. Raw data from the field was edited and screened to avoid biased information. Quantitative data was analyzed using (SPSS version 21.0) and descriptive statistics whilst qualitative data was analyzed using thematic analysis. Data was presented using tables, pie charts and bar graphs that were generated by making use of SPSS version 21.0. The choice of tables as data presentation tools was based from their ability to clearly classify different data.

## FINDINGS

**Demographic characteristics of the research participants**

**Table-2: The Response rate of questionnaires and interviews**

| | Frequency | Rate |
|---|---|---|
| **Questionnaires returned** | 71 | 100% |
| **Interviews conducted** | 10 | 100% |

Table-2 depicts a 100% percent response rate on the questionnaires, which is an excellent response that was considered good for analysis of the research. This indicated that the respondents contributed much to the gathering of information by the researcher. The high response rate was attributed to the fact that the questionnaires were delivered and collected by hand and hence there was a close contact and follow-up with the respondents. The successful execution of interviews with a rate of 100% was attributed to the fact that interviews were conducted on the agreed time and venues without any inconveniency on the part of the respondents.

**Descriptive Statistics**

This section will focus on the descriptive statistics to illustrate the characteristics of the sample studied and present the frequencies for the questions that are contained in the questionnaire.

**Profile of Respondents**

The respondents' characteristics were in the first section of the questionnaire. Descriptive statistics of the respondents are presented in below sections.

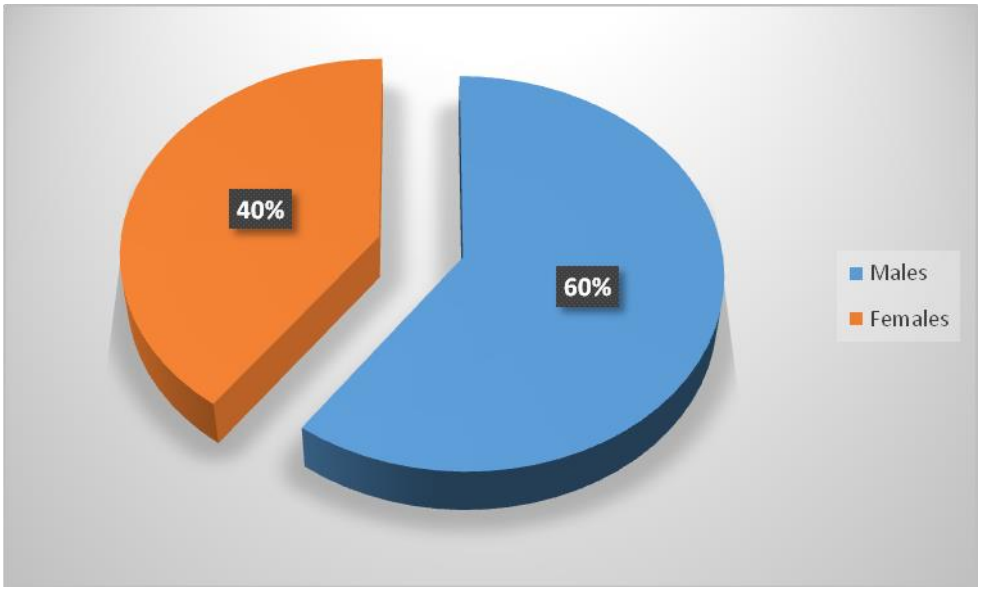


**Fig-1: Gender of respondents**

The results on Figure-1 indicated that 60% of the respondents were males whilst 40% percent were females. The variations in the gender compositions of the respondents of this study have a significant bearing on the interpretation of the results as some authors viewed gender as a factor that influences agricultural activities and this is important on interpretation of information regarding coping mechanisms to mitigate the effect of climate change particularly on food security. Fischer and Qaim [77] argued that women are more conscious to environment when executing agricultural activities than their male counterparts; hence they improve crop production through sustainable agriculture.

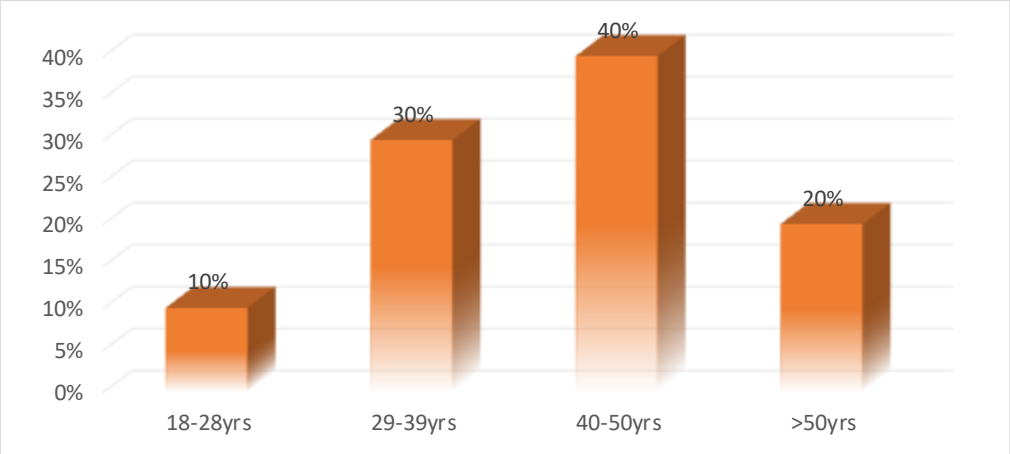


**Fig-2: Age of respondents**

The results on Figure-2 indicated that the majority of the respondents were of the age group between 40 and 50, with those between the age group of 29 and 39 constituting 30%. Those of the age group above 50 years were 20% of the composition and those between 18 and 28 years were least represented with 10%. The age of farmers is an important determinant of ability to produce crops to a certain level of output in the face of an attempt to mitigate the effects of climate change on food security. Nkamleuet [78] argues that age of a farmer determines his or her experience in farming and on the other side it defines the physical ability or agility of a farmer to be equal to both mental and physical demands of farming operations.

**Table-3: Socio-demographic Profile of Respondents (n=100)**

| Socio-demographic factors | Frequency | Percentages |
|---|---|---|
| **Level of education** | | |
| Primary level | | 8% |
| Secondary level | | 70 |
| Tertiary | | 20% |
| Others | | 2% |
| **Marital status** | | |
| Single | | 32% |
| Married | | 25% |
| Divorced | | 28% |
| Widow/widower | | 15% |
| **Family size** | | |
| < 2 | | 10% |
| 2 – 5 | | 35% |
| > 5 | | 55% |
| **Land holding size** | | |
| **< 2** hectares | | 5% |
| **2-5** hectares | | 30% |
| **> 5** hectares | | 65% |
| **Income earn per month** | | |
| < $ 500 | | 76% |
| $500 – 1000 | | 22% |
| > $ 1000 | | 2% |

Level of education: The results indicated that majority (70%) of the respondents have reached secondary as their highest level of education whilst 20% have reached tertiary education. 8% of the study composition had reached primary and the least represented were those from the category refers to others. It is also worth noting that educational level of a household representative has got any an impact on crop production and also on the understanding of climate change.

Marital status: The study revealed that 32% of the respondents were singles whilst 25% were married. 28% were categorized as divorced and 15% falls under the category of widow/widower.

Family size: According to researches has significant impact on food security and crop production. Majority (55%) of the respondents were from households with family sizes greater than 5. Those from the families' sizes ranging between 2 and 5 constituted 35% and the least represented were from families of the size less than 2. Family size influences crop production.

Land holding size: The indicated that 65% of the respondents owned land that is greater than 5 hectares in size and 30% owned or use land that is between 2 and 5 hectares in size for agricultural production. Only 5 % indicated that they own less than 2 hectares for agricultural production. Land holding size has an impact on agricultural production.

Income earn per month**:** The research revealed majority (76%) of the respondents earned less than $500 per month. This showed that majority of them were living under the poverty datum line and this will pose a serious challenge for them to be able to fund their crop production activities and adopt modern technology as a coping strategy to mitigate the effects of climate change. 22% of the respondents earned between $500 and $1000 per month and a small proportion of 2% earned more than $1000 per month.

## DISCUSSION

### The effects of climate change on human security

The research probe the impact of climate on human security and a five point Likert scale (1=no extent; 2= less extent;3=uncertain;4=great extent;5=very great extent) questionnaire was used in addition to key informant interviews and focus group discussions to gather data. The responses were computed into mean value as shown on Table 1 below.

**Table-4: Effects of climate change on human security**

| | N | Mean | | Std. Deviation |
|---|---|---|---|---|
| | Statistic | Statistic | Std. Error | Statistic |
| Climate change causes floods, droughts, storms and cyclones, fires, heat waves, and epidemics that cause loss of life and properties | 71 | 5.0000 | .00000 | .00000 |
| Climate change causes poverty, inequality, market failures, and policy failures | 71 | 4.6727 | .29558 | 1.38639 |
| Climate change causes large-scale social disruptions | 71 | 4.5455 | .39874 | 1.87025 |
| Climate change causes forced (mass) migration and reversed causality | 71 | 4.0909 | .32172 | 1.50899 |
| Climate change causes violent conflict as a result of resource scarcity | 71 | 1.0091 | .40510 | 1.90010 |
| Valid N (listwise) | 71 | | | |

The research revealed that to a very great extent (*mean=5; SD=0.0*) climate causes floods, droughts, storms and cyclones, fires, heat waves, and epidemics that cause loss of life and properties in Zvishavane District. The study also indicated that to a great extent (*mean=4.7; SD=1.4*) climate change causes poverty, inequality, market failures, and policy failures. According to Forster [79], the potential mechanisms through which climate change may increase human insecurity is the associated factors such as poverty, inequality, market failures, and policy failures. Climate change causes large-scale social disruptions with mean value of 4.5 and standard deviation of 1.9 (*SE=±0.4*) was ranked on the third position whilst climate change causes forced (mass) migration and reversed causality (*mean=4.1; SD=1.5*) was positioned on fourth position. Major decreases in living conditions or loss of territory due to environmental degradation as a result of climate change could trigger mass migration in various regions [48]. The study, however also showed that to no extent, climate change causes violent conflict as a result of resource scarcity in Zvishavane District.

The focus groups discussions revealed that droughts coupled with floods have been major threats to human security in Zvishavane District. 80 % of the respondents during focus group discussions indicated that drought has caused serious health, social and economic impacts with far-reaching consequences in their communities. Water use is part and parcel of almost every human activity as well as the life of plants and animals. On this basis, extended deficiency of water as a result of droughts has been affecting households in Zvishavane District both directly and indirectly. Agriculture is the predominant livelihood activity for people in Zvishavane District and the most important in terms of spatial extent. Agriculture is also the most affected livelihood activity due to the sensitivity of the sector to droughts and floods. About 90% of the population is engaged in farming; the area planted per household averaged 5 ha including 1.5 ha for sorghum, 2 ha for maize and 2 ha for groundnuts. The relatively recent major climatic events that hit the community are 2010 drought and flood were combined effect destroys communities' standing crop. Drought during the 2010 crop season affected crop production in Zvishavane District. Drought damaged on almost 1.55 ha of crop per household.

All households that participated during focus group discussions reported that their crops had been damaged by drought, majority of households affected by as much as a 90% decrease in expected output. The impact of the floods and droughts on the communities has been categorized into two components, namely leaving households food insecure because of reduction of crop production and economic costs. The economic costs involve indirect costs (affecting crop derived income). It was revealed during the focus group discussions that the principal livelihood which is agriculture was severely affected by the 2010 flood and drought. One of the participants of the focus group discussion said;

*"During floods or droughts the most affected households suffered from hunger and use to look for food from relatives"*

The respondents during the discussions indicated that droughts and floods in the district has exposed them to food insecurity as the natural calamities as a result of climate change that causes domestic animals and plants to die off as a consequence. Mainly, the damages arise out of extensive destruction of the wildlife habitats and reduction in water quality and quantity. The also reported that some plants and animals may completely fail to recover after the drought. Another participant of the focus group B lamented the devastating effects of droughts and reported that;

"*The last drought of 2010 left us with absolutely nothing to feed our families and we had to gather wild fruits to survive, I lost all my animals and my crops was heavily affected and I couldn't harvest even a single grain. We almost lost our lives because of hunger*"

When drought undermines or destroys food sources, people go hungry. When the drought is severe and continues over a long period, famine may occur. An official from the ministry of agriculture interviewed as a key informant reported that Zvishavane District have experienced devastating effects of dire consequences to human security, the official explained that;

*"Fertile lands are being lost as a result of drought, and in consequence, desertification sets in, soil moisture, which is essential for soil microbial activities, is reduced in drought conditions. As a result, soil quality is lowered because of minimized organic activity and continued dry spell which kills soil organisms. The end result is dry and cracked soil and it even becomes easier for decertification to occur. This has exposed many of our communities to reduced agricultural production lead to poverty and hunger.*''

The focus group discussions also indicated that majority (85%) of the participants concurred that droughts in the districts has resulted in serious social implications resulting in human insecurity. The participants identified some the effects such as outbreak of waterborne diseases, hunger, anemia, malnutrition, and even deaths as well as migration of people and anxiety. Since water scarcity is high during drought conditions in Zvishavane District, water quality significantly depreciates. This means the availability of clean water for drinking and water for sanitation and cleaning may not be sufficient. Drought often creates a lack of clean water for drinking, public sanitation and personal hygiene, which can lead to a wide range of life-threatening diseases.

According to the interviewed key informant from Zvishavane District Council, droughts are increasing the concentration levels of nutrients, chemicals, and solid particles or impurities in surface waters particularly in steams and weir that are used by many households in Zvishavane as sources of water for both agriculture and domestic use. As a result, managing and preventing waterborne diseases such as typhoid and cholera becomes increasingly difficult. A focus group discussion participated narrated that;

*In 2010, the whole village was affected with cholera, this was because we were fetching water for drinking from unprotected weir that we dug on Save river bank, because all the boreholes and wells in our gardens had run dry. The worst case was on area under headman X where almost every household reported a case of cholera, it was really pitiful*"

Households reported the erosion of social cohesion which they linked to adverse climatic conditions. More than half of the respondents (60%) stated that floods and droughts have impacted on social networks, especially the assistance they give each other in term of food.

As a result, the relationships among village families have been deteriorated, especially when affected families visited their relatives and were not given assistance. Furthermore, at the onset of drought or flood households are no longer in a position to help each other.

It also emerged during the focus group discussions that hunger, anemia, malnutrition and even deaths of people were witnessed in severely drought-stricken areas in the District.

An official from Christian Care which is one of the development agencies in the District helping households to alleviate poverty, interviewed said;

"*Drought is a great causal factor for low food production, thus, when experienced in poorer regions the effects of malnutrition, hunger, anemia and mortalities are compounded since there is little food available for consumptions, such is the case in Zvishavane District."*

The research through focus group discussions also uncovered the issues of migration as one of the social implication of climate change to human security. Faced with the other impacts of drought, many people in the district have been reported to be fleeing a severely drought-stricken area in search of a new home with a better supply of water, enough food, and without the disease and conflict that were present in the place they are leaving.

Focus group discussions participants (89%) reported that climate change in the area has resulted in high temperatures than normal being experienced in the District for the past decade. They said the district is now experiencing extremely high temperatures particularly in summer that is from September to late March of the following season. This was also echoed by Ministry of Agricultural official key informant interviewed who reported that;

*"We have reports of farmers that have reported and complained about heat exhaustion as a result of high temperatures. Heat exhaustion is a relatively common reaction to severe heat and the farmers particularly in Lower Zvishavane (bordering with Mberengwa) have experienced symptoms such as dizziness, headache and fainting".*

The experiencing of heat wave has also been cited by the respondents of the focus group discussion

as impacting negatively on agricultural operations as farmers in the district would not be able to work on their crop fields. One of the focus group discussions from Lower Zvishavane area said;

*"What's happened is that you've sweated out a lot of water, but even if you've been drinking water to replace it, you're not getting enough and you will end feeling headaches and dizziness. The only option if you are working on your field exposed to direct sun heat is to quit the work and look for a shade".*

The study also revealed that floods are also a major threat in the District particularly on the low lying areas of Lower Zvishavane adjacent to flood prone areas of Runde. Floods impact on both individuals and communities, and have social, economic, and environmental consequences in Zvishavane District. The respondents during focus group discussions reported the effects of floods in the area as direct mortality and morbidity and indirect displacement and widespread damage of crops, infrastructure and property. Immediate causes of death in floods include drowning and trauma or injury. Over an extended time period, there may also be increased mortality due to infectious disease. A key informant interviewed from Zvishavane Rural District Council narrated that;

*The immediate impacts of flooding include loss of human life, damage to property, destruction of crops, loss of livestock, and deterioration of health conditions owing to waterborne diseases. The floods also destroy communication links and infrastructure such as power plants, roads and bridges are damaged and disrupted, people are forced to leave their homes and normal life is disrupted as witnessed in 2010.*

It was also noted during the discussions that damage to infrastructure by floods in many parts of Lower Zvishavane has resulted in long-term impacts, such as disruptions to supplies of clean water, electricity, transport, communication, education and health care. Loss of livelihoods, reduction in purchasing power and loss of land value in the floodplains have left the communities economically vulnerable. The respondents also asserted that, Floods can also traumatize victims and their families for long periods of time. The loss of loved ones has deep impacts, especially on children. Displacement from one's home, loss of property and disruption to business and social affairs can cause continuing stress. For some people the psychological impacts can be long lasting.

The study also indicated that in the District, floods crop losses through rain damage, waterlogged soils, and delays in harvesting and further intensified by transport problems due to flooded roads and damaged infrastructure. The flow-on effects of reduced agricultural production therefore affect human security. A focus group discussion participant said;

*"Many people and animals have died in flash floods in 2010 in Lower Zvishavane. Many more were injured and others were made homeless. Water supply and electricity were disrupted and people struggle and suffer as a result. In addition to this, the floods bring a lot of diseases and infections including pneumonic plague and dysentery. Sometimes insects and snakes make their ways our homes and cause a lot of havoc during flooding".*

A key informant interviewed from the Ministry of Agriculture reported that incessant and heavy rains experienced in most parts of Zimbabwe from mid-January to mid-February 2014, have wreaked havoc in Zvishavane District. The rains have caused severe flooding resulting in loss of lives and livelihoods as crops and livestock have been swept away. Another key informant from the Action Aid Zimbabwe Project, a developmental agent operating in the district said;

*"About 109 households comprising 689 people have been affected by the floods in 2014. A total of six people have died. One elderly man and a woman were not identified as their bodies were seen floating in Nkankezi River in Zvishavane but no one has claimed their bodies. The scale of the Zvishavane disaster was huge with all wards having their fields and livestock destroyed. A total of 1041.2 hectares of cereals and 1509 hectares of cotton have been washed away. Crops were destroyed at maturity stage"*

A focus group discussion participant from Ward 16 in Zvishavane District who was affected by the floods said:

*"I was hurt when I saw my field destroyed as I was looking forward to harvest my maize at the end of February and my family is facing hunger. At the moment I have nowhere to get food. As a village we are devastated as two women and their babies from our village drowned in the Runde and Ngezi Rivers at the onset of the floods on their way from the hospital which is situated on the other side of the river. The canoe they were using to cross the river lost balance as heavy waters raged towards their direction and it overturned throwing the women into the river. One of the women survived but unfortunately she lost her baby and the other women together with her baby also passed on".*

Another affected person who participated in the focus group discussions from Ward 16 Zvishavane District said;

"*The state of our fields was distressing as we were left with nothing but damages to our environment, yellowing and wilting of plants. My hope was to receive assistance of maize seeds before end of March 2014 so that we can replant since the soils were still wet and can hold water for close to three months*"

The study through key informant discovered that about 118 families (577 people) of Runde and Ngezi areas were affected in 2014 flood disaster. Destruction of crops and houses was reported.

Climate causes floods, droughts, storms and cyclones, fires, heat waves, and epidemics that cause loss of life and properties in Zvishavane District. The impact was rated as the top major consequence of climate change on human security. The study confirmed Halperin and Heath [23] position who averred that climate change can and does undermine human security as a results of natural calamities such as floods, droughts, storms and cyclones, fires, heat waves, and epidemics. The results were also in sync with Vincent and Cull [19] postulate that scientists have identified a number of ways in which increasing global temperatures may affect long-term climate patterns, including an increase in the incidence of both flooding and droughts, rising sea levels, and stronger, more frequent hurricanes and typhoons. If successful mitigation strategies are not adopted, hundreds of millions of people may face increasing pressure on water resources, damage to crops and dwellings, and exposure to extreme weather, diseases, and pests. Metcalfe [80] confirm that Guruve area is prone to dry-spells and periodic seasonal droughts during the crop season that reduce crop production and leave local communities with hunger. This is consistent with the study by ECA [81] who stated that the majority of the populations in most African countries live in rural areas practicing rain-fed agriculture and recurrent drought put local communities in a poverty trap due to production losses. A characteristic of drought-induced production losses is that such losses take time to rebuild. If drought is recurrent or if households experience other constraints, households may enter a poverty trap from which it is difficult to escape [82]. Without any irrigation facilities or efficient water harvesting strategy, Guruve District is more likely to be vulnerable as the drought is exacerbating by climate change. According to O'Brien *et al*., [83] in arid zone, communities without higher irrigation rates are expected to have a lower capacity to adapt to climate challenges and other economic shocks.

Floods destroy shelter and properties and curtail ability to meet basic needs. For example, the Fiji flood in 2009 resulted in economic losses of F$24 million affecting at least 15% of farm households [89]. Occurrence of floods in Zvishavane render farms unproductive for the time it washed away crops and even deposit sandy soils on farms that will make cultivation expensive and difficult for some time exposing the communities to food insecurity. Such reduction in food production can lower nutrition standards and the loss of agricultural labour. IHP [87] confirms that, floods are the most taxing type of water-related natural disasters to humans and resources. It is the rural people that suffer the highest economic and human toll from the occurrence of floods [88]. Devereux [85] notes that, the impact of climatic event on rural livelihoods is on crop production. Floods undermine farm yields, reducing household food availability according to the extent that the family depends on agriculture for its food. Given that the livelihood of Zvishavane District is dependent on agriculture, derived income from agriculture is also affected and the starvation is likely to follows periods of floods. In southern Africa for instance, floods are a major problem for many rural communities where agriculture production have been affected and limited access to food [90]. It has been found that in Zimbabwe, floods have threatened food security and household economy in rural areas where the agriculture on which they rely has been flooded [90].

In the communities, people are dependent on the resources sensitive to climatic conditions, droughts and floods can plague social cohesion and erode communities' resilience. Devereux [85] argues that social obligations exists to address the impacts of droughts or floods and is triggered by hardship situations. However, during periods of droughts or floods the system of social obligation may not function properly since people need to cater for their well-being above all else. Poor rainfall has impacted on the propensity of households to be organized themselves as a cooperative for production [84]. This implies that droughts or floods leave no individual household the chance to help any other [91].

Interaction of climate change with poverty and other political, social, institutional, and environmental factors may adversely affect agriculture production and exacerbate the problem of food insecurity [86]. The results echoed the sentiments by Adesiji and Obaniyi [2] that, climate change threatens human security because it undermines livelihoods, compromises culture and individual identity, increases migration that people would rather have avoided, and because it can undermine the ability of states to provide the conditions necessary for human security. Changes in climate may influence some or all of the factors at the same time. Situations of acute insecurity, such as famine, conflict, and socio-political instability, almost always emerge from the interaction of multiple factors. For many populations like the rural communities of Zvishavane district that are already socially marginalized, resource dependent, and have limited capital assets, human security will be progressively undermined as the climate changes.

## CONCLUSIONS

To sum up, taking into account the findings of the present study, it is concluded that that rural communities in Zvishavane District are experiencing the adverse impact of climate change and they have adopted several coping mechanisms to mitigate the effects of climate change. Climate change as an adverse

change in weather impinges on human, environmental and agricultural activities. Some of the consequences on livelihood are drying of streams, flooding, damaging of roads and general damage to the ecosystem. The effects of climate change on agricultural productivity are numerous, including decrease in crop yields, altered crop growing period, decrease in water availability for irrigation, among others.

## RECOMMENDATIONS

In the view of the study findings and conclusion reached, the study recommends the following that:

- People in the district should stop engaging in deforestation and sand-filling of natural water bodies such as rivers as a result of stream bank cultivation, as all of which singly and/or complementarily leads to climate change. The rural communities should do afforestation in their areas.
- The communities should stop agricultural activities such as bush burning, fertilizer application, fermentation among others, as anthropological influencers they, contributes to climate change, instead they can practise zero-tillage and organic farming using organic manure.
- Government and NGOs can assist the rural communities that devoting adequate resources for the construction of support facilities for large scale water-saving for irrigation, building water harvesting schemes, water storage ponds and improve irrigation and drainage systems to combat drought and flood as they occur. Efforts need to be made to build new small-scale irrigation and drainage projects in areas that are currently not irrigated to fight drought and construction of water collective and utilization engine in hill mountainous areas. All these are meant to solve water availability for agriculture.
- Government and non-governmental organizations should invest in the research and development of agricultural technology especially in systems that are dominated by small holder investments and large private agricultural reproduction/propagation research companies. Specifically, efforts should be made to expand breeding programs to encourage research on seed and offspring varieties with traits that promote resistant to drought, high temperature, diseases and pests, and water logging for plants and animals.
- Farmers should be taught how to better manager fertilizer application and promote the increased use of organic fertilizer as a means of increasing soil fertility and reducing emissions of nitrous oxide.
- Farmers in the district should select and cultivate new well-bred animal and crop varieties with high yield potential and quality, superior, integrative stress resistance and wide adaptability and also select and cultivate stress resistant varieties with specific abilities of resistance to drought, high temperature and diseases and pest invasion.
- The communities should prevent aggravation of grassland desertification by controlling grazing intensity, recovering vegetation and increasing vegetation coverage of grassland.

### Areas of further studies

In future studies, a cross-sectional and longitudinal method to examine climate change, human security and coping mechanisms in rural communities are an approach that merits further examination. Other studies can be carried out in other districts and compare the results with the current research of Zvishavane District. The use of survey method accompanied by the use of a qualitative approach such as a personal face-to-face interview might support the findings from the survey and enhance the ability to comprehend the scopes covered.

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